NUNAVUT WILDLIFE MANAGEMENT BOARD
Agenda: Regular Meeting 002-2022
June 15, 2022
Aqsarniit Hotel

	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 RM002-2022	1	Chairperson	1 Minute
9:05 - 10:00 AM	4	Resumption of the Gulf of Boothia Polar Bear Total Allowable Harvest (For Decision)	2	NWMB	55 Minutes
10:00 - 10:15 AM		**BREAK**			15 Minutes
10:15 AM - 12:00 PM	4	Resumption of the Gulf of Boothia Polar Bear Total Allowable Harvest (For Decision)	2	NWMB	1 Hr & 45 Min
12:00 - 1:30 PM		**LUNCH**			1 Hr & 30 Min
1:30 - 2:30 PM	5	Request for decision on the proposed change in status of Dolphin and Union Caribou from Special Concern to Endangered under the federal *Species at Risk Act* (For Decision)	3	Environment and Climate Change Canada	1 Hour
2:30 - 3:00 PM	6	Update on the National Polar Bear Plan (Information)	4	Environment and Climate Change Canada	30 Minutes
3:00 - 3:15 PM		**BREAK**			15 Minutes
3:15 - 4:00 PM	7	Ekaluktutiak Hunters and Trappers Organization Update	5	Ekaluktutiak Chair	45 Minutes

4:30 - 5:00 PM	8	Decision/Advice on Redfish bycatch in the Western and Eastern Assessment Zones (Decision and Advice)	6	Fisheries and Oceans Canada	30 Minutes
5:00 - 5:30 PM	9	Advice on the Total Allowable Catch for Northern Shrimp in Shrimp Fishing Area 0 (Advice)	7	Fisheries and Oceans Canada	30 Minutes
	10	Adjournment of RM002-2022 Meeting		Chairperson	

NUNAVUT WILDLIFE MANAGEMENT BOARD
Agenda: Regular Meeting 002-2022
June 16, 2022
Aqsarniit Hotel

	No:	Item:	Tab:	Presenter:	Maximum Time
9:00 - 9:02 AM	11	Open Meeting		Chairperson	2 Minutes
9:02 - 9:04 AM	12	Declaration of Conflict of Interest		Chairperson	2 Minutes
9:04 - 9:05 AM	13	Agenda: Review and Approval of RM002-2022	1	Chairperson	1 Minute
9:05 - 10:00 AM	14	Baffin Island Caribou Total Allowable Harvest (For Decision)	8	Government of Nunavut & Qikiqtaaluk Wildlife Board	55 Minutes
10:00 - 10:15 AM		**BREAK**			15 Minutes
10:15 AM - 12:00 PM	14	Baffin Island Caribou Total Allowable Harvest (For Decision)	8	Government of Nunavut & Qikiqtaaluk Wildlife Board	1 Hr & 45 Min.
12:00 - 1:30 PM		**LUNCH**			1 Hr & 30 Min.
1:30 - 3:00 PM	14	Baffin Island Caribou Total Allowable Harvest (For Decision)	8	Government of Nunavut & Qikiqtaaluk Wildlife Board	1 Hr & 30 Min.
3:00 - 3:15 PM		**BREAK**			15 Minutes

3:15 - 3:30 PM	15	Decision required regarding possible plans for consultation in Nunavut and possible decision-making regarding the potential addition of the Sei Whale to the List of Wildlife Species at Risk on the *Species at Risk Act* (Information)	9	Fisheries and Oceans Canada	15 Minutes
3:30 - 3:45 PM	16	Decision required regarding possible plans for consultation in Nunavut and possible decision-making regarding the potential addition of the Eastern High Arctic–Baffin Bay Beluga Whale to the List of Wildlife Species at Risk on the *Species at Risk Act* (Information)	10	Fisheries and Oceans Canada	15 Minutes
3:45 - 4:00 PM	17	Bowhead Carcass Update, Kitikmeot Region (Information)	11	Fisheries and Oceans Canada	15 Minutes
4:00 - 4:15 PM	18	Information on request to carry-forward Shrimp in the Eastern Assessment Zone (Information)	12	Fisheries and Oceans Canada	15 Minutes
4:15 - 4:30 PM	19	Marine Conservation Initiatives (DFO)	13	Fisheries and Oceans Canada	15 Minutes
4:30 - 4:45 PM	20	Fisheries Management Operational Updates (Information)	14	Fisheries and Oceans Canada	15 Minutes
	22	Adjournment of RM002-2022 Meeting		Chairperson	

SUBMISSION TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: **Decision: X**

Date: May 12, 2022

Government of Nunavut Recommendation to the NWMB Regarding the Total Allowable Harvest for the Gulf of Boothia Polar Bear Subpopulation

Issue

At the Nunavut Wildlife Management Board's (NWMB) Regular Meeting (RM001-2021) on March 10, 2021, the Government of Nunavut requested that the NWMB makes no change to the Total Allowable Harvest (TAH) of 74 polar bears for the Gulf of Boothia subpopulation (the Government of Nunavut 2021 Proposal).

During its In-Camera Meeting (IC001-2021) on March 11, 2021, the NWMB decided to defer consideration of the Gulf of Boothia polar bear TAH until the polar bear Harvest Administration and Credit Calculation System (HACCS – referred hereafter as the Harvest Administration and Credit System) was approved. The NWMB considered the polar bear Harvest Administration and Credit System during the December 2021 Incamera Meeting and sent a decision to the Minister on February 1,2021. The Minister accepted the NWMB decision on February 7, 2022. Now, with the Harvest Administration and Credit System decided, the NWMB is returning to the Government of Nunavut's 2021 Proposal on the TAH for the Gulf of Boothia polar bear subpopulation in the June 2022 meeting. The NWMB informed co-management partners about its intentions and specifically requested the the three Regional Wildlife Organisations and affected Hunters and Trapper Organisations to provide input on a regional TAH allocation.

Background

The Gulf of Boothia polar bear subpopulation is one of the largest in Canada in terms of population size (see figure 1). With an estimated density of about 8.9 bears per 1,000 square kilometres, it is the highest known density of polar bears within any subpopulation in the world.

In 2005, the TAH for the Gulf of Boothia polar bear subpopulation was increased from 41 to 74 under the 2:1 male to female harvest ratio system. The 2005 increase in the TAH was following the 1998–2000 population abundance estimate of 1,592 (range = 1,231–1,953) bears and harvest risk assessment that showed a significant population growth rate.

Until 2019, polar bears in Nunavut were managed using a 2:1 sex harvest ratio system where, for every two males harvested, only one female could be harvested. The sex harvest ratio was changed from 2:1 to 1:1 in the 2019/2020 harvesting season.

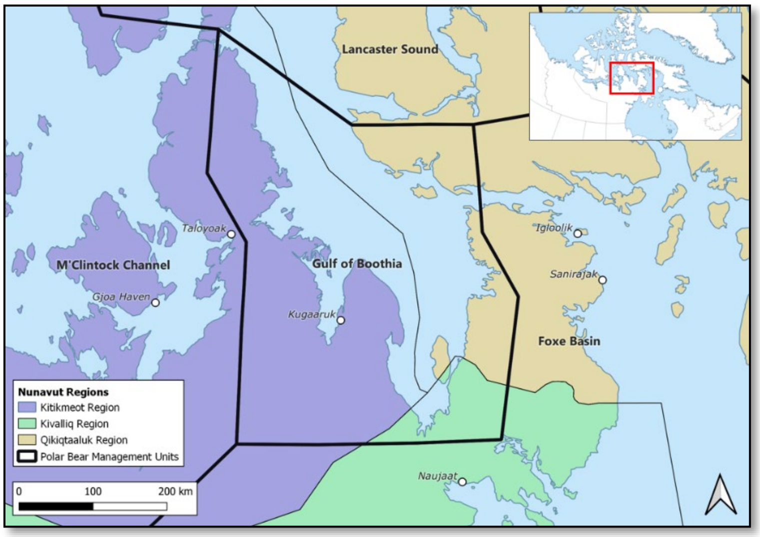

Figure 1. Map showing Gulf of Bothia polar bear subpopulation (black border in bold) and communities that harvest from it within the three Regions in Nunavut.

At the Nunavut Wildlife Management Board's Regular Meeting (RM001-2021) on March 10, 2021, the Government of Nunavut proposed that the Nunavut Wildlife Management Board makes no changes to the TAH of 74 polar bears for the Gulf of Boothia subpopulation to be harvested using the 1:1 male to female harvest ratio. The Government of Nunavut’s proposal was based on results from a genetic mark-recapture biopsy survey of the Gulf of Boothia polar bears, carried out from 2015 to 2017, with a new abundance estimate of 1,525 (range = 1,231–1,819) which showed a stable population. The Government of Nunavut’s proposal (TAB2B) included (1) a report of the 2015–2017 Government of Nunavut’s study to estimate the Gulf of Boothia subpopulation abundance and (2) an account of the Government of Nunavut’s in-person consultations with Hunters and Trappers Organizations in communities that traditional harvest from the population (Gjoa Haven, Sanirajak, Igloolik, Kugaaruk, Naujaat, and Taloyoak).

During the NWMB’s March 10, 2021 Regular Meeting, evidence and arguments were submitted the Government of Nunavut based on a science subpopulation abundance study (referred to above with the Government of Nunavut 2021 Proposal) including polar bear harvest records and credit status, and oral submissions from co-management partners. The NWMB also considered harvest data provided by the Government of Nunavut indicating an average harvest rate of 63 polar bears per year since 2005 for the Gulf of Boothia. This harvest rate had resulted in the accumulation of 112 harvest credits for the management unit. An Inuit Qaujimajatuqangit study on Gulf of Boothia polar bears commissioned by the Government of Nunavut (TAB2C), was not ready by the time the proposal was prepared but was latter submitted on March 2, 2021 and considered by the NWMB[1].

Regarding oral submissions, Environment and Climate Change Canada's recommended further assessment of harvest risk associated with the change from 2:1 to 1:1 sex harvest ratio. According to Environment and Climate Change Canada a harvest risk assessment was necessary giving that a TAH of 74 polar bears at a 1:1 harvest sex ratio increases the number of females to be harvested from the population with potential risks of population decline. The Qikiqtaluuk Wildlife Board's expressed concern with the Government of Nunavut's consultation process, stating that consultattions were inadequate and information on credit resets was not raised. The Qikiqtaluuk Wildlife Board proposed a delay in the NWMB decision on a Gulf of Boothia TAH to allow more time for communities and Regional Wildlife Organisations to be fully informed by Government of Nunavut about effects of a new TAH on their accumulated credits. Credit reset after a new TAH is established has long been and remains part of polar bear harvest management in Nunavut but was was not part of the consultation.

During the NWMB's In-Camera Meeting (IC001-2021), on March 11, 2021, the NWMB deferred its decision (TAB2D) on the Gulf of Boothia polar bear TAH until the proposed polar bear HACCS was concluded. The NWMB's reasons for defering the TAH decision was based on evidence and argument provided during the March 2021 Regular Meeting. The NWMB recognized the uncertainty regarding harvest credits accumulated by communities that harvest in the Gulf of Boothia due to the ongoing consultations on the polar bear Harvest Administration and Credit System. The NWMB recognized that a delay in the TAH decision would not have a negative impact on Inuit harvesting.

At the NWMB's In-Camera Meeting (IC004-2021) on December 10, 2021, the NWMB decided to approve Nunavut's Polar Bear Harvest Administration and Credit System. In the decision letter addressed to the Minister of Environment on February 1, 2022 (TAB2E), the Board also encouraged the Government of Nunavut and co-management partners to continue working together to improve polar bear harvest management and credit administration in Nunavut. The Minister accepted the NWMB decision and recommendations on February 7, 2022 (TAB2F).

[1] During the December 2021 Regular meeting the Kitimeot Regional Wildlife Board presented a summary of key finding from the Inuit Qaujimajatuqangit study on Gulf of Boothia and M'Clintock Channel polar bears commisisioned by the Government of Nunvat. The KRWB recommended that the NWMB considers Inuit Qaujimajatuqangit in its future decisions on the Gulf of Boothia polar bear subpopulation

The Harvest Administration and Credit System (TAB2G) replaces the 2019 Flexible Quota System, a form of which has been in use in Nunavut since 2005. The Harvest Administration and Credit System is a system that allows the Government of Nunavut to administer the portion of the polar bear TAH allocated to any given region or community. The purpose of the current Harvest Administration and Credit System is to administer changes to the polar bear harvest management in Nunavut resulting from the decision by NWMB in 2019 to change the sex-selective harvest ratio from 2:1 to 1:1[2]. The Harvest Administration and Credit System allows credits to be subtracted from the next year's base allocation when a community's annual base allocation is over-harvested or to accumulate in an under-harvest situation until a TAH is established, modified or removed in compliance with criteria in the Nunavut Agreement, at which point unused credits are reset to zero. The version of the Harvest Administration and Credit System approved by the NWMB in December 2021 was the second version. The first version was approved by the NWMB in September 2019 after revisions were made to the 2019 Flexible Quota System.

Following approval of the Harvest Administration and Credit System, the NWMB notified co-management partners on March 21, 2022, that it would return to consideration of the Government of Nunavut 2021 Proposal on the TAH for Gulf of Bothia during the June 2022 meeting. The NWMB specifically invited the three Regional Wildlife Organizations to provide input on how to split the TAH amongst the regions to prepare for a scenario where the NWMB decides to change the harvest limit for the Gulf of Bothia subpopulation. The Gulf of Boothia polar bear management unit encompasses the three Regions of Nunavut. In this kind of situation, the Nunavut Agreement (NA, s. 5.6.17(b)) directs the NWMB to express a total allowable harvest of a stock or population of a species ordinarily harvested by members of more than one HTO in terms of a regional total allowable harvest.

Status

In March 2021, the Government of Nunavut proposed that the Nunavut Wildlife Management Board makes no changes to the TAH of 74 polar bears for the Gulf of Boothia subpopulation to be harvested using the 1:1 male to female harvest ratio. All written and oral submissions to the NWMB during March 2021 Regular Meeting (RM001-2021) remain part of the record for this proposal.

The NWMB approved the Nunavut polar bear Harvest Administration and Credit System and gave notice to the Minister on February 1, 2022. This resolved a key consideration for the NWMB's decision to defer the decision on the Gulf of Boothia polar bear TAH in March 2021.

[2] The 1:1 harvest sex ratio allows females to be harvested up to 50% of the TAH. Male over harvest is not penalized in the 1:1 system as long as the TAH is not exceeded.

The NWMB provided notice to co-management partners on March 21, 2022, that it was returning to the Gulf of Boothia polar bear TAH decision-making process. In that notice, the NWMB invited the three Regional Wildlife Organizations and the affected Hunters and Trappers Organizations to provide input on splitting the TAH into three regional TAHs if the NWMB decides to change the harvest limit.

The NWMB will be considering written submissions as well as oral submissions provided during its June 15, 2022, Regular Meeting in addition to evidence and argument already submitted in March 2021.

Prepared By: Robinson Orume, Wildlife Management Biologist, NWMB
Reviewed By: Kyle Richie, Wildlife Management Biologist, NWMB; Bruce McRae, Legal Counsel, NWMB

SUBMISSION TO THE

NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: **Decision: X**

Issue: Total Allowable Harvest Recommendations for the Gulf of Boothia Polar Bear Subpopulation

Background:

- The Gulf of Boothia (GB) polar bear subpopulation is entirely managed by Nunavut (Figure 1). The last inventory study to estimate abundance was conducted between 1998-2000, which resulted in an estimate of 1592 bears. The GB polar bear subpopulation was considered stable in 2000, or slightly increasing.
- Communities from Igloolik, Sanirajak, Naujaat, Taloyoak, Gjoa Haven, and Kugaaruk harvest from GB. The current Total Allowable Harvest (TAH) for GB is 74 bears per year. The average harvest between 2004/2005 and 2018/2019 was 63 bears per year (Figure 2). The lower actual harvest relative to the TAH is likely a result of proactive management by communities, whereby they stopped the harvest when the female allocation in the 2:1 male to female quota was reached to avoid female overharvest and subsequent quota reductions, and poor ice conditions that prevented travel to preferred GB hunting locations.
- The population data were out-of-date, and a new study was needed to assess the status of this subpopulation. Following community consultations during 2012 and 2013, a new 3-year study began in 2015. The method used for this study was the less-invasive genetic mark-recapture DNA-biopsy sampling. The new study was conducted between 2015 and 2017.
- The Government of Nunavut, Department of Environment (DOE) initially planned to have a community project to collect local traditional knowledge from GB community members and hunters. However, the COVID-19 pandemic prevented local in-person meetings for interviews during 2020. As a result, that study could only be conducted remotely and is ongoing as of January 2021.

Current Status:

- The final report and results for the 2015-2017 study was completed and distributed to all relevant co-management partners in Summer 2020. The new abundance estimate of 1525 bears is not scientifically different from the previous estimate of 1592 (1998-2000).
- The new results suggest that the subpopulation is stable and has good reproductive performance. Mean cub-of-the-year and yearling litter sizes for the period 2015-2017 were 1.61 (95% confidence interval [CI] = 1.51 – 1.70) and 1.53 (95% CI = 1.41 – 1.64), respectively, with no apparent trend compared to 1998-2000.
- Body condition of bears in spring increased between the periods 1998-2000 and 2015-2017, which is likely due to changing sea ice conditions (i.e., reduction in multi-year ice) in the study area. The changes from less multi-year ice to more annual ice may have provided bears with improved prey accessibility.
- Due to the lack of movement data (e.g., telemetry/spatial) it is difficult to quantify the amount of immigration and emigration that occurs between GB and neighbouring subpopulations. Although there are subpopulation boundaries, bears in adjacent subpopulations likely move back and forth across boundaries at different times of year. The abundance estimate represents the “superpopulation” (e.g., it includes all bears that were using the GB management area).
- The TAH of 74 has not been filled for this subpopulation over the past ten harvest seasons. The average harvest over the last five years has been 64 bears (Figure 2).

Consultations:

- In-person community consultations with relevant representatives from GB Hunters and Trappers Organizations (HTO) were held between 20-28 October 2020.
- There was consensus among HTO members regarding the findings of the GN report, although some HTO members inquired about how they could get more tags.
- There was a consistent concern among HTOs that tag allocation needed to be revisited to ensure fairness and equity among the communities that harvest from the GB subpopulation
- Staff from Nunavut Tunngavik Inc., Nunavut Wildlife Management Board, Kitikmeot Regional Wildlife Board (KRWB), and Qikiqtaaluk Wildlife Board (QWB) were also available to attend several meetings (see details in GB Consultation Summary Report by GN DOE).
- Representatives from the Kivalliq Wildlife Board (KWB) were unable to attend.

Recommendations:

1. DOE recommends **no change to the current TAH of 74 bears at a 1:1 male to female sex harvest ratio.**

   Rationale:

   a. The recommended TAH considers the management objective to maintain a viable polar bear subpopulation. The results of the survey show that the population has remained stable with a TAH of 74 bears.
   b. The recommendation also factors in the changes to the ecosystem, of which GB bears are an integral part. The ecosystem has undergone a drastic change due to climatic changes and the long-term effects, as conditions continue to change, are unknown.
   c. Setting GB harvest levels too high increases the risk for biological decline or depletion, not only in GB but also for neighboring subpopulations due to the unknown emigration/immigration rates.
   d. The TAH of 74 has not been filled for this subpopulation over the past ten harvest seasons. The average harvest over the last five years has been 64 bears.

2. DOE recommends that all involved Regional Wildlife Organizations discuss the GB tag allocations with the affected communities, including the ones harvesting from the M’Clintock Channel (MC) polar bear subpopulation.

   Rationale:

   a. During consultation meetings (October 20-28, 2020) there were similar concerns expressed in each community that the current tag allocation for GB communities needed a revision and re-allocation.
   b. The TAH of 74 has not been filled for this subpopulation over the past ten harvest seasons. The average harvest over the last five years has been 64 bears.

Appendix 1

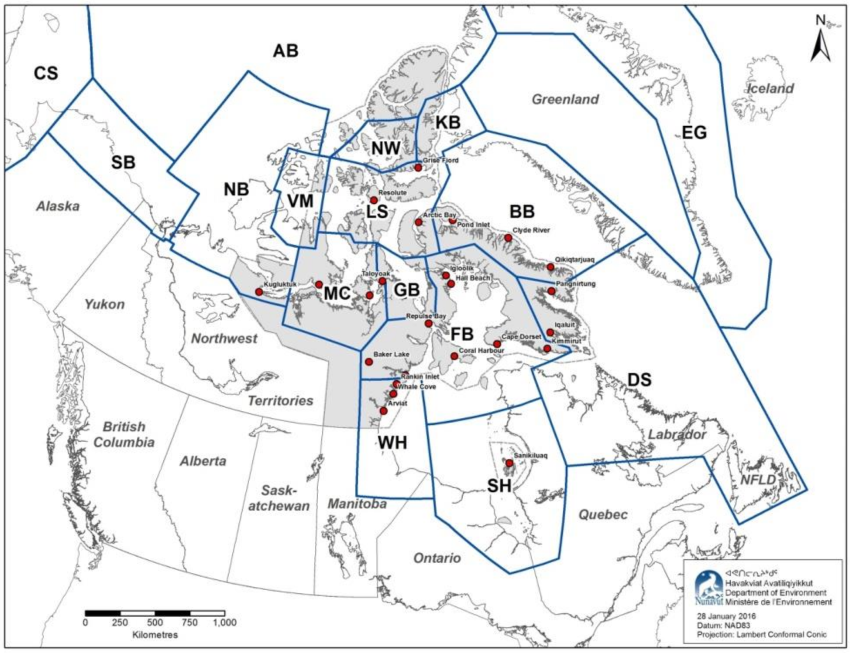

Figure 1. Overview of Nunavut polar bear subpopulations (GB = Gulf of Boothia, MC = M'Clintock Channel).

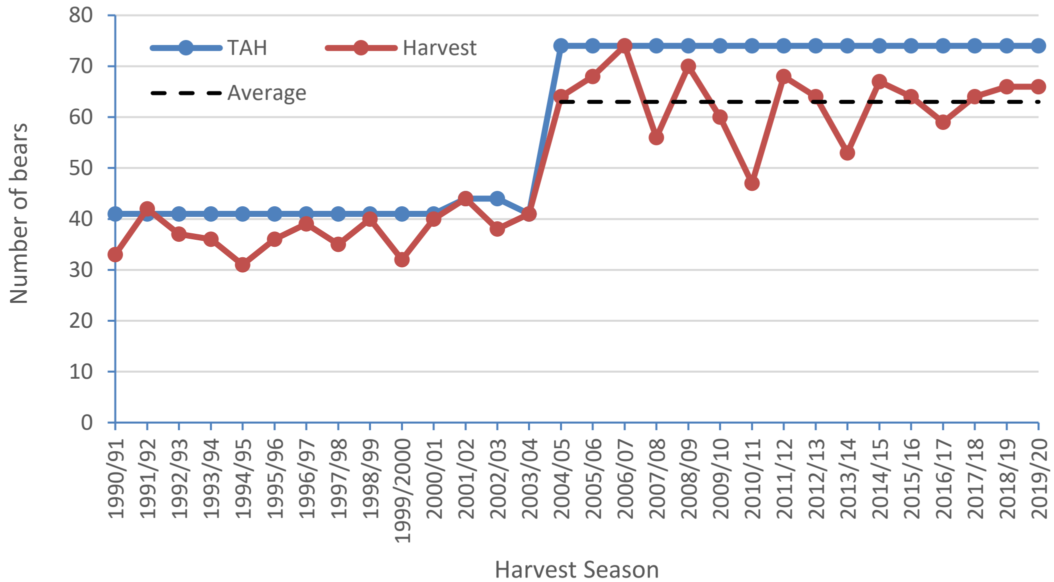

Figure 2. Overview of the Gulf of Boothia polar bear Total Allowable Harvest (TAH), actual and average harvest since 1990.

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Building Nunavut Together
Nunavuliuqatigiingniq
Bâtir le Nunavut ensemble

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Department of Environment
Avatiliqiyikkut
Ministère de l'Environnement

GULF OF BOOTHIA POLAR BEAR SCIENTIFIC STUDY RESULTS

Consultations October 20-28, 2020

Consultation Summary Report

Polar Bear Research Group
Department of Environment
Government of Nunavut
Igloolik, NU

Executive Summary

Government of Nunavut, Department of Environment (DOE) representatives, together with representatives from the Kitikmeot Regional Wildlife Board (KRWB), Nunavut Tunngavik Inc (NTI), Nunavut Wildlife Management Board (NWMB), where available, conducted consultations with Hunters and Trappers Organizations (HTOs) from October 20-28, 2020. The purpose of the consultations was to provide co-management partners with an overview of the most recent scientific study results on the Gulf of Boothia (GB) polar bear subpopulation, as well as collect feedback on the results presented and collect additional traditional knowledge (TK). Only the HTOs in communities that hunt from the GB subpopulation were consulted. The feedback and TK collected during these consultations will be considered when forming Total Allowable Harvest (TAH) recommendations for the GB subpopulation to be submitted to the NWMB for decision. This report attempts to summarize the comments made by participants during the consultations.

Preface

This report represents the Department of Environment’s best efforts to accurately capture all information that was shared during consultation meetings with the Hunters and Trappers Organizations of Gjoa Haven, Igloolik, Kugaaruk, Naujaat, Sanirajak, and Taloyoak. The views expressed herein do not necessarily reflect those of the Department of Environment, or the Government of Nunavut.

Contents

1.0 Report Purpose and Structure

This report is intended to collate and summarize comments, questions, concerns and suggestions provided by the HTOs in response to the results from the 2015-2017 GB scientific study. Pre-study consultations with these communities were conducted in 2013.

The following communities were consulted from October 20-28, 2020:

- Gjoa Haven, October 20, 2020
- Taloyoak, October 21, 2020
- Kugaaruk, October 22, 2020
- Naujaat, October 26, 2020
- Sanirajak, October 27, 2020
- Igloolik, October 28, 2020

During the meetings DOE provided input on what the GN's TAH recommendation would be for GB. Representatives from the NWMB, NTI, KRWB, Kivalliq Wildlife Board (KWB), and the Qikiqtaaluk Wildlife Board (QWB) were invited to these meetings and they participated whenever representatives were available to attend in person.

2.0 Purpose of Consultations

The purpose of these consultations was to discuss the newest scientific information regarding the GB polar bear subpopulation as reported in the GN scientific study report produced by the GN polar bear biologists. In addition, the GN also put forward a TAH recommendation during these consultations, but also discussed that management objectives can be formulated depending on the communities' needs and objectives for co-managing this subpopulation.

2.1 Format of Meetings

The meetings were held in the evening (e.g., beginning between 17:00 and 18:30) and ran between 2.5 to 4 hours depending on HTO. Meetings were facilitated and led by GN Polar Bear Biologists M. Dyck and J. Ware. The biologists presented the historic management background, and a detailed overview of the results from the 2015-2017 polar bear study conducted in GB (Appendix 1). The participants were invited to ask questions, raise concerns, or provide recommendations throughout the meetings. It was also pointed out that there is still the on-going GB TK study in which results are expected by the end of 2020, depending on how the COVID-19 pandemic evolves.

After the presentation, questions/discussion continued until no further questions were raised. At the end of the meeting, the GN position on the TAH for GB was presented. In addition, it was also mentioned that the GN position may not reflect the Management Objective goal of the communities and communities were encouraged to work with the Regional Wildlife Organizations (RWOs) and/or the GN to develop a Management Objective for the GB subpopulation. The biologists explained that consideration for a TAH that differs from the GN recommendation should include the uncertainty of the results, the changing environment, and the needs of communities. Discussions and questions were raised regarding the tag distribution in GB and M'Clintock Channel (MC) for communities that harvest from both subpopulations. The biologists advised the participants that this is a matter for relevant RWOs to consider as tag allocation within a subpopulation falls under their purview.

3.0 Summary by Community

The objectives of the consultation meeting were made clear to the HTO members prior to and at the start of each meeting. There were many similar questions, concerns and suggestions raised by HTO Board members in the communities consulted. A full, detailed report of the questions and comments from each community can be found in Appendix 2.

3.1 Gjoa Haven Consultation Summary

Date: October 20, 2020
Time: 18:50 – 21:15

Representatives:

- GN-DOE, Polar Bear Biologists M. Dyck, J. Ware
- GN-DOE, Conservation Officer J. Skilling
- GN-DOE, Regional Manager, K. Methuen
- Gjoa Haven HTO Board Members

Comments and Questions:

After the presentation about GB, board members discussed their experiences from over the past years and they lined up with the GN study results. Generally, the board members agreed with the GN findings. It also became clearer by comments from board members that currently, not much hunting in GB is done by Gjoa Haven hunters due to unpredictable ice conditions. Some points were raised that the distribution of tags for

GB and MC are not distributed fairly, especially now that MC shows an increase in bear abundance. The GN representatives suggested this subject be raised by the HTO with the KRWB. The board was thankful and appreciative that the GN visited the community to present the results and to have a discussion. Some clarity was provided on how BEARWATCH and individuals associated with the project are related to GN projects.

3.2 Taloyoak Consultation Summary

Date: October 21, 2020
Time: 17:45 – 20:15

Representatives:

- GN-DOE, Polar Bear Biologists M. Dyck, J. Ware
- GN-DOE, Conservation Officer D. Anavilok
- GN-DOE, Regional Manager, K. Methuen
- Taloyoak HTO Board Members

Comments and Questions:

After the presentation about GB, board members discussed their experiences from over the past years and how they lined up with the GN study results. Generally, the board members agreed with the GN findings. Some points were raised that the distribution of tags for GB and MC are not distributed fairly, especially now that MC shows an increase in bear abundance. The GN representatives suggested this subject be raised by the HTO with the KRWB.

3.3 Kugaaruk Consultation Summary

Date: October 22, 2020
Time: 18:50 – 21:20

Representatives:

- GN-DOE, Polar Bear Biologists M. Dyck, J. Ware
- Kugaaruk/ Kurtairojuark HTO Board Members
- KRWB representative Ema Qaqqutaq.

Comments and Questions:

After the presentation about GB, board members discussed their experiences from over the past years and how they lined up with the GN study results. Generally, the board members agreed with the GN findings. A longer discussion ensued about handling and collaring bears, and whether this could be applied in the future to answer questions from the HTO especially as it relates to shipping and industrial activities.

3.4 Naujaat Consultation Summary

Date: October 26, 2020
Time: 18:10 – 21:50

Representatives:

- GN-DOE, Polar Bear Biologists M. Dyck, J. Ware
- GN-DOE, Conservation Officer P. Papatsie
- GN-DOE, Acting Regional Manager J. Neely
- Naujaat HTO Board Members
- QWB Chairperson J. Qillaq
- NTI Director of Wildlife P. Irngaut
- NWMB D. Ndeloh, S. Mapsalak, KJ England

Comments and Questions:

After the presentation about GB, board members discussed their experiences from over the past years and how they lined up with the GN study results. Generally, the board members agreed with the GN findings. A longer discussion ensued about how current allocations are distributed among communities and that some communities would like to see this reviewed. It was also discussed what steps are involved to see allocation changed via relevant RWOs.

3.5 Sanirajak Consultation Summary

Date: October 27, 2020
Time: 19:15 – 21:15

Representatives:

- GN-DOE, Polar Bear Biologists M. Dyck, J. Ware
- GN-DOE, Conservation Officer B. Grosset
- GN-DOE, Acting Regional Manager J. Neely
- Sanirajak HTO Board Members
- QWB, Chairperson J. Qillaq
- NTI, Director of Wildlife P. Irngaut
- NWMB, Director of Wildlife D. Ndeloh, NWMB Biologist KJ England

Comments and Questions:

After the presentation about GB, board members discussed a little of their GB experiences and few observations from past years and they somewhat lined up with the GN study results. Some comments were made that just few bears are harvested in GB by Sanirajak.

3.6 Igloolik Consultation Summary

Date: October 28, 2020
Time: 18:40 – 21:42

Representatives:

- GN-DOE, Polar Bear Biologists M. Dyck, J. Ware
- GN-DOE, Acting Regional Manager J. Neely
- Igloolik HTO Board Members
- QWB, Chairperson J. Qillaq
- NTI, Director of Wildlife P. Irngaut
- NWMB, Director of Wildlife D. Ndeloh, Biologist KJ England

Comments and Questions:

After the presentation about GB, board members discussed sea ice changes, shipping, and that more bears are seen – though much of the observations were related to Foxe Basin. There was discussion about harvesting cubs and the permit for that, and how to get a TAH increase in Foxe Basin. Overall, the members agreed with the findings of the study.

4.0 Overall Consultation Summary

The consultations for all communities harvesting from GB were conducted in a roundtable, open discussion format in which all participants were able to provide feedback, ask questions, and speak. Participants offered context and understanding to the scientific results. The major points raised by communities regarding GB were:

1) agreement with the scientific findings that the population appears stable—no major changes based on land observations—since the last scientific study in 1998-2000, and

2) GB tag allocation is a major concern.

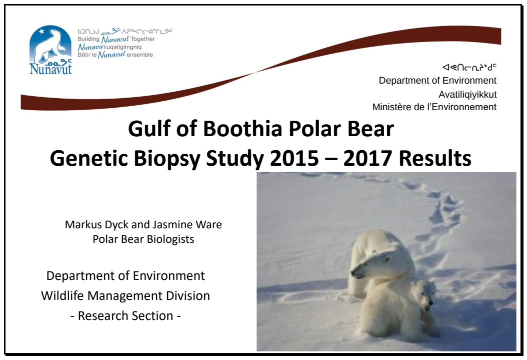
Minor points, which represent comments by some communities but not all, included an interest in gathering movement data to determine potential effects of increased industrial development and shipping and an interest in harvesting cubs.

The GN proposed no change in TAH for GB based on the scientific findings of a stable population. Given the overall community agreement with the findings, there were no major oppositions to this proposal. There is an ongoing Inuit Qaujimajatuqangit study for GB which may offer more comprehensive insight into hunters' and users' observations of bear distribution or abundance.

One of the major points brought up during consultation was that the tag allocation needed to be revisited to ensure fairness and equity among the communities that harvest from GB. This was raised most emphatically by communities that were harvesting from both MC and GB populations. The GN representatives discussed roles and responsibilities of the relevant bodies for creating the tag allocation among communities. The GN outlined the process via the RWOs and offered to provide guidance or further information to any interested community.

Appendix 1: Complete Consultation Presentation of the Gulf of Boothia Polar Bear Study Results 2015-2017

Slide 1



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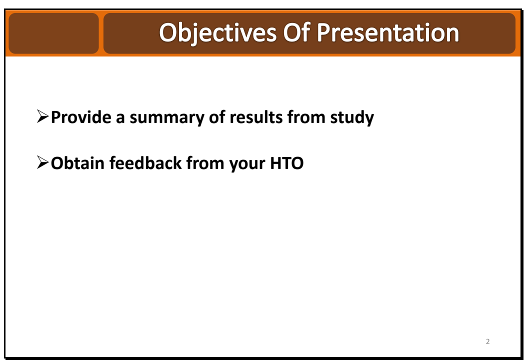


Slide 3

Background

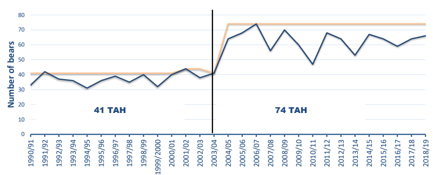
- First mark-recapture study between 1973-78
  - MC and GB treated as one unit, estimate of 1,081
- GB estimate increased to 900 in mid-90s based on local knowledge and biased sampling
- MC estimate decreased from 900 to 700 based on local knowledge in mid-90s
- Population boundaries in 1995 and 2001

3

Slide 4

Background

- 1998-2000--Mark-recapture estimate for GB was 1592 bears
- TAH of 41 for GB until 2003/2004
- Increased TAH to 74 bears in 2004/2005
- Average harvest per year: 63 bears since 2005



4

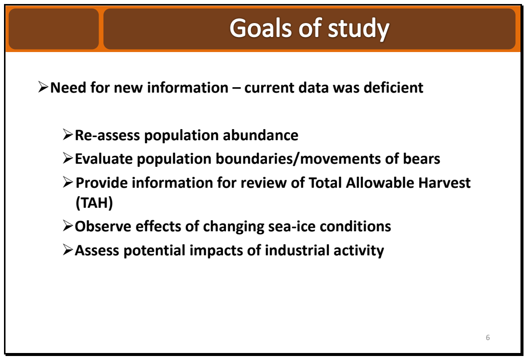
Slide 5

Background

- Population status unknown (stable? increasing?)
- Population boundaries of MC/GB/LS?
  Inuit Qaujimajatuqangit/genetics suggest movement between both units

5

Slide 6



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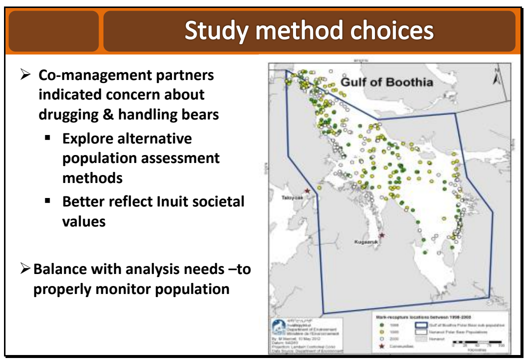

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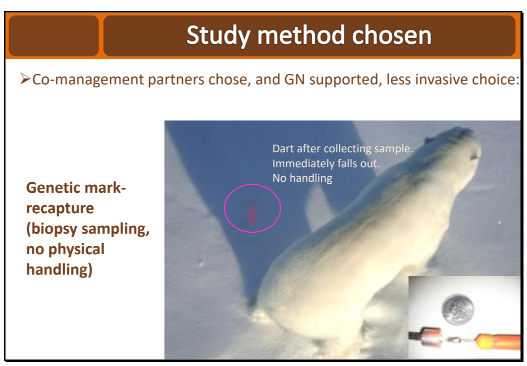
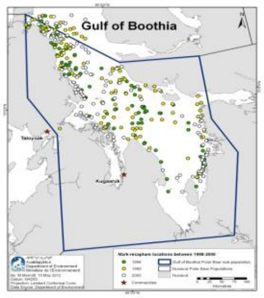


Slide 9

Genetic capture mark-recapture study goals

- Estimate polar bear abundance in GB
- Compare with 1998-2000 estimate
- Compare information on reproduction, survival
- Cannot estimate movement or boundaries with this method



Slide 10

Study funding and support

Environment and Climate Change Canada
Environnement et Changement climatique Canada

Nunavut

Nunavut General Monitoring Plan

WWF

QIKIQTAALUK WILDLIFE BOARD

HTOs from Gjoa Haven, Igloolik, Kugaaruk, Naujaat, Taloyoak, Sanirajak

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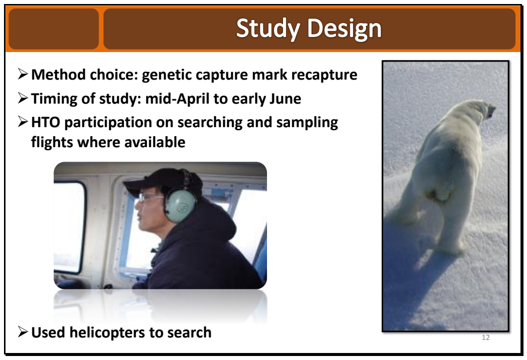
Slide 11

Study Design

Community Participation

- Survey design and method choice - 2013
- Survey observers – 2015 through 2017
- Review & evaluation of results - 2020

Slide 12



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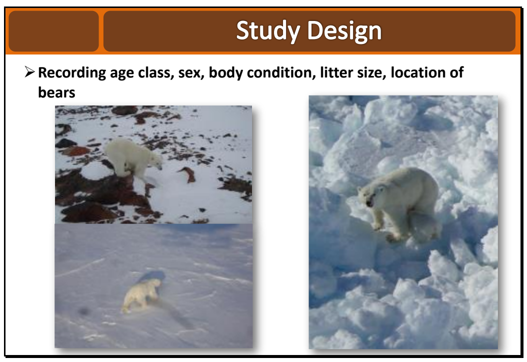

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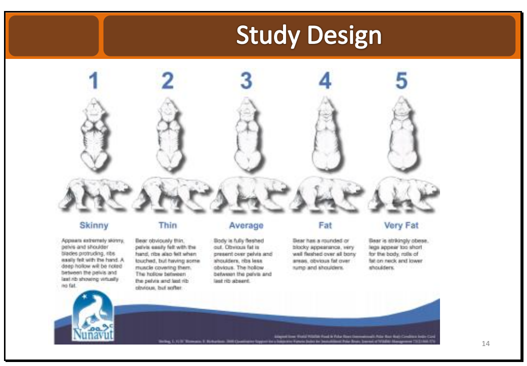

Slide 15

Study Design

- Collected small tissue samples for genetic analysis (to genetically identify and "mark" an individual)
- No cubs-of-the-year sampled
- No drugging, no collaring
- No specific ages or samples for other studies (e.g., contaminants)

Slide 16

Study Design - Analysis

- Included all available information for analysis:
  - Genetic mark-recapture (biopsy) information 2015-2017
  - 1998-2000 capture mark-recapture information
  - Harvest recoveries (e.g., when an ear tag/lip tattoo is recovered by a hunter) 1976-2017
  - 1976-1997 capture mark-recapture information

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Slide 17

Analysis Goals

- Use all information to determine:

1. Trends in abundance from 2000-2017
2. Survival rates of different age classes and sexes over time
3. Reproductive parameters such as size of litters, litter rate per adult female (how productive are the females/population)
4. Population growth rate – determined using survival rates and litter production rates
5. Evaluate body condition of bears across the entire GB area

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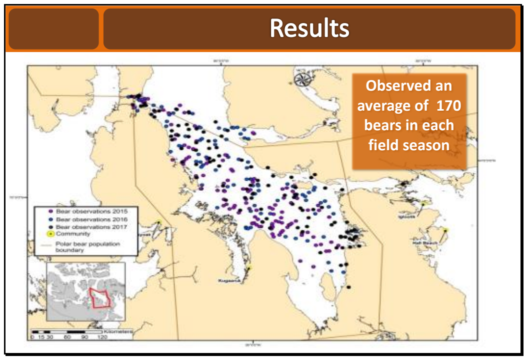
Slide 18



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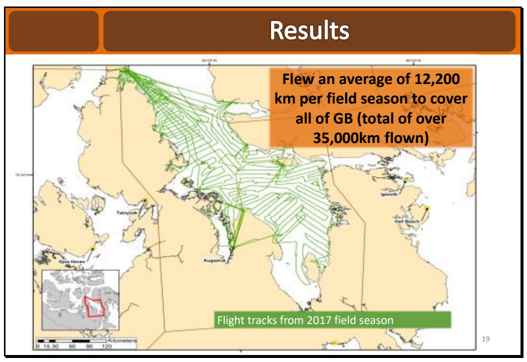

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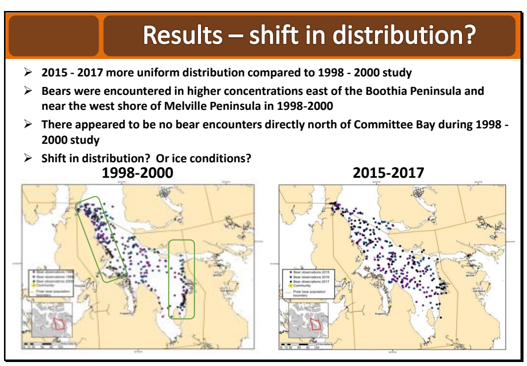
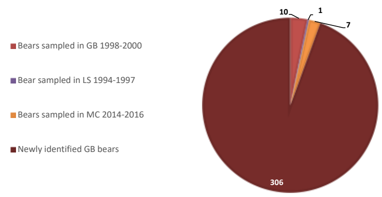


Slide 21

Results – mark-recapture samples

- 324 individual bears identified through genetic biopsy sampling using DNA
- 10 bears were previously marked in 1998-2000 study
- 1 bear previously marked in Lancaster Sound study in 1994-1997 study
- 7 bears marked in M'Clintock study 2014-2016



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Slide 22

Results – body condition

- Bears were in better condition (fatter) in 2015-2017 compared to 1998-2000
  - 30% chance of poor Body condition (1 or a 2 score) in 1998-2000
  - 7% chance of poor Body condition in 2015-2017

- Why? Your thoughts?

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Slide 23

Results – Reproduction

- What does "reproduction" mean? What do scientists look at?

- Litter size
  - data from 1998-2000 and 2015-2017
    - 99 females observed with COY litters
      - COY litter size: 1.61

    - 80 females observed with Yearling litters
      - Yearling litter size: 1.53

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Slide 24

Results – Reproduction cont.

- Number of offspring per adult female

1998-2000
- 0.51 COYs/adult female
- 0.37 yearlings/adult female

2015-2017
- 0.43 COYs/adult female
- 0.36 yearlings/adult female

  - 85% chance that COYs per adult female was less in 2015-2017 compared to 1998-2000

- Number of yearlings per adult female is important because it shows how many cubs-of-the-year survive to be yearlings
  - good measure of reproduction

- The GB subpopulation has healthy reproduction

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Slide 25

Results – Survival

- Females and males separated
- Adults and subadults separated

- Data support similar survival across time

- Unsurprisingly, subadults have the lowest survival of these groups with subadult males lower than subadult females.

- There were fewer adult males than expected, but that is likely due to the past harvest with a 2 males for 1 female harvest system

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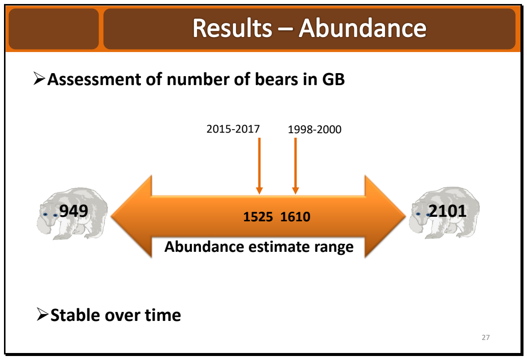
Slide 26

Results – Population growth rate

- Population growth rate similar to assessments from the last study
(growth rate is simply the difference between what is added through births minus the deaths and takes into account how animals survive)

- Growth rate indicates strong potential for growth

Slide 27



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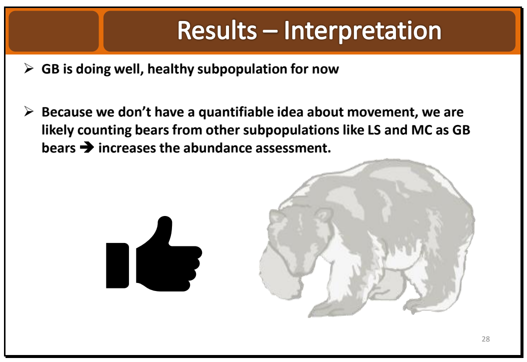

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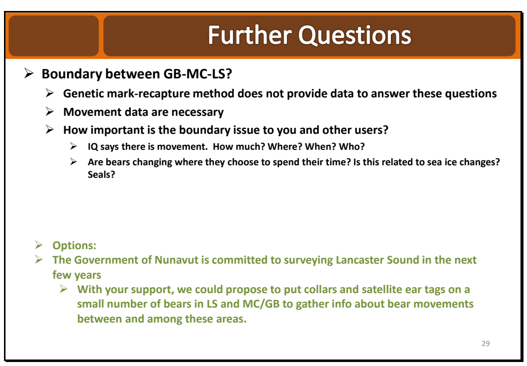

Slide 30

Further Questions

- Do you agree that the number of bears stayed relatively the same over time?
- What did you observe in the bears' body condition over time?
- Are there enough bears to harvest? Are there too few? Too many?
- Is there anything special that you observed and wanted to share with us?
- Where do you agree/disagree with our findings?

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Slide 31

GN Recommendation

- The GB subpopulation has remained stable – we recommend no change in TAH
- What are your thoughts about the recommendation?

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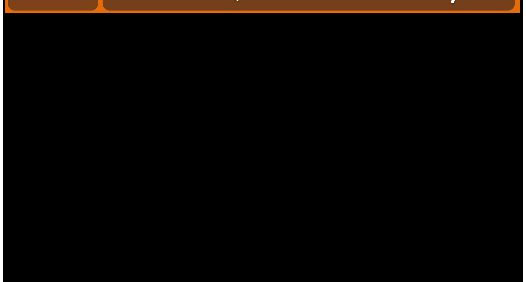
Slide 32

Further Questions? - Thank you



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Appendix 2: Complete Consultation Summary of the Gulf of Boothia Community Consultations

Nunavut Community Consultations on the results from the 2015-2017 Gulf of Boothia Polar Bear Study

October 20-28, 2020

HTOs Consulted:
Gjoa Haven
Taloyoak
Naujaat
Kugaaruk
Igloolik
Sanirajak

Summary of Consultations:

A: Gjoa Haven

October 20, 2020

Time Start: 18:50

Time End: 21:15

Participants:

Enuk Pauloosie
William Aglukkaq
James Qitsualik via cell phone video chat
Simon Komangat
Jimmy Qirqqut
Roger Ekilik
Ben Putuguq
Jimmy Pauloosie
Ralph Porter Sr.
J. Skillings – GN-DOE
K. Metheun – GN-DOE
M. Dyck – GN-DOE
J. Ware – GN-DOE
Jacob Keanik - translator

- Markus introduced option to go over background of MC/GB or skip it? Question to the board---what would you prefer?

- Ralph: we don't need super detailed on the background so you can go through it quickly.

Background slides: review – our objective to provide new data for the co-management partners and the NWMB to make decisions on setting harvest levels. We are here to hear feedback.

Study methodology: review, no questions

Community participation: review; no questions

Study design: review; no questions

Study design analysis: explained why the amounts of data matter for getting the results; no questions

- Ben: Years ago, when the moratorium came, I was one of the Board members back then and remember it. We used to go all the way to Prince of Wales Island before the quota system was put in place to harvest as much as we could.

- Markus: thank you, I'd like to hear about the ice back then.

- Ben: it's totally different. There isn't any ice really.

GB Results:

- Willy—the board isn't that interested in Gulf of Boothia because it is very rare that we go there to hunt. The ice conditions are too dangerous. Young hunters do not have any knowledge about that area. We are not that interested in this population.

- Ralph said if a bear doesn't want to show up, you can't see it. It is the knowledge of our ancestors.

- Ben: when our young hunters go to Gulf of Boothia, they don't have a clue about the ice conditions and it's very dangerous…the ice can just take them.

- Willy: that actually happened with a sport hunting group—the ice split and took the hunters out to sea.

- Ben: the hunters that were taken the sport hunters, I was there, and I managed to get home before the ice split. The younger generation doesn't have a clue how the ice conditions.

- Markus: I can go over GB very quickly. It is my job; I have to tell you about it.

GB Results/TAH recommendation: Because its stable and there are no changes that we can detect, we are recommending that there is no change to the TAH. If the communities feel differently—want more meat or public safety is an issue, then that is an opportunity to discuss how the TAH could change.

- Willy: It doesn't affect us.

- Markus: That's pretty much it for the presentation for the MC/GB. Are there any questions that the community here has with regards to GB/MC/LS boundaries and movements? We can hear these comments and try to see if they can be incorporated into our future work. We are doing LS and are going to be analyzing those samples in the next 4-6 years and we will let you know what we find—were there MC bears up there that we marked in 2014-2016.

- I know there is no desire from this community for collaring, but there are some communities that are interested in movements because they are wondering about climate change, increased development, increased shipping. For example, NTI approached me once about impact on bears from a development project, but

I couldn't answer those questions because we don't have movement data. For now, maybe this is okay, but this may be important in the future.

- If there are specific questions from the communities or specific areas of interest, bring those forth to the regional wildlife board/NWMB priority—those priorities help the GN determine how they focus their resources and money along with our mandate to get updated information for the polar bear subpopulations.

- **Question Simon**: Peter DeGroot seems to be doing a lot of research in the last 20 years. What does he do with you guys?

- **Answer Markus**: He works for a university, not affiliated with GN. He is part of a big project, multiple universities, maybe 25 organizations supporting BearWatch – Peter is involved, but he is not the lead. It is looking at genetics, bacteria, developing a kit for fecal sampling. A lot of different projects but Peter is a tiny part of the bigger project. The GN supported Bearwatch because there are bits and pieces of this project that could help for management that we could not collect alone.

- **Question Willy:** Is this work they are doing helping us? It is helping the government…but what is it doing for us?

- **Answer Markus**: the samples are still being analyzed…from the many samples they are trying to determine if it's possible to see contaminants and genetics. As the GN, we could not do it. The idea was to be able to harness the resources of universities and their labs to gather information and develop potential new methods for non-invasive health monitoring of the bears.

- **Answer Jasmine:** also, we don't know if what BearWatch has proposed will work –it was an idea that had to be tested. The idea was to develop less invasive technologies and methods, but will it actually work? Don't know.

- **Question Ralph**: so whatever Peter does it is not affiliated with the NWMB?

- **Answer Markus**: that is correct. Whatever Peter does is not counting bears and they are not primarily responsible to providing info to NWMB for management decisions.

- Willy: they are mostly doing contaminants, health, same as they are doing with the fish.

- Roger: Hunting bears in GB is too far—takes a lot of gas and people don’t go there. Mostly MC.

- Markus: the GN is not responsible for allocation—the KRWB does that. For GB, all 3 regional wildlife boards are involved for GB—they all have to talk to each other. That requires a lot of discussion, I think. I think it requires involvement of all the RWOs.

- Ben: Bears in MC once it starts to freeze up, they start to come to town…that’s because they are not being harvested due to the moratorium. Even during the summer, there are bear sightings now.

- Markus: Also, probably not that much noise and traffic going out, so they aren’t afraid.

- Ben: it’s because they aren’t being harvested or disturbed by machines. They are even sighted far inland on King William Island. The population is healthy.

- Willy: Another thing is that between here and Taloyoak, there used to be a lot of traffic between the two communities even in the spring. Lately they have been seeing bears between here and Taloyoak. Seeing a lot of bears tracks, even wolf and wolverine around Clarence islands. Packs of wolves on the sea ice – Markus you’ve seen the wolves come into camp, two of them. Even going up to Boothia. But there are packs of wolves and they can also kill polar bears, from experience.

- Markus: the wolves could have an impact on the offspring of polar bears

- Willy: bottom line is that we saw a lot of bear sign and the 3 bears we got were very healthy and over 10 ft.

- Markus: that lines up with what we are seeing –that is really nice to hear.

- **Question Simon**: you were going to talk about sea ice Markus?

- **Answer Markus**: I think the way we looked at sea ice was that we included it our body condition analysis and how that might affect the body condition. We know from satellite imagery from last 30 years that ice has changed. We didn’t do full analysis from satellite imagery or ice analysis on ice specifically. I don’t’ know if that’s answering your question.

- Simon/Willy nod it was sufficient answer

- Ben: Used to have icebergs that even have cracks and there used to be abundance of seals and there were ice packs and they were easy to spot. Nowadays the bears are moving more because there are less icebergs –we don't see the icebergs anymore.

- Willy: we don't see much ice anymore.

- Markus: agree with the satellite imagery—barely any ice in MC channel in fall

- Willy: people that used to go harvest belugas to Prince of Wales, but as soon as they get westerly winds the ice would get pushed in and they'd be stuck for weeks---they have a hard time getting through because of ice, but now no problem…20 years a big difference in sea ice.

- **Question Markus**: that's the other question I have---if this northern area is free of ice, what's going on with bears? Do they stay on the little ice? Do they go on land? What do you guys see when you travel int eh summer?

- **Answer Ben**: northwest king William island, bears would be swimming miles away from sea ice and can catch seal in open water. They're still hunting even if it's free of ice. They're always traveling even when it's full of ice.

- Willy: During the summer months, July/Aug prince of Wales, I stood and counted 33 bears in Cunningham bay—this happens when the beluga whales are coming in with their calves.

- Markus: to Willy---we tried to figure something out with you remember?

- Willy: polar bears going after belugas staying in the mouth of the bay to catch them.

- **Question James** (via video on smartphone): Going to that old MOU, remember we had that issue with Taloyoak with them "stealing" our tags when the TAH went to 12. But maybe this is a RWO issue.

- **Answer Markus**: You are correct, this is definitely a point to bring up with the RWO.

- **Question James**: I'm trying to make the numbers more equal. I'm just trying to make the communities have a fair trade. If we want a higher TAH is that NTI?

- **Answer Jasmine**: that would be the NWMB to raise the TAH. The RWO decides how to allocate the TAH.

- **Question Willy**: Why is Taloyoak involved in the TAH for MC when they were not involved when we signed the MOU. Taloyoak can harvest from MC but Gjoa can't get to GB. What are bears considered when they are harvested—MC/GB

- **Answer Markus**: The boundary goes right through Taloyoak

- Willy: so, if Taloyoak has a defense kill is that considered MC

- Ben: there was a big male harvested as defense and counted as GB -- happened last year

- Markus: that is something that Kevin/Jack look into

- Kevin: okay

- **Question Jack**: isn't within 30km of the management unit a buffer zone?

- **Answer Markus**: yes, there is a 30 km zone that they can go on both sides.

- Willy: to board---do you have any concerns on bears?—time to ask

- **Question**: ---is there going to be another polar bear survey again some time soon?

- **Answer Markus**: that is a very good question---we have seen with our experience that having these long empty data periods of many, many years, it makes analysis very, very challenging. Not just in MC, all the populations this is a struggle having these long gaps. That was the old system because it worked for money resources, bears are long-lived, and it was the management and monitoring plan initially, but now we have realized that 15–20-year gaps are not good for analysis. Ideally, we'd like to be back in a few years for a one-year effort to sample bears in MC. That would help us get better data and get better estimates for survival. That is where the HTO comes in—if you make it a priority and identify it to the RWO and NWMB---say it's not okay to have long huge gaps for population assessments---that helps then us and the GN to make our case to allocate time/funding.

- **Question Kevin**: question regarding the 30 km buffer zone – where did that come from?

- **Answer Markus**: that was originally from the MOU—because bears don't respect boundary and hunters may not have always a precise location.

- Willy: like the Hadley Bay population and with NWT

- **Question Jack**: does that get carried forwarded from the MOU into the new polar bear management plan?

- **Answer Markus**: not sure, probably, don't have it memorized, can check. Just want to thank you for allowing us to come in person and giving us your time. Just because we are talking here, doesn't mean that we have to end the conversation…we are open for contact and can help any way we can.

- **Question Simon**: how often could you come to Gjoa Haven?

- **Answer Markus**: 2013 and now 2020 – so maybe twice in 7 years? We rotate through the 12 subpopulations – we have a better chance to make it to the regional AGM and we are certainly open to joining via video conference on an HTO meeting if you have interest or questions for us.

- Jasmine: Unfortunately, you are looking at all the biologists for Nunavut. What we'd like to do personally isn't always what we can do realistically. We would ideally be able to make regular visits and updates for all communities.

- Simon: reason I'm asking is because we've been waiting to hear since 2017

- Markus: I'll tell you the same thing I told Cambridge Bay—it was a long time to wait for these results I admit, it is not ideal --- MC was challenging because the data was so sparse, analysts really struggled to analyze the little bit of data, ransomware, and COVID. I wanted to be able to stand behind these numbers and support them and so it took longer than we predicted. We apologize for that.

- **Question Wally**: another comment/concern I'd like to mention is did you do MC then to GB? --

- **Answer Markus**: we did them at the same time

- **Question Wally**: could you do a survey in the summer?

- **Answer Markus**: No---because there is still ice enough for bears, but not enough for pilots. The pilots don't want to fly over open water and bears would still be in the water and on ice pans during that time—we would not be able to do proper coverage of the area. You'd have to have really low ice and bears would have to be on shore.

- Wally: it is good to hear that we are having a recommended increase and the population is healthy. Of course, we'd like a bit more. A lot of activity and population is increasing.

- End of meeting

B: Taloyoak

October 21, 2020

Start: 17:45

End: 20:15

Participants:

Joe Ashevak, Chairperson HTO
Tommy Aiyout
Bruce Takolik
Jayko Neeveacheak
Kovalak Kootook
J. Ware – GN-DOE
M. Dyck – GN-DOE
K. Methuen – GN-DOE
D. Anavilok – GN-DOE

- Joe: Board wanted to know whether there was going to be a public meeting and were under the impression that there was going to be a public meeting. It appears that Jimmy the manager forgot to bring this up to the GN (Joe asked Jimmy if he let the GN know that the HTO wanted a public meeting and Jimmy indicated that he forgot). *Note, the GN did not receive any notification or request for a public meeting prior to this meeting.

- This is very important to us and we can wait—sometime this winter would be good. We really want this and have been waiting a long time. M'Clintock is very important. Is this a possibility to do?

- Markus/Jasmine – This is possible to do, but we don't know if it is likely and we cannot commit at this moment because we need to discuss with our supervisors and figure out a schedule.

Background slides: review; no questions

Study design/methods slides: passed around biopsy dart; answered a few questions regarding how the dart sampled the bear. No other questions.

Community participation slides: review; no questions

GB results:

- **Question Joe**: what is the TAH for GB?

- **Answer Markus:** 74

- **Question Jayko:** are you guys getting new equipment –like cameras and stuff to take pictures that have the built-in ability to see how big the bears are?

- **Answer Markus:** I think I know what you're saying, and it might be a bit more complicated to determine actual size from a picture -- we would need to know altitude, distance, focal length. It might be possible to calculate size and do that. We could look into that.

- **Question Tommy**: talking about quota –all those communities Gjoa, Igloolik, Sanirajak, What the quota like before MC was shut down?

- **Answer Markus:** it was 42 until 2003/2004. It was increased to 74 in 2004/2005 because the study in 1998-2000 showed ~1600 bears instead of 900. I was around at that time of the moratorium in MC that communities were given a few tags for GB to preserve traditions during that moratorium and low harvest in MC.

- Joe: that was a big jump from 42 to 74.

- Markus: yes, I don't know how the recommendation went, but it seems that the 74 has been okay because the population has remained stable, though there may be some environmental changes that have helped the population---like the sea ice thinning/reduction in multi-annual ice and becoming better habitat for fish/seals/algae/etc.

- **Question Jimmy**: no colons being collected anymore?

- **Answer Jasmine:** correct, that was a collaborator project and they had funding for only a set number of years. That funding has run out and now they are working on analyzing the data. I am not sure when reports/information will be ready, but reports will be sent to communities with what they find.

- **Question Jimmy:** about credits? If we want to have a sport hunt, can we use our credits for sport hunts?

- **Answer Kevin:** Yes, that is not a problem. However, keep in mind that we haven't approved any outfitter licenses due to COVID. But we can help support you for that if you have questions. Not much going on with sport licensing this year still with COVID.

- **Question David A.:** with the feces and Peter DeGroot study ---maybe ask the HTO to make sure there was approval – we're not sure there was approval.

- **Answer Markus:** I'm pretty sure that all Bearwatch research had permits—they would have gone through our department.

- **Question Kevin:** do you know when that permit expires?

- **Answer Markus**: I'm not sure—probably multi-year

- Kevin: during the research permit review period that is a good time to bring up any concerns or comments---that is the time to bring that forward and decide if you support. If you don't say anything, it is assumed to be approval from the HTO.

- **Question Bruce**: Is it mostly the GN that counts bears or do other people do it?

- **Answer Markus**: mostly it is GN, but sometimes we have to have help because it is only me and Jasmine. There are a few people that have lots of experience that we bring on to help out on big projects. I'm in charge of the program and I only get people with experience to do the work. And there are locals involved—it's not just the biologists.

- Following the meeting after Jasmine/Markus left, Kevin remained for other agenda items and it was mentioned again that there was **a lot of disappointment that the public would not be hearing these results**. Kevin reiterated that it appears this was not communicated to the GN and the biologists were not able to plan for this. Tonight, was the first it was brought up about the desire for a public meeting.

- End of meeting

C: Kugaaruk

October 22, 2020

Start: 18:50

End: 21:20

Participants:

Athol Ihakkaq
Jesse Apsaktaun
Mariano Uqqaraluk
Columban Pujuarajok
Mark Kutsiutikku
James Nasalik
Ema Qaqqutaq from KRWB
J. Ware – GN-DOE
M. Dyck – GN-DOE

Introduction and Objectives:

- mandate is to provide this information to co-management partners. Ideally, I would have liked to have both the science and IQ studies come out at the same time---unfortunately COVID impacted the IQ study researcher's ability to finalize the study at the same time.

Background:

- background of studies from 1970s to 2000. Heard from communities from last 3-4 days is that there have been a lot of changes in the environment and sea ice. Our obligation is to get new information to not just the GN, but also hunters, HTOs, RWOs, and to NWMB because they need the information to set the TAH; no questions

- The question that was important at the time—number of bears can be answered by the biopsy darting. However, with this method, we cannot answer questions about movement or industrial activity.

Community participation:

- incorporate the input from HTO/hunters to help us know where to look for bears---where were good places to search; no questions

Study Design/Methods: review; no questions

Study Design/Analysis: review; no questions

Results: shift in distribution? Why are there changes in the bear observations?

- Ema: that area in committee Bay was usually open water in 1998-2000

- Athol: Yeah, that is often open water near the floe edge

Results: body condition? Any thoughts or similar observations of you guys as to bear fatness? Are you seeing any skinny bears? No real comments---board seemed to agree

Results: reproduction – key measures we look at to help compare from old study to new study or to other populations

- **Question Jesse**: have the number of Coys per adult female gone down because there are more females in the population now than 1998-2000?

- **Answer Markus**: can't remember off the top of my head---will have to consult the report, but my memory is that the number of males has gone down slightly---likely because of the 2:1 harvest ratio. Females may have increased slightly.

- **Answer Jasmine** – cited report for female proportion – 57% in 98-00 and 61% in 15-17. That is in line with the 2:1 male to female sex ratio—that's why it's not 50:50.

Results: survival; no questions

Results: growth rate; no questions

Results: abundance; population is stable, even with changes in environmental changes. This is good news. This is a collective accomplishment among the hunters and government in managing this population.

GN Recommendation: we are not recommended a change in TAH.

- **Question Ema**: would you recommend to SARA to down list?

- **Answer Markus**: there isn't anything to down list because they look at polar bears as a whole. SARA and COSWIC looks at these data for the next assessment. The next assessment will be likely in 2025—I provide this information to them. Plus, this information not only goes into Canadian assessment, but also internationally. I am defending the Nunavut polar bear numbers internationally. This is good information for the outside world. However, it is important to remember to that we, me and you, we cannot know for certain what the future holds---what do the environmental changes impact for bears do in 5, 10, 20 years. What do the communities want and feel? There are different communities in Nunavut that note public safety, levels of social tolerance, I hear the communities say those things. It is important for the community to come up with what you want to do with this population---having a management objective. The decision you make now, always keep in mind to keep the future in mind.

Shows video of biopsy darting

- One more thing to mention to be fair since I've mentioned to the other communities. This is about movement….I respect that communities and HTOs do not want collaring or handling. I have had, in the past, organizations have asked about impacts of development on polar bears, but I could not provide that information because we do not have it. There is no pressure from me or the GN for collaring, but it's important to think about what questions you have and the information you need---describes benefits of collaring.

- I know that we have not been able to visit communities and I regret that. You are looking at the 2 people, sometimes 1 person, and we can't be there or everywhere.

- Jasmine: also, as the future unfolds, if there are priorities from the communities, bring those forth to the RWO and NWMB priority meetings because the GN uses those to help determine how they allocate funding. We have a mandate for abundance, but for other priorities, knowing what communities wants is very helpful.

- Markus: addresses why it has taken so long for us to get here with results. DNA analysis, finding old samples, ransomware, COVID

- Another thing we learned is that having long gaps of 15 years makes it very difficult to get survival. Doing one more year of marks/biopsy sampling would be helpful, maybe 5 years.

Questions:

- **Question Mariano**: did you see any bears that were wounded or sick?

- **Answer Markus**: in 3 years, I haven't seen any sick bears and no dead bears. I didn't see any dead cubs.

- Mariano: We had 4 bowhead whales die and was wondering if the bears were sick from that---not sure why the whales died.

- Jesse: going back to the topic of collars, I like the ideas of perhaps of collaring some bears because I do like seeing scientific data because it can tell a story. I'm not pushing back against IQ. But I like to see the procedure – what are the pros and cons --- how many bears would you collar. I would want to see the positive and negative impact. Because it would be good to see where the bears are traveling. In the past 3 years, we are having bowhead whale issues since the cruise ships. Is the Northwest Passage going to affect the bears?

- Jasmine: I feel like the IQ tells a story and the collars tell a story too –they together, tell a bigger story.

- Jesse: We need to get our residents to understand the positive and negative of bears. For example, if we have 10,000 bears and we collar 10 bears, what are the negative effects on those? I would recommend you providing a pros and cons. pamphlet

- Markus: Would it be helpful just to have a document, but that probably leads to more questions….it might be helpful to have a chat after you

- Athol: the Baffin area with the mine---they're going to put a shipping route in---that is going to affect the bears–we know that.

- Jesse: It's like we need the scientific data because we don't live out on the land like our grandparents did…I live in settlements 99% of the time. We have to educate ourselves and the future---like the shipping lanes.

- Markus: what you're exactly saying is similar to Baffin Bay and Kane Basin---communities saw climate change and wanted to know where the bears were going and what denning was doing. We worked with them and put out about 10 collars every year, a total of 30-35. And the data are huge

- Athol: the IQ and putting the collars together. I agree with the collars for the future.

- Markus: we are doing the LS starting next spring. We can maybe have communications to see what could work with the HTO. We have 3 years – maybe we could put a few collars out depending on your questions.

- Jasmine: to Jesse – maybe you could write your specific questions/concerns and that would help us design a study and collars.

- Mariano: I don't see any huge bears anymore 14-15ft bear.

- Markus: These are good observations to provide to Pam---that's the type of IQ that we need. When another study done in a few years, maybe there are different sizes and you document them.

- After board members left, GN representatives gave KRWB representative the MC presentation so that he also was informed about the study results.

D: Naujaat

October 26, 2020

Start: 18:10

End: 21:50

Participants:

NTI: Paul Irngaut
QWB Chairperson: James Qillaq
NWMB: Denis Ndeloh, KJ England, Steve Mapsalak
GN: Markus Dyck, Jasmine Ware, Jon Neely, Peterloosie Papatsie
HTO: Hugh Haqpi – acting manager
Paul Angotituar
David Ammaaq
John Ell Tinashlu
Peter Manniq
Dino Mablik
Mark Tigumiar – vice chairman

- Meeting started with introductions around the room

- Presentation
- GN representatives stressed that the IQ study is ongoing and has been delayed due to COVID because its results depend on ability of researcher, Pam Wong, being able to verify interviews and speak with interviewees. Ultimately, together the science and IQ will all go together to the NWMB for decisions for a bigger picture. Looking for a good discussion among everyone – we want to get feedback on what we present this evening.

- Paul Irngaut: Informing the group that NTI wasn't on the first leg of the consultations and explaining that he and James (QWB) are here as observers.

- Markus: asks board if they want to do background on GB and they agreed.
- **Background slide review:** no questions
- **Goals of Study/need for new info:** no questions

- **Question Hugh:** the boundary that you first showed is the boundary? What are the new boundaries that you show?

- **Answer Markus:** *reversed to previous slide showing 1970s boundary* Biologists back in the 1970s/Govt of NWT/local communities outlined as where there are a lot of bears and because they didn't know much about numbers of bears for any areas, they decided to survey this area. So, this circle (*shows red circle) was in a way arbitrary.

- Paul I.: can I explain a little bit? Explains the role of the Range States, Polar Bear committees like the PBAC/PBTC.

- Markus: Further explains the management unit boundaries---The brown lines show boundaries based on movements of female bears with collars that were put on bears in the 1980s-1990s.

- **Question David**: Question about the boundaries -- that NWT boundary (*red circle) that is pretty big --- do the tags depend on the boundaries?

- **Answer Markus:** For each of the areas, we know how many bears there are in each of these areas and the NWMB has set a TAH based on that. Based on how many bears there are in total and based on what the management objective is --- some communities want a population to stay stable, so you can't harvest as many if you want to keep population stable. From the total # that is determined the TAH. For Gulf of Boothia, NWMB decided 74 total allowable harvest and then the RWO decides how the tags get distributed.

- Denis: I think what he was asking: Is there a relationship to the size of the management unit to the number of tags?

- **Answer Jasmine:** No, the size doesn't tell you how many bears there are. Some areas are quite big but don't have many bears. MC/GB for example. Tags are based only on how many bears there are in an area.

- **Study method choices slides:** Discusses how alternative options to traditional capture mark recapture were presented during initial consultations in 2013 (aerial survey, DNA biopsy). Reviews biopsy darting and how it works. Shows biopsy dart, passes it around. Explains how the method differs from traditional mark recapture and why we don't get as much data.

- **Question Hugh:** does the genetic DNA biopsy indicate age and health of the bear? Has there been any disease since the start of the mine?

- **Answer Markus:** Lots of good questions in there. We cannot get the exact age because we do not have a tooth. We cannot see anything for contaminants–our sample is too small. And no disease can be seen other than a big injury on the bear because we are not handling or touching the bear. The hunters can report back if they notice something weird or sick with the bears, disease – fills in gaps that we have with the science study.

- **Community participation slides:** no questions

- **Study design slides:** no question

- **Question:** From the 70s study to now --- how do you see the health from then to now?

- **Answer Markus:** good question---we are going to get to that in a minute---not really from the 70s cause we don't have tissue and samples from back then, but we were able to compare to the 1998-2000 study and we will get to that shortly.

- **Results:**
- **Question Hugh:** was there any changes in the biopsy based on climate change? Were bears getting fat, getting skinny, any disease

- **Answer Markus** – We can't see disease from this type of study. We rely on hunters to bring in anything that looks diseased. Body condition we do know, and we will talk about that in a couple of slides.

- **Review of shifts in distribution slide:** Based on where we observed and sampled bears in 2015-17 compared to 1998/2000, appears to be a distributional change---maybe because of sea ice and seals? Bears have likely adjusted to these changes

- **Comment:** maybe more narwhal carcasses?

- **Peterloosie:** Those 2 high concentration areas in 2015-2017 – are two polynyas. Usually a polynya with open water around these areas that were empty of bear observations in 1998-2000.

- **Question Markus:** Do hunters notice changes in ice? How does ice look when compared to 20 years ago?
- David: The ice is very thin and more drifting snow---it's not compacting and not making ice. Not forming properly.

- Markus: how is that for seals?

- John: When it is very thick, it is good for the seals. When it is very thin, it is not good for seals.

- **Results: Body condition**

- Comment: Bears back then were skinnier so this fits with what you're showing us.

- **Question Hugh:** Have you noticed difference in temperature and its effects on body condition? As in warmer temperatures make bears skinnier and the cooler temps get them fatter and ready for hibernation?

- **Answer Jasmine:** we haven't looked at that, but we could easily see what the average temps were during the field work for each of the study years and compare.

- Peterloosie: I think that the seal pups are getting bigger – saw one that was 3 ft long –huge. Maybe they are bigger and feeding bears.

- Jasmine: Describes thinning ice and changing productivity of ecosystems with decreasing ice thickness and more dynamic ice being potentially helpful for bears because the ecosystem is boosted in productivity (algae, fish, seals, bears). Theory because we do not have data on seals or fish for these areas. Markus is working with DFO to try and get information for seals.

- Markus: describes efforts to get seal info with DFO. The Lancaster Sound is where we are going to try to get seal info as a start.

- Hugh: I'm from Baker Lake where there are no polar bears. Back in the 60s and 70s, there were 4 or 5 bears caught super inland --- the bears were migrating to the west. Cause looking at LS and GB and comparing the distance from Gjoa Haven and Hudson Bay is about the same distance.

- Markus: There are some bears that move a long distance. Gives a couple of examples.

- **Question John:** I have a question about scientists---do you keep in contact with other provinces, territories? Or do you not talk to the other scientists?
- **Answer Markus:** There are 8 populations in Nunavut that are shared between jurisdictions/provinces/territories that I work with when there are studies – mentioned Baffin Bay and James Qillaq working with Greenland. Also, Western

Hudson with Manitoba. All the jurisdictions meet once per year, more frequently on the phone, so definitely in contact with other scientists and jurisdictions.

- I also present information gathered in Nunavut to international community and defend the Nunavut harvesters and Nunavummiut. We exchange this information with different countries.

- Paul I.: talked in Inuktitut for a while and explained he reviewed the PBTC and polar bear advisory committee and status table. That you guys meet once per year and review the polar bear populations.

- John: conversation in Inuktitut with Paul I.

- Paul I: John was asking about the ECCC ongoing mark-recapture study in Western Hudson and the effects of being handled/lack of hearing. At the Advisory Meeting where ECCC is a member, we voiced our concerns with handling bears, but also mentioned that that handling occurs in Manitoba which Nunavut has no control or jurisdiction over.

- Inuit have been opposed to handling of wildlife of any kind, especially polar bears. We have pushed for biopsy darting. We have made this known to our counterparts in Manitoba and ECCC. They know our concerns and to date we haven't seen any changes on their part.

- Peterloosie: I think John that was saying is that the bears are going partly deaf after so many helicopters getting close and then landing next to them. Then the partially deaf bears are moving north into Nunavut and causing issues.

- Steven: you came here to do a presentation to do Gulf of Boothia; I think that maybe we stick on topic.

- Markus: We are happy to answer to any questions and it's not like we are here that often so we are more than happy to entertain any questions on any topics for as long as you all want.

- Break --- 10 minutes ---
- **Reproduction slides:** coys/yrlgs – offspring per ad. Female

- **Question Hugh** - Are there more cubs with females in old study?
- **Answer Jasmine** – there are a few that have 2 cubs more than just 1; some hunters see 3 coys, none were seen during the study period, but maybe recently this is happening more?

- **Question Peterloosie** – reproduction is low with 1.6?

- **Answer Markus:** I know it looks low, but in context, it is not a low number. That is actually very good reproduction numbers in Gulf of Boothia *explains values that would be concerning. The observation you see represent localized observations; our number is averaged across the entire study area at the same time so *all the moms with single cubs and twins get counted and averaged.

- **Question Hugh** – pb numbers are low with low seal numbers?

- **Answer Jasmine –** we do not have seal numbers in Nunavut, likely it is the case when seals are poor, bears likely do not reproduce.
- **Survival slides:** -- no questions
- **Pop growth slide** – no questions
- **Abundance slide** – no questions; describe the range of the number and why there is a range – uncertainty in science because no one thing can know all. It reflects that there are likely biases and errors in places, that is why the result produces a range of numbers rather than an exact number.

- **Further questions slide:** other questions that the hunters/communities have regarding boundaries, denning, development (mines, shipping) --- if these become concerns, methods such as collaring would likely have to employed. IQ and DNA biopsy can inform parts of the puzzle, but each method provides its own information.

- Markus: further questions – do you see bears staying the same?

- Comment: feels like they are increasing around.

- Markus: That's definitely true – between 1850-1935 that's when a lot of whalers came to Canada/Nunavut and bears were shot. Not many bears in the 1950s and 1960s –but definitely more bears now.

- John: even berry picking, we have to bring our gun and be a safety guide

- Paul: Can't even go camping anymore.

- Markus: that's good information – need to talk to Pam and see if that's helpful to include and help us to understand the bigger picture – have bear distribution changed? ---could ask that for Pam to include

- Hugh: population going up, bears come more to community. IQ says there is bear movement and that is true – larger bears move farther out. Now and then, there is sometimes a 12-footer, but average is 8 ft.

- Markus: do you see you big bears?

- Peterloosie: They are talking more Foxe Basin, not so much Gulf of Boothia for those big bears

- **GN Recommendation TAH slide**: with the info the government collected, and with the objective to maintain the subpopulation, we are not recommending a change in TAH.

- **Discussion with group about TAH Increase and Tag Allocations – originated organically from group and created lots of discussion with NTI, NWMB, QWB, and GN offering information on processes, options, and clarifications for how TAH increases or reallocation among communities may occur.**

- **Question:** about harvesting, can we have more than 5 tags?

- **Answer Markus:** There are a few options. The government is not recommending a change. However, depending what is presented to the NWMB, there are options for the Regional Wildlife Organizations and communities to talk ---have to be on the same page – the communities have to have the same objective –keep pop same, higher, lower. Then, the RWO, supported by HTO's needs, makes their submission to NWMB – may or may not be the same as the Governments.

- We have to understand that this is not black and white, we know that the population has stayed the same, but I don't have a crystal ball to know what the future holds. When the decision makers (RWO, NWMB, etc) increase the TAH, there is a risk that the system that you could screw up the system --- it is a question of how much risk are you willing to take. Are you willing to take a risk that is very high --- say TAH of 90-100? – but that is very very risky. We want to make sure we provide for future generations – that is our mandate in the Government. But it is not for us to say what the management objective for a population should be. This is a decision for the communities to think about. It is not an easy decision.

- Another option is to bring forth a request for reallocation to the Regional Wildlife Organizations– based on concern or need. The RWOs can redistribute the tags at any time—does not need to be a new study or anything like that.

- Anything that is not clear, contact us, we give you information. Our door is open.

- Hugh: Looking at TAH by Minister, maybe redistribute the tags ---like Coral Harbour. Difficult to talk to Arviat, Coral Harbour

- Markus: You can only discuss reallocation of tags with the communities that harvest from the same subpopulation. So, Gulf of Boothia communities. And Foxe Basin communities (Coral, Cape, etc)

- Comments: Naujaat suffering defense kills and impacts on their quota from hunters coming from Rankin and Arviat.

- Markus: we have to take a look at that and see. But harvests come off the hunter's home community – part of the Polar Bear Management Plan. MOUs are no longer in force

- *surprise comments from group indicating they are not aware of the Polar Bear Management Plan and have not seen it.

- Markus: *Explains the process the Polar Bear Management Plan went through before being ratified by the NWMB and Minister* --- The Polar Bear Management Plan was accepted after going through a multi-year process in which all HTOs across the territory were consulted. *NTI nods agreement* RWOs were consulted and part of it too. All partners were involved and – drafts sent back and forth and back and forth. Public hearing in fall 2018 and all HTOs invited.

- Denis: wanted to provide clarification for what Markus is talking about for the Polar Bear Management Plan – the wording about hunter's home community is part of an appendix that is approved on an interim basis right now.

- KJ: it is on the NWMB website.

- **Video of darting:** clapping from John – *not sure if sarcasm or true support of method/video*

- **Question Peterloosie:** what do you think of the 1:1 harvest ratio? I think that it will increase polar bear populations in the future.

- **Answer Markus:** This is something the communities wanted, maybe not every community, but the majority. Also, in the Polar Bear Management Plan hearings. There is a concern because the TAH was not adjusted when Nunavut went to 1:1. The TAHs were set to protect females and maximize sustainable harvest. But, when 1:1 went into effect, there is a chance that more females would be harvested and could be riskier. If there is a concern, the GN will bring those concerns to the NWMB. Just because it's 1:1 doesn't mean it has to stay that way if there is a conservation concern with consultation with community.

- Hugh: there was a concern we would like to know the male/female ratio, we want to have balance and not drive the population down and what happens with climate change in the future is not really known.

- Markus: When there are concerns, hunters raise the flag – like MC not being able to find males – that was a trigger to lower harvest in MC and to do study. We rely on hunters to provide information because it's not possible to do studies/surveys frequently – costly.

- **Question Paul I.:** Asking how much harvesting done from here.

- John: Yes 5

- **Question:** That's why I ask if we can get more than 5. More people are hunting up there. Would like more tags. And more people go camping to hunt in March. – mostly people go to the island in Committee Bay (Peterloosie – about half the hunters go to the big island in Committee Bay).
- Markus: You don't have to wait for a new study, you can raise this with the NWMB with information or bring up with RWO to reallocate.

- John/Paul: conversation in Inuktitut -- summarizes that HTOs can allocate half a tag for a cub – request has to come from HTO, then approved by someone, Superintendent maybe. Also, they have made requests to increase TAH to the KWB but haven't heard anything. We have a committee, under NTI, Nunavut Inuit Wildlife Secretariat, the chairs sit on the committee and we can bring it up at the next meeting.

- James Qillaq – adds comments in Inuktitut

- Comments – Rob Harmer explained procedure in spring, and we are just starting to put it on paper and we can't just have ask – we have to go through process.

- Paul I.: Six communities harvest from GB so it seems that the allocation isn't exactly fair. But if want an increase in TAH, will have to bring to RWO which brings it to NWMB. If you want a re-distribution, then RWO has to do that – KWB, QWB, KRWB – they all are responsible for allocating GB.

- Steve M.: I used to be the Chair for the HTO when the MOU, there was a decrease in the TAH, Mitch Taylor was the pb biologist. There was a quota of 3 for GB for Naujaat. When the quota went to 74, Naujaat went to 5. The way the tags are allocated is done by the Regional Wildlife Organizations – it's up to them. But they have to follow the TAH. *note – not clear what this reduction is referring to. MD is not aware that there was TAH reduction for GB while Mitch Taylor was working.

- **Question:** Do you know when this will be going to the NWMB?

- **Answer Markus:** We have to finish consultations first and we maybe are done by Wednesday, and we could get back to the office and be told to get something ready for the NWMB. I don't know though.

- Jasmine: And just to reiterate, even if nothing ever goes to the NWMB and this study never happened, the concerns and requests for redistribution of tags can go to the Regional Wildlife Organizations at any time. Technically, they can reallocate each year the tags. They usually don't but it is within their rights/responsibilities.

- Steve/John Ell/James: conversation in Inuktitut

- Denis: assuming the request comes from the GN to the NWMB at some point, what is going to happen very likely, because it is 3 regions and NWMB cannot set a TAH Nunavut-wide --- the Board will determine what the TAH is for Gulf of Boothia. The NWMB will then send a letter to the 3 RWOs and ask to know how the RWOs are going to share it. The RWOs will meet and decide and then provide that info to the NWMB and this will be sent to the Minister. This is also when the communities can have their voice heard.

- Paul I.: that is why I mentioned the committee at NTI that we will bring forth this issue. If communities want to increase the TAH within the already set TAH, then that is the RWO jurisdiction.

- John Ell: conversation in Inuktitut – about Foxe Basin – *not sure what was said. Left abruptly*

- Paul I.: I was explaining that communities get together to discuss and agree on what they want—if they bring that forth, it is much more powerful than a single request.

- KJ: because there are so many communities and regions are covered, the easiest option would be to request for a transfer of credits for a short-term increase in quota. Another option would be going to the RWO, to advocate with the other RWOs, for a change in allocation. Thirdly, work with all the RWOs and advocate for a change in TAH.

- **Question:** when do you plan to study Gulf of Boothia again?

- **Answer Markus:** With the previous study plans, studies were done every 10-15 years. With this analysis, we realized that this long timeframe is too long. Makes the analysis really difficult to have that long period with nothing. We ideally would like to come back in 4 or 5 years after study completion to sample bears in the entire area, but only for a single year. This would put more 'marks' as we call them into the population and give us better understanding of survival, reproduction. Four to five years after the single year sampling effort, we'd do another full study—where we survey the entire area 3-4 years in a row.   But that depends on what information is coming in --- from communities, or the environment. NWMB sets regional priority and makes list --- get what you think is important on the priority list. Helps the GN allocate funding and know what is pressing priorities.

- **Question Hugh:** would 4 or 5 years be enough for you?

- **Answer Markus:** we would do a single year, cover the whole area between April/June. We'd do this in 4-5 years. In 5 years, we need to put more marks out because the bears marked in 2015-2017 are dying.

- We cannot get a full population abundance by putting 1 year of marks out. There is maybe a chance if we do genetic samples in 1 year, there is maybe a way to update the abundance – but there is no guarantee because it will be the first time. We are learning as we go.

- Jasmine: noted the increase in time for DNA biopsy analysis. DNA analysis takes significantly longer than traditional mark-recapture – by at least 9-10 months.

- Markus: we are open to communication and work for you.

- Jon Neely: I didn't realize that defense kills from residents from other communities might be counted on your quota so we can look at that. We also have money in the deterrence budget – HTOs can apply for up to 10k for bear deterrence equipment – bear bins, fence. If a bear does damage your cabin, we have another program that can pay up to a few k for repairs and such. Talk to Peterloosie a bit tomorrow.

- Peterlooise: We applied for scare cartridges in early June – but we haven't heard.

- Jon: We can look into that – I wasn't aware of this application. I do apologize – I did not see that program application this year. That is something we will fix on our side. We will make sure that program works better for you.

- KJ: thanked the biologists and their work, difficult to get around – only 2 of them. Thanks to the HTO for community sampling program.

End of meeting

E: Sanirajak

October 27, 2020

Start: 19:15

End: 21:15

<u>Participants:</u>

NTI: Paul Irngaut
QWB Chairperson: James Qillaq
NWMB: Denis Ndeloh, KJ England
GN: Markus Dyck, Jasmine Ware, Jon Neely, B. Grosset
HTO: Lizzie Phillip-Qanatsiaq – secretary manager
Jopie Kaernerk – Chairperson
Danny Arvaluk
Jaypeetee Audlakiak
Sam Arnardjuak
Zillah Piallaq
Cain Pikuyak
George Innuksuk

Introductions around the room

Question to the Board re: background – Markus asks Board how much detail on background

Question: how much time with all the background?

Markus—material about 2-2.5 hrs but depends on interaction and how many questions the members have. I think it's beneficial to have the background so we can go over it.

Objectives of Presentation: reminds Members that the IQ study is ongoing for Gulf of Boothia. We are hoping that the information you have is provided to Pamela. Ideally, the science and IQ would be together, but COVID has prevented the IQ and the fact that Sanirajak has not had a Manager for quite some time.

Background review slides: no questions

Goals of study slides: Refreshed commitment of MOUs that new research had to be conducted for GB in 2015. Review goals including how sea ice changes incorporated – see how bears are doing as sea ice changes. No questions.

Study method choices slides: Refresh that DNA biopsy method was supported by communities back in 2013. The DNA biopsy method gives us information about the abundance. Reminded about drawbacks of biopsy darting. No questions.

Community participation slides: review, no questions

Study design/analysis slides: review, remind that hunters bring muscle and fat that can be used to address contaminants questions; no questions

Results slides…map with dots, flight lines….map comparison old vs new distribution – no questions

Question Jasmine – are you seeing bears evenly distributed like in the 2015-17 study? Didn't catch answer…something with Naujaat

Who was sampled slide – tells us some bears are moving between areas – no questions

Jasmine question -- Body condition slides – have you noticed fewer skinny bears than 20 years ago?

Comment: Maybe more carcasses on shore than other areas?

Hunters are only over in GB in spring only – bears are skinnier due to mating, Sanirajak only goes there in spring

Some people do not hunt bears anymore because the hides are not worth a lot of money

Reproduction slides – review; no questions

Survival slides, review;– no questions

Growth rates slides – no question

Abundance slide – interpretation slide – no questions

Questions slide – questions: walrus on top of ice in September – did bears get counted in spring down there?

Answer Jasmine – we sample them when there is ice in spring, when there is open water we can't sample really – too dangerous for flying

Question was more about FB – when we do FB we actually do it in fall, Aug and Sep.

Review of slides and questions…are there too many bears in GB, too few?

Comment: not too many bears hunted in GB, not too many sport hunts; COVID-19 likely not much sport hunts

Question – seal populations is having an impact on pb population? Under water sonar…might have an impact on bear populations

Answer Markus – explained NWMB priority list, work with RWO to have seal abundance and impacts on priority list; I can also ask DFO biologists to see if there is a desire for research

TAH slide – question-in the winter when the quota is not completed; traditional hunting and bears taste better in summer – can we hunt in summer.

Jasmine Answer – when you hunt is an HTO decision; The GN does not care when hunts occur; season is July 1 – June 30…all year.

Question: when there are more bears in summer, and there are sport hunters, how can we harvest more?

Answer JNeely – we normally distribute tags in fall, but tags can be sent sooner in the season to assist with sport hunts if you want to have summer hunts

Movie – darting…..

Question: When you are doing your research – have you seen the bigger bears? 12-14 feet or more?

Question Markus - In FB? Or GB?

Question: they move in March, Sanirajak hunts in spring in GB…where are they moving to?

We asked hunters to show but they could not tell because of the ice conditions, changing too much

Question: is that the same in Hudson Bay bears from Churchill?…assumed the question relates to abundance(?).

Markus Answer – there are different numbers of bears in the populations, and not every area that is large does not necessarily have a large number of bears.

No more questions - End of meeting

E: Igloolik

October 28, 2020

Start: 18:40

End: 21:42

Participants:

NTI: Paul Irngaut
QWB Chairperson: James Qillaq
NWMB: Denis Ndeloh, KJ England
GN: Markus Dyck, Jasmine Ware, Jon Neely
HTO: Jacob Malliki
David Irngaut – Chairperson
Gideon Taqaugak
Daniel Akittirq
Michelline Ammaaq
Joannie Alaralak
Salomon Mikki
Natalino Piugattuk
Loyd Idlout
Janet Airut - translator

Introductions around the room

Background slides: review; no questions

Goals of Study: review and reasoning for new research study – MOUs obligations for updated information and Total Allowable Harvest information to decision-makers – RWO/NWMB; no questions

Study method choices: review when initial consultations occurred in 2013. Balance between methods and the trade-offs between different method choices. Review that all HTOs supported the less invasive method. Describe DNA biopsy and passed around dart. Explained how skin sample and genetics works to 'mark' or identify a bear so that we can track it through time. No questions.

Community participation slides: Review; no questions

Study design/goals slides: review; no questions

Results: maps – questions – shift in distribution?

Salomon: answer – count up to 47 family groups in summer – count bears in summer would be better.

Jasmine – is it new to see more than 2 cubs; usually 2 offspring, but recently seen 3 cubs, a bit rare but seen

Question Salomon – Could you monitor in summertime? Is that possible?

Answer Markus: The area you pointed on the map is Foxe Basin and we do our monitoring in the summer there. But for GB the ice doesn't go away completely so we do it in the spring when most bears will be on the ice hunting and breeding.

Natalino – ice comes from aqqu, ice transports animals, no more ice up there and around Moag Bay there are polar bear tracks, some come up to community (this past summer); not so much ice through Hecla and Fury strait

Salomon – are bears afraid of ships? Is it because there was a ship? Ship in Hecla Strait, ice breaker…..this summer there were lots of bears near the cabins

Comment: this summer saw lots of bears in that area, more than usual…during September

Question Jasmine – do hunters go in springtime to GB or mostly summer? Do hunters see GB much in the spring?…..

Michelline – recently less ice in that area, lots of tracks.

Paul I….shifting ice is likely;

Jasmine…if more ice is shifting, ice breakers are coming through, maybe this is a time to find out how bears are moving, maybe if it's important to the community?

Gideon – if there is less ice, less polar bears, but we do not see a negative effect yet

Salomon – bears are usually where there is food; ships were dumping in that area and the seal moved; the seals went further up, maybe bears are moving up there; same in Lancaster sound across Arctic Bay

Natalino – if area is researched the funding is always a problem; excuse is always there is no funding available……

Markus/Jasmine – nod in agreement that funding is always a challenge for big projects

Question Salomon – why are you not searching up there – points to BB and KB…bears are likely moving up there and are coming down into our areas?

Answer Markus – we did sampling and research in Baffin and KB, and we had collars, but we are doing LS in 2021 for several years; maybe some bears move between MC/GB and we pick them up –

Jasmine – we are doing LS work in spring—same as MC and GB so that also might help to find out how/where they move/are at that time of year. Sampling at the same time of year gives us information that is more comparable compared to spring vs. fall sampling.

Question: why does our quota never get an increase when we feel bears are increasing? *Interpreter struggling to translate conversation – following meeting, Inuktitut-fluent GN staff member indicated that the conversation also included that Igloolik area igunaq caches were being raided by bears in FB and that's one of the reasons the HTO wants to harvest more bears in the FB area.

Answer Jasmine: gave Baffin Bay example and how process went for increase there.

Answer Markus: Describes RWO allocation responsibility and NWMB responsibility of increasing TAH. The reason there has not been an increase for GB is that there has not been new scientific information since 1998-2000.

Paul – you can approach NWMB with requests, this information goes to the govt, you have to clarify why you want quota increased; because of the studies and the results they give to NWMB; there are 3 RWOs for GB; the quota is 74 for all the communities; for FB you would need to talk to that RWO and communities.

Gideon – there are NWMB reps here; concerned about seals, there are no caribou, they would deny us quota increase for bears because they've done it before.

Natalino – took sport hunter to hunt bear, caught collared when I was 7 years old; collar came off and they lost it; head was "separated from neck"??....*maybe no fur on neck?*...a bear was caught and hide was no good and he is asking for replacement of hide from GN

Question Daniel – in FB they wanted a cub, or a family group?

Answer Paul I…it comes out of the quota,

Requested a mother and a cub last year but we did not hear about it…anyone catches a cub it counts 0.5 of a tag; *HTO comments and discussion about what 'half a tag' means. In order to stay on topic of presentation, GN indicated that these questions they could answer at an HTO meeting since they live in Igloolik and would be happy to answer harvest-related questions during a regular meeting*

James…to NWMB send your request about cubs….to them;

Results slide – describe how many individual bears and recaptures there were for GB

Question Jacob - Where is MC?

Answer Markus – explained where it is on a map

Results body condition –

Question Jasmine: Why are bears in better condition?

David: When Paul was kid almost no bears around; whenever a bear came near community, it made the news; because if there are more bears, they get skinnier – not enough food and they fight; haven't seen skinnier ones; I think and what I see is we used to wait until quota is increased, there are less bears and they are not attacking each other; the numbers will decline; not so much on the ice, more time on land; they tend to be fatter now; when people went caribou hunting hunters saw no caribou but polar bear tracks; they sometimes tend to stay in one place-someone cried about what is going to happen about to polar bears, it was a biologist, GB area always had polar bears – there are hardly any bears because they are on the land – we think if funding is available they should research sooner to get increase in quota; when they do research bears are not scared of machinery and people; the bears are not scared of people anymore; some hunters are aware of changes on bears; I would like to see more IQ being used;

Salomon – GB is being researched, I have been to Churchill and saw somebody attacked from bear; bears come into the community, up to 200 bears *unclear the time frame that the 200 observations came from*,

Natalino – went over quota, we were not penalized, we are grateful and there are lots of bears around

Paul I….talked about that the MOU is replaced by new plan; quotas were increased in BB; when a female is caught the quota is decreased, now it is 1 male or 1 female for any overharvest; the federal govt is not always in agreement with increase in quota but we have the reports from the government.

Reproduction slides – no questions

Survival slides – no questions

Growth – no slides

Abundance slides – no comments

Did not go over slides with boundary issues

Recommendations – slides

Denis – explains the process of how it works with TAH decisions and the role of NWMB; different ways of decisions and what info is used for decision making; says the GN position is to keep TAH same; Denis also explain or asks what is the risk the GN is willing to take with a new TAH decision

Paul I: the last TAH was changed in 2003 – no change in TAH since then, what is it what the communities want, The GN position is only a recommendation; send a request to NWMB, no problem if you do not agree with the recommendation right now

Natalino: chose a little increase in TAH because we have to kill bears or family group for different reasons; or the yearling is left behind when she is having another cub

Daniel-the other communities have not been communicating of what they want, and we can negotiate about the 74 bears; meet with other communities to increase quota, or talk to them

Jasmine – we are taking notes, we send them around to the communities so you can see what was discussed among the communities

Paul – we visited different communities, in Naujaat they hunt in GB, but Hall Beach does not really harvest there; have not heard from other communities

Salomon-if we make a request about GB, we need to ask QWB for support, and what government are they talking about? The Federal government, American government…?; would they say no about request immediately?

Paul explains process about how the RWOs need to discuss and decide how to split up the TAH and allocate among the communities. With NTI there is the NIWS that can assist; with NWMB you go take the request and then to RWO.

Film sampling

End of meeting

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Building Nunavut Together
Nunavuliuqatigiingniq
Bâtir le Nunavut ensemble

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Department of Environment
Avatiliqiyikkut
Ministère de l'Environnement

ASSESSMENT OF ABUNDANCE FOR THE GULF OF BOOTHIA POLAR BEAR SUBPOPULATION USING GENETIC MARK-RECAPTURE

Final Report

12 June 2020

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1.A) EXECUTIVE SUMMARY – ENGLISH -

Polar bears (*Ursus maritimus*) are managed across Nunavut, Canada, under a quota system that seeks to ensure harvest is sustainable. In recent decades, climatic changes across the Arctic have altered polar bear habitat at unprecedented rates. To retain viable polar bear subpopulations as part of the ecosystem ensure continued availability of a subsistence resource for Inuit, scientific research and monitoring studies are conducted to evaluate subpopulation status and whether management objectives are being met. Here we report the results of a population study for polar bears inhabiting the Gulf of Boothia (GB) conducted 2015 – 2017. Current samples were collected using less-invasive genetic biopsy darting without immobilizing or physically handling bears. Our analyses included 2015 – 2017 biopsy sampling data, live-capture data collected under a designed study 1998 – 2000, live-capture data collected opportunistically 1976 – 1997, and harvest recovery data over the entire period 1976 – 2017. Results of live-capture dead-recovery models fitted in Program MARK suggest that a mean abundance estimate of 1525 (standard error [SE] = 294) for the period 2015 – 2017 was similar to mean abundance in 1998 – 2000 (1610 [SE = 266] in this study; 1592 [SE = 361] in Taylor et al. [2009]). Mean cub-of-the-year and yearling litter sizes for the period 2015 – 2017 were 1.61 (95% confidence interval [CI] = 1.51 – 1.70) and 1.53 (95% CI = 1.41 – 1.64), respectively, with no apparent trend compared to 1998 – 2000. The mean number of yearlings per adult female for the period 2015 – 2017 was 0.36 (95% CI = 0.26 – 0.47) which suggests that GB is currently a productive polar bear subpopulation, despite sea ice change. This is consistent with our finding that polar bear body condition (i.e., fatness) in the spring increased between the periods 1998 – 2000 and 2015 – 2017. We detected sex- and age-specific variation in total survival rate (i.e., including harvest mortality) with higher estimates for adult females (0.95; 95% CI = 0.81 – 0.99) than adult males (0.85; 95% CI = 0.74 – 0.92) for the period 2005 – 2017. A potentially related effect was detected as an increase in the proportional abundance of females from 0.57 in 1998 – 2000 to 0.61 in 2015 – 2017. The asymptotic, intrinsic population growth rate calculated using a matrix projection model with estimates of total survival was 0.06 (95% CI = -0.06 – 0.12) for the period 2005 – 2017, suggesting strong

potential for growth. However, our results for subpopulation size and trend should be interpreted with caution because our estimate of abundance reflects the “superpopulation” (e.g., it includes all bears that use the GB management area, some of which spend time in other subpopulations as well) and our estimate of population growth rate does not account for permanent emigration from the GB management area. Overall, our findings suggest that the demographic status of the GB subpopulation is currently healthy, although we recommend that lower estimates of total and un-harvested survival for male bears warrant further investigation. We hypothesize that spatial and temporal reductions in sea ice may have provided transient benefits to the GB subpopulation due to increased biological productivity. Climate change is the primary long-term threat to polar bears and the threshold beyond which the GB subpopulation could be negatively affected by continued ice loss, like some other polar bear subpopulations, is currently unknown. This study represents the second structured population assessment in 22 years for the GB subpopulation. Based on experience garnered through this study and analysis, we submit several recommendations for consideration when planning future polar bear population studies. We suggest collecting additional data at approximately the midpoint between planned subpopulation assessments. In this case, that equals approximately 5 – 7 years from the 2017 completion of field work. Additionally, while the recommendation for movement data is not new, it continues to be highly recommended for subpopulations with known exchanges of bears between areas. In the absence of satellite telemetry data on polar bear movements, conducting a meta-analysis to investigate exchange between GB and nearby subpopulations (i.e., Lancaster Sound, GB, and M’Clintock Channel) may help alleviate some of the uncertainty around individual subpopulation estimates for these areas. Finally, when time, resources, and management objectives warrant it, we recommend conducting a quantitative harvest risk assessment to inform sustainable harvest levels.

