

Attachment 6

Early Warning Indicators – November 2019 Update



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Background

As part of Baffinland's ongoing monitoring efforts (e.g., Passive Acoustic Monitoring Program, Bruce Head Shore-based Monitoring Program), a growing long-term dataset built upon a large suite of comprehensive monitoring variables is being developed. Data collected as part of these monitoring efforts will serve to underlie decisions on the appropriate selection criteria process for determining what variables may serve as suitable EWIs and will provide a dataset for future comparison to thresholds (pending establishment with the MEWG). This comes with the understanding that not all variables being collected through monitoring efforts are suitable for use as EWIs.

Summary Results of Project Effects Monitoring and Adaptive Management

In considering Baffinland's compliance with PC Condition No. 110 and 111, it is important to highlight that Project monitoring has not detected any adverse behavioural effects on narwhal (i.e. large scale displacement or abandonment) from shipping beyond those predicted in the environmental assessment. This is in light of a continuous year-to-year increase in ship traffic in the RSA since the start of Project operations.

In spite of this, Baffinland has responded to perceived effects raised by the MHTO by adopting additional mitigation measures (e.g. limiting ore carrier transits during the spring shoulder season depending on ice coverage, establishing vessel buffer zone 40 km outside of the Nunavut Settlement Area (i.e., the Regional Study Area), and expanding its marine mammal monitoring programs (e.g., extending the passive acoustic monitoring program into Eclipse Sound and including acoustic monitoring of the shoulder seasons, extending the aerial surveys to include the floe edge prior to the start of shipping operations, adding visual observers to the ship-based observer program on the MSV *Botnica*, etc.). In other words, Baffinland has responded to Inuit perspectives with the same actions that would occur if thresholds for EWIs had been established and reached.

Summary of Past Engagement with MEWG on PC Condition No. 110 and 111

As part of ongoing efforts to achieve compliance with PC Conditions No. 110 and 111 during the spring in-person MEWG meeting held in Ottawa, ON, on 6 June 2018, Baffinland committed to providing the Marine Environment Working Group (MEWG) a framework for the development of Early Warning Indicators (EWIs; Appendix A). The framework was to be provided by Baffinland for the next scheduled MEWG teleconference meeting. As part of these discussions, MEWG members agreed to work on the development of thresholds and early indicators for adaptive management as an action item for the next in-person meeting (Appendix A).



Accordingly, on 13 September 2018, Baffinland provided a proposed framework (the Framework) for the development of EWIs via email to MEWG members (Appendix B). This Framework was outlined and discussed during the MEWG teleconference meeting, held on the same day (Appendix B). This provided Baffinland an opportunity to explain the Framework and enable MEWG members to ask questions and clarifications, as needed. The first step of the Framework requested MEWG members to propose variables for consideration as EWIs through a Submission Sheet provided with the Framework. This Submission Sheet was to be returned to Baffinland within four weeks after the teleconference meeting, i.e., by 11 October 2018, based on the milestones included in the proposed timeline, which consisted as follows:

- 13 September 2018 – MEWG Teleconference Meeting: present Early Warning Indicator Submission Sheet to the MEWG.
- 11 October 2018 – 4 weeks following Teleconference Meeting: MEWG members to submit their EWI Suggestion Sheet(s).
- December 2018 – In-person Meeting in Iqaluit: MEWG members to review the compiled suggestions and select appropriate EWIs and corresponding thresholds.
- 25 January 2019: MEWG members to submit proposed additional mitigations and adaptive management practices to be triggered upon reaching of EWI thresholds.
- Spring 2019 – Teleconference Meeting: compiled additional mitigations and adaptive management practices to be triggered by reaching EWI thresholds suggestions to be presented to the MEWG.
- Spring 2019 – In-person Meeting in Ottawa: finalization of additional mitigations and adaptive management practices to be triggered by reaching EWI thresholds.

Although the proposed timeline presented above was agreed upon by MEWG members attending the 13 September 2018 meeting, no proposed species, indicators or thresholds had been submitted by MEWG members by 10 October 2018. A response was provided by Oceans North on 11 October 2018 via email indicating that they were not able to provide comments without input from the community and other decision makers. Due to a lack of responses from the MEWG, Baffinland extended the submission deadline to provide additional time for MEWG members to provide feedback. In response, Parks Canada subsequently provided a submission on 23 October, and Fisheries and Oceans Canada (DFO; Appendix C) provided a submission on 26 October 2018 (Appendix D). No other submissions were provided by other MEWG members.

The October submissions from MEWG members did not formally narrow down the list of species to which EWIs should be applied. Rather, it was suggested that they be applied to all marine mammal species. With regards to establishing thresholds, DFO suggested in their October 2018 submission that “any statistically significant change detected in any parameter measured should represent the “warning” indicator” (Appendix D). Parks Canada generally deferred to DFO for discussions on specific thresholds/monitoring plans due to their “*limited science capacity*” though suggested some variables to monitor as potential short-term, long-term and cumulative options (Appendix C).



On 29 November 2018, Baffinland met in person with the Mittimatalik Hunters and Trappers Organization (MHTO) in Pond Inlet, NU, to present the Framework and the MEWG submissions received to date, and receive the MHTO's feedback with regards to important indicators to the MHTO. During this meeting, the MHTO indicated that they were particularly concerned with the number of narwhals (population size), potential impact on calving rate, and narwhal body condition.

At the 10 December 2018 fall MEWG meeting, the feedback received by Baffinland on potential indicator species and variables for consideration as EWIs was relayed to MEWG members (Appendix E), along with a summary of variables that were of highest concern to the MHTO. The proposed variables presented during the meeting for consideration as EWIs included:

- Decrease in regional abundance
- Change in calving rate
- Ship avoidance behaviour
- Change in diving and surface behaviour
- Change in vocalization characteristics
- Increase in stress hormones
- Change in body condition
- Change in harvest data (age, sex)
- Injury/mortality occurrence

As part of these meeting discussions, the MHTO noted that both narwhal and ringed seals should be priorities, while the Qikiqtani Inuit Association (QIA) also provided support for the inclusion of bowhead whales (see Minutes in Appendix E).

Following group discussions, it was assessed that EWIs should apply to narwhal, and perhaps to seal, given the MHTO's concerns about the effects to seals. However, there remains uncertainty as to whether seals could be monitored in a manner that could adequately inform the EWI process. A take-away action from this meeting was for Baffinland to develop an EWI screening table to support future discussions regarding the selection of variables (and thresholds) for consideration as EWIs.

Accordingly, the EWI Screening Table (Appendix F) was submitted by Baffinland via e-mail to MEWG members on 26 February 2019 (Appendix E). The bolded variables, i.e., those considered suitable for use as EWIs included: decrease in narwhal regional abundance, change in narwhal calving rate, and change in narwhal body condition. The Screening Table (Appendix F) also included monitoring methods already being implemented as part of ongoing monitoring efforts associated with the Project that could continue to be used to effectively monitor variables selected as EWIs for narwhal. The Screening Table also requested that MEWG members provide proposed thresholds for these indicators. As part of this email exchange, Baffinland requested that feedback be provided by 31 March 2019. Only the QIA provided feedback to this EWI by 1 April 2019 (Appendix G). However, the feedback provided by the QIA did not provide specific thresholds suggestions, but rather indicated the challenges in providing such thresholds as *"Thresholds need to be biologically appropriate and logistically feasible"* and that the QIA *"cannot suggest thresholds without additional information"*.



The limited feedback provided by MEWG members during the process has contributed to delays in the timeline and prevented completion of specific milestones as proposed initially in September 2018, including finalizing the list of appropriate variables for use as EWIs, establishment of thresholds, and identifying additional mitigations and adaptive management practices to be triggered should EWI thresholds be reached during the 2019 shipping season. As such, Baffinland intended to present a revised timeline during the MEWG meeting held in Iqaluit, NU, on 21 June 2019 based on proposed meeting agenda and presentation slides sent to members (Appendix H). However, due to lack of time during the meeting, MEWG members were unable to further discussions about EWIs nor provide input on the revised schedule which was aimed at finalizing this process for the 2020 shipping season (Appendix H).

Next Steps

Baffinland intends to pursue discussions with the MEWG on EWIs at the next in-person MEWG meeting (currently scheduled for January 2020). It is Baffinland's intent to facilitate a discussion specific to EWIs and the identification of adaptive management practices that may be adopted if any of the EWI thresholds (once confirmed) are reached. It is Baffinland's intention to work with the MEWG to finalize this work in advance of the 2020 shipping season, but notes that this is fully dependent on the meaningful participation of MEWG members in accordance with the requirements of the term and conditions.

Appendices

Appendix A. MEWG Meeting – 6 June 2018

Appendix B. MEWG Meeting – 13 September 2018

Appendix C. Final MEWG EWI Submission – Parks Canada, 23 October 2018

Appendix D. Final MEWG EWI Submission – Fisheries and Oceans Canada, 25 October 2018

Appendix E. MEWG Meeting – 10 December 2018

Appendix F. MEWG Distribution – EWI and Threshold Screening Table, 26 February 2019

Appendix G. MEWG EWI and Threshold Screening Table – Qikiqtani Inuit Association Response, 31 March 2019

Appendix H. MEWG Meeting Presentation Materials – 21 June 2019



Appendix A:
MEWG Meeting – 6 June 2018

Marine Environment Working Group Meeting

Date: June 6, 2018

Location: Ottawa Delta City Centre
101 Lyon Street North, Ottawa, ON, K1R 5T9, Canada

Member Organization	Participants		Member Organization	Participants	
Baffinland Iron Mines Corporation (Baffinland)	Megan Lord-Hoyle (MLH)	I	Parks Canada	Francine Mercier (FM)	I
	Joe Tigullaraq (JT)	I	Makivik	Gregor Gilbert (GG)	N
	Emma Malcolm (EM)	I			
Qikiqtani Inuit Association (QIA) and Consultants	Stephen Williamson Bathory (SB)	N	Mittimatalik Hunters and Trappers Organization (MHTO)	Elijah Panipakoocho (EP)	I
	Sean Joseph (SJ)	N		Phanuel Enooagak (PE)	I
	Fai Ndofo (FN)	N			
	David Qamaniq (DQ)	N			
	Jeff Higdon (JH)	I	Observer Organization	Participants	
Fisheries and Oceans Canada (DFO)	Kim Howland (KH)	I	World Wildlife Fund – Canada (WWF)	Andrew Dumbrille (AD)	I
	Laura Watkinson (LW)	I		Amanda Main Hanson	P
Environment and Climate Change Canada (ECCC)	Grant Gilchrist (GG)	I	Oceans North Canada	Erin Abou-Abssi (EAA)	I
	Anne Wilson (AW)	N		Kristen Westdal	N
	Loretta Ransom (LR)	N		Chris Debicki	N
Government of Nunavut	Brad Pirie (BP)	I	Baffinland Consultants	Participants	
	Lauren Perrin (LP)	I	Golder	Patrick Abgrall (PA)	I
	Jon Neely (JN)	N	Golder	Erin Linn (EL)	I
	John Ringrose (JR)	N	Golder	Phil Rouget (PR)	N
			EDI	Mike Setterington (MS)	I

P-phone in participation, I – In person, N- Not attending

Discussion and Comments
Baffinland Project Update
<p>6MTPA Application</p> <ul style="list-style-type: none"> Baffinland has applied to the Nunavut Impact Review Board (NIRB) for an amendment to Project Certificate No. 005 to increase the amount of iron ore that the Company can truck and ship. Also included in the 6 Million Tonnes Per Year (MTPA) application is a proposal to build a 380-person camp and increase fuel storage at Milne Port. The application proposes that Baffinland Iron Mines (BIM) will truck 5.5 MTPA and ship 5 MTPA in 2018, and increase this to 6 MTPA for both trucking and shipping in 2019. AD: How many additional ships does this mean there will be in 2018? MLH: It would result in an increase in 12 ships in 2018. AD: So in an 80-day season does that mean 2 transits by Pond Inlet every day? MLH: Yes EAA: Will this mean that there are multiple ships coming through the corridor at once? MLH: Vessels will wait at anchor ports before being called into ship by the Port Captain. BP: What types of ships will be used for the 6 MTPA operations? MLH: Panamax ships will be used within the current shipping season. <p>Fuel freight dock</p> <ul style="list-style-type: none"> This is an approved activity under the Early Revenue Phase (ERP) Project Certificate, but this year we are seeking our Fisheries Act Authorization (FAA) to construct the freight dock. <p>Agenda Overview</p> <ul style="list-style-type: none"> EL: The purpose of discussions today will be to review proposed marine programs for 2018. The objectives of the marine monitoring programs are to measure effects of the Project on the marine environment, confirm monitoring of terms and conditions of the project certificate, assess accuracy of predictions in Final Environmental Impact Statement (FEIS), and determine adaptive mitigation measures.
2018 Tremblay Sound Narwhal Tagging Program
<ul style="list-style-type: none"> PA: Participation in the Department of Fisheries and Oceans (DFO) Tremblay Sound Narwhal Tagging Program allows us to retrieve better data related to narwhal acoustic sounds/communications, using Acousonde tags, and behaviour patterns (dive + movement). Satellite location tags will provide horizontal data and Pop-up Archival Transmitting (PAT) tags will collect vertical (dive) data. Data from the tags will be sent to satellites and land-based receiving MOTES for data collection and storage. This program will help us understand behavioural changes narwhal may be experiencing as a result of shipping activities based on the direction they head in, how close they go to the ship, their distance from the shore, and their rate of travel. AD: Have the results from the 2017 narwhal tagging program been shared with the group yet? PA: They have not yet been fully shared with the group, although preliminary results were discussed at the March 2018 MEWG meeting. We are expecting final results in Quarter 3 of 2018. AD: Does the DFO intend to complete their own analysis outside of the results that Baffinland produces? EL: The current focus on behavioural changes from shipping is not the primary focus of DFO. They have their own research priorities to support stock assessment and fisheries management needs.

