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Your file Votre référence
08MN053

October 18, 2021

Our file Notre référence
07-HCAA-CA7-00050

Nunavut Impact Review Board (NIRB)
PO Box 1360
Cambridge Bay, NU
X0B 0C0

Dear NIRB,

**Subject: Mary River Project Phase 2 Development Proposal - DFO Responses to BIM
Written Comments**

Fisheries and Oceans Canada (DFO) would like to thank the Nunavut Impact Review Board (NIRB) for the opportunity to respond to Baffinland's Written Comments to the NIRB (see correspondence dated September 21, 2021). We will be commenting on new evidence provided by Baffinland on cortisol levels in narwhal and aquatic invasive species (*M. viridis*). We would like to confirm that the responses below have been prepared by DFO expert witnesses that have already been affirmed into the Public Hearing by NIRB legal counsel during the January 2021 proceedings.

Summary of DFO Response

DFO reiterates that cumulative and combined impacts on narwhal are within the scope of what Baffinland is required to monitor within the Regional Study Area, and that additional Early Warning Indicators (EWIs) are required to ensure that the full suite of potential impacts to narwhal (impacts to abundance, health, distribution, etc.) are sufficiently monitored and detected.

DFO remains concerned that *Marenzelleria*, as a genus, poses risk of aquatic invasion in the Eastern Arctic, and recommends that all experts, including DFO and its taxonomic experts, are involved in future discussions on the identity of *Marenzelleria* specimens.

Regardless of the details concerning the specific species identity, there is clear evidence that all specimens in question are of the *Marenzelleria* genus. They appeared in close vicinity of the Milne Port Ore Dock and anchorages, for the first time in 2016, after initiation of Project ore-

related shipping. Thus, DFO still has concerns about their origins and their potential to become invasive.

Based on multiple lines of evidence, DFO considers introductions through Project shipping vectors to be the most likely explanation for the recent appearance of specimens of *Marenzelleria* spp. in the Project area.

As the sole operator at Milne Port, it is reasonable to assume that any new records of *Marenzelleria* spp., at Milne Port, are attributable to Project-related activities. *Marenzelleria* spp. are known to be invasive in other marine ports. Therefore, DFO considers the genus to be a high-risk potential aquatic invasive species that has been introduced to the area, and that a genus-specific response plan should be developed.

A preliminary review of Baffinland's AIS Response Protocol has been undertaken. Overall, DFO is concerned that the AIS Response Protocol is insufficient, and notes that the Protocol should be finalized in consultation with DFO, the Marine Environmental Working Group (MEWG), and Inuit. A more in-depth Science Response is being prepared, and DFO will provide this to Baffinland and the MEWG once complete.

Detailed response: Cortisol levels in narwhal

In an extensive section in their written submission, Baffinland makes the following comments with respect to a paper published by DFO scientists on cortisol levels in narwhal:

On pdf page 56 (comment 110 (a)) in regards to Watt et al. (2021), a paper on blubber cortisol levels in narwhal harvested from Eclipse Sound, Baffinland states: *“Without further details regarding the data included and potentially excluded from the study, it is not possible to determine if there is a correlation between cortisol levels and Project shipping, if this is a naturally occurring process, or if this is an artifact of a low sample size.”*

On pdf page 57 (comment 110 (b)), it is stated: *“Baffinland has expressed its willingness to investigate this topic further, in collaboration with DFO, if the data from the study is released for further analysis. To-date, Baffinland's request for access to this data has been denied by DFO and it is not possible at this time to verify the information summarized in the study.”*

