
	NUNAVUT WILDLIFE MANAGEMENT BOARD Agenda: Regular Meeting 001-2025 February 26, 2025 Iqaluit, Nunavut				
	No:	Item:	Tab:	Presenter:	Maximum Time
9:00 - 9:02 AM	1	Open Meeting		Chairperson	2 Minutes
9:02 - 9:04 AM	2	Declaration of Conflict of Interest		Chairperson	2 Minutes
9:04 - 9:05 AM	3	Agenda: Review and Approval of RM001-2025	1	Chairperson	1 Minute
9:05 - 10:00 AM	4	Polar Bear Harvest Administration and Credit Calculation System and Use of Credits (Decision)	2	Government of Nunavut - Department of Environment	55 Minutes
10:00 - 10:15 AM		BREAK			15 Minutes
10:15 - 10:45 AM	5	Harvest Accumulation and Credits for Viscount-Melville Polar Bears	3	Ekaluktutiak Hunters and Trappers Organization	30 Minutes
10:45 - 11:15 AM	6	2025 Total Allowable Catch level for Northern Shrimp (<i>Pandalus borealis</i>) in Shrimp Fishing Area 0, and possibility of multiyear Total Allowable Catch (Advice)	4	Fisheries and Oceans	30 Minutes
11:15 - 11:45 AM	7	Establishment of a Marine Protected Area by Ministerial Order under the <i>Oceans Act</i> in Qikiqtait (Decision)	5	Fisheries and Oceans	30 Minutes
		LUNCH			1 Hr & 30 Minutes

1:15 - 1:45 PM	8	Establishment of a Marine Protected Area by Ministerial Order under the <i>Oceans Act</i> in Sarvarjuaq (Decision)	6	Fisheries and Oceans	30 Minutes
1:45 - 2:15 PM	9	Information on the updated stock structure of Belcher Islands - Eastern Hudson Bay Beluga following the 2023 genetic reanalysis (Information)	7	Fisheries and Oceans	30 Minutes
2:15 - 2:45 PM	10	Updated Precautionary Approach Framework for Northern Shrimp (<i>Pandalus borealis</i>) (Information)	8	Fisheries and Oceans	30 Minutes
2:45 - 3:15 PM	11	Department of Fisheries and Oceans Canada - Fisheries Management Operational Updates (Information)	9	Fisheries and Oceans	30 Minutes
		BREAK			15 Minutes
3:30 - 4:00 PM	12	Basic Needs Level for Southampton Island Caribou (Information)	10	NWMB	30 Minutes
4:00 - 4:45 PM	13	Amaruq Hunters & Trappers Organization Issues of Concern (Information)	11	Amaruq Hunters & Trappers	45 Minutes
4:45 - 5:15 PM	14	Agnico Eagle Mining Ltd. Nunavut Caribou Research and Monitoring Data (Information)	12	Agnico Eagle	30 Minutes
	15	Adjournment of RM001-2025			



SUBMISSION TO THE

NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information:

Decision: X

Issue: Polar Bear Harvest Administration and Credit Calculation System (HACCS) and Use of Credits

Background:

- The Department of Environment (ENV) has worked closely with co-management partners to develop and implement the Nunavut Polar Bear Co-Management Plan.
- A key component of the Co-Management Plan is a credit system, presently known as the Polar Bear Harvest Administration and Credit Calculation System (HACCS).
- HACCS, in its current form, has been in place since 2022 and there have been multiple requests for using credits made since its inception. Some notable requests include:
 - Arctic Bay requested the use of 5 credits in the 2022/2023 harvest year. This was under 25% of the Total Allowable Harvest (TAH) for Lancaster Sound (85) and was approved.
 - Kinngait requested the use of 12 credits in the 2022/2023 harvest year. This was under 25% of the TAH for Foxe Basin (123) and was approved.
 - Pangnirtung requested the use of 16 credits in the 2022/2023 harvest year. This was over 25% of the TAH for Davis Strait (61).
 - Arctic Bay requested the use of 6 credits in the 2023/2024 harvest year. This was under 25% of the TAH for Lancaster Sound (85) and was approved.
 - Kinngait requested the use of 6 credits in the 2023/2024 harvest year. This was under 25% of the TAH for Foxe Basin (123) and was approved.
 - Pangnirtung requested the use of 36 credits in the 2023/2024 harvest year. This was over 25% of the TAH for Davis Strait (61).
 - Sanikiluaq requested the use of 2 credits in the 2023/2024 harvest year. This was under 25% of the TAH for Southern Hudson Bay (35) and was approved.
- ENV has encountered challenges with the implementation of HACCS particularly surrounding the requirement for review by the Nunavut Wildlife Management Board (NWMB).

- Section 5.7.2.1 of HACCS states that, *Requests for credits that are greater than 25% of the subpopulation TAH in a given harvest year will automatically be sent to the NWMB for review of a potential conservation concern.*
- On January 16, 2024, the NWMB provides notice to its co-management partners that it will be moving to three meetings per year. This change could foreseeably cause delays in reviewing credit requests above the 25% threshold.
- We believe the need for a NWMB decision is unnecessary when the deciding parties (Regional Wildlife Organizations (RWO) and ENV) are in support of releasing the credits requested and agree there is no conservation concern.
- There is an active request by Cambridge Bay for 1 credit to be used for the Viscount Melville polar bear subpopulation. This request is above the 25% threshold for review by the NWMB as the current TAH for that subpopulation is 3 bears. Both the RWO and ENV agree there is not a concern with the release of this one tag, however we are restricted in releasing this by the process outlined in HACCS.
- This standard of review threshold has been noted by Canada during the Non-Detriment Review as a positive step in conservation, however in instances such as the Viscount Melville and Pangnirtung request has proven this process is impracticable and onerous in its implementation and needs to be reviewed to ensure speedy decisions on community credit requests.

Current Status:

- Through external and internal feedback, it is apparent there remains confusion around the exchange and request process for credits.
- In response to general feedback, ENV is proposing to remove HACCS Section 5.7.2.1, the 25% threshold for NWMB review. As part of this removal, ENV also recognizes that some requests for credit use may present a real or perceived conservation concern. In these instances of real or perceived conservation concerns, it is proposed that any affected party could bring this to NWMB for decision on the use of credits. This will also be more consistent with NWMB's role to consider harvest limitations when there is a potential conservation concern.

Consultations:

- There have been many informal discussions with the Regional Wildlife Boards since HACCS' inception. Based on our understanding, there remains a general lack of understanding about the system by harvesters who are most impacted by the system.
- ENV provided written notice to staff at the three Regional Wildlife Boards and Environment and Climate Change Canada on December 17, 2024, that it intends to bring the 25% threshold for NWMB review to the February 2025 meeting.

Recommendations:

1. ENV recommends that the NWMB approve the removal of the 25% threshold for NWMB review.
2. ENV further recommends that NWMB direct ENV to refine HACCS such that use of credits will only be brought to the Board where an affected party believes there to be a legitimate concern to polar bear conservation.



January 31, 2025

Written comments from ECCC - Canadian Wildlife Service Wildlife Management and Regulatory Affairs Division to the Nunavut Wildlife Management Board concerning: “TAB 2 - Polar Bear Harvest Administration and Credit Calculation System (HACCS) and Use of Credits”

General comments

- Environment and Climate Change Canada (ECCC) acknowledges the two recommendations submitted by the Government of Nunavut (ENV) to the Nunavut Wildlife Management Board (NWMB) of:
 1. ENV recommends that the NWMB approve the removal of the 25% threshold for NWMB review.
 2. ENV further recommends that NWMB direct ENV to refine HACCS such that use of credits will only be brought to the Board where an affected party believes there to be a legitimate concern to polar bear conservation.
- ECCC acknowledges that ENV is recommending the removal of HACCS Section 5.7.2.1: *“Requests for credits that are greater than 25% of the subpopulation TAH in a given harvest year will automatically be sent to the NWMB for review of a potential conservation concern.”*
- ECCC acknowledges that ENV has come to this recommendation based on “many information discussions with the Regional Wildlife Boards since HACCS inception” and provided notice to ECCC on December 17, 2024 that they would be bringing these recommendations to the NWMB’s February 2025 meeting.
- ECCC acknowledges the concern raised by ENV regarding the potential delays in reviewing credit requests above the 25% threshold based on the NWMB moving to three meetings per year.

ECCC believes the outcome of the TAB2 submission could affect matters of federal jurisdiction. Accordingly, ECCC would like to submit the following clarifying questions for consideration by the NWMB:

1. With regards to the implications for polar bear subpopulations subject to multiple authorities
 - The HACCS applies to all polar bear subpopulations in Nunavut. Therefore, recommended changes to the HACCS may have management implications for polar bear subpopulations with shared jurisdiction that are subject to multiple authorities. ECCC supports the sustainable harvest of polar bears and equitable sharing of harvest among shared jurisdictions. What mechanisms are currently in place to ensure communication on decisions regarding the use of harvest credits between jurisdictions? Would the proposed changes to the HACCS result in any changes to these processes?

- It was noted that the recommended changes to the HACCS may affect the evaluation of the release of credits by Regional Wildlife Organizations and the Government of Nunavut. Are the criteria of evaluating conservation concern (including real and perceived conservation concern) and the outcomes of evaluations published (publicly accessible) and/or shared with neighboring jurisdictions that may have shared management authority?
2. With regards to Polar Bear Trade under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- While the submission does not reference CITES, ECCC would like to offer the observation that Canada is a Party to CITES. Currently, the polar bear is listed on Appendix II of CITES, requiring a CITES export permit (as per requirements under Article IV of the Convention) to enter international trade. CITES export permits can be issued only upon advice from the country's CITES Scientific Authority that the trade will not be detrimental to the survival of the species (known as a non-detriment finding or NDF). Canada updated and published an NDF document in March 2024 ([available here](#)). The NDF document provides background and considerations of the Scientific Authority when making the NDF for export permit applications. While this NDF Report provides an overall assessment of non-detriment, each permit is evaluated on a case-by-case basis. Have there been any considerations regarding how the proposed changes to the HACCS may impact (whether real or perceived) on the sustainability of polar bear harvest? While ECCC is currently unaware of any uplisting petitions for polar bear, it is important to recognize the potential international implications of changes within polar bear harvest systems in Canada.

We appreciate the opportunity to submit these clarifying questions in advance of the NWMB meeting and are looking forward to the discussion on February 26th, 2025.

SUBMISSION TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: X

Decision: X

Issue: Harvest Accumulation and Credits for Viscount-Melville Polar Bears

Background:

Inuit continue to hold invaluable teachings and knowledge about how humans can mutually coexist with polar bears by continuing to practice, adapt, and share Inuit Qaujimagatuqangit (IQ). The preservation of IQ is also ensured through ongoing travel to and harvesting of wildlife in important traditional areas. As Inuit continue to experience increasingly frequent dangerous bear interactions, IQ and traditional knowledge are also becoming increasingly critical sources of knowledge and guidance.

In Cambridge Bay, community members harvest and encounter polar bears from M'Clintock Channel and Viscount Melville populations. For Viscount Melville, Hadley Bay is known as an important polar bear denning and general wildlife area. In the past, knowledge of this area also contributed to the creation of Nunavut and information on this area continues to inform Land Use Planning.¹ Today, fewer harvesters are traveling to the area because of the fewer polar bear harvesting opportunities and tags available for the long-distance trip to be worthwhile.

Hadley Bay is approximately 250 km north of Cambridge Bay and trips usually require two days of travel plus camping on the ocean in the bay or in nearby locations as harvesters approach the area. Harvesters begin to make their trips in March or April—when there is more daylight—and to travel in groups for camping and safety reasons; for example, travel could be rough and members have occasionally killed polar bears in defence while guiding sport hunts. On these trips, which also occur through Dolphin-Union caribou calving areas, hunters also harvest wolves as a form of predation management. Harvesters could spend from one to two weeks on the land traveling to or camping around Hadley Bay, depending on whether there are polar bear harvesting opportunities.

Specific to polar bear harvest management, the Ekaluktutiak Hunters and Trappers Organization (EHTO) is concerned about the following:

- Polar bears are managed using the Harvest Accumulation and Credit Calculation System (HACCS). This system requires timely communications, reports, and sharing of harvest data from the Government of Nunavut Department of Environment (GN DoE) Polar Bear Lab. This data continues to be collected by harvesters and is shared with the local GN DoE conservation officer. While GN DoE distributes annual “Polar Bear Harvest Tables” that summarize harvest data

¹ The 2023 Recommended Nunavut Land Use Plan includes mapped polar bear denning areas, which have been designated as Conditional Use areas: <https://www.nunavut.ca/land-use-planning/draft-nunavut-land-use-plan>

and available credits according to sex for each community and polar bear subpopulation, these data are not always readily available due to delays in genetic sexing to confirm harvests. Continued reliance on genetic diagnoses of harvest samples suggests Inuit cannot be trusted to report on and make accurate diagnoses of sex of their harvests.

- When harvest data are shared or used at national and international levels without consent, inclusion, or awareness of Hunters and Trappers Organizations (HTO) and Regional Wildlife Organizations (RWO), there is a risk that information is being interpreted and/or assumed about how and why communities harvest polar bears (e.g., their intentions). IQ and traditional knowledge are not always included or considered in these interpretations. This poses an ethical concern for Inuit self-expression and -representation.
- Kitikmeot HTOs continue to harvest at or below their annual recommended quota. The reason for this pattern varies depending on the HTO. Credit accumulation is due in part to a fear of law enforcement actions triggered by unintended overharvesting (e.g., defence kills), and restrictions posed by HACCS.
- Under HACCS, HTOs and RWOs are restricted in their rights under the Nunavut Agreement (to use non-quota limitations). HACCS section 5.7.2 states “*Credit requests are made to, and approved by, the responsible RWO. The GN will verify and confirm the number of available credits and raise any conservation concerns with the relevant co-management partners and management authorities, if warranted.*” HACCS continues to involve complex sex-specific regulations and accounting and HTOs and RWOs must rely on GN DoE (Polar Bear Lab) to verify and issue credits. In other words, this process does not permit HTOs or RWOs to independently manage their harvest credits.
- The language of HACCS generally prioritizes and positions polar bears and their conservation (subpopulation persistence) at the core; community interests, safety and/or well-being concerns are not necessarily implied, yet these remain priorities and core concerns for HTOs and RWOs.
- HACCS Section 5.7.2.1 states “*Requests for credits that are greater than 25% of the subpopulation TAH in a given harvest year will automatically be sent to the NWMB for review of a potential conservation concern.*” For Viscount Melville, EHTO currently manages a TAH of 3 and more than 16 credits (8 males and 8 females). A minimum credit request of 1 must be made to NWMB, who meets only 3 times a year.

Consultation:

- In March 2023 and March 2024, KRWB hosted polar bear workshops to develop a regional framework for polar bear management based on Inuit priorities. One of

the concerns that was raised was the need for Inuit confidence in polar bear management and in HTO obligations under the Nunavut Agreement.

- In October 2024, KRWB and EHTO expressed intentions to access Viscount-Melville Credits and exchanged communications with GN DoE's Polar Bear Lab. At this time, it was noted that a request that exceeds 25% of the TAH (1 credit) needs to be made to NWMB.
- On 31 October 2024, KRWB resolved that they are in support of EHTO making a request for use of Viscount-Melville credits to NWMB (MTN# 10-2024-02).
- The issue of restricted EHTO use of Viscount-Melville credits, and requirement for NWMB review, was raised again during KRWB's Annual General Meeting from 5–7 November 2024.
- EHTO met on 21 November 2024 to discuss polar bear credits and intentions to hold a special meeting to discuss Viscount Melville credits.
- From 9–12 December 2024, EHTO Chair, Vice Chair, and Manager informally met with KRWB staff to discuss a submission for decision to NWMB. During this time, KRWB staff consulted with an active harvester and board member from EHTO who frequently travels to the Hadley Bay area.

Recommendations:

- EHTO recommends 16 credits (8 males and 8 females for Viscount-Melville be issued to increase the "Annual Recommended Quota" for 2025–2026 from 3 to 19. The most recently completed subpopulation survey suggests a subpopulation increase occurred from 145 (Bayesian 95% credible interval 109–221) in 1989–1992 to 235 (Bayesian 95% credible interval 148–569) in 2012–2014.² Because communities have not harvested Viscount-Melville in recent years, it is likely the population has continued to increase; it has been three years since EHTO has harvested any polar bears in the area. It is also possible that the Annual Recommended Quota (19) will not be filled, as the successful harvest will depend on travel and weather conditions and interest among harvesters in Cambridge Bay. However, the higher quota would still be used to promote harvesting opportunities and encourage harvesting and travel to Hadley Bay.
- Although harvest data is being gathered by HTO and RWO members and submitted to GN DoE, that data is not openly nor easily accessible by HTOs and RWOs. Agreements between HTOs, RWOs, and GN DoE are needed to enable

² Regehr EV, Baryluk S, Boulanger J, Branigan M, d'Eon-Eggertson F, Pongracz J, Thom A and Richardson ES. 2024. Modeling movements improves capture-recapture estimates for mobile species with sparse data: polar bears (*Ursus maritimus*) in Viscount Melville sound. *Population Ecology*: 1–16. Available at <https://esj-journals.onlinelibrary.wiley.com/doi/full/10.1002/1438-390X.12198>

ethical, shared, and equitable access and use of data among co-management partners.

- There is a need to shift how polar bear management is viewed and approached in a way that truly respects and empowers Inuit self-determination, and considers the physical, mental, and cultural well-being of Inuit. The use of language such as “Annual **Recommended** Quota” and “Total **Allowable** Harvest” implies an external influence and restriction on Inuit ability to independently make decisions.
- Despite changes in how polar bears have been managed over the last three decades, staff turnover among co-management organizations, and the passing of both elders and staff, IQ and traditional knowledge continues to persist as a consistently reliable source of data, knowledge, and guidance across time. Community members continue to hold the deep and complex history of Viscount-Melville management—and polar bear management in general—in living memory and this cannot be overlooked.

Prepared by:

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Kitikmeot Regional Wildlife Board
pwong@krwb.ca

Submitted by:



For → Peter Evalik, Chair
Ekaluktutiak Hunters and Trappers Organization

Date: 10 January 2025



January 31, 2025

Nunavut Wildlife Management Board
310-1106 IKALUKTUUTIAK DRIVE
IQALUIT, NUNAVUT X0A 3H0
receptionist@nwmb.com

Dear Chairman Shewchuk and Board Members:

RM001-2025 – TAB3 KRWB Harvest Accumulation and Credits

The Government of the Northwest Territories (GNWT) recently became aware of the above-referenced agenda item that potentially affects polar bear management and harvesting in the Northwest Territories (NWT). The Kitikmeot Regional Wildlife Board (KRWB) has requested a decision from the Nunavut Wildlife Management Board (NWMB) regarding issuance of credits accumulated for the Viscount-Melville Sound (VM) polar bear subpopulation, which has a Total Allowable Harvest (TAH) that is shared with Inuvialuit harvesters in the NWT. Although the Harvest Accumulation and Credit Calculation System exists in Nunavut (NU), no equivalent system exists in the NWT for accumulations of unused polar bear tags year over year.

The current TAH for the VM subpopulation is 7, which is divided between the NWT and NU (4 and 3, respectively). As noted in the KRWB's submission, a new estimate for the VM subpopulation has recently been published (Regehr et al. 2024) and we have encouraged the Inuvialuit Game Council to reach out to their colleagues in NU to discuss recommendations for any changes to the TAH, and any additional management actions for the VM subpopulation, under the terms of the *Polar Bear Management Agreement for the North Beaufort Sea and Viscount Melville Sound Polar Bear Populations* (2006). According to this agreement, this user-to-user group is to meet annually to "review the best available information...and make recommendations for research and management." These recommendations would then feed into the respective co-management structures established under the *Nunavut Land Claims Agreement* and *Inuvialuit Final Agreement*. Unfortunately the Commissioners have not met since the publication of the new abundance estimate.

The GNWT has some concerns about the KRWB recommendation for issuance of 16 credits for the VM subpopulation. With the addition of 16 credit tags, the potential harvest from the VM subpopulation could be as high as 23 bears (4 NWT + 3 NU + 16 credits), which represents nearly 10% of the updated population estimate in Regehr et al. (2024) of 235 (Bayesian 95% CI 148-569).

.../2

Polar bears are not fast-reproducing animals, and the removal of a substantial portion of the breeding population (particularly females) can take years to recover from (Taylor et al. 2002) and can lead to changes in population composition and demographics (Regehr et al. 2024). Research has suggested that the VM subpopulation was previously overharvested at harvest levels of 8.2 bears annually (Regehr et al. 2024, Taylor et al., 2002), which reduced the subpopulation down to the numbers seen in the Taylor et al. (2002) estimate. This past overharvest resulted in a harvest moratorium in this subpopulation from 1995-1999. The VM polar bear subpopulation is a small population and has previously demonstrated sensitivity to overharvesting. Taylor et al. (2002) estimated the unharvested growth rate of this subpopulation at barely above replacement levels (1.059).

We would also note that KRWB's assertion that "Because communities have not harvested Viscount-Melville in recent years, it is likely the population has continued to increase" is unlikely to be accurate for the VM polar bear subpopulation. Evidence suggests that this subpopulation is near its environmental carrying capacity (Regehr et al. 2024), which is related to the availability of suitable habitat and food. Low levels of harvest in the area suggest that this subpopulation is not limited by human harvest. Taking a precautionary principle approach, we should not assume that this subpopulation has increased since the last assessment, unless there is evidence that has not been presented.

In light of the best available information for the VM subpopulation and given that the joint Commission for the Inuit and Inuvialuit have not had a chance to jointly review and discuss any changes to management in the VM area since the publication of Regehr et al. (2024), the GNWT feels it would be premature at this time to grant the KRWB's request for issuance of 16 polar bear credits. We acknowledge the desire to "promote harvesting opportunities and encourage harvesting and travel to Hadley Bay" for harvesters, but this needs to be balanced with the sustainability of polar bears in a relatively low productivity area like the VM.

Thank you for your consideration of our comments.

Sincerely,



Heather Sayine-Crawford
Director, Wildlife Management
Environment and Climate Change

Enclosures

- Polar Bear Management Agreement for the North Beaufort Sea and Viscount-Melville Sound Polar Bear Populations between the Inuit of the Kitikmeot West Region in Nunavut and the Inuvialuit (2006).
- Regehr, E. V., Baryluk, S., Boulanger, J., Branigan, M., d'Eon-Eggertson, F., Pongracz, J., Thom, A., & Richardson, E. S. (2024). Modeling movements improves capture–recapture estimates for mobile species with sparse data: Polar bears (*Ursus maritimus*) in Viscount Melville sound. *Population Ecology*.
- Taylor, M. K., Laake, J., Cluff, H. D., Ramsay, M., & Messier, F. (2002). Managing the risk from hunting for the Viscount Melville Sound polar bear population. *Ursus*, 185–202.

POLAR BEAR MANAGEMENT AGREEMENT

for the NORTH BEAUFORT SEA AND VISCOUNT-

MELVILLE SOUND POLAR BEAR POPULATIONS

**between the Inuit of the Kitikmeot West Region in Nunavut
and the Inuvialuit**

Signed by the Kitikmeot Hunters and Trappers' Association

and

Inuvialuit Game Council

The Parties to this agreement are the Inuvialuit and the Inuit of the Kitikmeot West Region in Nunavut:

Noting that both groups have traditionally harvested a portion of polar bears from the North Beaufort Sea and Viscount-Melville Sound polar bear populations;

And Noting that the continued hunting of polar bears is essential to maintain the dietary, cultural, and economic base of the groups;

And Noting that the maintenance of a sustained harvest for traditional users in perpetuity requires that the number of polar bears taken annually not exceed the productivity of the population;

And Noting that the US and Canadian management authorities have accepted the *Inuvialuit-Inupiat Polar Bear Management Agreement in the Southern Beaufort Sea* and it has proven to be an effective user-to-user agreement in the shared management of that polar bear population;

And Noting that nothing in this Agreement shall be read to abrogate the responsibilities of Federal or Territorial authorities under existing or future statutes;

And Noting that the Inuit of the Kitikmeot West Region in Nunavut and the Inuvialuit will have a long-term fundamental influence on the maintenance and use of this resource and that the efforts of other parties will also be required to ensure effective conservation;

the Parties have agreed as follows:

ARTICLE I

(a) The species considered in this Agreement is the polar bear (*Ursus maritimus*).

(b) The area covered by this Agreement is the area within the boundaries of the North Beaufort Sea and Viscount-Melville Sound Polar Bear Populations as defined in the appropriate legislation.

(c) The people covered by this Agreement are the Inuit of the Kitikmeot West Region in Nunavut and the Inuvialuit.

(d) The settlements and their outpost camps whose hunting practices may be affected by this Agreement are Cambridge Bay, Kugluktuk, Sachs Harbour, Ulukhaktok, and Paulatuk.

(e) Sustainable yield means a harvest level which does not exceed net annual recruitment to the population and accounts for all human-caused forms of removal from the population, and which considers the status of the population, based on the best available scientific information and Traditional Knowledge/Inuit Qaujimajatuqangit.

(f) A Joint Commission with responsibility to implement this agreement will be formed and shall consist of three (3) representatives designated by each of the Inuvialuit Game Council and the Kitikmeot Hunters and Trappers Association. A Technical Advisory Committee with responsibility for ensuring the collection and evaluation of all relevant management data, including Traditional Knowledge/Inuit Qaujimajatuqangit, and making recommendations to the Joint Commission, shall be appointed by the Joint Commission.

ARTICLE II

Objectives:

- (a) To maintain the North Beaufort Sea and Viscount-Melville Sound polar bear populations at healthy viable levels in perpetuity.
- (b) To manage polar bears on a sustained yield basis in accordance with all the best information available.
- (c) To provide protection to female polar bears by encouraging that the female proportion of the harvest not exceed one third of the sustainable total.
- (d) To encourage the collection of adequate scientific, Traditional Knowledge/Inuit Qaujimagatuqangit, and technical information in a timely manner to facilitate management decisions.
- (e) To minimize detrimental effects of human activities on polar bears and their habitat.
- (f) To identify research priorities.
- (g) To allocate the total sustainable yield between the two jurisdictions.
- (h) To encourage the wise use of the polar bear populations and all polar bear products.
- (i) To facilitate the import into the USA of hides and other products from polar bears harvested in the Kitikmeot West Region in Nunavut and in the Inuvialuit Settlement Region.
- (j) To meet annually to review the best available information on the aforementioned polar bear populations, and make recommendations for research and management.
- (k) To review this Agreement every 5 years, or sooner if requested by either Party.

ARTICLE III

Collection of Data and Sharing of Information:

- (a) The following data will be recorded for each bear killed: sex, date, and location of the kill.
- (b) The following specimens shall be collected from each bear killed: the lower jaw or an undamaged post-canine tooth to be used for age-determination, ear tags, lip tattoos, radio collars if present, the baculum from each male, and other specimens as agreed to by the hunters of either jurisdiction for additional studies.
- (c) A summary of all harvest information and pertinent research plans or results from each jurisdiction shall be exchanged annually, normally at the annual meeting referred to in Article II (j).
- (d) The number of collars deployed for research purposes shall be limited to the minimum number necessary to reach management objectives.
- (e) There shall be notification and consultation prior to undertaking research.

ARTICLE IV

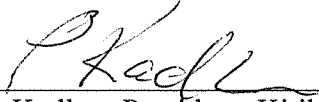
Duration and Administration of Agreement:

- (a) This Agreement shall enter into force when it has been signed by the duly authorized representatives of each Party.
- (b) This Agreement shall remain in force unless either Party requests it be terminated.
- (c) Amendments to the Agreement may be proposed by either Party, then accepted or rejected by mutual agreement of the Parties. Formal written notification of any amendments to the Agreement approved and accepted by both Parties should be made to the Nunavut Wildlife Management Board, the Government of Nunavut Department of Environment, the Wildlife Management Advisory Council (NWT) and the GNWT Department of Environment and Natural Resources.

The signatories of this document have no authority to bind, and do not purport to bind, the respective regulatory authorities to any agreement which would otherwise be in violation of their management authority, but are acting solely as representatives of the local traditional user groups of the polar bear resource in furthering the goals of conservation, consultation, management, and information exchange.

SIGNED on this, the 4th day of February, 2006 in the city of Yellowknife.

On behalf of the Inuit of the Kitikmeot West Region in Nunavut:

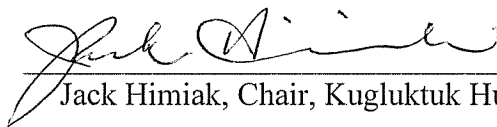


Philip Kadlun, President, Kitikmeot Hunters and Trappers' Association

Witnessed by:

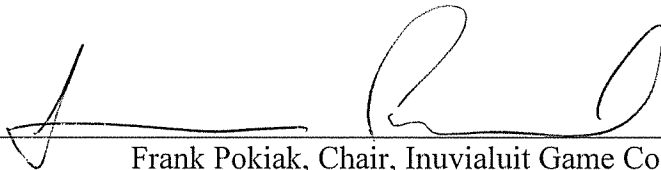


Attima Hadlari, Chair, Cambridge Bay Hunters and Trappers' Organization



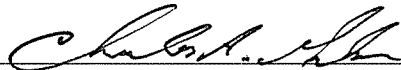
Jack Himiak, Chair, Kugluktuk Hunters and Trappers' Organization

On behalf of the Inuvialuit:

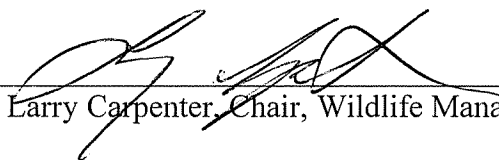


Frank Pokiak, Chair, Inuvialuit Game Council

Witnessed by:




Charles A. Gruben, Member, Inuvialuit Game Council



Larry Carpenter, Chair, Wildlife Management Advisory Council (NWT)

ORIGINAL ARTICLE

Modeling movements improves capture–recapture estimates for mobile species with sparse data: Polar bears (*Ursus maritimus*) in Viscount Melville sound

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Abstract

Wildlife management requires estimates of demographic parameters that are difficult to obtain for mobile species at low densities. Biased parameter estimates often result from capture–recapture (CR) studies due to small sample sizes and unequal recapture probabilities, the latter of which can be caused by animal movements with respect to the sampling area. We developed a multi-state CR model designed to minimize biases by including multiple data types (capture, harvest, natural mortality, and telemetry) and accounting for temporary emigration. We applied the model to data collected intensively from 2012 to 2014, and intermittently since the 1970s, for the Viscount Melville (VM) subpopulation of polar bears (*Ursus maritimus*) in the Canadian Arctic. The number of bears within the VM subpopulation boundary likely increased from an average of 145 (Bayesian 95% credible interval [CRI] [109, 221]) in 1989–1992 to 235 (95% CRI [148, 569]) in 2012–2014. Survival probability increased for all sex and age classes except adult females, for which estimates declined due to unknown reasons. Polar bear movements exhibited Markovian dependence with approximately 28% of the subpopulation located outside of the sampling area each spring. This contributed to inaccurate parameter estimates when using a simpler, single-state CR model that only included capture data. Although the interpretation of demographic status was complicated by statistical uncertainty and changes in study design, our findings suggest that—as of 2014—the VM polar bear subpopulation had likely recovered from an earlier period of overharvest, was stable, and had not exhibited detectable negative effects of climate warming.

KEYWORDS

capture–recapture, polar bear, radiotelemetry, temporary emigration, wildlife management

Marsha Branigan: Retired.

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1 | INTRODUCTION

Periodic estimates of vital rates (e.g., reproduction and survival) and population abundance are needed for the management and conservation of wildlife (Runge, 2011). This is especially important for adaptive or state-dependent management (e.g., adjusting harvest levels in response to changing abundance) of species exhibiting spatial and temporal variation in population status due to climate warming (e.g., Sekercioglu et al., 2012). Capture–recapture (CR) studies are commonly used to investigate wildlife demography (Williams et al., 2002). For many species, climate warming is concurrently affecting demographic status as well as animal movements and distribution (Pandey & Papes, 2018). If not accounted for during the design and analysis of CR studies, heterogeneous recapture probabilities caused by movements can lead to biased estimates of vital rates (Kendall et al., 1997; Schaub et al., 2004) and uncertainty about the definition of the study population (e.g., whether estimates of abundance represent the number of animals in an area at a specific time vs. the number of animals that use the area over an extended period; Regehr et al., 2009).

Polar bears exemplify the challenges discussed above. The species is considered Threatened under the U.S. Endangered Species Act (USFWS 2008) and Vulnerable by the International Union for the Conservation of Nature due to observed and forecasted sea-ice loss (Regehr et al., 2016). Although climate warming is the primary threat to polar bears (PBRs, 2015) and expected to negatively impact most bears in the long term (Atwood et al., 2016; Molnár et al., 2020), the status of the world's 19 polar bear subpopulations is currently variable due to differences in the rate of habitat change, ecosystem productivity, human-caused mortality, and other factors (Durner et al., 2018). Some subpopulations have declined due to sea-ice loss (e.g., Bromaghin et al., 2021; Lunn et al., 2016) while others, particularly those at high latitudes where biological productivity was historically limited by heavy ice, have remained stable (Dyck et al., 2023) or increased (Laidre et al., 2020; Wiig et al., 2022). Polar bears are among the most mobile quadrupeds (e.g., Amstrup et al., 2000; Wilson et al., 2022) and climate-mediated changes in sea-ice availability are affecting their seasonal distributions as well (Laidre et al., 2020). This may increase the chances that animal movements, especially nonrandom temporary emigration from the sampling area, will introduce bias into demographic parameter estimates (Peñaloza et al., 2014). Regehr et al. (2009) used a combination of empirical data and computer simulation to demonstrate that movement-related bias can be large for some CR studies of polar

bears and can potentially lead to incorrect conclusions about population status.

The Viscount Melville (VM) polar bear subpopulation occurs in Nunavut and the Northwest Territories (NWT), Canada. The most recent abundance estimate was 161 bears (standard error [SE] = 34 bears) for the period 1989–1992 based on Cormack-Jolly-Seber (CJS) CR models (Taylor et al., 2002). This makes VM one of the smallest polar bear subpopulations, increasing vulnerability to negative demographic effects and leading Taylor et al. (2002) to question the value of future CR studies due to the low precision of parameter estimates resulting from small sample sizes. Like other polar bear subpopulations in Canada, VM is subject to a legal and regulated subsistence harvest by Indigenous Peoples, which is guided by the *Polar Bear Management Agreement for the North Beaufort Sea and Viscount-Melville Sound polar bear populations between the Inuit of the Kitikmeot West Region in Nunavut and the Inuvialuit*, signed in 2006. Relatively high harvest levels from 1973 to 1992 (mean 8.2 bears/year) led to changes in population composition suggesting overharvest (Taylor et al., 2002), which resulted in the management decision to implement a harvest moratorium from 1995 to 1999, followed by reduced quotas corresponding to a mean harvest of 4.3 bears/year from 2000 to 2019 (Government of the Northwest Territories and Nunavut, unpublished data). Updated demographic information is needed to estimate the current sustainable harvest level and understand the impacts of climate warming on VM bears.

We conducted physical CR sampling on the VM subpopulation and applied satellite radiocollars to a limited number of adult females from 2012 to 2014. We analyzed these data, together with capture data collected intermittently since the 1970s, using a multistate model implemented in a Bayesian framework that sought to minimize potential biases associated with animal movements while maximizing the value of available data and knowledge. The model included multiple geographic states, used radiotelemetry data to inform transitions among states, included harvest data and observations of natural mortalities of research-marked animals, and used informative prior distributions for survival probability. Because the data were too sparse for time-dependent models, we explored long-term changes in demographic parameters using a two-period approach (1974–1999 and 2000–2019). Consistent with findings for other species (e.g., Bird et al., 2014), our analyses demonstrate that combining multiple data types and modeling movements can improve estimates of demographic parameters from CR studies of polar bears when sample sizes are small and animals move in and out of the sampling area.

2 | METHODS

2.1 | Study area

The VM polar bear subpopulation inhabits a marine area of approximately 101,000 km² (Stern & Laidre, 2016)

surrounding Melville Island, eastern Prince Patrick Island, northern Victoria Island, and VM Sound (Figure 1). It is considered part of the archipelago ecoregion for polar bears (Amstrup et al., 2008), which is characterized by heavy annual and multiyear sea ice that historically provided a year-round platform from which

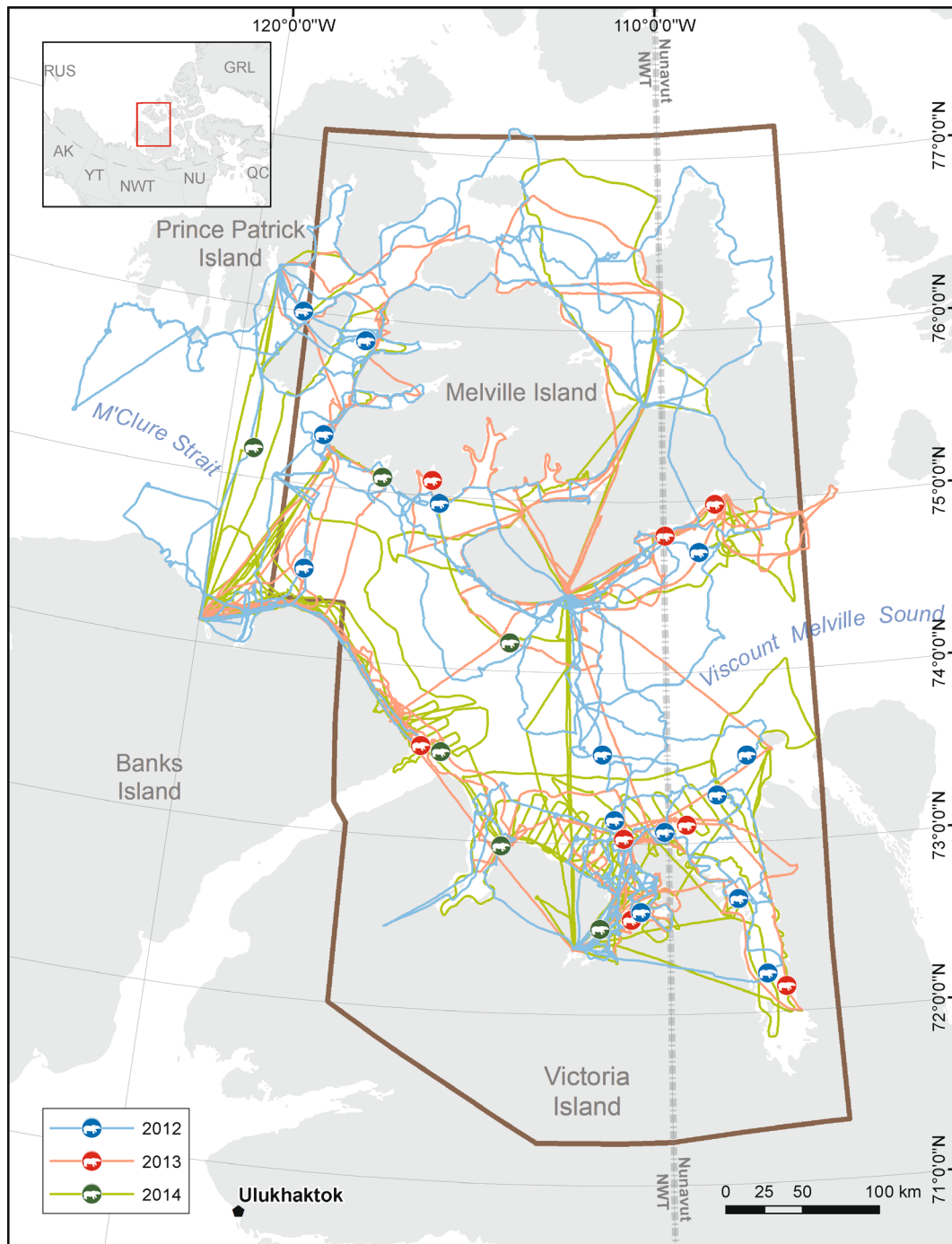


FIGURE 1 Management boundary of the Viscount Melville (VM) polar bear subpopulation (brown line) with global positioning system flight tracks (colored lines) and capture locations (colored symbols) from capture–recapture sampling conducted 2012–2014. The VM subpopulation occurs in the Northwest Territories (NWT) and Nunavut (NU), Canada. The inset in the upper left shows the depicted area in relation to Russia (RUS); Alaska, USA (AK); the Yukon Territory (YT) and Province of Quebec (QC), Canada; and Greenland (GRL).

polar bears could hunt (Messier et al., 1992). Areas of thick ice are generally poor habitat for ringed seals (*Pusa hispida*; Kingsley et al., 1985), the polar bears' primary prey (Amstrup, 2003), and therefore support relatively low densities of polar bears (Stirling, 2002; Stirling & Parkinson, 2006). From 1979 to 2016, the duration of the open-water season within the VM subpopulation boundary, as calculated from remote-sensing data using the methods of Stern and Laidre (2016), increased by an average of 11.2 days per decade. Concurrently, sea-ice concentration at the yearly minimum sea-ice extent declined by 6% per decade (Cavalieri et al., 1996, updated yearly). Similar shifts from heavy, multiyear sea ice to lighter, annual sea ice have been associated with improved body condition (i.e., fatness, a key indicator of reproductive success and survival) and increased abundance in some other high-Arctic subpopulations of polar bears (Dyck et al., 2021; Laidre et al., 2020).

2.2 | Field methods and data sources

We analyzed live-capture, radiotelemetry, and dead-recovery data collected from multiple sources over the period 1974–2019. Live-encounter data were available from CR programs conducted during the spring on the sea ice in 1974–1976, 1989–1992, and 2012–2014 using standard chemical immobilization techniques, as described in Taylor et al. (2002). Data were collected during 1989–1992 and 2012–2014 as part of a designed study with relatively large sample sizes. In contrast, live-capture data from 1974 to 1976 were collected opportunistically and did not include recaptures of previously marked individuals. Therefore, for analyses we pooled the 1974–1976 data into a single sampling occasion referenced to 1975 and modeled initial captures only by fixing recapture probability to 0 during this period (see Section 2.4). Live captures during 2012–2014 were approved by the Northwest Territories Wildlife Care Committee and conducted under research permit numbers WL005411, WL005418, and WL500236.

During physical captures, dependent young (cubs-of-the-year [C0] and yearlings [C1]) were aged based on body size and dentition. Independent bears (i.e., ≥ 2 years-old) were aged by counting the growth annuli in an extracted vestigial premolar (Calvert & Ramsay, 1998). From 2012 to 2014, sampling effort was distributed throughout the current VM subpopulation boundary, as evidenced by capture locations and global positioning system (GPS) tracklogs from the helicopter used for captures (Figure 1). In contrast, from 1974 to 1976 and 1989 to 1992, sampling effort was restricted to marine regions within the VM subpopulation boundary south of 76° latitude, excluding the small

marine region that is south of 76° but north of Melville Island. Changes over time in the geographic region exposed to sampling meant that the definition of the study population changed as well, which has ramifications for interpreting estimates of population abundance and trend (see Sections 3 and 4).

Some captured adult (≥ 5 years) female polar bears were fitted with satellite radiocollars (Platform Transmitter Terminal tags that provided data through the Argos system [www.argos-system.org] using Doppler-derived location estimates [1989–1992; Messier et al. (1992)] or GPS locations [2012–2014]). We used location data from telemetry to determine whether collared bears were inside, or outside, the VM subpopulation boundary during each spring sampling occasion. The sampling occasion during year t was determined by the first and last live captures in the spring of that year. For each female fitted with a collar in year t , we used location data to determine whether she was in or out of the sampling area in subsequent years for which the collar functioned. A bear was considered in the sampling area on occasion t if more than 50% of the total distance it traveled during the 1–3-week sampling occasion was inside the VM subpopulation boundary. Regehr et al. (2018) performed similar in-versus-out calculations while accounting for differences in collar transmission schedules and location accuracy using a continuous-time correlated random walk model. However, such standardization was not necessary in our analyses because location data for most collared bears were unambiguous (e.g., for the subset of bears considered “in,” on average 98% of the distance traveled by each bear during the spring sampling occasion was within the VM subpopulation boundary).

In addition to live-capture and radiotelemetry data, we included data from research-marked bears that were harvested for subsistence purposes or were found by researchers after apparently dying without human involvement. Although physical captures ended in 2014, we modeled dead recoveries through 2019. In the NWT and adjacent Nunavut, subsistence harvest was implemented at a target 2:1 male–female sex ratio under a quota system with standardized reporting requirements including sex, age, and the presence of research marks (i.e., lip tattoos and ear tags with unique identification numbers, and satellite telemetry devices). Harvest reporting was mandatory and nearly 100% (S. Baryluk, unpublished data) although it is possible that physical research marks were lost or became illegible over time (see Section 4). We included harvest data for all bears previously marked in the VM subpopulation, even if they were harvested and reported in an adjacent subpopulation. When logistically feasible from 2012 to 2014, we also investigated the fate of bears wearing GPS collars that

appeared stationary during the field season (i.e., to determine whether the bear was dead or had dropped its collar).

2.3 | Multistate capture–recapture model structure

We developed a multistate CR model to estimate survival and abundance (e.g., Lebreton et al., 2009; Warlick et al., 2023). Because of small sample sizes and extended periods without live captures we used a relatively simple model structure and, unlike some other analyses for polar bears (e.g., Bromaghin et al., 2021), did not model vital rates as a function of environmental covariates (e.g., sea-ice concentration) due to the risk of spurious correlations. To account for demographic stochasticity, we modeled population processes as binomial and multinomial outcomes, as described below.

The model included six states: (1) alive and in the sampling area, (2) alive and out of the sampling area, (3) recently harvested and reported in the sampling area, (4) recently harvested and reported out of the sampling area, (5) recently dead of natural causes and found by humans (all such observations occurred in the sampling area), and (6) an absorbing dead state. The state transition matrix (Table 1) focused on modeling movements in and out of the VM subpopulation boundary because reducing potential bias due to nonrandom temporary emigration was a primary objective. The structure of the multistate model did not include sex, age, or reproductive states reflecting the polar bear life cycle (Regehr et al., 2010) because the data were too sparse to fit highly parameterized models. However, we derived sex- and age-specific estimates of some parameters using individual- and group-based covariates (see Section 2.4).

Parameters in the state transition matrix were referenced to annual timesteps from the spring of year t to the

spring of year $t + 1$. Individual bears of all ages entered the dataset when captured, marked, and released for the first time. Transitions among states were determined by five parameters. Total survival (ϕ) represented the probability of surviving, considering all types of mortality. Movement probabilities allowed individuals in the sampling area in year t to either remain inside (Ψ_1) or move outside ($1 - \Psi_1$) in year $t + 1$, conditional on survival. Similarly, individuals outside the sampling area could either remain outside (Ψ_2) or move inside ($1 - \Psi_2$). Estimating Ψ_1 and Ψ_2 separately meant that the model allowed for Markovian dependence in movement probabilities. The final two parameters were conditional on death: harvest recovery probability, r , defined as the probability that a bear was killed by a human and reported to the responsible management authorities; and the parameter κ , defined as the probability that a bear that died of natural causes was detected by a human. We modeled harvest recoveries as states, which led to r appearing in the state transition matrix rather than in the observation matrix, because this parameterization can improve numerical estimation in some Bayesian implementations of live-recapture dead-recovery models (Kéry & Schaub, 2012). Although there were only two known natural mortalities, we accounted for them in the model structure because of the sparseness of VM data in the 2010s. We considered κ a nuisance parameter because it was a function of a nonrandom search process and did not have a biological meaning.

Processes leading to bear observations were represented by the observation matrix, which included eight possible observation types (Table 2). Parameters in the observation matrix included p , the probability of physical recapture conditional on being alive and in the sampling area. There were no physical captures outside of the sampling area. The observation matrix also included the individual time-varying covariate Tel , which was set to 1 if an adult female bear was wearing a radiocollar that

TABLE 1 State transition matrix for the multistate capture–recapture model of Viscount Melville polar bears.

	1	2	3	4	5	6
	Alive in	Alive out	Harvested and reported in	Harvested and reported out	Known-natural mortality	Dead (absorbing)
1 Alive in	$\phi \Psi_1$	$\phi (1 - \Psi_1)$	$(1 - \phi) \Psi_1 r$	$(1 - \phi) (1 - \Psi_1) r$	$(1 - \phi) \kappa$	$(1 - \phi) (1 - r - \kappa)$
2 Alive out	$\phi (1 - \Psi_2)$	$\phi (\Psi_2)$	$(1 - \phi) (1 - \Psi_2) r$	$(1 - \phi) \Psi_2 r$	$(1 - \phi) \kappa$	$(1 - \phi) (1 - r - \kappa)$
3 Harvested and reported in	0	0	0	0	0	1
4 Harvested and reported out	0	0	0	0	0	1
5 Known-natural mortality	0	0	0	0	0	1
6 Dead (absorbing)	0	0	0	0	0	1

Note: Rows and columns represent model states. The parameters in cell i, j define the probability of transitioning from the state in row i at year t , to the state in column j at year $t + 1$. Parameters are defined in the main text.

TABLE 2 Observation matrix for the multistate capture–recapture model of Viscount Melville polar bears.

	1 Capture in, no telemetry data	2 Capture in, known in due to telemetry	3 Not captured in, known in due to telemetry	4 Known out due to telemetry	5 Harvested and reported in	6 Harvested and reported out	7 Known- natural mortality	8 No observation
1 Alive in	$p(1-Tel)$	$p Tel$	$(1-p) Tel$	0	0	0	0	$(1-Tel)(1-p)$
2 Alive out	0	0	0	Tel	0	0	0	$(1-Tel)$
3 Harvested and reported in	0	0	0	0	1	0	0	0
4 Harvested and reported out	0	0	0	0	0	1	0	0
5 Known- natural mortality	0	0	0	0	0	0	1	0
6 Dead (absorbing)	0	0	0	0	0	0	0	1

Note: Rows represent model states and columns represent observation types. The parameters in cell ij define the probability of the observation type in column j at year t , conditional on being in the state in column i at year t . Parameters and covariates are defined in the main text.

confirmed she was alive and provided location data (i.e., that indicated whether the bear was in or out of the sampling area) and set to 0 otherwise.

The live-encounter, radiotelemetry, and dead-recovery data were analyzed jointly by expressing the state of individual i in year t as a categorical random variable:

$$z_{i,t} | z_{i,t-1} \sim \text{Cat}(\Theta_{z_{i,t-1}}), \quad (1)$$

where $\Theta_{z_{i,t-1}}$ is the vector of state transition probabilities for an individual that was in state $z_{i,t-1}$ in year $t-1$, as defined by parameters in the state transition matrix. Observation data for individual i in year t , $y_{i,t}$, were modeled as a function of its state in year t as well as covariates (e.g., presence of a functional radiocollar, see below). We assumed $y_{i,t}$ was a categorical random variable:

$$y_{i,t} | z_{i,t} \sim \text{Cat}(\Pi_{i,t,z_{i,t}}), \quad (2)$$

where $\Pi_{i,t,z_{i,t}}$ is the vector of detection probabilities for individual i in year t , as defined by the observation matrix. From 1989 to 1992, very high frequency (VHF) transmitters on radiocollars were used to locate several collared bears for physical capture. The resulting increase in p , compared to non-collared bears, was accounted for using an individual time-varying covariate (rad) that was

set to 1 if an adult female was wearing a functional radio collar 1989–1992, and set to 0 otherwise.

Finally, we modeled counts of individuals physically captured in the sampling area (state 1) in year t (n_t) as a binomially distributed random variable, with recapture probability p and latent abundance N_t :

$$n_t \sim \text{Binomial}(p, N_t). \quad (3)$$

Annual values of N_t were considered a Poisson-distributed random variable with rate parameter λ_t . We specified a time-constant rate parameter within each period of intensive CR sampling during which abundance estimation was possible (i.e., 1989–1992 and 2012–2014). Therefore, we report a mean value of N_t over each period of interest (e.g., $\bar{N}_{2012-2014}$). The values of n_t and p used here refer to bears that were physically captured and released alive after being randomly encountered while searching the sampling area by helicopter. To account for the small number of bears that were more likely to be detected from 1989 to 1992 due to the assistance of VHF telemetry (i.e., bears with $rad=1$), we adjusted estimates of N_t by adding numbers of radiocollared bears (N_t^{rad}) estimated using a Horvitz-Thompson equation (McDonald & Amstrup, 2001), as follows:

$$N_t^{rad} = n_t^{rad} / p_t^{rad}, \quad (4)$$

where n_t^{rad} is the number of radiocollared bears that were captured and p_t^{rad} is their corresponding recapture probability.

The parameter N_t represents the number of bears that used the sampling area during sampling occasion t . Because some polar bears were located outside of the sampling area each spring, N_t was necessarily smaller than the “superpopulation,” N_t^S , defined as the number of bears with a non-negligible probability of using the sampling area over a multiyear period (Kendall et al., 1997). We were interested in N_t^S because it is commonly estimated in CR studies of geographically open populations when using simpler models that do not account for movements in and out of the sampling area. Specially, the previous VM abundance estimates in Taylor et al. (2002) represent N_t^S . To derive approximate values of N_t^S , we created a 2×2 matrix model that included in and out states, with transitions among states defined by the posterior distributions of Ψ_1 and Ψ_2 from the multistate model. We then estimated the proportion of the superpopulation located within the sampling area on occasion t ($prop.in_t$) based on the matrix’s asymptotic stable-stage distribution, and subsequently calculated superpopulation size as $N_t^S = N_t / prop.in_t$.

2.4 | Model fitting and parameter estimation

We constructed a model for inference using the state transition and observation matrices (Tables 1 and 2, respectively). Parameters in the matrices were modeled as linear equations of covariates using a logit link function. Model structure was informed by biological and study-design considerations for the VM subpopulation as well as patterns in polar bear vital rates from other studies (e.g., sex- and age-specific variation in survival). The model was parameterized as follows, where the terms in parentheses represent parameter-specific submodels:

$$\begin{aligned} &\varphi \left(COC1^{per1} + SF^{per1} + AF^{per1} + SM^{per1} + AM^{per1} \right. \\ &\quad \left. + \beta_{(t)}^{per1} + COC1^{per2} + SF^{per2} + AF^{per2} + SM^{per2} \right. \\ &\quad \left. + AM^{per2} + \beta_{(t)}^{per2} \right) \psi_1(per1 + per2) \psi_2(per1 + per2) \\ &\quad \times r(F^{per1} + M^{per1} + F^{per2} + M^{per2}) \kappa(per2) p(per1 + per2 + rad^{per1}). \end{aligned} \tag{5}$$

Notation for sex is females (F) and males (M). Age classes consisted of C0s and C1s grouped together, due to small sample sizes ($COC1$); subadults (2–4 years; S), and adults (≥ 5 years; A). Terms used together represent

combined sex- and age-classes (e.g., SF refers to subadult females, whereas F without an age modifier refers to all females). For the survival submodel, the choice of age classes was based on previous demographic studies for polar bears (e.g., Regehr et al., 2007; Taylor et al., 2009). A sex effect was included because the VM subpopulation is subject to sex-selective harvest, a common management tool for polar bears (Taylor et al., 2008). The sex effect was not extended to dependent young because harvesting females with cubs was prohibited. We included a two-level fixed effect for period ($per1$ and $per2$) to evaluate changes in mean survival over time. We selected the year 2000 as a cutoff because it divided the overall study into periods of comparable length and marked the end of a harvest moratorium (Government of the NWT, unpublished data). When used as superscripts, the terms $per1$ and $per2$ denote demographic parameters for the periods 1974–1999 and 2000–2019, respectively. For example, $\varphi(S^{per1})$ represents subadult survival for the early period. Temporal random effects in survival were formulated as $\beta_{(t)} \sim Normal(0, \sigma^2)$, where σ^2 is the period-specific variance. The movement submodels included a period effect only because most location data were from adult females, which precluded more detailed sex and age structure. The harvest recovery submodel included period and sex effects because harvest of the VM subpopulation was selective and changed over time. The parameter κ was fixed to 0 in all years except during the second period of intensive CR sampling, for which it was modeled using an intercept only. Finally, the submodel for recapture probability included a period effect because of changes in sampling effort between the two periods of intensive CR sampling (1989–1992 and 2012–2014). Recapture probability was fixed to 0 in all other years.

We used informed prior distributions for survival corresponding to mean values and standard deviations (SD) on the probability scale of 0.72 (SD = 0.21) for C0s and C1s of both sexes, 0.87 (SD = 0.09) for SFs, 0.93 (SD = 0.04) for AFs, 0.80 (SD = 0.13) for SMs, and 0.89 (SD = 0.05) for AMs. These priors were developed using moment-matching methods based on the point estimates and SEs of apparent survival (i.e., including harvest mortality but generally not including emigration) for 12 other polar bear subpopulations with available data (Supporting Information S1). Because the demographic status of these subpopulations varied, our use of priors did not represent a specific assumption about the VM subpopulation (e.g., that it was growing or declining), but rather represented the assumption that survival of VM polar bears was within the range of empirical estimates of survival for the global population of polar bears. Non-informative priors were used for all other parameters in the model (Supporting Information S1).

To understand the effects of modeling multiple data types and accounting for animal movements, we compared our results with those from a single-state model that included live-encounter data only and was analogous to a traditional CJS model with time-constant structures for ϕ and p in the early and late periods of the study (Williams et al., 2002; Supporting Information S1). Goodness-of-fit (GOF) tests are not well developed for multistate models with individual covariates. Therefore, we also used the CJS-analog model to evaluate GOF based on tests derived from logistic regression in the R package *mra* (McDonald, 2018). Finally, we evaluated the sensitivity of results to the choice of priors by refitting the multistate model using non-informative priors for survival.

Models were fit in a Bayesian framework using JAGS (Plummer, 2017) with the *jagsUI* (Kellner, 2019) and *saveJAGS* (Meredith, 2021) packages, accessed through R version 4.02 (R Core Team, 2020). We used 40 parallel Markov Chain Monte Carlo simulations, each of which included 10,000 adaptive and burn-in iterations, and 200,000 posterior iterations, thinned by 20 to reduce file size. Chain convergence was evaluated visually and by confirming that values of the Gelman-Rubin statistic (Gelman et al., 2004) were less than 1.01 for all parameters. We report results as posterior modes (McElreath, 2020) and 95% Bayesian credible intervals (CRI) unless otherwise noted.

2.5 | Population growth rate

We performed post-hoc analyses to interpret estimates of vital rates for the period 2000–2019, for the purpose of informing management of the VM subpopulation. First, we used live-encounter data from 2012 to 2014 to estimate C0 litter size and litter production rate (lpr), defined as the proportion of adult females available to breed in year t that successfully produced a litter of C0s in year $t + 1$ (Taylor et al., 1987). We estimated variance in C0 litter size and lpr using a nonparametric bootstrap procedure with 1000 iterations during which live-encounters of individual bears were resampled with replacement. Second, we used estimates of ϕ from the multistate model, which included harvest mortality, to estimate un-harvested survival as $\phi^* = \phi + r \times (1 - \phi)$ (Peacock et al., 2013). This equation assumes that harvest of research-marked bears is reported, and that harvest mortality is additive (i.e., that no harvested bears would otherwise have died during a given interval). Finally, we used estimates of C0 litter size, lpr , and ϕ (or ϕ^*) to estimate the mean population growth rate (gr), defined as log of the dominant eigenvalue of a 10-stage

matrix projection model for polar bears, as developed by Regehr et al. (2017), populated with vital rates from the current study. We estimated variance in gr by repeating calculations using 1000 samples from the posterior distributions of survival together with the bootstrap distributions of C0 litter size and lpr . During this process, we retained the existing covariance structure within estimates of reproductive rates and within estimates of sex- and age-specific survival. The resulting estimates of gr represented the time-constant, asymptotic intrinsic growth rate at a stable stage distribution, including harvest mortality (when using estimates of ϕ) and excluding harvest mortality (when using estimates of ϕ^*). Estimates of gr calculated using ϕ^* can be interpreted as the potential growth rate of the VM subpopulation at its current relative density if harvest were stopped.

3 | RESULTS

3.1 | Data

A total of 166 unique females and 119 unique males were included in the VM polar bear dataset from 1974 to 2019. There were 45, 205, and 71 physical captures (i.e., including both initial captures and recaptures) in 1974–1976, 1989–1992, and 2012–2014, respectively. The number of research-marked bears that were re-encountered either alive or dead was low, especially in the later period (Table 3). Total sample sizes for observation types 1–7 (as defined in the Methods and column headers of Table 2) were 338, 13, 22, 10, 26, 9, and 2, respectively. From 1990 to 2019, the average number of research-marked bears reported in the harvest (observation types 5 and 6) was 1.2 per year (SD = 1.3) and the average proportion of females among research-marked bears reported in the harvest was 0.26.

3.2 | Abundance

Estimates of mean abundance in the sampling area were $\bar{N}_{1989-1992} = 145$ (95% CRI [109, 222], coefficient of variation [CV] = 0.19) and $\bar{N}_{2012-2014} = 235$ (95% CRI [148, 569], CV = 0.37; Table 4). This corresponds to a probability of 0.94 that abundance within the VM subpopulation boundary was higher in the 2010s, although interpretation is complicated by the expansion of the geographic sampling area (see Section 4). The corresponding estimates of superpopulation size were $\bar{N}_{1989-1992}^S = 221$ (95% CRI [152, 917]) and $\bar{N}_{2012-2014}^S = 340$ (95% CRI [214, 815]).

TABLE 3 Summary of observational data for Viscount Melville polar bears in a modified m-array format, 1975–2019.

Year	R	89	90	91	92	94	95	97	99	00	01	02	06	09	12	13	14	15	16	17	19	r	
75	45	2	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
89	42	-	13	9	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	27
90	22	-	-	12	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
91	68	-	-	-	22	2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	26
92	79	-	-	-	-	2	3	1	0	1	2	1	2	1	1	1	0	1	0	0	0	0	16
12	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	1	2	1	2	0	0	19
13	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	1	0	0	0	0	13
14	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	0	0	1	0	9
15	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	0	0	0	5
16	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0	0	1

Note: Counts for bears released alive (*R*) include physical captures in the sampling area without (observation type 1) or with (observation type 2) knowing the bear’s location due to telemetry, and bears that were alive and had a known location due to telemetry but were not physically captured inside (observation type 3) or outside (observation type 4) of the sampling area. Counts for re-encountered bears (*r*) include bears that were observed alive (observation types 1–4), bears that were harvested inside (observation type 5) or outside (observation type 6) of the sampling area, and known natural mortalities (observation type 7). Columns are excluded for years with no re-encounters. The symbol “-” is used for years preceding the year that releases occurred in a given row.

3.3 | Vital rates and movements

Estimates of survival varied by sex, age, and period (Table 4). Point estimates of ϕ increased between the early period (1974–2000) and late period (2001–2019) for all bears except adult females, for which estimates went from 0.95 (95% CRI [0.90, 0.98]) to 0.89 (95% CRI [0.81, 0.95]). Considering statistical uncertainty, this corresponds to a 0.92 probability that estimates of adult female survival declined. Although the mode of survival estimates for the combined C0 and C1 age class also declined, the posterior distributions were skewed such that their other moments increased between the early and late periods (e.g., mean values of 0.83 and 0.86 for the early and late periods, respectively). Modeling of temporal random effects in survival probability led to imprecise variance estimates that were similar for the early ($\sigma^2 = 0.08$, 95% CRI [0.00, 3.10]) and late periods ($\sigma^2 = 0.04$, 95% CRI [0.00, 2.3]; time-varying estimates of survival for adults are displayed in Figure S1). Because this variation likely reflected sampling uncertainty associated with sparse data between short periods of CR sampling, we report mean estimates of time-constant ϕ (i.e., with $\sigma^2 = 0$; Tables 4 and 5). Harvest recovery probabilities were higher for males than females, and similar across periods for both sexes.

Movement probabilities exhibited Markovian dependence and some estimates changed over time (Table 4). Most notably, the probability that a previously marked bear was located outside the VM subpopulation boundary on occasion $t + 1$, conditional on being located outside on occasion t (the parameter Ψ_2), was 0.88 (95% CRI [0.14, 0.98]) for the early period and 0.06 (95% CRI [0.01, 0.71]) for the late period, corresponding to an 0.89

probability of decline and potentially reflecting increased fidelity to the sampling area (i.e., a “rubber-band” effect). However, interpretation is complicated by large statistical uncertainty. The estimated proportion of the superpopulation located inside the VM subpopulation boundary (*prop.in*) was 0.72 (mean = 0.62, 95% CRI [0.19, 0.86]) in the early period and 0.73 (mean = 70, 95% CRI [0.52, 0.83]) in the late period, corresponding to an 0.64 probability of an increase and therefore providing little evidence for a biologically meaningful change.

We calculated mean intrinsic growth rate (*gr*) to help interpret the demographic status of the VM subpopulation. Reproductive parameters estimated from capture data collected 2012–2014 included mean litter production rate (*lpr*) = 1.0 (95% CRI [0.29, 1.0]) and C0 litter size = 1.67 (95% CRI [1.38, 1.92]). Use of these estimates in a matrix projection model, together with estimates of ϕ from the multistate model, resulted in an estimate of $gr = 0.00$ (95% CRI [−0.09, 0.06]). Alternatively, this metric can be expressed as the finite population growth rate: $\exp(gr) = 1.00$ (95% CRI [0.91, 1.06]). We also used estimates of ϕ and *r* from the multistate model to estimate un-harvested survival (ϕ^* ; Table 5). The corresponding estimate of un-harvested intrinsic growth rate was 0.01 (95% CRI [−0.06, 0.07]; alternatively, finite population growth rate = 1.01 [95% CRI [0.94, 1.07]]).

3.4 | Details of model fitting and sensitivity analyses

Demographic parameters in the multistate model were estimated using informed prior distributions on survival

TABLE 4 Estimated demographic parameters for the Viscount Melville polar bear subpopulation from the multistate capture–recapture model using informed prior distributions for survival probability.

Parameter	Mode	Lower CRI	Upper CRI
$\phi(COC1^{per1})$	0.99	0.57	0.99
$\phi(SF^{per1})$	0.87	0.67	0.97
$\phi(AF^{per1})$	0.95	0.90	0.98
$\phi(SM^{per1})$	0.84	0.65	0.96
$\phi(AM^{per1})$	0.87	0.79	0.97
$\phi(COC1^{per2})$	0.94	0.58	0.98
$\phi(SF^{per2})$	0.97	0.75	0.99
$\phi(AF^{per2})$	0.89	0.81	0.95
$\phi(SM^{per2})$	0.98	0.80	1.00
$\phi(AM^{per2})$	0.92	0.83	0.96
$\psi_1(per1)$	0.89	0.72	0.94
$\psi_2(per1)$	0.88	0.14	0.98
$\psi_1(per2)$	0.73	0.56	0.84
$\psi_2(per2)$	0.06	0.01	0.71
$r(F^{per1})$	0.06	0.02	0.19
$r(M^{per1})$	0.29	0.18	1.00
$r(F^{per2})$	0.09	0.04	0.25
$r(M^{per2})$	0.31	0.12	0.79
$\kappa(per2)$	0.09	0.03	0.42
$p(per1)$	0.32	0.23	0.45
$p(rad^{per1})$	0.75	0.50	0.90
$p(per2)$	0.11	0.06	0.22
$\lambda_{1989-1992}$	142	103	218
$\bar{N}_{1989-1992}$	145	109	221
$\bar{N}_{1989-1992}^S$	222	152	917
$\lambda_{2012-2014}$	239	147	570
$\bar{N}_{2012-2014}$	235	148	569
$\bar{N}_{2012-2014}^S$	340	214	815

Note: Values are posterior modes and 95% credible intervals (CRI). Parameters include total survival probability (ϕ), movement probabilities (ψ), harvest recovery probabilities (r), detection probability of known–natural mortalities (κ), recapture probability (p), rate parameter for Poisson distributions of abundance (λ), mean abundance in the sampling area (\bar{N}), and mean abundance of the superpopulation (\bar{N}^S). Early (1974–1999) and late (2000–2019) periods of the study are denoted *per1* and *per2*, respectively. Sex- and age-classes are denoted as follows: cubs-of-the-year of both sexes (CO), yearlings of both sexes (CI), females (F), males (M), subadults (2–4 years; S) and adults (≥ 5 years; A). Detailed parameter definitions are provided in the main text.

probability. The same model with non-informative priors led to estimates of mean ϕ for the period 2012–2014 that were lower (mean percent relative difference

TABLE 5 Estimates of un-harvested survival probability (ϕ^*) for the Viscount Melville polar bear subpopulation from the multistate capture–recapture model using informed prior distributions for survival probability.

Parameter	Mode	Lower CRI	Upper CRI
$\phi^*(COC1^{per1})$	0.99	0.57	0.99
$\phi^*(SF^{per1})$	0.89	0.69	0.97
$\phi^*(AF^{per1})$	0.96	0.91	0.98
$\phi^*(SM^{per1})$	0.89	0.75	1.00
$\phi^*(AM^{per1})$	0.91	0.85	1.00
$\phi^*(COC1^{per2})$	0.94	0.58	0.98
$\phi^*(SF^{per2})$	0.97	0.78	0.99
$\phi^*(AF^{per2})$	0.90	0.83	0.96
$\phi^*(SM^{per2})$	0.99	0.85	1.00
$\phi^*(AM^{per2})$	0.96	0.87	0.99

Note: Values are posterior modes and 95% credible intervals (CRI). Early (1974–1999) and late (2000–2019) periods of the study are denoted *per1* and *per2*, respectively. Sex- and age-classes are denoted as follows: cubs-of-the-year of both sexes (CO), yearlings of both sexes (CI), females (F), males (M), subadults (2–4 years; S) and adults (≥ 5 years; A). Detailed parameter definitions are provided in the main text.

[MPRD] = –4%) and considerably less precise (MPRD in the CV = 35%). Estimates of $\bar{N}_{2012-2014}$ using non-informative priors also were lower (MPRD = –10%) and slightly less precise (MPRD[CV] = 1%) compared with estimates using informative priors.

Estimates of survival for the period 2012–2014 from the CJS-analog model (Supporting Information S1) were much lower (MPRD = –46%) and less precise (MPRD [CV] = 73%) than corresponding estimates from the multistate model. Mean estimates of superpopulation size ($\bar{N}_{2012-2014}^S$) from the CJS-analog model, calculated using a Horvitz-Thompson equation (McDonald & Amstrup, 2001), also were lower (MPRD = –52%) and slightly less precise (MPRD[CV] = 4%) compared with estimates of $\bar{N}_{2012-2014}^S$ from the multistate model. We did not find evidence for a lack of fit in the CJS-analog model. The Osius-Rosjek test ($p = 0.51$) and overall Chi-square test ($p = 1.0$) were not significant, and the receiver operating characteristic test indicated good discrimination (0.82).

4 | DISCUSSION

Climate warming is affecting the movements, distribution, and status of wildlife populations around the globe (Brodie et al., 2013). The rapid rate of change presents challenges to research and management (LeDee et al., 2021), especially for large carnivores and other

mobile species that occur at low densities in remote areas (e.g., Laidre et al., 2022). In this paper, we present a CR model designed to accommodate animal movements and maximize the use of available data and knowledge. Similar models have been shown to reduce bias in estimates of demographic parameters for other species (e.g., Bird et al., 2014). We applied the model to longitudinal data from live captures, radiotelemetry, observations of natural mortalities, and harvest for the VM polar bear subpopulation to estimate the demographic parameters needed for management and conservation.

4.1 | Abundance

Abundance of polar bears within the VM subpopulation boundary, as estimated from the multistate model, was significantly higher in 2012–2014 ($\bar{N} = 235$) compared to 1989–1992 ($\bar{N} = 145$). Although the assessment of population trend is complicated by expansion of the geographic sampling area in the latter period, several factors suggest that abundance has increased in recent decades. First, during 2012–2014, no bears were observed in the area north of 76° latitude that was not sampled in the earlier periods, meaning that the search effort expended here did not contribute to the estimated number of animals. Second, a harvest moratorium from 1995 to 1999 and subsequent reduction in subsistence harvest levels from 1999 to 2019 likely allowed for growth of a previously overharvested subpopulation (Taylor et al., 2002). Another potential explanation for increasing abundance is that sea ice throughout the Canadian Arctic Archipelago is transitioning to be younger and thinner (Howell & Brady, 2019), leading to declines of approximately 5% and 10% per decade in total sea ice and multiyear sea ice, respectively, in VM Sound for the period 1986–2016 (Derksen et al., 2018). In some other high-latitude regions, lighter sea-ice conditions resulting from climate warming have led to transient increases in biological productivity (Ardyna & Arrigo, 2020) and environmental carrying capacity for polar bears (Dyck et al., 2021; Laidre et al., 2020). In an assessment of body condition and diet composition of VM polar bears using biological samples from physical captures 2012–2014, Florko et al. (2021) did not find evidence that declining sea ice has had a positive effect on foraging conditions. However, the short time series, high interannual variability, and lack of historical data in that study precluded drawing strong conclusions. Other scientific data are not currently available on how climate warming may be affecting the ecology of VM bears.

4.2 | Vital rates

Total survival (i.e., including harvest mortality) of all sex and age classes except adult females increased between the early and late periods (Table 4; noting that, although the mode of ϕ for the combined C0C1 age class decreased, the mean and median increased). For bears other than adult females, point estimates for the latter period (2000–2019) were, on average, 11% higher than the mean survival rates from other case studies for polar bears (Table S1). This suggests relatively high survivorship for most VM bears, although interpretation is complicated by the fact that some case studies estimated apparent survival (i.e., the probability of surviving and remaining in the sampling area), whereas our inclusion of harvest data from outside the VM subpopulation boundary meant that estimates of ϕ represented biological survival that was not affected by emigration. Harvest recovery probability (r) was higher for males than females due to sex-selective harvest. Estimates of mean r were similar for the early (1974–1999) and latter (2000–2019) periods, which may be due to small sample sizes, variable harvest levels within each period, or the underreporting of harvested bears due to tag loss during the species' 20–30-year lifespan (see below).

Point estimates of adult female survival declined from 0.95 in the early period to 0.89 in the latter period, which is below the mean value of 0.93 from other case studies (Table S1). We do not know to what extent this represents a true biological change versus bias or a statistical artifact. It is possible that lower adult female survival is related to a combination of changing harvest levels and a subpopulation that is nearing environmental carrying capacity. Taylor et al. (2002) reported a low proportion of adult males in the 1989–1992 capture sample and suggested this was due to relatively high, sex-selective harvest (63% male) from 1973 to 1992. We found that the proportion of males in the subpopulation increased from approximately 0.36 to 0.52 between the early and latter periods, likely due to recovery of males following reduced harvest quotas. More adult males, which have twice the body mass of adult females and exhibit social dominance (Derocher et al., 2005), may have increased competition for hunting opportunities or displaced females and family groups from preferred habitats (Stirling et al. 2004). Estimated harvested and un-harvested intrinsic growth rates for the latter period were $gr = 0.00$ and 0.01 , respectively, suggesting strong population regulation. However, the possibility that density dependence would disproportionately impact adult females is confounding given that, for long-lived species, density effects typically first appear in subadult survival and recruitment (Eberhardt, 2002;

Fowler, 1987), both of which were high in the latter period of our study (although with large uncertainty).

4.3 | Movements

One of our primary objectives was to evaluate temporary emigration with respect to the sampling area which, if nonrandom, can introduce bias into demographic parameters (Peñaloza et al., 2014). To accommodate animal movements, we modeled a quasi-unobservable state, defined as the area outside of the VM subpopulation boundary where live captures did not occur (i.e., where $p = 0$) and a bear could be detected only if it was wearing a functional radiocollar or reported dead in the harvest. Estimates of the movement parameter ψ_1 (Table 4) were greater than 0.50 in both periods, indicating that animals inside the sampling area in year t were more likely to be inside again in year $t+1$, compared with animals that were outside in year t . This suggests that VM bears exhibit a moderate degree of seasonal fidelity, similar to some other polar bear subpopulations (e.g., Amstrup et al., 2000). The probability that a bear outside sampling area in year t returned to the sampling area in year $t+1$ (i.e., $1 - \psi_2$) increased between the early and late periods, although uncertainty was large and the estimated proportion of the VM subpopulation located inside the sampling area during spring did not change significantly. Regehr et al. (2009) found evidence for Markovian dependence in movements based on 175 bear-years of telemetry data from springtime CR studies of polar bears in the Southern Beaufort Sea. They also demonstrated that heterogeneity in recapture probabilities resulting from these movements can lead to meaningful bias in estimates of demographic parameters. This is consistent with our finding that the point estimate of mean superpopulation size for the period 2012–2014 derived from the multistate model ($\bar{N}_{2012-2014}^S = 340$) was higher than the abundance estimate from the CJS-analog model ($\bar{N}_{2012-2014}^S = 227$; Supporting Information S1), which did not account for movements. Similarly, our estimate of $\bar{N}_{1989-1992}^S = 222$ for the early period was higher than the corresponding estimate of $\bar{N}_{1989-1992}^S = 165$ from the CJS models of Taylor et al. (2002).

4.4 | Modeling considerations

The multistate CR model was designed to incorporate multiple data types and account for key sources of variation. Nonetheless, estimated demographic parameters should be interpreted with caution for several reasons. Sparse data necessitated the use of a relatively simple

model structure that did not reflect extended maternal care in polar bears or allow vital rates to be linked to stage-specific abundances, a common feature of integrated population models (e.g., Regehr et al., 2018). The low number of recaptures, especially in the latter period (Table 3), likely increased susceptibility to bias resulting from un-modeled heterogeneity in the data (Pollock et al., 1990). Also, recaptures and harvest recoveries were identified using physical marks rather than genetic analysis (e.g., Atkinson et al. 2021), raising the possibility of tag loss given that lip tattoos can fade over time and plastic ear tags can be removed, especially by males during intra-specific competition for mates. Although this issue can be addressed analytically for doubly marked animals (Conn et al., 2004), it was not possible to do so for VM bears due to small sample sizes. Consequently, tag loss may have introduced negative bias in survival estimates and positive bias in abundance estimates (McDonald et al., 2003). Another caveat is that most movement information was obtained from radiocollars, which were applied to adult females only because collars can potentially injure growing bears and are often shucked by adult males due to the large circumference of their necks. Although data are limited, several studies have suggested sex-specific differences in polar bear movements during the spring (Laidre et al., 2013; Wilson et al., 2022). Finally, the assumption of independent data sources was violated because some adult females provided both capture and telemetry data, although other studies suggest that lack of independence generally has a minimal impact on parameter estimates (Abadi et al., 2010).

On the positive side, several other factors likely increased the accuracy of parameter estimates, including the use of multiple data types (Zipkin & Saunders, 2018) and the availability of accurate age information from vestigial premolar teeth collected during physical captures (i.e., as opposed to CR studies that use biopsy sampling and have relied on subjective estimates of age class, e.g., Dyck et al. (2023)). Precision also was increased by using informed prior distributions for survival probability, which constrained estimates to a range that was realistic for long-lived animals. Use of informed priors represented the assumption that survival of VM bears was not outside the range of empirical estimates for the species (e.g., that climate warming or other factors have not had unprecedented impacts on VM bears). This assumption was justified on the basis that VM is in the archipelago polar bear ecoregion, where negative effects of climate warming are expected to be delayed (Amstrup et al., 2008; Atwood et al., 2016), and that Traditional Ecological Knowledge of Indigenous Peoples in the region suggests that the VM subpopulation is recovering or increasing (SARC, 2021; York et al., 2016). Although it

is possible that some of the survival estimates used to develop informed priors (Table S1) were biased by unmodeled animal movements or other factors, the consequences of this were likely negligible compared to the alternative approach of using a model that did not reflect preexisting scientific information about polar bear life history.

The multistate model in this paper provided reasonable estimates of demographic parameters, in contrast with the CJS-analog model, which produced estimates that were less precise, biologically implausible, and conformed to expected patterns of bias. This underscores the importance of including multiple data types and modeling animal movements. Given that radiotelemetry data are increasingly rare for polar bears due to ethical concerns about chemical immobilization and the application of radiocollars (Laidre et al., 2022), we recommend that scientists, managers, Indigenous partners, and stakeholders consider the pros and cons of applying telemetry tags during the design phase of CR studies. In addition to potentially reducing bias, contemporary movement data are required to differentiate between the number of bears in the sampling area versus the superpopulation. Such calculations are necessary if the goal is to compare estimates of abundance that were obtained using different study methods (e.g., distance-sampling aerial survey vs. open-population CR). Our analyses also emphasize the importance of a functional management system capable of enumerating harvested bears, especially for CR studies with long intervals between periods of intensive sampling (Peacock et al., 2012).

4.5 | Management implications

Taken together, our findings suggest that, as of 2014, the VM subpopulation had likely recovered from an earlier period of overharvest, was stable, and had not exhibited detectable, negative demographic effects of climate warming. There was some evidence for changing movement patterns, which may be attributable to sea-ice loss but require additional data to understand. The low body condition of VM bears compared to the adjacent Northern Beaufort Sea subpopulation (Florke et al., 2021) and the decline in estimates of adult female survival (this study) are potential concerns that warrant further investigation. Updated parameter estimates from this analysis provide a basis for near-term management and conservation decisions and could be used in a quantitative harvest risk assessment (e.g., Regehr et al., 2021). Harvest risk assessments provide information on tradeoffs between higher harvest, which can lead to negative demographic effects—and lower harvest, which can limit opportunities

for the nutritional, cultural, and economic use of polar bears by Indigenous Peoples. Because our model estimated the number of animals within the VM subpopulation boundary as well as the corresponding superpopulation size, which was 44% higher but much less precise, management authorities will be able to evaluate which estimate is appropriate for informing harvest quotas. It is important to recognize that use of the former can underestimate the biological population capable of supporting harvest, whereas use of the latter can “double-count” animals that were enumerated as part of adjacent subpopulations. In contrast to questions raised by Taylor et al. (2002), our findings suggest that CR studies of polar bears can be useful even when the number of captures is relatively low, provided that radiotelemetry and harvest data are available. Given the rapid pace of climate warming and high cost of research in the Arctic, the methods presented here are likely applicable to other polar bear subpopulations as well as other mobile species.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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MANAGING THE RISK FROM HUNTING FOR THE VISCOUNT MELVILLE SOUND POLAR BEAR POPULATION

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Abstract: Managers of harvested polar bear (*Ursus maritimus*) populations are required to determine current status and sustainable harvest levels. Time series population estimates are unavailable or suspect for most polar bear populations, including the Viscount Melville Sound (VM) population in Canada. Between 1974 and 1992, 194 polar bears were captured within VM. We used mark-recapture and standing age analyses to estimate population size and the rates of birth and death for this population. Both the current and historical harvest were also recorded. From mark-recapture data, we estimated (1) age and sex-specific natural and total survival and (2) population size from estimated capture probabilities that varied by year and were higher for females with satellite transmitters. The average population estimate for 1989–92 was 161 bears (SE = 34). We used a simulation model to estimate the population growth rate without harvest at 1.059 (SE = 0.063). Historical harvest levels and changes in the population standing sex and age distribution and sex ratio indicated that the population had been reduced by over-hunting. Using Monte Carlo simulations that utilized the estimated variability in demographic parameters, we explored the risk to this population associated with a range of harvest rates. Because of uncertainty in our estimates, we found that the population was at risk at harvest levels less than the estimated sustainable kill. The estimated risk was proportional to harvest level. Large harvest rates increased the risk of further reductions to the population and extended the recovery period that would likely be required to return the population to its current number relative to lesser harvest rates. We question the value of frequent population inventory for Viscount Melville Sound because the small size of this population constrains both the precision and the accuracy of demographic estimates. We recommend instead conservative and precautionary harvest policies to reduce the risk of harvest and enhance long term recovery of this population.

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Key words: demography, harvest, life-table, mark-recapture, polar bear, population viability analysis, recruitment, survival, *Ursus maritimus*

Management of large long-lived mammals, like bears, usually involves controls on hunting. Habitat and population density are always important factors in determining natural demographic rates. However, in arctic and marine environments, it is often not possible or practical to manage habitat. When habitat cannot be managed, the typical management goal for harvested marine mammal populations is persistence at current numbers or recovery, in cases where the population has declined. When numbers are relatively constant over time, density effects need not be considered in determining sustainable harvest levels. For relatively stationary populations, habitat and current densities determine the natural (unharvested) rates of birth and death. The sustainable harvest depends on the sex and age composition of the harvest (Caughley 1994). The population size and vital rates can be estimated and the harvest can be monitored each year. This demographic information can be used to estimate the sustainable harvest (Caughley 1977).

However, such an approach neglects the uncertainty of the information. If the information were perfect and constant each year, the estimated sustainable harvest could be taken forever without risk to the population. When demographic estimates are based on samples collected over several years, both sampling and annual variability are

present. Hence, the estimate of sustainable yield will also be uncertain. Population growth rate and the maximum sustainable yield are summary parameters that are estimated but rarely measured directly for bear populations. The uncertainty of both the population growth rate and the sustainable yield estimates may be calculated using Monte Carlo methods when estimates of both vital rates and the harvest sex and age composition are known (Boyce 1992, Caughley 1994).

Our approach recognizes that there is no single correct harvest level. Because our information is uncertain, each harvest level poses a different level of risk for the population. Some harvest levels may be so low that the risk is essentially zero. Other harvest levels may be so high that the population will certainly decline rapidly. The most interesting harvest levels to managers are those that pose an acceptable risk to the population and still provide an acceptable number of harvest opportunities.

We summarize the available demographic information for the Viscount Melville Sound (VM) polar bear population and compare our estimates to published values from other populations. We show how our demographic information can be used to estimate the risk of various harvest levels for the VM population and discuss options for management.

¹ Deceased

STUDY AREA

VM polar bears are mainly distributed on the sea ice north of Banks and Victoria Islands and south of Melville Island (Fig. 1). The western portion of this area is part of the Inuvialuit Settlement Area and the eastern portion is part of Nunavut. The geographic boundaries of the VM polar bear population (Fig. 1) were established using mark-recapture movement data (Taylor and Lee 1995), DNA analysis (Paetkau et al. 1999), and cluster analysis of radiotelemetry data (Bethke et al. 1996, Taylor et al. 2001a).

The first polar bear population inventory ever conducted by the Government of the Northwest Territories included part of the area currently identified as the Viscount Melville Sound (VM) polar bear population (Taylor et al. 2001a). Hadley Bay and portions of Wynniatt Bay (Fig. 1) were investigated as part of a wider Central Arctic study (Schweinsburg et al. 1981, 1982; Furnell and Schweinsburg 1984). The boundaries of this population were uncertain until satellite radio-tracking technology became available (Bethke et al. 1996). Because the initial research in VM covered only a fraction of the population area, that initial work is difficult to interpret. This study constitutes the only polar bear research that included the entire VM population area.

Heavy multi-year ice is poor habitat for polar bears (Kingsley et al. 1985; Messier et al. 1994; Ferguson et al. 1998, 1999, 2000a,b, 2001;). Although polar bears can cross heavy multi-year ice, the concentration of good habitat inside a large expanse of poor habitat tends to restrict the movements of polar bears to relatively local areas. No permanent emigration from this population (i.e., bears that left the population and did not return during the time the radio collar was active) were recorded from telemetry observations (Bethke et al. 1996, Taylor et al. 2001a) and movements of marked bears into or out of this population were rare (Taylor and Lee 1995, Taylor et al. 2001a). Melville Island forms a land barrier to the north. Victoria Island and Banks Island form land barriers to the south. The western sea ice is heavy multi-year pack ice in most years and the polar bear densities in the northeastern part of the North Beaufort population are relatively low (Lunn et al. 1995). Similarly, the sea ice in eastern VM is heavy annual and multi-year mixed, with low densities of polar bears in the winter and spring (M.K. Taylor, unpublished data). This effectively concentrates both seals (*Phoca hispida* and *Erignathus barbatus*) and polar bears in the bays and coastal areas where there are tide cracks, active ice, annual ice, and mixed annual and multi-year ice (Messier et al. 1992, Bethke et al. 1996, Taylor et al.

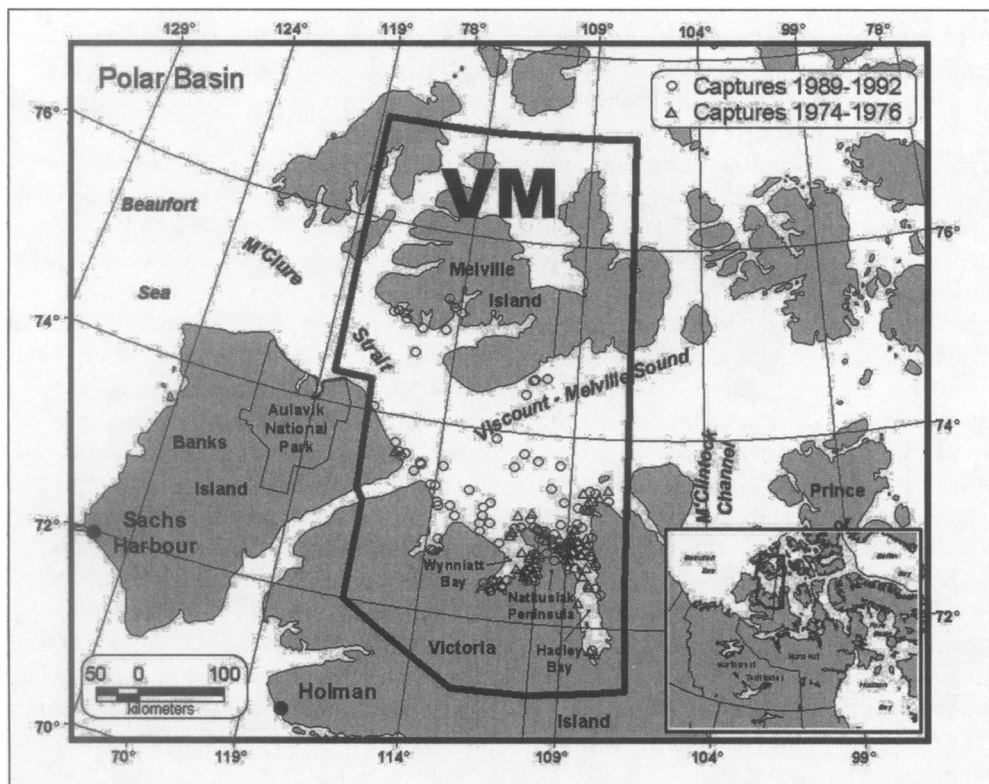


Fig. 1. Location of all captures and recaptures within the Viscount Melville Sound polar bear population, Canada, 1974–76 and 1989–92.

2001a).

Historically this population was hunted occasionally by aboriginal residents of Victoria Island; however, Usher (1974) found little evidence of year-round use in pre-settlement times. An annual harvest quota of 8 bears was allocated for Hadley Bay (Fig. 1) in the early 1970s and an additional harvest quota of 12 bears/year was allocated as the "Melville Quota" in the mid-1980s. Communities adjacent to this area could also harvest any number of their annual quota in VM until a distinct and exclusive VM quota was established in 1994. A 5-year harvest moratorium was implemented from 1995 to 1999 and the current total VM quota is 4 bears/year.

METHODS

Captures

Bears and their dependent cubs were captured from 1989–92 with tiletamine chlorohydrate and zolazepam chlorohydrate and marked according to procedures described by Stirling et al. (1989). Animal capture and handling procedures followed animal care protocol 950005 of the University of Saskatchewan, under the guidance of the Canadian Council of Animal Care. Bears and their dependent cubs were captured from 1974–76 with phenylcyclidine hydrochloride (Furnell and Schweinsburg 1984). Captures were opportunistic (every bear seen was captured or recaptured) during a systematic, geographically uniform search of the entire area in 1989–92. Captures from 1974–75 were restricted to the southeast portion of the population, mainly Hadley Bay (Fig. 1). Each bear was given a unique identification number, which was permanently tattooed on the upper inside lip and attached as a plastic ear tag. Each bear also was temporarily marked with a wax crayon on the fur to ensure that bears were not captured more than once per year. The bear's age was considered known if the bear was captured as a cub born that year (i.e., cub), or yearling, or was estimated by counting the annular rings of an extracted vestigial premolar (Calvert and Ramsay 1998).

Mark–recapture Analysis

Estimates of survival rate and abundance were constructed from capture–recapture data using the Cormack–Jolly–Seber (CJS) model formulation implemented in program MARK (White and Burnham 1999). The CJS likelihood for capture–recapture data is conditioned on the initial capture events (i.e., the initial capture is treated as a release). The likelihood is based solely on the recapture events of marked animals (i.e., previously caught) and is defined by user specified models for survival and (re)capture probabilities, which can be expressed as func-

tions of covariates such as sex, age, and year.

We used MARK to analyze the capture–recapture data collected during 1974–76 and 1989–92 in VM. Captures of bears in 1974–76 were used as initial captures, but recaptures in 1975–76 were ignored because captures were restricted to a local subset of the entire population area in those early years. Recapture probability for 1975–88 was set to zero because recaptures were excluded and no recapture effort occurred in that interval.

For 1989–92, we examined a series of models for capture probability that incorporated potential covariates. We expected that capture probability would vary by year because the amount of capture effort varied between years. During 1989–90 the focus was deployment of satellite transmitters on adult females, whereas during 1991–92 transmitters were not deployed and all effort focused on captures. Therefore, we considered a model that allowed capture probability to vary for each year and another model in which capture probability was the same for 1989–90 and 1991–92. Within the area searched in a given day, bears were located by visual observation and tracking from a helicopter. Successful location and eventual capture were likely to be affected by the number of bears in a group, their reaction to the helicopter, movement patterns, and fidelity to known high use areas. Because these factors were likely to vary for different sex and age classes, we categorized bears into 3 classes: (1) females, cubs, and yearlings; (2) sub-adults (age 2–4) of both sexes; and (3) adult males. We considered models in which capture probability varied for these classes. We also considered models in which bears with transmitters had a higher capture probability because their location was known at various times throughout the year. Cubs and yearlings of a female with a transmitter were considered to have the same probability of capture as their mother.

For survival probability, we considered models that included sex, age, and year. Because more males were harvested than females, we expected their survival to be lower. Survival was also likely to vary by age; in particular, we expected cubs to have lower survival than non-cubs. We considered 2 age-specific models with different survival for cubs and non-cubs and another model in which non-cubs were further divided into yearlings, sub-adults (age 1–5 years), and adults (≥ 6 years). Annual differences in harvest and environmental conditions could create variation in survival, so we considered models with 3 distinct annual survival rates for 1989–92 and a constant survival rate for the interval 1974–89.