- EAA: Who are the partners of the program?
- PA: The University of Windsor, Parks Canada, DFO and Golder are involved. Additional veterinary staff and other groups also participate, including the World Wildlife Fund (WWF).
- AD: Discussing this without having DFO in the room has been an ongoing issue with the MEWG. We did say that we were going to try and encourage participation from a marine mammal expert from DFO, but it seems like there is a huge gap without DFO being here.
- KH: I have encouraged marine mammal experts from DFO to participate in the meetings, but perhaps because Golder is here DFO may already feel the consultants have a thorough understanding of the data and program.
- MLH: Baffinland has also tried to request for marine mammal experts from DFO. It would be beneficial if another organization from the MEWG could volunteer to send a letter to DFO and NIRB requesting participation from one of their members. Golder is here, however, and able to present on the data that is relevant to BIM's monitoring for our own objectives. We also have the right information to present on the data that is relevant to BIM.
- PA: This year we will be getting additional information on fine-scale impacts, for example specific information relative to impacts on narwhal from shipping. Baffinland and DFO will be installing 2 new MOTE stations in 2018, for a total of 4 MOTE stations. These stations provide an opportunity to collect enhanced information on positions and movements of the narwhal. Adding 2 more MOTE stations will also give us the opportunity to collect additional fine-scale information across a broader geographical extent.
- EAA: Has behavioural changes been identified in the data – for example, are narwhals diving to avoid the ships? Is this something that's being looked at?
- PA: This will be included in the results if it is relevant.
- KH: With the shore-based land receivers, could a location be put in that would help the communities to understand the effects of other ship traffic (e.g. cruise ships) that could also be affecting the communities of Pond Inlet – or ship traffic near Pond Inlet?
- PA: We will be discussing locations of the shore-based station with MHTO later in consultation with the communities. We will determine a location that is suitable to them, but also allows for maintenance on the MOTE (as required) and will provide the best data relative to understanding interacting with shipping for the Project.
- AD: It is difficult to comment on this program without all of the results or without understanding how the data is going to be used in conjunction with other monitoring programs.
- EL: This is a DFO program so the program is running regardless. We are contributing to this through our tags and logistic support, and we are looking at studying what's happening in terms of relationship with shipping (Baffinland). The other elements of program are up to DFO.
- KH: Marianne Marcoux at DFO has informed me that we can expect DFO's results over the next couple of years.
- GG: It would be beneficial to the group, and likely to the collaborators, if there was a spreadsheet of all the programs/components and researchers, so that we understand which partners in the collaboration are using which data sets, analyzing it, reporting it, etc. Each group may have a different time frame. It would be helpful to know who controls which.
- MLH: That's an excellent suggestion, and Baffinland can have Golder put that together. That is often what happens with government research, but as a proponent we have a responsibility to turn these results around. Given that this is a much larger program, it would be beneficial to share what the group roles and responsibilities are. We are only able to discuss what information is available for Baffinland objectives, and there is still value in us seeking feedback from the MEWG without the results.

- JH: The issue is that we can't discuss how things should be done in 2018 until we see results from 2017.
- PA: We are still going to use this as an opportunity to share what we learned in 2017 to inform changes to the program in 2018.
- AD: Does Golder believe that the 2017 tagging program met the set goals? Was it successful? Did it allow the determination of shipping impacts on narwhal?
- EL: Yes. The DFO has also agreed that it is one of the most successful programs they have ever run and there was consensus that a second year with a finer scale data will be very valuable. This program will allow us to understand potential impacts at far more detail than programs prior to 2017. We really feel this will give us the information we need to make informed decisions, and to assess how narwhal are responding to vessel traffic to make informed decisions.
- AD: Should the MEWG recommend that there not be an increase in shipping until we have those results? We don't know the effect that is occurring, so maybe we should recommend that the Project footprint be frozen until we know the effects.
- EL: We do have an understanding of how narwhal are responding to shipping, but we do not have final results from this tagging program to present at this meeting.
- AD: We need to see results and discuss adaptive management. We don't do this at the MEWG.
- MLH: Full results from the tagging program are not available, but all other results from every other program are and have been discussed on an annual basis. All other monitoring reports are also available. WWF did not participate in the last MEWG meeting where the 2018 results were the focus of discussion – but these results are available and have been distributed to the MEWG. In this case we do not need the complete data set to help inform this year's program. Further, on of the intention of this group is to provide advice and guidance on the design of programs.
- EP: The study with DFO is very useful because at Bruce Head we observed and counted narwhals and estimated of whale numbers. The time to do this study was a long time ago, before you even thought of shipping your ore by boat. We have seen that narwhal behaviour does change when the ships are in the area. We had some video tapes to look at Greenland sharks and narwhals, and we did an estimate of where the ships would be. Nowadays we have cruise ships and so on; in my community they started shipping and using a sealift. When hunting in the spring and fall, the ship comes through then usually we have a school of narwhals. Now that you have a sealift this year, we didn't see any, so we feel shipping has affected narwhals. The tagging program will be useful to tell us if narwhals are fleeing. Seals are smarter than narwhals and will go a distance to get away from noise. Yes, the study is good – but it's too late.
- PE: Our observations of the movements of narwhals in Pond Inlet are similar to what EP is saying. Yes, because we are affected by the activity in our area, we do not want it do any harm to the wildlife in our area. Do it well and do it right.
- PA: Yes, it would have been helpful to have baseline, but we are still getting good information now that can inform decisions later.
- GG: What they are most interested in is in the next meeting seeing a table of topics with all of the topics and persons responsible etc. This could give us a sense of the number of people responsible for managing the data.
- MLH: Golder to provide this in the next meeting.
- FM: We are very impressed you are still looking to improve the data collection for 2018 – not everything is negative about this program. I think it will be very useful for understanding these key issues.

- We have 5 consecutive years of data from Bruce Head. In 2018, we are integrating an acoustic component and running a pilot program from vessel-based observations, rather than from the cliff face at Bruce Head. We are also going to integrate the use of drone video and still photography, which is one of the recommendations that has been made by the MEWG in the past.
- EP: What I saw at Bruce Head is that the narwhals were fleeing when the boat came. Once the boat was gone they will go back to their areas. When a boat is passing by, as long as they are not loading or offloading, if they are just passing through, it is not as scary to them. The boat that you see went to fjord to load or unload this is what upsets the narwhal because the boat travels faster. I think we need to tell the operators that once they are close to the land they need to tell the operators to slow down so it is not as noisy.
- PE: Hunters hunt and travel that route. We used to have narwhals in our ocean and they move away now. When you're a hunter at the fjord there is already a strong current. Once you increase the ship traffic, the hunters will be affected. If the ships were to go another way – not directly by Bruce Head – there should be another travel route.
- AD: Why is this is not at the same location as last year?
- EM: The Bruce Head platform blew off last fall during a high wind storm after the program was over. Baffinland is doing an internal safety audit and the Bruce Head monitoring area cannot be used until this is completed.

Ship-Based Observer Program

- There is an opportunity in 2018 to reinstate the Ship-Based Observer (SBO) program with the use of an Ice Management Vessel (IMV) to support shipping season for 2018.
- AD: In 2017, did you hire an IMV but end up not needing it?
- MLH: That is correct – in the end it wasn't needed.
- AD: Will they still be running this program even if the IMV isn't needed?
- MLH: The contract with the IMV includes supporting Marine Mammal Observers (MMOs) surveys.
- LW: Will the IMV stay in the area all season, or would it only be present during the shoulder seasons?
- MLH: The vessel will come in to the area for the start and end of the seasons, but will not be in the areas during the open water shipping season.
- AD: A few years ago, part of the ambition around the observer program was that the observers would also help with navigation and give advice to the captain of the ships about observing whale pods or maneuvering around certain areas. This seems like a good opportunity between the IMV and ore carriers and around some of these issues. I think this year there is going to be improved communications between the captains of ships and the communities. There is a good opportunity with this program to put this into practice.
- MLH: Baffinland will be in Pond Inlet tomorrow to talk about vessel traffic management and opportunities for improved communications.
- JH: We had a call a couple of weeks ago and we discussed this program – and we talked whether the MMOs will implement the Canadian Wildlife Service (CWS) protocol – so if I understand correctly that this has been revised and improved since that last call.
- PA: Yes, we were able to confirm with CWS that the program protocol design was appropriate and aligned with CWS.
- JH: Will the same MMOs participate in both the July and October programs, or will 4 separate MMOs participate?

- PA: We are going to consult on the HTO with this to determine what would be best.
- GG: This is a unique opportunity because CWS does not have the resources to conduct ship-based monitoring at this time. The protocol is accessible, and the data collected can be uploaded into a national database, so the research can be easily integrated with other data sets. There may even be an opportunity for Inuit MMOs to learn the protocol and how to upload into the database.
- GG: What have the narwhals been feeding on?
- EP: We look at stomach contents to see what they eat – trout, cod, lake fish, freshwater fish – also deep-water fish like turbot, certain kinds of crabs, and arctic char. Narwhals eat more deep-water fish than belugas.

Discussion on Ship Traffic Concerns

- EP: The hunters are worried about the narwhals. We wish for the ships not to get too close to that hunting area, so the narwhals don't leave. The area near Milne Inlet – there are cabins. People summer there in their cabins – it's a very good hunting area and we also camp along (BH) area towards Koluktoo – there are other hunter cabins along Milne Inlet where people are – it's too close the route.
- PE: The ships are not staying at the docking station; they are drifting. They are being told to stay at their docking stations, but they are still going there.
- MLH: Thanks for the comments. These are concerns that Baffinland has heard before as well. We will be talking in more detail to these concerns at the meeting in Pond this week – and additional management measures that we will be implementing this year to share with HTO in Pond. Input from community members and from the MEWG has shaped some of our operational procedures to date including:
 - All vessels having to follow the 9 knot limit, not just ore carriers.
 - Ensuring vessels stay near anchorage locations –and holding until vessel one coming north/south has passed a certain point.
 - Not having more than 3 vessels at anchorage locations.
 - Update the Standing Instructions to Master (SITM) to support improved vessel management.
- EP: I believe that vessel traffic should be very tightly controlled while one dock is loading, and that once the other boat has left, a few days later the other one can come. You should not have 2 ships loading or unloading at a time. Hunting provides our subsistence. So what we say to you is that you have to respect our food source and our lives. There was a lot of ships parked at Ragged Island last summer, and many of these ships that are supposed to park at Ragged Island drifted off and ended up getting in the way of harvesters. Drifting vessels sitting at anchorage locations are conflicting with harvesters. HTO is suggesting to minimizing the number of ships that are parked at anchorage locations.
- MLH: Baffinland is committed to working with the community to minimize any potential effects to the communities' traditional lifestyle and subsistence – we need to continue to work with the community – to be respectful because we know how important this is for the community.
- EAA: Nunavut Tunngavik Inc. (NTI) is concerned that hunters are losing control of the water and their ability to harvest. NTI is running a program to make sure that guidelines of where ships can go is being followed.
- EP: We can inform you from HTO how it has affected us and the community and environment. QIA should be helping us, and we can use additional support from QIA and we need to have a coordinated approach with them. However, it is very hard to get across to people who don't value Inuit Quajimajatuqangit (IQ) and experience and it is very frustrating. We have a lot of concerns and need to work together and it is

<p>better to be honest with your partners. We need to coordinate to protect the environment and our own lives.</p>
<p>Grant Gilchrist's Presentation: Inuit Science Training Program</p>
<ul style="list-style-type: none"> • JH: This is a fantastic program. • JT: This would be great if your group can present to high schools to inspire students to join this program and hear about these opportunities and opportunities to work in science and environmental studies • KH: Will the program only focus on teaching protocols that are relevant to your studies, or will there be a broader training program as you upscale? • GG: There will be other scientists who have other backgrounds including contaminants, water, vegetation and how local knowledge is complimenting scientific understanding / research occurring in this area. • The first summer will be with individuals from Coral Harbour. As we move our field stations, we will recruit from different communities that are nearby. The goal with the program is long-term mentorship.
<p>Marine Ecological Effects Monitoring Program (MEEMP)</p>
<ul style="list-style-type: none"> • EL: We have had the opportunity to revise and update the 2018 program. Based on our 2017 field season feedback from the Working Group through discussions and comments on the reports, the 2018 MEEMP program has undergone some changes. It is important to note that to date we have not seen any project related effects in the marine environment, or on water quality. • Benthic infauna was added as a study component in 2018, added this so we can also monitor for potential changes in the local infauna community. This will occur while we are completing our sediment samples at the same transects. • KH: I thought we were doing benthic infauna sampling last year? • EL: It is more than just doing the grab samples. Last year focused more on epifauna and epiflora. Some of the updates that have been made to the benthic epifauna and epiflora were based on comments received from MEWG members. This year we are going to be putting out and monitoring 10 rectangular belts (5 in study area / 5 reference points). • KH: Will having similar types of habitat in the reference areas be attempted? I would recommend you find a reference location with similar habitat types – ideally these should be comparable to the impact areas. • EL: These will be set primarily along in the existing transect areas. Exact locations will be set and that similar reference locations will be a consideration/factor.
<p>Marine Fish</p>
<ul style="list-style-type: none"> • Based on feedback received from Inuit technicians, the Working Group, and regulatory comments we are proposing to increase sampling efforts for fish. Last year we added quite a few additional techniques for fish sampling. The sampling program will occur 2 to 3 times over the 6-week program. Previously we have not sacrificed any fish for taxonomic analysis. Last year there were 2 incidental mortalities. HTO members have asked us to send more arctic char to the lab for body burden analysis – so we are going to increase this to 10 in 2018, with the HTO's approval. The Working Group also requested to see shellfish samples for taxonomic analysis so we will be adding this as well.
<p>Aquatic Invasive Species (EIS)</p>
<ul style="list-style-type: none"> • In 2017 we expanded this program to Ragged Island and increased the number of sampling areas at Milne Port. At previous MEWG meetings we discussed improving taxonomic identification, so for 2018 we are

proposing to send for DNA analysis if we are unable to identify through taxonomy. Last year we contemplated running a dive program. Due to health and safety reasons, we could not do this so we have developed solution (similar to 2017) to monitor hull biofouling via Remotely Operated Vehicle (ROV).