1.B) EXECUTIVE SUMMARY INUKTITUT

ᖃᐅᔨᓴᖅᓯᓂᖅ ᐅᓄᕐᓂᖓᓐᓄᑦ Gulf of Boothia–ᒥ ᓇᓄᕆᔭᐅᒃᑲᓂᖅᑐᓄᑦ ᐊᑐᖅᑐᖃᕐᓗᓂ ᑎᒥᖏᑎᒍᑦ ᓇᓗᓇᐃᒃᑯᑎᖅᓯᓂᕐᒥᒃ–ᐱᒃᑲᓐᓂᖅᓯᓂᕐᒥᒃ

ᐊᐅᓚᑦᑎᔮᓂᙱᖅᑐᑦ ᓇᐃᓈᖅᓯᒪᔪᖅ

ᓇᓄᐃᑦ (*Ursus maritimus*) ᐊᐅᓚᑦᑎᕙᐅᕙᒃᐳᑦ ᓄᓇᕘᓕᒫᒥ, ᑲᓇᑕᒥ, ᖃᖓᓱᕈᓐᓇᕐᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᕙᒃᑐᑎᒍᑦ ᕿᓂᖅᑐᒃᑯᑦ ᓇᓗᙱᑦᑎᐊᕈᒪᓂᕐᒧᑦ ᑕᒪᓐᓇ ᐊᖑᓂᕆᔭᐅᕙᒃᑐᖅ ᑲᔪᓐᓇᕈᓐᓇᕐᒪᖔᑦ. ᐊᕐᕌᒍᓴᖅᑐᓂ ᕐᑯᓕᓂ, ᓯᓚᐅᑉ ᐊᓯᔾᔨᕐᓂᕆᔭᖏᑦ ᐅᑭᐅᖅᑕᖅᑐᓕᒻᒪᒥ ᐊᓯᔾᔨᖅᑎᑎᑦᑎᓯᒪᕚᖅ ᓇᓄᐃᑦ ᐃᓂᕆᕙᒃᑕᖏᓐᓂᒃ, ᑕᒪᓐᓇᓗ ᓱᒃᑲᓕᖅᒪᕆᐅᓪᓗᓂ. ᐱᓯᒪᔪᒪᓗᓂ ᑲᔪᓯᓐᓇᑦᑎᐊᖅᑐᒥᒃ ᓇᓄᕐᓄᑦ ᓇᓄᖃᑎᓖᒃᑲᓐᓂᖅᑐᓄᑦ ᐃᓚᕆᔭᐅᓪᓗᑎᒃ ᓄᓇᒧᑦ ᓇᓗᙱᑦᑎᐊᕈᒪᓂᐅᕗᖅ ᑲᔪᓐᓇᖅᑐᒥᒃ ᒪᓂᒪᕙᕐᓂᖏᓐᓂᒃ ᐊᑐᖅᑕᐅᔪᓐᓇᖅᓗᓂ ᐃᓄᖕᓄᑦ, ᖃᐅᔨᓴᕐᓂᕐᒧᑦ ᓇᐅᑦᑎᖅᓱᖅᓯᓂᕐᒧᓪᓗ ᐱᓕᕆᐊᖑᕙᒃᐳᑦ ᖃᐅᔨᓴᖅᓯᔪᒪᓂᕐᒧᑦ ᓇᓅᖃᑎᓖᒃᑲᓐᓂᖅᑐᑦ ᖃᓄᐃᓕᖓᓂᖏᓐᓂᒃ ᐊᒻᒪᓗ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑐᕌᕆᔭᐅᔪᑦ ᐋᕕᓯᒪᔭᐅᓚᓗᐊᕐᒪᖔᑕ. ᐅᕙᓂ ᐅᓂᒃᑲᐅᓯᖅᑲᖅᐳᒍᑦ ᖃᓄᐃᓕᖓᓂᖏᓐᓂᒃ ᖃᓯᐅᓂᖏᓐᓄᑦ ᖃᐅᔨᓴᖅᓯᓂᕐᒥᒃ ᓇᓄᕐᓄᑦ ᓄᓇᓕᖕᓄᑦ Gulf of Boothia–ᒥ ᑲᔪᓯᓚᐅᖅᐳᖅ 2015-2017-ᒥ. ᒫᓐᓇ ᖃᓴᙳᓴᐃᑦ ᑲᑎᑕᐅᓚᐅᖅᐳᑦ ᐊᑐᖅᑐᖅᑲᖅᓗᓂ ᐸᖕᕙᓯᙱᓐᓂᖅᓴᒥᒃ ᑎᒥᖓᓂᑦ ᐂᖅᓯᐊᕐᔫᒃᓗᓂ ᓇᐅᒃᑲᖅᑕᐅᒻᒧᑦ ᐊᐅᓚᔪᓇᐃᓕᑎᑦᑎᙱᕐᓗᑎᒃ ᑎᒥᖏᑎᒍᓪᓘᓐᖓᓂᑦ ᑲᓴᓗᒃᑕᐅᙱᓪᓗᑎᒃ. ᖃᐅᔨᓴᕐᓂᕆᔭᕗᑦ ᐃᓚᖃᓚᐅᖅᐳᖅ 2015-2017-ᒥ ᑎᒥᖓᓂᑦ ᖃᐅᔨᓴᖑᒃᓴᒥᒃ ᑎᑎᕋᖅᓯᒪᔪᓂᒃ, ᐆᒪᔪᒥᑦ–ᐃᖅᓯᓂᒥᒃ ᑎᑎᕋᖅᓯᒪᔪᓂᒃ ᑲᑎᑕᐅᔪᓂᒃ ᐋᖅᑭᒃᓱᖅᑕᐅᓯᒪᔪᒥ ᖃᐅᔨᓴᕐᓂᕐᒥ 1998-2000-ᒥ, ᐆᒪᔪᒥᒃ–ᐃᖅᓯᓂᕐᒥᒃ ᑎᑎᕋᖅᓯᒪᔪᓂᒃ ᑲᑎᑕᐅᓚᐅᖅᑐᓂᑦ ᐱᕙᒃᓴᖃᕐᓂᕐᒧᑦ 1976–1997–ᒥ, ᐊᖑᔪᖃᖅᐸᖕᓂᖓᓄᓪᓗ ᐅᑎᖅᑎᑦᑎᓂᕐᒧᑦ ᑎᑎᕋᖅᓯᒪᔪᓂᒃ ᐅᕝᕙᓕᒫᖅ 1976-2017-ᒧᑦ. ᖃᐅᔨᔭᐅᔪᑦ ᐆᒪᔪᒥᒃ–ᐱᓯᓂᕐᒧᑦ, ᑐᕐᑯᔪᓂᑦ–ᐱᙯᕙᖃᕐᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᓇᔭᖅᑐᓂᒃ ᐋᖅᑭᒃᓱᖅᑕᐅᓯᒪᔪᓂ MARK-ᒥ ᐃᒪᐃᑎᑦᑎᖅᑰᔨᕗᑦ, ᖃᓱᐅᓂᖓᓐᓄᑦ ᖃᓱᐅᓇᑦᑎᔭᐅᔪᒥ 1525–ᓂᒃ (ᑕᒪᖅᑕᐅᓚᒃᐸᒃᑐᖅ [SE] = 294) 2015 – 2017–ᒧᑦ ᐊᔾᔨᖃᑲᓱᓚᐅᖅᐳᖅ ᐅᓄᕐᓂᕆᔭᖓᓐᓄᑦ 1998 – 2000–ᒥ (1610 [SE = 266] ᑕᕝᕙᓂ ᖃᐅᔨᓴᕐᓂᕆᔭᐅᔪᒥ; 1592 [SE = 361]ᐅᕙᓂ, Taylor et al. [2009–ᒥ]).

ᓇᓄᕋᓛᖅᑖᕆᔭᐅᔪᑦ ᐊᕐᕌᒍᒧᑦ ᐊᕐᕌᓂᓕᓴᐃᓪᓗ ᐊᖏᑎᒋᓂᖏᑦ 2015 – 2017–ᒧᑦ 1.61–ᖑᓚᐅᖅᐳᑦ (95%–ᒥᒃ ᑕᕝᕙᒪᕆᐅᓂᖏᓐᓂᒃ [CI] = 1.51 – 1.70) ᐊᒻᒪᓗ 1.53 (95% CI 1.41– 1.64), ᑭᖑᓪᓕᖕᓗᑎᒃ, ᐅᔾᔮᕐᓇᖅᑐᒥᒃ ᖃᓄᐃᓕᕙᓪᓕᐊᓂᑲᕋᓂ ᑕᑯᓪᓗᒍ 1998 – 2000. ᖃᓯᐅᓂᕆᔭᖏᑦ ᐊᕐᕌᓂᓕᓴᐃᑦ ᐃᓐᓇᕐᒧᑦ ᐊᕐᓇᒧᑦ 2015 – 2017–ᒧᑦ 0.36–ᖑᓚᐅᖅᐳᖅ (95% CI = 0.26 – 0.47) ᑕᒪᓐᓇᓗ ᐃᒪᐃᑎᑦᑎᖅᑰᔨᓪᓗᓂ, ᑖᓐᓇ GB ᒫᓐᓇ ᕿᑐᙵᕆᐅᕐᕕᐅᓪᓗᓂ ᓇᓄᕐᓂᑦ, ᓱᑯᖓ ᐊᓯᔾᔨᖅᓯᒪᓕᕋᓗᐊᖅᑎᓪᓗᒍ. ᑕᒪᓐᓇ ᐊᔾᔨᖃᖅᐳᖅ ᖃᐅᔨᔭᑦᑎᓐᓂᑦ ᓇᓄᐃᑦ ᑎᒥᖏᑕ ᖃᓄᐃᓕᖓᓂᖏᑦ (ᓲᓗ, ᖁᐃᓂᓂᖏᑦ) ᐅᐱᙵᒃᑯᑦ ᐊᖏᒃᓕᒋᐊᓚᐅᖅᓯᒪᔫᖅ ᐅᑯᓇᓂ, 1998-2000–ᒥ ᐊᒻᒪᓗ 2015-2017-ᒥ. ᖃᐅᔨᓚᐅᖅᐳᒍᑦ ᑭᓲᓂᖏᓐᓂᒃ ᖃᓯᓂᒡᓗ ᐊᕐᕌᒍᖃᕐᓂᖏᓐᓂᒃ–ᐱᔪᑎᖃᓪᓗᐊᑕᖅᑐᒥᒃ ᐊᔾᔨᙱᓐᓂᕐᒥᒃ ᑲᑎᕝᕗᒋᑦ ᐆᒪᔪᓐᓇᕐᓂᕆᔭᖏᓐᓂ (ᓲᕐᓗ ᐃᒪᓐᓇ, ᐃᓚᒋᔭᐅᓗᓂ ᐊᖑᔭᐅᓯᒪᔪᑦ ᑐᕐᖁᑕᐅᔪᑦ) ᖁᑎᖕᓂᖅᓴᒥᒃ ᖃᓯᐅᓇᓱᒋᓈᔪᖃᖅᑳᓂ ᐃᓐᓇᕐᓄᑦ ᐊᕐᓇᓄᑦ (0.95;95% CI=0.81-0.99) ᐃᓐᓇᕐᓂᑦ ᐊᖑᑎᓂᑦ (0.85;95% CI=0.74-0.92 ᐊᕐᕋᒍᓄᑦ 2005-2017. ᐊᒃᑐᐊᓂᖃᑐᐃᓐᓇᕆᐊᓕᖕᒥᒃ ᖃᓄᐃᓕᖓᓕᕐᓂᕐᒥᒃ ᖃᐅᔨᔭᐅᔪᖃᓚᐅᖅᐳᖅ ᐅᓄᖅᓯᒋᐊᕐᓂᐅᓪᓗᓂ ᖃᓯᐅᓂᕆᔭᖏᓐᓄᑦ ᐊᕐᓇᐃᑦ 0.57–ᒥᑦ 1998–2000-ᒥ 0.61–ᒧᑦ 2015–2017–ᒥ. ᖃᓯᐅᓂᖏᓐᓄᑦ ᐅᓄᖅᓯᕙᓪᓕᐊᓂᖏᑦ ᖃᓯᐅᓇᓱᒋᔭᐅᓂᖏᑦ ᐊᑐᖅᑐᖃᖅᑐᓂ matrix ᖃᓅᓂᐊᕋᓱᒋᓈᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᓇᔭᖅᑐᒥᒃ ᖃᓯᐅᓇᓱᒋᓈᔪᖃᑐᓂ ᑲᑎᕝᕗᒋᑦ ᐆᒪᓂᕆᔭᖏᑦ 0.06-ᖑᓚᐅᖅᐳᖅ (95% CI = 0.06 - 0.12) 2005-2007–ᒧᑦ, ᐃᒪᐃᑎᑦᑎᖅᑲᖅᑰᔨᓪᓗᑎᒃ ᓴᙱᕗᒥᒃ ᐊᕙᙱᓐᓂᖃᑐᐃᓐᓇᕆᐊᖃᖅᑐᑎᒃ ᐱᕈᖅᐊᓪᓕᐊᓂᕐᒥᒃ. ᑭᓯᐊᓂᓗᑦᑕᐅᖅ, ᖃᔮᔭᕙᑦ ᖃᓯᐅᓂᖓᑕ ᐅᓄᖅᑎᒋᓂᖏᑦ ᖃᓄᐃᓕᕙᓪᓕᐊᓂᖏᓪᓗ ᑐᑭᖃᖅᑎᑕᐅᓕᓪᓗᐊᖅᐳᑦ ᐅᔾᔮᖅᓯᑎᐊᖅᑐᖃᕐᓗᓂ ᐃᒪᐃᓐᓂᖓᓄᑦ, ᖃᓯᐅᓇᓱᒋᓈᓂᕙᑦ ᐅᓄᕐᓂᖏᑕ ᐊᒃᑐᐊᓂᖃᓪᓚᑦ "ᐅᓄᕐᔪᐊᕐᓂᖏᓐᓄᑦ" (ᓲᕐᓗ ᐃᒪᓐᓇ, ᑕᒪᓐᓇ ᐃᓚᖃᖅᐳᖅ ᓇᓄᓕᒫᓂᒃ ᐊᑐᖅᐸᒃᑐᓂᒃ GB-ᒥᒃ ᐃᓂᒥᒃ ᐊᐅᓚᑦᑎᕕᐅᔪᒥᒃ, ᐃᓚᖏᓪᓗ ᐊᓯᒥᓂᑦᑕᐅᖅ ᓇᓅᖃᑎᒋᔭᓃᑉᐸᒃᓗᑎᒃᑕᐅᖅ) ᖃᓯᐅᓇᒋᓈᓂᖅᐳᓪᓗ ᖃᓯᐅᓂᖏᑕ ᐅᓄᖅᓯᕙᓪᓕᐊᓂᕆᔭᖏᓐᓄᑦ ᐃᓚᕋᙱᓚᖅ ᐊᓯᐊᓄᐊᕋᔭᕐᓂᕐᒥᒃ ᑕᐃᑲᓃᖏᓐᓇᓂᕐᓗᓂᓗ GB–ᒥᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐃᓂᒥᑦ. ᐊᑕᖑᑦ ᓪᓗᓂ, ᖃᐅᔨᔭᕙᑦ ᑕᑯᑎᑦᑎᖅᑰᔨᕙᑦ ᓇᓂᐅᓂᖏᓐᓄᑦ ᖃᓄᐃᓕᖓᓂᖏᑦ GB–ᒥ ᓇᓄᕆᔭᐅᒃᑲᓐᓂᖅᑐᑦ ᒫᓐᓇ ᖃᓄᐃᙶᕈᑉᐳᑦ, ᐃᒪᐃᒃᑲᓗᐊᖅᑎᓪᓗᒍ, ᐃᒪᐃᓕᐅᕐᑰᔨᓇᔭᖅᑎᓪᓗᑕ ᐊᑦᑎᖕᓂᖅᓴᓂᒃ ᖃᓯᐅᓇᓱᒋᓈᓗᑎᒃ ᑲᑎᕝᕗᒋᑦ ᐊᖑᔭᐅᓯᒪᙱᑦᑐᓄᓪᓗ ᐆᒪᔪᓐᓇᕐᓂᕆᔭᖏᓐᓄᑦ ᐊᖑᑎᖏᑕ ᓇᓄᐃᑦ ᓱᓕ

ᖃᐅᔨᓴᖅᑕᐅᒃᑲᓐᓂᕆᐊᖃᖅᑎᑦᑎᕗᑦ. ᐃᒪᓐᓇᐅᓇᓱᒋᓐᓈᕗᒍᑦ, ᐃᓂᒥᓂ ᓇᓃᓐᓂᖕᒋᓐᓄᓪᓗ ᒥᑭᓪᓕᒋᐊᖅᑐᖅ ᑐᕋᒥ ᐱᑎᑦᑎᑐᐃᓐᓇᓇᐊᖃᖅᓯᒪᕗᖅ ᓅᓐᓂᕐᒧᑦ ᐱᕚᓪᓕᕈᑕᐅᓯᒪᔪᓂᒃ GB–Γ ᓇᓄᓇᔭᐅᒃᑲᓐᓂᖅᑐᓄᑦ ᑕᐃᒪᐃᔾᔪᑎᖃᖅᑰᑎᒃ ᓄᓇᒥᐅᑕᐅᓂᕐᒧᑦ ᐅᓄᖅᓯᕙᓪᓕᐊᕙᖕᓂᓇᔭᖕᒋᓐᓄᑦ. ᓯᓚᐅᑉ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᖕᒐ ᐱᓪᓗᐊᑕᕗᖅ ᐊᕗᖕᒐᑲᓪᓚᒃ ᖁᐊᖅᓛᕐᓇᖅᑎᑦᑎᓪᓗᓂ ᓇᓄᕐᓄᑦ ᐊᑐᖅᑕᐅᓕᕋᔭᖅᑐᒧᓪᓗ ᑕᒪᒃᑯᐊ GB–Γ ᓇᓄᓇᔭᐅᒃᑲᓐᓂᖅᑐᑦ ᐱᐅᙱᑦᑐᒃᑯᑦ ᐊᒃᑐᖅᑕᐅᓇᔭᕐᓂᖕᒋᓐᓂᒃ ᑲᔪᓰᓐᓇᖅᑐᒃᑯᑦ ᑐᕋᖅ ᓄᖑᑉᐸᓪᓕᐊᓂᕿᔭᖕᒐᓄᑦ, ᓱᕐᓗ ᐊᓯᖕᒋᓐᓄᑦ ᓇᓅᖃᑎᒋᓄᑦ, ᒫᓇᒧᑦ ᑎᑭᕝᕆᒍ ᖃᐅᔨᒪᔭᐅᙱᓚᖅ. ᑕᒪᓐᓇ ᖃᐅᔨᓴᐃᓄᒋᐊᓐᓂᖕᒋᑦᓂᓇᔭᐅᔪᖅ ᑭᒐᖅᑐᐃᕗᖅ ᐊᐃᑉᐸᖓᓂᒃ ᐋᖅᑭᒃᓱᖅᑕᐅᓯᒪᔪᓂ ᖃᔅᓯᐅᓂᖕᒋᓐᓄᑦ ᖃᐅᔨᓴᖅᓯᓂᖅ 22–ᓂ ᐊᕐᕌᒍᓂ GB-Γ ᓇᓄᓇᔭᐅᒃᑲᓐᓂᖅᑐᓄᑦ. ᑐᙵᕕᒋᓪᓗᒍ ᐱᓕᕆᖃᑦᑕᖅᓯᒪᓂᖅ ᐱᔭᐅᔪᖅ ᑕᕝᕙ ᖃᐅᔨᓇᓱᖕᓂᒃᑯᑦ ᖃᐅᔨᓴᕐᓂᒃᑯᓪᓗ, ᑐᓂᓯᕗᒍᑦ ᖃᔅᓯᑲᓪᓚᖕᓂᒃ ᖃᓄᐃᓕᐅᕐᑯᔨᓂᕐᓂᒃ ᐃᓱᒪᒃᓴᖅᓯᐅᕈᑕᐅᓂᐊᖅᑐᓂᒃ ᐱᕋᓖᔭᖅᑐᖅᑲᓕᖅᐸᑦ ᓯᕗᓂᒃᓴᒥ ᓇᓄᕐᓂᒃ ᖃᔅᓯᐅᓂᖕᒋᓐᓄᑦ ᖃᐅᔨᓴᕐᓂᓇᔭᐅᔪᓂ. ᐃᒪᓐᓇᐃᓕᐅᕐᑯᔨᓇᔭᖅᐳᒍᑦ, ᑲᑎᖅᓱᐃᔪᖃᕐᓗᓂ ᑎᑎᕋᖅᓯᒪᒃᑲᓐᓂᖅᑐᓂᒃ ᕿᑎᐸᓗᐊᓂ ᐱᕋᓖᔭᖅᑕᐅᓯᒪᔪᑦ ᖃᔅᓯᐅᒃᑲᓐᓂᕐᓂᖕᒋᓐᓄᑦ ᖃᐅᔨᓴᕐᓂᕐᓂ. ᑕᐃᒪᐃᓐᓂᖕᒐᓄᓪᓗ, ᑕᒪᓐᓇ ᓇᓕᒧᒋᔭᕐᑲᖅᐳᖅ 5–7–ᐸᓗᖕᓂᒃ ᐊᕐᕌᒍᓂᒃ 2017–Γ ᐱᔭᓇᖅᑕᐅᓚᐅᖅᑐᒥ ᓯᓚᒥ ᐱᓕᕆᓂᕆᔭᐅᔪᒥ. ᐊᒻᒪᓗᒃᑲᓐᓂᖅᑕᐅᖅ, ᑕᒪᓐᓇ ᖃᓄᐃᓕᐅᓕᕐᑯᔨᓂᖅ ᓄᒃᑕᖅᐸᖕᓂᖕᒋᓐᓄᑦ ᑎᑎᕋᖅᓯᒪᔪᑦ ᓄᑖᖑᙱᑎᓪᓗᒍ, ᐊᑐᕐᑯᔭᐅᓯᒪᑦᑎᐊᖅᓯᒪᕗᖅ ᓇᓅᖃᑎᒋᒃᑲᓐᓂᖅᑐᓄᑦ ᖃᐅᔨᒪᔭᐅᔪᑎᒍᑦ ᐃᓂᒥ ᐊᒥᖅᑲᑲᑎᖃᖅᐸᖕᓂᖕᒋᓐᓂᒃ ᓇᓄᐃᑦ ᑖᒃᑯᓇᓂ ᐃᓂᓂ. ᐱᑕᖃᙱᓐᓂᖕᒐᓄᑦ ᖃᖕᒐᑦᑕᖅᑎᑕᐅᓯᒪᔪᑎᒍᑦ ᑎᑎᕋᖅᑕᐅᓯᒪᔪᓂᒃ ᓇᓄᐃᑦ ᓄᒃᑕᕐᓂᓇᕋᒃᑕᖕᒋᓐᓄᑦ, ᑲᔪᓯᑎᑦᑎᓂᖅ ᖃᐅᔨᓴᖅᓯᓂᕐᒥᒃ ᖃᐅᔨᓴᕈᒪᓂᕐᒧᑦ ᐊᒥᖅᑳᖅᑲᑎᒌᒃᐸᖕᓂᓇᔭᖕᒋᓐᓄᑦ GB–Γ ᖃᓂᒋᔭᖕᒐᓂᓗ ᓇᓄᓇᔭᐅᒃᑲᓐᓂᖅᑐᓄᑦ (ᓱᕐᓗ ᑕᓪᓗᕈᑎᐅᑉ ᐃᒪᖓ, GB, ᐊᒻᒪᓗ M'Clintock Channel) ᐃᑲᔪᑐᐃᓐᓇᓇᐊᖅᑲᖅᐳᑦ ᒥᑭᓪᓕᒋᐊᖅᑎᑦᑎᓗᓂ ᐃᓚᖓᓂᒃ ᓇᓗᓇᕈᔪᒃᐸᒃᑐᒥᒃ ᐃᓛᒃᑰᖅᑐᓄᑦ ᓇᓄᓇᔭᐅᒃᑲᓐᓂᖅᑐᓄᑦ ᖃᔅᓯᐅᓇᓱᒋᓐᓈᓂᕐᓂᒃ ᑕᒪᒃᑯᓄᖓ ᐃᓂᓄᑦ. ᑭᖑᓪᓕᖅᐹᒥᒃ, ᐱᕕᒃᓴᖅ, ᐊᑐᖅᑕᐅᔪᓐᓇᖅᑐᑦ, ᐊᐅᓚᑦᓂᕐᒧᓪᓗ ᑐᕌᓇᔭᐅᔪᑦ ᑕᐃᒪᐃᑦᑐᓐᓇᖅᑎᑦᑎᒃᐸᑕ, ᐃᒪᓐᓇᐅᕐᑯᔨᓇᔭᖅᐳᒍᑦ, ᑲᔪᓯᑎᑦᑎᔪᕐᑲᕐᕐᓗᓂ ᖃᔅᓯᐅᓂᖕᒋᓐᓄᑦ ᐊᖑᓗᓂ ᖁᐊᖅᓵᕐᓇᑐᐃᓐᓇᓇᐊᓕᖕᒧᑦ ᖃᐅᔨᓴᖅᓯᓂᕐᒥᒃ ᑐᓴᐅᒪᑎᑦᑎᔪᒪᓂᕐᒧᑦ ᑲᔪᓰᓐᓇᕈᓐᓇᖅᑐᓄᑦ ᐊᖑᓂᕐᒧᑦ ᖃᔅᓯᕌᕈᓐᓇᕐᓂᓇᔭᐅᔪᓄᑦ.

1.C) EXECUTIVE SUMMARY INNUINAQTUN

Naunaiyaqni Amigaitpiaqni tapkuat Tariunga Boothia Nannut amigaitni Ilangi Atuqtauyut Aqnallut Anguhallut Titiqni-Angutqiktauyut

Aulapkaiyini Naittuq

Nannut (*Ursus maritimus*) aulatauyut humiliqak Nunavut, Kanata, atuqhugit haviktakhat havagutai pinahuat atuqpiaqni angutauyut ihuaqhihimanit. Taimaa 10nik ukiunik, hilaup aadlangurninnga tamainni Ukiuqtaqtumi aadlanguqtitait nanuit nayugangit aadlatqiiktumik nampanik. Pitariangi naamaktumik nannut amigaitni ilangi ilaunit tapkununga uumatyutit atuqpiaqni piyaunginnalaqnit niqikhanut piqaqnit tahapkununga Inuit, naunaiyainiq naunaiyaut munarinilu naunaiyautit havariyauyut naunairiangi amigaitni ilangi qanuritni aulatauninutlu ihumagini piyakhai. Hamani tuhaqhitautivut tapkuat qanuritni amigaitni naunaiyaut tapkununga nannut nayuqpaktat Tariunga Boothia (GB) havariyauyuq 2015-2017. Nutaat uuktuutingit katitiqtauyut aturhutik mikitqiamik-pittailiniq ihariagiyainnik niqinginnik piiyaqtauniq kapuqtauyut nutqaqtihimaittumik akhuraalukluuniit pilugit nanuit. Qauyihainivut ilalik 2015-2017 uumatyutit naunaiyautit tuhagakhat, uumatitlugit-tiguyauni tuhagakhat katitiqni atuqhugit hanatyuhikhat naunaiyaqni 1998-2000, uumatitlugit-tiguyauni tuhagakhat katitauni pilalirangata 1976-1997, angutauyutlu utiqtitni tuhagakhat tamaitnut pivigiyaini 1976-2017. Qanuritni uumatitlugit-tiguyaunituqungayut-utiqtitni pityuhit ihuaqhihimayut tapkunani Havagut MARK piniraqtai anginiqhamik amigaitni mikhautni tapkuat 1525 (atuqpakni ulamniqni [SE] = 294) pivigiyanut 2015-2017 ayyikkutapyagiya anginiqpaq amigaitni talvani 1998-2000 (1610 [SE = 266] uumani naunaiyaut; 1592 [SE = 361] talvani Taylor et al. [2009]). Anginiqpaq piarait-ukiumun tapkuatlu ukiulgit piarait aktilangi pivigiyanut 2015-2017 tapkuanguyut 1.61 (95% nalungitninut akunit [CI] = 1.51-1.70) tamnalu1.53 (95% CI = 1.41-1.64), tuklirinut, pitquhiqaqungitnit hutqikni tapkuat 1998-2000. Tamna anginiqpaq qaphiuni ukiulgit atuni iniqnit aqnallut pivigiyanut 2015-2017 tamnauyuq 0.36 (95% CI = 0.26-0.47) tapkuat piniraqtai tamna Tariunga

Boothia tatya piruttiaqtut nannut amigaitni ilangi, pigaluaqtitlugu tariup hikua allanguqnia. Una malikhaqmiya naunaiqtavut tapkuat nannut timingi qanuritni (naunaipkutariplugu, uqhuqaqnit) upingami ilagiaqtut akungani pivigiyai 1998-2000 tamnalu 2015-2017. Naunaiqtavut aqnallut anguhallut- ukiungilu-tainit allatqit katitlugit annaumani aktilat (naunaipkutariplugu, ilautitlugit angutat tuqutaunit) puqtutqiyautitlugit mikhautni iniqnit aqnallut (0.95; 95% CI = 0.81-0.99) tapkunangaunganit iniqnit anguhallut (0.85; 95% CI = 0.74-0.92) pivigiyanut 2005-2017. Atulaq turangayuq aktuania naunaiqtauyuq ilagiaqni avikhimaninut amigaitni qnallut talvanga 0.57 talvani 1998-2000 tikitlugu 0.61 talvani 2015-2017. Tamna ayyikkiquqni, taittiaqni amigaitni aglivaliani aktilat kititni atuqhugit kitityutit pinahuginit uuktut mikhauttaqnigut katitlugit annaktut tamnauyuq 0.06 (95% CI = -0.06-0.12) pivigiyanut 2005-2017, piniraqhugit akhut aglivalialaqni. Kihimik, qanuritnivut amigaitni ilangi aktilat pitquhitlu tukiliuqtakhat munarilugit piplugu mikhautnivut amigaitninut pihimani tapkuat “amigaitniqpanguni” (naunaipkutariplugu, ilalgit tamaita nannut atuqtat Tariunga Boothia aulatauvia inaa, ilangi nayuqtat ahii amigaitni ilangiluttauq) mikhautavutlu amigaitni aglivaliani aktilat piyaungittut ahiningartaqnit taphumanga Tariunga Boothia aulatauvia inaa. Tamaitnut, nalvaqtavut piniraiyut tapkuat amigaitni qanuritnit taphuma Tariunga Boothia amigaitni ilangi tatya nakuuyut, pinahuaquigaluaqhuta pukkitqiyat mikhautnit katitninut angutaungittutlu annaumani anguhalluit nannut naunaiyatqikharialgit. Pinahugiyavut tapkuat akuttuni mikhivallilaknilu tariup hikua piqarutaulat nuktiraqninut ikayuqtat tamna Tariunga Boothia amihuni ilangi piplugu ilagiaqni uumatyutit piaraniktaqni. Hilap allanguqnia tamna pityutauniqhaq hivituyumun hivuranauta nannut nayuqpaknitlu avataanut Tariunga Boothia amigaitni ilangi ihuittumik aktualaqni hikuiqpalianginnaqat, taimattauq ilai nannut amigaitni ilangi, tatya naunaqmata. Una naunaiyaut kivgaqtuta aipanik hanatyuhit amigaitni naunaiyaqni tapkunani 22 ukiut tahamunga Tariunga Boothia amigaiti ilangi. Piplugit atuqhimani piyauyut atuqhugu una naunaiyaut qauyihaqnitlu, tuniyavut qaphit aturahuaquni ihumagiyauyukhat parnaiyaititlugit hivunikhami nannut amigaitni naunaiyautit. Aturahuaquyavut katitiqni ilagiarutit tuhagakhat mikhaani qitqani akungani parnakhimayat amigaitni ilangi naunaiyaqni. Uumani piplugu, tamna piya mikhaani 5-7 ukiut talvanga 2017 iniqtauni maniqami havat. Ilagiaqhugu, pigaluaqtitlugit aturahuaquni nuktiraqnit tuhagakhat nutaungittut, huli pinahuaquyauqpiaqtuq tapkununga amigaitni ilangi ilihimayqnut himmiqtautai nannut akungani inait. Piqangititlugu qangattaqhimayunik takukhautitni tuhagakhat nannut nuktiraqnit, havarinia angiyumik-qauyihaqni naunaiyautit himmiqtautai akungani Tariunga Boothia hanianilu amigaitni ilangi (naunaipkutariplugu, Lancaster Hanikgakhik, Tariunga Boothia, tamnalu M'Clintock Kangikhuakyuk) ikayulat naunairutai ilai naunaqtut piplugu ilikkut amigaitni ilangi tahapkuat inait. Kingulliqpamik, pikpat pivikhait, piqaqni, aulataunilu ihumagiyauyut piyaqaliqturini, aturahuaquyavut havarini amigaitninut angutat hivuranaqni naunaiyaqni tuhaqhittangi ihuaqhihimani angutat puqtunit.

2. INTRODUCTION

Wildlife managers face complex decisions when seeking to balance conservation and human priorities. Decisions and outcomes must be evaluated periodically so that new information can be fed back into an adaptive management framework (Holling 1978, Lancia et al. 1996, Johnson 1999). Accurate and up-to-date estimates of population abundance are often a key component of informed management decisions (Nichols and Williams 2006). Typically, new estimates of abundance are acquired periodically according to a monitoring interval that is determined by management objectives, resource availability, and species' biology (Gibbs 2008). As climatic changes affect many areas around the globe, shortened monitoring intervals may be required to understand the concurrent effects of management interventions and environmental change. Broadly, more frequent monitoring can increase the probability of meeting management objectives and reduce the severity of potential negative outcomes resulting from mis-specified management interventions (Taylor et al. 2007, Regehr et al. 2017).

One species that has received significant monitoring attention is the polar bear (*Ursus maritimus* Phipps 1774). Polar bears are characterized by having delayed maturation, small litter sizes, and high adult survival rates (Bunnell and Tait 1981). They are apex predators and as such bioaccumulate environmental contaminants (e.g., Derocher et al. 2003, Fisk et al. 2009, McKinney et al. 2009, 2011, Letcher et al. 2010, Routti et al. 2019). As a circumpolar species that depends on the sea ice for hunting, travel, mating, and in some instances denning (Amstrup 2003), sea ice loss resulting from climate change is predicted to impact polar bear subpopulations severely (Derocher et al. 2004, Stirling and Parkinson 2006, Amstrup et al. 2008, Durner et al. 2009, Stirling and Derocher 2012, Atwood et al. 2016, Regehr et al. 2016). The global polar bear population, consisting of 19 subpopulation units, is estimated to be approximately 26,000 polar bears (Obbard et al. 2010, Wiig et al. 2015). Currently there is no empirical evidence for declines in global abundance due to sea-ice loss (Regehr et al. 2016). However, some subpopulations have exhibited negative effects resulting from climate change (e.g., Bromaghin et al. 2015, Lunn et al. 2016) and accurate assessment of global changes is complicated by poor data for many polar bear subpopulations (Durner et al. 2018, Hamilton and Derocher 2018), spatial and temporal variation in the effects of sea-ice loss (Rode et al. 2014), and the fact that some subpopulations have likely recovered in recent decades from overexploitation prior to the 1973 Agreement on the Conservation of Polar Bears (Honderich 1991, Larsen and Stirling 2009).

Despite the on-going research and monitoring efforts, reliable and updated abundance and demographic information about all subpopulations is still lacking (Obbard et al. 2010, Vongraven et al. 2012). Polar bear research is expensive and logistically challenging, especially for management jurisdictions that oversee multiple subpopulations. Nunavut, Canada, is home to 12 subpopulations (8 shared with other jurisdictions, 4 entirely within Nunavut; Obbard et al. 2010) and as such carries the major responsibility of polar bear research in Canada. In order to maintain healthy and viable polar bear subpopulations, population studies in Nunavut are carried out on average within a 10 - 15-year rotational cycle, which can vary depending on research needs, priorities, and available resource (Hamilton and Derocher 2018). Here we present findings from a 2015 - 2017 study to estimate abundance and evaluate the demographic status of the Gulf of Boothia (GB) polar bear subpopulation.

Gulf of Boothia (GB) is a relatively small polar bear subpopulation area that is entirely managed by Nunavut (Fig. 1). An initial physical mark-recapture study was carried out from 1973 - 78 for the M'Clintock Channel (MC) and the adjacent GB subpopulations, although at the time it did not identify these as separate management units. The total abundance estimate for both areas was 1081 bears (Furnell and Schweinsburg 1984, Urquhart and Schweinsburg 1984). The estimate was known to be biased by non-representative sampling and was subsequently increased to 900 for GB and 900 for MC (Furnell and Schweinsburg 1984, Aars et al. 2006) based on the fact that the entire area was sampled, and the knowledge of Inuit local hunters about polar bear abundance in the broader study area (Derocher et al. 1998, Aars et al. 2006).

The GB and MC subpopulations were later delineated based on movements of satellite radio-collared adult female bears, recoveries of research tags in the harvest (Taylor and Lee 1995, Taylor et al. 2001), Inuit knowledge about how local conditions may influence the movements of polar bears (Keith et al. 2005), and genetic analyses (Paetkau et al. 1999, Campagna et al. 2013, Malenfant et al. 2016).

Prior to this study, the most recent population inventory work for GB was completed in 2000, where abundance (mean ± SE) was estimated to be 1592 ± 361 polar bears (Taylor et al., 2009). Based on those results, the population was considered stable or very likely increasing during the early 2000s due to a high intrinsic growth rate and relative low harvest levels (Taylor et al. 1987, 2009, Durner et al. 2018). However, harvest rates for GB increased from an average of 40 bears per year (with a Total Allowable Harvest [TAH] of 41) as reported by Taylor et al. (2009), to 62 bears per year (22 females and 40 males on average annually with a TAH of 74 starting in 2004/2005; Government of Nunavut (GN), unpublished data), between 2005 and 2017 (GN, unpublished data). How this change in harvest may have affected the GB subpopulation abundance and status is unclear.

Polar bears in Nunavut are managed through a co-management system and memoranda of understanding (MOU) between each community's Hunters and Trappers Association and the territorial government[1]. These MOUs lay out harvest, management and research aspects for each polar bear subpopulation. Under the existing 2005 MOU, the GN committed to begin a new population study for GB in 2015. The new study had the objective to estimate the current subpopulation size and composition, and to compare these results to the former study. In addition, we sought to obtain data that would provide estimates on survival and reproductive parameters that can be used in population viability analyses and a quantitative harvest risk assessment. Lastly, by implementing a research method that was minimally-invasive and supported by local communities and stakeholders, we sought to evaluate whether genetic mark-recapture

[1] As of September 2019 the Nunavut Polar Bear Co-Management Plan is replacing the Memoranda of Understanding.

can be compared with traditional capture mark recapture studies previously done in GB in order to establish longer term trends for population monitoring (Vongraven and Peacock 2011, Vongraven et al. 2012).

3. STUDY AREA

The GB polar bear subpopulation lies entirely within Nunavut and encompasses an area of approximately 67 000 km^2 (excluding land; Taylor et al. 2001, 2009, Barber and Iacozza 2004, Hamilton and Derocher 2018; Fig. 1). The management unit is bound by the Boothia Peninsula to the west, and Brodeur Peninsula to the east. The geography of the study area is described in Schweinsburg et al. (1981). The current management boundary is mainly based on telemetry data for adult female bears that were fitted with radio-collars, tag returns from harvested bears (Schweinsburg et al. 1982, Bethke et al. 1996, Taylor et al. 2001), and genetic analyses (Campagna et al. 2013, Malenfant et al. 2016). Validity of the current boundary has been questioned by Inuit local knowledge (Keith et al. 2005).

Sea ice generally begins to form in early October and persists until July or August in most areas of GB (Schweinsburg et al. 1981). The most southerly area of GB, namely Committee Bay, remains mostly ice-covered throughout the year (Barber and Iacozza 2004). The presence of various ice types such as mobile, multi-year rubble, and first-year ice creates diverse seal habitat across GB (Barber and Iacozza 2004). Recent sea ice and climate data analyses indicate that the Arctic sea ice quality and abundance has changed during the past 30 years and that in most polar bear subpopulations, the sea ice melts sooner and forms later than in the 1980s (Stroeve et al. 2012, Stern and Laidre 2016, Regehr et al. 2016, Environment and Climate Change Canada 2019). Currently, sea ice persists across GB to various degrees throughout the year, but it is predicted that GB may be ice-free for 5 months each year by the late 21st century (Hamilton et al. 2014).

4. METHODS

Sampling – field collections

Our 2015 - 2017 study design was informed by the previous physical mark-recapture study conducted in GB 1998 - 2000 (Taylor et al. 2009; Fig. 2), although our study did not involve the immobilization and physical handling of bears. Inuit co-management partners in Nunavut expressed concern over wildlife capture and handling during a wildlife symposium in 2009 (Lunn et al. 2010, Department of Environment 2013). As a result, the responsible government management agency explored alternative research methods. Given the generally low densities of bears on the sea ice and the vast study area, genetic mark-recapture was selected since it is minimally invasive (Garshelis 2006) and has been successfully applied on various species, including bears (Brown et al. 1991 (right whales [*Eubalaena glacialis*]), Palsbøll et al. 1997 (humpback whales (*Megaptera novaeangliae*)), Boulanger et al. 2004, Olson 2009 (brown bear (*U. arctos*)), Pagano et al. 2014, SWG 2016 (polar bear)). From 2015 - 2017, our biopsy darting sampling sessions occurred between April to late-May each year where we searched the sea ice and near-shore areas for bears across the entire study area. We allocated approximately 100 hours of helicopter time for each field season to search for bears. We obtained genetic material for individual bears from a small sample of skin and hair collected via a remote biopsy dart (Pneudart Type C - Polar Bear) fired from a dart gun (Capchur Model 196) from inside a Bell 206 Long Ranger helicopter (Pagano et al. 2014). The extracted DNA was used to identify individual animals without the need for ear-tagging or lip-tattooing, which are typical methods for individual identification during live-capture studies (see section "Genetic analyses"). Recaptures occurred when a previously sampled bear was biopsy-darted on a later occasion or when a genetic sample was recovered through the Nunavut polar bear harvest-monitoring program. Every hunter in Nunavut is required to submit samples from each polar bear harvest so that age, gender and various other variables can be used in ecological and demographic assessments (Nunavut Wildlife Act, SNu 2003).

Search areas were initially discussed with hunters and local Hunters' and Trappers' Associations during pre-study consultations to gain insight about sea-ice conditions and bear distribution. We also took past capture locations (Taylor et al. 2009) into account when searching the sea ice, adjacent coastal areas, and small islands of our study area (Figs. 2b and 3).

Searches for bears were conducted at approximately 100 - 120 m above sea level, and at average speeds between 120 - 150 km per hour. To minimize potential sampling bias, and to allow replication of this study, we used a semi-structured sampling approach. Generally, we flew transect lines across the sea ice and small islands with search intensity proportional to apparent bear activity (or bear presence). When signs of bears (e.g., tracks, bears, seal kills) were rare or plentiful, search transect lines reflected that with further (i.e., 11 - 16 km) or nearer spacing (i.e., 7 - 10 km), respectively. In that fashion, we were able to cover large sections of the study area efficiently (Fig. 3). We decided to fly our survey transects from east to west and vice versa whenever possible, and to be perpendicular to suspected density gradients based on local knowledge, past capture and hunter-provided harvest locations.

Once we located a bear, a small sample of tissue (<5 mm diameter), mostly skin with some adipose tissue attached to it (Pagano et al. 2014), was taken using a biopsy dart. All bears except cubs-of-the-year (C0s) were darted in the rump area from an approximate distance (or altitude) of 3 - 7 m. C0s in early spring are still small and easily confused (Atkinson and Ramsay 1995, Robbins et al. 2012), and therefore were not darted to avoid possible injury and the splitting-up of family groups. Every bear that was biopsied received a unique field identification number so that the genetic results and our field data could be cross-referenced and linked.

The biopsy darts are designed to fall to the ground after impact and can be retrieved without handling a bear. The effectiveness of these darts for sampling polar bears has been previously demonstrated (Pagano et al. 2014, GN, unpublished data and reports, SWG 2016). The darts are quick and easy to use and require less pursuit of bears than live-capture operations. On average, it took less than 4 minutes from when a bear was initially spotted to the time when the dart was picked up after darting a bear (GN, unpublished data). The design and relatively low velocity of the dart means that risk of injury to a bear is minimal. Typically, bears show no or very little response to the impact of the dart and are left with no obvious visible mark. In order to facilitate easy spotting of darts on the ice or in deeper snow, a 10 - 15 cm long and ~2 cm wide strip of brightly colored flagging tape (C.H. Hanson, Naperville, IL; or Johnson, Montreal, PQ) was tied and wrapped around the distal end of the dart.

In addition to collecting the biopsy sample, we recorded the date, time and location of each observed bear (or group of bears), body condition based on visual assessment using a standardized fat index (e.g., Stirling et al. 2008; a scale from 1 - 5 with 1 being skinny, 3 average and 5 obese), specific markings or characteristics, group size or litter size, the estimated field age class (e.g., C0, yearling (C1), 2-year old, subadult [approx. 2 - 4 years], adult [approx. ≥ 5 years]) and estimated gender. Both field age-class and gender estimated included a confidence qualifier (i.e., a = high confidence; b = low confidence). Field age-class and gender throughout this project were assessed remotely from the helicopter at altitudes between 3 - 7 m by four experienced observers. When we encountered mothers and their dependent young, we distinguished C0s, C1s, and 2-year old offspring based on their size relative to their mother and physical features (e.g., blood or fecal/urine stains, scars) to a) assign them to a field age class, and b) avoid sampling the same individual more than once. Additional cues such as body size of the individual bear in relation to its surrounding or group members, body shape and proportions, presence of scars, secondary sexual characteristics, observation of urination, and gait were all used to estimate gender and age-class. Genetic microsatellite analysis was used later to confirm the gender of each sampled bear (see section Genetic analysis).

When field age class and gender of a bear were initially assessed with low confidence, additional field notes were taken. For example, young subadult male bears and younger adult females are at times difficult to discern from the air when they are solitary. If we thought that the encountered bear was a young adult female, but were uncertain (e.g., confidence classifier “b”) then we also noted what this bear could be as alternative – in this case “maybe a young subadult male”. When genetics confirmed the field estimate of sex, we assessed the identity of the bear as recorded initially. If the genetics returned a different sex, we reviewed our notes and concluded that the bear, in this example, must have been a young subadult male. Lastly, we recorded factors that may have influenced detection probability during sightings, including weather conditions (e.g., cloudy, clear, sun glare), bear activity when first observed, and sea-ice characteristics in general and within the immediate vicinity (~ 30 m) of an individual bear that may affect detection (e.g., sea ice type: flat, intermediate, rough multi-year ice).

Our work combined data collected during the genetic biopsy sampling sessions from 2015 - 2017, data from the previous capture-mark-recapture study conducted between 1998 - 2000, sporadic live-captures conducted from 1976 - 1997, and harvest recovery data for the entire period 1976 - 2017 (Peacock et al. 2012).

Sampling – recovering previously marked bears through harvest

To detect the recovery of previously individually identified bears (e.g., when bears were marked either during the initial mark-recapture study from 1998 - 2000, or from a previous biopsy-darting field season) by hunters, small muscle tissue samples were collected from all bears harvested in GB and surrounding subpopulations such as MC, Lancaster Sound (LS) and Foxe Basin (FB) throughout the duration of the current biopsy darting study (i.e., April 2015 - May 2017). Polar bear harvesting occurs throughout the year and these samples were stored in 2 ml cryovials (ThermoScientific, Nalgene long-term storage cryogenic tubes) at - 20˚C after submission to our laboratory until sample preparation and analyses.

Sampling - recovered bears from past population study

We examined captures and recaptures from the 1998 - 2000 population inventory, removed bears that we knew were dead (e.g., through a recovered ear tag or tattoo by harvest) and selected the remaining individuals that could be still alive (e.g., ≤ 34 years of age) in 2015 for genetic analyses. Samples (e.g., ear plugs from punching a hole through the pinna so that unique identification ear tags can be applied) of captured and re-captured bears from the initial study had been stored in cryovials at - 20˚C until preparation for genetic analyses.

Sample preparations

We used the same method to prepare all field and laboratory tissues or biopsy samples. Briefly, a lentil-size piece of skin (~ 1 - 1.5 mm thick) or tissue was obtained from either the biopsy sample, the ear plug, or the muscle tissue using a scalpel blade (# 20) then transferred onto a shipping card (Avery, 70 x 35 mm) and attached with scotch tape. Each sample card was labelled with the unique bear identification number, placed into a coin envelope (57 x 89 mm), and left to dry at room temperature for up to 3 days. The dried specimens where then sent to Wildlife Genetics International Inc. (Nelson, British Columbia) for individual genotyping and sex determination.

Genetic analysis

DNA was extracted from tissue with QIAGEN DNeasy Blood and Tissue Kits (Qiagen, Inc.). The tissue samples were genotyped at eight previously published dinucleotide microsatellite loci (REN145P07, CXX20, MU50, G10B, G10P, G10X, MU59, G10H; Paetkau and Strobeck 1994, Paetkau et al. 1995, 1998, Taberlet et al. 1997, Breen et al. 2001, Ostrander et al. 1993). Analysis of individual identity followed a 3-phase protocol previously validated for bears and described elsewhere (Paetkau 2003, Kendall et al. 2009).

To select markers for the analysis of individual identity, we used allele frequency data from approximately 1700 polar bears for which complete 20-locus genotypes existed before the genetic mark-recapture study began (GN, unpublished data). We ranked the 20 microsatellite markers in the dataset by expected heterozygosity. The eight most variable markers that could be analyzed together in a single sequencer lane were selected for use. These surpassed the required standard for marker variability (Paetkau 2003). In addition to the eight microsatellite markers, we analyzed sex, using a *ZFX*/*ZFY* marker. We searched the dataset for genotype matches that seemed unlikely based on our field data. In each case, three extra markers were added to the genotypes to lower the probability of chance matches between individuals. The extra loci confirmed these matches. Once the genotyping and error-checking was complete, we defined an individual for each unique eight locus genotype.

Sea-ice metrics

Other population studies have identified relationships between the spatial and temporal availability of sea ice and demographic parameters for polar bears (Regehr et al. 2007, Rode et al. 2012, Laidre et al. 2020). March and September mean ice concentrations were calculated for the entire GB area for each day sea-ice data were available and then averaged across 1979 - 2016 (Environment and Climate Change Canada 2018). We calculated the number of days between the sea ice retreat and sea ice advance in calendar year *t* using the transition dates when ice concentration dropped below, and exceeded, respectively, the midway point of sea ice concentration between the March and September mean (Environment and Climate Change Canada 2018). For the GB area, this transition sea-ice concentration was 63% (Environment and Climate Change Canada 2018). We describe the annual interval that sea-ice concentration was below the transition threshold as the “low-ice days” (Fig. 4). To evaluate the potential relationships between sea ice and the status of GB polar bears, we analyzed several metrics (e.g., body condition, recruitment, and survival) of bears in year *t* as a function of the duration of low-ice days in year *t*-1.

Body Condition Score

We compiled body condition score (BCS) data from two distinct time periods of mark-recapture population sampling in GB. Bears were assigned a BCS on a scale of 1 - 5 with 1 being skinny and 5 being obese (Stirling et al. 2008) through physical handling and capture (1998 - 2000) or aerial observation during biopsy sampling (2015 - 2017). All BCS observations occurred in April and May. Sex, age, and reproductive classes were assigned during physical handing during 1998 - 2000 and ages were determined based on previous capture history, known birth year, or from tooth analysis (Calvert and Ramsay 1998). During the biopsy sampling period, classification was done at approximately 3 - 7 m above the ground with sex verified by subsequent genetic analysis (SWG 2016). Observers who participated in classifying age class and sex during biopsy sampling had either participated in both sampling periods or were experienced in physical capture-mark-recapture studies.

The BCS raw scores were binned into 3 classes: 'poor' (1 - 2), 'average' (3), and 'good' (4 - 5) to follow recommended monitoring schemes (Stirling et al. 2008, Vongraven et al. 2012) and facilitate comparison with other studies (SWG 2016, Laidre et al. 2020). Like previous studies, we did not include dependent offspring in the BCS analyses because their body condition is dependent on maternal condition (SWG 2016). We excluded within-year observations of the same individual but retained observations of the same individual in different years.

We modeled BCS using ordinal logistic regression (Venables and Ripley 2002) and included *period* as an indicator of sampling period (early = 1998 - 2000 or late = 2015 - 2017). Reproductive status, age, and sex were combined into the four-level categorical variable *reproclass* (ADM = adult male, ADFI = independent adult female, ADFWO = adult female with offspring, and SUB = subadults of both sexes), and sampling day of year (*jul_cap_day)* were included as a continuous covariate to reflect the amount of time bears had on their preferred sea ice hunting platform before being sampled in year *t*. The sampling periods in this study also coincided with the annual seal pupping period, which is known to be prime feeding period for bears (Pilfold et al. 2012, Reimer et al. 2019). Thus, we predicted that increased time on the ice prior to sampling would be associated with higher BCS. The number of low-ice days ($icetm1_{t-1}$) was included to evaluate the hypothesis that interannual variation in BCS was related to sea-ice availability in the previous year. We selected a global model that reflected biological and environmental variables we hypothesized, or that have been shown in other studies, to be related to BCS (Rode et al. 2012, SWG 2016, Laidre et al. 2020). Finally, given our interest in evaluating whether different reproductive classes and genders had varying BCS based on the amount of time they spent on the sea-ice during the months immediately prior to observation (*jul_cap_day)*, and whether this relationship was different between our two sampling periods (*period)*, we included a three-way interaction between *reproclass, jul_cap_day,* and *period.* Once the global model was selected, we performed a backwards and forwards model comparison (stepAIC; Package MASS in the R programming language [R Core Team 2019]) to obtain the best-supported final model (ΔAIC < 2) (Table 1). We performed Lipsitz and Hosmer-Lemeshow tests to evaluate fit of the global ordinal regression model ($p > 0.1$; Fagerland and Hosmer 2017). Best-supported model covariates were considered significant at $p < 0.05$ (Wald X^2 tests) and predicted probabilities for each BCS class were calculated based on the suite of final-model covariates.

Reproduction

We evaluated reproductive indices for polar bears in GB using data from physical captures 1998 - 2000 and biopsy sampling 2015 - 2017. We used reproductive metrics that have been identified as important for monitoring polar bears (Vongraven et al. 2012). First, we C0 and C1 litter size as a function of biological, environmental, and temporal factors using logistic regression. We considered litter size (*ls*) for adult female *i* in year *t* to be a binary response variable (i.e., ls_{it} = 1 or 2). Analyses for C0 and C1 litters were performed separately using a three-step modeling approach, although we note that the C0 and C1 litter size data were not independent due to potential repeated measures and correlations (i.e., C1 litter size in year *t* is likely a function of C0 litter size in year t-1). We created a general model that included the main hypothesized sources of variation in the data. General models were simple due to small sample size. To ensure the general model was a suitable starting point for model selection, we evaluated goodness-of-fit (GOF) using Hosmer and Lemeshow tests (Hosmer et al. 2013). Second, we developed a candidate model set representing all combinations of main effects and interaction terms in the general model, with a marginality constraint to ensure that interactions were only included if the corresponding main effects were included. Third, we performed model selection using Akaike's Information Criterion adjusted for small sample size (AIC_c) and then estimated model-averaged parameters for all models with $\Delta AIC_c < 4$ (Burnham and Anderson 2002). Modeling was performed in the R programming language version 3.5.2 (R Development Core Team 2016) using package *MuMIn* (Bartón 2018) for multi-model inference.

The general model for C0 litter size was $ls_{it} = \beta_0 + \beta_1\, period_{it} + \beta_2\, icetm1_{it} + \beta_3\, BCS_{it} + \beta_4\, month_{it} + \beta_5\, period_{it} \times month_{it}$, where $period_{it}$ is a two-level factor indicating whether the observation of adult female *i* in year *t* was in the early or late period (1998 - 2000 and 2015 - 2017, respectively); $icetm1_{it}$ is the duration of the low-ice days in calendar year t-1 (see section Sea-ice Metric) for a polar bear observed in calendar year *t*; BCS_{it} is a three-level factor representing the body condition score of the adult female at the time of observation (see section Body Condition Score); $month_{it}$ is a two-level factor indicating whether a bear was observed in April or May; and $period_{it} \times month_{it}$ is an interaction term allowing the month effect to potentially differ between the early and late periods (e.g., because within-year temporal variation in litter size could change due to changes in sea-ice conditions, den emergence date, etc.). We hypothesized that litter size would be negatively correlated with *icetm1* (Laidre et al. 2020), positively correlated with *BCS* (Derocher and Stirling 1998), and negatively correlated with *month* because observations later in the spring reflected additional time in which cubs could die.

The general model for C1 litter size was $ls_{it} = \beta_0 + \beta_1\, period_{it} + \beta_2\, icetm1_{it} + \beta_3\, BCS_{it}$, where definitions of the predictor variables are the same as in the model for C0s.

We did not include the predictor $month_{it}$ because individual C1 survival is generally high (e.g., Regehr et al. 2017) and we did not expect litter size to change between April and May.

After evaluating patterns in litter size, we calculated the mean number of dependent young (C0 or C1) per adult female and evaluated differences between time periods. We also evaluated litter production rate, defined as the proportion of adult females that are available to breed in year t that produce a litter of C0 in year t+1 (Taylor et al. 1987). These metrics have been used as indices of productivity for other polar bear subpopulations (e.g., Peacock et al. 2013, Regehr et al. 2015). We quantified uncertainty using a nonparametric bootstrap procedure with 1,000 iterations during which observations of individual polar bears were resampled with replacement and the three reproductive metrics were calculated from the resampled data.

Survival

We used the Burnham capture-recapture model (Burnham 1993) in Program MARK (Cooch and White 2019) to analyze live-observation and dead-recovery data for the GB subpopulation. Live observations consisted of physical captures during which bears were assigned an individual identification number, or the identity of a previously captured bear was recorded; and biopsy sampling during which individual identification was determined from genetic analysis of a tissue sample (see sections above about recovering samples of bears through harvest and from the previous study). Live observations were conducted under random sampling protocols that attempted to search the entire area within the GB subpopulation boundary in 1998 - 2000 (physical captures) and 2015 - 2017 (biopsy sampling). Additionally, bears were physically captured and released each year 1976 - 1978, and sporadically during the period 1979 - 1997. Because research conducted from 1976 - 1997 did not follow a sampling protocol designed to evaluate demography, we included initial captures from this period but did not include recaptures of previously marked bears. This approach has been used in other analyses (e.g., Taylor et al. 2009) to increase the number of marked bears without introducing heterogeneity into recapture probabilities, which can result in biased parameter estimates (Peňaloza et al. 2014). Because recaptures were excluded or did not occur in some years, within the Burnham model we fixed recapture probability to 0 in 1976 - 1997 and 2001 - 2014. Throughout the entire study period 1976 - 2017, dead-recovery data were obtained from hunter reports of research-marked bears and genetic analysis of tissue samples from bears that were harvested.

The Burnham model is a common choice for estimating survival and abundance of polar bears (SWG 2016). Parameters in the model are survival (S; the probability of surviving interval *t* to *t*+1), recapture probability (p; the probability of re-observing a live marked animal), dead reporting probability (r; the probability that an animal which dies is killed by humans and reported to authorities), and fidelity (F; the probability that an animal does not permanently emigrate from the sampling area and remains available for live observation in future years). We limited our analyses to bears age ≥ 1 year (i.e., C1s and older) because in the 2010s most C0s were not biopsy darted or individually identified.

We developed a candidate model set based on combinations of parameter-specific submodels, with the structure of each submodel informed by hypotheses about polar bear biology and study design. We considered 16 submodels for *S* (Table 2). The temporal factor *year* allowed survival to differ between 1976 - 2004 and 2005 - 2017. We chose these year blocks to evaluate the potential influence of habitat changes in the past decade (Environment and Climate Change Canada 2018) and because total allowable harvest (TAH) for the GB subpopulation was increased in 2004 (see section Introduction). The two-level factors *sex* (female vs. male) and *sub* (C1s and subadults [2 - 4 year] vs. adults [age ≥ 5 year]) were included to allow sex- and age-specific variation in survival (e.g., Regehr et al. 2007). The covariate *icetm1*, calculated the same as for reproductive analyses, was included to evaluate the hypothesis that interannual variation in survival was related to sea-ice availability in the previous year. We considered five submodels for *r* that included *sex* and *year* to reflect sex-specific harvest and potential changes in harvest mortality associated with changes in harvest level. The four submodels for *p* included *sex* to allow potential variation in recapture probability resulting from sex-specific habitat selection or movement patterns (Laidre et al. 2013), and *year* to accommodate different levels of sampling effort in the 1990s and 2010s. We did not include a submodel with annual variation in *p* because sample sizes were similar within each three-year block of intensive capture-recapture research. The four submodels for *F* included *sex* and *year*. Unlike Taylor et al. (2009), we estimated *F* rather than fixing it to 1 because bears captured in the GB management unit have been harvested in adjacent subpopulations, suggesting some degree of permanent emigration (see section Discussion - Abundance). Each submodel was constructed as a linear function, on the logit scale, of the various factors, covariates, and interaction terms discussed above. We fitted all possible combinations of the parameter-specific submodels in Program MARK (Cooch and White 2019) accessed through the R programming environment (R Core Team 2019) using the package RMark (Laake 2013).

We performed model selection and multimodel inference using $QAIC_c$ (Burnham and Anderson 2002). We used the overdispersion factor $\hat{c}$ = 1.2, calculated as the ratio of live observations of dependent cubs (i.e., C1s and two-year-old cubs still accompanying their mothers) to total live observations (Taylor et al. 2009). For validation, we derived a separate estimate of $\hat{c}$ using the parametric bootstrap procedure in Program MARK (Cooch and White 2019) with the general model *S*(*year*+*sex*+*year*:*sex*)*r*(*year*+*sex*+*year*:*sex*)*p*(*year*+*sex*)*F*(*sex*), where "+" represents an additive effect and ":" represents an interaction. The bootstrap estimate of $\hat{c}$ was 1.2, suggesting that our empirical estimate adequately reflected extrabinomial variation in the data. Model-averaged parameter estimates were derived from all candidate models with $\Delta QAIC_c < 4$. Our estimates of *S* reflected harvest mortality, so we derived estimates of un-harvested survival as $S^* = S + r \times (1 - S)$ (Peacock et al. 2013) and estimated variance via the delta method (Taylor et al. 2008). This equation assumes that harvest of all marked bears is reported, and that harvest mortality is additive (i.e., that no harvested bears would otherwise have died during a given interval).

Abundance

We used Horvitz-Thompson type estimators (McDonald and Amstrup 2001) to derive abundances in year *t* as $\widehat{N}_t = n_t/\hat{p}_t$, where n_t is the number of individually identified animals observed alive in year *t*, and $\hat{p}_t$ is a model-averaged estimate of recapture probability in year *t*. To estimate abundance of bears age ≥ 1 year we stratified the subpopulation by sex and summed the female and male estimates, which was necessary to accommodate sex effects in recapture probability. Finally, we adjusted annual abundances to include approximate numbers of C0s by adding the product $(\widehat{N}_t^{AFC0} \times \overline{ls}^{C0})$, where $\widehat{N}_t^{AFC0}$ is the estimated number of adult females with C0 litters in year *t*, and $\overline{ls}^{C0}$ is overall mean C0 litter size. We used the delta method to construct variance estimates for annual estimates of total *N* and for average estimates of total *N* over several years. In doing so, we assumed that estimates of recapture probability and C0 litter size were independent. Note that abundance estimates from a capture-recapture framework that allows permanent emigration, but not temporary emigration, may not represent the number of animals within the sampling area at a given point in time. Specifically, abundance estimates from the current study represent the "superpopulation", defined as the group of animals that are alive and have a non-negligible probability of occurring within the sampling area, regardless of their actual location at a particular time. In other words, the superpopulation estimate in year *t* reflects temporary emigrants (i.e., animals that are outside of the GB management unit in year *t* but may return in future years).

Population growth

We used estimates of *S* and *S** from live-recapture dead-recovery modeling, together with estimates of litter production rate and C0 litter size, to estimate intrinsic population growth rate (*gr*) using a 10-stage matrix-projection model based on the life history of polar bears (Regehr et al. 2017). Because we did not estimate C0 survival in the current study, we used the mean estimate of 0.889 (SE = 0.179) for the period 1976 - 2000 from Taylor et al. (2009) for all matrix calculations. We estimated var(*gr*) by generating

10,000 correlated samples of the input vital rates using the model-averaged variance-covariance matrix for sex- and age-specific estimates of survival. We assumed that the correlation structure for C0 survival was the same as for subadults, that litter production rate and C0 litter size had a correlation coefficient of 1, and that there was no correlation between survival and reproductive parameters. Estimates of *gr* represent asymptotic intrinsic growth rate at a stable stage distribution.

5. RESULTS

General overview

During research operations in 2015 - 2017, we spent an average of 103 hours of flying in April and May each year in search of polar bears across the sea ice, with an average distance flown per year of about 12,200 km (Table 3, Figs. 2 and 3). The number of bears encountered during each survey season was similar, with a mean of 170 observed bears per field season.

The GB study area is vast and consists of differing ice types (Barber and Iacozza 2004). The distribution of bears during the 2015 - 2017 study appeared to be more uniform across the study area as compared to 1998 - 2000 when bears were encountered in higher concentrations east of the Boothia Peninsula and near the west shore of Melville Peninsula (Figs. 1 - 3). Moreover, there appeared to be no bear encounters directly north of Committee Bay during the 1998 - 2000 study, in contrast to our recent observations. During both studies no bears were encountered in the lower section of Committee Bay (Fig. 2).

Samples examined

We collected a total of 406 biopsy samples during research operations in 2015 - 2017. Of these, 397 (97.8%) contained sufficient material for genetic analysis. We identified 10 GB bears that were previously captured during the 1998 - 2000 study (Taylor et al. 2009), and 1 LS bear that was 22 years old in 2017 when it was sampled. We also identified 7 individuals that were previously sampled during the MC study between 2014 - 2016. Overall, 324 individual bears were identified from these field samples. Some bears were resampled within the same season: 18 bears were sampled twice, 2 bears were sampled three times, and 1 bear was sampled four times (representing 5% of all successful samples). Re-sampling of the same individual within the same field season was low and likely occurred because weather prevented coverage of a large area within a short time frame, allowing bears to move over longer distances. Biopsy sampling leaves no visible marks on the individual animal as is the case with traditional mark-recapture studies (e.g., Peacock et al. 2013) thus it is impossible to avoid some re-sampling.

Through the harvest sampling program, we submitted 1704 samples between 2005 - 2017 from GB and neighboring subpopulations (338 GB, 701 FB, 402 LS, 47 MC, and 216 with unknown subpopulation) for genetic analyses. Twenty-five bears from the biopsy sampling sessions were harvested and recovered, as well as 8 previously marked bears from the 1998 - 2000 study. Those 8 bears were recovered in GB (6), MC (1) and LS (1). The 6 recovered bears in GB were identified through genetic testing because no ear tags and tattoos were reported.

Field sampling activities

Biopsy sampling activities on the sea ice went very well. The darts do not leave a mark when bears are darted in the rump, and most bears do not react to the impact of the dart. Many of the adult males move very slowly away once darted, if at all. The colored flagging tape attached to the end of the dart makes dart retrieval easy and quick.

During our survey flights, additional observers besides the pilot and biologist were on board the helicopter. In order to safely maneuver during darting, some observers had to be safely dropped off once a bear was seen to reduce weight, but before the darting activities began. It took the crew, on average, 4.3 min (± SE; 0.19; range: 2 - 8 min; n = 62) from the time a bear was observed for the first time (e.g., at times > 1 km from the helicopter) and when the additional observer was picked up again. The direct darting activities involving the safe approach of the bear, darting the bear, and dart retrieval took an average of 2.0 min (± SE; 0.11; range: 1 - 5 min; n = 62; GN, unpublished data).

Body condition score

Body condition scores were higher between 2015 - 2017 compared to 1998 - 2000 (n = 626; $\chi^2 = 5.5$, $p = 0.02$; Fig. 5, Table 4). This was reflected in a decrease in the proportion of bears in poor condition (P_{poor}) and an increase in the proportions of bears in average and good condition (i.e., $P_{poor} = 0.31$ for early period vs $P_{poor} = 0.07$ for the late period; Fig. 5; Table 4). Adult females with offspring ($P_{poor} = 0.28$) and subadults ($P_{poor} = 0.26$) were more likely to be in poor body condition compared to other age and reproductive classes (mean P_{poor} for ADFI and ADM = 0.11; $\chi^2 = 11.4$, $p < 0.01$, Fig. 6). For females with dependent offspring, increasing amounts of time on the ice before being sampled (*jul_cap_day*) was associated with higher BCS ($\chi^2 = 9.0$, $p < 0.05$).

In the early period, bears were more likely to be in poor condition as $icetm_{t-1}$ increased (*icetm* = 70 d: $P_{poor\ early\ period} = 0.24$ and *icetm* = 104 d: $P_{poor\ early\ period} = 0.39$; $\chi^2 = 13.5$, $P < 0.001$). The opposite was true in the late period; the probability of being in poor condition decreased as $icetm_{t-1}$ increased (*icetm* = 70 d: $P_{poor\ late\ period} = 0.12$ and *icetm* = 104 d: $P_{poor\ late\ period} = 0.03$).

Reproduction

We observed 99 adult females with C0 litters during intensive capture-recapture studies conducted in 1998 - 2000 and 2015 - 2017 (Table 5). The general model for C0 litter size provided an adequate fit to the data (Hosmer and Lemeshow test: $X^2 = 6.91$, $df = 8$, $P = 0.55$). The candidate model set included eight models with $\Delta AIC_c < 4$, from which model-averaged parameter estimates were derived (Table 6). Low importance scores (i.e., sums of normalized AIC_c weights for models that included a variable) indicated a lack of support for variation in C0 litter size as a function of our proposed predictor variables (Table 6). The low-AIC_c model included one parameter (i.e., intercept only; β = 0.43, SE = 0.21, P = 0.04). Overall mean C0 litter size was 1.61 (95% CI = 1.51 - 1.70).

We observed 80 adult females with C1 litters during intensive capture-recapture studies conducted 1998 - 2000 and 2015 - 2017 (Table 5). The general model for C1 litter size provided an adequate fit to the data (Hosmer and Lemeshow test: X^2 = 5.96, df = 7, P = 0.54). The candidate model set included five models with $\Delta AIC_c < 4$, from which model-averaged parameter estimates were derived (Table 7). Low importance scores indicated a lack of support for variation in C1 litter size as a function of our proposed predictor variables (Table 7). The low-AIC_c model included one parameter (i.e., intercept only; β = 0.10, SE = 0.23, P = 0.65). Overall mean C1 litter size was 1.53 (95% CI = 1.41 - 1.64).

The other reproductive metrics for GB polar bears were similar, or slightly lower, in 2015 - 2017 compared to 1998 - 2000. Mean number of C0s per adult female was 0.51 (95% CI = 0.39 - 0.64) for the 1990s and 0.43 (95% CI = 0.32 - 0.44) for the 2010s, which corresponds to a probability of 0.85 that values were smaller in the 2010s. Mean number of C1s per adult female was 0.37 (95% CI = 0.27 - 0.48) for the 1990s and 0.36 (95% CI = 0.26 - 0.47) for the 2010s, which corresponds to a probability of 0.54 that values were smaller in the 2010s. Mean litter production rate was 0.76 (95% CI = 0.48 - 1.0) for the 1990s and 0.64 (95% CI = 0.41 - 0.98) for the 2010s, which corresponds to a probability of 0.71 that values were smaller in the 2010s. Note that the ratio estimator we used to calculate litter production rate was different from the estimator used by Taylor et al. (2009), which required assumptions about litter loss and population growth rate.

Demographic analyses

Survival - The capture-recapture data contained 987 live observations of individually identified polar bears and 139 dead recoveries of research-marked bears during the period 1976 - 2017 (Table 8). The candidate model set included 1280 live-recapture and dead-recovery models representing combinations of the parameter-specific submodels. Of these, 104 models had $\Delta QAIC_c < 4$, indicating relatively high model-selection uncertainty. To evaluate the explanatory power of the various factors, covariates, and interaction terms in each parameter-specific submodel, we calculated importance scores defined as the sum of $QAIC_c$ weights for all submodels containing a given term (Table 9). Importance scores for survival (*S*) suggested strong support for a sex effect and for a step change between the year blocks 1976 - 2004 and 2005 - 2017, relatively weak support for an age effect, and little or no support for interannual variation in survival in relation to our sea-ice metric. Importance scores for recovery probability (*r*) provided weak to moderate support for a sex effect and a step change between year blocks. Finally, importance scores for recapture probability (*p*) and site fidelity (*F*) provided little or no support for sex or temporal effects.

Our model-averaged parameter estimates were consistent with patterns that would be expected based on the importance scores for the various terms (Table 10). Point estimates of un-harvested survival (*S**) increased for females, and decreased for males, between the year blocks 1976 - 2004 and 2005 - 2017. Point estimates for *r* decreased slightly for females and increased slightly for males. Point estimates of *F* ranged between 0.93 - 0.99, suggesting relatively high fidelity to the GB management unit. Due to sampling uncertainty and potential process variation, no temporal changes in parameter estimates were statistically significant at an alpha level of 0.05.

Abundance - Mean model-averaged estimates of total subpopulation abundance, including numbers of C0s, were 1610 (SE = 266) for 1998 - 2000 and 1525 (SE = 294, 95% CI = 949 - 2101) for 2015 - 2017. Based on a randomization procedure, this corresponds to a probability of 0.57 that abundance of the GB subpopulation was approximately stable or increasing (subjectively defined as $N_{2015\text{-}2017} \geq 0.9\times N_{1998\text{-}2000}$), and a probability of 0.43 that abundance was declining (defined as $N_{2015\text{-}2017} < 0.9\times N_{1998\text{-}2000}$). Our estimate of mean abundance for 1998 - 2000 was very close to the estimate of 1592 (SE = 361) for the same period from Taylor et al. (2009).

Population Growth – The time-constant estimate of asymptotic intrinsic population growth rate (*gr*) for the period 2005 - 2017, calculated using estimates of total survival (*S*), was 0.06 (95% CI = -0.06 - 0.12). The estimate of un-harvested growth rate for the period 2005 - 2017 was *gr* = 0.07 (95% CI = -0.05 - 0.13). This suggests a strong potential for growth in the absence of harvest, although precision was low. For the period 1976 - 2004, estimates of harvested and un-harvested *gr* were 0.03 (95% CI = -0.07 - 0.09) and 0.05 (95% CI = -0.04 - 0.10), respectively. Although comparison is complicated by different model structures and datasets, these values are similar to the corresponding point estimates of *gr* = 0.02 and 0.06 for the period 1976 - 2000 reported in Taylor et al. (2009).

6. DISCUSSION

General

The GB study area experienced drastic sea ice changes over the past decades (Barber and Iacozza 2004, Stern and Laidre 2016, Environment and Climate Change Canada 2018). The quantity of multi-year sea ice has declined across the Canadian Archipelago (Mudryk et al. 2018, Perovich et al. 2018, Richter-Menge et al. 2018) and the fall freeze and spring thaw cycles in GB changed significantly, extending the period between sea-ice retreat and sea-ice advance by 16 days per decade (Stern and Laidre 2016). Moreover, the mean summer sea-ice concentration (June to October) has been decreasing by 9% per decade (Stern and Laidre 2016). As recently as the 1980's, the GB region was characterized by 40 - 50% multi-year ice during the summer, but this amount has declined to less than 10% between 2011 and now (Environment and

Climate Change Canada 2018) and the shift is predicted to continue (Sou and Flato 2009, Hamilton et al. 2014). The observed changes from multi-year to annual sea ice result in declining sea ice thickness. Younger and thinner sea ice is more mobile and susceptible to mechanical wind forcing. Annual sea ice is also more vulnerable to complete melting in the summer which contributes to the observed decrease in summer sea ice extent. (Richter-Menge 2018, Perovich et al. 2018). This reduction in sea ice results in the absorption of more heat by the upper ocean (Richter-Menge 2018). While sea ice loss overall is considered detrimental to the persistence of polar bears, in the short term, it may have beneficial effects in some parts of the high Arctic since many of the observed sea ice changes have been associated with greater marine productivity (Derocher et al. 2004, Häder et al. 2014, Frey et al. 2018).

Abundance

Our estimate of mean abundance for the period 1998 - 2000 was 1610 (SE = 266), which is very similar to the estimate of 1592 (SE = 361) for the same period from Taylor et al. (2009). The new mean abundance estimate of 1525 (SE = 294) for the period 2015 - 2017 corresponds to a probability of approximately 0.57 that the GB subpopulation has remained approximately stable or increased despite observed sea-ice changes. We suggest that abundance estimates from 1998 - 2000 and 2015 - 2017 are likely an accurate portrayal of trends in abundance given the consistent methodology between the intensive capture-recapture efforts. Taylor et al. (2009) suggested that the subpopulation could sustain a quota increase from 40 to 74 bears per year which was instituted in 2004/2005. The 74-bear quota was rarely filled over the past 14 years with an average of 62 bears per year (22 females and 40 males) removed from the subpopulation. The sex ratio of removed bears was 64.3% male in keeping with the 2:1 sex selective harvest management system in place in Nunavut during that time (range: 56.7 - 72.1% male for the 2004/2005 – 2016/2017 harvest seasons; GN, unpublished data).

The mean point estimate of the proportion of females among independent polar bears (i.e., age ≥ 2 years) increased from 0.57 for the period 1998 - 2000 to 0.61 for the period 2015 - 2017. This appears consistent with the estimates of harvest recovery probability and the estimated differences in total, and un-harvested, survival between females and males. This finding may suggest that the selective harvest of polar bears at a 2:1 male-to-female ratio has resulted in a gradual depletion of adult males in the subpopulation, which is consistent with model-based predictions of declining male numbers under a sex-selective harvest (McLoughlin et al. 2005, Taylor et al. 2008, Regehr et al. 2015). We suggest that this effect could be mitigated by lowering the TAH while maintaining a sex-selective harvest. Alternatively, maintaining the current TAH, but switching to a 1:1 sex ratio for several years could also mitigate the gradual depletion of males but would increase the risks of overharvest given that adult female bears are the most important contributors to population growth (Eberhardt 2002, Hunter et al. 2010). We recommend that a more thorough harvest risk assessment be conducted to further investigate this and other issues related to the sustainability of current removal levels from the GB subpopulation (e.g., change in carrying capacity and environment over time; Regehr et al. 2017).

The GB study area has an estimated density of 8.9 bears per 1000 km^2 based on the current abundance estimate, which is the highest, currently known, density of polar bears within the subpopulation boundaries recognized by the IUCN Polar Bear Specialist Group (Durner et al. 2018). It is more than 5 times the median density of 14 subpopulations for which abundance estimates exist (Hamilton and Derocher 2018). It is also important to note that our estimates of abundance from the current study, as well as from the past study (Taylor et al. 2009), represent the "superpopulation". A superpopulation is defined as all the animals with a chance (non-negligible probability) of occurring within the GB management boundary, regardless of where the animals were located at any given sampling occasion (e.g., Schwarz and Anarson 1996). Thus, estimates of superpopulation size in year *t* likely reflect some animals that were temporary emigrants in year *t*. We were not able to directly estimate temporary emigration from the sampling area (Cooch and White 2019) because our sample sizes were not sufficiently large to do so, and there are no recent radio-telemetry data to provide location and movement data. However, recoveries of previously marked bears in other subpopulations through the harvest sampling program indicate that movement into and out of GB is likely occurring (Fig. 7). Therefore, our estimates of abundance are likely larger than the actual number of animals within the GB subpopulation boundary at any given time. This should be taken into consideration when using these findings to inform management decisions. For example, if capture-recapture analyses are performed independently for multiple adjacent subpopulations that experience exchange of animals, the sum of the estimates of superpopulation size will be larger than the actual total number of bears in the subpopulations (i.e., there will be “double counting” of some bears). This could lead to cumulative TAH levels that result in removal of a larger proportion of polar bears each year than was intended based on the TAH levels for the individual subpopulations.

Population Growth

Our estimates of the population growth rate (*gr*) for the period 2005 - 2017 based on total survival (gr = 0.06) and un-harvested survival (gr = 0.07) for the 2010s are high for polar bears, suggesting strong capacity for growth. Our estimates of *gr* for the 1990s were similar to estimates from Taylor et al. (2009), although a direct comparison is complicated by statistical uncertainty and different modeling structures and datasets. Note that our estimates of *gr* for the 1990s had more statistical uncertainty than that of Taylor et al. (2009) because we accounted for covariance among demographic parameters, whereas it appears that Taylor et al. (2009) considered variation in the different demographic parameters to be independent.

The high estimates of *gr* from this study should be interpreted with caution because they are based on estimates of total survival. Therefore, they reflect the potential for biological population growth but not necessarily the trend in the numbers of polar bears that remain within the GB subpopulation boundary. Indeed, when the harvested population growth rate for the period 2005 - 2017 is recalculated using estimates of apparent survival (i.e., the probability of remaining alive and not permanently emigrating from the GB management unit) the point estimate is negative (*gr* = -0.024; i.e., suggesting that the number of bears within the GB subpopulation boundary may be decreasing). Direct interpretation is complicated by statistical uncertainty (e.g., the coefficient of variation for the estimate of *gr* based on total survival was 0.79). However, this may suggest that emigration from the GB region is one explanation for the apparently contradictory findings of (1) a lower point estimate of abundance for 2015 - 2017 compared to 1998 - 2000 and (2) high point estimates of *gr* for 2005 - 2017 that suggest the GB subpopulation was growing during this period. In other words, it is possible that high estimates of *gr* based on total survival do indeed reflect increasing numbers of bears (i.e., there are more births than deaths), but that a substantial proportion of these bears are permanently emigrating from the GB management area. As the ice becomes more dynamic in GB and the surrounding areas, bears may be more dynamic in their movements. Potentially high and variable levels of immigration and emigration across subpopulation boundaries can directly affect estimation and interpretation of population growth rate (Peňaloza et al. 2014). In some other subpopulation studies, radio-telemetry data have been critical to resolving these issues (e.g., Regehr et al. 2018). For regions where radio-telemetry is not available, we recommend that the best way to reconcile these interpretation challenges and provide accurate information to inform management is to perform a meta-analysis of the capture-recapture and harvest recovery data for all subpopulations within the region that are known to exhibit substantial levels of exchange (e.g., GB, MC, and LS).

Reproduction

Our estimates of reproductive indices (e.g., litter size, offspring per female) are on the higher end of the range of expected values for polar bears (Baffin Bay: SWG 2016, Foxe Basin: Stapleton et al. 2016, Western Hudson Bay: Dyck et al. 2017, Southern Hudson Bay: Obbard et al. 2018, Chukchi Sea: Regehr et al. 2018), suggesting that the GB subpopulation is currently capable of healthy reproduction. During our genetic biopsy sampling we were not able to collect data on the numeric age of most bears (i.e., through counting cementum annuli in teeth; Calvert and Ramsay 1998), hence we cannot comment on age of first litter for females or inter-birth intervals. However, our estimated number of C1 per adult female of 0.36 in 2015 - 2017 appears to be sufficient to maintain a viable subpopulation, provided that survival is within the normal range for healthy subpopulations (Regehr et al. 2015). The number of C1 per adult female (0.36 in this study) is considered a key reproductive parameter (Vongraven et al. 2012, Regehr et al. 2015) because it integrates cub production and cub survival. This is especially important when C0s cannot be sampled or handled, as in this study (see Method section above). Our estimates for 1998 - 2000 and 2015 - 2017 suggest that no significant change in recruitment occurred over time. Declines in reproductive performance in association with sea ice deterioration have been documented for some polar bear subpopulations (Derocher and Stirling 1995, Derocher 2005, Rode et al. 2010, Peacock et al. 2013, Rode et al. 2014). As spring sea ice break-up occurs earlier (which is also associated with later fall freeze-up; Stern and Laidre 2016, Regehr et al. 2016) feeding opportunities for polar bears presumably decrease, leading to poorer maternal body condition and reduced investment in reproduction. Despite changes in sea ice conditions over the past decades we did not detect any significant changes in reproductive output for GB polar bears, although if climate change continues as predicted (IPCC 2014) there will likely be a threshold beyond which reproduction declines (Laidre et al. 2020).

Survival

Opposite to what Taylor et al. (2009) found in their study, our estimated survival rates (total and un-harvested) demonstrated lower survival rates for males than females (Table 10). Estimates of total (i.e., including harvest mortality) survival for adult females of 0.95 for the period 2005 - 2017 were high relative to other subpopulations for which survival estimates are available (Regehr et al. 2018, their Table S3). However, direct comparison is complicated because most other estimates are of apparent survival which includes permanent emigration. Similar to our findings for the GB subpopulation, a recent study documented male survival rates to be reduced for the Baffin Bay subpopulation (SWG 2016). We are unaware of why un-harvested male survival may be declining for GB bears and we recommend this as an important area for research and monitoring. There also was moderate support for a time-period effect on survival, with total survival increasing for females and decreasing for males. This should be interpreted with caution because confidence intervals had substantial overlap. There was relatively low support for an age class effect in survival, with point estimates of survival lower for subadults than for adults, although again the CIs overlapped. No support for variation in survival as a function of the sea-ice covariates we explored was detected.

Estimates of un-harvested survival for adult females for the period 2005 - 2017 (0.97) were also high. When considered along with the reproductive indices, these findings suggest that the GB subpopulation remains capable of strong growth. As a note, estimates of total survival (*S*) reflect the probability of remaining alive. Estimates of *S* directly from the Burnham models are not estimates of apparent survival (i.e., the probability of remaining alive and not permanently emigrating) because the Burnham model directly estimates the fidelity parameter *F*. Unlike Taylor et al. (2009), we did not fix the fidelity parameter (*F*) to 1 (i.e., no assumed permanent emigration) based on the evidence of some movement from GB garnered from harvest recoveries. These factors suggest that there is some permanent emigration, which should be estimated to reduce potential bias in estimates of survival and abundance. Estimates of the parameter *F* ranged between 0.93 and 0.99 depending on sex and time period, with very large confidence intervals. Collecting movement data through radiotelemetry would provide better understanding of the movement into and out of the GB boundaries allowing more precise estimation of survival and abundance.

Body condition

Bears in GB were in better body condition in the most recent survey from 2015 - 2017 compared to the previous survey in 1998 - 2000. This is in direct contrast to some other subpopulation studies that have found decreasing body condition of bears in recent years (Rode et al. 2012, Stirling and Derocher 2012, SWG 2016, Laidre et al. 2020). However, polar bear subpopulation ecosystems vary widely. Within GB, multi-year sea ice predominated until recently (e.g., mid-1990s) when a shift to thinner, annual ice has occurred (Schweinsburg et al. 1981, Barber and Iacozza 2004, Howell et al. 2008, 2009, Sou and Flato 2009, Environment and Climate Change Canada 2018). This shift to annual ice may facilitate a short-term boost in hunting opportunities for bears as the ice is thinner and more prone to leads and cracks allowing access to bears' preferred prey, ringed seals (*Pusa hispida*). Indeed, we saw that in the recent time period, as the duration of low-ice days increased, bears were more likely to be in better condition. This is counterintuitive when thinking about polar bears' reliance on sea ice as a hunting platform. However, the GB ecosystem does not currently experience 100% ice-free periods and the low-ice days represented concentrations that were 63% or lower (see Methods: Sea-ice metrics) which are still within the range of preferred polar bear ice concentrations (Durner et al. 2009). It is worth noting that during the period 2009 - 2014 (Stern and Laidre 2016), the sea-ice area dipped to ~10%. Polar bears come onshore at concentrations of around 10-15% ice (Cherry et al. 2013) and thus, if sea ice coverage declines further, we may see a similar negative relationship of body condition and low sea ice concentration or extent as has been reported for other subpopulations (Regehr et al. 2007, Rode et al. 2012, SWG 2016, Laidre et al. 2020).

More favorable ice conditions relative to seal hunting, coupled with the seal pupping period that occurs roughly around mid-April, may account for our finding that body condition improved for bears sampled later in the field season (Stirling and Archibald 1977, Pilfold et al. 2014, Reimer et al. 2019). Females with offspring were much more likely to be in poor body condition compared to the other reproductive groups. When they were sampled earlier in the year, their probability of being in poor condition was highest which is unsurprising given the increased nutritional stress this reproductive class faces due to lactation and parturition. As time progressed, the likelihood of being in poor condition declined and they were more likely to be rated as ‘average’ suggesting that access to prey during the prime feeding period in the spring was beneficial for accumulating nutritional stores.

Similar to previous studies (SWG 2016, Laidre et al. 2020, GN unpublished data report MC 2020), the differences in body condition we observed are not likely related to the sampling method. Raw BCS scores were binned into 3 general categories to account for any potential small biases in observer classifications. Furthermore, in other similar studies in which comparisons in BCS were made for an earlier time period that used physical capture to determine BCS and a later time period in which aerial classifications were done, there were no trends of either method for BCS, suggesting that there is not an inherent bias in either method for BCS classification (e.g. Kane Basin: no change in BCS over time, Baffin Bay: decrease in BCS over time, M’Clintock: increase in BCS over time; SWG 2016, Laidre et al. 2020, GN unpublished data). In this study, the observer with the most sampling observations participated in both the early sampling period and recent one. The other observers were experienced and had participated both in physical capture studies and in aerial observation studies. The general application of our body condition index during physical handling has been shown to be a reliable indicator (Stirling et al. 2008). Moreover, there is the potential to assess the lipid content of the extracted adipose tissue from the biopsy darts (Pagano et al. 2014, McKinney et al. 2014) which could be used to verify the aerial condition assessments.

7. MANAGEMENT IMPLICATIONS

The need for continued monitoring

Climate change has affected the sea ice in every polar bear management unit (subpopulation) (Stern and Laidre 2016; Regehr et al. 2016), including GB. Over time, ice concentrations and thickness have declined, and the break-up and freeze-up dates have advanced and delayed, respectively (Stern and Laidre 2016). These changes in sea ice dynamics can elicit behavioural, nutritional, and demographic changes in bears. For example, studies in Baffin Bay documented that bears have reduced their home range size and are spending more time on shore during the ice-free period with reduced denning periods (SWG 2016). In other subpopulations, the effects of climate change on polar bears have been exhibited through reduced body condition, survival rates, and litter sizes (Regehr et al. 2007, Stapleton et al. 2014, Lunn et al. 2016, Dyck et al. 2017, Obbard et al. 2016, 2018). These sea ice changes and their impact on bears have only become apparent because of concerted monitoring efforts of both sea ice and bear movements over long periods of time.

Body condition, reproduction, and survival may reflect changes on a finer temporal scale than abundance and can help understand the mechanisms through which environmental change affects polar bears. The GB subpopulation currently has several knowledge gaps that present challenges for informed decision making. It is currently unknown how bears in GB spend their time during the sea-ice minimum (e.g., July to October) due to the lack of movement data. Also, the delineation of this subpopulation is inferred based on movement of collared female bears during the 1990s (Bethke et al. 1996, Taylor et al. 2001), prior to the large-scale changes in sea-ice habitat. Recoveries of previously captured, and subsequently harvested, bears indicate that there is emigration into LS, MC, and FB (Fig. 7), although whether this is permanent or temporary is difficult to determine without movement data. Note also that our abundance estimate is for the superpopulation (see Discussion section) which likely reflects more animals than occur within the GB management boundary.

In respecting Inuit societal values and concerns over physically handling wildlife, the GN, Department of Environment, did not carry out any collaring to collect radio-telemetry data in GB, despite efforts to garner support for a collaring program and the associated valuable data. The GN, together with other co-management partners, will have to decide on how monitoring polar bears in this subpopulation will continue in order to provide adequate information to decision-makers.

Harvest management and considerations

The GB polar bear subpopulation experienced a mean annual harvest of approximately 62 bears between the harvest years 2004/2005 and 2016/2017 (roughly 40 males and 22 females; GN, unpublished data) with a TAH of 74 bears per year. Our current abundance estimate for the superpopulation, together with other demographic data, suggest that the subpopulation has likely remained stable or only declined slightly given the removal rates and observed climatic sea ice changes. We suggest that taken together this study provides evidence that the GB subpopulation is currently healthy and productive. We documented a potential decline in the male proportion of the subpopulation, which may reflect the harvest system in place (i.e., 2 males for every female). However, similar to the Baffin Bay subpopulation (SWG 2016), we also found evidence for a decline in un-harvested survival for males, which we cannot currently explain. Future research and monitoring should seek to understand the causes and potential ramifications of male survival rates.

Here we provide several considerations to aid in harvest management decisions:

- Conduct a meta-population analysis that includes all possible subpopulations where some exchange of bears occurs (e.g., with LS and MC). This is important because the current abundance estimate for the GB subpopulation of 1525 bears (SE = 294) likely includes bears that also spend time in other management units. Assessing each subpopulation individually could lead to overestimating the total number of bears available and increases the risk of overharvest.

- Determine harvest management objectives (e.g., to maintain, reduce, or increase the subpopulation), taking into account possible changes in environmental carrying capacity in the future and the observed reduction in male proportion and survival rates. Perform a quantitative harvest risk assessment so that scientific information is available to help inform and justify management decisions.

Research recommendations for GB

These recommendations reflect both newly gained insight from the experience of conducting and analyzing the GB data as well as continued awareness of the importance of certain research methods.

1. Seek support from co-management partners to implement a radio-telemetry study to collect movement data in GB to obtain emigration estimates, resolve boundary issues, collect missing demographic data, improve precision and accuracy of demographic estimates, and evaluate changes in habitat use and denning in light of the sea ice changes. Before starting such a study, it would be possible to identify the sample size and duration required to address information needs so that no more bears are physically captured than necessary;

2. a) Sample bears (i.e., introduce more marks into the GB subpopulation) 5 - 7 years post-completion of field portion of last study (e.g., in 2023 or 2024) until the next comprehensive population study will be conducted (~10 – 15 yrs post-completion of last inventory; 2027 - 2032) to increase the number of marked individuals, recaptures and recapture probability of marked individuals. These factors will assist in determining more realistic survival rates when the next comprehensive study is undertaken (note that a power analysis will likely aid in determining whether additional marks really provide more data, and if this endeavor is cost-effective);

   b) Monitor reproductive metrics at the time of mark introduction to assess reproductive performance of GB, and if there are significant changes in reproduction consider whether the timing of the next comprehensive subpopulation assessment should be changed;

3. Or, increase population study length to 4 - 5 years to ensure that it covers a full reproductive cycle and reduces potential biases and assumptions that are required during the modeling process;

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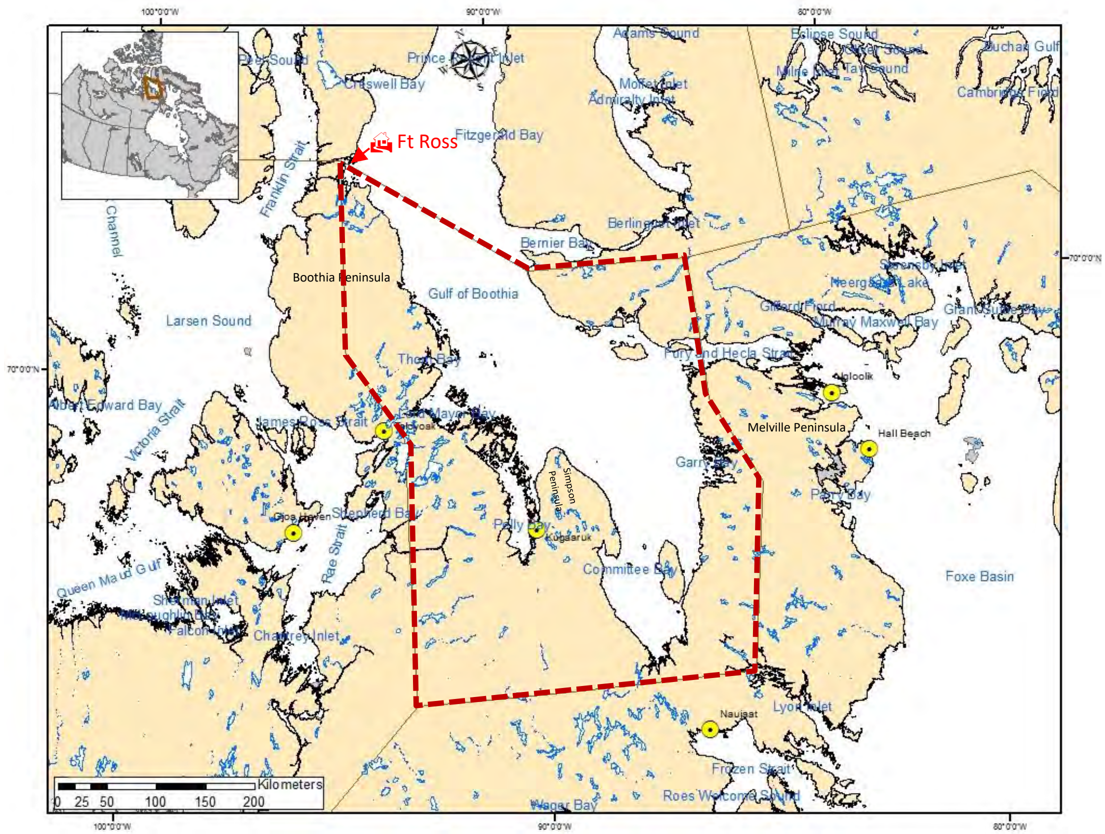
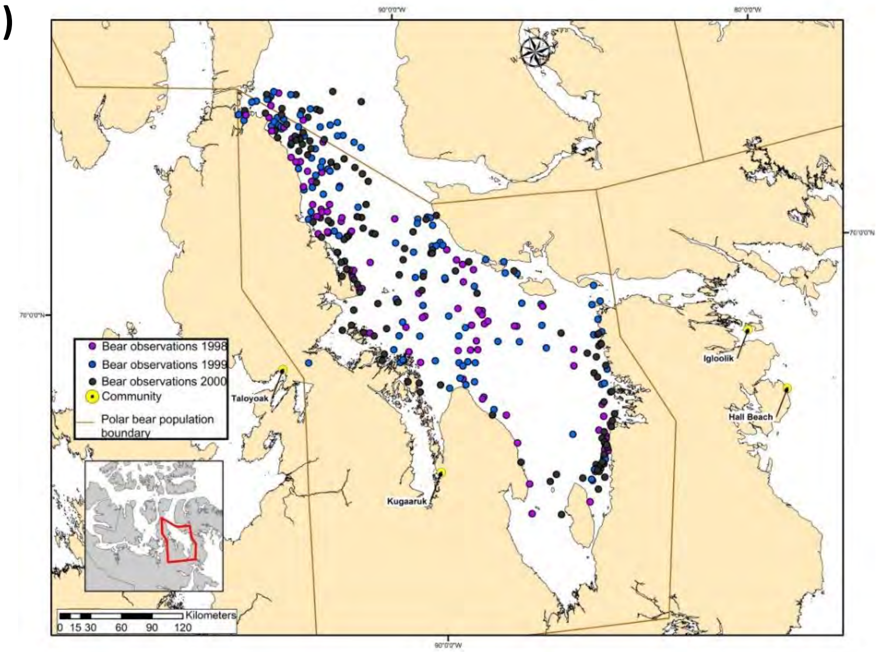


Figure 1. Basic overview and location of the Gulf of Boothia polar bear subpopulation delineated by red dashed line.

a)



b)

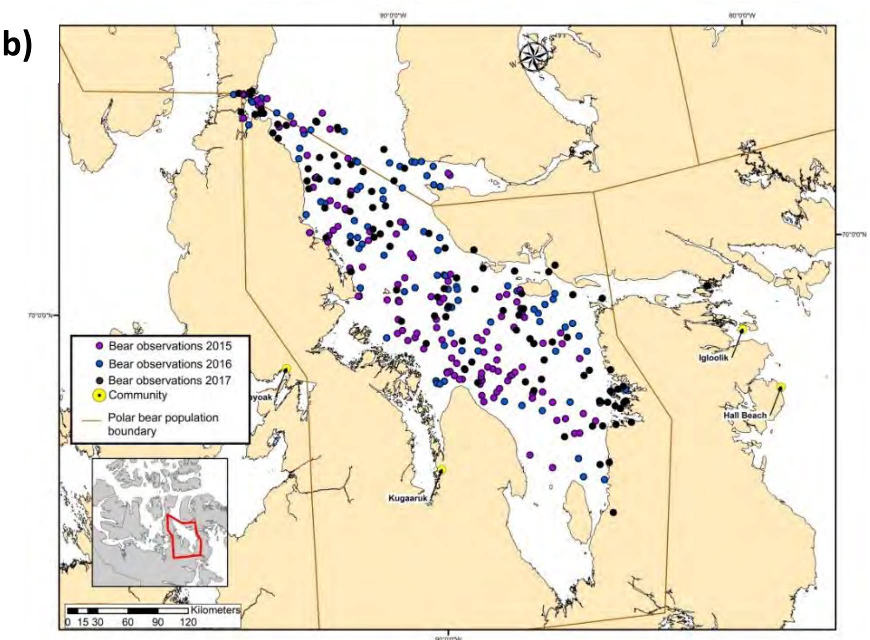


Figure 2. Locations of observed polar bears within the Gulf of Boothia study area during the 1998 - 2000 (a) and 2015 - 2017 (b) studies. Different colored dots indicate different years. Inset shows subpopulation boundary in red.