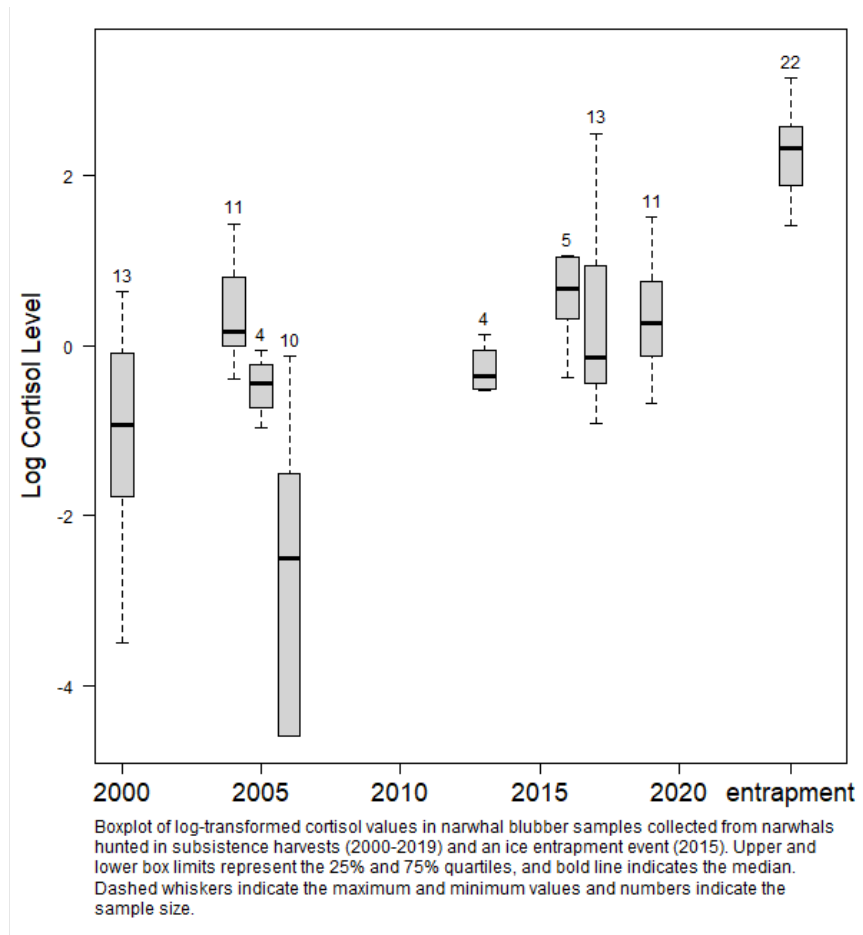
On pdf page 57 (comment 110 (c)), Baffinland states: *“Extensive behavioural and acoustic monitoring conducted by Baffinland do not indicate that narwhal response to Project vessels is indicative of a ‘high-stress’ interaction that would result in significant increases in cortisol levels as a direct result of Baffinland's shipping operations.”*

On pdf page 57 (comment 110 (e)), Baffinland states: *“There are a great number of other potential stressors on narwhals that could result in increased levels of cortisol in narwhal, including though not limited to, climate change, increased presence of predators and lack of prey availability. The potential impact of these ecological changes was briefly noted by Watt et al. (2021), but not quantified or further elaborated upon. The progressive increase in Baffinland's shipping operations between 2013 and 2019 was also not quantified by Watt et al. (2021).”*

Response to Baffinland's Written Comments

DFO would like to clarify to the NIRB that the data used in Watt et al. (2021) is from a research project that is being conducted by a PhD student at the University of Calgary in partnership with DFO, ArctiConnexion, and local Inuit. As such, the specific data that Baffinland has requested is not DFO's data to share, and requires the permission of the primary researcher. The Department will continue to share the data and information that it can with Baffinland and other parties. To alleviate concerns related to sample size, DFO has attached a boxplot figure for the data used in Watt et al. (2021), which displays both the yearly distribution of the data and the sample size.

As stated in the paper, the data presented in Watt et al. (2021) show the results of cumulative sources of stress, thus the increase in blubber cortisol levels, post-commencement of shipping, cannot be directly attributed to Baffinland's shipping activities. DFO recognizes the behavioural and acoustic monitoring that Baffinland has completed to date in support of Mary River Project. However, narwhal have long life histories and additional monitoring is required in order to determine if there are impacts to narwhal over time from repeated annual exposure to shipping activities. DFO reiterates that cumulative and combined impacts on narwhal are within the scope of what Baffinland is required to monitor within the Regional Study Area, and that additional Early Warning Indicators (EWIs) are required to ensure that the full suite of potential impacts to narwhal (impacts to abundance, health, distribution, etc.) are sufficiently monitored and detected. Although cortisol may be a sufficient indicator of cumulative and combined stress in narwhal, there are other indicators that may be better suited to detect early warning signs of specific project-related impacts. These indicators should be selected based on discussions with the MEWG and Inuit. The addition of body condition monitoring to the narwhal monitoring programs, as noted by Baffinland on pdf page 63 of their Written Comments, is positive but may not be sufficient to achieve the goals of the program.