- KH: Was there anything mentioned about settlement plates?
- EL: Last year we collected the settlement baskets, they had little colonization, and we redeployed them and new settlement plates. We will be collecting them for analysis this year. The results of these reports were distributed to the MEWG in February of 2018.
- AD: Are ship emissions being monitored? Are there thoughts of doing that?
- MLH: We do monitor all emissions at the site and at the port site. Currently we don't monitor or report on this for vessel transits.
- FM: It was said that tidal gauges will be reinstalled at the dock. We had a conversation about whether the ballast water discharge could affect tidal gauge readings.
- EL: The location of the tidal gauge may still need to be refined and will have to be considered relative to discharge.
- FM: Most of Parks Canada's comments on the annual reports were responded to and have been incorporated into the report / program design.
- EL: I would like to request feedback on the MEEMP program (specifically around catch / kill for fish for taxonomic analysis).
- EP: We have not gotten information about what happened to the fish that died when you were analyzing them. When it comes to tools from when we were working on the dock, the people that were drilling in the ocean, and explosives that you may have used when you were building the dock may have killed them. Maybe metal is also making them die off. We were informed recently that Greenland fish are now making it into our oceans so we may have invasive species from climate change that could affect our wildlife. The Greenland species eat the smaller fish. They are unsafe to eat because they are new to us and we have been informed that they are unsafe to eat. We know that the body burden analysis you did with the incidental mortalities will help us have a better understanding of any effects that are occurring.
- EL: On incidental mortalities – within the monitoring program, we are setting short-duration gill nets; two of the arctic char in the sampling program were not able to be released alive. Through the capture process they were injured and were euthanized. They were sent to the lab for body burden analysis, with weight, age class of the fish determined. Fish ages were 4 and 7, but need to check ages, and body burden analysis did not result in consumption concerns.
- KH: Do we know if the Greenland species is the same species that Baffinland was observing as well?
- EP: On the two invasive species; we are not used to seeing that fish, it is by Ragged Island, it was a small fish, foreign fish, saltwater fish. The man who caught the fish brought it to HTO to see what kind of species it was. It was sent to a lab and they were informed in Greenland they have that fish. This may have come from the ballast water. Our wildlife species are changing a lot.
- KH: Were there species that may have been new?
- EL: None of the fish species we captured last year were deemed to be aquatic invasive species; however a sand lance, was captured for the first time in the sampling program in 2018.
- EP: Could it be a capelin?
- EL: A capelin isn't considered an invasive species in the Canadian Arctic, they are already occurring. If you are seeing more capelin, it is likely due to increased populations or extension of ranges, but not something that was being introduced by ballast water.
- KH: Have new species that were documented been sent for a second lab analysis? Another level of classification would be useful to confirm.

- EL: This year we will complete DNA analysis if there is any uncertainty in the program. Will look into whether lab samples from last year are still available for a third level classification.
- KH: With our invasive species program – we preserve things in 90% ethanol – because it helps preserve some species. Another option is to do one in ethanol and one in formalin.

WWF Eastern Arctic Mariners Guide - Presentation from AD

- Discussed increase in ship traffic over the past couple of years. 11% of all traffic in the Arctic comes from the Mary River Mine.
- One objective of the mariner guide is to operationalize relevant Nunavut Impact Review Board conditions from Mary River Project and the draft Nunavut Land Use plan.
- Baffinland is reducing all vessels (including ore carriers and other vessel types) ship speeds to 9 knots – which is a really good example of adaptive management. Baffinland is also considering incorporating the WWF Guide into the SITM.
- WWF is looking to have these embedded into Canadian Hydrographic Services Charts.
- BP (seconded by MLH): has the WWF analyzed the percentage of the tonnage? AD had said that 11% of the total traffic in Arctic is from Mary River.
- AD: The 11% is the distance travelled in the Arctic based on km travelled by ships, not just ship traffic or number of vessels. We have all the automatic information system ship data from 2016 for the Arctic – which I can happily share with the group.
- MS: Why was Baffinland's shipping route highlighted on the Eastern Arctic Mariner's Guide when no other shipping tracks in the area were?
- AD: Because it is the biggest development this region has seen, so we are using this as an education tool. There are other well developed routes, but Baffinland is the only one that has a defined shipping route through the North Baffin Region Land Use Plan.
- EP: One other concern from the HTO is that there are many ways of doing studies and different methods. We don't mind the audio equipment, but the elders in our community did not like the tidal monitor because the animals can hear the echo and noise. I believe the tidal wave monitor may drive marine life further away from the community
- PA: For the tidal gauge – we are not emitting any sonar – they are strictly collecting passive data and monitoring the tides. For current monitoring, the Doppler does emit a high pitch sound that is well above the range of narwhal auditory range (it's high frequency, higher than what narwhal are hearing) so narwhal would have to swim directly above it to be influenced by it, although they still shouldn't be hearing or noticing them.

Thresholds / Early Indicators for Adaptive Management

- MLH: Several comments were submitted to NIRB on Baffinland's 2017 Annual Report by reviewers of organizations who participate in the MEWG regarding the status of Baffinland's development of a framework for early warning indicators and thresholds. The MEWG is the forum through which these types of concerns should be raised and discussed, and as indicated in Project Certificate Conditions 110, 111 and 112 this is to be developed in concert with the MEWG. However, while concerns related to the status of compliance with PC Conditions 110, 111 and 112 were raised in comments to NIRB, we are yet to have these types of discussions at the MEWG. We would like to propose to spend time today discussing these, and hearing the group's recommendations for the development of thresholds and early-warning indicators.

- EP: There is collective concern about the impacts – from hunters especially – those who are not employed with full time jobs. In 2011 when QIA approved going ahead with Baffinland, when we were working on protecting animals and wildlife in the environment, operating safely, and supporting each other and networking. We don't mind the way it is going ahead but if we had prepared ourselves more in the beginning and QIA was operated and managed by Inuit – then we would partner with Baffinland on an equal basis. I believe we need to focus more on listening to IQ because our Inuit values have informed us and kept us alive for so many years. It is very important that we think critically and work together to keep things safe and healthy.
- PA: It is important to collect IQ knowledge, and this is why it is so important for Baffinland to include Inuit in monitoring programs and consult with them on the project and on the monitoring programs.
- AD: Indicators and thresholds mean something different to other people We could develop a process over the next year where would could debate this and come up with collective thoughts. Also, the seals were not around last fall for the hunt – that is probably an indicator that it can be tied to shipping activity, so that's an example of a potential indicator. Noise thresholds; how much ship noise there can be before it affects the narwhal, also one ship at a time is a threshold. Based on community feedback, what is too much shipping – some of them are social values and some of them are scientific values. We could table this for the next call so that people can research and put some ideas together.
- MLH: The takeaway is that individuals who are interested in this conversation can do some research and come to next discussion with ideas of what they would like to see, and Baffinland can try to formalize this process. We do, however, need a better idea of what you are looking for. So when comments have been submitted about indicators and thresholds – what specifically are you looking to see?
- JH: The comments are based on the terms and conditions from NIRB – and so we need their input on this.
- KH: We can comment on whether or not the approach we've used is going to be able to detect changes – e.g. does your data have enough variation for you to detect a change to the level or granularity that you can detect a change for a set threshold.
- MLH: We don't want to lose sight of the fact that these thresholds have already been developed for the approved project – so maybe the question is where do you put your time and resources for best understanding the objectives.
- JH: At a broad level, coming up with these thresholds is fairly simple; for narwhal you can have both scientific and social thresholds. If we can't actually detect a 10% change, then the threshold is relatively useless so we need to give it more thought. I would suggest we go back to looking at Valued Components (VCs) as a guideline to flesh out everything else from there.
- MLH: There doesn't seem to be as much concern in areas where there are already regulatory guidelines; concerns are more where there are less established guidelines (e.g. fish populations / narwhal populations, etc.).
- MS: There are thresholds on both the marine and terrestrial side. In some cases, we have always predicted that narwhals would respond to ships; we expect that 100% of narwhals would swim away from ships but that doesn't mean we are having an effect. It is a fine line between threshold of response and effect at a population level. On the terrestrial side, with power analysis we have been able to understand our detection levels but this still doesn't mean we have a clearly defined threshold per se or an effect. If EP says there were no seals to hunt last year – well that is a big threshold. We cannot wait for NIRB to come up with thresholds – that is what the NIRB has mandated the Working Groups to do.
- EP: The narwhal might get used to the traffic over the years – but animals do not adapt very quickly. Fish numbers are different every year. We eat seals every day so we don't want to lose that food source at all. When they come back, if they are familiar with ship traffic and noise hopefully they will get used to it and

come back. Caribou are our land animals, they can go a long distance, so we believe if they are affected by the mine they will go away and maybe they will never come back. This is the food source we are talking about – both land and sea. From my understanding the shipping does affect the narwhal.

- MLH: I suggest to look at the Final Environmental Impact Statement (FEIS) – indicators for thresholds – and circulate with the group.
- MS: These are geared towards identifying something that is much earlier than a major significant impact.
- KH: If suggestions are made, are they likely to go anywhere? Because I've made suggestions in the past – but then they are not necessarily incorporated into monitoring programs.
- MLH: Baffinland would have to evaluate what the recommendation was – but we have clearly demonstrated that we have taken recommendations into consideration and operationalized them. My question is we are getting comments requesting for development of early warning indicators – so we are still unsure of whether or not your concern is related to fulfilling the question in the terms and conditions – or whether you have an idea of just trigger points. I think one of the benefits of the MEWG is that it can help inform evolving best practices for Baffinland.
- KH: Are thresholds developed? Will we need to develop adaptive mitigations?
- JH: The caribou decision tree that was developed by Baffinland – impact / action, and suggests looking into developing a similar tool for noise related to narwhal, or maybe a cumulative noise budget so that total noise vs behavioural response is looked at.
- PA: This is an example of what we can consider to determine if it is possible to assess this or measure with enough precision, etc. That way we can take this further as a possible threshold.
- EL: This discussion has been spurred on by comments received from MEWG members – and the directions in Project Condition (PC) 110 and PC 111 which say that it is the responsibility of the MEWG to come up with this, so it is important that each party is making real contributions. At the same time, if we can corroborate this with results from the narwhal tagging program, we can have a much more structured and productive conversation.
- JH: When QIA makes comments that Baffinland is out of compliance with PC 110 and 111 – this is the definition of early warning indicators that are being referred to.
- FM: This is why we need a marine mammal expert from DFO, so at the very least they can provide us with input regarding thresholds, as a starting point.
- EL: We can agree that at the next MEWG meeting, each of the working group members will come prepared to discuss thresholds and early indicators for adaptive management.
- MEWG members agreed to have thresholds and early indicators for adaptive management as an action item for the next in-person meeting.

Timing of Meetings: Suggestions

- The floor was opened to anyone with suggestions / recommendations to alter schedule of meetings.
- BP: It was beneficial for them that the meetings for the annual report review had just occurred because it allowed for really productive conversations. It is really difficult to get technical experts in for spring meetings.
- MLH: We can try and keep this in the end of May for next year, or get technical experts at one of the meetings. Is the group OK with still having an August call and then next face-to-face end of November in Iqaluit? Baffinland feels the 4 meetings per year are productive to ensure ongoing communication and allow for full participation.
- MEWG agreed this was a good next step.

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	Action Item	Action By	Update
1	MLH to look back at FEIS indicators for thresholds and circulate with the group.	Baffinland	These were reviewed and considered in development of EWI framework.
2	Golder to support Baffinland in providing some structure in next meeting relative to PC 110 111 and 112 and get confirmation from group on whether or not this should be scoped just to PC 110, 111 and 112.	Baffinland	EWI framework was based on description of objective as outlined in PC 110, 111 and 112.
3	Provide summary of what we heard in this meeting, share with this group, and assign some 'homework' to be done in advance of next meeting.	Baffinland	Partially-Complete on July 11, 2018. MEWG meeting minutes summarize what was discussed at the meeting. Correspondence sent with draft MEWG meeting minutes requesting MEWG participants to provide thoughts regarding framework for early-warning indicators in advance of next MEWG meeting.
4	On MEEMP: This year we will complete DNA analysis if there is any uncertainty in the program and will look into whether lab samples from last year are still available for a third level classification.	Baffinland	
5	On ballast water: MLH to follow up and share information about specific discharge locations.	Baffinland	If ballast water testing is performed while vessel is at Milne anchorage, then ballast water is discharged at Milne anchorage. If ballast water testing occurs when vessel is alongside Panamax Dock, then ballast is discharged alongside.
6	Consider whether or not Desgagnés MMO program has opportunity for cross-collaboration with our own SBO program.	Baffinland	Baffinland seeking more information from Desgagnés Group on the MMO program.
8	On DFO: Request that someone from the MEWG write a letter to Baffinland / DFO writing a letter to request marine mammal expert participation in the Working Group. Jeff to bring this request back to QIA – to see if they will write a letter requesting DFO participation in the group.	QIA	

9	Prepare a tagging table with all of the topics, persons responsible, which partners in the collaboration for the next meeting.	Golder	Golder will provide an update table for the Tremblay Sound Ecosystem Approach 2018 Program including components and contributors for the 4 th MEWG meeting of 2018.
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Appendix B:
MEWG Meeting – 13 September 2018



Marine Environment Working Group

Thursday September 13, 2018

10:00 am – 12:00 pm (EST)

Call-In Number: +1-416-607-0170 **Access Code:** 990 832 957 #

Member Organization	Participants	Member Organization	Participants
Baffinland Iron Mines Corporation (Baffinland)	Megan Lord-Hoyle (MLH)	Parks Canada	Francine Mercier (FM)
	Joe Tigullaraq (JT)	Makivik	Gregor Gilbert (GG)
	Emma Malcolm (EM)		
Qikiqtani Inuit Association (QIA) and Consultants	Stephen Williamson Bathory (SB)	Mittimatalik Hunters and Trappers Organization (MHTO)	Elijah Panipakoocho (EP)
	Sean Joseph (SJ)		Phaniel Enooagak (PE)
	Fai Ndofo (FN)		
	David Qamaniq (DQ)		
	Jeff Higdon (JH)	Observer Organization	Participants
Fisheries and Oceans Canada (DFO)	Kim Howland (KH)	World Wildlife Fund – Canada (WWF)	Andrew Dumbrille (AD)
	Laura Watkinson (LW)		
Environment and Climate Change Canada (ECCC)	Grant Gilchrist (GG)	Oceans North Canada	Kristen Westdal
	Anne Wilson (AW)		Chris Debicki
Government of Nunavut	Brad Pirie (BP)	Baffinland Consultants	Participants
	Lauren Perrin (LP)	Golder	Patrick Abgrall (PA)
		Golder	Erin Linn (EL)
		Golder	Phil Rouget (PR)

Agenda

Time	Activity
10:00am – 10:30am	Baffinland Update (Baffinland)

2275 Upper Middle Road East, Suite 300 | Oakville, ON, Canada L6H 0C3

Main: 416.364.8820 | Fax: 416.364.0193 | www.baffinland.com



Time	Activity
	<ul style="list-style-type: none"> • 2018 Shipping Season Update • 6MTPA production and shipping increase application • Phase 2 EIS Submission
10:30am - 11:00pm	2018 Marine Monitoring Programs Update (Golder) <ul style="list-style-type: none"> • Tremblay Sound Narwhal Tagging Program • Bruce Head Vessel-Based Monitoring • Ship-Based Observer Program • MEEMP • Physical Oceanography • Ballast Water Monitoring Program
11:00am – 11:30pm	Adaptive Management Framework Development Template <ul style="list-style-type: none"> • Overview of how to use template • Next steps
11:30am – 12:00pm	Roundtable and Action Items



Identifying Early Warning Indicators and Thresholds

The following Project Certificate (PC) Conditions are relevant to the identification of Early Warning Indicators (EWIs) and thresholds.