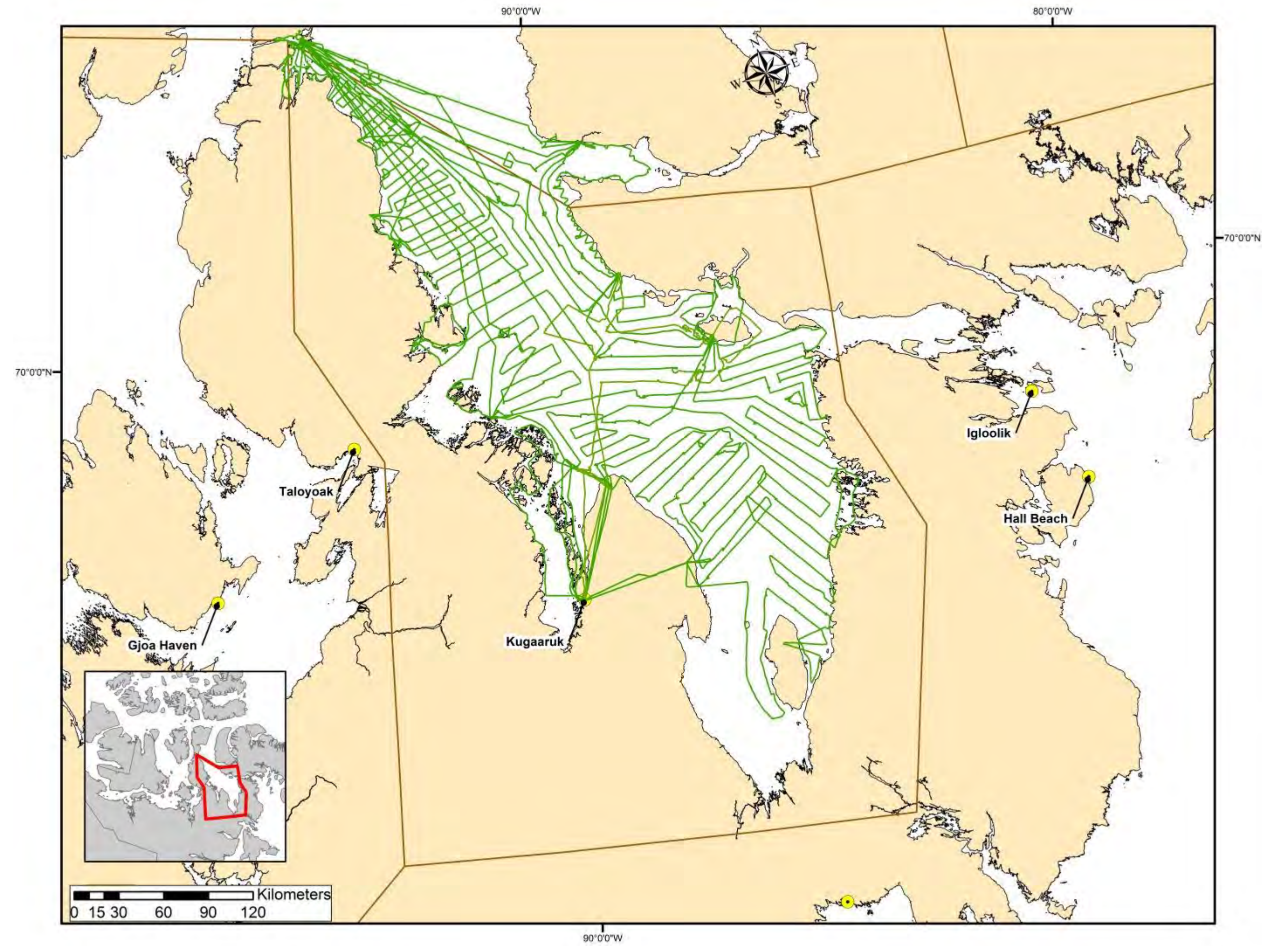


Figure 3. Flight tracks (green lines) of helicopter flown in search for polar bears in Gulf of Boothia, Nunavut, Canada, during April/May 2017. Inset shows subpopulation boundary in red.

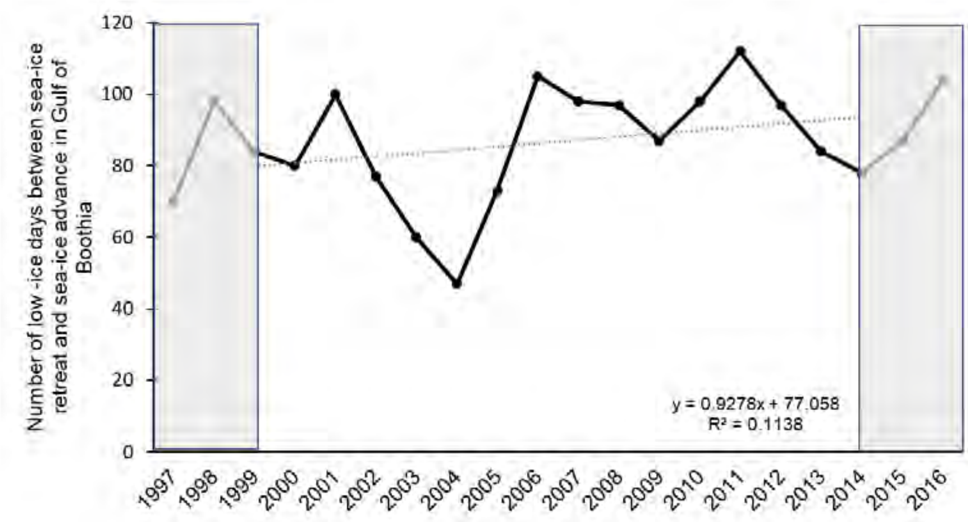


Figure 4. Sea-ice metric of 'low-ice days' calculated as the number of days between the sea ice retreat and sea ice advance in calendar year t *using the transition dates when ice concentration dropped below, and exceeded, respectively, the midway point of sea ice concentration between the March and September mean (Environment and Climate Change Canada 2018). Shaded boxes indicate sampling periods used in this study and intervening years are shown for context. Gray dotted line indicates the linear trend of low-ice days from 1997-2016.*

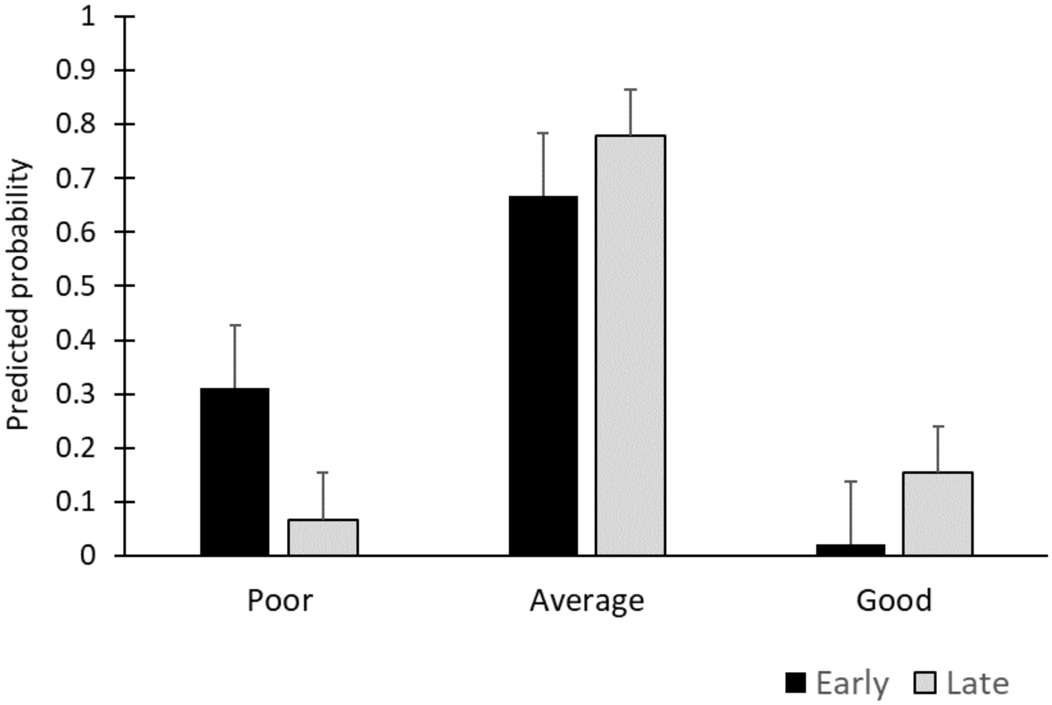


Figure 5. *Predicted probability based on best-fit model parameter estimates of a bear being classified as poor, average, or good body condition for each time period (Early = 1998 - 2000; Late = 2015 - 2017).*

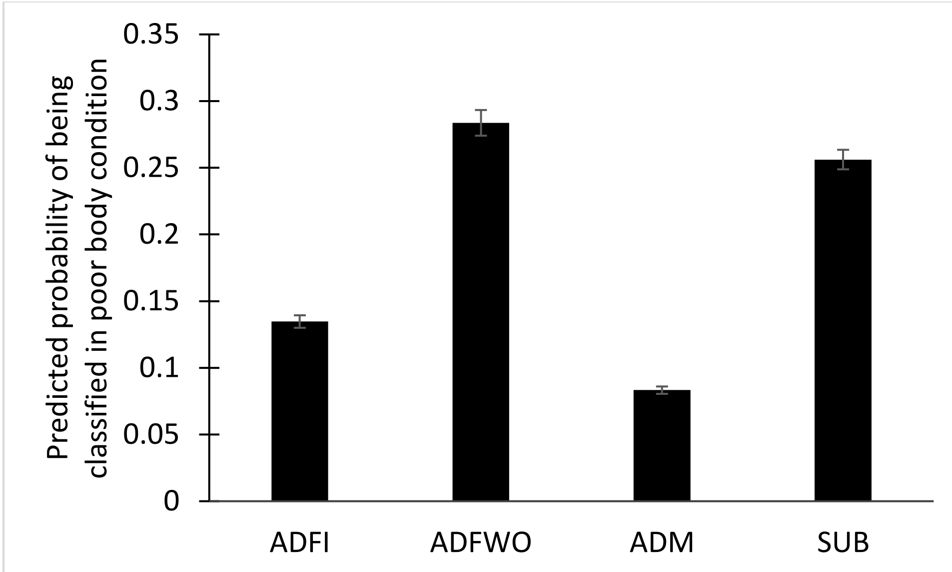


Figure 6. Predicted probability based on best-fit model parameter estimates of a bear being classified in poor body condition for each reproductive age class across both time periods. Adult females with offspring and subadults were more likely than other reproductive age classes to be classified in poor body condition at the time of sampling (ADFI = independent adult female, ADFWO = adult female with offspring, ADM = adult male, SUB = subadults of both genders).

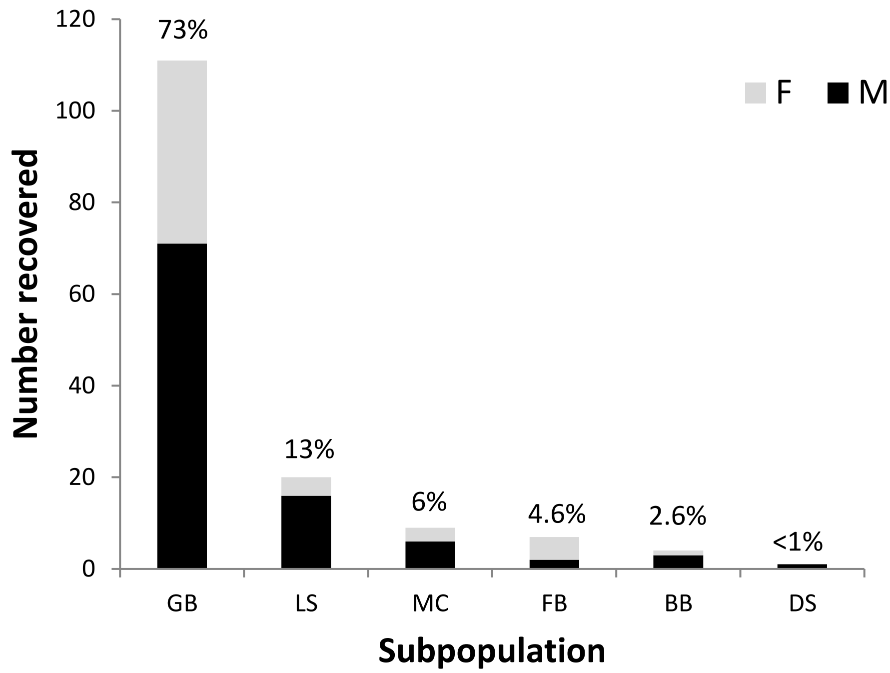


Figure 7. Number of polar bear tags that were initially deployed within the Gulf of Boothia subpopulation boundary and subsequently recovered through the harvest between 1972 and 2017. Percentages indicate the proportion of total recoveries that occurred in a given subpopulation (GB=Gulf of Boothia; LS = Lancaster Sound; MC=M'Clintock Channel; FB=Foxe Basin; BB=Baffin Bay; DS=Davis Strait).

Table 1. Parameter estimates for best-fit ordinal logistic regression model (reference level = “poor”/BCS = 1) for body condition score analysis of the Gulf of Boothia subpopulation.

Parameter	Estimate	SE	*p*
periodlate	3.77	1.61	0.02
reproclassADFWO	-5.70	3.12	0.07
reproclassADM	3.74	3.03	0.22
reproclassSUB	2.07	3.22	0.52
jul_cap_day	0.03	0.02	0.14
periodearly:icetm	0.04	0.01	0.001
periodlate:icetm	-0.02	0.01	0.08
reproclassADFWO:jul_cap_day	0.04	0.03	0.14
reproclassADM:jul_cap_day	-0.03	0.02	0.29
reproclassSUM:jul_cap_day	-0.02	0.03	0.35

Table 2. Parameter-specific submodels used to analyze live-recapture dead-recovery data for the Gulf of Boothia polar bear subpopulation.

Submodel name	Submodel structure
S1	.
S2	year
S3	icetm1
S4	sex
S5	sub
S6	year + sex
S7	year + sex + year:sex
S8	year + sub
S9	year + sub + year:sub
S10	icetm1 + sub
S11	icetm1 + sub + icetm1:sub
S12	sex + sub
S13	year + sex + sub
S14	year + sex + sub + year:sex + year:sub
S15	icetm1 + sex + sub
S16	icetm1 + sex + sub + icetm1:sex + icetm1:sub
r1	.
r2	year
r3	sex
r4	year + sex
r5	year + sex + year:sex
p1	.
p2	year
p3	sex
p4	year + sex
F1	.
F2	year
F3	sex
F4	year + sex

(*S* = survival; *r* = dead reporting probability; *p* = recapture probability; *F* = fidelity)

Table 3. Overview of descriptive field statistics of the Gulf of Boothia polar bear study 2015 - 2017.

Field Year	Search time (hr)	Number of bears/hr	Bears encountered[a]	Flown distance (km)	Duration
2015	96.0	1.90	185	11,737	29 April - 26 May
2016	99.3	1.62	161	12,867	20 April - 14 May
2017	115.0	1.40	162	12,200	26 April - 15 May

[a] The number of bears encountered does not represent the genetically corrected number of bears (e.g., some bears have been re-sampled within same sampling period)

Table 4. Body condition scores (BCS) for polar bears in the Gulf of Boothia subpopulation 1998 - 2000 and 2015 - 2017. Poor BCS corresponds to a thin bear and Good BCS corresponds to a fat/obese bear. Age classes are adult (≥ 5 years) and subadult (2 - 4 years).

	Body condition scores					
	1998 - 2000			2015 - 2017		
	Poor	Average	Good	Poor	Average	Good
Adult female without offspring	17	28	3	2	60	19
Adult female with offspring	30	40	2	5	86	4
Adult male	19	104	4	1	64	28
Subadult	25	34	2	4	43	2
Total	91	206	11	12	253	53

Table 5. Numbers and mean sizes of cub-of-the-year (C0) and yearling (C1) litters observed during capture-recapture studies on the Gulf of Boothia polar bear subpopulation.

	1998	1999	2000	2015	2016	2017
Number of C0 litters	20	13	20	12	22	12
Mean C0 litter size	1.60	1.54	1.70	1.75	1.50	1.58
Number of C1 litters	13	17	10	18	9	13
Mean C1 litter size	1.31	1.53	1.80	1.56	1.44	1.62

Table 6. Model-averaged parameter estimates for a binomial logistic regression on cub-of-the-year (C0) litter size for the Gulf of Boothia polar bear subpopulation.

Parameter	Estimate	SE	P	Importance
(Intercept)	0.78	1.12	0.49	NA
icefree.tm1	0.00	0.01	0.75	0.31
periodearly	0.02	0.19	0.90	0.18
month05	-0.01	0.18	0.98	0.17
BCS (level 1)	-0.07	0.27	0.79	0.15
BCS (level 3)	0.11	0.43	0.80	0.15

Table 7. Model-averaged parameter estimates for a binomial logistic regression on yearling (C1) litter size for the Gulf of Boothia polar bear subpopulation.

Parameter	Estimate	SE	P	Importance
(Intercept)	-0.74	1.53	0.63	NA
icefree.tm1	0.01	0.02	0.57	0.41
periodearly	-0.05	0.24	0.86	0.26
BCS (level 1)	0.02	0.13	0.91	0.06
BCS (level 3)	0.00	0.25	1.00	0.06

Table 8. Numbers of live-observations and dead-recoveries (in parentheses) of individually identified polar bears in the Gulf of Boothia subpopulation used in survival estimation.

Years	AFNC[a]	AFC0[b]	AFC1[c]	AM[d]	C1[e]	SF[f]	SM[g]
1976 - 1997	21 (18)	17 (0)	10 (0)	49 (23)	15 (0)	13 (4)	21 (0)
1998 - 2000	75 (3)	53 (0)	40 (0)	128 (6)	68 (0)	49 (3)	44 (5)
2001 - 2017	88 (5)	46 (0)	40 (0)	94 (19)	61 (0)	21 (1)	34 (5)

([a]AFNC = adult female no cubs; [b]AFC0 = adult females with cubs-of-the-year; [c]AFC1 = adult females with yearlings; [d]AM = adult male; [e]C1 = yearlings; [f]SF = subadult females; [g]SM = subadult males)

Table 9. Importance scores for the various factors and covariates within the parameter-specific survival submodels. Importance scores for interaction terms (e.g., year:sex) should be interpreted with caution because interactions can only appear in models with the corresponding main effects.

Factor or covariate	S	r	p	F
sex	0.82	0.33	0	0
year	0.71	0.35	0.06	0.16
year:sex	0.67	0.33	NA	NA
sub	0.23	NA	NA	NA
year:sub	0.23	NA	NA	NA
icetm1	0.05	NA	NA	NA
icetm1:sex	0	NA	NA	NA
icetm1:sub	0	NA	NA	NA

Table 10. Model-averaged parameter estimates for the Burnham model for survival and abundance.

Parameter	Class	Year block	Estimate	lci	uci
*S**	Adult female	1976-2004	0.94	0.90	0.98
*S**	Adult male	1976-2004	0.93	0.90	0.95
*S**	Subadult female	1976-2004	0.93	0.86	0.99
*S**	Subadult male	1976-2004	0.91	0.85	0.96
*S**	Adult female	2005-2017	0.97	0.91	1.00
*S**	Adult male	2005-2017	0.90	0.83	0.96
*S**	Subadult female	2005-2017	0.95	0.86	1.00
*S**	Subadult male	2005-2017	0.87	0.75	0.99
S	Adult female	1976-2004	0.92	0.86	0.96
S	Adult male	1976-2004	0.89	0.85	0.93
S	Subadult female	1976-2004	0.90	0.80	0.95
S	Subadult male	1976-2004	0.87	0.77	0.92
S	Adult female	2005-2017	0.95	0.81	0.99
S	Adult male	2005-2017	0.85	0.74	0.92
S	Subadult female	2005-2017	0.94	0.69	0.99
S	Subadult male	2005-2017	0.81	0.59	0.92
r	All female	1976-2004	0.26	0.17	0.38
r	All male	1976-2004	0.29	0.22	0.37
r	All female	2005-2017	0.22	0.08	0.46
r	All male	2005-2017	0.33	0.21	0.47
p	All female	1976-2004	0.11	0.08	0.15
p	All male	1976-2004	0.12	0.08	0.16
p	All female	2005-2017	0.10	0.07	0.14
p	All male	2005-2017	0.10	0.07	0.15
F	All female	1976-2004	0.95	0.71	0.99
F	All male	1976-2004	0.99	0.38	1.00
F	All female	2005-2017	0.93	0.79	0.98
F	All male	2005-2017	0.95	0.59	1.00

(S* = unharvested survival; S = total survival; r = dead reporting probability; p = recapture probability; F = fidelity)

INUIT QAUJIMAJATUQANGIT OF GULF OF BOOTHIA POLAR BEARS

FINAL REPORT

23 February, 2021

P.B.Y. Wong
Trailmark Systems Inc.

Report for Department of Environment
Box 209, Igloolik, NU, Canada X0A 0L0

Gjoa Haven Hunters and Trappers Organization, Gjoa Haven
Spence Bay Hunters and Trappers Organization, Taloyoak
Kurtairojuark Hunters and Trappers Organization, Kugaaruk
Aiviq Hunters and Trappers Organization, Naujaat
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Hall Beach Hunters and Trappers Organization, Hall Beach

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1. Summary

In Nunavut, both science and Inuit *Qaujimajatuqangit* (IQ) support co-management decision-making. To complement their recent scientific assessment of the Gulf of Boothia polar bear subpopulation, the Government of Nunavut Department of Environment contracted Trailmark Systems Inc. consultants to conduct an IQ study led by Inuit communities who harvest polar bears from Gulf of Boothia. From May to August 2020, we interviewed active hunters and elders from Gjoa Haven, Taloyoak, Kugaaruk, Naujaat, Igloolik, and Sanirajak remotely to document their knowledge of polar bear ecology, population changes (including relationships to humans), and management perspectives and considerations. In-person interviews were not possible due to social distancing and travel restrictions resulting from the COVID-19 pandemic. Interview participants reported increasing bear numbers, females and young bears, and bear encounters. Interviewees also described how they make inferences on population changes. Interviewees were concerned about harvest regulations that fail to take into account increasing bear numbers and human relationships to bears, from a cultural perspective. An appreciation and better inclusion of IQ is needed in bear management, which will inform how decision-making impacts animals, as well as the livelihood of the communities who co-exist with them.

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ᓄᓇᕗᒻᒥ, ᑕᒪᒃᐱ ᖃᐅᔨᓴᕐᓂᑦ ᐊᒻᒪ *ᐃᓄᐃᑦ ᖃᐅᔨᒪᔭᑐᖅᑲᖕᒋᑦ* ᐃᑲᔪᖅᑐᑦ ᐊᐅᓚᑦᑎᖃᑎᒌᖕᓂᕐᒥᒃ ᐋᖅᑭᒍᑎᒃᓴᓕᕆᓂᕐᓂ. ᐱᓪᓗᐊᑕᕆᓗᒋᑦ ᒫᓐᓇᓕᓴᖅ ᖃᐅᔨᓴᖅᑎᓄᑦ ᖃᐅᔨᓴᕐᓃᑦ ᐃᑭᕋᓴᐅᑉ ᐃᒪᖓᓂ ᓇᓄᐃᑦ ᐃᓚᒃᑲᓐᓂᖕᒋᑦ ᐅᓄᕐᓂᖕᒋᓐᓂ, ᓄᓇᕗᒻᒥ ᒐᕙᒪᒃᑯᑦ ᐊᕙᑎᓕᕆᔾᒃᑯᖕᒋᑦ ᐊᖕᒋᖅᑲᑎᒌᒍᑎᒃᑯᑦ ᐱᓕᕆᑎᑦᑎᓪᓗᑎᒃ ᐃᒡᓕᓂᓕᕆᔾᒃᑯᑦ ᐊᑐᖅᑲᑦᑕᖅᑐᓂ ᐱᓕᕆᔾᖕᒋᓐᓂ ᐱᓕᕆᐊᖅᑲᖅᓗᑎᒃ ᐃᓄᐃᑦ ᖃᐅᔨᒪᔭᑐᖅᑲᖕᒋᓐᓂ ᖃᐅᔨᓴᕈᑎᒃᓴᓂᒃ ᓯᕗᓕᖅᑕᐅᔪᖅ ᐃᓄᐃᑦ ᓄᓇᓕᖕᒋᓄᑦ ᓇᓂᐊᖅᑕᑦᑕᖅᑐᓄᑦ ᐃᑭᕋᓴᐅᑉ ᐃᒪᖓᓄᑦ. ᒪᐃ ᐊᒻᒪ ᐊᐅᒍᓯ 2020-ᒥᑦ, ᐊᐱᖅᓱᓚᐅᖅᑐᒍᑦ ᐊᖑᓇᓱᒃᑎᐅᔪᓂᒃ ᐃᓐᓇᑐᖅᑲᕐᓂᓪᓗ ᐃᖅᑲᓗᒃᑑᑦᓯᐊᒥ, ᐅᖅᓱᖅᑑᒥ, ᐊᒻᒪ ᑕᓗᕐᔪᐊᓂ ᓄᓇᖕᒋᓐᓂ ᑎᑎᕋᓚᐅᖅᓗᒋᑦ ᖃᐅᔨᒪᓂᖕᒋᑦ ᓇᓄᐃᑦ ᐆᒪᔪᑦ ᓇᔪᒐᖅᑲᖅᑎᒌᖕᓂᖕᒋᓐᓂᒃ ᓯᓚᖅᑲᑎᒌᖕᓂᖕᒋᓐᓂᒃᓗ ᖃᐅᔨᓴᕐᓂᖅ, ᐅᓄᕐᓂᖕᒋᓐᓂ ᐊᓯᔾᔨᖅᑐᓂ (ᐃᓚᐅᓪᓗᓂ ᐃᓄᐃᑦ–ᓂᕐᔪᑎᑦ ᖃᓅᖅᑲᑎᒌᒃᐸᖕᒪᖕᒫᑕ), ᐊᐅᓚᑦᑎᓂᕐᒧᓪᓗ ᐃᓱᒪᒋᔭᐅᔪᓂᒃ ᐱᕐᑯᔭᐅᔪᓂᒃᓗ. ᑕᐅᑐᖅᑕᑦᑕᐅᑎᓗᒋᑦ ᐊᐱᖅᓱᕐᓂᕐᓂ ᐊᔪᕐᓇᓚᐅᕐᒪᑦ ᐱᔾᔪᑎᒋᓪᓗᒍ ᖃᓂᒃᓴᓇᐊᖅᑲᖖᒋᓐᓂᖅ ᐃᓅᖅᑕᑎᒥ ᐊᐅᓪᓚᕐᓂᕐᒧᓪᓗ ᑭᒃᓕᖅᑲᖅᑎᑕᐅᔪᓄᑦ ᐱᑎᑦᑎᔪᓂᒃ ᓄᕙᒃᔪᐊᕐᓇᖅ–19 ᐊᒥᓱᓄᑦ ᖃᓂᒪᓐᓇᐅᔪᒧᑦ. ᐊᐱᖅᓱᖅᑕᐅᔪᑦ ᐅᖃᕐᓗᑎᒃ ᓇᓄᐃᑦ ᐊᒥᓱᕈᕆᐊᕐᓂᖕᒋᓐᓂᒃ, ᐊᕐᓇᓪᓗᐃᑦ ᐊᑎᑦᑕᓪᓚ, ᓇᓄᖅᓯᓐᓇᕐᓂᕐᓗ. ᐊᐱᖅᓱᖅᑕᐅᔪᑦ ᓇᓗᓇᐃᖅᓯᒋᓪᓗᑎᒃ ᖃᓄᖅ ᑐᓴᖅᑕᒥᒃ ᐃᓱᒪᑖᕐᕕᖃᖅᐸᖕᓂᕐᒥᓂᒃ ᐊᒥᓲᓂᖕᒋᓐᓂ ᐊᓯᔾᔨᖅᑐᓂᒃ.

ᐊᐱᖅᓱᖅᑕᑦ ᐃᓱᒫᓘᑎᖃᕐᓗᑎᒃ ᐊᖑᓇᓱᒃᑕᐅᔪᓐᓇᖅᑐᑦ ᒪᓕᒋᐊᓕᖕᒋᓐᓂ ᐊᑐᖅᑎᖖᒋᕐᓗᒍ ᐊᒥᓱᑭᕆᐊᖅᑐᑦ ᓇᓄᐃᑦ ᐃᓄᐃᑦᓗ ᖃᓄᐃᓕᐅᖅᑎᖕᒋᑦ ᓇᓄᖅᓄᑦ, ᐃᓕᖅᑯᓱᒃᑯᑦ ᐃᓱᒪᒋᔭᐅᔪᓂᒃ. ᖁᔭᓕᔾᔪᑎᖃᕐᓂᖅ ᐃᓚᐅᑎᑦᑎᑎᐊᕐᓂᕐᓗ ᐃᓄᐃᑦ ᖃᐅᔨᒪᔭᑐᖃᖕᒋᓐᓂ ᐱᔭᕇᐊᓕᒃ ᓄᓇᕐᓂᒃ ᐊᐅᓚᑦᑎᓂᕐᓂ, ᓇᑐᓇᐃᖅᓯᓇᔭᖅᑐᒥᒃ ᖃᓄᖅ ᐋᖅᑭᒍᑎᑦᑎᓂᖅ ᐊᒃᑐᐃᓂᖓᓂᒃ ᓂᕐᔪᑎᓂᒃ, ᐊᒻᒪᓗᑦᑕᐅᖅ ᐆᒻᒪᕆᑦᑎᐊᕐᓂᖅ ᓄᓇᓕᖕᓂ ᐱᑕᖅᑲᖅᓯᐅᑎᒋᔭᖕᒋᓐᓂ.

Naittuq titriaq

Nunavutmi, tamatkiknik naunaiyainiq tamnalu Inuit *Qaujimajatuqangit* (IQ) ikayuqtuqtai aulattiqatigikniq ihumaliurutit. Ilagiaqnianut tapkuat qangahaq nainaiyainiqmun qauyihaqni tahamna Tariunga Boothia nannut amigaiqatigikni, Tapkuat Kavamatkut Nunavut Timinga Avatiliqiyit kanturaqtitat Trailmark Systems Nanminilgit qauyimayiuyut havarininut tamna Inuit Qaujimajatuqangit (IQ) naunaiyaut hivuliqtat Inuit nunaliuyut angunahuaqpaktai nannut tahamanga Tariunga Boothia. Talvanga May tikitlugu August 2020, apiqhuqtavut angunahuaqpaktut inutuqatlu talvanga Uqhuqtuuq, Taloyoak, Kugaaruk, Naujaat, Igloolik, tamnalu Sanirajak ungahiktumin titiqhugit ilihimani nannut uumatyutai, amigaitni allanguqni (ilautitlugit piqatigikni inungnut), aulatyutitlu tautuquqnit ihumagiyaunilu. Tautugutiplutik apiqhuinit ayurnaqmat piplugu inungnut qaglivalaqtailinit aularniqmutlu pittailitit taphumanga Qalakyuarniq-19 aaniaqyuarniq. Apiqhuqtauyut piqatauyut tuhaqhityutai ilagiaqni nannut qaphiuni, aqnalluit piarahangugaluitlu nannut, nannutlu apquhaqtauyut. Apiqhuqtauyut unniqtuqmiyai qanuq ihumakaphukhutik amigaitniqnut allanguqni. Apiqhuqtauyut ihumaaluktut angunahuaqtauni maligait pingitai ihumagiqahiutini ilagiaqni nannut qaphiuni inungnutlu piqatigikni nannut, ilitquhiliqutit ihumagiyaunit. Quyagiyauni nakuuhivalliqnilu ilaliutyaqni Inuit Qaujimajatuqangit (IQ) piyalgit nannut aulatauni, tapkuat tuhaqhitauni qanuq ihumaliuqni aktuanit angutikhat, tapkualuttauq inuuhigigutai nunaliuyut uumaqatigit tapkununga.

2. Introduction

Accurate and reliable information on polar bear population status and trends are necessary for decision-making in polar bear management. Collaborative polar bear management among the Nunavut Wildlife Management Board, Government of Nunavut, Department of Environment (GN DOE), Nunavut Tunngavik Inc., Regional Wildlife Organizations, and Hunters and Trappers Organizations (HTOs) in Nunavut focuses on ensuring populations are viable so that Inuit can continue to harvest polar bears, in part through harvest regulations (e.g., Total Allowable Harvests [TAH] and non-quota limitations). Both conventional science and Inuit *Qaujimajatuqangit* (IQ) contribute to this process.

IQ includes knowledge of wildlife trends, as well as the values, opinions, concerns, traditional management practices, and perceived impacts to harvesting and livelihood that are held by Inuit (Wenzel, 2004). This unique characteristic of IQ differentiates it from conventional science, which tends to focus on wildlife data at the exclusion of human relationships and values. Incorporating IQ in polar bear management supports “Inuit harvesting rights and priorities and recognizes Inuit systems of wildlife management that contribute to the conservation of wildlife and protection of wildlife habitat” (Nunavut Agreement, Article 5). Documenting and using IQ require the direct inclusion and guidance of IQ holders in formulating research questions, analysing and validating results, and interpreting and presenting data (Wenzel, 2004). Culturally appropriate research methods are systematic yet informal and based on respectful communication, narrative discourses, subjective and personal engagement, and unhurried meeting styles (Ferrazzi et al., 2019).

GN DOE recently completed a biological survey and data analysis of the Gulf of Boothia polar bear subpopulation (GB; Fig. 1; Dyck et al., 2020). To complement this study, GN DOE sought to obtain IQ information, and contracted Trailmark Systems Inc. (Trailmark) Consultants to conduct an independent IQ study for the Gulf of Boothia, as well as M’Clintock Channel (Ekaluktutiak et al., 2020) polar bear subpopulations. The results from both scientific and IQ research may inform harvest recommendations to the Nunavut Wildlife Management Board—Nunavut’s main instrument of wildlife co-management. These data have the potential to guide TAH and management objectives for the two subpopulations. Here, we report on polar bear IQ documented from communities that harvest Gulf of Boothia polar bears.

3. Methods

We followed a grounded theory approach to guide this work, where hypotheses and patterns in information emerged inductively, without any pre-existing theory (Strauss & Corbin, 1994). This contrasts the deductive approach (Lewis, 1988) that is used in conventional wildlife science, where hypotheses are established and tested (Johnson, 2002).

Initially community visits were planned to conduct interviews with selected local knowledge holders. However, as the COVID-19 pandemic spread across Canada, we decided on an alternative and mutually agreed upon approach. A Trailmark consultant met remotely with Gjoa Haven, Spence Bay (Taloyoak), Kurtairojuark (Kugaaruk), Aivilik (Naujaat/Repulse Bay), Igloolik, and Hall Beach HTOs. HTOs suggested public community meetings be held in each community in March and April 2020 to document IQ. Trailmark staff drafted a list of guiding interview questions focusing on hunting experience, perceived population changes, knowledge of polar bear ecology, and management perspectives. This interview guide was circulated to each HTO and the GN before being finalized.

In March 2020, the COVID-19 pandemic restricted travel and community meetings were not possible. HTO staff suggested remote interviews over telephone and videoconferencing so that IQ research could continue. Because interviews occurred remotely and mostly through telephone, participatory mapping and GIS data collection was not possible; however, interview questions probed for place names to identify geographic locations when they were relevant for the discussion. HTO staff recruited all interview participants for their hunting experience, breadth of knowledge, and familiarity with polar bears, bear hunting, and hunting areas (i.e., purposeful sampling [Marshall, 1996]).

We interviewed participants in a semi-directive manner (Huntington, 1998; Huntington, 2000) remotely from May 21 to August 10, 2020. We interviewed five Taloyoak participants individually over Zoom videoconferencing. We interviewed all other participants over telephone: five as a group and one from Gjoa Haven; three from Naujaat; three from Igloolik; and five from Sanirajak (Hall Beach). Because interviews occurred as a group discussion in Gjoa Haven, the resulting information was interpreted as perspectives of the entire group, rather than individuals. It was not always possible to distinguish who was speaking over the telephone, so we identified individual interviewee’s quotations where possible, and otherwise denoted quotations with “unidentifiable Elder”. We replaced identifying names with alphanumeric codes (“GH”, “T”, “K”, “N”, “I”, and “HB” to denote Gjoa Haven, Taloyoak, Kugaaruk, Naujaat, Igloolik, and Hall Beach home communities, respectively) to protect participant confidentiality.

We conducted interviews in English, and interpreters provided translation between English and Inuktitut for four Taloyoak interviews, the group interview in Gjoa Haven, two interviews in Naujaat, and one in Hall Beach. We audio recorded and auto-transcribed interviews using Sonix transcription software (http://sonix.ai). We manually edited transcripts and analysed them using conventional content analysis, where common themes and categories were determined from the data (Hsieh & Shannon, 2005). We identified quotations that represented common themes and reported on them. Additional quotations are listed in Appendix 1.

We sent community interview summaries (English and Inuktitut) through email to each HTO. Because of travel restrictions and the limited time available for this work, HTO board members validated the results remotely instead of the participants for accuracy and representativeness for their community. In-person validations with each participant would have strengthened engagement and data analysis. Results need to be interpreted with this consideration in mind and any uses or applications of these results need to be approved by HTOs and/or interview participants.

4. Results and discussion

4.1. Participant hunting experience

Participant experience provided context to and reliability of interview data. In Gjoa Haven, one participant was an active polar bear hunter (had been polar bear hunting in the area this year) and the other four participants were elders (no longer actively hunting due to old age). These elders had harvested an innumerable number of bears over their lifetime before quotas were implemented; since then, they reported having been able to harvest only up to five bears due to limited access. In Taloyoak, three interviewees were active polar bear hunters. Two interviewees were elders and had not visited polar bear areas in the last 20 years.

In Naujaat and Igloolik, all interviewees were active hunters who had visited the Gulf of Boothia area (Appendix 2) in the last 3 years. In Hall Beach, three interviewees were active polar bear hunters; one interviewee recently stopped hunting but had been to hunting areas earlier this year; and the other interviewee was still actively polar bear hunting but had not harvested from Gulf of Boothia since 1999. HTOs recommended non-active hunters and elders for inclusion in this project because of their unique experiences, wisdom and/or historical knowledge of geographic areas.

4.2. IQ of polar bear ecology

Remote interviews occurred in the spring and summer and recruitment was challenging due to limited in-person coordination (HTO staff were on annual leave) and hunter availability. It is possible some interview participants did not feel comfortable sharing information openly over telephone. Some interviewees expressed a preference for face-to-face meetings, where additional contextual information could have been gathered (e.g., through participant observation).

Gjoa Haven and Taloyoak interviews also contributed to a M’Clintock Channel IQ study (Ekaluktutiak et al., 2020) and interviewees shared knowledge of both M’Clintock Channel and Gulf of Boothia subpopulations. Where possible, we distinguished the populations that interviewees referred to by geographic area. Gjoa Haven interviewees did not consider Gulf of Boothia their traditional hunting area and, as a result, focused most of their interview discussions on M’Clintock Channel (reported in Ekaluktutiak HTO et al. [2020]). Taloyoak interviewees harvest most of their polar bears from the Gulf of Boothia area and, conversely, focused most of their discussions on Gulf of Boothia bears. However, interviewees referred to polar bear characteristics broadly across both populations.

> The polar bears and animals don't have any boundaries. For example, on the map you set up a boundary or a line, and the hunters not supposed to pass that line. Well, the polar bear has no lines to cross. (Interpreter translating for unidentifiable Gjoa Haven elder, 3 June 2020; Ekaluktutiak HTO et al., 2020)

> The government sets boundaries right. Polar bears don't have boundaries. They go anywhere. (GH1, 3 June 2020; Ekaluktutiak HTO et al., 2020)

> Inuit believe that the Boothia Channel or Boothia population and the M'Clintock polar bear populations are the same. (GH2, 16 June 2020; Ekaluktutiak et al., 2020)

Interviewees indicated polar bears are curious animals and their behaviour varies from individual to individual.

> Mostly bears seem more personality than other animals. We know, we know other animals have different personalities. But the polar bears seem to have more, almost like in tune with human. (T1, 21 May 2020; Ekaluktutiak et al., 2020)

> The polar bears has its own inclinations, it's like some of them run away from the disturbance, some of them don't run away from the disturbance. (K1, 26 May 2020)

> They are different. Some very mean polar bears, some are not mean polar bears. Some polar bears are friendly, some polar bears are not friendly. I don't know why, just like a human being. (HB1, 23 July 2020)

They indicated younger bears are generally more curious and tend to be encountered on the mainland (versus open water).

> It's the younger ones that are coming more closer to town, like the younger ones, anything, any animal. Caribou, wolf, polar bear, they're more curious to see. And coming closer to town. But the older, older ones, there they know. They know more...like they're going to be hunted if they come closer, or they're going to be shot. But the younger ones, they're more curious. (Interpreter translating for N1, 16 June 2020)

> It's usually the older ones that always running away. It's the juveniles that are curious like human beings, they'll do stupid things as well. And they would come into camps wandering on and also to look at what's happening, like whether it's a dangerous area to go to or not. Like any humans, the young people would take chances to go into certain areas. Most of the bears that do come through the community are juveniles. Inside the ages of one year old to three or four years old. Those are the ones that are most nuisance. But the older ones always stay away from the communities. (I1, 13 July 2020)

> *Tulajuittuq*, that's extra-large polar bear, live in the ocean. They hardly go to the land...big bears *tulajuittuq* harder to go around here, because I think there's too many polar bears...usually mother with the young cubs around mainland, people see them a lot and they hardly see big ones now because they protection is not to go to the main ocean because they were eaten by bigger bears. (I2, 10 August 2020)

Interviewees indicated polar bears prefer rough ice, where seals are more easily accessible.

> In rough areas, the packed areas, they tend to be in that area. And when seals are giving birth it's pretty much all over you can see them. In that area where there's seal holes, breathing holes and that will usually be in April, May. (HB2, 23 July 2020)

> They used to be more in the more rough ice...maybe there's more seal, because there's more snow back in the more ice, and the rough ice. So, the snow builds up on the rough ice. (HB3, 23 July 2020)

Interviewees also reported polar bears prey on a range of species, including other polar bears.

> They go after bearded seals and other sea mammals but when they're hunting for them, when they see other polar bears, cannibalism comes into play to due to hunger. (Interpreter translating for HB4, 29 July 2020)

Interviewees indicated polar bears can be encountered all year round.

> Mostly summertime, when we're boating, they’re on our shore. And in the fall too, they're on the shore, and some in the water. Sometimes we hear [about] them miles from land, swimming. And fall time there's quite a bit near our hometown now. Wintertime, there's less to see, and early spring, you can see them on the sea ice. I mean the sea ice, yes, and there is more [captured] on the sea ice near where I go. And they, all winter, I think they stop moving, I don't know, maybe they go down to the ice, moving ice, pack ice. (N2, 15 June 2020)

Some interviewees described seasonal patterns in feeding, distribution, and denning.

> In the summertime, when they're swimming along, they get fatter, they eat more. I know that they eat more, refuelling. And in the wintertime they're mostly in the den, some of them, and they get fat mostly in summertime 'cause there's more prey, their prey is ringed seal. And they would also need, I've seen some bears eating grass in the summertime, or even in the winter they dig the grass. (K2, 13 May 2020)

> Polar bears are mostly noticed in maybe the open area, like open water area. Most polar bears go after seal in the water or on the ice for seal, make a hole in the ice all winter long. Polar bears, they tend to come in the area [south of] community in the fall time. Not so much in the springtime. They're more out north of us in the springtime hunting seal. (Interpreter translating for K3, 19 May 2020)

> Normally polar bears den in the fall time through October, beginning of October, that's for the pregnant female. But the males tend to den through in November, which is a bit

> later than the female. But there are a lot of people that don't bother denning all through their winter. (Interpreter translating for K3, 19 May 2020)

Even though bears are known to travel across population boundaries (Ekaluktutiak et al., 2020), some interviewees described differences between M'Clintock Channel and Gulf of Boothia populations.

> In M'Clintock Channel where we studied, before the bears over there are mostly always skinny and the bears on Gulf of Boothia are fatter bears, healthy bears, and they're more yellow because they're healthy and over on the other side of the ocean is because they're more skinnier. They're fur is more white. (K2, 13 May 2020)

> I've always noticed the M'Clintock Channel's bears are not as aggressive as the bears in Boothia. But that may be due to the size of the populations because the bears I get from the M'Clintock Channel have a lot less scars. They don't look as beat up and they're healthier...whereas the bears in Boothia, they tend to have a lot more scars. I guess there's too much competition for food or they seem to be a beat up a bit more in Boothia. (GH2, 17 June 2020; Ekaluktutiak et al., 2020)

> Bears on M'Clintock Channel area seems to be more slender, less fat. And it's always been that way, they always heard of it. And it's still like that today. And for Gulf of Boothia, you have the open floe edge area behind Astronomical Islands. The ice would close up, freeze, and then through the cycle of the strong current following the moon, the ice would open up. And there's many seals. And wherever you have a floe edge or open water, there's known to be more seals and more bears in those areas. And that is the difference and we've known it for a long, long time. (Interpreter translating for T2, 21 May 2020; Ekaluktutiak et al., 2020)

Hall Beach and Igloolik interviewees also distinguished Gulf of Boothia from Foxe Basin polar bears by their migration patterns, body size, and how avoidant they are of humans.

> I think the Gulf of Boothia I see more bull, bigger bears, male bears than here in Foxe Basin. That's the only thing I could really discuss, the difference between Gulf of Boothia and Foxe Basin. I see more bigger bears over at the Gulf of Boothia. (HB2, 23 July 2020)

> The one around there, they are a bit more scared. And on this side, the Foxe Basin, they don't get scared much. (HB3, 23 July 2020)

> Gulf of Boothia they only migrate once a year and they go back up again to the Gulf of Boothia once they are down here, and there's a big difference between the Gulf of Boothia polar bear and the Foxe Basin polar bear, so polar bear from the Gulf of Boothia they migrate down to Foxe Basin, they migrate back when it by the fall time. But these Foxe Basin polar bears are just on the Foxe Basin area. (HB5, 27 July 2020)

Interviewees indicated bears travel between Gulf of Boothia and Foxe Basin management boundaries.

> The ones that come from Foxe Basin and Gulf of Boothia, they change places. Like the one from Gulf of Boothia goes to Foxe Basin and the one from Foxe Basin goes to Gulf of Boothia. Yes he can tell that the one from Gulf of Boothia who's been there for a long time, you can tell it's been there for a while because of the back of the palm of his hand and (running) out of skin from hunting too much. But he can, all he can see is that he sees them same. From Gulf of Boothia and Foxe Basin. (Interpreter translating for N1, 16 June 2020)

Information on polar bear ecology and behaviour, as well as patterns, is learned through hunting experience and travelling and living on the land. This knowledge is important for hunting success, as well as hunting shared prey.

> How I know there's seal is if I can find polar bear tracks on the ice. They're hunting there. If I want to catch seals, I will try to look for polar bear tracks. They are the ones that know seals more than we do. (I3, 27 July 2020)

4.3. Description of hunting

Interviewees described polar bear hunting using tags (Appendix 3). Other animals such as caribou, wolverine, wolves and fish are harvested in polar bear hunting areas. In the past, polar bears were harvested using dog teams.

> The dog teams be using to hunt harvest polar bear besides snowmobile because they know the polar bear then and they have a little bit of like not a sound at all, not like a machine. (Interpreter translating for HB4, 29 July 2020)

Today, polar bears continue to serve as an important source of accessible food, as well as clothing and income from their hide.

> Polar bears are very important because in those days, the polar bears were everything to us. The fur itself would be used for clothing or you know, as well as the meat which was never wasted. It is very important to us to this current time. (K4, 26 May 2020)

> Currently, with the polar bears, how important to people, it's like when we catch a polar bear, it’s very important about the meat, where there's meat. And in those days, they were always important and still today, still important because we Inuit eat lots of country food and meat, and so because of polar bears’ meat that's how important it is. And with the hide, with the polar bear hide, the skin, we used them too in those days, but usually we kept them...today, with the hide, we try and make everything with the polar bear hide and that's how important it is to us. (Interpreter translating for K5, 26 May 2020)

> Polar bears are used as a mattress or they can use them for a wind pants because the fur will never, ever absorb moisture. It just never absorbs moisture. So, it's the best thing for to use is as a mattress or a wind pants, for Inuit style wind pants. And the meat we eat, it's like baby pork ribs. (Interpreter translating for N3, 4 July 2020)

In this manner, hunters are knowledgeable of and select for certain bear characteristics depending on what they harvest them for.

> I prefer younger than older. I didn't believe my parents when they were alive, now that I'm older, I prefer younger bears, because the meat is more tender, but they mostly go for bigger polar bear so some people today...most of them always look for bigger bear. Like sport, lots of people, the hunters I call sport hunter, they want bigger ones and some people, most of the people they sometimes, when they see a bear, they don't mind them if it's sow [female] with cubs even though if they're same size, they just leave them and look for bigger ones. (K2, 13 May 2020)

> Polar bears or any animals, the meat, they taste better in the winter season than in the springtime and that is why nobody really wants to catch polar bear around the springtime season. (K4, 26 May 2020)

> If I want to go polar bear hunting, male or female, I'm going to shoot the fat one and the very clean fur. That's what I'm always after, I don't kill skinny ones and bad furs. So, I shoot, more like that, I shoot for food, young and clean. Not very often, sometimes, if I see a polar bear, I'll just shoot it and sometimes if I go to Gulf of Boothia, I have to choose what I want. One time I was going polar bear hunting to Gulf of Boothia I saw many polar bears and I never get one, I go back empty handed. (HB1, 23 July 2020)

Older, more experienced polar bear hunters are able to discern polar bear characteristics.

> There's two different hunters now, the older one that's been hunting for polar bears for long period of time, they learn about how polar bears move. They have different movements, male and female. So, they watch and learn about the bear to see if it's a male or female. But these younger one now too that are starting to just hunt. When they go hunt, they as soon as you see a bear, there's a bear, so they just shoot it without noticing or learning about the bear. There's two types, I would say. But the older hunters, they can for sure tell if it's a female, or a male...the young hunters, all they know is if it's a big one that must be a big male. But if it's a female size, it's really hard to tell. (Interpreter translating for N1, 16 June 2020)

Uses of polar bears have shifted and, as a result, so have hunting practices. Hunting for the sale of hides encourages hunters to select for bigger bears.

> We catch a polar bear by a big size. The bigger size it is, the height will add more money into it. The meat we keep but due to the fact of fundamentally speaking, like even *qablunaaq*, the white people likes to have a bigger—they like to have a big polar bear skin around their home so we do the same thing, you know, we try catch a bigger

polar bear just because of the size of the hide that will you know, benefit. (Interpreter translating for K1, 26 May 2020)

In more old bears, the polar bear skins are important for their pants, for the mitts, or kamiks. But now, only for few people use them now. So not much polar skin goes there now. (HB3, 23 July 2020)

However, fewer community members harvest bears for their hide today, due to their lower economic value.

The polar bear hide is not very pricey around this time. Not too many people outside of Nunavut want to buy the hides of polar bear. Actually, there is a place where people sell down south for the polar bear hides and today's market is down. There's no interest in selling the polar bear hides to many people. (Interpreter translating for K3, 19 May 2020)

Nobody wants the polar bear hide anymore, it's very cheap, that's why in Gulf of Boothia nobody goes hunting, maybe five years, nobody goes hunting so we got right now lots of credit in Gulf of Boothia, nobody goes hunting because of highest risk route and the gas is so expensive, the food is expensive, nobody wants to go spend the money for nothing. I mean last spring, three hunters went polar bear hunting from Hall Beach to Gulf of Boothia, they got three more polar bears. And so that's the first in maybe 5 years someone go hunting polar bears to Gulf of Boothia. (HB1, 23 July 2020)

Income generated from selling hides is usually reinvested into hunting. Today, the lower market prices for hides can no longer support increasingly expensive hunting supplies.

When it's fat, they were eaten by the people and the fur, the pelt, was sold to the Hudson's Bay, I believe was the only place they sold furs anyway and it didn't cost very much. The last time I remember my mom, let's say my father caught one in early spring, and my mom did the fur, and she said, I remember she sold it for $40 at Hudson's Bay company. Later on, when I was a teenager, there were more bears. And people would sell the pelts and a good polar bear, a good size one would cost enough to buy a machine, like the early Bombardier machine. But those were really kind of small bills and one bear, let's say a small bill, were about $700, $800 for a machine, when I was a teenager. And people would buy a machine right away from the Co-op store or in order by the Hudson's Bay. Now, in the 90s, bears became more and in 2000, there were quite a bit around. So, I think the price went down a bit and then it grew, but I think the folks know about it. It was just a fraction of what you earned from the bear skin to buy a machine, that's around $18,000 worth now. (N2, 15 June 2020)

Expensive hunting equipment and supplies can limit access to hunting.

Not all of them have snowmobiles, all the equipment. Not a whole lot of people have the opportunity to go and catch a polar bear. (HB5, 27 July 2020)

> Oh my goodness, for my trip this past May it costs me just over $2000 out of my own pocket. You know, the gas is getting expensive, the grubs is getting expensive. All the bullets and whatnot are pretty much expensive. So, it's quite an expensive, would be an expensive hunting trip nowadays. That's what I experienced in May. It's quite far so you need other snowmobiles, like other guys that you need to go with too. So, it's a costly hunting. (HB5, 27 July 2020)

Hunting is also limited by employment.

> Most that are not working hunt polar bear either in fall or winter or like around this time, springtime. But whenever a person working, who has a full-time job just get a chance to maybe stay around on the weekend, they would go after that opportunity. (Interpreter translating for K3, 19 May 2020)

The practice of polar bear hunting alone is demanding and requires a lot of work to prepare and distribute meat.

> To be honest, catching a polar bear, a big game, is a lot of work and butchering the skin and preparing the meat and cutting up all the pieces into pieces. Make sure it's grabable for people to just grab without, you know, cutting themself a piece of meat. (HB5, 27 July 2020)

Polar bears can be harvested on the sea ice or land, depending on season and location.

> During the winter season we wouldn't have polar bears out on the sea ice. But during early fall about October November, we would catch polar bears, the ones that are mostly on the land. (Interpreter translating for K5, 26 May 2020)

> Everybody knows that bears can be in the ice or on the land, it's more like where you go hunting...on the ice is the best time because bears like to be on the ice most. But that [I have] hunted bears on the land. (N2, 15 June 2020)

> During summertime, you can catch a polar bear sooner than winter. During winter you're going to have to search for the polar bear. It depends on the season and it depends on the polar bear. (Interpreter translating for N3, 4 July 2020)

For Gjoa Haven (Ekaluktutiak et al., 2020), Naujaat, Hall Beach, and Igloolik communities, Gulf of Boothia bears are farther away than the other polar bear populations that they can access. Hunting in Gulf of Boothia areas requires considerable time, experience, safety precautions, and fuel.

> It's pretty far away from Hall Beach. Maybe the hunter is just going out for the weekend or spending the whole week over there. They really decide, oh well, they get first bear they see, or any bear that they see or if they're spending more time over, they will pick and choose which bear really like and really try to get the fatter ones. (HB2, 23 July 2020)

> They want to go polar bear hunting on the other side it usually lots of food and lots of gas. So not much people go up there. (HB3, 23 July 2020)

> The polar bears skin is too low now to sell the polar bear hide. That's the point and the point is the Gulf of Boothia is kind of far from our community. (Interpreter translating for HB4, 29 July 2020)

However, some community members prefer to make the trip.

> I prefer hunting in the Committee Bay region [Gulf of Boothia] because it's quite a trip and also hunting caribou at the same time and taking my time and that's what my father used to hunt as well, so I think that's one of the reasons why I enjoy hunting more on Committee Bay area. Or the west coast of Melville Peninsula. And also, around Frederik Island and in that area. Normally there's a lot of bears there and I could choose what type of bear that I would want and mostly males, and also there is all kinds of bears around there. (I1, 13 July 2020)

The considerations and risks involved with polar bear hunting shed light on the deep relationships between Inuit and polar bears. Barriers to accessing Gulf of Boothia bears might explain why the quota for the population has rarely been filled (Dyck et al., 2020). However, polar bears continue to play an important role for community members from a cultural, ecological, and economic standpoint. This importance is an incentive to preserve traditions, gather knowledge, and learn how to hunt. Being able to access harvesting also permits younger hunters to learn how to hunt and, through selection, distinguish polar bear characteristics.

4.4. Changes in abundance

Interviewees reported an increase in the polar bear population in the last two decades. This change was noted in comparison to the distant past, when bear encounters were rare and more time and effort were required to pursue them.

> When I was a child, polar bears were very scarce in the area. They've been scarce, not too many polar bears are spotted 50, 60, 70 miles around the area. One polar bear may have been spotted maybe [few times], once. Maybe four or five years at a time. Back then that was 1950s, 1960s. But today, there are polar bears being spotted in the area five miles, 10 miles 20 miles, something like that. (Interpreter translating for K3, 19 May 2020)

> When I was a kid ‘till when I was a teenager, there was almost no bears. We couldn't see one for a whole year. And I do a lot of traveling, I did a lot of traveling with my parents anywhere on the winter and summertime. We didn't get any bears in summertime, fall time, winter when we travelled. Now, you will see them everywhere in the summertime. Summertime, fall time, even near town. And when I was a small,

small kid I could walk around anywhere without a gun and my parents wouldn't even worry about me for the whole day I used to go out hunting. And like, talking [about] hunting, bear hunting. And my parents wouldn't even get worried about me and right now, you cannot even go camping without a dog or something or a tent. You have to have a cabin now if you go about, so many are out going camping...you can't get enough sleep because there will be bears when you're sleeping. There's bears all over right now. (N2, 15 June 2020)

> When she was growing up, she didn't really mind about polar bears or be concerned of them. But these days, these early 2020s, right now, polar bears are so many that she is scared for her grandkids now. That's her concern, is that there's too many polar bears now. Because when she was growing up, there was hardly polar bears that you can see, but now there are so many polar bears to be concerned of that because they're just coming to town. (Interpreter translating for N3, 4 July 2020)

The increase in bear numbers can be noticed when they gather during mating season. Hunters are also aware of these changes while traveling on the land over years.

> When we travel we see more bears. And nowadays we can see much bears when we are traveling, today we see them everywhere when we are traveling. (HB3, 23 July 2020)

> They gather more on the shorelines. And during mating seasons, pretty much in May, April, May, females are out more and so I would say that when it comes to mating season, they gather and once they gather, after that, they hunt and so once the solid ice is gone, they just go on the shore of the beaches, and you know not be solitary anymore and be with other polar bears. I guess that's also, perhaps something to do with the population increase too. (HB5, 27 July 2020)

Interviewees attributed the population increase to harvesting limitations.

> Due to the fact of the tags being placed after the tags being placed, that's how we see increasement of polar bears, now, more polar bears now because of the tags being in place. Now we cannot even catch a female polar bear with cubs because of the tags….hardly anyone is catching them nowadays and than in the past. (Interpreter translating for K1, 26 May 2020)

> They're like human beings. And in the past, back in the 1960s, the population of Inuit was very low and because of a better health system and also better food and welfare coming in, there's a lot more people. And exactly the same with polar bears. They're now being looked after and they're well looked after. There's not as many in the past, but now there's more. And that could be part of it. And the purpose of the quota system was to bring more bears in. And now we have more bears. (I1, 13 July 2020)

> In the old days, they don't have a quota and there is no law in the old days, if they see a polar bear with a cub, they kill it right away and use them for food or dog food, the skin, use it for clothing, and back in the 1970's, we got the quota system, we have a

> quota in 1960's or the 70's so we are not allowed to shoot the cubs anymore so we never shot a cub, with a cub before. If we have to we shoot sometime for safety and now, they don't kill them anymore so the population is growing up. (HB1, 23 July 2020)

Interviewees also indicated that bears are aware of how human relationships to them are changing.

> The change is that's the bear seems to know that the females with cubs are not to be shot. So, they're coming, they're more coming to town. 'Cause they know they're not supposed to shoot the female and the cubs. But the big one, male one, they don't really come closer to town. The female ones are getting more. (Interpreter translating for N1, 16 June 2020)

> These days, there's more female polar bears with the cubs that's going to town because they're just being scared with loud bullets or being scared with guns not being killed. So, I think the females are used to getting to town because they're not getting killed when they go to town. But just being scared, so I think they're used to it now. Because polar bears in Naujaat goes right to our house under the steps. That's how bear is in Naujaat, like they go right under the steps. Or they’re just four feet away... her concern is that there's too many females now that are just being shot at, not killed, but being scared with those bullets that just crack bullet. So, they're used to being to town now and then they go, and then about a year later, they come back. With female cubs, with baby cubs. And the polar bears are very hungry when they get to town. (Interpreter translating for N3, 4 July 2020)

More females are being encountered on the land versus male bears.

> I seem to notice that there are a whole lot of females, more female than male. (Interpreter translating for K3, 19 May 2020)

> I think I see some little bit of changes here on polar bears regarding the genders. I like to say that there's more female polar bears now than male polar bears. That's what I see. (K4, 26 May 2020)

Some interviewees added they can distinguish gender by observing tracks, body shape, and behaviour, as well as taste.

> We're not allowed to get bears with small cubs anymore. I see more females; I can tell by the tracks 'cause I can tell by the track now. I don't like calling myself an elder, but I know just by looking at the tracks. I could even tell these boys that's a female and male. Young male, female, so I've seen more female tracks than young male bear so I think there's more female than male these days. (K2, 13 May 2020)

> It's really easy to tell when there's a female or a male because of the feet, you know their feet, and the female polar bear has longer neck. (K4, 26 May 2020)

> The female polar bears' meat, it's tender than the male polar bears' meat. The meat of the male polar bears'...after you cook the meat, it tends to be stone hard. With the female polar bear, when you boil the meat, it's more tender, and it tastes more better. (K4, 26 May 2020)

> Males are more skinnier now, and females I guess they save their energy and the males tend to be more aggressive than females. And that's how we recognize them. (HB5, 27 July 2020)

Interviewees reported seeing more young bears.

> There seems to be more younger polar bear than older polar bears in the area...hunters go for more big male bears than the younger bears. But nowadays, people seem to go for the younger polar bear for their meat, for they're tender, like the meat that's from a younger polar bear. (Interpreter translating for K3, 19 May 2020)

> Seems like the smaller, younger bears are very many and easy to see. (Interpreter translating for T3, 21 May 2020; Ekaluktutiak et al., 2020)

> The younger ones seem to have increased due to the fact that we don't have to hunt them with their mother and so they're leaving their mother even on a very young age, like two years old, when they're supposed to be still with the mother, and I see them more often rather than the adults one. (HB4, 29 July 2020)

Females with more cubs are being observed, as an indicator that the population is increasing.

> We always see a sow [female] with three cubs instead of just two or one. These days we see more sow with three cubs...every year...every summer. When I was boating, we see sow with—we see four polar bear, mother with three cubs...it was more than one day and different bears. We saw about 10 bears in one day. And about two of them had three cubs and the others had two...in the late 90s we start seeing them, summertime, every summer when we're boating, we see polar bears down there at the bay. (K2, 13 May 2020)

> In summer, I notice there's more mother bears with a family. And more younger, younger bears around. I see quite a bit of a young bears in summertime now. (N2, 15 June 2020)

> In my late teens I would see a mother with two cubs mostly. But now, three years ago, I saw mostly, two or three years ago now, I see some with three cubs. Three cubs now. I think that there's more—I never saw a bear with three cubs when I was a teenager. (N2, 15 June 2020)

Interviewees reported polar bears going into meat caches is indicative of a population increase, as this behaviour was rarely observed in the past.

> In the summertime, people may have caches in the area like 30, 20 miles out of the community and polar bears will smell that animal buried there and they'll find where it is. That's one of the reasons that polar bears are coming, come near the community area, and other times they might be smelling the garbage dump. That's never often that go into the garbage but once in a while. (Interpreter translating for K3, 19 May 2020)

> The way I found out the polar bears are increasing is by like, when we cache the meat every year, and when we go out to go get our meat that our cache we can, in those days, those cached meat would be still there and when we get them. But in recent time, recent years, when we go get our cache meat, they're all been eaten by polar bears because the polar bears are increasing and that's where we find out that there are more polar bears now. (K4, 26 May 2020)

> We don't bury, leave the meat, get it after because there are so many polar bears now. So, before that, when we get here, we used to cover with all the rocks and then get it in wintertime. We can't go that way nowadays, Igloolik area, too many polar bears nowadays. (I2, 10 August 2020)

Hunting success was considered an indicator that the population is increasing.

> I'm a bear hunter and when I was young, we would be out for more than a week and sometimes we'd go home with no bear. But these days hunters go out, look for bear, and come same day. Hardly anybody ever overnight out there anymore. Only mostly me, when I'm out, I like to be out on the land. (K2, 13 May 2020)

> When the quota system opened and people were told that so many bears had to be caught once a year, so many of them, they put a number. And then people would be out hunting, and they would not find any. Keep looking for one until end of the season. I think we've been quite lucky for us to finish all the quotas. Now there's too many that actually comes to the community, which we hardly ever heard of before. We definitely know that there's more bears along the shorelines than ever before. And in the past, there was hardly any. (I1, 13 July 2020)

Interviewees expressed that shared observations among hunters confirm validity.

> He can say that the bears are coming more to, closer to town, and we look at the radio so other from this community to different community, he talks with a lot of people. So that's the same thing that they're saying, that we can see bears more, closer to town, and everybody is noticing that there are more populating. (Interpreter translating for N1, 16 June 2020)

Interviewees from all communities were in agreement that numbers of polar bears are increasing. Hunters shared unique observations that they have made over time to make inferences on population trends. These indicators provided insight into Inuit knowledge formation. Interviewees also shared information on polar bear population changes within the context of impacts to hunting and land use; population changes are inseparable from human relationships.

4.5. Changes in distribution and behaviour

All interviewees reported polar bears are more frequently encountered in and around communities in recent years.

> Some years are bad for bears coming into the community, and some years are okay. And she know that, they will come into the community again. Especially the young juvenile bears, the young cubs. They are very plentiful. (Interpreter translating for T4, 21 May 2020)
>
> To my knowledge about polar bears coming into the community, 20 years ago, today, there are more polar bears now coming into the community, maybe because of the scent of seal of the community garbage dump, they might smell some kind of an animal or a carcass around town [I think]. There's more polar bears now coming into the community than before so that's how I see the changes. (Interpreter translating for K5, 26 May 2020)
>
> Bears used to be around the floe edge all the time 'cause that's where there are good seals and hunting area. But now they're more spotting dead animals or unfinished harvest. So, they're used to be more at the floe edge, that was their environment. But now they're everywhere. They're on land near the community. (Interpreter translating for N1, 16 June 2020)

Interviewees were particularly concerned about human safety while camping on the land.

> I have concerns about polar bears, especially around time of the year they start to come around closer to the community...specific to people they're very dangerous because they sometimes can destroy or kill a human. (K4, 26 May 2020, Kugaaruk)
>
> If I were to go out camping near town or just out there on the land, currently it's more riskier now to camp inside an igloo or a tent because there is so many polar bears that always migrates from one place to another. To me, right now, I think to be in the camp, it's more appropriate to have a cabin, sleep in a cabin, than a tent or an igloo. Because of the population increasing that dramatically. (Interpreter translating for K5, 26 May 2020)
>
> It changed right now. Even though if I go to caribou hunting, I have to bring my own bag for safety or take some safety stuff for polar bear. Right now, it's very uncomfortable on the tent right now, even though not too far from here. Every year, I don't know how many years, I've been traveling towards the Repulse Bay area to hunt narwhal or polar bear. Every time in the 1980's, 1990's and 2000's, every time I go travelling, polar bears everywhere on the shoreline. They are growing up right now, lots of polar bears right now. (HB1, 23 July 2020)

In the past, dog teams could keep bears away.

> There's barely any more dogs, like traditional dog sleds, so that's something that there's no more dog watch for polar bears. And the dumps are so close to the community that polar bears now by dumpsters and that's her reason why she's thinking polar bears are coming to town. (Interpreter translating for N3, 4 July 2020)

Today, polar bears are more aggressive and no longer afraid of human activity.

> Our polar bears are not so afraid anymore in the community. There's some kind of an interaction with the environment, the polar bears are not really afraid to come into the community anymore, although there is so much traffic or so much activity happening in the community, when they hear any kind of noise in the community, the polar bears aren't afraid to come to town no more. (Interpreter translating for K5, 26 May 2020)

> They used to run away from people when I was a young person. Like walking along and a bear can see you, they run right away. They're scared of people. Now, they're more curious. They see people, they won't, most of them won't run away now. They stick around or try to figure out what you are. And they go to tents and they're not scared of tents anymore. (N2, 15 June 2020)

> Polar bears are just as human as they can show off. You know when humans are teenagers, they're active, very active and strong. And they can show or show off their muscles. Inuit, like humans, can do that, right. Polar bears are just like humans when they're young teenage polar bears, their super white, clean fur. The more white fur they have, that aggressive they are. When you see a polar bear, young polar bear going to town. They're just going to be as a young teenager who's showing off. 'I'm scary, I'm tough, I'm good looking. I'm bigger than you, I'm more powerful than you are.' That's how polar bears are when they're as young teenagers. They'll go to town and not be scared but show off everything with all their power. (Interpreter translating for N3, 4 July 2020)

Some interviewees indicated polar bears are more aggressive when there is a higher density of them.

> All polar bears vary, some of them are very vicious. Some of them aren't vicious. Some of them are, but yeah some of them are scary...to my knowledge I think they are more vicious now than in the past because of the population of the polar bears are increasing. There is more polar bears that are more. They've become more vicious. (K4, 26 May 2020)

Interviewees cautioned the increase in aggression is due to the lack of respect for bears by humans; interacting with bears without harvesting them is not considered respectful.

> Back then before the quotas, people, their rule was, if you're shoot a bear, don't just lose it, leave it, wound it. If you can catch it, kill it there. And before going out hunting,

elders would tell the young ones, don't talk about bears, don't tease them, don't wound them and leave it. And that was their rule, so elders would tell the young ones not to tease anything about bears, so any animal. So, don't make fun of it, don't get it wounded. If you do, kill it here. And there was a lot of use for it. But now, if they would see it, trying to scare off a bear back then, the elders would see that, they'd be so angry about the person that you're just getting angry, that you're trying to anger the bear. Don't do that. Don't throw rocks or don't use bear bangers or things like that. (Interpreter translating for N1, 16 June 2020)

Interviewees described the impacts of bear research on polar bears.

> As soon as they started using those tranquilizers, and when they started using the quotas, that's when he started, two years. It's roughly there, in between there, the population for the bears were getting more. (Interpreter translating for N1, 16 June 2020)

> They make them go to sleep, that's when they seem to lost their mind. Like Inuit, we used to be good friend, don't steal, things like that, we used to listen to law. Until white guys come around, start drinking booze, start smoking marijuana, we lost our mind. We seem to be so crazy today. That's how the polar bears are too. So well, the quota comes, you are to kill one bear. So, if we see two, we kill the other one, and the other one is mad. They've always not do anything, start breaking cabins, rip the tents. There's so much today. It's so dangerous today. (N1, 16 June 2020)

Interviewees indicated polar bears are learning from and responding to changes in human behaviour towards them. Human-bear relationships are no longer in balance.

> Polar bears know that they are protected by something. They know. They are intelligent animals, no matter what animal you are. They, as if, know what people are doing. What guidelines, what policies and procedures, as if they know what's going on with the tagging system. (Interpreter translating for T1, 21 May 2020; Ekaluktutiak et al., 2020)

> We have a traditional old belief that polar bear can hear when we talk about them. (I3, 27 July 2020)

> Long years ago, polar bear were so afraid to people who were from the community, want the people, want anything, human belonging, like igloos or we don't like too close right now, so I will turn into a different person. In my view, polar bears are polluted. Their brain is no good now. They could come up to you and usually they will smell you because ocean is polluted and filth and poison. What they eat is brain damage them, so it's very much different right now, years ago. Sometimes, few times, when I see polar bears...I always say, ‘oh that's a good polar bear’...because nowadays, they see you, they likely to come to you, smell you around, that's different. So, I can say their brain is not same anymore. (I2, 10 August 2020)

Interviewees also indicated individual bears are distinguishable and the same bears tend to come into town.

> You can recognize polar bears. The polar bears keep coming back and forth. Once you let them run away, try and scare them, they're going to come back for sure. They will come back. They really come back and there's no other way that they're just going to come back. You have no other choice but to say they're going to come back because there's some meat there. And that's the only way. The only way. You can recognize polar bears as human beings; you can recognize them by their skin colour or they have a scar or how fat they are or how small they are. They are just recognizable. (Interpreter translating for N3, 4 July 2020)

Interviewees indicated the changes in polar bear distribution and behaviour is largely due to changes in how humans perceive, relate to, and interact with polar bears. Relationships with polar bears have shifted from harvest-based ones to research interactions and scare tactics. Increasing aggression and distributions close to communities are a result of polar bears learning from and responding to these shifts.

4.6. Polar bear health

Interviewees reported polar bears over the last 10 years have been generally healthy.

> This winter all the bears they caught were very healthy bears they got. Like fatty bears all of them...I never really used to see an unhealthy bear. To tell you the truth, all the bears. (K2, 13 May 2020)

> There's not much really changes in the health of polar bears. It's just like us, like a human being, we get sick and [here and there]. But I don't see a lot of, you know, big concerns in this area because they get sick and you know, they get healthy. (K4, 26 May 2020)

> You never will ever see an unhealthy polar because all of the polar bears are healthy. The only time they will see an unhealthy polar bear is when they age and they can't do hunting anymore. That's the only polar bear that you would see that would not be healthy or not normal because of their age. Because all polar bears are all healthy and very well hunters. You'll never see an unhealthy polar bear until they're aged like they can't do hunting no more. (Interpreter translating for N3, 4 July 2020)

Sick bears are rarely encountered, and interviewees can distinguish them by their body fat and fur colour.

> The only thing I can tell is when a polar bear might be look sick is when the polar bear haven't had anything to consume or to eat or hunt. It's when the polar bears like famine or something like that. That's the only time when he had seen skinny polar bear that looks sick. (K4, 26 May 2020)

> The way I can tell when the animal is sick is when the polar bear is really, really doesn't look a natural bear. The fur, it's skin or the fur itself may not look that usual, really

> skinny, no fat. You know, that's how I would tell when a polar bear is sick...recently or currently I myself haven't seen the one like so many polar bears like that. (Interpreter translating for K5, 26 May 2020)

Interviewees indicated skinniness reflects poor hunting ability.

> Came back to my late grandfather, like some hunters are skilful and lucky, and the others some hunters are not very lucky. He said it's the same thing with bears. The bears that are not very good hunters, they die of starvation, but it’s rarely happened, he said, if you know what I'm saying. Those bears are not very good hunter...rarely get skinny polar bear. And I think just when the scientist see something skinny and they say the bears are starving it's not like that. It's been like that for thousands of years here 'cause the bear is not a very good hunter, the polar bear they die of starvation. (K2, 13 May 2020)

> Back then when they open up the polar bear hunt for Gulf of Boothia, they used to catch polar bears that are very fat and healthy, but now they're just mostly skinny now, cause they're poorly hunting now, the bears are poorly hunting. (Interpreter translating for N1, 16 June 2020)

Bears that had been previously handled for research are considered unhealthy.

> They have a second thought of eating the bear, cooking it and eating it. And the colour of the bear doesn't look as good as another bear that never been tranquilized or doesn't have a lip tattoo. On any given day, they'd rather have a hunt a bear without a lip tattoo or anything. (Interpreter translating for T2, 21 May 2020; Ekaluktutiak et al., 2020)

> Most of the ones that were caught were nice and fat and they seem healthy. But the ones that have tattoo and that, they tend to be skinnier. It's usually the older bears that have the tattoo and that, so could be because of age or that. But our elders that passed down were reluctant to have what was studied by scientists. They have tattoos and ear tags and that. And what, if they don't have tags or ear tags, or tattoos or ear tags; they a lot happier and know that they're healthier and they're less reluctant to consume it. (T5, 21 May 2020; Ekaluktutiak et al., 2020)

> Polar bears have become drug addicts because once you're tranquilize them they’re nice and high and even though you put them away, about 20 miles away, they always come back to the dumpster because get another fix. So, they become drug addicts. And also, with the meat that we consume, there is absolutely no taste and a strange taste to the bear meat. We would throw those away right away because they had been tranquilized. The ones that had been tranquilized had very different taste, quite unique. And even though, I don't know for how many years they have been in their system, they stay in their system for so many years, we don't know. But in the past, we would throw away the meat. The meat is already spoiled. And it's been tranquilized. (I1, 13 July 2020)

One interviewee indicated radio collaring for polar bear research interferes with the bears' ability to hunt.

> The ones that have radar collars, they're usually not healthy, very skinny, and under the collar, people who have actually caught bears with collars, we don't take the meat, the meat just behind the head on the neck part where the radio transmitter is. It's usually very rotten and spoiled. Doesn't smell good. (I1, 13 July 2020)

Aggressive bears that enter communities were considered atypical and unhealthy to eat.

> He knows the meat is really different today. He think it's mostly from the fast food or [all the] food [that] we're eating from the dumps and stuff like that. The quality of the meat is more different from a long time ago. And he knows like some meat are still good, a lot of polar bears are still good. But he notice some of them, they're not as good as they used to be. (Interpreter translating for T1, 21 May 2020; Ekaluktutiak et al., 2020)

> When you have polar bear is aggressive more, it doesn't taste as much good, but when you spot a bear and it's not running away. And if you should shoot it there and kill it. That's when it tastes better. He notice, I mean, he can tell the bear hasn't been running, that's when it tastes better. If it's been running away and you have to chase it for a while, it doesn't taste too good. (Interpreter translating for N1, 16 June 2020)

While interviewees described indicators of poor health, they emphasized that polar bears are generally healthy. Unhealthy polar bears are rarely encountered. When they are observed, poor health is attributed to poor hunting or human handling for research.

4.7. Disturbances to polar bears

Interviewees reported pollution and noises (helicopters, snowmobiles, shipping traffic, and seismic testing) are the main disturbances to polar bears.

> Mostly people will disturb polar bears. And aircraft, helicopters. Helicopters will disturb the polar bear during the February season, hunters will disturb the polar bear...the sounds of the snowmobile and sound of the helicopter. (Interpreter translating for K3, 19 May 2020)

> The ships or vessels using the passage of the sea ice and how polar bears could be affected by some kind of a traffic through vessels are going through the sea ice. (Interpreter translating for K1, 26 May 2020)

> Probably main thing is the transportation. They are very aware of the sounds they're surrounded with I guess; I would say it's more of the transportational sounds or any human presence. (HB2, 23 July 2020)

Interviewees indicated these disturbances make bears more aggressive toward humans.

They become more vicious because of there's traffic, vessels, air crafts flying over. Because so many traffics around these areas know where there's polar bears and [when they're] being interrupted with this kind of traffic [they have] become more vicious. And that's how I understand them. (Interpreter translating for K1, 26 May 2020)

Interviewees described changes in sea ice formation, thickness and consistency.

Like in my younger years, I don't hear elders talking about the changing or the condition of the weather, you know, the condition of the sea ice. I haven't heard people talking about that very much, back then. But there was a few of them that already knew what will be happening in the future. And up to today that forecast has happened and it's already happened. And I don't know how elders would know the future of the world coming. (Interpreter translating for K3, 19 May 2020)

I've noticed big time throughout my entire life that back then when the snow was melting, we used to get a lot of water on the ice. But nowadays snow melted just like that and it's supposed to get solid, but it just floats up and then starts to disappear. And it's a lot thinner nowadays. (Interpreter translating for HB4, 29 July 2020)

I know Repulse Bay every year. So, there was ice floe edge, it's been down about 30 miles from here when I was young guy, and it used to be like every year about 30 miles everywhere...now it's about 15 miles, about half of the Repulse Bay, only 15 miles every year now. So, it's less sea ice. I think it's less sea ice now. But on the fast ice. (N2, 15 June 2020)

Interviewees indicated these changes contribute to increasing bear encounters, as polar bears are more frequently gathering along shorelines.

The ice moves away a lot sooner and they usually end up on the lands. And they just following the shorelines to look for food. I think that's why we encounter them more. (HB2, 23 July 2020)

The solid ice is disappearing easier sooner than we anticipate. And, you know, by the time they're hunting seal pups, the solid ice is disappearing, and I think that is also a factor too. (HB5, 27 July 2020)

Interviewees felt these changes are very unlikely to impact population sizes.

With the ice changing and all that, I don't see any big changes to polar bears, you know, information ‘cause they move from, they migrate and they move from, they can swim, they can be on the ice and they can be on the land. With the ice being a factor, the ice condition, it is what it is but I wouldn't really see any changes on how polar bears could be affected by the condition of the icing. (K4, 26 May 2020)

Polar bears would never be affected by the climate or no matter how the weather is changing, the universe is different. Polar bears will never be affected by the weather or no nothing. Because they can walk through a really thin, thin ice, they can be on the water for a long time. I don't think polar bears climate will never ever be affected with this weather. They're very wise and smart...white people are concerned that the ice is thinning, there is little thin ice now and polar bears can't survive in the ice, weather, because there is no more ice. She wants the white people to know that even if the ice is melting, the polar bears can survive in the ocean where there's water. And she's saying polar bears are super, super smart...they are good at everything. (Interpreter translating for N3, 4 July 2020)

Interviewees disagreed with reports on bears being impacted by changing sea ice; polar bears can hunt in open water for long periods of time.

There seem to be a lot of concern about polar bears declining or being endangered or a risk of bears declining due to ice being thinner and that. Climate change is a big talk, and it's concerning some people, that talk about polar bears from the south. But polar bears are like sea mammals. They can swim for miles. They can catch seals. In the water even, even when there's no ice. There was a polar bear survey, and it wasn't talked about but one of the guys that was the helper was on the chopper or the plane, and they saw a bear right in the middle of the ocean between that area where Igloolik is and Gulf of Boothia. They saw a bear right in the middle of the ocean, holding a seal and eating it, like no ice close by to be seen. And some biologists and scientists think because there's no more ice, they'll have hard time harvesting seals, that's not so. Because seals do sleep in the water while they're floating, and they sleep. Anybody can walk up or go right close to a seal by boat while the seal is sleeping, floating, and same thing with the bear can catch up to, I mean [get] the seal while the seal is still sleeping in the water, it's floating, sleeping. So, some people don't know about that. They think that polar bear needs ice in order to catch a seal. They catch seal even if there's no ice to be seen for miles and miles. They're predators. They know what to do. (T5, 21 May 2020)

When there's no ice I've seen bears, some bears [food] like seals on the shore. Eating seals on the shore that I'm pretty sure they caught, because there is no hunters around [miles] from here. And bears eating seals on pack ice. So, I don't know, what I'm thinking is even if the ice is gone, they'll be hunting on the shore for seals. Catching them in open water...on the shore we saw bears with freshly caught seals and baby seals in the summertime, when there is no ice and somebody said they saw a bear hunting a caribou on the island, that they caught up to and ate. And also, I seen them with beluga whales, I'm pretty sure they caught on an island, too, and I've seen them eating seals and bearded seals on the ice too, summertime. (N2, 15 June 2020)

Believe it or not, in the Foxe Basin or Gulf of Boothia, the polar bear stay on the water for a month. They can stay on the water for a month, maybe two months. We got somewhere of August 'til, I mean of open water August 'til July, 'til October, late October, there's the freezing of the water, November. Right now, it's coming late and freezing water. So, they can stay on the water for two or three months without go in the land. (HB1, 23 July 2020)

Interviewees emphasized polar bears are persistent; they are intelligent animals and can respond to environmental and human impacts.

> They always said if the arctic doesn't, when the ice was melted, the polar bears are going to be died. I don't agree with them. I know the polar bears, they hunt even though if there is no ice, they always go hunting. They can swim, any kind of weather. (HB1, 23 July 2020)

> You would never ever decrease polar bears because they're very, very, very, very smart. And very independent, they're very wise. That's going to swim miles and miles and miles, and the elderly people always will say, or our culture, or our ancestors say that the polar bears are very wise, very smart. They can swim days after days on the ocean. They can dive under the water. They can live in the sea. And you still going to see polar bears that's gonna survive the hardest weather that you can imagine. So, she's saying that you'll never, ever see polar bears decrease. It's been like that since our ancestors as though they say polar bears have the power over anything. So yeah, you can't beat, or you can't decrease polar bears. No way. (Interpreter translating for N3, 4 July 2020)

Interviewees were not concerned about population declines. When asked about disturbances, transportation vehicles were considered threats, but only through impacts to presence/absence in an area or how polar bears behave toward humans.

4.8. Comparisons with scientific research

Community members shared their knowledge of polar bear behaviour and ecology. This information is important not only for hunting success, but also for safety and maintaining balanced human-bear relationships. Community members described the importance of polar bear hunting and how it has changed over time, as well as the challenges hunters must face today to achieve access to hunting and traditional practices. These contexts shed light on the impacts of harvest regulations on community members.

Community members indicated polar bears travel across management boundaries, which has been suggested through scientific research (Paetkau et al., 1999; Thiemann et al., 2008; Dyck et al., 2020). Community members also reported an increase in abundance, evidenced through unique indicators of population change. These observations are consistent with the recent scientific survey that reported Gulf of Boothia population as stable (Dyck et al., 2020). Increasing bear numbers was largely attributed to harvesting limitations, which has also contributed to more frequent bear encounters and aggression. Community members also reported increasing proportions of females and young bears, as well as encounters with larger family sizes due to harvest regulations; these observations are supported by empirical reports of high reproductive indices for the population (Dyck et al., 2020) and scientific predictions under sex-selective harvesting (McLouglin et al., 2005; Taylor et al., 2008).

Community members considered polar bears healthy (in agreement with [Dyck et al., 2020]) and described threats as impacts to distribution and behaviour. Community members also reported sea ice changes that are consistent with empirical data (Barber & Iacozza, 2004; Stern & Laidre, 2016; Environment and Climate Change Canada, 2018; Dyck et al., 2020). Community members indicated sea ice changes have contributed to increasing bear numbers and encounters. Although the long-term impacts of climate change and reduced sea ice on Gulf of Boothia polar bears cannot be predicted with certainty (Dyck et al., 2020), community members emphasized the unlikelihood that populations would decline as a result. Community members cautioned polar bears are intelligent and adaptable animals and perceive changes to populations and behaviours as a result of how humans relate to them. In addition, communities voiced their concerns, considerations and recommendations for polar bear management and research, summarized below.

4.9. Management considerations

Harvest limitations have shifted how polar bears are valued (appreciated) by community members. Management decisions impact human relationships to polar bears.

> In those days before the politics and regulations were placed in, the polar bears were so very important to us and but after the policy, the regulations, like to catch a polar bear, it requires tags now. In those days they were so more important, although right now they're important, but with the policy the regulation placed in I like to think it was that they're not more important as much as before. Because of the tags. (Interpreter translating for K1, 26 May 2020)

Even without harvest limitations, Inuit historically practiced their own traditional forms of management; animals should not suffer, nor should they be overharvested; meat is shared and not to be wasted.

> Traditionally speaking, custom law about harvesting animals, our traditional speaking of custom that we have is, if you were to try to kill an animal and if you injure or shoot at an animal and you just injured it without killing it, there was a policy, Inuit law that we have. We have to make sure that we Inuit destroy the animal effectively. Make sure it's not going to suffer. You don't just shoot, or you don't just shoot at an animal, putting a wound, people just shooting it. If you wound an animal, no matter what we're doing, don't let it suffer. We have to kill that animal. That's kind of a system that we have. (Interpreter translating for K5, 26 May 2020)

> When you catch an animal and of course we open the meat, we treat the meat, but we try not to also overharvest animals because we don't want to waste all that meat. So, we have indications as well to hunt for food. Of course, he said earlier too as well that we have to feed dogs and feed the family members. But we try not to overharvest as well. That was another custom law that he would add. (Interpreter translating for K5, 26 May 2020)

> I hate wasting you know, I don't like to waste what I caught, so after my both parents deceased pretty much, what, five years ago, I said to myself, I'm not going to hunt big games like polar bears due to you know, the meat will be just wasted nowadays. (HB5, 27 July 2020)

Harvest quotas should be increased to reflect increasing bear numbers and encounters. More quotas will also support hunters who rely on hunting as a source of income.

> We need more quotas. I always need more quotas so if we get more quotas for Gulf of Boothia, it's alright because the sport hunters, they got lots of money and today only one sport hunter comes to Hall Beach. They gave us more money than if I go hunting a polar bear down to Gulf of Boothia, if I get one, I lost quite a bit of money for hunting. I know I'm not gonna get my money back for that polar bear. So, if we have one polar bear sport hunter, they pay a guide 3000, or if two guides $6000. And the dog team owner only gets more, and the big business probably get more money. So, it's a lot of money for the polar bear sport hunting. We need more quota for sport hunters. (HB1, 23 July 2020)

> My thought is we need more polar bear tags so there can be less polar bears...whoever out camping they get disturbance by polar bear more. (HB3, 23 July 2020)

> I would like to see the number of tags we are given, I would like to see included being allowed to catch a few more each year to control the population a little bit more. There are way more polar bears than when I was young. (I3, 27 July 2020)

Some hunters expressed a desire to hunt male and female polar bears throughout the year, for safety reasons and their own preferences.

> When the polar bear hunting season opens, and when it closes in the month of May, and after all polar bear tags are used up, and then there's no more tags, more polar bears come close by community or comes right into the community. And they come into the community at the wrong timing because polar bear hunting season is closed, no more tags and when polar bears are always vicious in the community nearby...polar bears don't have borders and they you know, they come near town, or they come right into town and when they come into town and when there's no tags placed anymore it would be nice to [get] that polar bear be destroyed because they're vicious, they're vicious animals when they come into town. That's the only area that I like to see improved. (Interpreter translating for K1, 26 May 2020)

If they would open up the hunt, polar bear hunt season sooner before they start hibernating. November, December is when they start hibernating. And it would be a lot more fair if any bear that comes close to town that they can shoot the bear, even if it's a female. Male or female. Any bear that comes close to town. It'd be better if they can be able to hunt. (Interpreter translating for N1, 16 June 2020)

I would like to see us being able to hunt them the whole year. At some point while I'm still alive, I would like to see that, not have particular dates. Our elders tell us that they taste good in fall, like late August, September. But we are only hunting that one date, polar bear hunting March, April, especially the male. Not so much the female but the male bears. (I3, 27 July 2020)

Hunters stressed that certain polar bears are aware of whether or not harvesting is a threat. Traditionally, bear characteristics were selected for during harvest as a form of population control. Current regulations do not take this practice into account.

Once in a while when they get into town, even if they have cubs, even when they keep them in my town, they always destroy them right away. That's why there's hardly any threats here in Kugaaruk. 'Cause I know in the late 90s, my late uncle used to get mauled by a bear so after that, not very often but when they do come in town, we just destroy them, hunters destroy them and get tags for them. (K2, 13 May 2020)

You are to kill that many males and that many females. That's really that's female, and more males to be killed. So, these big males don't bother much coming into town or wrecking things, are the ones that we are killing. (Interpreter translating for N1, 16 June 2020)

They just go to town because they've done it before, so they're just used to it now. And males are killed, and they don't go to town. So only females and mother cubs go to town or communities. (Interpreter translating for N3, 4 July 2020)

Community members were concerned that management focuses too much on polar bear protection and not enough on human safety and livelihood.

I have been to my cabin, they break in, break things, wreck the camps and all that. I've talked to HTO, they'll talk to wildlife somewhere, but nobody never paid for all those wrecked things...seems like it's okay for a person if they wreck my boat, or sometimes when you break down and you have to leave your boat behind, they get at it. Your tent, not by accident, you have to leave it. They wrecked it. Then you have to buy another tent...the government maybe cares about the polar bear that want to have more polar bears. Not to kill the polar bears, don't seem to care about people. You know, kill the person. Eat the person, it's okay. It seems like they're doing that...I'm not too happy about the law and the polar bears. Since the government put up a law and they can't do nothing about them breaking things. All they care about is not shooting them or trying to scare them away. These polar bears that have been scared away are so mad. So, we have lots of polar bears that are so mad. Make them go to sleep. Trying to

> scare them away. Banging them, or tricks like that, it seems like we're trying to get them more mad, so they are so mad today. (N1, 16 June 2020)

Community members disagreed with species at risk listings.

> They say polar bears are some kind of endangered species, but I do not. I would say, again, I disagree on that. If they need the proper information, they just tell them to come experience in the community and see it for yourself. That's the only concern that I have, I mean, I would say they're not on endangered species list. (HB5, 27 July 2020)

Narratives concerning polar bears and the management decisions they influence need to take into account and include Inuit knowledge and wisdom gleaned from experience. Inuit should play a larger role in managing the resources they have interacted with for millenia.

> The Inuit *Qaujimajatuqangit* knowledge that they've left, that their wisdom from the elders, and like I mentioned, that I grew up within elders. And so, my father used to say that even though scientists say that in the future they might say that polar bears will be endangered due to the fact for climate change, pollutions, and multi-year ice are disappearing. But there are also multiyear ice that aren't pretty much seen. And that's where the polar bears are also not counted too. And so that is also I would say, an unknown factor by the scientists. That elders have knowledge, even though they say that multi-year ice is disappearing, polar bears are very adaptable animals and so my father used to say that they’re just like humans. But they walk on their four feet and we walk on with our two feet and they're pretty much like humans and they adapt very fast and so they know the currents they know their environment very well. And so, my father used to say, well, I guess there's a word that when it comes to something, don't just jump into a conclusion or what not. So that's what I'm sticking by with my old man's old words. These are the traditions that were let on and passed on to me and to you, the younger generation. (HB5, 27 July 2020)

> Looking at the law control by Inuit people, not from Ottawa, not from government. I think we should control more by the people who hunt, hunting people. But right now, it would be very difficult because the...system is too high, Inuit don't really like that, what white man is doing, just because it's white man it is true, but some of us Eskimo people, really some of them Inuit nowadays thinking we should control more animals than before, because we got rot bananas and apples from the store and can't get bears. Before that we didn't have anything, only we were given animals, so Eskimo, Inuit people, still trying to fight the law. I think it was fighting the white people most of the time, in my what I hear when I listen...before that, it was very different, the law, Inuit law, Inuit control, they were very different. Properly they were doing it, proper more than we doing right now. Without control by Ottawa, from Ottawa. So, if animal needs to control, I think those hunting, Inuit hunters should be running more. Inuit to Inuit, Eskimo to Eskimo. (I2, 10 August 2020)

Polar bear research should include IQ and Inuit participation. For example, surveys could be guided by Inuit knowledge of when and where bears are likely to be detected to reflect more accurate counts.

> Up on the Gulf of Boothia area he have noticed that when the sea ice, the solid ice, when it's disappearing, when it disappeared in the summertime polar bear swim more often. And by the time they're on the shoreline, I guess when their feet are cold, that's the time when they go on the shoreline and he have seen more polar bears on the shoreline, due to the fact that the solid ice has disappearing faster than expected. So, he'd like to probably make a recommendation that sea ice is disappearing fast, polar bears are on the shoreline more. And so, if there is any polar bear counting at this time of the year, whoever is dealing with counting to take off on the shoreline and take it from there. (Interpreter translating for HB4, 29 July 2020)

Community members criticized past surveys for not including local people and affecting meat quality and bear behaviour. This has contributed to a lack of trust in scientific methods and resulting management decisions.

> When biologists are in town, and you know, when they're counting the polar bears. They're not really hiring local peoples where locations are. You know, all these, all these knowledge are not associated with the communities since they know, they experience the land and the oceans and the sea ice where they are. Not just elders, but I have grown up in elders. And so, I pretty much know where the good hunting areas are thanks to my late father that I've been given this knowledge. And so, these can be, you know, worked on due to the fact that when they're tranquilize a polar bear it stays in the meat for quite a while. And so that was the concern that was given to me, and the meat becomes different. It becomes soft, all the way to the blubber. And so that was also a concern that they're not getting any fatter. Their population is decreasing. But there's community, more community sightings. And these are the only polar bears coming to town are the same polar bears. And so, the older polar bears are more, I would say, decreasing and young ones are more in the communities. And that's a concern to me nowadays too. Due to that the scientists say the ice is shrinking every year. And so that is also a concern to other hunters, elders. So, if they say they're endangered species I would disagree on that. They're not. The way Inuit culture it's not really familiarized by southerners. (HB5, 27 July 2020)

> When it comes to polar bear, I have not seen anyone going up to the helicopter. I mean, perhaps they have hired some kind of wildlife monitor, but I have not seen anyone who has that knowledge of polar bear migration routes, polar bear hunting areas and polar bear harvesting areas. All these matters are have to come in play when it comes to community, knowledgeable people. (H5, 27 July 2020, Hall Beach 2020)

> All those polar bears that researchers trying to figure out the weight, the height, the length, but they shoot it with the little needle, those are the main polar bears...they don't get scared at all to anything when the researchers shoot with that needle. (Interpreter translating for HB4, 29 July 2020)

Interviewees were concerned about losing access to hunting and with it, their traditional hunting practices.

> There is more people going out and they’re not as observant as they were in the past. Because in the past, during my father's time, they were actually living off the land and observing, knowing the behaviour of animals, especially the polar bears. And the dogs were trained to look after them from bears and this is not a reality any longer. Since we have motorized vehicles like boats, snowmobiles, four wheelers, hunt with them and it's now totally different. And it is now harder for us to teach the younger generation how to observe animals, especially bears. The movement of animals and to show respect to the animals. There have been quite a few unnecessary kills of animals because of a lack of knowledge. And these knowledges have hardly been recorded...it is important for individuals to actually learn the behaviours of animals once they go out on the land. A lot of the hunters are complaining like myself, for instance, it's cost too much money now to go on a caribou hunt or a bear hunt. It's not worth it. So, a lot of these things are—we're in the transition period where a lot of these are disappearing and dying off. (I1, 13 July 2020)

Management decisions need to take into account the ecological *and* cultural relationships between Inuit and polar bears, which include hunting and land use practices. For Inuit, polar bears are viewed as intelligent, adaptable, and responsive beings. These considerations may shape how community members share information and/or approach management.

> If we speak of polar bears, we have to speak respectful of them, even though they cannot hear us, we're not with any polar bears anywhere. It's as if they know what we are saying, what we're talking about. We cannot say hopefully a polar bear can come so we can hunt a bear, they know their well-being, they're as if they know true spirit that what we are saying. (Interpreter translating for T4, 21 May 2020; Ekaluktutiak et al., 2020)

> The animals in Nunavut or our land are going to be wrecked or ruined by the government if we get so much rules from the government and we try and follow them. That's not how we used to deal with it, because the elders know how goes it is. If the government gets too much rules, the animals and the land are going to get ruined. (Interpreter translating for N3, 4 July 2020)

> We have to be scared of any animal that we are around. That's a big, big belief. Often, we would never make fun of any animal, and how much respect we have for each animal and so much for the bears, how powerful they are. We will never make fun of them and never ask to see one. Because we have a big superstition that if we do ask to see one, we might come across one when we are not in a safe situation. There's a few men I know that have been attacked and are still alive telling us that they are very, very powerful animals. We fear them all the time. There's big respect for them. (I3, 27 July 2020)

Still, some interviewees praised co-management efforts and decisions.

> The HTO and in the Environmental Department are doing a great job in doing the polar bear population. Maintaining the proper bear population in Nunavut. (Interpreter translating for K3, 19 May 2020)

> Having this tagging system as well as policies, procedures, laws in place. They are there for a reason. Management, no matter what it may be, in life, we have to abide by the rules. Because if there weren't...you know, things can deteriorate right away if they [weren’t] in place. (Interpreter translating for T3, 21 May 2020; Ekaluktutiak et al., 2020)

> The numbers of tags for males and females are kind of consistent now, so he likes that area. (Interpreter translating for K5, 26 May 2020)

The concerns and considerations that community members expressed suggest Inuit engagement and involvement in polar bear research and decision-making processes have been inadequate. The cultural and traditional interactions between Inuit and animals need to be recognized and considered in management objectives. Management decisions impact polar bear populations, and—through their relationships with them—Inuit livelihood. These relationships can also guide scientific methodologies toward approaches that are respectful, yet effective in data collection. In addition, IQ can include unique indicators of population changes that could inform scientific models. A deeper appreciation and understanding of IQ through relationship-building and improved communication strategies with communities can also support collaborative knowledge co-production. Community engagement in this process should be guided and led by Inuit and their knowledge.

5. Summary

This study provided a rare opportunity for community members to share their knowledge and voice their concerns on the Gulf of Boothia polar bear subpopulation. Inuit have coexisted with polar bears for millennia; the knowledge that they have gathered across generations includes important information on polar bear ecology, which is important for human survival, as well as hunting success. Hunting practices traditionally included methods of selecting for bear characteristics and forms of population management; these practices have shifted over time as a result of contemporary forms of management in Nunavut. Community members reported increasing population numbers and encounters, which are a safety concern. Current harvest regulations fail to take these changes into account. Community members also criticized management and scientific practices for not including Inuit knowledge and perspectives, including important human-bear relationships, which has impacted how polar bears respond and interact with communities. However, the observations of population changes and activity reported here are consistent with scientific data. Better engagement and communications with communities within the context of bear research and management will cultivate more trusting relationships toward collaborative management.