We fitted a series of CJS models using each capture probability model with each survival probability model. We considered additive models with main effects (e.g., sex + year) but did not consider models with interactions because there were too few data to support the additional

complexity. We used Akaike’s Information Criterion adjusted for over-dispersion (QAIC_c) (Burnham and Anderson 1998) as a guide for model selection. The data were likely to be overdispersed (i.e., greater than binomial variation) because survival and capture events of family groups (e.g., female with cubs or yearlings) were not independent. We estimated the overdispersion coefficient \hat{c} based on the number of dependent cub captures relative to all captures (Appendix).

Because the CJS likelihood does not include the probability distribution for the unmarked animals, it may not provide the best precision from the data for estimating abundance when survival and capture probabilities are not time dependent (i.e., constrained Jolly-Seber model). However, we used the CJS formulation because of its modeling flexibility in the MARK software and the Jolly-Seber estimator for abundance (\hat{N}) using the estimated capture probabilities (\hat{p}) from the marked animals in the CJS likelihood (Pollock et al. 1990) for each year i :

$$\hat{N}_i = \frac{n_i}{\hat{p}_i}$$

We computed variance estimates using a Taylor series approximation that contains a component of variance for the number observed and another for estimation of p (Thompson 1992:165):

$$\hat{Var}(\hat{N}_i) = \frac{\hat{n}(1-\hat{p}_i)}{\hat{p}_i^2} + \frac{\hat{N}_i^2}{\hat{p}_i^2} \hat{Var}(\hat{p}_i)$$

When we stratified the population into k strata (e.g., sex–age class), the total estimated population was simply the sum of the stratum estimates:

$$\hat{N}_i = \sum_{j=1}^k \frac{n_{ij}}{\hat{p}_{ij}}$$

The variance estimator was extended to include covariances between estimated capture probabilities in the k strata:

$$\hat{Var}(\hat{N}_i) = \sum_{j=1}^k \frac{n_{ij}(1-\hat{p}_{ij})}{\hat{p}_{ij}^2} + \sum_{j=1}^k \sum_{j'=1}^k \frac{n_{ij} n_{ij'}}{\hat{p}_{ij}^2 \hat{p}_{ij'}^2} \hat{Cov}(\hat{p}_{ij}, \hat{p}_{ij'})$$

Our extension is equivalent to the variance estimators used by Huggins (1989) and Borchers et al. (1998) for abundance estimates constructed in a similar fashion. We used a similar estimator to estimate the variance of the mean population size over several years. Our abundance estimator is equivalent to the one proposed by McDonald and Amstrup (2001), but our variance estimator is different than theirs.

The estimates of survival derived from the capture–recapture data include harvest losses. We were interested in estimating natural survival to investigate the impacts of alternative harvest strategies and levels. We estimated

natural survival S_n from the average annual harvest (H), population size (N), and total survival (S) as:

$$S_n = \frac{S}{1 - \frac{H}{N}}$$

which assumed that harvest and natural mortality occurred in 2 separate time periods and $h = H/N$ is the estimated harvest rate. We also used a Taylor series approximation for the variance of natural survival:

$$\hat{Var}(\hat{S}_n) = \hat{S}_n^2 \left[\frac{\hat{Var}(\hat{S})}{\hat{S}^2} + \frac{\hat{Var}(\hat{N})h^2}{\hat{N}^2(1-h)^2} - 2 \frac{\hat{Cov}(\hat{N}, \hat{S})h}{(1-h)\hat{N}\hat{S}} \right]$$

where

$$\hat{Cov}(\hat{N}, \hat{S}) = - \frac{\hat{N} \hat{Cov}(\hat{S}, \hat{p})}{\hat{p}}$$

The variances and covariances for p and S were computed by program MARK after inflation by the over-dispersion coefficient. Non-symmetric 95% confidence intervals were constructed based on an assumed log-normal distribution (Burnham et al. 1987) to compensate for the skewed sampling distribution resulting from a lower bound on the estimate ($N > n$) and correlation between the estimate and its estimated variance (Pollock et al. 1990).

Standing Age Distribution Analysis

The standing age distribution was based only on captures and recaptures for 1989–92 that occurred inside the final VM boundaries. Only the 1989–92 captures and recaptures were used to estimate litter size and recruitment parameters. The sampling unit in this case was family units and individuals. Each individual or family group was recorded by age as a male, solitary female, female with a cub, female with 2 cubs, female with a yearling, female with 2 yearlings, female with a 2-year-old, or female with two 2-year-old cubs. One female with 3 offspring was observed and was treated as an observation of females with 2 offspring for the standing age distribution analysis.

Our method for estimating litter size, litter production rate, and cub survival from the standing age distribution is described in Taylor et al. (1987a, 2000) and available as the software package “Vital Rates” (Taylor et al. 2000). For comparison to the mark–recapture estimates of survival rate, the adult male and female survival rates (AMΦ and AFΦ respectfully) were estimated from the standing age distribution using the Chapman–Robson truncated method (Chapman and Robson 1960) from age 2 to the final age that had 5 or more records. We recognized that the Chapman–Robson survival estimate is actually not an age-constant survival rate, but is rather an age-constant survival rate divided by population growth rate for populations at stable age distribution (Caughley 1977). The

AF Φ value is required to determine other values which were based on standing age ratios and which were contingent on female survival (Taylor et al. 1987a).

The mean litter size of cubs (CLS) and yearlings (YLS) was used to estimate the survival rates of cubs (DeMaster and Stirling 1983; Taylor et al. 1987a, 2000). Dependent offspring survival rates were calculated based on the change in litter size observed from cubs to yearlings (cub individual survival, CISR) and yearlings to 2-year olds (yearling individual survival, YISR). Estimates of CISR and YISR are not affected by adult female survival rate because the entire litter is lost if their mother dies (i.e., no change in mean litter size). The cub standing age survival rate (CS Φ) was also calculated as the ratio of yearlings/cubs in the standing age distribution. Similarly, an age ratio yearling survival rate (YS Φ) was calculated as the ratio of 2-year olds/yearlings. CS Φ and YS Φ estimates are survival rate/population growth rate at stable age distribution, and include adult female mortality. The correction for adult female mortality and population growth rate is 1/AF Φ (Taylor et al. 1987a, 2000). Assuming stable age distribution and unbiased sampling, CISR, YISR, CS Φ , and YS Φ estimates are directly comparable to cohort estimates from telemetry or mark-recapture methods.

The estimates of age-specific litter production rate (LPR) were specific to females that were available to mate the previous year (i.e., those with no cubs or 2-year-olds), and did not include females with dependent cubs (i.e., cubs and yearlings). We viewed litter production rates for age 4 (LPR4) and age 5 (LPR5) as distinct (i.e., reduced) litter production rates. We assumed that by age 6, all females were producing litters at adult rates (LPR6). The average age of first birth (AFB) was determined for surviving females only.

Except as identified above, all rates were assumed to be age constant (i.e., no senescence). Because there were relatively few observations for older individuals, any reduction of rate estimates due to senescence was assumed to be negligible.

We also calculated 6 summary parameters based on the above values (DeMaster 1981; Taylor et al. 1987a, 2000): mean reproduction (litter production) interval (R-I), mean annual reproduction rate (R-R), mean mating (available to mate) interval (M-I), mean annual mating rate (M-R), proportion of females that reached adulthood but had only 1 litter (P₁ litter), and proportion of surviving females that reached adulthood but produced no litters (P₀ litter). The mark-recapture estimates of cub survival and adult survival were used to calculate the 6 summary parameters. The stable-age, zero-harvest population growth rate (λ) was also calculated according to Taylor et al. (1987c, 2001b). Mean annual reproduction rate could be used in

an annual life-table model; however, projections would only be accurate if populations were at stable age distribution (Taylor et al. 1987b, but also see Testa 1996).

We used the jack-knife method (Arveson 1969) to estimate the variance of the life history parameters estimated from the standing age distribution (Taylor et al. 1987a, 2000). The data were stratified by year. Our estimate of variance pooled both sampling error and inter-year environmental variation. Most of our rate estimates were ratios; however, the jack-knife estimate is a mean of means and the error was assumed to be normally distributed. The variance of the corrected (for AF Φ) cub survival estimate was calculated as the binomial variance of the corrected ratio. The variances of the summary parameters (R-I, R-R, P₁ litter, M-I, M-R, P₀ litter and λ) were determined using the Monte Carlo method with 1200 iterations (Taylor et al. 2000, 2001b). All comparisons of binomial parameter means used chi-square tests with the Yates correction (SigmaStat 1997). Differences were considered not significant for $P > 0.10$. Monte Carlo simulations to estimate the mean and SE of population growth rate were performed with a Visual Basic program called "RISKMAN RISK MANAGEMENT" (Taylor et al. 2001b). Both the Vital Rates and RISKMAN programs are available from the senior author.

Uncertainty Analysis

Monte Carlo simulations were used to explore harvest management options by estimating the risk of population reduction for various harvest scenarios. A population was considered at risk if the population trajectory after a set time interval left the population size below a threshold proportion (T) of the target population size that would allow recovery within a specified number of years (recovery time). The expected time to recovery (Y) from a reduced population size (N_r) to a recovered target population size (N_t) can be computed from the unharvested population growth rate (λ):

$$Y = \frac{-\ln(P)}{\ln(\lambda)}$$

where $P = N_r/N_t$. The threshold proportion (T) for a specified recovery time (Y) is:

$$T = e^{-Y \ln(\lambda)}$$

If a population is reduced, so long as $P \geq T$, it would be expected to recover within Y years with deterministic growth.

RISKMAN (Taylor et al. 2001b) was used to estimate the proportion of population trajectories that were not reduced below the threshold proportion (acceptable outcome) for a range of harvest levels (annual quota: 0–25).

RISKMAN differs from other population viability

analysis (PVA) simulation models in that it allows correct simulation of the 3-year life cycle for polar bears and allows the estimated sex and age selectivity/vulnerability of the harvest to be modeled dynamically. RISKMAN was developed to estimate the uncertainty associated with various harvest management options using estimates of the standard error of the input parameters. RISKMAN is an individual based model, so demographic uncertainty (Caughley 1994) is incorporated. The uncertainty associated with estimates of survival and recruitment pools both sampling and environmental uncertainty (part of what Thompson et al. [1998] call process variation). RISKMAN allows the user to partition the total uncertainty (variance) into sampling and environmental uncertainty. Generally, sampling uncertainty reduces the geometric mean population growth rate, which increases the fraction of population projections that are unacceptable. Because the jack-knife method for estimating variance does not lend itself to partitioning the total variance estimate (White 2000), partitioning the variance estimates from the standing age analysis was not possible. However, the root difficulty was the small sample size for this population. The number of recapture years and number of bears caught were insufficient to partition the variance into its 2 components. The environmental variance component was estimated as essentially 0 from the variance components output of program MARK. However, other studies (Stirling and Lunn 1997, Stirling et al. 1999) have demonstrated environmental variability in vital rates for some polar bear populations. Rather than incorrectly assuming that there was no environmental variation, we subjectively specified that 75% of the variance was due to sampling uncertainty and 25% was environmental variation. To evaluate this specification, we explored the 2 boundary conditions by assigning the total variance to sampling uncertainty and alternatively to environmental variation.

For each year of the simulation, the frequency of occurrence of unacceptable outcomes (based on our threshold value) was monitored and reported as cumulative proportion of total runs over the threshold at that time. Individual runs could recover from "depletion", but not from a condition where all males or all females or both were lost. The total unacceptable outcomes over an indefinite period were also of interest for exploring management options that do not involve periodic monitoring. Required population parameter estimates and standard error inputs included: annual natural survival rate (stratified by age and sex as supported by the data); age of first reproduction; age-specific litter production rates for females available to have cubs (i.e., females with no cubs and females with 2-year-olds); litter size; sex ratio of cubs; sex, age, family status distribution of harvest; and initial population size.

The initial age distribution was identified by determining the stable age distribution using total mortality values. The harvest selectivity and vulnerability array was identified by comparing the total-mortality stable age distribution with the sex, age, and family status distribution of the historical harvest. Harvest was stratified by sex, age (cubs and yearlings, age 2–5, age 6–19, and age >20), and family status (alone, or with cubs and yearlings, with 2-year-olds).

Harvest simulations were conducted using the natural survival rates from this study. Although the final year of sampling was 1992, simulations were approximately time referenced to 1999 by allowing 5 years of harvest moratorium. The starting (1999) population size (215, SE = 57.5) was determined by running the model in stochastic mode (2,500 iterations) for 5 years. We then ran the simulations for 15 years beginning with 1999. We choose 15 years as a simulation interval because we estimated that the fraction of the VM population that would still be marked after $15 + 7 = 22$ years (i.e., 7%) would be sufficient to re-estimate the population at the next population inventory. Adult survival rates of long-lived animals can be underestimated (J. Laake and M. Taylor, unpublished analyses) when there are few old marks in the population to observe and there is unmodeled heterogeneity in capture and survival probabilities. A range of harvest levels was used to estimate the harvest associated with a range of risk thresholds (i.e., proportions of unacceptable reductions to initial numbers). We also calculated risk over 75 years for annual harvest rates ranging from 0 to 25 bears to investigate the risk implications of irregular monitoring.

RESULTS

From 1974 to 1976, 30 females and 16 males were captured in VM (Table 1). These 46 bears were insufficient to estimate total numbers or survival and recruitment rates from either the mark-recapture data or the standing age distribution. Thus, we pooled the 46 initial captures from 1974–76 with the 90 females and 58 males that were captured and recaptured between 1989 and 1992 (Table 1) for the mark-recapture estimates of numbers and survival rates (Tables 2, 3). The estimates from analysis of the standing age distribution using the 1989–92 data were: $AM\Phi = 0.901$ (SE = 0.048), $AF\Phi = 0.963$ (SE = 0.007), $CISR = 1.0$ (SE = 0.0), $CS\Phi = 0.773$ (SE = 0.046), $YS\Phi = 0.920$ (SE = 0.033), and $YLS = 1.752$ (SE = 0.064).

Changes in the VM polar bear population were reflected in the differences between the 1973–76 and 1989–92 capture samples. There were 4 observations of females with 3-year-old cubs in 1989–92, but none in 1973–76. The sex ratio among adults (age ≥ 6) declined from 49% to

Table 1. Initial captures of polar bears by sex and age for 1974–76 and 1989–92 for Viscount Melville (VM) Sound population, Nunavut, Canada.

Sex	Year	Age					Total
		Cub	Yearling	2-yr old	3-yr old	>3-yr old	
Females	1974–76	3	7	0	2	18	30
	1989	10	0	0	0	12	22
	1990	0	1	2	0	5	8
	1991	5	8	1	1	15	30
	1992	6	4	4	2	14	30
Total males		24	20	7	5	64	120
	1974–76	4	1	0	0	11	16
	1989	4	2	3	2	6	17
	1990	0	0	1	0	1	2
	1991	4	5	3	0	4	16
	1992	12	4	3	1	3	23
Total		24	12	10	3	25	74

Table 2. The mean and standard error of natural (no harvest, upper rows) survival and actual (includes harvest, lower rows) survival rates for the Viscount Melville (VM) polar bear population in Nunavut Canada for the interval 1974–92.

Sex and age	Mean annual survival rate (SE)	
	No harvest	Harvest
Female		
0	0.693 (0.183)	0.693 (0.183)
1–5	0.957 (0.028)	0.905 (0.026)
6–19	0.957 (0.028)	0.905 (0.026)
≥20	0.957 (0.028)	0.905 (0.026)
Male		
0	0.448 (0.216)	0.448 (0.216)
1–5	0.924 (0.109)	0.774 (0.081)
6–19	0.924 (0.109)	0.774 (0.081)
≥20	0.924 (0.109)	0.774 (0.081)

29% males ($P = 0.061$, $n = 161$). The adult sex ratio of captures from 1973–76 did not differ from 50% ($P = 0.542$, $n = 54$). However, the adult sex ratio of captures from 1989–92 was 14 different from 50:50 ($P = 0.001$, $n = 107$). The sex ratio of cubs was not different between the 2 periods ($P = 1.000$, $n = 122$) and did not differ from 50:50 ($P = 0.543$, $n = 122$). In the 1989–92 sample, the fraction of adult captures that were males (29%) was lower than the fraction of male cub captures (45%); ($P = 0.010$, $n = 230$). The adult (>5 years) fraction of the population was 44% in 1989–92 and 62% in 1974–76 ($P = 0.053$, $n = 110$). Estimates of the mean annual recruitment rate (and interval), mating rate (and interval), and unharvested population growth rate (Table 4) were based on the mark–recapture survival estimates from the selected model (Table 2) and standing age estimates of recruitment parameters (Table 3).

The harvest between 1973 and 1992 was highly selective for male bears (36.6% females and 63.4% males, $n = 164$) and averaged 8.2 bears/year. However, the average annual harvest from 1985 to 1990 was 19.6 and the average annual harvest between 1980 and 1989 was 16.1. The relatively high harvest rates and strong selection for males

Table 3. The mean and standard error of cub litter size (CLS), litter production rate for 4, 5, and adult (≥6) age strata, proportion of cub litters that are male (PCM), and total number (i.e. all cubs and adults of both sexes) of males and females for the Viscount Melville (VM) polar bear population in Nunavut, Canada for the interval 1989–92.

Parameter	Mean (SE)
Cub litter size	1.64 (0.125)
Litter production rate:	
4-year olds	0.0 (0.0)
5-year olds	0.623 (0.414)
≥6-year olds	0.871 (0.712)
Proportion male cubs	0.535 (0.118)
Abundance average 1989–92	
Males	61 (16.6)
cubs	9 (9.5)
others	52 (15.2)
Females	100 (20.0)
cubs	21 (6.2)
others	79 (15.4)
Total	161.0 (34.5)

that occurred just before the population inventory in 1989–92 markedly reduced the number of adult males in the population.

Sixty-two percent of the 194 bears captured were females (Table 1). During 1989–92, 60 bears were recaptured (Table 5). Eleven percent of the bears initially captured from 1974–76 were recaptured at least once during 1989–92 and 44% of the bears initially captured from 1989–91 were recaptured at least once during 1990–92. There were 128 captures and recaptures for the years 1989–92 and of these 23 were cubs. The proportion of those captures that were not cubs was 0.82 and the estimate of the over-dispersion coefficient (\hat{c}) was 1.22 (1/0.82).

The model with minimum QAIC_c included survival parameters for males and females and capture probability parameters for year (1989–90 vs. 1991–92) and “transmitter” (i.e., capture probability was higher for females with satellite transmitters, Table 6). Several other models had QAIC_c values close to the minimum, including a model with a parameter for differential cub survival. We

Table 4. Estimates of the mean and standard deviation of polar bear reproduction parameters from uncorrected ANURSUS vital rate estimates for the Viscount Melville (VM) Sound population of polar bears in Nunavut, Canada, 1989–92. The vital rates estimates are: reproduction interval (R-I), litter reproduction rate (R-R), proportion of females that have only 1 litter (P_1 litter), mating interval (M-I), mating rate (M-R), proportion of females that have no litters (P_0 litter) and stable age unharvested population growth rate (λ). The Monte Carlo method (1,200 iterations) was used to estimate the standard deviation of these values.

	R-I (years)	R-R (litters/year)	P_1 litter	M-I (years)	M-R (matings/year)	P_0 litter	λ
Mean	2.976	0.338	0.119	2.545	0.397	0.049	1.059
SD	0.209	0.024	0.0753	0.255	0.039	0.030	0.063

Table 5. Recaptures for 1989–92 summarized by sex and age (cub or other) at initial capture. A bear initially caught in 1975 and first recaptured in 1991 becomes an entry in the 1991 releases. Recaptured cubs are shown in the releases of non-cubs. Recaptures prior to 1989 were not used in the analysis. The percent recaptured over a long-time span (i.e., mid 1970s to 1989) illustrates differences in survival rate. A (-) indicates no recaptures possible.

Sex	Age	Year	Released	Year of next recapture				Total	%
				1989	1990	1991	1992		
Females	cub	1974	0	0	0	0	0	0	-
		1975	0	0	0	0	0	0	-
		1976	3	0	0	0	0	0	0
		1989	10		2	3	0	5	50
		1990	0			0	0	0	-
	other	1991	9				2	2	22.2
		1974	6	1	0	0	0	1	16.7
		1975	17	1	0	1	1	3	17.6
		1976	4	0	0	1	0	1	25
		1989	14		4	4	3	11	78.6
		1990	14			8	1	9	64.3
Male	cub	1991					12	12	29.3
		1974	1	0	0	0	0	0	0
		1975	2	0	0	0	0	0	0
		1976	1	0	0	0	0	0	0
		1989	4		0	1	0	1	25
		1990	0			0	0	0	-
		1991	4				1	1	25
	other	1974	5	0	0	0	0	0	0
		1975	6	0	0	0	0	0	0
		1976	1	0	0	0	0	0	0
		1989	13		2	3	1	6	46.2
		1990	4			2	0	2	50
		1991	18				6	6	33.3

believe it is more biologically reasonable to include a separate cub survival and we know that males were selected during harvest, so the model with age and sex parameters was selected as the best model.

Capture probability varied from 0.15 to 0.70 (Table 7) and annual estimates of total abundance ranged from 73 to 208 (1989: $N = 208$, $SE = 84$; 1990: $N = 73$, $SE = 30$; 1991: $N = 165$, $SE = 32$; 1992: $N = 202$, $SE = 40$) with a mean of 161 bears ($SE = 34.5$) (Table 3). Female total survival rates (including harvest mortality) were higher than males. Nearly twice as many males were harvested annually than females (8.4 males vs. 4.3 females). The difference in natural survival rates of males and females was small (Table 2) and was well within the range of sampling error.

The unharvested population growth rate for VM ($\lambda = 1.059$) determines the minimum time required for recovery from any reduction in numbers. The population growth

rate can be restated as the proportion of the original population required for recovery times of 0, 3, 5, 10, ... X years (Table 8). For example, a population reduced to 0.751 of original numbers would require 5 years to recover and a population reduced to 0.842 of original numbers would require 3 years to recover, if $\lambda = 1.059$. A unique distribution of outcomes is defined for any given harvest level. Some proportion of outcomes fall within recovery thresholds of 1, 2, 3, ... X years and these we termed "acceptable outcomes". That proportion of acceptable outcomes depends on the frequency of monitoring (e.g., 15 years, Table 8; 75 years, Fig. 2), starting population size, survival rates, recruitment rates, harvest sex and age composition, harvest number, uncertainty of these parameters, and recovery threshold value (i.e., years).

We evaluated the sensitivity of risk estimates associated with a range of harvests to the relative apportionment of estimate uncertainty into sampling and

Table 6. QAIC_c values for some of the best Cormack-Jolly-Seber polar bear survival models fitted to the Viscount Melville Sound, Nunavut, Canada 1974–92 capture and recapture data. Age refers to cub and non-cub; capture model year refers to partitioning based on annual capture effort strata (i.e., 1989–90 different from 1991–92). Models with more refined age and year partitioning were not supported by the data (i.e., had higher QAIC_c values for equivalent models).

Survival model	Capture probability model ^a						
	Age–sex+ transmitter	Age–sex+ year	Transmitter + year ^b	Transmitter	Age/sex	Year	Constant
Age+sex ^b	228.3 (7)	228.4 (7)	220.4 (6) ^{b,c}	225.0 (5)	232.0 (6)	224.5 (5)	227.4 (4)
Age	230.3 (6)	229.8 (6)	221.7 (5) ^b	226.5 (4)	233.4 (5)	227.6 (4)	230.2 (3)
Sex	227.8 (6)	227.1 (6)	219.8 (5) ^b	224.6 (4)	230.7 (5)	223.4 (4)	226.5 (3)
Year	234.8 (6)	229.8 (6)	223.2 (5) ^b	230.7 (6)	234.8 (7)	229.8 (6)	233.6 (5)
Constant	230.3 (5)	228.7 (5)	221.5 (4) ^b	226.3 (3)	232.7 (4)	226.6 (3)	229.5 (2)

^a Number of estimated parameters in parenthesis.

^b Suite of best models.

^c The selected model (Survival model: age + sex, Capture model: transmitter + year) also considered biological reality (QAIC_c = 220.4).

Table 7. Capture probabilities and standard errors for best model of Viscount Melville Sound, Nunavut, Canada, polar bear population capture-recapture data.

	Capture probability	
	Estimate	SE
1989–90 without transmitter	0.152	0.058
1989–90 with transmitter	0.407	0.141
1991–92 without transmitter	0.38	0.064
1991–92 with transmitter	0.702	0.132

environmental uncertainty (Table 9) for the case when a population reduction of 0.751 from initial numbers was judged “acceptable”. The estimate of risk was insensitive to how uncertainty was apportioned into sampling and environmental components for harvest rates that were clearly conservative (i.e., almost always sustained) and for harvest rates that were clearly excessive (i.e., almost always resulted in a dramatic decline). The maximum deviations (0.09 = maximum observed, Table 9) occurred for intermediate harvest levels.

DISCUSSION

Currently, determination of population status and sustainable harvest levels of polar bears are based on estimates of vital rates that serve as input to a deterministic harvest simulation model (Taylor et al. 1987c). The vital rate estimates for the Taylor et al. (1987c) approach were

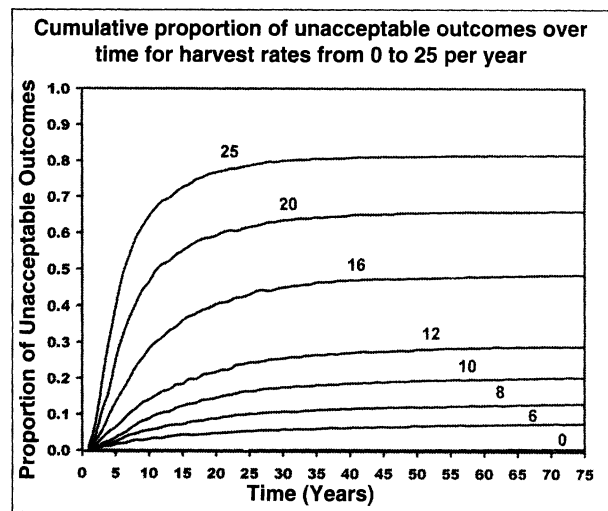


Fig. 2. Estimated probabilities of a population reduction that would require >5 years to recover to original numbers for a range of harvest rates (0–25 per year) and time intervals (0–75 years) shows that risk increases with monitoring interval.

based on an analysis of the pooled standing age distributions of essentially all of the polar bear capture data available at this time (Taylor et al. 1987a). Simulation results (Taylor et al. 1987a) indicated that the maximum sustainable harvest was about 1.5% of the total population of females (age ≥ 2+) and about 3% of the total population

Table 8. Proportion of acceptable simulation outcomes for a range of annual harvest values for polar bears in Viscount Melville Sound (VM), Nunavut, Canada, from 1997. Acceptable outcomes left the population at or above the critical threshold after 15 years. For example, if the VM annual harvest were 6, the probability that the population would either increase or decline no more that could be recovered in 5 years is 0.97.

Years to recovery ^a		Annual harvest								
		0	2	4	6	8	10	12	16	20
0	(1.000)	1.000	0.992	0.981	0.940	0.874	0.802	0.704	0.4884	0.300
3	(0.842)	1.000	0.997	0.984	0.966	0.921	0.859	0.757	0.542	0.348
5	(0.751)	1.000	0.998	0.991	0.972	0.938	0.877	0.804	0.575	0.393
10	(0.564)	1.000	1.000	0.997	0.987	0.961	0.932	0.868	0.686	0.476
15	(0.432)	1.000	1.000	0.999	0.993	0.979	0.948	0.895	0.765	0.554
20	(0.318)	1.000	1.000	0.998	0.996	0.986	0.967	0.929	0.807	0.612
25	(0.239)	1.000	1.000	0.999	0.998	0.989	0.977	0.944	0.846	0.703

^a The proportion of original population associated with a given recovery time (i.e., critical threshold) is listed in parenthesis.

Table 9. The proportion of runs that did not reduce initial population below 0.751 (i.e., not more than a 5-year recovery period at zero harvest) for harvest levels ranging from 0 to 20 bears/year for 3 simulations (2,500 iterations each) for which the ratio of sampling to environmental uncertainty was set to 1.0, 0.75, and 0.0 for Vicount Melville (VM) Sound population of polar bears, Nunavut, Canada.

Sampling to environmental uncertainty ratio	Annual harvest								
	0	2	4	6	8	10	12	16	20
1.00	1.000	0.995	0.985	0.963	0.926	0.858	0.784	0.578	0.396
0.75	1.000	0.998	0.991	0.972	0.938	0.877	0.804	0.575	0.393
0.00	1.000	0.998	0.999	0.992	0.981	0.968	0.898	0.652	0.410

of males (age ≥ 2). A pooled data set was used because analysis of population-specific standing age distributions produced estimates of some parameters that were nonsense in all cases (i.e., for all populations). Subadult and adult survival rates were assumed rather than estimated because neither the standing age analysis nor the mark-recapture analyses provided estimates that were consistent with the observed long-term persistence of harvested polar bear populations (DeMaster et al. 1980; M. Taylor, unpublished analyses). Taylor et al. (1987c) assumed that vital rate estimates based on pooled data from all populations and logical assumptions would result in the most accurate estimates of sustainable harvest rates. It was recognized that better sampling protocols and improved mark-recapture models were needed for improved population-specific estimates. Comparison of the actual harvest to the 1.5% of the total population (females) and 3.0% of the total population (males) is still the accepted method by which the status of polar bear populations are determined (Lunn et al. In Press; 2001 Canadian Federal/Provincial Polar Bear Technical Meeting Minutes, 2002).

The present work uses the same standing age analysis approach and the population simulation model is a stochastic version of the same harvest simulation model described by Taylor et al. (1987c). The main differences from previous population inventory studies are the way the data were collected, the mark-recapture analysis, and the incorporation of uncertainty into the harvest management recommendations. It is relevant to compare our results to other demographic studies completed since 1987 so that the reader can evaluate both our estimates of parameter values and the risk estimates that are based on them.

Mark-recapture Analysis

Only a few published studies report survival or abundance estimates from mark-recapture studies of polar bears after 1987 (Derocher and Stirling 1995, Lunn et al. 1997, Amstrup et al. 2001). Amstrup et al. (2001) suggested that previous mark-recapture studies of polar bears in the Beaufort Sea were compromised by unmodeled heterogeneity in survival and capture probabilities. Heterogeneity probably affects all mark-recapture studies to some degree but it was undoubtedly important for Amstrup et al. (2001) because they analyzed spring and fall capture

data collected by different researchers for different purposes from 1969 to 1998, and 38% of the 1,137 "captures" after 1981 were radio relocations. They modeled survival and capture heterogeneity of female polar bears and used a "modified" QAIC_c procedure (McDonald and Amstrup 2001) to select from 82 different models that included combinations of potential covariates. Our analysis differed from that of Amstrup et al. (2001) and McDonald and Amstrup (2001) in that our data were specifically collected for mark-recapture analysis and included both sexes. We used a different variance estimator which produced larger variance estimates because we feel the variance estimator they used neglected covariance between the estimated capture probabilities of individuals. Our model selection criteria were according to Burnham and Anderson (1998), except that we did not model average for "tied" models. We did not understand the modified QAIC_c method used by McDonald and Amstrup (2001) because QAIC_c already attempts to optimize for both bias and variance. Our survival estimates are provided; the reader may judge if they are reasonable and consistent with other estimates and with what is known about polar bear life history.

Since the analyses of Derocher and Stirling (1995) and Lunn et al. (1997), the development of computer software packages like MARK have enabled researchers to develop more sophisticated analyses to account for heterogeneity. However, this capability should not be viewed as a way to avoid a proper study design. Heterogeneity can only be modeled if the data are sufficient. Further, we cannot model extreme heterogeneity whereby some animals have no chance of being captured. Although our analysis was similar to that of Amstrup et al. (2001), we believe our data were less heterogeneous. We did have much smaller sample sizes and thus would expect to be able to identify less heterogeneity. However, we believe our data were less heterogeneous because we attempted to survey the entire VM area from 1989–92 in a geographically uniform manner and we captured every bear we encountered. The flexibility of MARK allowed us to incorporate the earlier limited effort from 1974–76 by using the initial captures but excluding recaptures of those bears until the years with uniform sampling coverage.

Unfortunately, uniform coverage of the survey area does

not guarantee homogeneity. We did have temporal variability in capture probability because telemetry efforts in 1989 and 1990 reduced the helicopter time available for search and capture operations. Also, female polar bears who were given radiocollars and their cubs (as yearlings) were more likely to be recaptured than other bears. This was only partly because some of the collared adult females were located and recaptured using radio signals. Even after the radiocollars were removed, these individuals still had higher capture probabilities. This may have been because these individuals had a preference for a particular geographic area where they were easily located year after year. However, our data were not sufficient to establish the mechanism by which radiocollared bears and their offspring were more likely to be captured than other bears. We did not identify any sources of capture heterogeneity that would cause bias in the analysis of the standing age distribution. However, the small sample sizes may have resulted in the failure to fit more stratified models to detect additional sex, age, or family status effects.

Based on our unpublished analyses of larger populations in Lancaster Sound, Baffin Bay, and Gulf of Boothia, we anticipated that survival would vary by age and sex. The best model based on QAIC_c only supported sex-specific rates, but we chose a closely competing model with separate cub (age 0) and non-cub (age 1+) survival rates. The failure of our analysis to identify additional age stratification in polar bear survival rates is probably because our data were too sparse to support additional model parameters. The population size imposes an obvious constraint on the number of captures. In turn, small numbers of captures limit analysis models to fewer parameters (e.g., simpler models). Thus, sample size can influence not only the precision, but also may influence the accuracy of the analysis.

Vital Rate Comparisons

Our estimates of cub and yearling litter size, AMΦ, AFΦ, and to a certain extent total cub survival and age of first birth fall within the general range of published values in spite of differences in methodology and the possibility of non-representative sampling on other studies. Our standing age estimates of survival were not independent of our mark-recapture estimates because they were based on the same data. However, we did observe that the standing age Φ for both male and female non-cubs was larger than the mark-recapture survival estimates (harvest mortality included) for the same parameters. The higher values for the standing age estimates suggest that population growth rate (λ) was less than 1.0 for most of the years represented in the standing age distribution. We used the mark-recapture survival estimates for our simulations because mark-recapture estimates are potentially adjusted

for differential capture probabilities and because we had no independent estimate of λ to correct the standing age survival estimates.

Lunn et al. (1997) estimated the annual adult (age ≥ 2) total (natural + harvest mortality included) female survival rates to be 0.88 for females and 0.86 for males in western Hudson Bay. Although the survival estimates were within the sampling range of our equivalent survival rates for VM non-cubs for both sexes, this comparison is compromised because the harvest mortality rates for the 2 populations are likely different. Lunn et al. (1997) did not report natural survival estimates. We were unable to compare our estimates with those of Amstrup et al. (2001) because they did not report survival estimates except as a function of covariates that were not clearly defined. Amstrup et al. (1986) assumed a range of annual survival rates from 0.82 to 0.94 bracketed the true survival rate of polar bears in the Southern Beaufort Sea. Amstrup and Durner (1995) later estimated the natural survival rate of adult females in the same population to be 0.996 and the total survival rate of adult females to be 0.969; however, this telemetry based estimate was not consistent with the age distribution of polar bears in this area (Amstrup 1995).

Comparisons with other vital rate values in the literature were often difficult because most other researchers used different methods and different terminology for the estimates they reported (Stirling et al. 1980, 1999; Ramsay and Stirling 1988; Derocher and Stirling 1992, 1995; Amstrup 1995). Most of the published estimates that were based on the standing age distribution ignored the 3-year reproduction cycle of polar bears and published annual summary rates (i.e., mean natality = male and female cubs/female/year, as per Stirling et al. [1980] and Ramsay and Stirling [1988]). This mean natality rate (MNR) was calculated as:

$$MNR = (C_x + \frac{Y_{x+1}}{p_0}) (\frac{1}{N_x + N_{x+1}})$$

where C_x = cubs (male and female) with females of age x ; Y_{x+1} = yearlings (male and female) with females of age $x+1$; p_0 = survival rate of age class 0 (i.e., cubs); N_x = females of age x . The estimate for p_0 was the standing age distribution ratio of yearlings (Y) to cubs (C), or Y/C. If the age distribution is stable and stationary, the ratio Y/C is actually p_0/λ (Caughley 1977). Additionally the mortality of females from age x to $x+1$ was not considered, although this would clearly affect how many yearlings were counted because age 0 cubs are completely dependent on their mother. The mean annual natality rate is an abstraction for species with a 3-year reproduction cycle and we suggest that mean natality estimates using the method described in Stirling et al. (1977, 1980) and Ramsay and Stirling (1988) are only correct when female

mortality rates are zero and thus not directly comparable to the product of mean litter size and reproduction rate used in this paper.

The method of calculating natality rate has also varied. For example, the mean litter production rate for polar bears in the western Hudson Bay population for the interval 1980–84 was given as 0.69 in Derocher and Stirling (1992) and 0.70 in Derocher and Stirling (1995). However, Stirling et al. (1999: their Fig. 6) indicate that natality rates ranged between 0.93–0.98 from 1981 to 1985 in western Hudson Bay. Similar discrepancies in reported natality rates for the western Hudson Bay population were also apparent for other intervals (Derocher and Stirling 1992, 1995; Stirling et al. 1999). The natality rates reported by Derocher and Stirling (1992, 1995) and Stirling et al. (1999) were calculated to examine trends over time, so this discrepancy between papers does not affect their main points.

Amstrup and DeMaster (1988) discussed measures of reproduction and concluded that recruitment rate (m_x) as calculated by pooling male and female cubs (i.e., litter size)/reproduction interval_x) was a more appropriate measure of recruitment than the m_x defined by Taylor et al. (1987c) (i.e., [% females available_{x-1}] [litter production rate_x/females available_x] [litter size_x]) because the latter requires an estimate of the percent of females available for breeding which was not available in their study. Any estimate that depends on the relative frequencies of females with cubs, females with yearlings, females with 2-year-olds and unencumbered females (e.g., reproduction interval) will be biased if these frequencies are distorted by non-representative sampling. Amstrup (1995:191) discussed these same issues for the Beaufort Sea populations, but concluded that the low estimates of natality were “not entirely” due to the sampling problems mentioned in Amstrup and DeMaster (1988). Amstrup (1995) found that the age distribution estimates of natality were not different from estimates based on cohorts of polar bears followed through time using radiocollars. Amstrup (1995:192) stated that “females with cubs were under-sampled throughout the study”, although he applied a correction factor based on the survival of cubs in an attempt to remove this bias. If females with cubs were under-sampled, then family group classes and solitary adults must have been oversampled and it is unclear why biased standing age distribution estimates would be the same as unbiased estimates based on telemetry cohorts.

Similar concerns were expressed about vital rate estimates for polar bear populations from the M’Clintock Channel and Gulf of Boothia (Furnell and Schweinsburg 1984). The parameter values reported in Taylor et al. (1987c) were calculated from a pooled data set that included all data collected in Canada, except western Hudson

Bay which was recognized as distinct. The available data in 1987 for individual population analysis (i.e., Southern Beaufort Sea, Northern Beaufort Sea, Viscount Melville Sound, M’Clintock Channel, Davis Strait, Lancaster Sound, Baffin Bay, and Davis Strait) using ANURSUS (Taylor et al. 1987a) produced results that were judged to be incorrect because of non-representative sampling. The pooled data estimates (Taylor et al. 1987c) were assumed to have compensating biases and represented the best available data at that time. The parameter values from Taylor et al. (1987a) gave a natality rate of 0.554. However, it is difficult to make meaningful comparisons to estimates that were based on pooled data with apparent but unquantified biases.

The discrepancies in reported estimates for mean annual natality rate estimates for the western Hudson Bay population (Derocher and Stirling 1992, 1995; Stirling et al. 1999) are unfortunate because an extensive database has been developed for this population. However, the values given by Derocher and Stirling (1995) (i.e., 1966–79: 0.75; 1980–84: 0.70; 1985–92: 0.52) for “mean annual recruitment” do seem comparable, in spite of the difference in methodology. A mean natality rate (i.e., cubs of both sexes produced/female/year) estimate of 0.849 was reported by Kolenosky et al. (1992) for the Southern Hudson Bay population. However, previously published estimates of natality rates reported by Kolenosky et al. (1992: Table 7) do not match the estimates reported in the references cited. Kolenosky et al.’s (1992) natality estimate was based only on females with cubs (as opposed to both females with cubs and yearlings as per Ramsay and Stirling [1988]). Stirling et al. (1980), also using both cub and yearling litters, estimated the natality rate (i.e., cubs of both sexes produced/female/year) of Davis Strait polar bears as 0.527; however, this estimate did not correct for cub to yearling survival.

The only previously published natality rate estimate that we view as unambiguous is the one presented by Amstrup (1995), because both the age distribution and the telemetry cohort estimates were not different. Amstrup’s (1995) mean annual natality rate (0.40, SE not reported) was marginally larger than our equivalent recruitment rate estimate of 0.356 (SD = 0.035). We were surprised that the 2 mean natality estimates were so close because Kingsley et al. (1985) reported that the habitat in VM has a lower density of seals than the Southern Beaufort Sea.

Historical Harvest and Natural History

Although the VM polar bear population (Fig. 1) is currently few in number, it encompasses a very large geographic area (203,100 km², of which 104,540 km² is sea ice). Wynniatt Bay has 3 polynya areas caused by current upwellings in shallow areas. Hadley Bay is separated from

Wynniatt Bay by the Natkusiak Peninsula. Both captures and the movements of radiocollared adult females suggested that most of the VM polar bear population was located in either Hadley or Wynniatt Bay or in the mixed annual and multi-year ice that extended about 50 km into VM in the same vicinity (Fig. 1). The concentration of bears may also explain why harvest quotas were so liberal in the 1970–95 years. Hunters had no difficulty harvesting polar bears in this area, even in the final years before the moratorium. One individual and his wife took 8 bears (5 females and 3 males) in the final year (1991) of the now discontinued Melville quota in a single hunting trip. The 20% shift in adult sex ratio (M/F) and 18% decline in the fraction of the population that were adults from 1974–76 to 1989–92 suggest that the population was severely over-harvested during this interval and that the initial numbers may have been between 500–600 bears.

It is unusual to find 4 females that kept their cubs to age 3, and we also observed one female that was accompanied by a cub of age 4. Only 3 other instances of females with 3-year-old cubs have been recorded previously in Canada; and no instances of females with 4-year-old cubs were known. Typically large males force 2-year-old cubs to leave their mothers during mating season. The reduced number of males in the population may have reduced encounter rates during mating season thus allowing cubs to remain with their mothers. Alternatively some females may have kept offspring an extra year in this area to increase their chance of survival post-weaning. A third possibility is that because the best habitat is concentrated in a relatively small area of VM, 2-year-old cubs re-associate with their mothers after mating and remain with females that do not enter maternity dens. We also observed a subadult male (age 5) accompanied by 3 females in estrous. Observations of multiple males with females are common, but we know of no other observations of a single subadult male with >1 adult female during the mating season. This observation is consistent with the suggestion that males were depleted in this population.

Assumptions of Harvest Risk Analysis

The sensitivity of risk estimates to partitioning of the uncertainty in demographic parameters (Table 9) demonstrates the need to use estimation procedures that partition total variance (White 2000) and to collect sufficient data to enable that partitioning. However, when population and sample sizes are small, or when the sampling occurs over too few years, it may not be possible to estimate the proportion of total variance that is due to sampling error and environmental variability. Our data were too sparse to partition survival and population variance estimates. Our variance estimates of recruitment parameters were determined using the jackknife method, which

did not allow partitioning the variance estimate (White 2000). The risk estimates did vary as a function of how the uncertainty was partitioned (Table 9).

The magnitude of the deviation in the proportion of runs that were identified as unacceptable (i.e., reduction to levels requiring 5 or more years of no hunting to recover) between simulations that assumed independence and simulations that set environmental covariance to 1.0 ranged from 0.0 to 0.124 and averaged 0.058 for a range of annual harvest rates from 0 to 20. The largest deviations were observed at harvest levels close to the deterministic sustainable yield value. The smallest deviations occurred at harvest levels either so small that they were almost certainly sustainable or so large that they were almost certainly not sustainable.

Our estimate of the over-dispersion coefficient (\hat{c}) is rational (Appendix), but is also somewhat subjective. The model based estimates of \hat{c} (i.e., 1.0) were clearly low, given that polar bear family groups are captured as groups, not individuals. Estimating \hat{c} as mean group size ($\hat{c}=2.0$) was clearly too large because most polar bears are not captured as family groups and because once a cub was weaned, it was no longer likely to be captured with its mother or litter mates. Perhaps better estimates may be possible from these data as analysis models continue to develop.

An additional limitation in our simulation results is that our Monte Carlo simulations assumed independence in both sampling and environmental random deviates. The standing age vital rate estimates were based on the same data and non-zero covariance was apparent. Our simulation model was not able to incorporate co-variance directly; however, it did contain an option that forced all random deviates for a given year (i.e., environmental uncertainty) to be based on the same uniform random deviate. This option allowed us to view the extreme covariance assumption with respect to parameters that might be expected to increase or be reduced simultaneously by good and bad years. The effect of setting environmental covariance to 1.0 was to slightly increase the variance of the simulation and thereby also slightly increase the risk associated with a given harvest level.

Harvest Risk

When information is uncertain, harvest presents a risk to the harvested population. Our field work was done in collaboration with local hunters and simultaneous with polar bear hunting. It was clear that the hunters were very adept at locating and harvesting polar bears. Although the area was large and the density of polar bears was relatively low, local hunters maintained high success rates in all years they hunted in Viscount Melville Sound. This hunt was legal and within the quota limitations set by the

Government of the Northwest Territories, Canada. The apparent over-harvest was not caused by a failure to obey conservation regulations. Rather, it was caused by lack of accurate information on the size and sustainable harvest rate for this population, which resulted in overly aggressive harvest quotas.

Although we were able to document that prior harvest had reduced the population and that the current harvest rate (4/year) is "likely" sustainable (Table 8), our information was too uncertain to identify an absolutely safe sustainable harvest rate for this population. The risk assessment is an expression of the uncertainty in the demographic process and parameters. The RISKMAN simulations indicated that even though the point estimate of population growth rate was >1 (i.e., 1.059), the confidence interval includes values <1 . The population is at some risk even if the annual harvest policy is zero (Table 8) because the uncertainty in demographic parameters causes a small fraction of the scenarios to result in unacceptable declines. Higher harvest rates constitute an increased risk (fewer acceptable outcomes) to the population. If managers and stakeholders are willing to accept long periods (e.g., decades) of no harvesting, the proportion of acceptable outcomes is increased. We indicated risk levels using recovery times (Table 8) rather than fractions of original numbers because this consequence of reduced numbers was more intuitive to many managers and stakeholders.

We suggest that these results are more realistic than a deterministic maximum sustained yield estimate that does not consider the uncertainty of the underlying information. Both managers and stakeholders must recognize that scientific information rarely provides exact and absolutely correct harvest rate or harvest quota values. Researchers have a responsibility to quantify the uncertainty of their measurements and the uncertainty of their management recommendations. Reporting scientific results in this manner identifies the distribution of solutions where local and traditional knowledge may be used to guide the final determinations.

MANAGEMENT IMPLICATIONS

Even when risk has been quantified, periodic monitoring is still required if the harvest level poses a significant risk to the population. Small populations limit the possible sample size of demographic studies. Estimates developed from few data may not be sufficiently precise or accurate (i.e., certain) to justify the cost and ethical considerations involved in frequent mark-recapture sampling. There may be some polar bear populations that are simply too small to be inventoried with sufficient precision and accuracy to provide a meaningful harvest at an ac-

ceptable risk level. These small populations may require particularly risk-averse harvest management policies. These small populations may be best managed as non-hunted, or harvested at conservative (i.e., clearly safe) rates, so that monitoring resources can be shifted into the larger populations where the return (harvest levels) is greater. We believe that total anthropogenic mortality from all sources (i.e., harvest, defense, accidental, and illegal) would have to be reduced to levels that posed essentially no risk to the population before it would be justified to extend or terminate the inventory cycle.

We quantified the associated risks for the range of annual harvest levels that we deemed to be practical. Management decisions must also consider the long-term goals for the population and the resources available for monitoring. Shorter intervals between population inventories could allow more aggressive harvest policies with the same level of risk, but these inventories are expensive, invasive, and time consuming. Whatever harvest level is chosen, stakeholders should be informed that the quota recommendations are based on uncertain information and that long-term harvest moratoriums may be required to regain the current number of bears. If the management goal for the VM population is recovery to pristine levels, the harvest rate will have to be very conservative or the likelihood of recovery will be small. Immigration from adjoining populations is likely to be low because adjoining populations are currently harvested at the estimated maximum sustained rate (Anonymous In Press, Lunn et al. In Press) and permanent immigration between polar bear populations is rare (Taylor et al. 2001a).

Our risk analysis results were specific for a 15-year interval between analyses. Longer monitoring intervals would increase the risk of harvest to the population. A systematic exploration of the risk implications for the entire range of monitoring options is beyond the scope of this paper. However, the risk of longer monitoring intervals for a range of harvest levels was explored using a 5-year recovery at zero harvest as the "acceptable" criteria (Fig. 2) for a 75-year time interval. Even the risk from low harvest rates was greater over the longer monitoring interval and the risk from intermediate and large harvest rates increased dramatically. The risk of a given harvest rate depends on the monitoring interval, and more frequent monitoring is required to manage the risk of aggressive harvest policies.

We were surprised to estimate the unharvested population growth rate of this population at 1.059 (SE = 0.063) because relatively low seal densities and heavy multi-year ice that characterize VM make this area relatively poor habitat for polar bears. Although our estimate of the mean population growth rate had considerable variance, it is one of the highest estimates of polar bear population growth

rate ever published. One could speculate that the over-harvest reduced the population to the point that density effects have been relaxed. Most of the population seemed to be concentrated in a relatively small part of the area during our study (Fig. 1). However, our estimates of recruitment parameters were numerically (but not significantly) lower than estimates for recruitment parameters from other polar bear populations areas (M. Taylor, unpublished analyses). The high population growth rate estimate was due to the high natural survival rate estimates that were age constant for non-cubs of both sexes. Both survival and population estimates had relatively large standard errors because of sample size limitations.

Harvest quotas based on deterministic estimates of the maximum sustained yield are difficult to evaluate and dangerous because they do not consider the uncertainty of the underlying information. However, incorporation of the uncertainty of the underlying demographic estimates also requires assumptions about how the total variance of the estimates is partitioned, and the estimated variance depends, in part, on the over-dispersion coefficient. We tried to make reasonable assumptions that were consistent with the data, analysis models, and natural history of polar bears. We were unable to validate all of these assumptions and suggest that the risk values that we present be viewed as the best currently available, but also be employed cautiously for management.

For small populations, an alternative to population-based assessments is a meta-analysis or empirical Bayes approach that would use information from other populations to derive demographic estimates with greater certainty (Meyers and Mertz 1998) and potentially improve the certainty of harvest levels and risk. However, to move in that direction, researchers must report unbiased vital rate estimates, and standard estimation methods should be used to make the estimates comparable. Additionally, the estimates of vital rates for a given population should be examined when reported to confirm that the population trajectory they imply is rational.

For example, when the mark-recapture survival estimates for the Western Hudson Bay (WH) population (Lunn et al. 1997) are combined with the recruitment estimates for the same area (Stirling et al. 1999), they indicate a rapid decline in polar bear numbers (M. Taylor, unpublished simulation). This decline is not supported by the WH population estimates (Lunn et al. 1997), which employ those same survival rates, or by qualitative observations of residents and long-term researchers.

Development of a conservative polar bear model that could be used with confidence, even when data are sparse or absent, will require systematic accumulation of accurate and internally consistent vital rate estimates for the various polar bear populations. We urge those reporting

polar bear vital rate estimates to make an effort to reconcile new information with what has been published previously and to ensure that the information reported is internally consistent or that any discrepancies are explained.

An example of a default population dynamics model used for management of populations where scant or no data are available for direct estimates of vital rates is the "potential biological removal" (PBR) management policy that is part of the U.S. Marine Mammal Protection Act (16 U.S. Code 4041–4042; Wade 1998, Taylor et al. 2000). The PBR method regulates the risk of human-caused mortality to acceptable limits by restricting takes to a proportion of the current minimum population size (i.e., a lower confidence limit value of the population estimate). The allowable proportion is one-half the maximum population growth rate which may be scaled back by a recovery factor (F_r) when the population status is unknown or the population is known to be recovering. Periodic monitoring allows adjustment of PBR based on population dynamics, or alternatively, values of F_r can be selected that would yield PBR values that would keep the population secure indefinitely (Wade 1998). This approach was designed as a management tool to prevent depletion of marine mammal populations from by-catch or other human-caused mortality and it is robust in terms of conservation. If PBR were applied as a tool for setting polar bear harvest quotas, it could greatly reduce harvest opportunities for populations that are recovering or where there is little information. However, the PBR approach or a similar "default" polar bear population dynamics model based on other polar bear populations could be a strong option for small populations where the cost:benefit ratio of population inventory research was prohibitive, or for large populations where the data were few or suspect.

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APPENDIX

Various approaches for estimating the over-dispersion coefficient \hat{c} have been suggested (Lebreton et al. 1992, White et al. In Press). The bootstrap goodness of fit option in MARK currently under-estimates over-dispersion for reasons that are not currently understood (G.C. White, Colorado State University, Boulder Colorado, USA, personal communication, 2001). The use of Test2 + Test3 from program RELEASE (Lebreton et al. 1992) also has limitations in coping with age-structure and non-time dependent covariates because inclusion of these factors as strata will often yield an over-parameterized model that may underestimate \hat{c} . Preliminary investigations indicated that both the bootstrap option in program MARK and program RELEASE estimated \hat{c} as less than one, which is clearly an underestimate because of extended parental care in polar bears. McCullagh and Nelder (1991:125) show that the over-dispersion coefficient is bounded above by the cluster (group) size for a population in equal-sized clusters in which the binomial response varies by cluster. Thus, we could have used an upper bound of $\hat{c} = 2.0$ bears per capture group. However, while captures of bears in groups are dependent, their survival and recapture are not necessarily linked except in the case of mothers and cubs.

To reflect this dependence, we chose to estimate \hat{c} as $n/(n-n_c)$ where n is the total number of bear captures and recaptures and n_c is the number of initial cub captures. We used the 1989–91 data because recaptures were excluded prior to 1989 and captures in the final year were not used as trials in further years. We used \hat{c} in the computation of QAIC_c and to inflate variance estimates. This \hat{c} adjustment effectively treats the survival and potential recaptures of cubs as entirely dependent on their mothers and can be viewed as a sample size adjustment. The use of mean group size as an upper bound would have yielded conservative (i.e., too large) variances and would have tended to favor simpler models. The alternatives (Lebreton et al. 1992, White et al. In Press) would have likely yielded underestimates of \hat{c} because the data were sparse. Underestimation of \hat{c} would lead to over-fitted models with optimistic estimates of precision that would be less useful for prediction. Our estimate of \hat{c} was subjective to a certain degree, but we feel it was justified until better methods for estimation of \hat{c} are developed.

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Associate Editor: Derocher.



January 31, 2025

Written comments from ECCC - Canadian Wildlife Service Wildlife Management and Regulatory Affairs Division to the Nunavut Wildlife Management Board concerning: “TAB 3 – Harvest Accumulation and Credits for Viscount-Melville Polar Bears”

General comments

- Environment and Climate Change Canada (ECCC) acknowledges the submission by the Kitkmeot Regional Wildlife Board and Ekaluktutiak Hunters and Trappers Organization to the NWMB.
- ECCC acknowledges the recommendations put forward to the NWMB regarding the recommendation to increase the “Annual recommended quota” for 2025-2026 from 3 to 19 for the Viscount-Melville (VM) polar bear subpopulation, the concerns raised regarding harvest data accessibility by HTOs and RWOs and the recommendation of shifting how polar bear management is viewed and approached to “respect and empower Inuit self-determination, and considers the physical, mental and cultural well-being of Inuit”.

ECCC believes the outcome of the TAB3 submission could affect matters of federal jurisdiction. Accordingly, ECCC would like to submit the following clarifying questions for consideration by the NWMB:

1. With regards to harvest data sharing

- ECCC would like to better understand the ethical concerns for Inuit self-expression and -representation expressed with regards to harvest data being shared or used at national and international levels without consent, inclusion or awareness of Hunters and Trappers Organizations (HTO) and Regional Wildlife Organizations (RWO). Could specific examples be provided? Within this context, we would like to share that ECCC continues to represent Canada as a Polar Bear Range State (PBRs) member and signatory to the *1973 Agreement on the conservation of polar bears*. The PBRs are currently advancing Objectives and Actions under the 10-year Circumpolar Action Plan (CAP). We would welcome an opportunity to understand whether data that appears on the Polar Bear Range States website (e.g. <https://polarbearagreement.org/working-groups/human-polar-bear-conflict/pb-conflict>) is of such concern?

2. With regards to Polar Bear Trade under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

- This submission does not reference any implications for CITES. However, ECCC would like to offer the observation that Canada is a Party to CITES. Currently, the polar bear is listed on Appendix II of CITES, requiring a CITES export permit (as per requirements under Article IV of the Convention) to enter international trade. CITES export permits can be issued only upon advice from the country’s CITES Scientific Authority that the trade will not be detrimental to the survival of the species (known as a non-detriment finding or NDF). Canada updated and published an NDF document in March 2024 ([available here](#)). The NDF document provides

background and considerations of the Scientific Authority when making the NDF for export permit applications. While this NDF Report provides an overall assessment of non-detriment, each permit is evaluated on a case-by-case basis. It is possible that there are implications under CITES under this recommendation. ECCC would like to flag these to the board for consideration.

3. With regards to the population status of the Viscount-Melville polar bear subpopulation
 - ECCC acknowledges the population status information submitted as part of the recommendation. ECCC would like to supplement this information and offer the observation that proposed potential quota of 19 bears for the 2025-2026 harvest season, if filled, would represent a potential harvest of 8.1% of the subpopulation.
 - Additionally, ECCC would like to note that although the Viscount Melville polar bear subpopulation grew from 1989-2014, partially in response to a harvest moratorium, results from the Regehr et al. 2024 paper referenced within the submission estimated an un-harvested intrinsic growth rate of 0.01 (95% CRI [-0.06, 0.07]; or alternatively, finite population growth rate = 1.01 [95% CRI [0.94, 1.07]]) and suggested very limited or slow population growth. ECCC notes that low body condition, low observed numbers of seal kills, and low adult female survival observed in this study suggest that a precautionary approach should be taken regarding harvest management.

We appreciate the opportunity to submit these clarifying questions and observations in advance of the NWMB meeting and are looking forward to the discussion on February 26th, 2025.

**SUBMISSION TO THE
NUNAVUT WILDLIFE MANAGEMENT BOARD**

FOR

Information:

Decision:

Recommendation: X

Issue: 2025 Total Allowable Catch (TAC) level for Northern Shrimp (*Pandalus borealis*) in Shrimp Fishing Area 0, and possibility of multiyear TAC



Northern shrimp (*Pandalus borealis*)

Background

A competitive fishery for Northern shrimp (*Pandalus borealis*) exists in Shrimp Fishing Area (SFA) 0, located in Baffin Bay. SFA 0 is immediately adjacent to and partially within the Nunavut Settlement Area (NSA), however fishing is only permitted outside of the NSA (see map at Appendix 1).

The fishery in SFA 0 operates on a calendar year (January 1 – December 31). Harvesting activity, if any, would likely occur no earlier than June due to ice conditions.

The TAC in SFA 0 has been 500 t since 1996 with the exception of 2020 and 2023, where an interim TAC was set. No catches have been recorded since the onset of this fishery. Nunavut fishing interests have access to the SFA 0 fishery via Qikiqtaaluk Corporation's offshore licence and through 50% ownership of the Unaaq offshore licence. Beginning in the 2024 fishing season, Qikiqtaaluk Corporation and Baffin Fisheries Coalition were granted access to SFA 0 as Nunavut entities.

As this fishery occurs in waters adjacent to the NSA, the Department is seeking a recommendation from the NWMB on maintaining the 2025 Total Allowable Catch (TAC) for *P. borealis* in SFA 0 at 500t. The Department is also seeking views on the possibility of having a TAC at this level for 2026.

Science Information

Regular stock assessment surveys for Northern shrimp are not conducted in SFA 0 as there has never been an active fishery in the area. SFA 0 was last assessed in 2010 based on surveys in 2006 and 2008 (Canadian Advisory Report 2010/024; Summary in Appendix 2).

These surveys indicated that biomass indices were low. The fishable biomass index was 750 t (2006) and 1,100 t (2008) with female spawning stock biomass index of 580 t (2006) and 800 t (2008). Based on the biomass indices from 2006 and 2008, if the historic 500 t competitive TAC was set and fully taken in 2023, the potential exploitation rate would be high (66.7 per cent and 45.4 per cent, respective of the fishable biomass index considered).

With only two surveys, no biomass trends can be determined. Current biomass levels and recruitment status are unknown. The area is not currently fished and based on the most recent observed biomass, future prospects for a fishery are limited. As there have been no surveys targeting SFA 0 since 2008, the Department may consider a request for a scientific survey in the coming years. However, such a request would be considered in the context of a number of other departmental priorities in regards to science research.

Consultations

In addition to requesting recommendations from the NWMB, the Department is seeking views from access holders and others with interest in this area (including the offshore fleet of Northern Shrimp Advisory Committee (NSAC), Nunavut Fisheries Association, QC and BFC as Nunavut entities) on maintaining the SFA 0 TAC at 500 t for 2025. Additionally, the Department is interested in obtaining views on the establishment of a multi-year TAC of 500 t for 2025 and 2026.

Recommendation

In the absence of an annual science survey, and given that no fishing has ever occurred in this area, the Department recommends maintaining the competitive TAC for Northern shrimp (*P. borealis*) of 500 t for at least 2025. Stakeholder views will help inform the possibility of setting a multiyear TAC into 2026.

Summary of Request

DFO is requesting from the Board:

- 1) Recommendation on the 500t competitive TAC for Northern Shrimp (*P. borealis*) in SFA 0 fishable outside the NSA for 2025, including the option to implement a multi-year TAC for two years.

Prepared by: Jorge Negrin Dastis, Fisheries Resource Management, Fisheries and Oceans Canada

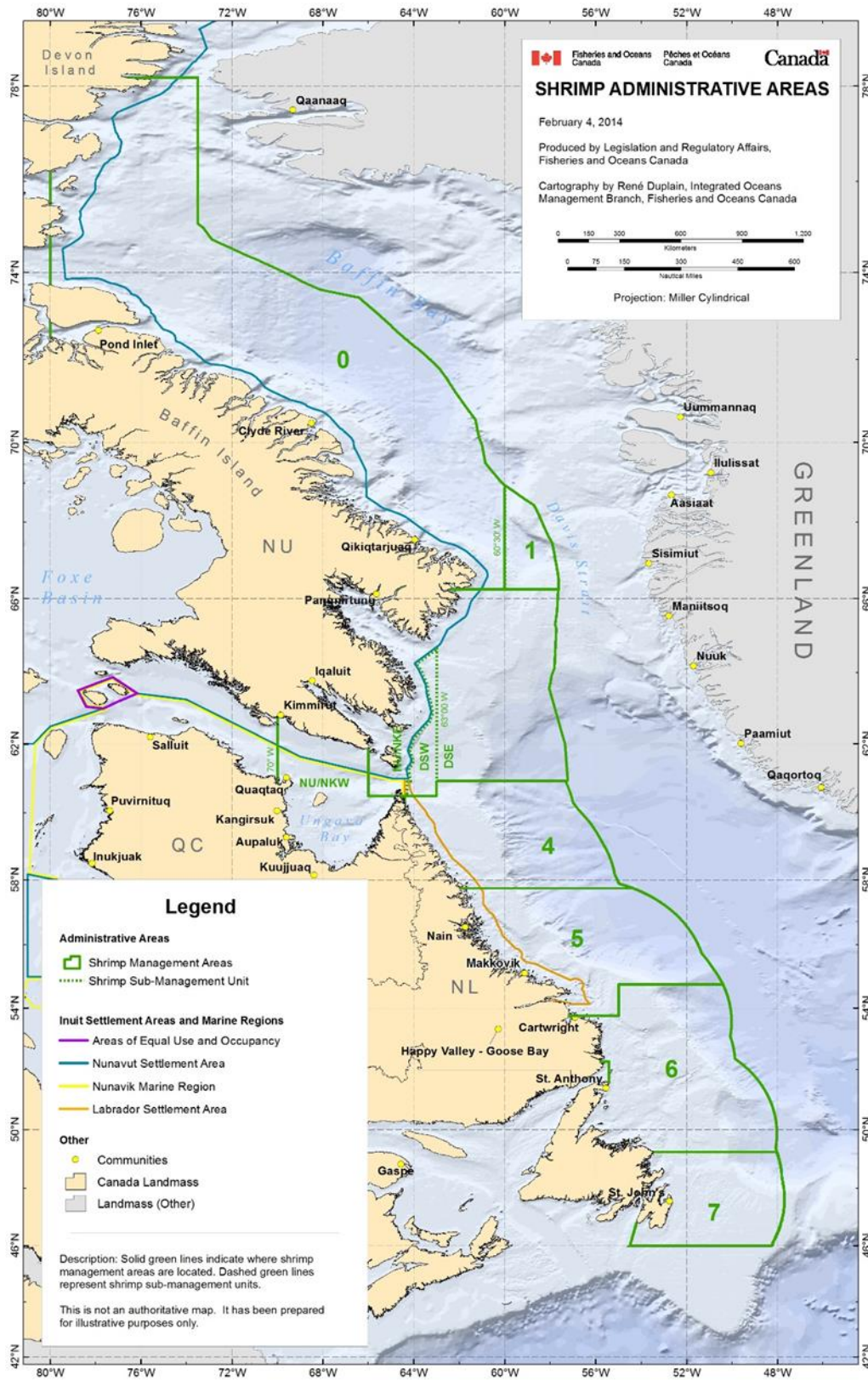
Date: January 3, 2025

Appendices (2)

Appendix 1 – Map of groundfish and shrimp administrative areas in Atlantic Canada (including Shrimp Fishing Area 0)

Appendix 2 – Summary: Assessment of Northern Shrimp (*Pandalus borealis*) in SFA 0, 2, 3 and Striped Shrimp (*Pandalus montagui*) in SFA 2, 3 and 4 west of 63°W (Science Advisory Report 2010/024)

APPENDIX 1



APPENDIX 2

Science Advisory Report 2010/024

SUMMARY: Assessment of Northern Shrimp (*Pandalus borealis*) in SFA 0, 2, 3 and Striped Shrimp (*Pandalus montagui*) in SFA 2, 3 and 4 west of 63°W

SFA 0 – *Pandalus borealis*

Fishery

- No fishery in recent years.

Biomass

- Resource status is based on two surveys conducted in 2006 and 2008.
- Fishable biomass index was 750 t (2006) and 1,100 t (2008).
- Female spawning stock biomass index was 580 t (2006) and 800 t (2008).

Recruitment

- Recruitment is uncertain.

Mortality

- Competitive TAC of 500 t could result in a potential exploitation rate index of 40%-70% based on the observed biomass. A lower TAC is recommended.

Current Outlook and Future Prospects

- Future prospects for a fishery are limited.
- There are no plans for future surveys in this area.

Submission to the Nunavut Wildlife Management Board

February 26, 2025

FOR

Information :

Decision: X

Issue: To seek approval from the Nunavut Wildlife Management Board (NWMB) for the establishment of a Marine Protected Area by Ministerial Order under the *Oceans Act* in Qikiqtait.

Background:

(a) How the issue relates to the NWMB mandate;

The establishment of a conservation area is directly related to the protection of wildlife and wildlife habitat under the *Nunavut Agreement*, and is located within the Nunavut Settlement Area.

(b) Why the issue is being presented;

Fisheries and Oceans Canada (DFO) is seeking NWMB approval for the establishment of a marine conservation area in Qikiqtait through the designation of a Marine Protected Area (MPA) by Ministerial Order (or "Order") under the *Oceans Act*, s35.1(2). This issue is pursuant to articles 5.2.34(a), 9.3.2, 15.2.1, and 15.3.4 of the *Nunavut Agreement*:

- Section 5.2.34(a): *"approve the establishment, disestablishment, and changes to boundaries of Conservation Areas, related to management and protection of wildlife and wildlife habitat."*
- Section 9.3.2: *"The establishment, disestablishment or changing of the boundaries of Conservation Areas related to management and protection of wildlife habitat shall be subject to the approval of the NWMB pursuant to Sub-section 5.2.34(a). Conservation Areas shall be co- managed by Government and the DIO as provided in Section 9.3.7."*
- Section 15.2.1: *"If a Park or Conservation Area is established and that Park or Conservation Area partially extends beyond the marine areas, Article 8 or 9, as the case requires, shall apply to that entire Park or Conservation Area."*
- Section 15.3.4: *"Government shall seek the advice of the NWMB with respect to any wildlife management decisions in Zones I and II which would affect the substance and value of Inuit harvesting rights and opportunities within the marine areas of the Nunavut Settlement Area. The NWMB shall provide relevant information to Government that would assist in wildlife management beyond the marine areas of the Nunavut Settlement Area."*

(c) The key facts and circumstances relating to the issue; and

Qikiqtait comprises the waters surrounding the Belcher Islands of southeastern Hudson Bay. The entire boundary of the proposed Qikiqtait MPA falls within the Nunavut Settlement Area. The proposed boundaries of Qikiqtait are adjacent to the community of Sanikiluaq.

Qikiqtait is a unique and important environment largely because it comprises valuable ecosystem components that includes: 1) Strong upwelling and a recurrent biologically important polynya system

in the winter. 2) Large river plume and estuaries providing nutrient-rich water to the Qikiqtait region; 3) A productive benthic invertebrate community; 4) Large aggregations of common eider (*Somateria mollissima sedentaria*); 5) Migratory Arctic char (*Salvelinus alpinus*) and subsistence foods such as scallops, sea urchin and sea cucumber; 6) Resident marine mammals such as Atlantic walrus (*Odobenus rosmarus rosmarus*), bearded seal (*Erignathus barbatus*), beluga whale (*Delphinapterus leucas*), polar bear (*Ursus maritimus*), and ringed seal (*Pusa hispida*); as well as 7) Feeding and calving areas for a proportion of these marine mammal species. Qikiqtait is a hotspot for marine biodiversity. The polynya system's open water provides a critical habitat for a diverse range of marine animals. The availability of open water in an otherwise icy environment allows for increased primary productivity.

The initial boundaries of the proposed Qikiqtait MPA were based on an evaluation conducted by Fisheries and Oceans Canada in 2011 to identify Ecologically and Biologically Significant Areas throughout Canada's Arctic. The boundaries were further refined in collaboration with the community of Sanikiluaq and the Qikiqtani Inuit Association (QIA).

Protection under a Ministerial Order MPA would freeze the footprint of activities in the area, for a period of up to five years. This would mean that activities that have lawfully occurred in the area over the 12 months prior to designation (or that were authorized by a federal or territorial permit, licence, or some other form of express authorization to occur but have not yet taken place) would be allowed to continue for the duration of the Order. For the duration of the Ministerial Order, no new human activities, other than Inuit activities provided for in the *Nunavut Agreement* and the *Nunavik Agreement*, and marine scientific research, and activities carried out for purposes of public safety, national defence, national security or law enforcement, or in response to emergency situations provided for under subsection 35.1(3) of the *Oceans Act*, would be allowed to occur in the area following this proposed designation.

DFO has consulted with the community of Sanikiluaq, QIA, the Government of Nunavut, stakeholders and other federal departments to identify existing and authorized (i.e., ongoing) activities in the proposed Qikiqtait MPA.

The proposed Order would be covered under the Qikiqtait and Sarvarjuaq Inuit Impact and Benefit Agreement (IIBA), currently being negotiated by the Government of Canada and QIA.

(d) The estimated time required to orally present the issue (excluding questions/discussion).

DFO and QIA will deliver a 30-minute PowerPoint presentation (included with this submission) that provides an overview of the proposal to establish a Ministerial Order in Qikiqtait.

Consultation:

(a) The means of consultation;

In November 2023 and April 2024, the Qikiqtait and Sarvarjuaq Working Group (the Working Group), represented by DFO, Environment and Climate Change Canada, QIA and the Government of Nunavut, consulted with the Sanikiluaq Qikiqtait Steering Committee (represented by the Sanikiluaq Hunters and Trappers Association, the Sanikiluaq Hamlet, and the Arctic Eider Society), and the public of Sanikiluaq.

In November 2023, Working Group members met with the 18 residents of Sanikiluaq from the Hamlet,

Hunters and Trappers Association and the Sanikiluaq Qikiqtait Steering Committee to conduct a two day-long meeting featuring presentations on the proposed MPA by Ministerial Order, Fisheries Management, Qikiqtait Terrestrial Protection and the Qikiqtani Regional Conservation Model. Working Group members also met with the Sanikiluaq general public on the proposed MPA by Ministerial Order under the *Oceans Act*. This first round of consultations focused on introducing the proposed Qikiqtait MPA, as well as discussing short and long-term protection goals and their associated timelines. A major focal point of the presentation was introducing the MPA's draft Conservation Objectives for discussion and distributing community surveys. The Sanikiluaq Qikiqtait Steering Committee provided updates on community priorities and community-led initiatives. QIA's vision for long-term protection for Qikiqtait and how this relates to the community's priorities was also discussed.

Similarly, in April 2024, the Working Group (represented by Fisheries and Oceans Canada, Environment and Climate Change Canada and the Qikiqtani Inuit Association) held a two and a half days meeting with the Sanikiluaq Qikiqtait Steering Committee. There was also an evening meeting with the public of Sanikiluaq with similar presentations. During this round of consultations, details of the regulatory intent for the proposed Marine Protected Area by Ministerial Order were explained. This included an overview of economic activities or potential activities for the area and what activities have been documented as occurring within the proposed Qikiqtait MPA. The boundaries for the proposed MPA were also reviewed in detail.

Following the consultations, in September 2024, a "What We Heard" Report was circulated to the Arctic Eider Society, the Hunters and Trappers Association, and the Hamlet Council summarizing the feedback received during these consultations. Edits to the report were provided by the Hunters and Trappers Association and the Arctic Eider Society. These edits were incorporated and a final version of the "What We Heard Report" is included with this submission.

In July 2024 letters were sent to industry and other stakeholders introducing Qikiqtait and proposing marine protection in the region using a Ministerial Order MPA. DFO requested information about ongoing activities in the region and invited stakeholders to comment on the proposal for a Ministerial Order MPA in Qikiqtait. Stakeholder groups included territorial stakeholders, environmental non-government organizations (ENGOS), fishing industry, shipping industry, cruise ship industry, oil and gas and mining industries, tour operators, and academia. In October 2024 a second round of letters were sent to stakeholders and industry to share proposed regulations for the Qikiqtait Study Area and to seek any comments or feedback.

DFO provided an update to the NWMB at its October 31, 2024 quarterly meeting to notify that a submission and presentation would be made for their approval in February 2025.

DFO submitted a proposal to the Nunavut Planning Commission (NPC) for conformity determination on November 6 2024, on November 13 NPC accepted the proposal for review. On November 15, 2024 NPC referred the proposal to the Nunavut Impact Review Board (NIRB) for further screening and public comment period.

DFO presented to the Qikiqtaaluk Wildlife Board (QWB) on the proposal on November 27, 2024 providing information on the community support letters received and notifying the Board that DFO would be seeking their endorsement. DFO will continue to engage the QWB on this site.

(b) A list of the organizations consulted and an estimate of the number of individuals consulted, including members of the public; and

Table 1. List of community organizations consulted in November 2023 and April 2024 and estimated number of individuals. All meetings were in person and individuals represent adult participants. The Sanikiluaq Qikiqtait Steering Committee has representation from the Hunters and Trappers, the Hamlet, the Mayor, Arctic Eider Society and other community members.

Community Group	Date of Consultation	Estimated Number of Individuals
Sanikiluaq Qikiqtait Steering Committee	November 2023	18
	April 2024	18
Sanikiluaq Public	November 2023	96
	April 2024	54

Stakeholders in Nunavut were engaged through letters distributed by emails. Stakeholders were identified with assistance from the Government of Nunavut and the Qikiqtani Inuit Association. The stakeholders engaged in this process included the following: Nunavut Tunngavik Incorporated, Nunavut Wildlife Management Board (NWMB), Nunavut Water Board, Qikiqtaaluk Wildlife Board, WWF-Canada, Oceans North, Ecology Action Centre, Arctic Eider Society, Canadian Wildlife Federation, Nunavut Fisheries Association, relevant stakeholders within the Eastern Arctic Groundfish Stakeholder Advisory Committee, Northern Shrimp Advisory Committee, Prairies and Northern Region-Canadian Marine Advisory Council, Nunavut Eastern Arctic Shipping Inc., Shipping Federation of Canada, Woodward Group of Companies, Association of Arctic Expedition Cruise Operators, Northwest Territories and Nunavut Chamber of Mines, Canadian Association of Petroleum Producers, Travel Nunavut, Keewaytinook Okimakanak, ArcticNet, Nunavut Research Institute, Amundsen Science, RV William Kennedy, Memorial University, Hudson Bay Consortium, Arctic Security Consultants, Inuit Circumpolar Council (ICC), Inuit Tapiriit Kanatami (ITK), Mushkegowuk Council, Cree Nation Government, Grand Council of the Cree, Eeyou Marine Region Wildlife Board, Eeyou Marine Region Impact Review Board, Eeyou Marine Region Planning Commission, Makkivik Corporation, Kativik Regional Government, Regional Nunavimmi Uumajulirijiit Katutjiqatigiinninga, Nunavik Marine Region Wildlife Board, Nunavik Marine Region Impact Review Board, and Nunavik Marine Region Planning Commission.

(c) A summary of the results, including any responses or accommodations to issues, concerns, etc. raised during the consultations.

Community interest in protecting Qikiqtait is based largely on the area’s ecological importance and significance to Inuit (past, present and future). The Sanikiluaq Hunters and Trappers and the Hamlet Council were in favour of the Ministerial Order MPA, and indicated the importance of Inuit Qaujimaqatigiangit, community input and decision-making in future decisions associated with long-term protection. There was an emphasis from the community of Sanikiluaq to remain at the forefront of conservation management and prioritize local leadership. See the enclosed “Consultation and Engagement Summary” and “What We Heard” documents for additional details.

Key take-aways from community consultations include:

- **Sanikiluaq Qikiqtait Steering Committee:** There has been a long history of environmental conservation work led by the community of Sanikiluaq and there is a desire to remain active and included in management decisions regarding marine protection in Qikiqtait. There is a strong desire for marine protection with the ability to explore inshore fisheries development.
- **The public of Sanikiluaq:** Meeting participants communicated support to protect Qikiqtait, they voiced their desire for employment opportunities arising from the development of the proposed Qikiqtait MPA. They also wanted to have updates about the progress with accessible language.
- **Letters of Support Received:** Following in-person consultations, letters in support of the proposal were received from the Sanikiluaq Hunter and Trappers Association, the Arctic Eider Society and the Sanikiluaq Hamlet Council. The Government of Nunavut also provided a letter in support of the proposed Qikiqtait Ministerial Order MPA.

At the request of the Government of Nunavut, Fisheries and Oceans Canada sought information from Kuhkenah (KNET), a company interested in surveying areas within the proposed Qikiqtait boundaries toward the possibility of laying fiber optic cable. KNET informed Fisheries and Oceans Canada that at present, their plans did not include Sanikiluaq in the fiber optic connectivity. After discussions with Fisheries and Oceans Canada, KNET advised that their planned activities would not fall within the proposed Qikiqtait boundaries.

Makkivik's Department of Environment, Wildlife and Research reached out to Fisheries and Oceans Canada requesting additional information about the proposed Qikiqtait MPA. In September 2024 Fisheries and Oceans Canada conducted a presentation including information about the regulatory intent. In addition, DFO provided more detailed information about the proposed Ministerial Order MPA as well as what activities would be allowed. There was no follow-up information requested.

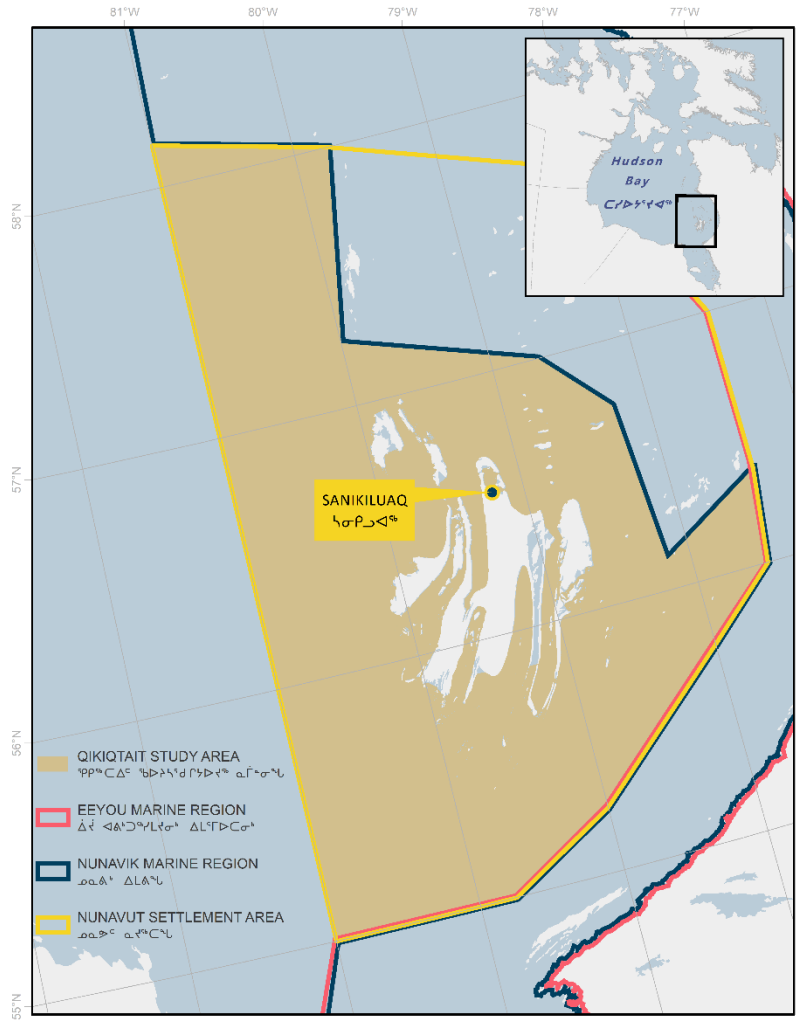
DFO sent notifications to partners, the Sanikiluaq Hunters and Trappers Association and the Sanikiluaq Hamlet Council, as well as stakeholders in advance of pre-publication of the proposed new regulation in Canada Gazette, Part I. This 30-day public comment period will open during December and close mid-January.

Recommendation:

DFO is recommending that NWMB approves the establishment of a Marine Protected Area by Ministerial Order under the *Oceans Act* in Qikiqtait. A decision is requested by April 1, 2025.

Prepared by: Lauren Candlish, Arctic Region – Fisheries and Oceans Canada, Marine Planning and Conservation Program

Date: February 26, 2025.



Map of the Qikiqtait Marine Protected Area by Ministerial Order.

Request for Nunavut Wildlife Management Board Approval of a Ministerial Order Marine Protected Area (MPA) in Qikiqtait

Consultation and Engagement Summary

Partnerships

Since 2019, the Government of Canada and QIA have been working together to identify options for the conservation and protection of Qikiqtait and other sites within the Qikiqtani Region of Nunavut. In 2021 a Qikiqtait and Sarvarjuaq Working Group (the Working Group) was created to advance the conservation and protection of the proposed Qikiqtait and Sarvarjuaq MPAs. The Qikiqtait and Sarvarjuaq Working Group consist of members from the Qikiqtani Inuit Association (QIA), Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada (ECCC), Transport Canada and the Government of Nunavut. The Working Group has supported the required processes to create the two potential Marine Protected Areas by Ministerial Order. The Working Group also provided awareness and shared information with the Inuit Impact and Benefit Agreement (IIBA) negotiation table as needed, with the objective to work in parallel. Only DFO, ECCC, QIA and the Government of Nunavut travelled to the communities as part of the consultations for Qikiqtait.

Community Consultations

In 2019, the community-led Sanikiluaq Qikiqtait Steering Committee (SQSC), comprised of representation from the Sanikiluaq Hunters and Trappers (HTA), the Sanikiluaq Hamlet Council and the Arctic Eider Society, was formed to advance Inuit environmental stewardship in and around Sanikiluaq. There are 18 members in the SQSC and it includes the chair of the Sanikiluaq HTA, the Mayor of Sanikiluaq, and the Executive Director of the Arctic Eider Society. The SQSC is the primary point of contact in Sanikiluaq on conservation matters. The SQSC met with QIA to assert their position that conservation in Qikiqtait must remain a community-driven process while expressing their support for the Government of Canada's proposed approach to protecting the area. QIA supported the SQSC's vision, and worked with the community to secure funding via the Canada Nature Fund while IIBA negotiations were underway.

Virtual meetings between the SQSC, QIA and the Government of Canada (represented by DFO and ECCC) began in July 2020 to support resource inventory activities in Qikiqtait. In 2021 and 2022, the SQSC further advanced its community-driven efforts to implement their conservation programs, including a wide variety of sea ice, oceanographic and wildlife monitoring programs.

Representatives of the Qikiqtait and Sarvarjuaq Working Group with members from QIA, DFO, ECCC and the Government of Nunavut, conducted two rounds of consultations. The first round of consultations occurred in Sanikiluaq, Nunavut between November 7 - 8 2023. During the November 2023 consultations, surveys were handed out to Sanikiluarmit present at the consultations, with 27 respondents in total. The survey consisted of three questions regarding the objectives of the proposed Qikiqtait MPA by Ministerial Order. The second round of consultations took place from April 16 - 18 2024. During the April 2024 consultations, surveys were also handed out, with 16 respondents in total. The second survey consisted of 11 questions about local use of the Qikiqtait area. The purpose of the second survey was to document the current and ongoing local activities being undertaken within the proposed boundaries of the MPA. The survey questions from the two rounds of consultations and a summary of the responses are included in the What We Heard Report.

On November 7, 2023, the 18 members of the SQSC hosted the Working Group members in the Qikiqtait Centre board room and provided updates on community priorities and community-led initiatives. This information was complementary to the focused conversations around marine and terrestrial protection for Qikiqtait. On November 8, 2023, Working Group members again met with the SQSC to conduct a day-long meeting featuring presentations on the proposed MPA by Ministerial Order, Fisheries Management, Qikiqtait Terrestrial Protection and the Qikiqtani Regional Conservation Model.

Working Group members also met with the Sanikiluaq general public on November 8, 2023, in the multi-purpose hall of Sanikiluaq High School. The meeting featured a presentation on the proposed MPA by Ministerial Order with DFO under the *Oceans Act*. QIA's long-term protection vision for Qikiqtait and how this relates to the community's priorities was also discussed. Simultaneous interpretation was provided by the Chair of Sanikiluaq Hunters and Trappers Organization. A total of 96 adult community members were present for this meeting.

On April 16, 2024, the Working Group returned to Sanikiluaq in the Qikiqtait Centre to engage in the second round of consultations, with the first day involving presentations from DFO, ECCC and QIA updating community members on progress to date, sharing the proposed boundaries of the MPA, and distributing surveys to determine from community members what activities are taking place within the proposed MPA boundaries. On April 17, 2024, the Working Group reconvened in the Qikiqtait Centre during the morning to continue discussions and questions. On April 17, a public meeting was held in the multi-purpose hall of Sanikiluaq High School with simultaneous interpretation into Inuktitut. The meeting featured similar presentations to what was shared with the SQSC, the proposed MPA boundaries were shared with the public, and a question period occurred. A total of 54 adult community members were present. On April 18, 2024, a presentation from Fisheries Management occurred, and the topic of emerging fisheries was discussed in relation to the proposed MPA and Sanikiluaq's interests.

There was discussion by community members about the approach for protecting the marine environment, with some indicating their support for the proposed Marine Protected Area by Ministerial Order. Discussions centered around local infrastructure interests, concerns about the health of rivers that flow into Qikiqtait, the importance of emergency response and prioritizing working together with adjacent Nunavik and Cree community members. In general, there was a lot of support indicated for protecting Qikiqtait, and many requests for communities to be involved in the long-term management of the area. DFO informed community members that after the second round of consultations were complete, they would receive a report summarizing the feedback received during consultations as well as a request for a letter to formally support the establishment of Qikiqtait as a Marine Protected Area by Ministerial Order.

In September 2024 DFO distributed a "What We Heard Report" to the Sanikiluaq Hunters and Trappers, the Arctic Eider Society and the Sanikiluaq Hamlet in English and Sanikiluaq Inuktitut dialect. This report included meeting summaries for all meetings held in both rounds of consultations, feedback received from the community and responses to questions that came up during the meetings. The report also included results of the survey distribution and informed recipients that DFO would be seeking Support Letters as a next step in the process toward establishment.

In October 2024 DFO received letters in support of the proposed Ministerial Order MPA from the Sanikiluaq Hunters and Trappers, the Arctic Eider Society and the Sanikiluaq Hamlet. The Government of Nunavut has also provided a letter of support.

Other Stakeholders

Stakeholders were identified with assistance from the Government of Nunavut and the Qikiqtani Inuit Association. The stakeholders engaged in this process included the following: Nunavut Tunngavik Incorporated, Nunavut Wildlife Management Board (NWMB), Nunavut Water Board, Qikiqtaaluk Wildlife Board, WWF-Canada, Oceans North, Ecology Action Centre, Arctic Eider Society, Canadian Wildlife Federation, Nunavut Fisheries Association, relevant stakeholders within the Eastern Arctic Groundfish Stakeholder Advisory Committee, Northern Shrimp Advisory Committee, Prairies and Northern Region-Canadian Marine Advisory Council, Nunavut Eastern Arctic Shipping Inc., Shipping Federation of Canada, Woodward Group of Companies, Association of Arctic Expedition Cruise Operators, Northwest Territories and Nunavut Chamber of Mines, Canadian Association of Petroleum Producers, Travel Nunavut, Keewaytinook Okimakanak, ArcticNet, Nunavut Research Institute, Amundsen Science, RV William Kennedy, Memorial University, Hudson Bay Consortium, Arctic Security Consultants, Inuit Circumpolar Council (ICC), Inuit Tapiriit Kanatami (ITK), Mushkegowuk Council, Cree Nation Government, Grand Council of the Cree, Eeyou Marine Region Wildlife Board, Eeyou Marine Region Impact Review Board, Eeyou Marine Region Planning Commission, Makkivik Corporation, Kativik Regional Government, Regional Nunavimmi Uumajulirijiit Katutjiqatigiinninga, Nunavik Marine Region Wildlife Board, Nunavik Marine Region Impact Review Board, and Nunavik Marine Region Planning Commission.

DFO also engaged all implicated federal departments, including (but not limited to) ECCC, Transport Canada, Crown-Indigenous and Northern Affairs Canada, Parks Canada, Natural Resources Canada, Canadian Coast Guard, Global Affairs Canada, and Department of National Defense.

In July 2024, DFO distributed letters to the identified stakeholders. These letters were provided in English, French and Inuktitut. The first letter informed stakeholders that the Qikiqtani Inuit Association, the Government of Nunavut and the Government of Canada were assessing short-term protection measures for Qikiqtait. The letter also introduced Marine Protected Areas by Ministerial Order as the proposed protection tool and requested feedback and information about ongoing and anticipated activities in the area. In October 2024, a second letter was distributed to stakeholders. The second letter outlined the proposed regulations for Qikiqtait and provided a list of the classes of ongoing activities documented. In the second letter, stakeholders were invited to provide comments and feedback on the proposed regulations. No feedback or comments on the proposed regulations were received.

In addition to the distribution of two stakeholder letters, DFO consulted with stakeholders further at their request. At the request of the Government of Nunavut, Fisheries and Oceans Canada sought information from Kuhkenah (KNET), a company interested in surveying areas within the proposed Qikiqtait boundaries toward the possibility of laying fiber optic cable. KNET informed Fisheries and Oceans Canada that at present, their plans did not include Sanikiluaq in the fiber optic connectivity. After discussions with Fisheries and Oceans Canada, KNET advised that their planned activities would not fall within the proposed Qikiqtait boundaries.

Makkivik's Department of Environment, Wildlife and Research reached out to Fisheries and Oceans Canada requesting additional information about the proposed Qikiqtait MPA. In September 2024 Fisheries and Oceans Canada conducted a presentation including information about the plans for Qikiqtait to become a Marine Protected Area by Ministerial Order. In addition, Fisheries and Oceans Canada provided more detailed information about a Ministerial Order MPA as well as what activities will be allowed if Qikiqtait becomes an MPA. There was no follow-up information requested.

DFO provided an update to the NWMB at its October 31, 2024, quarterly meeting to notify that a submission and presentation would be made for their approval in February 2025.

DFO submitted a proposal to the Nunavut Planning Commission (NPC) for conformity determination on November 6, 2024, on November 13 NPC accepted the proposal for review. On November 15, 2024, NPC referred the proposal to the Nunavut Impact Review Board (NIRB) for further screening and public comment period.

DFO presented to the Qikiqtaaluk Wildlife Board (QWB) on the proposal on November 27, 2024, providing information on the community support letters received and notifying the Board that DFO would be seeking their endorsement. DFO will continue to engage the QWB on this site.

DFO sent notifications to partners, community HTAs and hamlet councils, as well as stakeholders in advance of pre-publication of the proposed new regulation in Canada Gazette, Part I. This 30-day public comment period will open during December and close mid-January.

Request for Nunavut Wildlife Management Board Approval of a Ministerial Order Marine Protected Area in Qikiqtait

Project Description

1. Request for Approval

Fisheries and Oceans Canada (DFO) Marine Planning and Conservation Program, is seeking approval from the Nunavut Wildlife Management Board (NWMB) to establish a marine conservation area in Qikiqtait through designation of a Marine Protected Area (MPA) by Ministerial Order (or “Order”) under the *Oceans Act*, s35.1(2), consistent with the Nunavut Agreement s9.3.2 (establishment of conservation areas).

2. Collaboration and Proposal for a Ministerial Order MPA under the *Oceans Act*

Qikiqtait has been put forward by the community of Sanikiluaq and the Qikiqtani Inuit Association (QIA) as an important area to protect due to its importance to Inuit in providing key habitat for ecologically and culturally significant species. With the support of the community of Sanikiluaq and the Government of Nunavut, DFO and QIA are pursuing the establishment of a Ministerial Order MPA under the *Oceans Act* in Qikiqtait to limit the impact of additional unforeseen stressors on the area while partners explore options for long-term protection.