Detailed response: The status of *M. viridis*

Baffinland provided an updated review of *Marenzelleria* specimens collected at Milne Port based on consultation from a third taxonomist who has specific expertise on the Spionid order of worms, which include *Marenzelleria*. Based on this consultation, a subset of four specimens from the 2020 MEEMP AIS program previously identified as *M. viridis* by two other taxonomy labs (Biologica and Laval), were identified as *M. arctia*. Overall, the updated technical memorandum on *Marenzelleria* specimens provides a greatly improved overview of available information on this genus, along with details regarding the sampling and identification history of specimens from this group of worms found in Milne Port through Baffinland's MEEMP and AIS Monitoring Program. Although this is a vast improvement, DFO remains concerned that *Marenzelleria*, as a genus, pose risk of aquatic invasion in the Eastern Arctic, and recommends that all experts, including DFO and its taxonomic experts, are involved in future discussions on the identity of *Marenzelleria* specimens.

Regardless of the details concerning the specific species identity, there is clear evidence that all specimens in question are of the *Marenzelleria* genus. They appeared in close vicinity of the

Milne Port Ore Dock and anchorages, for the first time in 2016, after initiation of Project ore-related shipping. Thus, DFO still has concerns about their origins and their potential to become invasive.

Several species within the genus *Marenzelleria* (including *M. viridis* and *M. arctia*) are listed in global invasive species databases and are known for having invasive characteristics with populations that have reached high abundances in areas of northern Europe and elsewhere where they have been introduced and become invasive (Invasive Species Compendium 2021; Bastrop and Blank 2006; Fofonoff et al. 2021). This is clearly acknowledged on pdf page 3 of Golder's Technical Memorandum on the updated status of *Marenzelleria* spp. around Baffin Island (Reference No. 1663724-287-TM-Rev3-48000), with the statement that: "*Since the genus was first confirmed in the North Sea, invasions of one or more species (including M. viridis, M. neglecta and M. arctia) have been confirmed in the Pacific Ocean, North Sea, Baltic Sea, Barents Sea, White Sea and Sea of Azov (Bastrop and Blank 2006; ICES 2016; Fofonoff et al. 2021). Marenzelleria spp. are considered to be among the most successful invasive species in the Baltic Sea (ICES 2016): This is inconsistent with the statement on pdf page 23 of Baffinland's Written Comments (comment 32), which states: "Marenzelleria arctia is a species that commonly occurs in the Arctic and is not considered invasive"*.

Given that *Marenzelleria* spp. is known to become abundant in other introduced populations, it may be expected to do the same in the Milne Port area if introduced through Project shipping. If specimens detected to date are a 'recent' introduction, we can expect that their population(s) are in the 'lag' phase of establishment and could irrupt and become invasive if various thresholds are reached and conditions for success become optimal. This is well documented in other cases of so called 'sleeper' populations (Spear et al. 2021). Indeed, the 2020 MEEMP-AIS program survey results (Golder 2021) show that there has been an up to tenfold increase in relative abundance between 2019 and 2020 (from eight individuals/sample to up to 80 individuals/sample) at sites where the species had been detected, suggesting abundances are likely increasing since initial detections of the genus in 2016. Based on the history of this genus invading elsewhere, provided environmental conditions are suitable, there is a good chance it will do the same in Milne Port if it has been introduced. It is well demonstrated in the literature that a previous history of being invasive is a good predictor of invasiveness in new regions where a species is introduced (Hayes et al 2008).

Although Baffinland cites their 2020 MEEMP-AIS draft report (Golder 2021) with the statement: "*...increased sampling effort indicated no warning signs of invasion such as a decrease in community indicators (e.g., diversity, richness, evenness) in conjunction with an increase in the relative abundance of M. viridis. Rather benthic communities were shown to be diverse and well established throughout Milne Port*" (Technical Memo Reference No. 1663724-287-TM-Rev3-48000), DFO notes that not displaying certain invasive behaviours right away is what invasive species often do (Spear et al. 2021). Thus, one should expect a lag where benthic communities can remain unchanged for a long time (typically until after an introduced population irrupts) before reacting to the incursion of an introduced species.

Baffinland project vessels are known to transit mainly from ports in northern Europe, the region where *Marenzelleria* spp. including *M. viridis* and *M. arctia* are invasive (based on Transport Canada ballast reporting forms 2018-2019). Ballast water transport of larvae is thought to have been the main mode of introduction for *Marenzelleria* spp. (Molnar *et al.* 2008), with first records often made near ports (Leppäkoski and Olenin 2000). From the 1970s to the 1990s, at least three separate invasions of *Marenzelleria* spp. into the northeastern Atlantic have occurred, probably through ballast water discharges (Sikorski and Bick 2004; Bastrop and Blank 2006). Thus, potential of project vessels encountering and transporting larvae in ballast are high.