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Appendices

Appendix 1. Additional quotations

Importance of polar bears

> Their foots, they're the best—one of best source of meat for the people and some people they use them for their wind pants and they're very useful for the people, and mitts. (K2, 13 May)
>
> Around April perhaps they have good hair. The hair is thick, and it's a good quality for selling. Seems like that's when, is good time. Even though fall is a good time, but their hair is not as thick. (Interpreter translating for T4, 21 May; Ekaluktutiak et al., 2020)
>
> They're important 'cause they're our regular diet. And [Inuit] of course, we have polar bear meat, we pray for them when the season's over to have that dietary. They're important to us too, they're part of our diet, so, regular diet, annually it's, we do pray for them...we also make the hide into our clothing as well so it's quite important to our community [and the people]. (T5, 21 May; Ekaluktutiak et al., 2020)
>
> Some elders prefer to catch younger ones because they're more tender, smaller bears. Some people prefer possibly more people prefer the large male bears. Of course, it's hard to find work up here and they do have some price in them, to sell them. (T5, 21 May; Ekaluktutiak et al., 2020)
>
> At this time today, it's pretty hard to sell a polar bear hide...we are not allowed to sell any hides anymore to the States. And to certain areas like the parts of the world, so that's why it's a lot harder to sell the hides. And if that, you know, if you can't sell the hides to the States, even the auction where we send it first down, they don't even be bought anymore. I sent a hide two years ago I have not seen nothing yet 'cause it hasn't been bought yet. (T5, 21 May; Ekaluktutiak et al., 2020)
>
> Many years ago, they used the fur, the hide for clothing as well as the meat for food. It is very important for our way of life and even for today, we still enjoy the meat. We share the meat as well as the hide. We still use it for clothing today. And we can also sell the polar bear hide and make money off of the polar bear hide to sell. (Interpreter translating for T1, 21 May; Ekaluktutiak et al., 2020)
>
> Today, polar bears are very useful to the people. The meat, of course, that we don't waste. We take the meat and with the hide today, we have to survive, you know, financially. And so therefore we sell the hide to be financed. And that's how we deal with, that's how we know about polar bears. (Interpreter translating for K1, 26 May)
>
> The best time of the year to go out for harvesting for polar bears is probably about October or November...because of the meat...the meat is more tender. (Interpreter translating for K5, 26 May)

Before I hunted bears, they weren't too important because for any person, there wasn't much bears around. We didn't see them anywhere, sometimes for a whole year. And somebody caught one or that one time, my father caught one. The meat was eaten if it was fat, if it was skinny, you just use it for dog food. (N2, 15 June)

There's a lot of ways, use for polar bear. Let's say I catch a polar bear, if that bear is fat, the whole community wants. They share it to the whole community, and the hide, since it doesn't cost a lot much more, they use it for clothing now. I mean, they've been using it for clothing, but since it doesn't cost a lot to bring it now, they also use it for clothing. (Interpreter translating for N1, 16 June)

It's to maintain traditional ways. Store bought food, that is pretty expensive, and it can last longer than the store-bought items and it is shared with the community and provides a little bit of income for their pelt. So, I see those two that's an important part of the community. (HB2, 23 July)

I was taught to hunt smaller bears. That's what I want, for bear are taking food and each year it's in the skin and some men prefer to hunt bigger bears to sell their hide for a higher price. (I3, 27 July)

Description of hunting

A lot of young people are very interested in harvesting polar bear. Whenever they get a chance. Or whenever their dad would allow that person to harvesting polar bear, depends on their dad or parents for the young person to go after the polar bear. (Interpreter translating for K3, 19 May)

March, April, that's one of the good times too but on the first day of opening day, October or November, it's more people like to go out. (N2, 15 June 2020, Naujaat)

Going up to Gulf of Boothia is further. But going down to Foxe Basin is not that far from here. (Interpreter translating for N1, 16 June)

Gulf of Boothia, the trail is not the best going one up there. So, they usually don't go there until the trail is much better. But when it opens up in Foxe Basin, that's when they finish all the tags right away. (Interpreter translating for N1, 16 June)

The best part for the polar bear skins are November and September. But the government gave us by-law to follow, so we just follow the by-laws of HTO or the government policy. What they gave us for quota. So, they're good all year round. They're a good. It doesn't matter what date they are, just the furs are the best on September and November. (Interpreter translating for N3, 4 July)

Sometimes I go caribou hunting and I've been in the rangers for a long time now. We have to check the unmanned radar site in the Gulf of Boothia area, so we've been traveling a lot to Gulf of Boothia. (HB1, 23 July)

All day. We start driving in the morning and we get there at 9. By skidoo. Yeah, first time when I went up there but that was dog team, so we took four days to get up there by dog team. (HB3, 23 July)

We have to travel to the other side of another peninsula. It's about, if you take your time, it's about six-hour ride. But if you pretty much all by yourself, it's a four-hour trip pretty much nonstop. And so, and it's quite far, but you've got to know the routes from here...to the coast of Gulf of Boothia. You've got to know the route and it's quite a distance. (HB5, 27 July)

<u>Changes in abundance and impacts of harvest regulations</u>

There's more polar bears after we start that tag thing, what what how you say it and we're and we're not allowed to catch too many bears I mean, after we start that tag system we get more bears now. (K2, 13 May)

Right back in the 70s, when polar bears are very scarce. The government made bylaw or a policy that hunting polar bear, [that] we can only solely by tag using a [death] tag for polar bears. That's what raised the population of polar bears...after the people started using tags, polar bear tags for hunting, the polar bear population increased. And I have so far, I have not seen any decrease after people started using tags to hunt polar bear. (Interpreter translating for K3, 19 May)

They're go out perhaps within the few hours. Getting a hold of a tag and taking off within a few hours there, they harvest their polar bears, if not, the next day. Due to the fact that the numbers of polar bears are so many now. They're so protected, you're unable to hunt the cubs or anything like that. And you're only to harvest so many a year. And that is the reason why he knows for a fact that there's many, many bears today. (Interpreter translating for T3, 21 May; Ekaluktutiak et al., 2020)

Today there are too many bears. Especially in the summertime camping out, boating, when you're camping or at your outpost camp [they are] guaranteed for a bear to come into your camp. Because they are too plentiful and we Inuit like to do our hunting and we cache our meat we bury it. We ferment it. And you're guaranteed if you try and pick it up in the fall time in the winter, it's gone. You're guaranteed you'll lose that fermented or buried seal that they're trying to save for the winter. It will never be there. The bears will get to it regardless. No matter where we cache our meat. (Interpreter translating for T3, 21 May; Ekaluktutiak et al., 2020)

They’re would be in areas where there was polar bears, like there was polar bears, but they're not as plenty as now. They used to use dog team, once in a while they see the bear out in the outpost camp or out on the sea and they'd get a polar bear every so often. But it seems like there is a lot more polar bears within the last years, like starting around ‘90s up to today, even though we have snowmobiles. Seems like they're easier to see. (Interpreter translating for T1, 21 May; Ekaluktutiak et al., 2020)

Before the white people came around, before the tagging system, they were able to harvest whatever they want. Anything that you see, even the cubs because they're very good eating like a delicacy. As now, starting sometime in the 70s, you get the tagging system and you're not allowed to hunt any of the cubs. And he knows for a fact that is how they know that there's a lot of polar bears now. (Interpreter translating for T1, 21 May; Ekaluktutiak et al., 2020)

If I'm not going to choose what kind of polar bear I'm going to catch, I could catch a polar bear in the same day and come back home. (Interpreter translating for K1, 26 May)

After, you know, the NWMB or the GN put the policies and regulations on polar bears about, you know, total harvest of the year for polar bears. After they put policies on...didn't want us catching more females. So therefore, [there are] actually there are more females now. Because, you know, of the regulations and policies that we have to follow and the policies that we have now is that not to catch so much females than in the past and that's why I see more female now. (K4, 26 May)

Reason why I think they're increasing is because much more harvesters hunting for polar bears no more, and some polar bears they migrate from one location to another. And you know that's that's how I see the increasement of polar bears. Because you know not much in the year hardly any people capturing polar bears now than back in the day. (K4, 26 May)

The way I see this of concerning increasing the polar bear numbers, is by after the polar bear tags were placed in. And the tags are telling harvester to catch only limited of female polar bears and so much of male polar bears I believe, following those tag numbers because of those tag numbers or tags the polar bears are increasingly more now, because there are polar bear tags and, the government and they're saying that we only, we're only allowed to harvest only so much number female polar bear. And so some, maybe all the female polar bears would have cubs, and even in those days female polar bear has cubs, they still won't to catch it in those days but today with the policies changing, that's how I see the numbers increasing polar bears. (Interpreter translating for K5, 26 May)

As of today, someone can go out polar bear hunting and come back with a polar bear in the same day. (Interpreter translating for K5, 26 May)

In the past 20 years they feel like looking for a bear for a week, sometimes come back without a bear. But now once you go out, you can see a bear right away. (Interpreter translating for N1, 16 June)

I was born in 1952. Right there there was no law, Inuit ways. Any bear they see, or any game that they see, if they needed, they'd kill it. If it's even polar bears, even when they have a cubs they shoot them anyways. They can use the cubs for something. And they say little cubs are more, taste more better than the full grown. So that's what they were hunting, any bear. If there were three bears, you see, you hunt them all. But when they put up the ‘you're not allowed to shoot’, ‘shoot the mother with a cub’. We listen, that's when it start, when the bears start coming. Well, getting more. And they put up a quota, that's when it start raising up. (N1, 16 June)

In the Boothia peninsula I used to go out polar bear hunting and you wouldn't see polar bears at all. (GH2, 17 June)

Early 1960's there was no polar bear in the Gulf of Boothia and Foxe Basin, but in the Gulf of Boothia not too many polar bears in that time, my uncle and my uncle's hunting buddy, my uncle was pass away a long time ago, so they went for polar bear hunting by dog team. But there was no polar bear. I mean there is some, not very many. They ran out of food and they ran out of dog food. They finally went to open area, to open water, that floe edge. There under a really rough time to go down there, they have to walk to the floe edge so they shot a seal that, before maybe three days or maybe two days because they have two dog teams. On the way home, believe it or not, still down in Gulf of Boothia they saw a polar bear with a cub...they shot that with a cub and in that time there was not much of polar bears. Today it's a big difference. Last year around, I took a sport hunter, polar bear hunter I took last year. The tracks everywhere, everywhere and new ones and old ones, right now you cannot believe it's lots of polar bears. And my friend went polar bear hunting last April he said polar bears everywhere, he said lots of polar bears this year. (HB1, 23 July)

I grew up with elderly people and that like to go camping during summertime. We never see any encounter of polar bear while you are out camping, caribou hunting grounds. You never encountered any polar bears. But over the years, over the last 15 years or so we've been encountering more bears on the land, having to deal with them more. (HB2, 23 July)

When I was young, there used to be hardly any polar bears. And now today you can see them everywhere...because in the old days they didn't have a tag, polar bear tag. So they would just get them whenever they see them. Today, we only can hunt them with the tags. Unless they are a threat. (HB3, 23 July)

When we are hunting them up in Gulf of Boothia, we are seeing a lot of mother with cubs, but I don't think it's that much different than when I was younger, there are just everywhere, mother with cubs. Adults we see them both, male or mother with cubs. (I3, 27 July)

<u>Changes in distribution and behaviour</u>

Today, there are more polar bears near, you know, coming into town more every year. To me they seem to be more vicious now because they're not afraid to go right into the community or come by the community. That's how I see the big changes. (Interpreter translating for K1, 26 May)

The only time that we notice that when we get polar bears nearby or going to town is ['cause they're] especially around the fall season, especially around September, October, November. (Interpreter translating for K1, 26 May)

They're concern about their getting too many out there, is that they start attacking. Like they're getting too many. The population is for polar bears, is getting too much so that's, they start attacking. I mean, they're more aggressive. (Interpreter translating for N1, 16 June)

In the old days they shoot a polar bear they have to be very careful taking care to get the polar bear. If the polar bear notice that there's a man or a human, the polar bears right away they go get away and they don't go to community or a campsite or something like that. Right now, it's different they don't scare much anymore. (HB1, 23 July)

The only difference from many years up to today. Seems like they're more aggressive towards humans. Many years ago, they, as if like see people they would run away right away. Today it seems like it's not that way anymore. (Interpreter translating for T3, 21 May; Ekaluktutiak et al., 2020)

He has a big concern in this area because starting in the 1980s with the tagging system, if you're out camping at your outpost camp, don't matter what time of the year, you don't have a tag and you're trying to follow the rules of the HTO as well as the government. And if a bear were to get into the camp or the outpost camp and you don't have a tag and you have children with you and you're out on your outing, enjoying your time out on a land camping, it's you know, what are you really to do? You don't have a tag and you're told not to hunt. That is a very big concern for him today. (Interpreter translating for T1, 21 May; Ekaluktutiak et al., 2020)

Before there was a polar bear regulation, policy and procedure, they could catch the polar bear any time, even though it had cubs. Today there's so many polar bears and nobody, like we cannot catch them unless, you know, they're [totally] attacking. Trying to camp in the summer, spring and summer with your family and polar bear policy in place. He's afraid for his family, especially children, because the polar bear can attack any time, he's got no law or anything. The polar bear can attack the children any time he wants, the family any time he wants. But us, we've got a law that you know from that he's afraid, the polar bears keep coming into the camps nowadays. Destroying cabins nowadays. There's so many that he think it was, it's not, he knows that they will come into camps and all we have to do is try to scare them away. But if they're determined to come in, they will come in. (Interpreter translating for T1, 21 May; Ekaluktutiak et al., 2020)

It seems like the younger ones are more aggressive now, because even as mother bears with cubs too, a lot of time we’re camping, hunting a few miles from Naujaat, from my hometown and we notice cubs that weren't get mothers or family, weren't sort of [tense] anymore. Last time I went out, when I woke up there was a mother bear with cubs, we had some meat, raw meat with blood fat on it and the meat like at night ate up, a mother or cubs ate up the fat with the cubs, and of course she tried going under my tent ropes, so we never woke up, but seems like there's more, not scared of people anymore. (N2, 15 June)

Even though it's not just polar bears there's also other concerns that we have to deal with is like, you know, the climate change, the sea ice...the way I see it impact on all animals, not just polar bears, it could be any animal including the people the human beings. The way that I see this, concerns me is the climate change. It's that the climate change is affecting everything. (Interpreter translating for K1, 26 May)

<u>Disturbances to polar bears</u>

Today we have many planes flying over, jets, prospecting helicopters, planes flying over and hunters using snowmobiles with that sound of machinery. He thinks that they're a lot used to hearing that. Once, many years ago, once they hear something, they would run away right away. (Interpreter translating for T3, 21 May; Ekaluktutiak et al., 2020)

Due to machinery with the snowmobiles, jets flying over, planes and all this because polar bears have a very keen ear. They can hear from many miles, they hear machinery and they get spooked and it's as if harder to find [them] in a way, because of the machinery, the sound and smell. (Interpreter translating for T4, 21 May; Ekaluktutiak et al., 2020)

If that had gone through, the seismic, seismic testing perhaps that would have impacted our polar bear, polar bears numbers and statistics. (Interpreter translating for K1, 26 May)

As soon as they hear any type of machinery, snowmobiles, for example, they'd start to run. Even before you see them, once they hear you they'll run. (GH2, 16 June)

<u>Changes in sea ice</u>

Over these last few years, we get thinner ice, but we're still get lots of ice when it the floe edge is still the same spot where it is, if not a little bit further. There's not much change in the ice, the sea ice...it gets easier for them to get their prey. (K2, 13 May)

The ice condition has changed. It's not too long ago, I think that started back in the 2002, 2004, somewhere in that area. Before that ice condition was...normal. Like, when I say normal, it tends to freeze earlier in the fall time. And tends to melt later in the springtime. Today, ice condition will melt very quickly in the springtime. It will be gone like without you knowing it's going. And tends to freeze up later in the fall time like October, November. (Interpreter translating for K3, 19 May)

Unable to see icebergs up in Gulf of Boothia area many years ago. But seems like you see icebergs every so often after a few years, it might got to do with maybe the sea ice getting thinner that we started to see some icebergs up in Gulf of Boothia area. That might be a fact that true, the ice conditions and changes, that might be the reason why we see icebergs every so often in Gulf of Boothia. (Interpreter translating for T3, 21 May)

The sea ice right now is different I think everywhere in the Arctic. In the old days, back in 1960s, we have very cold weather. And there was no warm weather, and I don't know why the oceans right now the ocean, the whole ocean from south to north it's a lot warmer now that's why the broken ice melted very fast. Because of the ocean's a lot warmer than the past 40 years or more. (HB1, 23 July)

It's a lot more thinner than it used to be. Some areas you normally have an idea where the floe edge would be but it's for some reason it's not consistent these days. It's not the same edge where the floe edge used to be. It gets there but it's broken off usually now. And it's a lot thinner the way I see it. (HB2, 23 July)

And our summer is more longer. And sea ice is not forming fast enough these days. Our weather has changed I guess due to climate change, they say. Warmer weather, sea ice not forming, well by the time it's usually hard enough by December, back then, but it's not like that anymore. Sea ice, solid ice disappearing fast, early July. And so these are the factors. (HB5, 27 July)

Impacts of sea ice changes

I don't any very much effect on polar bear of sea ice change because polar bears will adapt to any season, just like we'll will adapt their home summer, fall or winter or spring. They'll adapt to any changes in the sea ice or anywhere. (Interpreter translating for K3, 19 May)

Us hunters don't have a concern about the bears of this ice condition changing. Bears are known to be great swimmers, divers. They're known to be good on ice. They're known to be on the land in the wintertime. They go denning up on the land. They're able. It's really not a big concern because they're adaptable, they adapt to the climate, whatever it may be, in the ocean, water, on land, on ice or snow. It's not much of a concern. They're very adaptable, unique creatures. (Interpreter translating for T2, 21 May; Ekaluktutiak et al., 2020)

Polar bears easy [to adapt to] environment. Whether there's lots of sea ice and whatnot, or if you don't have much sea ice, of course they go on the land. They just adapt to their environment. It's like a weather pattern they're following. (Interpreter translating for T3, 21 May; Ekaluktutiak et al., 2020)

I cannot say that polar bears being affected by sea ice changes because the polar bears can be on the sea ice, they can swim, and they can be on the land. I don't see any major issues. (Interpreter translating for K1, 26 May)

I don't think it's a big concern to me about how polar bears with their environment. Whether there you know traffic here or there by sea ice, water or by air. That area is very important to me because after the tags were placed in, that's where my concern was, is that when the tags were placed in, after the tags were placed in, then we start following those policies. There are more polar bears now, numbers of polar bears now, there are more polar bears now. With traffic and this environment around the polar bears, I don't have a big concern whether even if the ice is melted, even if there is no more ice, I don't think that's really a concern to me. That's how I, you know [that's what] I think about that area. (Interpreter translating for K5, 26 May)

They think the bears are going to become extinct or what not. But then for us living in the north, they're not. Where we live here. Well, I do. I've been following bears population for when I was a kid, so I have no concern about them vanishing or getting extinct. And people down south think they won’t survive because of global warming. The ice that has warmed, they are going to become extinct. I don't believe that. So to me there's no concern about bears getting extinct. (N2, 15 June)

<u>Management considerations</u>

More polar bear tags increase because of the population of polar bears that you know has increased dramatically. Most harvesters would like to see tags increase because 20, you're only allowed 25 tags in a year. It would be nice, like a lot of harvesters out there like he's not a regular polar bear hunter but he would like to see more tags. Tags given. (Interpreter translating for K5, 26 May)

There are so many bears now that it doesn't matter. You catch one now, the fur pelt is so small now, it's very cheap now...I like to go camping in springtime with my family. And they’re so many bears now...our hometown that dangerous to stay in a tent or a cabin, even a cabin is dangerous. I wish there would be more tags given out to the HTO or to the people. (N2, 15 June)

I never heard of any surveys in Gulf of Boothia and I don't think Hall Beach ever been part of it. There have been discussion in QWB—Qikiqtaaluk Wildlife Board annual meetings with NWMB before about the surveys being done in Gulf of Boothia but it was mainly focused on Kitikmeot regions communities. We didn't really get to be a part of it. (HB2, 23 July)

Appendix 2. Map of the Gulf of Boothia polar bear subpopulation

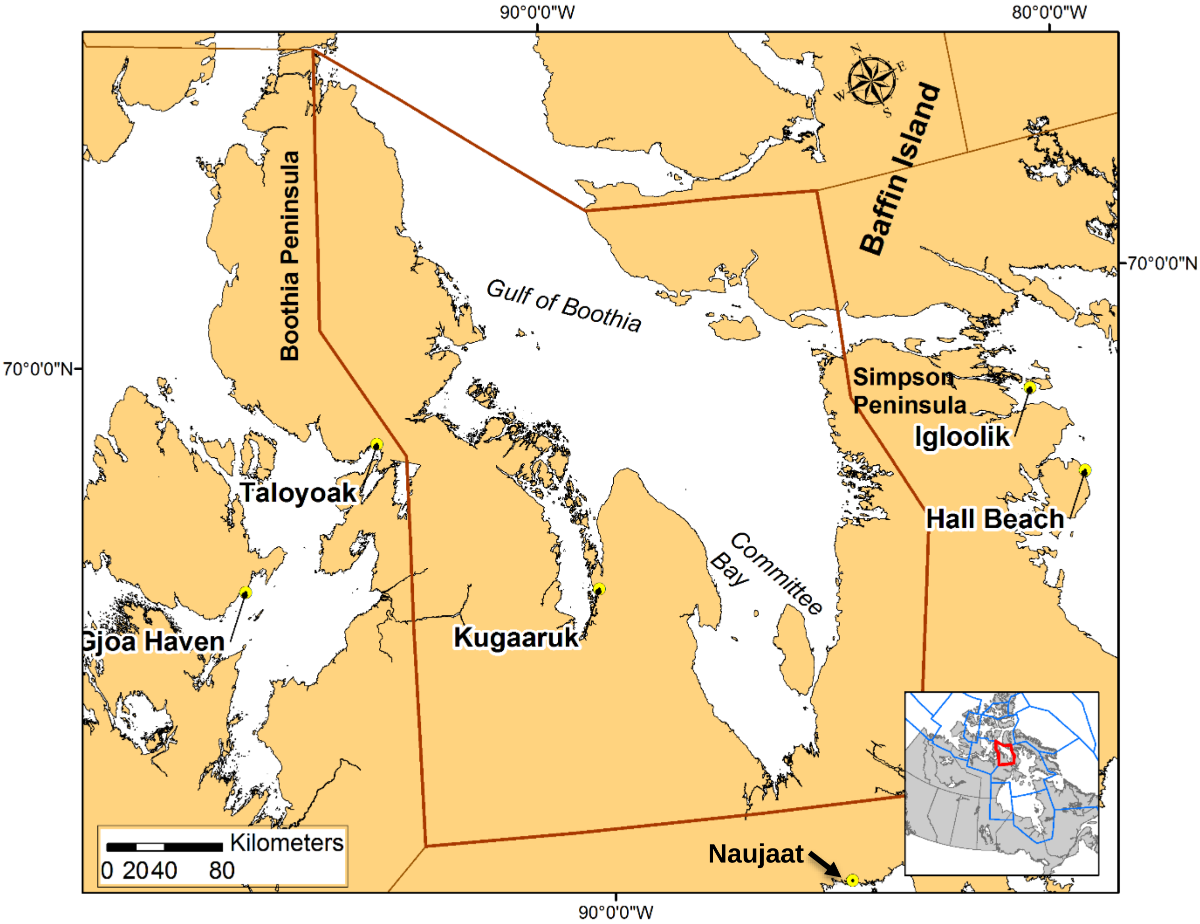

Fig. 1. Gulf of Boothia polar bear subpopulation (red border in bold) in Nunavut and the communities that harvest from there. The M'Clintock Channel subpopulation is located directly to the west.

Appendix 3. Description of polar bear management

Gjoa Haven and Taloyoak communities harvest both M’Clintock Channel and Gulf of Boothia polar bears. Gjoa Haven community members began harvesting from Gulf of Boothia after harvesting opportunities for M’Clintock Channel were limited. This year, Gjoa Haven received five tags for Gulf of Boothia. Once a hunter receives a tag, they are given up to five days in the community to prepare before going out on the land, where there is no time limit to harvest.

> Usually, the HTO would give us about five days to pack up and get ready. But once you're actually hunting out there, there's really no time limit until you come back home with or without a bear. And then when you do get back, usually we pull another name from the draw. (GH2, 16 June)

Interviewees indicated that overharvesting results in a reduction in the number of tags for subsequent years.

> When we overharvest—for defence kill or something, around the community—one tag is taken out from our quota. You know, if it's a female that's been caught in the community it might cost us two tags. So, we can't overharvest what is given to the community in terms of quotas. Today that's the only way we could hunt polar bears using quotas from the government (GH1, 3 June; Ekaluktutiak et al., 2020)

Taloyoak community members received 25 tags for Gulf of Boothia. To avoid overharvesting, the HTO allocates portions of tags at a time. There are usually more interested hunters than the number of tags that are available.

> The HTO open five tags at a time because they don't want to overharvest. They're trying to manage in a way that they don't overharvest so the next year won't be, some years they don't even have enough tags. There are a lot of people like to go polar bear hunt and once the five tags that are introduced, five polar bears were caught and then they'd introduce another five to open. And there are many people that like to go polar bear hunting, even though they have these many tags. Hunters are waiting in line to get a bear tag and other years, there is just never enough polar bear tags. There are a lot of people. These communities are growing. Especially today. We have a lot of people that like to have the opportunity to go out polar bear hunt and catch their first bear. But they're unable to do that because of the tagging system. (Interpreter translating for T2, 21 May)

Kugaaruk received 24 tags this year. The HTO distributes tags to hunters after their harvest and are distributed through a lottery system when tags are running low.

> Early in the season in October anyone may want to go out after polar bear to hunt. Do not required a draw to be done in the community but whoever want to go polar bear hunting will get a tag. That's how it goes all through the winter, spring. But when a tag is two, three tags left, the industry tag, then that's when the draws will start being done. (Interpreter translating for K3, 19 May)

Naujaat, Hall Beach, and Igloolik harvest from the Foxe Basin population in addition to Gulf of Boothia. These communities received 5, 4, and 11 tags for Gulf of Boothia, respectively. Gulf of Boothia bears are usually harvested on the west side of Melville Peninsula in Committee Bay. Interviewees indicated they usually receive a tag after the bear is harvested.

> They would announce on the local radio that there’s about so many tags for Foxe Basin and Committee Bay (Gulf of Boothia). And they would announce how many there are. And people just go out on the first opening day and catch some bears. It doesn't matter who, you can just go out and catch them without getting the tags I think, and then if you catch one, you can just go get the tag from the HTO...later on when the tags are not many in spring, the HTO would announce there's so many tags to go. (N2, 15 June)

> The Hunters and Trappers host a annual general meeting with polar bear tags in October and we decide when to open it. It's usually open in October but you can't go up in early fall or some days too dark, so usually March is people start traveling over there. And it's open, like whenever they, community members, approve of the opening date. It's open for public. Anyone can go up there, we don't usually get a tag for it, it's after we get a polar bear we will, anyone can go up to the conservation officer and pay him the tag. (HB2, 23 July)

> Going up to Gulf of Boothia it's usually straight out to Committee Bay area. Come around the island, Committee Bay area, and around that. Once I gone...towards the south and up the Gulf of Boothia...usually takes me about five to six, seven hours, depending on the speed I'm travelling and the snow, how smooth it is. (HB2, 23 July)

> There is always rules for polar bears. You can't just catch polar bears [if] you want to catch one, unless you have a quota or a tag. You can catch it or unless they tell you you can catch a female, they'll pick one. Or there is one thing that you can just go and kill the polar bear is when it goes to town and you have no choice to kill it. So, there is three options, and we can't use any option we want. It has to be by the government quota to use, how to kill it. They tell us to do it, we did it. So, we can't just shoot one if we want one. But if we can get it, we share. (Interpreter translating for N3, 4 July)

March 26, 2021

Hon. Joe Savikataaq
Minister of Environment,
Government of Nunavut

Dear Minister Savikataaq:

Re: NWMB Decision on the Government of Nunavut's Proposal to Establish a Total Allowable Harvest of 74 polar bears for the Gulf of Boothia subpopulation

NWMB Decision

At the Nunavut Wildlife Management Board's (NWMB or Board) Regular Meeting (RM001-2021) on March 10, 2021, your department presented a proposal requesting that the Board establish a Total Allowable Harvest (TAH) of 74 polar bears for the Gulf of Boothia polar bear subpopulation, thereby maintaining the current harvest limit. During the Board's In-Camera Meeting (IC001-2021), on March 11, 2021, the Board considered your department's proposal, along with (1) a report of the 2015–2017 Government of Nunavut study to estimate the Gulf of Boothia subpopulation abundance, (2) an account of Government of Nunavut in-person consultations with Hunters and Trappers Organizations in Gjoa Haven, Sanirajak, Igloolik, Kugaaruk, Naujaat, and Taloyoak, (3) an Inuit Qaujimajatuqangit study on Gulf of Boothia polar bears commissioned by the Government of Nunavut, and (4) oral submissions by co-management partners at the Regular Meeting. The Board made the following decision:

> *RESOLVED that the Nunavut Wildlife Management Board defers its decision on the Total Allowable Harvest for the Gulf of Boothia polar bear subpopulation pending the outcome of ongoing consultations on the polar bear Harvest Administration and Credit Calculation System (HACCS), which is anticipated to come to the Nunavut Wildlife Management Board for review and approval soon.*

NWMB Consideration

In reaching its decision, the Board considered the following arguments and evidence:

Science subpopulation abundance study

The Board assessed and considered evidence from the Government of Nunavut's 2015–2017 study to estimate the subpopulation abundance of Gulf of Boothia polar bears. The study estimated an abundance of 1525 (standard error = 1231–1819), similar to the 1998–2000 estimate of 1592. The study suggested that Gulf of Boothia polar bears are in better body condition than in 1998–2000. The proportion of adult females relative to males was reported to have increased from 0.57 (1998–2000) to 0.61 (2015–2017), consistent with model-based predictions of a declining male population in the Gulf of Boothia under the 2:1 sex-selective harvest. The study also showed good reproductive performance with a cub-of-the-year litter size of 1.61 (range = 1.51–1.70) and yearling litter size of 1.53 (range = 1.41–1.61).

Based on the Government of Nunavut's report, the Board considered that the Gulf of Boothia polar bear subpopulation is healthy and productive given the estimated subpopulation size, the body condition index, and the reproductive performance indices. The number of offsprings per female were higher than those reported for Baffin Bay, Foxe Basin, Southern Hudson Bay, and the Chukchi Sea subpopulations, indicating that the Gulf of Boothia subpopulation is productive.

Inuit Qaujimajatuqangit study

The Board reviewed an Inuit Qaujimajatuqangit study conducted by the Government of Nunavut. The report was based on interviews with Inuit in all six communities that harvest from the Gulf of Boothia polar bear subpopulation. Interviewees stated that the Gulf of Boothia polar bear subpopulation has increased relative to the 1970s; that people are seeing a lot of healthy polar bears, including females and young bears; that noise from shipping activities is a threat to polar bears; that the "solid ice" is disappearing faster; and bears come to the land sooner but changing ice conditions are unlikely to affect bears. Most interviewees were concerned that polar bear management decisions are most often made without considering Inuit knowledge and wisdom, including the cultural relationship between humans and polar bears. The Board is aware that interview participants were not directly asked to comment on the Government of Nunavut's TAH recommendation.

Harvest Records and Credits Status

The current TAH for Gulf of Boothia is shared by six Inuit communities as follows:

Igloolik (11), Sanirajak (4), Kugaaruk (24), Talojoak (25), Gjoa Haven (5) and Naujaat (5). The Board considered evidence provided by the Government of Nunavut concerning the harvesting of polar bears from the Gulf of Boothia between 2009–2019. These records show that the average harvest rate since 2019 remains below the harvest limit—at 63 bears per year over the past five years. Board members asked the Government of Nunavut why the full TAH is not being harvested. The Board heard that under the 2:1 harvest sex ratio, some communities stopped harvesting once female tags were used up to prevent over-penalization under the Flexible Quota System (the 2:1 Harvest sex ratio was changed in 2019). The Board also heard that rough ice conditions also played a role by restricting access to "prime harvesting locations."

As a result of harvesting below the Total Allowable Harvest for ten years, communities harvesting from the Gulf of Boothia subpopulation have accumulated 119 male and 22 female credits as of the end of the 2019–2020 harvest season. The Government of Nunavut explained that credits would be zeroed if the NWMB and Minister set a new TAH because the new population estimate and recommended TAH considers all bears in the subpopulation.

Oral Submissions at the Regular Meeting from Co-management Partners

At the NWMB Regular Meeting, the Board heard and considered oral arguments from its co-management partners. Environment and Climate Change Canada expressed that the current quota of 74 was based on modelling that assumed a harvest sex ratio of two males for every one female. Therefore, the proposed recommendation to maintain the TAH to be harvested at a sex ratio of one male for every one female could lead to long-term population declines, as "adult females are the most important contributors to population growth." Environment and Climate Change Canada recommended that a quantitative harvest risk assessment be conducted in advance of a TAH decision to inform management objectives and the proposed TAH.

The Board heard from the Qikiqtaaluk Wildlife Board, who stated that the Government of Nunavut consultations with affected communities were incomplete or insufficient because credit reset was not raised and discussed at the consultation meetings. The Qikiqtaaluk Wildlife Board further presented a motion, requesting the Board "delay a new decision on the TAH for Gulf of Boothia polar bears until after the communities, and Regional Wildlife Organizations have been fully informed of the effects on their credits, and have time to reply to the NWMB on this issue." In response to the Qikiqtaaluk Wildlife Board's position and motion to adjourn, the Government of Nunavut stated that credit reset following a new TAH is in line with the Interim Flexible Quota System and was not necessarily the subject of the consultations. The Government of Nunavut also pointed out that the Qikiqtaaluk Wildlife Board was present at the consultation meetings and could have raised the credit reset issue if they considered it was relevant to the TAH recommendation.

Reasons for NWMB Decision

Based on the Government of Nunavut's submissions and oral submissions from co-management partners during the Regular Meeting, the Board determined that the Gulf of Boothia polar bear subpopulation is healthy and productive. However, the Board could not ignore the credit issue raised by the Qikiqtaaluk Wildlife Board and supported by other Regional Wildlife Organizations. At the end of the 2019–2020 harvest season, communities that harvest from the Gulf of Boothia polar bear subpopulation have accumulated 119 male and 22 female credits that will be reset once a new TAH is set. Therefore, the Board decided to defer its decision making on the Gulf of Boothia polar bear TAH pending the outcome of ongoing consultations on the polar bear Harvest Administration and Credit Calculation System, which is anticipated to come to the NWMB for review soon. Moreover, the Board determined that a delay to its TAH decision making will not negatively impact Inuit harvesting rights as the current TAH is the same as the TAH recommended by the Government of Nunavut, and harvesting has been below the quota for the past ten years.

<u>Board determinations on request to discuss tag allocation with all affected communities</u>

In the Government of Nunavut's briefing note to the Board, they recommended that "Regional Wildlife Boards (RWOs) should discuss the tag allocation with all communities that harvest from both the Gulf of Boothia and the M'Clintock Channel subpopulations." During the Regular Meeting, the Government of Nunavut stated that their recommendation was in response to some participants at the consultation stating that their appeal to the Regional Wildlife Organizations to increase their community tags has not been considered. The Board determined that the Government of Nunavut should voice their concerns directly to the Regional Wildlife Organizations.

Conclusion

The NWMB looks forward to your reply and prompt completion of the *Nunavut*

Agreement Article 5 decision-making process. If you have any questions regarding this letter, please do not hesitate to contact the NWMB.

Sincerely,

Daniel Shewchuk

Daniel Shewchuk
Chairperson
Nunavut Wildlife Management Board

cc: Drikus Gissing, Government of Nunavut.

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Nunavut Wildlife Management Board

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Tammaqtailinahuarniriit anngutighat atuqhugit Inuit qaujimajatuqangillu ilihimaniillu ilitquhiannin
Conserving wildlife through the application of Inuit Qaujimajatuqangit and scientific knowledge

February 1, 2022

Honourable David Akeeagok
Minister of Environment
Government of Nunavut

Dear Minister Akeeagok:

Re: NWMB Decision on the Request for Approval of the Polar Bear Harvest Administration and Credit Calculation System (HACCS)

Background

At the Nunavut Wildlife Management Board's (NWMB or Board) Regular Meeting, held on December 9, 2021 (RM004-2021), the Government of Nunavut submitted an application to the Board to approve the polar bear *Harvest Administration and Credit Calculation System* (HACCS). The HACCS, a revised version of the *2019 Flexible Quota System* (FQS), is proposed to be used in Nunavut to administer the portion of the Total Allowable Harvest (TAH) allocated to a given community. The purpose of the HACCS is to administer changes to polar bear harvest management in Nunavut resulting from the decision by NWMB and Minister in 2019 to change the sex-selective harvest ratio from two males for every female (2:1) to up to one female for every male (1:1). It allows communities to accumulate credits for future use when the annual allocation is under-harvested. It also allows for credits to be deducted from the following year's base allocation when polar bears are over-harvested.

In August 2019, the FQS—first negotiated in 2005, was revised to accommodate the 1:1 male to female ratio for polar bear harvest across Nunavut. The revised FQS was approved by the NWMB on an interim basis in September 2019, pending further consultation with co-management partners. The Government of Nunavut revised and re-submitted the 2019 FQS[1] for approval by the Board in its June 10, 2020, Regular Meeting.

At the NWMB's In-Camera Meeting on June 11, 2020 (IC002-2020), the Board did not make a decision on the HACCS but decided to extend the validity of the 2019 FQS pending further consultations with co-management partners. The Board also recommended that Nunavut Tunngavik Incorporated (NTI) and the Regional Wildlife Organizations (RWOs), in

1 The revisions to the 2019 *Flexible Quota System* included the renaming of it to the *Harvest Administration and Credit Calculation System*.

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consultation with their communities' HTOs, provide feedback on the FQS and work with the Government of Nunavut to resolve any disagreements.

On November 5, 2021, the Government of Nunavut submitted a revised version of the HACCS for the Board's approval following consultation with and feedback from co-management partners.

NWMB Decision and Recommendation

During the Board's Regular Meeting on December 9, 2021, the Government of Nunavut presented the HACCS and made submissions on its consultation with co-management partners. Co-management partners also presented oral and written submissions.

At the NWMB's In-Camera Meeting on December 10, 2021 (IC004-2021), the Board considered the Government of Nunavut's application alongside oral and written submissions from co-management partners and made the following decision and recommendations:

RESOLVED that, pursuant to the Board's authority under Section 5.2.34(d)(i) of the Nunavut Agreement, the Nunavut Wildlife Management Board approves the Government of Nunavut's Polar bear Harvest Administration and Credit Calculation System.

FURTHER RESOLVED that the Nunavut Wildlife Management Board recommends that:

- *The Government of Nunavut and co-management partners work together towards a fair and acceptable accounting system for polar bears killed in defense of life and property (DLPK);*
- *The Government of Nunavut and co-management partners work together towards a fair and acceptable alternative to resetting harvest credits to zero when a new sub-population Total Allowable Harvest is set;*
- *The Government of Nunavut explore options to improve public access to polar bear harvest administration and increase involvement of Regional Wildlife Organizations in the management and allocation of community harvest credits.*

Reasons for NWMB Decision

***Decision to approve the* Polar Bear Harvest Administration and Credit Calculation System (HACCS)**

The application before the NWMB was to seek its approval of the Government of Nunavut's Polar bear Harvest Administration and Credit Calculation System (HACCS). The HACCS is intended to be an administrative tool to keep track of polar bear harvesting at the community level. The HACCS operates once a community allocation has been decided by the Regional Wildlife Organizations (RWOs) for 'regional TAHs' or by the NWMB and Minister for 'community TAHs'. The NWMB has discretionary authority under section 5.2.34(d)(i) of the *Nunavut Agreement* to approve plans for the management of wildlife. During the Regular Meeting, the GN stated there are no Non-quota Limitations in the HACCS.

The HACCS regulates the polar bear sex-selective harvest ratio and sets credit accumulation and use rules. The Government of Nunavut stated that the HACCS is integral to implementing the Board's and Minister's decisions on (1) the *Nunavut Polar Bear Co-Management Plan* and (2) the change in the sex-selective harvest ratio from 2:1 to 1:1. The Board approved the FQS on an interim basis in 2019. It has been implemented during the 2019/2020 and 2020/2021 harvest seasons. In June 2020, the Board extended the validity of the 2019 FQS, pending further consultations with co-management partners. In a letter to the then Minister of Environment on July 6, 2020, the NWMB encouraged the Government of Nunavut and relevant Inuit Organizations to work together and constructively resolve any disagreements in the HACCS.

During the regular meeting held on December 9, 2021, the Government of Nunavut presented the revised HACCS and made submissions on consultation with co-management partners. The consultation report stated that the Government of Nunavut organized two conference calls with co-management partners on April 1 and July 27, 2021. The three Regional Wildlife Organizations, NTI, NWMB staff, and seven HTOs (Cambridge Bay, Kugluktuk, Baker Lake, Kinngait, Igloolik, Resolute Bay, and Grise Fiord) attended the consultation meetings. The consultation report also stated that the Government of Nunavut presented revisions to the HACCS during the conference calls, and co-management partners present had the opportunity to ask questions and provide feedback. The Board noted that in addition to and following these consultation meetings, the Government of Nunavut distributed consultation packages and letters requesting additional feedback on the

HACCS from co-management partners on March 19 and October 1, 2021. The Board also noted that the Government of Nunavut postponed plans to submit the HACCS to the NWMB in September of 2021 to provide more time for feedback from co-management partners.

However, the Board also heard and considered requests from Kitikmeot Regional Wildlife Board and Qikiqtaaluk Wildlife Board to delay decision-making until all HTOs in the Kitikmeot and Kivalliq regions have been engaged. The KRWB stated "that the proposal is very technical and requires more discussion and engagement with Kitikmeot communities to fully understand the system."

In the end, the Board determined that given the evidence of follow-up engagement presented by the Government of Nunavut, the Board was able to proceed with making a decision on the HACCS.

There were concerns the 2019 FQS was a complicated document to understand. The HACCS has undergone changes to improve its structure and content, though there is room for improvement. The HACCS is written in plain language that is easier to understand. The efforts by the Government of Nunavut to include examples in sections (with calculations) may facilitate understanding of credits calculations and quota adjustments in different harvest scenarios. The two flow charts with annotations included in the HACCS[2] add clarity on credit use, credit exchange processes, and the role of co-management partners like the RWOs. The explanations provided in some sections have added detail and helped clarify the Government of Nunavut's rationale, especially in areas where co-management partners have raised concerns during consultation meetings, such as the issue of survival kills counting towards the TAH. The Board determined the changes to the HACCS in this version accommodate some concerns raised by co-management partners. However, there remain other unresolved concerns (such as DLPK and credit resets) that may prove challenging to administer when implementing the HACCS.

As the third harvest season (2022/2023) approaches under the 2019 FQS, the NWMB recognizes the need for a polar bear harvest administration system in Nunavut for the 1:1 sex-selective harvest ratio. On the basis of the simplified credit administration presented in the HACCS, the Board determined the current version of the HACCS is an improvement on the 2019 FQS in making its decision. As we proceed to implementation of the HACCS, the

[2] HACCS, pgs. 9, 10

NWMB will continue to make specific decisions on applications submitted to it on a case-by-case basis, including establishing, modifying or removing TAH or NQL.

Recommendations for Collaborative Improvement to the Nunavut Polar Bear Harvest Administration

The Government of Nunavut's submissions presented the HACCS exclusively as a polar bear administration tool for the NWMB's consideration. The Board is not aware that the Government of Nunavut provided notice or consulted with Inuit on potential rights limitations in the form of NQL if the HACCS is approved. Nevertheless, the Board considered the concerns raised by co-management partners through oral and written submissions that warrant attention, and specifically raises two issues in the paragraphs below.

Defence of life and property kills (defence kills) are counted as part of the TAH in the HACCS. The NWMB has heard Inuit frustrations about defence kills being counted in the TAH. The Government of Nunavut has submitted that not accounting for defence kills would interfere with sustainable harvest principles. The Government of Nunavut also argued that defence kills, like resetting credits to zero, are intended to enhance sustainable populations, which will facilitate Inuit harvesting opportunities in the future. Inuit submit that defence kills happen in unusual and sometimes life-threatening circumstances, they are not intentional harvests, and they should not be counted in the community TAH. By counting defence kills in the TAH, Inuit submit there are reduced harvesting and cultural expression opportunities, particularly in communities that experience problems with polar bears. The NWMB recommends exploring alternative options to count defence kills that takes Inuit concerns involving human-polar bear conflicts.

The HACCS states that a community's credits be reset to zero when a new TAH is established. The NWMB has heard Inuit oppose resetting credits to zero under those circumstances. The NWMB understands the Government of Nunavut's submission that resetting credits to zero when a new TAH is established avoids "double counting" of polar bears because the unharvested bears (credits) are counted in the new population estimate. Inuit organizations submit that resetting credits to zero unfairly removes earned credits and penalizes stewardship. The Board recommends the Government of Nunavut and co-management partners continue to work together towards a fair and acceptable alternative to resetting harvest credits to zero when a new sub-population TAH is set.

Given the complexity of polar bear credit administration, timely and accurate credit status information is relevant. The NWMB has heard concerns about finding out a community's credit status. RWOs are responsible for allocating a regional TAH to communities in the region. Under the HACCS, RWOs do not have a role in credit accumulation and use. The NWMB has heard questions about these different roles between base allocations and annual recommended quotas. The Board recommends that the Government of Nunavut explore options to enhance access to polar bear harvest data and in facilitating the involvement of RWOs in credit calculation and allocation processes. For example, there could be a public resource like a website where polar bear harvest and credit data could be viewed.

In approving the HACCS, the NWMB acknowledges statements by the Government of Nunavut Director of Wildlife expressing a willingness to engage in open dialogue with co-management partners. He expressed your department's willingness to engage in open dialogue with co-management partners on outstanding concerns and seek a fairer and more widely accepted polar bear harvest administration system in Nunavut.

Mr. Minister, the Board recognizes the importance of a sustainable polar bear harvest management system in Nunavut, where 11 of 19 global polar bear subpopulations are found. The Board also recognizes that wildlife management in Nunavut is a based on a co-management approach, so the development and implementation of harvest management systems must also reflect the views and knowledge of Inuit co-management partners. Through its recommendations, the Board encourages all co-management partners in Nunavut's polar bear harvest management to continue to seek common ground on these issues through sustained engagement, improved communication, increased transparency, and constructive feedback.

Sincerely,

Daniel Shewchuk

Daniel Shewchuk
Chairperson
Nunavut Wildlife Management Board

c.c. Drikus Gissing, Director of Wildlife Management, Government of Nunavut.

February 7, 2022

Mr. Daniel Shewchuk
Chairperson
Nunavut Wildlife Management Board
P.O Box 1379
Iqaluit, NU
X0A 0H0

Re: NWMB Decision on the Request for Approval of the Polar Bear Harvest Administration and Credit Calculation System

Dear Mr. Shewchuk:

Thank you for your decision sent on February 1, 2022 concerning the Polar Bear Harvest administration and Credit Calculation System.

To reiterate the decision of the NWMB:

RESOLVED that, pursuant to the Board's authority under Section 5.2.34(d)(i) of the Nunavut Agreement*, the Nunavut Wildlife Management Board approves the Government of Nunavut's Polar bear Harvest Administration and Credit Calculation System.*

FURTHER RESOLVED that the Nunavut Wildlife Management Board recommends that:
- *The Government of Nunavut and co-management partners work together towards a fair and acceptable accounting system for polar bears killed in defense of life and property (DLPK);*
- *The Government of Nunavut and co-management partners work together towards a fair and acceptable alternative to resetting harvest credits to zero when a new sub-population Total Allowable Harvest is set;*
- *The Government of Nunavut explore options to improve public access to polar bear harvest administration and increase involvement of Regional Wildlife Organizations in the management and allocation of community harvest credits.*

As per section 5.3.9(a) of the *Nunavut Agreement*, I hereby accept your decision to approve the Polar bear Harvest Administration and Credit Calculation System (HACCS).

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Minister of Environment
Ministaat Avatiliqiyitkut
Ministre de l'Environnement

I hereby acknowledge your recommendations to work together with co-management partners, including Regional Wildlife Organizations (RWO), on aspects of the polar bear harvest management system including defense of life and property kills and credit management, while working to improve public access to harvest information.

The Department of Environment is committed to working with co-management partners as evidenced by the development of the HACCS based on feedback from these partners. My department is optimistic that after filling their technical advisor positions, the RWOs will fully realize their roles and responsibilities in polar bear harvest management.

We must strive to balance management using sound science, Indigenous knowledge, and conservation principles. To that end, the department recognizes that the increases in co-management organizations' capacity will likely allow the full utilization of the harvest management system, as it is designed. I believe active engagement with co-management partners will address concerns of credit usage and management as well as improve public access to harvest information.

The decision will be implemented forthwith. This decision will remain in place until I receive a new NWMB decision.

I am confident that we will continue to work collaboratively in the implementation of this management decision. I appreciate the efforts that have been put forth in its consideration.

Sincerely,

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Hon. David Akeeagok,
Minister of Environment

Cc. Jimmy Noble Jr., Deputy Minister of Environment
Drikus Gissing, Director of Wildlife Research
Jason Aliqatuqtuq, Director of Wildlife Operations

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The Nunavut Polar Bear Harvest Administration and Credit Calculation System (HACCS) (Up to 1:1 Harvest System)

1. Rationale and background

During the public hearing process regarding the implementation of Nunavut's Polar Bear Co-Management Plan, by the Nunavut Wildlife Management Board (NWMB), many comments by Inuit organizations were brought forward that favoured a new harvest approach. For years, communities have expressed a desire to adopt a harvest regimen that does not penalize communities as sharply as the flexible quota system when females are overharvested, and that allows harvesting at an equal sex ratio. In response, the **up to one female for every one male harvest option (or 1:1)** was discussed and recommended by the Department of Environment (DOE). On August 26, 2019, the Minister of Environment accepted a decision from the NWMB to change the harvest sex ratio of polar bears in Nunavut to allow **up to one female bear to be harvested for every male bear (1:1).**

Each polar bear subpopulation within Nunavut has a set **Total Allowable Harvest (TAH)**, which is divided among the communities that harvest from the subpopulation by the appropriate Regional Wildlife Organization(s) (RWOs). This is termed the community **base allocation**. The relevant RWO can redistribute the base allocation annually among communities at its discretion. Each harvest season, communities are assigned an **annual recommended quota** which reflects the community's base allocation, any overharvests from previous seasons, and any credit usage. The base allocation and annual recommended quota can be the same number if there are no overharvests or credit usage by a community. Overharvests in one season result in a reduced community annual recommended quota the following season unless the community has accumulated sufficient credits to compensate for the overharvest. When a community harvests below their annual recommended quota they can accumulate sex-specific credits to be used in future harvest seasons or shared with other communities. Communities can request to increase their annual recommended quota through use of accumulated credits.

The updated harvest sex ratio, allowing up to one female bear harvested for every male bear harvested (1:1) does not constrain communities to adhere to the exact 1:1 sex ratio. Rather, it refers to the maximum number of female polar bears in the harvest that are allowed under this system. **The number of females in a community's base allocation can never exceed 50%.** However, the **annual recommended quota may exceed 50% females** depending on whether credits are used to increase the number of females in the annual recommended quota and/or if there was male overharvest in the past season(s) that resulted in a reduction of male bears in the annual recommended quota. Communities are not limited to 50% male bear harvest and communities can harvest their female bear allocation as males. Thus, **males can be harvested up to the limit of the**

annual recommended quota (100%) without going into an overharvest situation. Details are provided below.

The HACCS is a living document and can be reviewed at anytime, in whole or in part, at the request of the RWOs, the GN, or the NWMB. The organization requesting review shall notify all other parties and allow minimum 90 days for a response.

2. Overharvest situation

2.1. An overharvest situation occurs when:

2.1.1. The number of females harvested annually is greater than the number of females in the annual recommended quota, or

2.1.2. The number of males harvested annually is greater than the total annual recommended quota, or

2.1.3 A combination of the males and females harvested annually is greater than the total annual recommended quota.

3. Implementation

3.1. The implementation of the up to 1:1 harvest system begins with the 2019/2020 harvest season (July 1, 2019). The existing total annual base allocation of each community's TAH will be divided by two, to determine the sex ratio for each community. This represents the 1:1 base allocation for each community for 2019/2020. This process increases the number of females allowed in the harvest but does not constrain communities to harvest exactly a 1:1 male to female ratio. The annual base allocation will only change when there is a new allocation decision from the relevant RWO, or a new subpopulation estimate, and/or a new decision on the TAH by the NWMB (see section 5.4).

3.2. If a community's base allocation is an odd number, the RWOs give the DOE authority to alternate the base allocation such that the sex of the odd tag will alternate annually [Example: If a community's base allocation is 11 (6 males and 5 females) then the base allocation will alternate annually between 11(6 males and 5 females) and 11(5 males and 6 females)]. The DOE's authority to alternate the base allocation in these cases is superseded by the RWOs right to adjust these base allocations.

3.3. Annual recommended quotas are calculated using the previous harvest year's data.

3.4. Annual recommended quotas will be calculated based on the sections below.

4. Mortality accounting

4.1. All human-caused mortality to polar bears will count towards the annual recommended quota of the nearest community, except Sections 4.3 and 4.4.

4.2. A naturally abandoned cub or any bear found dead will be recorded as a natural death and not counted against the annual recommended quota.

4.3. Any bear that is found near death caused by starvation or injury, provided that the injury is not a result of human activity such as hunting or trapping, can be killed as a humane action where the Conservation Officer (CO) will certify that the bear was near death. After certification by the CO, the humane kill (euthanization) will not be counted against the annual recommended quota.

4.4. A bear may be killed as an emergency kill in accordance with section 97 of the *Wildlife Act* (the Act) to prevent a person's starvation. The kill will be evaluated to determined whether it was justified and necessary to prevent starvation. It must be clearly shown that the harvest occurred as a last resort, mismanagement cannot be construed as providing a lawful excuse to kill a bear without the proper authority (section 97(3) of the Act). If it is determined that the kill was justified and necessary to prevent starvation it will not be counted against the annual recommended quota, otherwise if it does not meet these criteria it will count against the annual recommended quota.

4.5. If an Inuk from Nunavut kills a bear, the tag will come from that person's home community if that community has an allocation from the TAH in the subpopulation from which the bear was harvested. Otherwise, the closest community to the harvest location must provide the tag.

4.6. For harvests within 30 km of a subpopulation boundary, the relevant HTO(s) may submit a request to the relevant RWO(s) to review and decide from which subpopulation to attribute the harvest (e.g., the subpopulation area from which the bear was harvested, or the subpopulation area bordering it). This decision will be made within the harvest year (July 1st – June 30th) of the given harvest and the RWOs will advise the Polar Bear Lab of the decision.

4.7. Harvesting of a family group or members of a family group is illegal in Nunavut; however, there are circumstances where a family group or members of a family group may be destroyed in Defence of Life and Property (DLP) circumstances.

4.7.1. When a female with cubs-of the-year (COYs), yearlings, or juveniles (2-year-old offspring) are **killed**, then:

4.7.1.1. For annual recommended quota determination purposes, the COYs and yearlings are counted as males and only ½ tag each.

4.7.1.2. The juveniles (2-year-old offspring) are counted as whole tags of whatever sex they are.

4.7.2. If the mother is killed but the COYs, yearlings or juveniles (2-year-old offspring) **run away**, then:

4.7.2.1. The COYs and yearlings are counted as ½ tag and all male (see section 4.7.1.1).

4.7.2.2. The juveniles (2-year-old offspring) that run away are considered as surviving animals. If juveniles are pursued and killed, they are counted as full tags (see section 4.7.1.2)

4.7.3. An HTO may apply to the Minister for a Wildlife Management Permit to allow COYs or yearlings to be harvested for food and cultural purposes. The permit must be issued in advance with a copy to the Wildlife Officer, and the HTO must monitor the hunt to ensure that the female (mother) is not harmed.

4.8. In a case where a community overharvests by one (1) COY or yearling, credits will be used to cover the harvest. In the event there are not enough credits to cover the overharvest of ½ male, the annual recommended quota will not be reduced by ½ tag at that time, and a record is kept with the Polar Bear Harvest Lab of these fractional reductions. The deduction will occur when there is another COY or yearling harvested to equal a full male bear reduction or, if the following year's harvest results in credit accumulation, the ½ credit deduction will be taken from the accumulated credits.

4.9. The parts that evidence the age, species, and sex of a polar bear are teeth for the age; the jaw or skull for the species; and the baculum (penis bone) of the male polar bear for the sex. When the baculum has been lost or forgotten, a hunter-signed Statutory Declaration or DNA extracted from other submitted samples shall constitute evidence of the sex. Where evidence is not provided, the kill will be counted as a female bear for annual recommended quota purposes.

5. Credits

5.1. Available credits may be used to address all types of kills, including accidental, illegal, and DLPs.

5.2. If a community is in an excess harvest situation, all available, applicable (e.g. male or female) credits accumulated by the community will be applied automatically by the Polar Bear Harvest Laboratory to cover the overharvest in order to ensure no reductions to the annual recommended quota occur for the following harvest season, if possible.

5.3. Credits are specific to a given subpopulation and cannot be used for other subpopulations.

5.4. Subpopulation credits accumulate until a TAH decision is made. This may follow a subpopulation inventory that results in a new final abundance estimate. In some circumstances, the NWMB may recommend a change in TAH for other management purposes. When a new TAH decision is made, all unused credits are set to zero because the credits have been carried forward through inclusion in the latest population estimate provided by science and/or Inuit Qaujimajatuqangit (IQ).

That is to say, bears that were unharvested (credits) have been accounted for in the updated population estimate through their contribution to population growth, or through population decline in the case of increased mortality or decreased reproduction. Thus, keeping bears as credits result in “double-counting”; they cannot be counted in credits AND the population abundance estimate. Carrying credits forward in perpetuity creates vulnerability in the sustainability of populations. Credits typically accrue over many years during which vital rates (e.g., reproductive rate, recruitment, survival) may change with the changing environment and/or population dynamics; no population of animals is static. Thus, credits accrued during a period of population growth and applied during a period of population decline would affect the population more negatively than intended, with an unknown magnitude. Resetting credits at the time of a new population estimate and TAH decision allows for managers to better adapt management targets to current population status.

5.5. Credits are accumulated as described in the following sections after the TAH decision is implemented, and during any harvest season:

5.5.1. Credits can accumulate for males and females.

5.5.2. Credits will accumulate for the number of unused males and females in the annual recommended quota.

5.5.3. No female positive credits accumulate when the number of females harvested exceeds the number of females in the annual recommended quota, or the total annual harvest equals or exceeds the annual recommended quota. [Example: if a community's annual recommended quota is 10 bears (5 males and 5 females) and the actual harvest includes 6 female bears, the community will not accumulate any female credits. Or, if the actual harvest meets or exceeds 10 total bears, the community will not accumulate any female credits].

5.5.4. In a single harvest season, female positive credits accumulate for unharvested female bears of the annual recommended quota given that the total harvest does not exceed the annual recommended quota. [Example: if a community's annual recommended quota is 10 bears (5 males and 5 females) and the actual harvest is 8 bears (5 males and 3 females), the community will accumulate 2 positive female credits for the number of unused females in the annual recommended quota].

5.5.5. In a single harvest season, male positive credits accumulate for unharvested male bears of the annual recommended quota. [Example: if a community's annual recommended quota is 10 bears (5 males and 5 females) and the actual harvest is 8 bears (3 males and 5 females), the community will accumulate 2 male credits for the number of unused males in the annual recommended quota. Alternatively, if the harvest is 8 bears (8 males and 0 females), the community will not accumulate male credits, but will accumulate 2 female credits which represent the number of females that were unused in the annual recommended quota].

5.5.6. In the case where a community has an annual recommended quota of zero, and a total harvest of zero, the community's full base allocation will be restored the following year, unless they still have negative credits that have not been replaced with positive credits (see section 5.6).

5.6 Negative credits are possible and represent the number of bears that have been removed from the subpopulation in excess of a community's annual recommended quota.

5.6.1 Negative credits are sex-specific and can accumulate for male and female bears.

5.6.2 Negative credits occur if there are insufficient credits to cover the excess harvest, and adjustments to the following year's annual recommended quota cannot cover the excess harvest. [Example: if a community's annual recommended quota is 10 bears (5 males and 5 females) and the actual harvest is 17 bears (12 males and 5 females), and there are insufficient male credits to cover the overharvest of males, the annual recommended quota the following year will be 5 bears (0 males and 5 females). Because there are no male credits to cover the 7 overharvested males, the 5 male tags for the following harvest season will count to cover part of the overharvest and the community will have negative 2 (-2) male credits that will still need to be replaced in subsequent harvest seasons. Alternatively, if a community's annual recommended quota is 10 bears (5 males and 5 females) and the actual harvest is 17 bears (5 males and 12 females), and there are insufficient female credits to cover the overharvest of females, the annual recommended quota the following year will be 5 bears (5 males and 0 females). The community will have negative 2 (-2) female credits that will need to be replaced in subsequent harvest seasons].

Credit exchange and request processes:

5.7 Credits can be exchanged between communities within the same subpopulation.

5.7.1 Communities that harvest from the same subpopulation can exchange credits, where needed, to restore their full annual recommended quota rather than facing a reduction when no community credits are available to cover an overharvest. The existing process for credit exchange between communities will be maintained (Figure 1).

5.7.2 Requests by communities to use credits to increase their annual recommended quota shall be made according to the process outlined in Figure 2. 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.

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.

6. Annual recommended quota adjustments

6.1. Reductions are sex-specific when there are insufficient credits to cover an overharvest.

6.2. To protect communities from years of reduced or no harvest opportunities resulting from persistent overharvest, the 1:1 system adapts to allow restoration of the full base allocation. The annual recommended quota will be set to zero in situations in which no credits are available, and a reduction in the annual recommended quota cannot restore the allocation [Example: if a community's base allocation and annual recommended quota is 10 bears (5 males and 5 females) and the actual harvest is 20 bears (10 males and 10 females); if there are no credits to cover the overharvested bears, the annual recommended quota for the next harvest season will be 0 bears. The new annual recommended quota of 0 covers the overharvested bears and the community will have its full base allocation following the 0-harvest year].

6.3. Negative credits are possible and represent the number of bears that have been removed from the subpopulation in excess of a community's annual recommended quota. Depending on the number of negative credits, there may be continued reductions in the annual recommended quota, over multiple harvest seasons, to restore negative credits to zero and reinstate the full base allocation (see Section 5.6).

Reductions in the annual recommended quota and credit administration occur as follows:

6.4. Adjustments in Cases of Female Overharvest:

6.4.1. When females are harvested in excess of the number of females in the annual recommended quota, a reduction of next year's annual recommended quota will occur if there are not sufficient female credits to cover the overharvest. The following year's annual recommended quota will be reduced by the number of females that were overharvested and not covered by credits. The reduction will affect the number of females in the next year's annual recommended quota [Example: if a community's annual recommended quota is 10 bears (5 males and 5 females) and the actual harvest is 12 bears (5 males and 7 females), and there are no female credits to cover the 2 overharvested female bears, the annual recommended quota for the following harvest season will be 8 (5 males and 3 females)].

6.5. Adjustments in Cases of Male Overharvest:

6.5.1. When the harvest exceeds the total annual recommended quota **and** the number of females in the harvest is less than, or equal to, the number of females in the annual recommended quota, then an overharvest of males occurred. Where application of credits does not cover this overharvest, a reduction equalling the number of overharvested males will be applied to the next year's annual recommended quota [Example: if a community's annual recommended quota is 10 bears (5 males and 5 females) and the actual harvest is 12 bears (7 males and 5 females), and there are no males credits to cover the 2 overharvested male bears, the annual recommended quota the following harvest season will be 8 (3 males and 5 females)].

6.6. Adjustments in Cases of Combination Male and Female Overharvest:

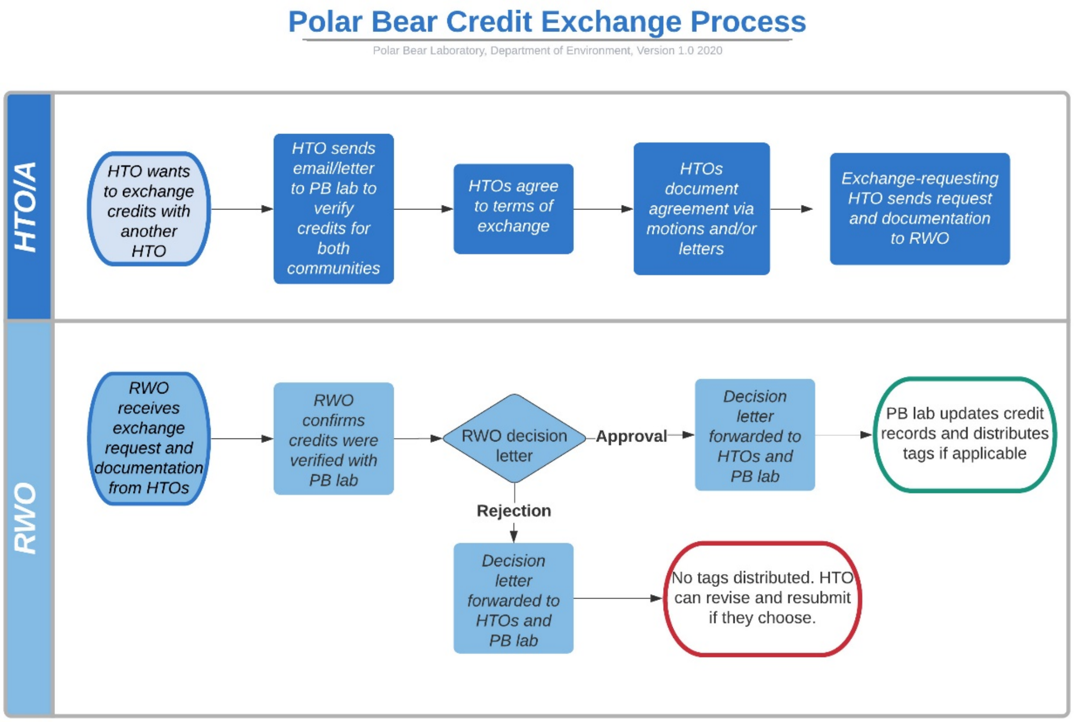
6.6.1. When females are harvested in excess of the number of females in the annual recommended quota **and** the sum of the total harvest (males and females together) exceeds the annual recommended quota, a reduction in the next year's annual recommended quota will occur for each sex, based on the number of bears overharvested [Example: if a community's annual recommended quota is 10 bears (5 males and 5 females) and the actual harvest is 13 (7 males and 6 females), and there are no credits to cover the overharvested bears, the annual recommended quota the following harvest season will be 7 bears (3 males and 4 females)].

7. Floating tags

"Floating tags" are additional tags allocated by RWOs. These floating tags are administered at the discretion of the RWOs, including the sex ratio. Once allocated by the RWOs, they are added to the total annual recommended quota for the recipient community for that year.

7.1. Unused floating tags are accumulated as credits in the sex they were allocated.

7.2. The RWO will advise the Polar Bear Laboratory annually of how they will allocate the floating tags for the next harvest season so that the tags can be attributed to the relevant communities.



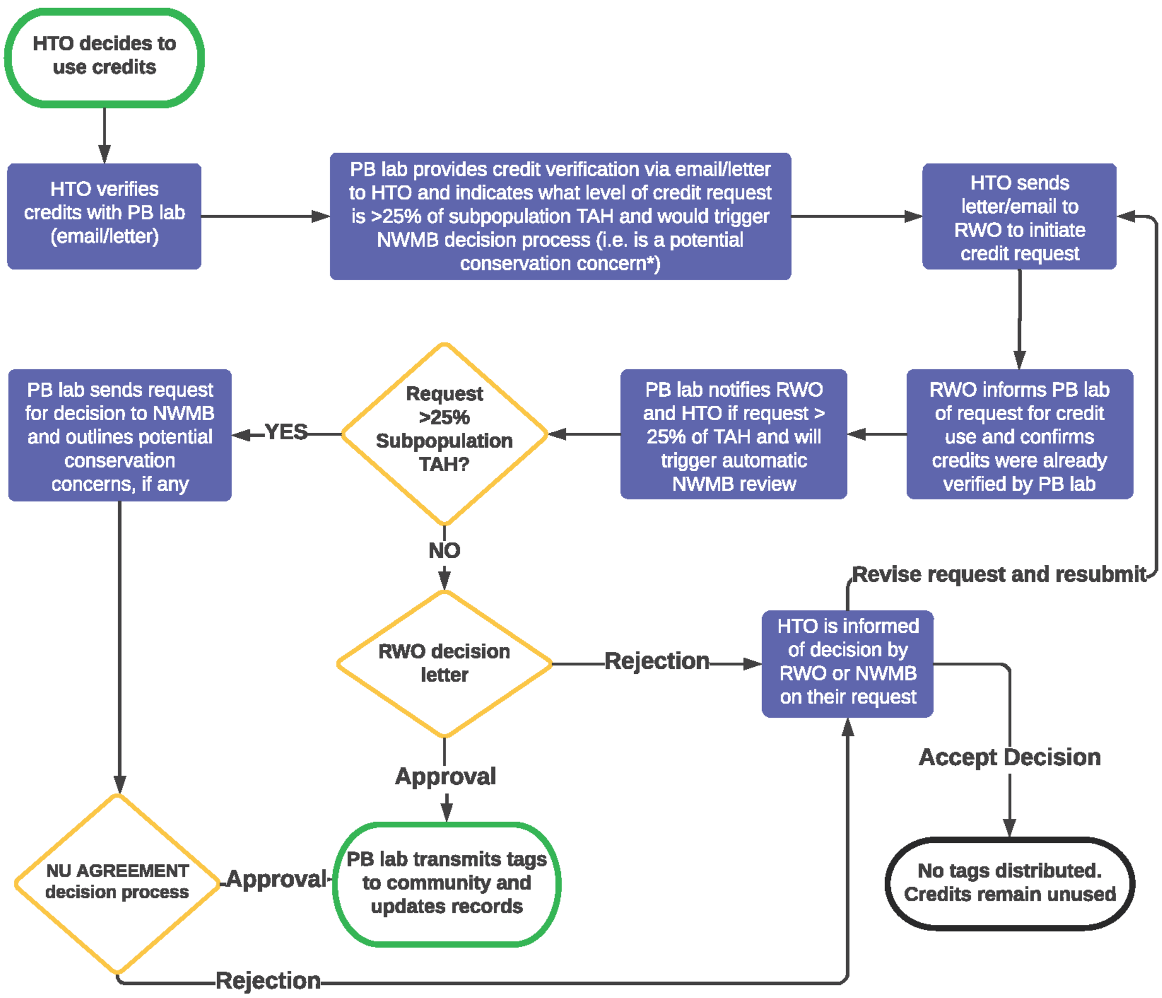
Key Points

1. Credit exchanges occur between communities within the same subpopulation.
2. Credit exchanges can be used to offset an overharvest situation.
3. Credit exchanges can be used in concert with credit usage to increase a community's annual recommended quota for a given harvest year.

Figure 1. Flow chart representing the RWO-managed decision process for credit exchange (chart designed by co-management partner GN).

Polar Bear Credit Use Process

Polar Bear Laboratory, Department of Environment, Version 2.0 2021



Key Points -- (see **Administration of Nunavut Polar Bear Up to 1:1 Harvest System: The Credit Calculation System for details)**

1. Credits are available upon request at any time to a community.
2. Community HTOs initiate credit requests, RWOs decide on requests.
3. Sex and harvest year of credits are specified by HTO in their request.
4. Requests greater than 25% of subpopualtion TAH, by 1 or more communities, automatically trigger NWMB review evaluating if request is a potential conservation concern.

*A conservation concern exists when the use of requested credits represents a substantial increase in the number of bears being harvested in a given year, or a substantial increase in number of females being harvested in a given year. There is no set number that would represent a conservation concern because this depends on the subpopulation status, the current TAH and the abundance estimate upon which the TAH is based, and the historic level of actual harvest for the subpopulation, among other things.

Figure 2. Flow chart representing the RWO-managed decision process for credit usage (chart designed by co-management partner GN).

SUBMISSION TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: X **Decision:**

Issue: Total Allowable Harvest of Gulf of Boothia polar bears

Background:

The Kitikmeot Regional Wildlife Board (KRWB) understands that the Government of Nunavut Department of Environment (GN DOE) is proposing a Total Allowable Harvest (TAH) of 74 for the Gulf of Boothia polar bear subpopulation for consideration by the Nunavut Wildlife Management Board (NWMB). This proposal will not change the current TAH and is based on the results of the most recent genetic mark-recapture survey that suggests the subpopulation is stable (Dyck et al. 2020). KRWB also understands that the proposal considers Inuit harvesting below the TAH, evidenced by accumulating credits for each community:

- 19.5 males, 4.35 females for Gjoa Haven
- 43.7 males, 1 female for Kugaaruk
- 46.26 males, 5.32 females for Taloyoak

KRWB understands that a decision on this proposal was deferred until the GN DOE's Harvest Administration and Credit Calculation System (HACCS) was approved. In letters between NWMB and the Minister of Environment (dated 1 and 7 February 2022, respectively) regarding the approval of HACCS, both NWMB and the Minister acknowledged "the Government of Nunavut and co-management partners work together towards a fair and acceptable alternative to resetting harvest credits to zero when a new sub-population Total Allowable Harvest is set".

For Gjoa Haven, Taloyoak, and Kugaaruk, KRWB notes the following:

- Community members have reported they are encountering more Gulf of Boothia polar bears in the last two decades. Hunters can tell the subpopulation is increasing because of how easy it is to encounter and/or hunt bears; observations every mating season; encountering more females, young bears, and/or females with more (up to four) cubs; and bears going into meat caches. Behaviour also changes when there are more bears; polar bears are more aggressive when there are higher densities of them (e.g., Gjoa Haven et al. 2021).
- Community members have also reported bears over the last 10 years have been physically healthy (e.g., Gjoa Haven et al. 2021).
- Experienced hunters can tell the sex and age of bears when they encounter them and/or their tracks, and they use this skill to select for bears while hunting.
- Gjoa Haven, Spence Bay (Taloyoak), and Kurtairojuark (Kugaaruk) Hunters and Trappers Organizations (HTOs), through the accumulation of their credits, demonstrate harvest management. Communities are not harvesting to the maximum level that is allocated to them. Resetting credits erases those records.

- Tags and credits are not always used because the accessibility of polar bears changes from year to year. Hunting also depends on experience, season, weather conditions, levels of interest in the community, etc. Some hunters will also wait until a preferable bear could be harvested.
- HTOs do not always want to maximize harvesting each year. Polar bear hunting can be a lot of work and hide sales and exports have dropped (90% and 80%, respectively, since 2012; E. Cooper 2022, personal communication).
- The way credits are currently managed encourages the use of a large number of credits in a small amount of time, specifically in the years approaching a new proposed TAH, when credits are reset.
- The resetting of credits to zero without an increase in TAH is perceived as unfair and puts pressure on HTOs to use all of their credits.
- The assumption that keeping credits would result in “double counting” should consider harvest selection. Credits could, for example, be used for older versus younger bears, sick bears, or bears behaving unusually. Credits could also be used for defence kills.
- Kitikmeot HTOs stress that they need to be able to meet with Igloolik, Sanirajak, and Naujaat HTOs on any decisions regarding Gulf of Boothia polar bears. Funding support for this is needed.

Consultation:

This submission was prepared after discussions with the KRWB executive on 26 April 2022. This submission was reviewed and approved by KRWB via teleconference on 29 April 2022. This submission was reviewed and refined by Gjoa Haven, Spence Bay (Taloyoak) and Kurtairojuark (Kugaaruk) HTOs at a workshop in Yellowknife on 4 May 2022.

Recommendations:

- Gjoa Haven, Spence Bay, and Kurtairojuark HTOs recommend an increase in the TAH for Gulf of Boothia polar bears.
- Gjoa Haven, Spence Bay, and Kurtairojuark HTOs recommend a face-to-face meeting with HTOs in Igloolik, Sanirajak, and Naujaat, through a workshop supported by NWMB, to discuss Gulf of Boothia polar bears further. KRWB staff could assist with planning.
- Gjoa Haven, Spence Bay, and Kurtairojuark HTOs do not support resetting credits to zero.
- Accumulating credits may be viewed as a “risk of overharvesting” but for communities, are an indicator of under harvesting and good management. Special credits should be used for defence kills.
- Population models should consider different options and scenarios that include using and/or not using credits, and resetting and/or not resetting them.
- From an ethical standpoint, communities should be included when harvest data and data on credits are being interpreted or used to represent their hunting practices. A consent process is needed on how the data that a harvester submits to GN DOE might be shared, used and/or interpreted.
- The current polar bear management plan and HACCS continues to encourage the perception and management of polar bears as “credits” and numbers. This contrasts

Inuit views of polar bears as animate and responsive to how people think about, talk about, and treat them. Work is needed to incorporate these views.
- There is a need to acknowledge past agreements about polar bear management and harvesting, both written and unwritten, that older community members continue to recall. Informed consent is an ethical responsibility, while it may not be a legal one.
- Work is needed to transition away from historically paternalistic approaches in polar bear management. KRWB encourages more capacity-building, information sharing, and management approaches that empower Inuit to make decisions about their wildlife.
- Research is needed to examine the meaning of credits for Inuit and how polar bear management affects how Inuit and future generations relate to and view their wildlife.

References:

Dyck, M., Regehr, E. V., & Ware, J. V. (2020). Assessment of abundance for the Gulf of Boothia polar bear subpopulation using genetic mark-recapture. Final Report, Government of Nunavut, Department of Environment, Iglulik, 74pp.

Gjoa Haven HTO, Spence Bay HTO, Kurtairojuark HTO, Aiviq HTO, Igloolik HTO, and Hall Beach HTO. (2020). Inuit Qaujimajatuqangit of Gulf of Boothia polar bears. Final Report, Government of Nunavut, Department of Environment, Iglulik. 53pp.

Prepared by:

Pamela Wong

Senior Research and Technical Advisor

Kitikmeot Regional Wildlife Board

Date:

5 May 2022

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May 6, 2022

Nunavut Wildlife Management Board
P.O. Box 1379
Iqaluit, Nunavut
X0A 0H0

Re: <u>Total Allowable Harvest/ Polar Bears.</u>

The Gjoa Haven Hunters & Trappers Assoc. are in total support of the Kitikmeot Regional Wildlife Board's decision on the breakdown of the TAH for polar bears for the communities of Gjoa Haven, Taloyoak and Kugaaruk.

On the other hand, the moratorium placed on polar bears for McClintock Channel by the Government of Nunavut has had significant impact for the community for over 20 years and in some cases, not a single polar bear was harvested during those many years.

Hunters in Gjoa Haven are given an option of harvesting polar bears in the Gulf of Boothia because the TAH for McClintock Channel is so minimal. With that option, it is difficult for most hunters to travel that distance and endangers the hunters by not knowing the sea ice as they are not familiar of that area.

In addition, GHHTA strongly prefers that the TAH for McClintock Channel be increased and the reason behind this is that, the community members continually sees polar bears roaming close by within less than 5 miles every year.

Distance to the Gulf of Boothia from Gjoa Haven and not knowing the condition of the ice is quite challenging for all hunters from Gjoa Haven so therefore, GHHTA is requesting that gas, oil and grub compensation be provided for the hunters as they cannot afford additional cost to provide gas, oil and grub to give to guides from Taloyoak, if any are willing to travel with them from Taloyoak.

Yours truly,

James Qitsualik

James Qitsualik
Chairperson

Cc: Pamela Wong, PhD
Senior Research & Technical Advisor, KRWB

Cc: Ema Qaggutaq
Regional Coordinator, KRWB

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ORGANIZATION

KURTAIROJUARK HUNTERS & TRAPPERS ASSOCIATION

May 6, 2022

Daniel Shewchuk
Chairperson
Nunavut Wildlife Management Board
P.O. Box 1379
Iqaluit, NU
X0A 0H0

Re: Gulf of Boothia polar bear TAH

The HTO met with KRWB staff and Gjoa Haven and Spence Bay HTOs on 4 May 2022 to review and discuss KRWB's submission to NWMB regarding the proposed TAH for the Gulf of Boothia subpopulation. The Kurtairojuark HTO supports KRWB's submission.

Yours truly,

C. K.

Canute Krejunark
Chairman

C.c.
Anthony Anguttitauruq, Gjoa Haven HTO
Jimmy Oleekatalik, Spence Bay HTO
Paul Ikuallaq, Kitikmeot Regional Wildlife Board
Bert Dean, Nunavut Tunngavik Inc.
Drikus Gissing, GN DOE

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ᑕᓗᕈᐊᑦ ᐊᖑᓇᓯᓚᕆᔨᖁᑦ ᑲᑎᖦᑎᖃᑎᒌᑦ
Spence Bay Hunters and Trappers Association

P.O. Box 20 Taloyoak, Nu. X0B 1B0 e-mail taloyoak@krwb.ca P (867) 561 5066 Fax (867) 561 5232

May 6, 2022

The Spence Bay Hunters and Trappers Association Board would like to submit a letter to NWMB on the tags and credit system on Subpopulation for Gulf of Boothia. The SBHTA would like an increase of 100 Total Allowable Harvest for Gulf of Boothia. The SBHTA Board feels that the proposed letter on Total Allowable Harvest (TAH) and credits system is a stab in the back for the members of Taloyoak Hunters. We work so hard to accumulate our credits and for the Government of Nunavut just to wipe them away is a double standard. The SBHTA has always used caution on managing the tags. The SBHTA board can get the members to finish the tags each year but with the less female ratio at the time we made sure to manage the tags when all the female tags are almost maxed. The SBHTA Board made a policy and issue the tag one by one and only male polar bears to be caught, or close the tags altogether, depending on how close to the hunting season end. The last three years we've been finishing our tags since it's been 1:1 ratio and used three male credits. Polar Bear is our diet and The Members of Taloyoak would like to hunt not only for sales of the hide but to make clothing out it.

Joe Ashevak, Chair - SBHTA

Environment and Climate Change Canada / Environnement et Changement climatique Canada

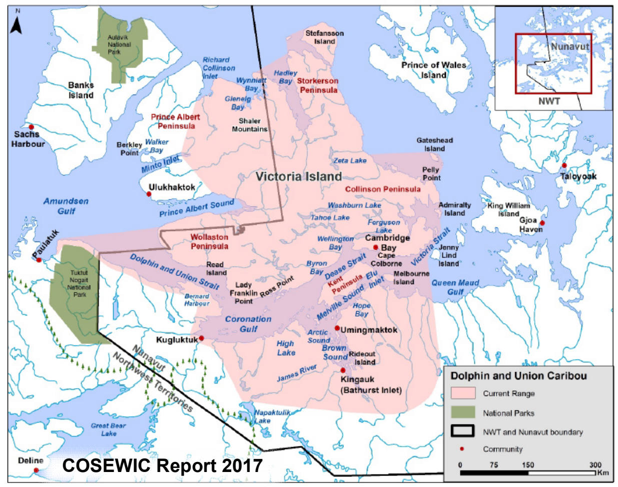
Canada

Submission to the Nunavut Wildlife Management Board

For

Information: **Decision: X**

Issue: Request for decision on the proposed change in status of Dolphin and Union Caribou from Special Concern to Endangered under the federal *Species at Risk Act*



Introduction

- **We have been consulting on this status change for 3 years.**
- **All partners recognized that this herd benefits from conservation/recovery actions, but there were many concerns with the COSEWIC assessment.**
- **We have worked with Inuvialuit and Inuit organizations to address various concerns, including making an addendum to the 2017 COSEWIC report that includes TK/IQ.**
- **There is still no support amongst Inuit organizations for this status change, principally because of the lack of engagement in the assessment process.**

Background

Distribution

- The range of Dolphin and Union Caribou spans two jurisdictions: Northwest Territories and Nunavut. In Nunavut, Dolphin and Union Caribou are found in the Kitikmeot region.

Assessments and Listings

- In 2004, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed Dolphin and Union Caribou as Special Concern.
- In 2011, Dolphin and Union Caribou was listed as Special Concern under the federal *Species at Risk Act* (SARA).
- In 2013, the Northwest Territories Species at Risk Committee (NWT SARC) assessed Dolphin and Union Caribou as Special Concern (the species was listed in NWT as Special Concern in 2015).
- In 2017, COSEWIC reassessed Dolphin and Union caribou as Endangered because of the steep population decline.

Population decline

- Three (3) surveys (1997, 2007 and 2015) were considered in the 2017 COSEWIC report and suggested an overall decline of 50% between 1997 and 2015.
- Since the 2017 COSEWIC assessment, two additional surveys were conducted by the Government of Nunavut in 2018 and 2020 (Figure 1). The population estimate for these two surveys are approximately 4,000 caribou, which indicates an overall decline of 78% between 2015 and 2018.

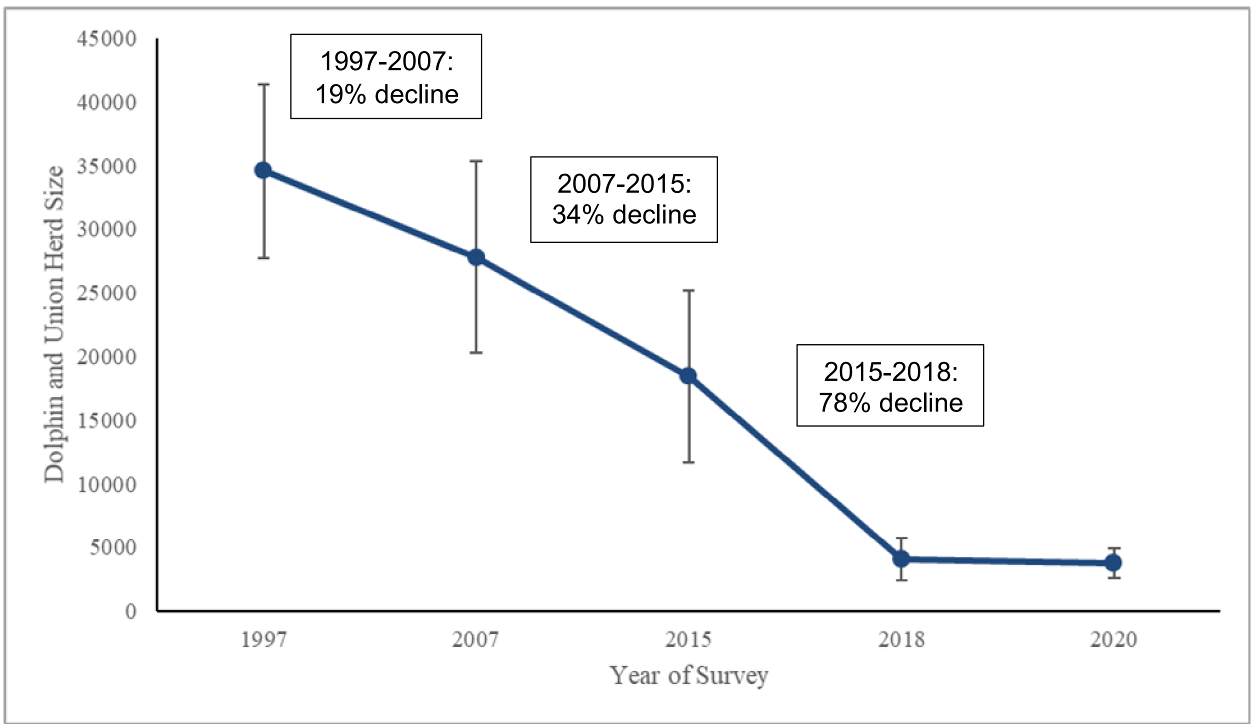


Figure 1. Population estimates with 95% confidence intervals error bars for Dolphin and Union Caribou between 1997 and 2020 (modified from Government of Nunavut). The population was 34,558 in 1997, fell to 27,787 in 2007, fell further to 18,413 in 2015, and continued to decline to 4,105 in 2018. In 2020 the population was 3,815 (including Victoria Island and the mainland).

Threats

- According to the COSEWIC report (2017), the population is experiencing multiple threats, and future decline is predicted based on ongoing threats.
- Threats to sea ice: The reduced connectivity of sea ice due to ice-breaker supported shipping and irregularity in sea ice conditions due to climate change are disrupting migration. Drowning and delayed migration are already being observed.
- Predation from wolves and Grizzly Bears, as well as interactions with muskox, were additional concerns.
- In 2017, COSEWIC identified harvesting as a concern because of the absence of (1) Total Allowable Harvest (TAH – later established in 2020 in Nunavut), and (2) mandatory harvest reporting. According to COSEWIC, the absence of harvest information becomes a serious threat if a population is declining because the effects of harvest impacts to a population are known to increase during a decline.
- The spread of insect pests and pathogens, as well as terrestrial habitat changes/severe weather events associated with climate change, were also identified threats.

> This was the main information COSEWIC used to assess Dolphin & Union Caribou as Endangered.
>
> When Dolphin & Union Caribou were listed as Special Concern in 2011, a Management Plan was developed. One element that emerged from that plan is the User-to-User working group which foster a collaboration between communities of Nunavut and NWT. If this herd gets up-listed to Endangered, a Recovery Strategy will have to be developed, and this working group will be key in this process.

Joint National Management Plan

- As required under SARA for species listed as Special Concern, a national Management Plan was developed between 2015 and 2018.
- The management plan was prepared jointly by the Government of Nunavut (GN) and the Government of the Northwest Territories (GNWT), in cooperation with the Government of Canada and co-management partners. Development of the management plan was done in close collaboration with HTOs and HTCs respecting co-management processes.

Implications of the change in status

- If Dolphin and Union Caribou status under the federal *Species at Risk Act* is changed from Special Concern to Endangered, a recovery strategy will be developed. Building from the existing management plan, the recovery strategy would identify:
  - Population and distribution objectives,
  - Recovery actions needed to stop or reverse the decline of the population,
  - Critical habitat necessary for the survival or recovery of Dolphin and Union Caribou in order to support the population and distribution objectives, and
  - Activities likely to destroy the critical habitat.
- Environment and Climate Change Canada (ECCC) would work collaboratively with all management partners in NU and NWT to identify those key elements.

- If Dolphin and Union Caribou status under the *Species at Risk Act* changed to Endangered, SARA's automatic prohibitions would not apply to Inuit exercising harvesting rights under the *Nunavut Agreement*. Harvest management decisions would continue to be made according to the processes established by Article 5 of the *Nunavut Agreement*, and existing wildlife management bodies and processes remain in place (as per the current TAH).
- If Dolphin and Union Caribou status under the *Species at Risk Act* changed to Endangered, communities would have more resources available to them to support conservation activities (e.g. monitoring programs, Inuit knowledge collection) through federal funding programs such as the Aboriginal Fund for Species at Risk.

Consultation on the proposed uplisting

- In April 2019, both the Hunters and Trappers Organizations (HTOs) and the public were consulted in-person in Kugluktuk, Cambridge Bay, Ulukhaktok and Paulatuk. The Bathurst Inlet HTO and Bay Chimo HTO were sent the consultation package and invited to the meetings in Cambridge Bay (see Appendix A and B).
- The Kitikmeot regional biologist with the Government of Nunavut-Department of Environment and one staff with Nunavut Tunngavik Incorporated (NTI) participated to the community tour in Nunavut. One Kitimeot Inuit Association (KitIA) staff participated to the public meeting in Cambridge Bay.
- Detailed meeting notes were produced, as well as a table summarizing the comments and concerns expressed by communities (see Appendix C). Main concerns expressed by communities in April 2019 included (see Appendix C for more details):
  - Survey methodology used by the Government of Nunavut that raised concerns about the validity of the population estimates;
  - Lack of TK/IQ in the COSEWIC assessment report, and lack of engagement efforts by COSEWIC during the assessment process;
  - Pro-active measures taken by HTCs/HTOs to manage the herd and support their recovery were not considered;
  - Some information was incomplete: Dolphin & Union caribou undergo population cycles and their distribution is changing, more research is needed to better understand those patterns.
- In April 2019, all communities did not support the proposed status change.
- In Nunavut, HTOs and KRWB were still opposed to the status change in 2022. In the Northwest Territories, all organizations supported the status change in 2021/2022.

Actions taken to address concerns expressed by communities

- Between April and June 2021, many virtual meetings were held with partners of Nunavut and NWT (see appendix B) to discuss the 2019 consultations and consider next steps to address their concerns. Two main options came out of these meetings:

  1. Request a “refer back to COSEWIC” and submit a new assessment collaboratively developed by all partners. This would have pushed the next COSEWIC assessment to after 2033 (instead of 2027), which was a concern for some partners. COSEWIC could have refused the “refer back”.

  2. Create an addendum to articulate concerns and share information for future assessments. This document would be submitted to COSEWIC and potentially posted on the registry to supplement the 2017 COSEWIC assessment.

- Partners preferred to develop an addendum to the 2017 COSEWIC report:
  - Monthly meetings were held with all users to develop the document in a collaborative way (see appendix B). This process was initiated by ECCC but is now led by KRWB and WMAC-NWT, with ECCC’s support.
  - The addendum includes new information available since the assessment in 2017: new population surveys (2018 and 2020), icebreaking agreement between the Cambridge Bay HTO and Transport Canada (Pro-Active Vessel Management Initiative), pro-active measures taken by the HTCs/HTOs, TAH in Nunavut, new TK/IQ reports. It also intends to rectify some information from the COSEWIC report that was misleading according to local knowledge.

Next Steps:

We are requesting a decision from the NWMB on the proposed change in status of Dolphin and Union Caribou under the federal Species at Risk Act (SARA) as per the Nunavut Agreement s.5.2.34(f) and 5.3.16 - 5.3.23.

Prepared by:
Environment and Climate Change Canada - Canadian Wildlife Service
Northern Region March 2022

COSEWIC
Assessment and Status Report

on the

Caribou
Rangifer tarandus

Dolphin and Union population

in Canada

ENDANGERED
2017

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

COSEWIC. 2017. COSEWIC assessment and status report on the Caribou, Dolphin and Union population, *Rangifer tarandus*, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 51 pp. (http://www.registrelep-sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1).

Previous report(s):

COSEWIC 2004. COSEWIC assessment and update status report on the Peary caribou *Rangifer tarandus pearyi* and the barren-ground caribou *Rangifer tarandus groenlandicus* (Dolphin and Union population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 91 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Gunn, A., F.L. Miller and D.C. Thomas. 1979. COSEWIC status report on the Peary caribou *Rangifer tarandus pearyi* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 40 pp.

Miller, F.L. 1991. Update COSEWIC status report on the Peary caribou *Rangifer tarandus pearyi* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 124 pp.

Production note:
COSEWIC would like to acknowledge Lee Harding (SciWrite Environmental Sciences Ltd.) for writing the draft status report on the Caribou (*Rangifer tarandus*), Dolphin and Union population in Canada, and Justina Ray for writing the revised provisional report. This report was prepared under contract with Environment and Climate Change Canada and overseen by Graham Forbes, Co-chair of the COSEWIC Terrestrial Mammals Species Specialist Subcommittee.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur le Caribou (*Rangifer tarandus*), population Dolphin-et-Union au Canada.

Cover illustration/photo:
Dolphin and Union Caribou. The bull, second from left, has shed his antlers. Photograph by Kim Poole, Aurora Wildlife Research.

Catalogue No. CW69-14/191-2018E-PDF
ISBN 978-0-660-26732-6

COSEWIC
Assessment Summary

Assessment Summary – November 2017

Common name
Caribou - Dolphin and Union population

Scientific name
Rangifer tarandus

Status
Endangered

Reason for designation
This Arctic caribou population is endemic to Canada, occurring in Nunavut and the Northwest Territories. Recognized for its unique migration pattern from Victoria Island across the sea ice to the mainland, observations have shown that its distribution has retracted and expanded since the beginning of the 20th century, in rough correspondence with population size. In the early 1900s, the herd was reported to be large, then a strong decline was likely precipitated by the introduction of firearms, combined with severe winters. A 50-60-year period of low densities and no sign of migration across the sea ice followed. The herd started to increase in the late 1970s, and resumed its migration to the mainland in the late 1980s, increasing in numbers until the 1990s. In 2015, the herd was estimated at about 18,000 animals. Three survey estimates over the last 18 years and Aboriginal Traditional Knowledge suggest a decline as high as 50-60%, which appears to have accelerated since 2010. The population is experiencing multiple threats, including reduced connectivity and disrupted migration between winter and summer range associated with commercial shipping in Dease Strait that is increasingly supported by ice-breakers. Climate change is linked with decreased periods of ice cover and irregularity of sea ice conditions, causing mortality through drowning and delays in migration with consequences for nutrition and parasite burdens. Overharvest has been involved in past declines and recent exploitation levels are unknown, although access opportunities from five additional communities have increased. The spread of insect pests and pathogens as a consequence of climate change is an additional concern. Natural fluctuations of the population remain a source of uncertainty.

Occurrence
Northern Territories, Nunavut

Status history
The original designation considered a single unit that included Peary Caribou, *Rangifer tarandus pearyi*, and what is now known as the Dolphin and Union population of Caribou, *Rangifer tarandus*. It was assigned a status of Threatened in April 1979. Split to allow designation of three separate populations in 1991: Banks Island (Endangered), High Arctic (Endangered) and Low Arctic (Threatened) populations. In May 2004 all three population designations were de-activated, and the Peary Caribou, *Rangifer tarandus pearyi*, was assessed separately from the Dolphin and Union population of Caribou, *Rangifer tarandus*. The Dolphin and Union population is comprised of a portion of the former "Low Arctic population", and it was designated Special Concern in May 2004. Status re-examined and designated Endangered in November 2017.

COSEWIC
Executive Summary

Caribou
Rangifer tarandus

Dolphin and Union population

Wildlife Species Description and Significance

Dolphin and Union Caribou are easily recognizable from Barren-ground and Peary Caribou. Intermediate in body size, they are morphologically and behaviourally distinct from both, and genetic analyses have consistently confirmed their uniqueness. A key distinguishing behavioural trait relative to other Caribou populations is the seasonal migrations that occur twice a year when members of this population cross the sea ice between Victoria Island and the mainland in a synchronous and coordinated way to reach their summer or winter ranges. They are integral components of Inuit and Inuvialuit culture, and have high spiritual, economic, and subsistence value.

Distribution

Endemic to Canada, the range of Dolphin and Union Caribou spans two jurisdictions: Northwest Territories and Nunavut. These Caribou summer as one population occupying most of Victoria Island. Having first been documented in the mid-1850s crossing the Dolphin and Union Strait, they now migrate across the Coronation Gulf, the Dease Strait and Queen Maud Gulf to winter on the mainland. Recorded observations show that the distribution of Dolphin and Union Caribou has retracted and expanded at various points in time since the beginning of the 20th century, in rough correspondence with population size.

Habitat

Calving areas on Victoria Island are not discrete and lie in the Northern Arctic Terrestrial Ecozone, while wintering areas on the mainland coast are in the Southern Arctic Ecozone. The annual range is composed of tundra habitats populated by prostrate dwarf-shrubs, forbs, sedges, mosses and lichens. Given their regular migrations between Victoria Island and the mainland, a key habitat requirement for Dolphin and Union Caribou is the seasonal sea ice connecting the Island and mainland.

Habitat changes brought about by climate change include changes to sea ice, shifts in vegetation community composition, and amount and timing of plant growth. Although there has been minimal natural resource development within the range to date, there are two operating mines and several proposed mining developments with accompanying infrastructure, as well as plans for ships passing through ice-crossing areas, that are likely to compromise habitat quality and continuity in the future.

Biology

Similar to Barren-ground Caribou, Dolphin and Union Caribou follow an annual cycle, undertaking pre-calving and fall migrations between seasonal ranges. Although pre-calving migration is relatively gregarious, individuals disperse to calve over much of Victoria Island. The rut likely occurs during either migration or staging and Caribou males will often mate with more than one female. Dolphin and Union Caribou have a reproductive lifespan of about 12 years, usually first calving when they are 3 years old, or at 2 years when high-quality forage is available. Generation time is estimated at 7 to 9 years. These Caribou have a similar morphology to Peary Caribou, which appears to have arisen by convergent adaptation to a highly seasonable and cold climate. They share their annual range with four large mammalian predators, two other populations of Caribou (Barren-ground and Peary), Muskoxen, and several species of smaller-bodied mammalian herbivores and waterfowl, all of which have experienced population and distribution changes in recent years. Humans and Wolves are the main predators of Dolphin and Union Caribou.

Population Sizes and Trends

In the early 1900s, the Dolphin and Union Caribou population was thought to be about 100,000 individuals, but this was a best guess. Shortly afterwards, this population declined precipitously, a likely consequence of the introduction of firearms combined with severe winters. By the 1920s, its migration across the Dolphin and Union Strait ceased. Caribou were rarely seen on Victoria Island for the next five decades. In 1959, the resident, non-migratory population on Victoria Island was estimated at 671 individuals. Inuit from Cambridge Bay began seeing Caribou in the 1970s and 1980s and, by 1993, up to 7,000 were once again migrating annually across Coronation Gulf and Dease Strait.