This proposal for a Ministerial Order MPA in Qikiqtait requires the negotiation of an Inuit Impact and Benefit Agreement (IIBA) under the *Nunavut Agreement*. An IIBA between the Government of Canada and QIA is currently being negotiated and will be completed prior to establishment.

The Qikiqtait Study Area (Qikiqtait) is a marine area located within the Belcher Islands Ecologically and Biologically Significant Area (DFO 2011) in southeast Hudson Bay. In addition to supporting community interests for protection, the proposed MPA would contribute to Canada’s goal of conserving 25 per cent of its oceans by 2025, and mandate to increase Indigenous collaboration on marine conservation.

Establishment of an MPA in Qikiqtait would advance reconciliation with Inuit through self-determination, Inuit leadership and collaboration in marine conservation stewardship.

Objectives identified for the proposed Qikiqtait MPA are:

- a) To support the conservation, protection, and understanding of the marine environment around the Belcher Islands, including the wildlife and other species, that is of immense value to Inuit and Inuit culture; and
- b) To support Inuit leadership in the conservation of Qikiqtait to ensure the continuity of Inuit culture, values, and practices, including accumulating and passing down Inuit knowledge as well as Inuit stewardship and governance.

Protection under a Ministerial Order MPA would freeze the footprint of activities in the area, for a period of up to five years. This would mean that activities that have lawfully occurred in the area over the 12 months prior to designation (or that were authorized by a federal or territorial permit, licence, or some other form of express authorization to occur but have not yet taken place) would be allowed to continue for the duration of the Order. For the duration of the Ministerial Order, no new human activities, other than Inuit activities provided for in the *Nunavut Agreement* and the *Nunavik Agreement*, and marine scientific research, and activities carried out for purposes of public safety, national defence, national

security or law enforcement, or in response to emergency situations provided for under subsection 35.1(3) of the *Oceans Act*, would be allowed to occur in the area following this proposed designation.

The proposed Qikiqtait Ministerial Order MPA would prohibit all human activities that disturb, damage, destroy or remove from that MPA any unique geological or archeological features or any living marine organism or any part of its habitat or is likely to do so within the designated boundaries, except the following activities:

Classes of Ongoing Activities

For the purposes of paragraph 35.1(2)(a) of the *Oceans Act*, the following classes of activities are ongoing activities in the MPA:

- Hunting and trapping (including sport hunting)
- Fishing (including sport fishing)
- Harvesting of marine plants
- Constructing, dismantling, maintaining and repairing, and using of temporary structures on sea ice
- Marine navigation
- National defence activities carried out by the Department of National Defence
- Canadian Coast Guard activities carried out by the Canadian Coast Guard
- Tourism activities
- Recreational activities
- Educational activities
- Travel over sea ice using motorized vehicles and non-motorized methods
- Inuit Qaujjimajatuqangit and community-based research activities (including stewardship activities)
- Scientific research activities
- Filming and media content development

DFO has consulted with the community of Sanikiluaq, QIA, the Government of Nunavut, stakeholders and other federal departments to identify existing and authorized (i.e., ongoing) activities in the proposed Qikiqtait MPA.

Activities under the *Nunavut Agreement* and the *Nunavik Agreement*

The proposed Order would not apply with respect to rights of Inuit in the Nunavut Settlement Area, as provided for under the *Nunavut Agreement* and the *Nunavik Agreement*.

Public Safety

Any activity carried out on behalf of His Majesty for the purpose of public safety, national defence, national security, or law enforcement or carried out in response to an emergency (including environmental emergencies) would be allowed by the way of the statutory exception provided under subsection 35.1(3) of the *Oceans Act*, such as emergency search and rescue, response to shipping or aircraft accidents, national security requirements.

b. Ecological Importance

The proposed Qikiqtait MPA represents a portion of the Canadian Arctic that contains critical year-round and seasonally important habitat for a variety of aquatic species. Encompassing the Belcher Islands Archipelago, Qikiqtait is a unique, important environment and is comprised of valuable ecosystem components that includes: 1) Strong upwelling and a recurrent biologically important polynya system in the winter; 2) Large river plumes and estuaries; 3) A productive benthic invertebrate community; 4) Large aggregations of Common Eider (*Somateria mollissima sedentaria*); 5) Migratory Arctic Char (*Salvelinus alpinus*) and subsistence foods; 6) Resident marine mammals such as Atlantic Walrus (*Odobenus rosmarus rosmarus*), Bearded Seal (*Erignathus barbatus*), Beluga (*Delphinapterus leucas*), Polar Bear (*Ursus maritimus*), and Ringed Seal (*Pusa hispida*), and finally; 7) Feeding and calving areas for a proportion of these marine mammal species.

Some of the coldest summer sea-surface temperatures in coastal Hudson Bay, south of Southampton Island, are located in the Belcher Islands region. These cold summer sea temperatures suggest strong vertical mixing that in turn are highly productive with increasing nutrient availability in the summer months, resulting in improved primary productivity within the marine system.

There have been at least eight polynyas identified in the proposed Qikiqtait MPA (Yurkowski et al. 2023). The polynyas around the Belcher Islands are highly productive and support a wide range of marine life such as providing key habitats for Polar Bears, and overwintering and feeding zones for Beluga and Atlantic Walrus (Yurkowski, et al. 2023). The community of Sanikiluaq utilizes these polynyas to hunt seabirds and seals during the winter months, which further enhances food security in the community.

Draining towards the proposed Qikiqtait MPA is the Great Whale River, Boutin River, Nastapoka and La Grande River from the coast of Quebec and James Bay. Extensive plumes form at the mouth of the Great Whale River and La Grande River that extend far offshore, allowing nutrient-rich inputs to fuel primary productivity in the marine environment (Yurkowski et al. 2023).

The seafloor of the proposed Qikiqtait MPA harbors a diverse benthic community that is heavily influenced by river runoff and seasonal ice cover. The polynya to the west and on the northern end of the Belcher Islands (near Inukjuak) have among the highest biomass values and taxonomic richness in the Hudson Bay Complex (Pierrejean et al. 2020). There is strong interest from community members in Sanikiluaq for a fisheries economy in the proposed Qikiqtait MPA, particularly for Icelandic Scallop (*Chlamys islandica*) and Sea Cucumber (*Cucumaria frondosa*).

The Hudson Bay subspecies of Common Eiders, estimated at ~255,000 birds (Sea Duck Joint Venture 2018), are known to almost exclusively breed, forage and overwinter within the proposed Qikiqtait MPA, making them unique to the area. Within the community of Sanikiluaq, a large, sustainably managed fall harvest of Common Eiders provides community members with eider down, further reinforcing the importance of this seabird species.

Arctic Char provides local food security for Sanikiluaq and is an important prey species for resident Belugas (Yurkowski et al. 2023). Char are captured year round from both marine and freshwater habitats. Migrating Arctic Char are noted to be an important prey species for resident Beluga populations.

In the proposed Qikiqtait MPA, six marine mammal species reside year-round, with some being restricted to polynyas during the winter months: Atlantic Walrus, Polar Bear, Bearded Seal, Beluga, Harbor Seal and Ringed Seal (Yurkowski et al. 2023). Polynyas in the area allow these resident marine mammals to forgo energetically costly seasonal migrations. In addition, the following species are known to frequent the area on a seasonal basis: Killer Whale (*Orcinus orca*), Bowhead Whale (*Balaena mysticetus*), Harp Seal (*Pagophilus groenlandicus*) and Narwhal (*Monodon monoceros*).

Arctic temperatures are rising faster than the global average, with significant negative effects to sea ice. The Arctic marine environment surrounding the Belcher Islands is changing, where the open water season is greatly increasing in duration. The species found in Qikiqtait play a critical role in maintaining ecosystem health; however, data related to sea-ice composition and associated biota in this region are limited.

c. Socio-economic Considerations

A socio-economic analysis completed by DFO's Policy and Economic Sector in 2024 indicated that activities occurring in the Qikiqtait area included annual sealift operations, icebreaking activities, marine research vessel activity, subsistence and traditional wildlife harvesting, recreational activities, and tourism. Additional activities were informed through community consultations, as well as industry and stakeholder engagement, and included harvesting of Eider Duck down for commercial purposes, marine plants harvested to make baskets for sale, and media and filming activities. There is currently no oil and gas development in the area, nor marine mining operations. DFO's analysis, consultation with other Federal departments, community consultations, and industry and stakeholder engagement informed the list of ongoing activities presented above.

The majority of economic activity in this region is conducted in the community Sanikiluaq. Forecasted economic growth within the proposed Qikiqtait MPA is related to natural resource management and eco/cultural tourism. Due to the preservation of natural ecosystems that are associated with a protected area, an increase in eco/cultural tourism is possible.

Currently, shipping and navigation activities around the Belcher Islands for the purposes of community re-supply, bulk transport, subsistence fishing, passenger vessels/tourism, research, and government operations (e.g., ice breaking for safety and security) is expected to increase as climate change continues to lengthen the open-water season. The proposed Qikiqtait MPA will ensure that additional activities which may exacerbate these impacts are prohibited while partners advance longer-term management options for the area.

It is important to note that Sanikiluaq community members are in the early phases of exploring a small scale multi-species commercial fishery, targeting scallops and sea cucumbers. Additional consultation and research is required to determine the sustainability of these potential commercial fisheries. The proposed Ministerial Order MPA allows for fishing to continue as a class of ongoing activities and therefor would not impact this work.

4. Consultation and Engagement

Below is a short summary of the consultations and engagements that have occurred. A more detailed description of the consultations and engagements undertaken is provided in a separate “Consultation and Engagement Summary” document and in the “What We Heard” Report, both included in this submission.

a. Partnerships

Since 2019, the Government of Canada and QIA have been working together to identify options for the conservation and protection of Qikiqtait and other sites within the Qikiqtani Region of Nunavut. In 2021 a Qikiqtait and Sarvarjuaq Working Group (the Working Group) was created to advance the conservation and protection of the proposed Qikiqtait and Sarvarjuaq MPAs. The Working Group includes representatives from the Government of Canada, QIA and the Government of Nunavut.

a. Consultation and Engagement

In 2019, the community-led Sanikiluaq Qikiqtait Steering Committee (SQSC) was formed to advance Inuit environmental stewardship in and around Sanikiluaq. The SQSC is the primary point of contact for DFO on conservation matters and includes representatives of the Sanikiluaq Hunters and Trappers Association (HTA), the Arctic Eider Society, QIA, and the Hamlet of Sanikiluaq. Meetings between the SQSC, QIA and the Government of Canada (represented by DFO and ECCC) began in July 2020 to support resource inventory activities.

Representatives of the Government of Canada (DFO and ECCC), QIA and the Government of Nunavut conducted the first round of community consultations between November 7-8, 2023, in Sanikiluaq. Meetings were held with the Hamlet, HTA, SQSC and the broader community to share information on the area, seek feedback on a proposed approach to protection, and to address community questions and/or concerns. Topics discussed included the ongoing conservation work and priorities being advanced by the community of Sanikiluaq in this area, the connections with Cree and Nunavik communities and the greater Hudson Bay ecosystem, and the role of Sanikiluaq in connecting communities and ecosystem components across the Hudson Bay region. The proposed Qikiqtait MPA conservation boundary, protected rights secured under the *Nunavut Agreement* (including traditional harvesting rights), IIBA negotiation status, Sanikiluaq community interest in commercial fisheries for benthic species, and MPA priorities for Qikiqtait were discussed. There was also meaningful discussion around conservation and other objectives for the proposed Qikiqtait MPA, and the community’s vision for protecting the area for future generations. Confirmation was received from the HTA Board Chair that the draft objectives proposed for the Qikiqtait MPA reflected the community’s vision. The HTA Board Chair indicated that there was strong community support for the proposal.

Between April 15-18, 2024, DFO, ECCC, QIA and Government of Nunavut conducted a second round of community consultations in Sanikiluaq to seek feedback on DFO’s proposed regulatory intent for an MPA by Ministerial Order under the *Oceans Act* in Qikiqtait. The SQSC, HTA, and the community of Sanikiluaq were consulted. While the proposal was well-received, the community and QIA indicated the need for further discussions on the possibility of a commercial fishery in Qikiqtait and an approach for marine and terrestrial conservation over the long term. The SQSC and community of Sanikiluaq also identified the importance of incorporating Inuit Qaujimagatuqangit in DFO’s process to establish and manage MPAs under the *Oceans Act*. DFO is continuing to engage QIA and the SQSC on these issues.

In September 2024, the Working Group distributed a “What We Heard” report to the community of Sanikiluaq which summarized the feedback provided by community members during consultations. Letters in support of the proposed regulation were received from the three member organizations of the SQSC; the Sanikiluaq Hamlet Council, the Sanikiluaq HTA and the Arctic Eider Society. The Government of Nunavut has also provided a letter of support.

Other Stakeholders

DFO engaged with industry and key stakeholders on the proposed Qikiqtait MPA by Ministerial Order in two phases. Stakeholder groups engaged in this process included, but were not limited to: the Nunavut Water Board, Nunavut Wildlife Management Board, Qikiqtaaluk Wildlife Board, Nunavut Tunngavik Inc., Inuit Circumpolar Council, Inuit Tapiriit Kanatami, environmental non-governmental organizations (ENGOS), commercial fishing industry, shipping industry, media industry, cruise ship industry, oil and gas and mining industries, tour operators, fiber optic industry, and academia. In July 2024, a letter was sent from all parties of the Working Group seeking input on any ongoing activities currently being conducted or planned within the Qikiqtait Study Area. Following this first round of engagement, in October 2024, DFO engaged these same stakeholders on its proposed regulatory intent for a Ministerial Order MPA in Qikiqtait, seeking their input.

DFO also engaged all implicated federal departments, including (but not limited to) ECCC, Transport Canada, Crown-Indigenous and Northern Affairs Canada, Parks Canada, Natural Resources Canada, Canadian Coast Guard, Global Affairs Canada, and Department of National Defense.

5. Establishment Timeline and Next Steps

If the NWMB approves DFO’s proposal to establish a Ministerial Order in Qikiqtait, DFO will proceed to publication of the Order in Canada Gazette, Part II, which designates the new MPA. Canada and its partners will continue to work toward long-term options for Qikiqtait, which includes the consideration of an Inuit Protected and Conserved Area.

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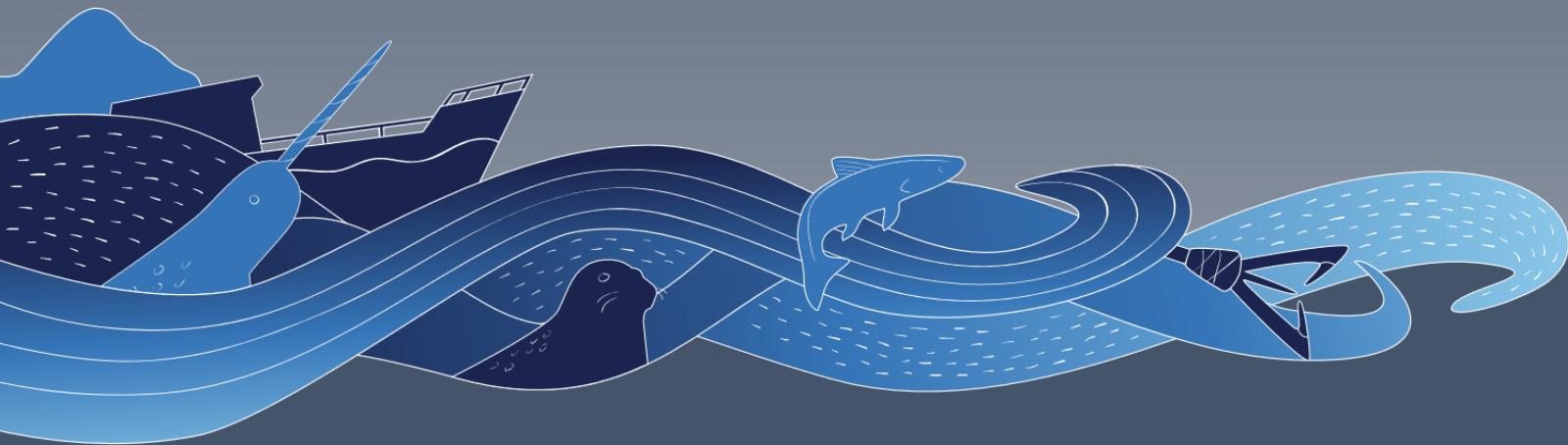


Fisheries and Oceans
Canada

Pêches et Océans
Canada

Proposal to Establish Ministerial Order Marine Protected Areas under the *Oceans Act* in Qikiqtait and Sarvarjuaq

Presentation to the Nunavut Wildlife Management Board
February 26, 2025



Canada 

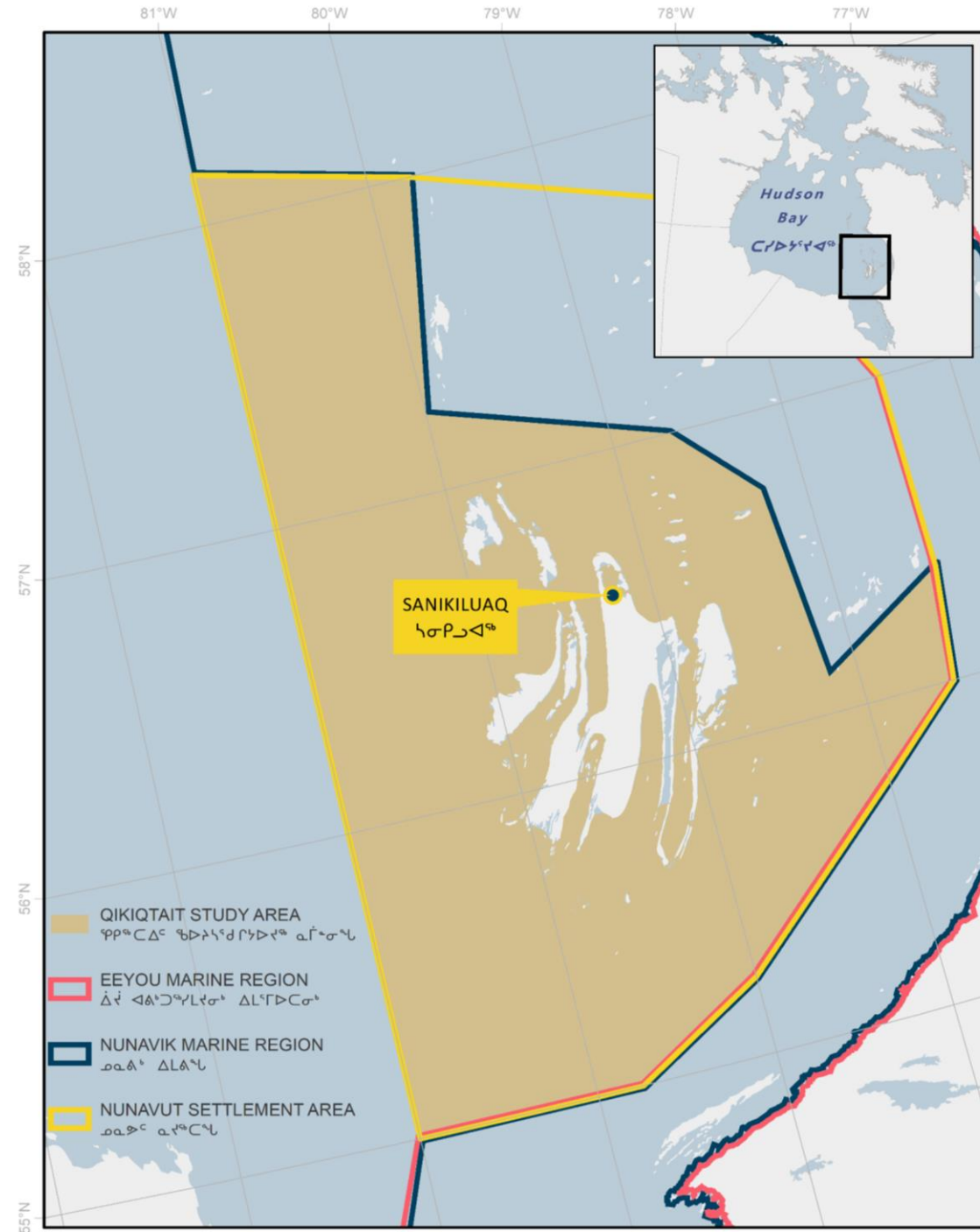
Purpose

DFO is seeking NWMB's approval to establish Ministerial Order Marine Protected Areas (MPAs) in Qikiqtait and Sarvarjuaq under the *Oceans Act*, which will be consistent with the Nunavut Agreement, s9.3.2



Qikiqtait

- Qikiqtait is located in southeastern Hudson Bay.
- Sanikiluaq and QIA have identified Qikiqtait as an area of importance to Inuit, providing critical habitat for many marine species.
- The area is home to several annually recurring polynyas that represent key habitats for polar bears, sea birds, and seals, beluga, Atlantic walrus, benthic populations, particularly in winter.
- These polynyas are vulnerable to the effects of climate change. The changes in ice cover and altered ocean currents may impact the animals that rely on it.



Sarvarjuaq

- Sarvarjuaq is located in northern Baffin Bay.
- Narrow channels help ice bridges form between Canada and Greenland, creating one of the largest recurring polynyas in the Arctic, the North Water Polynya.
- The polynya supports a large variety of marine life, including algae, fish, seabirds, and marine mammals.
- Sarvarjuaq is an important overwintering habitat and calving area, supporting the species harvested by communities throughout the Qikiqtani Region and beyond.
- The ice bridge has also been a method of travel for Inuit, connecting Canada and Greenland.



Proposed Ministerial Order MPA

- A Ministerial Order MPA freezes the footprint of ongoing activities in an area for a period of up to 5 years.
- This means that activities that are occurring, or are authorized to occur, in the year leading up to establishment are allowed to continue, but no new activities would be allowed for the duration of the Order.
- A joint Inuit Impact and Benefit Agreement (IIBA) for the proposed MPAs is being negotiated between the Government of Canada and QIA.
- The proposed MPAs would protect these vulnerable areas while partners consider long-term management and conservation needs for Qikiqtait and Sarvarjuaq, including Inuit Protected and Conserved Areas for both sites.

Proposed Ministerial Order MPA (cont)

Activities listed below would be allowed within the proposed Qikiqtait and Sarvarjuaq MPAs:

- Inuit activities provided for in the *Nunavut Agreement*
- All ongoing activities taking place 1 year prior to designation and activities that have otherwise been authorized to occur by applicable federal laws or by laws of a province/territory
- Marine scientific research
- Activities carried out for purposes of public safety, national defence, national security or law, or in response to emergency situations
- Exempted foreign activities

Classes of ongoing activities

The following have been identified as classes of ongoing activities in both Sarvarjuaq and Qikiqtait. These classes of activities will be allowed to continue under the Qikiqtait and Sarvarjuaq Ministerial Order MPAs:

- ✓ Hunting and trapping (including sport hunting)
- ✓ Fishing (including sport fishing)
- ✓ Harvesting of marine plants
- ✓ Constructing, dismantling, maintaining and repairing, and using of temporary structures on sea ice
- ✓ Marine navigation
- ✓ National defence activities carried out by the Department of National Defence
- ✓ Canadian Coast Guard activities carried out by the Canadian Coast Guard
- ✓ Tourism activities
- ✓ Recreational activities
- ✓ Educational activities
- ✓ Travel over sea ice using motorized vehicles and non-motorized methods
- ✓ Inuit Qaujimagatuqangit and community-based research activities (including stewardship activities)
- ✓ Scientific research activities
- ✓ Filming and media content development

Consultations Qikiqtait

November 2023 – April 2024:

Two rounds of in-person consultations with Sanikiluaq HTA, Sanikiluaq Hamlet Council, Arctic Eider Society, Sanikiluaq Qikiqtait Steering Committee and public of Sanikiluaq.

October 2024:

Letters in support of the Ministerial Order MPA were received from HTA, hamlet council and the Arctic Eider Society



Consultations Sarvarjuaq

October 2023 – June 2024: Two rounds of in-person consultations with the HTAs, hamlet councils and general public in Grise Fiord, Resolute Bay, Arctic Bay, Pond Inlet, Clyde River and Qikiqtarjuaq

May 2024: Newsletter distributed with consultation summary, objectives, an activities survey with return mail packaging provided and contact information

October 2024: Letters in support of the Ministerial Order MPA were received from all 6 community HTAs and hamlet councils

Stakeholder Engagement

- Stakeholders engaged were identified with assistance from the Government of Nunavut and the Qikiqtani Inuit Association.
- Letters were sent to stakeholders in English, French and Inuktitut. The first letters were distributed in July 2024. The second round of letters were sent in October 2024.
- DFO continues to be available to stakeholders as the process advances.

Nunavut Planning Commission (NPC) & Nunavut Impact Review Board (NIRB)

- DFO submitted the Qikiqtait and Sarvarjuaq proposals to the NPC for conformity determination as required under the Nunavut Planning and Project Assessment Act (NUPPAA).
- NPC referred the proposal to NIRB for further screening and a public comment period.

Pre-Publication in Canada Gazette, Part I

- DFO published its proposal to establish a new Ministerial Order MPA in Qikiqtait and Sarvarjuaq.
- The 30-day public comment period opened during December and closed in January.

Next Steps

If the NWMB approves of DFO's proposal to establish a new Ministerial Order MPA in Qikiqtait and Sarvarjuaq the next steps are:

- Signing of the IIBA between the Government of Canada and the Qikiqtani Inuit Association;
- Publication in Canada Gazette, Part II (designation of the new MPAs).

Nakurmiik! Qujannamiik! Thank You!



Richard Paton

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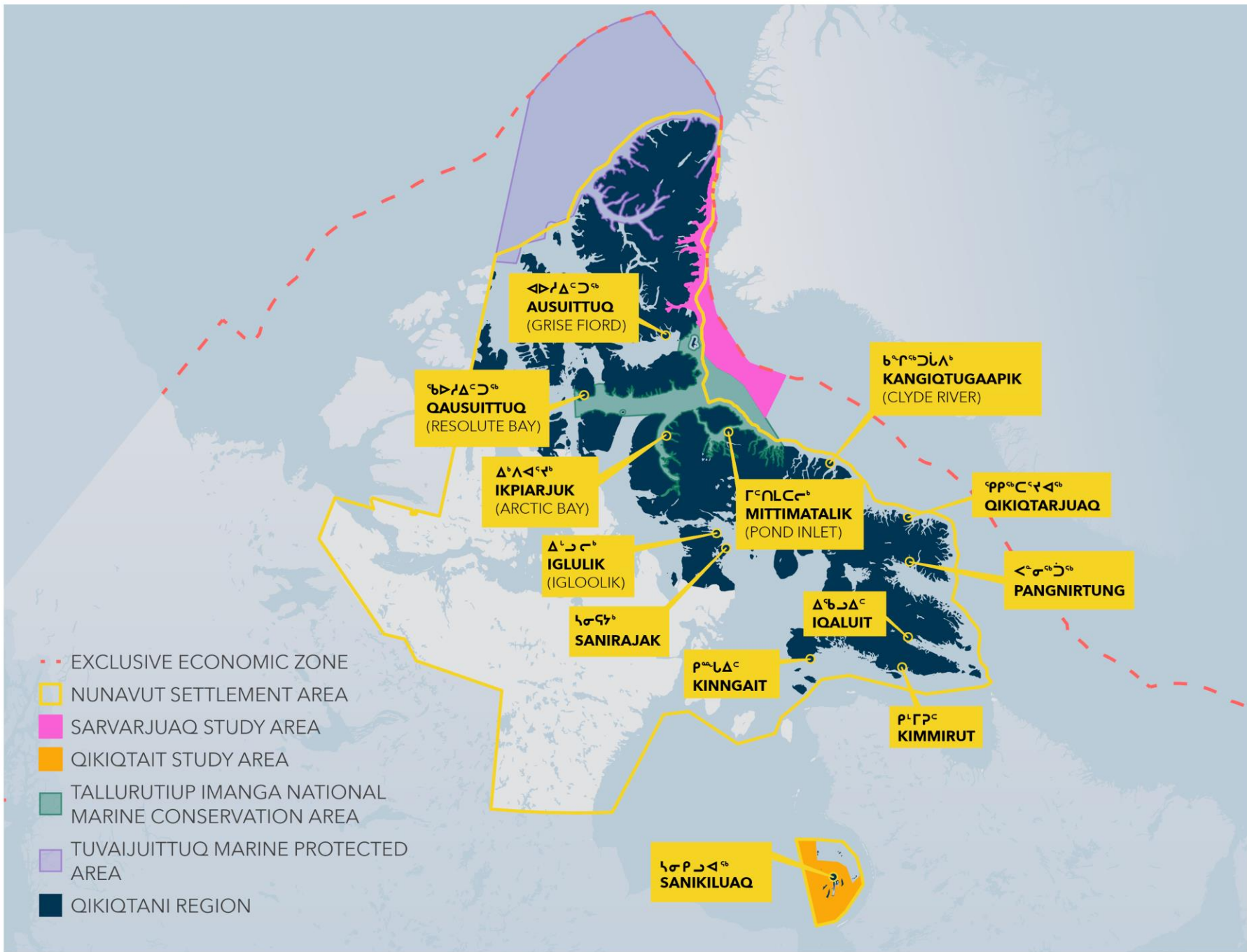
The word 'Canada' is written in a large, black, serif font. A small red maple leaf is positioned above the letter 'a'.

Thomas Hoggarth

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What We Heard Report: Sanikiluaq Community Consultations Qikiqtait a potential Marine Protected Area by Ministerial Order

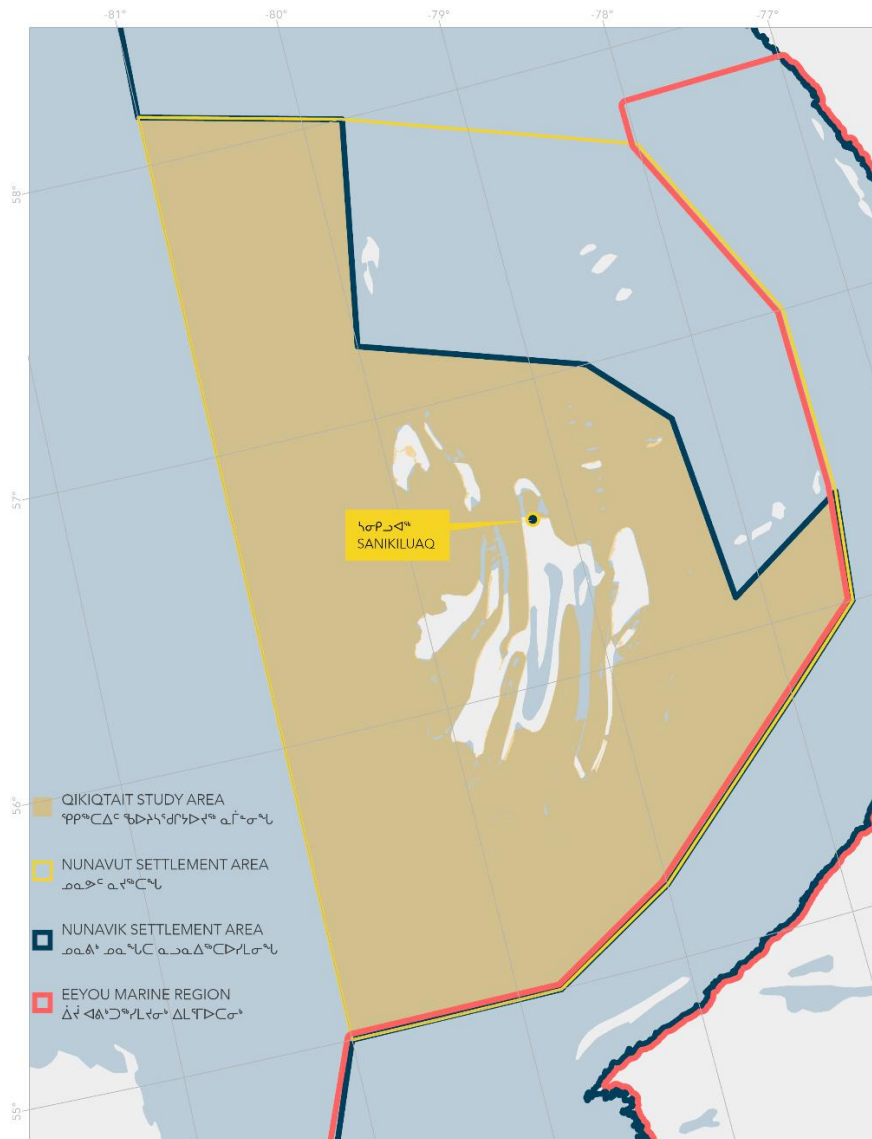


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Acknowledgement

The Qikiqtait and Sarvarjuaq Working Group would like to thank the community of Sanikiluaq for their time and hospitality during our community visits. We would especially like to thank the Hunters and Trappers Association, Hamlet Council, and the Arctic Eider Society for their participation and knowledge-sharing. Finally, we would like to thank the Sanikiluaq Qikiqtait Steering Committee for coordinating these meetings.

Our Team

The Qikiqtait and Sarvarjuaq Working Group consist of members from the Qikiqtani Inuit Association (QIA), Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada (ECCC), Transport Canada and the Government of Nunavut. The working group has been supporting the required processes for Sarvarjuaq and Qikiqtait, to create the two potential Marine Protected Areas by Ministerial Order. Only DFO, ECCC, QIA and Government of Nunavut travelled to the communities as part of the consultations for Qikiqtait.

Working Group representatives who participated in the Sanikiluaq consultations included Rosanne D’Orazio (QIA), George Qulaut (QIA – April Meeting only), Bernie MacIsaac (Government of Nunavut), Lisa Pirie (ECCC), Bethany Schroeder (DFO - November meeting only), John Onita (DFO - November meeting only), Lauren Candlish (DFO - April meeting only), Elizabeth Worden (DFO - April meeting only) and Kevin Tallon (DFO - virtually for the November meeting and in person in April).

Executive Summary

Purpose

For the first round of consultations, representatives of the Qikiqtait and Sarvarjuaq Working Group, with members from Qikiqtani Inuit Association (QIA), Department of Fisheries and Oceans (DFO), Environment and Climate Change Canada (ECCC), and Government of Nunavut (Government of Nunavut), conducted community meetings in Sanikiluaq, Nunavut between November 7 - 8 2023. The second round of consultations took place from April 16 - 18 2024, with representatives from the same organizations and institutions in attendance.

The purpose of these two rounds of consultations was to discuss the collective knowledge of Qikiqtait, the proposed approach to short-term marine conservation by Ministerial Order under the *Oceans Act*, next steps, and also to discuss an Inuit Protected and Conserved Area (IPCA) Qikiqtait Nunangit. The Working Group sought community feedback and support on the Qikiqtait Marine Protected Area (MPA) proposal. An overarching goal for the Working Group was to hear what the community of Sanikiluaq thinks about Qikiqtait MPA proposal, and learn of the community's experiences in and uses of the area.

The purpose of this report is to summarize the feedback provided by community members who attended the meetings, to provide transparency in the process, and to provide a record of the discussions and concerns shared by the community. To confirm accuracy of the information captured, this report was shared with the Sanikiluaq Qikiqtait Steering Committee, Sanikiluaq Hunters and Trappers Association and the Hamlet Council for review. After the Sanikiluaq Qikiqtait Steering Committee have had an opportunity to comment, these reports will be shared more broadly.

Summary of meetings

On November 7, 2023, members of the Sanikiluaq Qikiqtait Steering Committee hosted Working Group members in the Qikiqtait Centre board room and provided updates on community priorities and community-led initiatives. This information was complementary to the focused conversations around marine and terrestrial protection for Qikiqtait. On November 8 2023, Working Group members met with the 18 residents of Sanikiluaq from the Hamlet, Hunters and Trappers Association and the Sanikiluaq Qikiqtait Steering Committee to conduct a day-long meeting featuring presentations on the proposed MPA by Ministerial Order, Fisheries Management, Qikiqtait Terrestrial Protection and the Qikiqtani Regional Conservation Model.

Working Group members also met with the Sanikiluaq general public on November 8 2023 between 7:30 PM and 9:00 PM in the multi-purpose hall of Sanikiluaq High School. The meeting featured a presentation on the proposed MPA by Ministerial Order with DFO under the *Oceans Act*. QIA's long-term protection vision for Qikiqtait and how this relates to the community's priorities was also discussed. Simultaneous interpretation was provided by the Chair of Sanikiluaq Hunters and Trappers Organization. A total of 96 adult community members were present for this meeting.

On April 16 2024, the Working Group returned to Sanikiluaq in the Qikiqtait Centre to engage in the second round of consultations, with the first day involving presentations from DFO, ECCC and QIA updating community members on progress to date, sharing the proposed boundaries of the MPA, and distributing surveys to determine from community members what activities are taking place within the proposed MPA boundaries. On April 17 2024, the Working Group reconvened in the Qikiqtait Centre during the morning to continue discussions and questions. At 7:30 PM on April 17, a public meeting was held in the multi-purpose hall of Sanikiluaq High

School with simultaneous interpretation into Inuktitut. The meeting featured similar presentations to what was shared with the Sanikiluaq Qikiqtait Steering Committee, the proposed MPA boundaries were shared with the public, and a question period occurred. A total of 54 adult community members were present. On April 18 2024, a presentation from Fisheries Management occurred, and the topic of emerging fisheries was discussed in relation to the proposed MPA and Sanikiluaq's interests.

What we heard overall

Throughout the consultation processes in both November and April, Sanikiluarmit were very engaged in the meetings – sharing their expertise of the area and their perspectives, voicing concerns, providing advice, and raising important questions. Conversations during these consultations were categorized into five main categories for ease of presenting the results in this report.

The first category involved *general discussions on the Qikiqtait Protected Areas and its process*, and the major topics of conversation included community advice on proper consultation practices and the timing of when materials are provided for review; discussions regarding the conservation objectives; and how local, regional and national politics could affect this proposed MPA by Ministerial Order.

The second category was on *protection, regulations and enforcement*, and included topics such as regulations affecting oil, gas, mining and other pollutants; financial and legal responsibility for enforcement in the MPA; how to protect against regional disturbances such as Quebec Hydro, pollution and the freshening of Hudson Bay; and discussions surrounding the specifics of 'small and enclosed bays' and their removal from the proposed MPA boundaries.

The third category encompassed *commercial fisheries*, and many aspects of Sanikiluaq's position on emerging fisheries and conserving local harvesting practices. Discussion points included questions on the licensing phases; bottom contact fisheries; existing licenses in the region; and how Inuit traditional knowledge should be meaningfully incorporated into fisheries regulations.

The fourth category included topics on *rights under the Nunavut Final Agreement, legal and financial implications*. These included discussions surrounding the Inuit Impact and Benefit Agreement; rights protected under the Nunavut Final Agreement; and how regulations in a MPA vs. an IPCA may impact traditional Inuit rights.

Finally, the fifth category encompassed *Sanikiluaq perspectives and priorities*. This was a broader theme, with many topics included that are important to Sanikiluarmit. Some examples of topics are: Special places near Sanikiluaq and how a MPA by Ministerial Order may impact them; infrastructure interests; concern about rivers not flowing and what could be done to improve them; Crown land versus municipal land ownership; and Inuit cultural values and the dissonance often experienced between federal policies and local perspectives in Sanikiluaq.

Overall there was a general consensus that the Sanikiluaq Qikiqtait Steering Committee wanted to be a part of the discussions and plans for protection not only in the short-term of the Ministerial Order MPA but also for the long-term vision of the region. Their desire for a local commercial fishery was expressed and there were concerns that the community would be unable to pursue the commercial fishery if an MPA was put in place. The Sanikiluaq Qikiqtait Steering Committee also wanted to be a part of planning research and monitoring priorities within any protected area, including drafting a workplan for the time frame of the Ministerial Order MPA. Concern was also expressed that an MPA would be created without the community's explicit support.

Meeting Summaries

Hamlet, Hunters and Trappers Association and Sanikiluaq Qikiqtait Steering Committee Meetings November 7 – 8, 2023

On November 7 and 8 2023, 18 members of the Sanikiluaq Qikiqtait Steering Committee, Hunters and Trappers Association and Hamlet Council met with the Qikiqtait Working Group to share knowledge and discuss aspects of short-term and long-term marine and terrestrial protection of Qikiqtait.



Members of the Hamlet Council, Hunters and Trappers Association and the Sanikiluaq Qikiqtait Steering Committee meeting with Working Group Representatives during November 8, 2023 consultations on Qikiqtait MPA

Summary of November 2023 Presentations

Department of Fisheries and Oceans – Marine Planning and Conservation (Bethany Schroeder)

Fisheries and Oceans Marine Planning and Conservation presented the proposed approach for the Qikiqtait Marine Protected Area to the Sanikiluaq Qikiqtait Steering Committee in Sanikiluaq during November 2023. The presentation began by introducing Qikiqtait, as well as discussing short and long-term protection goals and their associated timelines. A major focal point of this presentation was introducing the MPA's draft Conservation Objectives for discussion.

Department of Fisheries and Oceans – Fisheries Management (Kevin Tallon via a virtual presentation)

The purpose of this presentation was to introduce the DFO's Fisheries Management branch, and how it relates to Sanikiluaq's interest in emerging fisheries, and the fisheries licensing process in its three Stages.

Environment and Climate Change Canada (Lisa Pirie)

Environment and Climate Change Canada presented material relevant to the proposed Qikiqtait Terrestrial Protected Area, demonstrating the importance of the area relating to birds, most notably a non-migratory species of Common Eider, and 6 other species at risk that occur in the area. ECCC presented on Indigenous Protected and Conserved Areas from their perspective, and what legislation could be used to govern an IPCA with QIA (*Section 7* agreement under *Canada Wildlife Act*).

Qikiqtani Inuit Association (Rosanne d'Orazio)

Qikiqtani Inuit Association presented on the Qikiqtani Regional Conservation Model, discussing the pillars of the model and how they relate to Sanikiluarmit, the proposed MPA, and a future IPCA. The presentation focused on Inuit stewardship, Indigenous-led governance, infrastructure support and fisheries reconciliation. Programs for monitoring and regional governance such as the Nauttiqsuqtiit Program were also covered.

Sanikiluaq Public Meeting November 8, 2023

Representatives of the Qikiqtait and Sarvarjuaq Working Group met with the community of Sanikiluaq on November 8, 2023 between 7:30 pm and 9:00 pm in the multi-purpose hall of Sanikiluaq High School and discussed the collective knowledge of Qikiqtait and the proposed approach to short-term marine conservation and next steps to advance the designation of Qikiqtait as an MPA Ministerial Order by 2025.

A total of **96 adult** community members were present at this meeting.



Sanikiluaq Public in attendance during November 8, 2023 consultations on Qikiqtait MPA proposal

The meeting featured presentations on:

- Marine Protected Area by Ministerial Order with DFO under the Oceans Act – (DFO – Bethany Schroeder).
- QIA’s long-term vision of protection through an IPCA for Qikiqtait and how this speaks to the community’s priorities
- Interpretation was provided in Inuktitut

Working Group members received responses from Sanikiluaq community members of their interest to participate in the protection of Qikiqtait for future generations. February or March 2024 was communicated by Working Group members as possible return dates for the second community tour to discuss next steps and share proposed regulatory documents and seek community input .

DFO thanked community members for their participation in the meeting and requested feedback on survey for draft Qikiqtait Conservation Objectives.

Hamlet, Hunters and Trappers Association and Sanikiluaq Qikiqtait Steering Committee Meetings April 16 – 18 2024

From April 16 – 18 2024, 19 members of the Sanikiluaq Qikiqtait Steering Committee, Hunters and Trappers Association, and Hamlet Council met with the Qikiqtait Working Group to provide updates from the previous November meetings, present the proposed boundaries for the protected area, learn about the activities taking place in the proposed Qikiqtait study area, and have discussions on multiple aspects of short and long-term protection for Qikiqtait. In response to questions asked regarding the development of an emerging fishery within an MPA boundary, DFO presented important points for consideration.

Summary of April 2024 Presentations

Department of Fisheries and Oceans – Marine Planning and Conservation (Lauren Candlish)

Fisheries and Oceans Marine Planning and Conservation presented updates on the proposed Qikiqtait Marine Protected Area, to the Sanikiluaq Qikiqtait Steering Committee in Sanikiluaq during April 2024. The presentation began with an initial review of background information on Qikiqtait, and discussing short and long-term protection goals, and reviewing the Conservation Objectives. New information presented included the finalized boundaries for the Qikiqtait MPA, and an open discussion of current, ongoing and planned activities taking place within the Qikiqtait MPA boundaries. This discussion was accompanied by the distribution of an activity survey to Sanikiluaq Qikiqtait Steering Committee members.

Environment and Climate Change Canada (Lisa Pirie)

Environment and Climate Change Canada presented updates relevant to the proposed Qikiqtait Terrestrial Protected Area, firstly updating on how ECCC has been involved in Eider duck research to date. ECCC stated they would submit recent data to Arctic Eider Society. In addition, ECCC presented on recent financial support to the Qikiqtait initiative, and pointed out the different designations of land. Finally, ECCC shared information and insights on how terrestrial protection could be put in place.

Qikiqtani Inuit Association (Rosanne d’Orazio and George Qulaut)

The Qikiqtani Inuit Association shared information and updates relevant to the proposed Qikiqtait terrestrial and marine conservation areas. QIA presented on funding and protection in the context of the Inuit Impact and Benefit Agreement, and maps of Qikiqtait Nunangit were discussed in the context of jurisdiction. Different options for how to create an IPCA through existing legislation were presented, and there were conversations on how to create new legislation to ensure adequate Inuit governance of Qikiqtait for the long-term. Finally, the concept of a Qikiqtani Conservation Committee (that would be developed in each of the 13 Qikiqtani communities) was discussed, but is in very early stages.

Department of Fisheries and Oceans – Fisheries Management (Kevin Tallon)

The purpose of this presentation was to introduce everybody to the Marine Conservation Target Program in DFO’s Fisheries Management branch, and how it relates to Sanikiluaq’s interest in emerging fisheries. The fisheries licensing process was shared, with a special focus on the requirements associated with each Stage of the license and how it relates to Sanikiluaq.

Sanikiluaq Public Meeting April 17, 2024

Representatives of the Qikiqtait and Sarvarjuaq Working Group met with the community of Sanikiluaq on April 17, 2024 between 7:30 pm and 9:00 pm in the multi-purpose hall of Sanikiluaq High School. Updates from the first round of consultations were presented, and the proposed boundaries of the Marine Protected Area were shared and discussed. Next steps were shared to outline how the designation of Qikiqtait as an MPA Ministerial Order could occur by 2025.

A total of **54 adult** community members were present at this meeting.



The meeting featured presentations on:

- Marine Protected Area by Ministerial Order with DFO under the Oceans Act (DFO – Lauren Candlish)
- Updates from Environment and Climate Change Canada on the terrestrial components (ECCC – Lisa Pirie)
- Updates from Qikiqtani Inuit Association on the terrestrial IPCA, Qikiqtait Nunangit, the Inuit Impact and Benefit Agreement and long-term protection through an IPCA (QIA – Rosanne D’Orazio and George Qulaut)
- Interpretation was provided in Inuktitut

Questions from the public included comments on the importance of being informed across the community, mismanagement of wildlife in nearby islands, the importance of coming back to communities after sharing information and following up, the desire to be able to charter planes to Sleeper Islands to practice harvesting activities, and how critical it is for people to get out on the land in order for knowledge to continue to get passed across generations.

Community Surveys

November 2023 – Conservation Objectives Survey

During the November 2023 consultations, surveys were handed out to Sanikiluarmit present at the consultations, with 27 respondents in total. The survey consisted of three questions regarding the conservation objectives of the proposed Qikiqtait MPA by Ministerial Order.

For the first question, *'What do you think about this Conservation Objective for Qikiqtait?'*, respondents overall were supportive of the Conservation Objectives, with 18 respondents explicitly expressing support. Some of those respondents stated their support with conditional statements such as 'As long as all the aspects listed are supported', or 'I approve the initiative as long as everything is updated if needed'. Three respondents expressed their desire for a sewing center in Sanikiluaq, and one highlighted the need for a community garage for public use. Four respondents described the importance of the environment and the animals living there, with one expressing concern that a marine environment cannot be guaranteed protection when polluted rivers are flowing in and mixing with it. Finally, two participants had comments, including one saying 'not so fast' and another asking 'how are you getting information and being able to comprehend what the objective for Qikiqtait should be concerning wildlife and weather conditions?'

For the second question, *'Are there other words that could help you connect more to this Conservation Objective?'*, nearly half of the respondents did not have follow-up comments. Five respondents stated that the app SIKU (developed by the residents of Sanikiluaq and the Arctic Eider Society) needs to continue. Four participants requested more outreach to the community, recommending avenues such as the Sanikiluaq Announcements, social media, or creating a website for the MPA. One participant requested that the PowerPoint presentation be more clear, and one participant requested a research kit. Finally, one resident restated the need for a community sewing center, and another cautioned that Qikiqtait has many gravesites.

For the third question, *'Is there anything else you would like to tell us today?'*, roughly half (15) of the respondents did not have further comments, with one saying 'Just do what would make a better future'. One participant asked if this organization would be doing something to the land, and another expressed frustration that the Working Group was interested in their land, stating they would never go south and impose anything on southern lands, and just wanted Qikiqtait to be left alone. Four participants stated that they wanted to keep consuming country food and harvesting. Some comments included: The Government of Nunavut needing a plan to respond to emergencies; that SIKU should get more funding as well as Elders teaching younger generations Inuit culture; that cabins are needed in the Belcher islands for hunters' survival; and that all variables (such as climate change, government, local people) should be kept in mind as this progresses into the future. Finally, one participant asked that if that animals were sick, was it because of water contaminated with garbage?

April 2024 – Activity Survey

During the April 2024 consultations, surveys were handed out to Sanikiluarmit present at the consultations, with 16 respondents in total. The survey consisted of 11 questions about local use of the Qikiqtait area. The purpose of the survey was to document the current and ongoing local activities being undertaken within the proposed boundaries of the MPA so that they may be included in the regulation and allowed to continue. Any activities falling under the description of Inuit harvesting rights in the Nunavut Settlement Area would not be subject to any restrictions and can continue unaffected by the MPA.

10 of the respondents answered that they were beneficiaries of the *Nunavut Agreement*, one said they were not, and five responses were left blank. 14 participants said they brought tourists to the Qikiqtait Study Area for guiding, outfitting, sport hunting or other types of tourism. 13 people said they harvested plants along the shoreline to sell and 12 people said they harvested Eider duck down to sell. When asked if they fished in the Qikiqtait Study Area for the purpose of selling their catch, 12 people said yes. When asked about traditional harvesting and travel activities such as fishing for food, hunting for country food, using the water and sea ice for methods of transportation, camping and whale/bird watching, 15 people said 'yes' to each question. Other activities identified by community members in written form included: Water monitoring, water samples, salinity studies, contaminant research, film-making, education / outreach, recreation, benthic invertebrate bottom contact harvesting, timelapses for oceanographic, weather and environmental purposes, and monitoring.

It is important to note that during the April 2024 consultations, it was expressed that the surveys should be worded differently (especially in Inuktitut – the translations did not capture the intent of the survey). It was also recommended that the surveys be shared to a select group prior to distribution so that they may be fine-tuned to be culturally relevant.

What We Heard

General discussion on the Qikiqtait Marine Protected Area and the process

November Meeting

- Question regarding timeline of Ministerial Order – is it guaranteed by 2025?
 - Response: Partners are working towards it, but recognize many steps must be completed first
- Question regarding upcoming federal election and how that may affect creation of MPA
 - Response: Commitments to Inuit within signed Inuit Impact and Benefit Agreements and Project Finance for Permanence will be upheld by the Government of Canada if they are finalized and implemented prior to the upcoming federal election. If these agreements are not finalized before the election, the elected government may choose not to advance these agreements and commitments promised may not be honoured by the new government. Similarly, if the Qikiqtait and Sarvarjuaq study areas have not been designated by Ministerial Order regulations prior to the election, the elected government may choose not to pursue conservation measures for these areas.
- Question if Conservation Objectives applied to Terrestrial Areas
 - Response: they only apply to Marine Areas in MPA
- Committee members want the inclusion of “future generations” in Conservation Objectives.
 - Response: DFO committed to look for additional feedback about how they can incorporate continuity between generations in the Conservation Objectives.
- Comment from the Hunters and Trappers Association Chair that the draft Conservation Objectives were consistent with the priorities of the Sanikiluaq Qikiqtait Steering Committee and reflected community vision.
- Committee members’ showed support for marine conservation in Qikiqtait.
- Committee members’ showed strong support for terrestrial protection through agreement with Environment and Climate Change Canada (ECCC) for an IPCA.

April Meeting

- Comment on how public needs to be consulted properly in order for information to be shared in timely manner
- Comment on how presentations need to be shared well in advance of meetings in order to give the Sanikiluaq Qikiqtait Steering Committee ample time to understand and put together questions
- Comment on how discussions about new committees and organizational structures regarding MPA (Qikiqtani Conservation Committee for ex.) are maybe not needed because Sanikiluaq has several committees in place already that are functioning decision-making bodies. Why not use existing structures that community has put in place?
 - Response from QIA: There can be overlap between existing committees and new ones

Protection, regulations and enforcement

November Meeting

- Question regarding contaminants coming from rivers into Hudson Bay and James Bay – will federal government help protect the rivers and the contaminants in them?
 - Response from ECCC: It is hard to stop pollution coming from outside

- Response from QIA: Through Environmental Impact Assessments – could be negotiated into an Inuit Impact and Benefit Agreement.

April Meeting

- Question from the Government of Nunavut: Once IPCA is in place, could there be a provision where QIA could allow oil, gas or mining?
 - Response from QIA: Goal is conservation economy, diversifying economy through different means. Economic opportunities could come from conservation or development.
- Question from the Arctic Eider Society: Who would be financially responsible for legal fees if enforcement was needed for those in violation of protection regulations?
 - Good point, need discussion at table with federal government – have not talked about financial responsibility towards things such as oil spills. Difference between marine and terrestrial designation, and enforcement attached to both types.
 - Follow-up question from the Arctic Eider Society: If enforcement rules were adopted under QIA as a bylaw, would they have to be enforced by QIA?
 - QIA answer: Yes
 - *Updated Response: Federal regulations and jurisdictions would still apply.*
- Question on which tools can be used to protect, and how will responses to disasters such as oil spills be carried out in the context of a MPA? And how can marine life be guaranteed safe to eat in the case of pollution?
 - Response: Lots of work going on between DFO and Coast Guard for emergency response for oil spills, this was also brought up at Hudson Bay Consortium. Regarding food security and safety for consumption, we will seek more information on that.
- Question on how to protect against freshening of Hudson Bay water – it is much less salty than it used to be
 - Response from DFO: Lots of research being done on this – it is of concern to many and they are trying to monitor it.
 - Response from QIA: Monitoring and research from Nauttiqsuqtiit shows baseline data, an IPCA could create a governance structure that could intervene in projects within Nunavut waters.
- Question about hydro projects in Quebec and if this MPA would protect against projects in other jurisdictions
 - Response from DFO: This MPA would not be able to protect against things happening in other regions.
- Discussion on how ‘small and enclosed bays’ have been removed from the proposed MPA due to the devolution agreement between the Government of Canada and Government of Nunavut, with questions arising during conversations in the meetings, but the boundaries could be revisited as part of the planning for long-term protection.
 - Comments on how more clarity was needed in understanding what defined a ‘small and enclosed bay’, more simple language was requested
- Comment on how they should be able to amend protection during 5 years if the environment changes within the 5-year time period (such as sea ice, animal populations, erosion, etc).

Commercial fisheries

November Meeting

- Sanikiluaq community interest in commercial fisheries (e.g., benthic species) in Qikiqtait and beyond
- Question regarding commercial fisheries and economic opportunities in Marine and Terrestrial areas – can they occur?
 - Response: Currently there are no blanket prohibition of commercial fisheries in the proposed Qikiqtait MPA. As long as active licenses for future commercial fisheries activity are in place before 2025 designation of MPA by Ministerial Order (for up to 5 years) these would be considered on-going. IPCA's goal (for long-term) is to create balance between economic opportunities and protection.
 - **Update from response provided in November:** *if there are licenses and authorizations in place prior to designations, these will be listed as on-going activities.*
- Question regarding benthic species in Qikiqtait and if other jurisdictions would have commercial fisheries
 - Response: Not discussed as of yet, good question
- Question on how bottom contact fisheries could both exist and be in an MPA
 - Bottom contact fishing is a restricted activity so it would need to be considered ongoing when MPA by Ministerial Order is designated. (Note that bottom contact fishing can only be ongoing during the Ministerial Order period)
 - **Update from response provided in November:** *In long-term MPAs by Governor in Council regulations there are protection standards where bottom contact fishing is a restricted activity. In a Ministerial Order MPA (for up to five years) the protection standard does not apply but bottom contact fishing would need to be listed as an ongoing activity or in a class of ongoing activities. Further discussions will occur during the fall 2024 fisheries workshop in Sanikiluaq to discuss some of these questions. We will also ensure communications will continue on any developments in regards to fishing authorizations.*
- Question on stage of fisheries license – Feasibility Stage now, how to go to Stage 2?
 - If activity were inconsistent with Conservation Objective, would need to undergo risk assessment. Discussions needed between Fisheries Management and other partners to determine what kind of license would be applicable, how to go from exploratory to commercial phase, and long-term vision under IPCA.
 - **Update from response provided in November:** *DFO believes the appropriate regulation to authorize the licenses for both Stage 1 and 2 of the New and Emerging Fisheries Policy for the community of Sanikiluaq, is by using the Aboriginal Communal Fishing Licenses Regulations. As the license type will not change if movement between stages is necessary during the five-year period of a Ministerial Order MPA, the question around license types and whether they are the same ongoing activity will be remedied.*

April Meeting

- Question if researchers need letter of support from community when requesting Article 52 Research License?
 - Response: Yes a support letter is required, researchers are also supposed to report back on work, although it is not a requirement.
- Question regarding licenses issued recently – research licenses issued over last 5 years, science licenses issued for scallop and sea cucumber fisheries in 2023/2024. What is difference between research and science licenses, and can they continue under an MPA? And where are they in the stages of licensing?
 - Licenses have been issued for Sanikiluaq but only for science, community is not in an emerging fishery stage. Existing licenses could inform a fishery. Need to work together to ensure progress

- need scientific knowledge to support a fishery, and if you have enough, it is possible to go to Stage 2 and skip Stage 1. Need to have more conversations and get more answers on how.
- Question regarding concern about catch-and-release for fishing licenses and if it is prohibited; not in agreement with catch and release
 - Response: Not sure what each license and subsequent research require, but likely the bycatch is released unless it is sampled for some reason.
- Question regarding Qipaluk Inlet (skinny, long inlet excluded from MPA in maps as it is a small and enclosed bay) in reference to scallops and sea cucumber potential fishery; it wouldn't be in protected waters and that is a concern
 - Response: This can be discussed as part of the long-term vision of Qikiqtait.
- Comment from Elder on how they would like more Inuit traditional knowledge integrated into decision-making and harvesting regulations to provide a more complete picture of animal populations and ecosystem dynamics
 - Response: Wants to be part of a discussion on how to do that in a good way, that ensures ownership stays with community and that the shared information is used in context

Rights under Nunavut Agreement, legal and financial implications

November Meeting

- Discussions regarding protected rights secured under the Nunavut Agreement, including traditional harvesting rights
- Discussions regarding Inuit Impact and Benefits Agreement negotiations status
- Question if enforcement will be in place once MPA is designated
 - Response: Interesting topic to discuss regarding options available for enforcement, based on community desire and jurisdictional ability.

April Meeting

- Question on if traditional harvesting has bottom contact, will it be allowed?
 - Response: Yes, traditional harvesting will be allowed within the MPA
 - Follow-up question: Will traditional harvesting be defined? Indigenous people have been fighting for what is traditional harvesting vs what is not, but sometimes these definitions aren't clear
 - Follow-up response: Rights under the *Nunavut Agreement* will be protected according to their definition in the Agreement.

Sanikiluaq perspectives and priorities

November Meeting

- Question regarding special places and impacts to these places – what activities can continue in 5 years of protection?
 - Response: Any activities that are occurring from one year prior to designation will continue
- Discussion on work and priorities being advanced by the community of Sanikiluaq
- Discussions on connections with Cree and Nunavik communities, and the greater Hudson's Bay ecosystem

- Agreement from the Sanikiluaq Qikiqtait Steering Committee members that the boundary in the 2022 QIA Prospectus “A regional conservation approach” is consistent with the boundary the community would like to protect in Qikiqtait.
- Through discussions, comments and the survey responses community members indicated interest in the following infrastructure and support:
 - Multi-use facility
 - Small engine repair shop/public garage
 - Bridge, roads and cabins around community
 - Community freezer and processing plant with funding for operations
 - Two flights schedule to and from Iqaluit per week
 - Sewing centre
 - Support for SIKU

April Meeting

- Comment on how qualitative concepts such as money, data and measurements are difficult to align with Inuit cultural values on conservation, which is based more on feeling, experience, and spirituality. A balance between the two worldviews needs to be found moving forward.
- Comment on how DFO doesn’t understand Inuit values and has demonstrated through past and present actions that they are still unable to understand. There is not enough recognition placed on Inuit expertise and knowledge, there is too much control and regulation based on Southern values.
 - Response: Hoping for progress in the right direction, acknowledging that there is a long way to go, but steps are being taken in trying to employ more Northern locals in decision-making roles.
 - Follow-up question to previous comment: Will DFO be able to truly work with Inuit?
 - Response: Yes, it is a primary focus to work with Inuit, and working towards a fully functional region in the Arctic. Although we are currently working with Federal tools, the goal is to make them Inuit-led.
- A big picture question on ‘are things getting worse’ regarding freshening of Hudson Bay, want more clarity and communication from researchers on this
 - Response from Arctic Eider Society: Yes it is getting worse but not sure how much worse
- Interest in using the SIKU app to inform the MPA’s design and implementation

Terrestrial Protection through an Inuit Protected and Conserved Area

Terrestrial protection is a QIA led process with support from ECCC. During consultations there were presentations and discussions on the terrestrial process. However this report is focusing on the marine process through DFO under the *Oceans Act*.

November Meeting

- Committee members’ showed strong support for terrestrial protection as an Inuit Protected and Conserved Area (IPCA)-
- Question if Sanikiluarmitut have to cede more rights in order to establish an IPCA?
 - Response from QIA: QIA has only expressed interest in an IPCA. There will be no ceding of right by Inuit in order to establish an IPCA.

April Meeting

- Question on if soapstone mining and gravel quarries will continue to be allowed?
 - Response from QIA: Soapstone mining is protected under the Nunavut Agreement, so yes. Gravel quarries, if ongoing, yes, but roads to access mines would need to be taken into account – would need to be discussed with management committee – but don't want to limit anybody in Sanikiluaq.
- Interest in transferring certain portions of Crown Land to municipal ownership, so access roads may be created by the Hamlet of Sanikiluaq
- Interest in diverting some rivers that no longer flow so they may flow again – community can do it, they have the means – they just need permission. Do they have the permission?
 - Response: If this happens on Inuit-owned land, it's a conversation between Inuit and QIA, but if the river is fish-bearing, other departments (such as DFO) would have to get involved. Recognize that this has discussion been ongoing for a while and follow-up answers are needed for permissions.

Other Points of Discussion

There were several questions and topics that were outside the scope of the protected areas conversations, and topics that will require additional conversations.

Topics that can be discussed during long-term planning for the area include:

- An area called Qipaluk Inlet (a long, skinny inlet), the 'small and enclosed bays' adjustment to the MPA now excludes this area from protection. Community members stated that as a concern and are wondering what the implications would be for sea cucumber populations there – potential fishery could be there but if it is in an unprotected area that is concerning.
- A follow-up discussion on how to include local and traditional knowledge into the regulations in a culturally appropriate way was requested.

Topics that were outside the scope of a Marine Protected Area:

- Further information was requested on how marine life in the region can be guaranteed to be safe for consumption, even with existing and potential pollutants.
- Regarding how some rivers no longer flow to the ocean, and how Sanikiluaq community members are requesting to take matters into their own hands to increase river flow (by dredging, for example), it was recognized this has been a question from the community for a while and the Government of Canada needed to provide more information on the permissions, especially if rivers are fish-bearing.
- More clarity from researchers was requested on the status of the freshening of Hudson Bay and how much worse it may be getting.

Next Steps

The next steps to pursue establishment of a new Ministerial Order MPA will be to seek stakeholder input on the proposal, seek formal community support, complete assessments and approvals needed under the Nunavut Agreement such as conformity determination by the Nunavut Planning Commission and Nunavut Wildlife Management Board approval, and complete DFO's regulatory process. Formal letters of support will be sought from community hamlets and Hunter and Trapper Associations. Community members are encouraged to communicate their feedback on the proposal to these organizations to inform their decision. DFO will notify communities and stakeholders prior to the proposal being published online in the Canada Gazette for a 30-day public comment period, additional input can be provided at that time as well.

It is important to us that we have summarized your input on this report correctly. If you feel that we have missed any input provided during our meetings or captured information incorrectly, please reach out to DFO.ArcticMPC-ArctiquePCM.MPO@dfo-mpo.gc.ca for any required corrections.

The Qikiqtait and Sarvarjuaq Working Group would like to thank all of the community members who attended these meetings - your feedback is vital and appreciated.

Thank you!

Appendix 1. Regulatory Intent for the Proposed Qikiqtait MPA

Regulatory Intent for the Proposed Qikiqtait Marine Protected Area by Ministerial Order

I. Background and Significance

The Belcher Islands Ecologically and Biologically Significant Area (EBSA) was identified in 2011 as part of a larger evaluation conducted by DFO to identify EBSAs throughout Canada's Arctic (DFO 2011). In 2019, Sanikiluaq considered developing Qikiqtait as a blend of Marine Protected Areas (MPA) and National Wildlife Areas (NWA) to protect both the marine and terrestrial areas. In February 2023, Qikiqtait was identified as a marine area under consideration for conservation by the Government of Canada.

Ecological Significance

Qikiqtait and the Belcher Islands are a distinctive geographic and oceanographic region in southeast of Hudson Bay. The archipelago covers a total area of approximately 13,000 square kilometers. The Belcher Islands have recurring, biologically important polynyas. The area is ecologically significant due to several factors:

- **Biodiversity:** High benthic diversity, including sea urchins, sea cucumbers, and bivalves are found in this area. Many higher trophic level species (e.g., Beluga, Walrus, Common Eider, Polar Bear, Seals) found within this area. Local marine life also includes. Lemmings, foxes and Arctic hare are found on land. The coast near Sanikiluaq is also home to Arctic char, capelin, cod, lumpfish, scallops, sea urchin, sea cucumber and sculpin (Gilchrist and Robertson, 2000).
- **Primary Production:** Qikiqtait plays a critical role in ecosystem function whereby strong vertical mixing as a result of cold summer sea-surface temperatures sustains high primary productivity (Galbraith and Larouche, 2011).
- **Migration and Breeding Grounds:** The Belcher Islands act as an winter habitat for beluga and walrus, important feeding grounds for polar bear, and support large populations of eider ducks. As well, the area supports high benthic diversity (DFO, 2011).
- **Climate Regulation:** The multiple reoccurring polynyas throughout Qikiqtait influence the exchange of heat, gases, and freshwater between the ocean and atmosphere, thereby playing a role in local and regional climate dynamics. It helps regulate the formation of sea ice and influences ocean circulation patterns (DFO, 2011).
- **Traditional Knowledge:** The people of Sanikiluaq call themselves Sanikiluarmit, meaning "people of the islands" (Qikiqtani Inuit Association, 2014). The earliest human habitation of the Belcher Islands dates to 700-500 BC (Maxell 1985). Subsistence harvesting for sea cucumber, scallops and sea urchin is done by community members in shallow waters close to communities, through the use of pull nets. Residents from Sanikiluaq also harvest beluga whale and walrus (WWF, 2021). Sanikiluarmit collect grasses along the shoreline and use the plant to make baskets (Lawrence, 2018).

Overall, the Qikiqtait area serves as a unique and vital ecosystem, supporting diverse marine life and is culturally important to Sanikiluaq.

Proposed Approach

Establishment of a Ministerial Order Marine Protected Area (MPA) under the *Oceans Act* has been proposed for Qikiqtait as an interim protection measure and a first step to establish long-term marine protection in Qikiqtait. While interim protection is in place, the Government of Canada will explore the options for a long-term conservation measures in the area with the Qikiqtani Inuit Association (QIA) and the Government of Nunavut, through analysis and further consultation. The consideration of long-term conservation measures will include an Inuit Protected and Conserved Area (IPCA).

The Ministerial Order MPA will allow the Minister of Fisheries, Oceans and the Canadian Coast Guard to freeze the footprint of ongoing activities in the area for up to five years. This will mean that no new activities will be allowed in the area following designation. Any activities that have occurred, or were authorized to occur, in the proposed Qikiqtait MPA during the 12 months prior to designation would be considered ongoing activities and would be allowed to continue in the proposed MPA.

II. Proposed Objectives for Qikiqtait

Conservation objectives are broad statements that describe what species or features in the protected area should be conserved. For an MPA under the *Oceans Act* conservation objectives need to refer to protecting or conserving marine species, unique habitats, high biodiversity, and/or the ecosystem. These objectives guide the interim nature of this work and long-term objectives will be developed, in the future.

The following objectives have been proposed for Qikiqtait. The second statement reflects our commitments to the United Nations Declaration on the Rights of Indigenous Peoples Act Action Plan and the recommendations from the Qikiqtani Truth Commission.

- (1) To support the conservation, protection, and understanding of the marine environment around the Belcher Islands, including the wildlife and other species, that is of immense value to Inuit and Inuit culture.
- (2) To support Inuit leadership in the conservation of Qikiqtait to ensure the continuity of Inuit culture, values, and practices, including accumulating and passing down Inuit knowledge as well as Inuit stewardship and governance.

III. Map and Boundaries

The proposed boundaries for Qikiqtait were put forward by QIA. These boundaries are shown in Figure 1. If established, the boundaries will follow the Nunavut Settlement Area surrounding the Belcher Islands excluding the north-eastern portion where the Nunavik Settlement Area overlaps. The boundaries exclude Small Enclosed Bays as described in Chapter 1, Definitions and Interpretation of the Nunavut Lands and Resources Devolution Agreement signed January 18, 2024 between the Government of Canada and the Government of Nunavut and Nunavut Tunngavik Incorporated.

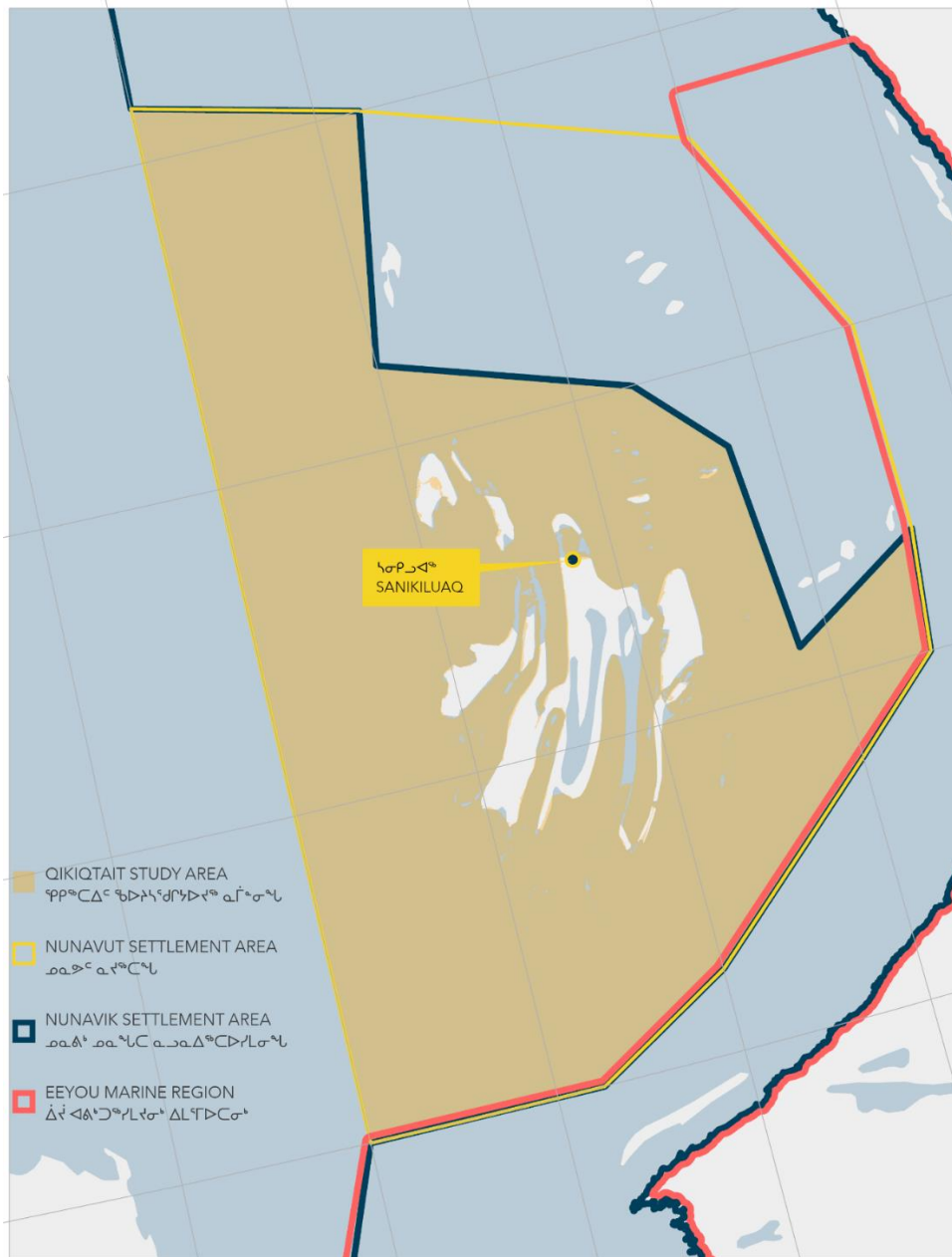


Figure 1. A map showing the boundaries of the proposed Qikiqtait MPA.

IV. Prohibitions and Allowed Activities

It is prohibited in the MPA to carry out any activity that disturbs, damages, destroys or removes from the MPA any unique geological or archeological features or any living marine organism or any part of its habitat, or is likely to do so.

However some activities would be allowed to occur. Activities listed below would be able to occur if Qikiqtait were to become an MPA by Ministerial Order:

- All rights provided for under the *Nunavut Agreement* are respected within the boundary of the Nunavut Settlement Area
- All ongoing activities (see list below) taking place one year prior to designation or activities that have otherwise been authorized to occur by applicable federal laws or by laws of a province/territory
- Research activities consistent with the conservation objectives of the MPA
- Safety, security and emergency activities

Under the *Oceans Act*, DFO would implement an MPA by Ministerial Order by prohibiting any other activities from occurring during the period of the Order, up to five years.

V. List of Ongoing Activities

Ongoing activities can continue to occur if Qikiqtait becomes an MPA by Ministerial Order under the *Oceans Act*. The definition of an ongoing activity is any activity that has taken place one year prior to designation, or activities that have otherwise been authorized to occur by applicable federal laws or by laws of a province/territory.

Activities occurring within the proposed Qikiqtait MPA boundaries have been categorized into classes of ongoing activities which will be allowed in the MPA:

- Hunting and trapping activities
- Fishing activities
- Harvesting of marine plants
- Marine navigation activities
- National defence activities carried out by the Department of National Defence
- Canadian Coast Guard activities carried out by the Canadian Coast Guard
- Tourism activities
- Recreational activities
- Educational activities
- Travel over sea ice using motorized vehicles and non-motorized methods
- Traditional Knowledge and cultural research activities
- Scientific research activities
- Filming activities
- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

Please let us know if you are aware of another ongoing activity that is not captured in the list above.

References

- DFO. 2011. Identification of Ecologically and Biologically Significant Areas (EBSA) in the Canadian Arctic. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/055. Available from <https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/344747.pdf>
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- Gilchrist, H.G., and Robertson, G.J. 2000. Observations of Marine Birds and Mammals Wintering at Polynyas and Ice Edges in the Belcher Islands, Nunavut, Canada. *Arctic* 53(1): 61-68.
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- Maxell, M.S. 1985. *Prehistory of the Eastern Arctic*. Academic Press, Orlando, FL. 170 p.
- Qikiqtani Inuit Association. 2014. Qikiqtani Truth Commission : Community Histories 1950-1975: Sanikiluaq. Available from <https://www.qtcommission.ca/en/communities/sanikiluaq>
- World Wildlife Fund. 2021. Working with a Nunavut Island Community to Build a Sustainable 'Blue Economy'. Available From [Working with a Nunavut island community to build a sustainable 'blue economy' - WWF.CA](#)

Appendix 2. Documented Activities Occurring in the Proposed Qikiqtait MPA

Activities We Heard From Communities and Stakeholders in the Proposed Qikiqtait MPA

Ongoing activities can continue to occur if Qikiqtait becomes an MPA by Ministerial Order under the *Oceans Act*. The definition of an ongoing activity is any activity that has taken place one year prior to designation, or activities that have otherwise been authorized to occur by applicable federal laws or by laws of a province/territory.

Activities documented as occurring within the proposed Qikiqtait MPA boundaries have been categorized and are listed below with some examples. These were informed through community consultations and stakeholder and industry engagement.

Hunting and Trapping Activities

- Hunting occurs for subsistence, traditional, and commercial use of marine mammals and bird species. Hunting also occurs by non-Inuit who live near Qikiqtait. Some examples of hunting includes:
 - Eider ducks are harvested for a food resource and the skin and feathers are used as material for clothing;
 - Beluga whales are hunted around the Lukisee Islands in the spring;
 - Seals are hunted in a bay near Flaherty Island;
 - A wide array of birds are hunted, with two known hunting spots being the Sleeper Islands and the large bay in Middle Island.
- Hunting also occurs for tourism, recreation and sport hunting. This includes guided expeditions of non-Inuit hunters.
- Hunting is also a part of research, monitoring and stewardship programs. Examples include:
 - Arctic Eider Society offers honoraria to hunters to document details of their harvest on SIKU
 - The Nauttisuqtiit program shares their harvests with Elders and the community to help Inuit access country food.

Fishing Activities

- Fishing occurs for subsistence, traditional and commercial use for fish and invertebrate species. It also occurs by non-Inuit who live near Qikiqtait.
- Fishing occurs for tourism and recreational use as well as sport fishing or guided expeditions of non-Inuit fishers.
- Fishing is done for scientific research which includes:
 - research to determine commercial fisheries potential.
- The Sanikiluaq Hunters and Trappers Association is currently undertaking the application process for a Stage I Feasibility license under the New and Emerging Fisheries Policy, aimed at pursuing a commercial fishery in the Belcher Islands area.

Marine Plant Harvesting

- Harvesting occurs for marine plant species for commercial purposes, traditional and subsistence use. An example includes:
 - Sea grass basket making.

Marine Navigation Activities

- There is local vessel traffic for subsistence, traditional and/or community use, this includes:
 - Boats and small motorized vessels;
 - Canoeing/qajaq or other non-motorized vessels.
- There is vessel traffic and associated activities for tourism and recreational use such as:
 - Outfitting;
 - Guided or self-guided sight-seeing expeditions;
 - Wildlife viewing;
- There is vessel traffic for commercial use such as:
 - Sealift/goods transportation.
- There is vessel traffic for research or monitoring, including but not limited to vessels such as:
 - CCGS Amundsen;
 - RV William Kennedy;
 - RV Ludy Pudluk.
- There is also vessel traffic for National Defense, and Canadian Coast Guard activities.

Safety, Security, and Emergency Activities

- Safety, security, and emergency activities occur in the area for public safety, national defense, national security, or law enforcement. This includes but is not limited to:
 - Emergency search and rescue;
 - Response to shipping or aircraft accidents;
 - National security requirements;
 - Activities carried out by the Department of National Defence;
 - Activities carried out by the Canadian Coast Guard.

Travel Over Sea Ice

- Inuit and non-Inuit use the sea ice as a method of travel in the proposed Qikiqtait MPA, this includes:
 - Travel routes for hunting by snowmobile and motorized vehicles, including snowmobiles towing boats to floe edges to facilitate the hunts;
 - Non-motorized methods of travel such as dog-sledding, walking, snowshoeing, skiing etc.;
 - Travel routes to visit nearby communities/Islands such as Baker Dozens Islands, Salikuit Islands, Camsell Island, Kugong Island, Sleeper Islands etc.

Tourism and Recreational Activities

- Inuit and non-Inuit use the area for tourism and recreational activities, examples include:
 - Arts and culture;
 - Wildlife viewing;
 - Birdwatching;
 - Eco-tourism;
 - Dog-sledding;
 - Sport hunting;

- Sport fishing;
- Camping on sea ice or traveling to camp sites or cabins;
- Other outfitting or guided excursions.

Educational Activities

- Educational activities occur in the marine environment and over sea ice, such as outreach programs or experience based learning programs.

Research and Monitoring Activities

- Research and monitoring programs occur in the Qikiqtait area, both in the marine and environment form research vessels or smaller vessels as well as sea ice based research programs. Types of research includes:
 - Community-led monitoring programs such as those supported by the Arctic Eider Society;
 - Academic research projects and programs supported by universities, colleges, etc.
 - Surveys to inform fiber optic cables;
- Traditional knowledge research
 - Community-led monitoring programs for the entire Belcher Islands.

Filming Activities

- Other activities documented to have occurred within the Qikiqtait area include filming and media content development. Examples include:
 - Documentary film making;
 - Google street view filming near Sanikiluaq and over sea ice travel routes;
 - Social media or social networking filming.



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Letters of Support for the Proposed Qikiqtait Marine Protected Area

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Sincerely,

A handwritten signature in black ink, consisting of several loops and a long horizontal stroke extending to the right.

Sanikiluaq Hunters and Trappers
September 25, 2024 , 2024



Sanikiluaq Hunters & Trappers Association
P.O. Box 174
Sanikiluaq, NU X0A 0W0
☎ 867-266-8709 📠 867-266-8131
✉ sani@baffinhto.ca

October 15, 2024

To: C. Thomas Hoggarth
Executive Director, Marine Conservation
Arctic Region
Fisheries and Oceans Canada

Richard Paton
Assistant Executive Director
Marine & Wildlife Conservation
Qikiqtani Inuit Association

RE: Designation of a new Ministerial Order Marine Protected Area in Qikiqtait

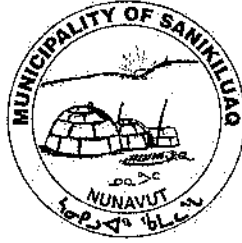
I am writing to express support from the Sanikiluaq Hunters and Trappers for the establishment of a Ministerial Order Marine Protected Area (MPA) in Qikiqtait. It is our understanding that a Ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the community and Sanikiluaq Qikiqtait Steering Committee to work with the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area for the marine environment.

We acknowledge that the following classes of documented activities will be allowed in the MPA:

- Hunting and trapping activities
- Fishing activities
- Harvesting of marine plants
- Marine navigation activities
- National defence activities carried out by the Department of National Defence
- Canadian Coast Guard activities carried out by the Canadian Coast Guard
- Tourism activities
- Recreational activities
- Educational activities
- Travel over sea ice using motorized vehicles and non-motorized methods
- Traditional Knowledge and cultural research activities
- Scientific research activities
- Filming activities
- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

Our community will continue to play a leading role in the process through the Sanikiluaq Qikiqtait Steering Committee as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

We look forward to working with you to advance the consideration of long-term protection in Qikiqtait following the establishment of the Ministerial Order MPA.



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Municipality of Sanikiluaq
Sanikiluaq, Nunavut, Canada. X0A 0W0
Tel: (867) 266-8307

October 31, 2024

To: C. Thomas Hoggarth
Executive Director, Marine Conservation
Arctic Region
Fisheries and Oceans Canada

Richard Paton
Assistant Executive Director
Marine & Wildlife Conservation
Qikiqtani Inuit Association

RE: Designation of a new Ministerial Order Marine Protected Area in Qikiqtait

I am writing to express support from the Sanikiluaq Hamlet Council for the establishment of a Ministerial Order Marine Protected Area (MPA) in Qikiqtait. It is our understanding that a Ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area for the marine environment.

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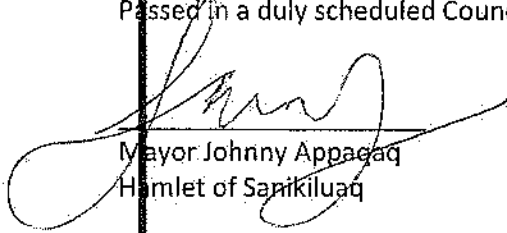
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- Scientific research activities
- Filming activities
- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

Our community will continue to be engaged during the process as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

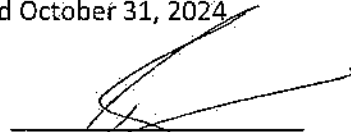
We look forward to working with you to advance the consideration of long-term protection in Qikiqtait following the establishment of the Ministerial Order MPA.

Sincerely;

Passed in a duly scheduled Council Meeting held October 31, 2024.



Mayor Johnny Appaqaq
Hamlet of Sanikiluaq



SAO Robert Hedley
Hamlet of Sanikiluaq



ARCTIC EIDER SOCIETY ᐱᐅᐃᑦ ᑦᑎᑦᑦᑦᑦ
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October 14, 2024

To: C. Thomas Hoggarth
 Executive Director, Marine Conservation
 Arctic Region
 Fisheries and Oceans Canada

Richard Paton
 Assistant Executive Director
 Marine & Wildlife Conservation
 Qikiqtani Inuit Association

RE: Designation of a new Ministerial Order Marine Protected Area in Qikiqtait

I am writing to express support from the Arctic Eider Society for the establishment of a Ministerial Order Marine Protected Area (MPA) in Qikiqtait. It is our understanding that a Ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the community of Sanikiluaq and Sanikiluaq Qikiqtait Steering Committee to work with the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area for the marine environment.

We acknowledge that the following classes of documented activities will be allowed in the MPA:

- Hunting and trapping activities
- Fishing activities
- Harvesting of marine plants
- Marine navigation activities
- National defence activities carried out by the Department of National Defence
- Canadian Coast Guard activities carried out by the Canadian Coast Guard
- Tourism activities
- Recreational activities
- Educational activities
- Travel over sea ice using motorized vehicles and non-motorized methods
- Traditional Knowledge and cultural research activities
- Scientific research activities
- Filming activities
- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

We understand that the community will continue to play a leading role in the process as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

We look forward to working with you to advance the consideration of long-term protection in Qikiqtait following the establishment of the Ministerial Order MPA.

Sincerely,



Joel Heath, Executive Director
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Submission to the Nunavut Wildlife Management Board

February 26, 2025

FOR

Information :

Decision: X

Issue: To seek approval from the Nunavut Wildlife Management Board (NWMB) for the establishment of a Marine Protected Area (MPA) by Ministerial Order under the *Oceans Act* in Sarvarjuaq.

Background:

(a) How the issue relates to the NWMB mandate;

The establishment of a conservation area is directly related to the protection of wildlife and wildlife habitat under the *Nunavut Agreement*, and a portion of the conservation area is located within the Nunavut Settlement Area.

(b) Why the issue is being presented;

Fisheries and Oceans Canada (DFO) is seeking NWMB approval for the establishment of a marine conservation area in Sarvarjuaq through the designation of a Marine Protected Area by Ministerial Order (or "Order") under the *Oceans Act*, s35.1(2). This issue is pursuant to articles 5.2.34(a), 9.3.2, 15.2.1, and 15.3.4 of the *Nunavut Agreement*:

- Section 5.2.34(a): *"approve the establishment, disestablishment, and changes to boundaries of Conservation Areas, related to management and protection of wildlife and wildlife habitat."*
- Section 9.3.2: *"The establishment, disestablishment or changing of the boundaries of Conservation Areas related to management and protection of wildlife habitat shall be subject to the approval of the NWMB pursuant to Sub-section 5.2.34(a). Conservation Areas shall be co-managed by Government and the DIO as provided in Section 9.3.7."*
- Section 15.2.1: *"If a Park or Conservation Area is established and that Park or Conservation Area partially extends beyond the marine areas, Article 8 or 9, as the case requires, shall apply to that entire Park or Conservation Area."*
- Section 15.3.4: *"Government shall seek the advice of the NWMB with respect to any wildlife management decisions in Zones I and II which would affect the substance and value of Inuit harvesting rights and opportunities within the marine areas of the Nunavut Settlement Area. The NWMB shall provide relevant information to Government that would assist in wildlife management beyond the marine areas of the Nunavut Settlement Area."*

(c) The key facts and circumstances relating to the issue; and

Sarvarjuaq (the Canadian portion of the North Water Polynya) is a marine area located in northern Baffin Bay, between Canada's Arctic Archipelago and Greenland. A portion of the proposed Sarvarjuaq MPA is located within the Nunavut Settlement Area. Other areas of the proposed MPA fall outside of the Nunavut Settlement Area.

Sea ice originating from the north, in the Lincoln Sea, is pushed south through the narrow channels of Nares Strait by strong winds and currents. This sea ice gets forced into the narrowest choke points of the strait, most often just south of Kane Basin in Smith Sound, creating an ice bridge. The passage of sea ice is then blocked by the ice bridge(s) creating the North Water Polynya, an area of open water (or very thin ice) in northern Baffin Bay. The polynya supports a rich diversity of marine life, including phytoplankton,

zooplankton, fish, seabirds, and marine mammals. Its open waters and high productivity provide abundant food resources, making it an important feeding ground for various species.

The initial boundaries of the proposed Sarvarjuaq MPA were based on an evaluation conducted by Fisheries and Oceans Canada in 2011 to identify Ecologically and Biologically Significant Areas throughout Canada's Arctic. The boundaries were further refined in collaboration with the Qikiqtani Inuit Association (QIA).

Protection under a Ministerial Order MPA would freeze the footprint of activities in the area, for a period of up to five years. This would mean that activities that have lawfully occurred in the area over the 12 months prior to designation (or that were authorized by a federal or territorial permit, licence, or some other form of express authorization to occur but have not yet taken place) would be allowed to continue for the duration of the Order. For the duration of the Ministerial Order, no new human activities, other than Inuit activities provided for in the *Nunavut Agreement*, exempted foreign activities, marine scientific research, and activities carried out for purposes of public safety, national defence, national security or law, or in response to emergency situations, provided for under subsection 35.1(3) of the *Oceans Act*, would be allowed to occur in the area following this proposed designation.

DFO has consulted with adjacent communities, the Qikiqtani Inuit Association (QIA), the Government of Nunavut, stakeholders and other federal departments to identify existing and authorized (i.e., ongoing) activities in the proposed Sarvarjuaq MPA.

The proposed Order would be covered under the Qikiqtait and Sarvarjuaq Inuit Impact and Benefit Agreement (IIBA), currently being negotiated by the Government of Canada and QIA.

(d) The estimated time required to orally present the issue (excluding questions/discussion).

DFO and QIA will deliver a 30-minute PowerPoint presentation (enclosed) that provides an overview of the proposal to establish a Ministerial Order in Sarvarjuaq.

Consultation:

(a) The means of consultation;

In October 2023, January 2024, May 2024 and June 2024 the Qikiqtait and Sarvarjuaq Working Group, represented by DFO, and QIA with the communities of Arctic Bay, Clyde River, Grise Fiord, Pond Inlet, Qikiqtarjuaq and Resolute Bay. The Government of Nunavut participated in the consultations as observers. Afternoon meetings were held with the Hunters and Trappers Associations and Hamlet Councils, and evening meetings were open for the public.

During the first round of community visits in October 2023 and January 2024, the consultations focused on introducing the proposed Sarvarjuaq MPA, as well as discussing short and long-term protection goals and their associated timelines. A major focal point of the presentation was introducing the MPA's draft conservation objectives for discussion and distributing community surveys.

In May and June 2024 the in-depth details regarding the regulations of marine protected areas by Ministerial Order were explained. There was also an overview of economic activities or potential activities for the area and what activities we have documented as occurring within the proposed Sarvarjuaq MPA. This information was presented to the Hamlet Council, Hunter and Trapper Association and the public of all consulted communities.

Similarly, in May and June 2024 the Working Group visited the six adjacent communities for a second round of consultations. During this round of consultations, details of the regulatory intent for the proposed Marine Protected Area by Ministerial Order were explained. This included an overview of the economic activities or potential activities for the area and what activities have been documented as

occurring within the proposed Sarvarjuaq MPA. The boundaries for the proposed MPA were also reviewed in detail.

Following the consultations, in September 2024, a “What We Heard” Report was circulated to each of the six Hunters and Trappers Associations, and Hamlet Councils summarizing the feedback received during these consultations.

In July 2024 letters were sent to industry and other stakeholders introducing Sarvarjuaq and proposing marine protection in the region using a Ministerial Order MPA. DFO requested information about ongoing activities in the region and invited stakeholders to comment on the proposal for a Ministerial Order MPA in Sarvarjuaq. Stakeholder groups included territorial stakeholders, environmental non-government organizations (ENGOS), fishing industry, shipping industry, cruise ship industry, oil and gas and mining industries, tour operators, and academia. In October 2024 a second round of letters were sent to stakeholders and industry to share proposed regulations for the Sarvarjuaq Study Area and to seek any comments or feedback.

DFO provided an update to the NWMB at its October 31, 2024 quarterly meeting to notify that a submission and presentation would be made for their approval in February 2025.

DFO submitted a proposal to the Nunavut Planning Commission (NPC) for conformity determination on November 6 2024, on November 13 NPC accepted the proposal for review. On November 15, 2024 NPC referred the proposal to the Nunavut Impact Review Board (NIRB) for further screening and public comment period.

DFO presented to the Qikiqtaaluk Wildlife Board (QWB) on the proposal on November 27, 2024 providing information on the community support letters received and notifying the Board that DFO would be seeking their endorsement. DFO will continue to engage the QWB on this site.

(b) A list of the organizations consulted and an estimate of the number of individuals consulted, including members of the public; and

Table 1. List of community organizations in October 2023 and January 2024, May 2024 and June 2024, and estimated number of individuals. All meetings were in person and individuals represent adult participants.