Project Certificate Condition 110: Marine Environment – Ship Noise

“The Proponent shall immediately develop a monitoring protocol that includes, but is not limited to, acoustical monitoring, to facilitate assessment of the potential short term, long term, and cumulative effects of vessel noise on marine mammals and marine mammal populations. The Proponent is expected to work with the Marine Environment Working Group to determine appropriate early warning indicator(s) that will ensure rapid identification of negative impacts along the southern and northern shipping routes.”

Project Certificate Condition 111: Marine Environment – Ship Noise

“The Proponent shall develop clear thresholds for determining if negative impacts as a result of vessel noise are occurring. Mitigation and adaptive management practices shall be developed to restrict negative impacts as a result of vessel noise. This shall include, but not be limited to:

- a. Identifications of zones where cumulative noise could be mitigated due to biophysical features (e.g., water depth, distance from migration routes, distance from overwintering areas etc.);
- b. Vessel transit planning, for all seasons, to determine the degree to which cumulative sound impacts can be mitigated through the seasonal use of different zones.”

Project Certificate Condition 112: Marine Environment – Ship Noise

“Prior to commercial shipping of iron ore, the Proponent, in conjunction with the Marine Environment Working Group, shall develop a monitoring protocol that includes, but is not limited to, acoustical monitoring that provides an assessment of the negative effects (short and long term cumulative) of vessel noise on marine mammals. Monitoring protocols will need to carefully consider the early warning indicator(s) that will be best examined to ensure rapid identification of negative impacts. Thresholds shall be developed to determine if negative impacts as a result of vessel noise are occurring. Mitigation and adaptive management practices shall be developed to restrict negative impacts as a result of vessel noise. This shall include, but not be limited to:

- c. Identification of zones where noise could be mitigated due to biophysical features (e.g., water depth, distance from migration routes, distance from overwintering areas etc.);
- d. Vessel transit planning, for all seasons.
- e. A monitoring and mitigation plan is to be developed, and approved by Fisheries and Oceans Canada prior to the commencement of blasting in marine areas.”



BACKGROUND

RELEVANT PROJECT INDICATOR SPECIES:

Marine mammals and marine mammal populations.

PROJECT ACTIVITIES THAT COULD INTERACT WITH INDICATOR SPECIES:

Shipping – Noise created by vessels

POTENTIAL PROJECT EFFECTS:

- Acoustic Disturbance
- Change in animal distribution in the region
- Change in abundance in the region
- Alteration of migration patterns
- Availability of marine mammals for harvesting

Early Warning Indicator Submission Guidelines

To aid in the submission process, the following guidelines have been drafted for use by the MEWG members to help provide a consistent streamlined process. The submission guidelines are outlined below.

General Guidelines:

- EWIs are to be identified for marine mammals and marine mammal populations only as indicated in Project Certificate Condition 110.
- EWIs should allow for evidenced changes to the indicator species or population.
- EWIs should be characteristics of marine mammal behaviour, population distribution and abundance, habitat use that can be effectively observed and/or quantified through monitoring programs. This means monitoring programs being currently or previously undertaken or potentially new monitoring programs that can be realistically undertaken to detect these EWIs, should they occur.
- More than one EWI can be proposed for a species.
- The same EWI can be proposed for multiple species.

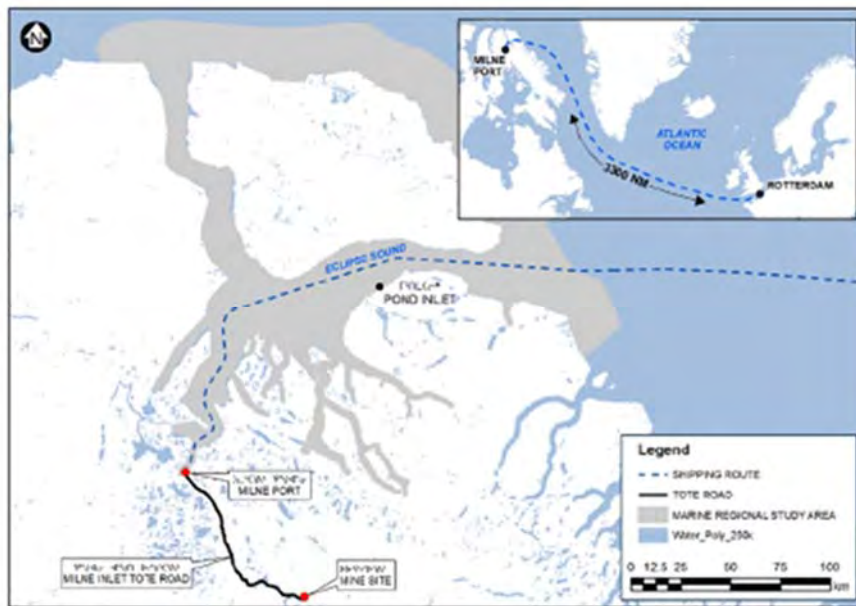
Step by Step Process:

The development of early warning indicators should consist of the following steps:

Review of potential effects / interactions

Consider and define what potential effects you think the Project could be having on marine mammals.

- Potential effects need to be directly related to the specifics of the approved project, be likely to occur and be within the geographical scope of the project's area of influence.
- For context, the relevant project operation is the shipment of iron ore through the Northern Shipping Corridor during the open-water season.
- The geographic extent is based on the Project's area of influence (e.g within the Northern Shipping Corridor, which encompasses Milne Inlet, Eclipse Sound, Pond Inlet and adjacent water bodies). See Figure 1 below:



Selection of early warning indicators:

- The early warning indicators should clearly indicate how the noise from Project-vessels are interacting with indicator species (e.g. narwhal) and be measurable through a quantifiable threshold.
- Indicators could be the number of individuals using an area (regional abundance), the type of individuals using an area (e.g. mother-calves), a change in the timing of the area being used (e.g. arrival date in an area or departure date from an area), or other characteristics of individual marine mammals or populations.
- Indicators should speak to a change that has occurred which is likely to be a direct result of noise from shipping activities.

Determine Appropriate Threshold for Indicator Species:

- Thresholds are limits of “acceptable change”.
- Quantitative thresholds need to be identified to determine whether the effect of noise from shipping activities is resulting in “acceptable changes” to an indicator (i.e. marine mammals).
- Examples of thresholds include the number of individuals or type of individuals in a regional population, a percentage decrease in the number of individuals or type of individuals in a regional population, and an arrival or departure date from an area.



Timeline for MEWG Development of EWIs

The following timeline has been created to introduce and develop the Early Warning Indicators as a group and promote participation from MEWG members and MEWG observers as per the above Project Conditions.

- 13 September 2018 – MEWG Teleconference Meeting: present Early Warning Indicator Submission Sheet to the MEWG.
- 11 October 2018 – 4 weeks following Teleconference Meeting: MEWG members submit their EWI Suggestion Sheet(s).
- December 2018 – In-person Meeting in Iqaluit: MEWG members to review the compiled suggestions and select appropriate EWIs and corresponding thresholds.
- 25 January 2019: MEWG members to submit proposed additional mitigations and adaptive management practices to be triggered by reaching EWI thresholds.
- Spring 2019 – Teleconference Meeting: compiled additional mitigations and adaptive management practices to be triggered by reaching EWI thresholds suggestions to be presented to the MEWG.
- Spring 2019 – In-person Meeting in Ottawa: finalization of additional mitigations and adaptive management practices to be triggered by reaching EWI thresholds.



Early Warning Indicator – Submission Sheet

Indicator species or population: _____

Proposed Early Warning Indicator: _____

Proposed Threshold: _____

Indicator species or population: _____

Proposed Early Warning Indicator: _____

Proposed Threshold: _____

Indicator species or population: _____

Proposed Early Warning Indicator: _____

Proposed Threshold: _____

Indicator species or population: _____

Proposed Early Warning Indicator: _____

Proposed Threshold: _____

Indicator species or population: _____

Proposed Early Warning Indicator: _____

Proposed Threshold: _____

Indicator species or population: _____

Proposed Early Warning Indicator: _____

Proposed Threshold: _____



2018 Summer Update

MEWG Meeting
13 September 2018



Baffinland Project Update

1) 2018 Shipping Season Update

- Start of shipping season and IMV
- Vessel transits and ore shipped to-date
- Vessel traffic management updates
- Fuel Spill

2) 6MTPA Application

3) Phase 2 EIS Submission

Baffinland Project Update – Shipping Season Overview

- ‡ Shipping season officially commenced on July 20
- ‡ Notification of start of season was provided to Hamlet of Pond Inlet and MHTO on July 20
- ‡ Ice management vessel was active from July 20 to August 10
- ‡ Ice management vessel is expected to re-enter Inlet September 28
- ‡ To date:
 - Ore carriers: 41
 - Fuel tanker: 3
 - Resupply: 3

Baffinland Project Update – Shipping Season – Vessel Traffic Management

- ✚ Baffinland held a meeting with Pond Inlet HTO in July to finalize vessel traffic adaptive management measures for 2018
 - Ensure all Project vessels comply with speed limit in the Inlet (9 knots)
 - Ensure all Project vessels navigate along way points for nominal shipping route
 - Ensure all Project vessels are aware of anchorage locations and restrictions for drifting
- ✚ Follow up site visit with MHTO occurred on August 30 and 31 to continue discussions regarding development of further enhanced vessel traffic management alternatives and options for improving communications between community and vessel operators
- ✚ Two avenues established for tracking and reporting on adherence to SITM
 - Community shipping complaint and response mechanism
 - Monitoring through AIS

Baffinland Project Update – Shipping Season – Fuel Spill

- ‡ July 22 - notification was provided to Canadian Coast Guard (CCG) that a tug boat had experienced a gearbox failure while travelling through Eclipse Sound
- ‡ Notification of event was also provided by Baffinland and the CCG to Hamlet of Pond Inlet and Hunter and Trappers Organization
- ‡ Once tug arrived at Milne Port, Baffinland deployed oil containment booms and sorbents to contain release
- ‡ Investigation revealed that approximately 30 L of gear oil had been released in Milne Inlet
- ‡ It appeared that oil dissipated quickly due to weather and wave conditions
- ‡ Baffinland confirmed with CCG that additional spill recovery methods were not recommended and tug was cleared by CCG for operations
- ‡ Follow-up spill report was issued to ECCC, CIRNAC and QIA on August 22

Baffinland Project Update – 6MTPA Application

- ✦ Community information session in Pond Inlet on July 12, 2018
- ✦ Comments submitted from reviewers on July 26
- ✦ Baffinland provided response to reviewer comment on August 9
- ✦ NIRB issued recommendation report to the Minister on August 31

Baffinland Project Update – Phase 2 EIS

- ✦ Baffinland submitted Phase 2 Amendment to NIRB on August 15
- ✦ NIRB concordance review will occur from September 4 to September 14
- ✦ Following successful conformity review NIRB and NWB will issue a coordinated review process timeline
- ✦ A copy of the Phase 2 EIS amendment will be available on NIRB public registry following conformity review

2018 Monitoring Programs

- 1) Tremblay Sound (Kangirluarjuk) Narwhal Tagging Program
- 2) Bruce Head (Iluvilik) Vessel-based Monitoring Program
- 3) Ship-based Observer (SBO) Program
- 4) Marine Ecological Effects Monitoring Program (MEEMP)
- 5) Physical Oceanography



Tremblay Sound Narwhal Tagging Program

- ✦ 14 July: Set up 2 new receiving stations (MOTES)
- ✦ 17 July: Arrival at Tremblay Camp
- ✦ Heavy ice on shoreline delayed net deployment
- ✦ 2 narwhals tagged in August



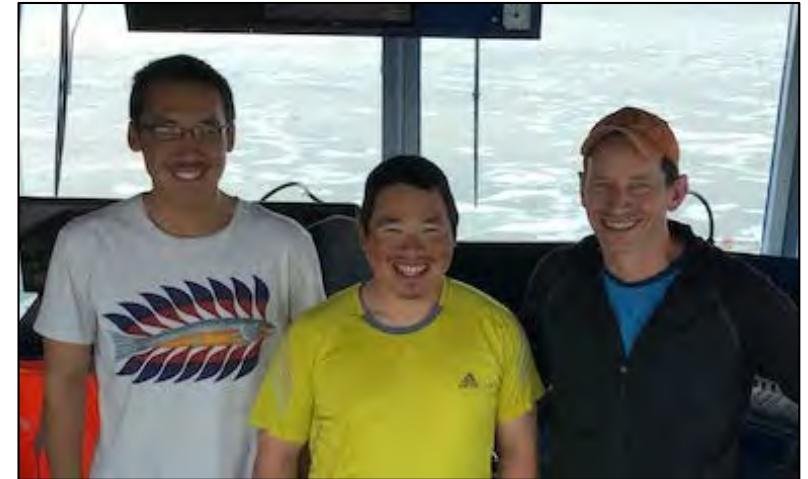
Bruce Head Vessel-based Program

- ✦ 16 July: AIS installation at MHTO
- ✦ 3 August: Training in Pond Inlet
- ✦ 4 August: 5 acoustic recorders deployed
- ✦ 7-14 August: Surveying
- ✦ 84 Relative Abundance and Distribution Counts over 8 days
- ✦ No narwhals observed in the Project Area during the study