Three surveys in 1997, 2007 and 2015 have deployed a consistent methodology, with comparable results, to allow for a quantitative trend estimate over three generations. The first two survey estimates were retroactively corrected: A 1997 survey that estimated 27,989 ± SE 3,367 total Caribou in the visual survey strata was later revised to 34,558 ± CI 6,801, extrapolated to include animals outside the survey area based on information from radio collars. In 2007, 21,753 ± SE 2,343 were estimated, later revised to 27,787 ± CI 7,537. In 2015, the population was estimated at 18,413 ± 6,795 (95% CI, 11,664- 25,182). Using the original and revised estimates from the surveys as minima and maxima, there has been an overall exponential decline of over 50% since 1997. Inuit Qaujimajatuqagit (IQ), Aboriginal Traditional Knowledge and local knowledge have also noted a declining trend of about 80%, which accelerated after 2010. IQ collected in 2014 observed declines in numbers in the young age classes, a high proportion of animals with poor body condition, and increased observations of diseased animals.

Threats and Limiting Factors

Dolphin and Union Caribou are facing a large number of direct threats to population persistence, which have been assessed as High-Very High Impact, although there is much uncertainty. Reduced connectivity of sea ice is a primary concern, with ice-breaker-supported shipping in Dease Strait already showing signs of disrupting migration. Decreased periods of ice cover and/or irregularity of sea ice conditions has also been observed, associated with climate change, which causes mortality through drowning and delays migration with consequences for nutrition and parasite burdens. Overharvest has been involved in past declines and recent exploitation levels are unknown, although access opportunities from five additional communities have increased. Predation from Wolves and Grizzly Bears is an additional concern. The spread of insect pests and pathogens associated with climate change is a threat. An unknown mortality factor may be involved in Dolphin and Union Caribou population declines, possibly involving Muskox populations through multi-prey interactions with wolves and/or multi-host interactions with parasites and pathogens. Also uncertain is the future cumulative disturbance and habitat change if any, or all, of several proposed mining projects with associated infrastructure (roads and ports) are approved for construction.

Protection, Status and Ranks

Dolphin and Union Caribou are co-managed in Nunavut according to the Nunavut Land Claims Agreement, and are co-managed in the Northwest Territories according to the Inuvialuit Final Agreement. These agreements confer primary wildlife management authority on the respective management boards: the Nunavut Wildlife Management Board and, in the NWT, the Wildlife Management Advisory Council and the Inuvialuit Game Council.

Dolphin and Union Caribou are currently listed as Special Concern under both the federal *Species at Risk Act* (2003) (on Schedule 1) and the territorial *Species at Risk (NWT) Act* (2013). COSEWIC originally assessed Dolphin and Union Caribou as Special Concern in May 2004, and this population was reassessed as Endangered in November 2017.

Globally, Caribou is listed by the International Union for Conservation of Nature (IUCN) as Vulnerable; subspecies or ecotypes are not differentiated. NatureServe ranked Caribou as secure globally and Not Yet Ranked for Dolphin and Union Caribou, which is ranked imperiled-vulnerable at the national level (N2N3), imperiled-vulnerable (S2S3) in the NWT, and unranked (SNR) in Nunavut.

Tuktuk Nogait National Park includes coastline in the southwestern portion of Dolphin and Union Caribou range and the Queen Maud Gulf Bird Sanctuary offers a certain level of habitat protection to part of the wintering range.

TECHNICAL SUMMARY

Rangifer tarandus

Caribou - Dolphin and Union population (Designatable Unit 2)

Caribou - Population Dolphin-et-Union (Unité désignable 2)

Range of occurrence in Canada (province/territory/ocean): Northwest Territories and Nunavut (Victoria Island and adjacent parts of the mainland).

Demographic Information

Generation time (usually average age of parents in the population; indicate if another method of estimating generation time indicated in the IUCN guidelines (2011) is being used)	7-9 yrs
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Yes
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	33.8% decline since 2007
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations]. *Based on three survey points, with much uncertainty as to trend and pattern of decline.*	~52% (using GT of 7 yrs) – 61% (9 yrs)
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future.	May be >50%
Are the causes of the decline a. clearly reversible and b. understood, and c. ceased?	a. no b. no c. no
Are there extreme fluctuations in number of mature individuals?	Unlikely

Extent and Occupancy Information

Estimated extent of occurrence (EOO)	499,449 km²
Index of area of occupancy (IAO) (Always report 2x2 grid value).	391,292 km²

Is the population "severely fragmented" i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a. no b. no
Number of "locations"* (use plausible range to reflect uncertainty if appropriate)	1
Is there an [observed, inferred, or projected] decline in extent of occurrence?	Likely, but unquantified
Is there an [observed, inferred, or projected] decline in index of area of occupancy?	Unknown
Is there an [observed, inferred, or projected] decline in number of subpopulations?	N/A (one subpopulation)
Is there an [observed, inferred, or projected] decline in number of "locations"*?	N/A (one location)
Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat?	Yes
Are there extreme fluctuations in number of subpopulations?	N/A
Are there extreme fluctuations in number of "locations"*?	N/A
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each subpopulation)

	N Mature Individuals
Total *This estimate includes an unknown number of immature animals*	18,413 ± 6,795 (2015)

Quantitative Analysis

Is the probability of extinction in the wild at least [20% within 20 years or 5 generations, or 10% within 100 years]?	Analysis not done

* See Definitions and Abbreviations on COSEWIC web site and IUCN (Feb 2014) for more information on this term

Threats (direct, from highest impact to least, as per IUCN Threats Calculator)

Was a threats calculator completed for this species? Yes
Total Impact: Very High-High

i. Shipping Lanes (IUCN Threat # 4.3) (High Impact)
ii. Problematic native species (IUCN Threat #8.2) (High-Low Impact)
iii. Hunting (IUCN Threat # 5.1) (Medium-Low Impact)
iv. Climate Change and Severe Weather (IUCN Threat #11) (Medium-Low Impact)
v. Parasites and Diseases (IUCN Threat # 8.1[Invasive non-native alien species]) (Medium-Low Impact)
vi. Storms and Flooding (11.4) (Medium-Low Impact)
vii. Energy Production and Mining (IUCN Threat #3) (Low Impact)

What additional limiting factors are relevant?

Rescue Effect (immigration from outside Canada)

Status of outside population(s) most likely to provide immigrants to Canada.	N/A (Endemic to Canada)
Is immigration known or possible?	N/A
Would immigrants be adapted to survive in Canada?	N/A
Is there sufficient habitat for immigrants in Canada?	N/A
Are conditions deteriorating in Canada?+	N/A
Are conditions for the source (i.e., outside) population deteriorating?+	N/A
Is the Canadian population considered to be a sink?+	N/A
Is rescue from outside populations likely?	No

Data Sensitive Species

Is this a data sensitive species?	No

Status History

COSEWIC: The original designation considered a single unit that included Peary Caribou, *Rangifer tarandus pearyi*, and what is now known as the Dolphin and Union population of Caribou, *Rangifer tarandus*. It was assigned a status of Threatened in April 1979. Split to allow designation of three separate populations in 1991: Banks Island (Endangered), High Arctic (Endangered) and Low Arctic (Threatened) populations. In May 2004 all three population designations were de-activated, and the Peary Caribou, *Rangifer tarandus pearyi*, was assessed separately from the Dolphin and Union population of Caribou, *Rangifer tarandus*. The Dolphin and Union population is comprised of a portion of the former "Low Arctic population", and it was designated Special Concern in May 2004. Status re-examined and designated Endangered in November 2017.

+See Table 3 (Guidelines for modifying status assessment based on rescue effect)

Status and Reasons for Designation:

Status: Endangered	**Alpha-numeric codes**: A2ad+4acd
Reasons for designation: This Arctic caribou population is endemic to Canada, occurring in Nunavut and the Northwest Territories. Recognized for its unique migration pattern from Victoria Island across the sea ice to the mainland, observations have shown that its distribution has retracted and expanded since the beginning of the 20th century, in rough correspondence with population size. In the early 1900s, the herd was reported to be large, then a strong decline was likely precipitated by the introduction of firearms, combined with severe winters. A 50-60-year period of low densities and no sign of migration across the sea ice followed. The herd started to increase in the late 1970s, and resumed its migration to the mainland in the late 1980s, increasing in numbers until the 1990s. In 2015, the herd was estimated at about 18,000 animals. Three survey estimates over the last 18 years and Aboriginal Traditional Knowledge suggest a decline as high as 50-60%, which appears to have accelerated since 2010. The population is experiencing multiple threats, including reduced connectivity and disrupted migration between winter and summer range associated with commercial shipping in Dease Strait that is increasingly supported by ice-breakers. Climate change is linked with decreased periods of ice cover and irregularity of sea ice conditions, causing mortality through drowning and delays in migration with consequences for nutrition and parasite burdens. Overharvest has been involved in past declines and recent exploitation levels are unknown, although access opportunities from five additional communities have increased. The spread of insect pests and pathogens as a consequence of climate change is an additional concern. Natural fluctuations of the population remain a source of uncertainty.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Meets Endangered A2ad, with 3-generation decline of 51-61% estimated, based on aerial surveys [a], with exploitation [d] also driving population decline. Also meets A4acd (past and future), because future decline is predicted based on ongoing threats.
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable.
Criterion D (Very Small or Restricted Population): Not applicable.
Criterion E (Quantitative Analysis): Not applicable.

PREFACE

This updated report incorporates information that became available after the last COSEWIC Status Update (COSEWIC 2004) for Dolphin and Union Caribou. In 1991, prior to the enactment of the *Species at Risk Act* (SARA), Caribou throughout the Canadian Arctic Archipelago (except for Baffin Island) were considered by COSEWIC to be Peary Caribou (Miller 1991). Although recognized as a distinct entity, Dolphin and Union Caribou were assessed as part of the Low Arctic Islands population, which included Peary Caribou. In 2004, COSEWIC assessed two entities in one status report (COSEWIC 2004): 1) Peary Caribou, which included all Caribou in the Arctic Archipelago except for Baffin Island and central and southern Victoria Island, and 2) Dolphin and Union Caribou, a genetically distinct population that occupies the remainder of Victoria Island, and migrates to the mainland in winter.

COSEWIC undertook an analysis of designatable unit (DU) structure of Caribou in Canada as a special project (COSEWIC 2011) to define the units for future status assessments and reassessments of this species according to the latest guidelines. Recognition of Peary Caribou and Dolphin and Union Caribou as two of 12 DUs in Canada was affirmed by this analysis, and an updated status assessment of Peary Caribou was undertaken in 2015 (COSEWIC 2015).

This report incorporates information collected since the 2004 COSEWIC Status Update for the Dolphin and Union Caribou, including data from surveys conducted in 2007 (Dumond and Lee 2013) and 2015 (Leclerc *et al*. in prep.; 2016), which allow for the calculation of trend estimates over a three-generation time span.

The Government of the Northwest Territories completed a status assessment for Dolphin and Union Caribou (SARC 2013) under the *Species at Risk (NWT) Act*. A Management Plan under the federal *Species at Risk Act* is being prepared jointly by the Government of Nunavut and the Government of the Northwest Territories, in cooperation with the Government of Canada and co-management partners (GNU and GNWT 2017). This COSEWIC report has been able to include key maps and figures produced for both documents, and also benefited from ATK (including Inuit Qaujimajatuqangit [IQ; Inuit Knowledge]) gathered through this process. IQ and ATK are considered to be synonyms in this report.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2017)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

Environment and Climate Change Canada
Canadian Wildlife Service

Environnement et Changement climatique Canada
Service canadien de la faune

Canada

The Canadian Wildlife Service, Environment and Climate Change Canada, provides full administrative and financial support to the COSEWIC Secretariat.

COSEWIC Status Report

on the

Caribou
Rangifer tarandus

Dolphin and Union population

in Canada

2017

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

Common names: Island Caribou (NWT and Nunavut; English), Arctic island Caribou (NWT and Nunavut; English), Mainland Caribou (Ulukhaktok, NWT; English), Dolphin and Union Caribou, Barren-ground Caribou (Dolphin and Union population) (English), Caribou du troupeau Dolphin-et-Union (French), Kiilliniq Caribou (Inuinnaqtun; Nunavut); Killinik (Inuktituk).

Caribou are members of the deer family (Order: Artiodactyla, Family: Cervidae, Subfamily: Capreolinae, Genus: *Rangifer*, Species: *tarandus*; Gilbert *et al.* 2006). Banfield (1961) classified *Rangifer* into sub-species and "inter-grades", based largely on Manning's (1960) morphometric measurements of skulls and leg bones, as well as pelage colouration and antler form. This taxonomy has not been updated, even though it was often based on few specimens and newer techniques, such as DNA analyses, are revealing different evolutionary relationships among Caribou populations.

Barren-ground Caribou of North America and Greenland (in which Dolphin and Union were likely included) were named *Cervus groenlandicus* by Borowski (1780) based on a specimen from Greenland, and later transferred to the genus *Rangifer* (Kellogg 1932). First singled out for their distinctiveness by Manning (1960), Dolphin and Union Caribou have been alternatively classified as *R. t. groenlandicus*, *R. t. pearyi* and *R. t. groenlandicus* × *pearyi*. In recognition of their uniqueness relative to neighbouring Peary and mainland Barren-ground Caribou, recent authors have referred to them as *R. t. groenlandicus* × *pearyi* (Poole *et al*. 2010; Nagy *et al*. 2011; SARC 2013; GNU and GNWT 2017). Despite some confusion over taxonomic classification, its genetic distinctiveness has been recently re-confirmed (McFarlane *et al*. 2016; see **Population Spatial Structure and Variability**). An overall revision of the genus is needed to clarify subspecies (Geist 2007, COSEWIC 2011).

Harvesters and elders interviewed in the Ulukhaktok area recognize two types of Caribou (Peary, and Dolphin and Union) on Victoria Island, and tend to differentiate Dolphin and Union Caribou from other Caribou by differences in size, colour, and taste (Elias 1993 in SARC 2013).

This Caribou population is named after the Dolphin and Union Strait, which they once crossed twice yearly on their northward spring migration and southward fall migration. Their current migration patterns, however, are concentrated in the Coronation Gulf and Dease Strait (see **Dispersal and Migration**).

Morphological Description

Dolphin and Union Caribou are highly recognizable and distinguishable from Barren-ground and Peary Caribou (GNU and GNWT 2017, SARC 2013). Individuals are smaller than Barren-ground Caribou, but larger than most Peary Caribou (SARC 2013). They have similar pelage patterning to that of Peary Caribou except that they are slightly darker, with gray down the front of their legs instead of white. The early winter coat is white with a pale brown back. Skeletal and antler differences further distinguish them from most Peary Caribou. Dolphin and Union and Peary Caribou share three characteristics that contrast them with those belonging to the Barren-ground Caribou: grey antler velvet, proportionally long molar tooth rows, and wider hooves (Manning 1960; Gunn and Fournier 1996; SARC 2013).

Mean body length has not been published, but Gunn and Fournier (1996) compared skull measurements of southern Victoria Island female Caribou with female Barren-ground Caribou from Pelly Bay: the mean condylobasal length was 297.83 ± SE 1.31 mm in the Victoria Island Caribou compared to 317.86 ± SE 3.21 mm in the Pelly Bay skulls.

Population Spatial Structure and Variability

Genetic Structure

North American Caribou have been divided into two lineages using genetic analysis of mitochondrial DNA (mtDNA) sequences. The Beringian-Eurasian Lineage and the North American Lineage refer to Pleistocene refugia that they originated from (COSEWIC 2011; Klütsch *et al*. 2012; Yannic *et al*. 2014). Barren-ground (COSEWIC in press), Peary (COSEWIC 2015), and Dolphin and Union Caribou are part of the Beringian-Eurasian Lineage. After the last ice age, as populations expanded and colonized (or re-colonized) northern lands, hybridization resulted in introgression of haplotypes from each lineage into the other at a low enough frequency to leave each lineage distinct and clearly separable (Klütsch *et al*. 2012). Phylogenetic data based on mitochondrial DNA (Eger *et al*., 2009) suggest that Dolphin and Union and the Bathurst subpopulation of Barren-ground Caribou (see Designatable Units) diverged from one other another approximately 1000 years ago (Eger *et al*., 2009; McFarlane *et al*., 2016). Estimates from microsatellite DNA suggest that the divergence time from other mainland subpopulations occurred around the same time, whereas divergence of Dolphin and Union Caribou from eastern arctic island subpopulations occurred earlier (about 3000 ybp) (McFarlane *et al*. 2016).

Genetic analyses based on nuclear (microsatellite) DNA have consistently confirmed the distinctiveness of Dolphin and Union Caribou from other designatable units (Eger *et al*. 2009; Zittlau *et al.* 2009; COSEWIC 2011; Serrouya *et al*. 2012; McFarlane *et al*. 2014, 2016). Despite this, low to moderate levels of gene flow have been detected between Dolphin and Union Caribou and mainland Barren-ground Caribou, particularly in historical times (*i.e.,* several hundred years ago; McFarlane *et al*. 2016).

Subpopulation Structure

All available evidence points to Dolphin and Union Caribou belonging to one demographic unit (subpopulation). Although calving is dispersed across a large part of Victoria Island, only one rutting area has been described from collared Caribou (Gunn and Fournier 2000, Nishi 2000) which supports the single subpopulation. When this herd was reduced to low numbers in the 1920s, the migration ended and did not become regular until several decades later (see **Population abundance and trends**). However, it was the same type of Caribou that had previously migrated between Victoria Island and the mainland, based on their skull measurements, pelage colour, and the migratory behaviour of Caribou on southern Victoria Island in the 1980s being similar to those previously described by Manning (1960) for the Dolphin and Union herd (Gunn and Fournier 1996).

Designatable Units

Dolphin and Union Caribou were first assessed by COSEWIC in 1979 as part of Peary Caribou (Gunn *et al*. 1979). In 1991, Dolphin and Union Caribou were recognized by COSEWIC (Miller 1991) as a separate 'population' from Peary, but were not assessed separately until COSEWIC (2004). COSEWIC (2011) confirmed the Dolphin and Union Caribou as one of 11 extant Caribou DUs.

Measures of genetic divergence between Dolphin and Union Caribou and both Peary and Barren-ground Caribou populations support their discrete nature. New genetic information since COSEWIC (2011) re-affirms the uniqueness of Dolphin and Union Caribou (McFarlane *et al*. 2014, 2016). Morphology (e.g., skull shape, antler velvet colour, hoof size, and breeding pelage pattern; Gunn & Fournier 1996; Manning 1960; see **Mophological Description**) provides additional evidence of discreteness. Dolphin and Union Caribou are geographically or temporally isolated from most other Caribou during calving and rutting (Gunn and Fournier 2000; Nishi and Gunn 2004, Poole *et al*. 2010; Nagy *et al*. 2011), although spatial overlap during winter with the Ahiak (Barren-ground) herd does occur (L. Leclerc, pers. comm., 2017).

In terms of evolutionary significance, while Dolphin and Union Caribou share haplotypes with members of adjacent DUs, the retention of some distinct genetic lineages (Eger *et al*. 2009) suggests possible local adaptations by these Caribou. They differ significantly from Barren-ground Caribou (DU3) because their regular twice-annual migratory pattern across sea ice is unique and reflects the unique ecological setting. The scale of this migration (thousands of individuals) is also distinct from the often dispersed uncoordinated individual-scale movements over sea ice observed in Peary Caribou (COSEWIC 2011). Although the Dolphin and Union Caribou have a strong migratory annual cycle that is similar to Barren-ground Caribou, they have a dispersed individualistic calving strategy similar to Peary Caribou (Nishi 2000; Poole *et al.* 2010). They are also isolated from other populations during the rut on Victoria Island (Poole *et al.* 2010; Nagy 2011).

Special Significance

Inuit and Inuvialuit peoples of the Canadian Arctic have harvested Caribou for > 4,000 years (Manseau *et al.* 2004). Dolphin and Union Caribou share cultural, historical, economic, and ecological importance with Peary Caribou (COSEWIC 2015). Ancient Caribou drive systems made of stone lines and cairns and communal Caribou kill sites found on southern Victoria Island span several millennia, covering the whole of modern Inuit occupation and, before them, the unrelated Dorset culture (Brink 2005; Friesen 2013). These records show that the Caribou on both Victoria Island and the mainland are a deeply integral component of Inuit and Inuvialuit culture, Arctic ecology and Canadian history. Humans harvested Caribou within the region for centuries (Manning 1960; Savelle and Dyke 2002; Brink 2005). Today, this Caribou population is the source of fresh meat for four Inuvialuit and Inuit communities and two outpost camps. In addition, Dolphin and Union Caribou have likely been an important factor in the distribution of the genetic signatures of wolves (*Canis lupus*) that follow them (Carmichael 2007).

DISTRIBUTION

Global Range

Dolphin and Union Caribou range is entirely within Canada.

Canadian Range

The range of Dolphin and Union Caribou spans two jurisdictions: Northwest Territories and Nunavut (Figure 1). These Caribou occupy most of Victoria Island (except for the northwest portion) as well as sections of the mainland coast. Their range includes Gateshead Island, Jenny Lind Island and Admiralty Island and islands in Coronation Gulf, Queen Maud Gulf and Dolphin and Union Strait, and the adjacent mainland coast (summarized by SARC 2013). Dolphin and Union Caribou are also known to travel to Read Island and Cambridge Bay (Elias 1993 in SARC 2013).

Recorded observations describe the distribution of Dolphin and Union Caribou retracting and expanding at various points in time since the beginning of the 20th century, in rough correspondence with population size (Table 2 in GNU and GNWT 2017). For example, population numbers were so low in the 1920s, that animals ceased to migrate across the Dolphin and Union Strait for several decades (see **Population Abundance and Trends**). In the 1960s to 90s, during a time of population increase, the winter range extended further south on Victoria Island than in the past (ATK and community knowledge sources cited in SARC 2013).

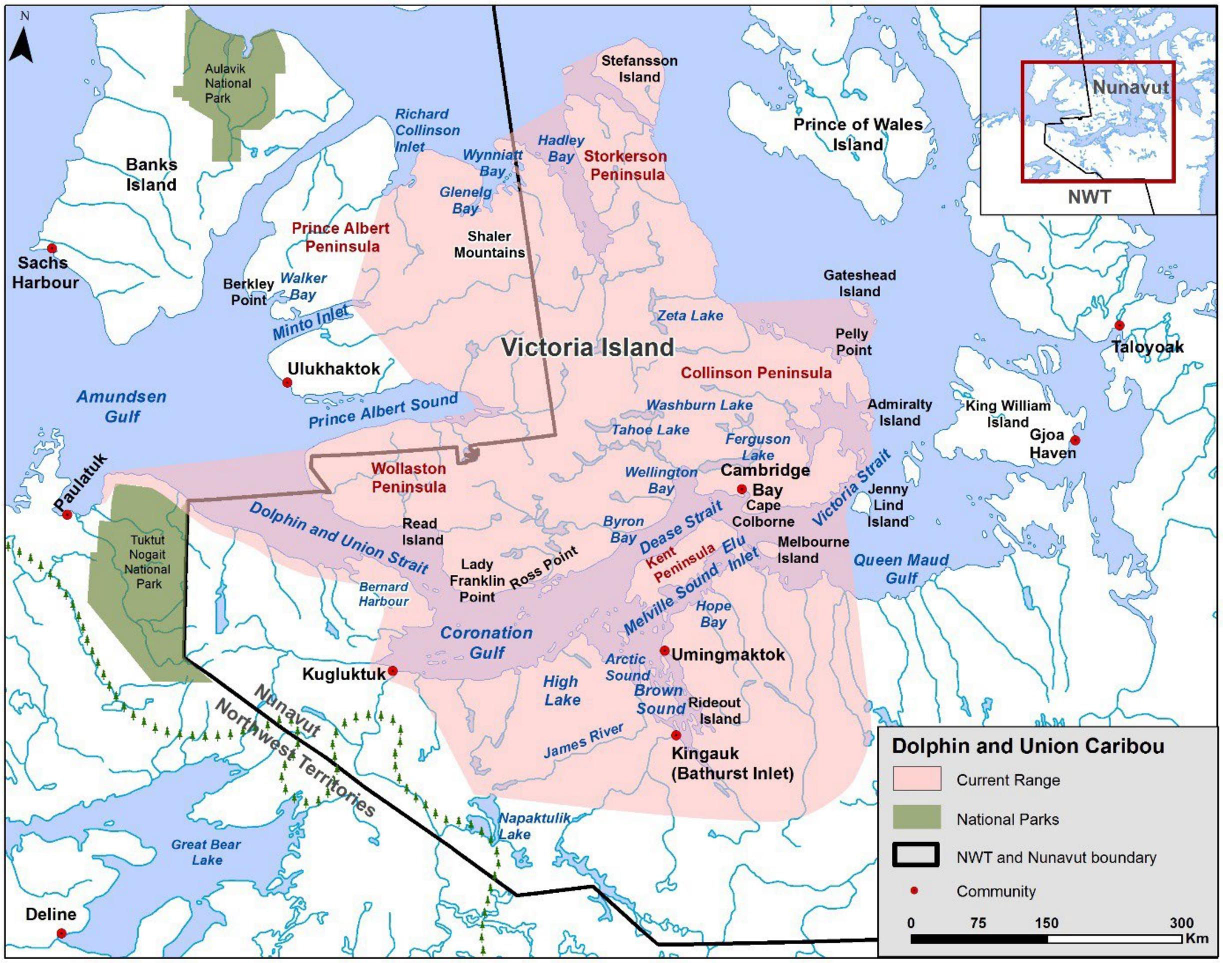

Figure 1. Current range of Dolphin and Union Caribou, including notable place names (NWT Environment and Natural Resources, range data developed for Species at Risk program 2016).

In the 1980s, harvesters' reports corroborated biologists' surveys showing a shift in winter distribution of the Dolphin and Union Caribou from the south and east of Victoria Island (Gunn *et al.* 1997). In the 1990s and 2000s, the Dolphin and Union population extended its winter range on the coast of the mainland and individuals were seen north of Great Bear Lake in the range of mainland Barren-ground Caribou (elder Phillip Kadlun of Kugluktuk, cited in Golder Associates Ltd. 2003; Tomaselli *et al*. 2018; Figure 2). They have also been seen west as far as Tuktut Nogait National Park (Gau pers. comm. 2011 cited in SARC 2013).

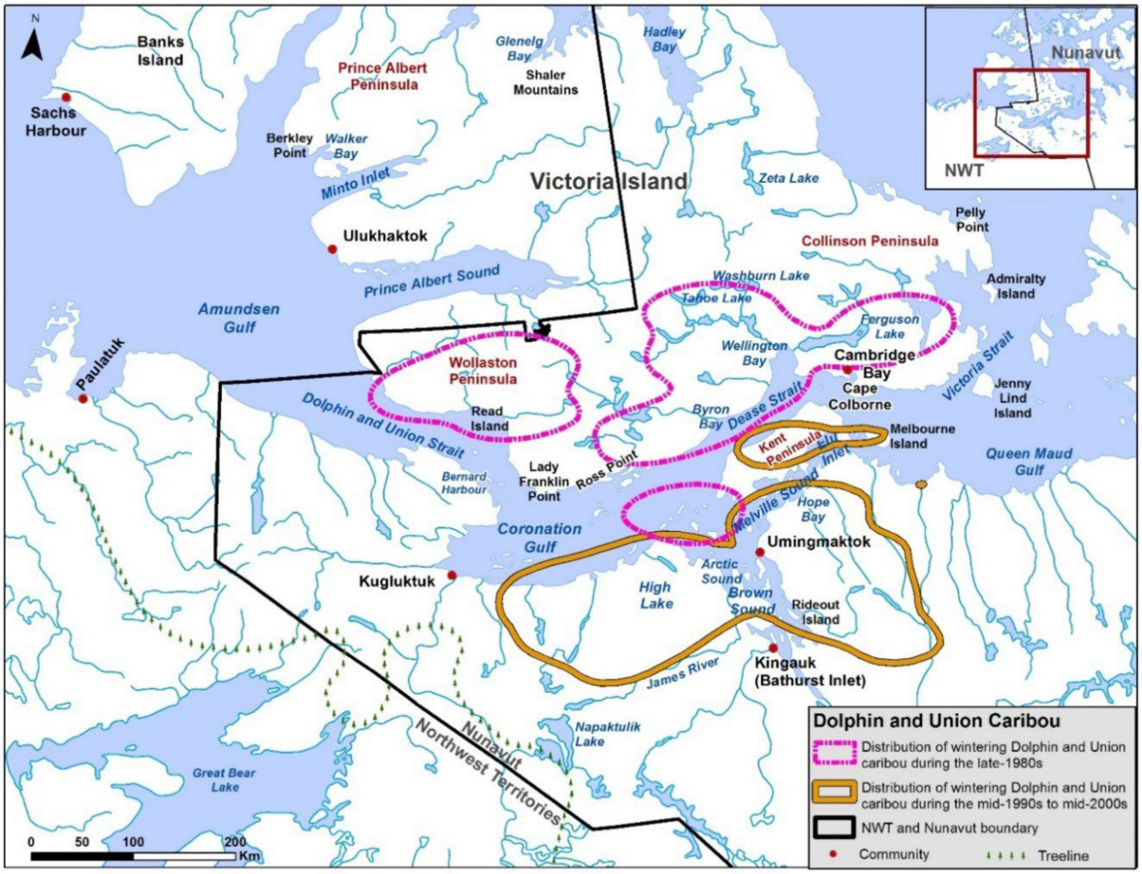

Figure 2. Approximate distribution of wintering Dolphin and Union Caribou during the late 1980s (pink line), and the mid-1990s to mid-2000s (gold line), based on satellite-collared Caribou. Data from Poole *et al*. (2010); figure reproduced from the SARC (2013) by B. Fournier, GNWT-ENR 2016.

Extent of Occurrence and Area of Occupancy

The extent of occurrence (EOO) for Dolphin and Union Caribou was estimated as 499,449 km^2 for the population, encompassing areas where these Caribou have been recorded since 1980. The index of area of occupancy (IAO) was estimated as the surface area of 2 x 2 km grid cells that intersect the area of occupancy and totalled 391,292 km^2 (SARC 2013). In light of IUCN guidance that the “smallest area essential at any stage to the survival of existing populations of a taxon” might be a more relevant measure of area of occupancy (IUCN Standards and Petitions Subcommittee 2017:49), the area of the fall staging area on the southern shore of Victoria Island might qualify, but has not been consistently mapped and is variable in location and size. Dolphin and Union Caribou follow a dispersed calving strategy scattered over a large proportion of Victoria Island.

Search Effort

Inuvialuit and Inuit from the communities, including Ulukhaktok and Paulatuk (NWT) and those from Cambridge Bay, Kugluktuk, Umingmaktok and Kingauk (formerly Bathurst Inlet) in Nunavut, regularly hunt throughout the range of the Dolphin and Union Caribou.

They also trap and conduct other traditional activities in these areas, and are always alert to the presence or unexpected absence of Caribou (SARC 2013). Experienced hunters can visually distinguish Dolphin and Union Caribou from other Barren-ground Caribou and from Peary Caribou. Their observations have been reported (e.g., Nishi 2000) and collected by focused interviews (e.g., Thorpe *et al*. 2001; SARC 2013, Tomaselli *et al*. 2016; 2018; GNU and GNWT 2017).

The widespread adoption of snow machines in the 1970s effectively increased search effort because hunters could cover greater distances searching for Caribou or Muskoxen or travelling cross-country for other reasons (Condon 1996 cited in SARC 2013). Due to the amount of time spent on the land and the experience and skills required to continue their cultural traditions the Inuvialuit and Inuit have a high level of awareness of Caribou and other wildlife distribution, density and condition (c.f. Dumond 2007; SARC 2012; 2013).

Information particular to wildlife management is also shared in meetings of local Hunters and Trappers Organizations (Nunavut) and Committees (Inuvialuit), and between them and regional wildlife management boards. In this way, knowledge of status, movements and condition of wildlife is accumulated and spreads among communities. The search effort entailed in the wildlife management aerial surveys varied prior to 1997 but typically was low coverage and/or only parts of the island were surveyed (Jakimchuk and Carruthers 1980; Gunn and Fournier 2000; Nishi and Buckland 2000), partly because Victoria Island is so large. The large area was a leading reason since 1986 for switching to VHF, satellite and GPS collars to locate Caribou, although the low number of collars (<25/year) reduces precision of analyses. Collar locations are used to map Caribou in the fall to allocate aerial survey effort (Nishi and Gunn 2000, Dumond and Lee 2013).

HABITAT

Habitat Requirements

Dolphin and Union Caribou require high-quality forage while reducing their risk of exposure to mosquitos and warble flies (*Hypoderma* sp.), parasites and predators (ATK summarized in SARC 2013). They may use eskers for fly-free travel and for the Moss Campion (*Silene acaulis*), a preferred food, as noted in the Olokhaktomiut Community Conservation Plan (2008). Information on forage habitat requirements specific to Dolphin and Union Caribou is limited, due to incomplete or few descriptions of their diet, and the wide distribution of forage by vegetation types and feeding sites relative to plant phenology or snow conditions (SARC 2013). The energetic costs of foraging when snow and ice restrict forage access are also unknown.

A key habitat requirement for Dolphin and Union Caribou is the seasonal connectivity of the sea ice between Victoria Island and the mainland. Poole *et al*. (2010) reported that these Caribou require >90% ice coverage in the fall. While the Caribou may cross on recently formed new ice (<10 cm thickness), they generally cross when most of the surface is young ice (e.g., grey coloured, 10–30 cm thick), which is in the transition stage from new ice to first-year ice.

The climate is strongly seasonal and continental, with short, dry, summers and long cold winters. Mean annual daily temperature was -13.9 ^{0}C (1981-2000) with a mean July temperature of 8.9 ^{0}C at Cambridge Bay on Victoria Island (http://climate.weather.gc.ca/climate_normals/). Mean annual precipitation is 138.8 mm at Cambridge Bay (59% as snow) (http://climate.weather.gc.ca/climate_normals/).

West and southern Victoria Island lies within the 7-9 ^{o}C mean July temperature while central and eastern Victoria are cooler being within 5-7 ^{o}C (Gould *et al*. 2003). The annual range of Dolphin and Union Caribou is within the Northern and Southern Arctic Ecozones. Calving areas on Victoria Island lie in the Northern Arctic Terrestrial Ecozone, while wintering areas on the mainland coast are in the Southern Arctic Ecozone (Gunn *et al*. 2011; Rankin *et al*. 2011).

The low summer rainfall means that the drought index is high, especially in August compared to mainland herds (CARMA unpubl. data). The cooler summers reduce the warble fly index to about half that recorded for the mainland Caribou ranges. Cumulative snow depth averages 80 cm on the winter range, which is relatively deep and the snow density is relatively high compared to Barren-ground Caribou winter ranges.

The vegetation is mostly prostrate dwarf shrubs and mosses, with dwarf shrubs and non-tussock grasses and shrubs (Gould *et al*. 2002). The calving, summer, and fall ranges on Victoria Island are characterized by discontinuous upland vegetative cover, varying between 5-80% coverage and dominated by prostrate dwarf shrubs including Purple Saxifrage (*Saxifraga oppositifolia*), Dryas spp., and Arctic Willow (*Salix arctica*), along with Alpine Foxtail (*Alopecurus alpinus*), Wood Rush (*Luzula nivalis*), and other saxifrages (Gould *et al*. 2003). The vegetation is relatively sparse as most of the island has 5-50% plant cover and less than 500 g/m^2, which contrasts to the nearby mainland where above-ground biomass and plant productivity is higher (Gould *et al*. 2003, Hughes 2006). The variety of dwarf shrubs, grasses and forbs provides sufficient high quality forage despite the relatively low cover of lichens.

Diet

The diet of Dolphin and Union Caribou is high in protein-rich vascular plants (sedges, grass, and willows) and in flowers in summer. Unusually dry summers tend to yield relatively poor forage quality, which can lead to population-level impacts the following year (Dumond 2007).

Winter diet on Victoria Island in the late 1980s and in May 2004 was dominated by dwarf shrubs (Mountain Avens [*Dryas octopetala*], willow) and sedges but, on the nearby mainland, Arctic Heather (*Cassiope tetragona*) and lichens dominated the diet (Hughes 2006, SARC 2013; GNU and GNWT 2017). The mainland has quite different topography and geology compared to Victoria Island but these influences on forage selection are unmeasured.

Dolphin and Union Caribou must adjust their foraging to changing snow conditions, which are affected by terrain (slope and aspect) and the timing of snowmelt (Larter and Nagy 2001; SARC 2013). Snow cover can also affect energy costs, e.g., access forage through digging for food and travel (Thorpe *et al*. 2001).

Habitat Trends

A lack of information hampers assessing habitat trends, except for the general satellite-derived mapping of arctic vegetation which can be related to underlying trends in summer warmth and reduced sea ice cover (for example, Bhatt *et al.* 2017). Climate trends for Victoria Island are described in **Threats and Limiting Factors**.

Other possible habitat trends are the effects of anthropogenic development and activities on habitat, but there have been no scientific assessments within Dolphin and Union Caribou calving and summer ranges. One mine (TMAC Resources' Hope Bay project) began operating in 2017, and there are mineral exploration camps and proposed mining projects in the mainland part of the winter range that could influence habitat use for these animals in the future (see **Energy Production and Mining**).

Inuit and Inuivialuit living in the summer range of Dolphin and Union Caribou reported an increase in plant growth, and consequently better forage, over the last three decades of the 20th century, which they attributed to climate change (Thorpe *et al.* 2001). Informants also said that acceptable forage is appearing in new areas and existing forage is increasing in quality and this trend sustained the population increase (SARC 2013). Hunters from Kugluktuk, however, thought that the “grass was quite sparse on Dolphin and Union summer range” (ENR 1998, cited in SARC 2013), possibly due to heavy grazing by Caribou associated with a peak in population about 1997.

After members of the Dolphin and Union Caribou population migrate through an area, the vegetation is so decimated that it takes two years to grow back (Phillip Kadlun of Kugluktuk cited by Golder Associates Ltd. 2003). The concentration of Caribou on southern Victoria Island during the rut and along the coast in preparation for fall migration has resulted in visible, but unquantified, effects on forage over the years (Nishi and Gunn 2004).

BIOLOGY

Life Cycle and Reproduction

Similar to Barren-ground Caribou, Dolphin and Union Caribou follow an annual cycle, undertaking pre-calving and fall migrations between seasonal ranges. In the spring, they migrate northward to where they calve in early to mid-June (Gunn and Fournier 2000, Nishi 2000) and then spend the summer gaining weight. In the fall, they move to the south coast of Victoria Island where they stage waiting for freeze-up, after which they migrate to the over-wintering grounds (Poole *et al*. 2010; SARC 2013) (see **Dispersal and Migration**). Although pre-calving migration is relatively gregarious (groups of dozens of females), individuals disperse to calve over much of Victoria Island east to the eastern coast (Gunn and Fournier 2000; Nishi 2000; Nishi and Buckland 2000). The rut likely occurs during either migration or staging and the mating system is polygynous (c.f. Holand *et al*. 2007), with bulls tending small groups of females which are relatively synchronized in their oestrus (Mysterud *et al*. 2003).

Dolphin and Union Caribou have a reproductive lifespan of about 12 years (SARC 2013), and assuming they are similar to Peary Caribou (Thomas 1982), usually first calve when they are 3 years old, or at 2 years old when there is high-quality forage available. SARC (2013) presented data on pregnancy rates for the Dolphin and Union Caribou from 1987 to 1997 that varied from 43% to 100% over this time period. Hughes (2006) found the age of harvested Dolphin and Union Caribou females ranged from 1.8 to 13.8 years, with a mean age of 6.5 years.

Information regarding generation time is lacking for Dolphin and Union Caribou. Moreover, age structure and sex ratio changes with each severe winter that is followed by reduced survival and fecundity. For the Dolphin and Union population, COSEWIC (2004) and the SARC (2013 citing Boulanger pers. comm. 2011) estimated the intergeneration time as 7 to 9 years, based on unpublished data on adult survival and fecundity.

Physiology and Adaptability

Special adaptations of Dolphin and Union Caribou are undescribed. Their migration pattern is broadly similar to Barren-ground Caribou populations, except that they undertake long ice crossings and their winter and summer ranges are farther north. Their morphological similarity to Peary Caribou (relatively large hooves, molariform tooth row, and smaller body size) suggests adaptation to similar selection pressures, which include the highly seasonal and cold climate and relatively sparse forage (Miller *et al*. 2007; Zittlau *et al*. 2009).

Dispersal and Migration

Before about 1920, when numbers were still high, Caribou crossed the Dolphin and Union Strait at various points as far west as Cape Bexley and Coronation Gulf east to Queen Maud Gulf in the spring (summarized in SARC 2013). They moved rapidly northwards to the north coast and spread out over most of Victoria island. Some individuals remained on the Wollaston Peninsula during the summer, while the main herd continued north past Prince Albert Sound. In the fall, after the rut, they returned to the mainland south of Coronation Gulf and west at least to Cape Dalhousie (Nishi 2000; Poole *et al.* 2010). Scientific observations and hunters' reports indicate that, during the 1980s, Caribou shifted their fall aggregation areas to the south and east on Victoria Island (Gunn *et al.* 1997).

Currently, most of the central-southern-eastern Victoria Island Caribou migrate to the mainland in winter. Some of those Caribou crossed to Read Island, while others went east to Cambridge Bay. A few individuals remain on Victoria Island all year (Thorpe *et al*. 2001). Elias (1993 in SARC 2013) summarized Inuvialuit traditional knowledge and found that the resident Victoria Island Caribou migrated north of Prince Albert Sound to calve in the spring; they wintered around there or on islands to the east or south of the coast. Those that migrate across the sea ice to winter on the mainland in November return in April to southeast Victoria Island.

Archaeological studies on southeast Victoria Island reveal a high likelihood of the persistence of the fall staging and migration of Dolphin and Union Caribou. Pre-Dorset 11th-13th century CE) and Thule people (16-18th century CE) depended on the Caribou and fish (Howse 2008, Howse and Friesen 2016). Wolverine (*Gulo gulo*) bones were associated with Pre-Dorset and Wolf bones with Thule (Howse and Friesen 2016). Examination of the bones suggests the Caribou were killed during fall and spring. Rae (1852, cited in Manning 1960) was the first European explorer to describe the migration across to southwest Victoria in 1851.

Major migration routes follow a consistent pattern (ATK in SARC 2013, Poole et 2010). In fall, Caribou in the Victoria Island's Cape Colbourne area cross Dease Strait south to the Kent Peninsula, reaching Umingmaktok (Bathurst Inlet) by mid-November; those in the Read Island area cross Dolphin and Union Strait to the mainland, although this occurs much more rarely than it did in the early 2000s. In spring, Caribou move from the mainland to Melbourne Island and across Queen Maud Gulf or Dease Strait to Victoria Island. Those starting in the Browne Sound area cross to Arctic Sound and Rideout Island towards Elu Inlet (on the south side of the Kent Peninsula), then across Dease Strait to Cambridge Bay, while those further west cross Coronation Gulf west of Bathurst Inlet to Ross Point on Victoria Island.

Scientific evidence regarding the migration across the Dolphin and Union Strait is congruent with ATK (Figure 3). Satellite tracking records of 46 individuals from 1987–2006 demonstrated that Caribou crossed throughout the western Queen Maud Gulf-Dease Strait-Coronation Gulf area and that only two individuals crossed the Dolphin and Union Strait (Poole *et al.* 2010), as they did historically.

The Dolphin and Union Caribou begin moving southward in October to staging areas along the southern coast of Victoria Island while waiting for freeze-up; Caribou that summer farther north on Victoria Island arrive later, shortening their time spent on the staging area. They begin migrating south in fall as soon as the sea ice is formed and most depart from just a few locations, which they tend to use consistently for year to year (Poole *et al.* 2010). In winter, ATK has suggested increasing overlap of Dolphin and Union and Barren-ground Caribou herds on the mainland (summarized by SARC 2013).

The Ekaluktuktiak Hunters and Trappers Association in Cambridge Bay reported that Melbourne Island is an important area for the Dolphin and Union Caribou in the spring (cited by Gunn *et al.* 1997). They also stage and feed intensively on the Kent Peninsula and other areas along the mainland coast. It is believed that island-hopping routes are chosen to maximize foraging before crossing the sea ice to Victoria Island (Gunn *et al.* 1997).

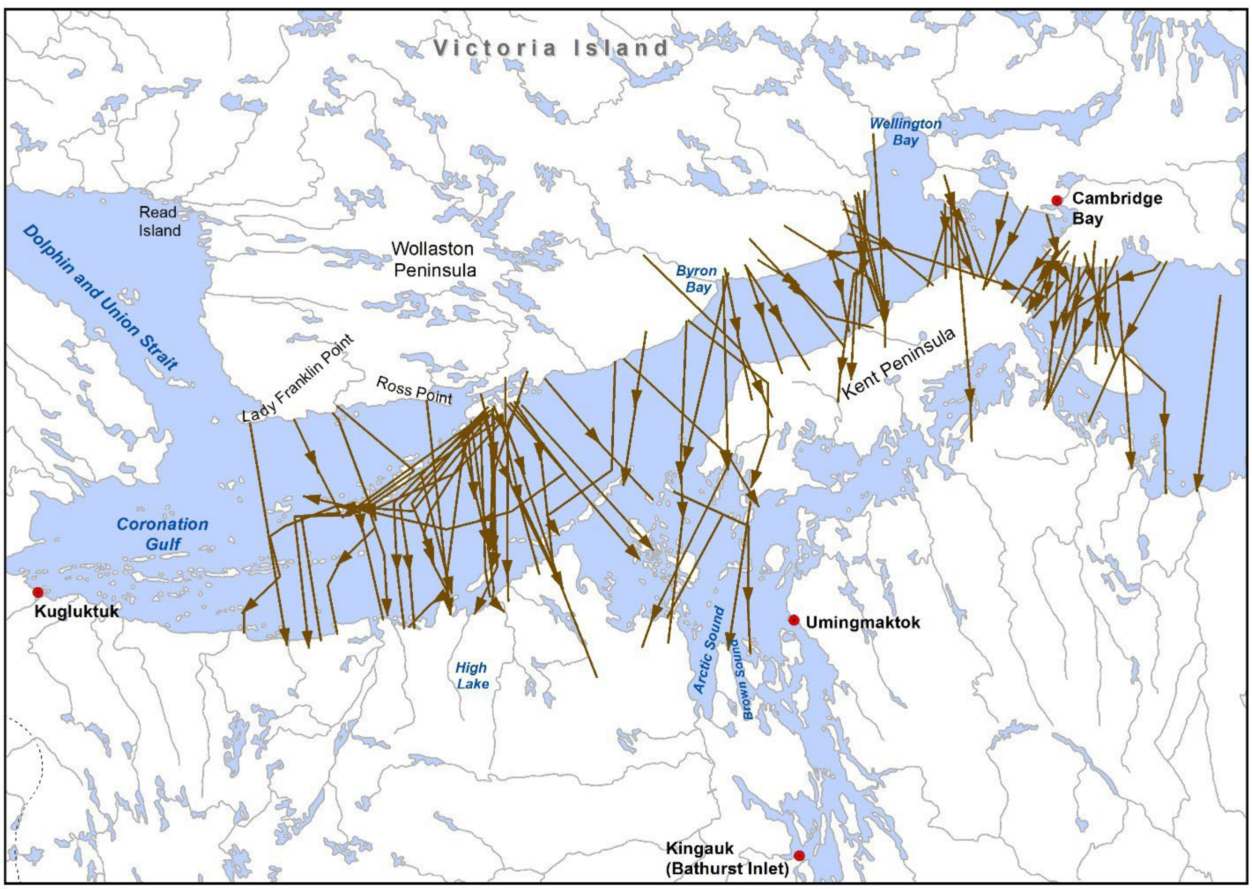

Figure 3. Dolphin and Union Caribou fall migration between Victoria Island and the mainland since 1986 (modified from Poole *et al*. 2010, by B. Fournier, GNWT-ENR 2016). Note: although not depicted here, some movements are still known to occur across the Dolphin and Union Strait (SARC 2013).

Interspecific Interactions

Dolphin and Union Caribou share their annual range with four mammalian predators (Wolf, Grizzly Bear [*Ursus horribilis*], Wolverine, and Polar Bear [*U. maritimus*]), two other populations (designatable units) of Caribou (Barren-ground and Peary), Muskoxen, and four species of smaller-bodied herbivores: Arctic Hare (*Lepus arcticus*), ptarmigan (*Lagopus* spp.), and lemming (*Dicrostonyx groenlandicus*, *Lemmus trimucronatus*). Wolves are the primary predators of Dolphin and Union Caribou, although Grizzly Bears are also known to take Caribou, especially calves.

Over the past decade, there have been documented changes to populations of some sympatric species. For example, Wolf numbers are increasing, as judged by more frequent sightings of wolves during aerial surveys for Caribou and Muskoxen (SARC 2013). Grizzly Bears have recently expanded their range onto Victoria Island (COSEWIC 2012). There is no direct information on predation rates.

Muskox abundance increased on Victoria Island in the 1980s and 1990s (Gunn and Patterson 2012), but showed a decline by 2013-2014 (L. Leclerc, pers. comm. 2016). Numbers of smaller herbivores normally fluctuate on the Arctic Islands. (Schaefer *et al*. (1996) documented the tendency for Hares, ptarmigan and Muskoxen to have distinct patterns of habitat use from Caribou during one study on southeast Victoria Island during winter in the mid-1990s).

Geese populations (e.g., Snow Goose (*Chen caerulescens*) and Ross's Goose (*C. rossi*)) on the east side of the Dolphin and Union Caribou wintering range (Queen Maud Gulf) have increased so substantially that they were recently designated as overabundant (CWS Waterfowl Committee 2014; 2015).

POPULATION SIZES AND TRENDS

Sampling Effort and Methods

Documenting population trends of arctic-dwelling Caribou within narrow limits of statistical confidence is difficult because of the irregularity of surveys and the relative inconsistency of survey coverage and methods until 1997. Surveys are expensive because of the vast area involved, and weather conditions can prevent completion of planned surveys. The first informal estimates for Dolphin and Union Caribou were conducted by estimating the number of animals that crossed the Dolphin and Union Strait (Anderson 1917). Count estimates of this population were largely from sightings documented during unsystematic flight surveys in summer by Macpherson (1961), who compiled Caribou observations during an airborne geological survey of the western Arctic Islands in the summers of 1958–59. In recent decades, abundance estimates for Dolphin and Union Caribou have been based on animal counts from strip transects during systematic aerial surveys.

Jakimchuk and Carruthers (1980) conducted the first systematic aerial survey of the entire Victoria Island in summer to determine distribution and abundance of Caribou and Muskoxen as part of an environmental assessment for the proposed Polar Gas Project. The next systematic aerial surveys in the early 1990s were during the calving period and covered the western portion of the island, followed by a larger survey of western and central Victoria Island in June 1994 (Nishi and Buckland 2000). Subsequent systematic aerial surveys were restricted to northwest Victoria Island in 1998, 2001, 2005 and 2010 (see SARC 2013) but were targeted for Peary Caribou and Muskoxen.

In the late 1990s, biologists recognized that aerial surveys used to estimate abundance of Dolphin and Union Caribou would be most efficient and effective if conducted in the fall (October) when individuals stage along the south coast of Victoria Island waiting for the sea-ice to freeze. The trade-off is the poor flying weather at this time of year. Nishi and Gunn (2004) developed the strip transect design, orienting flight lines mainly perpendicular to the coast, with some inland lines to identify any gradient of distribution. The formal survey would be preceded by an aerial reconnaissance survey and radio-tracking VHF collars to stratify the survey according to observed densities observed.

Surveys using this methodology were conducted in 1997 (Nishi and Gunn 2004), 2007 (Dumond and Lee 2013), and 2015 (Leclerc *et al.*, in prep.; 2016). Dumond and Lee (2013) corrected the 1997 and 2007 fall survey results to account for those individuals that had not yet reached the coastal staging area. However, the use of satellite collar data from animals for 2000-2002 to estimate the probability of Caribou being close to the coast in 2007 to derive correction factors was challenged by SARC (2013). Dumond and Lee (2013) used the 1997 VHF collars as a correction factor even though they had been all located on the coast in 1997, and Leclerc *et al*. (in prep.; 2016) used 2015 collars to derive the extrapolated 2015 survey estimates. In this report, because of the uncertainty whether all Caribou aggregate on the south coast at the same time and the applicability of correction factors, we present the corrected and uncorrected estimates (Figure 4) for 1997, 2007 and 2015 surveys as minimum and maximum estimates, respectively. Numbers of mature individuals cannot be estimated, as non-mature adults and calves were included in the counts.

The population estimates obtained in 1997, 2007 and 2015 are comparable with one another and provide a time period near three generations (assuming a 7-9 year generation time from 2017) over which to estimate population trend. However, there are considerable uncertainties associated with the calculation of this trend, including corrections applied to the individual population estimates, lack of data on generation time, and lack of understanding of patterns of decline and the extent to which natural fluctuations are at play.

Abundance

Anderson (1917) guessed the number of Caribou crossing the Dolphin and Union Strait to be between 100,000 and 200,000 animals. Manning (1960) gave a detailed account of the historic migration. He suggested that these and other early observations indicated a migratory and a resident population of Caribou on Victoria Island and referred to the former as the Dolphin and Union Strait herd. He used the lower of Anderson's range, 100,000 Caribou that summered on Victoria Island before the 1920s, as the most realistic estimate. However, SARC (2013:86) suggested this estimate is likely "unrealistically high" as the overall density at 100,000 Caribou would be 0.4 Caribou/km^2. In comparison, the peak density of Peary Caribou on Banks Island in the 1970s (12,000 Caribou; Urquhart 1973) was 0.2 Caribou/km^2.

Caribou numbers sharply declined and by the early 1920s had ceased migrating across the Dolphin and Union Strait. This decline coincided with the opening of trading posts along the coast, which led to changes in hunting practices (Manning, 1960; Freeman, 1975). At the same time, Inuit elders noted that severe icing storms caused Caribou deaths (Gunn, 1990). The herd was assumed to be extinct (Macpherson 1961), and these Caribou were rarely seen on Victoria Island for the next five decades (Poole *et al*. 2010).

Macpherson (1961) compiled observations of geologists, who recorded Caribou observations in summer 1959, yielding an estimate of 670 animals. Inuit from Cambridge Bay began seeing Caribou in the 1970s and 1980s. Jackimchuk and Carruthers (1980) surveyed Victoria Island in summer and estimated 7,936 ± SE 1100 Caribou (Miller 2004), just under 3,500 of which were likely Dolphin & Union Caribou (SARC 2013). By 1993, up to 7,000 Caribou were migrating annually across Coronation Gulf and Dease Strait (Gunn *et al*. 1997; Gunn and Nishi 1998).

In June 1994, Nishi and Buckland (2000) flew transects across the western 63% of Victoria Island, estimating 14,539 ± SE 1015 adult Dolphin and Union Caribou. The surveys included the range of Peary Caribou on northwestern Victoria Island, but only 4 Caribou were seen there, an insignificant proportion of the total. Unsystematic aerial searches and VHF radio-tracking, however, documented Caribou throughout the eastern 37% of the island. Dumond and Lee (2013) revised the Nishi and Buckland (2000) estimate to 22,368 individuals (no variance calculated), using the proportion of VHF radio-collars. However, factors such as the variability in the densities across survey strata and differences in group sizes between systematic surveys in the west and reconnaissance surveys in the east suggest that it may be problematic to extrapolate mean densities from the west to the eastern part of the island.

Nishi and Gunn (2004) flew transects in October 1997, just before freeze-up when male and female Caribou were massing along the south shore of Victoria Island prior to crossing the straits, under the assumption that most of the population would be in the pre-migration aggregation. Their estimate was 27,989 ± SE 3,367 total Caribou. Dumond (2007) estimated 21,753 ± SE 2,343 Caribou in the survey area on the south of Victoria Island in 2007 and Dumond and Lee (2013) later revised this upward to 27,787 ± CI 7,537 by extrapolating to areas not covered that had been assumed to be unoccupied, but were later found by satellite telemetry to be populated (see **Sampling Efforts and Methods**). Dumond and Lee (2013) retroactively applied this same probability of VHF collared Caribou as a correction factor to the 1997 estimate (which had used the same methods and covered the same area), resulting in a revised estimate of 34,558 ± CI 6,801 for 1997.

The Government of Nunavut completed an aerial population assessment in fall 2015, estimating 14,730 Dolphin and Union Caribou, and extrapolated this to 18,413 ± 6,795 (95% CI, 11,664- 25,182) by using information for Caribou collared in the same year (Leclerc *et al*. in prep.; Leclerc 2016; GNU and GNWT 2017). Changes in distribution were also documented, with no animals observed in the eastern one-third of the survey area, east of Wellington Bay (Leclerc 2016).

Fluctuations and Trends

An overall trend estimate for the Dolphin and Union Caribou population can be derived from the only three relatively comparable surveys undertaken in 1997, 2007, and 2015, covering a period of 18 years, or not quite three generations (21-27 years). Uncertainty around these population estimates, all of which involve extrapolation and/or correction factors, is a further complicating factor. Prior to 1997, aerial surveys did not include the southeastern portion of Victoria Island where animals aggregate prior to migrating to the mainland. The change in survey design and area suggest that it is inappropriate to compare estimates and resulting population trends from the 1995 survey with the 1997, 2007, and 2015 surveys (Figure 4).

Dumond and Lee (2013) reported that the apparent decline between 1997 and 2007 was not statistically significant (2-tailed $z = 1.51$, $P = 0.13$), concluding that the population was, at best, statistically stable. However, information from local hunters and conservation officers (SARC 2013), as well as low adult survival rates from 1999-2006 (Poole *et al*. 2010), were more indicative of a population decline during this period. The most recent (2015) survey confirmed a decline relative to the 2007 survey estimates (z-test, $Z=-2.19$, $p=0.036$). Leclerc *et al*. (in prep.) concluded the population declined by 33.8% from 2007 to 2015.

The most recent survey estimates from 2015 (Leclerc *et al*. in prep; Leclerc 2016; GNU and GNWT 2017) provide some basis by which to derive an approximate three-generation trend estimate from uncorrected (minimum) and corrected (maximum) survey estimates (Figure 4). Assuming a 7-year generation time, a population trend was extrapolated over three generations (beginning in 2017) by fitting a model based on an exponential rate of decline, using the IUCN Red List Assessment Tool for Criterion A (see IUCN Standards & Petitions Subcommittee 2017). This yielded a three-generation trend estimate of -52% and -52.6% for corrected and uncorrected estimates, respectively. A 9-year generation time suggested higher decline rates (-61.1% and -61.7%) for both estimates.

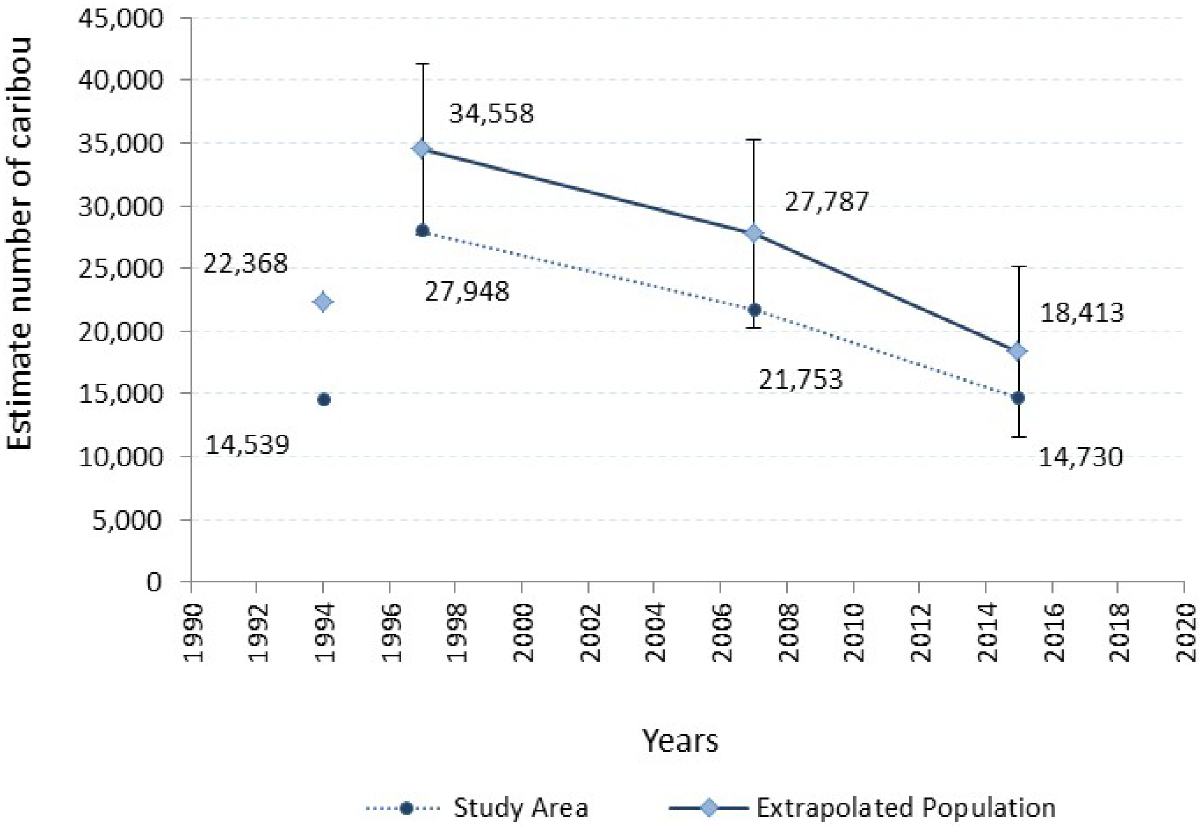

Figure 4. Population estimates (±SE) from 1997 to 2015, and minimum (Nishi and Buckland 2000) and extrapolated (Dumond and Lee 2013) estimates from 1994. Reproduced from GNU and GNWT (2017).

A declining trend since the 1990s is also reported by IQ (ATK) and local knowledge collected in a 2014 study conducted in the community of Ikaluktutiak (Cambridge Bay) on Victoria Island, Kitikmeot Region, Nunavut. Community members observed 80% (75-90%) fewer Dolphin and Union Caribou in the Cambridge Bay area compared to what they used to see in the 1990s, reporting that such declines began around 2005, with a major decline after 2010 (Tomaselli *et al*. 2018). Participants also observed an overall decrease of the young age classes, smaller group sizes, a higher proportion of those in poor body condition and increased observations of diseased animals, thus providing some explanatory factors for the decline (Tomaselli *et al*. 2018).

To place the estimated decline rate over the past three generations into a broader context (Figure 5), the Dolphin and Union Caribou population abruptly declined and experienced a recovery once before over the past century. In the early 1900s, the herd was documented in high numbers, followed by a 50-60-year period of very low densities with no sign of migration across the sea ice. The herd started to increase in the late 1970s, and resumed its migration in the late 1980s (Gunn and Nishi, 1998; Gunn and Fournier, 2000). Numbers increased until the late 1990s and began a decline sometime thereafter, with ATK and survey evidence both pointing to a significant shift in the mid-2000s and accelerated decline since about 2010. Evidence suggests that the severe bottleneck of 100 years ago was caused by the introduction of firearms, possibly interacting with winter icing, and recovery took place over seven decades. Hence the degree to which this population undergoes natural fluctuations similar to other Caribou populations (e.g., COSEWIC 2016) is uncertain (SARC 2013).

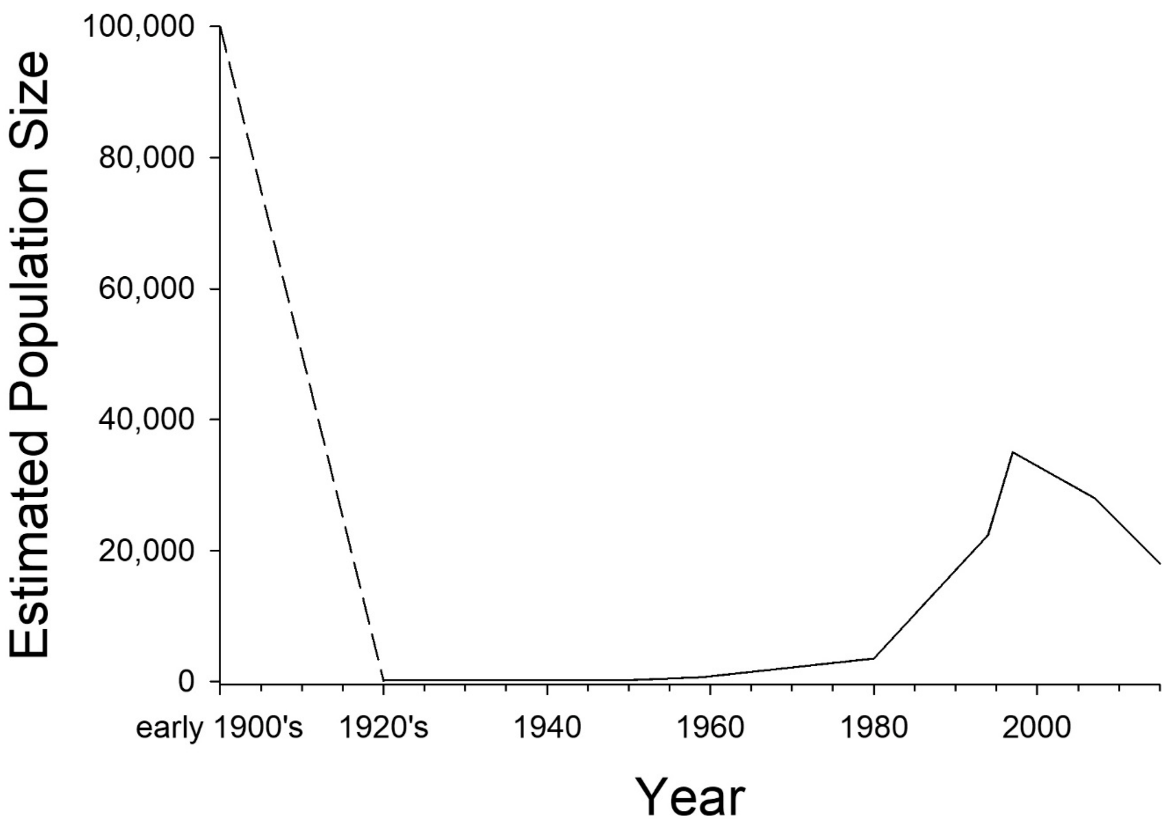

Figure 5. Depiction of approximate population trajectory of Dolphin and Union Caribou since the early 1900s (Anderson 1922, Manning 1960, Banfield 1950, MacPherson 1961, Jackimchuck and Carruthers 1980, Nishi and Buckland 2000, Nishi and Gunn 2004, Dumond and Lee 2013, Leclerc 2016).

Rescue Effect

For the endemic Dolphin and Union Caribou population, there is no possibility of immigration from outside of Canada.

THREATS AND LIMITING FACTORS

Direct threats facing Dolphin and Union Caribou assessed in this report were organized and individually evaluated based on the IUCN-CMP (World Conservation Union-Conservation Measures Partnership) unified threats classification system (Master *et al*. 2009). Threats are defined as the proximate activities or processes that directly and negatively affect each population.

The threat classification table for Dolphin and Union Caribou (Appendix 1) was completed by a panel of IQ, TK and scientific experts on Dolphin and Union Caribou in December 2014 and updated in February 2016. Each threat was assessed separately in relation to its impact, scope, severity and timing.

Narrative descriptions of the threats are provided below in the general order of highest to lowest overall impact threats. For many threats, there was significant uncertainty as to impact. For example, shipping lanes and predation will be high impact under certain future scenarios and how threats interact and potentially compound one another is difficult to discern or predict. Several additional low and medium-impact threats act in tandem, resulting in an overall High-Very High calculated and assigned threat impact.

Shipping lanes (IUCN Threat # 4.3) (High Impact)

Declining sea ice within Canadian Arctic waters (see Sea Ice Loss) offers enhanced opportunities for the Northwest Passage through the Canadian Arctic Archipelago to become a seasonally viable alternative shipping route (Pizzolato *et al*. 2016). Given the Caribou migration across sea ice, increased shipping in the Queen Maud Gulf, Dease Strait, and Dolphin and Union Strait (where the majority of the ships travel) could seriously hinder or delay Dolphin and Union Caribou movements, depending on timing and frequency. The increasingly shorter sea ice season enables increased marine traffic access over an extended time period (Poole *et al*. 2010). Increased icebreaker-supported shipping would exacerbate the climate-induced effect of thinner ice and more lengthy ice-free periods (Poole *et al.* 2010; Gunn *et al.* 2011).

Shipping activity significantly increased from 1990 to 2015 in this southern route of the Northwest Passage (Pizzolato *et al*. 2016). Passages of cruise ships increased more than threefold between 1993 and 2007, although the total number is still low (Judson, 2010, cited in Gunn *et al.* 2011). For the shipping season of 2016, eleven cruise vessels declared itineraries that include voyages within the Canadian Arctic, but these were all during summer months (Marine Security Operations Centre East 2016).

In 2007, Dumond *et al*. (2013) photographed approximately 1,000 Dolphin and Union Caribou trying to migrate across Dease Strait in the fall and being impeded for at least 6 days by an open-water channel that was being maintained by an ice-breaking tug near Cambridge Bay. Local harvesters have noted an increase in the number of Caribou drownings in recent years, sometimes in the hundreds (Thorpe *et al*. 2001; GNU and GNWT 2017; Miller *et al*. 2005; First Joint Meeting 2015; Leclerc 2016; Second Joint Meeting 2016). A ship was recently observed to break through about 30 cm of ice during the third week of October (fall migration) (Ekaluktutiak HTO 2016). With at least 10 cm of ice required to allow Caribou to cross, concerns have been raised that a further increase in shipping traffic will mean there will be inadequate time for the ice to re-freeze (First Joint Meeting 2015). Miller *et al*. (2005) suggested that year-round marine traffic and ice breaking activities could ultimately prevent the Dolphin and Union Caribou's fall and spring migrations altogether and fragment the Dolphin and Union range.

Any population-level impact to Dolphin and Union Caribou from shipping would have to occur through ice-breaking vessels during the time of the sea-ice migration; open water shipping occurring during the ice-free season would not be a direct threat. However, with Dolphin and Union Caribou beginning their crossing as early as October 15 and into December, even 2-3 boats coming through at that time of year could halt or delay the migration and increase Caribou drownings. This threat would depend on when the ice has an opportunity to re-freeze and whether the Caribou die trying to cross the re-freezing ice or become trapped in leads, or open water that develops when sea ice pulls apart. Shipping in late fall, such as early October-end of September, could delay ice formation and impact ice condition (due to leads by ship wakes) (ENR 2015; 2016). The survival rate of satellite-collared adult Dolphin and Union Caribou females during 1999-2006 was lowest during fall and early winter crossing period and then mid- to late winter on the mainland coast (Patterson unpubl. data 2002 in Poole *et al*. 2010). The nature of the risk to Caribou is considerably less on the return migration in late winter-spring from the wintering range on the mainland to calving areas on Victoria Island, given the higher predictability of ice conditions during that time, lack of staging, and relative speed of the migration (Poole *et al*. 2010).

The implications of a delayed or halted migration are uncertain and likely include reduced body condition as the Caribou would be foraging in areas of lower plant productivity and harder wind-packed snow compared to the mainland. If migration was delayed, the Caribou would be staging along the south coast where forage quality is already likely reduced (Nishi and Gunn 2004).

Globally, access to and exploration of Arctic resources (including fisheries, minerals, and tourism) are the chief factors determining the extent of Arctic shipping (Eguíluz *et al*. 2016). For example, among other projects (see **Energy Production and Mining** below) the Nunavut Impact Review Board (NIRB 2017) has been considering a new deepwater port and a road connecting the port to several proposed mines, which will stimulate shipping traffic.

Problematic native species (IUCN Threat #8.2) (High-Low Impact)

Possible multi-prey and predator interactions were noted earlier (see **Interspecific Interactions**). This is a subject of much speculation and a paucity of hard data, such that future population-level impacts remain highly uncertain. Although the impact of Wolf predation on arctic Caribou population dynamics is unknown, many authors consider it likely to become a major threat to recovery when population sizes are low (Nagy *et al*. 1996; Gunn *et al*. 2000b; SARC 2012).

During the meetings to inform the development of the joint management plan for Dolphin and Union Caribou (GNU and GNWT 2017), Inuit and Inuvialuit repeatedly expressed serious concerns over increases in Wolf numbers and potential impacts (Ulukhaktok TK interviews 2011-2013; First Joint Meeting 2015; Ekaluktutiak HTO 2016; Kugluktuk HTO 2016; Second Joint Meeting 2016). SARC (2013) suggested that sympatric Muskoxen populations may support more Wolves, thereby increasing the vulnerability of individual Dolphin and Union Caribou to predation (SARC 2013). However, Muskoxen on Victoria Island are declining more rapidly than Caribou at present (Kutz *et al*., 2016).

Increasing goose populations may be affecting the vegetation, potentially affecting habitat quality of fragile arctic ecosystems (Batt 1997). Potential impacts include vegetation removal through the alteration or elimination of plant communities, and changes to soil salinity, nitrogen dynamics and moisture levels, which may compromise Dolphin and Union Caribou winter habitats and forage (CWS Waterfowl Committee 2014; 2015).

Hunting (IUCN Threat # 5.1) (Medium-Low Impact)

Modern Inuit and the cultures that preceded them, including the Thule from whom Inuit are descended, and the unrelated Dorset and pre-Dorset cultures, have been harvesting Caribou in the region for at least 4,000 years (Manseau *et al.* 2005; Howse 2008; Friesen 2013).

Beneficiaries (i.e., Inuit) of the Nunavut Land Claim Agreement (NLCA) and Inuvialuit Final Agreement are not restricted through legislation from hunting Caribou, unless a conservation issue arises that results in establishing a Total Allowable Harvest (TAH); without a TAH, there is only voluntary report of the Caribou harvested (NLCA, s. 5.6.1; IFA, s.14. (36) (a,b,c,d)). Harvest records in the absence of a TAH and mandatory reporting are not kept consistently, which prevents quantitative analysis or enumeration of trends. The absence of the harvest information becomes a serious threat if a population is declining as the effects of harvesting are known to increase during a decline.

The distribution of the population and movements of individual Caribou relative to human settlements dictate harvesting opportunities and potential population-level impacts. Generally, residents of Cambridge Bay and Ulukhaktok (formerly Holman) harvest Dolphin and Union Caribou in the spring and fall as Caribou migrate between Victoria Island and the mainland. Kugluktuk, Umingmaktok and Kingauk community members harvest during winter and spring. There is also a limited non-resident sport hunt for Dolphin and Union Caribou operated out of Cambridge Bay in the fall (GNU and GNWT 2017).

Subsistence harvesting levels are unknown, given lack of mandatory reporting (SARC 2013). Harvest studies that have relied on voluntary participation (e.g., Inuvialuit Harvest Study 2003, NWMB 2004) are subject to several sources of error and significant inter-annual variability (GNU and GNWT 2017). Unpublished records and estimates compiled by Dumond (2007) and summarized by the SARC (2013) suggested that the total number of all Caribou harvested by Kugluktuk hunters was similar between periods 1997-2001 and 2004-2007 at about 1,000–2,000 animals; however, the Dolphin and Union Caribou proportion of the harvest was estimated to have shifted from about 20%–30% of all Caribou harvested during 1997–2001 to about 75% in 2006–2007. From 1991 through 2010, the hunters in the Prince Albert Sound area of Victoria Island annually harvested 40–400 Dolphin and Union Caribou (SARC 2013).

The number of hunters targeting Dolphin and Union Caribou may be increasing, likely in response to declines in access or availability of other Caribou populations (Second Joint Meeting 2016), yet the overall number of hunters is declining (First Joint Meeting 2015). However, SARC (2013) suggested that the annual harvest may be between 2,000 and 3,000 animals from Nunavut communities and < 200 from NWT, or about 11% of the 2007 corrected population estimate of ca. 27,000 individuals (see **Population Size and Trend**). SARC (2013) commented further that this harvest rate would not be sustainable unless the herd is increasing and has strong calf recruitment. Given the current declining trend, harvesting may become an increasingly important threat, especially if mortality rates from predation or drowning increase.

Changes in hunting technology may have been a cause of the past decline for Dolphin and Union Caribou. The disappearance of the Dolphin and Union Caribou by around 1920 was thought to be due at least in part to hunting following the introduction of firearms (Anderson 1934; Manning 1960). Elias (1993 in COSEWIC 2004) reported from ATK the widespread availability of rifles at this time, and snow machines after the 1960s, which affected hunting efficiency. Several elders reported wastage of meat after high-powered rifles were available and Caribou were killed only for their skins.

<u>Climate change and severe weather (IUCN Threat #11) (Medium-Low Impact)</u>

Climate change is already affecting the Arctic. Inuit of the Kitikmeot region reported for the mainland (Golder Associates Ltd. 2003 and sources therein) a variety of effects including longer summers, unusual freeze-thaw cycles in the spring, earlier spring break-up and open sea-ice, later fall freeze-up, thinner ice (both lakes and sea-ice), lower water levels, less snow, shifts in Caribou migration, and changes in animal distribution

(COSEWIC 2015; GNU and GNWT 2017). Although severe weather events are predicted to increase in frequency and severity, there is considerable uncertainty with respect to location and timing of such events, and the effects on population dynamics within the next three generations.

Habitat Shifting and Alteration (#11.1)

Long-term arctic warming trends are continuing at unprecedented rates. The average surface air temperature for the year ending in September 2016 was the highest recorded since 1900, (Richter-Menge *et al*. 2016), and since 2005 has been higher than for any five-year period since first measured in the 1880s (AMAP 2012). Evidence from lake sediments, tree rings, and ice cores suggest that recent summer temperatures have been higher than at any time in the past 2,000 years (AMAP 2012). Minimum sea ice extent in 2016 was the second lowest since records began in 1979, and spring snow cover extent was the lowest recorded (since 1967) (Richter-Menge *et al*. 2016). Sea-ice thickness is also decreasing and sea-ice cover is increasingly dominated by younger, thinner ice (AMAP 2012).

Future temperatures in the Arctic are difficult to model because of uncertainties regarding extent of snow cover and retreat of sea ice, which are accelerating much faster than previously predicted (see below). Nevertheless, experts agree that by 2100, mean projections for Arctic winter air temperatures under various CO^2 concentration scenarios will be an increase of 2–9 °C above the 1986–2005 average; the highest projections range up to about 15 °C above the 1986–2005 average (IPCC 2013). By 2035, Christensen *et al*. (2013) predicted mean annual surface temperature in the Arctic to rise by 1.5 °C, with mean winter (December to February) temperature expected to increase more than mean summer (June-August) temperature (+1.7 °C winter vs. 1 °C summer). From 1951 to 2008, mean annual precipitation increased by 0.63-5.83 mm/yr/decade across the Arctic (IPCC 2013). Records from NWT Climate stations indicate an increase in snowfall by 20-40% in the Arctic tundra (GNWT 2014). Mean annual precipitation is projected to further increase by 6% in 2035, more in winter than summer (Christensen *et al*. 2013).

This suite of changes will directly affect Dolphin and Union Caribou by leading to sea ice loss, terrestrial habitat changes, and sea level rise. Individually and collectively, these are expected to affect all of Dolphin and Caribou range, with the overall impact ranging from moderate to serious, depending on multiple competing factors.

Sea ice loss:

The most significant impact to Dolphin and Union Caribou habitat from a changing climate is likely to be a reduction in sea ice along the migratory route. Warming temperatures are already delaying ice freeze-up and hastening spring thaw (Miller *et al*. 2005; Gunn 2004; Poole *et al*. 2010; First Joint Meeting 2015; Kugluktuk HTO 2016; Second Joint Meeting 2016). Warmer fall temperatures on the south coast of Victoria Island affect the chances of sea ice becoming sufficiently and uniformly thick during the season. For example, the formation of new ice (<10 cm thick) was delayed by 10 days and grey ice (10-15 cm thick) by 8 days in 2008 compared to 1982 (Poole *et al*. 2010).

There are various consequences to such changes in ice thickness. Deaths of Dolphin and Union Caribou migrating over thin, unstable and freshly formed sea ice are increasingly reported, e.g., through drowning events from falling through thin ice (First Joint Meeting 2015; Second Joint Meeting 2016; SARC 2013). Some proportion of individuals can become stranded on the ice and drift out to sea (Kugluktuk HTO 2016), dying from exhaustion, starvation or hypothermia. Delays in freeze-up can result in attempts to change movement patterns, resulting in wasted energy (GNU and GNWT 2017). The condition of Dolphin and Union Caribou fall ranges can also be affected by later sea ice formation, with delayed migration and longer staging times on the fall range forcing individuals to use up summer fat reserves and increase grazing pressures on the range, as well as increasing the vulnerability of individual animals to predation and hunting (Poole *et al*. 2010). Linked to the longer staging times and consequent increased local densities and social and nutritional stresses, is increased exposure, and susceptibility, to parasites in the environment and those that are contact transmitted (Altizer *et al*., 2013, Kutz *et al*., 2014).

Ultimately, melting of sea ice could eliminate the migration to and from Victoria Island for Dolphin and Union Caribou as a result of the combined impact of climate change and increased shipping. Although migration did cease at one point for this population (see **Migration and Dispersal** and **Population Abundance and Trends**), this resumed once the population reached sufficient numbers, suggesting that a sea-ice connection may be fundamental to the size, sustainability and recovery of Dolphin and Union Caribou (GNU and GNWT 2017; Miller *et al*. 2005; Dumond *et al*. 2013).

The reduction in sea ice and warming of Arctic sea waters also has changed circum-arctic vegetation although the patterns are complex: a satellite-based measure of plant greening (NDVI) increased during 1982–1998, suggesting an earlier green-up of the vegetation but then NDVI declined from 1999–2015 (Bhatt *et al*. 2017). The causes are only just beginning to be understood and underscore the complexity of predicting how climate change will affect Dolphin and Union Caribou.

Terrestrial habitat changes:

Temperature increases (and possibly other climate changes such as increased CO^2) have brought about increases to plant biomass. Ahern (2010) used analysis of the satellite-sensed normalized-difference vegetation index (NDVI) to show that plant growth has increased in the range of Dolphin and Union Caribou over the past 30 years. These changes include plants leafing out and blooming earlier, which correlates with the general warming over the same time period (Oberbauer *et al*. 2013). Ecosystem responses are likely to include displacement of treeline northward by 5–10 km/year, or 500 km this century, and shrinking the global area of tundra by half (Callaghan *et al*. 2005). Although this suggests that forage may be increasingly available on Victoria Island, the greening is due primarily to a vegetation shift to woody biomass (especially evergreen shrubs). Therefore, the extent to which it will improve habitat or forage, and be of sufficient nutritional content for Dolphin and Union Caribou, is unknown.

Sea level rise:

Sea level has risen about 0.19 m in the last 110 years (IPCC 2013). In the next 90 years, sea level is likely to rise further between 0.26 to 0.82 m (IPCC 2013). Such an increase could cause unknown areas of land on Victoria Island to be inundated, resulting in habitat loss for Dolphin and Union Caribou.

<u>Parasites and Diseases (IUCN Threat # 8.1 [Invasive non-native alien species]) (Medium-Low Impact)</u>

Dolphin and Union Caribou are subject to increased levels of parasites, disease and insect harassment, all of which are already exacerbated by a changing climate. Population-level impacts can result from declines in individual body condition, fertility and productivity, and survival. Local communities have reported increasing numbers of diseased Caribou (Poole *et al*. 2010; First Joint Meeting 2015; Tomaselli *et al*. 2018).

Warming temperatures may result in range expansion and/or amplification of temperature-limited pathogens (Dobson *et al*. 2015). For example, in 2010, the Caribou Lungworm, *Varestrongylus eleguneniensis*, previously limited to the mainland, became established on Victoria Island and now cycles in both Caribou and Muskoxen on the island — likely a direct result of climate warming in the region (Kutz *et al*., 2013; Kafle *et al*., unpubl. data). While this parasite is not considered to be particularly pathogenic unless occurring at high intensities, its recent emergence on Victoria Island demonstrates that ecological conditions have changed and are facilitating survival and transmission of some pathogens. This is supported by ATK, IQ and local knowledge where community members are reporting increasing numbers of sick Caribou (Poole *et al*. 2010; First Joint Meeting 2015; Tomaselli *et al*2018). Local people have also noted increased incidence of *Taenia* (tapeworm) cysts and are concerned about the possibility that the Dolphin and Union Caribou are being exposed to more disease by travelling farther to the south (ENR 1998 cited in SARC 2013).

Among the key known parasites and pathogens of concern for the Dolphin and Union Caribou are: the bacteria *Erysipelothrix rhusiopathiae* and *Brucella suis* Biovar 4; gastrointestinal nematodes; and increasing levels of insect harassment.

Erysipelothrix rhusiopathiae, a generalist and opportunistic bacterium, emerged from 2010-2014 as a previously unknown cause of widespread Muskoxen mortalities on Victoria and Banks islands (Kutz *et al*. 2015a). In domestic pigs and poultry, disease caused by this bacterium is often associated with increased stress and can manifest as a variety of syndromes including: skin lesions, arthritis, endocarditis and acute mortality. This bacterium recently has also been implicated in the mortality of boreal woodland Caribou and Muskoxen in Alaska (Schwantje *et al*. 2014; Forde *et al*., 2016; Kutz *et al*., 2017) and there is widespread evidence of exposure (seropositivity) in Caribou across North America, including the Dolphin and Union Caribou (Kutz, Anholt unpubl data). However, its impact on Caribou populations is not known.

Brucella suis Biovar 4 is the bacterium responsible for brucellosis. Brucellosis is an important cause of lameness and infertility in Caribou and has been associated with declines in other populations, e.g., Southampton Island (Kutz *et al*. 2015b). This bacterium is known from Barren-ground Caribou across its range. However, increasing observations of limping animals (Tomaselli *et al*., 2018), recent isolation of the bacterium from a Dolphin and Union Caribou (CWHC) and an increasing number of cases and seropositivity in Muskoxen on Victoria Island (Kutz *et al*. 2015b; Tomaselli *et al*. 2018; Tomaselli, Kutz *et al*., unpubl. data) suggest that this disease may be increasing in frequency on the island.

Gastrointestinal nematodes, particularly those that parasitize the abomasum, are known to negatively impact body condition and fecundity of Caribou (Albon *et al*., 2002; Stien *et al.* 2002; Irvine *et al.*, 2006; Hughes *et al*., 2009). Hughes *et al*. (2009) found that mature Dolphin and Union Caribou females lost weight with increasing nematode burden, and were thinner with a lower probability of being pregnant with increasing warble infestation — effects that were greater in the non-pregnant fraction of the population.

Rising levels of increased insect harassment (e.g., by mosquitoes, bot flies and warble flies) are already occurring due to longer summers (First Joint Meeting 2015; Russell and Gunn 2016). On Victoria Island, harassment by warble flies and nasal bot flies (*Cephenemyia trompe*) is increasing and warbles are now being seen earlier in summer (Dumond 2007). Cambridge Bay Inuit also reported increasingly numerous mosquitoes on Victoria Island (Bates 2006 in SARC 2013).

Russell and Gunn (2016) found an increasing trend in cumulative June-July growing degree days in the mainland part of the range from 2000-2014 brought about by warming temperatures. The same warming temperatures have increased the trend in the warble fly index, which is based on temperature and wind. SARC (2013) describes how the cumulative warble index and length of warble season increased on average 7% and 2% per decade, respectively, between 1979 and 2009. The number of warbles counted on late winter hides has increased since the later 1980s (SARC 2013).

Each pathogen on its own is often not a concern, but together, and/or with increasing stressors such as climate warming, freezing, disturbance, etc., these can become a significant cumulative factor influencing population dynamics. This is likely going to become an increasingly important issue for the Dolphin and Union Caribou for which climate and isolation resulted in low exposure levels for quite a number of both native and novel pathogens.

Storms and Flooding (11.4) (Medium-Low Impact)

Several high-mortality incidences following severe weather events have been recorded in arctic Caribou populations over the past four decades. For example, Peary Caribou die-offs were linked to unusually warm weather in early winter, which caused the upper few centimetres of snow to melt and then subsequently freeze solid, preventing access to forage. This resulted in 46% (1973-74) and 30% (1996-97) mortality in one winter, and >90% when there were three successive years of severe weather. An event such as this tends to occur as an ice crust on top of the snow, or the melted snow percolates through the snowpack and refreezes at depth or on contact with the ground (COSEWIC 2015). Such events tend to be localized, but could conceivably affect a large proportion of the Dolphin and Union population, and result in significant mortality through starvation. In the winter of 1987-88, Cambridge Bay hunters reported freezing rain and Dolphin and Union Caribou dying from what appeared to be malnourishment (Gunn and Fournier 2000).

How much of a threat climate change may be to Dolphin and Union Caribou will depend on the frequency and severity of icing (rain-on-snow and melt-freeze) events within their range. Although severe weather events are predicted to increase in frequency and severity (Hansen *et al.* 2011; IPCC 2013), there is considerable uncertainty with respect to location and timing of such events, and the consequent effects on population dynamics within the next three generations. Climate models predict increased frequency and intensity of weather events (Gunn and Skogland 1997; Gunn 1998b; Miller and Gunn 2003; Harding 2004; Tews *et al.* 2007; Sharma *et al.* 2009; Tews *et al.* 2012).

Energy Production and Mining (IUCN Threat #3) (Low Impact)

Within the range of Dolphin and Union Caribou in Kitikmeot region of Nunavut west of Bathurst Inlet, there are currently two operating and two abandoned mines, and four proposals (NIRB 2017) and active mineral leases. These projects have associated infrastructure (roads, transmission lines, ports) and activity (helicopter traffic, vehicle traffic, air charters, blasting, etc.) that will extend the area that is disturbed, and have the potential to facilitate additional development projects. Transport of materials into the mine sites and transport of ore and waste out will likely increase shipping traffic and icebreaking activity in areas used by the Dolphin and Union Caribou in their migrations. For example, a partnership was forged in 2017 between the Government of Nunavut and the Kitikmeot Inuit Association on a proposal for a deep-water port on the Arctic Ocean with a 230-kilometre all-season road into the mineral-rich Slave Geological Province. A future phase would link Nunavut to Canada by road for the first time in Canada's history by extending the all-season road a further 95 km to the NWT border (GNU 2017).

Habitat loss from cumulative impacts of individual projects and associated infrastructure is a chief cause of concern for Caribou in general (Vistnes *et al.* 2008; Festa-Bianchet *et al.* 2011). The scale of development currently being contemplated by industry and the Government of Canada — new ports, mines, roads and expanding human populations (Government of Canada 2013) — may be a threat if not managed as to intensity (cumulative impacts), location, and timing (e.g., migration routes, calving and rutting areas) of construction. Caribou change their behaviour and sometimes avoid industrial activities including roads and off-road vehicle traffic, especially if hunting is associated with the road (Plante *et al.* 2016, Nellemann and Cameron 1998); they also respond to helicopters (Gunn and Miller 1980). Although these effects are localized, they may involve increased energy expenditure during nutritionally challenging periods and displacement from preferred habitats.

Number of Locations

The opening of the Northwest Passage bordering Victoria Island as a shipping channel and ensuing boat traffic, if it occurs during times when members of the population are crossing the ice or prevents/delays ice formation, is a plausible threat to Dolphin and Union Caribou (see **Threats**). If this were to occur, it would disrupt the annual migration, with unknown but potentially serious consequences to the population, thereby meeting the definition of one location.

PROTECTION, STATUS AND RANKS

Dolphin and Union Caribou are co-managed in Nunavut according to the NLCA, and are co-managed in the Northwest Territories according to the Inuvialuit Final Agreement. These agreements confer primary wildlife management authority on the respective management boards: the Nunavut Wildlife Management Board and, in the NWT, the Wildlife Management Advisory Council (NWT), and the Inuvialuit Game Council.

Legal Protection and Status

Dolphin and Union Caribou are currently classified as Special Concern under the federal *Species at Risk Act* (Part 4 Schedule 1; Canada Gazette Part II, Vol. 145, No. 4, 2011-02-16). Under the territorial *Species at Risk (NWT) Act*, they were listed as Special Concern in 2015. Regulations for Species at Risk designation under the *Nunavut Wildlife Act* (2011) have not yet been enacted. COSEWIC originally assessed Dolphin and Union Caribou as Special Concern in May 2004, and this population was reassessed as Endangered in November 2017.

Non-Legal Status and Ranks

Globally, Caribou was listed by the International Union for Conservation of Nature (IUCN) as Least Concern until 2016, when the species was re-assessed as Vulnerable (IUCN 2016). Caribou subspecies or ecotypes are not differentiated.

NatureServe ranked Caribou (*R. tarandus*) as secure globally and Not Yet Ranked for Dolphin and Union Caribou (as defined by COSEWIC) in 2012. It is ranked imperiled-vulnerable at the national level (N2N3), imperiled-vulnerable (S2S3) in the NWT and unranked (SNR) in Nunavut (NatureServe 2017). The 2015 national general status for Caribou in Canada will not be available until the 2015 General Status Report is published in August 2017. This Canada-wide rank will apply to all designatable units of Caribou combined, with no specific rank to Dolphin and Union Caribou. The 2015 territorial rank for NWT is S3 (Sensitive) (WGGSNS 2016). At present, there is no specific rank for Barren-ground Caribou for NU; however, for all DUs combined, the territory-specific general status rank in Nunavut is S4 (Apparently Secure) (Etiendem, pers. comm. 2017).

Habitat Protection and Ownership

Tuktuk Nogait National Park includes coastline in the southwestern portion of Dolphin and Union Caribou range. The Queen Maud Gulf Bird Sanctuary, located on the mainland across from Cambridge Bay, overlaps with a portion of the wintering range. This offers some level of habitat protection against industrial and major infrastructure developments.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER(S)

Dr. Justina Ray is President and Senior Scientist of the Wildlife Conservation Society Canada and has been co-chair of COSEWIC's Terrestrial Mammals Subcommittee since 2009. In addition to overseeing the operations of WCS Canada, she is involved in research and policy activities associated with conservation planning in northern landscapes, with a particular focus on Wolverine and Caribou. Although she worked for years in African and Asian tropical forests, North America has been her predominant geographic focus over the past two decades. She is a member of the IUCN Taskforce on Biodiversity and Protected Areas. She is Adjunct Professor at the University of Toronto (Faculty of Forestry) and Trent University (Environmental & Life Sciences Graduate Program).

Dr. Lee E. Harding has a BSc in wildlife management and a PhD in wildlife toxicology. He is the principal of SciWrite Environmental Sciences Ltd. and was formerly a senior biologist and science program manager with Environment Canada from 1976 until he took early retirement in 1997. From 1977 to 1980 he managed the Impact Assessment division of the Environmental Protection Service district office in Yellowknife, NWT. During 1972-1976, as an environmental consultant assessing the impact of industrial developments in the Arctic, he studied Barren-ground Caribou and reindeer in the Mackenzie Delta, Mountain Caribou in British Columbia and Yukon and Peary Caribou on Bathurst, Melville and Little Cornwallis Islands. He first called attention to the possible endangered status of British Columbia's Mountain Caribou in a magazine article in 1975. He was the author of the 2004 COSEWIC re-assessment of Peary Caribou and Dolphin and Union Caribou.

Appendix 1. Threats Assessment for Caribou, Dolphin and Union population.

Species or Ecosystem Scientific Name	Dolphin & Union Caribou (DU2)		
Element ID		**Elcode**	
Date (Ctrl + ";" for today's date):	08/12/2014		
Assessor(s):	Meeting #1: Justina Ray (COSEWIC), Dave Fraser (COSEWIC, BC), Suzanne Carriere (COSEWIC, NWT), Nic Larter (COSEWIC, NWT), Donna Hurlburt (COSEWIC, ATK), Lee Harding (report writer), Tracy Davison (GNWT), Lisa Worthington (GNWT), Lisa-Marie LeClerc (GNU), Melanie Wilson (GNU), Donna Bigelow (EC/ CWS), Dawn Andrews (EC/CWS), Lisa Pirie (EC/CWS), Kim Poole (Aurora Wildlife Research), David Nivingalok (Kugluktuk HTA), Kevin Klengenberg (Kugluktuk HTA), Ema Qaggutaq (Kitikmeot Regional Wildlife Board), Joseph Oliktoak (Olohaktomiut HTC) Meeting #2: Justina Ray (COSEWIC), David Fraser (COSEWIC), Lisa-Marie LeClerc (GNU), Ema Qaggutaq (KRWB), Amy Ganton (EC/CWS), Isabelle Duclos (EC/CWS), Peter Sinkins (Parks Canada), Jimmy Haniliak (Ekaluktutiak HTA), Howard Greenley (Ekaluktutiak HTA), George Angohiatok (Ekaluktutiak HTA), Joshua Oliktoak (Olohaktomiut HTC), Myles Lamont (GNU), Diane Ruben (Paulatuk HTC), Joe Illasiak (Paulatuk HTC).		
References:			
Overall Threat Impact Calculation Help:		**Level 1 Threat Impact Counts**	

Threat Impact		high range	low range
A	Very High	0	0
B	High	2	1
C	Medium	2	0
D	Low	1	4
	Calculated Overall Threat Impact:	Very High	High

Assigned Overall Threat Impact:	**AB = Very High - High**
Impact Adjustment Reasons:	
Overall Threat Comments	***Two threat calculator meetings were held (8/12/2014 and 8/2/2016), and results were combined***

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
1	Residential & commercial development		Negligible	Negligible (<1%)	Extreme (71-100%)	High (Continuing)	
1.1	Housing & urban areas		Negligible	Negligible (<1%)	Extreme (71-100%)	High (Continuing)	Scope includes portion of species range that is alienated by human settlements plus a buffer zone for animals displaced by disturbance. There is the possibility that municipal boundaries may increase in the coming years, but this still makes the scope very low. Although very few D&U animals are or will be exposed to this threat, any that come within a certain distance of human settlements will very likely be killed, hence the high severity.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
1.2	Commercial & industrial areas						
1.3	Tourism & recreation areas						
2	Agriculture & aquaculture						
2.1	Annual & perennial non-timber crops						
2.2	Wood & pulp plantations						
2.3	Livestock farming & ranching						
2.4	Marine & freshwater aquaculture						
3	Energy production & mining	D	Low	Restricted (11-30%)	Slight (1-10%)		
3.1	Oil & gas drilling		Not Calculated (outside assessment timeframe)			Insignificant/Negligible (Past or no direct effect)	No seismic activity or O&G development at present, and not expected in the foreseeable future within the D&U range
3.2	Mining & quarrying	D	Low	Restricted (11-30%)	Slight (1-10%)	High (Continuing)	The scope is currently very low, but it is plausible for this to increase with a higher percentage of the population being directly affected by mines themselves within the next 10 years. This does not include shipping, flights, or roads associated with mines, which are counted elsewhere here. Most direct mortality from the mines themselves will be very low.
3.3	Renewable energy						
4	Transportation & service corridors	B	High	Pervasive - Large (31-100%)	Serious (31-70%)	Moderate (Possibly in the short term, < 10 yrs)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
4.1	Roads & railroads	D	Low	Restricted (11-30%)	Slight (1-10%)	Moderate (Possibly in the short term, < 10 yrs)	Currently the scope is negligible but if MMG/Izok Corridor proceeds with its project for a mine with an all-weather road from the coast 325 km inland, (or a similar one, e.g., within the Hope Bay greenstone belt) the impact of roads would greatly increase. It is possible that other development will happen in next 10 years. It is not believed that this project would include a network of winter roads coming off the all-weather road. Even one road, depending on where it is situated, could be encountered by a large proportion of the population. The direct impact of that road (mortality) will still be low, even if indirect effects are high
4.2	Utility & service lines		Negligible	Negligible (<1%)	Negligible (<1%)	Unknown	
4.3	Shipping lanes	B	High	Pervasive - Large (31-100%)	Serious (31-70%)	High (Continuing)	Category includes both open water and ice-breaker shipping. Open water shipping (which currently occurs) is not an issue, rather impact is entirely from winter shipping that involves any ice breaking (including relatively thin ice that does not qualify as ice breaking by Transport Canada definitions). Currently most activity is local ice-breaking activity early season around Cambridge Bay, but occasional ships are passing through so this threat is already occurring. The current proposal for shipping out of the bottom of Bathurst inlet could affect half the D-U population. Impact of shipping depends on timing. Caribou can start crossing as early as October 15 and into December. 2-3 boats during migration could entirely stop migration and cause 40% of the animals to drown. On the other hand, the whole population doesn't cross at same time and ice can refreeze between crossings. Not every icebreaking event will cause massive fatalities.
4.4	Flight paths	D	Low	Restricted (11-30%)	Slight (1-10%)	High (Continuing)	Category is for regularly scheduled flights, i.e., to mines. The possibility of scheduled flights increasing significantly, especially when/if proposed projects start operating. Large planes to mines could be more than flights to communities. On the other hand, flights are mostly high, and only go only low for landing. Modelling work has shown relatively low direct impact. Severity is likely at the low end of slight (1-10%) range. If flight paths were to change to impact calving, the severity would increase.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
5	Biological resource use	CD	Medium - Low	Pervasive (71-100%)	Moderate - Slight (1-30%)	High (Continuing)	
5.1	Hunting & collecting terrestrial animals	CD	Medium - Low	Pervasive (71-100%)	Moderate - Slight (1-30%)	High (Continuing)	Harvesting of Dolphin-Union Caribou is unregulated. There is no hunting season or limit. Harvest levels change depending on location of Caribou in a given year, and availability of other harvested species. 3 communities harvest Dolphin-Union Caribou: Ulukhaktok (harvest in summer), Cambridge Bay (harvest in fall), and Kugluktuk (harvest in winter and spring when they come across the ice). There may be a shift in harvest from mainland Caribou, which are in steep decline. D&U population has declined since the last surveys, but has also changed its distribution such that animals are not so accessible to these communities anymore. This will decrease harvest. Very large range of uncertainty in severity due to unknown harvest levels and uncertainty of population numbers in the future. Score for severity encompasses both worst and best case scenarios. Also, a change in distribution may expose animals to harvest elsewhere.
5.2	Gathering terrestrial plants						
5.3	Logging & wood harvesting						
5.4	Fishing & harvesting aquatic resources						
6	Human intrusions & disturbance		Negligible	Restricted (11-30%)	Negligible (<1%)	High (Continuing)	
6.1	Recreational activities		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	
6.2	War, civil unrest & military exercises		Not Calculated (outside assessment timeframe)			Insignificant/Negligible (Past or no direct effect)	Military exercises not a threat in this region; no seasonal overlap with D&U Caribou
6.3	Work & other activities		Negligible	Restricted (11-30%)	Negligible (<1%)	High (Continuing)	Includes (primarily) research activities (e.g., surveys and capture/collaring)
7	Natural system modifications						
7.1	Fire & fire suppression						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
7.2	Dams & water management/use						
7.3	Other ecosystem modifications						
8	Invasive & other problematic species & genes	BD	High - Low	Pervasive (71-100%)	Serious - Slight (1-70%)	High (Continuing)	
8.1	Invasive non-native/alien species	CD	Medium - Low	Large - Restricted (11-70%)	Moderate (11-30%)	High (Continuing)	This category includes all diseases and pathogens (both native and non-native). Climate change expected to increase parasites and disease. Parasites increasing and expected to increase further. Lungworm increasing in muskox, but not necessarily fatal. We do have to include that we seeing evidence that there is potential for more to occur. Biting flies are also an issue
8.2	Problematic native species	BD	High - Low	Pervasive (71-100%)	Serious - Slight (1-70%)	High (Continuing)	This category includes all predator/competitor interactions (both native and non-native). Grizzly bears have moved into Victoria Island in the last decade or so can have an impact on numbers. Wolves have increased on Victoria Island. Given the multi-prey interactions, predators like wolves have potential to wipe out Caribou when muskox numbers are high. Impact is greater with a small population, and less when they have the opportunity to escape the predators. Severity and Scope could be high during the fall migration while they are waiting for the sea ice to form, but there is enormous uncertainty.
8.3	Introduced genetic material		Unknown	Large - Small (1-70%)	Unknown	High (Continuing)	Interbreeding with Barren-ground and Peary Caribou. Although there are some claims that D&U is a hybrid (Rangifer groenlandicus x pearyi), this is not accurate. Genetics work over past decade shows Dolphin-Union as a genetically distinct population with a very small amount of Peary intergradation. A significant number of individuals would need to be inter-breeding to impact population. Communities have seen Peary Caribou traveling with D&U, Barrenground traveling with D&U (more rare). Chances of hybridization are low due to the separation of the rutting grounds. Likely on the low end of both the scope and severity ranges, although the higher degree of uncertainty on severity reflects our lack of knowledge on the impacts of interbreeding. Really, particularly considering ATK, the impacts are unknown.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
9	Pollution						
9.1	Household sewage & urban waste water						
9.2	Industrial & military effluents						
9.3	Agricultural & forestry effluents						
9.4	Garbage & solid waste						Contaminants are not currently regarded as a threat, given successful clean-up of the Dew Line.
9.5	Air-borne pollutants						
9.6	Excess energy						
10	Geological events						
10.1	Volcanoes						
10.2	Earthquakes/tsunamis						
10.3	Avalanches/landslides						
11	Climate change & severe weather	CD	Medium - Low	Pervasive (71-100%)	Moderate - Slight (1-30%)	High (Continuing)	
11.1	Habitat shifting & alteration	CD	Medium - Low	Pervasive (71-100%)	Moderate - Slight (1-30%)	High (Continuing)	Category includes changes to habitat (vegetation and ice) conditions due to climate change over the next decade. Scope will affect entire population. With respect to severity, there is and will be much variability (i.e., positive and negative effect). Could get a trophic shift where there is a mismatch of greening and Caribou life cycle, which could affect calving and calf survival. There is also a possibility that forage could increase with climate change. In either case, severity is not likely to be very severe. Could get a bad year or two, but will recover unless hits every year repeatedly, which is unlikely. With respect to ice, there is a small core area for Dolphin-Union, so ice conditions aren’t as big a threat as they were to Peary Caribou.
11.2	Droughts						
11.3	Temperature extremes						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
11.4	Storms & flooding	CD	Medium - Low	Large (31-70%)	Moderate - Slight (1-30%)	Moderate (Possibly in the short term, < 10 yrs)	Icing events (storms) not as big an issue for Dolphin-Union as it is for Peary, and is currently unknown for D&U. Scope: Because winter range is a small area, one storm event could impact a large portion of the population. Over 3 generations, expect to be able to recover from a weather event, unless happens repeatedly year after year. Less likely to have bad weather events for multiple years in a row, which would knock back the population without a chance for recovery.