Date	Community Group	Estimated Number of Individuals
First Round of Consultations (October 2023 and January 2024)		
Oct 24, 2023.	Mittimatalik Hunters and Trappers Association Pond Inlet Hamlet Council	7
Oct 24, 2023.	Pond Inlet community	39
Oct 25, 2023.	Nangmoutaq Hunters and Trappers Association Clyde River Hamlet Council	7
Oct 25, 2023.	Clyde River community	56
Oct 26, 2023.	Qikiqtarjuaq Hunters and Trappers Association Qikiqtarjuaq Hamlet Council	11
Oct 26, 2023.	Qikiqtarjuaq Community	Cancelled due to weather
Jan 15, 2024.	Resolute Bay Hunters and Trappers Association Resolute Bay Hamlet Council	14
Jan 15, 2024.	Resolute Bay community	9
Jan 17, 2024.	Ikajutit Hunters and Trappers Association Arctic Bay Hamlet Council	14
Jan 17, 2024.	Arctic Bay community	41
Jan 18, 2024.	Iviq Hunters and Trappers Association Grise Fiord Hamlet Council	5
Jan 18, 2024.	Grise Fiord community	12
Second Round of Consultations (May 2024 and June 2024)		
May 13, 2023.	Mittimatalik Hunters and Trappers Association	12

	Pond Inlet Hamlet Council	
May 13, 2023.	Pond Inlet community	14
May 15, 2023.	Nangmatauq Hunters and Trappers Association Clyde River Hamlet Council	8
May 15, 2023.	Clyde River community	11
May 16, 2023.	Qikiqtarjuaq Hunters and Trappers Association Qikiqtarjuaq Hamlet Council	13
May 16, 2023.	Qikiqtarjuaq Community	33
June 4, 2024.	Ikajutit Hunters and Trappers Association Arctic Bay Hamlet Council	10
June 4, 2024.	Arctic Bay community	11
June 5, 2024.	Resolute Bay Hunters and Trappers Association Resolute Bay Hamlet Council	9
June 5, 2024.	Resolute Bay community	3
June 6, 2024.	Iviq Hunters and Trappers Association Grise Fiord Hamlet Council	8
June 6, 2024.	Grise Fiord community	8

Stakeholders in Nunavut were engaged through letters distributed by emails. Stakeholders were identified with assistance from the Government of Nunavut and the Qikiqtani Inuit Association. The stakeholders engaged in this process included the following: the Nunavut Marine Conservation Target Steering Committee (represented by Environment and Climate Change Canada [ECCC], PC, Crown-Indigenous Relations and Northern Affairs Canada [CIRNAC], Transport Canada, DFO, the Government of Nunavut Department of Environment, and Nunavut Tunngavik Inc.), Nunavut Water Board, and Qikiqtaaluk Wildlife Board. Industry and non-government organizations included the Canadian Marine Advisory Council, Nunavut Eastern Arctic Shipping Inc., Shipping Federation of Canada, Woodward Group of Companies, Nunavut Fisheries Association, relevant stakeholders within the Eastern Arctic Groundfish Stakeholder Advisory Committee, Northern Shrimp Advisory Committee, Oceans North Canada and Greenland, World Wildlife Fund-Canada (WWF-Canada), Canadian Wildlife Federation, Ecology Action Centre, Association of Arctic Expedition Cruise Operators, Northwest Territories and Nunavut Chamber of Mines, Canadian Association of Petroleum Producers, Black Feather, Travel Nunavut, Atii (Let's go) Tourism, Arctic Kingdom, ArcticNet, Ice, Climate and Environment Laboratory, Nunavut Research Institute, Arctic Security Consultants, Canadian High Arctic Research Station, Polar Continental Shelf Program, Inuit Tapiriit Kanatami, Inuit Circumpolar Council Canada, Greenlandic Institute of Natural Resources, Fishers and Hunters Association in Greenland and Greenland and the Government of Greenland.

(c) A summary of the results, including any responses or accommodations to issues, concerns, etc. raised during the consultations.

Community interest in protecting Sarvarjuaq is based largely on the area's ecological importance and significance to Inuit (past, present and future). Communities are interested in learning more about the research that is occurring in Sarvarjuaq and the surrounding area, primarily its animals and habitats, climate change impacts, future economic. Communities were in favour of the Ministerial Order MPA, and indicated the importance of Inuit Qaujimajatuqangit, community input and decision-making in future decisions associated with long-term protection. Across all communities, there was an interest in working together with Greenlandic communities to discuss common concerns and learn about other communities priorities. See the enclosed "Consultation and Engagement Summary" and "What We Heard" documents for additional details.

Key take-aways from individual community consultations include:

- **Arctic Bay:** Comments highlighted that narwhal and bowhead whales travel to the proposed Sarvarjuaq MPA when the ice has formed elsewhere. There was concerns that if protection did not

occur that mining in the area may be allowed in the future. Concerns were also raised about the level of vessel traffic in the area.

- **Clyde River:** Meeting participants communicated support to protect Sarvarjuaq. They voiced their desire for employment opportunities arising from the development of the proposed Sarvarjuaq MPA.
- **Grise Fiord:** The community was interested to hear information about the collaborative activities between governments and researchers from Canada and Greenland. Community members expressed worry for the risk of industrial accidents in the Sarvarjuaq area and the desire to benefit from economic activities occurring in the area.
- **Pond Inlet:** Pond Inlet community members were generally supportive for protecting of Sarvarjuaq by a Ministerial Order MPA. They were concerned that the summer habitat to local populations of narwhal and beluga was disturbed due to industrial activity and highlighted the importance of protecting their overwintering habitat in the Sarvarjuaq area.
- **Qikiqtarjuaq:** Qikiqtarjuaq community members detailed how the wildlife in the Sarvarjuaq area travel by ice and breed in that area, therefore the ecosystem activities that take place in Sarvarjuaq impact their community. There was concern voiced about vessel traffic and the potential for oil spills in the Sarvarjuaq area and surrounding areas.
- **Resolute Bay:** Resolute Bay community members pointed out additional areas outside of the proposed boundaries they desire to be protected in the future. Discussions included questions about some of the threats to Sarvarjuaq including how climate change is affecting the area. Participants also talked about the familial connections between Canada and Greenland in communities adjacent to the area and their use of the area for harvesting. There were concerns about increased ice melt in the area and how vessel traffic may negatively impact this area.

Following in-person consultations with the communities of Arctic Bay, Qikiqtarjuaq, Clyde River, Grise Fiord, Pond Inlet and Resolute Bay, letters in support of the proposal were received from the HTAs and hamlet councils of all six communities. The Government of Nunavut also provides a letter in support of a Ministerial Order MPA in Sarvarjuaq.

Baffin Fisheries Coalition requested a meeting with DFO to gather further information about the Ministerial Order MPA regulations and the potential impact on the Nunavut commercial fisheries. Once DFO clarified that all ongoing commercial fisheries active in Sarvarjuaq would be allowed to continue for up to 5 years, Baffin Fisheries Coalition had no further concerns.

DFO sent notifications to partners, the six Hunters and Trappers Associations and the six Hamlet Councils, as well as stakeholders in advance of pre-publication of the proposed new regulation in Canada Gazette, Part I. This 30-day public comment period opened during December and closed in January.

Recommendation:

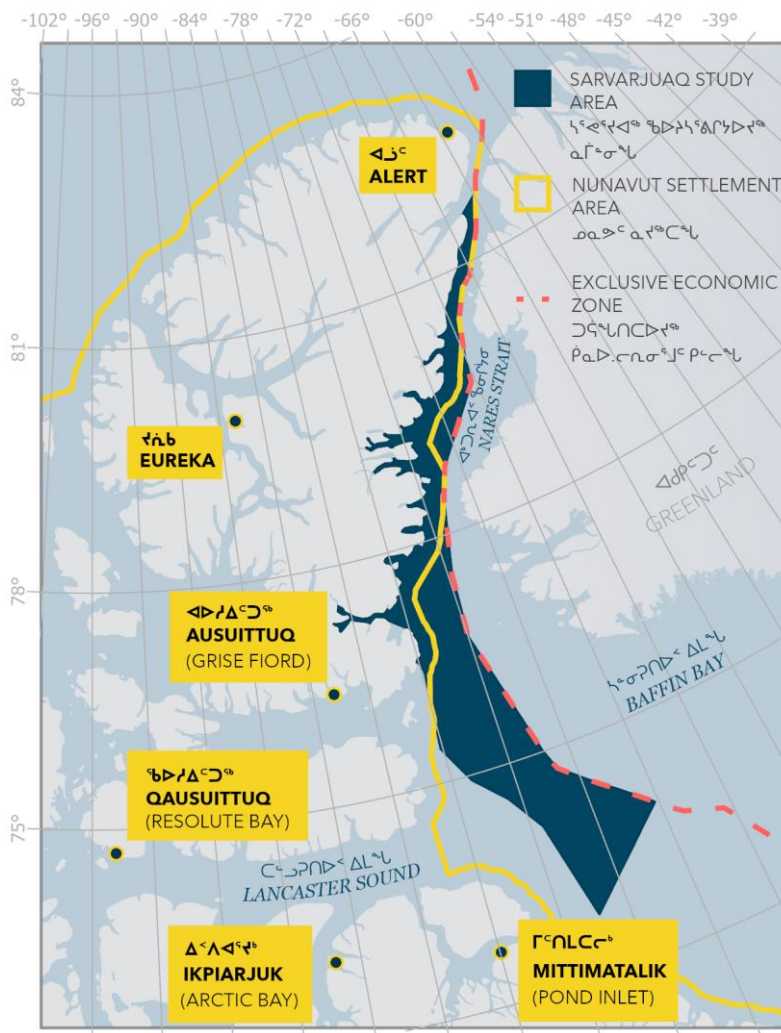
DFO is recommending that NWMB approves the establishment of a Marine Protected Area by Ministerial Order under the *Oceans Act* in Sarvarjuaq. A decision is requested by April 1, 2025.

Prepared by:

Lauren Candlish, Arctic Region – Fisheries and Oceans Canada, Marine Planning and Conservation Program

Date:

February 26, 2025.



Map of the proposed Sarvarjuaq Marine Protected Area by Ministerial Order.

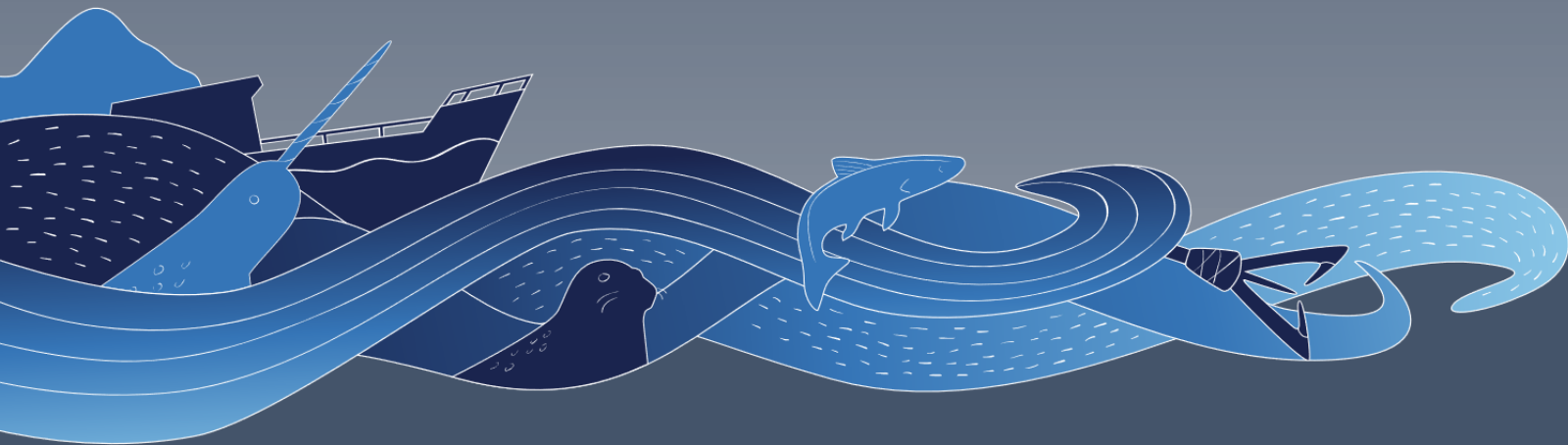


Fisheries and Oceans
Canada

Pêches et Océans
Canada

Proposal to Establish Ministerial Order Marine Protected Areas under the *Oceans Act* in Qikiqtait and Sarvarjuaq

Presentation to the Nunavut Wildlife Management Board
February 26, 2025



Canada 

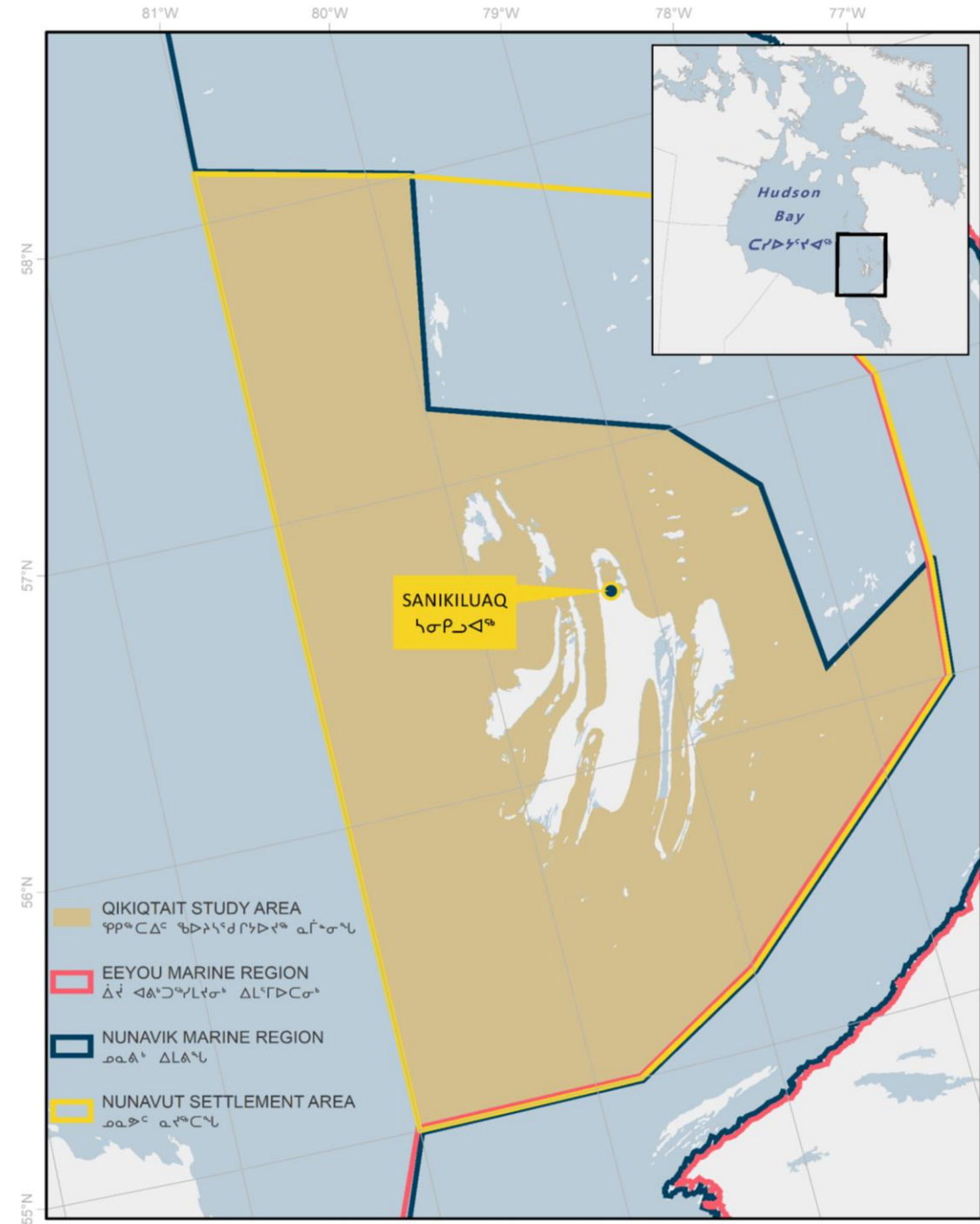
Purpose

DFO is seeking NWMB's approval to establish Ministerial Order Marine Protected Areas (MPAs) in Qikiqtait and Sarvarjuaq under the *Oceans Act*, which will be consistent with the Nunavut Agreement, s9.3.2



Qikiqtait

- Qikiqtait is located in southeastern Hudson Bay.
- Sanikiluaq and QIA have identified Qikiqtait as an area of importance to Inuit, providing critical habitat for many marine species.
- The area is home to several annually recurring polynyas that represent key habitats for polar bears, sea birds, and seals, beluga, Atlantic walrus, benthic populations, particularly in winter.
- These polynyas are vulnerable to the effects of climate change. The changes in ice cover and altered ocean currents may impact the animals that rely on it.



Sarvarjuaq

- Sarvarjuaq is located in northern Baffin Bay.
- Narrow channels help ice bridges form between Canada and Greenland, creating one of the largest recurring polynyas in the Arctic, the North Water Polynya.
- The polynya supports a large variety of marine life, including algae, fish, seabirds, and marine mammals.
- Sarvarjuaq is an important overwintering habitat and calving area, supporting the species harvested by communities throughout the Qikiqtani Region and beyond.
- The ice bridge has also been a method of travel for Inuit, connecting Canada and Greenland.



Proposed Ministerial Order MPA

- A Ministerial Order MPA freezes the footprint of ongoing activities in an area for a period of up to 5 years.
- This means that activities that are occurring, or are authorized to occur, in the year leading up to establishment are allowed to continue, but no new activities would be allowed for the duration of the Order.
- A joint Inuit Impact and Benefit Agreement (IIBA) for the proposed MPAs is being negotiated between the Government of Canada and QIA.
- The proposed MPAs would protect these vulnerable areas while partners consider long-term management and conservation needs for Qikiqtait and Sarvarjuaq, including Inuit Protected and Conserved Areas for both sites.

Proposed Ministerial Order MPA (cont)

Activities listed below would be allowed within the proposed Qikiqtait and Sarvarjuaq MPAs:

- Inuit activities provided for in the *Nunavut Agreement*
- All ongoing activities taking place 1 year prior to designation and activities that have otherwise been authorized to occur by applicable federal laws or by laws of a province/territory
- Marine scientific research
- Activities carried out for purposes of public safety, national defence, national security or law, or in response to emergency situations
- Exempted foreign activities

Classes of ongoing activities

The following have been identified as classes of ongoing activities in both Sarvarjuaq and Qikiqtait. These classes of activities will be allowed to continue under the Qikiqtait and Sarvarjuaq Ministerial Order MPAs:

- ✓ Hunting and trapping (including sport hunting)
- ✓ Fishing (including sport fishing)
- ✓ Harvesting of marine plants
- ✓ Constructing, dismantling, maintaining and repairing, and using of temporary structures on sea ice
- ✓ Marine navigation
- ✓ National defence activities carried out by the Department of National Defence
- ✓ Canadian Coast Guard activities carried out by the Canadian Coast Guard
- ✓ Tourism activities
- ✓ Recreational activities
- ✓ Educational activities
- ✓ Travel over sea ice using motorized vehicles and non-motorized methods
- ✓ Inuit Qaujimajatuqangit and community-based research activities (including stewardship activities)
- ✓ Scientific research activities
- ✓ Filming and media content development

Consultations Qikiqtait

November 2023 – April 2024:

Two rounds of in-person consultations with Sanikiluaq HTA, Sanikiluaq Hamlet Council, Arctic Eider Society, Sanikiluaq Qikiqtait Steering Committee and public of Sanikiluaq.

October 2024:

Letters in support of the Ministerial Order MPA were received from HTA, hamlet council and the Arctic Eider Society



Consultations Sarvarjuaq

October 2023 – June 2024: Two rounds of in-person consultations with the HTAs, hamlet councils and general public in Grise Fiord, Resolute Bay, Arctic Bay, Pond Inlet, Clyde River and Qikiqtarjuaq

May 2024: Newsletter distributed with consultation summary, objectives, an activities survey with return mail packaging provided and contact information

October 2024: Letters in support of the Ministerial Order MPA were received from all 6 community HTAs and hamlet councils

Stakeholder Engagement

- Stakeholders engaged were identified with assistance from the Government of Nunavut and the Qikiqtani Inuit Association.
- Letters were sent to stakeholders in English, French and Inuktitut. The first letters were distributed in July 2024. The second round of letters were sent in October 2024.
- DFO continues to be available to stakeholders as the process advances.

Nunavut Planning Commission (NPC) & Nunavut Impact Review Board (NIRB)

- DFO submitted the Qikiqtait and Sarvarjuaq proposals to the NPC for conformity determination as required under the Nunavut Planning and Project Assessment Act (NUPPAA).
- NPC referred the proposal to NIRB for further screening and a public comment period.

Pre-Publication in Canada Gazette, Part I

- DFO published its proposal to establish a new Ministerial Order MPA in Qikiqtait and Sarvarjuaq.
- The 30-day public comment period opened during December and closed in January.

Next Steps

If the NWMB approves of DFO's proposal to establish a new Ministerial Order MPA in Qikiqtait and Sarvarjuaq the next steps are:

- Signing of the IIBA between the Government of Canada and the Qikiqtani Inuit Association;
- Publication in Canada Gazette, Part II (designation of the new MPAs).



- EXCLUSIVE ECONOMIC ZONE
- NUNAVUT SETTLEMENT AREA
- SARVARJUAQ STUDY AREA
- QIKIQTAIT STUDY AREA
- TALLURUTIUP IMANGA NATIONAL MARINE CONSERVATION AREA
- TUVAIJUITTUQ MARINE PROTECTED AREA
- QIKIQTANI REGION

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(GRISE FIOR)

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QAUUITTUQ
(RESOLUTE BAY)

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SANIKILUAQ

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KANGIQTUGAAPIK
(CLYDE RIVER)

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QIKIQTARJUAQ

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PANGNIRTUNG

Request for Nunavut Wildlife Management Board Approval of a Ministerial Order Marine Protected Area in Sarvarjuaq

Consultation and Engagement Summary

Partnerships

Since 2019, the Government of Canada and the Qikiqtani Inuit Association (QIA) have been working together to identify options for the conservation and protection of Sarvarjuaq and other sites within the Qikiqtani Region of Nunavut. In 2021 a Qikiqtait and Sarvarjuaq Working Group (the Working Group) was created to advance the conservation and protection of the proposed Qikiqtait and Sarvarjuaq MPAs. The Qikiqtait and Sarvarjuaq Working Group consist of members from the Qikiqtani Inuit Association (QIA), Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada (ECCC), Transport Canada and the Government of Nunavut. The Working Group has supported the required processes to create the two potential Marine Protected Areas by Ministerial Order. The Working Group also provided awareness and shared information with the Inuit Impact and Benefit Agreement (IIBA) negotiation table as needed, with the objective to work in parallel. Only DFO, QIA and the Government of Nunavut travelled to the communities as part of the consultations for Sarvarjuaq.

Community Consultations

Representatives of the Qikiqtait and Sarvarjuaq Working Group with members from QIA and DFO conducted two rounds of consultations from October 2023 to June 2024. The Government of Nunavut participated in the consultations as observers.

The first round of consultations occurred in Pond Inlet, Clyde River and Qikiqtarjuaq from October 24-27, 2023 and in Arctic Bay, Grise Fiord and Resolute Bay from January 16-18, 2024. During the first round of consultation meetings were held with the Hamlet Councils, Hunters and Trappers Organizations and the general public in each community. Unfortunately the public meeting in Qikiqtarjuaq scheduled for October 26 was cancelled due to bad weather. During all the meetings DFO's presentation began by introducing the proposed Sarvarjuaq MPA, as well as discussing short and long-term protection goals and their associated timelines. A major point of DFO's presentation was introducing the MPA's draft conservation objectives and hearing feedback about the objectives. In all meetings, QIA also presented on the Qikiqtani Regional Conservation Model, discussing the pillars of the model and their vision for long-term protection as an IPCA. QIA also discussed Inuit stewardship, Indigenous-led governance, infrastructure support and fisheries reconciliation. Programs for monitoring and regional governance such as the Nauttisuqtiit Program were also covered.

In general during the first round of consultations, communities were supportive of protection and expressed interest in future economic opportunities in Sarvarjuaq adjacent communities. A common theme heard across communities was a desire to learn more about Sarvarjuaq as research continues, to be updated on the progress of the assessment and long-term protection options, and the importance of Inuit-led decision-making in conservation. There was also a desire across all communities to work together with communities in Greenland to discuss priorities for long-term management.

During first round of consultations, surveys were also handed out to the community members who were present. The survey consisted of questions regarding the objectives for the proposed Sarvarjuaq MPA by

Ministerial Order and asked about the types of activities that were occurring in the area. The survey questions and a summary of the responses are included in the “What We Heard” Report.

During the first round of consultations there was a request for information to also be provided to communities through a newsletter that could be mailed to everyone who lived in the six communities. In the early spring of 2024 DFO distributed a newsletter to every PO box in all six communities. The newsletter introduced Sarvarjuaq and the history of work that has led to marine protection in the region. The newsletter also introduced Marine Protected Areas by Ministerial Order as a proposed short-term conservation tool along with Inuit Protected and Conserved Areas as QIA’s vision for long-term protection. Contact information and other opportunities for engagement were also included in the newsletter. DFO will continue to send newsletters to all six communities to provide updates on the progress for establishment.

During the first round of consultations there were also requests to hear more about the research that has been occurring in the Sarvarjuaq and surrounding areas. In February and March 2024, DFO visited all six communities to present updates on scientific research in the area. Where possible, school visits and radio presentations were also undertaken to provide information at the request of communities. The information was well received, and communities expressed that they would like to have increased involvement in research efforts moving forward.

The second round of consultations took place in Pond Inlet, Clyde River, and Qikiqtarjuaq from May 13-15 2024, and in Arctic Bay, Resolute Bay and Grise Fiord from June 3-7 2024. The second round of consultation meetings again were held with the Hamlet Councils, Hunters and Trappers Organizations and the general public in each of the six community. During these meetings DFO presented additional information regarding the proposed Marine Protected Area by Ministerial Order including a review of the progress, an in-depth overview of the Ministerial Order as a protection tool, the proposed boundaries. DFO also presented on the regulatory intent that included an overview of economic activities or potential activities for the area and what activities we have documented as occurring within the proposed Sarvarjuaq MPA. QIA presented more details about their vision of an Inuit Protected and Conserved Areas as a proposed long-term protection tool.

During the second round of consultations many community members again indicated their support for the proposed approach of establishing a Marine Protected Area by Ministerial Order. Many comments highlighted the importance of Sarvarjuaq and protecting the area. Community members detailed the abundance of wildlife observed in Sarvarjuaq, the importance of the area as a wintering and breeding habitat and the importance of Sarvarjuaq as a hunting area. Concerns were shared about the potential negative impacts of industrial activity, vessel traffic and increasing tourism on the health of the ecosystem if Sarvarjuaq were not protected. There were also comments on allowing for local economic opportunities. In general there was a lot of support indicated for protecting Sarvarjuaq, and many requests for communities to be involved in the long-term management of the area.

In September 2024 DFO distributed “What We Heard Reports” to all six communities. These reports included meeting summaries for all communities in both round of consultations, feedback received from the community and responses to questions that came up during the meetings. The reports also included results of the survey and informed the communities that DFO would be seeking Support Letters as a next step in the process toward establishment.

In October 2024 DFO received letters in support of the Ministerial Order MPA from all six community Hunters and Trappers and Hamlet Councils. The Government of Nunavut has also provided a letter of support.

Other Stakeholders

Stakeholders were identified with assistance from the Government of Nunavut and the Qikiqtani Inuit Association. The stakeholders engaged in this process included the following: the Nunavut Marine Conservation Target Steering Committee (represented by Environment and Climate Change Canada [ECCC], PC, Crown-Indigenous Relations and Northern Affairs Canada [CIRNAC], Transport Canada, DFO, the Government of Nunavut Department of Environment, and Nunavut Tunngavik Inc.), Nunavut Water Board, and Qikiqtaaluk Wildlife Board. Industry and non-government organizations included the Canadian Marine Advisory Council, Nunavut Eastern Arctic Shipping Inc., Shipping Federation of Canada, Woodward Group of Companies, Nunavut Fisheries Association, relevant stakeholders within the Eastern Arctic Groundfish Stakeholder Advisory Committee, Northern Shrimp Advisory Committee, Oceans North Canada and Greenland, World Wildlife Fund-Canada (WWF-Canada), Canadian Wildlife Federation, Ecology Action Centre, Association of Arctic Expedition Cruise Operators, Northwest Territories and Nunavut Chamber of Mines, Canadian Association of Petroleum Producers, Black Feather, Travel Nunavut, Atii (Let's go) Tourism, Arctic Kingdom, ArcticNet, Ice, Climate and Environment Laboratory, Nunavut Research Institute, Arctic Security Consultants, Canadian High Arctic Research Station, Polar Continental Shelf Program, Inuit Tapiriit Kanatami, Inuit Circumpolar Council Canada, Greenlandic Institute of Natural Resources, Fishers and Hunters Association in Greenland and Greenland and the Government of Greenland.

DFO also engaged all implicated federal departments, including (but not limited to) ECCC, Transport Canada, Crown-Indigenous and Northern Affairs Canada, Parks Canada, Natural Resources Canada, Canadian Coast Guard, Global Affairs Canada, and Department of National Defense.

In July 2024, DFO distributed letters to the identified stakeholders. These letters were provided in English, French and Inuktitut. The first letter informed stakeholders that the Qikiqtani Inuit Association, the Government of Nunavut and the Government of Canada were assessing short-term protection measures for Sarvarjuaq. The letter also introduced Marine Protected Areas by Ministerial Order as the proposed protection tool and requested feedback and information about ongoing and anticipated activities in the area. In October 2024, a second letter was distributed to stakeholders. The second letter outlined the proposed regulations for Sarvarjuaq, provided a list of the classes of ongoing activities. In the second letter, stakeholders were invited to provide comments and feedback on the proposed regulations. No feedback or comments on the proposed regulations were received.

In addition to the distribution of two stakeholder letters, DFO consulted with stakeholders further at their request. A meeting was held with Baffin Fisheries Coalition and representatives from the Government of Canada, Department of Fisheries and Oceans. Baffin Fisheries wanted more information about the proposed Sarvarjuaq MPA and if it would impact their activities in the region. DFO conducted a presentation similar to that shared during community consultations indicating that fishing would be considered one of the classes of ongoing activities and therefore the activity could continue in the proposed Sarvarjuaq MPA.

DFO provided an update to the NWMB at its October 31, 2024, quarterly meeting to notify that a submission and presentation would be made for their approval in February 2025.

DFO submitted a proposal to the Nunavut Planning Commission (NPC) for conformity determination on November 6, 2024, on November 13 NPC accepted the proposal for review. On November 18, 2024, NPC referred the proposal to the Nunavut Impact Review Board (NIRB) for further screening and public comment period.

DFO presented to the Qikiqtaaluk Wildlife Board (QWB) on the proposal on November 27, 2024, providing information on the community support letters received and notifying the Board that DFO would be seeking their endorsement. DFO will continue to engage the QWB on this site.

DFO sent notifications to partners, community HTAs and hamlet councils, as well as stakeholders in advance of pre-publication of the proposed new regulation in Canada Gazette, Part I. This 30-day public comment period opened during December and closed in January.

Request for Nunavut Wildlife Management Board Approval of a Ministerial Order Marine Protected Area in Sarvarjuaq

Project Description

1. Request for Approval

Fisheries and Oceans Canada (DFO) Marine Planning and Conservation Program, is seeking approval from the Nunavut Wildlife Management Board (NWMB) to establish a marine conservation area in Sarvarjuaq through designation of a Marine Protected Area (MPA) by Ministerial Order (or “Order”) under the *Oceans Act*, s35.1(2), consistent with the Nunavut Agreement s9.3.2 (establishment of conservation areas).

2. Collaboration and Proposal for a Ministerial Order MPA under the *Oceans Act*

The Sarvarjuaq Study Area (Sarvarjuaq) surrounds the North Water Polynya which is located between Canada and Greenland in northern Baffin Bay. This region is characterized by one of the largest recurring polynyas in the Arctic, which supports high productivity and biodiversity. In March 2019, the Prime Minister of Canada, Justin Trudeau, released a joint statement with Canadian Inuit leaders that committed to working in partnership to advance the sustainable marine management and environmental protection of the region surrounding the North Water Polynya. DFO and QIA are pursuing the establishment of a Ministerial Order MPA under the *Oceans Act* in Sarvarjuaq to limit the impact of additional unforeseen stressors on the area while partners explore options for long-term protection.

This proposal for a Ministerial Order MPA in Sarvarjuaq requires the negotiation of an Inuit Impact and Benefit Agreement (IIBA) under the *Nunavut Agreement*. An IIBA between the Government of Canada and QIA is currently being negotiated and will be completed prior to establishment.

The North Water Polynya was identified by DFO in 2011 as one of the Ecologically and Biologically Significant Areas within Canada’s Arctic. In addition to supporting community interests for protection, the proposed MPA would contribute to Canada’s goal of conserving 25 per cent of its oceans by 2025, and mandate to increase Indigenous collaboration on marine conservation. Establishment of an MPA in Sarvarjuaq would advance reconciliation with Inuit through self-determination, Inuit leadership and collaboration in marine conservation stewardship.

Objectives identified for the proposed Sarvarjuaq MPA are:

- (1) To support the conservation, protection, and understanding of Sarvarjuaq (the North Water Polynya) and its unique biologically productive ecosystem that is of immense value to Inuit and Inuit culture.
- (2) To support Inuit leadership in the conservation of Sarvarjuaq to ensure the continuity of Inuit culture, values, and practices, including accumulating and passing down Inuit knowledge, as well as Inuit stewardship and governance.

Protection under a Ministerial Order MPA would freeze the footprint of activities in the area, for a period of up to five years. This would mean that activities that have lawfully occurred in the area over the 12 months prior to designation (or that were authorized by a federal or territorial permit, licence, or some other form of express authorization to occur but have not yet taken place) would be allowed to continue

for the duration of the Order. For the duration of the Ministerial Order, no new human activities, other than Inuit activities provided for in the *Nunavut Agreement*, exempted foreign activities, marine scientific research, and activities carried out for purposes of public safety, national defence, national security or law, or in response to emergency situations, provided for under subsection 35.1(3) of the *Oceans Act*, would be allowed to occur in the area following this proposed designation.

The proposed Sarvarjuaq Ministerial Order MPA would establish the boundaries and designate an MPA in the area found in the Nares Strait in Northern Baffin Bay, at the entrance to Smith Sound; extending both North and South along the international boundary between Canada and Greenland.

The proposed Sarvarjuaq Ministerial Order MPA would prohibit all human activities that disturb, damage, destroy or remove from that MPA any unique geological or archeological features or any living marine organism or any part of its habitat or is likely to do so within the designated boundaries, except the following activities:

Classes of Ongoing Activities

For the purposes of paragraph 35.1(2)(a) of the *Oceans Act*, the following classes of activities are ongoing activities in the MPA:

- Hunting and trapping (including sport hunting)
- Fishing (including sport fishing)
- Harvesting of marine plants
- Constructing, dismantling, maintaining and repairing, and using of temporary structures on sea ice
- Marine navigation
- National defence activities carried out by the Department of National Defence
- Canadian Coast Guard activities carried out by the Canadian Coast Guard
- Tourism activities
- Recreational activities
- Educational activities
- Travel over sea ice using motorized vehicles and non-motorized methods
- Inuit Qaujimajatuqangit and community-based research activities (including stewardship activities)
- Scientific research activities
- Filming and media content development

DFO has consulted with the communities of Arctic Bay, Clyde River, Grise Fiord, Pond Inlet, Resolute Bay and Qikiqtarjuaq, QIA, the Government of Nunavut, stakeholders and other federal departments to identify existing and authorized (i.e., ongoing) activities in the proposed Sarvarjuaq MPA.

Activities under the Nunavut Agreement

The proposed Order would not apply with respect to rights of Inuit as provided for under the *Nunavut Agreement*.

Public safety

Any activity carried out on behalf of His Majesty for the purpose of public safety, national defence, national security, or law enforcement, or in response to an emergency (including environmental

emergencies), would be allowed to occur within the MPA by way of the statutory exception provided under subsection 35.1(3) of the *Oceans Act*, such as emergency search and rescue, response to shipping or aircraft accidents, or national security requirements.

3. About the Area

a. Location

The proposed Sarvarjuaq MPA is found in the Nares Strait and in Northern Baffin Bay (Figure 1). The boundaries were refined in collaboration QIA. A portion of the proposed Sarvarjuaq MPA falls within the Nunavut Settlement Area (NSA). The outer portion of the proposed Sarvarjuaq MPA extends further to the southeast and runs along the boundary of Canada’s Exclusive Economic Zone. It also includes the seabed, the subsoil to a depth of five metres and the water column, including the sea ice, each of which is below the low-water line. Adjacent Canadian communities to the Sarvarjuaq region include Grise Fiord, Resolute Bay, Arctic Bay, Pond Inlet, Clyde River and Qikiqtarjuaq.

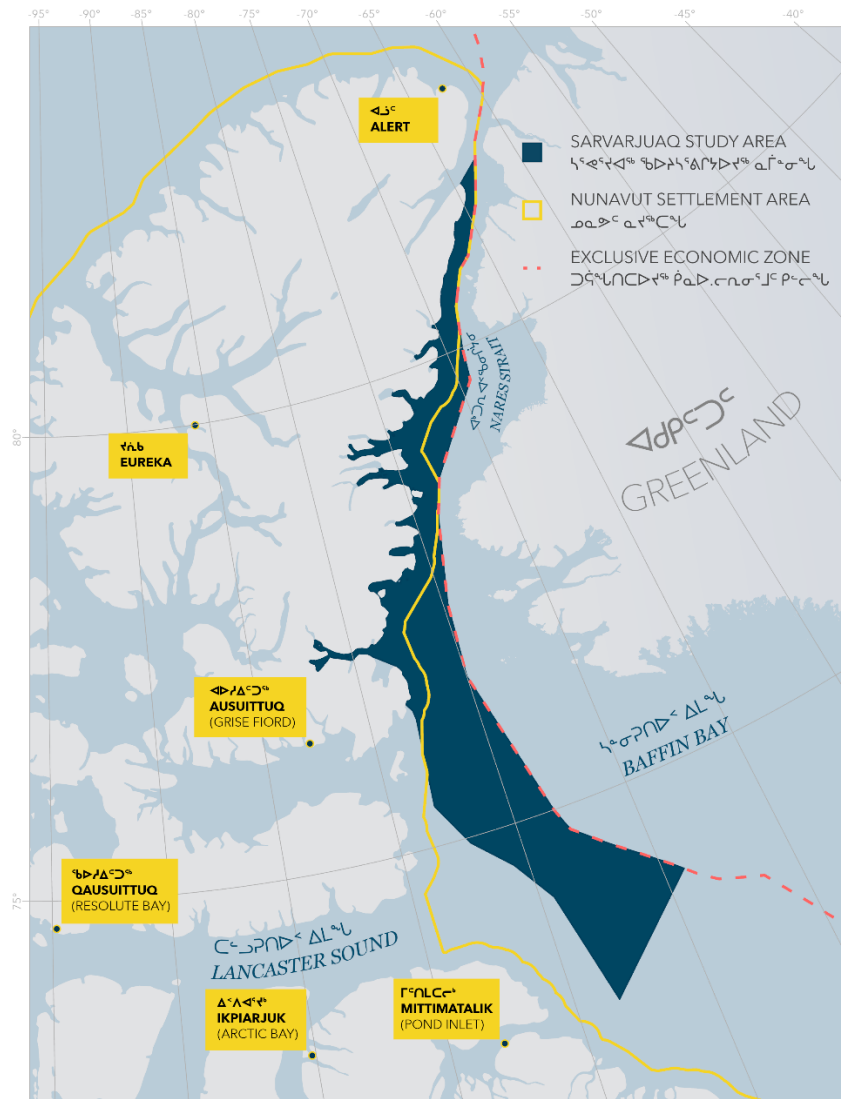


Figure 1. Map of the proposed Sarvarjuaq MPA

b. Ecological Importance

A major feature in the Sarvarjuaq area is the North Water Polynya (also known as Pikialasorsuaq), which is an area of year-round open water surrounded by sea-ice cover. The North Water Polynya is one of the largest (80,000 km²) polynyas in the Arctic, and is well known for its seasonally early and reliable productivity, as well as its high biodiversity. The polynya provides critical habitat for a number of marine mammal species, such as Atlantic walrus (*Odobenus rosmarus rosmarus*), beluga (*Delphinapterus leucas*) and bowhead whale (*Balaena mysticetus*), narwhal (*Monodon monoceros*), ringed seal (*Pusa hispida*), bearded seal (*Erignathus barbatus*), and polar bear (*Ursus maritimus*), as well as sea birds, fish and other marine life. The Sarvarjuaq area is also home to an estimated 60 million birds, including the endangered ivory gull, and the largest aggregation of dovekies/little auks on earth.

The region serves as a crucial feeding and breeding ground for many Arctic marine species. Species like seals, walrus, whales, and seabirds rely on the polynya's open waters to access food resources. Seabirds also use the coastal-fiord regions surrounding the polynya for breeding, foraging and nesting. These species often migrate long distances to reach the polynya, highlighting its importance in their life cycles.

The high biodiversity and species presence in the Sarvarjuaq region are largely attributed to a series of unique physical features in the area. These include:

- Atmospheric and oceanic circulation patterns creating dominant northerly winds and ocean currents, which push sea ice south through Nares Strait into Baffin Bay (DFO, 2021);
- Ice bridges forming in Nares Strait, Kane Basin and Smith Sound, largely due to narrow channels blocking the passage of sea ice southward, resulting in less sea ice south of Smith Sound (DFO, 2021);
- Ocean circulation patterns and upwelling mixing nutrient-rich waters, with cold Pacific water flowing south from the Arctic (along the Canadian coast) and warmer Atlantic waters coming flowing north from Davis Strait (along the Greenlandic coast) (DFO, 2021);
- Increased primary productivity due to a longer ice-free period.

Other significant biophysical features in the Sarvarjuaq Study Area that contribute to its ecological importance include; a high presence of glaciers and their subsequent freshwater runoff into the marine environment, early phytoplankton blooms providing an early source of food. In addition, the North Water Polynya is considered to be a carbon sink and is regionally important in the exchange of carbon dioxide and other gases.

The North Water Polynya has dynamic and fluctuating oceanographic features, stemming from both sea ice and icebergs from glaciers in the region. Fresh water flows and mixes into the marine environment, fed by the melting ice caps in Canada and Greenland. The effects of climate change and increased meltwater on the North Water are uncertain. Recently, the ice bridges that help in the formation of the polynya are becoming less stable and occurring with less predictability. Like many other Arctic regions, the polynya is vulnerable to the effects of climate change, such as shifts in ice cover, altered ocean currents and impacts on species that rely on it (ICCC, 2017; DFO, 2021).

Sarvarjuaq and the wider area of Pikialasorsuaq are both socially and culturally important. For millennia, this region has been home to some of the northern-most human settlements. The polynya has connected communities across Canada and Greenland (ICCC, 2017), and supported many of these settlements.

Overall, the North Water Polynya serves as a unique and vital ecosystem, supporting diverse marine life, playing a role in regional climate dynamics, and providing cultural importance to Inuit communities. It is important to understand and preserve this unique ecosystem for those who rely on the region, as well as for global climate change research and conservation efforts.

c. Socio-economic Considerations

A socio-economic analysis was completed by DFO's Policy and Economic Sector. The majority of economic activity for Sarvarjuaq falls within the categories of natural resource management and eco/cultural tourism. Activities identified through the socio-economic analysis include annual sealift operations, vessel transportation of materials from the Mary River iron ore mine, icebreaking activities, passenger and cruise ship traffic, marine research vessel activity, media and filming activities, subsistence and traditional wildlife harvesting, recreational activities, and tourism. DFO's analysis, consultation with other Federal departments, community consultations, and industry and stakeholder engagement informed the list of ongoing activities presented above.

Forecasted possible economic growth in the proposed Sarvarjuaq MPA lies within recreational and tourism activities. It is important to note that one variable in future economic development is climate change, as scientific studies have shown a reduction in ice thickness and age (DFO, 2021) could lead to greater accessibility of the Sarvarjuaq region.

Limited commercial fishing activities have taken place within the proposed Sarvarjuaq MPA. The proposed MPA overlaps with the boundaries of the North Atlantic Fishing Organization (NAFO) fishing division 0A. The NAFO Convention regulations allow Nunavut offshore license holders to harvest Greenland Halibut.

No current mineral exploration or exploitation licenses are held within the proposed Sarvarjuaq MPA. Baffinland's Mary River Mine, is currently the only operational mine in proximity to Sarvarjuaq. The mine is located a few hundred kilometers south of Sarvarjuaq, on northern Baffin Island (Baffinland, 2017). Vessel transportation of materials from the mine can route through the proposed MPA.

There is currently a moratorium on new oil and gas exploration licensing in and around Sarvarjuaq. According to the Strategic Environmental Assessment in Baffin Bay and Davis Strait (Nunavut Impact Review Board, 2019), there is currently little interest from oil and gas companies to undertake development in the region.

Currently, shipping and navigation traffic in and around the propose Sarvarjuaq MPA boundaries occurs for the purposes of general cargo, fishing, tanker, passenger ship and pleasure craft, government and icebreaking. Vessel traffic could potentially increase in the future if resource projects within mining, oil and gas were developed/approved.

Due to the preservation of natural ecosystems that are associated with a protected area, an increase in eco/cultural tourism is possible. An increase in cruise vessel visits in Nunavut and the Qikiqtani region has been observed and linked with decreasing sea ice and longer ice-free seasons. Currently, there are eight different licensed outfitters and ten different licensed tour operators in the communities of Grise Fiord, Pond Inlet, Clyde River, Resolute and Arctic Bay. These licensed outfitting and tour operators provide tourists a variety of recreational activities. An increase in recreational and tourism activities may be possible in the future if sea ice continues to decrease.

4. Consultation and Engagement

Below is a short summary of the consultations and engagements that have occurred. A more detailed description of the consultations and engagements undertaken is provided in a separate “Consultation and Engagement Summary” document and in the “What We Heard” Report, both included in this submission.

a. Partnerships

Since 2019, the Government of Canada and QIA have been working together to identify options for the conservation and protection of Sarvarjuaq and other sites within the Qikiqtani Region of Nunavut. In 2021 a Qikiqtait and Sarvarjuaq Working Group (the Working Group) was created to advance the conservation and protection of the proposed Qikiqtait and Sarvarjuaq MPAs. The Working Group includes representatives from the Government of Canada, QIA and the Government of Nunavut.

b. Consultation and Engagement

Through the Working Group DFO has been working with QIA to implement an approach to community consultations in the Qikiqtani region of Nunavut. QIA indicated that consultations should focus on the six communities in closest proximity to the proposed Sarvarjuaq MPA: Grise Fiord, Resolute Bay, Arctic Bay, Pond Inlet, Clyde River, and Qikiqtarjuaq.

The first round of consultations occurred in Pond Inlet, Clyde River and Qikiqtarjuaq from October 24-27, 2023 and in Arctic Bay, Grise Fiord and Resolute Bay from January 16-18, 2024. During the first round of consultation meetings were held with the Hamlet Councils, Hunters and Trappers Organizations and the general public in each community. Unfortunately the public meeting in Qikiqtarjuaq scheduled for October 26 was cancelled due to bad weather. During all the meetings DFO’s presentation began by introducing the proposed Sarvarjuaq MPA, as well as discussing short and long-term protection goals and their associated timelines. A major point of DFO’s presentation was introducing the MPA’s draft conservation objectives and hearing feedback about the objectives. In all meetings, QIA also presented on the Qikiqtani Regional Conservation Model, discussing the pillars of the model and their vision for long-term protection as an IPCA. QIA also discussed Inuit stewardship, Indigenous-led governance, infrastructure support and fisheries reconciliation. Programs for monitoring and regional governance such as the Nauttiqsuqtiit Program were also covered.

The second round of consultations took place in Pond Inlet, Clyde River, and Qikiqtarjuaq from May 13-15 2024, and in Arctic Bay, Resolute Bay and Grise Fiord from June 3-7 2024. The second round of consultation meetings again were held with the Hamlet Councils, Hunters and Trappers Organizations

and the general public in each of the six community. During these meetings DFO presented additional information regarding the proposed Marine Protected Area by Ministerial Order including a review of the progress, an in-depth overview of the Ministerial Order as a protection tool, the proposed boundaries. DFO also presented on the regulatory intent that included an overview of economic activities or potential activities for the area and what activities we have documented as occurring within the proposed Sarvarjuaq MPA. QIA presented more details about Inuit Protected and Conserved Areas as a proposed long-term protection tool. During these meetings, communities members expressed their support for to advance protection of Sarvarjuaq.

In September 2024, the Working Group distributed a “What We Heard” report to the six communities which summarized the feedback provided by community members during consultations. Letters in support of the proposed regulation were received from all six communities’ Hunters and Trappers Organizations and Hamlet Councils. The Government of Nunavut has also provided a letter of support.

Other Stakeholders

DFO engaged with industry and key stakeholders on the proposed Sarvarjuaq MPA by Ministerial Order in two phases. Stakeholder groups engaged in this process included, but were not limited to: the Nunavut Water Board, Nunavut Wildlife Management Board, Qikiqtaaluk Wildlife Board, Nunavut Tunngavik Inc., Inuit Circumpolar Council, Inuit Tapiriit Kanatami, environmental non-governmental organizations (ENGOs), commercial fishing industry, shipping industry, media industry, cruise ship industry, oil and gas and mining industries, tour operators, fiber optic industry, and academia. In July 2024, a letter was sent from all parties of the Working Group seeking input on any ongoing activities currently being conducted or planned within the Sarvarjuaq Study Area. Following this first round of engagement, in October 2024, DFO engaged these same stakeholders on its proposed regulatory intent for a Ministerial Order MPA in Sarvarjuaq, seeking their input.

DFO also engaged all implicated federal departments, including (but not limited to) ECCC, Transport Canada, Crown-Indigenous and Northern Affairs Canada, Parks Canada, Natural Resources Canada, Canadian Coast Guard, Global Affairs Canada, and Department of National Defense.

5. Establishment Timeline and Next Steps

If the NWMB approves DFO’s proposal to establish a Ministerial Order in Sarvarjuaq, DFO will proceed to publication of the Order in Canada Gazette, Part II, which designates the new MPA. Canada and its partners will continue to work toward long-term options for Sarvarjuaq, which includes the consideration of an Inuit Protected and Conserved Area.

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What We Heard Report: Community Consultations

Sarvarjuaq a potential Marine Protected Area by Ministerial Order



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Acknowledgement

The Qikiqtait and Sarvarjuaq Working Group would like to thank the communities of Arctic Bay, Resolute Bay, Grise Fiord, Qikiqtarjuaq, Pond Inlet and Clyde River for their time and hospitality during our community visits. We would especially like to thank the Hunters and Trappers Associations, Hamlet Council, and the general public for their participation and knowledge-sharing.

Our Team

The Qikiqtait and Sarvarjuaq Working Group consist of members from the Qikiqtani Inuit Association (QIA), Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada (ECCC), Transport Canada and the Government of Nunavut. The working group has been supporting the required processes for Sarvarjuaq and Qikiqtait, to create the two potential Marine Protected Areas by Ministerial Order. Only DFO, QIA and the Government of Nunavut travelled to the communities as part of the consultations for Sarvarjuaq.

Working Group representatives who participated in the Sarvarjuaq consultations included Geneva Noble (QIA), Martha Nuyalia (QIA), Mark Pitseolak (QIA) and Joseph Pinguartuk (QIA), Bernie MacIsaac (Government of Nunavut), Laura Harris (Government of Nunavut), Justin Hack (Government of Nunavut) and Maryam Abdullahi (Government of Nunavut), Bethany Schroeder (DFO), Jesslene Jawanda (DFO), Lauren Candlish (DFO), Thomas Hoggarth (DFO), and Alasdair Beattie (DFO).

Executive Summary

Purpose

For the first round of consultations, representatives of the Qikiqtait and Sarvarjuaq Working Group, with members from Qikiqtani Inuit Association (QIA), Fisheries and Oceans Canada (DFO), and Government of Nunavut, conducted community meetings in Pond Inlet, Clyde River and Qikiqtarjuaq from October 24-27, 2023. The last community visits for the first round of consultations took place in Arctic Bay, Grise Fiord and Resolute Bay from January 16-18, 2024 with representatives from the same organizations and institutions in attendance. From May 13-15 2024 the second round of consultations took place in Pond Inlet, Clyde River and Qikiqtarjuaq. The final meetings took place in Arctic Bay, Resolute Bay and Grise Fiord from June 3-7 2024.

The purpose of these two rounds of consultations was to discuss the collective knowledge of the Sarvarjuaq area, the proposed approach to short-term marine conservation by Ministerial Order Marine Protected Area (MPA) under the *Oceans Act*, next steps, and also to discuss QIA's vision for an Inuit Protected and Conserved Area (IPCA). Community feedback was sought during the meetings and it was noted that support Letters of Support on the Sarvarjuaq Marine Protected Area proposal would be requested. An overarching goal was to hear what the communities think about the proposed Sarvarjuaq MPA proposal, and learn of the community's experiences, and uses, of the area.

The purpose of this report is to summarize the feedback provided by community members who attended the meetings, to provide transparency in the process, and to provide a record of the discussions and concerns shared by the community. To confirm accuracy of the information captured, this report was shared with the Hunters and Trappers and Hamlet Councils for review. After community organizations have had an opportunity to comment, these reports will be available to be shared with the public of Arctic Bay, Pond Inlet, Clyde River, Qikiqtarjuaq, Grise Fiord and Resolute Bay.

Summary of meetings

During the first round of consultations in October 2023 and January 2024, DFO conducted presentations on the proposed MPA by Ministerial Order to the Hamlet Councils and Hunters and Trappers Organizations in each community. DFO also recorded feedback, questions and concerns as well as distributed surveys to community members to gather input. The QIA presented information about their vision for an Inuit-led Protected and Conserved Areas as their proposed approach for long-term protection in Sarvarjuaq and how it can relate to the communities priorities.

From May to June 2024 DFO presented additional information regarding the proposed MPA by Ministerial Order including a review of the progress, an in-depth overview of the Ministerial Order as a protection tool and updated proposed boundaries. DFO also presented an overview of economic activities or potential activities for the area and what activities we have documented as occurring within the proposed Sarvarjuaq MPA. A summary of these activities is included in the appendices. The QIA presented more details about IPCAs as a proposed long-term protection tool.

What we heard overall

Throughout the consultation process in October 2023, January, May and June 2024, the community members in attendance were very engaged in the meetings – sharing their expertise of the area and their perspectives, voicing concerns, providing advice, and raising important questions.

There were general discussions on the proposed Sarvarjuaq MPA and its process, with community members from all six consulted communities indicating their support for the proposed approach of establishing a Marine Protected Area by Ministerial Order. There was also many comments and questions wanting to know more about the Inuit Impact Benefit Agreement and what benefits would be seen within each community. There was also interest in having more conservation or protected areas further south of the proposed Sarvarjuaq boundaries and closer to the communities.

There were many comments about how to have additional communication and increased community involvement regarding Sarvarjuaq. This included suggestions for Nunavut communities to meet and work together for the long-term management of Sarvarjuaq. There was also interest to meet with communities from Greenland to discuss the management of both the Canadian side and the Greenlandic side of the polynya. Additionally, there were also recommendations for how the Working group can share updates with communities outside of consultation meetings.

Many comments highlighted the importance of Sarvarjuaq and protecting the area. Community members detailed the abundance of wildlife observed in Sarvarjuaq, the importance of the area as a wintering and breeding habitat and the importance of Sarvarjuaq as a hunting area. Concerns were shared about the potential negative impacts of industrial activity, vessel traffic and increasing tourism on the health of the ecosystem in Sarvarjuaq. There were also comments on allowing for local economic opportunities.

In general there was a lot of support indicated for protecting Sarvarjuaq, and many requests for communities to be involved in the long-term management of the area.

Meeting Summaries

Summary of Presentations

Department of Fisheries and Oceans Canada – Marine Planning and Conservation (Bethany Schroeder and Lauren Candlish)

DFO Marine Planning and Conservation presented the proposed approach for the proposed Sarvarjuaq MPA to the Hunters and Trappers Associations, Hamlet Council and the public of each of the consulted communities October 2023 and January 2024. The presentation began by introducing the proposed Sarvarjuaq MPA, as well as discussing short and long-term protection goals and their associated timelines. In October 2023, a major focal point of the presentation was introducing the MPA's draft Conservation Objectives for discussion and distributing community surveys.

In May and June 2024 the in-depth details regarding the regulations of marine protected areas by Ministerial Order were explained. There was also an overview of economic activities or potential activities for the area and what activities we have documented as occurring within the proposed Sarvarjuaq MPA. This information was presented to the Hamlet Council, Hunter and Trapper Association and the public of all consulted communities.

Throughout the consultation process the Working Group members met with the Hamlet and Hunter and Trapper Association during the afternoon for 2-3 hours and the general public in the evening for 2-3 hours. In some cases the Hamlet or Hunter and Trapper Associations requested to attend the public meeting instead due to scheduling conflicts. During the final meetings in each community, DFO thanked community members for their participation and told the community they would be sharing additional information with the Hamlet Council and Hunters and Trappers and seeking support through a Letter of Support in the early fall of 2024.

Qikiqtani Inuit Association (Geneva Noble, Martha Nuyalia, and Joseph Pinguartuk)

In all meetings, the QIA presented on the Qikiqtani Regional Conservation Model, discussing the pillars of the model, the proposed MPA, and their vision for long-term protection as an IPCA. Major foci of the presentation were on Inuit stewardship, Indigenous-led governance, infrastructure support and fisheries reconciliation. Programs for monitoring and regional governance such as the Nauttiqsuqtiit Program were also covered.

Community Meeting Summaries

A very short summary is provided for the meetings and discussions that occurred in each of the six communities. Following these summaries is the What We Heard Overall section where there are more details of the questions and topics that were discussed across all the meetings.

Pond Inlet Meetings

On October 24 2023, 39 members of the public and 7 members of the Hunter and Trapper Association and Hamlet Council met with the Working Group. On May 13 2024, 14 members of the public and 12 members of the Hamlet Council and Hunters and Trappers gathered to share knowledge and discuss aspects of short-term and long-term marine protection of the Sarvarjuaq area.



Members of the Hamlet Council and Hunter and Trapper Association meeting with Working Group Representatives during October 2023 consultations.

Representatives of the Working Group met with the community of Pond Inlet on October 24 2023 in the Community Hall of Pond Inlet. The Working Group met with public of Pond Inlet again in May of 2024 in the Community Hall and discussed the collective knowledge of Sarvarjuaq and the proposed approach to short-term marine conservation and next steps to advance the designation of Sarvarjuaq as a Ministerial Order MPA by 2025. A total of 39 adult community members were present in October and 14 adult community members were present in May 2024.

What We Heard from Pond Inlet

Pond Inlet community members were generally supportive for protecting of Sarvarjuaq by a Ministerial Order MPA. They were concerned that the summer habitat to local populations of narwhal and beluga was disturbed due to industrial activity and highlighted the importance of protecting their overwintering habitat in the Sarvarjuaq area. Community members communicated their interest in collaborating with Canadian and Greenlandic communities to work toward protection of the North Water polynya through meetings, increased engagement with research being conducted in the area and the interest to visit the area. There was interest in limiting cruise ship activity.

Clyde River Meetings

On October 25 2023, 56 adult members of the public and 7 members of the Hunter and Trapper Association and Hamlet Council met with the Working Group. On May 15 2024, 11 adult members of the public and 8 members of the Hamlet Council and Hunter and Trapper Association gathered to exchange knowledge and discuss aspects of short-term and long-term marine protection of the Sarvarjuaq area. Inuktitut interpretation was provided by Luu Paneak.

Representatives of the Working Group met with the community of Clyde River on October 25 2023 in the Community Hall of Clyde River. The Working Group met with public of Clyde River again in May of 2024 in the Qujuaq School.



Clyde River public meeting October 2023

What We Heard from Clyde River

Meeting participants communicated support to protect Sarvarjuaq and in both October and May, they discussed the desire for the southern boundary of the proposed Sarvarjuaq MPA to extend further to be adjacent to Clyde River. There was a desire communicated for the communities in Nunavut to participate in a collaborative workshop with Greenland communities.

The Hunter and Trapper Association voiced their desire for employment opportunities arising from the development of the proposed Sarvarjuaq MPA and the QIA discussed their vision for the expansion of the Nauttisuqtiit program in the discussion for long-term management of the proposed Sarvarjuaq MPA. They also expressed interest in sending community representatives to the proposed Sarvarjuaq MPA by vessel in the future.

Qikiqtarjuaq Meetings

On October 26 2023, 11 members of the Hunter and Trapper Association and Hamlet Council met with the Working Group. On May 16 2024, 33 adult members of the public and 13 members of the Hamlet Council and Hunter and Trapper Association gathered to discuss long-term marine protection of the proposed Sarvarjuaq MPA. Inuktitut interpretation was provided by Rosemary Metuq.



Qikiqtarjuaq meeting May 2024.

What We Heard from Qikiqtarjuaq

Qikiqtarjuaq community members detailed how the wildlife in the Sarvarjuaq area travel by ice and breed in that area, therefore the ecosystem activities that take place in Sarvarjuaq impact their community.

There was concern voiced about vessel traffic and the potential for oil spills in the Sarvarjuaq area. When asked if consultations identified shipping routes, the response was that shipping will continue in the area. Future discussions on the long-term IPCA could address shipping and corridors.

Members of the Hunter and Trapper Association and the Hamlet voiced concern about materials and equipment washing ashore in Qikiqtarjuaq and expressed a desire for further information about research that is conducted adjacent to their community. Several members of the community, hamlet and Hunter and Trapper Association expressed support for the development of Sarvarjuaq as a Ministerial Order MPA and a request to be updated in regard to the progress of establishment.

Arctic Bay Meetings

Members of the public, the Hunter and Trapper Association and the Hamlet in Arctic Bay hosted Working Group members on January 17 and June 4 2024. In January, 14 members of the Hunter and Trapper Association and Hamlet were present and 41 members of the public attended the meetings. In June, 10 members of the Hunter and Trapper Association and Hamlet were present while 11 adult members of the public attended.

Inuktitut interpretation was conducted by Audrey Qamaniq and Geela Ejangiaq. The meetings were held in the Community Hall in January and the Inuujaq School in June.



Arctic Bay public meeting June 2024.

What We Heard from Arctic Bay

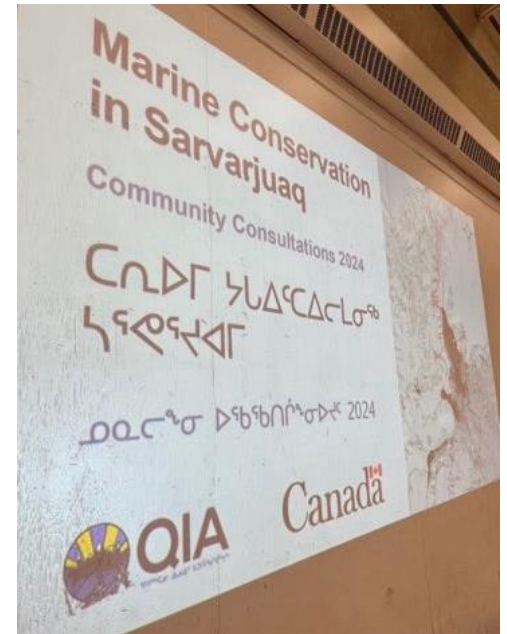
Community members in Arctic Bay requested information regarding the proposed regulations and potential benefits as well as the role of Arctic Bay as a result of developing the proposed Sarvarjuaq MPA. The QIA detailed their vision for a Regional Governance Model and expanding the Nauttisuqtiit Program and explained that the harvesting rights held by Beneficiaries of the *Nunavut Agreement* would not be impacted by the implementation of the proposed Sarvarjuaq MPA within the Nunavut Settlement Area. Comments highlighted that narwhal and bowhead whales travel to the proposed Sarvarjuaq MPA when the ice has formed elsewhere.

During the consultation meeting in June, Ikpiarjummiut voiced support for the protection of the proposed Sarvarjuaq MPA and shared concerns that if protection did not occur, some worried that mining in the area may be allowed in the future. Concerns were also raised about the level of vessel traffic in the area. Community members expressed interest in learning of future opportunities for community members to be hired in the research activities that occur in the proposed Sarvarjuaq MPA. Members of the public shared their preference for future meetings to occur in the late fall instead of the spring and summer.

Resolute Bay Meetings

The Working Group met with community members in Resolute Bay on January 14 and June 5 2024. In January, 14 members of the Hunter and Trapper Association and Hamlet attended the meeting with an additional 9 adult members of the public. In June, 9 members of the Hunter and Trapper Association and Hamlet joined the meeting with an additional 3 adult members of the public.

Inuktitut interpretation was conducted by Saroomie Manik and Susan Salluviniq. The meetings were held in the ATCO Conference Room in January and the Hamlet Gymnasium in June.



Sarvarjuaq Community Consultation presentation 2024

What We Heard from Resolute Bay

Resolute Bay community members expressed support for the protection of the proposed Sarvarjuaq MPA and pointed out additional areas outside of the proposed boundaries they desire to be protected in the future. Community members expressed interest in participating in discussions about the regulations of the area for the long-term. There was concern shared about unreported harmful activities in the area. Discussions included questions about some of the threats to Sarvarjuaq including how climate change is affecting the area. The meeting participants held a discussion about research and monitoring in the area, discussing gaps in research and how the long-term vision for an IPCA could address that. Presenters explained that there is currently a moratorium on oil and gas development in the area therefore it is not considered an ongoing activity and would not be allowed to occur in the area for up to 5 years if the Ministerial Order is established – community members expressed support for that restriction on industrial activities. During the public meeting a community member expressed a desire for long-term opportunities for vessel traffic in the area to address shipping and development needs. During the January meetings there were comments from community members expressing desire to restrict commercial fishing in the northern portion of the proposed Sarvarjuaq MPA to protect wildlife habitat. Participants also talked about the familial connections between Canada and Greenland in communities adjacent to the area and their use of the area for harvesting. There were concerns about increased ice melt in the area and how vessel traffic may negatively impact this area.

Grise Fiord Meetings

The Working Group members travelled to Grise Fiord on January 18 and June 6 2024. In January, 5 members of the Hunter and Trapper Association and Hamlet attended the meeting with an additional 12 adult members of the public. In June, 8 members of the Hunter and Trapper Association and Hamlet joined the meeting with an additional 8 adult members of the public.

Inuktitut interpretation was conducted by Jaypetee Akeeagok. The Hunter and Trapper Association and Hamlet meetings were held in the Hamlet Chambers while the public meetings were held in the Community Hall.



Grise Fiord, June 2024

What We Heard from Grise Fiord

The community raised concerns about the issue of community based capacity to participate in management structures for protected areas in general and there were a few questions regarding the management of Tallurutiup Imanga with Imaq. QIA provided some information on current governance models and the proposed Regional Governance Model. The community was interested to hear information about the collaborative activities between governments and researchers from Canada and Greenland.

Community members expressed worry for the risk of industrial accidents in the Sarvarjuaq area and the desire to benefit from economic activities occurring in the area. It was also noted that community members expressed support for protection of the proposed Sarvarjuaq MPA and want to see additional monitoring in the area however there was concern that the process was being rushed. QIA highlighted that for other protected areas, maritime situational training was offered to community members to help monitor the area.

Surveys

During the October 2023 and January 2024 first round of consultations to the 6 communities of Pond Inlet, Clyde River, Qikiqtarjuaq, Arctic Bay, Resolute Bay and Grise Fiord, surveys were handed out to community members present at the consultations, with 34 respondents in total. Unfortunately due to weather, the first public meeting in Qikiqtarjuaq was cancelled and thus surveys were not distributed in Qikiqtarjuaq. The survey consisted of three questions regarding the Conservation Objectives of the proposed Sarvarjuaq MPA by Ministerial Order.

For the first question, *‘Does this conservation objective describe a priority or a reason for you to support conservation in the area?’*, responses varied by community, but respondents generally shared comments that were supportive of the Conservation Objective. Pond Inlet residents said that they did not want shipping and other industrial activity occurring around their wildlife areas, that they supported protection because of the next generation and finding solutions, and also stated the Pond Inlet Hunter and Trapper Association needed a bigger freezer. Clyde River residents generally agreed with the Conservation Objectives, but also mentioned that they were seeing more activities such as cruise ships and yachts. Arctic Bay residents generally supported the Conservation Objectives, with people recognizing that the marine mammals they hunted overwintered in the proposed Sarvarjuaq MPA, and another being concerned that the area would become subject to increased marine traffic if not protected. Resolute Bay residents were also generally supportive, with respondents recognizing that the polynya’s open water helped the marine life they hunted, and describing conservation positively overall. Grise Fiord was also supportive of the Conservation Objectives, sharing that research helped them access and learn more about important areas, and another respondent saying that more protection was good.

For the second question, *‘Are there other words that could help you connect more to this conservation objective?’*, there were varied responses. Pond Inlet residents asked if there were websites to learn more, and said that the papers should ‘run’, wanting more information shared with the community. Clyde River respondents stated they wanted restriction or banning of cruise ships so people may connect more to the area. An Arctic Bay respondent said that they wanted to protect wildlife, sea birds, algae and fish. Community members in Resolute Bay said that areas need more study in order to have more support. A Grise Fiord respondent said ‘No. This Conservation Objective is good for us to have little to no knowledge of the area and land and ice we live in. It would be good to know what’s around us in.’

For the third question, *‘Is there anything else you would like to tell us?’* respondents had some suggestions. Pond Inlet respondents suggested that a round table be conducted in the future for engagement, and that they needed a store for equipment to sell country food. Clyde River respondents suggested that cruise ships should be banned or restricted from entering conservation areas, and asked if there was an inventory of marine mammals and ecosystems in the proposed MPA. Arctic Bay respondents stated they wanted rights maintained and not removed, and also mentioned that people use Admiralty Inlet year-round, including camping. Resolute Bay residents stated that the proposed Sarvarjuaq MPA was a wintering ground for animals and biodiversity needed to be more studied, and that icebergs go through that area, which residents use for drinking water. A Grise Fiord respondent said that, ‘With research, there is often Canadian Coast Guard vessel. The things from not only the emissions and noise contamination may keep away wildlife from their natural (untouched) habitats. The ice breakers may interfere with ice coverage, causing ocean to heat up and increase climate change effects.’

There were also eight questions that related to activities conducted either within the proposed Sarvarjuaq MPA boundaries and the Nunavut Settlement Area, or within the proposed Sarvarjuaq MPA boundaries but outside of the Nunavut Settlement Area.

1. *'Do you harvest or hunt for country food?'* 16 respondents said they did in Sarvarjuaq and the Nunavut Settlement Area, and 5 did in Sarvarjuaq but outside of the Nunavut Settlement Area.
2. *'Do you fish for your food?'*, 18 respondents said they did in Sarvarjuaq and inside the Nunavut Settlement Area, and 5 did within Sarvarjuaq but outside of the Nunavut Settlement Area.
3. *'Do you commercially fish?'*, 2 respondents said they did in Sarvarjuaq and in the Nunavut Settlement Area, and none did in Sarvarjuaq but outside the Nunavut Settlement Area.
4. *'Do you use the water for transportation, boating, canoeing or qajaq?'*, 20 respondents said they did in Sarvarjuaq and in the Nunavut Settlement Area, and 4 said they did in Sarvarjuaq but outside the Nunavut Settlement Area.
5. *'Do you use the ice for transportation, snowmobiling or dog sledding?'*, 21 respondents said they did in Sarvarjuaq and in the Nunavut Settlement Area, and 4 said they did in Sarvarjuaq but outside the Nunavut Settlement Area.
6. *'Do you use the area for recreation, camping, whale or bird watching?'*, 20 said they did in Sarvarjuaq and in the Nunavut Settlement Area, and 3 said they did in Sarvarjuaq but outside the Nunavut Settlement Area.
7. *'Do you bring tourist to the area for outfitting, guiding, or other types of tourism?'*, 6 respondents said they did in Sarvarjuaq and in the Nunavut Settlement Area, and 1 said they did in Sarvarjuaq but outside the Nunavut Settlement Area.
8. *'Do you use the area for other activities?'* some answers included, 'day trips'; 'film productions and scientific expeditions'; and several others said they don't go there because it is too far, too risky, too much open water, they don't have a machine, and it's too much fuel.

What We Heard Overall

Through the consultation meetings there was many similar questions and discussions. Below we summarized the topics that were discussed and the types of questions that were asked. Voice recordings were made during hamlet and Hunter and Trapper Association meetings with the permission of everyone present at the meetings. Members of the Working group also took notes during both the Hamlet/ Hunter and Trapper Association meetings and the public meetings. These notes and recordings helped develop this What We Heard Overall section, but not the information presented below is not word for word as it was presented in many different meetings and discussed by many different people.

General discussion on Sarvarjuaq MPA and process

- Question regarding timeline of Ministerial Order – is it guaranteed by 2025?
 - Response: Partners are working towards it, but recognize many steps must be completed first
- Question regarding upcoming federal election and how that may affect creation of MPA
 - Response: Commitments to Inuit within signed Inuit Impact and Benefit Agreements and Project Finance for Permanence will be upheld by the Government of Canada if they are finalized and implemented prior to the upcoming federal election. If these agreements are not finalized before the election, the elected government may choose not to advance these agreements and commitments promised may not be honoured by the new government. Similarly, if the Qikiqtaaluk and Sarvarjuaq study areas have not been designated by Ministerial Order regulations prior to the election, the elected government may choose not to pursue conservation measures for these areas.
- Community members' from all six communities expressed support for marine conservation in the proposed Sarvarjuaq MPA.
 - **Context:** *Formal support will be requested in the form of a letter from the Hunter and Trapper Associations and Hamlet Councils. Community members are encouraged to share their support and / or concerns with their Hunter and Trapper Association and / or Hamlet or contact DFO directly.*
- Comment on how elders in particular needs to be consulted accessibly in order for information to be shared in timely manner
- Discussions regarding protected rights secured under the Nunavut Agreement, including traditional harvesting rights
- Discussions regarding x negotiations status
- Question if enforcement will be in place once MPA is designated
 - Response: Interesting topic to discuss regarding options available for enforcement, based on community desire and jurisdictional ability.
- Question on when will the requests happen for support from Hunter and Trapper Associations and Hamlets?
 - Response: Once we finalize the What We Heard Reports, they will be distributed to all communities with time to review. During this time DFO will seek Letters of Support from Hunter and Trapper Associations and Hamlets.

Proposed Sarvarjuaq MPA Boundaries

- There were several questions regarding the boundaries of the proposed Sarvarjuaq MPA – how were they decided and if they can be extended further south?
 - Response: The QIA proposed the boundaries of the proposed Sarvarjuaq MPA as presented. There will be more discussions in the future to propose additional areas for marine protection.
- Discussions also occurred about the Devolution Agreement. Due to the Devolution Agreement small and enclosed bays are not included in the boundaries of the proposed Sarvarjuaq MPA.

Communication and Increased Community Involvement

All the suggested for increasing communication and increasing community involvement have been noted below. Certain suggestions have been implemented and others may be able to occur in the future.

- Recommendation to gather representatives from each of the consulted communities in Nunavut in person to discuss establishment and management.
- Request to send community representatives to the proposed Sarvarjuaq MPA by vessel in the future.
- Recommendation to gather consulted Nunavut communities with representatives from Greenland to discuss establishment, management and the future of Pikiyasorsuaq.
- Recommendation to provide a regular newsletter to community members P.O. boxes, the Hamlets and the Hunter and Trapper Associations.
 - **Updated Response:** *A newsletter has been started with the first newsletter sent to P.O. Boxes in May 2024.*
- Request to have more updates with the results of ongoing research activity in the area.
 - **Updated Response:** *A DFO scientists visited communities in February and March 2024 to provide updates on the research occurring in Sarvarjuaq. DFO will continue to provide more information about ongoing research.*

Importance of the Sarvarjuaq area

- Many comments about wildlife using Sarvarjuaq as a breeding area and an overwintering area. The value of wildlife travelling from Sarvarjuaq closer to communities.
- Comments about community members travelling and harvesting within the proposed boundaries of Sarvarjuaq.
- There were concerns shared about the potential of oil and gas development in the area and how it would negatively impact the wildlife.
- There were many concerns shared about increased vessel activity in Sarvarjuaq and near to communities. Especially the increase in pleasure crafts and yachts as well as cruise ships.
 - **Context:** *the Ministerial Order MPA discussed at these consultations would not restrict activities as it is an ongoing activity. However, this is something a long-term MPA could look at.*
- Comments about the desire for future economic activities in the area.

Community Priorities

- Through discussions, comments and the survey responses community members indicated interest in the following support:
 - Increased employment opportunities.
 - Increased opportunities for training (i.e. monitoring training, research activities).
 - Opportunities to discuss with other communities in both Canada and Greenland about the future management of the region.
 - Opportunities to be more involved in research in Sarvarjuaq.
 - Being more involved in the discussions for long-term management of the area.

Other Points of Discussion

There were several questions and topics that would require additional conversations or were outside the scope of the protected areas conversations.

Topics that can be discussed during long-term planning for the area include:

- Benefits that the communities will receive as a result of the Inuit Impact and Benefit Agreement negotiation for the proposed Qikiqtait and Sarvarjuaq MPAs.
- The management plan and structure and how to ensure the community has capacity to navigate management of multiple protected areas.

Topics that were outside the scope of a Marine Protected Area:

- Discussions surrounding the method of narwhal aerial surveys.
- Hiring community members to join research activities in and around the Sarvarjuaq area.
- Protecting the land adjacent to the MPA.

Next Steps

The next steps to pursue establishment of a new Ministerial Order MPA will be to seek stakeholder input on the proposal, seek formal community support, complete assessments and approvals needed under the Nunavut Agreement such as conformity determination by the Nunavut Planning Commission and Nunavut Wildlife Management Board approval, and complete DFO's regulatory process. Formal letters of support will be sought from community hamlets and Hunter and Trapper Associations. Community members are encouraged to communicate their feedback on the proposal to these organizations to inform their decision. DFO will notify communities and stakeholders prior to the proposal being published online in the Canada Gazette for a 30-day public comment period, additional input can be provided at that time as well.

It is important to us that we have summarized your input on this report correctly. If you feel that we have missed any input provided during our meetings or captured information incorrectly, please reach out to DFO.ArcticMPC-ArctiquePCM.MPO@dfo-mpo.gc.ca for any required corrections.

The Qikiqtait and Sarvarjuaq Working Group would like to thank all of the community members who attended these meetings - your feedback is vital and appreciated.

Thank you!

Appendix 1. Regulatory Intent for the Proposed Sarvarjuaq MPA

Regulatory Intent for the Proposed Sarvarjuaq Marine Protected Area by Ministerial Order

I. Background and Significance

Sarvarjuaq is the Qikiqtani Inuit name for the Canadian side of the North Water Polynya. It is an ecologically significant area located in Northern Baffin Bay between Greenland and Canada. In 2011, Sarvarjuaq was designated as an Ecologically and Biologically Significant Area (EBSA) by Fisheries and Oceans Canada (DFO) (DFO 2011, 2015). In 2013, the Inuit Circumpolar Council Greenland and Oceans North hosted a cooperative workshop called 'Pikialasorsuaq: Bridging the Bay', with participation from Canadian and Greenlandic communities, as well as researchers from both countries. From this workshop, the Pikialasorsuaq Commission was established to provide an informed Inuit vision for the future of the North Water Polynya. Their 2017 final report 'The Future of the Pikialasorsuaq', the Commission recommended Inuit led-conservation and management aimed at ensuring the long-term health of this important ecosystem.

The North Water Polynya has also been evaluated through other international processes led by Greenland and Denmark, emphasizing its unique cultural and ecological value. For instance, the polynya achieved the highest score and highest priority on the basis of the International Maritime Organization's (IMO) criteria for identifying 'Particularly Sensitive Sea Areas' (PSSA) in a national assessment of important and vulnerable marine areas in Greenland (Christensen et al. 2012, 2017). In another strategic effort to enhance area-based protection of Greenlandic biodiversity, an overview of areas of ecological and biological significance in West and South-East Greenland was prepared and published in 2016 by using the EBSA and other international criteria, to identify important areas in Greenland. The report identified 23 areas, including three within the North Water (Christensen et al. 2016).

Ecological Significance

The area is ecologically significant due to several factors:

- **Biodiversity:** The polynya supports a rich diversity of marine life, including phytoplankton, zooplankton, fish, seabirds, and marine mammals. Its open waters and high productivity provide abundant food resources, making it an important feeding ground for various species.
- **Primary Production:** The polynya experiences seasonal ice melt, creating open water areas that promote high rates of primary production. Phytoplankton blooms occur in these nutrient-rich waters, which form the base of the marine food chain and support the growth of other organisms.
- **Migration and Breeding Grounds:** Many species of birds, such as thick-billed murres, dovekies, and fulmars, rely on the North Water Polynya as a crucial stopover site during their migration. Additionally, several marine mammals, including bowhead whales, narwhals, and seals, utilize the polynya as a breeding and calving ground.
- **Climate Regulation:** The North Water Polynya influences the exchange of heat, gases, and freshwater between the ocean and atmosphere, thereby playing a role in local and regional climate dynamics. It helps regulate the formation of sea ice and influences ocean circulation patterns.

- **Traditional Knowledge:** The North Water Polynya holds significant cultural and ecological value for Inuit communities. They have traditional knowledge and sustainable practices associated with the polynya, which contributes to the conservation and preservation of its ecological significance.

Overall, the North Water Polynya serves as a unique and vital ecosystem, supporting diverse marine life, playing a role in regional climate dynamics, and providing cultural importance to Inuit communities.

Proposed Approach

Establishment of a Ministerial Order Marine Protected Area (MPA) under the *Oceans Act* has been proposed as an interim protection measure in Sarvarjuaq as a first step toward establishing long-term marine protection. While interim protection is in place, the Government of Canada will explore the options for a long-term conservation measures in the area with the Qikiqtani Inuit Association (QIA) and the Government of Nunavut. The consideration of long-term conservation measures will include an Inuit Protected and Conserved Area (IPCA).

The Ministerial Order MPA will allow the Minister of Fisheries, Oceans and the Canadian Coast Guard to freeze the footprint of human activities in the area for up to five years. This will mean that no new activities will be allowed in the area following designation. Any activities that have occurred, or were authorized to occur, in the proposed Sarvarjuaq MPA during the 12 months prior to designation are considered ongoing activities and will be allowed to continue in the proposed MPA.

II. Proposed Objectives for Sarvarjuaq

Conservation objectives are broad statements that describe what species or features in the protected area should be conserved. For an MPA under the *Oceans Act* conservation objectives need to refer to protecting or conserving marine species, unique habitats, high biodiversity, and/or the ecosystem. These objectives guide the interim nature of this work and long-term objectives will be developed, in the future.

The following objectives have been proposed for Sarvarjuaq. The second statement reflects DFO's commitment to the United Nations Declaration on the Rights of Indigenous Peoples Act Action Plan and the recommendations from the Qikiqtani Truth Commission.

- (1) To support the conservation, protection, and understanding of Sarvarjuaq (the North Water Polynya) and its unique biologically productive ecosystem that is of immense value to Inuit and Inuit culture.
- (2) To support Inuit leadership in the conservation of Sarvarjuaq to ensure the continuity of Inuit culture, values, and practices, including accumulating and passing down Inuit knowledge, as well as Inuit stewardship and governance.

III. Map and Boundaries

The proposed boundaries for Qikiqtait were put forward by QIA. These boundaries are shown in Figure 1. If established, Sarvarjuaq will be located inside and outside of the Nunavut Settlement Area, but within Canada’s Exclusive Economic Zone. The boundaries exclude Small Enclosed Bays as described in Chapter 1, Definitions and Interpretation of the Nunavut Lands and Resources Devolution Agreement signed January 18, 2024 between the Government of Canada and the Government of Nunavut and Nunavut Tunngavik Incorporated.



Figure 1. A map showing the boundaries of the proposed Sarvarjuaq MPA.

IV. Prohibitions and Allowed Activities

It is prohibited in the MPA to carry out any activity that disturbs, damages, destroys or removes from the MPA any unique geological or archeological features or any living marine organism or any part of its habitat, or is likely to do so.

However some activities would be allowed to occur. Activities listed below would be able to occur if Sarvarjuaq were to become an MPA by Ministerial Order:

- All rights provided for under the *Nunavut Agreement* are respected within the boundary of the Nunavut Settlement Area
- All ongoing activities (see list below) taking place one year prior to designation or activities that have otherwise been authorized to occur by applicable federal laws or by laws of a province/territory
- Research activities consistent with the conservation objectives of the MPA
- Safety, security and emergency activities
- Laying, maintenance and repair of cables and pipelines by a foreign state

Under the *Oceans Act*, DFO would implement an MPA by Ministerial Order by prohibiting any other activities from occurring during the period of the Order, up to five years.

V. List of Ongoing Activities

Ongoing activities can continue to occur if Sarvarjuaq becomes an MPA by Ministerial Order under the *Oceans Act*. The definition of an ongoing activity is any activity that has taken place one year prior to designation, or activities that have otherwise been authorized to occur by applicable federal laws or by laws of a province/territory.

Activities occurring within the proposed Sarvarjuaq MPA boundaries have been categorized into classes of ongoing activities which will be allowed in the MPA:

- Hunting and trapping activities
- Fishing activities
- Harvesting of marine plants
- Marine navigation activities
- National defence activities carried out by the Department of National Defence
- Canadian Coast Guard activities carried out by the Canadian Coast Guard
- Tourism activities
- Recreational activities
- Educational activities
- Travel over sea ice using motorized vehicles and non-motorized methods
- Traditional Knowledge and cultural research activities
- Scientific research activities
- Filming activities
- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

Please let us know if you are aware of another ongoing activity that is not captured in the list above.

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Appendix 2. Documented Activities Occurring in the Proposed Sarvarjuaq MPA

Activities We Heard From Communities and Stakeholders in the Proposed Sarvarjuaq MPA

Ongoing activities can continue to occur if Sarvarjuaq becomes an MPA by Ministerial Order under the *Oceans Act*. The definition of an ongoing activity is any activity that has taken place one year prior to designation, or activities that have otherwise been authorized to occur by applicable federal laws or by laws of a province/territory.

Activities documented as occurring within the proposed Sarvarjuaq MPA boundaries have been categorized and are listed below with some examples. These were informed through community consultations and stakeholder and industry engagement.

Hunting and Trapping Activities

- Hunting is of high importance to all communities near the proposed Sarvarjuaq MPA, and Inuit from these communities hunt marine mammal and bird species for subsistence, traditional, and commercial purposes. Hunting also occurs by non-Inuit who live near the proposed Sarvarjuaq MPA. Some examples include:
 - Narwhal are hunted from the floe edge and other open water;
 - Beluga are hunted by residents of Grise Fiord during summer and fall months.
- Hunting also occurs for tourism, recreation and sport hunting. This includes guided expeditions of non-Inuit hunters for species such as polar bear, wolves, and Atlantic walrus.
- Hunting is also a part of research, monitoring and stewardship programs. Examples include:
 - The Nauttisuqtiit program shares their harvests with Elders and the community to help Inuit access country food.

Fishing Activities

- Fishing occurs for subsistence, traditional and commercial use for fish and invertebrate species. It also occurs by non-Inuit who live near the proposed Sarvarjuaq MPA.
 - Arctic Fishery Alliance works with Arctic Bay, Grise Fiord, Resolute Bay and Qikiqtarjuaq to support access and travel to harvest country foods for community food security.
 - Baffin Fisheries' Inuit commercial fishing vessels Inuksuk I and Sivulliq harvest Greenland Halibut in Baffin Bay
- Commercial fishing licenses overlap between the North Atlantic Fishing Organization (NAFO) fishing division OA and the proposed Sarvarjuaq MPA. These licenses are for Greenland Halibut (*Reinhardtius hippoglossoides*).
- Commercial shrimp fishing is authorized in the Shrimp Fishing Area, SFA0, which overlaps with the proposed Sarvarjuaq MPA boundaries.
- Fishing occurs for tourism and recreational use, including guided expeditions of non-Inuit fishers.
- Fishing is also conducted for the purposes of scientific research, with an example being:
 - Research to determine commercial fisheries potential through Arctic Fishery Alliance, in partnership with Memorial University Marine Institute, Nunavut Fisheries Association, GN and the Canadian Northern Economic Development Agency.

Marine Plant Harvesting Activities

- Harvesting occurs for marine plant species for traditional and subsistence use. An example is residents of Grise Fiord harvesting kelp for consumption.

Marine Navigation Activities

- There is local vessel traffic for subsistence, traditional and/or community use, such as:
 - Boats and small motorized vessels;
 - Canoeing/qajaq or other non-motorized vessels.
- There is vessel traffic and associated activities for tourism and recreational use such as:
 - Outfitting;
 - Guided or self-guided sight-seeing expeditions;
 - Wildlife viewing;
 - Pleasure crafts, yachts and cruise ships.
- There is vessel traffic for commercial use such as:
 - Sealift/goods transportation.
- There is vessel traffic for research or monitoring, including but not limited to vessels such as:
 - CCGS Amundsen;
 - Vagabond research sailboat.
- There is also vessel traffic for National Defence, and Canadian Coast Guard activities.

Safety, Security, and Emergency Activities

- Safety, security, and emergency activities occur in the area for public safety, national defence, national security, or law enforcement. Examples include:
 - Emergency search and rescue;
 - Response to shipping or aircraft accidents;
 - National security requirements;
 - Activities carried out by the Department of National Defence;
 - Activities carried out by the Canadian Coast Guard.

Travel Over Sea Ice

- Inuit and non-Inuit use the sea ice as a method of travel in the proposed Sarvarjuaq MPA, for example:
 - Travel routes for hunting by snowmobile and motorized vehicles, including snowmobiles towing boats to floe edges to facilitate the hunts;
 - Non-motorized methods of travel such as dog-sledding, walking, snowshoeing, skiing etc.;
 - Travel routes to visit nearby communities, islands and important ecological features such as:
 - Into Baffin Bay to the floe edge for hunting purposes;
 - To some of the seven *aukkarniit* (polynyas) in the Canadian waters of Northern Baffin Bay and Davis Strait; and

Tourism and Recreational Activities

- Inuit and non-Inuit use the area for tourism and recreational activities such as:
 - Arts and culture;
 - Wildlife viewing;
 - Birdwatching;
 - Eco-tourism, cruise tourism and associated activities;
 - Dog-sledding;
 - Sport hunting;
 - Sport fishing;
 - Camping on sea ice or traveling to camp sites or cabins; and
 - Other outfitting or guided excursions.

Educational Activities

- Educational activities occur in the marine environment and over sea ice, such as outreach programs or experience based learning programs.

Research and Monitoring Activities

- Research and monitoring programs occur in the proposed Sarvarjuaq MPA from research vessels, or smaller vessels such as motorized boats, sailboats or Zodiacs, as well as research programs based on sea ice. Types of research and examples include:
 - Community-led monitoring programs such as those supported by SmartICE;
 - Nauttisuqtiit monitoring programs;
 - Academic research projects and programs supported by universities, colleges; and
 - Traditional knowledge research.

Filming Activities

- Other activities that have occurred within the proposed Sarvarjuaq MPA include filming and media content development. Activities may include:
 - Documentary film making;
 - Films by non-governmental organizations such as the World Wildlife Fund; and
 - Social media or social networking filming.



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Letters of Support for the Proposed Sarvarjuaq Marine Protected Area

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September DATE, 2024
October 25, 2024

To: C. Thomas Hoggarth
Executive Director, Marine Conservation
Arctic Region
Fisheries and Oceans Canada

Richard Paton
Assistant Executive Director
Marine & Wildlife Conservation
Qikiqtani Inuit Association

RE: Designation of a new Ministerial Order Marine Protected Area in Sarvarjuaq

I am writing to express support from the Ikajutit Hunters and Trappers for the establishment of a Ministerial Order Marine Protected Area (MPA) in Sarvarjuaq. It is our understanding that a Ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area in Sarvarjuaq that aligns with QIA's vision and Inuit interests for the region.

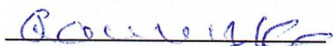
We acknowledge that the following classes of activities will be allowed in the MPA:

- Hunting and trapping activities
- Fishing activities
- Harvesting of marine plants
- Marine navigation activities
- National defence activities carried out by the Department of National Defence
- Canadian Coast Guard activities carried out by the Canadian Coast Guard
- Tourism activities
- Recreational activities
- Educational activities
- Travel over sea ice using motorized vehicles and non-motorized methods
- Traditional Knowledge and cultural research activities
- Scientific research activities
- Filming activities
- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

Our community will continue to be engaged during the process as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

We look forward to working with you to advance the consideration of long-term protection in Sarvarjuaq following the establishment of the Ministerial Order MPA.

Sincerely,



Ikajutit Hunters and Trappers



HAMLET OF ARCTIC BAY
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P.O. Box 150
Arctic Bay, NU
X0A 0A0
Phone: (867) 459-5917

To: C. Thomas Hoggarth
Executive Director, Marine Conservation
Arctic Region
Fisheries and Oceans Canada

October 18, 2024

Richard Paton
Assistant Executive Director
Marine & Wildlife Conservation
Qikiqtani Inuit Association

RE: Designation of a new Ministerial Order Marine Protected Area in Sarvarjuaq

I am writing to express support from the Arctic Bay Hamlet for the establishment of a Ministerial Order Marine Protected Area (MPA) in Sarvarjuaq. It is our understanding that a Ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area in Sarvarjuaq that aligns with QIA's vision and Inuit interests for the region.

We acknowledge that the following classes of activities will be allowed in the MPA:

- Hunting and trapping activities
- Fishing activities
- Harvesting of marine plants
- Marine navigation activities
- National defence activities carried out by the Department of National Defence
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- Scientific research activities
- Filming activities
- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

Our community will continue to be engaged during the process as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

We would like to remind the Department of Fisheries and Oceans that we have not heard anything about the promise made by the Federal Government and the QIA" (Part of the agreement Lancaster Sound Marine Conservations Tallurutiup Imanga area)" requesting a "small craft harbour "zone for Arctic Bay.

We look forward to working with you to advance the consideration of long-term protection in Sarvarjuaq following the establishment of the Ministerial Order MPA.

Sincerely,

O. NAQI-TARVIK
Mayor/ Arctic Bay Hamlet

October 29 2024

To: C. Thomas Hoggarth
Executive Director, Marine Conservation
Arctic Region
Fisheries and Oceans Canada

Richard Paton
Assistant Executive Director
Marine & Wildlife Conservation
Qikiqtani Inuit Association

RE: Designation of a new Ministerial Order Marine Protected Area in Sarvarjuaq

I am writing to express support from the Nangmoutaq Hunters and Trappers for the establishment of a Ministerial Order Marine Protected Area (MPA) in Sarvarjuaq. It is our understanding that a Ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area in Sarvarjuaq that aligns with QIA's vision and Inuit interests for the region.