Ship-based Observer (SBO) Program

- ✦ Leg 1: 28 July – 7 August 2018
- ✦ 147 marine mammal watch hours
- ✦ 1,680 marine mammals observed
 - 19 narwhals
 - 1,660 seals
- ✦ 102 5-minute seabird watches completed
- ✦ Most common seabird species: Northern fulmar and black-legged kittiwake
- ✦ Leg 2: 28 September – 24 October



Marine Ecological Effects Monitoring Program (MEEMP)

- ✦ The 2018 MEEMP program started with the arrival of Golder staff at Port on July 25, weather and ice delayed the arrival of the Inuit crew and boat from Pond Inlet until August 2. The program was successfully completed on August 28.
- ✦ Water, sediment and benthic samples were successfully obtained. All samples collected were shipped for laboratory analysis. Permanent transect plots were deployed and surveyed using the ROV.
- ✦ AIS program was completed. The ROV was used to collect video of 3 ore carrier hulls, no accessible epifaunal growth was found for sample collection. Rocks from settlement baskets deployed in 2016 were photographed, collected and sent for taxonomic analysis.
- ✦ *Fisheries Act* offset monitoring was completed. Cod were observed during video surveys of the offset habitat.
- ✦ Fishing efforts were completed weekly throughout the program as recommended by MEWG and the HTO.
- ✦ The MEEMP crew also supported tag recovery efforts for the Tremblay program.



Physical Oceanography

- ‡ The 2018 program consisted of tidal gauge installation and monitoring at Milne Port and the collection of metocean data at Bruce Head and Milne Port.
- ‡ The tidal gauge was installed at Milne Port on 30 June 2018 to extend the tidal data set previously collected and provide insight to relative sea level and storm surges at the project site.
- ‡ Metocean data collection at Bruce Head and Milne Port occurred via subsurface tautline moorings installed at Bruce Head and Milne Port to provide a time series of water level and current throughout the water column as well as salinity and temperature data.
- ‡ Golder deployed 3 moorings from August 3-6, 2018.

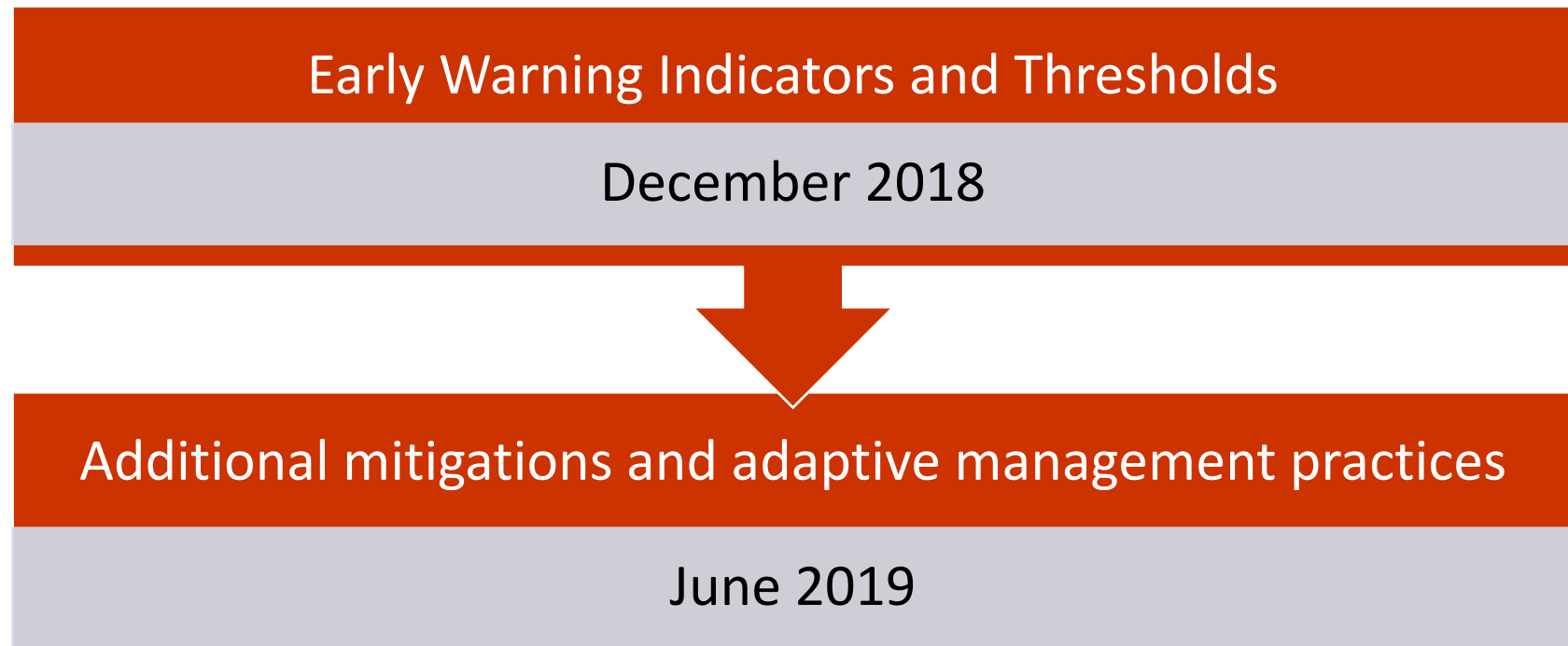


Early Warning Indicators

- ✚ See separate handout as well

- ✚ Project Conditions 110-112

- ✚ Timeline



Early Warning Indicators (EWI) - Guidelines

- ‡ For marine mammals and marine mammal populations.
- ‡ Linked to noise from shipping activities.
- ‡ Characteristics of behaviour, population distribution and abundance, or habitat use.
- ‡ Can be observed and/or quantified through monitoring programs.
- ‡ Can propose more than one EWI for each species.
- ‡ Can propose the same EWI for multiple species.
- ‡ Thresholds are quantitative limits to “acceptable change”.

Questions & Discussion



Marine Environment Working Group Meeting

Date: September 13, 2018

Location: Teleconference

Time: 10:00 am – 12:00 pm (EST)

Call-In Number: +1-416-607-0170 **Access Code:** 990 832 957 #

Member Organization	Participants		Member Organization	Participants	
Baffinland Iron Mines Corporation (Baffinland)	Megan Lord-Hoyle (MLH)	N	Parks Canada	Francine Mercier (FM)	N
	Joe Tigullaraq (JT)	P	Makivik	Gregor Gilbert (GG)	N
	Emma Malcolm (EM)	P			
Qikiqtani Inuit Association (QIA) and Consultants	Stephen Williamson Bathory (SB)	N	Mittimatalik Hunters and Trappers Organization (MHTO)	Elijah Panipakoocho (EP)	P
	Sean Joseph (SJ)	N		Joshua Arreak (JA)	P
				Billy Merkosak (BM)	P
	Fai Ndofo (FN)	N			
	David Qamaniq (DQ)	P			
	Jeff Higdon (JH)	P	Observer Organization	Participants	
Fisheries and Oceans Canada (DFO)	Kim Howland (KH)	N	World Wildlife Fund – Canada (WWF)	Andrew Dumbrille (AD)	N
	Laura Watkinson (LW)	N		Amanda Main Hanson	P
				Brandon Laforest	P
Environment and Climate Change Canada (ECCC)	Grant Gilchrist (GG)	N	Oceans North Canada	Kristen Westdal	P
	Anne Wilson (AW)	N		Chris Debicki	N
Government of Nunavut	Brad Pirie (BP)	P	Baffinland Consultants	Participants	
	Lauren Perrin (LP)	N	Golder	Patrick Abgrall (PA)	P
			Golder	Erin Linn (EL)	P
			Golder	Phil Rouget (PR)	N

P-phone in participation, I – In person, N- Not attending

Discussion and Comments
Baffinland Project Update
<p>Overview of Shipping Season (EM)</p> <p>Baffinland's shipping season started on 20 July, with the first ore carrier being loaded on 24 July. The ice management vessel, (Botnica) was active until 10 August. We are expecting the Botnica to return 28 September until approximately 20 October. To date, we have had 41 ore carriers, 3 fuel tankers, 3 resupply vessels called to Port.</p> <p>AHM: Was the IMV used for wildlife observers as planned?</p> <p>EM: Yes, there will be a slide later speaking to the SBO program.</p> <p>Vessel Traffic Management (EM)</p> <p>Throughout the 2018 season, Baffinland has made an effort to continue to improve shipping practices. To kick-off the season, we held a meeting with the Pond Inlet HTO in July before the start of the shipping season. Both the HTO and Hamlet were notified on July 20 when the Botnica first entered the Inlet. Key mitigations for the 2018 season include:</p> <ul style="list-style-type: none"> • Ensure compliance with speed limit (9 knots). • Ensure vessels follow nominal shipping route. • Ensure usage of anchorage locations and restriction of drifting is understood. <p>We also held a site meeting with MHTO members on 30-31 August to discuss their perspectives on efficacy of 2018 vessel traffic management measures to seek feedback on recommendations for further mitigations that could be applied during the latter end of the season and into 2019.</p> <p>Two avenues were established for tracking and reporting on adherence to the Standing Instructions to Masters, which included development of a community shipping complaint and response mechanism, as well as setting up an AIS monitoring station at Pond Inlet HTO office. Baffinland also used AIS data for compliance monitoring to actively respond to alerts when vessels were not adhering to speed restrictions.</p> <p>Fuel Spill (EM)</p> <p>At the beginning of the season, we had a minor fuel spill as a result of one of the tug boats suffering a gearbox failure. Baffinland responded quickly by deploying oil containment booms and sorbents to contain the release. Investigation indicated that approx. 30 L of gear oil had been released, and that is dissipated quickly.</p> <p>Baffinland confirmed with Canadian Coast Guard (CCG) that additional measures for spill clean-up were not recommended and the tug was cleared by the CCG for operations.</p> <p>MHTO: Are all the tugs and ore carriers inspected by Transport Canada?</p> <p>EL: Transport Canada is regularly at site. Our small zodiac MEEMP boat is even reviewed to ensure it meets standards.</p> <p>MHTO: What spill equipment do the tug boats have on board?</p> <p>EM: I will reach out to the operators to provide a response.</p> <p>MHTO: We don't think the fuel spill has been cleaned up yet?</p>

EM: We completed reconnaissance surveys that show the spill has dissipated. There is no visible sheen left, and the CCG recommended that no additional clean-up measures were required. The follow up report has been shared with MHTO, which details information related to this incident.

6MTPA Application (EM)

NIRB recommendation was that Baffinland should not be approved to proceed with proposed activities of increasing hauling and shipping to 6MTPA. Baffinland will be issuing a public response in the coming weeks on how we plan to follow up on this recommendation.

DQ: When does Baffinland expect to hear back from the Minister on a decision?

EM: At this point, we are not sure. Baffinland is planning to issue a response respond in the next 2 weeks or so.

JT: As a clarification, the Minister has 90 days to issue a decision, but we are not sure when a decision will come within this timeframe.

Phase 2 EIS (EM)

Baffinland submitted our Phase 2 EIS on 15 August to NIRB. We are expecting to hear a response from NIRB on conformity with the EIS Guidelines by 14 September.

2018 Marine Monitoring Program Overview

Narwhal Tagging Program

Golder presented an overview of the marine monitoring programs and preliminary results to date

JH: What were the age and sex of the narwhal tagged with the MiniPat tags?

PA: They were females. Both the Acousonde and MiniPat tags that were deployed were recovered. We are expecting some interesting data as the two tagged narwhals appeared to have stayed in the Project area.

Post-Meeting Note: At the time of the call, Golder was unable to recall the sex of the whales that were tagged. The meeting minutes have been updated to reflect the confirmed sex of narwhals tagged with MiniPat tags.

DQ: Were you able to recover all of the tags?

PA: Yes, at one point we thought we may lose one of the tags when the narwhal entered Lancaster Sound, but we were able to retrieve.

DQ: I heard at the co-op that we could earn \$200 if we recovered the tags.

EM: Baffinland was not part of this program, although DFO could have led that initiative. However, we do hire local boat operators to help retrieve the tags.

PA: There were 4 whales tagged in total during 2018: 2 with GPS tags positioning and 2 with Acousondes only.

MHTO: Where were the acoustic recorders deployed?

PA: We will present a map at the next MEWG meeting illustrating where the recorders were deployed.

Bruce Head Vessel-Based Program

DQ: Is Baffinland going to run the vessel-based program again next year, or will you reinstate the shore-based program from Bruce Head?

MHTO: The observation station at Bruce Head is much better than the vessel-based program, because there is no additional noise created by the vessel when conducting shore-based monitoring.

PA: We are exploring options for the program next year. We should note however, that the vessel used for the Bruce Head program was anchored, and therefore was not producing noise during the observation period.

JH: Were drones used as part of this program?

PA: Yes, but as there was no narwhal spotted during this time, we were not able to complete counts as part of this program in the same way we have done in the past.

EM: Baffinland acknowledges that the Bruce Head shore-based observation program is important to the community of Pond Inlet. We will continue to investigate ways to revitalize the program in future years, depending on the enhancement of safety features for the program.

Marine Environmental Effects Monitoring and Aquatic Invasive Species Program

MHTO: We have seen some new species of fish in the area this year. We are not sure what they are called, but we are looking to see what the results of the program will be.