Classification of Threats adopted from IUC

Appendix A: Consultation material

1. Presentation made for pre-listing consultation in 2019
2. COSEWIC summary sheet
3. Presentation made for the EHTO meeting in February 2021
4. Presentation made to explain the impact of listing on communities and the link between the Addendum and pre-listing Consultation.

Appendix A-1: Presentation made for pre-listing consultation in 2019

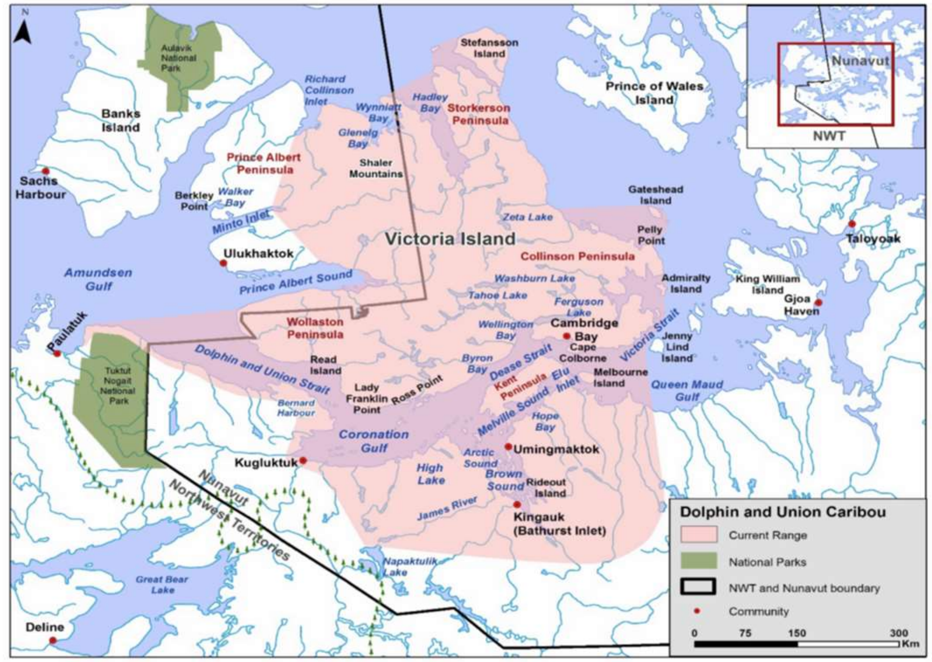
Public and HTO meetings in Cambridge Bay and Kugluktuk

Environment and Climate Change Canada | Environnement et Changement climatique Canada

Canada

Dolphin & Union Caribou
Should they be listed as Endangered under the federal Species at Risk Act?

© Kim Poole, Aurora Wildlife Research

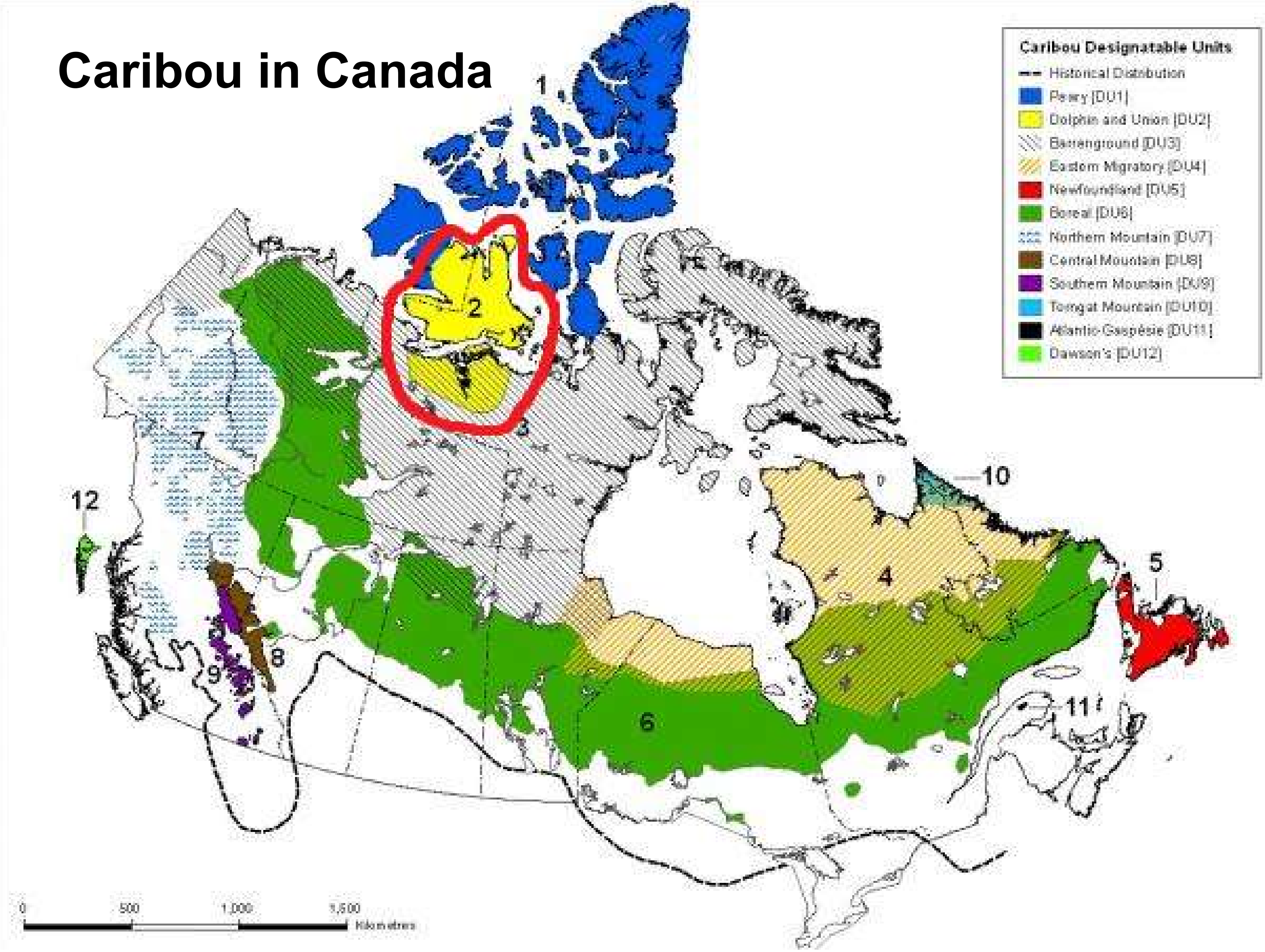


SARA's Purpose:

- Prevent plants & animals from disappearing from Canada
- Help species that aren't doing well with additional management tools

Canadian Wildlife Service, 2019

Caribou in Canada



From *Special Concern* to *Endangered*

high

Endangered

Species likely to disappear from the wild if immediate action is not taken.

2017

Threatened

2004

Special Concern

Species still have a strong population size, but declines have been noticed or are anticipated because of new or increasing threats

Not at Risk

low

Where are we now in the process?

Re-assessed

Assessment
COSEWIC

Independent, non-government committee

Assessed (2017) **Endangered**

Add to SARA List?
Federal process

ECCC consults

Federal Environment Minister recommends

Federal Cabinet decides

Recovery Planning

SARA applies:

- Recovery Strategy & Action Plan
- Critical Habitat

Implementation

Undertake conservation measures described in the plans

- Protect Critical Habitat

First Nations, Inuvialuit, Inuit & WMBs input required at all stages

****Separate Processes****

Why did COSEWIC recommend "Endangered"?

Estimated decline of <u>50-60% over 18 years</u>

- **Local Knowledge / Inuit Qaujimajatuqangit (IQ) in Cambridge Bay**
  - Observed declines in numbers in the young age classes, and a high proportion of animals with poor body condition
  - Decline accelerated after 2010.

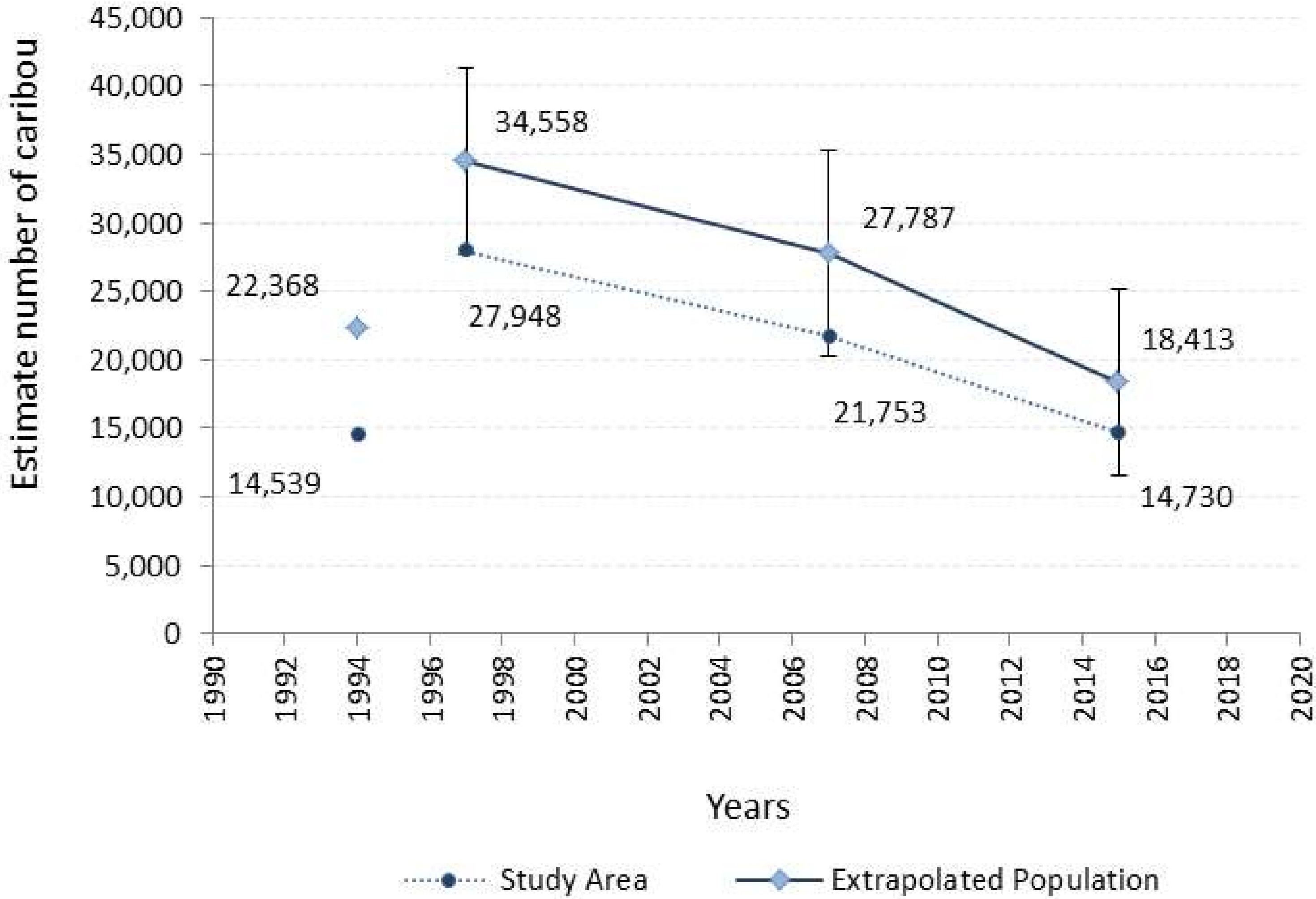
- **Counting surveys - Government of Nunavut**
  - From 1997 to 2015, counting surveys have measured a population decline going from 34,000 to 18,000 individuals.

Population fluctuations based on Local and Traditional Knowledge / Inuit Qaujimajatuqangit

Communities reported historical fluctuations (cycles) over the past 100 years

- Before 1920s: observed large herd of caribou migrating between Victoria Island and the mainland
- 1920s – 1970s: few observations of caribou (migration stopped)
- 1980s – 1990s: numbers increased (recovery)
- 1990s – today: observed a decline, & decline accelerated after 2010

Population estimates based on western science



Threats to Dolphin & Union Caribou

Current threats include:

- Climate change
  - Reduced period of ice cover and irregularities in sea ice conditions leads to drowning and delay in migrations.
  - New insect pests and pathogens

Threats to Dolphin & Union Caribou

Future threats include:

- Shipping lanes
- Potential for over-harvest (opportunities from five additional communities have <u>increased</u> & <u>no</u> mandatory <u>harvest reporting</u>)

Threats to Dolphin & Union Caribou

Future threats include:

- Future potential habitat disturbance if proposed mining projects are approved.


CBC.ca


Marie Fast ECCC


Eric Reed ECCC

What would change if Dolphin & Union Caribou were listed as *Endangered* ?

high

low

Endangered

Automatic Harvest Restrictions

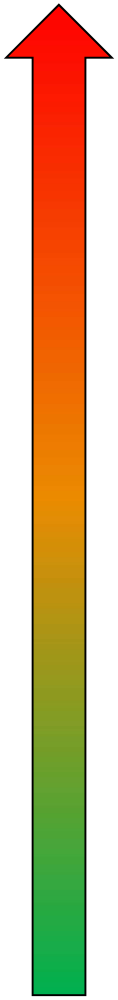
- These only apply to **non-Indigenous people**
- Apply only in National Parks, National Wildlife Areas & Migratory Bird Sanctuaries for non-indigenous people
- Do not apply anywhere else unless Cabinet makes an "order"

What would change if Dolphin & Union Caribou were listed as *Endangered* ?

high

low

Endangered



Land Claims take priority over *SARA*

- Subsistence harvest rights are not affected
- Existing wildlife management bodies & processes remain in place (***SARA* does not change this**)
  - Wildlife Management Boards, HTCs/HTOs, Regional Wildlife Organizations, territorial governments
  - Harvest decisions follow the process set out in the land claims

What would change if Dolphin & Union Caribou were listed as *Endangered* ?

high

Endangered

low

National Recovery Strategy will be required

- Coordinated approach across Caribou range
- Developed cooperatively with all key partners
  - communities, organizations and governments
  - HTCs/HTOs, Wildlife Management Boards, etc.
  - Territorial governments
- **Critical Habitat** will need to be identified & protected
- Federal funding for species at risk

What would change if Dolphin & Union Caribou were listed as *Endangered* ?

high

low

Endangered

Identification and Protection of Critical Habitat

Identification

- Critical Habitat will be identified in collaboration with YOU, while we develop the recovery strategy TOGETHER

Protection

- ECCC committed to collaboratively develop a path forward for the protection on lands held by Indigenous peoples under land claims agreements
- Several options can be explored such as CONSERVATION AGREEMENTS

Listing consultation – Federal Process

WHO?	WHAT?	TO?
-Wildlife Management Boards -HTO/HTCs -First Nations, Inuvialuit, Inuit communities, organizations and governments -Territorial governments -General public	-Should it be up-listed in SARA? -What are the **impacts** (ecological and socioeconomic)?* -What are the **benefits** (ecological and socioeconomic)?* -Any other information / concerns / comments?	1-ECCC provides ALL comments to **Wildlife Management Boards** 2-ECCC provides ALL comments to the **Federal Environment Minister** 3- Federal Environment Minister send it recommendation to **Cabinet for FINAL decision – 3 options**

* Impacts and benefits of the identification and protection of critical habitat should be also considered?

Listing consultation – Federal Process

Final decision by the **Cabinet**
consider socio-economic impacts

1. Accept to list
2. or Reject to list
3. or Refer back to COSEWIC

ALL PARTNERS

– Develop the recovery strategy & identify critical habitat

– Federal funding for species at risk

– Nothing change

NEW information

– When **new available information** is likely to change the proposed status

– A refer back recommendation is considered **only** when it can be done **without increasing the risk** to the species

Consultation on changing Dolphin-Union caribou status under *SARA*

Who? Wildlife Management Boards, RRCs, HTO/Cs, First Nations, Inuvialuit, Inuit, territorial governments, general public

When? **Until October 2019**

What? Should it be up-listed in SARA?
What are the impacts?
What are the benefits?
Any other information / concerns / comments?

Why? Provide input to the Federal Environment Minister, Cabinet and WMBs

Next steps? ECCC will provide all comments to Wildlife Management Boards
Federal Environment Minister's recommendation to Cabinet
Cabinet can Accept, Reject or refer back to COSEWIC (2020?)

Questions? Comments?

Please send feedback to:
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Canadian Wildlife Service
5019 52nd Street
PO Box 2310
Yellowknife, NT X1A 2P7
(867) 669-4706
ec.sarnt-lepnt.ec@canada.ca

Appendix A-2: COSEWIC summary sheet

Sent to all partners in 2019 as part of the pre-listing consultation package.
Paper copies in English and Inuinnaqtun were distributed at the public and HTO meetings of Cambridge Bay and Kugluktuk.

Caribou - Dolphin and Union population

Photo: © Mathieu Dumond

Name change, currently listed on SARA Annexe 1 as Barren-ground Caribou (Dolphin and Union population)

Scientific name
Rangifer tarandus

Taxon
Mammal

COSEWIC status
Endangered

Canadian range
Northern Territories, Nunavut

Reason for designation

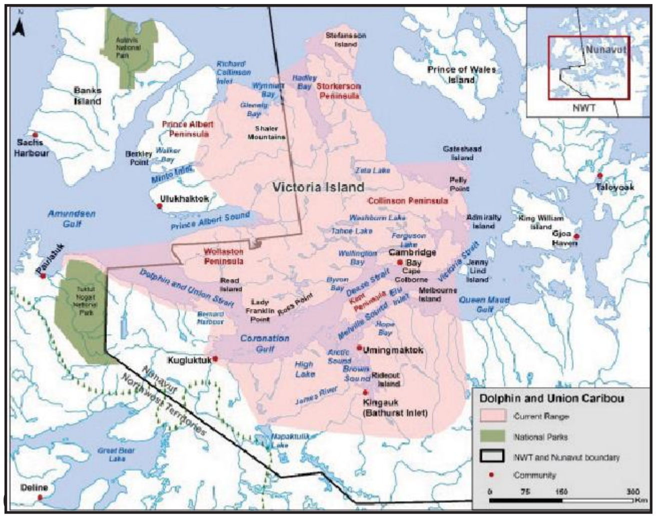
This Arctic caribou population is only found in Canada, occurring in Nunavut and the Northwest Territories. Recognized for its unique migration pattern from Victoria Island across the sea ice to the mainland, observations have shown that its distribution has retracted and expanded since the beginning of the 20th century, in rough correspondence with population size. In the early 1900s, the herd was reported to be large, then a strong decline was likely due to the introduction of firearms, combined with severe winters. A 50-60-year period of low densities and no sign of migration across the sea ice followed. The herd started to increase in the late 1970s, and resumed its migration to the mainland in the late 1980s, increasing in numbers until the 1990s. In 2015, the herd was estimated at about 18,000 animals. Three survey estimates over the last 18 years and Aboriginal Traditional Knowledge suggest a decline as high as 50-60%, which appears to have accelerated since 2010. The population is experiencing multiple threats, including reduced connectivity and disrupted migration between winter and summer range associated with commercial shipping in Dease Strait that is increasingly supported by ice-breakers. Climate change is linked with decreased periods of ice cover and irregularity of sea ice conditions, causing mortality through drowning and delays in migration with consequences for nutrition and parasite burdens. Overharvest has been involved in past declines and recent exploitation levels are unknown, although access opportunities from five additional communities have increased. The spread of insect pests and pathogens as a consequence of climate change is an additional concern. Natural fluctuations of the population remain a source of uncertainty.

Wildlife species description and significance

Dolphin and Union Caribou are easily recognizable from Barren-ground and Peary Caribou. Intermediate in body size, they are morphologically and behaviourally distinct from both, and genetic analyses have consistently confirmed their uniqueness. A key distinguishing behavioural trait relative to other Caribou populations is the seasonal migrations that occur twice a year when members of this population cross the sea ice between Victoria Island and the mainland in a synchronous and coordinated way to reach their summer or winter ranges. They are integral components of Inuit and Inuvialuit culture, and have high spiritual, economic, and subsistence value.

Distribution

Endemic to Canada, the range of Dolphin and Union Caribou spans two jurisdictions: Northwest Territories and Nunavut. These Caribou summer as one population occupying most of Victoria Island. Having first been documented in the mid-1850s crossing the Dolphin and Union Strait, they now migrate across the Coronation Gulf, the Dease Strait and Queen Maud Gulf to winter on the mainland. Recorded observations show that the distribution of Dolphin and Union Caribou has retracted and expanded at various points in time since the beginning of the 20th century, in rough correspondence with population size.



Canadian distribution of Dolphin and Union Caribou.

Source: COSEWIC. 2017. COSEWIC assessment and status report on the Caribou, Dolphin and Union population, *Rangifer tarandus*, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 51 pp.

Habitat

Calving areas on Victoria Island are not discrete and lie in the Northern Arctic Terrestrial Ecozone, while wintering areas on the mainland coast are in the Southern Arctic Ecozone. The annual range is composed of tundra habitats populated by prostrate dwarf-shrubs, forbs, sedges, mosses and lichens. Given their regular migrations between Victoria Island and the mainland, a key habitat requirement for Dolphin and Union Caribou is the seasonal sea ice connecting the Island and mainland.

Habitat changes brought about by climate change include changes to sea ice, shifts in vegetation community composition, and amount and timing of plant growth. Although there has been minimal natural resource development within the range to date, there are two operating mines and several proposed mining developments with accompanying infrastructure, as well as plans for ships passing through ice-crossing areas, that are likely to compromise habitat quality and continuity in the future.

Biology

Similar to Barren-ground Caribou, Dolphin and Union Caribou follow an annual cycle, undertaking pre-calving and fall migrations between seasonal ranges. Although pre-calving migration occurs in relatively large social groups, individuals disperse to calve over much of Victoria Island. The rut likely occurs during either migration or staging and Caribou males will often mate with more than one female. Dolphin and Union Caribou have a reproductive lifespan of about 12 years, usually first calving when they are 3 years old, or at 2 years when high-quality forage is available. Generation time is estimated at 7 to 9 years. These Caribou have a similar morphology to Peary Caribou, which appears to have arisen by convergent adaptation to a highly seasonable and cold climate. They share their annual range with four large mammalian predators, two other populations of Caribou (Barren-ground and Peary), Muskoxen, and several species of smaller-bodied mammalian herbivores and waterfowl, all of which have experienced population and distribution changes in recent years. Humans and Wolves are the main predators of Dolphin and Union Caribou.

Population Sizes and Trends

In the early 1900s, the Dolphin and Union Caribou population was thought to be about 100,000 individuals, but this was a best guess. Shortly afterwards, this population declined precipitously, a likely consequence of the introduction of firearms combined with severe winters. By the 1920s, its migration across the Dolphin and Union Strait ceased. Caribou were rarely seen on Victoria Island for the next five decades. In 1959, the resident, non-migratory population on Victoria Island was estimated at 671 individuals. Inuit from Cambridge Bay began seeing Caribou in the 1970s and 1980s and, by 1993, up to 7,000 were once again migrating annually across Coronation Gulf and Dease Strait.

Three surveys in 1997, 2007 and 2015 have deployed a consistent methodology, with comparable results, to allow for a quantitative trend estimate over three generations. The first two survey estimates were retroactively corrected: A 1997 survey that estimated 27,989 ± SE 3,367 total Caribou in the visual survey strata was later revised to 34,558 ± CI 6,801, extrapolated to include animals outside the survey area based on information from radio collars. In 2007, 21,753 ± SE 2,343 were estimated, later revised to 27,787 ± CI 7,537. In 2015, the population was estimated at 18,413 ± 6,795 (95% CI, 11,664- 25,182). Using the original and revised estimates from the surveys as minima and maxima, there has been an overall exponential decline of over 50% since 1997. Inuit Qaujimajatuqagit (IQ), Aboriginal Traditional Knowledge and local knowledge have also noted a declining trend of about 80%, which accelerated after 2010. IQ collected in 2014 observed declines in numbers in the young age classes, a high proportion of animals with poor body condition, and increased observations of diseased animals.

Threats and Limiting Factors

Dolphin and Union Caribou are facing a large number of direct threats to population persistence, which have been assessed as High-Very High Impact, although there is much uncertainty. Reduced connectivity of sea ice is a primary concern, with ice-breaker-supported shipping in Dease Strait already showing signs of disrupting migration. Decreased periods of ice cover and/or irregularity of sea ice conditions has also been observed, associated with climate change, which causes mortality through drowning and delays migration with consequences for nutrition and parasite burdens. Overharvest has been involved in past declines and recent exploitation levels are unknown, although access opportunities from five additional communities have increased. Predation from Wolves and Grizzly Bears is an additional concern. The spread of insect pests and pathogens associated with climate change is a threat. An unknown mortality factor may be involved in Dolphin and Union Caribou population declines, possibly involving Muskox populations through multi-prey interactions with wolves and/or multi-host interactions with parasites and pathogens. Also uncertain is the future cumulative disturbance and habitat change if any, or all, of several proposed mining projects with associated infrastructure (roads and ports) are approved for construction.

Protection, Status and Ranks

Dolphin and Union Caribou are co-managed in Nunavut according to the Nunavut Land Claims Agreement, and are co-managed in the Northwest Territories according to the Inuvialuit Final Agreement. These agreements confer primary wildlife management authority on the respective management boards: the Nunavut Wildlife Management Board and, in the NWT, the Wildlife Management Advisory Council and the Inuvialuit Game Council.

Dolphin and Union Caribou are currently listed as Special Concern under both the federal *Species at Risk Act* (2003) (on Schedule 1) and the territorial *Species at Risk (NWT) Act* (2013). COSEWIC originally assessed Dolphin and Union Caribou as Special Concern in May 2004, and this population was reassessed as Endangered in November 2017.

Globally, Caribou is listed by the International Union for Conservation of Nature (IUCN) as Vulnerable; subspecies or ecotypes are not differentiated. NatureServe ranked Caribou as secure globally and Not Yet Ranked for Dolphin and Union Caribou, which is ranked imperiled-vulnerable at the national level (N2N3), imperiled-vulnerable (S2S3) in the NWT, and unranked (SNR) in Nunavut.

Tuktuk Nogait National Park includes coastline in the southwestern portion of Dolphin and Union Caribou range and the Queen Maud Gulf Bird Sanctuary offers a certain level of habitat protection to part of the wintering range.

Source: COSEWIC. 2017. COSEWIC assessment and status report on the Caribou, Dolphin and Union population, *Rangifer tarandus*, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 51 pp.

For more information, please visit www.sararegistry.gc.ca.

Appendix A-3: Presentation made for the EHTO meeting in February 2021

Meeting to update the new board of directors.

Environment and Climate Change Canada
Environnement et Changement climatique Canada
Canada

Dolphin & Union Caribou
Should they be listed as Endangered under the federal Species at Risk Act?

© Kim Poole, Aurora Wildlife Research

***Species at Risk Act*'s:**

- **Prevent** plants & animals from disappearing from Canada
- Help species that aren't doing well with **additional management tools**

Objective

- Up-listing consultations have been on hold due mainly to COVID
- Purpose of this document is to remind involved organizations where the process is at and review next steps

COSEWIC Recommendation

COSEWIC = assesses species in Canada

Special Concern

2004

Threatened

Endangered

2017

Low Risk

High Risk

- 2015 – Development of a National Management Plan with partners
- 2018 – Management Plan published & User-to-User Working Group
- 2019 – ECCC consulted on the Endangered recommendation

SARA process to date

2004
- COSEWIC assessment – **Special Concern**

2011
- **Listed** as Special Concern under SARA

2015
- Development of multi-party Management Plan

2017
- COSEWIC re-assessment

2018
- Management Plan published

2017
- COSEWIC re-assessment **Endangered**

2019
- Consultations initiated

2021?
- Next steps

We are here

2019 consultations in Nunavut & NT

In April 2019, consulted the **Hunters and Trappers Organizations** (HTOs) & the **public**

- Nunavut: Kugluktuk, Cambridge Bay (including Bay Chimo and Bathurst Inlet)
- NWT: Ulukhaktok and Paulatuk

User-to-User Working Group met in February and May 2019

Message heard:

Proposed change in status is **not supported**

What We Have Heard So Far from Communities

- Lack of traditional and local knowledge, and engagement efforts during the COSEWIC assessment process
- Unclear how COSEWIC interpreted the TK study in Cambridge Bay
- Inuit/Inuvialuit are the traditional knowledge holders

> Message heard: Crucial knowledge has not been considered during the assessment

What We Have Heard So Far from Communities

- Caribou populations undergo **natural cycles** but not recognized by COSEWIC: *low number of caribou is normal and doesn't mean caribou are near extinction*
- Population distribution is changing, which has an impact on the results of **GN surveys**
- Great concerns about the methods to survey Dolphin-Union caribou
- HTOs/HTCs have already taken **pro-active measures** to manage the herd, but these measures not considered by COSEWIC

<u>Message heard</u>:
Endangered proposed status is not appropriate

What We Have Heard So Far From Communities

- Threats: concerns about impacts of **predators** (wolves and grizzly bears) and climate change
- Stronger wolf and grizzly bear control incentives
- Concerned about the impacts on **harvest rights** if status is changed to Endangered
- Need more information on how **protection of critical habitat** will apply/be implemented under SARA

Next Steps

1. All 4 HTCs and HTOs want to meet together to end the consultation period
   - Follow-up / Address some of the concerns expressed
   - Review ECCC material/report before submitting to NWMB
2. In NU, need to consult GN, KIA and NTI
3. ECCC to provide ALL comments from communities to NWMB & requests NWMB for a decision on the proposed listing
   - ➢ NWMB may conduct public hearing before making a decision
   - ➢ **ECCC and NWMB correspond until a final decision is reached under the Nunavut Agreement**

Next Steps (…)

4. ECCC staff send consultation material (including a regulatory package) to the **Federal Environment Minister**
5. Federal Environment Minister send its recommendation to the **federal Cabinet for decision**
6. Public Consultation Period
7. The **Cabinet** takes the **FINAL decision**
   - ➢ Accept to list
   - ➢ Reject to list
   - ➢ Refer back to COSEWIC

** Cabinet considers **socio-economic impacts**

Questions?

1. **Plan for a meeting this SPRING** to end the community consultation period? **Combine to a User-to-User** meeting!?
   – All 4 HTCs and HTOs + other northern partners
   – Review the results
   – Follow-up / Address concerns expressed

2. **Provide a list of pro-active measures** (only have Kugluktuk list)

Note: at the time, only Kugluktuk had sent their pro-active measures. Now all those measures are included in the Addendum.

Questions? Comments?

Please send feedback to:

Isabelle Duclos

Canadian Wildlife Service

5019 52nd Street

PO Box 2310

Yellowknife, NT X1A 2P7

isabelle.duclos@canada.ca

Appendix A-4: Presentation made to explain the impact of listing on communities and the link between the Addendum and pre-listing Consultation.

Presentation was sent to EHTO, KAA and KRWB in October 2021.

DOLPHIN & UNION CARIBOU

Additional information on:

- Listing process and impact of listing on communities
- Link between the listing and the addendum

Assessment & Listing Process for DU Caribou

ASSESSMENT by COSEWIC

- Using publicly available reports only. DU caribou: Assessment conducted in 2017, but the report was transmitted to ECCC in early 2019
- COSEWIC **recommends** a status to the federal government

LISTING RECOMMENDATION

- **ECCC conducts pre-listing consultations to inform a recommendation (2019 – now for DU caribou)**
- All comments and Wildlife Management Board decisions are used to inform the federal Environment Minister, who will make a recommendation to the Governor in Council (GiC) on whether to list the species* Minister also forwards the COSEWIC report to GiC

LISTING DECISION

- Governor in Council (or federal Cabinet) **decides** whether to list the species
- Includes a 30-day public comment period (CG1)

**In Nunavut, ECCC submits consultation results to NWMB for decision on listing. NWMB and Minister correspond until final decision is reached under the Nunavut Agreement. Minister must respect this final decision in its recommendation to GiC.*

Impact of listing on Indigenous People and Harvest

- Automatic application of SARA's s32 General Prohibitions, also referred to as "automatic prohibitions", do NOT apply for Sec. 35 rights based harvest.
- Responsibility for harvest management remains with territorial, provincial and Indigenous governments, and as such harvest management processes currently in place do not change (ex. TAH process will continue to follow established Land Claim processes).
- A SARA-listing does not give jurisdiction to ECCC to establish unilateral TAH levels or manage harvest.

What happen if any infringement of harvest rights were contemplated under SARA due to conservation concern?

- The Minister is legally bound to consult Wildlife Management Boards and to follow existing harvest management processes established under Land Claim agreements.
- SARA states that any implicated Wildlife Management Boards must be consulted.
- The Crown would also owe a legal Duty to Consult with any potentially affected Indigenous government or organization, to understand how their rights may be impacted, and to explore ways to avoid or limit any infringements of these rights.
- SARA also suggests an expectation that the provinces and territories will take necessary measures to provide effective protection to SARA-listed Endangered and Threatened species.

Implications if the status changes from Special Concern to Endangered

- The national management plan will be converted into a national **recovery strategy**.
  - A recovery strategy identifies recovery actions to stop or reverse the decline of the population so that caribou are available for future generations
- **Critical habitat** necessary for the survival or recovery of DU Caribou will need to be identified as a component of the recovery strategy in order to support the Population and Distribution Objectives.
- ECCC will work collaboratively with all management partners in NU and NWT to identify critical habitat and discuss methods for protecting it from activities likely to destroy it. For example, important habitat such as sea ice and calving areas could be protected.

Addendum & Listing

Concerns expressed by communities during the consultations in 2019

ECCC visited communities within the DU caribou range in April 2019.

The main concerns expressed were:

- Methodology used by the Government of Nunavut to conduct their surveys which raised concerns about the validity of the results on the population estimates;
- COSEWIC process: lack of TK/IQ in the report, and lack of engagement efforts by COSEWIC during the assessment;
- Pro-active measures taken by HTCs/HTOs to manage the herd and support their recovery were not considered;
- Some information was incomplete or not to date: sport hunting in Cambridge Bay, population cycles, species distribution.

How to address some of the concerns – Addendum

- Developing an Addendum is an attempt to address 3 of the main concerns expressed by communities during the uplisting consultations
- This document includes all new information since the last COSEWIC assessment (2017)
- Will be submitted to COSEWIC requesting that the Addendum be posted on the Species at Risk Registry with the 2017 status report
- Participation to the Addendum <u>does NOT imply</u> you support the listing.
  - It is a way to contribute to the last COSEWIC assessment (2017)
  - Information may be used for the next COSEWIC assessment (expected in 2027)

Appendix/Table B. Pre-listing consultation efforts on the proposed change in status of Dolphin & Union Caribou

Date	Meeting/E-mail	Invited	Attended	Outcome
Pre-listing consultation community tour and other meetings/calls				
2019, March	Pre-listing package was sent to all partners in Nunavut and NWT with invitation to our consultation meetings. Partners include: EHTO, KAA, OHTO, BHTO, PHTC, OHTC, KRWB, NTI, KitIA, WMAC-NWT, GN, GNWT.			
2019, April 3rd	Kugluktuk Angoniatit Association (KAA) **(in person)**	KAA, GN, NTI	6 HTO directors, 3 GN biologists and 1 NTI	Do not support
2019, April 3rd	Kugluktuk public meeting **(in person)**	Open to public. KAA, KRWB, KitIA, NTI, NWMB, GN.	Community members (31) and representatives from NTI, KAA, KRWB and GN.	Do not support
2019, April 4th	Cambridge Bay HTO **(in person)**	EHTO, BHTO, OHTO, GN, NTI	8 HTO directors and 2 GN biologists, NTI	Do not support
2019, April 4th	Cambridge Bay public meeting **(in person)**	Open to public. EHTO, OHTO, BHTO, KRWB, KitIA, NTI, NWMB, GN.	Community members (18) and representatives from NTI, EHTO, KitIA and GN.	Do not support
2019, April 24th	Paulatuk public meeting & HTC **(in person)**	Open to the public. PHTC, WMAC-NWT, GNWT, IGC	Community members (26) and representatives from PHTC, WMAC, GNWT.	Will support decisions made by neighbouring communities.

2019, April 25th	Ulukhaktok public meeting & HTC **(in person)**	Open to the public. OHTC, WMAC-NWT, GNWT, IGC	Community members (48) and representatives from OHTC, WMAC, GNWT.	Do not support (changed to "supported" in 2021, see below)
2019, October	ECCC traveling to Cambridge Bay to participate to the Icebreaking Workshop. **(in person)**	Tentative in-person meetings in Cambridge Bay with KRWB, and KitIA.		KRWB and KitIA could not join.
2020, March 23rd	Public meeting in Cambridge Bay **(in person – postponed to Fall 2020)**	Open to public EHTO, KRWB		Postponed due to COVID.
2020, fall	Public meeting in Cambridge Bay **(in person - postponed to February 4th)**	Open to public EHTO, KRWB		Postponed due to COVID.
2021, Feb. 4th	Public meeting in Cambridge Bay. **(in person – cancelled due to COVID)** ECCC provided an update on the consultation process, and a summary of the comments/concerns received in 2019 to the new board of directors. **(virtual)**	EHTO	8 EHTO directors	EHTO would like to see actions to address lack of TK/IQ in COSEWIC assessment.

Discussion on how to address concerns heard				
2021, March 5	Conference Call to start discussion on the approach with WMAC, IGC, GNWT **(virtual)**	WMAC, IGC, GNWT	WMAC, IGC, GNWT	Supported general approach. ECCC to contact HTCs.
2021, March 11	Conference call to start the discussion with KRWB and NTI **(virtual)**	KRWB, NTI	KRWB, NTI	Supported general approach. ECCC to contact HTOs.
2021, April 9th	Conference call with HTO chairpersons **(virtual)**	EHTO and KTHO chairs	EHTO chair and KAA chair	Supported general approach.
2021, April 27th	Conference call with Omingmaktuk HTO & Bathurst HTO **(virtual)**	OHTO, BHTO	OHTO	Supported general approach.
2021, April 29	Conference Call with HTCs & WMAC **(virtual)**	PHTC, OHTC, WMAC	PHTC, WMAC	Supported general approach.

2021, June 10th	Conference call with all DU caribou users to confirm approach of Addendum **(virtual)**	EHTO, KAA, BHTO, OHTO, OHTC, PHTC, KRWB, IGC, WMAC, GNWT, GN	EHTO, PHTC, OHTC, OHTO, WMAC, IGC, KRWB	ECCC presented two options: 1.Re-do assessment and refer back to COSEWIC; 2. Development of an Addendum to the last assessment report. Partners unanimously chose option 2 - the development of an Addendum to the 2017 COSEWIC assessment.
Development of the addendum to COSEWIC assessment				
2021, Sept 2nd	Monthly conference call in Fall 2021 to develop Addendum **(virtual)**	EHTO, KAA, BHTO, OHTO, OHTC, PHTC, KRWB, IGC, WMAC, GNWT, GN	EHTO, KAA, OHTC, KRWB, WMAC, IGC, GNWT	ECCC proposed an outline of the document. Received input and new information. WMAC (NWT) and KRWB representatives nominated to help the drafting of the document.
2021, Oct 6th	Monthly conference call in Fall 2021 to develop Addendum **(virtual)**	EHTO, KAA, BHTO, OHTO, OHTC, PHTC, KRWB, IGC, WMAC, GNWT, GN	EHTO, KAA, PHTC, OHTC, KRWB, WMAC, GN,	ECCC/WMAC presented a first draft earlier that week. Went through the draft with the group, received comments. KRWB to provide more feedback after she meets with HTOs
2021, Nov 3rd	Monthly conference call in Fall 2021 to develop Addendum **(virtual)**	EHTO, KAA, BHTO, OHTO, OHTC, PHTC, KRWB, IGC, WMAC, GNWT, GN	EHTO, KAA, OHTO, PHTC, IGC, WMAC, KRWB, GNWT,	No major changes to the addendum, EHTO and KAA will meet with KRWB before sharing knowledge.

2021, Nov 26th	Monthly conference call in Fall 2021 to develop Addendum **(virtual)**	EHTO, KAA, BHTO, OHTO, OHTC, PHTC, KRWB, IGC, WMAC, GNWT, GN	EHTO, KAA, PHTC, OHTC, KRWB, WMAC, NTI	No changes were made to the addendum. User to User group wants to meet together before sharing new version of addendum.
2022, January 16	User-to-user meeting **(virtual)**	EHTO, KAA, BHTO, OHTO, OHTC, PHTC, KRWB, IGC, WMAC	EHTO, KAA, OHTC, PHTC, KRWB, IGC, WMAC,	Only users met to discuss and review the Addendum.
Finalizing pre-listing consultation				
2021, October 8th	An email to KRWB, EHTO and KAA was sent: presenting a draft package for NWMB and seeking comments. (ECCC was planning to present at the March 2022 meeting).			
2021, October 19th	An email to KRWB, EHTO and KAA was sent to clarify questions heard during monthly conference call (October 6th). A presentation was attached addressing how the addendum fits in the listing process and what are the impacts of Listing.			
2021, Nov. 4th	KRWB sent a letter to ECCC expressing their position on the proposed change in status. Do not support.			
2021, Dec. 1st	Ulukhaktok HTC **(virtual)**	OHTC, IGC, WMAC	6 OHTC directors	Support to list as Endangered
2021, Sept. 25th	WMAC (NWT) quarterly board meeting **(virtual)**		WMAC board	Support to list as Endangered
2022, January 14	User-to-user meeting **(virtual)**	EHTO, KAA, BHTO, OHTO, OHTC, PHTC, KRWB, IGC, WMAC, GNWT, GN, ECCC	EHTO, KAA, OHTC, PHTC, KRWB, IGC, WMAC, GNWT, GN, ECCC	ECCC gave an update on the consultation process and the next steps before closing the consultation period: presenting to IGC in March 2022 and NWMB in June 2022.

2022, March 10th	Inuvialuit Game Council quarterly board meeting **(virtual)**		IGC board	Support to list as Endangered
2022, April 7th	An email to KRWB, EHTO and KAA was sent: presenting the final package for NWMB and seeking last comments.			

List of acronyms:

EHTO: Ekaluktutiak Hunters and Trappers Organization (Cambridge Bay)

KAA: Kugluktuk Angoniatit Association (HTO)

OHTO : Omingmaktok Hunters and Trappers Organization

BHTO : Burnside Hunters and Trappers Organization

OHTC : Ulukhaktok Hunters and Trappers Committee

PHTC: Paulatuk Hunters and Trappers Committee

WMAC-NWT: Wildlife Management Advisory Council (NWT)

IGC: Inuvialuit Game Council

KRWB: Kitikmeot Regional Wildlife Board

KitIA : Kitikmeot Inuit Association

NTI: Nunavut Tunngavik Inc.

NWMB: Nunavut Wildlife Management Board

GN: Government of Nunavut

GNWT: Government of Northwest Territories

SUBMISSION TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: X **Decision:**

Issue: Proposed listing of Dolphin and Union caribou under the Species at Risk Act

Background:

In 2017, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) conducted an assessment of Dolphin and Union (DU) caribou that resulted in a proposed uplisting from the Special Concern to Endangered status. It is the Kitikmeot Regional Wildlife Board's (KRWB) understanding that Environment and Climate Change Canada (ECCC) is submitting the proposed uplisting of DU caribou to "Endangered" to the Nunavut Wildlife Management Board (NWMB) for consideration.

As ECCC's proposal indicates, the COSEWIC assessment lacked Inuit Qaujimajatuqangit (IQ), traditional knowledge (TK), local knowledge, and local community engagement. In attempting to address the concerns raised by communities about the lack of their inclusion and consultation, ECCC endeavored to develop an addendum to the assessment in collaboration with KRWB, Ekaluktutiak (Cambridge Bay) Hunters and Trappers Organization (EHTO), and Kugluktuk Angoniatit Association (KAA), as well as Hunters and Trappers Committees in the Northwest Territories. These communities reside, hunt, and work within the range of DU caribou. The addendum would contain their information and management initiatives that are essential to the understanding of the species' current situation. However, when IQ or TK is recorded—even with the intention to preserve or include it—there is a risk that it could be interpreted and used in a way that was not originally intended, expected or agreed upon by Inuit, especially if it is made available to the public. KRWB, EHTO, and KAA will continue to work on an addendum that avoids these risks and outlines considerations for community engagement in the Species at Risk Act (SARA) process.

Consultation:

This report was prepared after discussions with EHTO, KAA, and KRWB throughout ECCC's consultation process. This report was reviewed by KAA on 27 April 2022 and KRWB on 29 April 2022.

Recommendation:

Below we provide important information and management initiatives from KAA and EHTO when considering DU caribou.

<u>Dolphin and Union caribou ecology</u>

- Inuit hunters are knowledgeable of DU caribou and herd composition when they encounter them, based on their trails and physical characteristics
- DU caribou occur where vegetation is available and avoid predators and other animals that share the same habitat (e.g., muskox and snow geese). Caribou migrations reflect these patterns.
- DU caribou are known to migrate between Victoria Island and the mainland (Hanke et al. 2020; Wong et al. 2021), but not all caribou migrate across the sea ice. Some DU caribou have been encountered on the mainland or Victoria Island year-round. The Government of Nunavut recently attempted to collar these "resident caribou" but were unable to because of logistical limitations. Studies that take these DU caribou into account are needed.
- Community members continue to report the DU caribou range is broader than what recent aerial abundance surveys and/or collar data suggest; for example, community members have reported encounters near Sachs Harbour, Contwoyto Lake, and MacKay Lake (Northwest Territories). KRWB's monitoring program and EHTO and KAA harvest sampling have the potential to record precise locations of DU caribou that are encountered beyond their expected range.
- Threats to DU caribou include hunting practices (whether subsistence, predator, and/or sport hunting), development and human disturbance, climate change, sea ice changes along migration routes, insects, and their combined effects (Hanke and Kutz 2020; Wong et al. 2021)

<u>Dolphin and Union population changes</u>

- IQ on DU caribou has been documented during interviews by the Government of Nunavut (in 2003; Hanke and Kutz 2020), Tomaselli et al. (2018), Hanke and Kutz (2020), and Wong et al. 2021. These interviews suggest DU populations are dynamic and experience cycles of increase and decrease over time. The 2018 COSEWIC assessment suggests we are currently in a period of low population abundance.
- Perceptions of fewer caribou in hunting areas could reflect changes in distribution, rather than overall population decline. Hanke and Kutz (2020) suggest caribou have shifted eastward and inland since the 1990s, due to sea ice freeze up delay and earlier sea ice formation in the east.
- Statements about caribou numbers that are made during IQ interviews reflect unique and individual encounters by hunters, depending on where and when they travel. Caribou encounters also depend on ability to access certain hunting areas. How numbers of caribou in hunting areas reflect population numbers (the entire DU range) is unknown and requires collaboration among HTOs and Hunters and Trappers Committees in the Northwest Territories.
- Researchers have suggested hunting range becomes smaller when population numbers are high, and expand when population is lower due to increase in search effort (Neis et al. 1999; Kendrick and Manseau 2008;

Hanke and Kutz 2020). However, search effort could also decrease when population is low because DU caribou in low numbers aggregate together. An increase in search effort is also expected when DU caribou are moving from one area to another.

Community-led management initiatives

- EHTO and KAA are proactive in DU caribou management. KAA stopped all sport hunting of caribou and commercial harvesting in 2007 and EHTO stopped all sport hunting of Dolphin and Union caribou in 2018.
- The Victoria Island Waterway Safety Committee (EHTO, Transport Canada, and Canada Coast Guard) enhances communication between vessels and community members using waterways through a Notice to Mariners. Vessels transiting the DU migration area are required to notify the hamlet and EHTO before they transit. The Notice also includes specific dates where transit is permitted, corresponding to DU migration timing.
- Wolves and grizzly bears have increased in abundance. In the past, predators were harvested to manage caribou populations. Today, predators require time and work to harvest and prepare meat, with fewer incentives to hunt them. Sport hunting and monetary incentives can support predator management. KAA participates in wolf monitoring programs in the Northwest Territories.
- Community members continue to highlight the need to preserve and pass on IQ and TK around harvest. Education opportunities between elders and youth are needed to share information about how to select the right animal, properly butcher and handle the harvested animal, and identify safe meat, as well as etiquette around meat sharing and harvest quantity (Hanke and Kutz 2020).
- EHTO will be initiating a project led by youth to interview elders about predators this year.
- Both KAA and EHTO actively participate in harvest monitoring of DU caribou health, in collaboration with University of Calgary and the Government of Nunavut. KAA and EHTO continue to document DU caribou harvests and encounters through NWMB's Community-Based Monitoring Network and KRWB's caribou monitoring program.

References

Hanke, A. and Kutz, S. 2020. Kitikmeot traditional knowledge studies on Dolphin and Union Caribou, 2003 and 2018–2020. Research. Update submitted to KAA, EHTO, Olokhaktomiut Hunters' and Trappers' Committee, KRWB, Wildlife Management Advisory Council, Government of Nunavut Department of Environment, Government of Northwest Territories Environment and Natural Resources, Environment and Climate Change Canada, Nunavut Tunngavik Inc.

Kendrick, A. and Manseau, M. 2008. Representing traditional knowledge: resource management and Inuit knowledge of barren-ground caribou. Society and Natural Resources, 21: 404–418.

Neis, B., Schneider, D.C., Felt, L., Haedrich, R.L., Fischer, J. and Hutchings, J.A. 1999. Fisheries assessment: what can be learned from interviewing resource users? Canadian Journal of Fisheries and Aquatic Sciences 56: 1949–1963.

Tomaselli, M., Kutz, S., Gerlach, C. and Checkley, S. 2018. Local knowledge to enhance wildlife population health surveillance: conserving muskoxen and caribou in the Canadian Arctic. Biological Conservation, 217: 337–348.

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Prepared by:

Pamela Wong

Senior Research and Technical Advisor

Kitikmeot Regional Wildlife Board

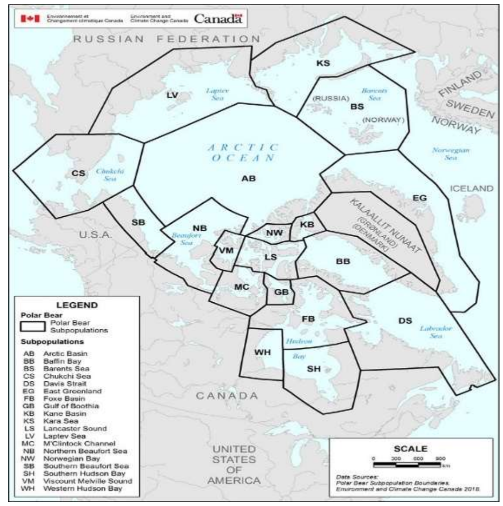
Date:

3 May 2022

Submission to the Nunavut Wildlife Management Board for

Information: X **Decision:**

Issue: Update on the National Polar Bear Management Plan



Background Information:

- Polar Bear is currently listed as Special Concern (2011) under the federal *Species at Risk Act* (SARA). Under provincial/territorial legislation, the species-at-risk listing status of polar bear varies in different provinces and territories in Canada, and ranges from not at risk to threatened. In Nunavut, polar bear is not listed under the *Nunavut Wildlife Act*.

- As required under SARA for species listed as Special Concern, and to respect co-management processes legislated by the *Nunavut Agreement*, a National Polar Bear Management Plan is being developed in cooperation with co-management partners. Once complete, the National Polar Bear Management Plan will be a compendium of six jurisdictional management plans and recovery strategies (Inuvialuit Settlement Region, Nunavut, Manitoba, Ontario, Québec-Eeyou Marine Region-Nunavik Marine Region, Newfoundland and Labrador), tied together by a federal addition.

Development of the Federal Addition to the National Polar Bear Management Plan:

- The development of the federal addition began in 2018. It was developed by Environment and Climate Change Canada (ECCC), in consultation with an advisory working group, consisting of provincial and territorial government representatives, wildlife management board representatives, and Inuit land claims organization representatives from throughout the species range.

- The working group had regular meetings in 2018 through 2021 and a draft final version of the federal addition was completed in February 2022.

Federal Addition content:

- The federal addition contains the required sections for a federal management plan. For example, it includes a threat assessment, a management objective and conservation measures at a national level.
- Matters such as harvest management and polar bear subpopulation-specific abundance targets and management goals are addressed in jurisdictional management plans and recovery strategies, which form parts 2 – 7 of the National Polar Bear Management Plan.
- Matters that are generally under federal management authority, such as Canada's action on climate change and arctic shipping, are addressed in the federal addition.

Summary of Consultations:

- ECCC participated in the development of jurisdictional management plans and recovery strategies throughout Canada, and took part in community-level consultations in collaboration with provincial/territorial partners.
- In Nunavut:
    - Community-level consultations on Nunavut's Polar Bear Co-Management Plan were led by the Government of Nunavut, throughout the area of application of the Nunavut Polar Bear Co-Management Plan, in 2016. A representative from the Canadian Wildlife Service of ECCC attended these consultations. During these consultations, Inuit Qaujimajatuqangit (IQ) was shared, and polar bear management objectives were discussed.
- The Nunavut Wildlife Management Board held a public hearing in November 2018 to consider the proposed final version of the Nunavut Polar Bear Co-Management Plan. ECCC was an active participant and took note of the information shared and incorporated it, as relevant, into the federal addition to the National Polar Bear Management Plan.
- Working group representatives that advised ECCC on the development of the

federal addition noted that, in many cases, an additional round of community consultations focused on the federal addition to the National Polar Bear Management Plan may not be necessary given the extensive nature of provincial/territorial-led consultations.

- To address consultation and accommodation requirements under the Nunavut Agreement, ECCC has sent letters to communities, Regional Wildlife Organizations (RWOs), and Hunters and Trappers Organizations (HTOs) in Nunavut. The letters provide a high-level overview of the federal addition, indicate what consultations have occurred in different regions of Canada on the different jurisdictional management plans and recovery strategies, and ask rights holders how they would like to be engaged on the federal addition.
- ECCC looks forward to feedback from rights holders, and is prepared to engage in any manner (e.g., virtual, in-person) that is requested.

Next Steps for the National Polar Bear Management Plan:

- ECCC proposes to seek final comment on the federal addition through two avenues: (1) direct outreach to communities, HTOs and RWOs (spring and summer 2022), and (2) posting for comment on the national Species at Risk Public Registry (60 day public comment period in fall 2022).
- ECCC is seeking input from the eight[1] Wildlife Management Boards and Advisory Councils across the species range regarding the content included in the federal addition, and to confirm their support for ECCC's proposal to reach out directly to communities, RWOs and HTOs, in parallel with posting for public comment on the national Species at Risk Public Registry.
- ECCC will consider all feedback received during consultations with rights holders, and during the 60-day public comment period, and will ensure that comments are carefully considered and addressed. ECCC will then present the 'proposed final' version of the federal addition to the eight Wildlife Management Boards and Advisory Councils. At that time, the Nunavut Wildlife Management Board will have the opportunity to consider whether to approve the federal addition.

Prepared by:
Environment and Climate Change Canada - Canadian Wildlife Service, Wildlife Management Directorate, Wildlife Management and Regulatory Affairs Division; April 2022

[1] The eight Wildlife Management Boards and Advisory Councils across the range of polar bear in Canada include three in the Inuvialuit Settlement Region (the Wildlife Management Advisory Council (North Slope), the Wildlife Management Advisory Council (Northwest Territories), and the Inuvialuit Game Council), one in Nunavut (the Nunavut Wildlife Management Board), three in Québec (the Nunavik Marine Region Wildlife Board, the Eeyou Marine Region Wildlife Board, and the Hunting, Fishing and Trapping Coordinating Committee), and one in Labrador (the Torngat Wildlife and Plants Co-Management Board).

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National Polar Bear Management Plan:

Overview of the Federal Addition, consultation and engagement efforts, and next steps

Lauren Schmuck, Wildlife Biologist
Wildlife Management and Regulatory Affairs Division, Canadian Wildlife Service, Environment and Climate Change Canada
June 15, 2022

Presentation outline:

- **National Polar Bear Management Plan**
  - Background and Structure
  - Status of documents to be included in the National Polar Bear Management Plan
- **Federal Addition**
  - Overview
  - Key Information
- **Consultation and engagement with Indigenous rights' holders and coordination with co-management partners in Nunavut**
- **Next Steps**
- **Appendix I: Consultation on the Management Plan: A National Perspective**

Background and Structure of the National Polar Bear Management Plan

- First written by Environment and Climate Change Canada (ECCC) in 2014 as a single National Management Plan
- Original National Plan drew heavily from the Polar Bear Administrative Committee (PBAC)-approved *National Polar Bear Conservation Strategy for Canada* (2011)
- Following review and discussion of ECCC's preliminary draft, PBAC advised to instead structure the National Plan as the six jurisdictional documents, tied together by the Federal Addition (2016)
- Drafts of Federal Addition shared with co-management partners for comment in October 2018, July 2019 and October 2021

National Polar Bear Management Plan

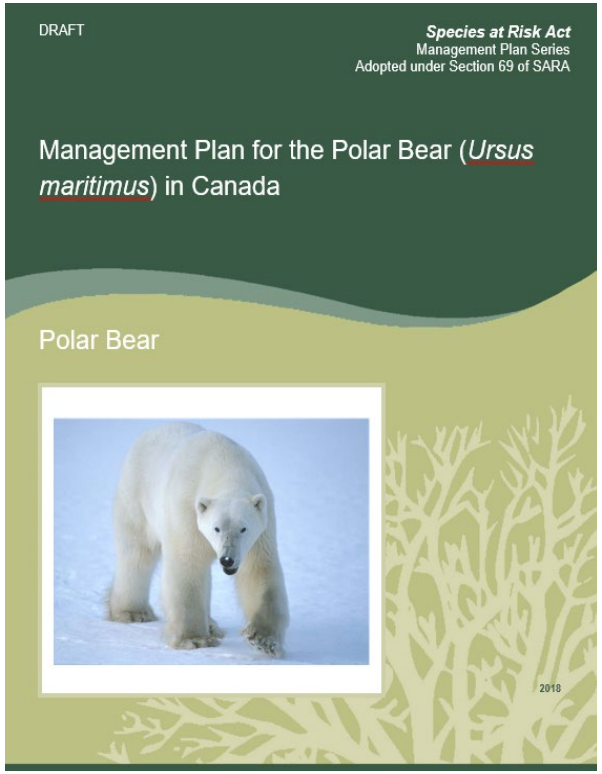
Part 1 – Federal Addition (ECCC)	Part 2 – Inuvialuit Settlement Region Joint Polar Bear Management Plan	Part 3 – Nunavut Polar Bear Co-Management Plan	Part 4 – Manitoba Polar Bear Conservation and Recovery Strategy	Part 5 – Ontario Polar Bear Recovery Strategy and Government Response Statement	Part 6 – QC-EMR-NMR Polar Bear Management Plan	Part 7 – Newfoundland and Labrador Polar Bear Management Plan

Status of Documents to be included in the National Polar Bear Management Plan

Federal Addition – Part 1	• Three drafts completed and shared with partners for comment (2018 – 2021). Current draft ready for discussion with Boards.
ISR – Part 2	• Completed in 2017
Nunavut – Part 3	• Completed in 2019
Manitoba – Part 4	• Draft produced in August 2021; with senior management for review
Ontario – Part 5	• Completed in 2011
Québec-EMR-NMR – Part 6	• Submitted to Boards/Advisory Committee in spring 2021. Approval/advice pending
Newfoundland and Labrador – Part 7	• Document finalized in November 2021. In discussions regarding consultations

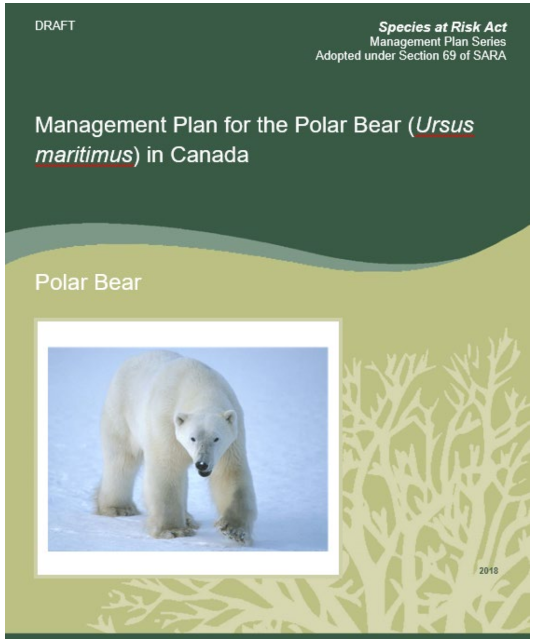
Federal Addition – Overview

- Developed by ECCC with significant input from P/T governments, WMBs and Indigenous land claims organization co-management partners
- Written in parallel with jurisdictional documents; in many cases being informed by joint federal/jurisdictional engagement with rights holders
- Key considerations:
  - Threat assessment borrowed from the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)'s November 2019 status report
  - Geographic scope: all polar bears within Canada
  - Contains all sections of a federal management plan that are required by the federal *Species at Risk Act* (SARA)
  - No critical habitat identified



Key Information included in the Federal Addition (1/2)

- **COSEWIC Species Assessment Information, Species Status Information, and Species Information**: standard sections required in federal Management Plans
- **Threats**: COSEWIC assessment
  - Climate Change (HIGH): sea ice habitat loss from increasing temperatures
  - Biological Resource Use (LOW): management of human-induced mortality, including sustainable harvest
  - Pollution (LOW): Polar bears can be exposed to pollutants that bioaccumulate
  - Other (NEGLIGIBLE): mining, transportation, and human activities
  - Other (UNKNOWN): dams & other ecosystem modifications, and invasive species
- The Federal Addition focuses on conservation actions within the federal mandate (e.g., climate emissions, arctic shipping regulations) and refers the reader to jurisdictional documents for matters under P/T authority (e.g. harvest management is generally under P/T authority, and is addressed in jurisdictional management plans and recovery strategies)



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Canada

Key Information included in the Federal Addition (2/2)

- **Management Objective**: Maintain the resilience, redundance and representation of the population in the species' known range in Canada.

- **Broad Strategies and Management Actions** (limited to matters under federal jurisdiction; actions that most directly impact subsistence rights are generally in the jurisdictional management plans and recovery strategies).
  - Work with Canadian partners to co-manage and conserve polar bears and their habitat
  - Work with international partners to manage and conserve polar bears on circumpolar scale
  - Conduct scientific and Indigenous Knowledge research and monitoring in Canada and internationally
  - Promote and support public outreach and education related to polar bear management and conservation
- **Measuring Progress**: Identifies how success will be measured every 5 years, based on the goal stated in the Management Objective

- **Effects on the Environment and Other Species**: Identifies whether outcomes of the document could be harmful to the environment or other species.

Consultation and engagement with Indigenous rights' holders and coordination with co-management partners in Nunavut:

What consultations occurred on the territorial management plan?

- Community-level consultations were completed throughout the area of application of the Nunavut Polar Bear Co-Management Plan (2016)
- ECCC was involved in these consultations, and heard the concerns raised by rights holders

What coordination with co-management partners has occurred to date on the Federal Addition?

- All PBAC organizations offered opportunity to comment on three drafts of the Federal Addition
- Five P/T governments (Northwest Territories, Nunavut, Ontario, Quebec and Yukon), the Inuvialuit Game Council, Makivik Corporation, Nunavik Marine Region Wildlife Board, and the Wildlife Management Advisory Councils (Northwest Territories and North Slope) involved in development of Federal Addition

What opportunities are there for additional engagement on the Federal Addition?

- Letters sent to communities, Regional Wildlife Organizations, and Hunters and Trappers Organizations to offer consultation
- 90-day public comment period on SAR Registry: opportunity to comment on content of Federal Addition

Note: All consultations on all parts of the Management Plan are summarized in Appendix I

Next Steps

Step 1 (We are here)

Outreach to Boards to do a signals' check and discuss proposed process

Step 2

If Boards support:

1. Post the Management Plan to the SAR Registry for public comment (90 days; July – September 2022)
2. Complete community consultations (January – September 2022)

Step 3

Revise Federal Addition based on comments received (fall 2022)

Step 4

Submit 'proposed final' National Polar Bear Management Plan to Boards (winter 2023)

Boards determine process for considering whether to approve/support

Thank you

Appendix I: Consultation on the Management Plan: A National Perspective

Jurisdiction:	Consultation on jurisdictional management plan or recovery strategy:	Federal Addition:
Inuvialuit Settlement Region	Community-level consultations completed throughout the area of application (2016).	Board staff and other co-management partners involved in development of the Federal Addition (2018 – 2021) Consultation invitations will be extended to communities (March 2022)
Nunavut	Community-level consultations completed throughout the area of application (2016). In-person NWMB public hearing (2018).	Co-management partners involved in development of the Federal Addition (2018 – 2021) Consultation invitations will be extended to communities (March 2022)
Manitoba	To be determined	To be determined
Ontario	Community-level consultations completed by Government of Ontario (2010)	Community-level consultations partially completed in 2019. Consultation invitations extended to remaining communities in November 2021.
Québec	Community-level consultations completed throughout the area of application (2016 – 2017) NMRWB-EMRWB joint written hearing (2021 – 2022)	Board staff and other co-management partners involved in development of the Federal Addition (2018 – 2021) Consultation invitations will be extended to communities (March 2022)
Newfoundland and Labrador	Consultations anticipated to begin in 2022	ECCC intending to participate in joint consultations with provincial government (anticipated 2022)

DRAFT

Species at Risk Act
Management Plan Series
Adopted under Section 69 of SARA

Management Plan for the Polar Bear (*Ursus maritimus*) in Canada

Polar Bear

2022

Recommended citation:

Environment and Climate Change Canada. 2022. Management Plan for the Polar Bear (*Ursus maritimus*) in Canada [DRAFT]. *Species at Risk Act* Management Plan Series. Environment and Climate Change Canada, Ottawa. xx + XX pp.

Official version

The official version of the recovery document is the one published in PDF. All hyperlinks were valid as of date of publication.

Non-official version

The non-official version of the recovery document is published in HTML format and all hyperlinks were valid as of date of publication.

For copies of the management plan, or for additional information on species at risk, including Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry[1].

Également disponible en français sous le titre

« Plan de gestion de l'ours blanc (*Ursus maritimus*) au Canada »

ISBN ISBN to be included by SARA Responsible Agency

Catalogue no. Catalogue no. to be included by SARA Responsible Agency

[1] https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

MANAGEMENT PLAN FOR THE POLAR BEAR

(*Ursus maritimus*) IN CANADA

2022

Under the Accord for the Protection of Species at Risk (1996), the federal, provincial and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada.

In the spirit of cooperation of the Accord, the relevant jurisdictions (Governments of Yukon, Northwest Territories, Nunavut, Ontario, and Québec), and the relevant Wildlife Management Boards (WMB), Advisory Councils and Indigenous governments within these jurisdictions, have given permission to the Government of Canada to adopt their management plans or recovery strategies for the Polar Bear (*Ursus maritimus*) (Parts 2, 3, 5 and 6) under Section 69 of the *Species at Risk Act* (SARA). Environment and Climate Change Canada has included a federal addition (Part 1) which completes the SARA requirements for this Management Plan. The Polar Bear Recovery Strategy and Management Plan which will be prepared by the Governments of Manitoba and Newfoundland and Labrador, respectively, will be adopted as Parts 4 and 7 of the National Polar Bear Management Plan once they are transmitted to Environment and Climate Change Canada.

The federal Management Plan for the Polar Bear (*Ursus maritimus*) in Canada consists of seven parts:

Part 1 – Canada:
Federal Addition to the Management Plan for the Polar Bear *(Ursus maritimus)* in Canada, prepared by Environment and Climate Change Canada

Part 2 – Inuvialuit Settlement Region:
Inuvialuit Settlement Region Polar Bear Joint Management Plan 2017, prepared by the Joint Secretariat Inuvialuit Settlement Region

Part 3 – Nunavut:
Nunavut Polar Bear Co-Management Plan, prepared by the Nunavut Polar Bear Co-Management Working Group

Part 4 – Manitoba:
Document will be inserted and adopted as Part 4 of the National Polar Bear Management Plan once transmitted to Environment and Climate Change Canada by Manitoba

Part 5 – Ontario:
Part A: Government Response Statement to the Recovery Strategy for Polar Bear, prepared by the Ontario Ministry of Natural Resources and Forestry (2016)(species-specific policy)

Part B: Recovery Strategy for Polar Bear (*Ursus maritimus*) in Ontario, prepared by M.B. Tonge and T.L. Pulfer (2011) (technical advice)

Part 6 – Québec-Eeyou Marine Region-Nunavik Marine Region:
Management Plan for the Polar Bear (*Ursus maritimus*) for Québec, the Eeyou Marine Region and the Nunavik Marine Region, prepared by the Québec - Eeyou Marine Region - Nunavik Marine Region Polar Bear Working Group

Part 7 – Newfoundland and Labrador:
Document will be inserted and adopted as Part 7 of the National Polar Bear Management Plan once transmitted to Environment and Climate Change Canada by Newfoundland and Labrador

Table of Contents

PART 1: Federal addition to the Management Plan for the Polar Bear (*Ursus maritimus*) in Canada, prepared by Environment and Climate Change Canada

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[2] agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of management plans for listed species of special concern and are required to report on progress within five years after the publication of the final document on the SAR Public Registry.

The Minister of Environment and Climate Change and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Polar Bear and has prepared the federal component of this management plan (Part 1), as per section 65 of SARA. SARA section 69 allows the Minister to adopt all or part of an existing plan for the species if the Minister is of the opinion that an existing plan relating to wildlife species includes adequate measures for the conservation of the species. The Governments of Yukon, Northwest Territories, Nunavut, Ontario, and Québec provided the attached management plans and recovery strategy for the Polar Bear (Parts 2, 3, 5, and 6). The Province of Ontario also led the development of the attached Government Response Statement (Part 5A), which is the Ontario Government's policy direction on Polar Bear. This policy summarizes the prioritized actions that the Ontario Government intends to take and support in response to the provincial recovery strategy. The Polar Bear Recovery Strategy for Manitoba and Management Plan for Newfoundland and Labrador will be adopted as Parts 4 and 7, respectively, of the National Polar Bear Management Plan once they are transmitted to Environment and Climate Change Canada. This Federal Addition to the National Polar Bear Management Plan consists of the adoption of the jurisdictional recovery documents for the entire Designatable Unit in Canada. To the extent possible, this Management Plan was prepared in cooperation with the relevant jurisdictions (Governments of Yukon, Northwest Territories, Nunavut, Ontario and Québec), Indigenous governments and organizations[3], Wildlife Management Boards/Advisory Councils[4], and other co-management partners within the range of Polar Bear in Canada as per section 66(1) of SARA.

Success in the conservation of this species depends on the commitment and cooperation of the many different constituencies that will be involved in implementing the directions set out in this plan and will not be achieved by Environment and Climate Change Canada and the Parks Canada Agency, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this plan for the benefit of the Polar Bear and Canadian society as a whole.

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[2] http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1%20-%202
[3] Makivik Corporation, Nunavut Tunngavik Inc., Cree Nation Government, Nunatsiavut Government, and the Inuvialuit Game Council
[4] Wildlife Management Advisory Council (NWT) and Wildlife Management Advisory Council (North Slope), Nunavut Wildlife Management Board, Nunavik Marine Region Wildlife Board, Eeyou Marine Region Wildlife Board, Torngat Wildlife and Plants Co-Management Board

Implementation of this management plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

ACKNOWLEDGEMENTS

Lauren Schmuck, Sam Iverson (Wildlife Management and Regulatory Affairs Division, Wildlife Management Directorate, Canadian Wildlife Service) and Véronique Brondex (Species at Risk Implementation Division, Wildlife Management Directorate, Canadian Wildlife Service) led the preparation of the Federal Addition (Part 1) to the National Polar Bear Management Plan. The contributions of Caroline Ladanowski, Ryan Zimmerling (Wildlife Management and Regulatory Affairs Division, Wildlife Management Directorate, Canadian Wildlife Service), Peter Hale (formerly Wildlife Management and Regulatory Affairs Division, Wildlife Management Directorate, Canadian Wildlife Service), Matthew Huntley (Species at Risk Implementation Division, Wildlife Management Directorate, Canadian Wildlife Service), Cecilia Lougheed (International Biodiversity Division, Biodiversity Policy and Partnerships Directorate, Canadian Wildlife Service), Gina Schalk (Species at Risk Implementation Division, Wildlife Management Directorate, Canadian Wildlife Service), Teresa Tufts (Northern Region, Regional Operations Directorate, Canadian Wildlife Service), Diana Ghikas (Prairie Region, Regional Operations Directorate, Canadian Wildlife Service), Ken Tuininga (Ontario Region, Regional Operations Directorate, Canadian Wildlife Service), Mark Mills (Québec Region, Regional Operations Directorate, Canadian Wildlife Service), Paul MacDonald (Atlantic Region, Regional Operations Directorate, Canadian Wildlife Service), Nick Lunn, Evan Richardson and Dominique Henri (Wildlife Research Division, Wildlife and Landscape Science Directorate, Science & Technology Branch), Joanne Tuckwell (Conservation Programs Branch, Protected Areas Establishment and Conservation Directorate, Parks Canada Agency), Scott Chiu (Aquatic Ecosystems, Biodiversity Management, Species at Risk Program, Fisheries and Oceans Canada), Karine Robert (Ecosystem Science, Fish Population Science, Ecosystems and Oceans Science, Fisheries and Oceans Canada), and the Marine Mammal Science Branch, Ecosystem and Ocean Sciences sector, Ecosystems Science Directorate of Fisheries and Oceans Canada are acknowledged and appreciated.

Environment and Climate Change Canada appreciates the input of the Wildlife Management Boards, Advisory Councils, and Inuit, Inuvialuit, Cree and First Nation individuals across the species' range. Environment and Climate Change Canada has, to the extent possible, attempted to integrate the Indigenous Knowledge shared by Inuit, Inuvialuit and Cree, alongside scientific knowledge, to develop this Management Plan.

Environment and Climate Change Canada would like to express its gratitude to the Working Group of organizations on the Polar Bear Administrative Committee (PBAC) for their guidance and input on the development of the first draft of the Federal Addition (Part 1) of the National Polar Bear Management Plan. In addition, gratitude is extended to the following Indigenous, provincial, territorial and federal organizations for their insightful comments and collaboration throughout the development of this document:

- Inuvialuit Game Council
- Wildlife Management Advisory Council (North Slope)
- Government of Yukon
- Wildlife Management Advisory Council (Northwest Territories)
- Government of Northwest Territories
- Nunavut Wildlife Management Board
- Nunavut Tunngavik Incorporated
- Government of Nunavut
- Government of Manitoba
- Government of Ontario
- Makivik Corporation
- Nunavik Marine Region Wildlife Board
- Eeyou Marine Region Wildlife Board
- Gouvernement du Québec
- Torngat Wildlife, Plants and Fisheries Secretariat
- Nunatsiavut Government
- Government of Newfoundland and Labrador
- Parks Canada Agency

Lastly, the contributions of the citizens, non-governmental organizations, Indigenous organizations, scientists and various interest groups who provided guidance, comments and recommendations to improve this Management Plan during the consultation processes are acknowledged.

Additions and Modifications to the Adopted Documents

The following sections have been included to address specific requirements of the federal *Species at Risk Act* (SARA) that may not be addressed in the jurisdictional management plans or recovery strategies for the Polar Bear (*Ursus maritimus*) (Parts 2, 3, 5 and 6 of this document, referred to henceforth as “the jurisdictional management plans or recovery strategies”), and/or to provide updated or additional information. Parts 4 (Manitoba) and 7 (Newfoundland and Labrador) will be inserted and adopted into National Polar Bear Management Plan when they are transmitted to Environment and Climate Change Canada.

Under SARA, prohibitions regarding the protection of species and their habitat do not apply to species of special concern. Conservation measures in the jurisdictional management plans dealing with the protection of individuals and their habitat are adopted to guide conservation efforts but do not result in federal legal protection.

1. COSEWIC Species Assessment Information

Assessment Summary – November 2018[5]

Common name
Polar Bear

Scientific name
Ursus maritimus

Status
Special Concern

Reason for designation
This apex predator depends on the availability of sea ice from which to hunt its preferred prey—ice-adapted seals. Reduction in the area and period of sea ice coverage due to climate warming in the Canadian Arctic, with consequent reductions in feeding opportunity, is the primary threat to the persistence of this species. However, the magnitude of the impact on population numbers is uncertain and will vary across the range. Population levels and trends are currently uncertain, as population estimates undertaken since the last COSEWIC assessment in 2008 exist for less than half of the range and survey methodology has changed. This precludes the use of quantitative trend analysis for most of the Canadian population. The total

[5] The November 2018 COSEWIC Species Assessment Information is taken directly from the 2018 In-Press COSEWIC Assessment and Status Report on the Polar Bear *Ursus maritimus* in Canada.

population in Canada likely exceeds 10,000 mature individuals. ATK indicates stable or increasing populations in all 13 management units, while scientific knowledge suggests a decline associated with poorer body condition, decreasing productivity, and sea ice decline in three management units in the southern part of the range. The Canadian population is predicted to decline over the next three generations (35 years) due to a reduction in seasonal coverage of sea ice. This species may become Threatened in the future because the effects of sea ice loss on this species will be extensive and ongoing.

Occurrence
Yukon, Northwest Territories, Nunavut, Manitoba, Ontario, Québec, Newfoundland and Labrador, Arctic Ocean.

Status history
Designated Not at Risk in April 1986. Status re-examined and designated Special Concern in April 1991. Status re-examined and confirmed in April 1999, November 2002, April 2008, and November 2018.

2. Species Status Information

It is estimated that approximately 60% of the global population of the Polar Bear is found in Canada (Wiig et al. 2015; Obbard et al. 2010). The International Union for the Conservation of Nature (IUCN) has ranked the Polar Bear as globally Vulnerable (A3c) due to the potential for large reductions in the global Polar Bear population if the losses in sea ice extent and quality measured over the last several decades continue as forecast (Wiig et al. 2015). International, national, provincial and territorial NatureServe rankings for the Polar Bear are captured in Table 1, below.

Table 1. List and description of NatureServe* rankings for the Polar Bear.

Region:	Status:
Global	G3 (Vulnerable)
Canada	N3
Yukon	S1
Northwest Territories	S2S3
Nunavut	S3
Manitoba	S2
Ontario	S3
Québec	S2
Newfoundland and Labrador	S2S3

* The NatureServe rankings for the Polar Bear are designated by a number from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global, N = National, and S = Subnational). The numbers have the following meaning: 1 = critically imperiled, 2 = imperiled, 3 = vulnerable, 4 = apparently secure, 5 = secure.

In Canada, the Polar Bear was designated as a species of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1991 and the special concern status was confirmed by COSEWIC in 1999, 2002, 2008 and 2018 (COSEWIC 2018). Polar Bear was listed as a species of special concern under the *Species at Risk Act* by the Government of Canada in 2011 (SOR/2011-23). The special concern listing does not impose automatic federal prohibitions – management of Polar Bears in Canada will continue as it was prior to the listing. A special concern listing does, however, trigger the development of a federal Management Plan, which plays an important role in preventing the Polar Bear from becoming a threatened or endangered species. A Management Plan lays out the actions that are required to prevent any further decline of the species. The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Table 2 provides a summary of provincial and territorial government designations for the Polar Bear.

Table 2. List and description of various conservation status designations for the Polar Bear in Canada.

Province/Territory	Legislation	Designation	Year
Yukon	*Yukon Wildlife Act*	No status	–
Northwest Territories	*Species at Risk (NWT) Act*	Special Concern	2014
Nunavut	*Nunavut Wildlife Act*	Not listed	-
Manitoba	*Endangered Species Act*	Threatened	2008
Ontario	*Endangered Species Act, 2007*	Threatened	2009
Québec	*Loi sur les espèces menacées ou vulnérables*	Vulnérable[6]	2009
Newfoundland & Labrador	*Endangered Species Act*	Vulnerable[7]	2002

The Polar Bear is listed within Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and has been listed since CITES came into effect in 1975. This means that any international shipment of Polar Bears or parts thereof requires an export permit from the country of origin (Government of Canada, 2017a). In Canada, CITES is implemented by the federal government through the *Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act* (WAPPRIITA). For more information on CITES and WAPPRIITA, please refer to section 6.

[6] Equivalent to Special Concern under SARA
[7] Equivalent to Special Concern under SARA

3. Species Information

3.1 Species Description

The Polar Bear is a large carnivorous mammal that inhabits both terrestrial and marine areas and occurs in Canada, Greenland, Norway (Svalbard), Russia, and the United States. Polar Bears are apex predators, and they occupy the highest trophic levels in arctic marine ecosystems (Thiemann et al. 2008). In the wild, female Polar Bears can live up to 30 years, and male Polar Bears can live up to 25 years (Cohen 2004). Females generally produce litters of one or two cubs at a time, though triplets are occasionally born (Ramsay and Stirling, 1988). In most areas, females care for cubs during the first two and a half years of their cubs' life, which means females are capable of mating once every three years (Stirling 2011).

While some genetic differences exist between Polar Bears found throughout Canada, COSEWIC concluded that these differences do not meet the criteria for dividing the Canadian Polar Bear population into multiple Designatable Units (DUs) (COSEWIC 2018). For management purposes, the global Polar Bear population is divided into 19 subpopulations, 14 of which occur in whole or in part in Canada (see Figure 1, below). These 14 subpopulations are considered to comprise the single DU in Canada (COSEWIC, 2018). Abundance inventories are conducted and status and trend is monitored at a subpopulation level. Thirteen of Canada's 14 subpopulations are actively managed by Canadian authorities, whereas the Arctic Basin subpopulation, which lies to the north of any permanent settlements, is not actively managed. The federal addition to the National Polar Bear Management Plan applies to Canada's Polar Bear Designatable Unit as a whole.

For additional information pertaining to the ecology and natural history of the Polar Bear, please refer to Parts 2 – 7 of this Management Plan.

3.2 Population and Distribution

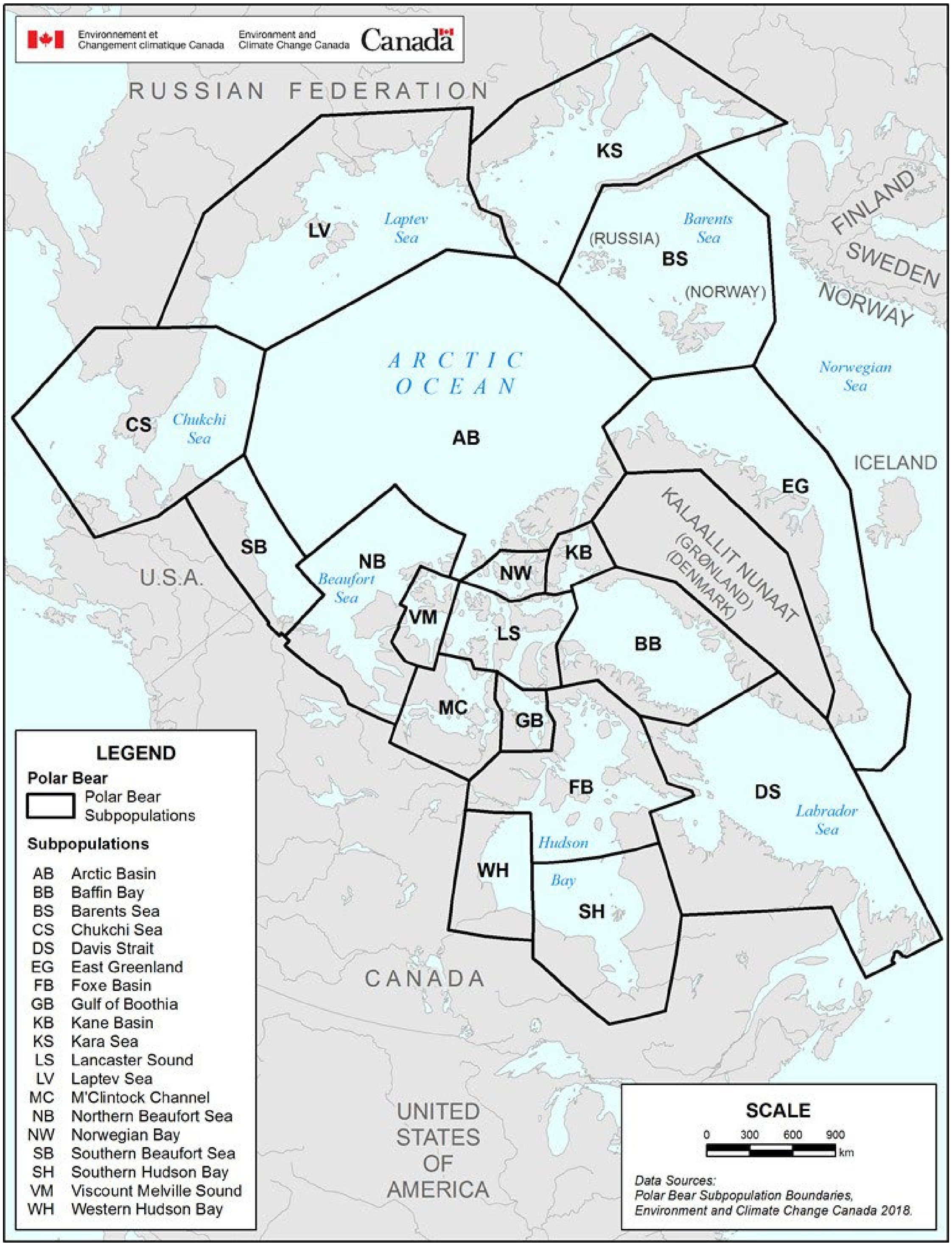

Figure 1: Global Polar Bear subpopulations (source: ECCC 2018b)

Canada is home to approximately 16,000[8] of the estimated 20,000 – 26,000 Polar Bears found throughout the circumpolar arctic. Subpopulation surveys are conducted according to a pre-determined schedule of studies, with an objective of obtaining updated abundance estimates every 5 to 15 years. It is not logistically feasible to survey all subpopulations concurrently and some subpopulations have not been surveyed in >15 years. As such, it is difficult to generate a precise estimate of the overall abundance of Polar Bear in Canada.

The boundaries of Polar Bear subpopulations in Canada are delineated based on the best available scientific and Indigenous Knowledge related to the movements and genetics of Polar Bears, as well as management considerations (Figure 1) (Lunn et al. 2010). The term "subpopulation", as used in this document, is consistent with its use by the International Union for the Conservation of Nature (IUCN)/Species Survival Commission (SSC) Polar Bear Specialist Group (PBSG), and Canada's Polar Bear Technical Committee (PBTC) (for more information on the PBTC, please refer to section 6.1). The term subpopulation as applied to Polar Bear has the same meaning as the term "management unit" as used in COSEWIC assessment and status reports for the species.

In Canada, Polar Bear management is a shared responsibility of federal, provincial and territorial governments, Wildlife Management Boards/Advisory Councils, and Land Claim Organizations that represent Indigenous rights holders. With respect to government regulation, provinces and territories have authority over Polar Bears on provincial and territorial lands. The federal government has authority on federal lands, such as National Parks and National Wildlife Areas. Offshore areas in Canada are generally under federal authority, however, within Indigenous land claim settlement areas that encompass both land and sea (Inuvialuit Settlement Area, Nunavut, Nunatsiavut), provincial and territorial authorities exercise management actions, such as the determination and enforcement of harvest levels, that have application onshore and offshore, in accordance with treaty and land claims processes.

Organizations with management authority for Polar Bears in Canada, including federal, provincial and territorial governments, Wildlife Management Boards/Advisory Councils and Land Claim Organizations that represent Indigenous rights holders, work together to manage Polar Bears in Canada. More information about Canada's domestic conservation and management of Polar Bears can be found in section 6.1 of this document.

Most of the Polar Bear range in Canada occurs within areas where modern Crown-Indigenous Land Claims Agreements are in place. Within these Land Claims Areas, Total Allowable Take/Harvest levels are determined in processes that flow through Wildlife Management Boards/Advisory Councils. Table 3 enumerates the relevant Wildlife Management Boards/Advisory Councils or other similar entities for each subpopulation, as well as the federal, provincial and territorial governments to which Polar Bear harvest management

[8] The estimate of a Canadian population of 16,000 Polar Bears is a summation of the most recent estimates for each subpopulation. This sum was reached by adding the abundance estimates for each subpopulation from the most recent PBTC status table (2020).

decisions or recommendations are currently forwarded. The jurisdictional plans in Parts 2-7 of this Management Plan (noted in Table 3) provide additional information regarding Polar Bear subpopulations throughout Canada and provide jurisdiction-specific management objectives and actions.

Table 3. Canadian Polar Bear subpopulations and the management authorities that currently share decision-making responsibility.

Subpopulation	Wildlife Management Boards, Advisory Councils and Other Similar Entities†	Canadian Federal, Provincial and Territorial Management Authorities	Foreign Governments and other Co-Management Partners	Corresponding Jurisdictional document(s):
Arctic Basin * (AB)	NWMB, IGC, WMAC (NWT)	Nunavut, Northwest Territories	Greenland, Norway, Russia and the United States	See Parts 2 and 3 of this document
Baffin Bay (BB)	NWMB	Nunavut	Greenland	See Part 3 of this document
Davis Strait (DS)	NWMB, NMRWB, HFTCC, TWPCB	Canada, Nunavut, Québec, Newfoundland and Labrador	Greenland	See Parts 3, 6 and 7 of this document
Foxe Basin (FB)	NWMB, NMRWB, HFTCC	Canada, Nunavut, Québec	None	See Parts 3 and 6 of this document
Gulf of Boothia (GB)	NWMB	Nunavut	None	See Part 3 of this document
Kane Basin (KB)	NWMB	Nunavut	Greenland	See Part 3 of this document
Lancaster Sound (LS)	NWMB	Nunavut	None	See Part 3 of this document
M'Clintock Channel (MC)	NWMB	Nunavut	None	See Part 3 of this document

Subpopulation	Wildlife Management Boards, Advisory Councils and Other Similar Entities[†]	Canadian Federal, Provincial and Territorial Management Authorities	Foreign Governments and other Co-Management Partners	Corresponding Jurisdictional document(s):
Northern Beaufort Sea (NB)	NWMB, IGC, WMAC (NWT)	Nunavut, Northwest Territories	None	See Parts 2 and 3 of this document
Norwegian Bay (NW)	NWMB	Nunavut	None	See Part 3 of this document
Southern Beaufort Sea (SB)	IGC, WMAC (NWT), WMAC (NS)	Northwest Territories, Yukon	United States, Iñupiat	See Part and 3 of this document
Southern Hudson Bay (SH)	NWMB, NMRWB, EMRWB, HFTCC	Canada, Nunavut, Québec, Ontario	None	See Parts 3, 5 and 6 of this document
Viscount Melville Sound (VM)	NWMB, IGC, WMAC (NWT)	Nunavut, Northwest Territories	None	See Parts 2 and 3 of this document
Western Hudson Bay (WH)	NWMB	Nunavut, Manitoba, Ontario	None	See Parts 3, 4 and 5 of this document

[†]Abbreviations. EMRWB: Eeyou Marine Region Wildlife Management Board; HFTCC: James Bay and Northern Québec Agreement (JBNQA) Hunting, Fishing and Trapping Coordinating Committee; IGC: Inuvialuit Game Council; NMRWB: Nunavik Marine Region Wildlife Management Board; NWMB: Nunavut Wildlife Management Board; TWPCB: Torngat Wildlife and Plants Co-Management Board; WMAC-NS: Wildlife Management Advisory Council – North Slope; WMAC (NWT): Wildlife Management Advisory Council - Northwest Territories.

** Note that there is no active monitoring or management in the Arctic Basin subpopulation*

The status of Canada's Polar Bear subpopulations is updated by the Polar Bear Technical Committee when new information is available, and information pertaining to subpopulation status can be found on the Polar Bear Administrative Committee's website[9]. For more information pertaining to the Polar Bear Administrative Committee and the Polar Bear Technical Committee, please refer to section 6.1 of Part 1 of this Management Plan.

[9] https://www.polarbearscanada.ca/en/polar-bears-canada/canadas-polar-bear-subpopulations

Indigenous peoples and Polar Bear:

In Canada, the Polar Bear has and continues to play an integral role in the social, cultural, and economic lives of northern Indigenous peoples. The species is intricately linked to the traditions of northern Indigenous peoples who have harvested the Polar Bear for thousands of years and valued the species for both consumptive and non-consumptive purposes (COSEWIC 2018). The Polar Bear has been a principal feature in cultural and traditional forms of expression and imagination including mythology, spirituality, storytelling, art, and song (Saladin 1990; Joint Secretariat 2017).

Indigenous peoples recognize the Polar Bear for its importance in preserving cultural identity and connection to the environment (Species at Risk Committee 2021). The act of hunting is essential for building and fostering human-animal and human-human relationships (Dowsley and Wenzel 2008), promoting a sense of community through celebration, social gathering and storytelling, in addition to sharing food from the hunt (Slavik 2013). The Polar Bear has been used for subsistence in many northern communities through the consumption of meat (Slavik 2010; Wenzel 2011; Freeman and Wenzel 2006). In addition to the subsistence and cultural importance of Polar Bear, the hides, teeth, claws, bones, and skulls from a harvested Polar Bear are used for clothing, mattresses, tools, household items and medicine, in addition to being sold as artifacts and crafts. Due to the economic value of the species, Polar Bear hides, teeth, claws, bones and skulls may also enter the commercial trade (Slavik 2013; Peacock et al. 2011; Kendrick 2013). The continued hunting of the Polar Bear is an essential part of the identity, values, livelihood, and culture of northern Indigenous peoples in Canada.

3.3 Needs of the Species

In Canada, Polar Bears rely on both marine (sea ice) and terrestrial habitat to meet their life history requirements. Their area of occupancy includes landfast, offshore pack ice, maritime coastlines with a preference for areas over the continental shelf and terrestrial areas (within 50 kilometers of the coast and up to 120 kilometers in some cases) of Labrador, Québec, Ontario, Manitoba, Nunavut, Northwest Territories, and Yukon (COSEWIC 2018). This range encompasses regions where sea ice melts completely each summer (known as annual sea ice); areas where sea ice forms along the shore and then retreats during summer, but remains offshore; and areas where locally formed or transported ice remains year-round (known as convergent or archipelago sea ice) (Atwood et. al 2016). Some Polar Bears are also known to frequent multi-year ice, and some have also been observed traveling long distances in-land between ocean bays (Joint Secretariat 2015). Within each of these ice ecoregions, the productivity of Polar Bear habitat is closely linked to the physical attributes of sea ice and the density and distribution of ice-dependent seals, especially ringed seals (*Pusa hispida*) (Stirling et al. 1997; Stirling 2002; Pilfold et al. 2015).

The relationship between Polar Bears, sea ice, and prey (primarily ringed and bearded seals) is extremely complex, involving ice conditions, type (such as multi-year and annual ice, and local conditions like pressure ridges, open leads, and rubble ice), thickness, and location (SARC 2021). Polar Bear locations, body condition, and productivity are closely and complexly related to ice conditions, ocean productivity, and seals, and they must be understood in the context of large interannual variation (SARC 2021).

For additional information pertaining to the biology, ecological role and habitat needs of the Polar Bear, please refer to Parts 2 – 7 of this Management Plan.

4. Threats

4.1 Threat Assessment

The Polar Bear threat assessment is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system. Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational). Limiting factors are not considered during this assessment process. In this threat assessment, only present and future threats (over the next 10 years) are considered. Historical threats, indirect or cumulative effects of the threats, or any other relevant information that would help understand the nature of the threats are presented in the Description of Threats section.

The threat assessment for Polar Bear (below) was conducted in April 2018, and was led by COSEWIC. Polar Bear co-management partners (e.g. federal, provincial and territorial governments, Wildlife Management Boards/Advisory Councils, Indigenous governments, Indigenous organizations, and University researchers) throughout Canada were represented. The threat assessment pertains to the single Polar Bear Designatable Unit in Canada, as defined by COSEWIC, and was developed using the best available information.

Table 4. Threat calculator assessment[10].

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
1	Residential & Commercial Development	Negligible	Negligible (<1%)	Extreme (71-100%)	High (Continuing)
1.1	Housing & Urban areas	Negligible	Negligible (<1%)	Extreme (71-100%)	High (Continuing)

[10] This threat calculator assessment is taken directly from the 2018 In-Press COSEWIC Assessment and Status Report on the Polar Bear *Ursus maritimus* in Canada.