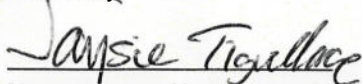
We acknowledge that the following classes of activities will be allowed in the MPA:

- Hunting and trapping activities
- Fishing activities
- Harvesting of marine plants
- Marine navigation activities
- National defence activities carried out by the Department of National Defence
- Canadian Coast Guard activities carried out by the Canadian Coast Guard
- Tourism activities
- Recreational activities
- Educational activities
- Travel over sea ice using motorized vehicles and non-motorized methods
- Traditional Knowledge and cultural research activities
- Scientific research activities
- Filming activities
- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

Our community will continue to be engaged during the process as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

We look forward to working with you to advance the consideration of long-term protection in Sarvarjuaq following the establishment of the Ministerial Order MPA.

Sincerely,



Nangmoutaq Hunters and Trappers



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October 29 2024

To: C. Thomas Hoggarth
Executive Director, Marine Conservation
Arctic Region
Fisheries and Oceans Canada

Richard Paton
Assistant Executive Director
Marine & Wildlife Conservation
Qikiqtani Inuit Association

RE: Designation of a new Ministerial Order Marine Protected Area in Sarvarjuaq

I am writing to express support from the Hamlet of Iviq Hunters and Trappers for the establishment of a Ministerial Order Marine Protected Area (MPA) in Sarvarjuaq. It is our understanding that a Ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area in Sarvarjuaq that aligns with QIA's vision and Inuit interests for the region.

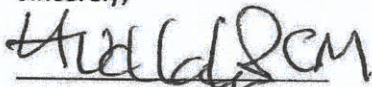
We acknowledge that the following classes of activities will be allowed in the MPA:

- Hunting and trapping activities
- Fishing activities
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- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

Our community will continue to be engaged during the process as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

We look forward to working with you to advance the consideration of long-term protection in Sarvarjuaq following the establishment of the Ministerial Order MPA.

Sincerely,



Iviq Hunters and Trappers



Hamlet of Grise Fiord
P.O. Box 77, Grise Fiord, NU
X0A 0J0

September 26, 2024

To: C. Thomas Hoggarth
Executive Director, Marine Conservation
Arctic Region
Fisheries and Oceans Canada

Richard Paton
Assistant Executive Director
Marine & Wildlife Conservation
Qikiqtani Inuit Association

RE: Designation of a new Ministerial Order Marine Protected Area in Sarvarjuaq

I am writing to express support from the Hamlet of Grise Fiord for the establishment of a Ministerial Order Marine Protected Area (MPA) in Sarvarjuaq. It is our understanding that a Ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area in Sarvarjuaq that aligns with QIA's vision and Inuit interests for the region.

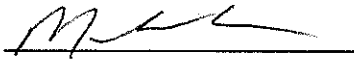
We acknowledge that the following classes of activities will be allowed in the MPA:

- Hunting and trapping activities
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- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

Our community will continue to be engaged during the process as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

We look forward to working with you to advance the consideration of long-term protection in Sarvarjuaq following the establishment of the Ministerial Order MPA.

Sincerely,



Mayor/ Grise Fiord Hamlet



Mittimatalik Hunters & Trappers Organization
P O Box 189, **Building 808-A**
Pond Inlet, Nunavut, XOA OSO
Tel: (867) 899-8856
Email: pond@baffinhto.ca

To: C. Thomas Hoggarth
Executive Director, Marine Conservation
Arctic Region
Fisheries and Oceans Canada

Richard Paton
Assistant Executive Director
Marine & Wildlife Conservation
Qikiqtani Inuit Association

RE: Designation of a new Ministerial Order Marine Protected Area in Sarvarjuaq

I am writing to express support from the Mittimatalik Hunters and Trappers for the establishment of a Ministerial Order Marine Protected Area (MPA) in Sarvarjuaq. It is our understanding that a Ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area in Sarvarjuaq that aligns with QIA's vision and Inuit interests for the region.

We acknowledge that the following classes of activities will be allowed in the MPA:

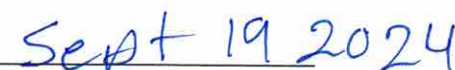
- Hunting and trapping activities
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- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

Our community will continue to be engaged during the process as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

We look forward to working with you to advance the consideration of long-term protection in Sarvarjuaq following the establishment of the Ministerial Order MPA.

Sincerely,


Mittimatalik Hunters and Trappers


Date

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X0A 0S0



Hamlet of Pond Inlet
P.O. Box 180
Pond Inlet, Nunavut
X0A 0S0

Date: September 26, 2024

To: C. Thomas Hoggarth
Executive Director, Marine Conservation
Arctic Region
Fisheries and Oceans Canada

Richard Paton
Assistant Executive Director
Marine & Wildlife Conservation
Qikiqtani Inuit Association

RE: Designation of a new Ministerial Order Marine Protected Area in Sarvarjuaq

I am writing to express support from the Pond Inlet Hamlet for the establishment of a Ministerial Order Marine Protected Area (MPA) in Sarvarjuaq. It is our understanding that a Ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area in Sarvarjuaq that aligns with QIA's vision and Inuit interests for the region.

We acknowledge that the following classes of activities will be allowed in the MPA:

- Hunting and trapping activities
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Our community will continue to be engaged during the process as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

We look forward to working with you to advance the consideration of long-term protection in Sarvarjuaq following the establishment of the Ministerial Order MPA.

Sincerely,


Joshua Idlout, Deputy Major

Hamlet of Pond Inlet, NU



October 28th, 2024

C. Thomas Hoggarth
Executive Director, Marine Conservation
Arctic Region
Fisheries and Oceans Canada

Richard Paton
Assistant Executive Director
Marine & Wildlife Conservation
Qikiqtani Inuit Association

RE: Designation of a New Ministerial Order Marine Protected Area in Sarvarjuaq

I am writing to express support from the Nattivak Hunters and Trappers Association for the establishment of a Ministerial Order Marine Protected Area (MPA) in Sarvarjuaq. It is our understanding that a ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area in Sarvarjuaq that aligns with QIA's vision and Inuit interests in the region.

We acknowledge that the following classes of activities will be allowed in the MPA:

- Hunting and trapping activities
- Fishing activities
- Harvesting of marine plants
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- Canadian Coast Guard activities carried out by the Canadian Coast Guard
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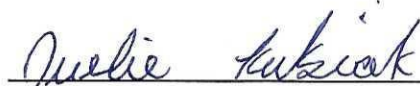
P.O. Box 10 Qikiqtarjuaq, Nunavut X0A 0B0
Telephone: (867) 927-8836 Fax: (867) 927-8525 E-mail: nattivak@baffinhto.ca

- Traditional knowledge and cultural research activities
- Scientific research activities
- Filming activities
- Activities provided for and carried out in a manner not consistent with the Nunavut Agreement

Our community will continue to be engaged during the process as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

We look forward to working with you to advance the consideration of long-term protection in Sarvarjuaq following the establishment of the Ministerial Order MPA.

Most Sincerely,



Juelie Kuksiak

Chairperson

Nattivak Hunters and Trappers Association



MUNICIPALITY OF QIKIQTARJUAQ

P. O. Box 4

Qikiqtarjuaq, NU X0A 030

Tel (867) 927-8832 Fax (867) 927-8120

October 2, 2024

To: C. Thomas Hoggarth
Executive Director, Marine Conservation
Arctic Region
Fisheries and Oceans Canada

Richard Paton
Assistant Executive Director
Marine & Wildlife Conservation
Qikiqtani Inuit Association

RE: Designation of a new Ministerial Order Marine Protected Area in Sarvarjuaq

I am writing to express support from the Qikiqtarjuaq Hamlet for the establishment of a Ministerial Order Marine Protected Area (MPA) in Sarvarjuaq. It is our understanding that a Ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area in Sarvarjuaq that aligns with QIA's vision and Inuit interests for the region.

We acknowledge that the following classes of activities will be allowed in the MPA:

- Hunting and trapping activities
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- Educational activities
- Travel over sea ice using motorized vehicles and non-motorized methods
- Traditional Knowledge and cultural research activities
- Scientific research activities
- Filming activities
- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

Our community will continue to be engaged during the process as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

September ~~DATE~~, 2024

October 30-2024

To: C. Thomas Hoggarth
Executive Director, Marine Conservation
Arctic Region
Fisheries and Oceans Canada

Richard Paton
Assistant Executive Director
Marine & Wildlife Conservation
Qikiqtani Inuit Association

RE: Designation of a new Ministerial Order Marine Protected Area in Sarvarjuaq

I am writing to express support from the Resolute Bay Hunters and Trappers for the establishment of a Ministerial Order Marine Protected Area (MPA) in Sarvarjuaq. It is our understanding that a Ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area in Sarvarjuaq that aligns with QIA's vision and Inuit interests for the region.

We acknowledge that the following classes of activities will be allowed in the MPA:

- Hunting and trapping activities
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- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

Our community will continue to be engaged during the process as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

We look forward to working with you to advance the consideration of long-term protection in Sarvarjuaq following the establishment of the Ministerial Order MPA.

Sincerely,



Resolute Bay Hunters and Trappers



Hamlet of Resolute Bay

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September 26, 2024

To: C. Thomas Hoggarth

Executive Director, Marine Conservation
Arctic Region
Fisheries and Oceans Canada

Richard Paton
Assistant Executive Director
Marine & Wildlife Conservation
Qikiqtani Inuit Association

RE: Designation of a new Ministerial Order Marine Protected Area in Sarvarjuaq

I am writing to express support from the Resolute Bay Hamlet for the establishment of a Ministerial Order Marine Protected Area (MPA) in Sarvarjuaq. It is our understanding that a Ministerial Order MPA, will freeze the footprint of ongoing activities in the area for up to five years. This time will allow the Qikiqtani Inuit Association (QIA), Government of Canada, and Government of Nunavut to explore an Inuit Protected and Conserved Area in Sarvarjuaq that aligns with QIA's vision and Inuit interests for the region.

We acknowledge that the following classes of activities will be allowed in the MPA:

- Hunting and trapping activities
- Fishing activities
- Harvesting of marine plants
- Marine navigation activities
- National defence activities carried out by the Department of National Defence
- Canadian Coast Guard activities carried out by the Canadian Coast Guard



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- Tourism activities
- Recreational activities
- Educational activities
- Travel over sea ice using motorized vehicles and non-motorized methods
- Traditional Knowledge and cultural research activities
- Scientific research activities
- Filming activities
- Activities provided for and carried out in a manner not inconsistent with the Nunavut Agreement

Our community will continue to be engaged during the process as to whether the area should be protected over the long term, on the boundary of the area being considered for protection, and type of protection recommended.

We look forward to working with you to advance the consideration of long-term protection in Sarvarjuaq following the establishment of the Ministerial Order MPA.

Sincerely,

DocuSigned by:

A4A719F40DF24B2...

Mayor / Resolute Bay Hamlet



SUBMISSION TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: X

Decision:

Issue

Information on the updated stock structure of Belcher Islands – Eastern Hudson Bay beluga following the 2023 genetic reanalysis.

Background

Belugas from the Hudson Bay-Strait complex have been harvested by Inuit for millennia. Beluga are of profound cultural significance and an important source of food security for northern residents.

Previous studies have suggested that some beluga populations undertake seasonal migrations, demonstrating a strong tendency to return to their natal summering areas every year, while other populations can be considered as resident, remaining in one area year-round. Knowledge of summering grounds and migratory routes are understood to be transmitted from older individuals to juveniles, and from mothers to their offspring, resulting in genetic structures among beluga populations defined by their summering location. There has been compelling evidence that beluga tend not to recolonize suitable summering habitat that was previously used as aggregation areas once they are abandoned or the local population is extirpated. Multiple populations mix at different times of the year, for example, during spring-fall migrations, or they may share overlapping wintering areas.

Beluga sampling programs have been in place in the Hudson Bay-Strait complex since the 1980s. The mitochondrial DNA (mtDNA) in the samples is analyzed to estimate the contribution of each population to the harvest outside of summering grounds and from fall to spring. Analysis of short sequences (234 base pairs haplotypes) from the mtDNA have allowed for the identification of four distinct populations in the Hudson Bay-Strait complex: Western Hudson Bay (WHB); Eastern Hudson Bay (EHB); James Bay (JAM); and Cumberland Sound beluga (CSB). Based on short haplotype analysis, most beluga harvested in Sanikiluaq were considered to be WHB animals. A 2023 reanalysis using longer mtDNA sequences (615 base pairs haplotypes) from the mtDNA identified a fifth distinct population in the Hudson Bay-Strait complex, which is harvested year-round by Sanikiluaq residents and was therefore named the Belcher Islands (BEL) beluga population (TAB 1). This newly identified BEL population summers within the geographic summer distribution area of EHB beluga. The spatial overlap between BEL and EHB beluga prevents estimating the abundance of these two populations separately. Therefore,

Fisheries and Oceans Canada (DFO) considers beluga summering between the eastern coast of Hudson Bay and up to 60 km west of the Belcher Islands to be a mixed BEL-EHB stock.

The last BEL-EHB stock assessment, carried out in 2021, suggests the stock has declined from 3,600-3,900 individuals in 2015 to 2,900-3,200 individuals in 2021 (i.e., ~3% per year), and that the decline is primarily attributed to unsustainable harvest levels throughout the BEL-EHB stock range (Tab 2).

Since the mid-1980s, harvesting restrictions have been in place to ease pressures on the Eastern Hudson Bay (EHB) beluga, which has been assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). BEL-EHB beluga are present in multiple jurisdictions. Management measures in the Nunavik Marine Region (NMR) and the shared zone with the Eeyou Marine Region (EMR) are detailed in the 2021-26 Nunavik Beluga Management System and include a total allowable take (TAT) of 20 beluga in the Eastern Hudson Bay Arc management zone and non-quota limitations in the rest of the NMR. The management system aims to ensure a 50% probability that the EHB stock remains stable at 2015 levels (the 2021 population abundance was not available at the time) after 5 years and recommends total annual removals of EHB not exceed 58 individuals. A voluntary summer closure between July 15 and September 30 has been in effect in Sanikiluaq since 2014 with the goal of reducing harvesting pressure on EHB beluga.

Implications

The 2023 genetic reanalysis indicates that a significant portion of beluga harvests previously assigned to the WHB population are instead from the BEL population. As such, the number of annual removals from the joint BEL-EHB stock has been underestimated. The identification of the BEL stock and the reanalysis of previous genetic samples has significant impacts on the harvest proportions in the Hudson Strait during the spring and fall migrations and around the Belcher Islands throughout the year (TAB 3). The genetic reanalysis suggests total removals by Nunavik and Nunavut harvesters of BEL-EHB across their range has been underestimated by over 80% between 1996 and 2022.

Consultations

An updated stock structure has been presented to the Sanikiluaq Hunters and Trappers Organization, the Nunavik Marine Region Wildlife Board (NMRWB), the Nunavik Anguvigaq, Makivvik, and the five Hudson Bay communities in Nunavik. DFO staff are planning a public meeting in Sanikiluaq to present the stock structure to the community, respond to questions, and gather feedback and concerns.

Recommendation

The NWMB may wish to consider scheduling a joint decision making process with the Nunavik Marine Region Wildlife Board (NMRWB) and the Eeyou Marine Region Wildlife Board (EMRWB) on the management of the shared BEL-EHB beluga stock.

Prepared by: Michael Hale – Fisheries Management - Fisheries and Oceans Canada – Arctic Region

Date: December 11, 2024

Attachments:

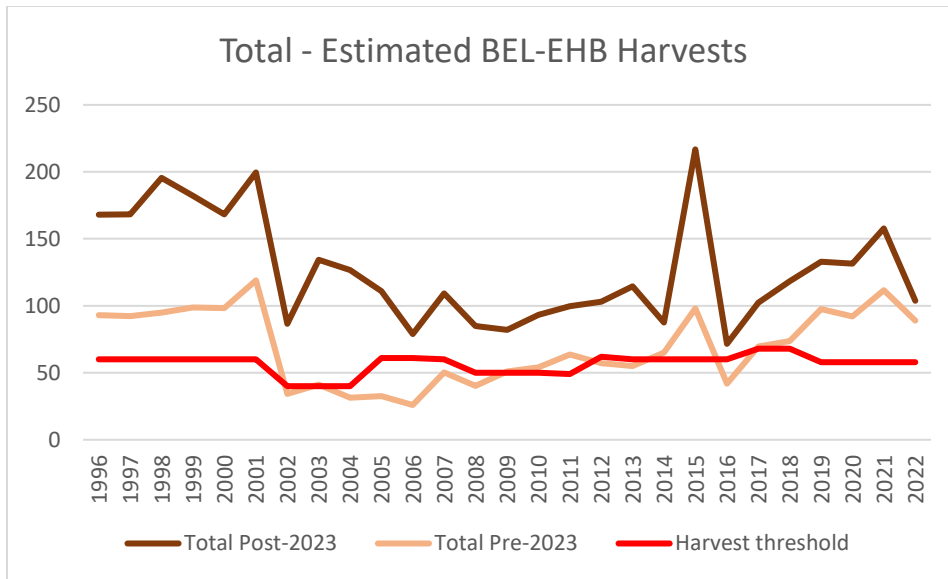
TAB 1 - [Re-examining populations of beluga in the Hudson Bay-Strait Complex and assessing the impact on harvests in Nunavik and Sanikiluaq management units](#)

TAB 2 - [Recovery Potential Assessment for Beluga \(*Delphinapterus leucas*\) Stocks in Nunavik \(Northern Quebec\)](#)

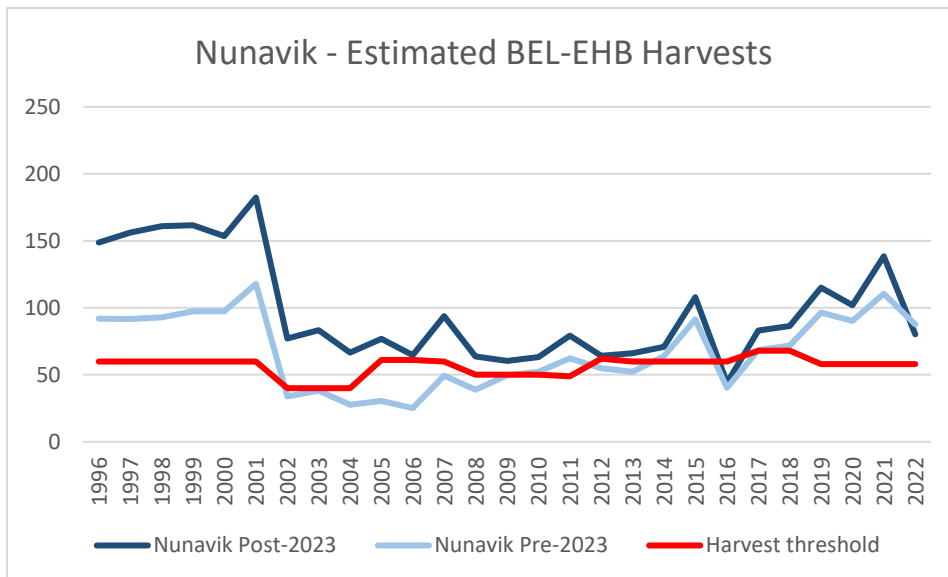
TAB 3 - ANNEX A – Graphs and tables (attached)

ANNEX A – Graphs and tables

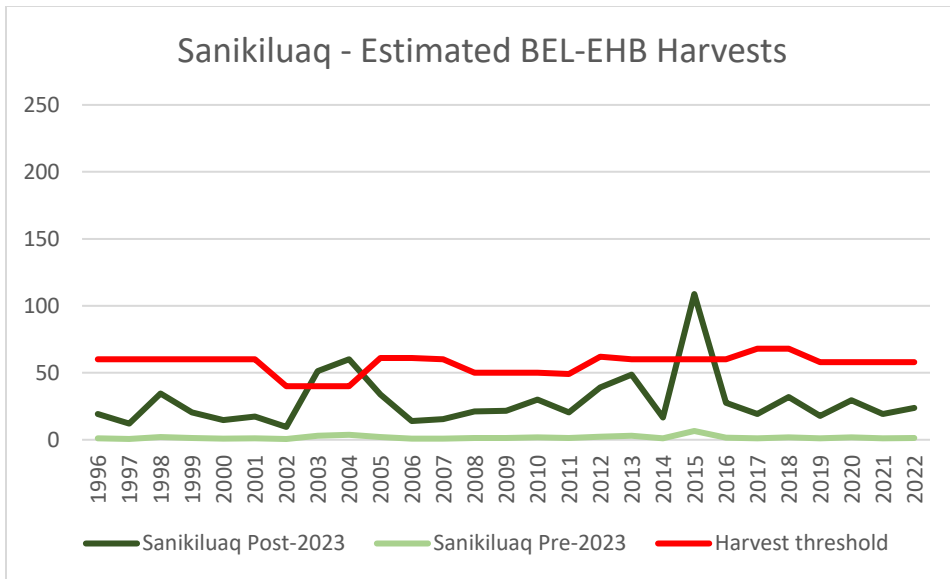
Graphs



Harvest statistics comparing estimated BEL-EHB harvest numbers pre and post 2023 genetic reanalysis. Total estimated BEL-EHB harvests in Nunavik and Sanikiluaq combined post-2023 reanalysis (dark orange) and pre-2023 reanalysis (light orange). The red line represents the Harvest Threshold of BEL-EHB animals, i.e. the maximum number of removals recommended by DFO to meet the management objectives.



Harvest statistics comparing estimated BEL-EHB harvest numbers pre and post 2023 genetic reanalysis. Total estimated BEL-EHB harvests in Nunavik post-2023 reanalysis (dark blue) and pre-2023 reanalysis (light blue). The red line represents the Harvest Threshold of BEL-EHB animals, i.e. the maximum number of removals recommended by DFO to meet the management objectives.



Harvest statistics comparing estimated BEL-EHB harvest numbers pre and post 2023 genetic reanalysis. Total estimated BEL-EHB harvests in Sanikiluaq post-2023 reanalysis (dark green) and pre-2023 reanalysis (light green). The red line represents the Harvest Threshold of BEL-EHB animals, i.e. the maximum number of removals recommended by DFO to meet the management objectives.

Figures and data from (Note: Harvest data from 1974-1995 has been excluded):

[Total Abundance and Harvest Impacts on Eastern Hudson Bay and James Bay Beluga 2015– 2022](#)

Tables

Nunavik – BEL-EHB harvest proportions before and after 2023 genetic reanalysis					
		Pre-2023 Reanalysis		Post-2023 Reanalysis	
Season	Zone	%WHB	%EHB	%WHB	%BEL-EHB
Spring (Feb1-Aug31)	Hudson Strait	82.9	11.7	75.7	12.3
	NE Hudson Bay	No data	No data	No data	No data
	Ungava Bay	87.4	6.0	87.8	4.7
Fall (Sep1-Jan31)	Hudson Strait	67.6	29.1	49.6	44.0
	NE Hudson Bay	49.1	44.5	37.3	50.1
	Ungava Bay	No data	No data	No data	No data

Sanikiluaq – BEL-EHB beluga harvest proportions before and after 2023 genetic reanalysis					
		Pre-2023 Reanalysis		Post-2023 Reanalysis	
Season		%WHB	%EHB	%WHB	%BEL-EHB
Spring		77	2	7	63
Summer		62	26*	0	100*
Fall		98	0	28	61
Winter		31	37	44	40

Past genetic mixture analysis (1982-2018) using the Pella-Masuda model to determine the proportions of beluga from WHB or BEL-EHB stock in the harvest of Nunavik and Sanikiluaq management units (format modified, from Hammill et al. 2021; BEL-EHB stock was identified as EHB population in the original document). WHB: Western Hudson Bay, EHB: Eastern Hudson Bay.

Tables and data from:

[Re-examining populations of beluga in the Hudson Bay-Strait Complex and assessing the impact on harvests in Nunavik and Sanikiluaq management units](#)

Acronyms:

BEL: Belcher Islands beluga

EHB: Eastern Hudson Bay beluga

BEL-EHB: Belcher Islands-Eastern Hudson Bay beluga

WHB: Western Hudson Bay beluga



Fisheries and Oceans
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et des océans

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Quebec Region

Re-examining populations of beluga in the Hudson Bay-Strait Complex and assessing the impact on harvests in Nunavik and Sanikiluaq management units

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Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

Belugas from the Hudson Bay-Strait Complex are harvested by hunters from Nunavik and Nunavut communities. In past studies, a genetic mixture analysis (GMA) was used to determine the contribution of animals from the Western Hudson Bay (WHB) and Eastern Hudson Bay (EHB) populations to harvests in the different management units. The population definition of WHB and EHB relied on short haplotypes from the mitochondrial (mt) DNA control region. However, studies with long haplotypes have shown that four populations could be identified in the Hudson Bay-Strait Complex. Here, we aim to 1) revisit the definition of populations within this area by resequencing and comparing short and long haplotypes for the mtDNA control region of 2 861 belugas, and 2) update the relative contribution of the newly-defined reference groups in management units using a GMA. Long haplotypes confirmed the existence of four previously defined populations, WHB, EHB, James Bay (JAM), and Cumberland Sound (CSB). They also allowed for the identification of a fifth population in the Belcher Islands (BEL). For the second objective, we tested the validity of the five populations using a leave-one-out approach and observed a high rate of erroneous assignments between EHB and BEL populations. Misassignments were due to shared genetic matrilineages and possible admixture during summer. Assignments were improved when EHB and BEL populations were combined in as a single reference named BEL-EHB stock. The GMA with the four new reference groups (WHB, JAM, CSB populations and BEL-EHB stock) led to higher proportions of the BEL-EHB stock in the fall harvest in Hudson Strait (5.6%) and Northeastern Hudson Bay (14.9%), and year-round in Sanikiluaq (3.3 to 61.2%), compared to previous studies using only two reference groups. Changes in reference groups, and not resequencing, likely caused most of the variation in the proportional estimate of the BEL-EHB stock in management units. Results from this study have increased the accuracy of the proportional contribution from reference groups to the harvest by the Nunavik and Nunavut (Sanikiluaq) communities.

INTRODUCTION

The beluga is a medium sized cetacean with an Arctic and sub-Arctic circumpolar distribution. Telemetry studies have shown that belugas in some areas undertake seasonal long-distance movements, whereas others can be considered as resident (O’Corry-Crowe et al. 2010). Belugas regularly exhibit philopatry to natal locations, in spite of persistent perturbations (Caron and Smith 1990; Smith et al. 1994; Lewis et al. 2009; Turgeon et al. 2012; Colbeck et al. 2013; Ouellet et al. 2021). The existence of genetic structure among belugas is likely a consequence of cultural and vertical transmission from mothers during repeated use of migratory routes, repeated seasonal movements, and preferred habitat (Brown Gladden et al. 1997; O’Corry-Crowe et al. 1997, 2002, 2010, 2018, 2020; de March et al. 2002, 2004; de March and Postma 2003; Meschersky et al. 2008, 2013; Turgeon et al. 2012; Colbeck et al. 2013; Skovrind et al. 2019). Other studies suggest a structure that is much more complex than just matrilineal dominance (Palsbøll et al. 2002; O’Corry-Crowe et al. 2020). It has been proposed that loss of some population components, particularly older animals, has resulted in loss of ecological knowledge within groups, and consequently limits potential for population recovery (O’Corry-Crowe et al. 2010, 2018, 2020; Colbeck et al. 2013; Whitehead 2017; Brakes et al. 2021; Bonnell et al. 2022).

Within the Hudson Bay-Strait Complex, genetic studies using the mitochondrial (mt) DNA control region (or D-loop) of beluga have identified distinct genetic groups, which are geographically segregated during the summer period (July and August, Fig. 1; de March et al. 2002, 2004; de March and Postma 2003). Early studies using short haplotypes (ca. 234 nucleotides) of the mtDNA control region identified that eastern Hudson Bay (EHB) and western Hudson Bay (WHB) animals had distinct haplotype compositions (Brown Gladden et al. 1997; de March et al. 2002, 2004; de March and Postma 2003). Later studies with longer haplotypes (ca. 609 nucleotides) have also suggested the genetic distinctiveness of individuals summering in James Bay (JAM) and Cumberland Sound (CSB, Turgeon et al. 2009; 2012; Postma et al. 2012; Postma 2017), which are considered to be year-round resident populations in their respective areas, showing little or no seasonal migration (Richard and Stewart 2009; Bailleul et al. 2012; Watt et al. 2020). In the Belcher Islands, both the existence of a local summer population and of an admixture of various beluga populations from Hudson Bay has been suggested (Turgeon et al. 2012; Postma 2017).

Philopatry to summering areas has led to the use of discrete summering aggregations as conservation units in the Hudson Bay-Strait Complex (e.g., Smith and Hammill 1986; Richard et al. 1990; Richard 2010; Mosnier et al. 2017). These conservation units have also been identified as Designatable Units (DUs), namely WHB, JAM, EHB, CSB, by the Committee on the Species of Endangered Wildlife in Canada (COSEWIC). These DUs are considered as discrete and evolutionarily significant units that would, if lost, likely not be replaced through natural dispersion (COSEWIC 2016).

Several Nunavik Inuit communities and some Nunavut communities hunt belugas for subsistence from an admixture of the EHB and WHB populations (Fig. 1). The EHB population numbers around 3,400 animals (Hammill et al. 2021), and was designated as Threatened by COSEWIC (2016). In contrast, the WHB population is an order of magnitude larger with approximately 54,000 animals (Matthews et al. 2017). Beluga harvests in Nunavik (northern Quebec) have been regulated using a combination of Total Allowable Takes (TAT), and seasonal and spatial closures, as defined in management plans, which are re-examined on a regular basis (Lesage et al. 2001).

In both Nunavik and Nunavut, hunters provide tissue samples from some of the belugas they harvest. These samples are haplotyped for the mtDNA control region to estimate the contribution of each population to the harvest in each of the defined management units (Fig. 2, de March and Postma 2003; Turgeon et al. 2009; Doniol-Valcroze et al. 2016; Mosnier et al. 2017). This information is then used to determine removals from the threatened stock summering in the Eastern Hudson Bay to remain within sustainability limits (Mosnier et al. 2017; Hammill et al. 2017; Hammill et al. 2021).

The proportion of belugas from different populations harvested in each of the management units in Nunavik and Nunavut (Sanikiluaq) are estimated using a genetic mixture analysis (GMA). In the past, the GMA was based on short mtDNA haplotypes and assessed the proportions of EHB and WHB populations harvested (Turgeon et al. 2009; Turgeon et al. 2012). This type of analysis was selected due to its robustness even with mtDNA haplotypes shared between populations (Turgeon et al. 2009; Doniol-Valcroze et al. 2016; Mosnier et al. 2017).

Only EHB and WHB populations have been used as references in past GMAs developed for the Nunavik and Sanikiluaq management units. Previous studies using three reference populations, namely WHB, EHB and CSB, suggested that a proportion of the belugas harvested by the southern Hudson Strait were from the CSB population (Turgeon et al. 2009; Turgeon et al. 2012). Those results were considered unlikely as the CSB population is quite small, on the order of ca. 1,000 animals, and is considered to remain in the Cumberland Sound area throughout the year. Instead, those results were attributed to haplotype sharing between WHB and CSB populations (Doniol-Valcroze et al. 2016; Marcoux et Hammill 2016). In recent assessments, WHB and EHB were therefore the only two populations considered in GMAs (Doniol-Valcroze et al. 2016; Mosnier et al. 2017; Hammill et al. 2021).

In this study, we sequenced all available samples collected between 1982 and 2021 to first re-examine the distinctiveness of populations in the Hudson Bay-Strait Complex by comparing short and long mtDNA haplotypes (Fig. 1). Previous studies extended the length of the control region sequenced from 234 to 609 nucleotides, which increased the number of variable nucleotides from 19 to 39 in samples from all of the Canadian DUs (Postma et al. 2012; Postma 2017). Short haplotypes were available on a large proportion of samples from animals harvested in the past four decades in the Nunavik and Sanikiluaq management units. In contrast, long haplotypes were originally only available for a subset of these samples due to time and funding limitations. We then estimated the proportional contribution of each of the newly-defined genetic groups to the harvest conducted in Nunavik and Sanikiluaq management units (Fig. 2). We contrasted these results with those obtained using only two reference populations and short haplotypes, and assessed the effect of resequencing on harvest allocations.

This document presents concepts from evolutionary biology and resource management, that can cause confusion in definitions. The terms “population” and “stock” have been associated with variable meanings in biology (e.g., Waples and Gaggiotti 2006; Stewart 2008; Cadrin 2020). In evolutionary biology, the term “population” is often used to define a group of interbreeding individuals that exist together in space and time (Waples and Gaggiotti 2006). For beluga, this definition of “population” captures the strong family genetic structure present geographically during the summer and the gregarious migration within the Hudson Bay-Strait Complex (Brown Gladden et al. 1997; de March et al. 2002, 2004; de March and Postma 2003; Turgeon et al. 2012). The expression “populations of belugas” also corresponds to the DUs used by COSEWIC for conservation efforts in Canada. In contrast, a stock is defined here as animals located in a management unit and may include more than one population. We consider a management unit as defined by a geographic area, restricted temporally, as used for harvest

management. Note that the stock definition varies within the primary literature and DFO documents.

METHODS

SAMPLES

Tissues from 2,861 belugas harvested, biopsy sampled, or tagged between 1982 and 2021 in or close to the Hudson Bay-Strait Complex were selected (Fig. 1). The exact location where each animal was harvested was usually unknown and was attributed to the area in which the harvest event occurred (Table 1, see Table S1 for detailed information on each sample). Sampling metadata is usually provided for each sample but for some, only harvest month and year were available.

Most tissues were preserved in a saturated salt solution containing 20% dimethyl sulphoxide (DMSO) and 0.5 mol/L ethylene diamine tetraacetic acid (EDTA, Seutin et al. 1991). Some samples were only frozen while others were frozen first and preserved later using the DMSO solution.

HAPLOTYPING

DNA was extracted from all samples using DNeasy Blood and Tissue kit (QIAGEN, Valencia, USA). The long (615 nucleotides) sequences of the control region of mtDNA were amplified using primers and PCR conditions from Postma et al. (2012), with Multiplex PCR Kit (QIAGEN, Valencia, USA). Sequencing was processed as in Postma et al. (2012) using an ABI 3130 sequencer (Applied Biosystems Inc., Foster City, USA) at Maurice Lamontagne Institute.

Consensus sequences using the forward and the reverse sequencing outputs were produced and manually edited using Geneious Prime 2020.1 (Biomatters, Ltd, Auckland, New Zealand). Sequences were then aligned using the *muscle* algorithm available for the package Biostrings 2.62.0 (Pagès et al. 2021, penalties for gap opening: 10000, extension: 400) in R (R Core team 2022). The limits of the short and long haplotypes corresponded to the following positions in the complete mtDNA control region (Lillie et al. 1996): 126 and 359 (short), and 38 and 652 (long). Single nucleotide polymorphism (SNPs) were identified using the R package adegenet 2.1.5 (Jombart 2008; Jombart and Ahmed 2011). Haplotypes were defined using sequences without missing base pairs or ambiguities at SNPs. Both short and long haplotype were designated with unique numbers according to sequence libraries (Table S2, Table S3).

DEFINING AND VALIDATING REFERENCE POPULATIONS

To define reference populations, we first characterized the genetic composition of each summering area with a haplotype network (statistical parsimony network, PopART, Leigh and Bryant 2015) and in terms of number of polymorphic sites, number of haplotypes, private haplotypes (i.e., haplotypes specific to a summering area or a reference population), and haplotype diversity (adegenet and pegas 1.1 packages in R, Jombart 2018; Paradis 2010). The genetic distinctiveness between summering areas was also assessed with principal component analyses (PCAs) using haplotype frequencies (ade4 1.7.16 package, Dray and Dufour 2007).

We then evaluated the validity of genetically distinct populations as reference groups for a genetic mixture analysis (GMA). A self-assignment test was performed using the leave-one-out procedure (Anderson et al. 2008), which is available within the rubias 0.3.2 R package (Moran and Anderson 2019). Unique numbers of long haplotypes were used as input to the leave-one-out algorithm. The output is the posterior probability (hereafter, probability) of

assigning a specimen to each reference group. We used the results to quantify the proportion of specimens that were correctly assigned to their original reference population at four probability thresholds: $\geq 95\%$, $\geq 80\%$, $\geq 60\%$, and $\geq 40\%$. In an ideal system, a well-defined reference population would result in a high accuracy (probability threshold $\geq 80\%$) of assignment for a high proportion (e.g. $> 80\%$) of the specimens. However, such accuracy is rarely achievable using a single genetic marker.

GENETIC MIXTURE ANALYSES (GMA) OF HARVESTS IN MANAGEMENT UNITS

The proportions of individuals belonging to reference groups per management unit or per period were estimated with a GMA performed using SPAM version 3.7b (Debevec et al. 2000; Alaska Department of Fish and Game 2003) as in Turgeon et al. (2009a).

Standard errors were also computed using a leave-one-out jackknife resampling procedure to remove, at each iteration, individuals hunted on the same date in the same area and account for autocorrelation between samples (as previously done by Doniol-Valcroze et al. 2016).

The Pella-Masuda Bayesian mixture analysis method was selected in SPAM to allow for the possible occurrence of unknown reference groups (see Mosnier et al. 2017). Unknown reference groups may contribute to the harvested belugas, as in previous assessments.

In Hammill et al. (2021), GMA reference groups EHB and WHB were based on 206 and 132 individuals, respectively. In 2022, we used the sequences from 186 and 318 reference individuals for EHB and WHB, respectively. Reference individuals used in Hammill et al. (2021) and this study were identical for 98% for EHB (N = 183) and for 13% (N = 41) for WHB.

RESULTS

HAPLOTYPING

We obtained 2,861 high quality (no ambiguity) haplotypes from samples collected in 12 areas (Fig. 1, Table 1). A total of 43 short and 126 long unique haplotypes were identified from the 2,861 sequences (Table S1, Table S2, Table S3). Individuals from South Hudson Strait (SHS) and South West Hudson Bay (SWH) represented the largest (N = 1,372) and smallest number (N = 17) of individuals per area (Table 1), respectively.

From the 2,861 individuals, a subset of 1,600 individuals were haplotyped for the short control region by both the Freshwater Institute (FWI) and Maurice Lamontagne Institute (MLI) facilities. The FWI and MLI facilities identified 35 and 33 short haplotypes, respectively. Thirty haplotypes, the most common haplotypes, were common to both datasets. Differences in haplotyping increased steeply from 1.5% for the two most abundant haplotypes to 4.9% for the six most abundant haplotypes, and 7.0% for all possible comparisons (i.e., 25 haplotypes with two or more samples; Fig. 3).

REVALUATING POPULATION STRUCTURE IN THE HUDSON BAY-STRAIT COMPLEX

Multiple complementary approaches were used to identify populations of beluga in the Hudson Bay-Strait Complex. Using a subset of 1,136 individuals sampled during July and August from 11 areas (Table 1) we first investigated the haplotypic specificity of animals within summering areas using networks with both haplotype lengths. Eastern and western haplogroups were separated by two and four mutations for the short and the long haplotype networks, respectively (Fig. 4). In both the long and short haplotype networks, the vast majority of Eastern Hudson Bay (EHB) beluga samples had a haplotype from the eastern haplogroup (77% for both lengths).

The western haplogroup included mostly samples from Western Hudson Bay (WHB; North Hudson Bay: NHB, North West Hudson Bay: NWH, and South West Hudson Bay: SWH) but also those from all other summering areas. Haplotypes highly specific to Cumberland Sound (CSB) were observed in both networks in the western haplogroup (e.g., short: HS014; long: HL024; Fig. 4). Haplotypes highly specific to James Bay (JAM) and Long Island (LON) were observed in both haplogroups (e.g., short: western HS029, eastern HS017, Fig. 4a; long: western HL070, eastern HL038, Fig. 4b). In all regions, the number of haplotypes, the haplotype diversity, and the number and proportion of private (only present in one summer area, Fig. 1) haplotypes were higher for long than short haplotypes (Table 2). The highest proportion of private haplotypes for both haplotype lengths was observed in CSB (Table 2). The haplotypic diversity in JAM was the lowest using both haplotype lengths. For the short haplotype, only CSB had a proportion of private alleles > 5%. For the long haplotypes, CSB, LON, NWH, and EHB all had proportions of private haplotypes > 5% (Table 2). Using long haplotypes, the high haplotypic specificity of animals within summering areas suggests that WHB, JAM, LON, EHB, and CSB form different populations.

The principal component analyses (PCAs) identified different numbers of distinct summering aggregations using frequencies of short and long haplotypes. For the short haplotypes, the PCA results showed three groups, consisting of EHB, JAM/LON, and all other summer aggregations (Fig. 5a). For the long haplotypes, EHB, JAM, LON, and Belcher Islands (BEL) were each separated from all other summering aggregations (NHB, NWH, SWH, South Hudson Strait: SHS, Ungava Bay: UNG, Frobisher Bay: FRB, CSB), indicating five distinct genetic groups (Fig. 5b). For the long haplotypes, JAM and LON have very similar haplotype frequencies (Table S4). In addition, the two most abundant haplotypes in JAM and LON were the same (HL008, HL070; Fig. 5b, Table S4). These results suggest that JAM and LON form a single population (JAM population will include LON individuals hereafter). In contrast, the two most abundant haplotypes in EHB (HL009, HL016) are different from those of BEL (HL001, HL022; Table S4). We tested further if BEL animals differed from other genetic groups with a third PCA of long haplotype frequencies from populations (EHB, WHB, JAM, CSB) and from management units (considering areas and seasons; Fig. 2). In this PCA, WHB, JAM, EHB, and CSB populations separated from each other (Fig. 6). Haplotype frequencies from BEL across the four seasons formed a separate cluster from other genetic groups in the PCA (Fig. 6), also suggesting that a distinct population inhabits the Belcher Islands.

Five populations were identified within the summering areas with long haplotypes, namely WHB, JAM, EHB, BEL, and CSB. The leave-one-out approach showed an increasing proportion of correct assignment to reference groups with decreasing threshold of posterior probability, except for the CSB population which plateaued at 39.1% at a $\geq 60\%$ probability threshold. Such a result is expected since the CSB population shares multiple haplotypes with WHB (Fig. 6). A large proportion (> 75%) of individuals was assigned correctly to WHB and JAM populations at a $\geq 40\%$ probability threshold (Table 3). In contrast, lower proportions of individuals were assigned to the EHB (69.4%) and BEL (19.7%) populations at a $\geq 40\%$ probability threshold (Table 3). Grouping EHB and BEL populations as BEL-EHB stock increased the proportion of reassignments to BEL-EHB stock (84%) at a $\geq 40\%$ probability threshold (see “Four populations and BEL-EHB stock” in Table 3). Proportions of correct assignments were identical for WHB, JAM and CSB at all probability thresholds for both assignment tests (Table 3).

ESTIMATING HARVESTED PROPORTIONS OF REFERENCE GROUPS IN MANAGEMENT UNITS

We estimated the proportions of new reference groups (WHB population, JAM population, BEL-EHB stock, and CSB population) harvested by the Nunavik and Sanikiluaq communities in

the different management units using the long haplotypes. The proportions of animals from the BEL-EHB stock harvested in Hudson Strait (12.3%) and Ungava Bay (4.7%) in spring were similar to previous estimates (Hudson Strait: 11.7%, Ungava Bay: 6.0%, Tables 4 and 5). Increases of proportion EHB beluga harvested were observed in the fall for Hudson Strait (44.0%) and Northeastern Hudson Bay (50.1%), respectively, compared with the previous estimates (Hudson Strait: 29.1%, Northeastern Hudson Bay: 44.5%, Tables 4 and 5). In Hudson Strait, dividing the fall samples into a finer time scale did show that the proportion of BEL-EHB stock in harvest declines late in November (Table 7). We observed the largest increases, ca. 60%, in the proportion of BEL-EHB stock harvested, in samples from the spring and fall from Sanikiluaq (Tables 4 and 5). Similar proportions of harvested BEL-EHB stock were observed between the current estimates and the previous assessments (Tables 4 and 5).

The JAM or CSB populations represented small proportions of harvested animals in the Northeastern Hudson Bay, Hudson Strait, and Ungava Bay management units (Table 5). In these management units, the highest proportion of JAM and CSB populations were harvested in Northeastern Hudson Bay in fall and Hudson Strait in spring, respectively. In Sanikiluaq, the JAM population was more frequent in spring and winter harvests compared to those of fall (Table 5). No CSB animals were harvested in Sanikiluaq (Table 5).

In all management areas, the proportion of individuals associated with an unknown population is significantly lower than in the last assessment, especially Sanikiluaq in spring and winter. (Tables 4 and 5). The proportions of unknown were still the highest in the Sanikiluaq management units with the current estimates (Table 5).

QUANTIFYING THE EFFECT OF CHANGES ON GMA

We quantified the effect of resequencing and changes in reference populations on estimates of the proportion of BEL-EHB stock in the harvest per management unit (short haplotypes from 1,517 individuals). The resequencing effect resulted on average in a 4.3% (\pm SEM 1.0%) change in the estimated proportion of BEL-EHB stock harvested per management unit. The largest resequencing effect (12.0%) on the proportion of BEL-EHB stock harvested was observed in Sanikiluaq during winter (Table 6).

DISCUSSION

In this study, we revisited the short and long mtDNA control region sequences and refined the number of populations from four to five within the Hudson Bay-Strait Complex. Our results using the long haplotypes confirm that WHB, JAM, EHB, and CSB are distinct populations. It also identifies that beluga harvested around the Belcher Islands (BEL), have a genetic composition that is distinct from WHB. From a conservation perspective, the BEL population should be considered as a newly described distinct evolutionary unit, i.e. another Arctic beluga population. However, the performance of the GMA when BEL and EHB populations were used as independent references was reduced by haplotype sharing between the two. It is also currently impossible to separately estimate the abundance of BEL and EHB beluga since they overlap spatially and temporally during summer surveys. Therefore, a more parsimonious approach is to consider the combined abundance of the BEL and EHB populations as a BEL-EHB stock from both stock assessment and management perspectives. The greatest impact of combining the BEL and EHB populations was the increased proportions of BEL-EHB stock animals harvested year-round in Sanikiluaq management unit. In Nunavik, the increase in estimates of BEL-EHB stock harvested over the season is variable, but it is larger in fall in northeastern Hudson Bay compared to the Hudson Strait. Altogether, this study provides a more reliable tool for the management of all of the DUs in the Hudson Bay-Strait Complex (COSEWIC 2016).

FIVE POPULATIONS IN THE HUDSON BAY-STRAIT COMPLEX

Our results confirm that the mtDNA control region can characterize population structure of beluga summering populations in the Hudson Bay-Strait complex (Brown Gladden et al. 1997; de March and Postma 2003; Turgeon et al. 2012; Postma 2017). They also confirm the separation of haplotypes into two haplogroups that are broadly geographically restricted, i.e., western and eastern haplogroups (Postma 2017). WHB and EHB populations were detected, confirming results from past studies (Turgeon et al. 2009; Turgeon et al. 2012). Our findings also highlight the necessity to consider three new populations in the Hudson Bay-Strait Complex, namely JAM, CSB, and BEL. Their genetic composition using the long haplotypes is distinct from those of WHB and EHB.

Analyses of long haplotypes highlighted the specificity of the JAM population, which was also observed in previous studies (Postma et al. 2012; Postma 2017). Our study also showed the similarity between the haplotype frequencies of JAM and LON individuals during summer. Previous studies suggested the presence of individuals with haplotypes from the EHB haplogroup in LON area during summer (Postma et al. 2012; Postma 2017). Although this is consistent with our results, JAM and LON have similar most abundant haplotypes, which are different from those of EHB. JAM and LON have highly specific haplotypes from both western (e.g., HL070, HL072, HL074) and eastern haplogroups (e.g., HL038). Together, those results suggest that the majority of individuals harvested from LON are part of the JAM population. This is consistent with the current management framework which groups catches from the Long Island area with those from James Bay (Fig. 1b).

The CSB population had the highest proportion of private haplotypes with both the short and long haplotypes. There was also a large proportion of haplotypes shared with the WHB population, which is consistent with previous studies (de March et al. 2002, 2004; Turgeon et al. 2009; Turgeon et al. 2012; Postma 2017). Satellite telemetry data indicate that CSB beluga whales form a distinct population that inhabits the area year round (Richard and Stewart 2009). Alternatively, traditional knowledge indicates that different types of beluga whales visit CSB each year (Kilabuk 1998; Watt et al. 2020). The mixed composition observed in the summer in CSB could reflect both telemetry and traditional knowledge information, and may suggest the occurrence of both migratory and resident individuals.

The analyses of the long haplotypes identified BEL individuals as forming a distinct population. With the short haplotype, the BEL population was grouped with the WHB population, mostly due to haplotype sharing. However, the long haplotype showed that the most abundant haplotypes from the western haplogroup differed between the WHB (HL003) and BEL (HL001) populations. Moreover, BEL did not share its two most abundant haplotypes with EHB, although they shared a few non-abundant haplotypes that are part of the eastern haplogroup. These results support those from previous studies showing that 20% of individuals harvested in the Belcher Islands had private or highly specific long haplotypes or mitogenomes (Turgeon et al. 2012; Postma 2017). The larger sample sizes used in the present study show that the Belcher Islands belugas form a distinct population, similar to other DUs of beluga in the Arctic (COSEWIC 2016).

No reference population was identified in other summering areas, namely SHS, UNG and FRB. In these areas, the two most abundant haplotypes were HL001, and HL003, which are abundant haplotypes in the WHB population. There were no or few private haplotypes detected for the long sequences in SHS, UNG, and FRB, suggesting that there are no endemic populations summering in these areas. The Hudson Strait is acknowledged as a migration corridor and a wintering area for the WHB and EHB populations (Finley et al. 1982; Bailleul et al. 2012). However, it also appears that individuals form a mixture of the WHB and EHB populations summer in the Hudson Strait area. These represent very few animals detected in summer aerial

surveys in Hudson Strait during the 1980s, 2008 and 2010, but survey effort has been limited in this area (Fig. 7, Finley et al. 1982; Gosselin et al. 2009; Gosselin, J.-F. personal observations).

FOUR REFERENCE GROUPS IN THE HUDSON BAY-STRAIT COMPLEX

We identified four valid reference groups for the GMA when considering a $\geq 40\%$ probability threshold for self-assignment rates: the WHB, JAM, and CSB populations and the BEL-EHB stock. Self-assignment rates were high for WHB and JAM either with five reference populations or four reference groups. These results are in agreement with previous studies highlighting that WHB and JAM populations had distinct genetic compositions (Turgeon et al. 2012; Postma et al. 2012; Postma 2017). With both sets of reference groups, CSB self-assignment rates were lower (39%) than those of WHB and JAM at a $\geq 40\%$ probability threshold. Private haplotypes and a large proportion of haplotypes shared with WHB explain these low self-assignment rates for CSB, which are also consistent with previous studies (Turgeon et al. 2009; Turgeon et al. 2012). Self-assignment rates were poor (19.7%) for the BEL population and acceptable (69.4%) for the EHB population when considering five reference populations. This is likely due to sharing between the BEL and EHB populations of multiple non-abundant haplotypes from the eastern haplogroup. Haplotype sharing between BEL and EHB populations may be due to shared lineages. Alternatively, telemetry research has shown movement between the mainland and the Belcher Islands (Bailleul et al. 2012).

The use of EHB and BEL summering individuals as a single reference group, identified as a BEL-EHB stock, considerably improved the self-assignment rates. The term “BEL-EHB stock” is used here to define the grouping of BEL and EHB populations and describe the genetic composition of animals summering in eastern Hudson Bay that are counted during aerial surveys (St-Pierre et al. in prep.¹). In past documents (e.g., Hammill et al. 2017; 2021), the animals summering in these areas were described under the term “EHB stock”. The use of the term “BEL-EHB stock” now captures the change in the definition of the genetic composition of those animals, indicating the combination of two populations within a same space (eastern Hudson Bay).

HARVESTED BEL-EHB STOCK INCREASED IN SOME MANAGEMENT UNITS

The large increases in the proportions of beluga harvested from the BEL-EHB stock observed in Sanikiluaq was mainly due to the addition of the BEL population to the BEL-EHB stock. The capacity of the long haplotype to discriminate BEL from WHB populations allowed for an improved genetic definition of belugas summering in the eastern Hudson Bay region. Using short haplotypes, previous assessments identified animals harvested year round in the Belcher Islands mostly as WHB animals (e.g. Hammill et al. 2021). Results from this study using long haplotypes support the hypothesis that harvests of beluga by the Sanikiluaq community are mostly from a population specific to the Belcher Islands (Turgeon et al. 2012; Postma 2017). This analysis also shows that previous analyses have likely underestimated the impact of harvesting on animals summering in the eastern Hudson Bay area.

Within Nunavik management units, the proportion of belugas harvested during the spring hunt in Ungava Bay and Hudson Strait pertaining to the BEL-EHB stock were similar to past estimates. The 4.7% BEL-EHB stock estimated in the Ungava Bay spring hunt corresponds approximately to the 6% ratio in abundance estimates between the BEL-EHB stock and WHB populations

¹ St-Pierre, A.P., Gosselin, J.-F., Mosnier, A. and Hammill, M.O. Abundance estimates for beluga (*Delphinapterus leucas*) in James Bay and the Belcher Islands-eastern Hudson Bay area in summer 2021. DFO Can. Sci. Advis. Sec. Res. Doc. In preparation.

(6% = 3300/(3300+54000), Matthews et al. 2017; Hammill et al. 2021). However, the proportions of BEL-EHB stock estimated in the spring hunt in Hudson Strait and in the fall hunt in Hudson Strait or Northeastern Hudson Bay were larger. In the latter areas, approximately half of the harvested animals are estimated to belong to the BEL-EHB stock, representing a much greater proportion than expected based on the relative size of the BEL-EHB and WHB populations. The estimated proportion of BEL-EHB stock animals in the fall hunt in Hudson Strait and Northeastern Hudson Bay is also higher than in the previous assessment. Considering that the BEL population is now contributing to the definition of the genetic composition of the BEL-EHB stock, this result suggests that a fraction of the BEL population may also migrate out of the Hudson Bay along with individuals from the EHB population. The other fraction of the BEL population likely overwinters in the Belcher Islands, as animals harvested during winter had similar genetic composition to those harvested in summer. In Hudson Strait, sample sizes were large enough to test for changes in the proportion of BEL-EHB stock animals in the hunt during November. Proportions of BEL-EHB stock were high (51.5%; 95% confidence interval: 39.0-63.9%) in early November and decreased to 10.4% late November (95% confidence interval: 0.9-29.5%; Table 7).

PROPORTIONS OF JAM, CSB, AND PUTATIVE OTHER POPULATIONS WERE LOW IN ALL MANAGEMENT UNITS

Small proportions of JAM and CSB populations were harvested in Hudson Strait, Ungava Bay, and Northeastern Hudson Bay, while a larger proportion of the JAM population was harvested by the Sanikiluaq community during the spring and winter. Some individuals of the JAM population may overwinter near Belcher Islands in areas of loose ice (polynya) (McDonald et al. 1997). We also observed smaller proportions of the JAM population in Hudson Strait in spring and in Northeastern Hudson Bay in fall, suggesting the movement of some JAM belugas outside of James Bay and Belcher Island areas. These results contrast with telemetry data obtained from 23 animals tagged in James Bay that showed no seasonal migration (Bailleul et al 2012); however, the number of tagged animals was small relative to the overall estimated population of 19,200 animals and likely captures only a fraction of the possible movement patterns of animals in this population (Hammill et al. in prep.²). In contrast, we did not detect any individuals from the CSB population in Hudson Bay, in agreement with a previous study (Turgeon et al. 2012). The presence of CSB animals in Hudson Strait and Ungava Bay is interesting and has been reported elsewhere. This underlines the complexity of beluga social behavior where some animals may be resident, while others may undertake larger scale migrations (Richard and Orr 1986; de March et al. 2004; O’Corry-Crowe et al. 2010, 2020). Note that the GMA may underestimate harvest of the CSB population for individuals bearing frequent haplotypes in the WHB population. We did not encounter a bias from the WHB population towards the CSB population with the GMA, whereas this bias was important for the management regions from the Eastern Hudson Bay in a past study (Doniol-Valcroze et al. 2016). The larger number of reference individuals from WHB has likely limited this effect.

Proportions of unknown reference groups were lower than those from the past genetic mixture analyses in most management units. This can be explained by the incorporation of the BEL population into the BEL-EHB stock. Still, proportions of unknown reference groups were larger in the Sanikiluaq management units. We examined the haplotype frequencies of Sanikiluaq harvest samples in spring, fall, and winter. The large proportion of HL001, BEL’s most abundant

² Hammill, M.O., St-Pierre, A.P., Mosnier, A., Parent, G.J., and Gosselin, J.-F. Total abundance and harvest impacts on Eastern Hudson Bay and James Bay beluga 2015–2022. DFO Can. Sci. Advis. Sec. Res. Doc. In preparation.

haplotype, across seasons, suggests that some components of the local population (BEL) may overwinter in the Belcher Islands area. We also identified haplotypes (i.e., HL036, HL037, HL089, HL131, HL132, HL133, HL134, HL135) harvested only in the Sanikiluaq spring, fall, and winter management units, suggesting that additional unknown populations may overwinter around the Belcher Islands. We know of at least two other groups of beluga that have been observed in the south of Hudson Bay, which have little to no genetic data available for analysis. In this study, the SWH summer aggregation is represented by a small sample size (N = 17) and previous studies have suggested some genetic specificity in that region (Turgeon et al. 2009; Postma 2017). There is also a large group of beluga whales often observed in the northwestern part of James Bay during aerial surveys (Gosselin et al. 2013), which has never been characterized genetically.

NEW REFERENCE POPULATIONS/STOCK, NOT RESEQUENCING, HAD THE LARGEST EFFECT ON HARVESTED PROPORTIONS

Resequencing explained a small change in the proportions of the BEL-EHB stock harvested (4.3%). Differences in sequencing results between the two facilities (FWI and MLI) can be explained mostly by changes in methodologies over the last 20 years. The haplotyping program for beluga management started in approximately 2000 at the FWI (de March and Postma 2003). In the early stage of haplotyping, error rates associated with Taq polymerase or sequencing technologies were higher. Consequently, singleton (unique haplotype) grouping with most abundant haplotypes was a procedure undertaken each year to improve the performance of GMA and avoid bias due to rare, potentially erroneous, haplotypes. With the years, Taq polymerase and sequencing technology error rates improved, while reducing haplotype grouping. We did not perform haplotype grouping with the MLI dataset, as error rates were likely negligible since all of the sequences were synthesized in the last year. Furthermore, the error rate was overall lower with the MLI database as all sequences were produced using consensus sequences, with forward and reverse sequencing outputs. To reduce cost, only forward sequencing was conducted for harvest samples at the FWI. Chromatogram interpretation is another potential source of error. At the FWI, a single technician reviewed the chromatograms, which reduces the error rate. At the MLI, we generated a standard operating procedure for the production of consensus sequences that could be transferred to any sequencing facility in the future. Since the resequencing effect was low, we can conclude that the major differences observed between results from previous GMA (Hammill et al. 2021) and those from this study were caused by the change in number of newly-defined reference groups, from two to four.

IMPROVING GENETIC CLASSIFICATION IN THE FUTURE

Genetic characterization of individuals from southern Ungava Bay was not possible in this study. The Ungava population experienced excessive commercial whaling in the late 19th and early 20th century and is currently designated as Endangered (COSEWIC 2016). This population has high site fidelity to the southern part of Ungava Bay in an area where hunting is restricted. A project started in 2018 in collaboration with the Nunavik Hunting, Fishing and Trapping Association (Regional Nunavimmi Umajulirijit Katujjiqatigininga; RNUK), and conducted a few biopsies (n = 3) on beluga from this area, but there are not enough samples for inclusion in population structure analyses. Environmental DNA sampling is now being developed for beluga haplotyping to limit the impact of harvest on these animals.

New genetic markers (mitogenomes, SNPs from the nuclear genome) may improve classification and assignment to reference populations of the Hudson Bay-Strait Complex. The mtDNA sequence cannot discriminate between seasonal migrants (not reproducing with the local population) or effective migrants (reproducing with the local population). Genetic markers

derived from nuclear DNA could discriminate between the two types of migrants, if populations are genetically distinct at nuclear loci. Past studies using nuclear markers indicated some genetic differentiation between CSB or JAM with other populations, but not between WHB and EHB populations, which may interbreed (Turgeon et al. 2012).

Other proxies may also improve classification to reference populations of the Hudson Bay-Strait Complex. A previous study combining stable isotopes and trace elements was successful in defining summering stocks and their relative contributions to subsistence harvest in Nunavik (Rioux et al. 2012). Combining the characterization of stable isotopes, trace elements, and mtDNA haplotypes for control regions in each reference individual could help to identify different types of migrants and further reduce the uncertainty around classification of the WHB population and the BEL-EHB stock. Combining proxies while using these new reference populations based on the extended mtDNA sequence may complement genetic assignment and refine classification while reducing uncertainty.

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FIGURES

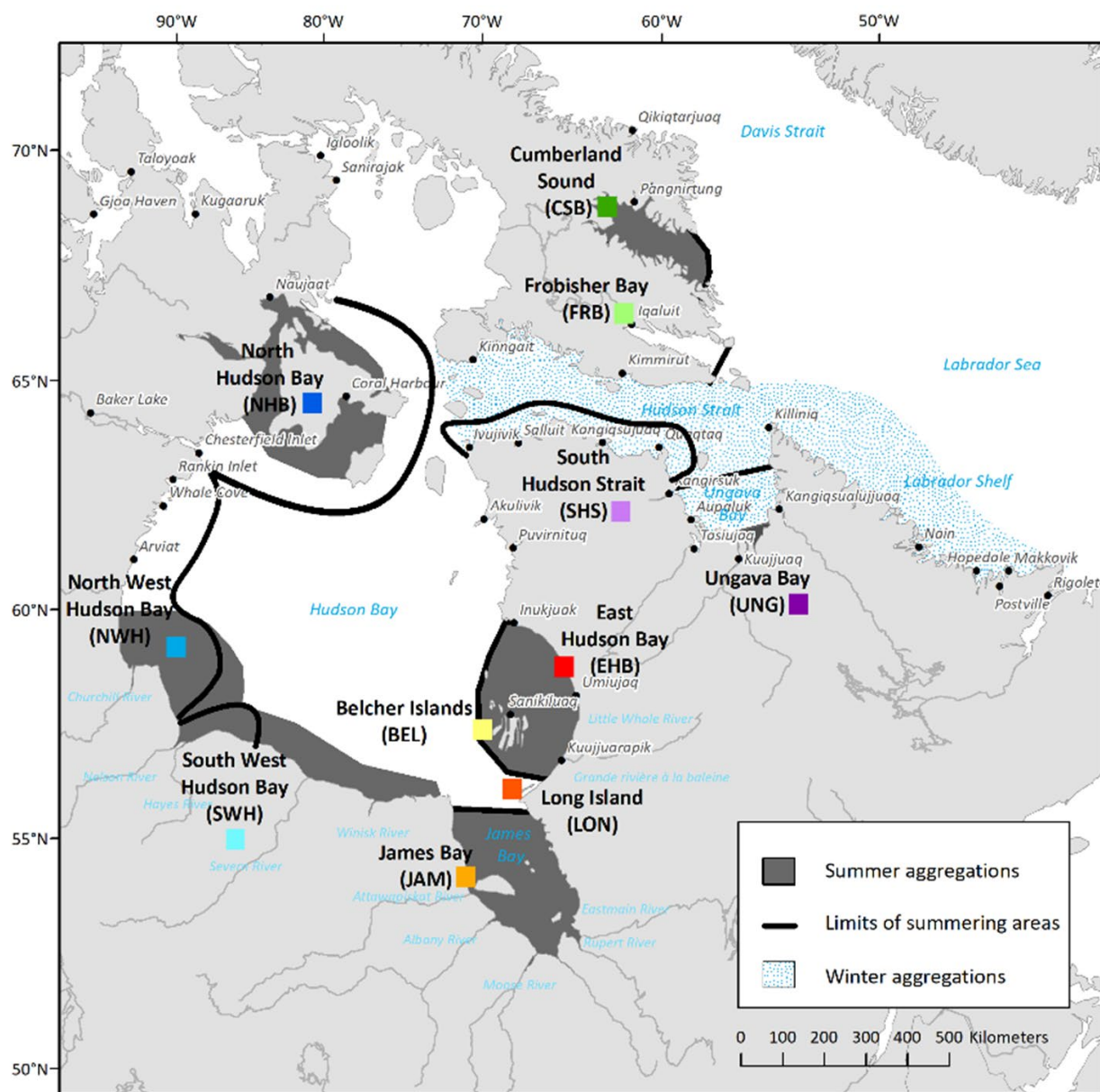


Figure 1. Geographic delimitation of summering areas investigated for population structure of beluga in the Hudson Bay-Strait Complex. Major Inuit communities (also harvest locations in Table 1) considered in each area are indicated but may not reflect all of the hunting regions of Inuit communities. The four largest summering aggregations indicated in dark grey (a) are western Hudson Bay (WHB), James Bay (JAM), eastern Hudson Bay (EHB) and Cumberland Sound (CSB, see Table 1 for all acronyms for summering areas). The WHB and the EHB are migrating through the Hudson Strait to the hypothetical winter area (dotted blue). Summering and wintering aggregations adjacent to Hudson Bay are reproduced from DFO (2002) or Hobbs et al. (2019).

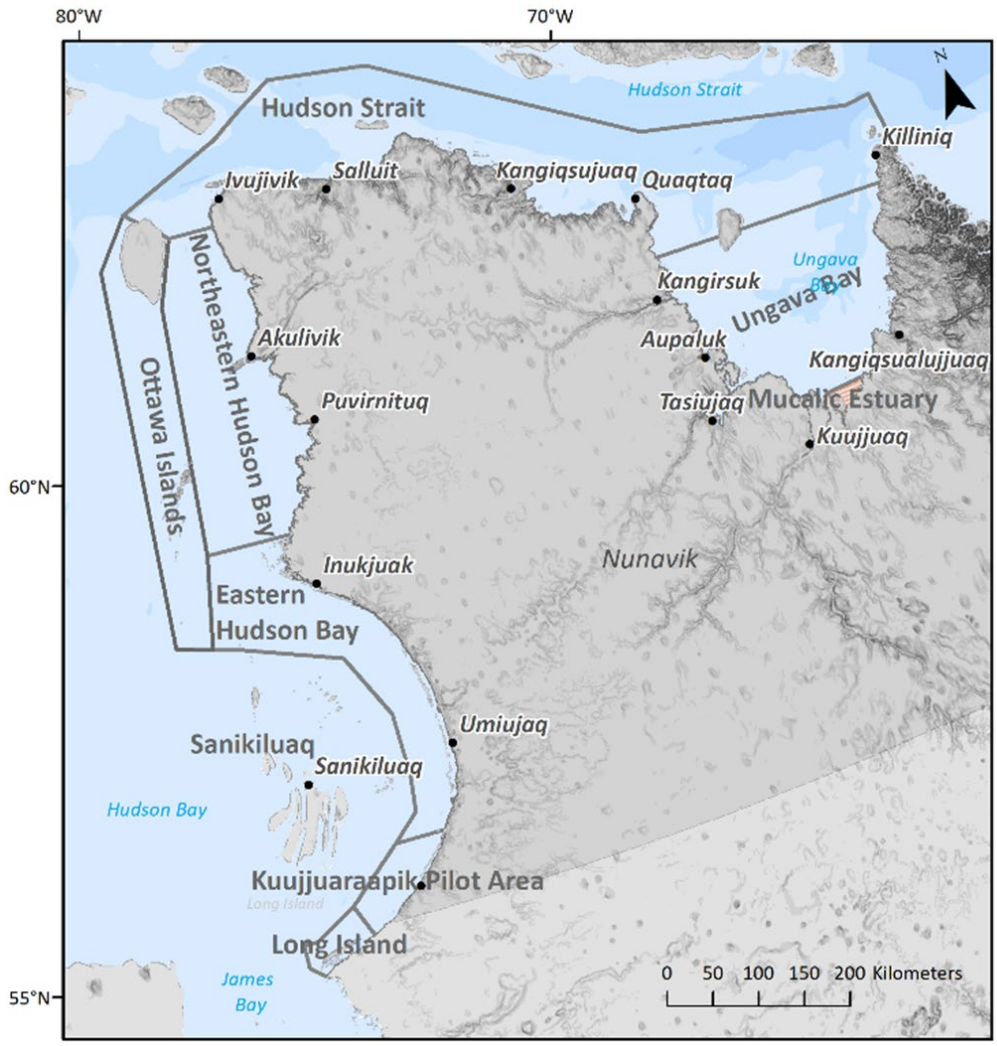


Figure 2. Nunavik management areas. The smaller management areas of the Nastapoka River and Little Whale River are not presented due to the scale of the map. There are no official geographic limits to the Sanikiluaq management area.

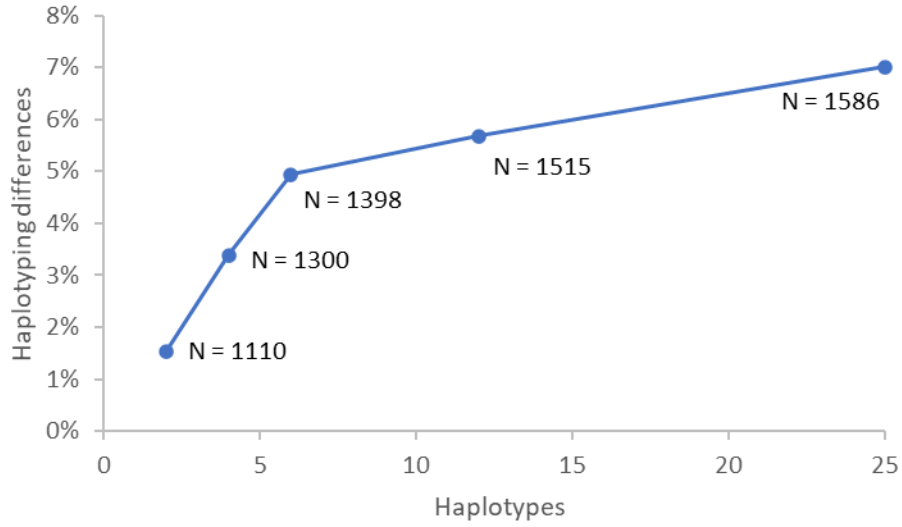


Figure 3. Increasing haplotyping differences with haplotype rarity between databases from the FWI and MLI facilities. Sample size are indicated as cumulative values for more abundant haplotypes (to the left) and combined with rarer haplotypes (to the right). This figure shows that haplotype discrepancies between both databases are not for the two most abundant haplotypes (N = 1110 samples) but for the 3 to 6 more abundant haplotypes. Rarer haplotypes also increase haplotyping differences but to a lesser extent due to their low sample sizes.

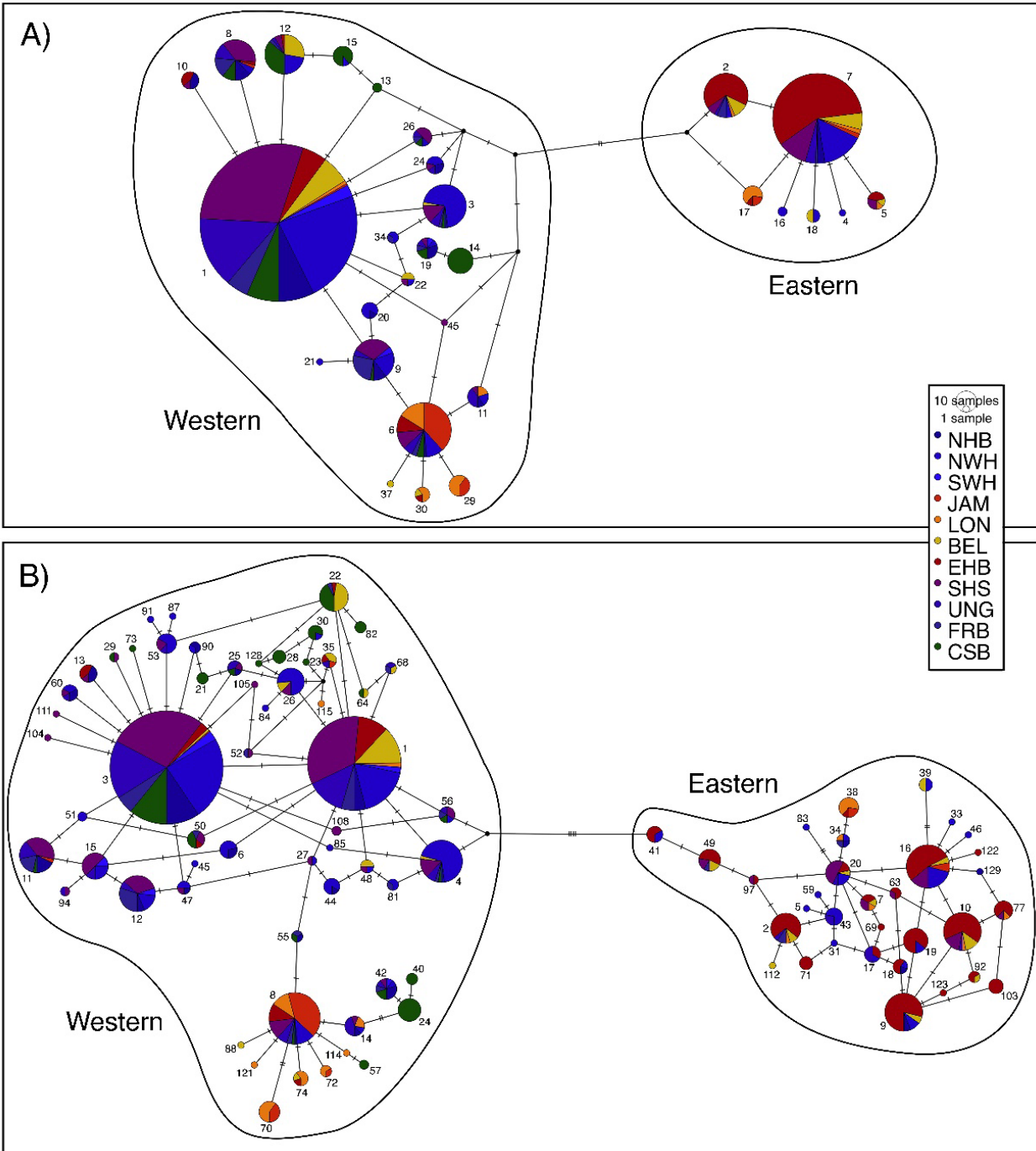


Figure 4. Haplotype networks of the mitochondrial DNA control region short (234 nucleotides, A) or long (615 nucleotides, B) haplotypes for belugas from the summering areas in the Hudson Bay-Strait Complex. Geographic limits of summering areas are described in Fig. 1 and acronyms defined in Table 1. A statistical parsimony (TSC) network using PopArt is presented. Small perpendicular bars along lines between two haplotypes indicate the number of mutations between haplotypes. Black circles lacking haplotype numbers indicate missing haplotypes in the evolution of the network. In both panels, the western and the eastern haplogroups are presented in the left and right, respectively.

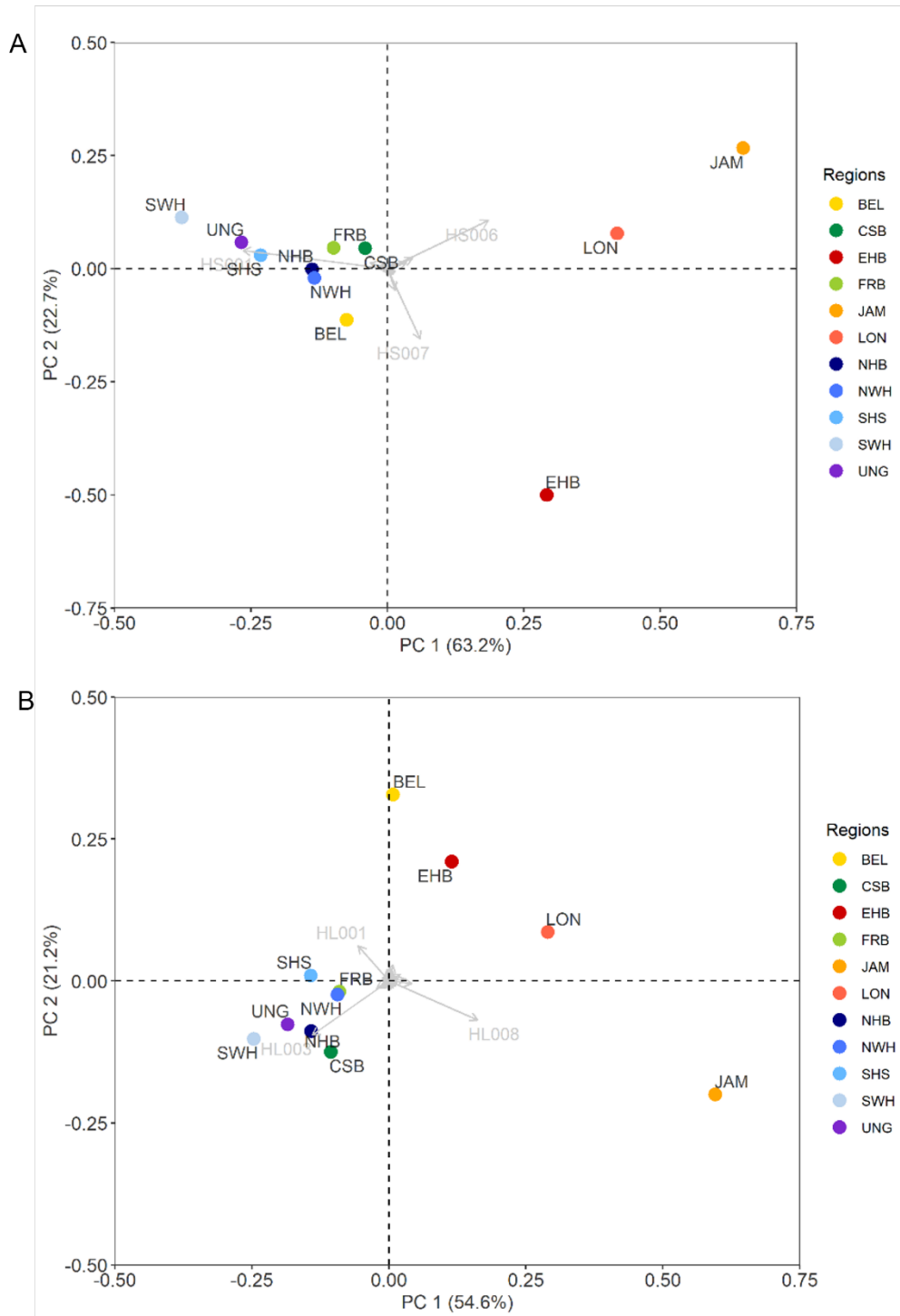


Figure 5. Biplot from the principal component analyses (PCA) using haplotype frequencies of the short (A, 234 nucleotides) or long (B, 615 nucleotides) mitochondrial DNA control region for belugas from the summer areas in the Hudson Bay-Strait Complex (see Table 1 for acronyms). The length and direction of arrows explain the effect of the haplotypes on the distance between summer aggregations.

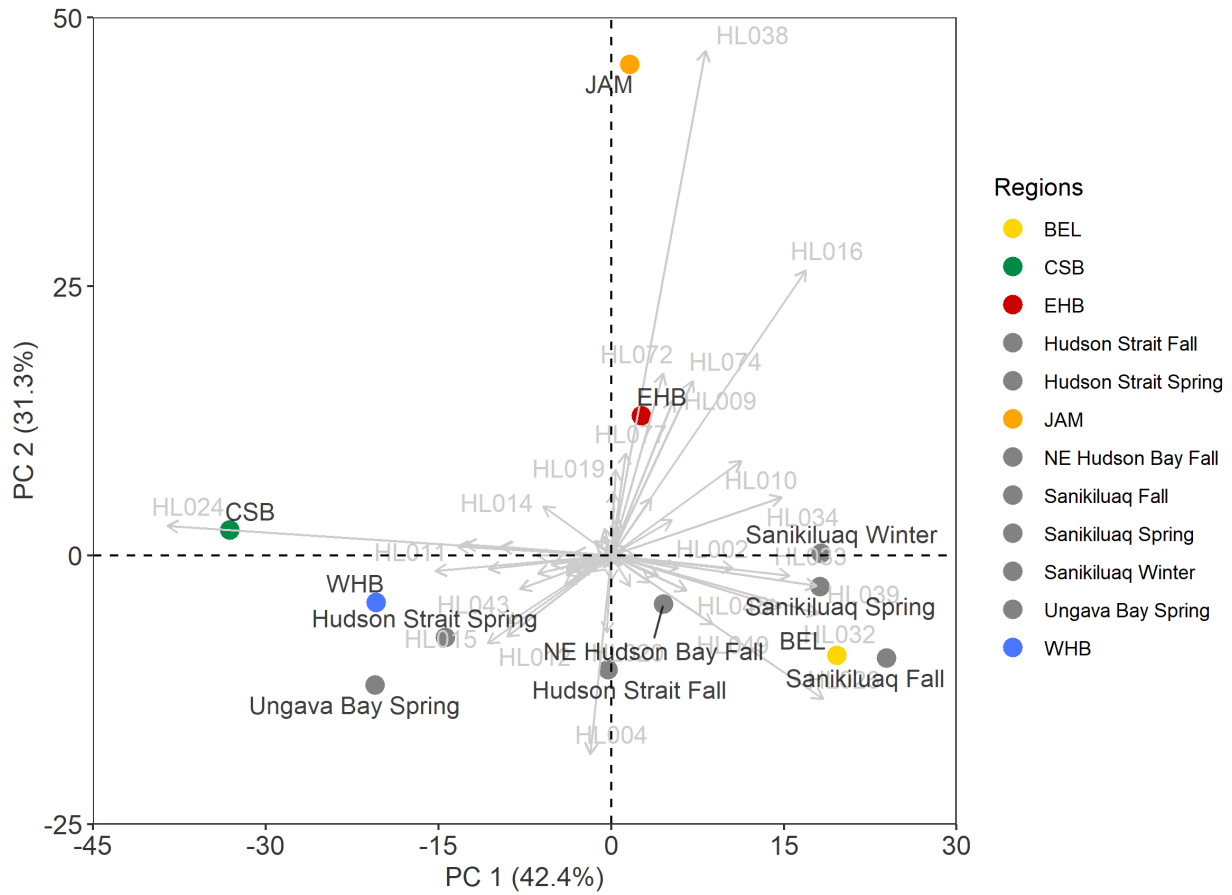


Figure 6. Biplot from the principal component analysis (PCA) using haplotype frequencies of the long haplotype (615 nucleotides) for the mitochondrial DNA control region for belugas from five populations (in color; WHB, JAM, EHB, BEL, CSB; see Table 1 for acronyms) and from Nunavik or Sanikiluaq management units (in grey, see Fig. 1b for locations, NE: Northeastern). The length and direction of arrows explain the effect of the haplotypes on the distance between summer aggregations.

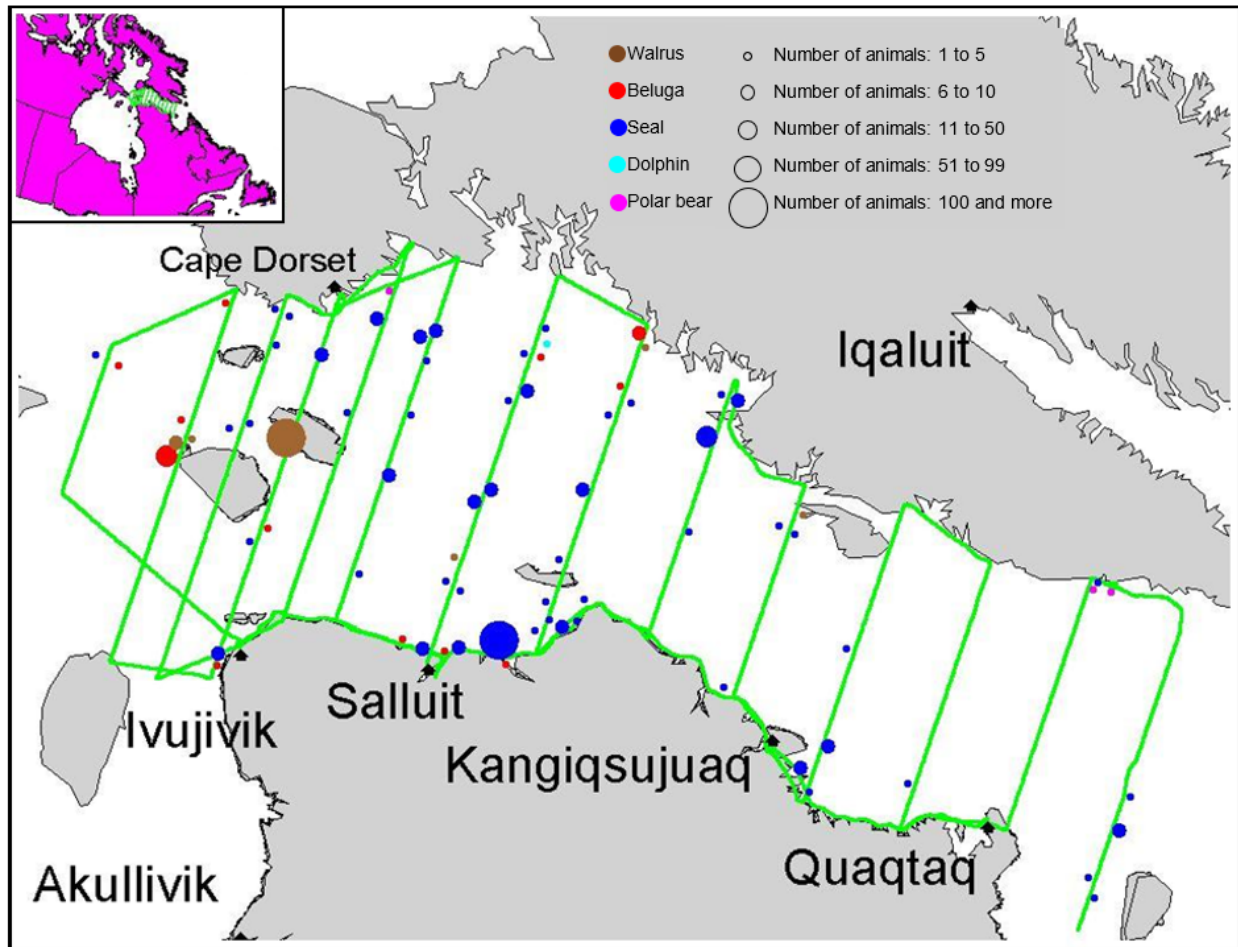


Figure 7. Marine mammal observations from systematic aerial surveys flown 9-12 August, 2010. A total of 69 belugas were counted (J-F Gosselin, personal observations).

TABLES

Table 1. Summarized metadata of all samples and a subset of summer samples. Table S1 provides more details on each individual.

Areas	Month range	All samples		Summer aggregations		
		Year range	N	Month range	Year range	N
North Hudson Bay (NHB)	Apr.–Nov.	1989–2009	90	Jul.–Aug.	1993–2009	67
North West Hudson Bay (NWH)	Jun.–Oct.	1985–2015	264	Jul.–Aug.	1985–2015	234
South West Hudson Bay (SWH)	Jul.–Aug.	2002–2005	17	Jul.–Aug.	2002–2005	17
James Bay (JAM)	Jul.–Oct.	2002–2016	45	Jul.–Aug.	2003–2016	38
Long Island (LON)	Jun.–Oct.	2003–2018	59	Jul.–Aug.	2003–2018	37
Belcher Islands (BEL)	Jan.–Dec.	1993–2021	422	Jul.–Aug.	1994–2020	66
South East Hudson Bay (EHB)	May–Oct.	1990–2020	230	Jul.–Aug.	1994–2019	183
North East Hudson Bay (NEH)	May–Oct.	1998–2019	48	-	-	0
South Hudson Strait (SHS)	May–Nov.	1994–2021	1372	Jul.–Aug.	1995–2020	241
North Ungava Bay (UNG)	Jun.–Dec.	1994–2020	157	Jul.–Aug.	1994–2020	113
Frobisher Bay (FRB)	Jun.–Aug.	1991–2004	53	Jun.–Aug.	1991–2004	53
Cumberland Sound (CSB)	May–Aug.	1982–2018	104	Jun.–Aug.	1982–2018	87
Total		-	2861		-	1136

Table 2. Genetic composition from the 11 summering areas of belugas from or close to the Hudson Bay-Strait Complex using short (234 nucleotides) and long (615 nucleotides) mtDNA control region sequences (haplotype). See table 1 for acronyms of summer aggregations and sample sizes. Polymorphic sites (S) were quantified with adegenet 2.1.5 (Jombart 2008; Jombart and Ahmed 2011), haplotype diversity (Pi) was estimated with the hap.div function of pegas 1.1 (Paradis 2010), whereas the number of haplotypes (H), private haplotypes (i.e., only present in one summering aggregation, Hp) and the proportion of private haplotypes (Hp%) were calculated manually.

Summering aggregations	Short haplotype					Long haplotype				
	S	H	Pi	Hp	Hp%	S	H	Pi	Hp	Hp%
NHB	13	11	0.61	0	0.0	22	20	0.81	1	1.5
NWH	16	20	0.66	3	1.7	31	42	0.87	12	5.6
SWH	5	3	0.32	0	0.0	8	5	0.74	0	0.0
JAM	9	6	0.52	0	0.0	19	8	0.56	0	0.0
LON	11	9	0.85	0	0.0	23	15	0.91	3	8.1
EHB	13	10	0.61	0	0.0	23	29	0.92	5	6.6
BEL	12	10	0.71	1	1.5	21	21	0.83	2	3.0
SHS	15	16	0.52	1	0.4	25	34	0.80	4	2.1
UNG	12	12	0.46	0	0.0	22	21	0.75	0	0.0
FRB	13	11	0.72	0	0.0	20	17	0.86	0	0.0
CSB	10	11	0.76	2	19.5	19	22	0.84	9	34.5
Total	17	29	0.72	7	2.0	39	90	0.89	36	5.8

Table 3. Estimating robustness of the reference groups for harvested belugas from the Hudson Bay-Strait Complex using the package rubias in R (more details in methods; Moran and Anderson 2019). Results should be read in rows, i.e., 15.1% of the WHB reference individuals were reassessed to WHB at probability equal or greater than 95%. Random probabilities of reassignment are 25 and 20% for 4 and 5 reference groups, respectively.

Reference groups	N	≥95%	≥80%	≥60%	≥40%
Five populations					
WHB population	318	15.1	27.0	71.4	87.1
JAM population	75	28.0	70.7	74.7	77.3
EHB population	183	0.0	11.5	26.8	69.4
BEL population	66	0.0	0.0	3.0	19.7
CSB population	87	13.8	35.6	39.1	39.1
Four populations and BEL-EHB stock					
WHB population	318	15.1	27.0	71.4	87.1
JAM population	75	28.0	70.7	74.7	77.3
BEL-EHB stock	249	2.4	23.3	43.0	84.7
CSB population	87	13.8	35.6	39.1	39.1

Table 4. Past genetic mixture analysis (1982-2018) using the Pella-Masuda model to determine the proportions of beluga from WHB or BEL-EHB stock in the harvest of Nunavik and Sanikiluaq management units (format modified, from Hammill et al. 2021; BEL-EHB stock was identified as EHB population in the original document). Ns: number of individual samples; Nv: number of different hunt dates (events); P: proportion; WHB: Western Hudson Bay, EHB: Eastern Hudson Bay, UNK: Unknown; CI: confidence interval based on variance among hunting events; CV: coefficients of variation based on individual samples (CVs) / hunting events (CVv). ND: not determined (sample size < 10).

Nunavik communities

Season	Ns/Nv	WHB population (%)		BEL-EHB stock (%)		CVs/CVv	UNK P (%)
		P	95% CI	P	95% CI		
		<u>Spring (Feb.1–Aug.31)</u>					
Hudson Strait	770/347	82.9	78.5–87.0	11.7	8.1–16.0	0.2/0.2	5.3
NE Hudson Bay	2/1	ND	-	ND	-	-	-
Ungava Bay	122/76	87.4	77.8–94.6	6.0	0.8–15.8	0.6/0.7	6.6
<u>Fall (Sep.1–Jan.31)</u>							
Hudson Strait	454/180	67.6	60.3–74.5	29.1	22.4–36.3	0.1/0.1	3.3
NE Hudson Bay	31/14	49.1	26.4–72.0	44.5	23.5–66.5	0.3/0.3	6.5
Ungava Bay	4/4	ND	-	ND	-	-	ND

Sanikiluaq

Season	Ns/Nv	WHB population (%)		BEL-EHB stock (%)		CVs/CVv	UNK P (%)
		P	95% CI	P	95% CI		
		<u>Spring (Apr.1–Jun.30)</u>					
Spring (Apr.1–Jun.30)	301/107	76.8	69.2–83.7	1.6	0.0–6.6	0.1/0.1	12.6
Ext. Spring (Apr.14–Jul.1)	31/18	75.1	67.2–82.2	4.6	1.1–10.2	0.4/0.5	20.4
Summer (Jul.1–Aug.31)	45/30	61.5	32.8–86.2	25.6	4.9–56.0	0.4/0.5	12.9
Fall (Sep.1–Nov.30)	45/30	97.8	91.8–99.9	0.0	-	-	2.2
Winter (Dec.1–Mar.31)	56/7	31.3	6.1–65.6	36.6	9–70.7	0.2/0.5	32.1

Table 5. Updated genetic mixture analysis using the long haplotypes (MLI database) and new reference groups for harvested belugas from Nunavik communities, and Sanikiluaq. NE Hudson Bay: Northeastern Hudson Bay; Ns: number of individual samples; Nv: number of different hunt dates (events); P: proportion; WHB: Western Hudson Bay, EHB: Eastern Hudson Bay, JAM: James Bay, CSB: Cumberland Sound, UNK: Unknown; CI: confidence interval based on variance among hunting events; CV: coefficients of variation based on individual samples (CVs) / hunting events (CVv). ND: not determined (sample or event size < 10).