PA: Once we have results we can discuss at upcoming MEWG meetings.

DQ: Did you fish in any of the areas where we wanted to see if fish were being contaminated?

EL: yes, we fished in the DFO permitted areas around Milne Port and Inlet as permitted and planned for 2018.

Mortalities from those efforts are being analyzed for body burden analysis. We were not able to add extra areas in the field as we didn't have the permits needed to sample fish in other locations. We can discuss expanding the Arctic Char monitoring program or areas at upcoming MEWG meetings.

Early Warning Indicators

In advance of the meeting, Baffinland provided MEWG participants with an Early Warning Indicator (EWI) submission form template in both English and Inuktitut.

Golder presented on the proposed timelines for developing EWIs to meet Project Certificate Conditions No. 110-112, and provided guidance on the development of indicators to be proposed by MEWG participants.

	Action Item	Action By	Update
1	EM to retrieve list of spill response equipment on tug boats.	Baffinland	
2	Golder to include map identifying where acoustic recorders were deployed at the December MEWG meeting	Golder	
3	MEWG participants to submit EWI comment forms to Baffinland by	MEWG Members / Baffinland	<p>Baffinland received comments from Parks Canada and DFO.</p> <p>Oceans North indicated that they were not able to provide comments without first hearing input from QIA and MHTO.</p> <p>No other comments from MEWG members were received.</p> <p>Separate consultation with MHTO members on the EWIs is scheduled for November 28, 2018.</p>



Appendix C:
Final MEWG EWI Submission – Parks
Canada, 23 October 2018

Cc: Mercier, Francine (PC) <francine.mercier@canada.ca>

Subject: [External]RE: [External]RE: [EXTERNAL] Early Warning Indicators and Thresholds Template- Parks canada

CAUTION: This email was received from outside of Baffinland systems. It may contain malicious attachments or links. If you are not familiar with the content of the email do not open the attachments or click embedded links.

Hello Emma,

Sorry for the delay, our team has been very busy with a lot of files this month. Due to our limited science capacity in Parks Canada we will leave much of the specific thresholds/monitoring plans to DFO as this is far more their field of expertise. However we have submitted a number of possible options for the MEWG to consider basing formal monitoring plans off of.

1) Short-term

- narwhal, bowhead whale, and pinniped behavioural response utilizing existing monitoring programs (i.e. heading change, speed change, group composition change, etc...)
- narwhal and bowhead whale acoustic response (i.e. changes or cessation of vocalisations, can be monitored with hydrophones)
- acoustic tags attached to narwhals, bowhead whales, and/or pinnipeds to provide live information of noise levels experienced by individual mammals.

2) Long-term

- population status of narwhal, bowhead whales, and pinnipeds assessed through long term monitoring programs
- changes in time spent within Milne inlet once entered over time for narwhals and bowhead whales (i.e. through use of tagged narwhal data collected by DFO).

3) Cumulative

- body condition of observed narwhal

It is difficult to create a monitoring program without initial baselines, and it is unfortunate that these plans were not put in place several years ago as outlined in the project certificate.

Let me know if you have any questions or concerns

Cheers,
Ryan Eagleson

From: Emma Malcolm [<mailto:Emma.Malcolm@baffinland.com>]

Sent: October-18-18 3:46 PM

To: Eagleson, Ryan (PC) <ryan.eagleson@canada.ca>

Cc: Mercier, Francine (PC) <Francine.Mercier@pc.gc.ca>

Subject: RE: [External]RE: [EXTERNAL] Early Warning Indicators and Thresholds Template- Parks canada

Hi Ryan,

Wondering if you're planning on submitting something on behalf of Parks Canada?

Thanks
Emma

Emma Malcolm | Sustainability Specialist

Oakville - 2265

T: +1 416 364 8820 x5089



2265 Upper Middle Road East, Suite 100, Oakville, Ontario, Canada, L6H 0G5

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From: ryan.eagleson@pc.gc.ca [<mailto:ryan.eagleson@pc.gc.ca>]

Sent: Wednesday, October 10, 2018 2:25 PM

To: Emma Malcolm <Emma.Malcolm@baffinland.com>

Subject: [External]RE: [EXTERNAL] Early Warning Indicators and Thresholds Template- Parks canada

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Sorry. I meant if you had a copy from other government departments (i.e. ECCC and DFO). Thanks :)

cheers,



Ryan Eagleson

Conseiller du programme marine

Direction générale de l'établissement et de la conservation des aires protégées

Parcs Canada

ryan.eagleson@pc.gc.ca

Tél: 819-938-0326

Marine Program Advisor

Protected Areas Establishment and Conservation Directorate

Parcs Canada

ryan.eagleson@pc.gc.ca

Tel: 819-938-0326

Parcs Canada - 450 000 km² de souvenirs / Parks Canada - 450 000 km² of memories

From: Emma Malcolm <Emma.Malcolm@baffinland.com>

To: "ryan.eagleson@pc.gc.ca" <ryan.eagleson@pc.gc.ca>

Date: 10/10/2018 02:20 PM

Subject: RE: [EXTERNAL] Early Warning Indicators and Thresholds Template- Parks canada

Hi Ryan,

I haven't received anything from Parks Canada to-date.

Thanks
Emma

Emma Malcolm | Sustainability Specialist

Oakville - 2265

T: +1 416 364 8820 x5089



2265 Upper Middle Road East, Suite 100, Oakville, Ontario, Canada, L6H 0G5

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From: ryan.eagleson@pc.gc.ca [<mailto:ryan.eagleson@pc.gc.ca>]

Sent: Wednesday, October 10, 2018 2:05 PM

To: Emma Malcolm <Emma.Malcolm@baffinland.com>

Subject: [EXTERNAL] Early Warning Indicators and Thresholds Template- Parks canada

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Hello Emma,

I was just wondering if you had any copies of the templates you were emailed so far? I am just checking to make sure we don't repeat the exact same thing from each department. Thanks :)

cheers,



Ryan Eagleson

Conseiller du programme marine

Direction générale de l'établissement et de la conservation des aires protégées

Parcs Canada

ryan.eagleson@pc.gc.ca

Tél: 819-938-0326

Marine Program Advisor

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Appendix D:
Final MEWG EWI Submission – Fisheries
and Oceans Canada, 25 October 2018

Baffinland Phase II Expansion: Identifying Early Warning Indicators and Thresholds

Oct 25, 2019

The Marine Environment Working Group (“MEWG”) has requested that DFO provide suggestions for “early warning indicators” (EWI) with respect to the potential impacts related to increased shipping noise (with Phase II expansion) that may occur in marine mammal stocks/populations present in the area of interest. They list potential impacts, and guidance for developing EWI and thresholds, as follows (blue text):

Potential impacts:

- Acoustic disturbance
- Change in animal distribution in the region
- Change in animal abundance in the region
- Alteration of migration patterns
- Availability of marine mammals for harvesting

Selection of early warning indicators:

- The early warning indicators should clearly indicate how the noise from Project-vessels are impacting indicator species (e.g., narwhal) as defined using measurable, quantitative thresholds.
- Indicators could be the number of individuals using an area (regional abundance), the type of individuals using an area (e.g., mother-calves), a change in the timing of the area being used (e.g., arrival date in an area or departure date from an area), or other characteristics of individual marine mammals or populations.
- Indicators should speak to a change that has occurred which is likely, beyond reasonable doubt, to be a direct result of noise from shipping activities.

Determine Appropriate Threshold for Indicator Species:

- Thresholds are limits of “acceptable change”.
- Quantitative thresholds need to be identified to determine whether the effect of noise from shipping activities is resulting in “acceptable changes” to an indicator (i.e., marine mammals).
- Examples of thresholds include the number of individuals or type of individuals in a regional population, a percentage decrease in the number of individuals or type of individuals in a regional population, or an arrival or departure date from an area.

BACKGROUND

When developing mitigation measures and adaptive management practices for reducing noise impacts on marine mammals, and associated thresholds for negative impacts, including within the context of an early warning indicator (EWI) system, the full breadth of potential negative impacts needs to be considered. These can include physiological, behavioural, and ecological effects. Table 1 provides a list of potential effects/responses that anthropogenic noise sources can have on marine mammals as well as the potential impacts/consequences to animals and populations. Though this table was developed to evaluate the impacts of seismic airgun noise on marine mammals, almost all of the potential effects and impacts listed are relevant to ship noise, with the one potential exception being non-auditory physiological effects.

Ship noise can cause temporary hearing threshold shifts (TTS), and in some cases if loud enough, even permanent hearing threshold shifts (PTS). It can also cause changes in the behaviour of the animals that extends beyond displacement (or movement from an area), including the potential behavioural effects listed in Table 1. Ship noise can also mask the vocalizations of animals, such as their social calls as well as echolocation (foraging) clicks; this

may alter their ability to forage, socialize/communicate, and avoid predators (and other anthropogenic activities). If ship noise has any impact on prey distribution or abundance, and if marine mammal foraging behaviour or success is reduced, this may be reflected in reduced reproductive propensity or success, or poor body condition. Exposure to shipping noise can also induce stress responses (e.g., Rolland et al., 2012).

Many of these impacts can cause (directly or indirectly, and cumulatively) reduced fitness/health, reduced reproductive rates and calf production, and survival, and thus may lead to population-level impacts. It is particularly critical to note that any population or density estimates will have sufficient uncertainty that a very high level of change must be demonstrated before an impact is actually detected (e.g., Jewell et al. 2012). With the added confounding factors of climate-related, environmental and prey changes, and newly-invading predators and other invasive species, it will be much harder to conclude that such large observed changes are unequivocally linked to increased shipping; rather, we can say that the risk of such impacts is higher.

SELECTION OF EWIs, THRESHOLDS, AND SOURCES OF UNCERTAINTY

Within the EWI guidance document, the examples of EWIs (and thresholds for indicator species) provided are largely focused on changes in the numbers of animals in the area over time (i.e., displacement from the area). The selection of EWIs should reflect the full range of varying potential effects; there are examples related to other types of potential impacts (e.g., animal health or condition) that should be considered. It should be noted that marine mammal responses to noise are highly species- and context-specific (see Gomez et. al. 2016) and individuals may not always leave an area even if a negative impact is occurring (particularly if it is important to a life history function such as calving or feeding) if animals show a high degree of natal philopatry or site fidelity (e.g. narwhal in Eclipse Sound). Note that if displacement has already occurred (e.g., if a statistically significant number of the animals left the area during the Phase I operations), then the impact has already happened and this may not be a good example of an “early” warning system, unless Phase II results in further avoidance of the area.

In fact, “early” warning indicators are very difficult to establish for long-lived marine mammals, as potential impacts may take years to detect (e.g., population-level impacts). While in some cases marine mammals affected or displaced by noise disturbance may return once the noise source is reduced or removed (observed in some harbour porpoise populations after cessation of windfarm construction), there have been documented cases of noise-producing activities displacing whales with individuals not returning to the area for many years, even after the noise source was removed. For example, known gray whales were displaced from one of their breeding lagoons for over five years when exposed to industrial sounds and they returned only several years after the activities stopped (Jones et al. 1994). Similarly, very few of the beaked whales recorded in the Bahamas prior to the navy sonar-associated stranding have been seen in the area since.

Furthermore, displacement may lead to knock-on consequences that could be catastrophic for the population. For example, over 1,000 narwhals died in Canada and northwest Greenland following ice entrapments that may have been caused by avoidance of seismic surveys (Heide-Jørgensen et al., 2013). In some cases, some species and populations may be unable to leave certain habitats, which may make them especially vulnerable, even if no displacement is observed (see Forney et al. 2017). The community of Pond Inlet has suggested that the 2015 ice entrapment was due to delayed movements of narwhals out of Eclipse as a result of ice breaking and shipping traffic in the shoulder season.

Displacement may be difficult to detect, and certainly to ascribe this response as a direct consequence of increased shipping noise. For example, the Canadian portion of the Baffin Bay population of narwhal consists of at least four narwhal stocks which aggregate in summer: the Somerset Island, Admiralty Inlet, Eclipse Sound and East Baffin Island stocks. It was previously thought that narwhals exhibit strong fidelity to their summering areas; however, recent satellite tagging data has revealed that animals may move between summering areas, both within and between years (as evidenced by tagging data showing movements of narwhals between Eclipse Sound and Admiralty Inlet). These movements may make very localized changes in abundance difficult to detect. Therefore, any changes in localized abundance must be considered within the context of the entire population, assuming we can detect changes in other stocks, and that we can quantify immigration and emigration processes.

It is important to note that there is relatively limited knowledge about the short- and long-term impacts of ship noise exposure on narwhals and other marine mammal species. In particular, our understanding of the potential sub-lethal impacts on individuals and resulting population-level impacts is incomplete. This will hamper our ability to derive “acceptable” thresholds for impacts, and thus when developing EWIs and associated thresholds a precautionary approach needs to be taken.

Finally, although the EWIs appear to focus on noise-related impacts, acoustic impacts are not the only ones that might occur as a result of the proposed increase in shipping activity. For example, increased traffic will lead to increases in routine operational spills, as well as the risk of accidental oil spills/leaks. Likewise, greater shipping traffic also increases the potential for vessel strikes and other direct injuries to local marine mammals, especially given the confines of the area under discussion. Such non-acoustic impacts also merit attention.

Some potential EWIs to consider (relevant for all marine mammals found in the area):

1. Real time monitoring

- Increase in anthropogenic noise levels/sound exposure levels within the area or an increase in received sound levels (receivers located in critical use areas)
- Changes in animal vocalization characteristics, rates or patterns (as it has been shown that animals tend to respond to noise acoustically, rather than through observable behavioural reactions; Gomez et al. 2016).
- Changes in diving or surfacing behavior.
- Reductions in echolocation or communication space (i.e., level of masking occurring, as determined from modelled/measured noise levels within the area).
- Ship avoidance behaviour, representing an early indicator of change in population health (Bejder et al. 2006; Williams et al. 2006).