Both *M. viridis* and *M. arctia* are known to be cold tolerant and have characteristics that could allow for survival and reproduction under conditions present at Milne Port. For example, *M. viridis* survival has been experimentally demonstrated for several months at temperatures of 0°C (George 1966) and there are well established populations along the east coast north to Newfoundland (OBIS) where there is ice cover and winter water temperatures likely drop below 0°C. *M. viridis* can spawn at temperatures as low as 2°C and larvae can develop at 5°C (George 1966). Based on DFO sampling during August 2017, suitable conditions for reproduction are present near Milne Port (Howland *et al.*, unpublished data). *M. arctia* populations occur throughout much of the coastal region in Alaska and Siberia (Sikorski and Bick 2004) where conditions would be expected to be comparable to those in the Milne Port area and high densities of individuals have been reported from Siberian waters ranging from -1.25 °C to 19 °C (Sikorski and Bick 2004).

The sudden appearance of specimens from the genus *Marenzelleria* only in the area of the Ore Dock in 2016 following commencement of Project shipping, and their continued consistent occurrence in samples from this area thereafter, is a pattern consistent with recent introduction (Chapman and Carlton 1994; Campbell *et al.* 2018).

Reported occurrences of *Marenzelleria* spp. in the Canadian Arctic are few (see Figure 1 and Table 1), with *M. arctia* only reported from Alaska, west across Siberia and not in the Canadian Arctic (Sikorski and Bick 2004, also see Golder's Technical Memo 1663724-287-TM-Rev3-48000 and references therein). Of further note, the only record of the *Marenzelleria* genus in the Canadian Eastern Arctic comes from an unpublished report of two specimens (identified as *M. viridis*; Table 1). These two specimens were collected in Southern Davis Strait, a distance of 1500 km from Milne Port that would require natural dispersal against the prevailing Baffin Island Current. Further, they were found at depths of 200-300 m, and 900-1000 m, far exceeding the normal range of less than 30 m *Marenzelleria* spp. are found in (Figure 2). Therefore, the validity of these identifications is highly questionable. Finally, the Arctic is a large geographic area, so while *M. arctia* occur elsewhere in the Arctic outside of Canada, evidence for natural connectivity to the project area is lacking. Therefore, based on multiple lines of evidence, DFO considers introductions through shipping vectors to be the most credible explanation for the recent appearance of specimens of *Marenzelleria* spp. in the project area.

It must be emphasized that although there may be records of a species in the Arctic, it does not mean that the species is not potentially invasive elsewhere in the Arctic. Further, it does not mean that Baffinland is not responsible for records and potential invasion of those species at Milne Port, where Baffinland is the sole operator. We support Baffinland's decision to "*continue to undertake targeted monitoring for this genus in Milne Port*", (see comment 24 in their Written Comments), and to share additional specimens with the Spionid Polychaete expert, Dr. Radashevsky, but would encourage dialogue with the other two taxonomic teams who identified specimens initially to ensure transparency and better understand reasons behind the differences in their identifications. We also support next steps of collection of specimens in Milne Port to confirm the species, but have concerns with the statement that "*Baffinland will treat all identified Marenzelleria specimens as having the potential to be invasive until the classification of M. arctia is confirmed through molecular methods*", for the multiple reasons noted above. Even if specimens are confirmed to be *M. arctia*, this does not mean they are indigenous to the Regional Study Area (RSA) or the broader Canadian Eastern Arctic region or that introduction of the species is not Project-related as outlined below. DFO therefore recommends that population genetic studies also be conducted to identify potential origins of specimens from the RSA in relation to known distributions of indigenous and invasive populations of *Marenzelleria* spp..

According to Baffinland's AIS Response Protocol: "*An introduction is considered Project-related if a species/taxon was not documented in baseline surveys or if there are no documented occurrences in the Canadian Arctic prior to the commencement of shipping operations.*" DFO is not aware of any records of *Marenzelleria* spp., particularly *M. viridis* and *M. arctia*, in Baffinland's baseline surveys. Further, Baffinland is the sole operator at Milne Port, and therefore it is reasonable to assume that any new records of *Marenzelleria* spp. at Milne Port are attributable to Baffinland. As noted above, *Marenzelleria* spp. are known to be invasive in other marine ports. As such, DFO considers *Marenzelleria* spp. to be a high-risk potential aquatic invasive species that has been introduced to Milne Port, and a genus-specific response plan should be developed. Taxa (optimally species level)-specific response plans should ideally be developed in advance of species introduction (as per commitment DFO 3.6.10 NEW). Barring this, they should be developed at first detection, prior to establishment and spread, in order to be as effective as possible in preventing further spread of potential AIS, making likelihood of successful eradication/control more difficult.