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
1.2	Commercial & Industrial areas	Negligible	Negligible (<1%)	Extreme (71-100%)	Insignificant/Negligible (past or no direct effect)
3	Energy Production & Mining	Negligible	Negligible (<1%)	Extreme (71-100%)	Low (possibly in the long term, >10 years/3 generations)
3.1	Oil & Gas Drilling	Negligible	Negligible (<1%)	Extreme (71-100%)	Low (possibly in the long term, >10 years/3 generations)
3.2	Mining & Quarrying	Negligible	Negligible (<1%)	Extreme (71-100%)	Low (Possibly in the long term, >10 years/3 generations)
4	Transportation & Service Corridors	Negligible	Small (1-10%)	Negligible (<1%)	Moderate (possibly in the short term, <10 years/3 generations)
4.1	Roads & Railroads	Negligible	Negligible (<1%)	Negligible (<1%)	Low (Possibly in the long term, >10 years/3 generations)
4.2	Utility & Service Lines	Negligible	Negligible (<1%)	Negligible (<1%)	Insignificant/ Negligible (Past or no direct effect)
4.3	Shipping Lanes	Negligible	Small (1 – 10%)	Negligible (<1%)	Moderate (Possibly in the short term, < 10 years/3 generations)
4.4	Flight Paths	Not a Threat	Negligible (<1%)	Neutral or Potential Benefit	High (Continuing)
5	Biological Resource Use	Low	Pervasive (71-100%)	Slight (1-10%)	High (continuing)
5.1	Hunting & Collecting Terrestrial animals	Low	Pervasive (71-100%)	Slight (1-10%)	High (Continuing)
6	Human Intrusions & Disturbance	Negligible	Restricted (11-30%)	Negligible (<1%)	High (continuing)
6.1	Recreational Activities	Negligible	Small (1 – 10%)	Negligible (<1%)	High (Continuing)
6.2	War, Civil Unrest, & Military Exercises	Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)
6.3	Work & Other Activities	Negligible	Restricted (11 – 30%)	Negligible (<1%)	High (Continuing)

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
7	Natural System Modifications	Unknown	Small (1 – 10%)	Unknown	High (continuing)
7.1	Fire & Fire Suppression	Not a threat	Negligible (<1%)	Neutral or Potential Benefit	High (Continuing)
7.2	Dams & Water Management/Use	Not a threat	Negligible (<1%)	Neutral or Potential Benefit	Low (Possibly in the long term, >10 years/3 generations)
7.3	Other Ecosystem Modifications	Unknown	Small (1 – 10%)	Unknown	High (Continuing)
8	Invasive & Other Problematic Species & Genes	Unknown	Pervasive – Large (31-100%)	Unknown	High (Continuing)
8.1	Invasive Non-Native/Alien Species	Unknown	Unknown	Unknown	High (Continuing)
8.2	Problematic Native Species/Diseases	Unknown	Pervasive – Large (31 – 100%)	Unknown	High (Continuing)
8.3	Introduced Genetic Material	Negligible	Small (1 – 10%)	Negligible (<1%)	High (Continuing)
9	Pollution	Low	Pervasive (71-100%)	Slight (1-10%)	High (Continuing)
9.1	Domestic & Urban Waste Water	Negligible	Negligible (<1%)	Unknown	High (Continuing)
9.2	Industrial & Military Effluents	Unknown	Small (1 – 10%)	Unknown	High (Continuing)
9.3	Agricultural & Forestry Effluents	Negligible	Negligible (<1%)	Unknown	High (Continuing)
9.4	Garbage & Solid Waste	Negligible	Small (1-10%)	Negligible (<1%)	High (Continuing)
9.5	Air-Borne Pollutants	Low	Pervasive (71 – 100%)	Slight (1-10%)	High (Continuing)
10	Geological Events	Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)
10.3	Avalanches/Landslides	Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
11	Climate Change & Severe Weather	High	Pervasive (71-100%)	Serious (31-70%)	High (Continuing)
11.1	Habitat Shifting & Alteration	High	Pervasive (71 – 100%)	Serious (31-70%)	High (Continuing)
11.2	Droughts	Negligible	Negligible (<1%)	Unknown	Low (Possibly in the long term, >10 years/3 generations)
11.3	Temperature Extremes	Unknown	Small (1 – 10%)	Unknown	High (Continuing)
11.4	Storms & Flooding	Unknown	Unknown	Unknown	High – Low
11.5	Other Impacts	Unknown	Unknown	Unknown	Unknown

[a] **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

[b] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

[c] **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

[d] **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

4.2 Description of Threats

The information in section 4.2 is based on the "Threats" section of the COSEWIC Assessment and Status Report on the Polar Bear, which was published in fall 2019. For more information on Threats to Polar Bears in Canada, refer to parts 2 – 7 of this Management Plan.

The primary threats to Polar Bear in Canada include the following:

High Threat Categories:

Climate Change and Severe Weather (IUCN/CMP Threat # 11.1 – Habitat Shifting and Alteration):

The most significant threat facing the Canadian and global Polar Bear population is sea ice habitat loss resulting from increased atmospheric temperatures caused by global greenhouse gas emissions (Tynan and DeMaster 1997; Derocher et al. 2004; Laidre et al. 2008; Kovacs et al. 2010; IPCC 2013). Over the past 40 years, data from satellites have shown a decrease in arctic sea ice cover which is unparalleled in the past 150 years (Derksen et al. 2019). Inuvialuit Knowledge holders have observed intensifying effects of climate change on the ocean and weather since the 1980s. The forecasted continuation of these changes will result in sea ice habitat loss, likely leading to direct and indirect negative effects on Polar Bear body condition, adult and cub survival rates, reproductive success, distribution and abundance of prey, contaminant transfer, and habitat fragmentation (COSEWIC 2018). For example, declines in the recruitment of Ringed Seals (the primary prey of Polar Bears in many areas) have been noted and linked to warmer temperatures and decreasing snow depth (Ferguson et al. 2005). Declines in distribution and abundance of Ringed Seals will likely impact the ability of Polar Bears to harvest their primary prey (Stirling and Øritsland 1995; Hart and Amos 2004; Keith 2005; Joint Secretariat 2015; York *et al.* 2015).

Negative impacts of sea ice habitat loss have been recorded in several subpopulations, though considerable regional variability exists (Derksen et al. 2019). Based on current trends, it is expected that greenhouse gas emissions will continue to increase, leading to a decrease in sea ice habitat (Stern and Laidre 2016; Wiig et al. 2015). For example, in the Arctic Ocean, a substantial portion of the multiyear ice, which traditionally lasts for at least one complete summer melt season, has been replaced by seasonal first-year ice, the entirety of which melts during the summer (Derksen et al. 2019). Though climate change is widely believed to lead to decreased habitat availability for Polar Bears, some have hypothesized that areas in Canada's far north which are currently covered in thick multiyear ice may gradually convert to a largely seasonal/annual ice cover (Derocher et al. 2004). Sunlight is able to penetrate seasonal/annual ice to a larger extent than multiyear ice, and increased sunlight is likely to lead to greater biological productivity in the far north. Some research suggests that this conversion from multiyear ice to seasonal/annual ice cover may facilitate the development of conditions that are more suitable for Polar Bears than are currently present in northern subpopulations (Derocher et al. 2004; Stirling and Derocher 2012). In particular, an increase in the primary productivity of an ecosystem can lead to the formation of better ice habitat for Ringed Seals and other Polar Bear prey (Kingsley et al. 1985; Derocher et al. 2004; Arrigo et al. 2008; Barber et al. 2015). Some Indigenous Knowledge holders have indicated that a transition from multiyear ice to annual ice may benefit Polar Bears because annual ice provides better seal hunting platforms. Others suggest that Polar Bears may move north to follow multiyear ice (SARC 2021). Subpopulations with high proportions of multiyear sea ice, such as Norwegian

Bay, M'Clintock Channel, and Lancaster Sound, may eventually experience this gradual shift from multiyear ice to a largely annual/seasonal ice cover (Stirling and Derocher 2012). This is further discussed below.

In seasonal ice environments, Polar Bears accumulate fat reserves to survive the ice-free season fasting period, and pregnant female Polar Bears must reach a body mass sufficient to sustain their survival during winter denning and lactation periods (Watts and Hansen 1987; Atkinson and Ramsay 1995; Robbins et al. 2012). During the spring hyperphagic[11] period, Polar Bears forage in an effort to gain weight and improve body condition (Molnár et al. 2010, 2014; Pilfold et al. 2016a). However, during the ice-free season, research in Hudson Bay found that fasting adult males held at the Churchill holding facility experienced a median weight loss of approximately 1 kilogram per day (Pilfold et al. 2016a). These findings aligned with observations on fasting free-ranging bears on land (Atkinson et al. 1996, Polischuk et al. 2002). If foraging time is decreased as a result of sea ice loss due to climate change, this may lead to declines in body condition, which may affect Polar Bear survivorship, reproduction and abundance (Stirling and Archibald 1977; Stirling and Øritsland 1995; Stirling et al. 1999). Recent research on the Baffin Bay subpopulation supports this concern. Earlier spring retreat of sea ice and later reform in the fall has resulted in an extended ice-free season, which led Polar Bears in the Baffin Bay subpopulation to spend at least 30 more days on land between 2009 and 2015, as compared to the amount of time spent on land between 1991 and 1997. This extended ice-free season has also been associated with a corresponding reduction in body size and reproductive success among the Baffin Bay subpopulation (Laidre et al. 2020). However, Indigenous Knowledge holders have noted that despite significant changes in habitat conditions due to climate change, the impact of sea ice loss on Polar Bears is unclear, given the complexity of sea ice habitat (SARC 2021). Ice conditions are fundamentally important and are changing Polar Bear movements and range, but population and body condition have been observed to be stable over time in the Northern and Southern Beaufort Sea, notwithstanding considerable variation between seasons and years (JS 2015).

One empirical effect of climate change in arctic marine ecosystems has been the gradual replacement of multiyear ice with seasonal/annual sea ice, which melts completely during summer (Derksen et al. 2019). As discussed above, a transition from multiyear ice to predominantly seasonal/annual sea ice may lead to an increase in primary productivity and improved sea ice habitat. If this hypothesis is correct, it is reasonable to suggest that this change will, at least initially, benefit Polar Bears in subpopulations with high proportions of multiyear ice (Stirling and Derocher 2012). However, considerable uncertainty surrounds the ecological ramifications of the gradual replacement of multiyear ice with seasonal/annual sea ice in arctic ecosystems (COSEWIC 2018). Indigenous Knowledge is an excellent source of information on changes in Polar Bear distribution and feeding habits, and should be utilized to help determine the implications of such changes on Polar Bears. Over the long term, if sea ice loss continues, scientific evidence suggests that negative impacts are expected as outlined above.

[11] A period of excessive food consumption (COSEWIC 2018).

If sea ice becomes increasingly fragmented due to climate change, the temporal and spatial distribution of Polar Bear habitat may become compromised (Sahanatien and Derocher 2012). If climate change leads to a loss of multiyear sea ice, it is hypothesized that the fidelity that some Polar Bears have shown to some specific regions may be disrupted (Schweinsburg and Lee 1982; Schweinsburg et al. 1982; Taylor et al. 2001). Changes in sea ice distribution and break-up timing can separate Polar Bears from important habitat such as the receding multiyear sea ice front, summer retreat habitat, and traditional denning areas in the spring and summer (COSEWIC 2018), and can delay Polar Bears from returning to sea ice in the fall/winter (Derocher et al. 2004; Durner et al. 2011; Pagano et al. 2012; Stirling and Derocher 2012; Laidre et al. 2020). In the Baffin Bay subpopulation, for example, it is hypothesized that sea ice loss is associated with seasonal range contraction (Laidre et al. 2008). Furthermore, Polar Bears have been observed to undertake more energy intensive long distance swims due to increased distance between pack and landfast ice, or as a result of sea ice fragmentation (Monnett and Gleason 2006; Molnár et al. 2007; Durner et al. 2011; Pagano et al. 2012; Pilfold et al. 2016b). The energetic demands created by long-distance swims may be a contributing factor to Polar Bear mortality, though there are currently no known cases of Polar Bear mortality occurring as a direct result of drowning (Pagano et. al 2012). Mating opportunities (Molnár et al. 2007; Molnár et al. 2008) and access to foraging areas may also be reduced as a result of a loss of spatial connectivity of sea ice in the spring (COSEWIC 2018). Indigenous Knowledge holders have also noted changes in Polar Bear distribution, movements, and local abundance over time related to ice and weather conditions (SARC 2021). Because sea ice habitat is often naturally fragmented, it is important for Polar Bears to be able to swim long distances (Slavik et al. 2009). However, changes in sea ice habitat may put stress on their adaptability with potential impacts on their health and diet, range and movements (SARC 2021).

It is known that Polar Bears rely on the presence of sea ice platforms to enable them to capture their primary prey (i.e. ringed seals) (Stern and Laidre 2016), however, more research is needed to fully understand the impacts of climate change on Polar Bears, and the extent to which climate change will amplify the other threats listed below. For example, while it has been hypothesized that Polar Bears may be able to adapt to a changing climate by shifting their diet to terrestrial-based food sources (COSEWIC 2018), considerable uncertainty exists surrounding the ability of Polar Bears to compensate for diminished access to marine food sources in this manner (Rode et al. 2015; Sciullo et al. 2016).

Given the unpredictable and variable nature of Polar Bear habitat, as well as the intelligence and adaptability of Polar Bears themselves, Indigenous Knowledge holders have emphasized the need for humility in understanding Polar Bears and their habitat, and the importance of not speculating about the future (Joint Secretariat 2015).

For more information on climate change-related initiatives being led by Environment and Climate Change Canada, please refer to the Broad Strategies, section 6. More information on climate change-related initiatives being led by provinces and territories can be found in parts 2 – 7 of this Management Plan.

Low Threat Categories:

Biological Resource Use (IUCN/CMP Threat # 5.1 – Hunting and Gathering Terrestrial Animals):

Polar Bear harvest is a legally-protected right of Indigenous people in Canada. In areas where Canada has concluded modern Land Claims Agreements, Polar Bear harvest quotas are determined or recommended by Wildlife Management Boards or Advisory Councils that include representatives from the Government of Canada, provincial or territorial governments, and Indigenous organizations/governments. Total Allowable Harvest levels (or harvest quotas) are currently in place throughout Nunavut, the Inuvialuit Settlement Region (Yukon and Northwest Territories) and Nunatsiavut (Newfoundland and Labrador) to manage for sustainable harvest. Within the Nunavik Marine Region and an overlap area between the Nunavik Marine Region and Eeyou Marine Region, which is offshore from Québec, a harvest quota has been established by the Government of Canada and the Government of Nunavut for the Southern Hudson Bay subpopulation. In mainland (onshore) areas of Ontario, Manitoba and Québec, harvest management falls under the jurisdiction of the respective provinces. In Ontario, Treaty 9 does not set out a process for cooperative federal-provincial-Indigenous harvest management, and Indigenous implementation of provincial harvest limits is voluntary. In Manitoba, provincial legislation does not permit the harvesting of Polar Bear. In Québec, the James Bay and Northern Québec Agreement (JBNQA) sets out a guaranteed harvest level for subsistence requirements, subject to the principles of conservation.

Guided sport hunting is permitted in Nunavut and the Inuvialuit Settlement Region (ISR), via transfer of exclusive right, and in both jurisdictions local hunting and trapping organizations decide if they wish to allocate a portion of the quota to this practice. Guided sport hunting is closely regulated by Inuit communities and is part of the harvest management system mentioned above. In both jurisdictions, guided sport hunts must be conducted using traditional methods, including the use of dog sled teams as a means of transportation. In both jurisdictions, if a Polar Bear is successfully harvested, it counts against the quota. Therefore, the total number of Polar Bears that may be harvested as a result of guided sport hunting does not increase the overall harvest. Additionally, in the Inuvialuit Settlement Region, once a tag is provided to a guided hunt it cannot be reused, whether or not the hunt was successful (Joint Secretariat 2017).

Other human-induced Polar Bear mortality can include defense of life and property kills and humane kills. The frequency of defense of life and property kills generally increases during the ice-free season when Polar Bears are on land (McDonald et al. 1997; Makivik Corporation 2001; Stirling and Parkinson 2006; Dowsley 2007; Dowsley and Wenzel 2008; Canadian Wildlife Service 2009; Nirlungayuk and Lee 2009; Towns et al. 2009; Henri 2010, 2012; Kotierk 2010; Lemelin et al. 2010; Clark et al. 2012). A number of different factors have the potential to increase the frequency of defense kills. Some of these factors include the increasing length of time Polar Bears spend on land due to longer ice-free seasons, increased Polar Bear-human interaction, bears coming off the sea ice in poor body condition, increasing human activity (e.g. growing communities, camps, tourism, mineral exploration and development, oil and gas industry, research activity) in Polar Bear habitat, and greater amounts of garbage and carcasses to attract bears (Stenhouse et al. 1988; Stirling et al. 1999; Derocher et al. 2004; Dyck 2006; Schliebe et al. 2008). In areas where quotas exist, defense of life and property kills are usually taken out of the total allowable harvest of that area. When a Polar Bear is sick or injured, the usual practice is for a Conservation Officer to carry out a humane kill. Unlike defense of life and property kills, humane kills are usually not taken out of the total allowable harvest for the area where the humane kill occurs (Government of Nunavut 2018). The exception to this is within the ISR, where humane kills are taken out of the total allowable harvest.

From the 2014-2015 season to the 2018-2019 season, the average number of human-caused mortalities (including harvest, defense kills, mortalities due to research), and mortalities due to other human activity (such as a Polar Bear being struck by a vehicle, or a ship) of Polar Bears within Canadian subpopulations (and subpopulations shared with other countries) was approximately 519.3 annually.

Canada has had a strong adaptive management system in place for Polar Bears for decades (PBAC 2011). This management system is based on conservation principles and Indigenous harvesting rights (PBAC 2011). It is an ongoing and dynamic collaboration between partners involved in Polar Bear management in Canada. Polar Bear harvest systems vary by jurisdiction, and are described in Parts 2 – 7 of this document.

Polar Bears face naturally limiting factors, such as low reproductive rates due to delayed maturity, small litter sizes, 2-3 years of maternal dependency, and high cub mortality (Bunnell and Tait 1981). While the number of Polar Bears harvested in Canada each year is typically well below the Total Allowable Harvest on a national scale, if harvest and other sources of human-induced mortality are not properly managed, these naturally limiting factors may contribute to population declines (COSEWIC 2018).

For more information on polar bear harvest management, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

Pollution (IUCN/CMP Threat # 9.1 – Domestic & Urban Waste Water; IUCN/CMP Threat # 9.2 – Industrial & Military Effluents; IUCN/CMP Threat # 9.4 – Garbage & Solid Waste; IUCN/CMP Threat # 9.5 – Air-Borne Pollutants):

Apex predators, including Polar Bears, are often exposed to high levels of organic and inorganic pollutants due to the fact that the pollutants bioaccumulate in the marine food web (AMAP 2017). Polar Bears' reliance on a high-fat diet of marine species increases their indirect exposure to chlorinated, brominated, and fluorinated compounds[12], and heavy metals (AMAP 2017). Most of these pollutants originate in industrialized areas of the world and are transported to arctic marine ecosystems (Bard 1999), though some are currently sequestered in glaciers and permafrost and may be released as atmospheric temperatures rise (Schuster et al. 2018).

Pollution levels, types of pollutants (i.e. organic vs inorganic), and temporal patterns in pollutant levels vary across Polar Bear subpopulations (Norstrom et al. 1998; Dietz et al. 2006; Letcher et al. 2010, 2018). Some research has shown that pollutants affect Polar Bears' sex steroids, thyroid levels, vitamins, growth and development, liver and renal histopathology, reproductive organs, central nervous system toxicity, bone density, immune system function, carcinogenicity, and reproductive performance (e.g., McKinney et al. 2010; Sonne 2010; Sonne et al. 2011; Dietz et al. 2015; Gabrielsen et al. 2015). There is concern that lactating female Polar Bears may transfer pollutants to their offspring through their milk (Polischuk et al. 2002; Bytingsvik et al. 2012; Jenssen et al. 2015).

Correlative studies have found relationships between biological processes (e.g., hormone level, bone density) and pollution quantity at the individual level (Sonne 2010). Generally, it is difficult to demonstrate that pollutants cause population level declines (Jenssen et al. 2015). However, one study documented high enough concentrations of PCB, DDT, etc. in archived tissue samples from Svalbard to conclude that toxins likely limited the growth of the Polar Bear population that was expected after a prohibition on Polar Bear hunting was implemented (Derocher et al. 2003).

It has been hypothesized that as sea ice melts, Polar Bears will increasingly seek terrestrial food sources (Gormezano et al. 2013), and in doing so may wander into human settlements where they may come into contact with and ingest plastics. More research is needed on the effects of plastics on Polar Bears (Orihel et al. 2019). Both scientific research and Indigenous Knowledge have identified the presence of plastics in Polar Bear scat (Gormezano et al. 2013; Toth 2019) and in the stomachs of harvested Polar Bears (Iversen et al. 2013; Toth 2019). However, the intention of these studies was not to focus on the quantity of plastics in Polar Bear stomachs or scat. Additional scientific and Indigenous Knowledge research is required to determine whether increased exposure of Polar Bears to plastics will have a population-level impact on the species. For more information on polar bears and pollution, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

<u>Negligible Threat Categories:</u>

[12] Chlorinated, brominated and fluorinated compounds primarily originate from industrial and agricultural activities south of the arctic, and are transported to the arctic by air and ocean currents and river outflows (Routti et al. 2019).

Energy Production and Mining (IUCN/CMP Threat # 3.1 – Oil & Gas Drilling; IUCN/CMP Threat # 3.2 – Mining & Quarrying):

Human activity involving exploration for energy and minerals has been occurring in the arctic since the mid-1960s (COSEWIC 2018). Oil and fuel spills have the potential for mortality and disturbance of Polar Bears (Stirling et al. 1990; Hurst et al. 1991; Durner et al. 2000; Arctic Council 2009). Some studies have shown that Polar Bears may experience an inability to effectively thermoregulate if their fur is oiled. Organ failure and death can occur if Polar Bears ingest oil by grooming or eating contaminated prey (Stirling et al. 1990; Hurst et al. 1991; Durner et al. 2000; Arctic Council 2009). Maternity den disturbance also may occur, and negative impacts to Polar Bear prey (such as seals) have occurred as direct result of oil and fuel spills (COSEWIC 2018). No major spills have occurred to date in areas where Polar Bear inhabit, and this may be partially attributable to the relative inaccessibility of the Northwest Passage in its current state. There is, however, potential for significant ecological consequences if a large spill does occur, as current infrastructure and capacity for handling large spills is limited in the Canadian arctic (COSEWIC 2018). In the event that wildlife is exposed to spills of hazardous chemicals, such as hydrocarbons, there are no facilities available for decontamination (COSEWIC 2018). The Government of Canada is currently undertaking initiatives to mitigate the negative ecological consequences of potential future oil and fuel spills (Transport Canada 2018a). For example, $1.5 billion has been invested in Canada's Oceans Protections Plan with the goal of protecting Canada's coasts and waterways. In particular, $161 million of that $1.5 billion investment will help achieve greater marine protection for Canada's arctic, through initiatives such as expanding the National Aerial Surveillance Program to detect oil spills in the arctic (Transport Canada 2018b).

Large oil and gas reserves occur within the Norwegian Bay, Davis Strait, Baffin Bay, Lancaster Sound, Viscount Melville Sound, and Southern and Northern Beaufort Sea subpopulations (Chen et al. 2004; Gautier et al. 2009). In the past, these reserves were not exploited because of their northern location and the challenging environments in which they occur. However, environmental change is likely to facilitate greater industrial access to oil and gas reserves, leading to an increase in industrial activities in the arctic (Prowse et al. 2009). Increasing exploration, seismic activity and development is occurring in the Davis Strait subpopulation (CNLOPB 2018), though the majority occurs in the Greenland portion of the Davis Strait subpopulation. The Lancaster Sound subpopulation is an exception to this, as a large portion of this subpopulation is covered by the Tallurutiup Imanga National Marine Conservation Area. No oil or gas extraction is permitted within National Marine Conservation Areas (Parks Canada 2018a).

Intense mineral exploration occurs across much of the Canadian arctic within the range of Polar Bears in the Northwest Territories, Nunavut, Québec and Labrador (COSEWIC 2018). Polar Bears can be displaced from terrestrial ice-free season refuge and denning habitat by construction of mines (Amstrup 1993; Linnell et al. 2000; Atatahak and Banci 2001; Dyck and Baydack 2004; Keith 2005; Slavik 2010, 2013), and if year-round shipping occurs in association with mining operations, displacement from marine habitat is also possible (COSEWIC 2018). The construction of mines and associated year-round shipping are both subject to approval via the processes set out in the applicable Land Claims Agreements.

For more information on polar bears and energy production and mining, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

Transportation and Service Corridors (IUCN/CMP Threat # 4.3 – Shipping and Shipping Lanes):

Over the past 10 years, the amount of shipping activity in Canadian arctic waters has increased (Derksen et al. 2019). Disturbance and the potential for shipping accidents associated with increasing levels of shipping activity in the arctic, including community re-supply, industrial shipping and tourism, present increasing threats to Polar Bears (PBAC 2011).

Construction of new ports and year-round shipping requiring ice-breaking could lead to the displacement of Polar Bears from marine foraging habitat, and may negatively affect Polar Bear prey species (i.e. seal species) (Blix and Lentfer 1992; Slavik 2010, 2013; Canadian Wildlife Service 2009). Ice-breaking in the Northwest Passage would enable arctic shipping routes to open by mid-century and container ship traffic would likely increase as a result (COSEWIC 2018; Smith and Stephenson 2013).

For more information on polar bears and transportation and service corridors, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

Human Intrusions and Disturbance (IUCN/CMP Threat # 6.1 – Recreational Activities; IUCN/CMP Threat # 6.3 – Work & Other activities):

The impacts of tourism on Polar Bears are largely unknown (Prestrud and Stirling 1994; Dyck and Baydack 2004; Lemelin 2006; Andersen and Aars 2008). In one study, managers, tour operators, community members, and scientists who were interviewed expressed a general consensus that <10% of the Polar Bear population in Canada is exposed to most types of recreation, including tourism (Rode et al. 2018), though this is an approximation. Polar Bear viewing tourism occurs in Manitoba, Nunavut, Northwest Territories, Ontario, the Nunavik Marine Region, the Eeyou Marine Region, and Labrador (COSEWIC 2018), though concerns exist that viewing bears in the wild displaces them from terrestrial and sea ice habitats and may cause habituation that will create changes in behaviour leading to more human-bear conflict (Tetlichi et al. 2004; Nirlungayuk and Lee 2009). Increased interaction between humans and Polar Bear is already occurring in northern communities (Government of Nunavut 2018). Further human-bear conflicts may arise in the future as anthropogenic activities, such as tourism, increase. Human-bear conflicts have resulted in the destruction of property, danger to humans, danger to bears due to human-caused harassment, and bear mortality in defense of life or property (Government of Nunavut, 2018).

As cruise ship traffic and interest in visiting Polar Bear dens (particularly in the Churchill, Manitoba area) increases, there is a growing need for more research on the impact(s) of human intrusions and disturbance on Polar Bears.

For more information on polar bears and human intrusions and disturbance, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

<u>Unknown Threat Categories:</u>

Invasive and Other Problematic Species and Genes (IUCN/CMP Threat # 8.1 – Invasive Non-Native/Alien Species/Diseases):

As climate change causes warming temperatures, and shifts in the distribution of some species, novel pathogens (i.e. pathogens that do not traditionally occur in a given area) may enter the arctic ecosystem (Burek et al. 2008; Kutz et al. 2013), where Polar Bears may come into contact with them. Recent research suggests that several pathogens are already increasing in prevalence at the southern limit of the Polar Bears range (Pilfold et al. 2021). Further, existing pathogens, which have not caused substantial challenges for Polar Bears in the past, could become a significant mortality factor for Polar Bears, or they may reduce productivity on individual bears that are physiologically stressed (Patyk et al. 2015). This threat should be further investigated, as its impact on Polar Bears is unknown, though some research suggests that Polar Bears may have a relatively low immunity to pathogens because they have evolved in a harsh environment that limits parasite richness (Weber et al. 2013).

An increase in some native species, such as Brown Bears, onto sea ice habitat due to climate change may threaten Polar Bears due to increased interspecific conflict between the species (Joint Secretariat 2015; Miller et al. 2015).

For more information on polar bears and invasive and other problematic species and genes, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

Natural System Modifications (IUCN/CMP Threat # 7.3 – Other Ecosystem Modifications):

While there are many unknowns regarding the impacts of natural system modifications on Polar Bears, concerns exist regarding potential biotic and abiotic ecosystem changes. Some examples of potential biotic changes include alterations in Polar Bears' prey dynamics and prey capture rates due to sea ice changes (Derocher et al. 2004), population-level impacts on seals resulting from commercial fisheries (DeMaster et al. 2001), or indirectly through decreased availability of ringed seals as prey (Bradley et al. 2005; Cattet et al. 2004), a potential increase in seal predation by Orcas (COSEWIC 2018), and an increase in Bowhead Whale carcass availability to Polar Bears as a result of increasing Bowhead Whale predation by Orcas (Galicia et al. 2016).

Two examples of potential abiotic changes include ecosystem changes resulting from altered fresh water inputs from Hudson Bay dams (Barber 2015), and altered water flows (impacts of water diversion) affecting freeze-up in Southern Hudson Bay (COSEWIC 2018). Some concern also exists in regards to the threat of future hydro development projects in Labrador (COSEWIC 2018). Hydro dams can release freshwater onto sea ice, and this may lead to various changes in sea ice dynamics with potential negative implications for Polar Bears (Laforest et al. 2018; NMRWB 2018). The threat to Polar Bears is not the construction of the dams, but the impact that freshwater outputs from the dams can have on sea ice.
More research is needed to clarify the severity of Natural System Modifications as a threat to Polar Bears.

For more information on polar bears and natural system modifications, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

5. Management Objective

The management objective for Polar Bear is to maintain the resilience, redundance and representation of the population in the species' known range in Canada.

The above management objective pertains to the single Polar Bear Designatable Unit in Canada, as defined by COSEWIC. The management objective recognizes the ecological and cultural importance of the Polar Bear in Canada. Achieving this management objective will help ensure that the species meets its life history[13] requirements and will help provide sustainable harvest opportunities to current and future generations of Indigenous rights holders.

Resilience, as used in the above management objective, is the ability of a species to recover after a perturbation. In order to ensure the resilience of the Canadian Polar Bear population, sufficient genetic diversity, health, and subpopulation abundance above minimum viability thresholds must be maintained such that the Canadian Polar Bear population is resilient enough to be able to withstand catastrophic events (e.g. new diseases, natural disasters, etc.), rebound from disturbance, and Indigenous rights holders continue to have harvest opportunities. If the

[13] A species' life history is its pattern of survival and reproduction, along with the traits that directly affect survival and the timing or amount of reproduction (Fox and Messina 2013).

Canadian Polar Bear population maintains resilience, it will be more capable of rebounding from disturbance or perturbations (such as over harvest, oil spills, a disease outbreak, etc.).

Redundance, as used in the above management objective, is the presence of multiple and widespread subpopulations of a species that enables the species' long-term persistence in the face of ecological and environmental change occurring in specific locations. On the national and international scale, the Canadian Polar Bear population is managed as a single Designatable Unit. On the jurisdictional scale, Polar Bear is managed on the basis of the 14 subpopulations that occur across seven provinces and territories in Canada. The species is more likely to persist over the long term if all 14 subpopulations persist.

Representation, as used in the above management objective, refers to the occurrence of Polar Bear in a range of ecosystem types (refer to section 3 for more information about ecosystem types), the extent of genetic diversity that the species possesses, and the species' overall ability to withstand environmental change. Maintaining Polar Bears across their present range in these habitats is a vital component of ensuring sufficient representation. There are some unknowns regarding how sea ice conditions will change across the Canadian Arctic, and the capacity of Polar Bears to adapt over time; see section 4.2 Description of Threats (Climate Change and Severe Weather (IUCN/CMP Threat # 11.1 – Habitat Shifting and Alteration) for additional information .

Polar Bear management objectives for each of the 14 subpopulations, which have been identified by the relevant jurisdictional authorities, are described in Parts 2-7 of this document.

6. Broad Strategies and Management Actions

6.1 Actions Already Completed or Currently Underway

Conservation and Management of the Polar Bear and its habitat in Canada:

In 2011, Environment and Climate Change Canada worked closely with the PBAC to publish the National Polar Bear Conservation Strategy for Canada. This strategy was developed by the PBAC and its purpose was to guide Polar Bear co-management activities by partners across Canada, including federal, provincial and territorial governments, Wildlife Management Boards/Advisory Councils, and Indigenous organizations. It contains over-arching objectives aimed at promoting coordination and providing guidance for Polar Bear management and conservation of actions across jurisdictions, and with co-management partners within Canada. There are also a series of annexes that provide an overview of how Canada's Polar Bear co-management partners manage key conservation threats and challenges. The strategy was completed before the Polar Bear was listed as a species of special concern under the SARA, and was not intended to fulfill the legislative requirement for a Management Plan.

The PBAC provides a forum for provincial, territorial and federal governments, as well as Indigenous organizations and Wildlife Management Boards/Advisory Councils, to work together to manage Polar Bears in Canada (Lunn et al. 2002), and to ensure that Canada fulfills its obligations to the *Agreement on the Conservation of Polar Bears* (1973). In particular, the PBAC provides input, advice and recommendations to the relevant management authorities regarding research, monitoring, and management requirements and initiatives, to help ensure the conservation and management of Polar Bears in Canada, as well as to help facilitate cooperation and coordination between jurisdictions in Canada. The Polar Bear Technical Committee (PBTC) provides a forum for technical experts to share and discuss information and advice among themselves. That information and advice is then reported back to the PBAC. In particular, the PBTC supports the PBAC by reviewing scientific research and Indigenous Knowledge and providing an annual status assessment of the 14 Polar Bear subpopulations in Canada. The status assessment is updated when new information about one or more subpopulations becomes available. The PBTC includes representatives from each jurisdiction in Canada where Polar Bears are found, as well as representatives from Wildlife Management Boards or Advisory Councils and Land Claim organizations. The information provided in the PBTC's annual status assessment table helps facilitate the adaptive management of Polar Bear in Canada by providing management authorities with the latest information related to the status of Canada's Polar Bear subpopulations.

Climate change is the largest threat facing Polar Bears (COSEWIC 2018), and Canada is undertaking several initiatives to address the impacts of climate change (ECCC 2016). For example, Environment and Climate Change Canada worked collaboratively with provinces and territories to develop the Pan-Canadian Framework on Clean Growth and Climate Change, which was published in 2016 and can be accessed at: http://publications.gc.ca/site/eng/9.828774/publication.html. The framework's goal is to enable Canada to meet its 2030 target for reducing emissions as agreed to in the Paris Agreement during the 2015 United Nations Framework Convention on Climate Change. In April 2021, Canada updated its emissions reduction target under the Paris Agreement on climate change to 40-45% below 2005 levels, by 2030 (Office of the Prime Minister, 2021). Future work is required to implement the measures to reduce greenhouse gas emissions as specified in the Pan-Canadian Framework on Clean Growth and Climate Change (ECCC 2016). In addition, Environment and Climate Change Canada provides support to Indigenous partners to implement climate change strategies, such as the National Inuit Climate Change Strategy (ECCC 2019b). Most of Canada's provinces and territories have also produced climate change strategies. More information is available on provincial and territorial websites.
Total Allowable Harvest levels are in place throughout Nunavut, the Inuvialuit Settlement Region (Yukon and Northwest Territories) and Nunatsiavut (Newfoundland and Labrador). In the aforementioned areas, Canada has concluded modern treaty agreements, and removal levels are determined or recommended by Wildlife Management Boards or Advisory Councils. Wildlife Management Board and Advisory Council decisions and recommendations are generally given effect by provincial and territorial government authorities, who accept, reject or vary the decisions/recommendations, and implement them using provincial and territorial legislation. Within the Nunavik Marine Region and an overlap area between the Nunavik

Marine Region and Eeyou Marine Region (offshore from Québec), a harvest quota has been established by the Government of Canada and the Government of Nunavut for the Southern Hudson Bay subpopulation. The management of Polar Bears harvested onshore in Ontario, Manitoba and Québec falls under provincial jurisdiction. Harvest management systems within Canada's subnational jurisdictions are further described in Parts 2 – 7 of this Management Plan, where applicable.

In 1991, Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC; formerly Indian and Northern Affairs Canada) established the Northern Contaminants Program (NCP) in response to concerns about human exposure to elevated levels of contaminants in wildlife species (such as the Polar Bear) that are important to the traditional diets of northern Indigenous peoples (Government of Canada 2019). The NCP, in collaboration with regional health authorities, regularly reports information about contaminants so consumers of traditional/country foods can make informed decisions (Government of Canada 2019).

The Impact Assessment Agency of Canada (IAAC; formerly the Canadian Environmental Impact Assessment Agency) is the federal agency responsible for administering the *Impact Assessment Act* (IAA). The IAA requires that projects which may have an adverse impact on the environment undergo an environmental assessment to minimize or avoid adverse environmental effects before they occur, and incorporate environmental factors into decision making (IAA 2018). In areas where Land Claim Agreements are in place, the potential adverse impacts of proposed projects can also be assessed by Impact Review Boards (IRBs) (ECCC 2018a). IRBs are established under Land Claim Agreements and their role is to conduct environmental assessments on proposed projects in the area(s) covered by the applicable Land Claim Agreement (ECCC 2018a). Examples of projects which may impact Polar Bears and would likely require an environmental assessment may include oil and gas drilling projects, as well as mining and quarrying projects.

Transport Canada is the federal agency responsible for domestically implementing the international standards set by the International Maritime Organization (IMO) (Transport Canada 2017). For example, the *Polar Code* (an international code for the safety of and prevention of pollution from ships operating in polar waters, adopted in 2015) introduced requirements for arctic Shipping at the international level. Amongst other things, the *Polar Code* helps protect the marine environment by addressing the risks unique to polar waters not covered by other IMO instruments (International Maritime Organization, n.d.). For example, the *Polar Code* prohibits oil, noxious substances, and (with some exceptions) sewage and garbage, all of which can have a negative impact on Polar Bears and other species which are dependent upon marine environments, from being discharged into the sea (International Maritime Organization, n.d.). As well, the *Polar Code* requires that vessels that operate in polar waters have double hull construction to help prevent oil spills in case of an accident (International Maritime Organization, n.d.). The *Oceans Protection Plan* is another initiative that has been undertaken by Transport Canada to protect Polar Bear habitat. More information on the *Oceans Protection Plan* can be found in section 4.2 (Negligible Threat Categories: Energy Production and Mining) of this document.

In 2004, the Government of Canada, working closely with provincial and territorial partners, produced ‘An Invasive Alien Species Strategy for Canada’. The strategy seeks to reduce the frequency and impact of harmful species introductions through the development of early warning systems and response plans that specify eradication, containment and control procedures (ECCC 2004). In addition, in June 2018, federal, provincial and territorial governments finalized a ‘Pan-Canadian Approach to Wildlife Health’. The approach seeks to coordinate wildlife health surveillance and management programs across portfolios and levels of government, and work with key non-government partners, experts, and Indigenous rights holders, to move Canada from a reactive disease-by-disease approach to addressing wildlife health threats to a proactive regime (ECCC 2018c).

In Canada, the management of hydro development projects falls under the jurisdiction of the provinces and territories, and authorities from these jurisdictions may be contacted to obtain more information related to specific projects. However, the construction of a hydro dam is likely to be captured by federal legislation, namely the *Canadian Environmental Assessment Act*, CEAA) (Government of Ontario 2017). The CEAA requires that proponents of proposed hydro development projects undertake an environmental assessment to determine what negative environmental impacts, if any, may occur once the proposed project is completed and operational (Government of Ontario 2017).

The Government of Canada is committed to continuing to establish and maintain protected areas including habitat important to Polar Bears, such as National Parks, National Marine Conservation Areas, National Wildlife Areas, Marine National Wildlife Areas, Migratory Bird Sanctuaries and Marine Protected Areas (ECCC 2018b; ECCC 2019a). Figure 2 depicts federal and non-federal protected areas within the Canadian Polar Bear distribution range. In National Parks such as Sirmilik National Park and Ukkusiksalik National Park, Parks Canada has taken measures to effectively manage access to Polar Bear dens during key periods by establishing zoning measures (Parks Canada 2018b). Marine Protected Areas in Canada are protected from mining, oil and gas extraction, dumping, and trawling (Jessen et al. n.d.). In August 2019, the Government of Canada announced the establishment of a memorandum of understanding between the Government of Canada, the Government of Nunavut and the Qikiqtani Inuit Association to support the advancement of marine protection in Tuvaijuittuq. The Tuvaijuittuq Marine Protected Area is Canada’s largest Marine Protected Area and is a significant contribution towards surpassing Canada’s goal of protecting 10% of its marine areas by 2020.

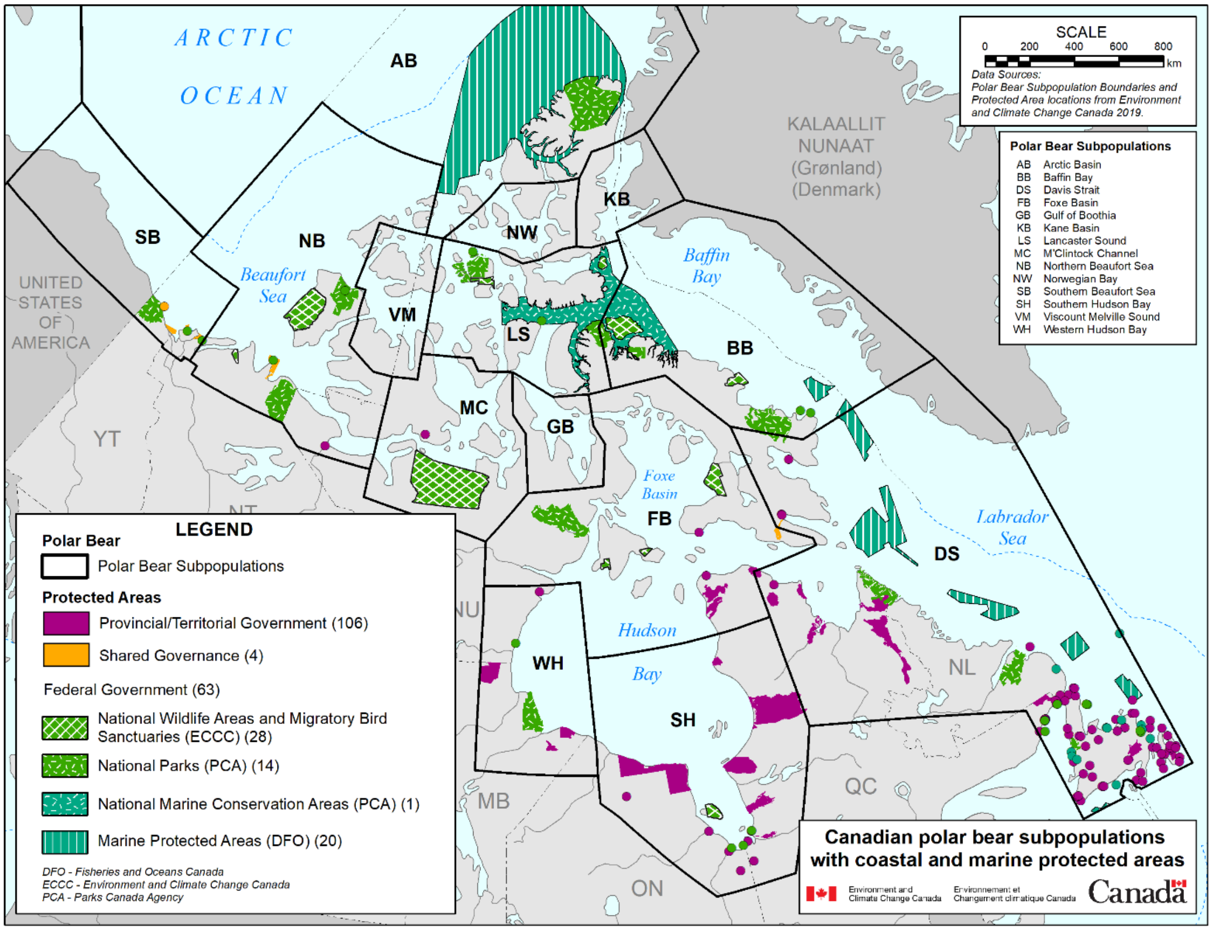

Figure 2: Protected areas within Canadian Polar Bear subpopulations (source: ECCC 2018b). The dotted line surrounding Canada represents the exclusive economic zone.

International Cooperation

As a signatory to the *Agreement on the Conservation of Polar Bears* (1973), Canada works with other Range States (Greenland, Norway, Russia, and the United States) to protect Polar Bears and their habitats. In 2015, the Range States produced the Circumpolar Action Plan, which is a Conservation Strategy for the Polar Bear throughout the circumpolar arctic. The Circumpolar Action Plan states that the Range States will identify best practices to ensure the long-term persistence of Polar Bear by taking action to mitigate threats such as climate change, while continuing to provide sustainable harvest opportunities for Indigenous rights' holders (Polar Bear Range States 2015). In particular, the Range States (including Canada) will share, develop and implement Best Management Practices (BMPs) to help address threats to Polar Bears from natural resource development, contaminants, tourism, shipping and interactions with humans (Polar Bear Range States 2015).

In the case of Polar Bear subpopulations that are shared between Canada and international co-management partners, international agreements such as Memoranda of Understanding (MoUs) or user-to-user arrangements have been developed in accordance with Land Claim Agreements and respective of jurisdictional protocols or interjurisdictional agreements. Such agreements act as mechanisms to reach concurrence on management objectives, Total Allowable Harvest, and shared harvest allocation. Existing agreements include the Inuvialuit-Iñupiat Agreement for the shared Southern Beaufort Sea subpopulation – originally signed in 1988; the MoU between Canada and the United States for the shared Southern Beaufort Sea subpopulation – 2008; and the MoU between Greenland, Nunavut and Canada for the shared Kane Basin and Baffin Bay subpopulations – 2009.

Canada is a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Government of Canada 2018). CITES aims to ensure that international trade of listed species does not threaten their survival. Under CITES, Polar Bears have been listed on Appendix II since the inception of the convention in 1975 and international trade of the species is tracked. A permit for export of Polar Bear from Canada is only issued if the Polar Bear (including any Polar Bear part) has been legally obtained and only if advice from the CITES Scientific Authority in Canada indicates that the trade will not be detrimental to the survival of the species. This advice is termed a non-detriment finding or NDF (Government of Canada 2017a). Considerations for making the non-detriment finding include the biology, conservation status, trade levels and harvest management of the species, and this information is publicly available on the Government of Canada website[14]. In Canada, CITES is implemented through the Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act (WAPPRIITA) by Environment and Climate Change Canada (Government of Canada 2017b).

The Stockholm Convention on Persistent Organic Pollutants (POPs) was signed and ratified by Canada in 2001 (ECCC 2017). Its goal is to reduce levels of POPs entering the environment over time; as a result of eliminating or restricting releases of POP industrial chemicals and pesticides, unintentionally produced POP by-products and stockpiles and wastes of POPs (ECCC 2017). Canada occasionally makes documented submissions to suggest the regulation of emerging and/or priority POPs through their addition to Annex A, B or C of the Stockholm Convention (R. Letcher, pers. comm.).

In Canada, legislation regulating tourism falls under the jurisdictions of the provinces and territories. However, the Circumpolar Action Plan calls for the Range States to “collect occurrence data, and develop BMPs, with the goal of balancing needs of tourism-related activities and their impact on Polar Bears” (Polar Bear Range States 2015: page 59).

Scientific and Indigenous Knowledge Monitoring and Research

Collaboration on research and monitoring initiatives between the federal Government and partners is essential for the conservation and management of Polar Bears in Canada. The

[14] https://www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/non-detriment-findings/polar-bear.html

partners (including Wildlife Management Boards, Advisory Councils, and federal, provincial and territorial governments) involved in Polar Bear management in each Canadian subpopulation are listed in Table 3 in section 3.2 of this document. Environment and Climate Change Canada works closely with partners to determine research priorities which will help inform effective Polar Bear conservation and management in Canada (Government of Canada 2009). Canada's partners each have one or more specific focuses, such as ensuring sustainable harvest levels, harvest monitoring, and furthering understanding of Polar Bear demography, ecology, status, and health.

Federal research forms part of Canada's broad commitments under the international *Agreement on the Conservation of Polar Bears* (1973). To meet commitments made under the *Convention on Biological Diversity* (1992), CITES, and Canada's *Species at Risk Act* (2002), both scientific and Indigenous Knowledge must be given thorough consideration when decisions are made relating to the long-term conservation of Polar Bears, including protection from overexploitation from international trade. Federal research focuses on broad ecological questions applicable to Polar Bears across the circumpolar arctic. Targeted research enhances scientific knowledge and mobilizes Indigenous Knowledge of population dynamics, Polar Bear health, and threat assessments, and furthers understanding of barriers to potential recovery while aiding in the development and implementation of effective conservation actions. This information is then used by jurisdictions and committees (such as COSEWIC and the PBTC) who regularly assess the status of Polar Bears in Canada.

Environment and Climate Change Canada's research focus includes furthering understanding of Polar Bear ecology and arctic marine ecosystems, contributing to assessments of Polar Bear subpopulation abundance and trend, and understanding relationships between Polar Bears, prey, and sea ice. Currently, Environment and Climate Change Canada has five primary scientific and Indigenous Knowledge research priorities, as outlined in Table 5, below. The Department recognizes the importance of both scientific and Indigenous Knowledge in Polar Bear research and monitoring and is committed to inclusion and partnerships with Indigenous organizations and communities. Each of the five research priorities includes ongoing engagement and knowledge exchange with northern communities, Indigenous organizations, and co-management partners. Jurisdictional research priorities are further expanded in Sections 2-7 of the Management Plan.

Table 5: Environment and Climate Change Canada's research priorities for Polar Bear

Research Priority	Description	Examples of Ongoing Research
Habitat and climate change	Understanding links among changes in climate, sea ice habitat, Polar Bear behaviour, body	▪ Long-term research to evaluate the impacts of climate change on ecology, population dynamics, and status of Polar Bears ▪ Research linking Polar Bear and ringed seal population dynamics

Research Priority	Description	Examples of Ongoing Research
	condition and population status	▪ Ecological studies of Polar Bears on multiyear sea ice ▪ Ecology and movement of Polar Bears ▪ Long-term monitoring of trends in declining sea ice habitat
Population assessment	Development of potential new field and statistical methodologies to assess Polar Bear population demography	▪ Development of integrated population models incorporating harvest information, individual movements and Indigenous Knowledge ▪ Co-production of scientific and Indigenous Knowledge to assess Polar Bear health and status
Genetics and health	Research into population genetics and Polar Bear health	▪ Measuring Polar Bear health through analysis of various biological metrics ▪ Information related to Polar Bear health and body condition, such as the presence of plastics, is gathered from harvesters and Indigenous Knowledge holders ▪ Studies of disease prevalence in Polar Bears ▪ Assessing body condition using biological metrics ▪ Monitoring and surveillance of pollutants and heavy metals in fat and liver tissues to monitor polar bear health and contaminant trends. ▪ Assessment of population genetics and unique genetic variation to inform Designatable Units ▪ Assessing the role of genetic diversity in polar bear fitness and the adaptive potential of the species.
Foraging ecology and ecosystem dynamics	Polar Bear foraging ecology in relation to prey dynamics in marine and terrestrial environments	▪ Using new technologies to study the impact of Polar Bear predation of ancillary prey species ▪ Understanding prey dynamics, ecosystem function and energetics

Research Priority	Description	Examples of Ongoing Research
Indigenous Knowledge and local perspectives of Polar Bears, seals, and arctic marine ecosystems	Engagement with Indigenous partners in Polar Bear research and monitoring	▪ Documenting Indigenous Knowledge about Polar Bear abundance, distribution, health and habitat in the Davis Strait subpopulation ▪ Ongoing engagement and knowledge exchange with northern communities, Indigenous organizations, and co-management partners

Many of the ongoing research initiatives listed above are done in collaboration with regional jurisdictions and international partners.

Table 5 (above) focuses on Environment and Climate Change Canada's scientific and Indigenous Knowledge research and monitoring priorities. Specific information pertaining to scientific and Indigenous Knowledge monitoring and research initiatives related to Polar Bears at the regional level can be found in Parts 2 – 7 of this Management Plan.

Public Outreach and Education

Environment and Climate Change Canada maintains a webpage for members of the public to learn about the initiatives which are being undertaken by the Government of Canada to manage and conserve Polar Bears in Canada. In particular, this webpage addresses Polar Bears and CITES, the specific management and conservation actions being taken by the Government of Canada at the national and international level, actions being taken to address the impacts of climate change, and scientific and Indigenous Knowledge research initiatives related to Polar Bears. The webpage can be accessed here[15].

Environment and Climate Change Canada works closely with the Government of Nunavut to maintain the PBAC website[16]. The purpose of this website is to share information pertaining to: PBAC and PBTC; Polar Bear biology; Canada's Polar Bear subpopulations; the cultural significance and economic importance of Polar Bears to Indigenous peoples; provincial, territorial, federal, and international legislation related to Polar Bears; national and international Polar Bear management and harvest initiatives; and scientific and Indigenous Knowledge research initiatives related to Polar Bears. This website provides contact information for members of the public to contact the Environment and Climate Change Canada PBAC Secretariat for further information.

[15] https://www.canada.ca/en/services/environment/wildlife-plants-species/wildlife-habitat-conservation/conservation-polar-bears.html
[16] https://www.polarbearscanada.ca/

The National Polar Bear Conservation Strategy for Canada[17] (hereafter, 'the Strategy') was collaboratively developed and published by PBAC in 2011. As an active member of PBAC, Environment and Climate Change Canada played a key role in the finalization of the Strategy. The Strategy is available to members of the public and it provides information pertaining to the roles and responsibilities of all Polar Bear co-management partners in Canada, and it discusses the key threats that Polar Bears face in Canada. Annex I of the Strategy discusses the monitoring of Polar Bears and their habitat, and contains guidelines to help ensure coordinated timelines, and monitoring and sampling protocols for baseline monitoring that use both scientific and traditional user knowledge. Annex II of the Strategy discusses harvest management, and contains guidelines aimed improving the overall coordination of harvest management in Canada. The main principles of those guidelines are embedded within the broad strategies and management actions discussed in this document.

Through funding programs such as the Aboriginal Fund for Species at Risk (AFSAR), Environment and Climate Change Canada has supported projects aimed at increasing knowledge about Polar Bears and their habitat, as well as addressing human and Polar Bear safety in areas where conflicts may occur. Activities implemented under such projects include Indigenous communities hosting bear safety workshops to provide training on how to mitigate human-Polar Bear conflicts.

Several Canadian jurisdictions have public outreach and education initiatives in place which provide information related to Polar Bear. For more information pertaining to these initiatives, please refer to Parts 2 – 7 of this Management Plan.

Information pertaining to broad strategies, including actions that are completed or currently underway, for Polar Bear conservation and management at the regional level can be found in the jurisdictional recovery strategies and management plans (Parts 2 – 7 of this Management Plan).

6.2 Broad Strategies

The primary threat to Polar Bears is habitat loss resulting from climate change (Tynan and DeMaster 1997; Derocher et al. 2004; Laidre et al. 2008; Kovacs et al. 2010; IPCC 2013). While other factors have been assessed by COSEWIC as low or negligible threats, cumulative impacts and interacting relationships between threats may be a potential concern, though knowledge surrounding the impacts of cumulative effects is generally lacking (Vongraven and Richardson 2011). Managing these threats will require the commitment of various levels of government, Indigenous partners, stakeholders, conservation organizations and the public, and cannot be achieved by Environment and Climate Change Canada alone. To achieve the federal

[17] https://www.polarbearagreement.org/resources/individual-range-state-action-plans/canada/national-polar-bear-conservation-strategy-english

management plan objectives, the following federal broad strategies are recommended and are intended to serve as guidance to the jurisdictions and authorities responsible for the management of Polar Bear in Canada:

- Work closely with Indigenous partners, governments, and stakeholders to co-manage and conserve the Polar Bear and its habitat in Canada

- Support international cooperation for management of the Polar Bear and its habitat throughout the entirety of its range

- Conduct scientific and Indigenous Knowledge research and monitoring initiatives in Canada and support international initiatives to address knowledge gaps regarding Polar Bears

- Promote and support public outreach and education on matters related to Polar Bear management and conservation in Canada

Information pertaining to broad strategies for Polar Bear conservation and management at the regional level can be found in the jurisdictional recovery strategies and management plans (Parts 2 – 7 of this Management Plan).

6.3 Conservation Measures

The following table outlines the conservation measures that are recommended to achieve the overall federal management plan objective, and gives a timeline for their implementation. Conservation measures are organized by the four broad strategies: co-manage and conserve Polar Bears in Canada; support international cooperation; scientific and Indigenous Knowledge research and monitoring; and public outreach and education. Specific information pertaining to conservation measures related to Polar Bears at the regional level can be found in the jurisdictional Management Plans and Recovery Strategies (Parts 2 – 7 of this Management Plan). This section focuses on matters under federal jurisdiction.

Table 6. Conservation Measures and Implementation Schedule

Broad Strategy	Conservation Measure	Priority[e]	Threats or Concerns Addressed	Timeline
Co-manage and conserve Polar Bears in Canada	1.1 Work closely with domestic partners through such forums as the Polar Bear Administrative Committee (PBAC) and the Polar Bear Technical Committee (PBTC) to support the development and	High	All threats	Ongoing

Broad Strategy	Conservation Measure	Priority[e]	Threats or Concerns Addressed	Timeline
	communication of policy, programs and guidelines that manage threats and conserve and enhance Polar Bears and their habitat, particularly in areas subject to habitat loss due to climate change			
Co-manage and conserve Polar Bears in Canada	1.2 Review new and updated science and Indigenous Knowledge information on a regular basis to inform management and conservation decisions and actions	High	All threats	Ongoing
Co-manage and conserve Polar Bears in Canada	1.3 Support jurisdictions and co-management partners in working with Indigenous and local northern communities to reduce and monitor Polar Bear-human conflict. Conservation actions will be informed by Land Claims Agreements (where applicable) and may include local and regional initiatives (e.g., managing human-bear conflict, Guardian and monitoring programs, gathering Indigenous Knowledge) up to the national scale (e.g., participation in national conservation and species assessment initiatives).	High	Human intrusions and disturbance (IUCN/CMP Threat #6)	Ongoing
Co-manage and conserve Polar Bears in Canada	1.4 Support jurisdictions and co-management partners in working with Indigenous and local northern	High	Biological resource use (IUCN/CMP Threat #5)	Ongoing

Broad Strategy	Conservation Measure	Priority[e]	Threats or Concerns Addressed	Timeline
	communities to ensure a sustainable harvest of Polar Bear that follows conservation principles. Conservation actions will be informed by Land Claims Agreements (where applicable) and may include local and regional initiatives (e.g., harvest management, Guardian and monitoring programs, gathering Indigenous Knowledge) up to the national scale (e.g., participation in national conservation and species assessment initiatives).			
Co-manage and conserve Polar Bears in Canada	1.5 Work closely with Indigenous, governmental, and industry partners to minimize the negative effects of human activities on Polar Bears and Polar Bear habitat	Medium	All threats	Ongoing
Co-manage and conserve Polar Bears in Canada	1.6 Promote public engagement in matters related to public safety by encouraging participation in provincial/territorial government wildlife deterrence programs to reduce the risk to human life by Polar Bears, reduce destruction of property by wildlife, and reduce and monitor the number of Polar Bears killed in defence of life and property	High	Biological resource use (IUCN/CMP Threat #5) Human intrusions and disturbance (IUCN/CMP Threat #6)	Ongoing

Broad Strategy	Conservation Measure	Priority[e]	Threats or Concerns Addressed	Timeline
Co-manage and conserve Polar Bears in Canada	1.7 Ensure that jurisdictional management framework (including co-management regimes, federal, provincial and territorial legislation, land claim agreements, and inter-jurisdictional agreement(s) are followed	High	All threats	Ongoing
Support international cooperation	2.1 Support and participate in international Polar Bear conservation, research and monitoring initiatives (e.g. the implementation of the *Agreement on the Conservation of Polar Bears* (1973), Circumpolar Action Plan (2015 – 2025), etc.) with the goal of managing and conserving Polar Bear and its habitat throughout the species' range	High-Medium	All threats	Ongoing
Support international cooperation	2.2 Continue to regulate international trade of Polar Bears and Polar Bear products, in accordance with obligations as a signatory party to CITES	High-Medium	Biological resource use (IUCN/CMP Threat #5)	Ongoing
Scientific and Indigenous Knowledge, research and monitoring	3.1 Support scientific and Indigenous Knowledge research, and community-based monitoring projects that improve our understanding of Polar Bear distribution, abundance, and subpopulation trends within Canada to allow for	High – Medium	All threats	Ongoing

Broad Strategy	Conservation Measure	Priority[e]	Threats or Concerns Addressed	Timeline
	targeted conservation efforts			
Scientific and Indigenous Knowledge, research and monitoring	3.2 Monitor the presence and investigate the impacts of contaminants and plastics on Polar Bears	Medium – Low	Pollution (IUCN/CMP Threat #9) Energy production and mining (IUCN/CMP Threat #3)	Ongoing
Scientific and Indigenous Knowledge, research and monitoring	3.3 Use scientific and Indigenous knowledge to understand links between changes in climate, sea ice habitat, Polar Bear behaviour, body condition and population status	High	Climate change and severe weather (IUCN/CMP Threat #11)	Ongoing
Scientific and Indigenous Knowledge, research and monitoring	3.4 Conduct research into population genetics and Polar Bear health	Medium	All threats	Ongoing
Scientific and Indigenous Knowledge, research and monitoring	3.5 Conduct research focusing on Polar Bear foraging ecology in relation to prey dynamics in marine and terrestrial environments	Medium	Climate change and severe weather (IUCN/CMP Threat #11)	Ongoing
Public outreach and education	4.1 Promote the sharing of science and Indigenous Knowledge (including the importance of Polar Bears to Indigenous peoples, and the impacts of climate change on Polar Bears) with the Canadian public,	High	All threats	Ongoing

Broad Strategy	Conservation Measure	Priority[e]	Threats or Concerns Addressed	Timeline
	international audiences, and decision makers			
Public outreach and education	4.2 Support and extend current conservation efforts in protected areas in Canada through the promotion of Polar Bear conservation and stewardship programs	Medium	All threats	Ongoing
Public outreach and education	4.3 Support the development and implementation of education, outreach and public engagement activities related to Polar Bear conservation and stewardship	Medium	All threats	Ongoing

[e] "Priority" reflects the degree to which the measure contributes directly to the conservation of the species or is an essential precursor to a measure that contributes to the conservation of the species. High priority measures are considered those most likely to have an immediate and/or direct influence on attaining the management objective for the species. Medium priority measures may have a less immediate or less direct influence on reaching the management objective, but are still important for the management of the population. Low priority conservation measures will likely have an indirect or gradual influence on reaching the management objective, but are considered important contributions to the knowledge base and/or public involvement and acceptance of the species.

7. Measuring Progress

Every five years, success in implementing the management plan and progress towards achieving the management plan objective will be measured against the following performance indicators:

- Resilience has been maintained in the Canadian Polar Bear population: The health and genetic diversity of the Canadian population, and subpopulation abundance above minimum viability thresholds, has been maintained such that the Canadian Polar Bear population has enough resilience to be able to withstand catastrophic events, rebound from disturbance, and persist over the long term; thereby ensuring the species' resilience in Canada. This resilience has helped to ensure that harvesting by Indigenous rights holders has remained sustainable.

- Redundance has been maintained in the Canadian Polar Bear population: The 14 widespread Polar Bear subpopulations have continued to persist over the long-term across the Canadian jurisdictions where Polar Bears currently occur, despite ecological and environmental change; thereby ensuring the species' redundance in Canada

- Representation has been maintained in the Canadian Polar Bear population: Polar Bears continue to occur in a range of ecosystem types, have maintained their current level of genetic diversity, and have maintained the ability to withstand environmental change; thereby ensuring the species' representation in Canada

8. Effects on the environment and other species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals[18]. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy[19] (FSDS)'s goals and targets.

Conservation planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of management plans may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the plan itself, but also are summarized below in this statement.

The potential for the management plan to inadvertently lead to adverse effects on the environment or other species was considered. Since the focus of recommended activities is primarily on non-intrusive measures such as working with domestic and international partners, conducting scientific and Indigenous Knowledge research and monitoring initiatives, and promoting and supporting public outreach and education, it is unlikely that the management plan will entail significant adverse effects for the environment or other species.

Support and cooperation among domestic and international partners to manage and conserve the habitat of Polar Bear (*Ursus maritimus*) throughout its range may benefit species that utilize sea ice habitat, such as Ringed (*Pusa hispida*), Bearded (*Erignathus barbatus*) and Harp (*Phoca Groenlandica*) Seals, Walrus (*Odobenus rosmarus*), Beluga (*Delphinapterus leucas*), Narwhal (*Monodon monoceros*), Arctic Fox (*Vulpes lagopus*), and others. Narwhals, for example, are also directly impacted by climate change, as melting sea ice may alter their migratory routes, could

[18] http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1
[19] http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1

lead to the introduction of new predators, and may increase noise pollution from shipping and development. Therefore, Narwhals would likely benefit from the management and conservation of arctic sea ice habitat on a domestic and international scale, as recommended by this management plan.

Other species that utilize sea ice habitat (in addition to Polar Bears) may also benefit from ongoing research that is being carried out to learn more about Polar Bears and their habitat. For example, research focusing on Polar Bear foraging ecology in relation to prey dynamics in marine and terrestrial environments will have indirect benefits on the species that Polar Bear prey on, because researchers will learn more about their life history requirements.

Public outreach and education initiatives may also benefit other species. For example, supporting and extending current conservation efforts in protected areas in Canada through the promotion of Polar Bear conservation and stewardship programs will indirectly benefit other species found in the same protected areas.

Provided conservation measures and management actions are applied, it is unlikely that the present management plan will produce any significant negative effects on the arctic environment, or the species that live there.

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Part 2: Inuvialuit Settlement Region Polar Bear Joint Management Plan, prepared by the Joint Secretariat Inuvialuit Settlement Region

Part 3: Nunavut Polar Bear Co-Management Plan, prepared by the Nunavut Polar Bear Co-Management Working Group

Part 4: Recovery Strategy for the Polar Bear (*Ursus maritimus*) in Manitoba

NOTE: The Recovery Strategy for the Polar Bear in Manitoba will be adopted as Part 4 of the National Polar Bear Management Plan once it is transmitted to Environment and Climate Change Canada.

Part 5A: Government Response Statement to the Recovery Strategy for Polar Bear, prepared by the Ontario Ministry of Natural Resources and Forestry (2016) (species-specific policy)

Note: The Government Response Statement for Polar Bear in Ontario was published in 2016 and contains references to commitments made in Ontario's Climate Change Strategy and Action Plan. Since the publication of this document, a revised provincial approach to addressing climate change has been proposed in the Made-in-Ontario Environment Plan.

Part 5B: Recovery Strategy for Polar Bear (*Ursus maritimus*) in Ontario, prepared by M.B. Tonge and T.L. Pulfer (2011) (technical advice)

Part 6: Management Plan for the Polar Bear (*Ursus maritimus*) for Québec, the Eeyou Marine Region, and the Nunavik Marine Region, prepared by the Québec - Eeyou Marine Region - Nunavik Marine Region Polar Bear Working Group

Part 7: Management Plan for the Polar Bear (*Ursus maritimus*) in Newfoundland and Labrador

NOTE: The Management Plan for the Polar Bear in Newfoundland and Labrador will be adopted as Part 7 of the National Polar Bear Management Plan once it is transmitted to Environment and Climate Change Canada.

Summary of the Federal Addition to the National Polar Bear Management Plan

Under the *Species at Risk Act* (SARA), a management plan must be developed for each species listed as Special Concern in order to identify measures for the conservation of the species. This document highlights the key sections of the draft management plan.

Species Conservation Status

The Polar Bear (*Ursus maritimus*) is listed as Special Concern under SARA (since 2011). In Nunavut, polar bear is not listed under the *Nunavut Wildlife Act*.

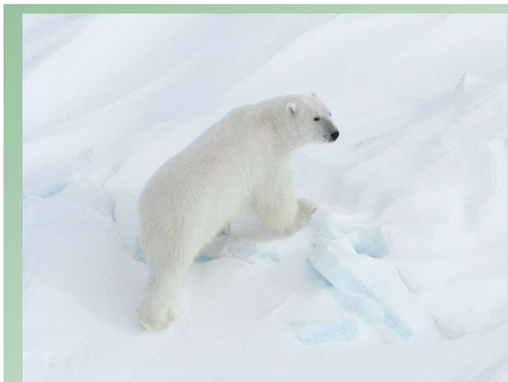
Description and Distribution

The Polar Bear is a large carnivorous mammal that inhabits both terrestrial and marine areas and occurs in Canada, Greenland, Norway (Svalbard), Russia, and the United States. Polar Bears are apex predators and they occupy the highest trophic levels in Arctic marine ecosystems.

Canada is home to approximately 16,000 of the estimated 20,000 – 26,000 Polar Bears found throughout the circumpolar Arctic. For management purposes, the Canadian Polar Bear population is divided into 14 subpopulations, and the global Polar Bear population is divided into 19 subpopulations (see below map). In Canada, Polar Bears live in Yukon, the Northwest Territories, Nunavut, Manitoba, Ontario, Québec, and Newfoundland and Labrador.

Habitat Needs

Polar Bears rely on both marine (sea ice) and terrestrial habitat to meet their life history requirements. Their range encompasses regions where sea ice melts completely each summer (known as annual sea ice); areas where sea ice forms along the shore and then retreats during the summer, but remains offshore; and areas where locally formed or transported ice remains year-round (known as convergent or archipelago sea ice).



Polar Bear © David McGeachy

Threats to the Species' Survival

- **Climate Change:** Sea ice habitat loss resulting from increased atmospheric temperatures caused by global greenhouse gas emissions
- **Biological Resource Use:** While the number of Polar Bears harvested each year is typically sustainable, if harvest and other sources of human-induced mortality are not properly managed, this may lead to population declines
- **Pollution:** Apex predators, including Polar Bears, are often exposed to high levels of pollutants that bioaccumulate in the marine food web
- **Energy Production and Mining:** Oil and gas drilling, and fuel spills have the potential for mortality and disturbance of Polar Bears
- **Transportation and Service Corridors:** Increasing levels of shipping in the Arctic has the potential to disturb and displace Polar Bears

- **Human Intrusions and Disturbance:** More research is needed before the impacts of tourism on Polar Bears can be accurately assessed
- **Invasive Species:** New species and diseases with the potential to impact Polar Bears may enter Arctic ecosystems due to climate change
- **Natural System Modifications:** Some concerns exist regarding the impact of potential biotic and abiotic ecosystem changes on Polar Bears

Management Objective

Maintain the resilience, redundance and representation of the population in the species' known range in Canada.

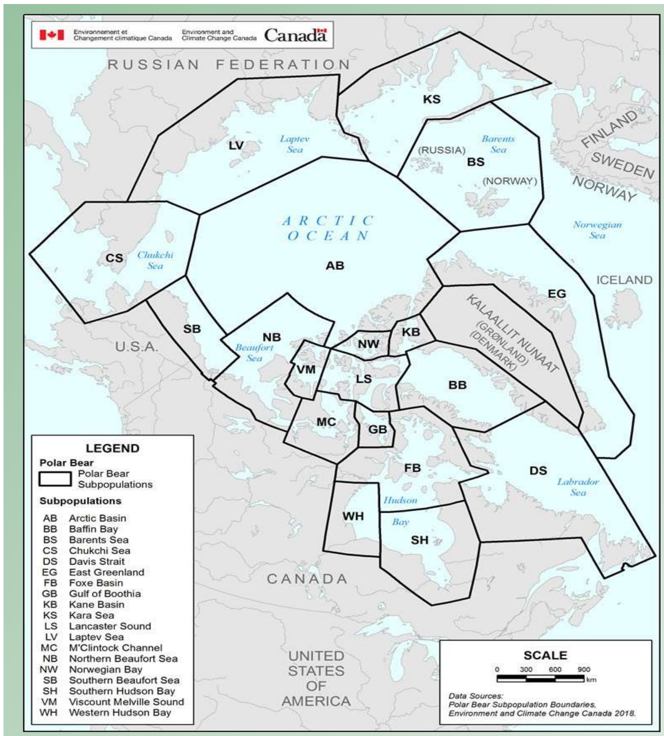
Strategies to Help Meet Objectives

Broad strategies to address the threats to the survival and recovery of the species include:

- Conserving and managing Polar Bear and its habitat in Canada through actions such as supporting the development and communication of policy, programs and guidelines that manage threats and conserve and enhance Polar Bears and their habitat, particularly areas subject to habitat loss due to climate change;
- Cooperating with international partners to conserve and manage Polar Bear and its habitat on a global scale through actions such as supporting and participating in international Polar Bear conservation, research and monitoring initiatives (e.g. the implementation of the 1973 Agreement on the Conservation of Polar Bears, and the Circumpolar Action Plan (2015 – 2025))
- Conducting scientific and Indigenous Knowledge monitoring and research with a focus on the following priorities:
    - Habitat and climate change,
    - Population assessment,
    - Genetics and health,
    - Foraging ecology and ecosystem dynamics, and
    - Indigenous Knowledge and local perspectives of Polar Bears, seals, and Arctic marine ecosystems
- Promoting and supporting public outreach and education on matters related to Polar Bear management and conservation in Canada

How You Can Help

- Learn more about the Polar Bear, and the threats to its survival and its habitat needs at *www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html*
- If you live in a community where polar bears are known to occur, follow best management practices to minimize human-polar bear conflicts. For example, ensuring attractants, such as garbage, are managed appropriately



The 19 global subpopulations of Polar Bear. Source: Environment and Climate Change Canada. Available at https://www.canada.ca/en/environment-climate-change/services/biodiversity/maps-sub-populations-polar-bears-protected.html

For more information, please contact us directly at:

Environment and Climate Change Canada (ECCC) – Canadian Wildlife Service,
National Capital Region
351 Boulevard Saint-Joseph, Gatineau QC, J8Y 3Z5
Email: ec.planificationduretablissement-recoveryplanning.ec@canada.ca
You can also visit the following website for more information:
Species at Risk Public Registry (www.sararegistry.gc.ca)

Aussi disponible en français

EHTO CHAIRMAN'S REPORT

I am Bobby Greenley, Chairman of EHTO

Due to the Covid-19 outbreak, this has been a year of delays in our usual HTO business but we all manage to continue communication with online meetings and presentation.

EHTO received Country Food funds from Economic Development & Transportation (ED&T) which started April 1, 2020 and consist of Omingmak (muskox), Tuktu (caribou) from the Beverly Ahiak herd, Eklaluk (fish).

Country Food distribution funds:

Since April 2020 to February 2022 EHTO received $164,000 in contributed funds for Country Food distributions.

NTI funds $5000 in March of 2020
KIA funds $85,000 from March 2020 to date
Dept. of Environment (DOE) funds, April 2020 $25,000 and February 2022 of $25,000 one time funds
Economic Development & Transportation $24,000

Local Hunters harvested muskox, caribou, fish and a few seals.
Local Hunters received funds for gas/oil (DOE funds)
Labors that cut up country food and deliveries to Elders and single parents.

Thank you to all Departments and Organizations for country food distribution, our Community Members were able to continue their traditional meals for their families.

Our Elders requested caribou but the caribou was and is very far, HTO hired a hunter from Baker Lake to harvest 8 caribou to distribute to Elders only the spring of 2021.

Our Elders, Single Parents, Arctic College Students and those who have no equipment to provide for their family were very thankful to receive country food.

Our hunters and fishermen were thankful to continue to go out on the land to harvest country food and receive income as they are seasonal workers.

Qiviut

Thank you to, Jamie Panioyak, Joseph Keyok and Donna Tologanak who sheared Qiviut. The Qiviut was sold too Jacques Cartier Clothier Banff.

At the EHTO AGM on February 16th, 2016 a Motion was passed to put a Season on Muskox herd of Victoria Island, season closing April 15th and opens July 15^{th,} 2016. This is still ongoing year after year (continuous)

Victoria Island Caribou, Muskox and their predators (VICMP):

EHTO submitted a proposal to Nunavut General Monitoring Program (NGMP) for 3 year funding, to conduct our own studies on caribou, muskox and their predators on Victoria Island. NGMP has granted the funding and the monitoring will continue up to 2022.

HTO hired Brandon Langan – VICMP Coordinator who works with Matilde Tomaselli, Wildlife researcher with Polar Knowledge Canada, and Dr. Susan Kutz, University of Calgary on this project.

As part of the NGMP – permit outline is to collected 20 sample kits for muskox and caribou, the kits have been sent to University of Calgary and we are waiting results. We also collected 20 wolves and wolverine to study the stomach contents (has not been studied yet). HTO has set up trail cameras around Surray River and 30 Mile to record any wildlife around the area. The Cameras were set in late August and retrieved in December 2020. The camera's recorded caribou at 30 Mile and a couple of predators. We plan to set the camera's up again this spring.

The cameras captured no wildlife on the Surray River trailcams, but the 30 mile captured 1 wolf and small herd of Dolphin and Union and some birds in the spring.

Department of Fisheries (DFO)

HTO continues to work with DFO on char studies. Char have tags clipped on their fins, the yellow tags ($25) shows where the fish traveled. Some of the char have acoustic implant ($40) so DFO can detect time the char crossed a sensor. Red tagged fish ($100) is to age the fish but harvesters must give the whole fish to DFO for studies.

Lawrence Otokiak was hired by DFO to collect char samples at Gravel pit in the fall of 2021.

DFO and HTO will work on a "Microplastic project". DFO found microscopic plastics in fish stomach. Proposal had been submitted to Northern Contaminates Program.

Sports Hunts:

End of March 2020, we only had 2 sports hunters and 1 hunter was successful. Canada North Outfitting (CNO) and HTO had to cancel the rest of spring and fall Sports Hunts due to Covid-19.

CNO compensated guides with a little bit of funds for Covid relief but it had a hardship on the guides seasonal activities.

CNO and HTO will give a "Enhanced Tourist Training Course" for Guide Level II, April 5-9, 2021. We want to support our guides and give back some income they lost in 2020. We will have 3 senior guides assist with the training. The course was successful.

CNO has filled sports hunts for winter/spring and fall of 2022.
Nine of our guides were successful with filling the muskox sports hunts.

Guides did our first Grizzly Bear sports hunts:

April 25-May 5th, hunter was successful in the Grizzly bear sports hunt.

April 25-May 11th, To be announced
May 7-20th, to be announced

We are planning a snow geese sports hunt in June to help with the over population and hopefully help the regrowth of the vegetation.

Ocean Protection Pilot Project: Victoria Island Waterways Safety Committee (VIWSC)

EHTO has been selected by Transport Canada (TC) to coordinate and report on the "Cumulative Effects of Marine Shipping, Proactive Vessel Management and Maritime Awareness Information System under the Oceans Protection Plan (OPP).

The VIWSC has set up a "Notice to Mariners" (see attached)

- Navigate in the Kitikmeot Region: Dolphin and Union herd migrates from Victoria Island and the Mainland. The open ice created by vessels jeopardized the migration of the caribou and in the fall and spring the people crossing between the mainland and island.
- Voluntary Avoidance: slowdown to minimum speed from December 1 to June 30th, (red area)

- Reporting: Notice is required prior to transiting the Northwest Passage between October 15the June 30th.

Small Vessel Operators Proficiency (SVOP) Training, May - June 2021 with Chad McCallum, Roland Emingak, David Klengenberg, Kyle Weese.

EHTO deployed a shallow water hydrophone to collect noise data from ships passing and hopefully hear seals and whales. The data is being extracted now. Trail cameras were set to take pictures of passing ships and to look at how ships wakes increase erosion.

8 VHF radios have been installed on community members boat and we have plans to order more for our membership.

EHTO did a presentation for NWMB in September on the work we have been doing with Transport Canada – Ocean Protection Pilot Project.

SmartIce

Monitors are measuring the ice thickness for SmartIce. We had little activities with SmartIce equipment because of some equipment failure. The last good reading was in November 2020.

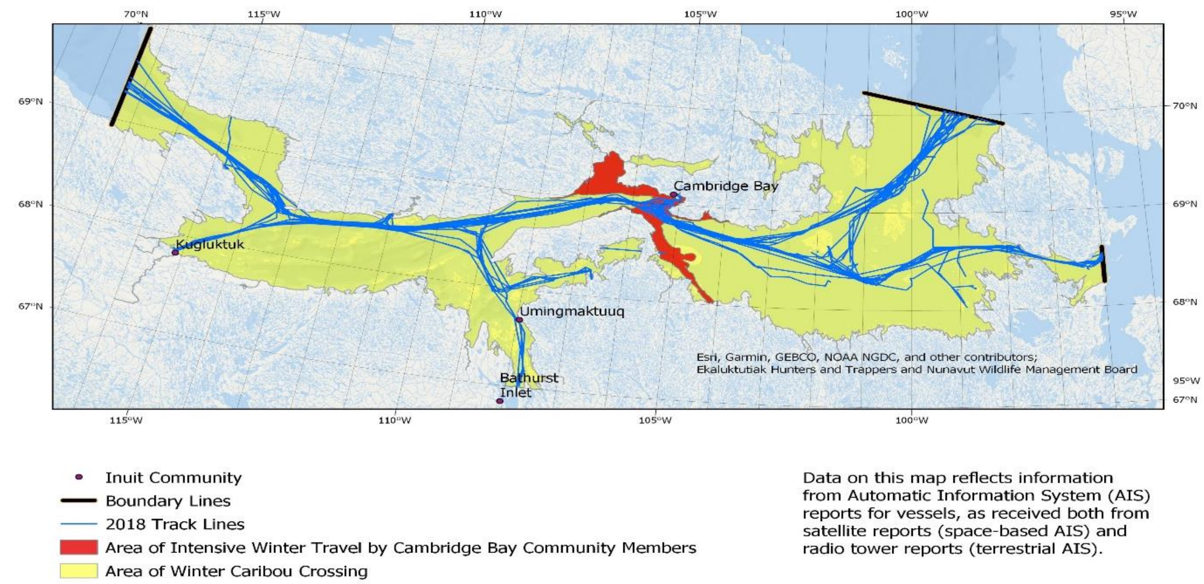
Trailmark:

EHTO will continue to work with Trailmark and Trailmark will give more training for coordinators and local membership.

EHTO continues to take Covid-19 precaution to protect our staff and membership.

Thank you,

7C Vessels Intending to Navigate in Kitikmeot Region in Canada's Northern Waters



Navigation In Kitikmeot Region

Dolphin and Union Caribou migrate from Victoria Island to the Mainland. The open ice created by vessels jeopardizes the migration of the caribou in the fall and spring and the safety of people crossing between the mainland and the island.

Voluntary Avoidance

Voluntary measures apply to any vessel transiting within the protection zone outlined in this notice (see yellow and red areas in map above) and should only be taken when they will not jeopardize the safety of navigation. These include:

1. Slowdown to minimum safe speed from December 1st to June 30th (Red Area);
2. Slowdown to minimum safe speed if caribou or people are encountered;
3. Use local information to avoid passing in front of caribou or people travelling on sea ice;
4. Avoid opening multiple leads.

Reporting

Notice required a week prior and follow up call/email before transiting the areas as follows. October 15th to November 30th and April 15th to June 30th to minimize risks to migrating caribou (Yellow Area), and December 1st to June 30th (Red Area) to minimize risks to people travelling across sea ice.

Calls should be made, in order, to:

1. Hamlet Main Office: 867-983-4600
2. Hamlet After Hours of Arctic Senior Administrative Officer: 867-983-5203
3. Ekaluktutiak Hunters and Trappers Organization (EHTO) Main Office: 867-983-2426
4. Ekaluktutiak Hunters and Trappers Organization (EHTO) After Hours: 867-445-3614

Western Boundary	69° 58' N 117° 22' W;	68° 56' N 117° 22' W
NorthEastern Boundary	69° 58' N 101° 04' W;	69° 54' N 097° 57' W
SouthEastern Boundary	68° 14' N 096° 00' W;	68° 36' N 096° 00' W

Authority: Transport Canada

Community-driven program to monitor muskoxen, caribou and their predators on Victoria Island, Nunavut

Interim Report, April 29, 2022

Prepared by Dr. Fabien Mavrot, Dr. Susan Kutz
Department of Ecosystem and Public Health, Faculty of Veterinary Medicine, University of Calgary

Summary

The project "Community-driven program to monitor caribou, muskoxen, and their predators on Victoria Island, Nunavut" (NGMP project # 19EC66) led by the Ekaluktutiak Hunters and Trappers Organization has completed its second year. The Kutz Research group (University of Calgary) has received and processed 48 of the 56 caribou and muskox kits collected in 2019-21. Lab analyses for these kits are about 75% complete. Additional caribou kits from the 2021-22 season arrived in early April 2022 and will be processed over the coming months. Notable results to date include an apparent decrease of stress level in DU caribou over the last year and a constant presence of the zoonotic bacterium *Brucella* in both species. A more detailed analyses will be provided in the next community bulletin and annual report.

Future work includes the completion of the pending analyses and the processing of the kits recently received. The collaboration between Ekaluktutiak Hunters and Trappers Organization and the Kutz Research group has also resulted in a successful grant on emerging diseases from the Canada Inuit Nunangat-UK grant as well as a grant from National Geographic to assess how the community-based wildlife health monitoring program has operated during COVID-19.

Introduction

The Ekaluktutiak Hunters and Trappers Organization in collaboration with Polar Knowledge Canada was successful in obtaining funding from the Nunavut General Monitoring Plan (NGMP) to carry out the 'Community-driven program to monitor caribou, muskoxen, and their predators on Victoria Island, Nunavut' (NGMP project # 19EC66) in the community of Ekaluktutiak during the years 2019-22.

The program aims to collect baseline knowledge and track change in the health and population dynamics of muskoxen and Dolphin and Union caribou around the community of Ekaluktutiak. The program is overseen in the community by the HTO with support from Matilde Tomaselli and Ian Hogg from Polar Knowledge Canada.

As part of the monitoring program, sample kits are made available to community harvesters and sent to the Kutz Research Group at the University of Calgary for analysis. In addition to specific samples, the kits also contain a datasheet used to record important information on the animals sampled or observed. Harvesters can also use the kits to collect any abnormal tissue they encounter in a harvested animal. This serves as a passive health surveillance system to detect possible health concerns in the muskox and caribou populations.

Below we present the preliminary results from sample and data analyses to date. Note that these analyses are ongoing and these are not the final results.

Update as of April 2022

Sample kits collected:

As of March 2022, 48 sample kits (32 DU caribou and 16 muskoxen) have been shipped to the University of Calgary. Eight additional kits have been collected but were not part of the shipment. The project monitor updated the database with the kits received and the information on the forms up until March 2021. Additional kits were shipped on April 2022 and will be processed this summer.

Datasheet:

When the harvester is able to observe the herd and can provide information on herd size and the number of young animals, this can give us really important insight into the population structure and what it might mean for the herd. As an example, below is a plot showing how the number of calves and yearlings observed in the DU caribou herd changes over time (Figure 1). There is a high proportion of calves observed in fall (after calving) and fewer calves observed in spring (just before calving). **In the past years, it seems that the proportion of calves in fall fluctuates around 15-20% of the total number of DU caribou observed at the time.**

The plot also shows that some seasons have very broad confidence intervals. This happens when there were only a few observations available and highlights the importance of having every datasheet fully completed. It is important to note that the observations in Figure 1 are from sample kits collected in all three communities harvesting DU caribou (Ekaluktutiak, Kugluktuk, and Ulukhaktok).

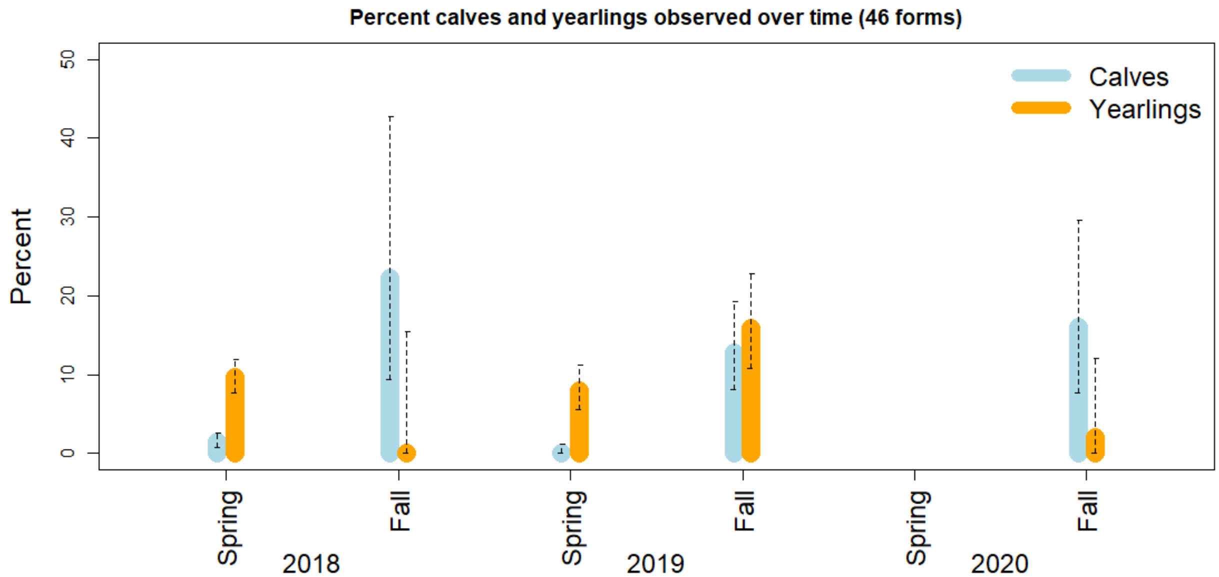


Figure 1: Proportion of calves and yearlings of total animals observed for Dolphin and Union caribou and recorded on the sample kit forms in Ekaluktutiak, Kugluktuk, and Ulukhaktok. Calves and yearling proportions are shown for spring (April to June) and fall (September to December).

Another important piece of information on the sample kit form is the body condition. By recording it, we can compare the information from year to year and across different populations. We use two different complementary measures for body condition: the backfat and the assessment made by the harvester (skinny, not bad, fat, or very fat). The backfat is a reliable metric if it is measured in the same way by all harvesters. The assessment of the harvester takes into account the harvester's experience and traditional knowledge about what would be expected for that season or age of the sampled animal. Backfat measures and harvester's assessments thus provide different, yet complementary measures of body condition.

In figure 2, we show the results of both the harvester assessment recorded on the sample kit datasheet and the results of the kidney fat index measured in our lab. On the upper panel, the body condition documented by the harvester is shown on the vertical axis and is qualitative (ranging from skinny to very fat). The horizontal axis represents the timeline starting in 2017. The black circles represent which body conditions were reported for each month (a larger circle means that more harvesters reported an animal in this body condition category). The probability of a caribou being in a better condition than "skinny" is shown by the red lines for females (continuous) and males (dotted). Finally, the community where the data was collected is shown at the bottom of the chart as colored lines. **Note: the results presented here are from all sample kits and forms collected in Ekaluktutiak, Kugluktuk, and Ulukhaktok until 2019.**

It is also important to note that the body condition score assessed by hunters was removed from the data sheet of DU caribou sample kits in Ekaluktuktiak and thus this information could not be added for the years 2020-21. This is particularly relevant when assessing the DU caribou herd as the information from animal sampled in three communities (Ekaluktuktiak, Kugluktuk, and Ulukhaktok) are complementary and should be ideally collected in a standardized way. After discussing with the HTO, we agreed that the body condition should be put back on the data sheet.

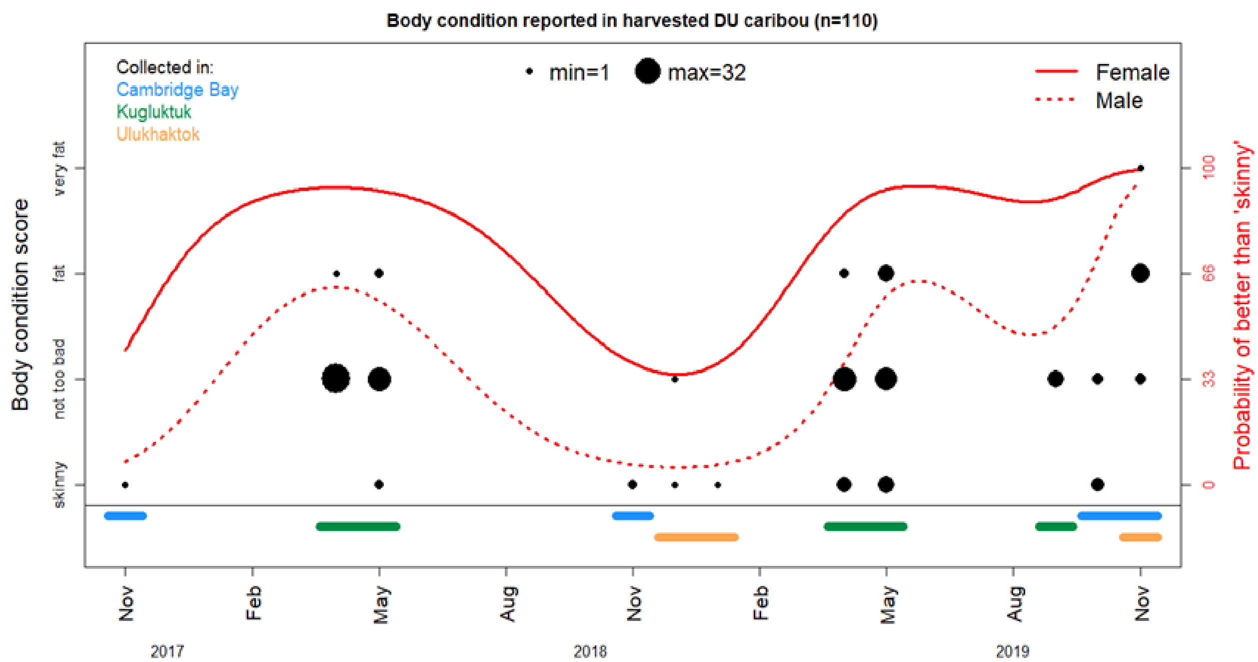


Figure 2: Body condition of Dolphin and Union caribou assessed by the harvesters on animals sampled in Ekaluktutiak, Kugluktuk, and Ulukhaktok.

<u>Sample Analyses</u>

Although 56 kits were reported as collected, only 48 kits were shipped down to Calgary so far. For muskoxen, lab analyses have been completed for parasitology, *Brucella* and *Erysipelothrix* serology, metatarsal measurement, *Besnoitia* examination, pregnancy, kidney and bone marrowfat assessment, and corticosterone in feces. For caribou, analyses have been completed for parasitology, *Brucella, Erysipelothrix*, *Toxoplasma*, Herpes virus, and Pestivirus serology, kidney fat assessment, cortisol in feces, and cortisol in hair. In addition, genetic analyses were also performed on DU caribou muscle samples to evaluate the ecotype of the sampled animal. This is particularly relevant as there have been discussions about Barren-ground and Peary caribou mixing together with DU caribou and possibly responsible for changes in migratory behavior of the herd.

In the course of the fiscal year 2021-22, several barriers delayed the processing of the samples and the completion of the analyses: first the backlog from the previous fiscal year due to the COVID-19 pandemic and subsequent closure of the University and partner labs delayed sample analyses. In addition, we have modified several of our protocols (qiviut sorting, leg and jaw processing) and in some cases, had to run pilot studies to validate our new methods (e.g. quantifying cortisol in muskox hair using both qiviut and intermediate guard hair instead of qiviut only). Some issues with lab equipment for the hair mineral analyses also needed to be addressed before the analyses could be ran. Finally, the discovery of a *Brucella* case in a sampled kidney from an apparently healthy muskox from Ekaluktutiak (see Passive surveillance section in this report) has also forced us to change our workflow and biosafety procedures, slowing some of the sample processing.

Table 1: Summary of lab analyses conducted and still pending for the 48 received sample kits of muskoxen and DU caribou.

Analyses	Muskox	DU caribou
Coprology	Completed	Completed
***Besnoitia* examination**	Completed	Completed
Serology *Brucella*	Completed	Completed
Serology *Erysipelothrix*	Completed	Completed
Serology Herpes virus	Pending	Completed
Serology Pestivirus	Pending	Completed
Serology *Toxoplasma*	Pending	Completed
Metatarsal measurements	Completed	Completed
Bone marrow fat	Completed	Pending
Kidney fat	Completed	Completed
Jaw examination	Completed	Pending
Fecal stress hormones	Completed	Completed
Hair stress hormones	Pending	Completed
Pregnancy	Completed	Pending
Hair trace minerals	Pending	Pending

What follows is a preliminary summary of some of the analyses that have been completed. When summarizing trends over time, we included results from previous years of monitoring, and in the case of DU caribou, we also considered all DU caribou samples collected in Ekaluktutiak, Kugluktuk and Ulukhaktok.

Figure 3 shows the measured corticosterone for muskoxen sampled around Ekaluktutiak. Fecal corticosterone is an indicator on how stressed the animal was in the days/weeks before it was sampled. Exposure to different stress factors is known to vary a lot depending on the season, the age, and the sex (for example, muskox bull might be more stressed than juveniles or females during the rut). Therefore, it makes sense to control for those factors when considering the results. In addition, we separated our results between muskoxen from Victoria Island or the Kent Peninsula on the adjacent mainland. This distinction is important as we have indications that the animals on the mainland have different health and population trend than on the island. This adds to the complexity of the analyses and means we need more samples to be able to interpret the results of corticosterone analyses correctly.

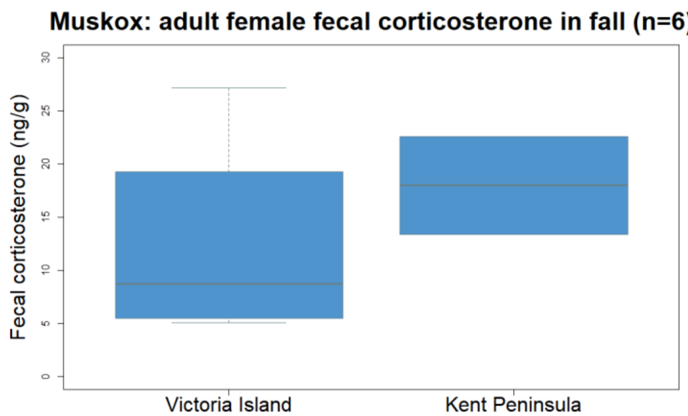


Figure 3: Level of fecal stress hormone (corticosterone) in adult female muskoxen sampled in fall on around Ekaluktutiak. Results are presented for animals sampled on Victoria Island (left) and the Kent Peninsula on the mainland (right).

Cortisol level in the hair is an indicator on how much stress the animal was exposed to when the hair was growing. When considering all DU caribou sampled since 2015 in Ekaluktutiak, Kugluktuk and Ulukhaktok, the level of cortisol in the hair seems to have decreased in the past years, indicating less stress.

Two out of 18 examined DU caribou legs (11.11%) had detectable *Besnoitia* cysts on the metatarsal bone. None of the examined muskox legs (0/14) had visible *Besnoitia* cysts. *Besnoitia* is a typical parasite of caribou that forms cysts under the skin, around the eyes, on the testicles and on the membrane covering the bones. It is usually not associated with disease although some individuals can present symptoms such as hair loss, swollen eyelids and in rare cases, poor body condition and general health. The parasite has also been reported in muskoxen.

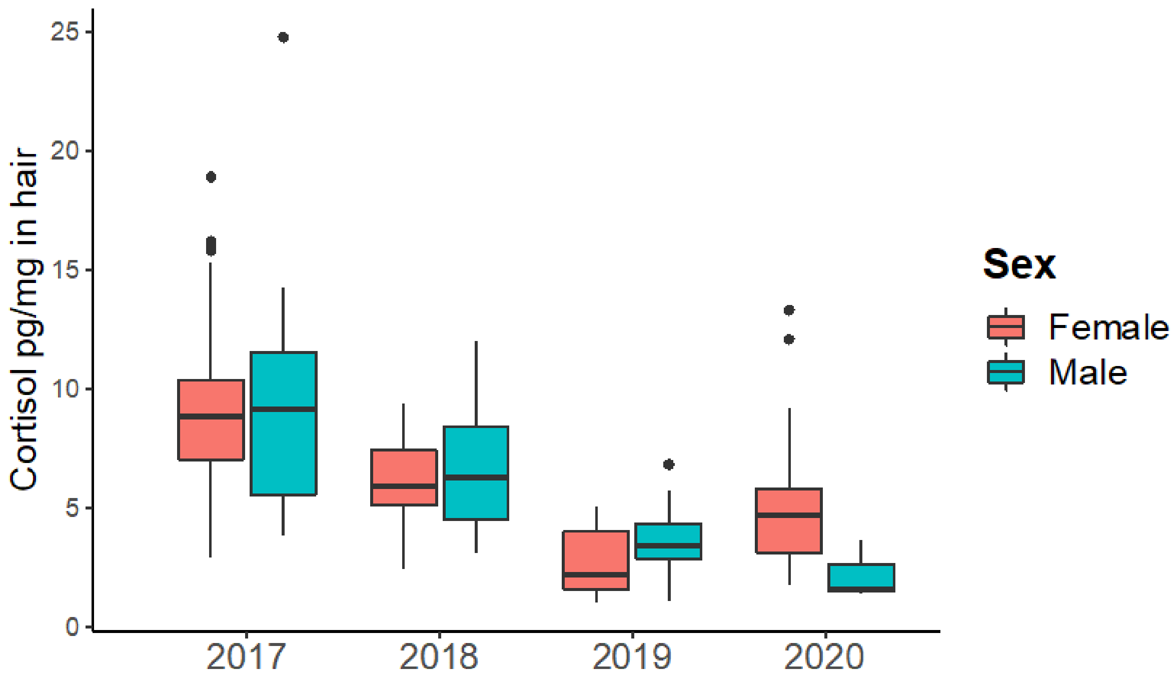


Figure 4: Cortisol hair level measured in DU caribou sampled in Ekaluktutiak, Kugluktuk, and Ulukhaktok.

For animals sampled around Ekaluktutiak in 2019-21, only one caribou out of 29 had parasite larvae (most likely the lungworm *Varestrongylus eleguneniensis* or *Parelaphostrongylus andersoni)* that could be detected in the fecal sample. In contrast, lungworms (*Umingmakstrongylus pallikuukensis* and *V. eleguneniensis)* were detected in almost all (13/14) muskox fecal samples analyzed, although most were with a low count of parasites (Figure 5). Lungworms are not dangerous to people but might reduce the overall health of heavily infected animals.