Nunavik communities

Season	Ns/Nv	WHB population (%)			BEL-EHB stock (%)			JAM population (%)			CSB population (%)			UNK P (%)
		P	95% CI	CVs/CVv	P	95% CI	CVs/CVv	P	95% CI	CVs/CVv	P	95% CI	CVs/CVv	
<u>Spring (Feb.1–Aug.31)</u>														
Hudson Strait	824/364	75.7	70.5–80.6	0.0/0.0	12.3	8.6–16.5	0.1/0.2	2.6	0.6–5.9	0.5/0.6	6.5	3.6–10.2	0.2/0.3	2.9
NE Hudson Bay	2/1	ND	-	-	ND	-	-	ND	-	-	ND	-	-	-
Ungava Bay	143/87	87.8	76.5–95.7	0.1/0.1	4.7	0.8–11.8	0.6/0.6	1.1	0.0–8.1	2.3/2.2	5.1	0.7–13.3	0.6/0.7	1.3
<u>Fall (Sept 1–Jan. 31)</u>														
Hudson Strait	512/202	49.6	40.0–59.2	0.1/0.1	44.0	35.1–53.0	0.1/0.1	0.0	-	-	2.8	0.7–6.1	0.5/0.5	3.6
NE Hudson Bay	45/19	37.3	18.0–59.0	0.3/0.3	50.1	23.9–76.2	0.2/0.3	8.2	0.4–26.3	0.8/0.9	-	-	-	4.4
Ungava Bay	6/6	ND	-	-	ND	-	-	ND	-	-	-	-	-	ND

Sanikiluaq

Season	Ns/Nv	WHB population (%)			BEL-EHB stock (%)			JAM population (%)			CSB population (%)			UNK P (%)
		P	95% CI	CVs/CVv	P	95% CI	CVs/CVv	P	95% CI	CVs/CVv	P	95% CI	CVs/CVv	
Spring (Apr.1–Jun.30)	229/99	7.2	2.1–14.8	0.5/0.5	62.8	51.5–73.4	0.1/0.1	17.4	9.4–27.2	0.2/0.3	-	-	-	12.6
Fall (Sep.1–Nov.30)	49/35	28.4	9.6–52.6	0.4/0.4	61.0	35.1–83.9	0.2/0.2	2.4	0.0–16.1	2.3/1.9	-	-	-	8.2
Winter (Dec.1–Mar.31)	76/11	43.7	20.1–69.0	0.3/0.3	39.9	13.0–70.8	0.3/0.4	13.7	2.6–32.0	0.5/0.6	-	-	-	2.7

Table 6. Quantifying the effect of resequencing on proportions of beluga from each population and unknown (UNK) harvested in Nunavik and Belcher Islands managements units. Note that the proportions of Eastern Hudson Bay (EHB) population presented in this table are not reliable due to the low number of reference individuals in the Western Hudson Bay (WHB) population ($n = 41$, see methods for more details) or low sample size per management unit (using only samples in common to FWI and MLI databases). DIFF are the absolute difference between EHB proportions from simulations with FWI samples until 2019 and same or different reference samples for MLI samples until 2019, respectively.

Management units	N	FWI samples until 2019 (%)			MLI samples until 2019 (%)			DIFF (%)
		WHB	EHB	UNK	WHB	EHB	UNK	
Hudson Strait								
Spring	621	81.6	13.3	5.2	78.2	12.6	9.2	0.7
Fall	359	71.7	25.5	2.8	64.8	30.2	5.0	4.7
Ungava Bay								
Spring	96	90.2	3.6	6.3	83.5	10.2	6.3	6.6
Northeastern Hudson Bay								
Fall	22	50.9	44.6	4.6	47.2	48.3	4.6	3.7
Sanikiluaq								
Spring	181	55.3	23.1	21.6	51.4	26.5	22.1	3.4
Fall	31	86.2	10.6	3.2	85.8	11.0	3.2	0.4
Winter	48	59.6	38.3	2.1	20.5	50.3	29.2	12.0

Table 7. Genetic mixture analysis using the long haplotypes and new reference groups for harvested belugas from the Hudson Strait at different periods. September-October represents harvested proportions during the usual hunt closure period. Ns: number of individual samples; Nv: number of different hunt dates (events); P: proportion; WHB: Western Hudson Bay, EHB: Eastern Hudson Bay, JAM: James Bay, CSB: Cumberland Sound, UNK: Unknown; CI: confidence interval based on variance among hunting events; CV: coefficients of variation based on individual samples (CVs) / hunting events (CVv). ND: not determined (sample or event size < 10).

Period	Ns/Nv	WHB population (%)			BEL-EHB stock (%)			JAM population (%)			CSB population (%)			UNK P (%)
		P	95% CI	CVs/CVv	P	95% CI	CVs/CVv	P	95% CI	CVs/CVv	P	95% CI	CVs/CVv	
May	6/6	ND	-	-	ND	-	-	ND	-	-	ND	-	-	ND
Jun.	577/230	71.3	64.977.3	0.0/0.0	12.4	7.9–17.7	0.2/0.2	4.8	2.0–8.8	0.4/0.4	8.6	4.7–13.5	0.2/0.3	2.9
Jul.	223/114	84.7	77.2–90.9	0.0/0.0	11.0	5.6–18.0	0.3/0.3	0.0	-	-	1.6	0.0–6.7	1.0/1.1	2.7
Aug.	18/14	75.8	46.8–95.3	0.2/0.2	13.7	0.0–57.4	0.8/1.2	4.7	0.0–33.2	1.9/1.9	0.3	0.0–0.6	0.5/0.6	5.6
Sept.	26/7	ND	-	-	ND	-	-	ND	-	-	ND	-	-	ND
Oct.	223/104	49.5	37.5–61.6	0.1/0.1	47.3	34.7–60.1	0.1/0.1	0.0	-	-	0.0	-	-	3.1
Nov.	263/91	45.9	32.3–59.8	0.1/0.2	45.1	33.0–57.6	0.1/0.1	0.0	-	-	4.4	1.1–9.7	0.5/0.5	4.6
Nov. 1–10	167/62	41.2	27.8–55.2	0.2/0.2	51.5	39.0–63.9	0.1/0.1	0.0	-	-	4.4	0.5–12.2	0.6/0.7	3.0
Nov. 11–20	96/29	50.1	22.5–77.6	0.2/0.3	33.9	13.9–57.6	0.2/0.3	4.5	0.5–12.5	1.0/0.7	4.3	0.5–12.1	0.8/0.7	7.3
Nov. 21–30	49/13	71.9	47.9–90.6	0.1/0.2	10.4	0.9–29.5	0.5/0.7	0.0	-	-	7.5	0–35	1.0/1.3	10.2

SUPPLEMENTARY MATERIAL

Table S1

Metadata for each beluga from this study (N = 2861)

Table S2

Sequence library of short control region in the mtDNA of belugas from the Hudson Bay-Strait Complex

Table S3

Sequence library of long control region in the mtDNA of belugas from the Hudson Bay-Strait Complex

Table S4

Long haplotype frequencies per summering area

All tables are available at this link: [Reexamining populations of beluga in the Hudson Bay-Strait Complex and assessing the impact on harvests in Nunavik and Sanikiluaq management units](#)



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Quebec Region

Recovery Potential Assessment for Beluga (*Delphinapterus leucas*) Stocks in Nunavik (Northern Quebec)

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Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

In 2020, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the eastern Hudson Bay (EHB) and Ungava Bay (UB) beluga designatable units (DUs) as Threatened and Endangered, respectively. These two DUs are currently under ministerial review for listing under the *Species at Risk Act* (SARA). DFO Science has been tasked to undertake a Recovery Potential Assessment (RPA) for these two DUs to help inform the listing decision and, if the listing is confirmed, the future development of recovery documents. Since the last beluga DU review by COSEWIC in 2016, a distinct genetic population has been identified in the Belcher Islands (BEL), within the EHB DU's geographic summer distribution area. Therefore, this RPA is not specific to the EHB genetic population alone, but rather to the joint BEL-EHB stock. Beluga aggregations are observed during summer in the estuaries and along the coast of the eastern Hudson Bay arc. In the fall, beluga from this area undertake a northward seasonal migration along the Nunavik coast to reach wintering areas in Hudson Strait and along the Labrador coast. While UB beluga were historically abundant in southern Ungava Bay, no large beluga aggregation has been seen during surveys conducted over the past 40 years. However, continued sightings and occasional harvests either suggest that the Ungava Bay DU persists at a very low level, or that neighbouring DUs frequent Ungava Bay. Most recent data indicates a continuous decline in BEL-EHB beluga since the 1970s, with an abundance estimate of 2,900-3,200 beluga in 2021. Management of subsistence beluga harvest is the main challenge for BEL-EHB and UB beluga survival and recovery. Other threats from human activities in the habitat of BEL-EHB and UB beluga include anthropogenic noise, industrial development, vessel traffic, chemical pollution, commercial fisheries, and climate change. A long-term (i.e., over > 100 years) distribution objective would be to recover the historical distribution of beluga in eastern Hudson Bay estuaries and within southern Ungava Bay and its estuaries. Three recovery abundance objectives are proposed for BEL-EHB beluga: 1) attain an abundance equal to or exceeding the 2015 abundance estimate in ten years, 2) attain an abundance equal to or exceeding the Precautionary Reference Level (PRL = 5,300 individuals) in 86 years, and 3) attain an abundance corresponding to the demographic growth given no harvest from this stock. The current harvest levels are incompatible with any of these recovery targets. Two recovery targets for abundance are proposed for UB beluga: 1) maintain population size at or above the 2022 abundance estimate, and 2) attain a population size corresponding to the demographic growth given no harvest from this DU. Perpetuating current harvest levels for UB beluga would lead to population decline and extirpation of any remaining stock in this area within 4 to 21 years. The Potential Biological Removal for BEL-EHB and UB beluga was estimated at 5 and 0 whales per year, respectively based on 2022 abundance estimates. Projections indicate that it is feasible for the BEL-EHB stock to reach the PRL in 86 year with an annual harvest level of 20 beluga.

CONTEXT

In 2016, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has identified eight recognized designatable units (DUs) of beluga in Canada, including the Eastern Hudson Bay (EHB) and the Ungava Bay (UB), populations. In 2020, COSEWIC assessed the EHB DU as Threatened and the UB DU as Endangered. These two DUs are currently under ministerial review for listing under the *Species at Risk Act* (SARA). In support of listing recommendations for EHB and UB beluga populations, DFO Science has been asked to undertake a Recovery Potential Assessment (RPA) for these two DUs.

Since the last COSEWIC beluga DU review, a distinct genetic population has been identified in the Belcher Islands (BEL), within the EHB DU's geographic summer distribution area. Accordingly, this RPA is not specific to the EHB genetic population alone, but rather to the joint BEL-EHB stock, and hereafter referred to as BEL-EHB beluga to better reflect the composite nature of the beluga aggregations occurring in this area during summer (see Caution section below for details).

The information presented as part of the current report has been reviewed during the February 20-24, 2023 National marine mammal peer review committee meeting (Appendix A), and updates and/or consolidates any existing advice regarding both EHB and UB beluga. The current RPA may be used to inform both scientific and socio-economic aspects of the listing decision, the development of a recovery strategy and action plan, or the actions undertaken by DFO following SARA listing.

CAUTION

Since the last COSEWIC beluga designatable unit (DU) review, a genetic re-analysis of beluga samples by DFO has identified a distinct population in the Belcher Islands (BEL), i.e., within the geographic summer distribution area of the EHB DU (Parent et al. 2023; COSEWIC 2016). Aerial surveys in eastern Hudson Bay showed that there was a continuous distribution of beluga from the coast between Kuujuarapik and Inukjuak, which extends as far offshore as the Belcher Islands (Smith and Hammill 1986; Kingsley 2000; Gosselin et al. 2002, 2009, 2013; St-Pierre et al. 2024). In addition, most beluga equipped with satellite transmitters in estuaries of the eastern Hudson Bay performed repeated inshore-offshore movements extending out to the Belcher Islands during summer (Bailleul et al. 2012a). Therefore, there is likely a spatial overlap between the BEL and EHB genetic population distributions, and beluga summering in this area are considered together throughout this report, and referred to as the BEL-EHB management stock (DFO 2022). The conclusions from this report should be interpreted with caution as the potential for recovery and the recovery targets are not specific to the EHB genetic population alone, but rather based on the abundance and distribution of the joint BEL-EHB stock.

In addition, there is uncertainty as to whether the Ungava Bay beluga DU still exists or whether it has been extirpated. Beluga in this DU were defined by a summer aggregation centered near the Marralik River estuary, with concentrations at other rivers in southern Ungava Bay (COSEWIC 2016). However, COSEWIC (2004) defines the Ungava Bay area as the range for this DU, and it is generally recognized that beluga from other DUs occur in Ungava Bay from spring to fall, but not in summer (Lewis et al. 2009; Cuerrier et al. 2012; Cardinal 2013). Consequently, aerial surveys conducted in summer over the full extent of Ungava Bay provide an abundance estimate for the entirety of the bay (Sauvé et al. 2023; Smith and Hammill 1986; Kingsley 2000; Hammill et al. 2004; Gosselin et al. 2009). Although beluga were detected during the 2022 summer survey of Ungava Bay, none were observed in the historical aggregation areas in the south of the bay (Sauvé et al. 2023). Therefore, there is uncertainty as to whether

beluga sighted during the 2022 survey represent beluga from the UB DU itself or animals from other stocks that interrupted their summer migration the central Ungava Bay area. Nevertheless, a small number of beluga continue to be sighted and harvested in estuaries in southern Ungava Bay (e.g., Durkalec et al. 2020). The present assessment of the potential for recovery for the UB DU is based on the most recent, 2022 survey, which covered the entirety of Ungava Bay. For consistency with the surveyed area, we considered harvest levels occurring throughout Ungava Bay when estimating threats and potential biological removals.

INTRODUCTION

The beluga (*Delphinapterus leucas*) has a nearly circumpolar distribution in Arctic and subarctic waters (NAMMCO 2018). Only one species is recognized worldwide, with no recognized subspecies. A significant proportion of the species' global range is distributed in Canadian waters. Populations are defined based on summering aggregations (Richard 2010; COSEWIC 2016; NAMMCO 2018), informed by lines of evidence underlining that beluga show strong intra- and inter-annual site fidelity based on behavioural (Caron and Smith 1990), as well as telemetry (Bailleul et al. 2012a), genetic (Brown Gladden et al. 1999; de March and Postma 2003; Postma et al. 2012; Turgeon et al. 2012; Colbeck et al. 2013; Parent et al. 2023), isotopic and trace element (Rioux et al. 2012) studies.

There are eight recognized DUs of beluga in Canada, namely the Eastern Beaufort Sea (EBS), Eastern High Arctic – Baffin Bay (EHA-BB), Cumberland Sound (CS), Ungava Bay (UB), Western Hudson Bay (WHB), Eastern Hudson Bay (EHB), St. Lawrence Estuary (SLE), and James Bay (JB) populations (Figure 2). Among all eight recognized beluga DUs, the CS, EHB and UB DUs are currently under ministerial review for listing, while the SLE DU is listed under the *Species at Risk Act* (SARA).

The COSEWIC first assessed the EHB and UB beluga DUs in 1988, affording them a status of Threatened and Endangered, respectively (Reeves and Mitchell 1988). The status of UB beluga has remained Endangered throughout COSEWIC's reassessments (COSEWIC 2004, 2020a). EHB beluga were reclassified as Endangered in 2004 based on a declining demographic trend and overharvesting, but their status was revised to Threatened in 2020 after stabilisation of the demographic trend and harvest removals (COSEWIC, 2004, 2020a).

After the COSEWIC assesses an aquatic species as Threatened, Endangered, or Extirpated, DFO undertakes a number of actions required to support implementation of the SARA. Many of these actions require scientific information on the current status of the wildlife species, threats to its survival and recovery, and the feasibility of recovery. Formulation of this scientific advice is typically developed through a RPA that is conducted shortly after the COSEWIC assessment. This timing allows for consideration of peer-reviewed scientific analyses into SARA processes, including recovery planning.

In 2005, DFO conducted a RPA for EHB and UB beluga conjointly with the CS and SLE beluga (DFO 2005). Since then, various research projects have been undertaken by DFO Science to increase the understanding of EHB and UB beluga populations. The advice generated via the present process updates and/or consolidates any existing advice regarding both the BEL-EHB and UB beluga stocks.

ASSESSMENT

SPECIES INFORMATION

Element 1: Summarize the biology of EHB and UB Beluga.

Element 2: Evaluate the recent species trajectory for abundance, distribution and number of populations.

Element 3: Estimate the current or recent life-history parameters for EHB and UB Beluga

Biology

The beluga is a medium-sized, toothed whale inhabiting Arctic and sub-Arctic waters. Along with the narwhal, it is one of two cetacean species of the *Monodontidae* family, and the only member of the *Delphinapterus* genus. They have a round head adorned with a melon which they use for echolocation. They lack a dorsal fin, which is probably an adaptation to life in partially ice-covered waters, and have an unfused cervical vertebrae which allows flexibility in the neck. Beluga calves are born dark grey or brown in colour and measure around 1.5 m at birth (Lesage et al. 2014; COSEWIC 2020a). They gradually transition to white between 10-20 years of age (COSEWIC 2020a). Mature individuals are white in colour and are sexually dimorphic, with a size ranging between 2.6 and 4.5 m, and adult female lengths nearing 80% the length of adult males (Lesage et al. 2014; COSEWIC 2020a). Size at sexual maturity may vary among populations. Beluga sampled in Hudson Bay were of relatively small size at maturity compared to other regions (see Lesage et al. 2014 for review), with estimated asymptotic length for mature males and females of 3.5 and 3.3 meters, respectively (Doidge 1990a). Whether this observed smaller size represents a phenotypic trait of Hudson Bay beluga populations or results from the long history of heavy exploitation that might have depleted older, bigger individuals from the area is unknown.

Gregarious in nature, belugas can form large aggregations (>300 individuals) throughout their habitat, and both closely related and unrelated individuals may group together (O’Corry-Crowe et al. 2020). They have a large repertoire of acoustic calls, such as clicks, burst pulses, whistles, and combined signals. Belugas mostly vocalize in the 0.1 to 12 kHz frequency range (Erbe et al. 2016), although they produce sounds up to 160 kHz (Southall et al. 2007). Their peak hearing frequency is situated between 0.5 and 130 kHz (Erbe et al. 2016). Vocalizations are used for communication, navigation, and foraging.

Beluga are generalists, with a diet which includes small pelagic, demersal, and riverine fish species, as well as invertebrates such as shrimps, squids, and sea worms (e.g., Doidge et al. 2002; Marcoux et al. 2012; Kelley et al. 2010; Quakenbush et al. 2015; Breton-Honeyman et al. 2016; Lesage et al. 2020). Beluga can dive to depths of hundreds of metres to forage, with dives generally lasting 8-15 minutes (Heide-Jørgensen et al. 1998; Kingsley et al. 2001; Martin et al. 2001).

Additional information on beluga biology can be found in the latest COSEWIC assessment and status report (COSEWIC 2020a).

Life history

Age at physical maturity was estimated at 15 and 10 years of age for females and males, respectively, using length-at-age curves from Doidge (1990a) and assuming deposition of one growth layer group (GLG) per year in teeth dentine (Table 1). Beluga longevity is unknown and likely underestimated given that old individuals systematically suffer from tooth wear, some losing their teeth altogether. Although the maximum age of sampled individuals mostly ranges between 45-60 years of age (Lesage et al. 2014; Hobbs et al. 2015; Ellis et al. 2018), the oldest free ranging beluga sampled was 89 years old (Ferguson et al. 2020). Generation time is defined as the average age of the parents of the current cohort (i.e., newborns), and reflects the turnover rate of breeding individuals in a population (Taylor et al. 2007). Beluga generation time is estimated at 28.6 years (Lowry et al. 2017), although there are caveats associated with that

estimate, and a generation time closer to 20-23 years may be more accurate (COSEWIC 2020a). Throughout this document, we use the 28.6 year generation time retained by COSEWIC (2020a) for consistency and because the difference between this and other suggested values did not affect the conclusions of this RPA for BEL-EHB and UB beluga.

On average, females give birth to one calf every three years (Vladykov 1944; Doidge 1990a; Suydam 2009), with a gestation period of 12.8 to 15 months (COSEWIC 2014; Matthews and Ferguson 2015). Therefore, approximately one-third of the sexually mature females are expected to become pregnant each year (Mosnier et al. 2015). Body size has been identified as a driver of reproductive activity in Hudson Bay beluga females (Ferguson et al. 2021). Perinatal mortality of the calf may result in decreased calving intervals as females may become available for mating one year earlier (Doidge 1990b; Mosnier et al. 2015). Lactation may continue for up to three years (Doidge 1990b; Matthews and Ferguson 2015), partially overlapping with the next gestation period. Ingestion of solid food starts during the calf's first to second year (Matthews and Ferguson 2015). The timing of mating and calving varies among populations, but mating generally occurs in late winter and spring, while calving takes place during summer. Beluga from eastern Hudson Bay are thought to mate in offshore areas in early May, with calving in late May of the following year (Doidge 1990b). There is no available information specific to Ungava Bay beluga. The beluga is one of the rare species with females showing signs of menopause (post-reproductive lifespan in females; Ellis et al. 2018). However, there is variability in age at sexual senescence, since pregnant females aged 60-70 years have been reported (Burns and Seaman 1986). Because of tooth wear in older beluga, age at senescence is difficult to assess.

Age-specific mortality rates differ among beluga populations and over time depending on the relative occurrence of the different causes of natural mortality (e.g., dystocia and peripartum complications, cancers, contaminants, predation) affecting the population. Beluga mortality rates were estimated based on individuals harvested on the eastern coast of Hudson Bay at 31% for young calves (age 0-1 year), and varied between 12-21% and 2-10% for beluga aged 2-9 years and ≥ 10 years, respectively (Doidge 1990b). There is no data available for UB beluga. However, Hammill and Lesage (2019) estimated similar trends in SLE and Alaska beluga: 14-29% for young calves (0-1 year), 2-7% for old calves/juveniles (1-8 years), 3-6% for young adults (9-44 years), and 8-17% for older adults (≥ 45 years). A recent model, which estimated median (\pm SE) mortality rates during 1980-2021 in SLE beluga, suggested lower mortality rates for most age classes: $49 \pm 3\%$ for young calves (0-1 year), $3 \pm 1\%$ in yearlings (1-2 years), $0.9 \pm 0.1\%$ in juveniles (4-7 years), and $0.8 \pm 0.1\%$ in young adults (8-11 years) (Tinker et al. 2024). The Hoenig's (1983) mean regression equation for teleosts and marine mammals, which is based on maximum age for populations and assumes a constant mortality rate after early life history stages, provided a mortality estimate ranging between 5.1-10.0% for a maximal age ranging between 45 and 89 years (Table 1).

Cultural significance

Beluga are deeply anchored in the Inuit culture and identity as a reliable source of nutritive food for families and communities (Inuit Tapiriit Kanatami and Inuit Circumpolar Council 2012; Lemire et al. 2015). The hunting, butchering, and sharing of beluga represent social and cultural practices that allow the perpetuation of Inuit knowledge, skills, and social bounds (Tyrrell 2007, 2008; Breton-Honeyman et al. 2021). Therefore, beluga are extremely important as a top predator in their ecosystem, and to the culture and lives of Nunavik (Northern Quebec) Inuit.

Number of populations, distribution and abundance

Sub-units of a species are defined as ‘populations’, ‘stocks’, and ‘DUs’ among other terms, and there is considerable debate as to how to differentiate these (Stewart 2008). See Appendix B for the definitions of species sub-unit terms, and how they apply to BEL-EHB and UB beluga.

Twenty-two putative stocks of beluga are recognized worldwide by the International Whaling Commission (IWC), totalling more than 150,000 animals, two-thirds of which are found in Canadian waters (NAMMCO 2018; Figure 3). Eight recognized DUs of beluga occur in Canada (Figure 2; COSEWIC 2016). There is a certain level of range overlap between the WHB, EHB, and UB DUs in Hudson Strait and between the WHB, EHB and JB DUs in the Belcher Islands region in eastern Hudson Bay. The newly identified BEL population also overlaps in its summer range with beluga from the WHB, EHB, and JB populations (Parent et al. 2023). The BEL population was genetically identified after the most recent definition of beluga DUs by COSEWIC (Parent et al. 2023; COSEWIC 2016), therefore, there is a mismatch between the current DU definitions and our understanding of population structure in the eastern Hudson Bay area. Moreover, there might be some interbreeding among animals from different DUs on shared wintering grounds.

BEL-EHB beluga summer in the estuaries of the eastern Hudson Bay arc, and can be seen up to 60 km west of the Belcher Islands (Figure 4; Bailleul et al. 2012b). Historically, the largest aggregations were observed in July and August in Richmond Gulf, Little and Great Whale rivers, and the Nastapoka River (Smith and Hammill 1986; Caron and Smith 1990). Commercial over-harvesting decimated the beluga summering in Great Whale River which left Little Whale and the Nastapoka rivers as the main aggregation areas (Reeves and Mitchell 1987a). Although occasional sightings are still reported in the Nastapoka River estuary, no beluga have been observed there during aerial surveys since 2004, suggesting that it is no longer an important beluga summering area along the eastern coast of Hudson Bay (Gosselin et al. 2017; COSEWIC 2020a; St-Pierre et al. 2024). Consequently, the Little Whale River estuary appears to be the only remaining area in the eastern Hudson Bay Arc where significant numbers of animals occur (Figure 4). In the fall, beluga from the eastern Hudson Bay coast undertake a seasonal migration along the Nunavik coast and may sometimes travel in Ungava Bay to reach wintering areas in Hudson Strait and along the Labrador coast (Lewis et al. 2009; Bailleul et al. 2012a). The most recent population model abundance estimate for the BEL-EHB stock is 2,900 animals (95% CI= 1,500-4,200; Hammill et al. 2023).

UB beluga were historically abundant in southern Ungava Bay, mostly aggregating in the Koksoak, Leaf, Whale, Marralik (Mucalic), and George rivers, as well as in Hopes Advance Bay (near the community of Aupaluk) from mid-July to mid-August (Figure 1; Reeves and Mitchell 1987b). However, no large beluga aggregation has been seen during surveys conducted in the Ungava Bay area since the 1980's (Boulva 1981; Finley et al. 1982; Smith and Hammill 1986; Hammill et al. 2004; Gosselin et al. 2009; Sauv   et al. 2023). Continued sightings and the occasional harvest of animals suggest that the Ungava Bay DU either persists at a very low level, or that neighbouring DUs frequent Ungava Bay (DFO 2005; Durkalec et al. 2020). Information on distribution and seasonal movements are fragmentary for this population. While assessments by COSEWIC present the Ungava Bay as the area of extent of the UB DU, traditional knowledge suggests some animals may leave the bay and overwinter in Hudson Strait and off the Labrador coast. It is not clear if these reported movements were from UB beluga and/or from animals from other stocks (e.g., BEL-EHB and WHB) known to be migrating through Ungava Bay (Lewis et al. 2009; Bailleul et al. 2012a; Cuerrier et al. 2012; Breton-Honeyman et al. 2013; COSEWIC 2016; Durkalec et al. 2020).

Summer samples collected since 1994 ($n = 113$) from northern Ungava Bay indicate no genetic structure suggestive of an isolated matrilineage in this area based on mitochondrial DNA haplotypes (Parent et al. 2023). There is limited possibility to collect genetic samples from historical aggregation sites in southern Ungava Bay during summer, which limits our ability to examine the genetic identity or define the characteristics of beluga summering in the area. An Inuit-led research project initiated in 2019 yielded four samples from a limited hunt in the Marralik (Mucalic) River and three biopsies, providing tissues which can be used to start building a sample library to address stock identity.

Recent Trajectory

Historically, BEL-EHB beluga were thought to number around 12,500 animals in the 1800s. Commercial whaling during the eighteenth, nineteenth, and early twentieth centuries resulted in a sharp decline in abundance (DFO 2005; Lawson et al. 2006; Hammill et al. 2017a), and continued high subsistence harvests have limited the recovery, with climate change and habitat modification being additional underlying factors. In 2001, a stock assessment estimated that if harvests were not reduced, the BEL-EHB stock would go extinct within two to three decades (Bourdages et al. 2002). A series of severe management measures to which a relatively high compliance was observed (Lesage et al. 2001a) slowed the population decline. Population models fitted to the aerial survey abundance estimates, and taking into account reported harvests, indicated that the population had declined from 6,600 animals in 1974 to a minimum of 3,100 in 2001. A reduction in harvest levels resulted in an increase to 3,400 (95% CI=2,200-5,000) in 2015 (Hammill et al. 2017a), which provided support for revising the DU status from Endangered to Threatened in 2020 (COSEWIC 2020a; Figure 5a). Since 2015, reported catches have exceeded recommended harvest levels. An assessment in 2022 that fitted the model to the updated survey time series, including the most recent survey flown in 2021, indicated that the population had probably been declining, albeit a very slow rate (approx. 1% per year) between 2001-2015. Since 2015, the rate of population decline had accelerated (approx. 3% per year), leading to a decline in abundance from 3,700-3,900 in 2015 to 2,900-3,200 in 2021, depending on model assumptions (Hammill et al. 2023; Figure 5b). This estimate reflects the combined abundance for the BEL-EHB stock, as defined by the most recent genetic analysis (Parent et al. 2023).

Beluga summering in Ungava Bay were estimated to have numbered over 1,900 whales in the late 1800s, i.e., prior to the active commercial whaling that occurred from 1867 to 1911, which severely depleted the DU (DFO 2005). Continued subsistence harvest during summer until the mid 1980s (mean annual takes 1974-1985: 83, CV= 19%; Smith 1998) likely contributed to further reductions in abundance (DFO 2005; Boulva 1981; Finley et al. 1982). Beginning in 1986, the Marralik (Mucalic) estuary was closed to hunting and quotas were implemented for Ungava Bay beluga (Lesage et al. 2001a). The Marralik estuary remained closed until a limited harvest of three beluga was allowed in 2021 and 2022. A series of four systematic visual surveys conducted between 1985 and 2008, and covering nearshore and offshore areas of Ungava Bay failed to detect beluga on transects, and yielded very low numbers of observations in nearshore areas (maximum daily count range: 0-36 beluga; Smith and Hammill 1986; Kingsley 2000; Hammill et al. 2004; Gosselin et al. 2009). Given the absence of beluga sightings on transects flown during these four consecutive surveys, Doniol-Valcroze and Hammill (2011) estimated a maximal population size of 32 (95% CI: 0-94) UB beluga. The last survey conducted in the summer of 2022 yielded an estimated abundance of 68 (95% CI: 23-202) individuals based on three sightings (for a total of four beluga; Sauvé et al. 2023). The 2022 abundance estimate is not significantly different from the previous zero-count derived estimate, suggesting little change in abundance over the last four decades. This is in agreement

with the hunter's perception that there has been a lack of increase in beluga numbers in the southern UB estuaries (Durkalec et al. 2020).

HABITAT

Element 4: Describe the habitat properties that EHB and UB Beluga need for successful completion of all life-history stages.

Beluga are highly mobile, tolerate a broad range of environmental conditions, and occupy a vast habitat spanning 221,000 and 51,000 km² for the BEL-EHB and UB DUs, respectively (COSEWIC 2020a). These factors led COSEWIC (2020a) to suggest that it may be more appropriate to refer to beluga habitat *preferences* rather than habitat requirements. Habitat preferences vary seasonally and between the sexes (Barber et al. 2001).

In summer, beluga generally occupy coastal and offshore waters within their summering distribution, but aggregate in large numbers in estuaries and river mouths (Sergeant 1973; Sergeant and Brodie 1975; Smith et al. 1985; Smith and Hammill 1986; Smith and Martin 1994; NAMMCO 2018). As discussed in the Distribution section above, Little Whale River estuary is currently the main aggregation in eastern Hudson Bay based on surveys conducted since 2004, but aggregations have been reported in the Richmond Gulf, the Little Whale River and the Nastapoka River during previous surveys (Smith and Hammill 1986; Gosselin et al. 2017; COSEWIC 2020a; St-Pierre et al. 2024). Beluga aggregation behaviour in estuarine habitat is incompletely understood, but estuaries are believed to serve multiple biological functions, including foraging on concentrations of anadromous fish, moulting, rearing of calves and predation avoidance (Frost and Lowry 1990; St. Aubin et al. 1990; Watts et al. 1991; Richard et al. 2001; Loseto et al. 2006; Smith et al. 2017). Females with young calves are seen in higher numbers in estuaries than large males, which are more likely to be observed offshore (Hauser et al. 2017; Loseto et al. 2006; Barber et al. 2001; Smith et al. 1994;). This spatial segregation of male and females in summering grounds raised the idea that estuaries might play an important role as calf-rearing grounds, notably by providing shelter from large-sized predators (most notably killer whales; Loseto et al. 2006; Smith et al. 2017).

In summer, BEL-EHB and UB beluga feed on various fish species notably capelin, salmonids, sculpin, Arctic cod, whitefish, and crustaceans (Kelley et al. 2010; Breton-Honeyman et al. 2016). To what relative extent estuaries and offshore waters contribute to beluga diet is for the most part undetermined: although traditional ecological knowledge (TEK), field observations, and isotopic evidence show that beluga feed on estuarine species (Kelley et al. 2010; Breton-Honeyman et al. 2016; Durkalec et al. 2020), most stomach contents from beluga harvested in the summer in estuaries were empty (Caron 1987; Kelley et al. 2010). However, beluga are reported to regurgitate their stomach content during the chase associated with harvesting (Vladykov 1944; Byers and Roberts 1995; Norton and Harwood 2001), indicating that food is ingested in summering grounds but that the reliability of dietary analyses based on stomach contents from harvested individuals is limited. Beluga tagged along the eastern Hudson Bay coast undertook frequent inshore to offshore movements during the summer, which are thought to represent foraging trips influenced by tidally-driven prey availability (Ezer et al. 2008; Bailleul et al. 2012a). A variety of factors are thought to influence beluga presence in estuaries, including winds and waves (Scharffenberg et al. 2020), bathymetry (Hornby et al. 2016), seabed composition (Whalen et al. 2020), currents and upwellings (Williams et al. 2006; Hauser et al. 2015), tides (Simard et al. 2014), and anthropogenic disturbances (Halliday et al. 2020). In the fall, females start making more frequent trips offshore (Barber et al. 2001), and increase their diving activity during the weeks preceding migration (Heide-Jørgensen et al. 1998; Bailleul et al. 2012a).

In late summer or early fall, most beluga populations migrate, generally in groups of related individuals (Colbeck et al. 2013), to various wintering sites that may be shared by several DUs. Wintering sites include offshore open water or loose pack ice close to sea ice edges (Jonkel 1969; Finley and Renaud 1980; McDonald et al. 1997; Lewis et al. 2009; Heide-Jørgensen et al. 2010). In the spring, beluga often follow the floe edge along their migration routes towards summering areas (Cardinal 2013). The pattern of seasonal migration varies among beluga populations and suggested environmental factors that could be directing these migrations include the distribution of prey species, climate indicators of ecosystem productivity, the risks of ice-entrapment and predation (Bailleul et al. 2012b; Hauser 2016). Summer movement of beluga tagged on the eastern Hudson Bay coast and the initiation of their fall migration has been linked to sea-surface temperature (Bailleul et al. 2012b). These satellite-tagged beluga were associated with a sea-surface temperature of around 3°C in both summer and winter (Bailleul et al. 2012a, 2012b). During their seasonal migration, tagged beluga remained close to the coastline, presumably to benefit from currents prevailing along the east side of Hudson Bay (Saucier et al. 2004; Bailleul et al. 2012a). Beluga from the eastern Hudson Bay area over-winter in partially ice-covered, open water (e.g., polynya) or deeper warmer water areas in offshore waters of eastern Hudson Strait, Ungava Bay and on the continental shelf along Labrador (Bailleul et al. 2012a; Durkalec et al. 2020; Babb et al. 2021).

Seasonal migration of UB beluga is not as well documented but the summer use of estuaries is recognized and they also require partially ice-covered, open water and deeper warmer open water areas in winter. Satellite telemetry and genetic information show that animals from different DUs, including EHB and WHB are present in Ungava Bay, Hudson Strait, and the Labrador Sea in winter. There is uncertainty on the potential extent of any seasonal migration of UB beluga (COSEWIC 2016; Cuerrier et al. 2012).

Little is known about foraging activities in wintering grounds: fish species that might be of interest to beluga in Hudson Strait and on the continental shelf of Labrador Sea include capelin, Arctic cod, Greenland halibut and American sand lance (Stewart and Lockhart 2004). Beluga are thought to forage extensively in their wintering habitats as they tend to be fatter at the end of the winter and thinner in the fall (Breton-Honeyman et al. 2016). Moreover, a greater proportion of beluga daily activity is spent diving 1-2 months prior to the fall migration and at wintering grounds compared to during the migration (Bailleul et al. 2012a).

Studies of beluga from other Canadian DUs and Alaska suggested that habitat selection is driven by bathymetry, ice cover, sea-surface temperature and turbidity (Barber et al. 2001; Hauser et al. 2017, 2018; Noel et al. 2022). However, habitat preferences are likely to differ among beluga populations. While seasonal satellite telemetry and summer systematic aerial survey data exist to document the distribution of BEL-EHB beluga, information on the distribution for UB beluga is not sufficient to develop habitat selection or preference models.

One important aspect of beluga habitat use and migration routes is that beluga exhibit strong philopatry to natal locations (Caron and Smith 1990; Smith et al. 1994; Turgeon et al. 2012; O’Corry-Crowe et al. 2018). Knowledge of summering grounds and migratory routes are considered to be transmitted culturally from older individuals to juveniles (Palsbøll et al. 2002; O’Corry-Crowe et al. 2020), and from mothers to their offspring (Brown Gladden et al. 1997; O’Corry-Crowe et al. 1997, 2018; Turgeon et al. 2012; Colbeck et al. 2013), resulting in genetic structures among beluga populations defined, at least partly, by their summering location.

Sources of uncertainty

- Migration patterns of BEL-EHB beluga were derived from 32 beluga tagged in the Nastapoka and Little Whale rivers in the summers of 1993 to 2004 (Bailleul et al. 2012a).

Our understanding of BEL-EHB beluga is therefore inferred from animals tagged at two aggregation sites along the eastern Hudson Bay coast, while no telemetry data is available from the Belcher Islands or for UB beluga. Moreover, tag battery life was insufficient to document the spring migration for tracked individuals. Migration phenology was derived from shoreline Inuit observations, which have a restricted spatial extent (Lewis et al. 2009). Further studies of beluga movement and distribution within, to, and from their summer and winter habitat would improve our understanding of habitat functions.

- Further studies examining BEL-EHB and UB beluga diving behaviour would help identify important foraging grounds, both in summering and wintering habitats.
- There is uncertainty related to habitat-specific carrying capacity limits (K) for the different habitats used by BEL-EHB and UB beluga. Pre-commercial whaling abundance can only be inferred from the quantities of oil recorded and the trade in skins, and there is a gap of > 100 years in harvest reports from the eastern Hudson Bay coast (Hammill et al. 2017b). It is therefore difficult to estimate catches over time, and thus K at the time of commercial exploitation of the stocks. Moreover, there have been changes in ecosystem conditions since the late 1800s, suggesting that an historic estimate of K might not be valid under current conditions (Hammill et al. 2017b). Although the BEL-EHB population model used for beluga provides a proxy of overall, population-specific K (see Recovery Target section), it does not provide any insight into which habitats used by beluga have the most limiting effect on population dynamics. Studies examining the bioenergetics of Nunavik beluga, compounded with habitat-specific prey availability studies, would improve our understanding of beluga habitat functions, and their relationship with fitness and population dynamics.

HABITAT SPATIAL EXTENT: NOT RELEVANT

Element 5: Provide information on the spatial extent of the areas in EHB and UB Beluga's distribution that are likely to have these habitat properties.

Beluga matrilineages consistently return to the same estuaries in summer (Turgeon et al. 2012). This is considered to constrain the beluga's behavioural plasticity to environmental change and anthropogenic disturbance (Laidre et al. 2008; Smith et al. 2017). As such, areas where beluga used to aggregate in high numbers which were subsequently depleted by over exploitation have not been recolonized (e.g., Great Whale River in the eastern Hudson Bay arc, and the Marralik (Mucalic) Estuary in southern Ungava Bay). Beluga continue to occupy the Nelson and Churchill estuaries, where water flow has been modified by hydroelectricity development (Reeves and Mitchell 1987b, 1987c, 1989; Hammill et al. 2004; Smith et al. 2017), and they were observed consistently returning to the Nastapoka estuary within an average of 7.7 days following hunting or motor boat disturbance (Caron and Smith 1990). In eastern Hudson Bay, the Nastapoka River used to be an important aggregation area until the early 2000s, but no large aggregations has been observed during aerial surveys conducted over the last two decades (Gosselin et al. 2017; COSEWIC 2020a; St-Pierre et al. 2024). Whether this change in beluga distribution is due to undocumented local environmental changes altering the suitability of the habitat for beluga or to local extirpation due to unreported removals is unknown. A better understanding of the factors that led beluga to stop aggregating in the Nastapoka River could help the projection of important habitat use in other estuaries. Given current BEL-EHB and UB beluga demographic trends, the probability of beluga colonizing new estuaries in the next ten years is very low.

SPATIAL CONSTRAINTS: NOT RELEVANT

Element 6: Quantify the presence and extent of spatial configuration constraints, if any, such as connectivity, barriers to access, etc.

Beluga move freely, inhabiting a wide vertical distribution in the water column as well as a broad geographical distribution in the Arctic and sub-Arctic waters. During winter, sea ice creates a spatial constraint to beluga distribution, movement, and habitat use since most of their summering habitat is covered. Changes in the timing of freeze-up and breakup, in sea ice coverage, as well as in icebreaker activity are expected to increase beluga wintering habitat availability and connectivity. Therefore, spatial constraints to beluga movements, if any, may weaken due to climate change and anthropogenic activity.

CONCEPT OF RESIDENCE: NOT RELEVANT

Element 7: Evaluate to what extent the concept of residence applies to the species, and if so, describe the species' residence.

SARA defines "residence" as "a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating" (SARA s.2(1)). The concept of residence is not applicable to marine mammals, including beluga.

THREATS AND LIMITING FACTORS

Element 8: Assess and prioritize the threats to the survival and recovery of EHB and UB beluga.

Element 9: Identify the activities most likely to threaten (i.e., damage or destroy) the habitat properties identified in elements 4-5 and provide information on the extent and consequences of these activities

Element 10: Assess any natural factors that will limit the survival and recovery of EHB and UB beluga.

Element 11: Discuss the potential ecological impacts of the threats identified in element 8 to the target species and other co-occurring species.

THREATS SUMMARY

Important population declines in both BEL-EHB and UB stocks are attributable to intensive commercial hunting in the mid-19th and early 20th centuries. Since then, continued high levels of subsistence harvesting have contributed to further declines (DFO 2005). Management of subsistence beluga harvest remains the main challenge for BEL-EHB and UB beluga recovery, where short and long term harvest rights and long term conservation objectives must be balanced.

Threats from current human activities in the habitat of beluga include subsistence harvest, anthropogenic noise, potential industrial development, vessel traffic, chemical pollution, and commercial fisheries in Hudson Strait and Labrador Sea (Table 2). Climate change is also considered a threat to beluga through diverse effects on the ecosystem. Threats identified for BEL-EHB and UB beluga also affect other Canadian DUs, with some variation on the level of impact depending on respective distribution ranges. In Nunavik, whale carcasses are rarely retrieved from shores. Data from necropsies are thus unavailable for both BEL-EHB and UB beluga, limiting any quantification of the impact the threats detailed below pose to beluga recovery, except for subsistence harvest.

THREATS DESCRIPTION

Subsistence harvest – Beluga are an important source of nutrients (Lemire et al. 2015), are essential to Inuit food security and constitute an integral part of the Inuit culture (Alayco et al. 2007; Inuit Tapiriit Kanatami and Inuit Circumpolar Council 2012). Between the mid-19th and early 20th centuries, intensive non-Inuit commercial beluga exploitation substantially reduced some Canadian populations, notably those in Cumberland Sound, Ungava Bay, and eastern Hudson Bay. Beluga from the eastern Hudson Bay coast were mainly harvested between 1854 and 1877, with more than 8,000 individuals harvested between 1854 and 1863 (Reeves and Mitchell 1987a). Whaling in Ungava Bay occurred between the 1860's and early 1900's, but no total number of catches has been reported for that area (Reeves and Mitchell 1987b). By the 1960s and 1970s, all large-scale commercial beluga hunting had ceased (Sergeant and Brodie 1975; Kemper 1980; Reeves and Mitchell 1989).

Although local knowledge attributes the continued decline of BEL-EHB and UB beluga to increased vessel traffic (Johannes et al. 2000), this hypothesis is not supported by the available information. In areas such as Little Whale River, the Churchill River estuary (Manitoba), and the Mackenzie River estuary (Northwest territory) where vessel traffic, oil and gas exploration, and/or commercial whale watching take place, abundant concentrations of beluga are still seen (Norton et al. 1986; Hammill et al. 2004). In contrast, summering areas where beluga were seemingly extirpated have not been recolonized by large aggregations (Reeves and Mitchell 1987a, 1987b, 1989; Hammill et al. 2004). Severe local population reductions can therefore have long-lasting effects on beluga distribution (Wade et al. 2012).

The depletion of BEL-EHB and UB beluga due to excessive commercial exploitation and their failure to recover as a result of high subsistence harvest levels led DFO to establish management plans in the mid-1980s. Measures included a combination of quotas, and seasonal and area closures for subsistence beluga harvest. The Whale, Marralik (Mucalic), Tuctuc, and Tunulic river estuaries (all part of the Marralik (Mucalic) Estuary, Ungava Bay) were completely closed to harvesting in 1986, while seasonal closures were implemented in the Nastapoka and Little Whale River estuaries (eastern Hudson Bay) in 1990 and 1995, respectively. While the management of beluga was initially the sole responsibility of DFO, since the signature of the *Nunavik Inuit Land Claim Agreement* (NILCA) in 2006, beluga harvests in the Nunavik Marine Region waters have been co-managed by the Nunavik Marine Region Wildlife Board (NMRWB), DFO, and the Eeyou Marine Region Wildlife Board in areas where the land claims overlap (NILCA 2007). Since 2014, plans incorporate a flexible total allowable take (TAT) which uses available information on beluga migration timing and seasonal relative abundance of BEL-EHB beluga compared to WHB beluga to determine the number of beluga allocated for subsistence harvest in different Nunavik regions.

Management plans are renewed every three to five years and the current plan covers the 2021-2026 period (NMRWB and DFO 2021). The present management plan conservation objective is to maintain the BEL-EHB stock at or above the 2015 abundance estimate of 3,400 animals and that the probability of a decline due to harvesting must not exceed 50% (Hammill et al. 2017a, 2021). Management measures to meet this objective include combinations of harvest limits in the south-eastern Hudson Bay coastal area and seasonal closures in Hudson Strait and Ungava Bay (NMRWB and EMRWB 2020). The Marralik (Mucalic), Nastapoka and Little Whale River estuaries are still closed to hunting, but harvest may be authorised under certain circumstances. For example, the harvest of a low number of beluga in the Marralik (Mucalic) estuary has been approved for cultural purposes since 2021 (2 belugas taken in 2021 and in 2022). The killing of calves and of adults accompanied by calves is forbidden.

Management efforts to limit harvest of the BEL-EHB stock slowed the population declines to 1% or less between 2004 and 2014, but the rate of decline increased to > 3% annually since then (Hammill et al. 2023). These declines in abundance are not unexpected since harvests have consistently exceeded the recommended TAT levels (Figure 6), and previous assessments under-estimated the proportions of BEL-EHB beluga in Nunavik landings (DFO 2020; Hammill et al. 2023).

Anthropogenic noise – Anthropogenic noise is one of the most important threats to marine mammals worldwide since it can disturb normal behaviour, mask communications, interfere with feeding and diving patterns, and ultimately lead to hearing damage (Weilgart 2007). Due to their broad hearing frequencies, a variety of anthropogenic noise sources may disturb beluga. Beluga have been reported fleeing estuaries for up to 48h following acute sound disturbances (Reeves and Mitchell 1987a; Caron and Smith 1990). In addition, changes in vocal behaviour have been described, including reduction in calling frequency, suggesting predation avoidance mechanisms, and increases in the rate of repeated calls, similar to warning signals (Finley et al. 1990; Lesage et al. 1999; Halliday et al. 2019). In high circulation areas, notably the St. Lawrence river and Cook Inlet, vessel noise can mask beluga vocalization in the soundscape up to 94% of the time and impair mother-calf communication (Gervaise et al. 2012; Castellote et al. 2018; Vergara et al. 2021). Nevertheless, beluga are seen in high circulation areas such as Churchill (WHB DU – Manitoba), the St. Lawrence estuary (SLE DU – Québec), Longyearbyen (Svalbard beluga – Norway), Anadyr (Anadyr beluga – Russia) and Anchorage (Cook Inlet beluga – Alaska, United States). Yet, at least three of the five beluga stocks listed above are of concern (NAMMCO 2018), and anthropogenic noise is recognized as an important contributing factor to their decline (COSEWIC 2014; Castellote et al. 2018). Inuit consider that anthropogenic noise may have been an important contributing factor to the drastic reduction in population size for BEL-EHB and UB beluga (Doidge et al. 2002). Similarly, Inuit in Cumberland Sound consider that beluga are thinner than in the past due to increased energy expenditure devoted to boat traffic avoidance (Kilabuk 1998).

The main sources of anthropogenic noise that may affect BEL-EHB and UB beluga are from icebreakers, shipping vessels, sonars and seismic surveys in their wintering habitat, and recreational boats and aircraft in their summering habitats (Finley et al. 1990; Cosens and Dueck 1993; Lesage et al. 1999; Weilgart 2007; Moore et al. 2012; Halliday et al. 2017). Among these, large vessels (shipping vessels and icebreakers) are the most prominent sources of anthropogenic noise. Most large vessels circulate through Labrador Sea and Hudson Strait, although some enter Hudson and Ungava bays mainly to deliver goods to communities and for ore shipping. The increasing vessel traffic into and through the Northwest passage may change the soundscape in the eastern end of BEL-EHB and UB wintering distribution. Noise from vessels can last for hours due to ships' relatively slow travel speed (Castellote et al. 2018) and can be heard up to 80 km from the source underwater (Finley et al. 1990; Halliday et al. 2017). Other important sources of very loud underwater anthropogenic noise within BEL-EHB and UB habitat is seismic exploration, which is widespread in high latitudes. Since the western portion of the Hudson Bay, Hudson Strait, Ungava Bay and Labrador Sea are major hydrocarbons basins (Reeves et al. 2014), some seismic surveys have been completed throughout the Hudson Bay complex, including eastern Hudson Bay (Lavoie et al. 2019; Figure 7). Seismic airguns can generate up to 70 dB in noise at low frequency bands, and may still be heard at higher frequency bands past 48 kHz (Kyhn et al. 2019). Beluga usually tend to remain 20-30 km away from operating seismic survey vessels (Miller et al. 2005). Sound emitted from aircraft and recreational boats is of lower impact to beluga: emission duration is generally limited to a few seconds to minutes, and the number of events, even in high circulation areas, is considerably lower than shipping noise and hydrocarbon-related activities (Castellote et al. 2018). Nevertheless, controlled experiments in the St. Lawrence Seaway suggested that the vocal

communication of beluga was altered both by low-frequency noise produced by a ferry moving along a predictable path and by high-frequency noises from a small outboard motorboat moving erratically (Lesage et al. 1999). Similarly, Inuit hunters report that beluga respond to the noise of small hunting vessels and snowmobiles (Kilabuk 1998). Despite these considerations, it is difficult to evaluate the relative impact of anthropogenic noise disturbance on BEL-EHB and UB beluga.

Industrial development – Industries that are a cause for concern in areas inhabited by BEL-EHB and UB beluga include offshore oil and gas development, port development related to mining, and the construction of hydroelectric dams. Industrial development can pose a threat to beluga via different mechanisms. It can cause acute and chronic underwater anthropogenic noise through seismic surveys, drilling, ship traffic, and construction of infrastructure such as pipelines and ports.

Industrial development also introduces the risk of toxic spills from maritime transport and gas exploitation, which can harm beluga through direct contamination, or through contamination of their prey (Meador et al. 1995; Wilson et al. 2005). Large oil spills can lead to recruitment failures of fish populations (Nahrgang et al. 2010; Laurel et al. 2019), potentially reducing prey availability for beluga. Moreover, hydrocarbons can persist in the environment for decades and be released by future dredging activities (Bagby et al. 2017). Spills are relatively rare in Canada (Marty and Potter 2014), and spill risk is particularly low in the Arctic given the limited vessel traffic in the area (Marty et al. 2016). Nevertheless, single spills vary largely in their severity depending on the substance involved, the volume, the spatial extent, the location, and the timing. Since the Hudson Bay complex is an inland sea, spills can remain enclosed for extended periods of time, increasing the severity of their impacts on wildlife (Tao and Myers 2021). Additionally, there are uncertainties related to the efficiency of the response in case of a spill in remote Arctic areas (AMAP 2007).

One project of concern identified in the last COSEWIC assessment was the construction of a port to support the operations of an iron mine projected for 2019-2021 near Aupaluk, southwest Ungava Bay. This project was not initiated, and the environmental assessment was terminated without being completed by Oceanic Iron Ore Corporation in 2022 (Impact Assessment Agency of Canada 2022). Nevertheless, the rich iron reserves in the soil of western Ungava Bay may lead to future interest in exploitation of the area (Oceanic Iron Ore Corp. 2012). The Raglan Mine is a nickel mining complex located ≈100 south of Deception Bay, between the Nunavik communities of Salluit and Kangiqsujuaq and has been operating since 1997. The ore produced is trucked to Deception Bay, where a 152 m icebreaking bulk carrier ensures shipping to Quebec City. The icebreaking activity and shipping lanes overlap with BEL-EHB migration routes and both BEL-EHB and UB wintering habitat.

Another project of industrial development of concern is the Mary River Iron Mine North of Baffin Island (DFO 2014b, 2019; Gavrilchuk and Lesage 2014) because the migration routes of BEL-EHB beluga (as well as those of other DUs which are not the focus of the present RPA) overlap with the shipping lanes associated with the port of Milne and the projected port at Steensby.

Hydroelectric dams modify water flow, salinity, sedimentation rates and turbidity, alter pelagic communities in favour of lake species, especially near reservoirs, and increase mercury levels in the environment for up to 15 years (Lawrence et al. 1992; Hayeur 2000). Resulting modifications to estuarine physical and biotic conditions represent alterations to beluga summering habitat, which may have consequences for their behaviour and/or fitness. For example, in the Nelson River estuary, WHB beluga aggregate further from the estuary when dam water discharges are higher (Smith et al. 2017). Local people in Waskaganish, QC, also report that beluga no longer swim upriver to feed and are observed in fewer numbers since the

diversion of the Rupert River to support the Eastmain and La Grande Complex projects (Blackned 2019). More drastically, SLE beluga, which once occupied Manicouagan banks in the summer, never recolonized the area after the construction of dams up Manicouagan river (COSEWIC 2014), but over hunting may also have contributed to their extirpation of the area.

The development of the James Bay hydroelectric complex and the La Grande system induced changes in the Hudson Bay freshwater balance through the construction of reservoirs which retain water in the spring and release it in the winter. River inflow into Hudson Bay shifted from spring and summer, when most of river runoff, precipitation, and sea ice melt contributed to freshwater entering Hudson Bay, to winter, when river runoff used to be low as the land remained frozen and the formation of sea ice withdraws freshwater from the surface of the ocean (Eastwood et al. 2020). This freshwater input in the winter was noticed by Inuit in the Belcher Islands area, where polynyas representing eider duck wintering habitat experienced rapid freezing (Eastwood et al. 2020). These changes in ice coverage and dynamics may impact a portion of BEL-EHB beluga, since a fraction of the BEL population may overwinter in the Belcher Islands (Parent et al. 2023).

Most of the hydroelectric development in Nunavik occurred in the La Grande complex in James Bay (Hydro-Québec) and Churchill and Nelson Rivers in Hudson Bay (Manitoba Hydro). The Innavik Hydro project is currently building a run-of-river power plant on the Innuksuac River to supply the community of Inukjuak with hydroelectricity. The dam and turbines are being installed upriver and are not expected to directly affect beluga, although minor fish habitat loss and mortality (Pituvik Landholding Corporation 2010) may result in some indirect effects through changes in prey availability. Starting in 1970, Hydro-Québec planned another major hydroelectric development in the Great Whale River basin, which would have altered both Great Whale River and Little Whale River estuaries (Hayeur 2000). The project was abandoned in 1994, but discussions on revival of the project have been underway with the provincial government since 2022 (Bell and Stewart 2022). Hydro-Québec also assessed the hydroelectric potential of rivers from the Marralik (Mucalic) Estuary, but no hydroelectric development project was undertaken (Hayeur 2000). Any future hydroelectric development in Nunavik is likely to have significant impacts on BEL-EHB and/or UB beluga.

Chemical pollution – Beluga are apex predators with large lipid reserves, which make them highly vulnerable to persistent organic pollutants (POPs) which bioaccumulate in their tissues. High concentrations of POPs have been correlated to immunosuppression and endocrine malfunction in beluga (Letcher et al. 2010). Males tend to accumulate higher levels of POPs compared to females, a difference that can be attributed to elimination through pregnancy and lactation (Addison and Brodie 1987; Stern et al. 2005) and/or differential diets between males and females (Lesage et al. 2001b; Nozères 2006).

Nunavik is considered a pristine environment due to the low human and industrial occupation (14 communities along the coast of Hudson and Ungava Bay with c.a. 14,000 residents). Consequently, most pollutants arrive from the south via oceanic and atmospheric transport (Lohmann et al. 2007). Burdens of contaminants, organohalogens, perfluorinated compounds, mercury and other heavy metals are considerably lower in Canadian arctic and subarctic beluga populations than in SLE beluga (Muir et al. 1990; Ray et al. 1991; McKinney et al. 2006). While contaminants are thought to play a role in the non-recovery of SLE beluga (DFO 2005; COSEWIC 2014), their current impact on BEL-EHB and UB beluga is likely minor, yet difficult to assess. With the global ban of several POPs in 2004 (UNEP 2019), the concentration of POPs in arctic wildlife tissues is on a downward trend (Rigét et al. 2019). Nevertheless, because of its effects on contaminant cycling, sedimentation and processing, climate change may reintroduce some contaminants into the arctic food web (Noël et al. 2018).

Commercial fisheries – Beluga are not considered susceptible to entanglement in fishing gear due to their particularly acute echolocation abilities and their ability to swim backwards (NAMMCO 2018). Yet, entanglements account for 1% of deaths for SLE beluga (Lair et al. 2016), and netting is a traditional Inuit beluga harvest technique that is still practised. There is no existing entanglement or by-catch record for BEL-EHB and/or UB beluga. Beluga caught in fishing gear in areas where subsistence hunting occurs are likely reported as harvest rather than by-catch (NAMMCO 2018).

The other mechanism by which commercial fisheries might affect beluga is through competition for their prey. No important commercial fisheries are currently exploited in the summer range of BEL-EHB and UB beluga. There is a commercial shrimp fishery in Hudson and Davis Straits, and in the northern Labrador Sea. A bottom trawl Greenland halibut fishery is conducted in the Labrador Sea (Coté et al. 2019; Storey and Eibner 2021). The Greenland halibut fishery occurs in the Northwest Atlantic Fisheries Organization (NAFO) Subarea 0, which includes Baffin Bay (Division 0A) and Davis Strait (Division 0B; DFO 2014c; Figure 8). Fisheries for Greenland Halibut and shrimp were identified as a significant concern for narwhal (NAMMCO 2018), which lead to the closing of an area that overlaps the winter foraging range of narwhals in NAFO Division 0A (DFO 2007, 2014c; Figure 8). Beluga telemetry data suggested a main winter residency area at the southern junction between Hudson Strait and Labrador Sea (Bailleul et al. 2012b). Although tagged beluga remained close to the coast in that area, fisheries in the south-western portion of NAFO Division 0B may overlap with beluga winter foraging grounds. Since beluga also prey on Greenland Halibut and shrimp during the winter (Watt et al. 2016), there may be competition with fisheries in this area. However, information on beluga energetic requirements and foraging patterns in their wintering habitat is currently too sparse to evaluate the extent to which these fisheries may affect beluga. Bycatch of forage fish species by the shrimp fishery may be another source of competition for prey between beluga and fisheries (NMRWB 2019).

With climate change, productivity in Arctic regions is expected to increase, leading to the potential development of new or more intensive fisheries. However, current projections suggest that the enhanced productivity in the Canadian arctic ecosystem is unlikely to sustain profitable fisheries like those exploited in subarctic areas (Dunbar 1970; Slagstad et al. 2015; Tai et al. 2019). Further research on beluga foraging behaviour in wintering habitats and the extent of competitive pressure posed by fisheries is needed to better characterise the associated threat to BEL-EHB and UB beluga recovery.

Vessel traffic – The passage of large vessels, recreational boats, and aircraft can affect beluga. Such physical disturbances can increase stress, force beluga to flee a given area for extended periods of time (up to 48h; Caron and Smith 1990), and modulate their vocalization rates (Lesage et al. 1999; Halliday et al. 2019). This can, in turn, negatively affect the rearing of young, especially if the disturbance occurs in estuaries, result in increased energy expenditure, and interfere with beluga's ability to forage. Vessel traffic also increases collision risks. Strikes caused by small, high speed vessels can severely injure beluga which may reduce their fitness or be lethal. In the St. Lawrence estuary, where more than 8,000 vessels navigate the waterway every year, vessel strikes account for 2% of deaths in SLE beluga (Lair et al. 2016). Across BEL-EHB and UB beluga distribution, most small vessel traffic occurs along the coasts, surrounding Inuit communities. There is no available data on vessel strike-induced mortalities for BEL-EHB and UB beluga, but the relatively low traffic level suggests it likely minimal. Vessel traffic in Nunavik is most prominent during the open-water season (May through October). BEL-EHB and UB beluga are therefore most susceptible to vessel strikes in their summering habitat or during their migration.

Other effects of increased vessel traffic in Hudson Strait are related to the use of icebreakers. The passage of icebreakers creates artificial open-water channels which beluga can follow and get trapped in once ice re-forms. The noise generated by icebreakers may also delay fall migration through avoidance of the Hudson Strait area, resulting in whales being trapped in the ice before they can reach wintering grounds (Nacke 2017).

Climate change – Climate warming of the Arctic is two to three times faster than the rest of the globe (Holland and Bitz 2003), and Nunavik is particularly vulnerable to its effect, notably in the Hudson Bay area, which is warming two times faster than the rest of polar regions (Brand et al. 2014).

Among the first noticeable changes are the lengthening of the ice-free season and the increase in sea surface temperatures. Changes in beluga migration phenology in response to changes in the timing of autumn freeze-up and spring break-up differ across populations. In some populations, beluga delay their fall migrations, and initiate their spring migrations to match ice dynamics (Bailleul et al. 2012b; Hauser et al. 2017). In the case of beluga from the eastern Hudson Bay coast, observations between 1995 and 2010 indicated fall migration has been delayed by 18 days per decade, while spring migration has been occurring 8 days earlier every decade (Hammill 2013).

Changes in ice regimes also generate unpredictable conditions, possibly increasing the risk of ice entrapments. Ice entrapments occur when rapid shifts in wind direction and drops in temperature rapidly close breathing holes in the pack ice, leading to mass drowning or inability to escape predation by polar bears. Ice entrapments can lead to mass casualties of several hundreds of individuals. In 1955, more than 3,000 belugas died in Disko Bay, Greenland, due to an ice entrapment (Golodnoff 1956). In small populations such as BEL-EHB and UB beluga, the effect of mass mortalities associated with ice entrapment could be disproportionate since it could reduce the population to an abundance from which recovery would no longer be possible (Hobbs et al. 2015). Furthermore, because related beluga tend to travel together (Colbeck et al. 2013; O’Corry-Crowe et al. 2018), entire lineages could be lost in a single event. Yet, the reduction in sea ice may also decrease the risk of ice entrapments depending on the area. In Disko Bay, where sea ice coverage has decreased significantly over the last decades, there has been no large-scale ice entrapment of beluga since 1990 (Heide-Jørgensen et al. 2010).

Another change caused by climate change is the shift in species composition. Hudson Bay forage fish assemblages, where lipid-rich Arctic cod (*Boreogadus saida*) was once dominant, is shifting in favour of boreal taxa, notably sand lance (*Ammodytes hexapterus*) and capelin (*Mallotus villatus*) (Ponton et al. 1993; Watt et al. 2016; Schembri 2022). Changes in the distribution of predators are also expected, and killer whales are being sighted with increasing frequency in Hudson Strait, Ungava Bay, and Hudson Bay (Higdon and Ferguson 2009; Ferguson et al. 2010). The loss of sea ice coverage due to climate change may result in beluga being more accessible to killer whales. Killer whales and polar bears are the most prominent predators of beluga (Ferguson et al. 2012), and increased predation rates on small populations may lead to extirpation if abundance falls below a certain threshold (Hobbs et al. 2015).

Other impacts of climate change that may indirectly affect beluga include landslides and permafrost thaw, which may increase in frequency and intensity (Owczarek et al. 2020). For example, in 2021, an important landslide occurred up Great Whale River, with 45 million cubic meters of sediments spilled in the river. Two smaller landslides also occurred in Little Whale River in the fall of 2022. Such events may alter beluga in and surrounding estuaries by increasing turbidity, reducing oxygen levels for fish, and reducing river flow (Geertsema et al. 2009). Similarly, permafrost thaw, which is predicted to accelerate (Dagenais et al. 2020; Smith et al. 2022), is expected to change hydrologic flows (Connon et al. 2014; Walvoord and Kurylyk

2016) and could lead to the release of a wide variety of contaminants into the water (Miner et al. 2021), with consequences on physical and chemical characteristics of estuarine habitats, and thus potentially beluga health and fitness.

THREATS TO CO-OCCURRING SPECIES

Other marine mammals found in the Nunavik Marine Region are also impacted by most of the threats listed above (Huntington 2009). If threats to BEL-EHB and UB DUs were abated, it would thus benefit multiple species, including some listed as of special concern by COSEWIC, notably the ringed seal, polar bear, bowhead whale, narwhal, and killer whale. Similarly, a reduction in the risk of spills and the implementation of mitigation measures for anthropogenic noise and pollution could benefit the whole ecosystem. Subsistence harvest pressure varies substantially among species and is managed differentially.

LIMITING FACTORS

Disease – Beluga in high latitudes are considerably less affected by infectious diseases than beluga living in other areas, for example SLE beluga (Martineau et al. 1999; Mikaelian et al. 1999; Lair et al. 2014). Nonetheless, climate change is expected to alter wildlife disease dynamics, including exposure and transmission, through changes in host-pathogen-environment interactions (Burek et al. 2008). The warming climate has been associated with a worldwide increase of diseases in marine species (Kuiken et al. 2006). Therefore, epidemiological monitoring in Arctic and subarctic beluga populations, integrated with demographic data and the relationship with environmental factors is needed to understand the effects of climate change on beluga health. Such baseline data could act as an early warning system to foresee potential consequences for Threatened and Endangered populations.

Allee effect – The Allee effect, also known as depensation in the field of fisheries sciences, is defined as positive density dependence (i.e., per capita population growth is slowed at very small population sizes; Allee and Bowen 1932). The mechanisms involved include reduced reproduction due to the inability to find a mate, inbreeding depression, and behavioural changes such as reduced foraging success or protection from predators (Wade 2018). A decline in population growth rates at low levels can increase the risk of extinction of small populations, or prevent their recovery despite relief from anthropogenic threats (Dennis 1989; Liermann and Hilborn 2001). The absence of recovery in severely depleted cetacean populations in spite of it being several decades since the cessation of commercial whaling suggests that Allee effects might play a role in the population dynamics of marine mammals (Clapham et al. 2008). There are substantial uncertainties related to the UB beluga population trend. The population size might have been lower than the 2022 abundance estimate and recovering over the last decades. Alternatively, the UB beluga population may be stagnating despite over three decades since the closure of the southern Ungava Bay and the Marralik (Mucalic) Estuary to hunting, as a result of reduced productivity in this very small population. Contrasting reproductive rates among beluga populations of various statuses, and monitoring temporal trends in reproductive rates within populations would be useful to explore the role of potential Allee effects in the dynamics of beluga populations, as well as their significance for the achievability of recovery targets.

RECOVERY TARGETS

Caution: All recovery target abundance numbers provided in the following sections of the document are subject to change as new survey and harvest data become available to input into the population model. The recovery objectives used prevail over the population sizes shown in

Tables 3 and 4, regardless of whether model demographic trends and estimates change in future BEL-EHB and UB beluga stock assessments. In addition, recovery targets identified in this section are not specific to EHB beluga but to the joint BEL-EHB stock.

Element 12: Propose candidate abundance and distribution target(s) for recovery.

The EHB DU was assessed as Threatened in 2020 according to COSEWIC's criteria A1: 'Decline in total number of mature individuals' based on the approximately 50% decrease in population size between 1974 and 2015. The causes of decline were deemed understood and ceased (Hammill et al. 2017a; COSEWIC 2020a). However, the most recent survey and modelling data suggest that the BEL-EHB stock is still declining (Hammill et al. 2023, St-Pierre et al. 2024). Therefore, we propose three possible objectives (recovery targets) for the BEL-EHB stock (see Table 3 for corresponding population size benchmarks):

1. Attain a population size at or exceeding the 2015 abundance estimate in ten years. It should be noted that this objective is similar to the conservation objective of the current 2021-2026 beluga management plan.
2. Attain a population size which meets or exceeds the Precautionary Reference Level (PRL; defined as 48% of the carrying capacity) in 86 years (3 generations). This is based on the DFO-Maximum Sustainable Yield framework (DFO 2006).
3. Attain a population size corresponding to the estimated maximal demographic growth given no harvest from this stock.

Under SARA, population and distribution recovery objectives are set at the best achievable condition for a species (SARA 2021). In this context, objective 3) represents the best achievable condition for BEL-EHB beluga. However, beluga management plans aim at balancing harvesting rights with conservation objectives as identified within the land-claim agreements. The current conservation objective identified in the 2021-2026 management plan is to maintain the population at or above an abundance of 3,400 animals and that the probability of a decline due to harvesting must not exceed 50% (Hammill et al. 2017a, 2021). This is considered a high risk management approach because it fails to establish any buffer for implementation errors and possible model bias, likely under-estimates parameter uncertainty, and does not consider possible recovery of the stock. In contrast, precautionary approach frameworks aim at managing threats of serious irreversible harm to stocks where there is scientific uncertainty by accounting for the risk of unknown errors in model parameters (Doniol-Valcroze et al. 2013; Hammill and Stenson 2013; Hammill et al. 2017b). Objective 2) above aims for the stock status to attain the Healthy Zone under the precautionary approach framework (DFO 2006), and thus represents an intermediate recovery target integrating Inuit rights and sustainability of harvests.

In addition to a targeted abundance and a timeframe to reach that abundance, recovery targets should identify a probability that the targeted population size is attained. The current 2021-2026 management plan identified 50% as the acceptable probability of meeting the conservation objective. This management approach is highly risky, as is equivalent to accepting a 50% chance of failure to maintain the population at its current, low level. Alternatively, management objectives aiming for a 80% or 95% probability of maintaining or reaching the target population size would provide good, or very good chances of reaching the recovery target, respectively (e.g., Hammill and Stenson 2003, 2007, 2010, 2013; Stenson et al. 2012).

Another aspect of the BEL-EHB recovery objectives include the stock distribution within its summering habitat. Given the philopatry to summering sites displayed by individual beluga, and the potential desertion or extirpation from a formally major beluga aggregation area along the coast of eastern Hudson Bay (c.a., the Nastapoka Estuary) over the last two decades, there would be interest in avoiding further loss from the current BEL-EHB beluga summering

distribution. Additionally, a long-term objective (i.e., over > 100 years) would be to recover the historical distribution of beluga in eastern Hudson Bay estuaries previously frequented during the summer, including Richmond Gulf and the Nastapoka River.

The Ungava Bay population was assessed as Endangered in 2020 based on criteria A2: 'Decline in total number of mature individuals', with a decline > 50% over the last three generations, and criteria D1: 'Very small or restricted population. Total number of mature individuals < 250'. Although the last assessment suggests a population size of 68 whales in total in the Ungava Bay area, uncertainty remains whether these individuals are part of a remanent UB DU or migrants from other units. Therefore, the possibility that the UB DU may be extinct cannot be discarded. Because there is no carrying capacity (K) estimate available for UB beluga, it is not possible to compute a PRL for this DU (see Allowable Harm Assessment section). Thus, we propose two possible recovery targets for the UB beluga, assuming the DU still exists at very low levels (see Table 4 for corresponding population size benchmarks):

1. Maintain the population size at or above the 2022 abundance estimate. This represents the survival objective for this DU.
2. Attain a population size corresponding to the estimated maximal demographic growth given no harvest from this DU.

The main summering areas for UB beluga (south of Ungava Bay and the Marralik (Mucalic) Estuary) have been closed to hunting since 1986 to protect this small population. However, harvesting in UB has continued and, given the very small size of any remaining DU, any removals or unusual mortality event would substantially limit recovery. In addition, there is substantial uncertainty related to the UB demographic trend and its drivers. In this context, the survival target (objective 1) may be the most achievable recovery target for this DU. Alternatively, objective 2) aims for population growth under a no mortality, and no density-dependence assumptions (i.e., no Allee effect affecting population dynamics). Although aiming for population growth for UB beluga would be highly recommended, a better understanding of population distribution, abundance, and dynamics within this DU would be required to assess the feasibility of this recovery target.

A distribution objective for UB beluga could be to recover the historical distribution of the population within southern Ungava Bay and its estuaries. This includes the Koksoak, Leaf, Whale, Marralik (Mucalic), and George rivers, as well as Hopes Advance Bay. This objective can only be considered on the long term (i.e., > 100 years).

Sources of uncertainty

- Although recovery targets for UB beluga are presented in the document, research efforts are necessary to establish whether the UB DU still exists or is extinct.
- The population models (see Element 13 for description) used to determine maximal growth objectives assumes that the only source of density-independent mortality for beluga whales is harvest. Under the current harvest levels, this assumption is considered a valid simplification of beluga population dynamics, where population size would stabilize around the carrying capacity in the absence of harvests. However, other factors, such as disease epidemics, ice entrapments or environmental events may also be responsible for beluga mortality, which are not captured in the maximal growth rate abundance numbers. In addition, if UB beluga productivity were affected by an Allee effect, the stock would not grow at its maximal rate of 4%, and therefore projections from the exponential growth function would not apply. Thus, the corresponding recovery targets may be overly optimistic.

- Any remanent of the UB beluga DU is highly vulnerable to stochastic demographic and environmental events given its highly limited size. Therefore, unpredictable causes may lead to extirpation of this DU even in the absence of harvest.
- There has been compelling evidence that beluga display strong philopatry to their natal site, and tend not to recolonize suitable habitat that was previously used as aggregation areas once they are abandoned or the local population is extirpated (Reeves and Mitchell 1987b, 1987c, 1989; Hammill et al. 2004). However, high population density can lead to increased dispersal through intraspecific competition (Lambin et al. 2001). It is therefore conceivable that beluga may recolonize suitable habitats if populations substantially increase to a point where densities approach local carrying capacities. Beluga population sizes at which such density-dependent dispersal may arise in eastern Hudson Bay and Ungava Bay, and likewise the timeframe within which this may occur, are unknown because it has not yet been observed.

Element 13: *Project expected population trajectories over a scientifically reasonable time frame (minimum of 10 years), and trajectories over time to the potential recovery target(s), given current EHB and UB beluga population dynamics parameters.*

Population model structure – All BEL-EHB demographic trajectories described in the present document were generated using the stochastic stock-production population model described in Hammill et al. (2023). Briefly, Bayesian methods are used to fit a state-space model that considers survey abundance data to be the outcome of two stochastic processes: a state process and an observation process (De Valpine and Hastings 2002). The state process describes the underlying population dynamics and the temporal series for the true stock using the formulae:

$$N_t = N_{t-1} \cdot (1 + (\lambda_{max} - 1) \cdot [1 - (N_{t-1}/K)^\theta]) \cdot \varepsilon_{p_t} - R_t \quad (\text{Equation 1})$$

$$\text{with } \varepsilon_{p_t} \sim \text{logN}(0, \tau_p) \quad (\text{Equation 2})$$

where N is the abundance at time t or $t-1$, λ_{max} is the maximum rate of increase, K is the environmental carrying capacity, theta (θ) defines the shape of the density-dependent function, and ε_{p_t} is the process error. Removals (R_t) were calculated by adjusting reported catches (C_t) of whales for struck and loss (SL , i.e., the proportion of animals that were wounded or killed but not recovered), as well as non-reported catches:

$$R_t = C_t \cdot (1 + SL) \quad (\text{Equation 3})$$

The observation process describes the relationship between the true population size (N_t) and the survey estimates (S_t) where

$$S_t \sim \Gamma(\alpha, \beta) \quad (\text{Equation 4})$$

$$\text{with } \alpha = N_t \cdot \beta \quad (\text{Equation 5})$$

$$\text{and } \beta = N_t \cdot \varepsilon_{S_t} \quad (\text{Equation 6})$$

And ε_{S_t} corresponds to the precision of the survey estimate.

Model parametrization – The BEL-EHB abundance estimates from the eight surveys conducted between 1985 and 2021 (St-Pierre et al. 2024) were used to fit the model. The runs used the same model and fitting as outlined in Hammill et al. (2023), with the exception that the reported harvests were updated to include harvesting reported to 27 November 2022 (see Appendix B).

Model output – Perpetuating current harvest levels (110 for BEL-EHB beluga; including landings from Nunavut and Nunavik, and derived from BEL-EHB proportions from most recent genetic data; Hammill et al. 2023) would result in BEL-EHB abundances having a 50% probability of being $\geq 2,300$ in ten years, and most ($> 97\%$) projections predicting extinction within 33 years (Figure 9). Therefore, the current population dynamic parameters, most notably harvest levels, are incompatible with any of the recovery targets, and have high probabilities of resulting in BEL-EHB beluga extinction within the next two generations.

Exponential growth function – The 2022 survey provided the first abundance estimate for the UB beluga distribution area, despite being the fifth of a series of systematic surveys covering Ungava Bay since 1985 (Sauvé et al. 2023). No beluga were detected on transect lines in any of the four previous surveys, yielding no abundance estimate, although a small number of animals were seen off transect (Smith and Hammill 1986; Kingsley 2000; Hammill et al. 2004; Gosselin et al. 2009). Therefore, no abundance time series was available to fit a population model for UB beluga. In addition, since the Marralik (Mucalic) Estuary has been closed to hunting since 1986, there has been no reported harvest in the area over the last decades, except for those resulting from the estuary hunt plans in 2021 and 2022 (2 landings each year). Finally, negative population-dependence is unlikely to affect the UB demographic growth at its current size. Therefore, an exponential growth function with an intercept corresponding to the 2022 survey estimate and a 4% growth rate was fitted to make projections for the UB beluga population size under different harvest levels. Harvests were subtracted from the total population following annual growth, and a struck and loss of 27% (median estimated by the population model for BEL-EHB beluga) was applied since no struck and loss data from Ungava Bay was available.

Estimating current UB harvest levels is challenging due to the lack of genetic data available to derive season-specific proportions of UB beluga harvested in Ungava Bay. Because Ungava Bay is frequented by beluga from other, larger DUs during migration, only beluga harvested in summer in Ungava Bay were considered taken from the UB DU. There is uncertainty relative to the timing of the end of the period during which migrants from other DUs leave Ungava Bay in the spring. Therefore, three alternative periods were used to estimate UB beluga harvest levels: 2022 harvests taken by the communities of Aupaluk, Tasiujaq, Kuujjuaq, and Kangiqsualujuaq between 1) August and September (harvest = 4), 2) Mid-July and September (harvest = 10), and 3) July and September (harvest = 22). Perpetuating any of these harvest levels for UB beluga would result in a population decline leading to extirpation of any remaining stock within 4 to 21 years. Therefore, both the growth and survival recovery objectives are unachievable under current harvest levels (Figure 10).

Sources of uncertainty other than those identified in Element 12

- Aerial survey estimates for beluga are known to be highly variable. The BEL-EHB 2021 aerial survey abundance estimate was very low, yet estimated to be more precise than other surveys of this DU (St-Pierre et al. 2024). Given the relatively few surveys that have been completed for this stock, our understanding of current trends is sensitive to changes in the last survey estimate used in the model.
- There is uncertainty relative to the estimation of the number of BEL-EHB beluga harvested annually. BEL-EHB and WHB annual takes are considered to represent a proportion of the total number of beluga landed in Nunavik and Sanikiluaq. These proportions are area- and season-specific, and introduced as priors informed by genetic studies into the population model (Annex A; Hammill et al. 2023; Parent et al. 2023). Recent genetic data indicated that BEL-EHB animals represent a greater proportion of total landings than initially thought (Parent et al. 2023; see Element 15). The TATs and management measures established in

the current beluga management plan (NMRWB and EMRWB 2020) rely on previous, less conservative EHB proportions of total landings. In this document, revised, more conservative proportions are used. Nevertheless, both previous and revised proportions result in beluga removals exceeding the Science advice (DFO 2022).

- Field observations of animals struck and killed but not recovered or reported is an important source of uncertainty in the BEL-EHB population model. Any nonreporting or underreporting of takes has a high impact on model fitting and derived predictions for the population trend. In addition, the median struck and lost level estimated from the BEL-EHB model (27%) was used in the UB beluga demographic projection because no estimate was available for the Ungava Bay harvest efforts. Given the small size of the UB beluga DU, under- or overestimations of the struck and lost level applied to UB beluga harvests are likely to have substantial consequences for the UB beluga demographic projections.
- The UB beluga demographic projection was based on an exponential growth function assuming a constant 4% growth rate, corresponding to the default maximum natural growth rate for cetaceans (Wade 1998). Considering that the stock is depleted, UB beluga could be expected to exhibit a rate of increase close to their intrinsic maximum, which is not well known for beluga specifically. Alternatively, it is possible that UB beluga are subject to an Allee effect, where population growth is negatively influenced by density at very low population sizes. The projections from the 4% growth curve should therefore be interpreted as maximal population sizes.

Element 15: Assess the probability that the potential recovery target(s) can be achieved under current rates of population dynamics parameters, and how that probability would vary with different mortality (especially lower) and productivity (especially higher) parameters.

Under current harvest levels, the probability of reaching any of the recovery objectives for BEL-EHB or UB beluga is null. Decreasing anthropogenic mortality (i.e., harvest) would increase chances of recovery for BEL-EHB and UB beluga (Figure 11).

There has been substantial changes in the BEL-EHB population model predictions since the COSEWIC evaluation (COSEWIC 2020a). The most recent assessment indicates that the BEL-EHB stock abundance is not stable as previously thought (Hammill et al. 2017a, 2021), but has been declining at a rate of 3% per year since 2015 (Hammill et al. 2023). This decline is due to high levels of harvests that have consistently exceeded sustainable levels and an under-estimation of the proportion of BEL-EHB animals in the harvest (Hammill et al. 2023). The latter results from a re-analysis of the genetic information that determined that the stock could be further subdivided into an EHB and a separate Belcher Island (BEL) components. In previous analyses using short haplotypes, many of the beluga from the newly identified Belcher Island component had been grouped with WHB animals (Parent et al. 2023). This has important consequences for model parametrization and projections, since a proportion of landings from Sanikiluaq (Belcher Islands) that were previously deemed non-EHB beluga, are now considered as BEL-EHB animals when calculating their proportion in the total Nunavik and Sanikiluaq landings.

Using these updated proportions, no harvest level can provide a 50% probability that the BEL-EHB stock will be > 3,700 in 2026 (current management objective for the beluga management plan; NMRWB and EMRWB 2020). In contrast, the probabilities of BEL-EHB stock abundance being \geq 3,700 whales in ten years (recovery target 1 identified above) or in one, two, or three generation times given different annual harvest levels are presented in Figure 12.

Probabilities that the BEL-EHB beluga stock would be above the LRL and PRL (recovery target 2) listed above) are presented in the Allowable Harm Assessment section. The probability of

attaining a growing population of 3,900 BEL-EHB whales in ten years or 10,200 whales in 86 years is 50% under no harvesting pressure and is unachievable under harvest levels ≥ 1 (by definition of this maximal growth recovery objective).

In the population model used, productivity is modulated via a density-dependent function and a maximum rate of population growth (Hammill et al. 2023). Although the maximum rate of population increase is not known, most studies have suggested a median estimate around 4%, with a range of 2–8% (Alvarez-Flores and Heide-Jørgensen 2004; Hobbs et al. 2006; Lowry et al. 2008; Doniol-Valcroze et al. 2012, 2013). The prior distribution used for λ_{max} in the current model is a Beta distribution with a range of 0.02 to 0.06 (Appendix C), while the median model estimate for λ_{max} was 0.035 (2.5%-97.5% quantiles = 0.021-0.055). It appears unrealistic that this number would increase, and the current model already accounts for density dependence on productivity. Therefore, no simulations of increased productivity were attempted.

Regarding UB beluga, the exponential growth function suggest that at a harvest level of 2 annual takes, the population would remain stable, while any higher harvest level would result in rapid population decline.

Sources of uncertainty

Sources of uncertainty identified in Elements 12 and 13 apply.

SUPPLY OF SUITABLE HABITAT: NOT RELEVANT

Element 14: Provide advice on the degree to which supply of suitable habitat meets the demands of the species both at present and when the species reaches the potential recovery target(s) identified in element 12.

Due to philopatry to natal sites and cultural and vertical transmission of migration routes, BEL-EHB and UB beluga distribution is considered restricted to the summering and wintering grounds they occupy. Their recovery is not limited by the supply of suitable habitat.

SCENARIOS FOR MITIGATION OF THREATS AND ALTERNATIVES TO ACTIVITIES

Beluga are non-commercially exploited by Inuit from Nunavik and Nunavut. Inuit have harvesting rights under land claim agreements (NILCA and NLCA), and therefore do not require permits to harvest beluga. At present, the main hunting method is the use of a rifle (Breton-Honeyman et al. 2021), although traditional methods are allowed, including harpooning first and netting. There are no hunting fleets, but rather small private motorboats that are used by groups of hunters (Breton-Honeyman et al. 2021). The main hunting locations include the coastal waters off the 14 Nunavik communities and the waters off Belcher Islands, but hunting camps are also set at more remote locations, including Long Island (southeast Hudson Bay) and Marralik (Mucalic) River.

Most Nunavik Marine Region waters are currently managed without a total allowable take (TAT), except within the Eastern Hudson Bay Arc Region where a TAT is shared among communities (Figure 13) to protect BEL-EHB beluga (NMRWB and EMRWB 2020). The Nastapoka, Little Whale River and Marralik (Mucalic) Estuaries are closed to harvesting, and other seasonal closures are in place to protect BEL-EHB beluga during their seasonal migrations (*Marine Mammal Regulations* SOR/93-56, 2018). There is no TAT in Sanikiluaq (Nunavut), but the municipality implements voluntary closures from July 15 to September 30 annually to protect BEL-EHB beluga (DFO 2016). Harvesters are required to report all beluga harvested to DFO and/or Uumajuit Wardens. Nunavik hunters report a struck and lost rate of 5.7% (NMRWB and

EMRWB 2020), but the population model's median estimate for BEL-EHB is 27.3%. This model estimate also includes non-reporting.

Element 16: *Develop an inventory of feasible mitigation measures and reasonable alternatives to the activities that are threats to the species and its habitat (as identified in elements 8 and 10).*

Element 17: *Develop an inventory of activities that could increase the productivity or survivorship parameters (as identified in elements 3 and 15).*

Table 5 proposes mitigation measures that would likely decrease mortality and/or stressors of BEL-EHB and UB beluga. It is difficult to directly increase productivity of beluga populations, as it is dependent on environmental conditions influencing prey availability and carrying capacity. Productivity can likely be indirectly influenced by reducing anthropogenic threats to reproductively mature females and calves. Likewise, there is very little available data on BEL-EHB and UB natural mortality, and harvesting is considered the most important source of mortality for both stocks. Under current conditions, precautionary management of subsistence harvests represents the most likely measure for increasing BEL-EHB, and possibly UB, beluga survival.

The primary threat to BEL-EHB and UB beluga is overharvesting. Under the amended provisions of the *Fisheries Act* (2019), there is renewed emphasis on the sustainability of fisheries through the development of a management framework based on the Precautionary Approach. Under the DFO-MSY approach, the BEL-EHB stock lies in what is considered the Cautious zone, below the PRL but slightly above the LRL (Figure 14). Harvest strategies should focus on rebuilding the BEL-EHB stock within a certain timeframe. This is important both from a conservation perspective, but also to meet the needs of a growing population of hunters in Nunavik. One of the recovery objectives identified in this RPA for the BEL-EHB stock is recovery above the PRL within three generations (86 years), and harvest levels that could achieve this objective are presented in the Allowable Harm Assessment section of this document. In addition, given the known strong philopatry to summering sites expressed by beluga, management of harvests at the estuary level would represent a precautionary approach to avoid depleting family groups of beluga who may be vulnerable to single, large harvest events.

In contrast, the UB population is in the critical zone, under the LRL which is considered a lower limit below which significant harm can occur to the stock, significantly jeopardizing its recovery (Stenson et al. 2012; Doniol-Valcroze et al. 2013; Hammill et al. 2017b). It is unknown whether the non-recovery of UB beluga despite four decades of harvest closure in their main summering habitat is due to the small size of the population altering productivity via Allee effects, to non-reported continued harvests, or to the fact that this population may be extinct, and that animals observed in southern Ungava Bay and its estuaries in the summer may be migrants from other populations. Growth curves indicate that any harvest on remaining UB beluga would be unsustainable and pose serious threats to the survival of any residual population.

The impacts of other threats on BEL-EHB and UB beluga survival and recovery are difficult to assess, mostly due to the restricted data available on migration routes and timing, distribution in wintering grounds, season-specific diet and energetic requirements, and the physiological and fitness effects of the different stressors. A better understanding of spatiotemporal overlap of beluga migration and winter distribution with fisheries efforts, vessel traffic, and seismic exploration is required to estimate the reduction in mortality and increase in productivity expected by proposed mitigation measures or alternatives. Additionally, the implementation of a marine mammal carcass reporting and sampling program in Nunavik could provide valuable data on natural and anthropogenic causes of beluga mortality other than hunting.

Element 19: Estimate the reduction in mortality rate expected by each of the mitigation measures or alternatives in element 16 and the increase in productivity or survivorship associated with each measure in element 17.

Element 20: Project expected population trajectory (and uncertainties) over a scientifically reasonable time frame and to the time of reaching recovery targets, given mortality rates and productivities associated with the specific measures identified for exploration in element 19.

The current Nunavik beluga population model is a surplus production model, characterized by no age structure, and no explicit mortality or reproductive rates. The maximum rate of increase parameter (λ_{max}) integrates total births and mortalities and is fitted for the entire time series. It is, therefore, difficult to predict what impact on population dynamics individual mitigation measures would have. However, the one cause of mortality that is explicitly included in the model is removals through harvesting. Any reduction in harvest levels represent mortalities that are avoided. How this reduction in anthropogenic mortality interacts with density-dependent effects depends on the relative population size and carrying capacity. Figures 15 and 16 show the projected population trends with varying harvest levels for the BEL-EHB and UB stocks, respectively.

Element 21: Recommend parameter values for population productivity and starting mortality rates and, where necessary, specialized features of population models that would be required to allow exploration of additional scenarios as part of the assessment of economic, social, and cultural impacts in support of the listing process.

The parameter values estimated by the model are presented in Table 6. One aspect that the current model does not account for is unusual mortality events (UME) due, for example, to ice entrapments or disease epidemics, that are likely to affect overall abundance and, if repeated over time, may impact the overall productivity estimate. We simulated occasional UME in the BEL-EHB stock where 60 whales are harvested per year to explore potential impacts on population dynamics (Figure 17). While events causing additional mortality of 10 whales every 20 years had little impact on population dynamics, events removing an additional 50 beluga every 20 years resulted in delayed population growth. This demonstrates that stochastic, punctual events causing the mortality of several tens of beluga should be accounted for when modelling population dynamics.

A recently developed progesterone titration method allows the calculation of female pregnancy rates from beluga blubber samples (Renaud et al. 2023). Moreover, genetic sexing of historic beluga samples from harvest suggest sex biases in removals (Parent and Sauvé, DFO, unpublished data). Sex-skewed harvest can have numerous effects on mammal population dynamics, including impaired fecundity in low reproductive potential species (e.g. Ginsberg and Milner-Gulland 1994; Langvatn and Loison 1999; McLoughlin et al. 2005; Taylor et al. 2008). Therefore, incorporating information on age-specific reproductive rates and age- and sex-specific harvest levels into a sex- and age-structured demographic model could represent a way to integrate the effects of environmental variability and harvest biases into beluga population dynamics.

Element 18: If current habitat supply may be insufficient to achieve recovery targets (see element 14), provide advice on the feasibility of restoring the habitat to higher values.

Habitat supply is unlikely to limit BEL-EHB and UB beluga to achieve recovery targets.

ALLOWABLE HARM ASSESSMENT

Element 22: Evaluate maximum human-induced mortality and habitat destruction that the species can sustain without jeopardizing its survival or recovery.

Currently, the Government of Canada does not have a standardized, quantitative definition of Allowable Harm. In contrast, the U.S. Government adopted the potential biological removal (PBR) level as a tool for quantifying the maximum annual number of animals that may be removed in addition to natural mortality while still allowing the target population to reach or maintain its optimum sustainable population size within 100 years (Wade 1998). The PBR therefore has an implicit management objective, which is to identify harvest levels that have a 95% probability of the population being above the Maximum Net Productivity Level, defined as 50% of the carrying capacity over a period of 100 years (Wade 1998). The PBR is calculated as:

$$PBR = 0.5 R_{max} \times RF \times N_{min} \quad (\text{Equation 7})$$

Where R_{max} is the maximum rate of population increase (by default set to 4% for cetaceans), RF is a recovery factor ranging between 0.1 and 1, and N_{min} is the estimated population size using the 20th percentile of the assumed log-normal distribution around the abundance estimate (Wade 1998). N_{min} is calculated using the equation:

$$N_{min} = \frac{N_{est}}{\exp(z\sqrt{\ln(1+CV(N_{est})^2)})} \quad (\text{Equation 8})$$

where N_{est} is the point estimate of the most recent population size, z is the standard normal variate (0.824 for the 20th percentile), and $CV(N)$ is the coefficient of variation for N_{est} .