2. Longer-term monitoring

- Increases in underwater sound level in the environment, , as well as changes in species complement, and social activity of local marine mammals
- Increases in the level of stress hormones (cortisol, aldosterone, and corticosterone, at a minimum) in the animals as measured in faeces or direct sampling
- Decreases in body condition (could be indicative of hampered foraging efficiency or displacement from better feeding areas or prey, for example)
- Changes in calving rates (though this is not really an “early” warning indicator).

- Increases in observed injuries/mortalities (though again, this isn't really an "early" warning)
- Changes in demographic parameters such as reproductive rates, sex ratio, age at maturity, disease, stress, and body condition may be monitored with assistance from community-based sample collection programmes
- One of the first signs of population decline is the decrease in recruitment. The proportion of the number of calves to the number of adults provides an index of the recruitment in the population. This proportion could be calculated by measuring age classes of narwhals in aerial photographs. Age class data is available since 2013 and could be used as a baseline (Charry et al. 2018)
- Harvest age, sex, and size composition may also be an indication of population level change, particularly for those hunts that are more targeted (e.g. male narwhal for tusk)

Frequent assessments, both within (including the shoulder season to capture changes in migration patterns) and between years, of marine mammal abundance/density should be conducted in order to develop a population index, and to detect changes in this index. Methods of assessment could include aerial survey or other type of assessment methods such as mark-recapture methods (Moore et al. 2012). Narwhals utilise the Eclipse Sound summering area for different purposes. A change in narwhal distribution could be an early indication that the summering area does not fulfill their needs anymore. Photographic aerial surveys conducted throughout the summer and into the shoulder seasons would be essential to determine narwhal abundance and distribution (Sheldon et al. 2017)

•

Thresholds

"Thresholds" for these impacts cannot currently be identified, as there are no global accepted interpretations of "acceptable change" for any marine mammal characteristic. Therefore, we suggest that any statistically significant change detected in any parameter measured should represent the "warning" indicator. For survey derived indicators, statistical power to detect biologically significant differences is directly dependent on the frequency of those surveys. We also recommend measures of multiple parameters (see examples below). In addition to those discussed above, there are multiple other stressors, associated (or not) with the proposed shipping expansion (e.g., fishing, climate variability, vessel-interaction, pollution), that can also adversely affect marine mammals and/ or their habitat. As a result, there is a need to account for cumulative effects from multiple stressors acting simultaneously, as well as for effects of stressors that accumulate over time.

Baseline Data Collection

To assess the potential impacts to wildlife populations of a given project, adequate baseline data are needed for each EWI and species chosen. In the Baffinland context, data collected after the proposed expansion to Phase II should be compared to data collected during both pre- and post- Phase I development.

It would be important to identify existing sources of information, including their temporal and spatial coverage, with regards to EWI before some of these are selected for tracking purposes.

Table 1. List of potential effects/responses and potential impacts/consequences of seismic airgun sounds on marine mammal physiology, behavior and ecology (table adapted from Table 1 in *DFO. 2015. Review of Mitigation and Monitoring Measures for Seismic Survey Activities in and near the Habitat of Cetacean Species at Risk. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/005*)

Potential effects/responses	Direct potential impacts/consequences	Indirect potential impacts/consequences
Physiological effects		
Non-auditory physiological effects	Emboli formation, organ/tissue damage, neurological effects, increased stress hormones	Stranding/near-stranding/at-sea death, reduced socializing/foraging, malnutrition, reduced reproduction/survival
Auditory physiological effects (e.g., TTS, PTS)	Loss of hearing sensitivity	Reduced socializing/foraging, malnutrition, starvation, increased exposure to threats, reduced reproduction/survival
Behavioural effects		
Changes in dive and respiratory patterns	Stranding/near-stranding, emboli formation, tissue damage, increased energetic cost, reduced socializing/foraging	Stranding/near-stranding/at-sea death, malnutrition, increased exposure to threats, reduced reproduction/survival
Displacement and migratory diversion	Increased energetic cost, reduced socializing/foraging	Malnutrition, increased exposure to threats, reduced reproduction/survival
Changes in social behavior (e.g. hampered parental care and bonding, hampered breeding, etc.)	Reduced socializing/foraging	Calf mortality, reduced reproduction/ survival
Changes in vocalization patterns (e.g., hampered communication and echolocation)	Reduced socializing/foraging	Malnutrition, reduced reproduction/survival
Changes in time budget (e.g., proportion of time spent performing various activities such as resting, foraging, socializing)	Increased energetic cost, reduced socializing/foraging/resting	Malnutrition, increased exposure to threats, reduced reproduction/ survival
Changes in cognitive processes (e.g., distraction)	Reduced socializing/foraging	Malnutrition, increased exposure to threats, reduced reproduction/ survival
Ecosystem effects		
Hampered passive acoustic detection of prey, predators, and conspecifics	Predator-related injury/mortality, reduced socializing/foraging	Malnutrition, increased exposure to threats, reduced reproduction/ survival
Hampered avoidance of anthropogenic threats (e.g., ship strikes, bycatch, etc.)	Anthropogenic injury/mortality	Increased exposure to threats, reduced reproduction/ survival
Hampered use of critical habitat/reduced occupancy	Reduced socializing/foraging	Reduced reproduction/ survival

References (not comprehensive)

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Appendix E:
MEWG Meeting – 10 December 2018



Marine Environment Working Group

Monday December 10, 2018

9:00 am – 5:00 pm (EST)

Delta Hotels Ottawa City Centre

101 Lyon Street North, Ottawa K1R 5T9 Canada

Call-In Number: +1-416-607-0170 **Access Code:** 993 649 525 #

Member Organization	Participants	Member Organization	Participants
Baffinland Iron Mines Corporation (Baffinland)	Megan Lord-Hoyle (MLH)	Parks Canada	Francine Mercier (FM)
	Joe Tigullaraq (JT)	Makivik	Gregor Gilbert (GG)
	Emma Malcolm (EM)		
Qikiqtani Inuit Association (QIA) and Consultants	Stephen Williamson Bathory (SB)	Mittimatalik Hunters and Trappers Organization (MHTO)	Enookie Inuarak (EI)
	Sean Joseph (SJ)		Phanuel Enoogak (PE)
	Fai Ndofo (FN)		
	Rick Hoos (RH)		
	Jeff Higdon (JH)	Observer Organization	Participants
Fisheries and Oceans Canada (DFO)	Kim Howland (KH)	World Wildlife Fund – Canada (WWF)	Andrew Dumbrille (AD)
	Laura Watkinson (LW)		Amanda Hanson Main
Environment and Climate Change Canada (ECCC)	Grant Gilchrist (GG)	Oceans North Canada	Brandon Laforest (BL)
	Anne Wilson (AW)		Kristen Westdal (KW)
Government of Nunavut	Brad Pirie (BP)	Baffinland Consultants	Participants
	John Ringrose (JR)	Golder	Patrick Abgrall (PA)
	Alexander Kelly (AK)	Golder	Phil Rouget (PR)



Agenda

Time	Activity
9:00am – 9:30am	Welcome and introductions (Baffinland, All)
9:30am – 10:30am	Baffinland Update (Baffinland) <ul style="list-style-type: none">• Overview of 2018 Shipping Season• 6MTPA Application• Phase 2 EIS Submission
10:30am – 10:45am	Health Break
10:45am – 12:30pm	Marine Monitoring Programs (Golder) <ul style="list-style-type: none">• Narwhal Tagging Program (2018 and 2017 Report)• Bruce Head Monitoring Program (2018 and 2014–2017 Integration Report)• Ship-Based Observer Program
12:30pm – 1:00pm	Lunch (to be provided)
1:00pm – 2:00pm	Marine Monitoring Program (Golder) - continued <ul style="list-style-type: none">• MEEMP and AIS Monitoring Program• Physical Oceanography
2:00pm – 3:15pm	Early Warning Indicators (Golder)
3:15pm – 3:30pm	Health Break
3:30pm – 4:30pm	Early Warning Indicators (Golder) - continued
4:30pm – 5:00pm	Roundtable and Action Items



Early Warning Indicators

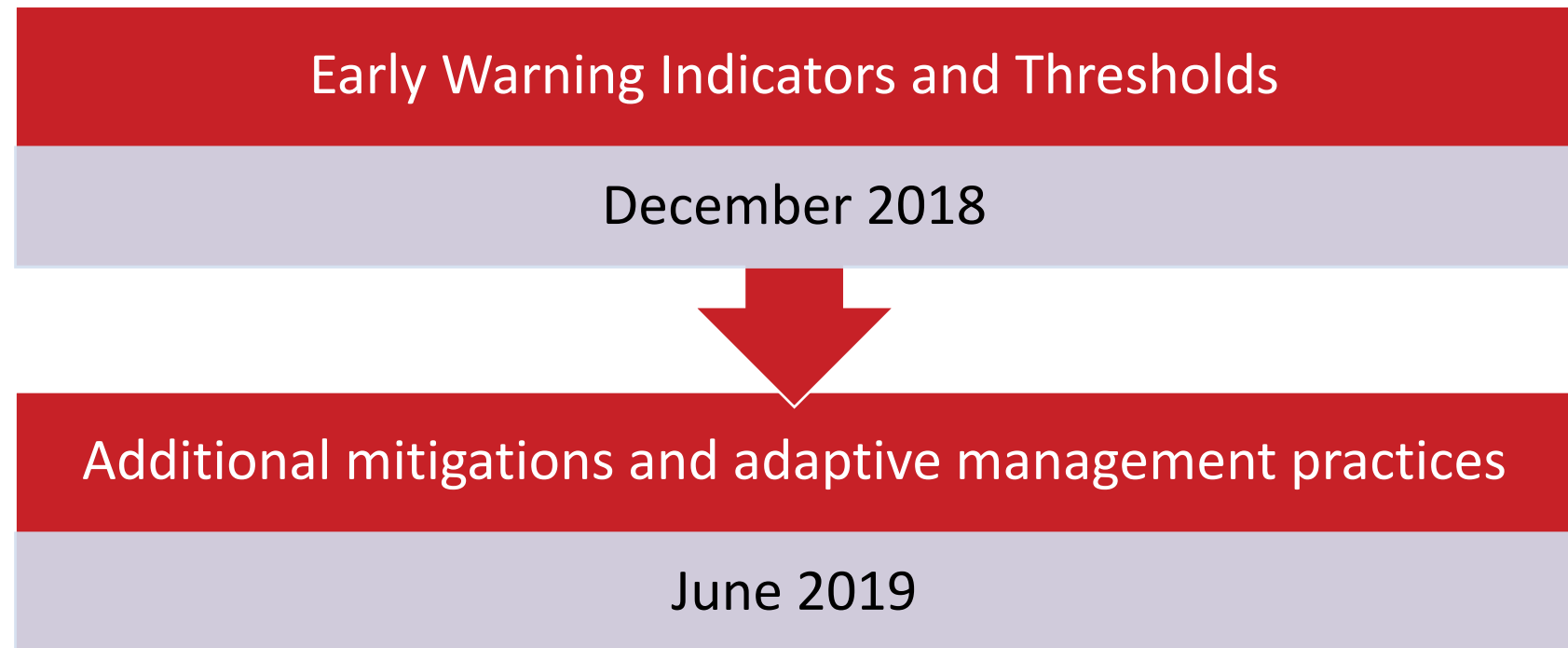
Fall MEWG Meeting – Ottawa, ON
10 December 2018



Early Warning Indicators (EWIs)

✦ Project Conditions 110-112

✦ Timeline



Guidelines

- ‡ For marine mammals and marine mammal populations.
- ‡ Linked to noise from shipping activities.
- ‡ Characteristics of behaviour, population distribution and abundance, or habitat use.
- ‡ Can be observed and/or quantified through monitoring programs.
- ‡ Can propose more than one EWI for each species.
- ‡ Can propose the same EWI for multiple species.
- ‡ Thresholds are quantitative limits to “acceptable change”.

MEWG Suggestions – Indicators

- ‡ Decrease in regional abundance
- ‡ Change in calving rate
- ‡ Ship avoidance behaviour
- ‡ Change in diving and surface behaviour
- ‡ Change in vocalization characteristics
- ‡ Increase in stress hormones
- ‡ Change in body condition
- ‡ Change in harvest data (age, sex)
- ‡ Injury/mortality occurrence

Indicator Species

- ‡ Suggested: All marine mammal species
- ‡ 2012 FEIS identified Key Indicators within the Marine Mammal VEC (see Table 8-1.1)
 - Ringed seal
 - Walrus
 - Beluga
 - Narwhal
 - Bowhead whale
 - Polar bear

Fisheries Act 35 (2)(b) Authorization

- ✦ “The Proponent shall develop and implement a monitoring program to confirm the predictions made in the Final Environmental Impact Statement- Addendum, with respect to disturbance impacts of shipping noise on the distribution of marine mammals. The survey shall be designed to monitor effects during the shipping season and include locations in Milne Inlet, Eclipse Sound and Pond Inlet. The survey shall continue over a sufficiently lengthy period of time to determine the extent to which habituation occurs for Narwhal and Bowhead whales. (NIRB T&C 109)”

Thresholds

- ‡ Statistical significance?
- ‡ FEIS (2012) Evaluation Criteria
 - Level 1 (Low): 1-10 %
 - Level 2 (Moderate): 10-20 %
 - Level 3 (High): >20 %



Appendix F:
MEWG Distribution – EWI and Threshold
Screening Table, 26 February 2019

Early-Warning Indicators

As it is not operationally feasible to effectively monitor all of the Early Warning Indicators (EWIs) proposed by MEWG members, and given that the intent of identifying EWIs is not to identify all pathways that could be impacted by the noise produced by Project vessels but rather to select a few key EWIs to focus on, the **bolded** EWIs have been selected to be brought forward. These EWIs were also indicated as being of greatest concern to the Mittimatalik Hunters and Trappers Organization (MHTO), during a community meeting held in Pond Inlet in November 2018.

The monitoring methods indicates the monitoring programs currently or potentially being conducted to provide the data required to identify and assess thresholds related to the selected EWIs. As indicated in the table below, other proposed EWIs that have not been selected are, for the most part, being actively monitored and the potential impact from Project activities are continuously being assessed.