DFO has currently reviewing Baffinland's AIS Response Protocol (submitted March 22, 2021 in Baffinland's Post-Hearing Question Responses), and is preparing a Science Response that will be provided Baffinland and the MEWG once complete. DFO remains concerned that Baffinland's application of the AIS Response Protocol is inconsistent, and recommends that determination on whether or not a species is considered non-indigenous within the Project Area should be done in consultation with DFO and other relevant parties, and be based on information found in invasive species databases and relevant literature. Overall, DFO is of the opinion that the AIS Response Protocol needs considerable work to finalize, which should be done in consultation with DFO, the MEWG, and Inuit.

If you have any questions with the content of this letter, please contact Alexandra Sorckoff by email at Alexandra.Sorckoff@dfo-mpo.gc.ca . Please refer to the file number referenced above when corresponding with the Program.

Sincerely,



Thomas Hoggarth
Regional Director, Aquatic Ecosystems
Ontario & Prairie Region
Fisheries and Oceans Canada

cc: Alexandra Sorckoff – DFO-FFHPP
Gabriel Bernard-Lacaille – DFO-FFHPP
Alasdair Beattie – DFO-FFHPP
Marianne Marcoux – DFO Science
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Figure 1. Map of Canadian Arctic records for *Marenzelleria spp.* Sources listed in Table Numbers on map correspond to sources and information listed in Table 1.

Table 1. Location, number of specimens, collection dates, sources and additional information related to Canadian Arctic records for *Marenzelleria spp.*

Location	Number of specimens	Year collected	Source	Comments
1. Tuktoyaktuk Harbor-Mason Bay	4	1975	Miller et al. 2014	Specimens from this location originally identified as <i>M. arctica</i> , but entered in OBIS database as <i>M. viridis</i> . Specimens being re-examined by DFO (C. Nozeres)
2. Tuktoyaktuk Harbor-Mason Bay	12	1985-88	Hopky et al. 1994 (same records cited by BIM as GBIF 2021)	Listed as <i>Scolecopides viridis</i> , re-examined specimens from this locale identified as <i>M. neglecta</i> (Sikorski and Bick 2004)
3. Gjoa Haven, King William Island	Unknown	2005-06	Brown et al. 2011	Specimens identified as <i>M. viridis</i> . Primary author has been contacted by DFO to review identification methods and request access to specimens if available
4. Southern Davis Strait	2	1977	Conover and Stewart 1978 (same records cited by BIM as Cusson 2018)	Only records of genus <i>Marenzelleria</i> (identified as <i>M. viridis</i>) in eastern Arctic; specimens found at depths (200-1000 m) far exceeding normal reported range of <30 m

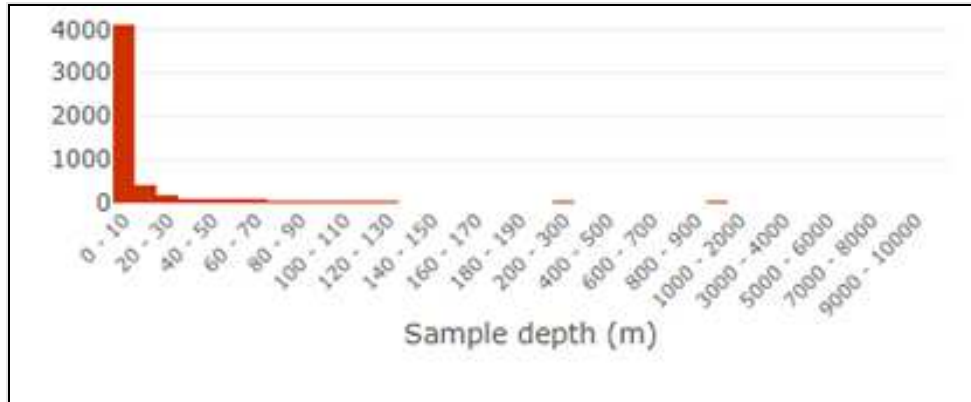


Figure 2. Frequency of *Marenzelleria* records by sample depth based on global OBIS records

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