The median BEL-EHB abundance estimate for 2022 was 2,833 (CV = 22.73%), resulting in an N_{min} of 2,355. For UB, we calculated N_{min} using the most recent survey abundance estimate of 68 (CV = 61.85%; Sauvé et al. 2023), the estimate N_{min} was 43.

Recovery factor values < 1 allocate a proportion of the expected net production to demographic growth, while accounting for uncertainties hindering population recovery (National Marine Mammals Service 2016). Default values of 0.1 and 0.5 are recommended for Endangered and Threatened DUs, respectively (Barlow et al. 1995; Wade 1998). Nevertheless, Canadian criteria suggest a RF of 0.1 for small, declining populations or populations with unknown trends (DFO 2018). We thus used a RF of 0.1 for both populations.

Using these parameters, the PBR for BEL-EHB was 4.71 whales per year, while the PBR for UB was 0.085 whales per year. These PBR values represent an estimate of total removals from the population, thus including harvests, struck and loss, non-reported harvest, and other sources of human-induced mortality such as bycatch and vessel strikes. The TAT should therefore be lower than the PBR to account for sources of human-induced mortality other than harvesting.

In the case of BEL-EHB beluga, a certain level of information on abundance, trend and population dynamics is available. Therefore, a precautionary approach framework, which is more structured and leads to the calculation of different harvest levels which would still meet management objectives, can be applied to this DU (Hammill et al. 2017b). International agreements have identified the MSY as a management objective. Estimating MSY requires information on ecosystem carrying capacity (K) and the shape of the density dependent relationship. For some species, historic catch data have been used to infer pre-commercial hunt population sizes, which is assumed to be an estimate of K . In the case of BEL-EHB beluga, there is important uncertainty in historical catch. Moreover, there has been a change in ecosystem conditions in the Hudson-James Bay complex, including a shortening of the ice-covered season and the construction of hydro-electric dams that modified waterflow within the Bay (Tsuji et al. 2009; Galbraith and Larouche 2011; Hammill and Stenson 2013). This suggests

that K might have varied since the late 1800s, and that other proxies of K under current conditions should be used (Hammill and Stenson 2007).

The model fitted to the 1985-2021 aerial survey data and including the 1974-2022 catch data produced an estimate of K for the period of the modelling (Table 6) that could act as a proxy in setting the PRL and LRL under the MSY approach (Hammill et al. 2017b). Assuming that maximum productivity occurs at 60% of K , the PRL and LRL are set at 48% and 24% of this K estimate, respectively (Hammill et al. 2017b). This results in a BEL-EHB beluga PRL and LRL of 5,300 and 2,700 whales, respectively. The median current population estimated from the population model was 2,800 whales. The probability that the 2022 population is above the PRL is zero, while the probability that it is above the LRL is 60%. The DU, therefore, lies in the cautious zone, below the PRL but above the LRL. Thus, under the precautionary approach framework, BEL-EHB beluga harvest strategies should focus on rebuilding the stock above the PRL within a certain time frame, which represents recovery objective 2) identified in Element 13. A recommended management objective is to maintain a 95% probability that the population is above the LRL and 80% probability that the population is above the PRL (Hammill and Stenson 2003, 2007, 2010, 2013; Stenson et al. 2012). The probabilities that the BEL-EHB stock increases above the LRL and PRL in 10 years, and in one, two, and three generation times considering different harvest levels are presented in Figures 18 and 19.

Projections, therefore, suggest that attaining a BEL-EHB stock size above the PRL in one generation is relatively unlikely (<70% probability under no annual harvest), while attaining the PRL in three generations is feasible with reasonable probability (e.g., 80%) with annual harvest levels of 20 beluga. Annual harvest levels ranging between 20-30 beluga are compatible with a 90-95% probability that the population remains over the LRL over the next two to three generations.

Sources of uncertainty

- Because the relative sizes of the EHB and BEL populations are unknown, it is currently not possible to derive population-specific allowable harm levels within the BEL-EHB stock. Nevertheless, total allowable harm reported in this section may exceed the yet undetermined EHB- or BEL-specific allowable harm levels if harvests differentially target the EHB and BEL populations. Exceeding the population-specific allowable harm levels could lead to extirpation of matrilineages occurring on the eastern Hudson Bay coast or around the Belcher Islands. Avoiding harvesting several beluga from a same group and distributing harvest efforts across the BEL-EHB distribution range are practices that could contribute to avoiding differential targeting of the BEL and EHB populations. In addition, assessing the relative population sizes of BEL and EHB beluga would allow calculation of population-specific allowable harm levels.

RESEARCH RECOMMENDATIONS

Different aspects of beluga distribution, behaviour and population dynamics for which additional information is required to better characterize the level of impact of the different threats and provide a more meaningful Allowable Harm assessment have been highlighted throughout this document. The three main aspects which are of particular importance are: 1) whether the UB DU still persists or is extinct, 2) the strong influence of the 2021 BEL-EHB abundance estimate on demographic model trends and projections, and 3) the scarcity of information on BEL-EHB and UB beluga feeding behaviour and winter distribution.

To address the question of the persistence of the UB beluga DU, beluga tissue samples from the summer distribution area must be collected and contrasted with that of other populations.

The lack of samples from this area is attributable to the absence of harvest in the south of Ungava Bay and the Marralik (Mucallic) Estuary since 1986, before genetic sampling was instigated. Biopsies, which provide samples from live animals, would represent a potential way of increasing sampling in that area without promoting removals on this very small, if not extinct population. Environmental DNA (eDNA) also represents a non-invasive sampling method, however only mitochondrial DNA can be analysed from eDNA samples due to nuclear DNA degradation. Recent analyses suggest nuclear DNA is more promising for identifying beluga populations than mitochondrial DNA (Geneviève Parent, DFO, personal communication). Caution is however warranted, as the absence of a genetically-distinct population in Ungava Bay in summer would not represent unequivocal evidence that the DU is extinct. Many beluga DUs in Canada are defined based on philopatry to summering grounds. Therefore, collecting behavioural (e.g., telemetry) data on beluga summering in southern Ungava Bay to document movements and characterize the summer distribution of these animals may be necessary to determine if beluga frequenting the area are summer residents or migrating individuals.

The addition of the low and unusually precise 2021 survey estimate into the time series used to fit the BEL-EHB demographic model changed the estimated population trend and projections. The extent to which the 2021 abundance estimate exerts a disproportional effect on the population model is unknown, but derived model estimates and projection raise concern as to the DU's status. Beluga aerial survey-derived abundance estimates from a same area are highly variable, which is thought to result from the small size of surveyed populations, coupled with the non-random or contagious distribution of individuals that spend most of their time under the surface (Kingsley and Gauthier 2002; Gosselin et al. 2007; Gosselin et al. 2014). Conducting repeated surveys allows to capture the variability associated with the contagious distribution of beluga (e.g., Gosselin et al. 2007). Repeating aerial surveys to obtain other recent BEL-EHB stock abundance estimates to input into the population model would therefore provide a better understanding of current population trends and may reduce uncertainty associated with individual survey estimates. Moreover, incorporating sex- and age-specific data related to harvest and reproductive as well as environmental factors into a stochastic, rather than deterministic population model would better capture aspects of beluga population dynamics that are unaccounted for with the model currently used.

Over the last decades, telemetry devices have improved drastically in terms of battery life and data storage. The deployment of modern satellite telemetry tags which could collect dive data from beluga on the eastern Hudson Bay coast and from the Belcher Islands would provide unprecedented information on Nunavik beluga foraging behaviour, as well as information on movements to and within wintering grounds. This, compounded with detailed information on fishing effort, shipping traffic, seismic exploration and environmental variables, would allow a better assessment of the level to which the different threats may affect BEL-EHB beluga recovery, and would allow the development of habitat selection models.

Finally, TEK has provided extremely valuable information on beluga diet, distribution, condition, and the timing of migration which has been presented in this RPA. Additional efforts are needed among hunters, researchers, and managers so that Inuit knowledge and values that have been gained over countless generations are passed on and integrated into meaningful collaborations contributing to our understanding of beluga biology, behaviour, and demographic trends.

CONCLUSIONS

Beluga have general life-history traits that result in a low intrinsic rate of population increase and relatively long generation time. In addition, they display strong philopatry to their summering areas and culturally transmitted migration routes. These characteristics makes their populations

highly susceptible to harvesting pressure, the main threat identified for both the BEL-EHB and UB stocks.

There are important uncertainties relative to the threat assessment, estimated probabilities of reaching the different recovery targets identified, and to the current population trends for both BEL-EHB and UB beluga. Nonetheless, most recent data indicates a continuous decline in BEL-EHB beluga since the 1970s, interspersed with periods where the decline has slowed or the population briefly stabilised. The population size of UB beluga remains very small, assuming the DU is not extinct. Management objectives should, therefore, target the recovery of both stocks, not only from a conservation perspectives, but also to ensure the continuation of the socio-culturally important beluga harvesting practices along the coasts of Nunavik. Collaborative research efforts and community engagement are critical to increase our understanding of the interactions between beluga behaviour and population dynamics, its changing ecosystem, and human activities including, but not limited to, harvesting.

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FIGURES

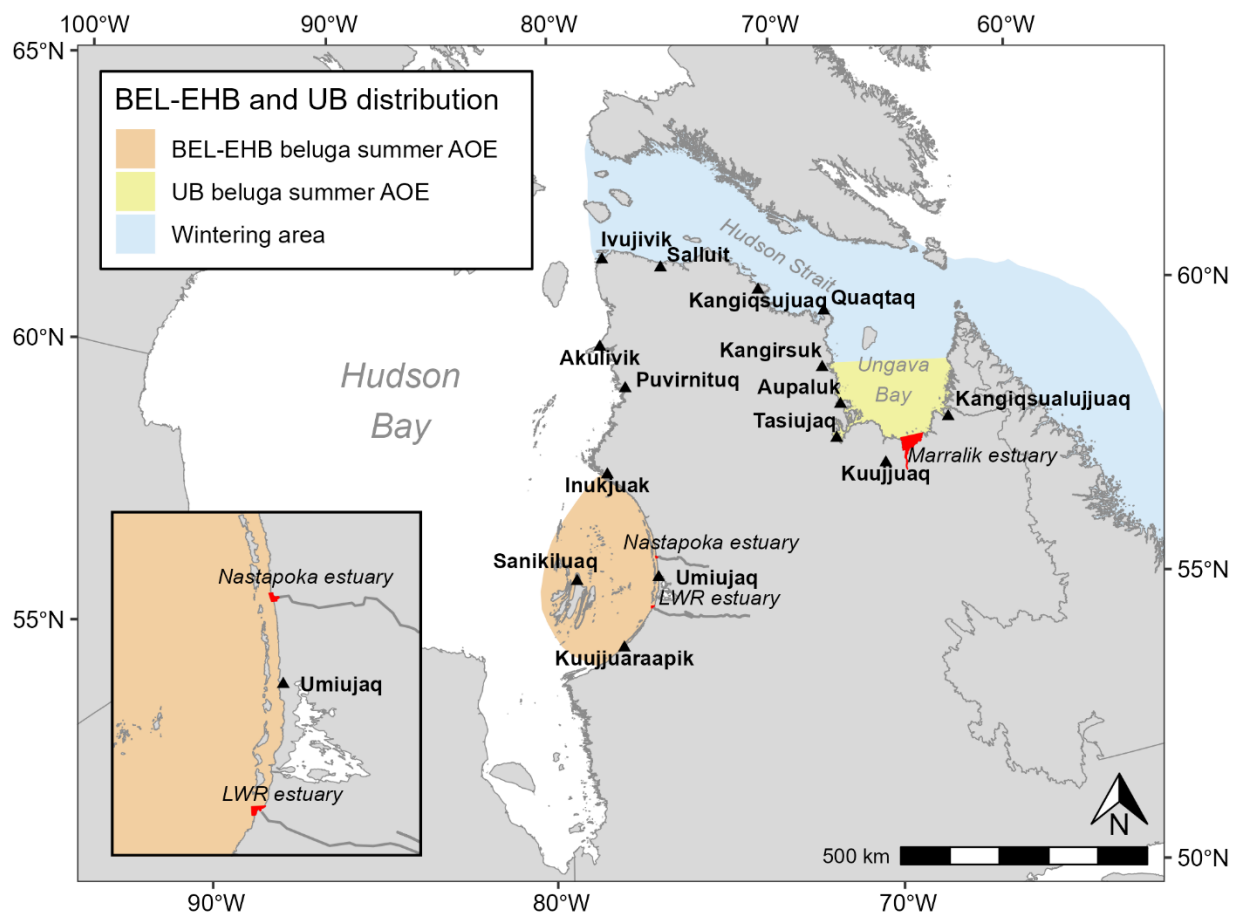


Figure 1. Geographic delimitation of summering and wintering areas of extent (AOE) for the Belcher Islands-Eastern Hudson Bay (BEL-EHB) beluga stock and the Ungava Bay (UB) beluga designatable unit. The red polygons represent the areas which are closed to harvesting year-round to protect BEL-EHB beluga (Nastapoka and Little Whale River (LWR) estuaries) and UB beluga (the south of Ungava Bay and Marralik Estuary).

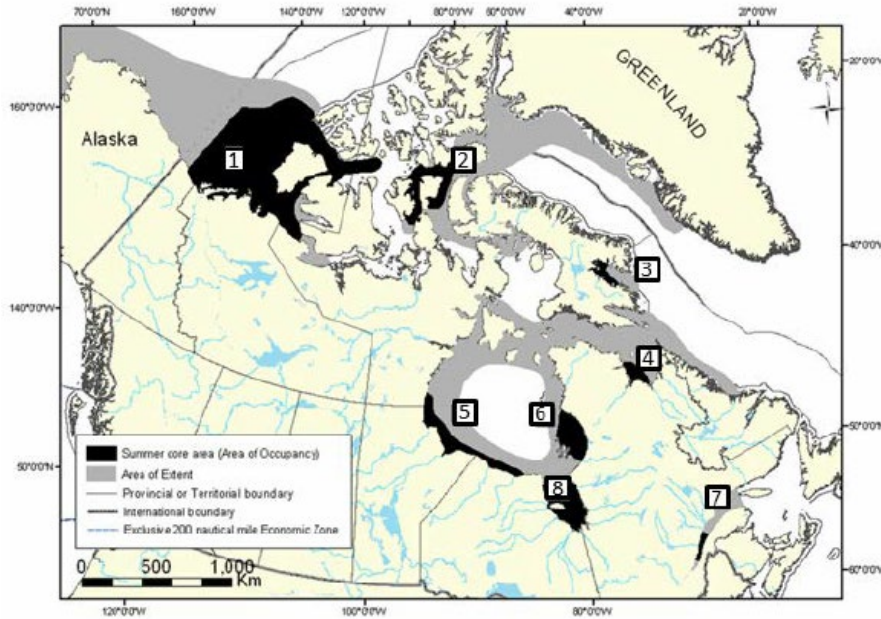


Figure 2. Distribution of beluga in Canada and recognized DUs: 1) Eastern Beaufort Sea (EBS); 2) Eastern High Arctic-Baffin Bay (EHA-BB); 3) Cumberland Sound (CS); 4) Ungava Bay (UB); 5) Western Hudson Bay (WHB); 6) Eastern Hudson Bay (EHB); 7) St. Lawrence Estuary (SLE); and 8) James Bay (JB). Source: COSEWIC (2020a).

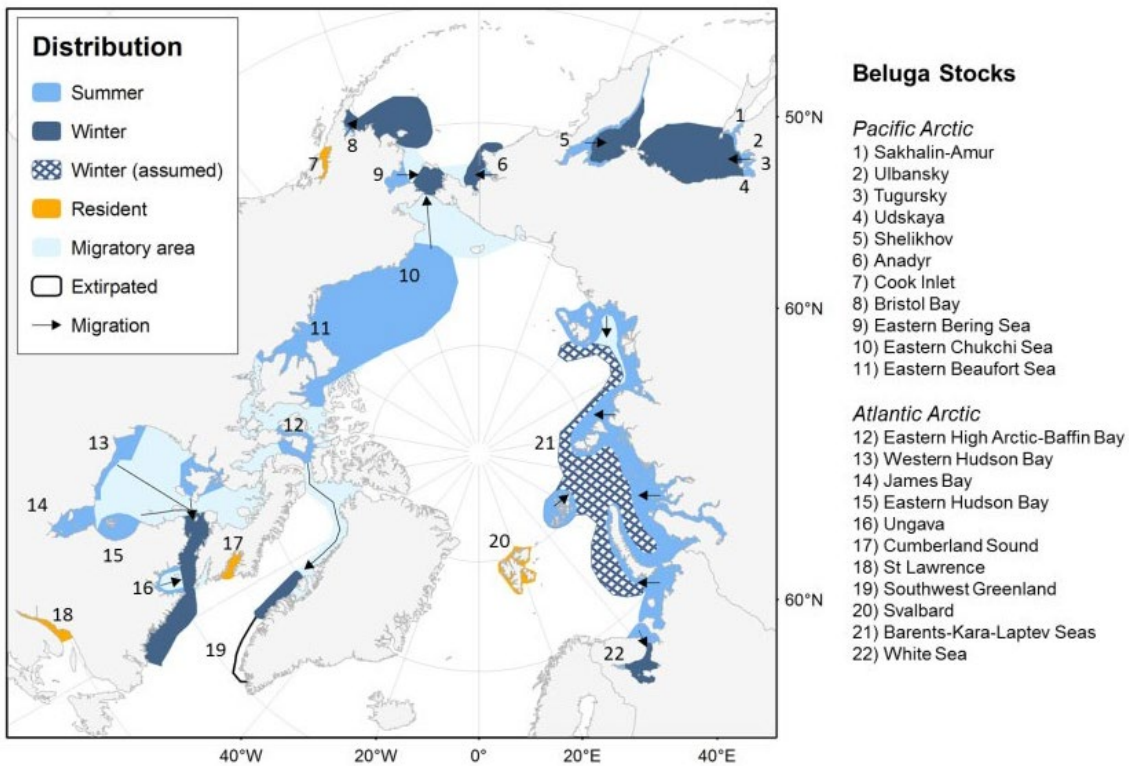


Figure 3. Global range of beluga, displaying currently recognized stock distribution and some indication of migratory movement. Source: NAMMCO (2018).

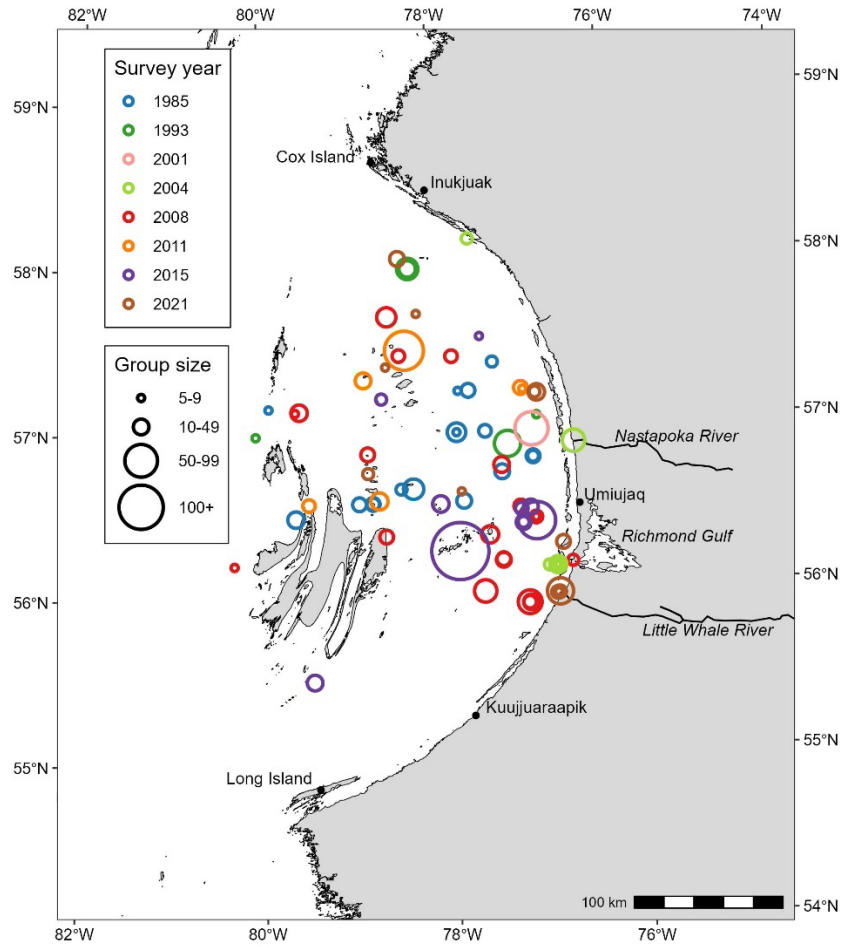


Figure 4. Spatial distribution of beluga aggregations (c.a., groups ≥ 5 individuals) detected during aerial surveys conducted from mid-July to September between 1985 and 2021. For the 2011, 2015 and 2021 surveys, which were flown using a double platform design, only the sightings from primary observers are depicted to avoid duplicates.

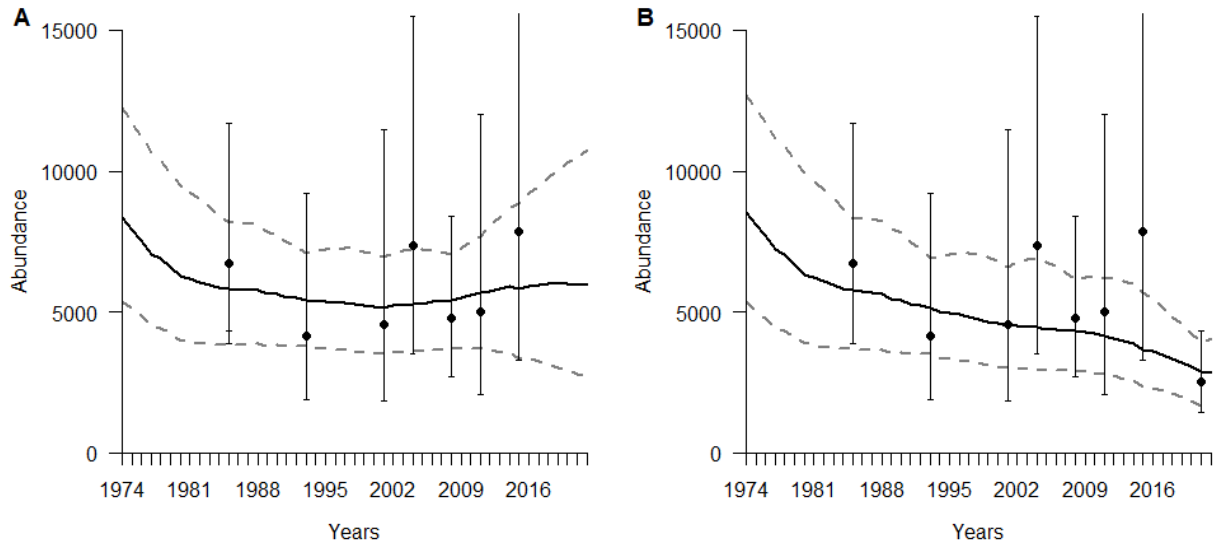


Figure 5. Estimated trajectory of the BEL-EHB beluga stock obtained by fitting a density dependent model to aerial survey abundance estimates, and accounting for reported harvests (1974-2022). Survey estimates (black circles \pm 95% CI), median (black solid line) and 95% CI (grey dashed lines) are displayed. The model was fitted A) without and B) with the 2021 survey abundance estimate.

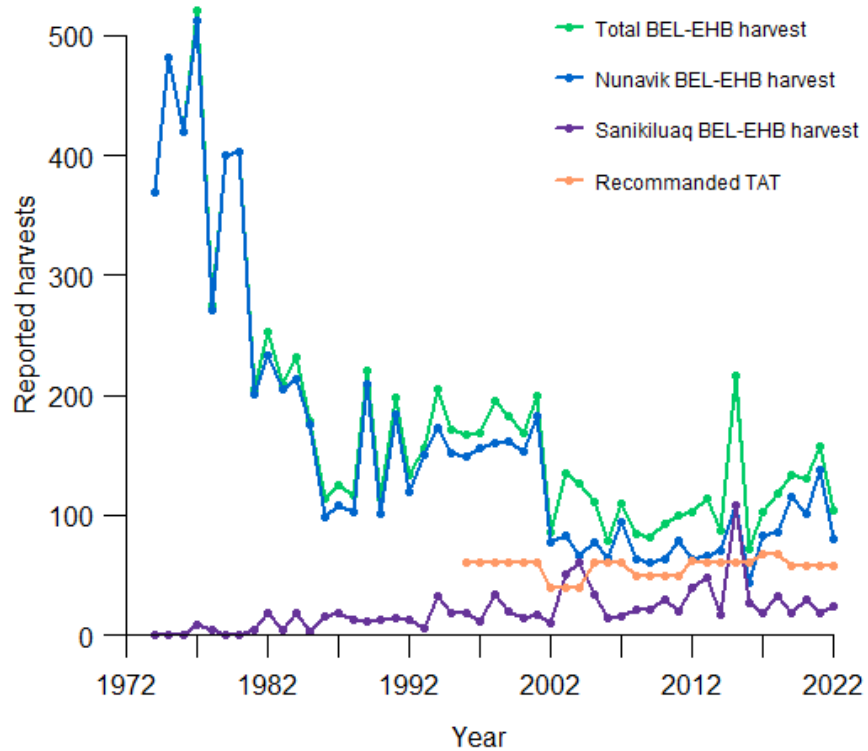


Figure 6. Harvest statistics derived using total reported harvest of beluga in Nunavik and revised season- and location-specific proportions of total landing representing BEL-EHB animals based on genetic data (Hammill et al. 2023; Parent et al. 2023). The total allowable take for BEL-EHB beluga is shown for reference.

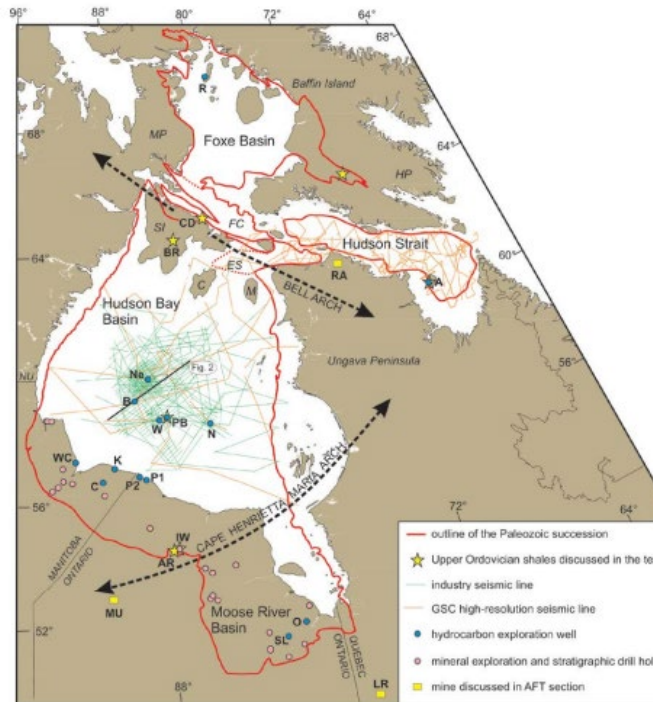


Figure 7. Distribution and extent of seismic research activities conducted under the Geomapping for Energy and Minerals programs between 2008 and 2018 in Hudson Bay Basin and adjacent basins. Multichannel industry seismic lines and Geological Survey of Canada (GSC) high-resolution seismic lines are depicted. Source: Lavoie et al. 2019.

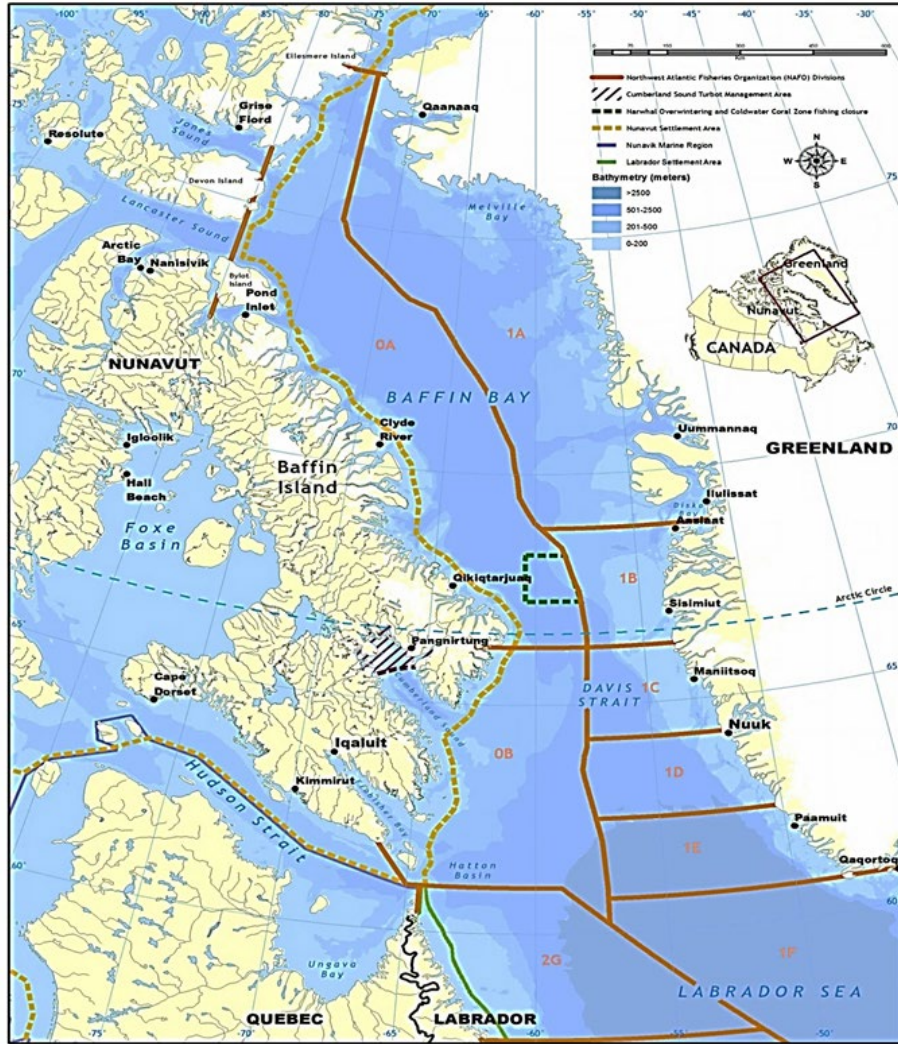


Figure 8. Northwest Atlantic Fisheries Organization Subareas and Divisions relevant to the Greenland Halibut fishery. Source: DFO (2014c).

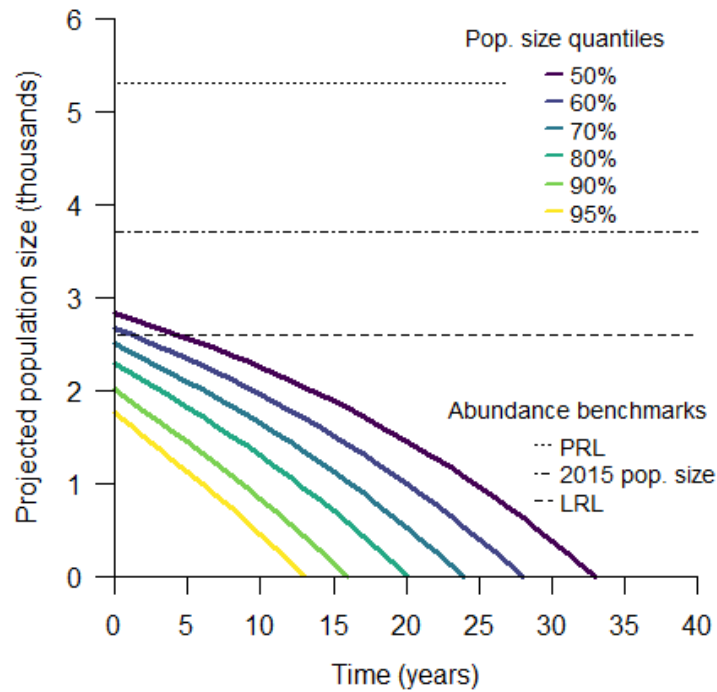


Figure 9. BEL-EHB stock abundance projected over the next decades under current harvesting levels (BEL-EHB: harvest = 110).

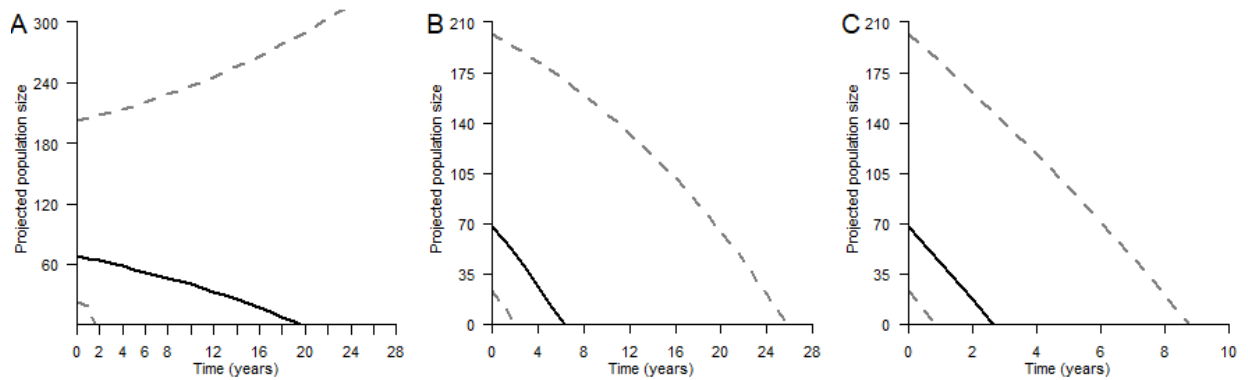


Figure 10. UB beluga population size projected over the next decades using a 4% exponential growth curve and the 2022 aerial survey estimate (full black line) and 95% confidence interval upper and lower limits (grey dashed curves) as initial population sizes under current harvest levels. Current harvest levels were estimated based on 2022 harvests taken in Ungava Bay between: A) August and September (harvest = 4), B) Mid-July and September (harvest = 10), and C) July and September (harvest = 22) of 2022.

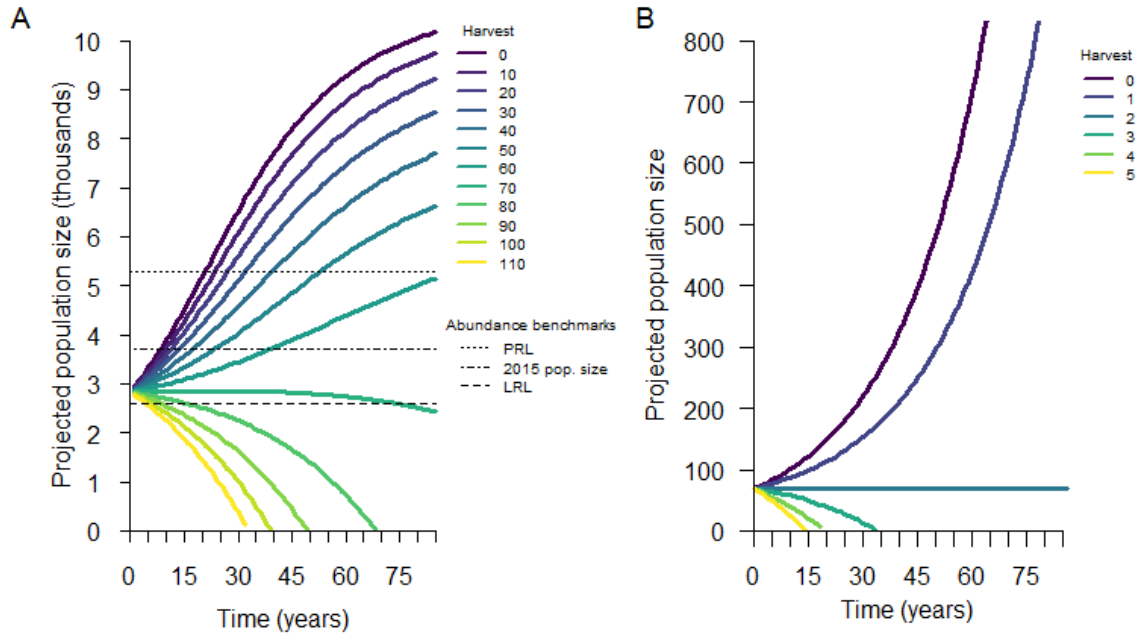


Figure 11. A) Median BEL-EHB and B) UB beluga stock abundance projected over the next three generations based on different harvest levels. Initial year is 2022. Projections are based on a population model for BEL-EHB and use a 4% exponential growth curve in the case of UB beluga. Colored curves refer to different annual harvest levels. Precautionary approach (PRL, dotted line) and limit reference (LRL, dashed line) levels are shown, as well as the 2015 abundance estimate (two-dashed line) as suggested recovery objectives.

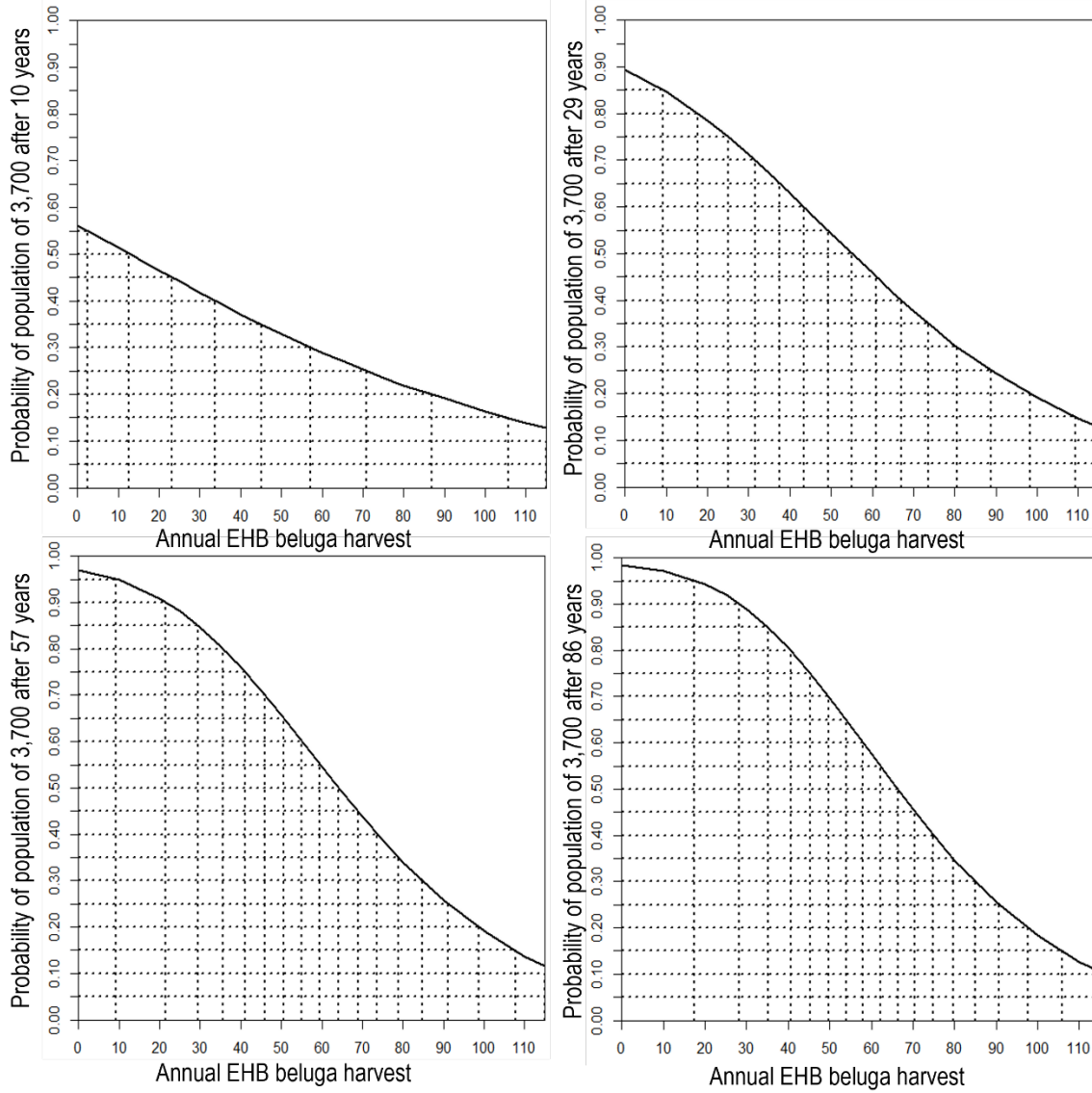


Figure 12. Probability that the BEL-EHB beluga stock would be greater than the 2015 abundance estimate after 10 years, or one, two or three generation times.

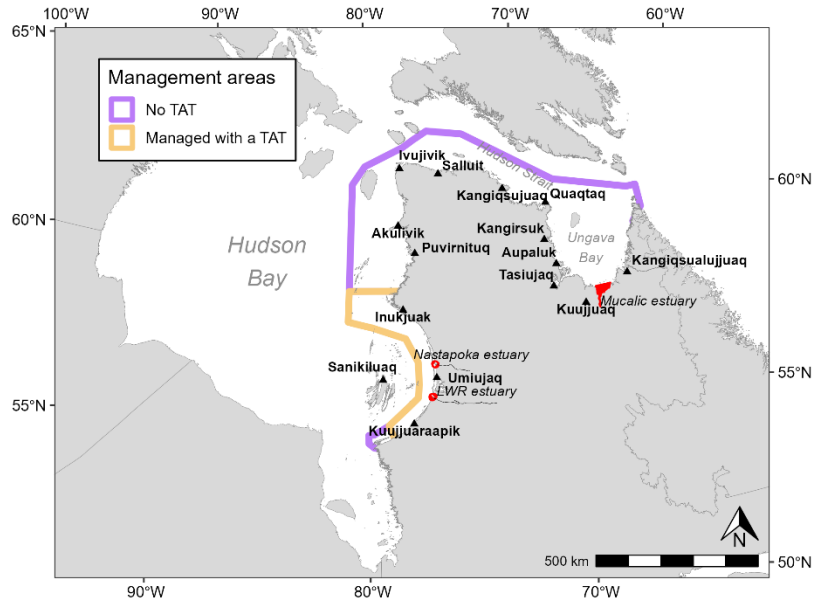


Figure 13. Nunavik beluga management areas, characterized by a total allowable take (TAT) and non-quota limitations (yellow contour), non-quota limitations only (purple contour), and estuaries closed to hunting (red zones).

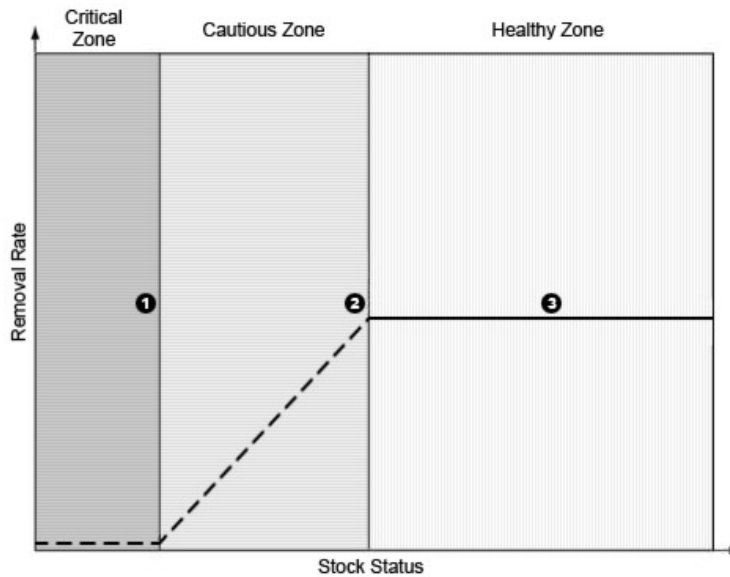


Figure 14. Suggested precautionary approach framework for Fisheries and Oceans Canada (DFO). 1) The limit reference level (LRL); 2) the precautionary preference level (PRL); and 3) a removal rate identified to maintain the resource within the Healthy zone (DFO 2006).

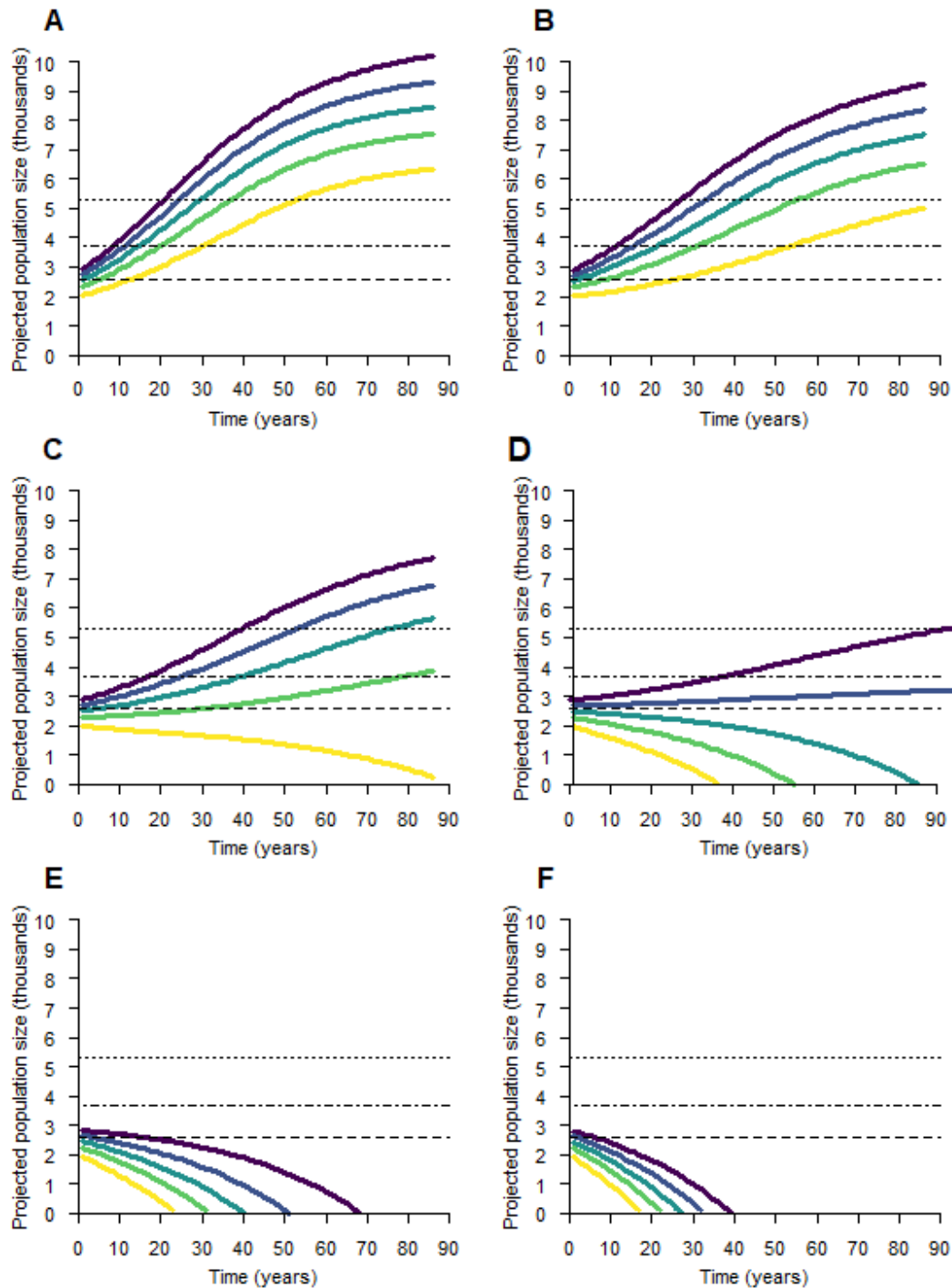


Figure 15. Population model projections for BEL-EHB beluga abundance over the next three generations (86 years). Initial year is 2022, and panels A, B, C, D, E, and F display projections assuming annual harvests of 0, 20, 40, 60, 80 and 100 whales, respectively. Dark purple, purple, blue, green and yellow lines represent > 50%, >60%, >70%, >80% and > 90% population percentiles, respectively. Precautionary approach (PRL, dotted line) and limit reference (LRL, dashed line) levels are shown, as well as the 2015 abundance estimate (two-dashed line) as a suggested recovery objective.

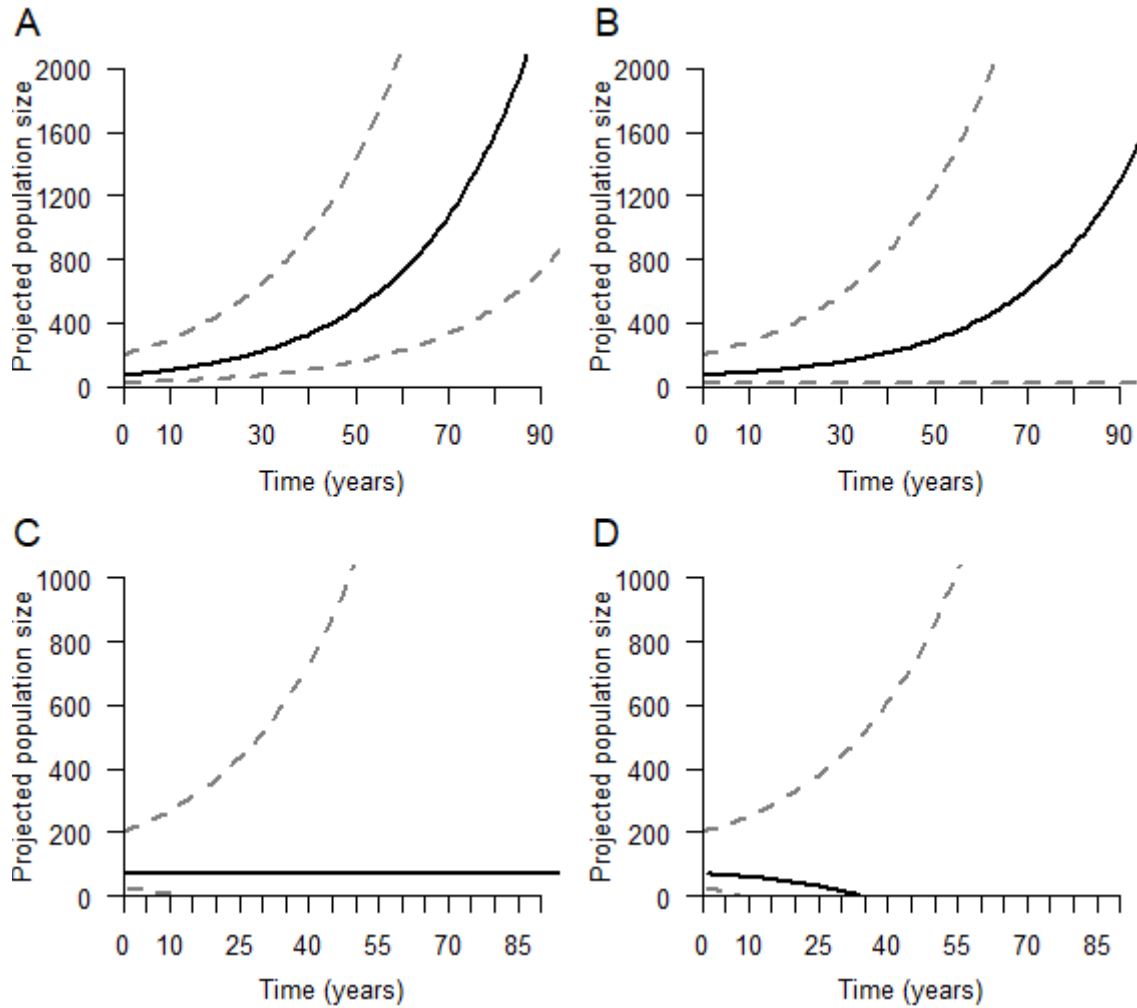


Figure 16. UB beluga population size projected over the next three generations using a 4% exponential growth curve and the 2022 aerial survey estimate (full black line) and 95% confidence interval upper and lower limits (grey dashed curves) as initial population sizes assuming annual harvests of 0, 1, 2 and 3 whales, for panels A, B, C and D, respectively. Note differences in y-axis scales between panels A-B and C-D.

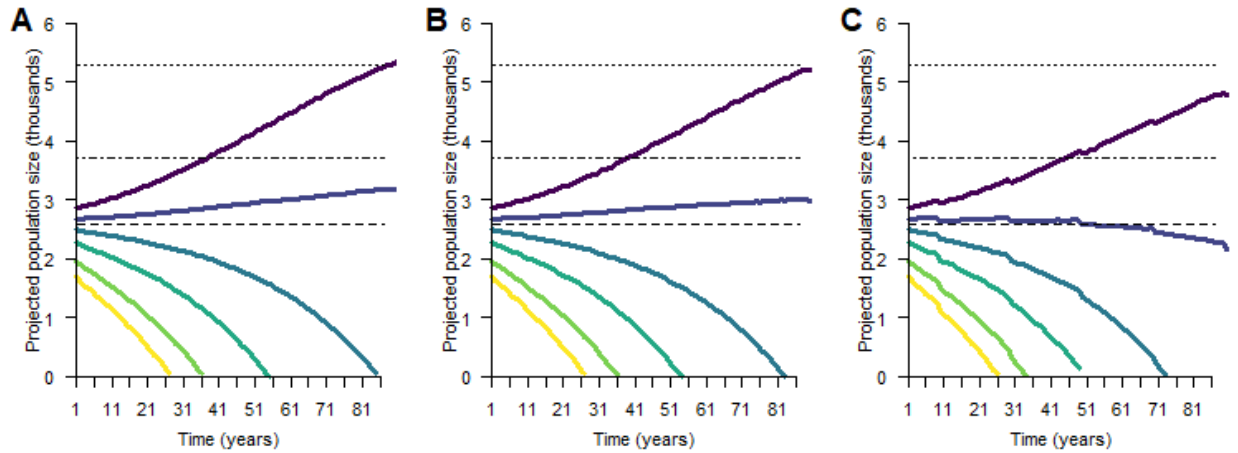


Figure 17. Exploration of the effects of UME on BEL-EHB beluga stock demography. Baseline harvest is set to 60 removals annually, and an UME occurs every 20 years of the simulation. A) No UME; B) An UME causing the mortality of 10 beluga every 20 years; C) An UME causing the mortality of 50 beluga every 20 years. Dark purple, purple, blue, turquoise, green and yellow lines represent > 50%, >60%, >70%, >80%, > 90%, and > 95% population percentiles, respectively. Precautionary approach (PRL, dotted line) and limit reference (LRL, dashed line) levels are shown, as well as the 2015 abundance estimate (two-dashed line) as a suggested recovery objective.

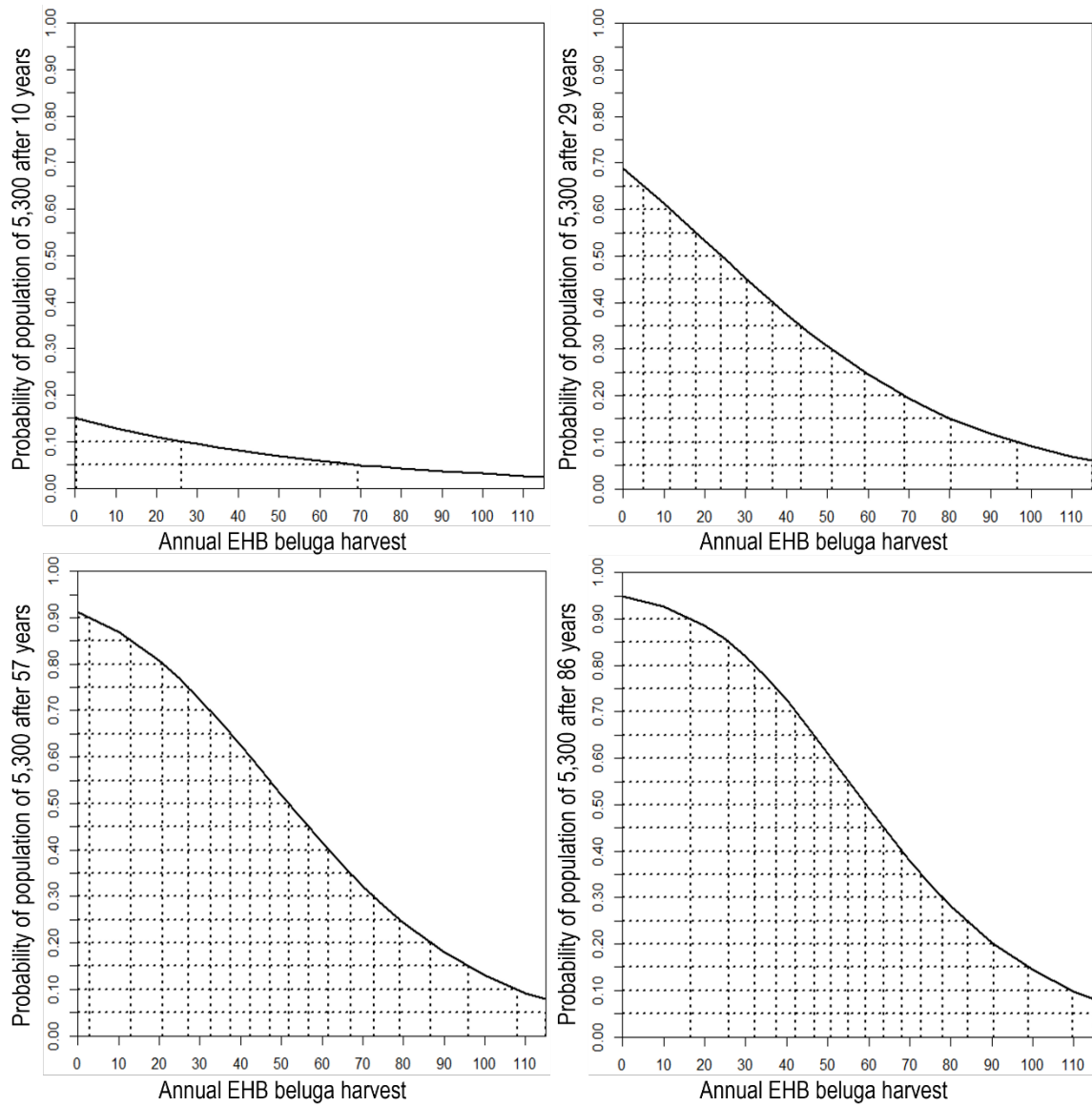


Figure 18. Probability that the BEL-EHB beluga stock would be greater than the PRL (5,300 whales) after 10 years, or one, two or three generation times.

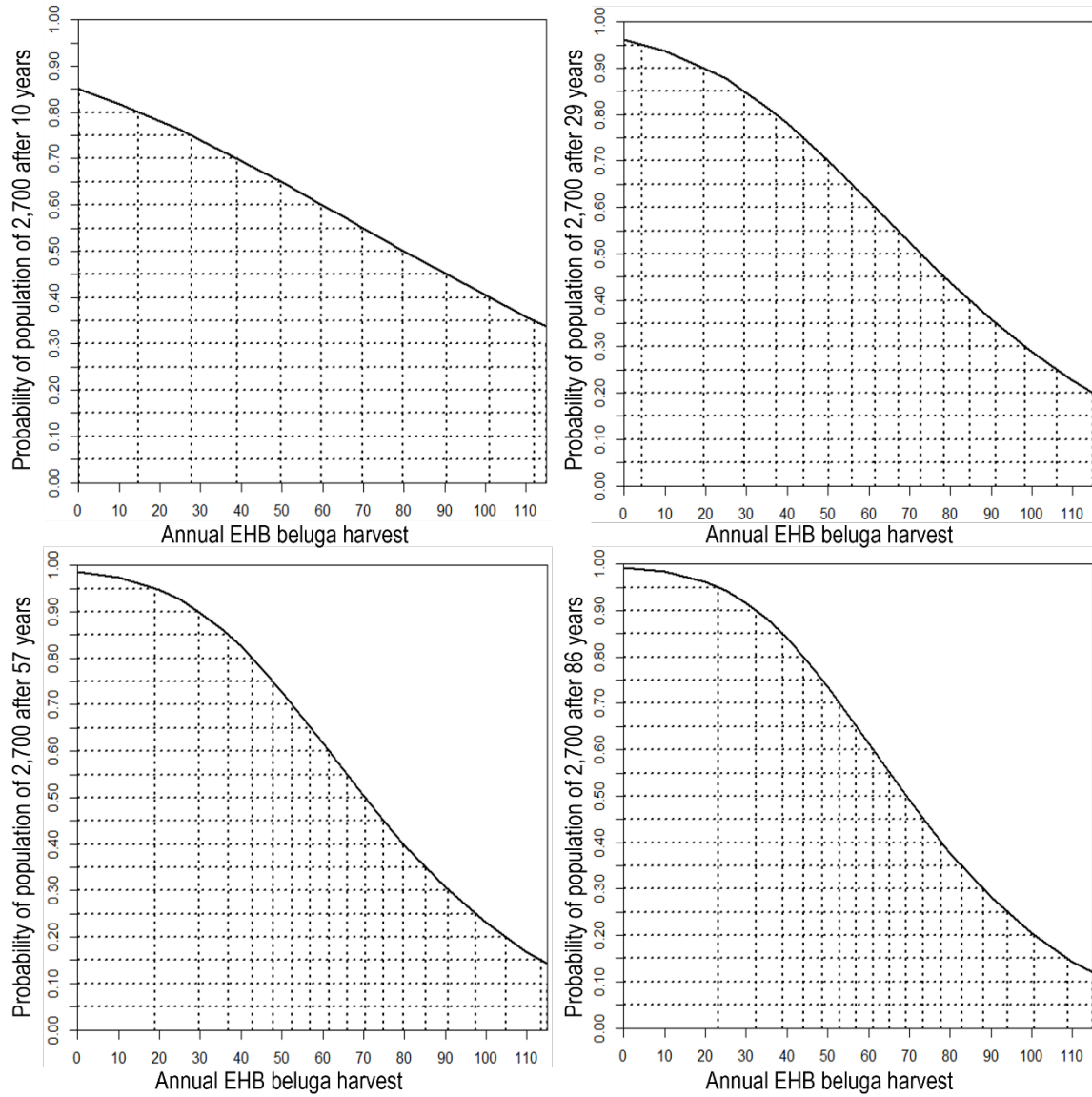


Figure 19. Probability that the BEL-EHB beluga stock would be greater than the LRL (2,700 whales) after 10 years, or one, two or three generation times.

TABLES

Table 1. Life history parameters for BEL-EHB and UB beluga. Parameters from studies where age was estimated assuming the deposition of two growth layer groups (GLG) per year were adjusted to reflect the fact that beluga deposit only one GLG per year. (F): female, (M): male.

Life-history parameter	Value	Reference
Age at sexual maturity	(F) 8-14 years (M) 8-22 years	Doidge 1990b; Sergeant 1973; Ferguson et al. 2020
Age at physical maturity (BEL-EHB only)	(F) 15 years (M) 10 years	Derived from Gompertz curves in Doidge 1990a
Age of reproductive senescence of females	35-50 years (but can be > 70 years)	Burns and Seaman 1986; Ellis et al. 2018; Ferguson et al. 2020
Longevity	45-89 years	McAlpine et al. 1999; Hobbs et al. 2015; Lesage et al. 2014; Ferguson et al. 2020
Gestation time	12.8-15 months	Doidge 1990b; Matthews and Ferguson 2015
No. of offspring per birth	1	Doidge 1990b; Matthews and Ferguson 2015
Lactation duration	2 years	Doidge 1990b; Matthews and Ferguson 2015
Inter-birth interval	3 years	Doidge 1990b; Matthews and Ferguson 2015
Generation time	26.8 years	Lowry et al. 2017
Adult natural mortality		Hoening 1983, Burns and Seaman 1986; Doidge 1990b; Hobbs et al. 2015; Mosnier et al. 2015; Hammill and Lesage 2019; Tinker et al. 2024
Young adults (9-44 years)	1-6%	
Old adults (> 45 years)	8-17%	

Table 2. Threat assessment for the BEL-EHB and UB belugas based on DFO (2014a) guidelines. H: Historical, C: Current, A: Anticipatory.

Threat	Likelihood of Occurrence	Level of Impact	Causal Certainty (Rank)	Population-Level Threat Risk	Population-Level Threat Occurrence	Population-Level Threat Frequency	Population-Level Threat Extent
Subsistence Harvest	Known	High (BEL-EHB), Extreme (UB)	Very high	High	H, C, A	Continuous	Extensive
Anthropogenic noise	Known	Medium-low	High-Medium	Unknown	C, A	Recurrent	Extensive
Chemical pollution	Unlikely	Low	Medium	Low	A	Continuous	Extensive-Narrow*
Industrial development	Likely	Unknown	Medium	Unknown	H, C, A	Continuous	Narrow
Vessel traffic	Likely	Unknown	Medium	Unknown	C, A	Recurrent	Broad
Commercial fisheries	Known	Unknown	Low	Unknown	C, A	Recurrent	Broad
Climate change	Likely	Unknown	Very low	Unknown	C, A	Continuous	Extensive

*Population-level threat extent may vary depending on the type of chemical pollution. A small restricted oil spill will only impact a fraction of the population in comparison to continuous inputs of chemicals widespread in the ecosystem which may affect the population as a whole.

Table 3. Temporal population size benchmarks related to the recovery targets identified for BEL-EHB beluga. The total number of beluga are presented along with the number of mature individuals in parentheses. These numbers are subject to change based on future survey results and population model simulations informed by the latter.

Recovery target	Population in 10 years	Population in one generation (28.6 years)	Population in two generations (57.2 years)	Population in three generations (85.8 years)
1. Attain or exceed the 2015 abundance estimate.	3,700 (2,500)	3,700 (2,500)	3,700 (2,500)	3,700 (2,500)
2. Attain a population \geq PRL in 3 generations	3,000* (2,000)	3,400* (2,300)	4,300* (2,900)	5,300 (3,600)
3. Attain a population size corresponding to the maximal demographic growth given no harvest	3,900 (2,600)	6,300 (4,300)	9,100 (6,200)	10,200 (6,900)

*Based on a harvest level of 60 beluga annually, which represents the highest harvest level compatible with this objective. Inter-annual variations in harvest levels would result in various scenarios to attain this recovery target.

Table 4. Temporal population size benchmark related to the recovery targets identified for UB beluga. The total number of beluga are presented along with the number of mature individuals in parentheses. These numbers are subject to change based on future survey results and population growth functions informed by the latter.

Recovery target	Population in 10 years	Population in one generation (28 years)	Population in 2 generations (57 years)	Population in 3 generations (86 years)
1. Maintain the population at or above the 2022 abundance estimate	70 (50)	70 (50)	70 (50)	70 (50)
2. Attain a population size corresponding to the maximal demographic growth given no harvest	100 (70)	200 (140)	640 (440)	1,980 (1,300)

Table 5. Overview of feasible mitigation measures and alternatives to activities considered as threats to the BEL-EHB and UB beluga in Canada.

Threat	Mitigation measures and/or alternatives to activities
Subsistence harvest	<ol style="list-style-type: none"> 1) Continue to develop co-management strategies for traditional whaling, in support of treaty negotiated rights. 2) Implement precautionary approaches in co-management strategies. 3) Manage beluga harvest at the estuary level, and develop management measures to avoid over harvesting within family groups of beluga who may be vulnerable to single, large harvest events. 4) Public outreach and communication within eastern Hudson Bay and Ungava Bay communities on the status and population trends of BEL-EHB and UB beluga to improve support and compliance with management measures, and improve reporting of struck and loss.
Anthropogenic noise	<ol style="list-style-type: none"> 1) Apply DFO standards for mitigation of seismic noise, regional implementation protocols (i.e., The Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment). 2) Ensure adequate enforcement of the Canadian <i>Marine Mammal Regulations</i> (MMR) regional guidelines. 3) Avoid, reduce or shift (geographically and/or temporally) underwater anthropogenic noise sources which overlap or are in close proximity to important habitat for BEL-EHB and UB beluga. 4) Promote development of quieting technologies for vessels.
Industrial development	<ol style="list-style-type: none"> 1) Avoid coastal development, industrialization, or any other activity with the potential to disrupt or destruct costal summering habitat used by BEL-EHB and UB beluga. 2) Review project proposals with potential to impact to areas used by BEL-EHB and UB beluga (e.g., use of seismic or sonar surveying) and provide project-specific advice for mitigation or avoidance with respect to beluga habitat use.
Chemical pollution	<ol style="list-style-type: none"> 1) Document and identify sources of marine pollution. Investigate how to reduce marine pollution at the source. 2) Ensure preventative measures are in place to avoid toxic spills of any nature. 3) Develop a comprehensive toxic spill response to mitigate or avoid impacts to beluga whales or their habitat in Canada. 4) Ensure those responsible for toxic spills have appropriate teams, training and materials to rapidly respond to and remediate spill events.
Fisheries	<ol style="list-style-type: none"> 1) Initiate and promote a beluga entanglement reporting system in the Nunavik Marine Region and Labrador Sea. 2) Public outreach and communication on the importance of reporting beluga bycatches. 3) Undertake a spatial-temporal mapping exercise to document fishing efforts in the beluga wintering grounds. 4) Acquire more data on beluga distribution in wintering grounds, areas important for foraging, diet, and energetic requirements to quantify any competition between BEL-EHB and UB beluga and commercial fisheries.
Vessel traffic	<ol style="list-style-type: none"> 1) Initiate and promote a vessel strike reporting system in the Nunavik Marine Region 2) Ensure adequate enforcement of the Canadian <i>Marine Mammal Regulations</i> (MMR) regional guidelines.

Threat	Mitigation measures and/or alternatives to activities
	3) Acquire more data on BEL, EHB and UB migration routes and timing, and undertake a spatial-temporal mapping exercise to identify high-risk areas and periods for vessel strikes, icebreaker-induced ice entrapments, and physical and noise disturbance caused by vessels. These high-risk areas and periods could be targeted for mitigation measures aimed at reducing the threat to BEL-EHB and UB beluga recovery posed by vessel traffic.
Climate change	Mitigation measures to limit climate change are global and non-specific to beluga populations. All efforts aiming at reducing emissions of greenhouse gases are susceptible to moderate the impacts of climate change on BEL-EHB and UB beluga.

Table 6. Posterior estimates of carrying capacity (K), maximum rate of increase (λ_{max}), struck and loss, and population abundance in 2022 (N_{2022}) for the BEL-EHB stock.

Parameter	BEL-EHB estimate (95% CI)
K	11, 043 (6,437-19,410)
Lambda max	0.035 (0.021-0.055)
Struck and loss	0.273 (0.017-0.756)
N_{2022}	2,833 (1,541-4,073)

APPENDIX A – LIST OF MEETING PARTICIPANTS

Table A.1. This Research Document is from the February 20-24, 2023 national peer review on Recovery Potential Assessment of Beluga Whale (Eastern Hudson Bay and Ungava Bay populations). The authors wish to acknowledge the meeting participants who contributed to the revision and improvement of the present RPA.

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Valentin, Alexandra	DFO – Species at Risk Program, Quebec Region
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Zuur, Alain	Highland Statistics

APPENDIX B – TERMS USED TO DESCRIBE SUB-UNITS OF A SPECIES, AND APPLICATION TO BELCHER ISLANDS-EASTERN HUDSON BAY (BEL-EHB) AND UNGAVA BAY (UB) BELUGA

Sub-unit term	Definition	Application to BEL-EHB beluga	Application to UB beluga
Stock	A group of animals capable of independent exploitation or management (Royce 1972). A stock therefore refers to animals located within a management unit and may include more than one population, or only a subset of individuals from a population.	Aerial surveys conducted to estimate beluga abundance in the eastern Hudson Bay area extend from the Hudson Bay coast to the East, to West of Belcher islands. Population models and derived projections and harvest advices therefore encompass all beluga summering in that management unit. Based on most recent genetic data, beluga from this area form a genetically mixed BEL-EHB stock (Parent et al. 2023), and there is currently no data to inform the relative size of these two populations forming the stock.	Aerial surveys conducted to estimate abundance of beluga summering in Ungava Bay encompasses the entire bay, from bottom to 61.0°N, as well as most estuaries in southern Ungava Bay. Harvest advices derived from this survey data thus apply to beluga harvested in summer throughout Ungava Bay, including its southern estuaries.
Population	A group of interbreeding individuals occurring together in time and space (Waples and Gaggiotti 2006). A population therefore captures the notion of genetic structure among geographically delineated areas. Beluga populations are geographically defined based on their summer habitat, as less is known about beluga winter distribution and there is potential spatial overlap among populations during winter.	In the Belcher Islands-eastern Hudson Bay area, two genetically distinct beluga populations are identified during summer: one harvested around the Belcher Islands (BEL), and one harvested along the coast of eastern Hudson Bay (EHB) (Parent et al. 2023). In previous genetic studies that used a shorter haplotype for genotyping, most BEL beluga were indistinguishable from Western Hudson Bay (WHB) individuals (Parent et al. 2023).	No endemic population summering in Ungava Bay could be identified based on mitochondrial DNA analyses (Parent et al. 2023). However, sample size for this area is very limited, especially for the south of the Bay where historical aggregations occurred. Obtaining addition samples from southern Ungava Bay and its estuaries in summer is necessary to assess whether beluga summering in the area form a genetically distinct population.
Designatable unit (DUs)	Discrete and evolutionarily significant units of the taxonomic species (COSEWIC 2020b). Discreteness refer to little or no transmission of heritable information between units, and encompasses genetic differentiation, natural disjunction between portions of the species range, or ecological isolation. Evolutionary significance refer to the importance of the unit to the evolutionary legacy of the species, and that if lost the individuals forming the unit would not be replaced through natural dispersion.	The EHB DU is defined by estuarine concentrations at the Nastapoka, Great Whale, and Little Whale rivers, with the main area of summer coastal occupation extending from Kujjuarapik to Inukjuak (COSEWIC 2016). Individuals perform repeated inshore-offshore movements extending out to the Belcher Islands (Bailleul et al. 2012a), where they mix with beluga from other DUs (WHB, JB) during summer (COSEWIC 2016). The genetic distinctiveness of EHB beluga was used to support the discreteness and evolutionary significance criteria in the last COSEWIC assessment (2016), before the identification of the BEL population. Therefore, the beluga DU structure in the eastern Hudson Bay and Belcher Islands area may eventually be redefined by COSEWIC.	The UB beluga DU is defined based on a historical aggregation centered near the Marralik River estuary, with additional smaller concentrations at the George, Soak, Leaf, and Whale river. The recognition of the UB DU is based primarily on TEK and historical harvest records. There are no genetic data to support or refute the discreteness or significance of this DU. However, COSEWIC considers that migrating beluga from other DUs occur in Ungava Bay in spring, fall and winter, but not summer. Hence, if the UB DU were to become extirpated, or has been already, much of southern Ungava Bay would remain unoccupied by beluga during summer (COSEWIC 2016).

APPENDIX C – PRIORS USED TO FIT BELUGA POPULATION MODELS

Table C.1. Prior distributions, parameters, and hyper-parameters used in the BEL-EHB beluga population models. Median and 0.025 and 0.975 quantiles are shown.

.Parameters	Notation	Prior distribution	Hyper-parameters	Parameter value	Prior median	0.025	0.975
Survey precision (t)	ε_{St}	Fixed		$1 / (\text{Survey standard error})^2$	-	-	-
Process error (t)	ε_{pt}	Log-normal	$\mu p / \tau p$	0 / estimated	1 / inf	0	inf
Precision (Process)	τp	Gamma	$\alpha p / \beta p$	1.5 / 0.005	236.6	21.6	934.8
Theta	θ	Fixed	-	-	2.39	-	-
Struck and loss 25%	SL	Beta	$\alpha sl / \beta sl$	1.135 / 2.763	0.25	0.015	0.755
Initial population (BEL-EHB)	Start	Uniform	Nupp / Nlow	15,000 / 2,000	8,500	2,325	14,675
Carrying capacity (BEL-EHB)	K	Uniform	Nupp / Nlow	20,000 / 5,000	12,500	5,375	19,625
Maximum rate of increase	λ_{max}	Beta	$\alpha sl / \beta sl$	15.618 / 373.015	0.039	0.023	0.062

Table C.2. Prior distributions used in the population model for the proportion of BEL-EHB animals harvested in Nunavik and Nunavut, by region. HSUB = prior to 2009 most samples were from the Hudson Bay-Ungava Bay area from the fall but harvest area is not known. These are assigned the same parameters as HS_F. Median and 0.025 and 0.975 quantiles are shown.

Nunavut

Parameters	Notation	Prior distribution	Hyper-parameters	Parameter value	Prior median	0.025	0.975
Sanikiluaq (Spring)	PSAN_S	Beta	$\alpha san / \beta san$	45.778 / 27.164	0.629	0.515	0.734
Sanikiluaq (Fall)	PSAN_F	Beta	$\alpha san / \beta san$	8.194 / 5.323	0.6113	0.344	0.837
Sanikiluaq (Winter)	PSAN_W	Beta	$\alpha san / \beta san$	3.697 / 5.493	0.396	0.131	0.7151
Sanikiluaq (Summer)	PSAN_SU	Fixed	-	-	1	-	-

Nunavik

Parameters	Notation	Prior distribution	Hyper-parameters	Parameter value	Prior median	0.025	0.975
Hudson Strait (Spring)	PHS_S	Beta	$Ahs_{sp} / \beta_{hs_{sp}}$	32.11 / 229.09	0.122	0.086	0.165
Hudson Strait (Fall)	PHS_F	Beta	Ahs_f / β_{hs_f}	50.58 / 64.36	0.44	0.351	0.532
HSUB *	PHSF	Beta	α_{hs} / β_{hs}	50.58 / 64.36	0.44	0.351	0.532
Ungava Bay (Spring)	PUB_S	Beta	$\alpha_{ub_s} / \beta_{ub_s}$	3.13 / 57.43	0.047	0.015	0.12
Ungava Bay (Fall, used HS Fall)	PUB_F	Beta	$\alpha_{ub_f} / \beta_{ub_f}$	50.58 / 64.36	0.44	0.351	0.532
Northeast Hudson Bay (used HS spring)	PNEHB_S	Beta	$Anehb_s / \beta_{nehb_s}$	32.11 / 229.09	0.122	0.086	0.165
Northeast Hudson Bay (Fall)	PNEHB_F	Beta	$Anehb_f / \beta_{nehb_f}$	6.228 / 6.20281	0.50	0.24	0.762

**SUBMISSION TO THE NUNAVUT WILDLIFE
MANAGEMENT BOARD AND NUNAVIK MARINE
REGION WILDLIFE BOARD**

FOR

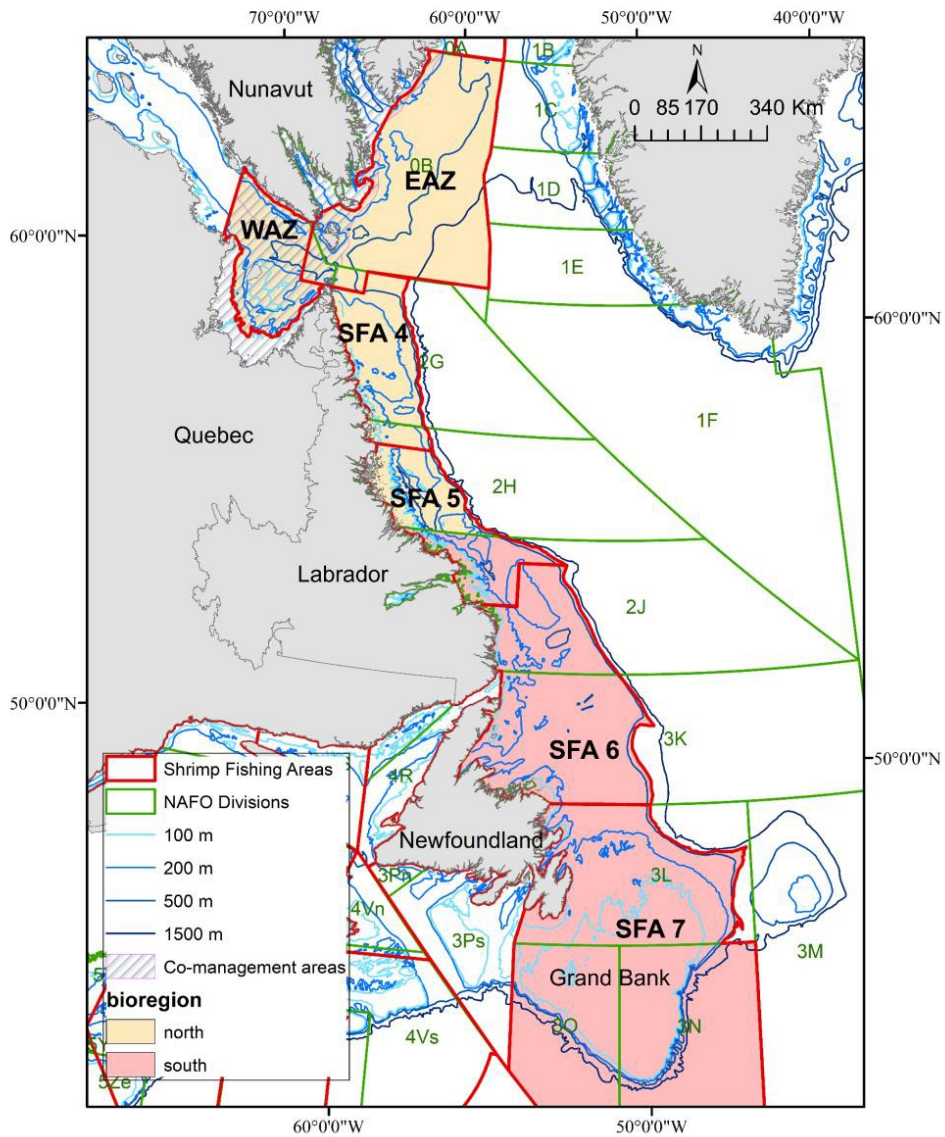
Information: X

Decision:

Recommendation:

Issue: Updated Precautionary Approach Framework for Northern Shrimp (*Pandalus borealis*).

Map:





Northern shrimp (*Pandalus borealis*)

Background

Northern Shrimp (*Pandalus borealis*) is an economically important, commercially harvested species of shrimp.

Historically, the Northern Shrimp in waters surrounding Nunavut were assessed in two delineated areas, namely Western and Eastern Assessment Zones (WAZ and EAZ), which were roughly corresponding to Hudson Strait and Davis Strait, respectively.

The fishery in these areas operates April 1 – March 31. Harvesting activity typically commences in June to July, subject to ice conditions.

Where this fishery occurs within and adjacent to the Nunavut Settlement Area (NSA) and Nunavik Marine Region (NMR), decisions and recommendations on TAC and harvest levels for each species are requested annually from the Nunavut Wildlife Management Board (NWMB) and the Nunavik Marine Region Wildlife Board (NMRWB; the Boards).

This briefing note (BN) is intended to provide background and updates on the development of a new Precautionary Approach (PA) Framework for Northern Shrimp. The primary components of a PA Framework include: Reference points (Limit Reference Point and Upper Stock Reference) to define stock status zones (Healthy, Cautious and Critical) and Harvest Decision Rules (HDRs).

Note that the Science assessments and management of Striped Shrimp (*Pandalus montagui*) will remain unchanged.

Science Advice

Following the science process that took part between December 9 and 13, 2024 (Canadian Science Advisory Secretariat meeting), a new understanding of the Northern Shrimp population structure was adopted. The spatial scale of assessment for Northern Shrimp has now changed from the six areas (Eastern and Western Assessment Zones, and Shrimp Fishing Areas 4 – 7), to two assessment regions - North and South - divided by the boundary between

NAFO Divisions 2H and 2J (approximately half point in the SFA 5 – see map above). The Nunavut-adjacent waters will fall into the North assessment region along with SFA 4 and half of SFA 5. The assessment regions were delineated by the difference in shrimp size and distribution, proportion of females to males, larval settlement patterns and genetic differences.

The estimation of shrimp biomass will be now based on the spatio-temporal model output. This method is more reliable than the previous method because it takes into account the entire North region, removes the uncertainty related to shrimp movement across the assessment areas, and uses more indices than just shrimp distributional patterns (includes also the shrimp size and contribution of males and females). The input data which will feed into the model remains the same such that the stock will continue to be surveyed with the joint DFO-Northern Shrimp Research Foundation (NSRF) survey.

A Limit Reference Point (LRP) of 50% of Bmsy was adopted for both the North and South assessment regions. This 50% level is more precautionary relative to the previous LRPs, which were set at 30% or 40% of Bmsy, depending on the fishing area. A proposed USR at 80% of Bmsy was suggested for both the North and South assessment regions. This level is consistent with the previous USRs.

Important consideration: This new approach to Northern Shrimp has no implications for science assessments or management of Striped Shrimp (*Pandalus montagui*).

Summary of Request

The aim of this note is to inform the Boards about the planned changes to how the assessment of the Northern Shrimp stocks will be conducted in the years to come.

**SUBMISSION TO THE
NUNAVUT WILDLIFE MANAGEMENT BOARD
FEBRUARY 2025**

FOR

Information: X

Recommendation:

Decision:

Issue: Department of Fisheries and Oceans Canada (DFO) – Fisheries Management (FM) Operational Updates

Updates:

Marine Mammals:

1. Narwhal

- The total reported landings for Narwhal management units in the 2023/24 harvest season were: Jones Sound 39, Smith Sound 0, Northern Hudson Bay 188, Somerset Island 103, East Baffin Island 122, Admiralty Inlet 247, and Eclipse Sound 145.
- A photographic survey to estimate Northern Hudson Bay (NHB) narwhal abundance occurred in August 2024 and will add an abundance estimate to the time-series, allowing for development of a Limit Reference Point (LRP). An LRP marks the boundary between the cautious and critical zones under DFO's Sustainable Fisheries Framework, and the Framework requires the development of LRPs for key regional fisheries. LRP development for NHB narwhal will continue in 2024/25, with anticipated completion by end of 2025/26.
- A judicial review concerning Baffin Bay narwhal management units was initiated in late 2022 by the Qikiqtaaluk Wildlife Board (QWB) and four Qikiqtaaluk Hunters and Trappers Organizations/Associations (HTOs/HTAs). This judicial review is still in process.
- Following confirmation of season dates and allocations for 2024/25, narwhal tags (including carry-over tags) and information packages were distributed to all harvesting communities in the spring/summer of 2024.
- Consultations on DFO Science advice regarding Baffin Bay narwhal were recently conducted with the communities and HTAs in Arctic Bay and Pond Inlet in February and June 2024, respectively. [SAR 2020/048](#) contains information related to the delineation of the Eclipse Sound and Admiralty Inlet narwhal stocks. [SAR 2020/051](#) describes an estimated abundance and Total Allowable Landed Catch for the Eclipse Sound narwhal stock.
- A Canadian Science Advisory Secretariat (CSAS) peer-review meeting will be held on January 14, 2025, regarding "Considerations for a New Management System: Sustainability of Narwhal in Northern and Eastern Baffin Island". Co-managers have been invited to participate.

- A CSAS peer-review meeting is anticipated for spring 2025 to update abundance estimates and sustainable harvest level advice for Baffin Bay narwhal stocks.
- The Nunavut Narwhal Working Group continues to work on its collaborative review and update of the *Integrated Fisheries Management Plan (IFMP) for Narwhal in the Nunavut Settlement Area*. The most recent Narwhal Working Group meeting was held in February 2024. DFO looks forward to ongoing participation from the Nunavut Wildlife Management Board (NWMB) at these Working Group meetings.
- In planning for the 2025/26 narwhal harvest season, DFO requests that Hunters and Trappers Organizations/Associations (HTOs/HTAs) return both the used and unused tags and harvest sheets from 2024/25 by the close of the season (March 31, 2025).
- Prior to distributing 2025 harvest tags, 2024 harvest data will be reconciled, carry-over allocations will be calculated, and community allocations will be sought from Regional Wildlife Organizations (RWOs).

2. Walrus

- The total reported subsistence landings for walrus within the Nunavut Settlement Area for the 2023/24 season is currently 12. However, 2023/24 walrus harvest reports have not yet been provided to DFO from most communities throughout Nunavut.
- The total reported landings of walrus by sport hunters in 2023/24 was 27.
- Following a decision by the Nunavut Wildlife Management Board to discontinue their Interim Walrus Sport Hunt Policy after the 2023 season, the Nunavut Walrus Working Group co-developed a new licensing process for use starting in 2024. Under the new Walrus Sport Hunt Licensing Process in the Nunavut Settlement Area, walrus will continue to be sustainably harvested by Inuit and sport hunters while providing economic benefits to Nunavut communities.
- The 2024/25 fiscal year was the first season utilizing the new licensing process, which allowed for quicker application approvals compared to previous years.
- Following the new process outlined above, 137 walrus sport hunts were approved for 2024 (Arviat 4, Coral Harbour 62, Igloolik 25, Iqaluit 3, Pangnirtung 3, Pond Inlet 7, Rankin Inlet 3, and Sanirajak 30). Ultimately, 71 walrus sport hunt licences were issued and DFO has received reports of 27 successful hunts. DFO staff will continue to follow up with sport hunt outfitters to ensure receipt of reporting information and biological samples in the coming months.
- In planning for next year's 2025/26 walrus sport hunting season, all three RWOs have confirmed their preference for DFO to process walrus sport hunt applications within their region. The processing of applications involves issuing a call for applications to HTOs and outfitters in addition to reviewing applications. A call for 2025 walrus sport hunt applications was distributed on November 14, 2024, with a submission deadline of February 21, 2025.

- A CSAS peer-review meeting to update abundance estimates for high Arctic Atlantic walrus stocks is scheduled for January 28-29, 2025.

3. Beluga

- The total reported landings for beluga within the Nunavut Settlement Area for the 2023/24 season is currently 193. However, 2023/24 beluga harvest reports have not yet been provided to DFO from most communities throughout Nunavut.
- The Cumberland Sound Beluga (CSB) Working Group continues to meet and work towards sustainable management of beluga by reviewing historical material, identifying current knowledge gaps, and through the application of the best available *Inuit Qaujimaqatuqangit* (IQ) and scientific knowledge.
- The most recent CSB Working Group meeting was held in Pangnirtung on October 16, 2024. Co-management partners provided updates to the community and answered questions during a public meeting later the same day. The next CSB Working Group meeting will be held virtually on February 12, 2025, followed by in-person working group and community meetings in Pangnirtung in June 2025. DFO acknowledges the ongoing participation of the NWMB at the CSB Working Group and community meetings.
- DFO looks forward to continued collaboration with co-management partners to ensure the sustainable management of the Cumberland Sound Beluga population by working towards developing an IFMP.
- A CSB Hunt Coordinator team (boat captain and assistant) was hired for the 2024 harvest to support the Pangnirtung HTO in monitoring the hunt and ensuring the quota is followed. The CSB Working Group would like to see additional hunt coordinators hired for 2025 to provide more coverage for the large hunt area. With support from DFO staff, the Pangnirtung HTO has applied for funding for increased monitoring through the [DFO Indigenous Fishery Monitoring Fund](#).

4. Bowhead

a. 2024 Bowhead Hunts:

- The Total Allowable Harvest (TAH) of Eastern Canada-West Greenland (ECWG) bowhead whales in Nunavut waters is 5 per year. This TAH is shared regionally: 2 per year in each of the Qikiqtaaluk and Kivalliq Regions, and 1 per year in the Kitikmeot Region.
- In 2024, the QWB approved the Bowhead Hunt Plans submitted by Arctic Bay and Pond Inlet, however both of these hunts were ultimately cancelled.
- In 2024, the Kivalliq Wildlife Board (KWB) approved the Bowhead Hunt Plans submitted by Coral Harbour and Naujaat. Following completion of penthrite grenade training by Nunavut Tunngavik Inc. (NTI), DFO issued a Marine

Mammal Fishing Licence to the Coral Harbour and Naujaat Bowhead Hunt Captains.

- In 2024, the Kitikmeot Regional Wildlife Board (KRWB) informed DFO that they did not receive interest from any Kitikmeot communities to host a bowhead hunt and therefore no host community was selected.
 - DFO has received harvest information and biological samples from the 2024 bowhead hunt in Naujaat. DFO thanks the hunters for providing biological samples from this whale for analysis.
 - Unfortunately, Coral Harbour has not provided DFO with any hunt information (date/location of harvest and sex/length of the whale), datasheets, or biological samples collected from their bowhead harvest in 2024. It is very important that the Coral Harbour Hunt Captain share this information with DFO as soon as possible so that the limited information provided from memory by the HTO Manager can be confirmed.
 - DFO emphasizes the importance of timely and accurate marine mammal harvest reports for all species, including bowhead whales.
- b. Bowhead Co-Management
- DFO's Sustainable Fisheries Framework requires the development of Limit Reference Points (LRP) for key regional fisheries. LRPs have not yet been developed for the ECWG bowhead fishery, because aerial surveys cannot include their vast geographic range.
 - Updated abundance estimates for ECWG bowhead whales have been developed recently from genetic mark-recapture data ([Frasier et al. 2020](#), [Biddlecomb et al. 2023](#)) and [Ferguson et al \(2021\)](#) have proposed a precautionary management approach for ECWG bowheads. ECWG bowheads.
 - In response to a DFO Fisheries Management request for Science Advice, a DFO CSAS process is scheduled for January 27, 2025. Invitations have been sent to Inuit co-management representatives in Nunavut (NWMB and NTI) and in Nunavik [Nunavik Marine Region Wildlife Board (NMRWB) and Makivvik Corporation]. At this meeting, participants will review recent peer-reviewed publications on the ECWG bowhead whale population with respect to abundance estimates and precautionary management approaches, specifically examining LRPs.
 - The CSAS recommendations and conclusions will be presented for review and discussion among Bowhead Working Group members as they co-develop recommendations for an updated bowhead management plan for decision by the NWMB and NMRWB.
- 5. Harvest Reporting**
- Timely and accurate reporting is required under the *Fisheries Act*, *Marine Mammal Regulations*, and the *Nunavut Agreement*. Reports of total marine

mammal hunting mortality (landed and lost) are essential to develop reliable advice on sustainable harvests. It is strongly recommended that co-management organizations emphasize the importance of harvest reporting and monitoring.