In proposing thresholds for the selected EWIs, it is important to keep in mind that the Final Environmental Impact Statement that was approved for Project Certificate No. 005, indicated that as a result of the project, >10% of animals in Regional Study Area (RSA) could exhibit strong avoidance reactions that lead to (seasonal) abandonment of areas identified as important habitat. Therefore, a change of >10% is considered within the predicted range.

Instructions for Use

Please provide proposed threshold for the selected EWIs using the fourth column in the table below. Include a rationale to support selection of threshold.

Next Steps

Once the MEWG has provided feedback on thresholds for the EWIs, discussion of proposed and selected thresholds will occur at the succeeding MEWG meeting.

Early Warning Indicators	Monitoring Methods	Rationale	Threshold
Narwhal			
Decrease in regional abundance	Visual and photographic aerial surveys; Shore-based monitoring; Community-based monitoring – Reduced harvest	Indicated as important by the MHTO, indicator of potential population-level effects	
Change in calving rate	Visual and photographic aerial surveys; Shore-based monitoring	Indicated as important by the MHTO, indicator of potential population-level effects	
Ship avoidance behaviour	Shore-based monitoring; Satellite tagging; Ship-based Observer Program	Local indicator monitoring in proximity to vessels, not population-level indicator	N/A

Early Warning Indicators	Monitoring Methods	Rationale	Threshold
Change in diving and surface behaviour	Shore-based monitoring; Satellite tagging	Local indicator monitoring in proximity to vessels, not population-level indicator	N/A
Change in vocalization characteristics	Underwater passive acoustic monitoring; Acousonde tags	Local indicator monitoring in proximity to vessels, not population-level indicator	N/A
Increase in stress hormones	Community-based monitoring	Very difficult to link directly to impacts of vessel noise	N/A
Change in body condition	Photographic aerial surveys; Community-based monitoring	Very difficult to link directly to impacts of vessel noise	N/A
Change in harvest data (age, sex)	Community-based monitoring	Changes more likely to be initially observed in terms of overall numbers (suggested use of “Decrease in regional abundance” as an EWI).	N/A
Injury/mortality occurrence	Ship-based Observer Program; Shore-based monitoring; Community-based monitoring	Lack of evidence to date of injury/mortality	N/A



Appendix G:
MEWG EWI and Threshold Screening Table
– Qikiqtani Inuit Association Response, 31
March 2019

Early-Warning Indicators

As it is not operationally feasible to effectively monitor all of the Early Warning Indicators (EWIs) proposed by MEWG members, and given that the intent of identifying EWIs is not to identify all pathways that could be impacted by the noise produced by Project vessels but rather to select a few key EWIs to focus on, the **bolded** EWIs have been selected to be brought forward. These EWIs were also indicated as being of greatest concern to the Mittimatalik Hunters and Trappers Organization (MHTO), during a community meeting held in Pond Inlet in November 2018.

The monitoring methods indicates the monitoring programs currently or potentially being conducted to provide the data required to identify and assess thresholds related to the selected EWIs. As indicated in the table below, other proposed EWIs that have not been selected are, for the most part, being actively monitored and the potential impact from Project activities are continuously being assessed.

In proposing thresholds for the selected EWIs, it is important to keep in mind that the Final Environmental Impact Statement that was approved for Project Certificate No. 005, indicated that as a result of the project, >10% of animals in Regional Study Area (RSA) could exhibit strong avoidance reactions that lead to (seasonal) abandonment of areas identified as important habitat. Therefore, a change of >10% is considered within the predicted range.

Instructions for Use

Please provide proposed threshold for the selected EWIs using the fourth column in the table below. Include a rationale to support selection of threshold.

Next Steps

Once the MEWG has provided feedback on thresholds for the EWIs, discussion of proposed and selected thresholds will occur at the succeeding MEWG meeting.

Early Warning Indicators	Monitoring Methods	Rationale	Threshold
Narwhal			
Decrease in regional abundance	Visual and photographic aerial surveys; Shore-based monitoring; Community-based monitoring – Reduced harvest	Indicated as important by the MHTO, indicator of potential population-level effects	
Change in calving rate	Visual and photographic aerial surveys; Shore-based monitoring	Indicated as important by the MHTO, indicator of potential population-level effects	
Ship avoidance behaviour	Shore-based monitoring; Satellite tagging; Ship-based Observer Program	Local indicator monitoring in proximity to vessels, not population-level indicator	N/A

Early Warning Indicators	Monitoring Methods	Rationale	Threshold
Change in diving and surface behaviour	Shore-based monitoring; Satellite tagging	Local indicator monitoring in proximity to vessels, not population-level indicator	N/A
Change in vocalization characteristics	Underwater passive acoustic monitoring; Acousonde tags	Local indicator monitoring in proximity to vessels, not population-level indicator	N/A
Increase in stress hormones	Community-based monitoring	Very difficult to link directly to impacts of vessel noise	N/A
Change in body condition	Photographic aerial surveys; Community-based monitoring	Very difficult to link directly to impacts of vessel noise	N/A
Change in harvest data (age, sex)	Community-based monitoring	Changes more likely to be initially observed in terms of overall numbers (suggested use of "Decrease in regional abundance" as an EWI).	N/A
Injury/mortality occurrence	Ship-based Observer Program; Shore-based monitoring; Community-based monitoring	Lack of evidence to date of injury/mortality	N/A

QIA comments (Jeff W. Higdon), 31 March 2019

- Re: the FEIS (and Addendum) for the approved project predicting a change of $\geq 10\%$, the FEIS (Vol. 8, 5.9.1.2 Disturbance) for narwhal disturbance (Table 8-5.13 Measurable Parameters and Threshold Values for Narwhal (p. 215 of 318) states the following:
 - The "Effect" is "Disturbance caused by underwater noise, pulsed or continuous."
 - The "Measurable Parameter" is "Change in occupancy of an area that has been identified as important feeding, nursing, calving, breeding, wintering, or summering habitat."
 - ◆ And furthermore to above, for continuous sound (i.e., shipping), "Narwhals exposed to sound levels from shipping, vibratory pile driving, or dredging where the received levels exceed 120 dB re 1 μ Pa (rms) and 135 dB re 1 μ Pa (rms) may exhibit "disturbance" and "avoidance" responses, respectively.
 - The "Threshold" is " $\geq 10\%$ of narwhals in the RSA exhibit strong disturbance and avoidance reactions that lead to (seasonal) abandonment of areas identified as important habitat."



- If the FEIS is to be used for guidance, the threshold, whatever it is, needs to be linked to "important feeding, nursing, calving, breeding, wintering, or summering habitat[s]"
- Thresholds, if linked to FEIS predictions, need to consider changes in narwhal abundance at appropriate spatiotemporal scales to determine whether "seasonal abandonment" occurs
- The "decrease in regional abundance" listed in the Table as an EWI needs to be fleshed out in additional detail, for example scale of assessment (see above)
- Thresholds need to be biologically appropriate and logistically feasible (with the first factor the most important of the two - effort can be increased to increase power to detect change, for example)
 - As such, we cannot suggest thresholds without additional information
- Ringed seal should be included. What is MHTO position on ringed seal inclusion?



Appendix H:
MEWG Meeting Presentation Materials – 21
June 2019



Marine Environment Working Group

Friday June 21, 2019

9:00pm – 5:00pm (EST)

Frobisher Inn – Koojesse North Boardroom, Iqaluit, NU

Call-In Number: +1-416-607-0170 **Access Code:** 997 187 780 #

Member Organization	Participants	Member Organization	Participants
Baffinland Iron Mines Corporation (Baffinland)	Megan Lord-Hoyle (MLH)	Parks Canada	Allison Stoddart (AS)
			Chantal Vis (CV)
			Jacquie Bastick (JB)
	Joe Tigullaraq (JT)	Makivik	Gregor Gilbert (GG)
	Emma Malcolm (EM)		
	Genevieve Morinville (GM)		
Qikiqtani Inuit Association (QIA) and Consultants	Stephen Williamson Bathory (SB)	Mittimatalik Hunters and Trappers Organization (MHTO)	Caleb Sangoya (CS)
	Jared Ottenhof (JO)		
	Bruce Stewart (BS)		
	David Qamaniq (DQ)		
	Jeff Higdon (JH)	Observer Organization	Participants
Fisheries and Oceans Canada (DFO)	Kim Howland (KH)	World Wildlife Fund – Canada (WWF)	Andrew Dumbrille (AD)
	Laura Watkinson (LW)		Amanda Main Hanson (AMH)
	Marianne Marcoux (MM)		Brandon Laforest (BL)
Environment and Climate Change Canada (ECCC)	Grant Gilchrist (GG)	Oceans North Canada (Oceans North)	Kristin Westdal (KW)
	Anne Wilson (AW)	Nunavut Impact Review Board (NIRB)	Chris Debicki (CD)
			Solomon Amuno (SA1)
			Cory Barker (CB)
Government of Nunavut	Brad Pirie (BP)	Baffinland Consultants	Participants
	Alexander Kelly (AK)	Golder	Patrick Abgrall (PA)
	John Ringrose (JR)		Phil Rouget (PR)
	Stephen Atkinson (SA)		



Agenda

Time	Activity
9:00am – 9:30am	Welcome and Introductions
9:30am – 10:30am	Baffinland Update (Baffinland) <ul style="list-style-type: none"> • 2019 Shipping Season Overview • Shipping Mitigation and Management Review • Restricted Areas and Drifting Zone Review • 2019 Communications Protocol • Shipping Monitors • MEWG Mandate and Effectiveness • Incorporation of IQ in Monitoring Programs
10:30am – 10:45am	Health Break
10:45am-11:15am	2019 Marine Monitoring Program Overview <ul style="list-style-type: none"> • 2017 Narwhal Tagging Program Report – Updates Review • Aerial Survey Program
11:15am – 12:30pm	2019 Marine Monitoring Program Overview <ul style="list-style-type: none"> • Bruce Head Shore-based Monitoring Program • Ship-Board Observer Program
12:30pm – 1:00pm	Lunch
1:00pm - 3:00pm	2019 Marine Monitoring Program Overview <ul style="list-style-type: none"> • Acoustic Monitoring • Marine Ecological Effects Monitoring Program • Aquatic Invasive Species • Habitat Offset Monitoring
3:00pm – 3:15pm	Health Break
3:15pm – 3:30pm	2019 Marine Monitoring Program Overview <ul style="list-style-type: none"> • Physical Oceanography
3:30pm – 4:30pm	Early Warning Indicators <ul style="list-style-type: none"> • Indicator Development Update • Feedback from Group
4:30pm – 5:00pm	Roundtable and Action Item Review



Early Warning Indicators

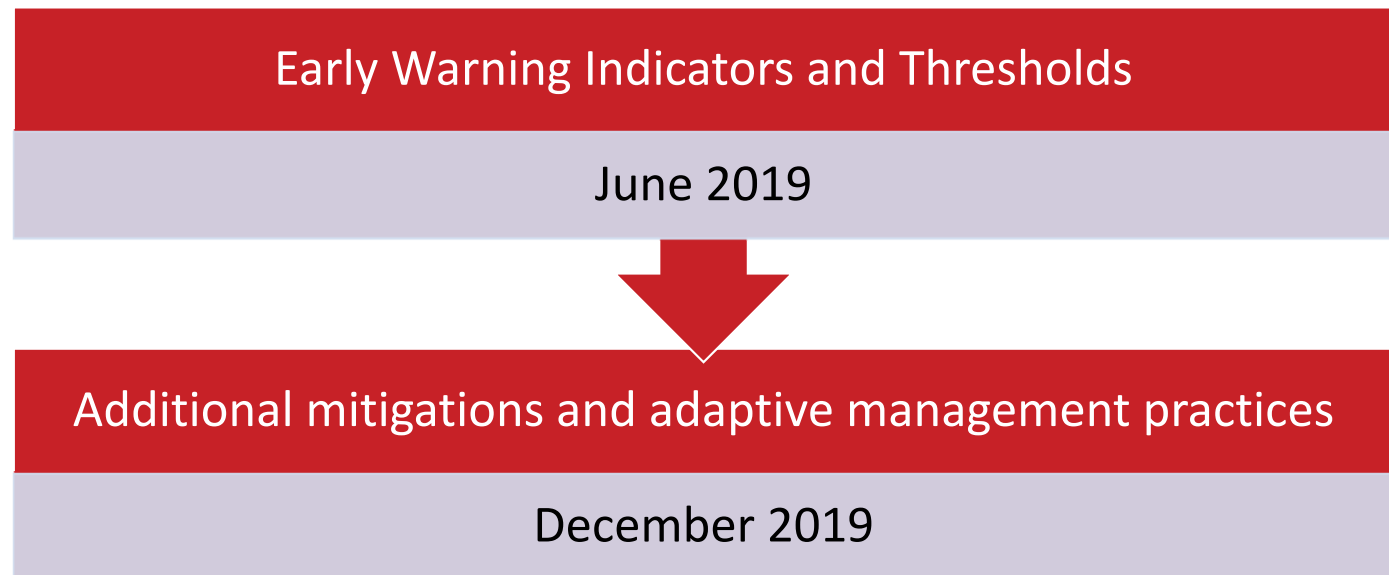
Spring MEWG Meeting – Iqaluit, NU
21 June 2019



Early Warning Indicators (EWIs)

📌 Project Conditions 110-112

📌 Timeline



Early Warning Indicators	Monitoring Methods	Threshold
Narwhal		
Decrease in regional abundance	Visual and photographic aerial surveys; Shore-based monitoring; Community-based monitoring – Reduced harvest	
Change in calving rate	Visual and photographic aerial surveys; Shore-based monitoring	
Ship avoidance behaviour	Shore-based monitoring; Satellite tagging; Ship-based Observer Program	
Change in diving and surface behaviour	Shore-based monitoring; Satellite tagging	
Change in vocalization characteristics	Underwater passive acoustic monitoring; Acousonde tags	
Increase in stress hormones	Community-based monitoring	
Change in body condition	Photographic aerial surveys; Community-based monitoring	
Change in harvest data (age, sex)	Community-based monitoring	
Injury/mortality occurrence	Ship-based Observer Program; Shore-based monitoring; Community-based monitoring	