- Staff from the Iqaluit DFO office have contacted all Nunavut HTOs/HTAs and Government of Nunavut (GN) Wildlife Office staff requesting mid-year harvest updates for beluga, walrus, narwhal and bowhead whales for the 2024/25 fiscal year which began on April 1, 2024.
- Due to minimal harvesting reporting for the 2023/24 fiscal year that ended on March 31, 2024, DFO staff have also followed up with HTOs and GN Wildlife Office staff regarding 2023/24 harvest reports.
- Additionally, DFO urges continued reporting of unusual marine mammal occurrences and events for follow up by co-management organizations, such as beached carcasses and ice entrapments.

6. Avian Influenza

- Avian Influenza Virus (AIV) is highly contagious among domestic and wild birds. In the fall of 2024, the GN received reports of sick/dead birds observed near several Nunavut communities which also involved sick/dead marine mammals.
- Canada's national surveillance program for AIV includes the Canadian Wildlife Health Cooperative (CWHC), the GN and other provincial/territorial governments, the Canadian Food Inspection Agency, the Public Health Agency of Canada, and Environment and Climate Change Canada – Canadian Wildlife Service.
- In Nunavut, public communications regarding AIV testing are coordinated by the GN (Dept. of Environment and Dept. of Health) and the CWHC.
- In late November 2024, DFO and its partner organizations began to discuss how DFO can best assist in responding to reports of sick/dead marine mammals, in a way that respects existing roles of Federal-Provincial-Territorial departments and partners in the national AIV surveillance program. These meetings will continue in early January 2025, in order to finalize DFO's support role going forward.

Arctic Char

1. Pangnirtung:

- The 2024/25 summer fishery in Cumberland Sound resulted in a total of approximately 13,424 kg round weight of char reported landed at the Pangnirtung fish plant.
- In 2024, stock assessment data collection began on Opingivik Lake (PG002), one of four commercially fished Arctic char stocks located in Cumberland Sound. Arctic char were also sampled from lakes Kingnait (PG014) and Qasigiyat (PG015) to contribute to an ongoing spatial assessment exploring Arctic char genetic trends through time across a wide range.

- From each of the sampled sites in 2024, some stomachs were preserved from sampled Arctic char to contribute to a diet analysis study.
- Arctic char previously tagged at PG027, Iqalugaarjuit Fiord (formerly known as Iqalujjuaq Fiord), in 2021, 2022, and 2023 continue to be caught and returned by fishers. Tagged Arctic char returned in 2024 are currently being processed by DFO staff, with assessment of the mark-recapture data to begin in the upcoming months.

2. Kivalliq:

- The 2024/25 summer commercial Arctic char harvest in the Kivalliq region was approximately 9,754 kg (round weight) reported landed at Kivalliq Arctic Foods in Rankin Inlet.
- In 2024, the second year of an acoustic telemetry project occurred in Rankin Inlet with continued support and study design input from the Kangiqliniq HTO.
- DFO tagged 63 Arctic char and 19 Greenland cod in the Rankin Inlet area with small acoustic transmitters to track species movements. So far, community fishers have recaptured 20 tagged Arctic char and 1 tagged Greenland cod.
- With the assistance of two local technicians, various instruments were deployed in the marine environment around Rankin Inlet including acoustic receivers to record the movement of tagged fish, a hydrophone to record ship traffic, temperature and light recorders, and instruments to assess marine microplastic levels.
- The acoustic receivers that were deployed in 2023 were also recovered. Information on fish movement will be shared with the community when it is available.
- The study on Arctic char diet, muscle colour, and marine microplastic first started in 2021 was continued in 2024, with 50 sea-run Arctic char captured from the Diana River.
- DFO also collected 38 Greenland cod, 26 sculpin, and 71 capelin from the Rankin Inlet area to assess levels of marine microplastics. Results from this work will be shared with the community when they are available.

3. Cambridge Bay:

- A pre-season fishery meeting was held in June 2024 at the Kitikmeot Foods Ltd. fish plant. DFO Fisheries Management staff met with fishers and provided a refresher on the importance of logbooks to record catch-per-unit effort, bycatch, and discard information.
- Arctic char commercial harvest occurred at five sites in the 2024 summer/fall harvest season at Ekalluk, Halokvik (30-Mile), Jayko, Surrey, and Lauchlan Rivers. A total of 42,453 kg (round weight) was harvested.
- DFO is planning an IFMP Working Group meeting and post-season fishery meeting this winter.
- The Cambridge Bay commercial plant sampling program was once again successful this past summer in providing DFO with biological data and samples

Commented [WS1]: This section has been updated now.

from 200 Arctic char from three of the five locations that were commercially fished. This is the longest-running program of its kind in Nunavut, spanning five decades, and has formed the backbone of stock assessments for the region.

- Recent genetic and telemetry results have suggested that the Cambridge Bay Arctic char commercial fishery is a mixed-stock fishery. Discussions will occur over the winter on the most appropriate approach for managing a mixed-stock fishery and what studies would be most valuable for informing future management decisions.

Greenland Halibut (Turbot):

1. Cumberland Sound Turbot Management Area (CSTMA):

- The 2024 winter Greenland halibut fishery in Cumberland Sound occurred from February to April, with a total of approximately 290 t (round weight) landed at the Pangnirtung fish plant. Approximately 300 fishery-dependent biological fish samples were collected throughout the 2024 winter fishery and 120 additional commercially harvested fish were sent to DFO for sampling.
- DFO issued a licence in early August 2024 for open-water summer fishing in Cumberland Sound, but no landings were ultimately reported.
- DFO staff are planning in-person pre-season meetings in Pangnirtung in January 2025 prior to the start of the 2025 winter fishery.
- DFO Science is using a Baited Remote Underwater Video system to estimate the number of Greenland Sharks in Cumberland Sound, to assess the impact of fishery bycatch mortality on the Greenland Shark population. The project started in 2023 and is planned to continue into 2026.
- With support from the Pangnirtung HTO, the Ocean Tracking Network (OTN) has deployed a line of fish tracking moorings across Cumberland Sound to detect tagged Greenland halibut as they leave the Sound. Data will be used to estimate the rate of emigration from Cumberland Sound to better understand connectivity with Northwest Atlantic Fisheries Organization (NAFO) Division 0B.

2. Division 0A Inshore

- With support from the Nangmoutaq HTO, DFO issued a licence in the spring of 2024 for on-ice Greenland halibut fishing in the Clyde River area. The licence was issued for 3 t of the available 100 t of quota allocated for inshore fishing within the NAFO Division 0A. Approximately 1.7 t of Greenland halibut was ultimately landed and biological samples/data such as length and weight were collected from 200 fish by local fishers and sent to DFO scientists.
- DFO has received interest in accessing inshore Greenland halibut quota in 2025. DFO is working with interested fishers on the licence application process and preparing for the upcoming fishing season.
- DFO will continue to work with co-managers and fishers regarding future fishing of the 100 t of NAFO Division 0A inshore Greenland halibut quota.

Fish Stocks Provisions

- DFO has received feedback on a proposal for a regulatory amendment to the *Fishery (General) Regulations* to identify the second batch of major fish stocks in spring 2025 (tentative) that would be subject to the Fish Stocks provisions (sections 6.1-6.3) of the *Fisheries Act*. This includes Arctic char stocks in Cambridge Bay and Cumberland Sound and northern and striped shrimp in the Eastern Assessment Zone (EAZ).
- The Fish Stocks provisions include obligations to maintain major fish stocks identified in regulation at levels necessary to promote their sustainability and to develop and implement rebuilding plans for stocks that have declined to or below their Limit Reference Point.
- DFO staff presented this proposal to the Cambridge Bay Arctic Char IFMP Working Group in June 2023 and the Pangnirtung HTO Board in July 2023, with general support for identifying Cumberland Sound and Cambridge Bay char stocks as major fish stocks.
 - If these stocks are prescribed to the Fish Stocks provisions, there would be no immediate management changes as the stocks are considered healthy and the current management of the fishery is sustainable.
- DFO staff also requested feedback on this proposal at the KRWB and QWB Annual General Meetings in 2023 and 2024 and no concerns were expressed.
- The proposal to identify these stocks as major fish stocks was also pre-published in *Canada Gazette*, Part I, on October 12, 2024, for a 30-day public comment period that ended on November 11, 2024. No concerns were expressed regarding identifying these Arctic char or EAZ shrimp stocks as major during this public comment period.
- The current proposed timeline to include these stocks in the regulation through publication of *Canada Gazette*, Part II is by spring 2025, before the next scheduled NWMB meeting in June.
- Recent information regarding northern shrimp in the EAZ suggests that this stock is part of a larger stock complex, and thus the current stock area description and associated Limit Reference Point are no longer applicable. Given this recent information, consultation with stakeholders and rightsholders would need to occur before identifying this stock as major with the new proposed stock structure. Northern shrimp in the EAZ is thus being proposed for removal from the second batch of major fish stocks.

Ghost Gear Program

- The DFO Ghost Gear Program was established in 2019 with the goal of eliminating abandoned, lost, or otherwise discarded fishing gear, also known as ghost gear.
- The program is currently developing the *Canadian Ghost Gear Action Plan* that is due in 2027 and will outline concrete actions to address ghost gear in Canada.

- Ongoing engagement and consultations are a key part of developing the Action Plan. In 2024, the Ghost Gear Program completed the following activities in the Arctic Region:
 - Held two Arctic Region virtual Program Update Meetings which were attended by government and non-government organizations, HTOs, and fishery stakeholders;
 - Launched the second year of the Ghost Gear Community Clean-Up program where communities in the region were able to apply for funding to perform shore-line clean-up projects in and around community fishing areas;
 - An online survey was made available to the public from October 28 to November 30, 2024, with the purpose of collecting public, stakeholder, and rightsholder opinions on the Ghost Gear program and Ghost Gear in Canada.
 - Announced the 2nd International Gear Summit on ghost gear and whale safe gear to be held on February 25 and 26, 2025 in Moncton, New Brunswick. The Summit will be invitation only, so if you or your organization are interested in attending, please let us know at DFO.GGProgram-ProgrammeEF.MPO@dfo-mpo.gc.ca

Prepared by: Fisheries Management, Arctic Region – Fisheries & Oceans Canada

Date: December 18, 2024

SUBMISSION TO THE
NUNAVUT WILDLIFE MANAGEMENT BOARD
FOR



Information: X

Decision:

Re: Determination of the Basic Needs Level (BNL) for Southampton Island Caribou

Issue

The Nunavut Wildlife Management Board (NWMB or Board) staff seeks the Board's approval to initiate the process for determining the Coral Harbour Basic Needs Level (BNL) for Southampton Island Caribou.

Background

Southampton Island Caribou

Caribou were hunted to extirpation on Southampton Island by 1953. In 1967, 48 animals were translocated to Southampton Island from Coats Island. The population quickly grew—benefiting from abundant vegetation, a high female reproductive rate (97% in 1996), and the absence of predators. By 1997, the abundance of caribou on Southampton Island was estimated to be 30,381 animals.

The Southampton Island caribou population started to decline by 2003 due to extremely low pregnancy rates caused by the reproductive disease Brucellosis (50% prevalence in 2006). Other factors that contributed to the decline including a government-regulated commercial harvest introduced between 1993–2009 and extensive icing and extreme freezing events during the winter of 2010/2011 that reduced access to food.

In 2012 and 2013, the Department of Environment, through ministerial orders, established a total allowable harvest of 1,000 caribou, and a non-quota limitation (NQL) restricting the harvest of females with calves. An aerial survey in May 2015 produced a

population estimate of 12,297 caribou, suggesting that the population had increased compared to the 2003 survey (7,287) due in part to immigration from the mainland.

After the 2015 population increase, the NWMB and the Minister of Environment increased the total allowable harvest to 1,600 caribou. However, surveys in May 2017 revealed a decrease in abundance, prompting the modification of the total allowable harvest from 1,600 to 1,000 in an effort to stabilize the trend. The current total allowable harvest remains at 1,000 caribou.

Basic Needs Level

Once the NWMB has determined a total allowable harvest in accordance with Sections 5.6.16 and 5.6.17 of the *Nunavut Agreement*, the Board shall strike a BNL pursuant to Part 6 of Article 5 of the *Nunavut Agreement*.

The BNL shall constitute the first demand on the total allowable harvest. Where the total allowable harvest is equal to or less than the BNL, Inuit shall have the right to the entire total allowable harvest (NA 5.6.20).

In December 2013, the Board initiated a proceeding to consider the Southampton Island caribou BNL for the community of Coral Harbour. During the proceeding, the NWMB adjourned the session to allow the parties time to provide additional submissions.

The NWMB will now resume the determination of the Basic Needs Level for Southampton Island caribou for the community of Coral Harbour.

Calculating the Basic Needs Level for Southampton Island Caribou

In accordance with the NWMB's Basic Needs Levels policy of July 18, 2024 (attached), the determination of the Basic Needs Level for Southampton Island caribou will rely on data from the 2014 Nunavut Wildlife Harvest Study and exclude any commercial harvesting records that may be available.

Where a total allowable harvest is established with respect to a stock or population not previously subject to a total allowable harvest (like Southampton Island caribou), the NWMB shall calculate the BNL in **a two-step process** as the higher of (NA 5.6.23):

- a) An amount based on data from the original five-year NWMB Harvest Study, calculated according to the method described in Sub-section 5.6.21 (a) of the *Nunavut Agreement*, or, where a Hunters & Trappers Organization has previously elected the method described in Sub-section 5.6.21(b), the harvest level of the stock or population in the identified year; or

- b) The aggregate of the greatest amount harvested in any one year during the five years prior to the imposition of a total allowable harvest and the average annual amount taken over the five years of the NWMB Harvest Study, which aggregate is then divided by two.

The Coral Harbour Hunters and Trappers Organization did not nominate a specific year during the NWMB Harvest Study to use in calculation of BNL. So, the method described in S.5.6.23 of the Nunavut Agreement must be used.

Step One of Two of BNL Calculation (NA 5.6.21(a))

The aggregate of the greatest amount harvested in any one year during the NWMB Harvest Study and the average annual amount harvested over the five years of the Study, which aggregate is then divided by two:

$$\text{BNL} = \frac{\text{Max(Harvest)} + \text{Avg(Harvest)}}{2}$$

Where:

- Max(Harvest) = The greatest amount harvested in any one year during the NWMB Harvest Study.
- Avg(Harvest) = The average annual amount harvested over the five years of the NWMB Harvest Study.

The greatest amount of caribou harvested per year recorded during the NWMB Harvest Study in Coral Harbour is 1940 (Table 1, in year 1999).

The average amount of caribou harvested during the 5-year NWMB Harvest Study in Coral Harbour is 1470 (Table 1).

So,

$$\text{BNL} = \frac{\text{Max(Harvest)} + \text{Avg(Harvest)}}{2}$$

Max(Harvest) = 1940 and Avg(Harvest) = 1470:

$$\text{BNL} = \frac{1940 + 1470}{2}$$

$$\text{BNL} = \frac{3410}{2}$$

BNL = 1705 caribou

Step Two of Two of BNL Calculation (NA 5.6.23(b))

The aggregate of the greatest amount harvested in any one year during the five years prior to the imposition of a TAH and the average annual amount taken over the five years of the NWMB Harvest Study, which aggregate is then divided by two:

$$\text{BNL} = \frac{\text{Max(Pre-TAH Harvest)} + \text{Avg(Harvest)}}{2}$$

Where:

- Max(Pre-TAH Harvest) = The greatest amount harvested in any one year during the five years prior to the imposition of a TAH.
- Avg(Harvest) = The average annual amount harvested over the five years of the NWMB Harvest Study.

In making any calculations under Sub-section 5.6.23 (b), the NWMB shall rely on the best evidence available regarding the levels of harvesting by Inuit in the five years before the TAH was established (NA 5.6.24). For Southampton Island caribou, this refers to evidence from 2008 and 2012. NWMB is unaware of any subsistence (non-commercial) records of caribou harvest in Coral Harbour between 2008 and 2012. The NWMB could engage the Coral Harbour Hunters and Trappers Organization to enquire about such records.

Next steps

As mentioned above, NWMB are seeking the Board's direction to engage the Coral Harbour Hunters and Trappers Organization to find out if any evidence exists regarding the levels of harvesting by Inuit between 2008 and 2012.

If reliable evidence and record of subsistence (non-commercial) caribou harvest is made available by the Coral Harbour Hunters and Trappers Organization, staff will proceed with **Step Two of BNL Calculation**.

If no reliable records exist, the Board shall proceed to establish a Southampton Island caribou BNL of 1705 for Coral Harbour.

Prepared by: Denis Ndeloh, NWMB
Reviewed by: Jason Akearok, NWMB
Date: January 07, 2025

Table 1. Caribou records in the community of Coral Harbour during the five-year (1997-2001) Nunavut Wildlife Harvest Study conducted by the NWMB.

NWMB HS Date	Community	Species	# Harvested
Year 1(1997)	Coral Harbour	caribou	1,376
Year 2(1998)	Coral Harbour	caribou	1,213
Year 3(1999)	Coral Harbour	caribou	1,940
Year 4(2000)	Coral Harbour	caribou	1,128
Year 5(2001)	Coral Harbour	caribou	370
5-year Average			1,470



Issue 1 – Caribou Allocations and Enforcement

The Amaruq HTO would like to bring following topics of discussion to the attention of the NWMB:

1. The Issue – There are two general issues related Caribou allocations that the Amaruq HTO is concerned about:
 - a) The NWMB is currently relying on outdated information and previous ineffective policies to determine harvesting quotas.
 - i. Research should be conducted every 2 years to more accurately determine the actual size of the Caribou population.
 - ii. HTOs should have a greater role in the research that supports the harvesting quotas.
 - b) The lack of clear guidelines and an understanding of the roles and responsibilities amongst the parties that are task with management of the allocations.
 - i. The current system of issuing tags to HTOs is not flexible enough to ensure that the total number of tags are ultimately harvested.
 - ii. GN enforcement of harvesting quota does not appear to follow the terms set out in the Nunavut Agreement.

2. Amaruq HTO Position – The Amaruq HTO board is specifically concerned about the following:
 - a) Research – The NWMB currently utilizes outdated data (2009 to 2014) to determine harvesting quota.
 - i. The Caribou population on Baffin Island has been increasing annually yet the allocations do not reflect that. To ensure that the allocations are properly determined, the NWMB should work with HTOs or closely and expand its data collection methods.
 - ii. HTO members can provide additional information on Caribou herd growth and movement. As per the Nunavut Agreement, Inuit knowledge must be incorporated into the information that determines the ultimate allocations. When this knowledge is excluded, the accuracy and credibility of the data collected is in question.

The Amaruq HTO and its members are interested in having a greater role in conducting the research that supports harvesting allocations both through existing methods as well as the use of newer technology such as drones.

 - b) Wildlife Management and Enforcement – Tags issued for harvesting should be fully utilized to ensure that Inuit have full access to the available harvest. Additionally, enforcement of the wildlife harvest should follow the terms of the Nunavut Agreement.



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- i. Allocations – Recently, the Amaruq HTO encountered a situation which demonstrates a shortcoming in the current tag distribution method. The Amaruq HTO received and then distributed 33 tags for Caribou harvesting which were utilized by its members. The Arctic Bay HTO had not used all its tags, so a member travelled the Amaruq HTO area to harvest some Caribou.

The Amaruq HTO has concluded that this activity may negatively impact its members as additional Caribou are harvested within its region by members from another HTO could reduce future availability. If additional Caribou can be harvested close to its community, should be done so by its own HTO members who are in the better position to determine any potential risks to their community from this activity.

- ii. Enforcement – Recently, an Amaruq HTO member was fined by the GN for harvesting Caribou without a tag. According to section 5.7.11 of the Nunavut Agreement, Inuit harvesters should not be prevented from harvesting for the purpose of meeting the consumption needs of themselves or their dependents. It is unclear to the HTO why this member was charged when they were harvesting for their own use.

3. Recommended Action – The Amaruq HTO recommends the following actions be taken to address the previously identified issues:

- a) Credible Data Collection – The board of the Amaruq HTO recommends that the NWMB take the following actions to help improve the quality of the data on which Caribou allocations are made:
 - i. Establish a strategic plan that ensures that wildlife research (which is ultimately used to determine harvesting allocations) should be conducted every 2 years and rely on various data collection techniques from multiple sources including Inuit knowledge (i.e., fresh tracks, picture taking, etc.), HTO members, and modern technology. This is a stock population request.
 - ii. Advocate for additional funding (with letters of support from HTOs and RWOs) from both the Government of Nunavut and the Government of Canada to support additional research activities including those that utilize newer technology such as drones.
 - iii. Develop guidelines for better coordinating with HTOs for the collection of data including HTO member wildlife sightings and the inclusion of Inuit knowledge.
 - iv. Ensure that when other survey work is being done within the settlement area, those surveyors, using credible data, also report other wildlife sighted in the area. That data within the incorporated into all the other information used to determine harvesting allocations.



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- b) Wildlife Management and Enforcement – Develop a clear set of guidelines for HTOs and RWOs that:
 - i. Clarifies how tags are managed within the Nunavut settlement area. These guidelines should also include other considerations that ensure that the total number of tags issued for a region are ultimately harvested. This could include for example, the redistribution of tags. If such considerations do not exist, the NWMB should investigate potential additional methods in consultation with the HTOs.
 - ii. Clearly outline the role that HTOs and others have in the management, tracking and enforcement of wildlife harvesting. It should be specifically noted that HTOs are not responsible for the tracking and enforcement of quotas as that is the sole responsibility of the Government of Nunavut.

Issue 2 – Bylaw/Guideline Precedent

The Amaruq HTO would like to discuss the issue of bylaw and/or guideline conflicts between HTOs, RWOs, and NWMB. This includes the process of resolving such conflicts as well as their communication with individual HTO members.

1. The Issue – HTOs need guidance as to whose bylaws and/or guidelines take precedent when NWMB/RWO/HTO bylaws and/or guidelines caseloads conflict and the conflict is not specifically addressed in the Nunavut Agreement. For example:
 - a) When conflicts do arise, who decides on which bylaw and/or policy prevails and how is that process mediated?
 - b) If the HTOs' bylaws and/or policies are superseded by either the NWMB or RWO, who is responsible for communicating infractions to HTO members as well as the enforcement of any potential discipline and or penalties?

Examples of specific conflicts include:

- i. Under what authority does the NWMB/NIWS force the HTOs to pay \$12,000 a year each to help fund the NIWS?
 - ii. Under what authority can the NWMB and/or the NIWS dictate to HTOs (particularly when that directive conflicts with the HTO's bylaws) who they should be negotiating with regarding their operational funding?
 - iii. Why would the RWO proceed with a challenge of a defensive kill of a polar bear without notifying the member's HTO and including them in the decision process?
2. Amaruq HTO Position – The Amaruq HTO board is requesting clarification on the previously identified issues.
 - a) Bylaw Conflicts – The Nunavut Agreement states that (Section 5.7.9) “the NWMB, RWOs and HTOs shall develop guidelines indicating the extent to which each HTO shall be obliged to conform to by-laws and decisions of the RWO in its region”.



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The only reference in the Nunavut Agreement to a hierarchy that may determine which organization's (NWMB/RWO/HTO) bylaws take precedence, is found in section 5.7.10 states that the HTOs “shall be obliged to conform to RWO bylaws and decisions in relation to allocation of regional basic need levels and adjusted basic needs levels”.

Based on a reading of section 5.7.10, it appears that the NWMB and the RWO do not have the expressed right to create bylaws that run counter to HTO bylaws other than those that relate to the allocation of regional basic need levels and adjusted basic need levels. If there are no other guidelines and/or regulations that establish additional precedents, could the NWMB please explain the following:

- i. Under what authority were the HTOs obligated to pay \$12,000 per year to the NIWS?
 - ii. Since the Amaruq HTO (and most likely many others) have in their bylaws that they are to negotiate with the NWMB as per the Nunavut Agreement, under what authority can the NIWB and/or the NWMB obligate the HTOs to disregard their own bylaws and negotiate with the NIWS, and organization not identified in the Nunavut Agreement?
- b) Member Communication and Enforcement – The Nunavut Agreement (5.7.3.d and 5.7.6.d) states that both the HTO and RWO are generally responsible for “the management of harvesting among members”. Unfortunately, these 2 clauses create some confusion as to which organization is ultimately responsible for enforcing bylaws and regulations as well as representing the ultimate interest of individual HTO members.

If it is assumed that both organizations are ultimately interested in ensuring that individual members understand and participate in the efficient management of harvesting activities in their areas, greater clarity needs to be established regarding communication between the NWMB and RWOs and individual HTO members.

- i. RWOs should ensure that HTOs are fully aware of and can provide feedback on any actions they are considering taking against any HTO member. For example, recently the QWB challenged an Amaruq HTO member's defensive kill of a polar bear without informing or consulting with the HTO prior to acting.
3. Recommended Action – The Amaruq HTO recommends the following actions be taken to address the previously identified issues:
- a) The NWMB should work with HTOS and RWOs to develop and distribute the guidelines (as outlined in Section 5.7.9 of the Nunavut Agreement) to all HTOs including a thorough description of the process that was used to develop the guidelines and any relevant discussions that impacted the development of those guidelines. These guidelines should include references to the following:



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- HTO bylaws will take precedence as long as they do not contravene existing laws and/or regulations.
 - Inuk beneficiaries are the sole deciders as to which organization they want to utilize to pursue any claims.
 - Application approval process for Outpost Camps is the sole responsibility of the applicable HTO.
- b) A thorough review of all member HTO bylaws should be done by each RWO to determine whether any conflicts exist between their bylaws and their member HTO bylaws.

Any conflicts that are identified should be discussed, mediated, and reconciled during a general meeting of members of that RWO. Once the conflict is resolved, if applicable, the RWO should assist the member HTOs in the updating of their bylaws.

- c) The NWMB should create a policy for RWOs that ensures that before any enforcement actions are taken against an HTO member, the HTO is consulted and can provide feedback on the issue at the heart of the enforcement action.

Issue 3 – HTO Funding

The Amaruq HTO would like to discuss the issue of general HTO funding, in particular, some of the current practices that are negatively impacting that funding and impeding the functioning of the HTOs.

1. The Issue – In Article 5 (Wildlife), Part 7 (Special Features of Inuit Harvesting), Clause 13, the Nunavut agreement states that “adequate funding for the operation of HTOs and RWOs shall be provided by the NWMB”.

There are several previous actions and current practices that have impacted the funding of the HTOs to their detriment.

These issues are:

- a. HTOs submit funding requests to RWOs rather than directly to the NWMB.
 - b. The creation of the Nunavut Inuit Wildlife Secretariat.
2. Amaruq HTO Position – The 2 issues mentioned previously have created a situation where the organization responsible for ensuring that HTOs have “adequate funding” (NWMB) is not communicating directly with those organizations to determine their needs and has taken actions that have not been approved by the HTOs yet negatively impact their budgets.
 - a. HTO Operational Funding – Currently, each HTO submits their annual funding requests to the appropriate RWO who then submits that information to the NWMB. This situation creates an extra level of bureaucracy where the specific needs and



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concerns of each HTO may or may not be transmitted to the NWMB who, as per the Nunavut agreement, has a responsibility for negotiating the overall funding with the Government of Canada.

Since the NWMB has been designated the responsibility of negotiating the HTO funding with the Government of Canada (not NTI), they should be in direct contact with the HTOs to ensure that they are fully aware of the requirements/needs of HTOs across the territory. RWOs should also be aware of those requirements so they can add their support funding discussions and better represent the needs of their HTOs.

HTO bylaws also establish that they are to negotiate with NWMB on funding as per the Nunavut Agreement, not with the RWOs. Which organizations guidelines, rules, or bylaws take precedent in these situations was also discussed previously.

- b. The Nunavut Wildlife Secretariat was created (without consultation/approval with the HTOs) to assist HTOs with their finances. \$12,000 per HTO has been taken from their annual budgets (\$300,000 total) to help fund the NIWS. Every HTO has have their budgets reduced by this amount regardless of whether they require the assistance of the NIWS. In addition, issues and solutions that have been implemented for HTOs that require assistance are then imposed on all HTOs regardless of the need of any individual HTO.

The Amaruq HTO understands that unfortunately, some HTOs do require the support of the NIWS at some point in their history and the NIWS can provide valuable assistance on those occasions. The concern of the Amaruq HTO is not whether the NIWS has a role and/or should exist but rather whether the HTOs should be contributing to the funding of the organization.

Annual HTO operational budgets should reflect their own forecasted needs each year and should not be used to assist with the funding of another organization. If the NWMB wants to provide such support services, they should fund such an organization through separate funding agreements with the government of Canada and/or Nunavut and/or NTI, and not through the operational funding for each HTO.

The most efficient way for the NWMB to provide such additional services would be by increasing its own capacity to provide the services rather than to create another organization. This would be more efficient from both a management perspective (reducing the bureaucracy and management oversight) as well as from a cost perspective.

Additional questions/concerns:

- If NIWS was established to assist HTOs with their finances, why are some HTOs still 5 years behind in filings? How effective is the NIWS in their role?



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- The Nunavut Agreement does not mention NIWS so where do they get their authority to negotiate 10-year funding agreements for funds used by the HTOs?
3. Recommended Action – The Amaruq HTO would like to see the following corrective actions taken to ensure that all HTOs receive the adequate funding for their operations as per the Nunavut Agreement.
- a. HTO Operational Funding – All HTOs should submit their funding requests to the NWMB while cc'ing the relevant RWO to ensure better communication between the body responsible for negotiating the funding of HTOs and the Government of Canada.
 - b. Nunavut Wildlife Secretariat – Contributions to the NIWS (\$12,000 per year per HTO) from the annual HTO operational budgets, should no longer be required. The NWMB, NTI and RWOs should fund the NIWS (and other similar organizations should they be established in future years) through their own budgets or through separate contribution agreements with NTI, Government of Nunavut, Government of Canada, or others. The NWMB should also ensure that the NIWS, or other similar organizations established by the NWMB, are established in the most efficient way and build upon NWMB's existing capacity rather than create additional bureaucratic layers.

Issue 4 – Meeting Notice & Submission Deadlines

The Amaruq HTO would like to bring to the attention of the NWMB the meeting notice and submission deadlines.

1. The Issue – The length of time between when the meeting notice is distributed, and the submission deadlines are established is relatively short and therefore difficult for HTOs to meet.
2. Amaruq HTO Position – Once the notice of the meeting is distributed to HTOs, along with the agenda for the meeting, HTOs must review the agenda, discuss potential issues that they wish to address at the meeting and develop written submissions and presentations for the meeting. Given that the positions on the HTO boards are voluntary and the technical and/or internal capacity limitations that most HTOs face, this process requires a minimum of 6 weeks (ideally 8 weeks) to complete.

For this February 26 meeting, the original notice was sent out on November 14, 2024 with the deadline for submissions being January 3, 2025. No consideration is given to the extended Christmas holiday breaks that are common across the territory. Once the holiday break is taken into consideration, HTOs had only about 4 weeks to review, discuss, and prepare responses for any issues they identified.



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It should be noted that there was less time allotted to HTOs to prepare their submissions (49 days) than the NWMB had (54 days) to review those submissions even when counting the holidays. Once the holiday break is considered, the HTOs had approximately 26 business days to complete their work while the NWMB was given 37 days to review the submission and prepare their own responses even though the NWMB has considerably more internal capacity to review submissions send the HTOs.

In the case of the Amaruq HTO, this required contracting of a consultant to assist in the preparation of the issues that the HTO wanted to present at the meeting and necessitated work to be conducted over the holiday break, something the NWMB did not have to inconvenience itself with.

3. Recommended Action – The NWMB must always ensure that HTOs have at least 8 weeks/40 business days notice (excluding holidays) for submissions to the NWMB prior to meetings.

SUBMISSION TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: ✓

Decision: N/A

Issue: *Agnico Eagle Mining Ltd. ("AEM") Nunavut caribou research and monitoring data*

Background:

(a) *how the issues relates to the NWMB mandate;*

On April 19, 2016, the NWMB decided (in summary) to recommend to the Federal Minister of Indigenous and Northern Affairs that:

1. A moratorium on development on caribou calving grounds was warranted,
2. that caribou protections contained in the *NPC 2015 Draft Land Use Plan* needed to be strengthened, and
3. that prohibitions and restrictions on development within other key caribou habitats in Nunavut were also warranted.

The NWMB has mandates associated with caribou habitat (i.e., NWMB Mission statement), which may include restrictions on development. NWMB also has a responsibility to provide advice to Government Departments, NIRB and other agencies regarding mitigation and compensation arising for industrial development on wildlife habitat.

The NWMB may approve wildlife management plans, conservation areas, and wildlife designations included those for caribou, that similarly impact mineral development.

(b) *why the issue is being presented;*

In exercising its mandate, the NWMB may affect AEM existing rights.

The NWMB, as a tribunal, is subject to administrative law. As such, the NWMB is subject to the principles of procedural fairness.

Section 5.2.37 of the Nunavut Agreement provides a role for the NWMB in wildlife research, including collecting, classifying, and disseminating wildlife statistics and information and maintaining a data base adequate for such purposes.

AEM wishes to share caribou monitoring and mitigation strategies and results with the NWMB that could be consideration in any future NWMB decisions affecting AEM.

(c) *the key facts and circumstances relating to the issue; and*

AEM exploration and mine operation tenures in Nunavut overlap with the ranges of the Dolphin and Union, Ahiaik, Beverly, Northeast Mainland, Lorillard, Wager Bay and Qamanirjuak caribou herds.

The NPC develops planning policies, priorities and objectives regarding the conservation, development, management and use of land in the Nunavut Settlement Area. A 2023 version of a Nunavut Land Use Plan is currently submitted to Signatories for approval, affecting AEM existing

rights in Nunavut. AEM has submitted evidence related to AEM land use and caribou to the NPC several times during this land use planning process.

The NIRB screens, reviews, and determines whether projects may proceed in Nunavut, and if so, under what terms and conditions. Several AEM gold projects have been subject to NIRB scrutiny. These are currently approved and now operate under NIRB Project Certificates, including Meadowbank Complex mine, Meliadine Mine, and Hope Bay Mine. Detailed NIRB terms and conditions exist related to wildlife monitoring and mitigation at these sites under formalized management plans, subject to Inuit and Government review and input.

AEM is currently the largest mineral explorer, mine developer and operator in Nunavut. AEM possesses, large, multi-year data sets of caribou interactions with development including caribou monitoring methods and results, and caribou mitigation methods and results.

For Hope Bay, this is summarized in the Hope Bay Wildlife Mitigation and Monitoring Program (“WMMP”), and for Meadowbank Complex and Meliadine, within site specific Terrestrial Environment Monitoring and Mitigation Programs (“TEMMPs”). AEM technical capacity also extends to review and analysis of relevant independent and government scientific caribou research.

Although this information is normally reported annually to the NIRB, and is available on the NIRB Public Registry, this may not be readily available for NWMB consideration.

(d) the estimated time required to orally present the issue (excluding questions/discussion).

Anticipate 30 minutes to present the material.

Keep the language as non-technical as reasonably possible.

Anticipate the questions that the NWMB may ask.

Consultation:

Summarize the consultations which have been undertaken before submitting the issue to the NWMB. This summary should include the following:

(a) the means of consultation;

Public consultation is required prior to, during, and after the Nunavut Impact Assessment and Permitting process. Developers such as AEM utilize a number of consultation methods such as 1 on 1 meetings with stakeholder organizations, directed public events, use of social media, and subject-specific workshops. AEM conducts between 3-400 discrete consultations per year in Nunavut. Results of these consultations are reported and available on the NIRB and NWB Public Registries.

Specifically in relation to wildlife management and monitoring, AEM employs specified consultation methods aimed at effectively designing and implementing mine level programs. In the case of Hope Bay, an Inuit Environmental Advisory Committee has been formed and between the Kitikmeot Inuit Association and the company to inform the Hope Bay WMMP. In the case of both

Kivalliq mine operations, Terrestrial Advisory Groups (“TAGs”) have been formed for the same purpose, and include other indigenous groups besides Inuit, and government regulators.

(b) a list of the organizations consulted and an estimate of the number of individuals consulted, including members of the public; and

1. Nunavut Tunngavik Incorporated including NTI Wildlife Department
2. Kivalliq Inuit Association
3. Kitikmeot Inuit Association.
4. Kivalliq Wildlife Board
5. Kitikmeot Regional Wildlife Board.
6. All Kivalliq Hunters and Trappers Organizations
7. All Kitikmeot Hunters and Trappers Organizations
8. Hope Bay Inuit Environmental Advisory Committee
9. Kivalliq Elders Advisory Committee
10. Meadowbank Complex and Meliadine Terrestrial Advisory Group
11. Several hundred members of the public in Kivalliq and Kitikmeot regions per year.

(c) a summary of the results, including any responses or accommodations to issues, concerns, etc. raised during the consultations.

The Hope Bay WMMP and Meadowbank Complex and Meliadine Mine TEMMPs are requirements stemming from the NIRB environmental assessment of our mine development proposals. These plans are periodically reviewed and updated based on input from rights holders and stakeholders. These plans and activities are subject to approval from the NIRB.

The WMMP and TEMMPs are designed to test Impact predictions, and to mitigate known or suspected negative effects of mine development on wildlife.

The WMMP and TEMMPs have been in effect for a number of years. Some impact predictions have been proven true. Some impact predictions have yet to be addressed and are subject to continued monitoring effort. Wildlife mitigation efforts have been adjusted periodically based evidence of effectiveness, and on input from consultations.

Public, rightsholder and stakeholder concerns over mine development and operation impact on barren ground caribou in Nunavut remains the subject of highest wildlife concern for AEM.

Recommendation:

Options for addressing the issue or a recommended course of action

Course of action is a discussion on monitoring and mitigation associated with development activities related to caribou habitat.

Prepared by:

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Date:

December 12, 2024.

Agnico Eagle Caribou Mitigation and Monitoring

Nunavut Wildlife Management Board
February 2025



OUTLINE

- Agnico Eagle Projects
- Caribou Monitoring Programs
- Caribou Mitigations
- Monitoring Program Results



Agnico Eagle Projects



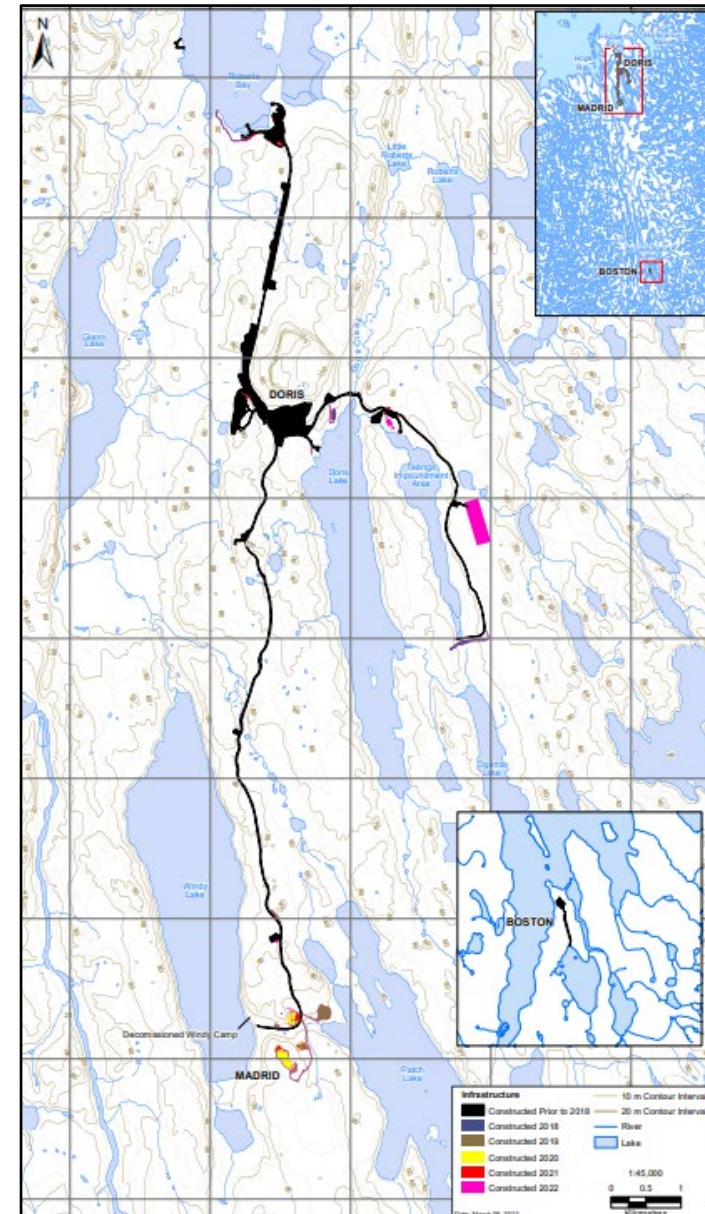
AGNICO EAGLE

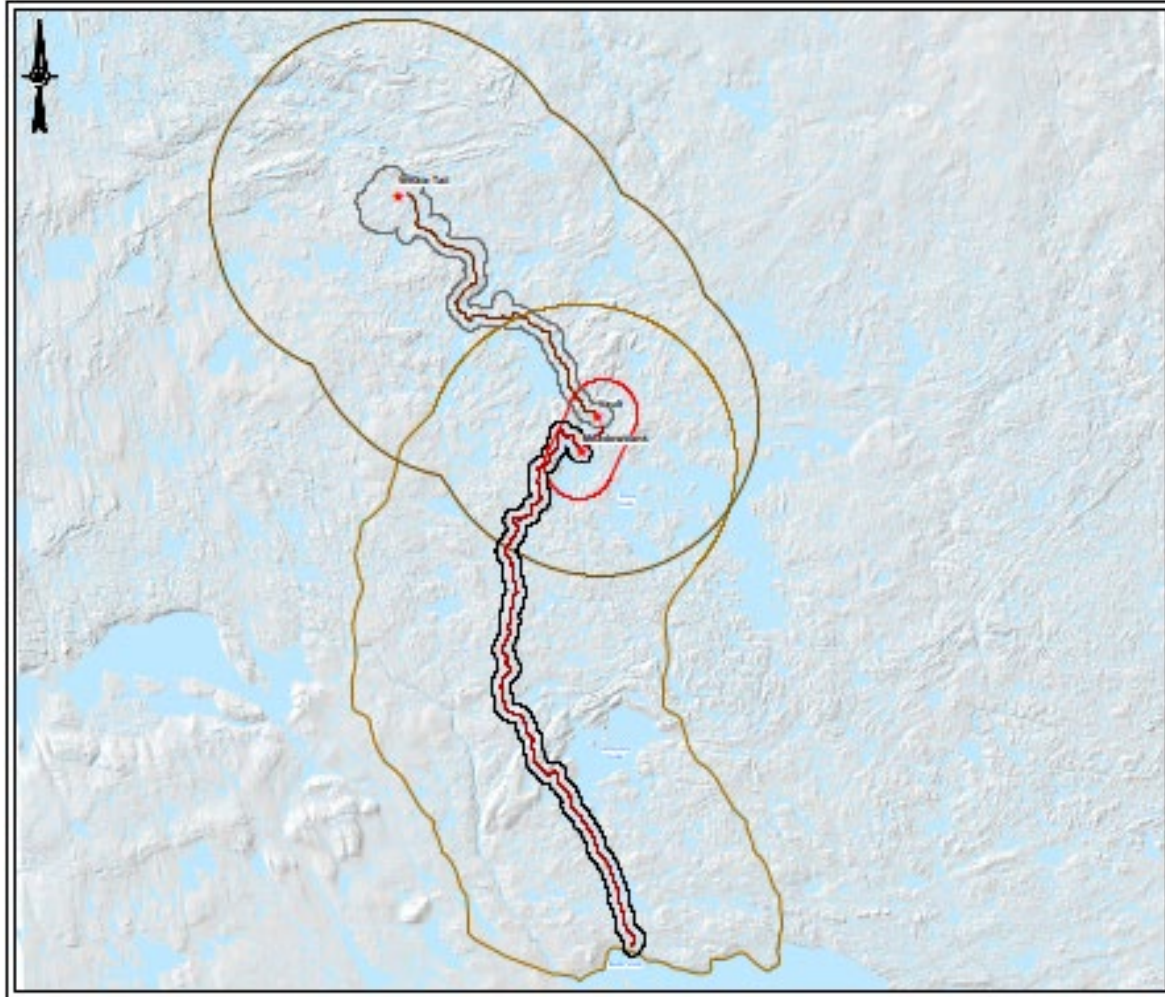
HOPE BAY

- The Hope Bay property is located in the Kitikmeot region of Nunavut which include portions of the Hope Bay and Elu greenstone belts
 - Three gold deposits (Doris, Madrid, and Boston)
- Exploration activities by Agnico Eagle at Hope Bay began in February 2021 and are ongoing

The Project footprint contains infrastructure such as:

- Underground mine development at the Doris and Boston deposits
- A fully enclosed conventional processing plant and a tailings impoundment area at Doris
- A gravel airstrip at Doris and a secondary gravel airstrip at Boston
- A port with a laydown facility and fuel storage at Roberts Bay
- An all-weather road network, a diesel power plant, and an office-accommodations complex





- The Meadowbank Mine is located in the Kivalliq region of Nunavut
- Construction began in 2008. Mine components include open pits, waste rock storage facilities, and a tailings storage facility.
- Mine facilities on surface include a mill, power plant, maintenance facilities, tank farm for fuel storage, water treatment plant, sewage treatment plant, airstrip, and accommodations.
- An all-weather road connects Whale Tail to Meadowbank
- An all-weather road connects the Mine to Baker Lake
- Barge unloading with a laydown facility and fuel storage at Baker Lake

Community- Based Monitoring



AGNICO EAGLE

COMMUNITY-BASED MONITORING - HOPE BAY

- Hope Bay height of land caribou surveys
 - Developed with the Inuit Environmental Advisory Committee (IEAC) and surveys carried out by a local Inuit Monitor via the Cambridge Bay Hunters and Trappers Organization (HTO)
- Hope Bay wildlife camera monitoring
 - A Project Caribou ID guide was developed with the IEAC during a caribou ID workshop to sort caribou into either Beverly/Ahiak or Dolphin and Union based on herd characteristics
 - Any caribou detections with uncertain herd characteristics are provided to the IEAC for additional input



COMMUNITY-BASED MONITORING - MELIADINE

- Meliadine height of land caribou surveys
 - Surveys carried out by a local Inuit Monitor via the Kivalliq Inuit Association (KIA) and Kangiqliniq Hunters and Trappers Organization (KHTO).
- Meliadine road surveys
 - Surveys carried out by a local Inuit Monitor via the Kivalliq Inuit Association (KIA) and Kangiqliniq Hunters and Trappers Organization (KHTO).

Terrestrial Advisory Group (TAG)

- KIA
- KHTO
- Baker Lake Hunters and Trappers Organization (BLHTO)
- Sayisi Dene First Nation (SDFN)
- Northlands Denesuline First Nation (NDFN)
- Government of Nunavut (GN)
- Agnico Eagle



- Meadowbank Complex
 - Surveys carried out by a local Inuit Monitor via the Kivalliq Inuit Association (KIA) and Baker Lake Hunters and Trappers Organization (BLHTO).
- Meadowbank Complex road surveys
 - Surveys carried out by a local Inuit Monitor via the KIA and BLHTO.
- Community input on mitigations:
 - Identification of lead caribou for protection measures

Terrestrial Advisory Group (TAG)

- KIA
- BLHTO
- Government of Nunavut (GN)
- Agnico Eagle



Caribou Monitoring Programs



CARIBOU MONITORING PROGRAMS

- Collared caribou monitoring (Meliadine, Meadowbank)
 - Receive collar maps from GN as early warning of caribou approach
- Wildlife camera monitoring (Meliadine, Meadowbank, Hope Bay)
 - Cameras deployed at varying distances from Project footprints to evaluate effects on caribou, including road crossing, movement, and Zone of Influence (ZOI)
- Height of Land Surveys (Meliadine, Meadowbank, Hope Bay)
 - Monitoring triggered by collars approaching the Mine (Meliadine, Meadowbank)
 - Monitoring triggered when >25 caribou are reported within 5 km of Project activities (Hope Bay)
 - Used to trigger mitigation
- Behaviour Monitoring (Meliadine, Meadowbank, Hope Bay)
 - Evaluation of caribou response to potential disturbances, including vehicles, blasting, Mine activities



CARIBOU MONITORING PROGRAMS



AGNICO EAGLE

- Track Surveys (Meliadine, Meadowbank, Hope Bay)
 - Completed along Project roads, in conjunction with snowbank height monitoring during winter months
- Caribou Herd Identification (Hope Bay)
 - Classification of caribou herds for wildlife camera events (Beverly/Ahiak or Dolphin Union)
- Blast monitoring (Meadowbank, Hope Bay)
 - Caribou responses to blasting
- Noise Monitoring (Meliadine, Meadowbank, Hope Bay)
 - Evaluation of noise during different levels of operation, at different distances from the Mine
 - What would caribou hear when approaching the Mine?
- Incidental Observations (Meliadine, Meadowbank, Hope Bay)
 - Reported by all staff on-site, in addition to community members, local HTO's, GN, KivIA and KitlA staff



Caribou Mitigations



MITIGATION THROUGH DESIGN (EXAMPLES)

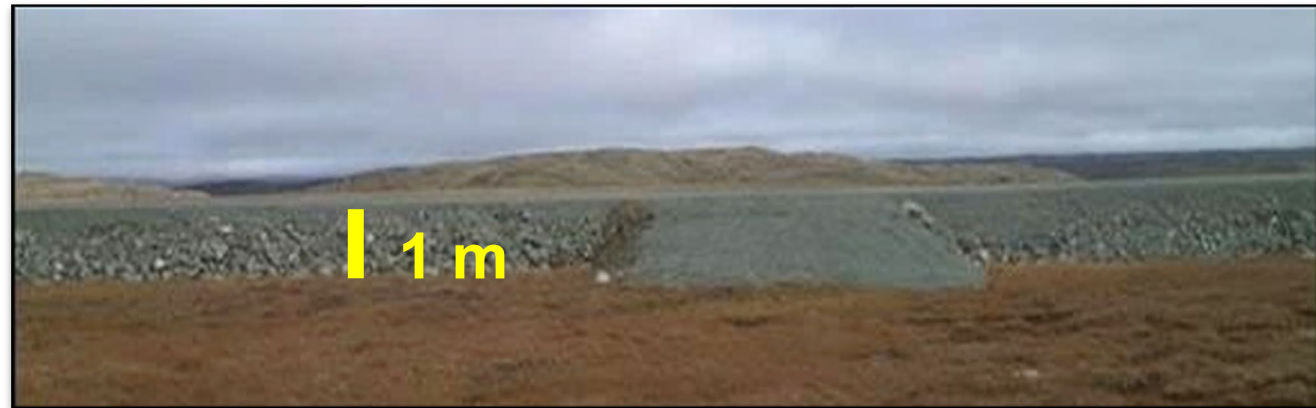
Mine Site:

- Footprint as small as possible
- Mufflers and noise attenuation
- Constructed visual breaks
- Lighting mitigation



Roads:

- Designing roads to be low
- Installing crossing ramps and underpasses
- Burying waterlines (Meliadine)
- Avoiding important wildlife habitat



ACTIVE MITIGATIONS

Mine Site:

- Caribou Management System
 - Includes restricting surface activities
- Speed limits
- Dust control
- Attractant management



Roads:

- Speed limits
- Closures when caribou are present:
 - Whale Tail Haul Road (Meadowbank, seasonal GSTs and "lead" caribou)
 - All-Weather Access Road (Meliadine, >50 caribou within 100 m)



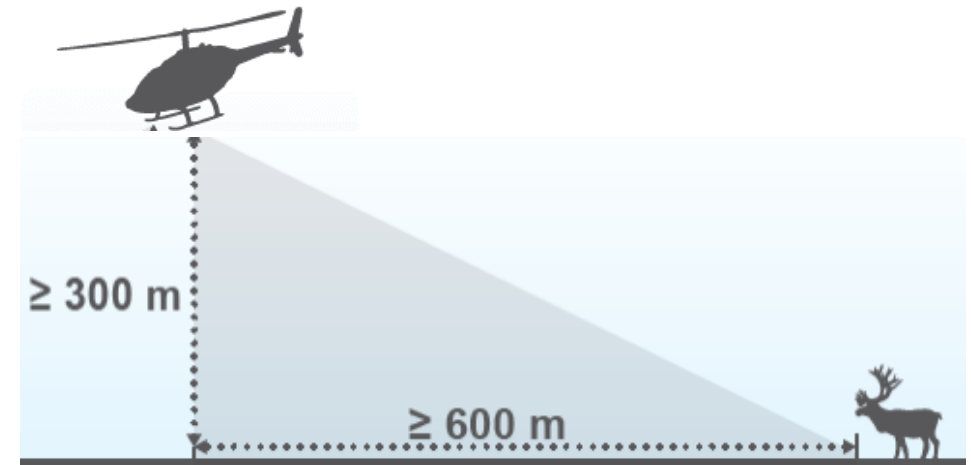
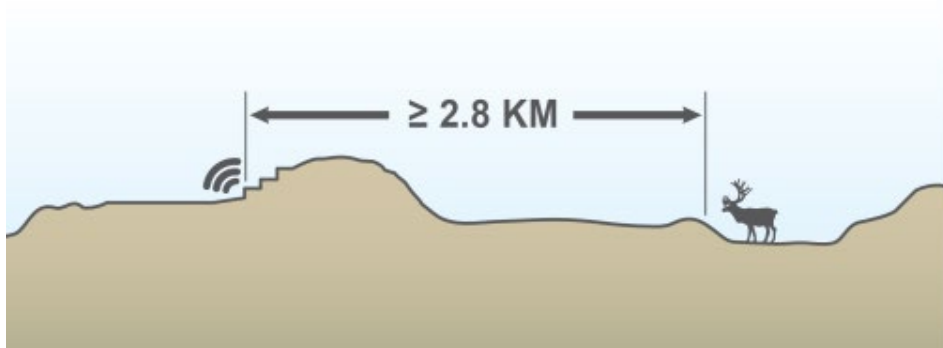
Blasting:

Stop blasting when groups of caribou are near the Mine:

- Meliadine: 50 caribou <5 km
- Meadowbank: \geq GST <5 km
- Hope Bay: 1 caribou <2.8 km

Aircraft:

- Avoid caribou horizontally or vertically
- Defer flights if caribou are near the runway (Hope Bay)
- During sensitive seasons helicopters are grounded

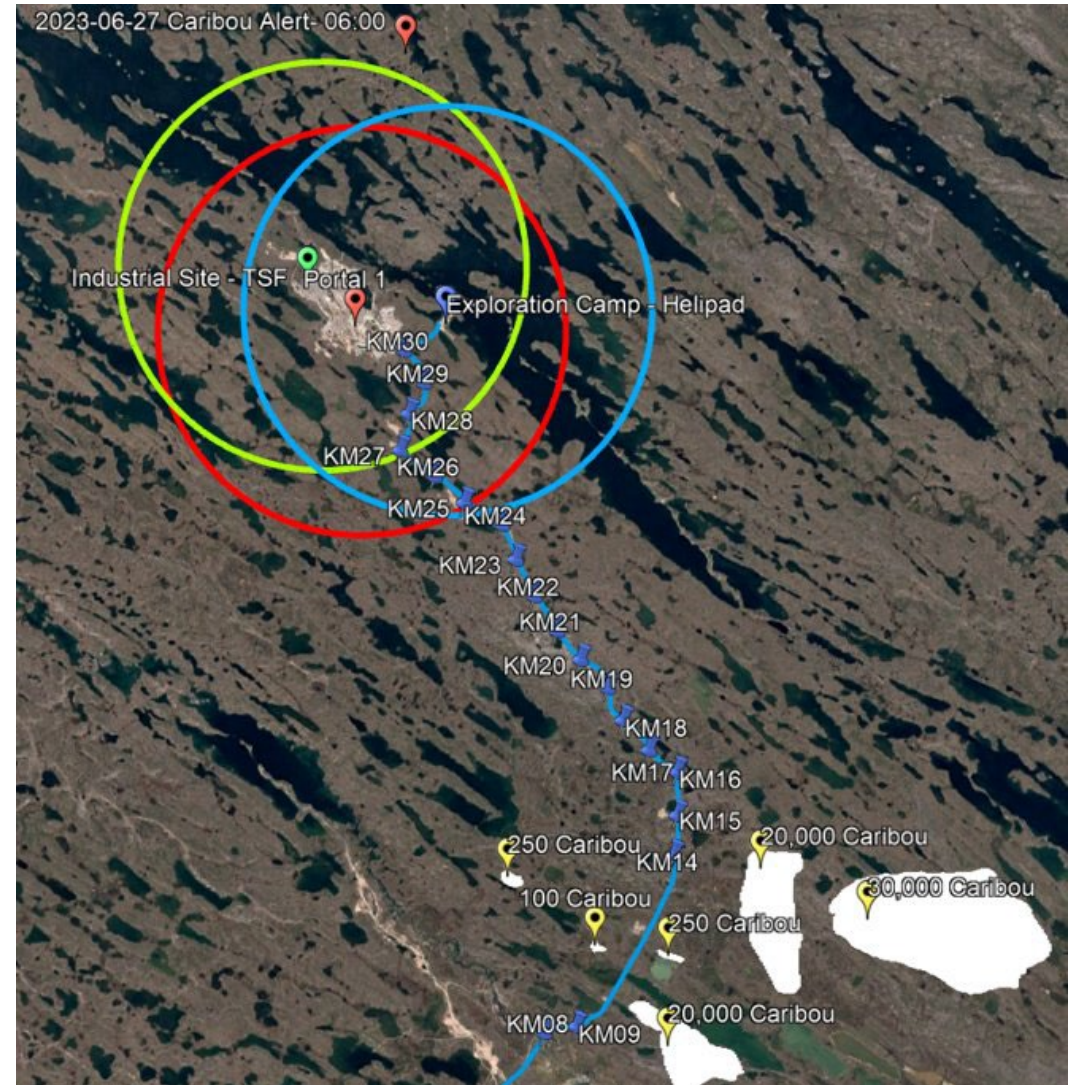


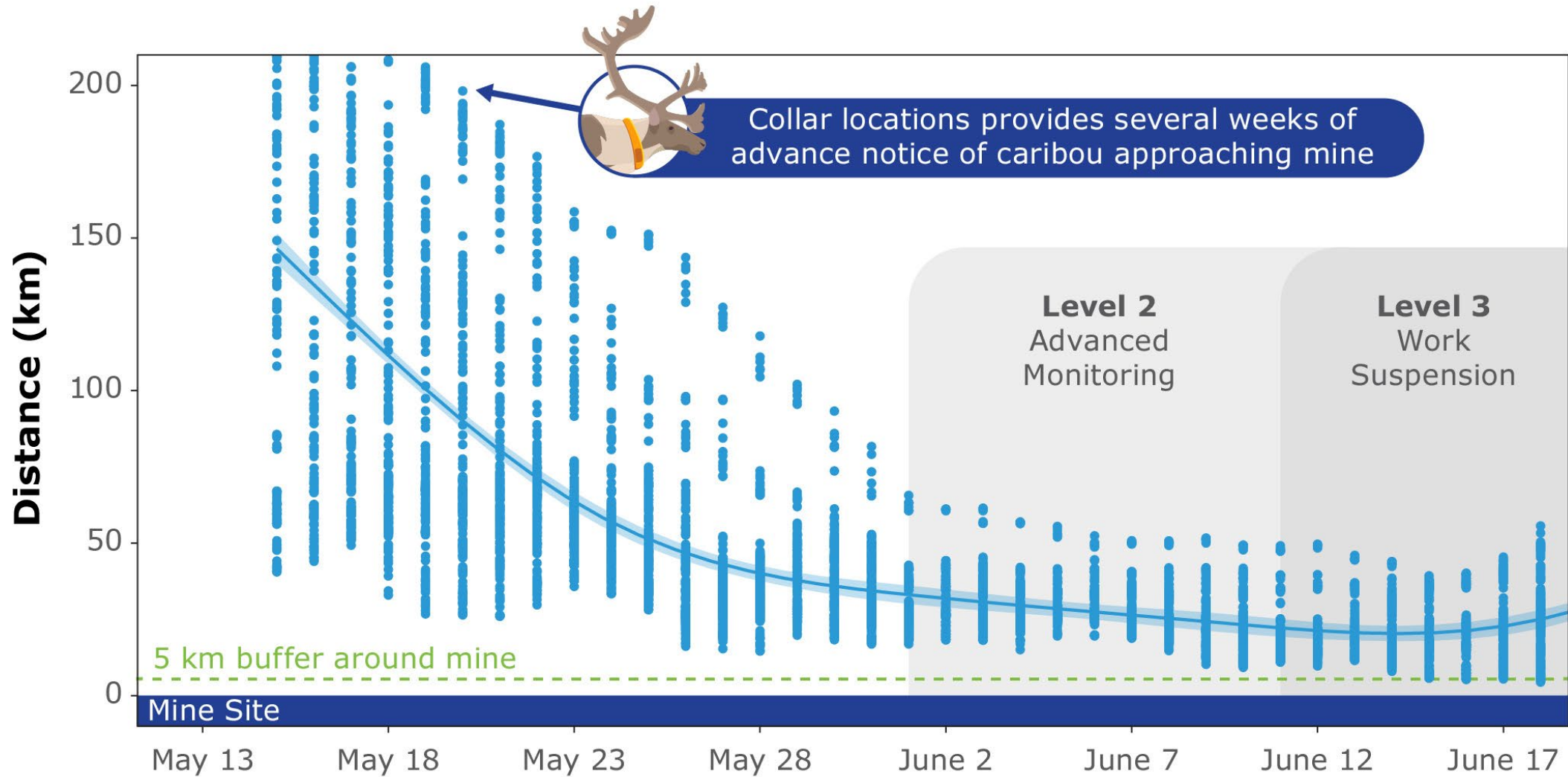
Monitoring Program Results



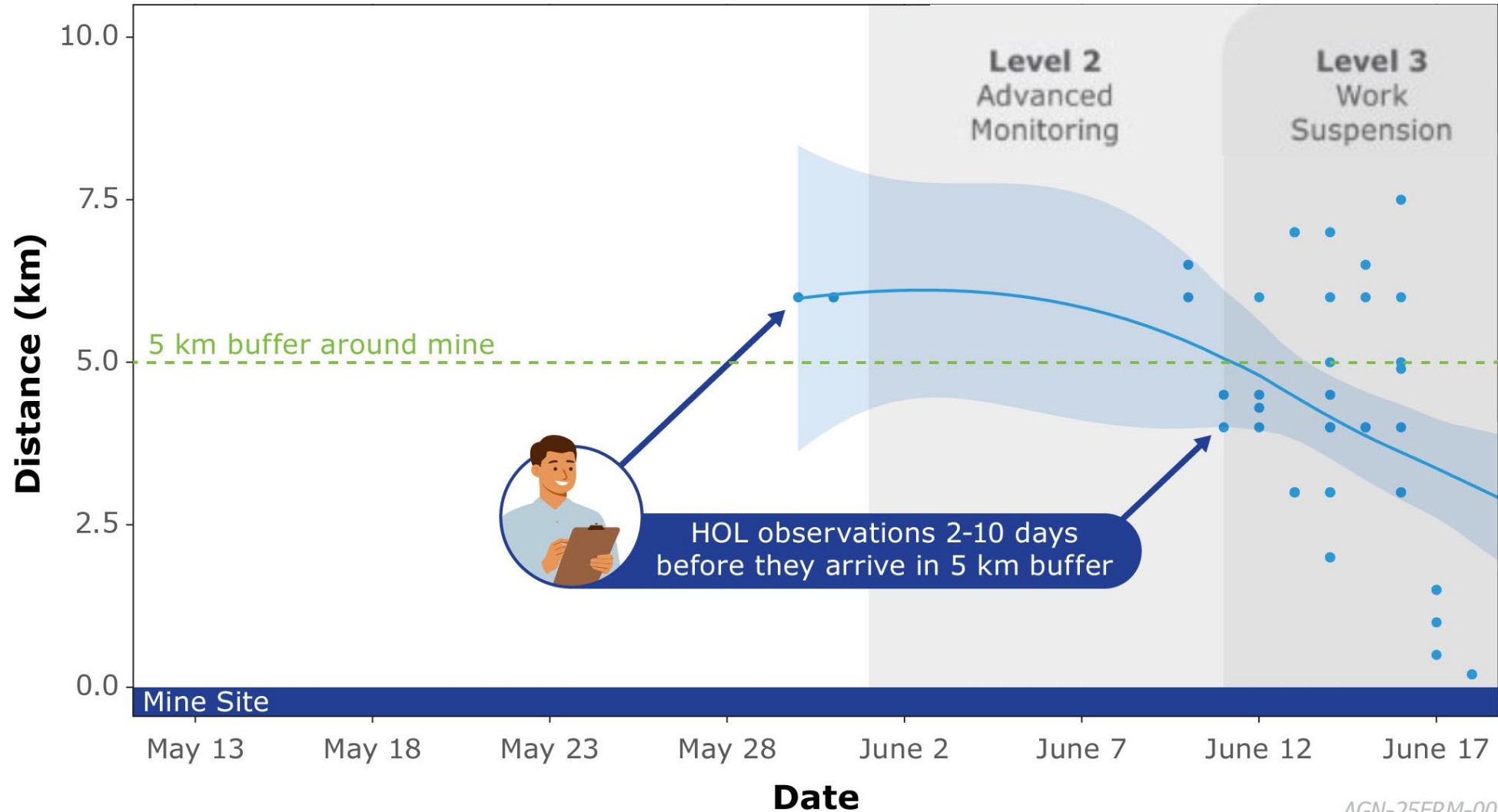
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- **Caribou Collar Data** indicate when caribou are starting to leave their calving grounds
- **Height of Land Surveys** are conducted to identify where groups of caribou are (the white polygons) and whether they are within 5 km of site (circles).
- **Driving Surveys** are conducted every day when caribou may be on site (June/July).

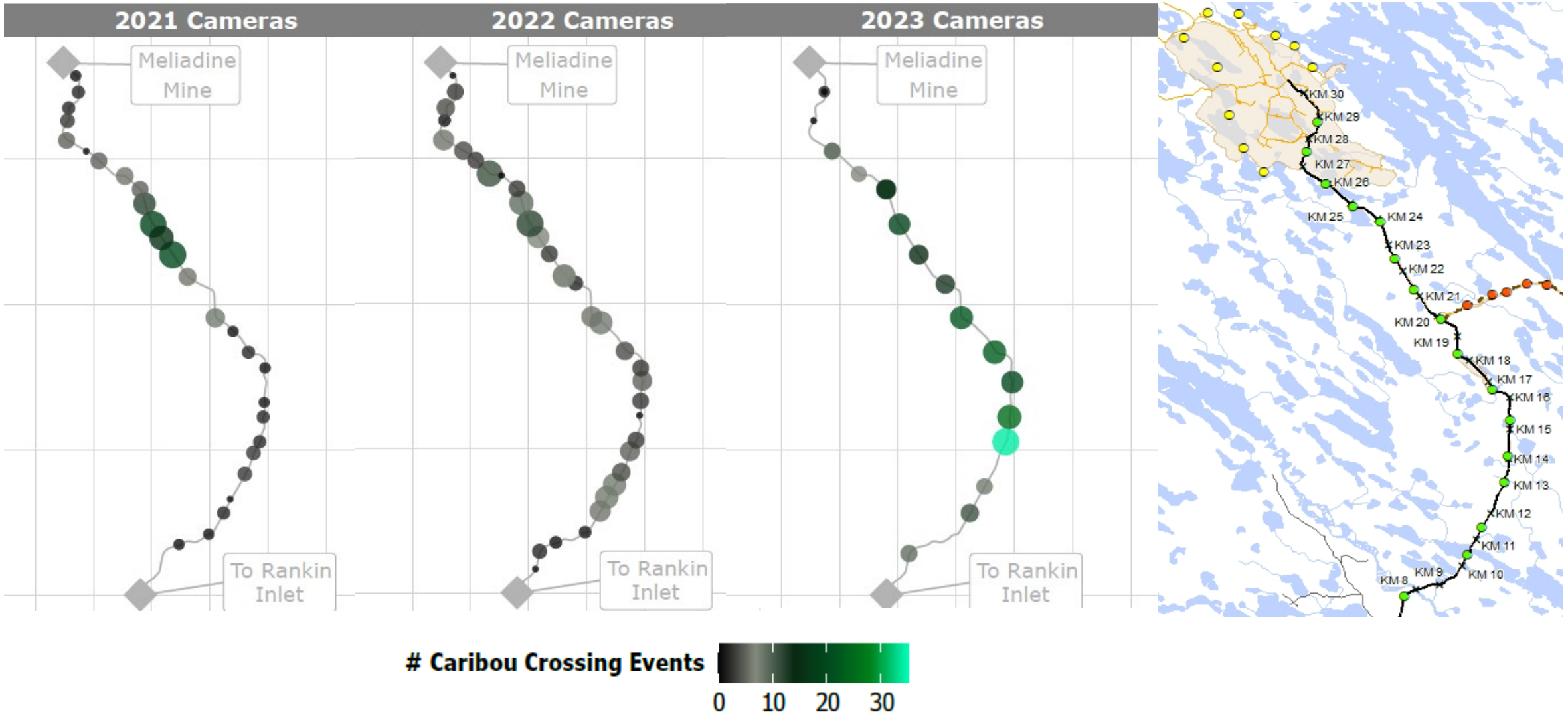




MELIADINE: COLLAR DATA AND HEIGHT OF LAND SURVEYS



MELIADINE: CAMERA MONITORING

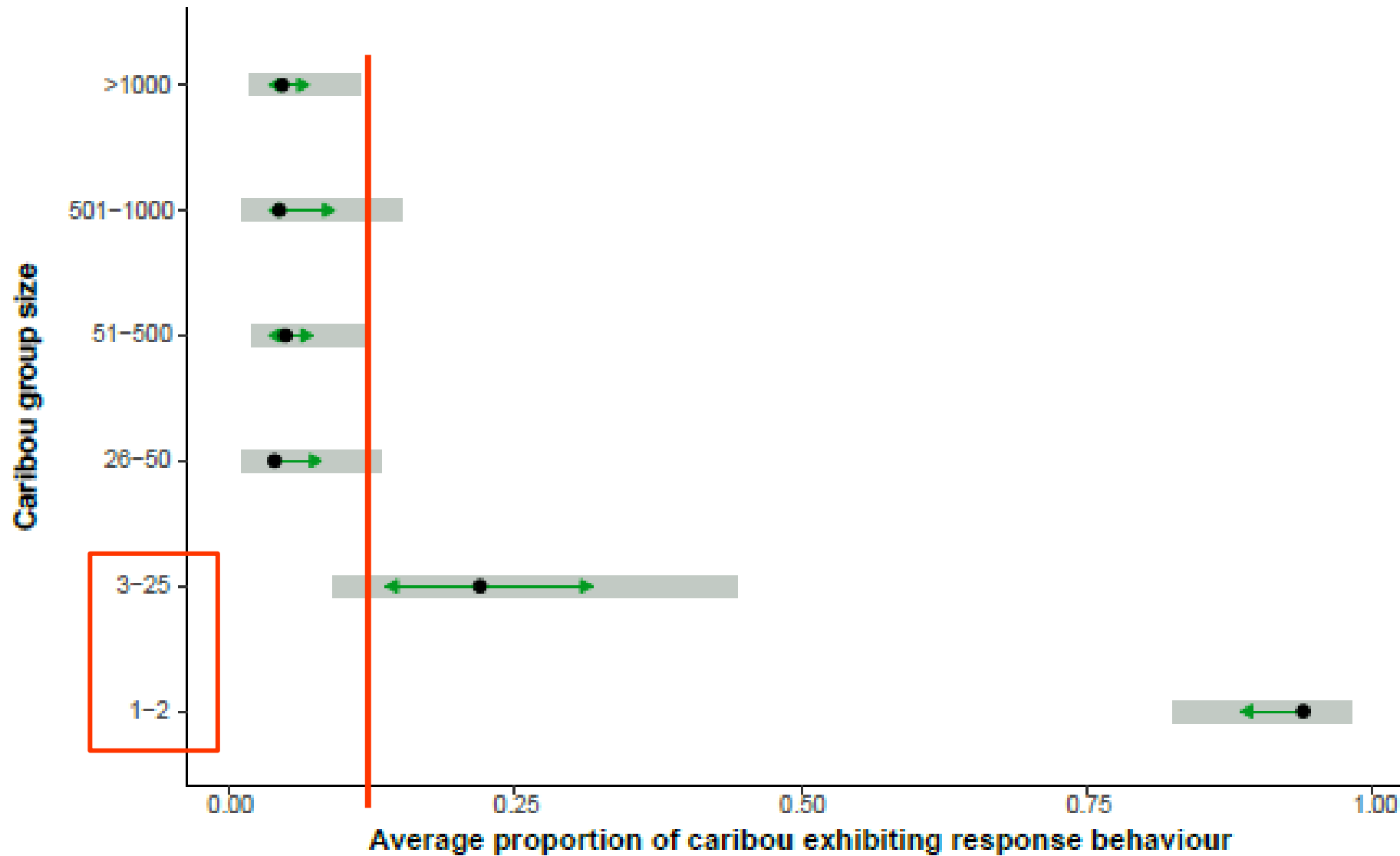


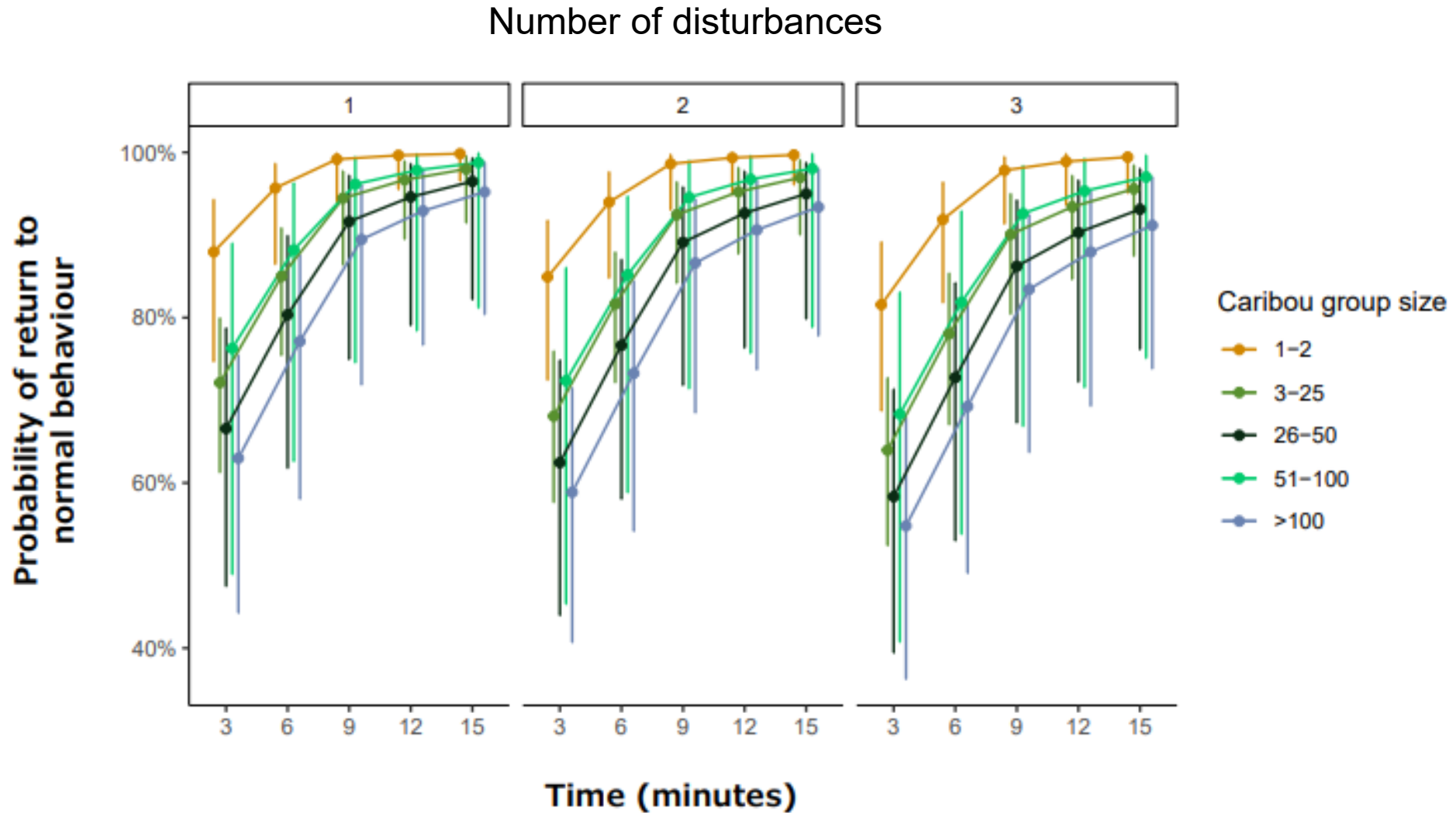
MELIADINE AND MEADOWBANK: BEHAVIOUR MONITORING

- 230 surveys completed from 2020 to 2024 at Meliadine.
- 354 surveys completed from 2020 to 2023 at Meadowbank.
- Standardized methods are effective, including TAG suggested improvements.
 - Incorporation of laser range finder for caribou distance
 - Insect harassment index
 - Expanded convoy surveys

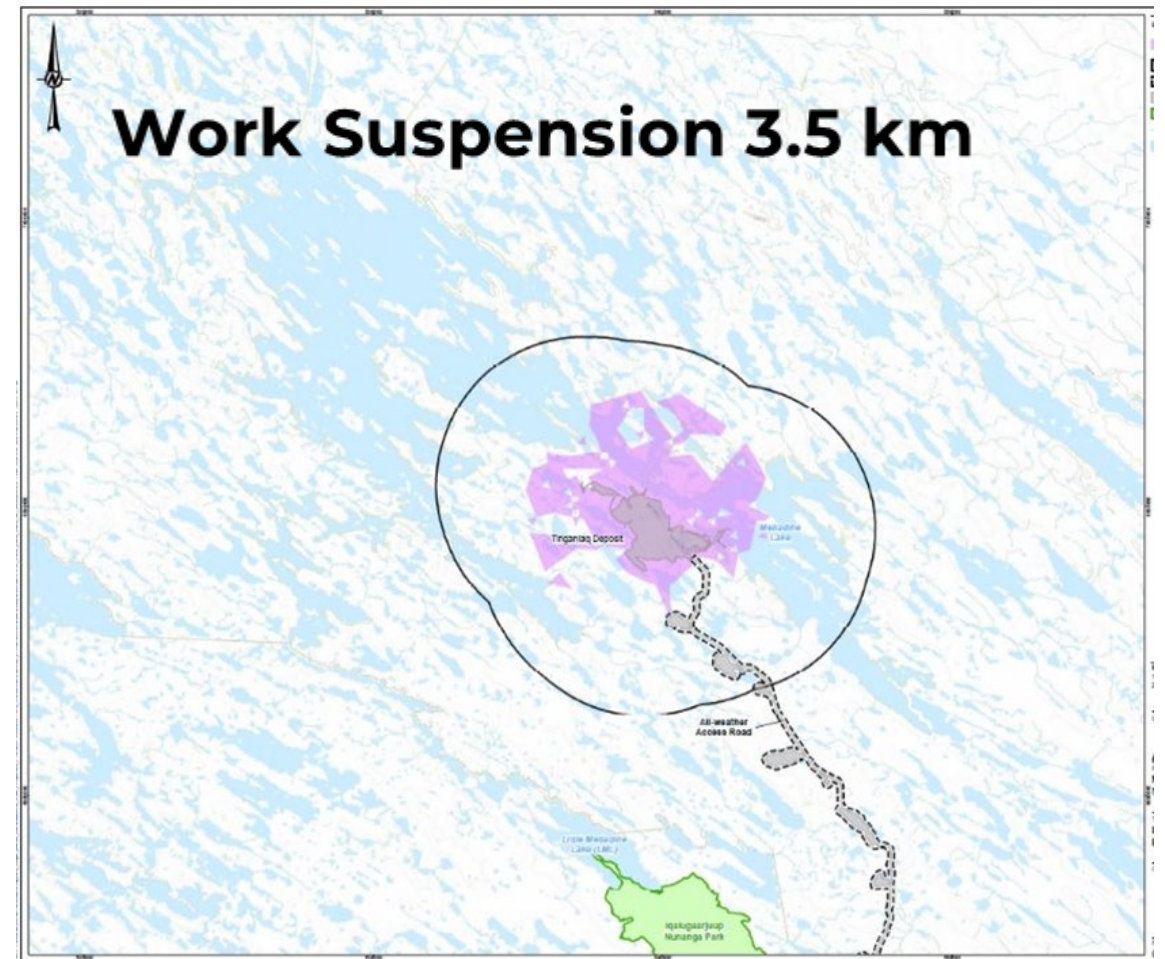
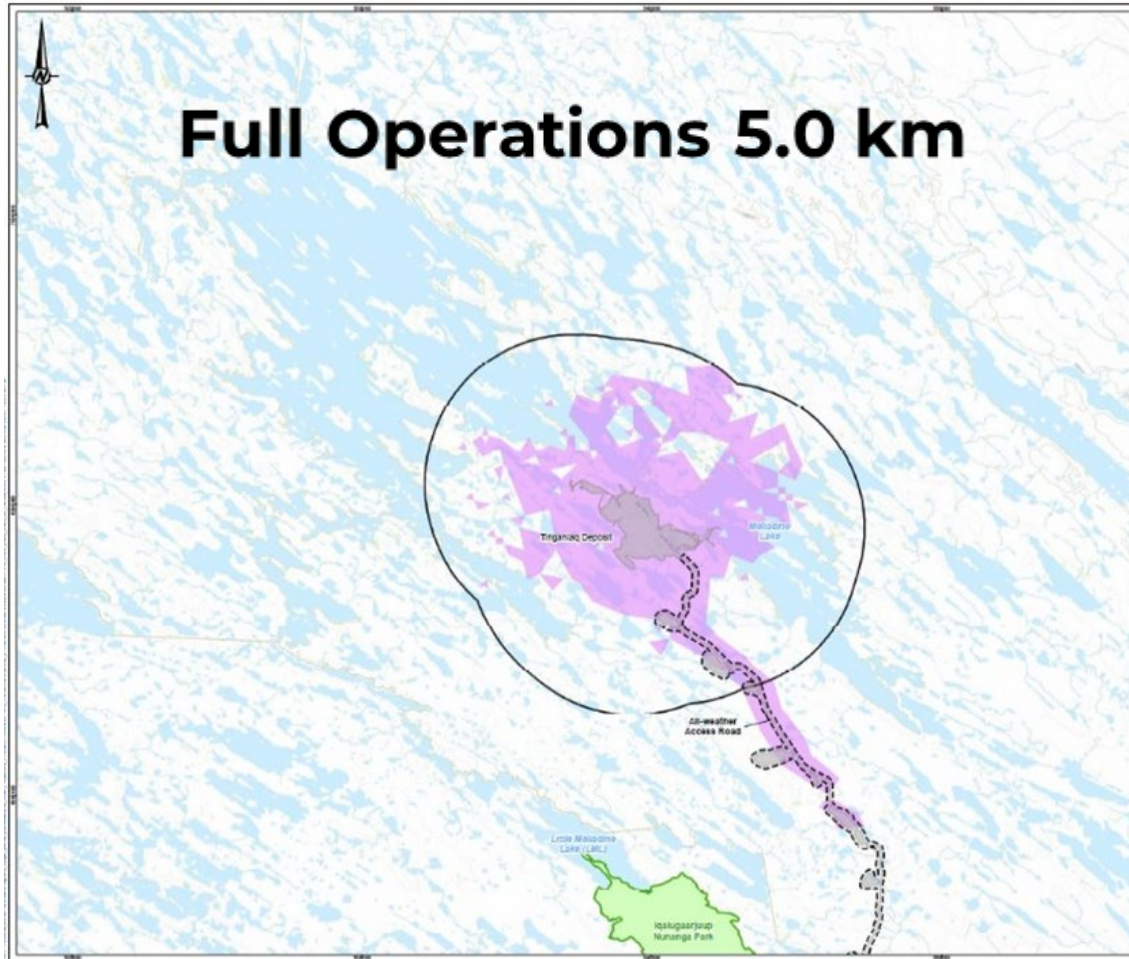


MELIADINE AND MEADOWBANK: BEHAVIOUR MONITORING





Spatial propagation when wind is 8.2 – 21.6 km/hr



HOPE BAY: WILDLIFE CAMERA MONITORING



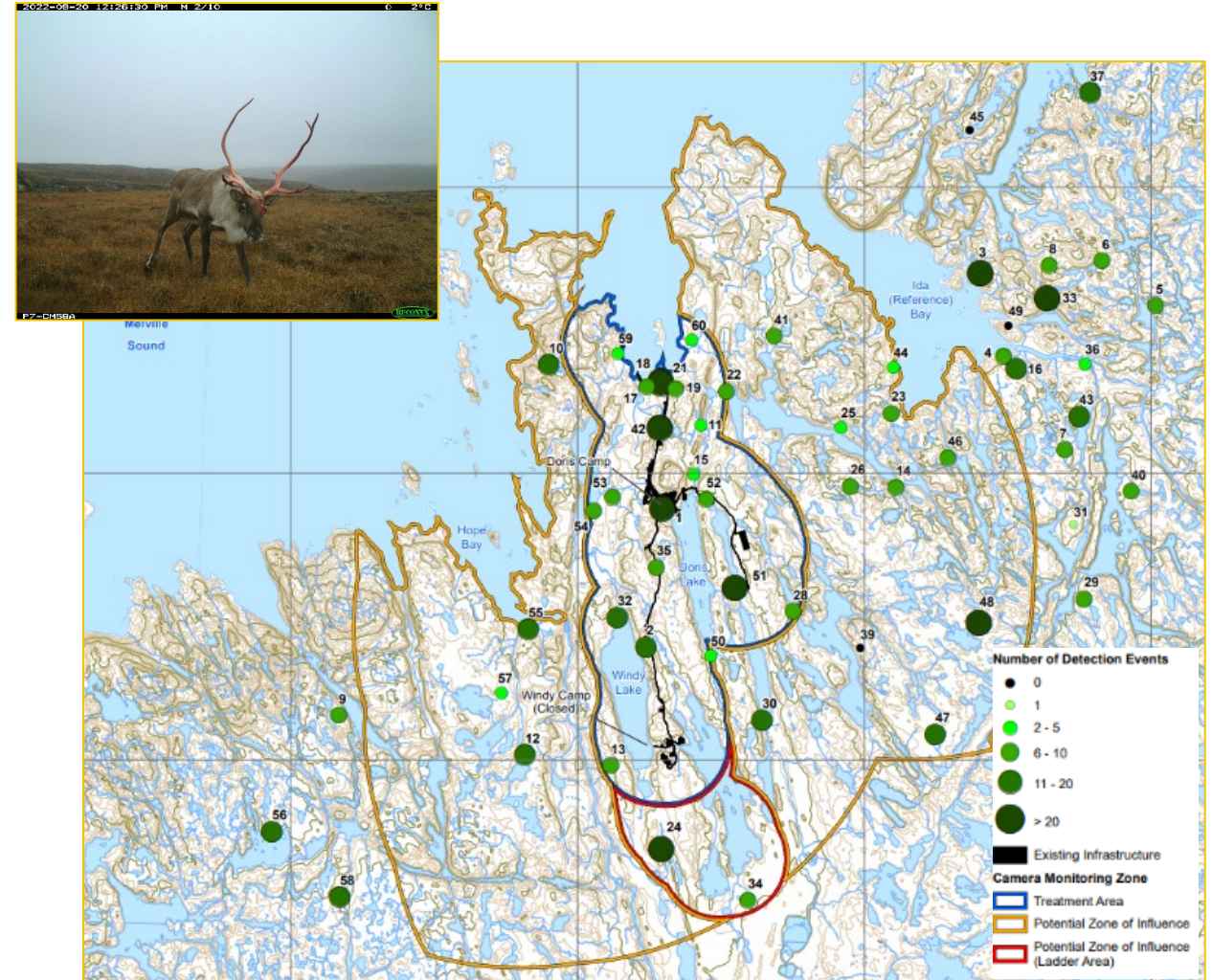
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FEIS PREDICTION: Caribou may avoid Hope Bay by 3 to 4 km (not significant)

RESULTS (Statistical Analysis 2016-2023):

- Fewer caribou camera detections in Treatment Zone (< 2km from the Project) compared to Control area (>10 km) from fall to spring
 - Likely related to landscape features/travel corridors and more suitable winter habitat further from the Project
- Caribou events more common during post-calving season
- Caribou common in July/August at specific areas near the Project for insect avoidance

CONCLUSION: Caribou not likely avoiding the Project



HOPE BAY: HEIGHT OF LAND SURVEYS

- In 2022, three height of land monitoring sites were independently selected by an Inuit environmental team member and further scoped by the IEAC
- The monitoring SOP was developed during several workshops with the IEAC from 2021 to 2023, and onsite training was provided in March 2023
- Surveys completed in 2024 during expected periods of caribou presence





FEIS PREDICTION: No specific predictions were included but the FEIS described plowing procedures to prevent snowbanks from posing a barrier to caribou

RESULTS (Analysis 2020-2023):

- Snowbank height along the All-Weather Road (AWR) was monitored monthly during winter months (October to May 2020-2023)
- Average snowbank height of 12.6 cm
- Higher snowbank heights were isolated to small portions of the road and were at low inclines
- No track surveys have yet been triggered at snowbank monitoring locations

CONCLUSION: Following appropriate road clearing management, snowbanks along the AWR do not pose a crossing barrier to caribou

HOPE BAY: NOISE MONITORING

- Blasting noise monitoring will confirm the avoidance radius for caribou near blasting
 - Caribou research papers determined a pressure level of 96 decibels (dBA)
 - Noise modelling for the FEIS determined this noise level is at 2.8 km from blasts, which is the current radius for no-blasting if caribou are present
- A standard operating procedure was developed and has been in testing since 2018.
 - Results indicate that equipment is functional but additional work is required to obtain results sufficient for testing the sound level at the exact time of the blasts
 - Testing is ongoing and blasting noise monitoring methods may be altered with input from the IEAC (e.g., height of land and behavioural monitoring surveys)



MEADOWBANK: NOISE MONITORING

- Blast noise and vibration model created in 2021 using field sensors for sound and vibration.
- Caribou behavior (group scan methods) monitored ~20 minutes before and after blasts (2021 to 2023) from 800m to 2,800m from blast source (18 caribou groups)
- An increase in alert and walking behavior during blast.
- Two strongest vibration exposures yielded an increase in walking and feeding 3 minutes after blast
- Two strongest noise events caribou increased feeding for both, 3 minutes after blast.
- Trotting or running away was never observed.

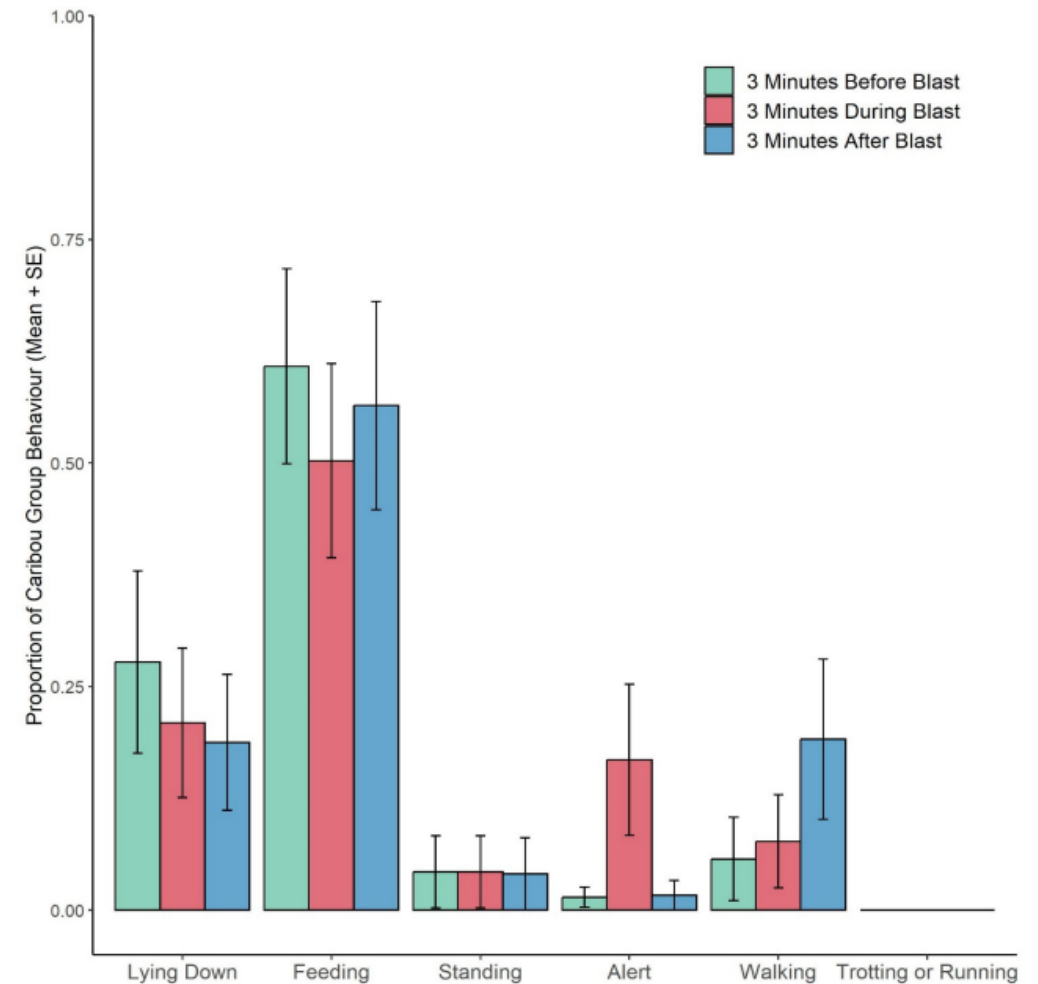


Figure 9-2: Caribou Behaviour Before, During, and After Blasting.

CONCLUSIONS



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- AEM projects have been subject to Environmental Assessment; where caribou have been extensively discussed.
- Design mitigation reduces noise and allows caribou to cross sites
- Management for caribou follows mobile protection measures – operations are managed reduced when caribou approach
- NIRB has mandated caribou monitoring.
- Monitoring includes IQ, TK and stakeholder input, continuously updated and conducted with local groups
- Long term monitoring show no significant impacts to caribou
- AEM is supporting our consultants to peer-review publish Nunavut caribou monitoring and mitigation reports.
- When published, AEM will submit these studies to the NWMB for your information.



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