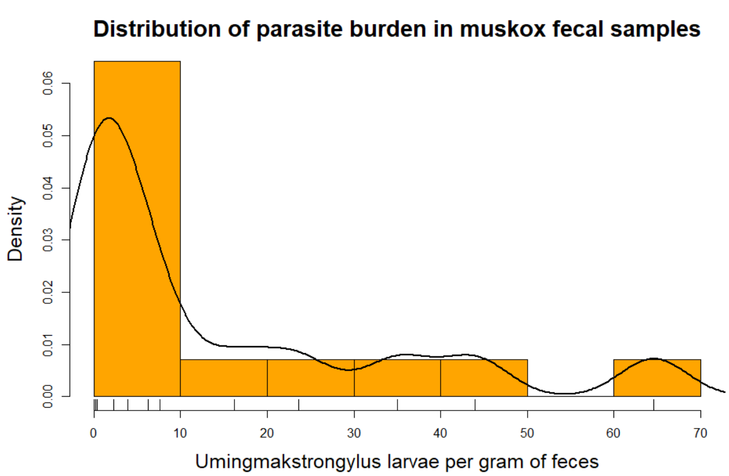


Figure 5: Distribution of burden of the lungworm Umingmakstrongylus pallikukensis *in muskoxen sampled around Ekaluktutiak in 2019-20. The observed distribution is typical of parasitic infection with most samples having a low count of parasites and only a few animals with high counts of parasites.*

We ran blood tests to determine if caribou and muskoxen had been previously exposed to two important pathogens, *Erysipelothrix* or *Brucella*. Among the caribou sampled around Ekaluktutiak in 2019-21, three out of 32 (9.4%) were seropositive (previously exposed) to *Brucella*. For muskoxen, 6.7% (one out of 15) were seropositive. For both species, the proportion of seropositive animals seems to be constant since 2014, although the lower number of samples collected during the COVID pandemic when compared to previous years limits our ability to capture changes in the epidemiology of the disease.

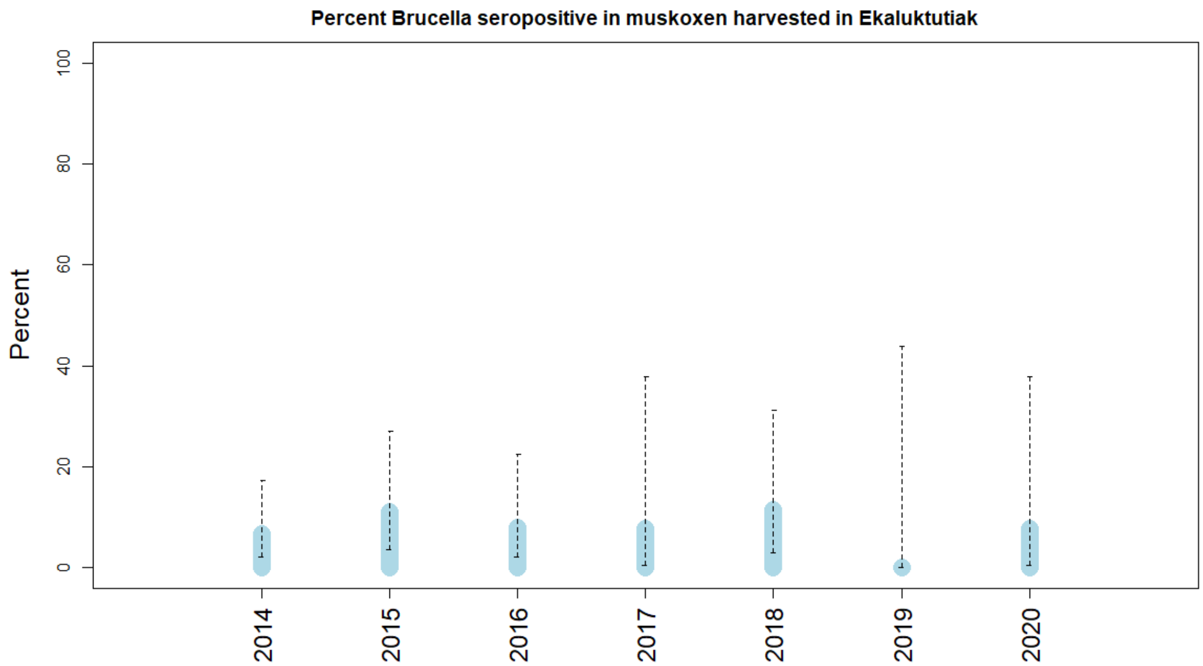


Figure 6: Percentage of muskoxen sampled around Ekaluktutiak that were previously exposed to Brucella*.*

None of the 32 DU caribou sampled around Ekaluktutiak in 2019-2021 was seropositive for the bacterium *Erysipelothrix.* In contrast, 3/14 (21.4%) of sampled muskoxen were seropositive for *Erysipelothrix*. This is particularly important as *Erysipelothrix* was the cause of several large muskox die-offs around Ekaluktutiak in 2009-2013. Yearly variations are apparent (figure 7) with a seroprevalence above 40% in 2019. However, the limited number of samples collected during the pandemic prevent us to infer more on any trend.

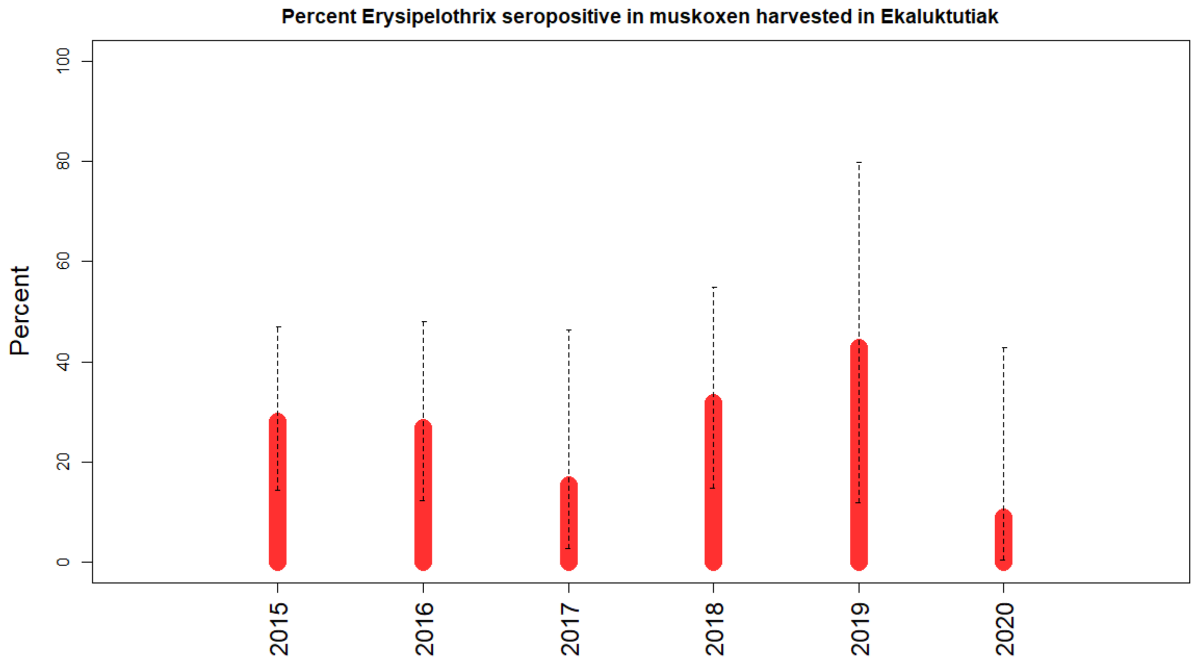


Figure 7: Percentage of muskoxen sampled around Ekaluktutiak that were previously exposed to Erysipelothrix.

Passive health surveillance:

During the processing of muskox kidney samples at the University of Calgary, we discovered one kidney with multiple abscesses. The kidney was sent to the Canadian Wildlife Health Cooperative for diagnostic and was positive for *Brucella*. *Brucella* is a bacterium and can be transmitted to people eating or handling sick animals. In this case the harvester didn't notice any sign of illness in the animal. The Canadian Food Inspection Agency, as well as Public Health Services and the territorial biologist in Nunavut were alerted. However, by the time the harvester was notified, the muskox had already been eaten, without anybody showing signs of infection, fortunately. This finding highlights the importance of maintaining a surveillance system to detect potential Public Health concerns in harvested animals.

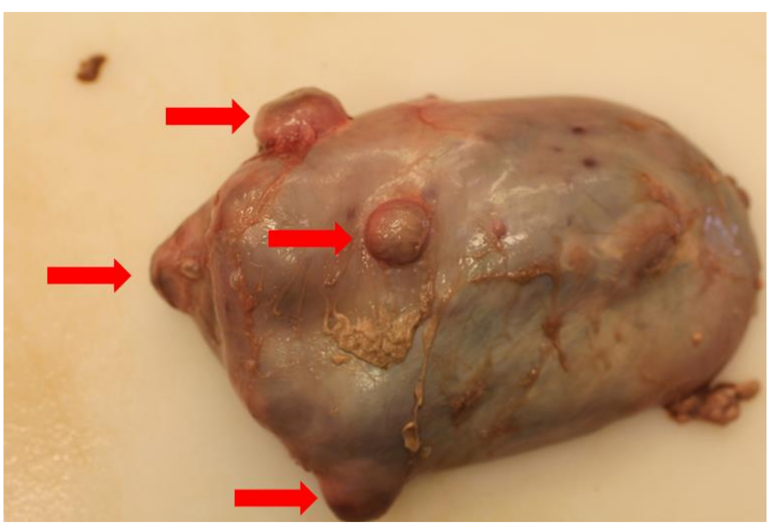


Figure 8: Kidney sample collected on an apparently healthy muskox. Note the multiple abscesses protruding from the surface of the kidney. Bacteriological investigations confirmed that the animal was infected with Brucella *spp., a bacterium that can also infect people.*

Reporting and data ownership:

The general meeting of the Ekaluktutiak Hunters and Trappers Organization did not happen last year, thus we could not present our results there. We did, however, arrange to present the preliminary results of the program to the Ekaluktutiak Hunters and Trappers Organization through a zoom meeting in June 2021. During this meeting we also presented a bulletin on all the muskox and caribou monitoring done by the Kutz Research group in collaboration with the communities and governments in the Kitikmeot and Inuvialuit regions. The EHTO expressed some concern about the *Brucella* results and how they may be used in management.

Future work

The lab analyses of the initial 48 kits as well as those received in April 2022 will be completed by the fall and final data analyses is planned for spring 2023. Preliminary results will be included in the community bulletin in summer 2022 and presented at the next general meeting of the Ekaluktutiak Hunters and Trappers Organization.

In addition to the caribou and muskox health monitoring, the Kutz Research Group facilitated the contact between Doug Clark (USaskatchewan) and the EHTO around a recently funded ArcticNet project on Grizzly bears. Additionally, the EHTO and the Kugluktuk and Ulukhaktok hunters and trappers organizations, together with the Kutz Research Group developed and successfully applied for two grants. The first is from National Geographic to evaluate how COVID-19 impacted the muskox and caribou monitoring program. This project and will help improve the community-based monitoring especially in regard to mobilizing local capacity. The second grant, a Canada-Inuit Nunangat-UK grant, is to fund traditional and scientific knowledge research on the two zoonotic pathogens – *Brucella* and *Erysipelothrix* – in Arctic wildlife.

The results generated by the monitoring program in Ekaluktutiak, together with information from similar monitoring in Ulukhaktok and Kugluktuk will help to better understand the drivers of muskox and caribou health and what it can tell us on the trajectory of the populations. This will ultimately help to guide the co-management of those species.

SUBMISSION TO THE

NUNAVUT WILDLIFE MANAGEMENT BOARD AND
NUNAVIK MARINE REGION WILDLIFE BOARD

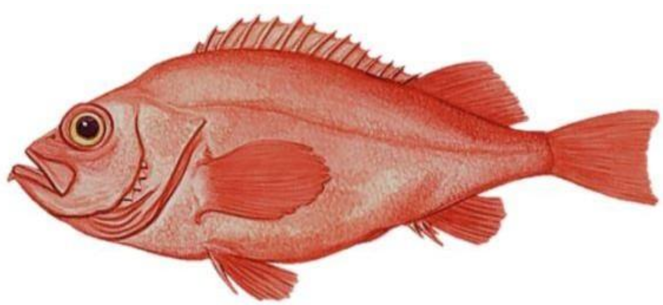
FOR

Information: **Decision: X** **Recommendation:**

Issue: Extension of provisions for the bycatch of Juvenile redfish (*Sebastes mentella* and *Sebastes fasciatus*) in the Northern Shrimp Fishery in the Western Assessment Zone and the Eastern Assessment Zone until March 31, 2023

Northern shrimp (*Pandalus borealis*)

Striped shrimp (*Pandalus montagui*)



Redfish (*Sebastes mentella and S. fasciatus*)

Background

Two shrimp species (*P. borealis* and *P. montagui*) occur in the Northern shrimp fishery that takes place in the Davis Strait and eastern Hudson Strait. This fishery is managed according to two distinct stock assessment zones, the Western Assessment Zone (WAZ) and the Eastern Assessment Zone (EAZ) (Appendix 1).

In October 2020, representatives of the offshore Northern shrimp sector reported high juvenile redfish bycatches in portions of the EAZ (Davis Strait West) and Shrimp Fishing Area (SFA) 4 to the extent that it triggered move-away provisions within Conditions of Licence (COL).

These provisions require vessels to change fishing locations by a minimum of 10 nautical miles in the event that groundfish bycatch (including redfish) in any tow exceeds a pre-defined threshold (the greater of 2.5% by weight of the catch of shrimp, or 100kg) (Appendix 2). There is currently no open directed redfish fishery in this area. The redfish fishery in Northwest Atlantic Fisheries Organization (NAFO) Subarea 2 + Division 3K has been under moratorium since 1997.

In fall 2020, industry reported that these move-away provisions were repeatedly triggered in the EAZ and SFA 4 to the extent that they inhibited successful prosecution of the shrimp fishery, posing a serious economic viability concern for the offshore shrimp sector. The occurrence of high juvenile redfish bycatch was considered an urgent and unusual circumstance. The need for a management response to address the interruption of shrimp fishing was urgent since fishing opportunity remaining was limited and subject to ice conditions. The high prevalence of redfish bycatch has persisted into the 2021-22 season based on industry reports and is expected to continue in 2022-23.

In November 2020, the Department sought views from industry and Nunavut Wildlife Management Board (NWMB) and the Nunavik Marine Region Wildlife Board (NMRWB) staff on an interim management response to high redfish bycatch that allowed harvesters to successfully prosecute the remainder of the 2020-21 shrimp fishery, while taking into consideration the potential impact on redfish stocks. The use of an interim measure was intended to facilitate innovative fishing techniques by harvesters in the affected areas to reduce future redfish bycatch. The Department carefully considered industry-proposed measures in consultation with NWMB and NMRWB staff and Fisheries and Oceans Canada (DFO) Science.

In late November, offshore shrimp COLs were amended to require vessels to move 5 nautical miles if the total bycatches of redfish over the previous six tows exceeded 10% by weight of the total catch of shrimp (Appendix 2). This measure would allow for increased redfish bycatches and reduce the frequency of move-aways. This interim measure was approved for a period of 8 weeks (November 26, 2020, to January 21, 2021). Given the persistence of the issue into 2021, the interim measure was then approved for two additional 8 week periods (May 28, 2021 to July 23, 2021 and July 30, 2021 to September 24, 2021) to allow for the successful prosecution of the fishery. Finally, an extended interim measure was approved on September 25, 2021 to account for the remainder of the year (September 25, 2021 to December 31, 2021).

This targeted, responsive approach was limited to SFA 4 and Davis Strait West management units in November. In late May, the scope was expanded to include SFA 5. Where Nunavut and Nunavik allocation holders may cross the between Davis Strait West and Nunavut / Nunavik East management units in the same tow, extension of this interim measure to Nunavut / Nunavik East was required from an operational standpoint.

In April 2022, industry, technical staff from the NWMB and the NMRWB, and DFO met on two occasions to discuss the continued approach and provide updates. Recent data (Appendix 3) indicates an average redfish bycatch of 1.3% and the data support the nature of the unpredictable aggregations encountered. At this time, there is support from industry for the mitigation and monitoring measures currently in place through the 5.3.24 interim decision.

<u>Science Advice</u>

Redfish stocks exhibit periodic pulse recruitment, exhibited by very small year classes in most years and occasionally extremely large year classes that can be a decade apart. These periodic large pulses of population recruitment are important to sustain the population over time.

Where redfish and Northern shrimp are found in similar environments, the first sign of a strong cohort is typically evidenced via increased bycatch rates in other fisheries with non-selective gear types like Northern shrimp. Redfish bycatch may consist of two or three species (depending on the area) that are not separated in fishery reporting or for stock assessment purposes. The relative abundance of each redfish species in bycatches changes with latitude.

The last assessment of the redfish stock in NAFO Subarea 2 + Division 3K occurred in 2016. Survey results showed that redfish biomass increased considerably from 2003 to 2010 and that biomass during 2010-2015 was approximately half of the pre-collapse (1978-1990) levels. The 2016 survey showed that redfish recruitment since 2000 was above the long term average, with a time-series high in 2014 (Appendix 4, Appendix 5).

More recent preliminary results from the multi-species survey (not dedicated to surveying redfish) in NAFO Subarea 2 + Division 3K show an increase in juvenile redfish recruitment in 2019 (likely 2018 year-class), as well as variability in the indices since the 2016 assessment.

Given there are no recent biomass estimates for redfish populations in the EAZ or WAZ, it is not possible to estimate the impact of juvenile redfish bycatches in these areas on population recovery. Further, it is not yet known if these recent large recruitments will persist over time in the population. DFO - Fisheries Resource Management has submitted requests for peer-reviewed stock assessments for redfish in NAFO Subarea 2 + Division 3K and Subarea 0 (overlapping with the EAZ).

In spring of 2021, research was conducted regarding whether trawl modifications could potentially help address the prevalence of redfish bycatch. The purpose of the project was to evaluate the effectiveness of various Nordmøre grid bar spacings in mitigating bycatch of juvenile redfish. Two experimental grids of 17mm and 15mm were used, in comparison to the tradition 22mm grid often used by industry. This project was conducted in SFAs 4 and 5. Preliminary results indicated that a reduction in grid size reduced redfish bycatch by 28.37% for 17mm grids and 18.69% for 15mm grids.

For 2022, the offshore fleet has proposed undertaking additional research using additional trawl modifications by including a window in the trawl to further promote redfish escapement and reduced redfish bycatch, a technique used successfully in other shrimp fisheries internationally. Up to 3 vessels will participate in the project that will use twin trawls, one with a window and one without, as well as different configurations of the window to determine if bycatch levels can be further reduced below the current

1.3% experienced in the 2021 fishery. While in-season bycatch will continue to be closely monitored, upon completion of this experimental work a report on the impact of using windows in trawl nets would be produced and shared with the Department to assist in future decisions on redfish bycatch.

In addition, a retroactive analysis of redfish bycatch in the Northern shrimp fishery was conducted for the Canadian Association of Prawn Procurers by Pisces Consulting (Appendix 6). This report was shared with the Department in the summer of 2021 to support decision-making. It indicates that while redfish bycatch is still a concern, it has mostly remained under the adjusted limit and does not represent a worst-case scenario. An updated redfish bycatch rollup report was provided in March 2022 (Appendix 3).

Summary of Request

In order to ensure continued operations in 2022, it is recommended that:

1. To provide longer term certainty and eliminate the need to revisit this issue frequently in spite of little to no new information, there be an extension of the provision in the EAZ and WAZ until March 31, 2023. This will be accompanied by regular monitoring and continued meetings of the redfish bycatch working group to assess effectiveness.

DFO - Fisheries Resource Management would apply this measure to SFAs 4 and 5 as well and will continue to monitor bycatch in the Northern shrimp fishery in the WAZ and EAZ and neighboring shrimp management units to better understand the potential impact to harvesters and to the conservation of redfish stocks. In addition, DFO will support further industry initiatives to test innovative fishing techniques that may reduce future redfish bycatches, and consider the possible use of these techniques in future management decisions, where appropriate. All measures will be considered to protect the growth of the redfish stocks while balancing socioeconomic considerations of the shrimp fishery.

Prepared by: Fisheries Resource Management, Fisheries and Oceans Canada

Date: May 6, 2022

Appendices

Appendix 1 – Map of groundfish and shrimp administrative areas in Atlantic Canada

Appendix 2 – Condition of Licence amendments

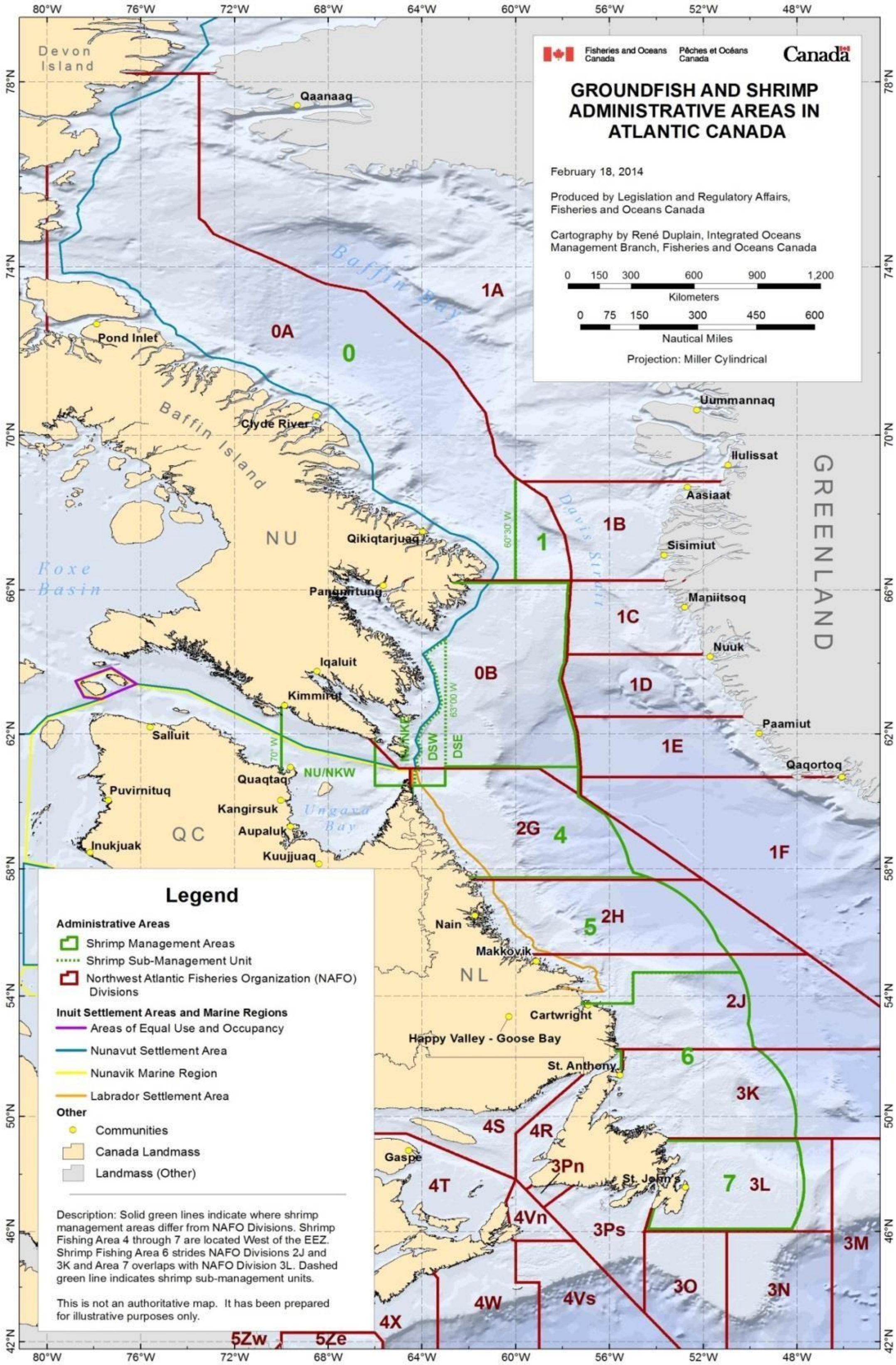
Appendix 3 – December 2021 to February 2022 Redfish Bycatch Rollup Report

Appendix 4 – Summary: Stock status of redfish in NAFO SA 2 + Divs. 3K (Science Advisory Report 2020/021)

Appendix 5 – Full publication: Stock status of redfish in NAFO SA 2 + Divs. 3K (Science Advisory Report 2020/021)

Appendix 6 – Full publication: Retroactive Analysis Redfish Bycatch in the Northern Shrimp Fishery

APPENDIX 1



Fisheries and Oceans Canada
Pêches et Océans Canada
Canada
GROUNDFISH AND SHRIMP ADMINISTRATIVE AREAS IN ATLANTIC CANADA
February 18, 2014
Produced by Legislation and Regulatory Affairs, Fisheries and Oceans Canada
Cartography by René Duplain, Integrated Oceans Management Branch, Fisheries and Oceans Canada
0 150 300 600 900 1,200
Kilometers
0 75 150 300 450 600
Nautical Miles
Projection: Miller Cylindrical
Legend
Administrative Areas
Shrimp Management Areas
Shrimp Sub-Management Unit
Northwest Atlantic Fisheries Organization (NAFO) Divisions
Inuit Settlement Areas and Marine Regions
Areas of Equal Use and Occupancy
Nunavut Settlement Area
Nunavik Marine Region
Labrador Settlement Area
Other
Communities
Canada Landmass
Landmass (Other)
Description: Solid green lines indicate where shrimp management areas differ from NAFO Divisions. Shrimp Fishing Area 4 through 7 are located West of the EEZ. Shrimp Fishing Area 6 strides NAFO Divisions 2J and 3K and Area 7 overlaps with NAFO Division 3L. Dashed green line indicates shrimp sub-management units.
This is not an authoritative map. It has been prepared for illustrative purposes only.
Devon Island
Qaanaaq
Baffin Bay
Pond Inlet
Baffin Island
Clyde River
NU
Qikiqtarjuaq
Pangnirtung
Foxe Basin
Iqaluit
Kimmirut
Salluit
Quaqtaq
NU/NKW
NU/NKE
DSW
DSE
60°30'W
63°00'W
70°W
Puvirnituq
Kangirsuk
Aupaluk
Ungava Bay
QC
Inukjuak
Kuujjuaq
Nain
Makkovik
NL
Cartwright
Happy Valley - Goose Bay
St. Anthony
Gaspe
St. John's
GREENLAND
Uummannaq
Ilulissat
Aasiaat
Sisimiut
Maniitsoq
Nuuk
Paamiut
Qaqortoq
Davis Strait
0A
0
1A
1B
1
1C
0B
1D
1E
2G
4
1F
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5
2J
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3K
4S
4R
3Pn
4T
7
3L
4Vn
3Ps
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3O
3N
4W
4Vs
4X
5Zw
5Ze
80°W 76°W 72°W 68°W 64°W 60°W 56°W 52°W 48°W
78°N 74°N 70°N 66°N 62°N 58°N 54°N 50°N 46°N 42°N

APPENDIX 2

Offshore Shrimp Condition of Licence

5.2. If total by-catches of all groundfish species in any haul exceed the greater of 2.5% by weight of the catch of shrimp or 100 kg, the licence holder or vessel operator must immediately change fishing area by a minimum of ten (10) nautical miles from any position of the previous tow in an effort to avoid further by-catches of all groundfish. If after moving and for all subsequent moves, the next haul exceeds the greater of 2.5% by weight of the catch of shrimp or 100kg, the vessel must continue to move 10 nautical miles from any position of the previous tow to avoid by-catch. The licence holder or vessel operator must record in the logbook (in the Remarks field)the active avoidance measures taken in response to any tows that contained excessive groundfish by-catch, the position (latitude and longitude) at the time of groundfish by-catch, as well as the quantity caught by weight in kilogram.

Condition of Licence amendment effective November 26, 2020, to January 21, 2021:

5.2.3 Notwithstanding section 5.2 above, while fishing within and/or across the waters of the following Management Units on a single fishing trip: Nunavut East, Nunavik East, Davis Strait West, and/or Shrimp Management Unit 4, if total by-catches of Redfish exceed 10% by weight of the total catch of shrimp over the previous six tows, the licence holder or vessel operator must immediately change fishing area by a minimum of five (5) nautical miles from any position of the previous tow. Whenever the vessel moves five (5) nautical miles or more from any position of the previous tow, the following tow is to be considered to be the first of the next six tows to be considered. The licence holder or vessel operator must record in the logbook (in the Remarks field) the active avoidance measures taken in response to any tows that contained excessive Redfish by-catch, the position (latitude and longitude) at the time of Redfish by-catch, as well as the quantity caught by weight in kilogram. The above provisions of 5.2.3 are effective between 0001 UTC on November 26, 2020, to 2400 UTC on January 21, 2021.

Condition of Licence amendment effective May 28, 2021, to July 23, 2021:

5.2.3 Notwithstanding section 5.2 above, while fishing within and/or across the waters of the following Management Units on a single fishing trip: Shrimp Management Unit 1, Nunavut East, Nunavik East, Davis Strait West, Davis Strait East, Shrimp Management Unit 4,and/or Shrimp Management Unit 5, if total by-catches of Redfish exceed 10% by weight of the total catch of shrimp over the previous six tows, the licence holder or vessel operator must immediately change fishing area by a minimum of five (5) nautical miles from any position of the previous tow. Whenever the vessel moves five (5) nautical miles or more from any position of the previous tow, the following tow is to be considered to be the first of the next six tows to be considered. The licence holder or vessel operator must record in the logbook (in the Remarks field) the active avoidance measures taken in response to any tows that contained excessive Redfish by-catch, the position (latitude and longitude) at the time of Redfish by-catch, as well as the quantity caught by weight in kilogram. The above provisions of 5.2.3 are effective between 0001 UTC on May 28, 2021, to 2400 UTC on July 23, 2021.

APPENDIX 2

Condition of Licence amendment effective July 30, 2021, to September 24, 2021:

5.2.3 Notwithstanding section 5.2 above, while fishing within and/or across the waters of the following Management Units on a single fishing trip: Shrimp Management Unit 1, Nunavut East, Nunavik East, Davis Strait West, Davis Strait East, Shrimp Management Unit 4,and/or Shrimp Management Unit 5, if total by-catches of Redfish exceed 10% by weight of the total catch of shrimp over the previous six tows, the licence holder or vessel operator must immediately change fishing area by a minimum of five (5) nautical miles from any position of the previous tow. Whenever the vessel moves five (5) nautical miles or more from any position of the previous tow, the following tow is to be considered to be the first of the next six tows to be considered. The licence holder or vessel operator must record in the logbook (in the Remarks field) the active avoidance measures taken in response to any tows that contained excessive Redfish by-catch, the position (latitude and longitude) at the time of Redfish by-catch, as well as the quantity caught by weight in kilogram. The above provisions of 5.2.3 are effective between 0001 UTC on July 30, 2021, to 2400 UTC on September 24, 2021.

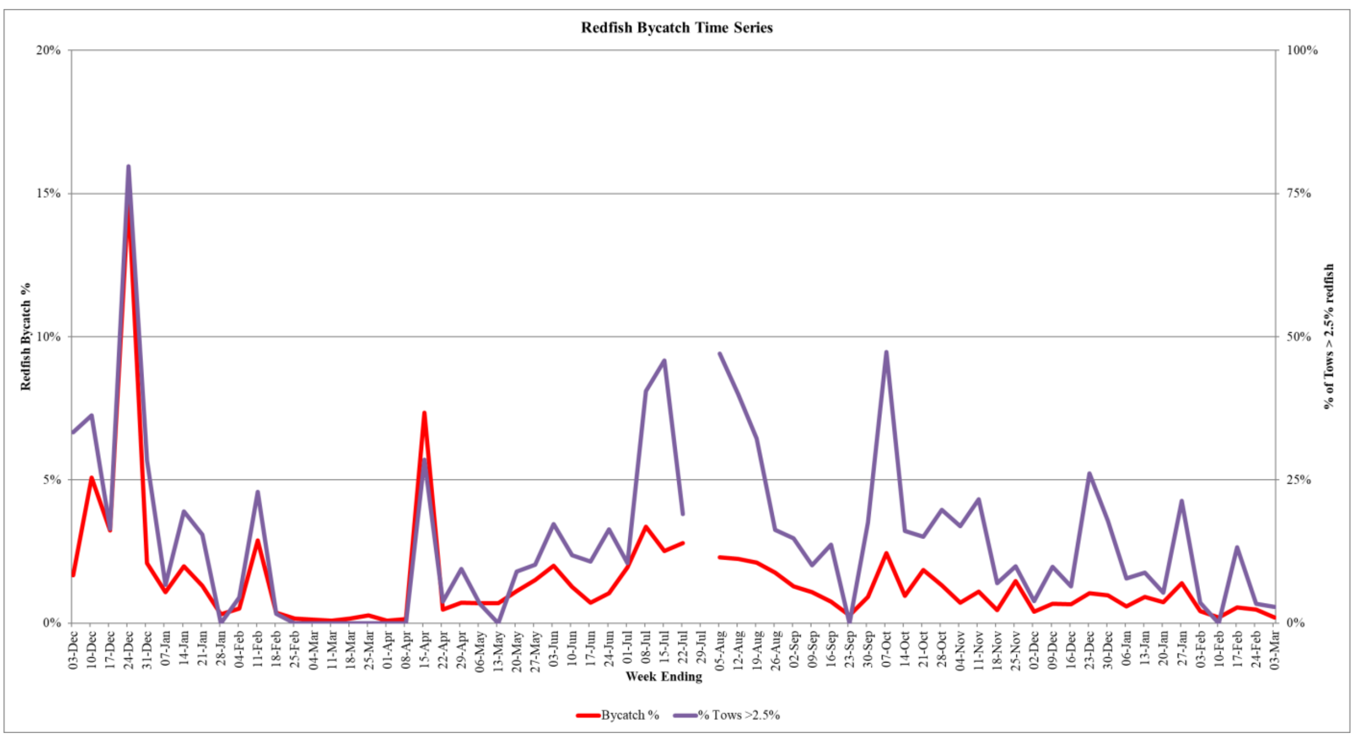
Condition of License amendment effective September 25, 2021, to December 31, 2021:

5.2.3 Notwithstanding section 5.2 above, while fishing within and/or across the waters of the following Management Units on a single fishing trip: Shrimp Management Unit 1, Nunavut East, Nunavik East, Davis Strait West, Davis Strait East, Shrimp Management Unit 4,and/or Shrimp Management Unit 5, if total by-catches of Redfish exceed 10% by weight of the total catch of shrimp over the previous six tows, the licence holder or vessel operator must immediately change fishing area by a minimum of five (5) nautical miles from any position of the previous tow. Whenever the vessel moves five (5) nautical miles or more from any position of the previous tow, the following tow is to be considered to be the first of the next six tows to be considered. The licence holder or vessel operator must record in the logbook (in the Remarks field) the active avoidance measures taken in response to any tows that contained excessive Redfish by-catch, the position (latitude and longitude) at the time of Redfish by-catch, as well as the quantity caught by weight in kilogram. The above provisions of 5.2.3 are effective between 0001 UTC on September 25, 2021, to 2400 UTC on December 31, 2021.

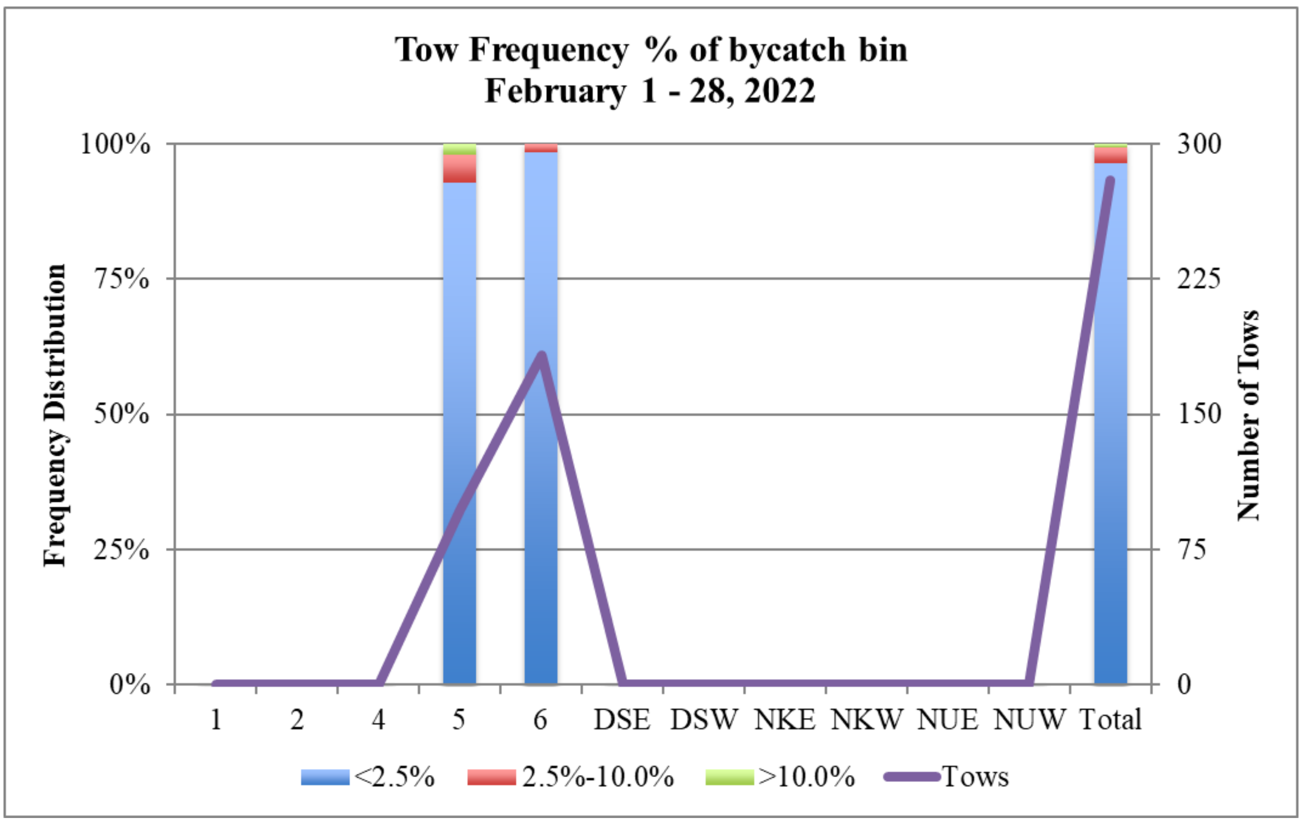
Appendix 3

Redfish Bycatch Rollup Report
December 1, 2020 – February 28, 2022

Area	Shrimp (kg)	Redfish (kg)	Redfish %	Tow Frequency Distribution <2.5%	2.5%-10.0%	>10.0%
1	182,101	10,728	5.9%	23	30	16
2	982,420	21,267	2.2%	139	18	18
4	10,999,167	210,830	1.9%	1,137	263	72
5	12,404,282	120,499	1.0%	1,494	165	30
6	4,523,855	10,135	0.2%	616	8	3
DSE	1,856	5,830	314.1%	4	-	12
DSW	6,705,903	162,746	2.4%	945	196	125
NKE	417,859	621	0.1%	36	-	-
NKW	7,217,212	22,863	0.3%	829	15	-
NUE	417,132	1,745	0.4%	41	2	2
NUW	69,310	188	0.3%	13	2	-
Total	43,921,097	567,452	1.3%	5,277	699	278



Area	Shrimp (kg)	Redfish (kg)	Redfish %	Tow Frequency Distribution <2.5%	2.5%-10.0%	>10.0%
1						
2						
4						
5	630,644	4,758	0.8%	90	5	2
6	1,444,205	2,568	0.2%	180	3	-
DSE						
DSW						
NKE						
NKW						
NUE						
NUW						
Total	**2,074,849**	**7,326**	**0.4%**	**270**	**8**	**2**



END OF DOCUMENT

SUMMARY: Stock status of redfish in NAFO SA 2 + Divs. 3K (Science Advisory Report 2020/02)

- Biomass increased considerably from 2003 to 2010. Biomass during 2010-2015 was approximately half of the pre-collapse (1978-1990) levels.
- Recruitment (abundance of Redfish <15 cm) since 2000 was above the long term average with a time-series high in 2014.
- A fishing mortality proxy has been very low (<1%) since 2006. The fishery remains under moratorium, and average bycatch (including discards) since 2006 has been approximately 500 t.
- The meeting was neither able to validate nor invalidate existing reference points (DFO 2012) derived from production models due to substantive concerns about input data and an incomplete documentation of the rationale for model formulation.
- Other options for Limit Reference Points (LRPs) were considered. However, considering difficulties with respect to application of the LRP concepts for Redfish including its episodic recruitment, species separation, and other data limitations, these other LRP options were not accepted.
- No LRP examined (including DFO 2012) was considered applicable at this time.
- In the absence of a LRP, it is not possible to identify what zone of the Precautionary Approach (PA) framework this stock is currently within. It is recommended that adaptive and cautious management be applied to any reopened fishery.

Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans

Newfoundland and Labrador Region

Canadian Science Advisory Secretariat
Science Advisory Report 2020/021

STOCK STATUS OF REDFISH IN NAFO SA 2 + DIVS. 3K

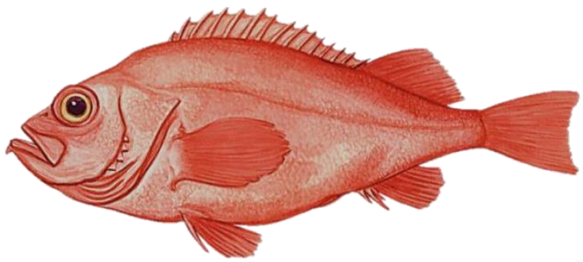


Image: Redfish

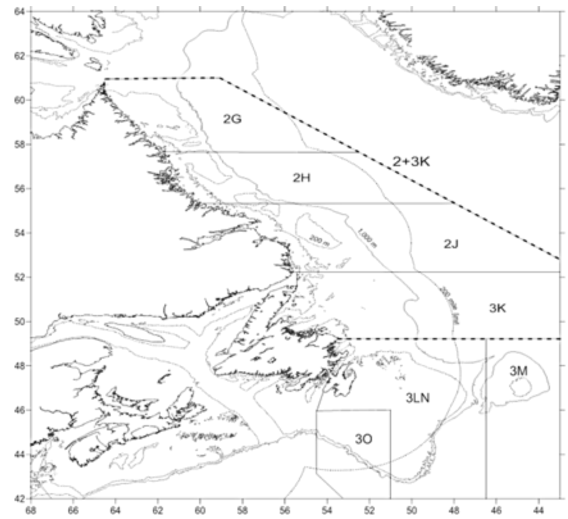


Figure 1. Map of the Northwest Atlantic indicating the SA 2 + Divs. 3K management area for Redfish.

Context:

In the Northwest Atlantic, Redfish range from Baffin Island in the north, to waters off New Jersey in the south and are managed in several discrete units. Redfish in Northwest Atlantic Fisheries Organization (NAFO) Subarea 2 (2G, 2H, and 2J) + Division 3K comprise stock complexes of two species (Sebastes mentella and S. fasciatus) recorded together in the landings because they cannot easily be distinguished visually, plus an additional less dominant species S. marinus that is visually distinct from the other species. The fishery on this stock was under Total Allowable Catch (TAC) regulation from 1974 (30,000 t) to 1996 (200 t). From 1997 to the present, the stock has been under moratorium to directed fishing. A previous assessment in 2001, of Redfish in stock status in Subarea (SA) 2 + Divs. 3K concluded that the population declined rapidly over a 10 year period from 1980-1990 and that surveys up to 2000 continue to indicate that the resource was at a low level reflecting over 25 years of recruitment failure. A Recovery Potential Assessment was conducted in a 2011 Zonal Advisory Process in which limit reference points (LRPs) were determined. During this process, stock status was updated and it was concluded that the biomass had remained stable at a low level from the mid-1990s until the mid-2000s when a period of marginal increase was evident.

This Science Advisory Report is from the October 19-21, 2016 Assessments of Redfish in Northwest Atlantic Fisheries Organization (NAFO) Subarea 0, and Subarea 2 and Division 3K. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SUMMARY

- Biomass increased considerably from 2003 to 2010. Biomass during 2010-2015 was approximately half of the pre-collapse (1978-1990) levels.
- Recruitment (abundance of Redfish <15 cm) since 2000 was above the long term average with a time-series high in 2014.
- A fishing mortality proxy has been very low (<1%) since 2006. The fishery remains under moratorium, and average bycatch (including discards) since 2006 has been approximately 500 t.
- The meeting was neither able to validate nor invalidate existing reference points (DFO 2012) derived from production models due to substantive concerns about input data and an incomplete documentation of the rationale for model formulation.
- Other options for LRPs were considered. However, considering difficulties with respect to application of the LRP concepts for Redfish including its episodic recruitment, species separation, and other data limitations, these other LRP options were not accepted.
- No LRP examined (including DFO 2012) was considered applicable at this time.
- In the absence of a LRP, it is not possible to identify what zone of the Precautionary Approach (PA) framework this stock is currently within. It is recommended that adaptive and cautious management be applied to any reopened fishery.

INTRODUCTION

Redfish have been fished commercially in both the Atlantic and Pacific Oceans. They occur on both sides of the north Atlantic Ocean in cool waters (3 to 8°C) along the slopes of banks and deep channels generally in depths of 100-1,000 m. In the Northwest Atlantic, Redfish range from Baffin Island in the north, to waters off New Jersey in the south (Gascon 2003, Fig. 1).

Redfish found on the Northeast Newfoundland and Labrador Shelves (NAFO SA 2 + Divs. 3K) comprise a stock complex formed by three distinct species, *Sebastes mentella* (Deepwater Redfish) and *Sebastes fasciatus* (Acadian Redfish), which dominate commercial fisheries, and *Sebastes marinus* (Golden Redfish) which is much less abundant. Currently, *S. marinus* is recognized as being synonymous with *S. norvegicus* with most authorities reverting to *S. norvegicus* as the accepted binomial name. However, for consistency with previous Canadian Science Advisory Secretariat (CSAS) and Department of Fisheries and Oceans (DFO) publications, and this stock assessment, we will refer to this species as *S. marinus*. *S. mentella* and *S. fasciatus* are visually and anatomically very similar, and historically they have not been separated in commercial catches or in research vessel (RV) surveys. *S. marinus* can be distinguished by colour, eye size and the relative size of a bony protrusion on its lower jaw. These species are not separated in the fishery and are managed together. The current assessment is based upon *S. fasciatus, S. mentella,* and *S. marinus* combined.

Along the continental shelves and slopes *S. mentella* range predominantly from the Gulf of St. Lawrence northward whereas *S. fasciatus* range predominantly from the southern Grand Banks to the Gulf of Maine. Generally, *S. mentella* is distributed deeper than *S. fasciatus* (Gascon 2003).

Redfish are longlived (up to 75 years) with a slow growth rate (Campana et. al. 1990). Estimates of size at maturity vary between and within populations with lower estimates in the range of 22-24 cm (Sévigny et al. 2007) and upper estimates of 38-39 cm for deep-sea *S. mentella* (Magnússon and Magnússon 1995). Redfish produce live young that can disperse over large distances (Valentin et. al. 2015). Recruitment is episodic and there may be decades between strong cohorts. They form aggregations throughout life and survey results for Redfish are typically dominated by one or two very large samples which has an unknown influence on survey results.

Fishery Removals

A Canadian and non-Canadian Redfish fishery has been prosecuted in SA 2 + Divs. 3K since the late 1940s. Total Allowable Catch (TAC) was established in 1974 when a 30,000 t quota was implemented (Fig. 2). The TAC was increased to 35,000 t in 1980 and remained at that amount until it was lowered to 20,000 t in 1991 (Fig. 2). The TAC decreased to 1,000 t in 1994 and was reduced to 200 t in 1995. The stock has been under moratorium since 1997 (Fig. 2).

The highest recorded removal of SA2 + 3K Redfish was 187,000 t in 1959 (Fig. 2). Removals from 1980 onwards also include discard estimates from Canadian shrimp (1980-2015) and Canadian Greenland Halibut fisheries (1995-2015) derived from fishery observer data scaled to total shrimp and Greenland Halibut landings. Reported removals fell to 56,000 t in 1961 and varied between 14,500 t and 56,000 t during the period 1962 to 1987 (Fig. 2). Removals declined after 1987 ranging from 30 t to 7,500 t up to the declaration of the moratorium in 1997 (Figs. 2 and 3). Removals from bycatch and discards have ranged between 50 t and 1,500 t since the 1997 moratorium (average of 500 t annually). From 1980 to 1996, discards ranged between 15 t to 700 t annually, averaging 200 t per year. Since the moratorium in 1997, estimates of discards ranged between 50 t and 600 t annually, averaging <300 t per year (Fig. 3). Note that Russian (2001-2008) and Lithuanian (2001-2011) catches are considered to be from the Irminger Sea and are not included in SA2 + 3K removal totals for those years.

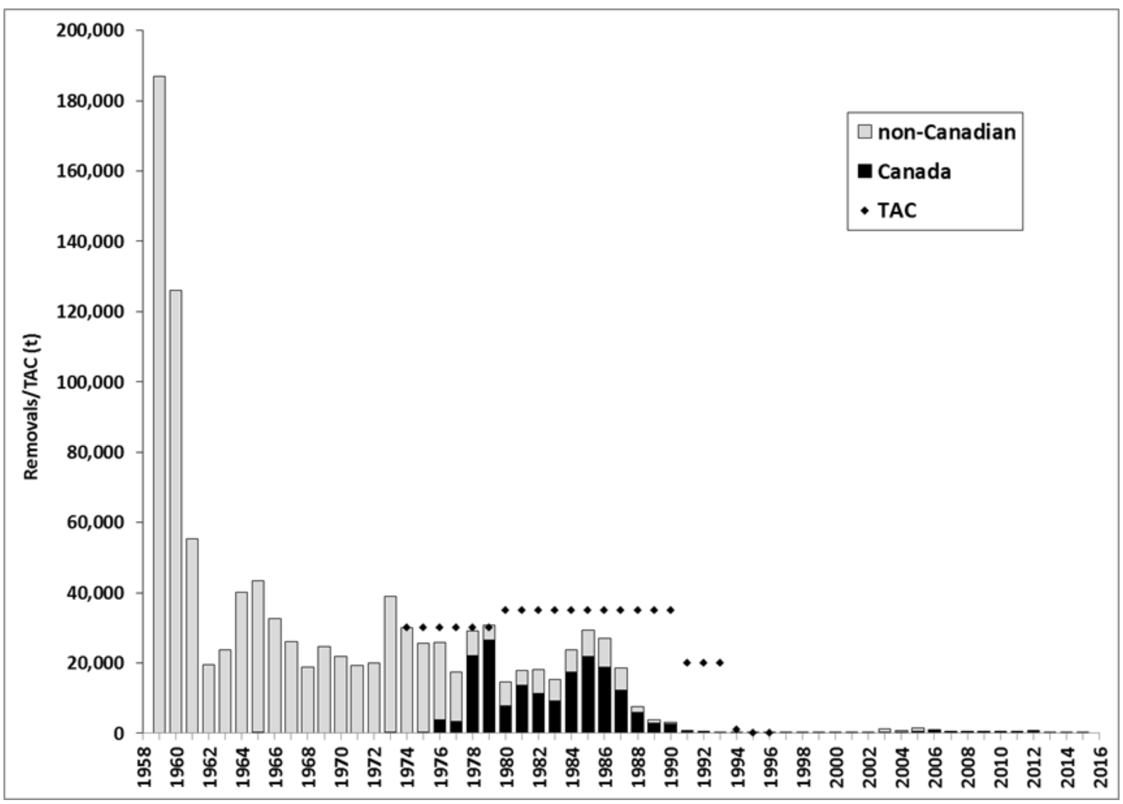


Figure 2. Redfish reported removals (t) by Canadian and non-Canadian fleets (including Canadian discard estimates from 1980-2015) and TAC in SA 2 + Divs. 3K from 1959 to 2015.

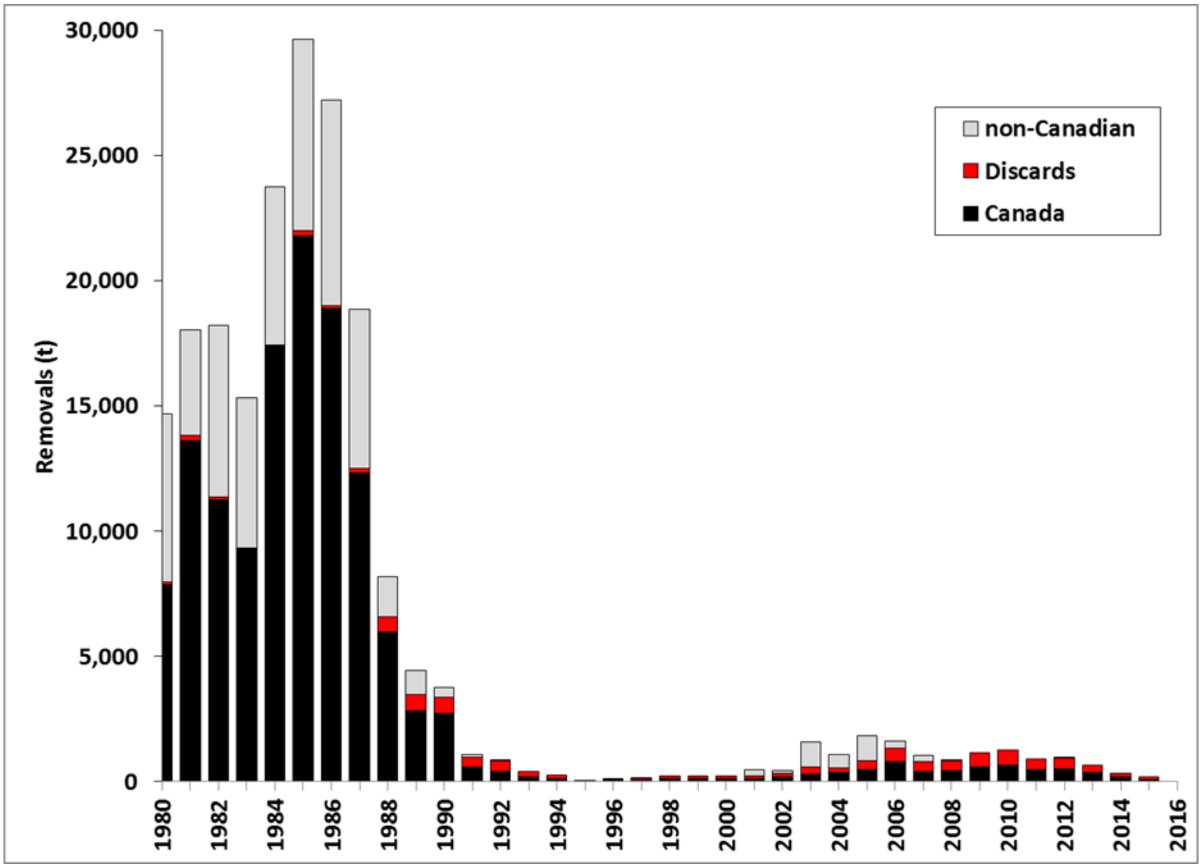


Figure 3. Redfish reported removals (t) by Canadian and non-Canadian fleets in SA 2 + Divs. 3K from 1980-2015 with Canadian discard estimates shown in red.

ASSESSMENT

This assessment considered information from landings from all countries (1959-2015) in conjunction with analyses of data from research vessel (RV) surveys conducted during autumn from 1978 to 2015.

Survey Methodology

Stratified random bottom trawl surveys were conducted in the autumn in Divs. 2J and 3K from 1977 to 1995 covering depths from 100 to 1,000 m and from 1996 to 2015 covering depths from 100 to 1,500 m. Surveys in Divs. 2G were conducted sporadically with varying spatial coverage and timing between 1978 and 1999 (the last year this Division was surveyed). Surveys were conducted sporadically in Divs. 2H between 1978 and 2010. Between 1978 and 1995 Divs. 2H surveys sampled depths from 100 to 1,000 m; in 1996 the depth range was extended to 1,500 m. Surveys have been conducted annually in Divs. 2H since 2010, although deep strata (>700 m) were not sampled in 2014 and 2015. Due to the inconsistent coverage of Divs. 2G and 2H, the primary indices for this stock are from Divs. 2J and 3K combined.

Survey Indices

Abundance and Biomass

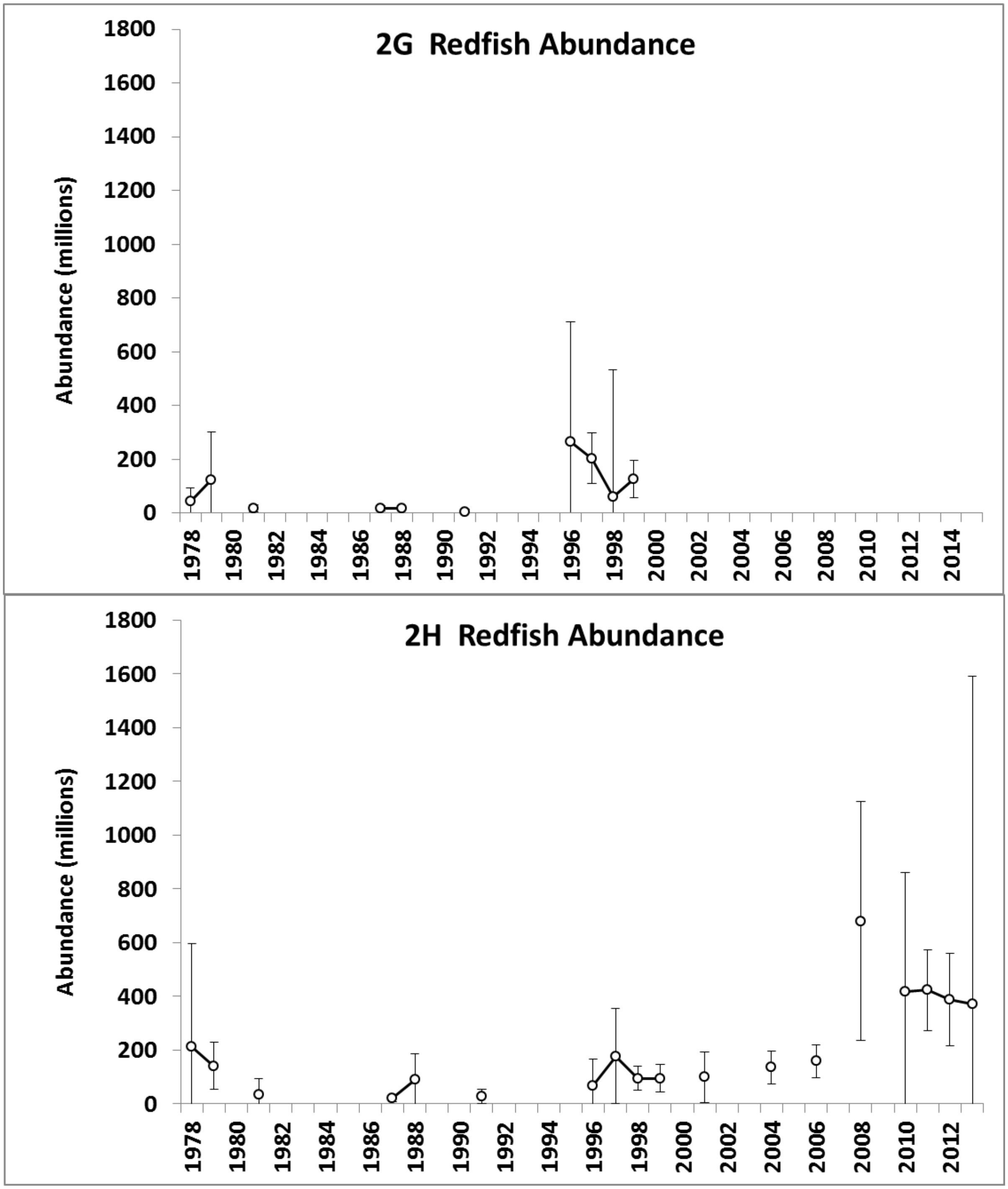


Figure 4. Abundance indices (millions) for Redfish in NAFO Divisions 2G and 2H from 1978 to 2013 (vertical lines represent 95% confidence intervals). Note that deep strata (>700 m) were not sampled in 2H in 2014 and 2015 (gaps represent years when the Division was not sampled).

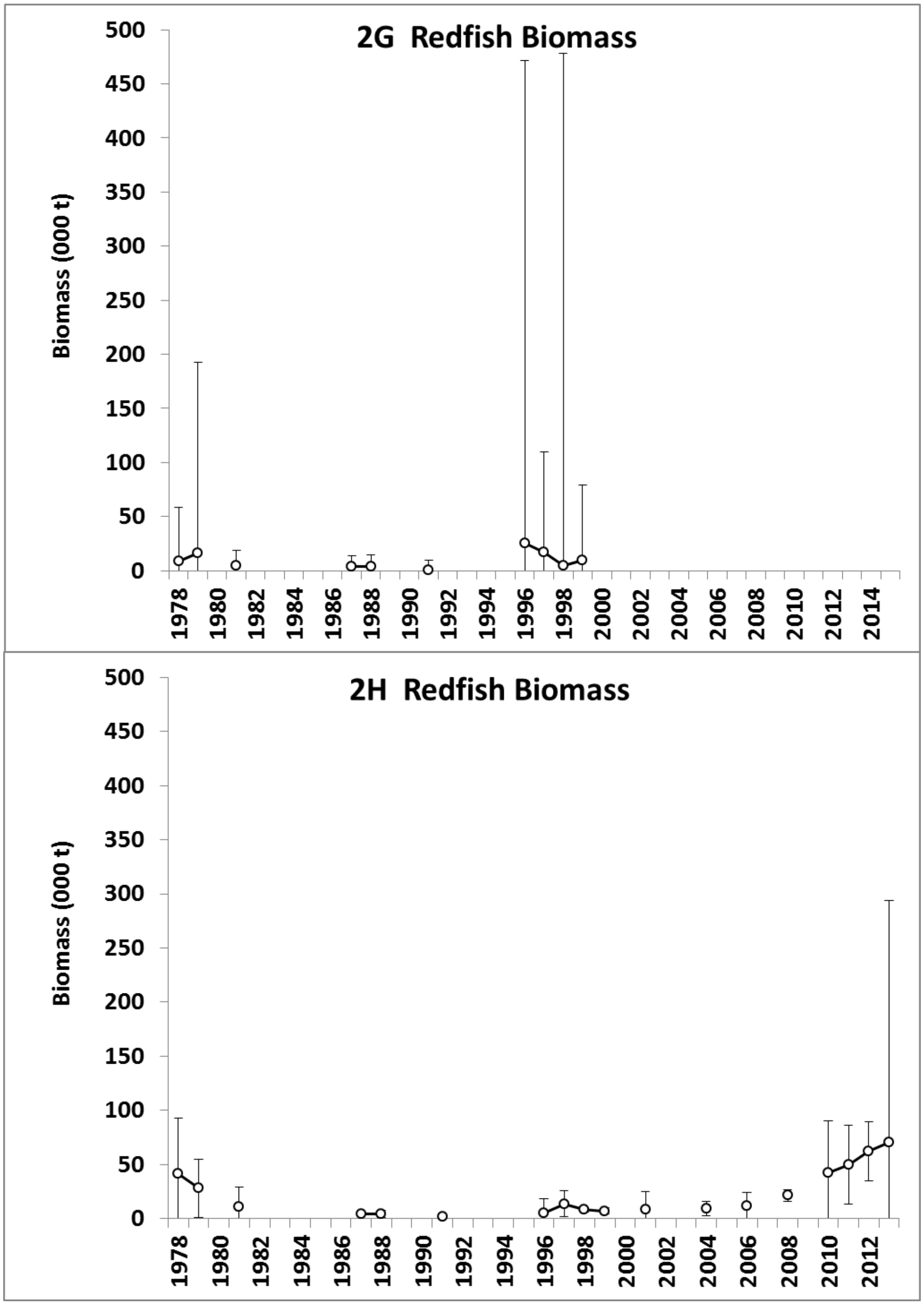


Figure 5. Biomass indices (000 t) for Redfish in NAFO Divisions 2G and 2H from 1978 to 2013 (vertical lines represent 95% confidence intervals). Note that deep strata (>700 m) were not sampled in 2H in 2014 and 2015 (gaps represent years when the Division was not sampled).

Abundance indices were relatively stable in Divs. 2H from 2010 to 2013 (Fig. 4). During this period, biomass values increased (Fig. 5) due to fish growth. In 2014 and 2015 the survey was incomplete as important areas for Redfish (depths >700 m) were not covered. Overall, both 2G and 2H represent a relatively small portion of the Redfish abundance and biomass within Divs. SA 2 + Divs. 3K.

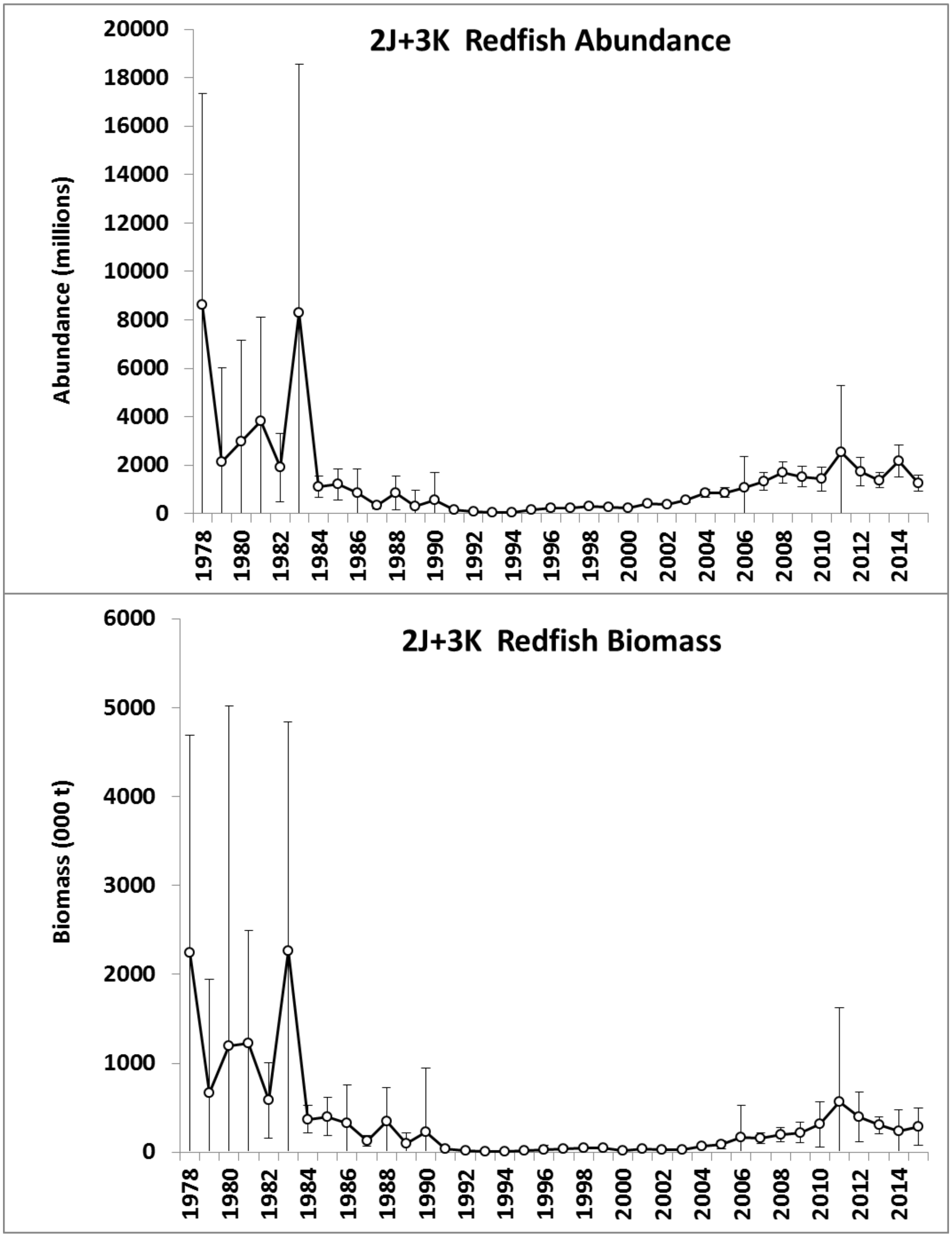


Figure 6. Abundance (millions) and biomass (000 t) indices for Divs2J3K Redfish from 1978 to 2015 (vertical lines represent 95% confidence intervals).

Abundance and biomass (Fig. 6) indices for Divs. 2J3K) were relatively high from 1978 to 1983, compared to the 1991 to 2003 collapse period. The biomass index increased by approximately a factor of 10 from 2003 to 2011. Biomass from 2011 to 2015 declined marginally but was relatively stable at approximately half of the pre-collapse (1978-1990) levels. Abundance values from 2011 to 2015 were also relatively stable at approximately 70% of pre-collapse levels. Generally, patterns were consistent between the abundance and biomass indices.

Mortality

A proxy for fishing mortality was calculated as the ratio of total landings (including discard estimates) in a given year to the RV survey biomass index from the previous year. This proxy was variable from the 1980s to the mid-2000s but since 2006, has been low (<1%) (Fig. 7).

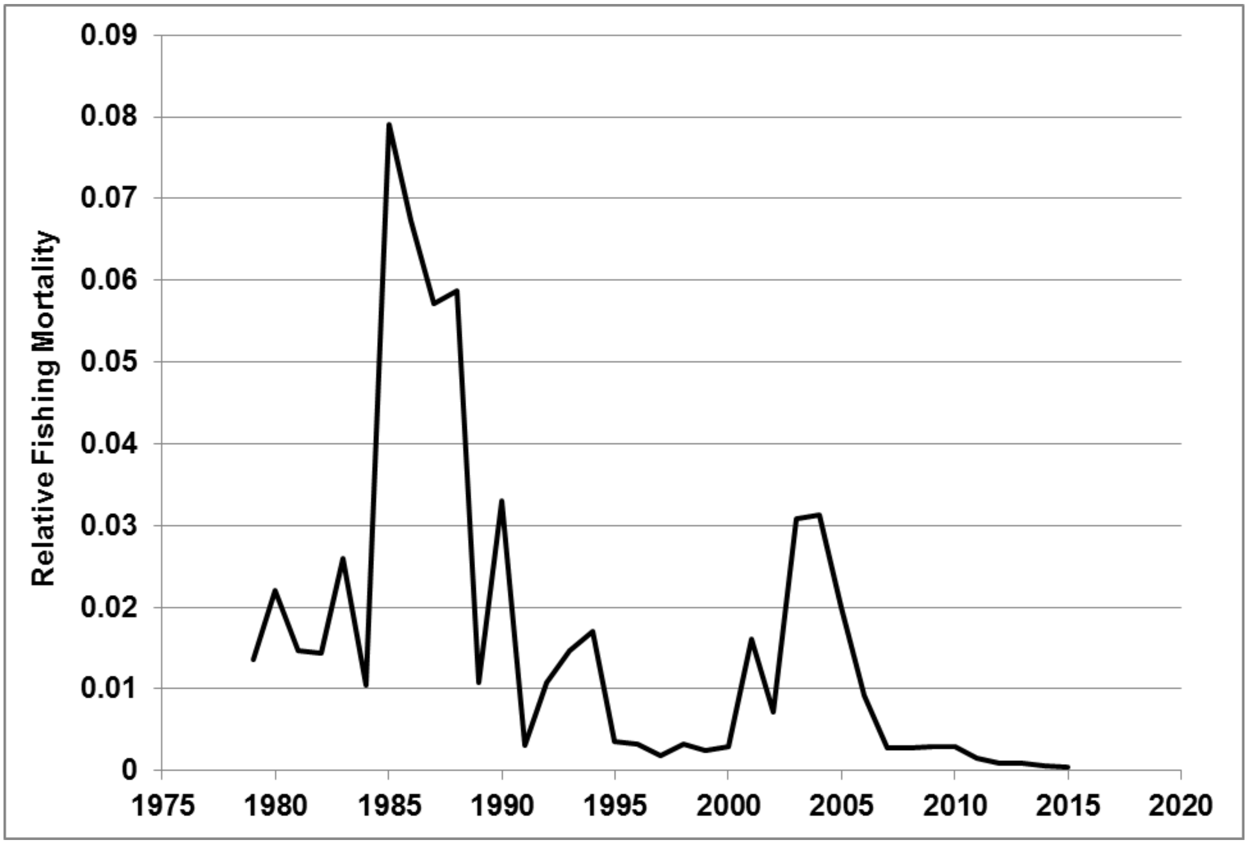


Figure 7. Proxy for Redfish fishing mortality from 1978 to 2015 in SA 2 + Divs. 3K calculated as the ratio of total landings in a given year to the survey biomass index in the previous year.

Recruitment

Length Composition

Although the Campelen trawl (1995 onward) samples small (<20 cm) Redfish more effectively than the Engel trawl, relatively few small Redfish were collected in annual sampling before 2001. From 2002 onward, one or multiple length modes were apparent in the length frequency distributions within Divs. 2H, 2J, and 3K. These modes persisted over time and some can be tracked over several years. However, few fish larger than 30 cm were sampled recently relative to the 1978 to 1983 period.

A strong length mode that first appeared in Divs. 3K during 2014 at 6 cm was apparent in both Divs. 2J and 3K at approximately 10 cm during 2015. Presently, it is unclear how these young fish will contribute to future fisheries. Previously, similar events have been observed in survey results, but modes were not tracked consistently over time.

Recruitment Index

A recruitment index, calculated as the abundance of Redfish less than 15 cm, was relatively low from 1979 to 2000 (Fig. 8). Since then, the recruitment index has generally been near or above the long term average with a time series high in 2014 (Fig. 8). As Redfish grow quite slowly, sequential index values are not independent and annual index values are comprised of multiple cohorts.

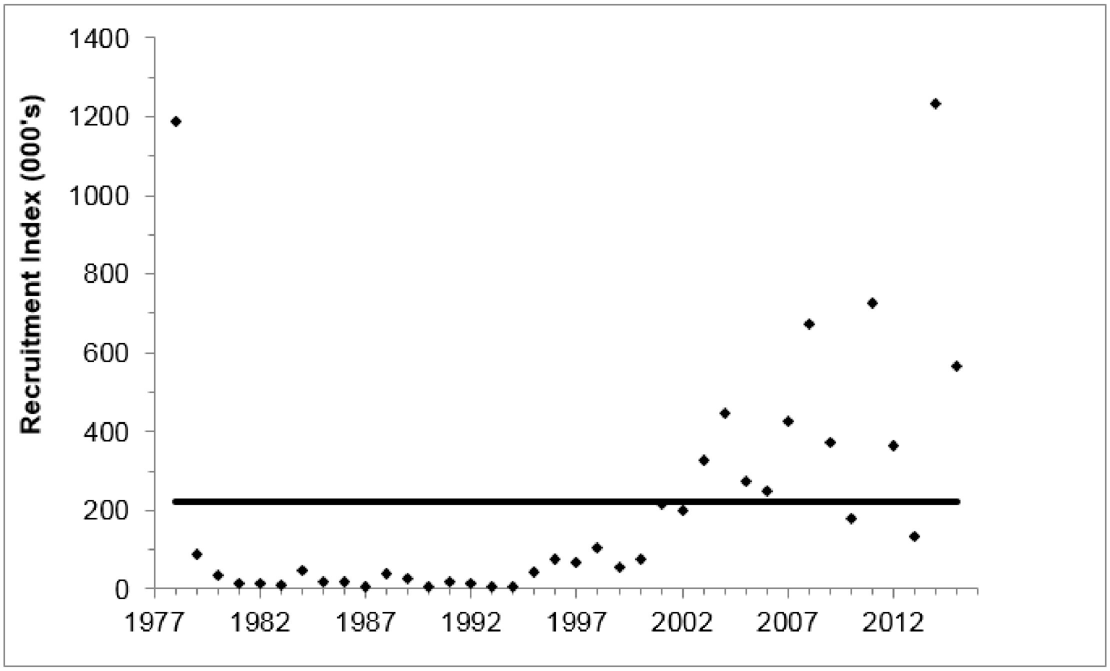


Figure 8. Recruitment index for Redfish in SA 2 + Divs. 3K based on total abundance estimates of Redfish less than 15 cm. The solid line indicates the time series average.

Reference Points

Models were developed through an external contract to explore LRPs for Redfish based on survey mature biomass (MacAllister and Duplisea 2011). Reference points for several Redfish stocks in the Northwest Atlantic were adopted by DFO based upon Bayesian production model results and various empirical methodologies (DFO 2012). This model was designed to investigate reference points but has not been applied directly to SA 2 + Divs. 3K stock assessments, nor has it been formally accepted for this purpose. Participants noted that assessments for Unit 1 and Unit 2 Redfish have discarded the production model. Prior to the current assessment of SA 2 + Divs. 3K Redfish, DFO received a critique of the existing production model and limit reference points for the stock from a former DFO Redfish biologist (GEAC [Atkinson, D.B. 2016] in Lee et al. in prep, Appendix 1[1]).

During the assessment plenary session it was agreed that there were substantive concerns about the input data and incomplete documentation of the rationale for model formulation.

[1] Lee, E., Ings, D. Mello, L., and R. Rideout. In prep. Stock status of Redfish (*Sebastes sp.*) in NAFO SA 2 + Div. 3K. Appendix 1 – GEAC (Atkinson D. B. 2016) An investigation of inputs to the analytical model used to determine stock status and limit reference points (LRP's) for Redfish (*Sebastes sp.*) in NAFO Subarea 2 + Division 3K. CSAS Res. Doc.

Specifically, the meeting recognized issues with separating the species in the survey and commercial catch data based on preliminary results from studies in the 1980s.

The assessment model for *S. mentella* was developed for the designatable unit spanning SA 2 + Divs. 3KLNO rather than just the SA 2 + Divs. 3K stock complex. This required apportioning biomass between Divs. 2J3K and Divs. 3LNO based on area of occupancy for the determination of LRPs. The meeting identified concerns with the validity of using this approach to delineate the critical/cautious and healthy zones for the SA 2 + Divs. 3K Redfish complex. The model built for *S. fasciatus* was specific to 2J3K. In both models, survey Q was allowed to vary across time blocks informed by Bayesian posteriors. Q shifts were incorporated to improve model fit, and were not based on gear changes. The need to sub-divide the survey series into multiple time periods to produce acceptable model fit caused concern as there is no *a priori* justification to support these groupings.

Length at maturity was based on empirical results from Unit 2 (Gulf of St. Lawrence/Southeastern NL). However, it is known that L_{max} increases in more northern populations; this may lead to overestimation of the spawning stock biomass if the L_{50} applied is less than the real L_{50}. Further, index-based LRPs using both $B_{Recovery}$ and B_{MSY} concepts were also presented to the meeting but were not accepted due to difficulties with respect to applying LRP concepts to Redfish, including its episodic recruitment, species separation and other data limitations.

Due to the incomplete documentation of model formulations, resource and data limitations, the existing model was not updated during the meeting nor were the previously calculated reference points accepted. Therefore, no LRP, including the previously established values (DFO 2012), was considered applicable at this time. In the absence of a LRP, it was not possible to identify which zone of the Precautionary Approach framework the stock is currently within.

Ecosystem

Physical Oceanographic Environment

The SA 2 + Divs. 3K region extends off northern Labrador to the eastern Newfoundland Shelf with bottom topography consisting of relatively shallow banks, deep cross-shelf channels and steep continental slopes. The ocean circulation is dominated by the southward-flowing Labrador Current which transports colder relatively fresh water from the north, as well as warmer saltier Labrador Sea water along the continental slope regions. Hydrographic conditions are determined in part by these and other factors, such as local winds and air temperatures. The main features of an analysis of historical climate data show mostly above average temperature conditions during the 1960s, a brief cold period during the early 1970s and again in the mid-1980s. Temperature conditions then declined to the coldest on record in the early 1990s and remained below normal until the mid-1990s. Since then there has been a significant warming trend with temperature values reaching record highs in the late 2000s. The most recent years, notably 2014 and 2015, experienced a short term decline but data available to date in 2016 indicates a return to a warming trend.

Invertebrate and fish community

The structure of the ecosystem within NAFO Divs. 2J and 3K has undergone significant changes since the mid-1990s. The entire fish community collapsed in the late 1980s and early 1990s, with average fish size also declining during this period. After the collapse, the system became highly dominated by shellfish, with peak dominance in 2003 when more than 60% of the estimated Fall RV biomass was shellfish. Consistent signals of rebuilding of the fish community appeared in the mid-to-late 2000s; this signal was also associated with an increase in average fish size. In the 2010s the overall biomass has remained relatively stable, but the dominance of groundfish has increased, while shellfish has decreased. Redfish is the dominant fish among plank-piscivores, having a three-fold increase in biomass between the mid-1990s and the 2010s.

Studies of diet composition of key groundfish species in Divs. 2J and 3K since 2008 indicate that Redfish is a frequent food item for Atlantic Cod and Greenland Halibut, and an occasional one for American Plaice. Despite its regular occurrence, Redfish does not appear as a dominant prey for these predators. However, long term diet data for Greenland Halibut indicate that Redfish represented up to 20% of its diet in the late 1980s, while available data from Divs. 2H shows up to a maximum of 30% of Redfish in the Greenland Halibut diet in 2010. Major diet changes in recent years involve the shift from shrimp to capelin as key prey item among fish top predators. As a predator, Redfish shows a variable diet composition between years, but amphipods, shrimp, myctophids, and euphausiids appear as consistently important prey items.

Sources of Uncertainty

Russian (2001-2015) and Lithuanian (2001-2015) catches assigned to Divs. 2J in the NAFO Statlant 21 database are fished outside the 200 mile limit and likely originate from the Irminger Sea pelagic stock (Power 2001). Subsequently, these values are omitted from the catch totals for SA 2 + Divs. 3K (2J + 3K) for the years 2001 to 2015. Prior to 2001, Russian and Lithuanian (and non-Canadian) catch are assumed to be primarily within the 200 mile limit and are included in the catch total. It is possible that a larger portion of non-Canadian catch currently assigned to SA 2 + Divs. 3K also originates within the Irminger Sea.

Redfish in SA 2 + Divs. 3K are composed of a mixture consisting primarily of *S. mentella*, lesser amounts of *S. fasciatus*, and sporadic occurrences of *S. marinus. S. mentella* and *S. fasciatus* are similar in appearance and are not separated in either the commercial or research survey catch. Despite their physical similarities the species have different depth and temperature preferences; changes in environmental conditions will not affect the three species equally, increasing the difficulty in interpreting survey indices changes in the stock complex.

Atlantic *Sebastes spp.* are known as episodically recruiting species where large year-classes may occur only once a decade or less frequently even in healthy populations.

Redfish survey catchability can vary significantly due to biological (formation of dense aggregations) or environmental (water temperature effects or depth range) reasons. This can result in inconsistent catch results within surveys, leading to high inter-annual variation at times. This is exacerbated by the combination of three species into a stock complex since the catchability of individual species can change independently in response to environmental changes.

Incomplete observer coverage of certain gear types, such as <50% coverage of trawl effort or <10% of gillnet effort, can introduce bias and/or uncertainty into analyses to determine Redfish bycatch and/or discards within commercial fisheries.

Lack of age information precludes certain types of analyses such as weight at age and cohort-based population modelling.

CONCLUSIONS AND ADVICE

Redfish biomass increased considerably from 2003-2010 with biomass during 2010-2015 reaching approximately half of the pre-collapse (1978-1990) levels. Recruitment (abundance of Redfish <15 cm) since 2000 was above the long term average with a time-series high in 2014. The fishery remains under moratorium, and average bycatch (including discards) since 2006 has been approximately 500 t. The meeting was neither able to validate nor invalidate existing reference points (DFO 2012) derived from production models due to substantive concerns about input data and an incomplete documentation of the rationale for model formulation.

In the absence of a LRP, it is not possible to identify what zone of the PA framework this stock is currently within. It is recommended that adaptive and cautious management be applied to any reopened fishery.

LIST OF MEETING PARTICIPANTS

Name	Affiliation
Darrell Mullowney (Chair)	DFO Science
Jim Meade (CSA Office)	DFO Science
Shelley Dwyer	NL Department of Forestry, Fisheries and Aquaculture
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Brian Healey	DFO Science
Dawn Maddock Parsons	DFO Science
Danny Ings	DFO Science
Karen Dwyer	DFO Science
Dennis Slade	Icewater Seafoods
Joanne Morgan	DFO Science
Don Power	DFO Science
Joel Vigneau	IFREMER Science
Eugene Colbourne	DFO Science
John Brattey	DFO Science
Rick Rideout	DFO Science
Erin Carruthers	FFAW
Roland Hedderson	FFAW
Wayne Masters	Fish Harvester, Red Harbour
Jeff Roberts	Fish Harvester, Hermitage
Brian J. Careen	Fish Harvester, St. Bride’s
Kris Vascotto	GEAC
Peter Shelton	DFO Science
Emilie Novaczek	MUN (rapporteur)
Margaret Warren	DFO-Science
Corina Busby	DFO Science-NHQ
Nadine Wells	DFO Science
Geoff Evans	DFO Science
Bob Verge	CCFI-MI
Kevin Hedges	DFO Science - C&A
Margaret Treble	DFO Science - C&A
Paul Regular	DFO-Science

SOURCES OF INFORMATION

This Science Advisory Report is from the October 19-21, 2016 Assessments of Redfish in Northwest Atlantic Fisheries Organization (NAFO) Subarea 0, Subarea 2 and Division 3K. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

DFO 2011. Recovery potential assessment of Redfish (*Sebastes fasciatus* and *S. mentella*) in the Northwest Atlantic. DFO Can Sci. Advis. Sec. Advis. Rep. 2011/044.

DFO 2012. Reference points for Redfish (*Sebastes fasciatus*, *S. mentella*) in the Northwest Atlantic. DFO Can Sci. Advis. Sec. Advis. Rep. 2012/004.

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Retroactive Analysis

Redfish Bycatch in the Northern ShrimpFishery

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August 12, 2021

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1. BACKGROUND

CAPP, and other northern shrimp harvesting groups, commenced having independent monitoring of redfish bycatch in the northern shrimp fishery in December 2020. Until late July detailed information regarding various grid sizes, angles and styles was collected and reviewed by the MI. The objective ofthis phase of the study was to determine the relationship, if any, between shrimp capture and bycatch capture using various gear configurations.

Commencing late July 2021, a simplified data collection method has been adopted by the vessels operators and observer companies, both of which provided information independently to the MI. Analysis of detailed data was inconclusive on either a spatial of temporal basis, though further analysis may be completed. Ongoing data analysis will be completed by Pisces Consulting Limited using the simplified reporting format that focuses almost exclusively on redfish bycatch for specified time periods

Data collection and analysis completed to date was transferred to Pisces in order to continue the data set until the beginning of the new contract period with Pisces. This data and analysis was reviewed and found to be quite comprehensive, though the methodology to determine the period bycatch percentages was questionable[1]. Given the potential for this questionable method to misrepresent the results, a retrospective analysis was completed. Review of line data indicates a moderate number of reporting errors and numerous data omissions (no catches reported). These errors and omissions were removed from the data set if they could not be verified from independent observer source documents.

The data limitations are that the entire data set is based on reported results, and there are likely some limited reporting omissions. For future reporting the reporting for each week will be quantified by comparing observer reports to the vessel reports. Missing vessel reports will be solicited to ensure a complete data set going forward.

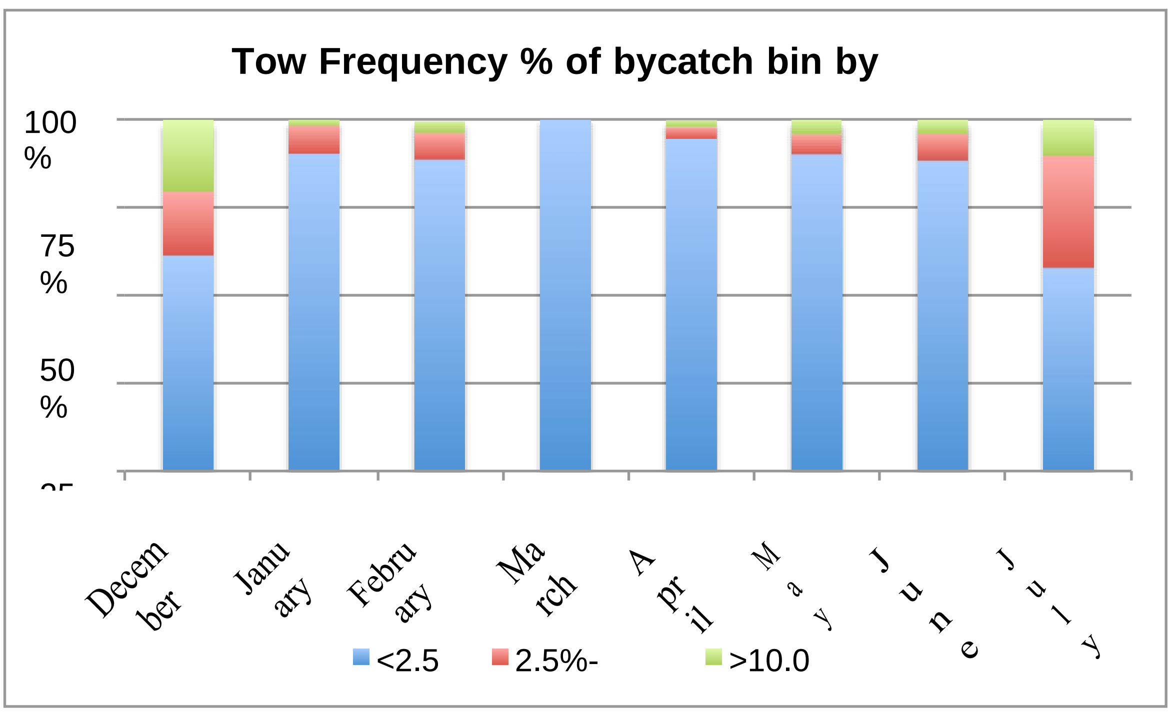
[1] The period bycatch percent was a straight average of the individual tow bycatch percent rather than a weighted average.

2.0SUMMARY RESULT

Results by month: The data set results indicate 19,132mt of shrimp were captured with 318mtof redfish bycatch. The months on highest encounters were December and July.

Month	Shrimp (kg)	Redfish (kg)	Redfish	Tow Frequency <2.5%	Tow Frequency 2.5%-10.0%	Tow Frequency >10.0%
December	1,819,807	92,358	5.1%	213	63	71
January	3,546,167	39,707	1.1%	432	38	8
February	1,502,107	21,300	1.4%	188	16	8
March	804,573	1,398	0.2%	72	0	0
April	2,286,706	13,825	0.6%	231	8	5
May	3,316,328	45,640	1.4%	415	26	19
June	3,963,109	48,496	1.2%	464	40	21
July	1,893,360	56,227	3.0%	147	81	26
Total YTD	**19,132,157**	**318,951**	**1.7%**	**2,162**	**272**	**158**

Management measures have permitted various redfish bycatch allowances (2.5%, 10.0%). The following graph illustrates the tow frequency of when these bin thresholds occurred.



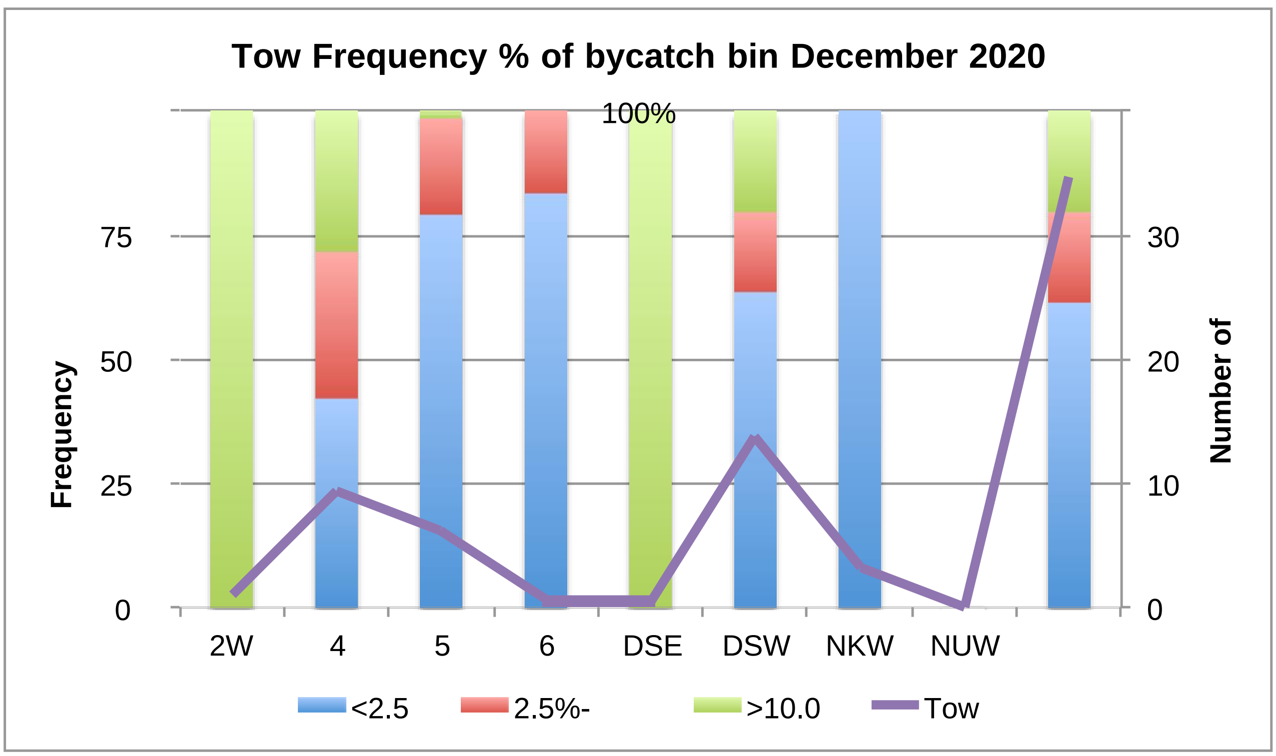
The monthly results by area are provided in the following table. Further examination of effort and bycatch levels by month are provided in Section 3.0.

Area	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**
2W	535.5%							
4	6.5%	2.5%	6.2%	0.0%	0.0%	1.8%	0.9%	1.8%
5	1.9%	1.0%	0.6%	0.2%	0.8%	0.9%	1.3%	2.3%
6	0.9%	0.3%	0.3%	0.1%	0.1%	0.0%		
DSE	2002.0%						96.6%	0.0%
DSW	8.4%					1.5%	5.0%	7.8%
NKW	0.1%						1.1%	0.0%
NUW							0.3%	0.0%
Total	**5.1%**	**1.1%**	**1.4%**	**0.2%**	**0.6%**	**1.4%**	**1.2%**	**3.0%**

3.0MONTHLY RESULTS BY AREA

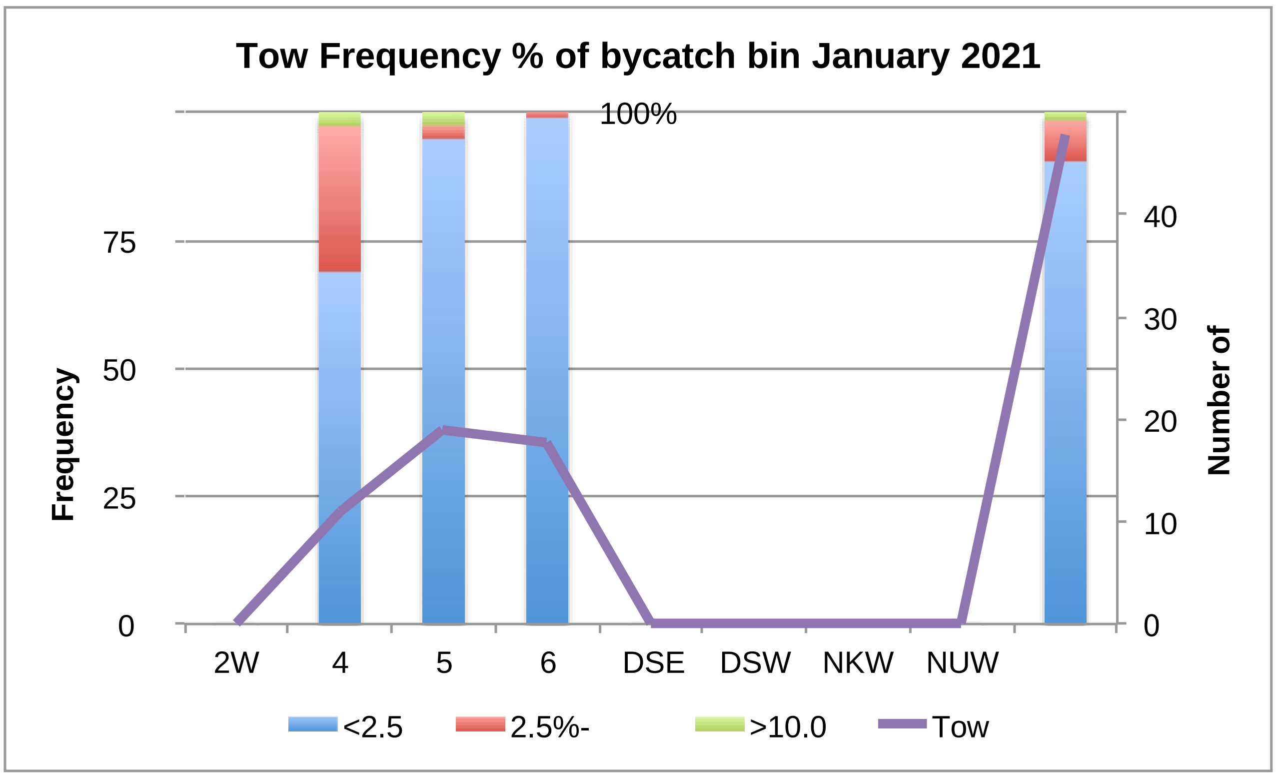
December 2020

Area	Shrimp (kg)	Redfish (kg)	Redfish %	Tow Frequency <2.5%	Tow Frequency 2.5%-10.0%	Tow Frequency >10.0%
2W	453	2,426	535.5%	0	0	10
4	642,694	41,562	6.5%	40	28	27
5	331,792	6,468	1.9%	49	12	1
6	19,766	180	0.9%	5	1	0
DSE	252	5,045	2002.0%	0	0	5
DSW	430,750	36,268	8.4%	87	22	28
NKW	394,100	409	0.1%	32	0	0
NUW						
Total	**1,819,807**	**92,358**	**5.1%**	**213**	**63**	**71**



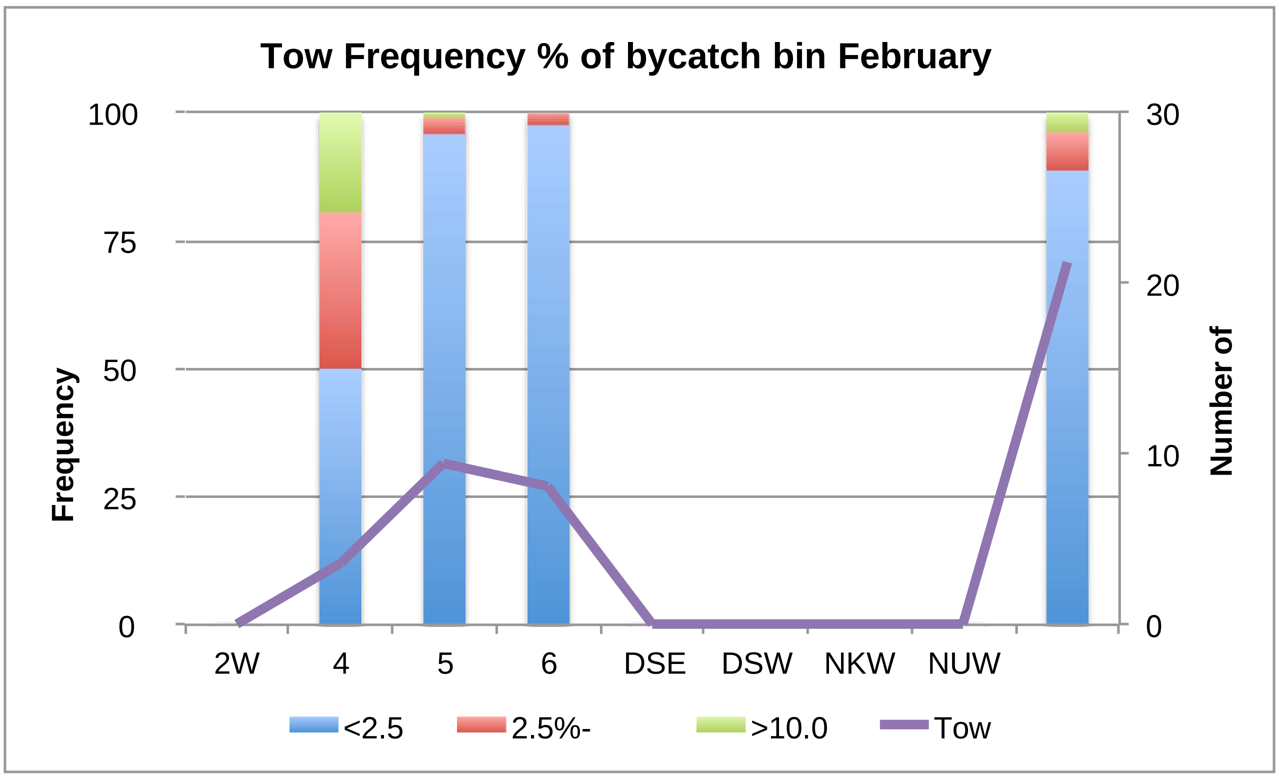
January

Area	Shrimp (kg)	Redfish (kg)	Redfish %	Tow Frequency <2.5%	2.5%-10.0%	>10.0%
2W						
4	823,340	20,416	2.5%	75	31	3
5	1,569,369	15,273	1.0%	181	5	5
6	1,153,458	4,018	0.3%	176	2	0
DSE						
DSW						
NKW						
NUW						
Total	**3,546,167**	**39,707**	**1.1%**	**432**	**38**	**8**



February

Area	Shrimp (kg)	Redfish (kg)	Redfish %	Tow Frequency <2.5%	2.5%-10.0%	>10.0%
2W						
4	250,049	15,403	6.2%	18	11	7
5	672,900	3,880	0.6%	91	3	1
6	579,158	2,017	0.3%	79	2	0
DSE						
DSW						
NKW						
NUW						
Total	**1,502,107**	**21,300**	**1.4%**	**188**	**16**	**8**



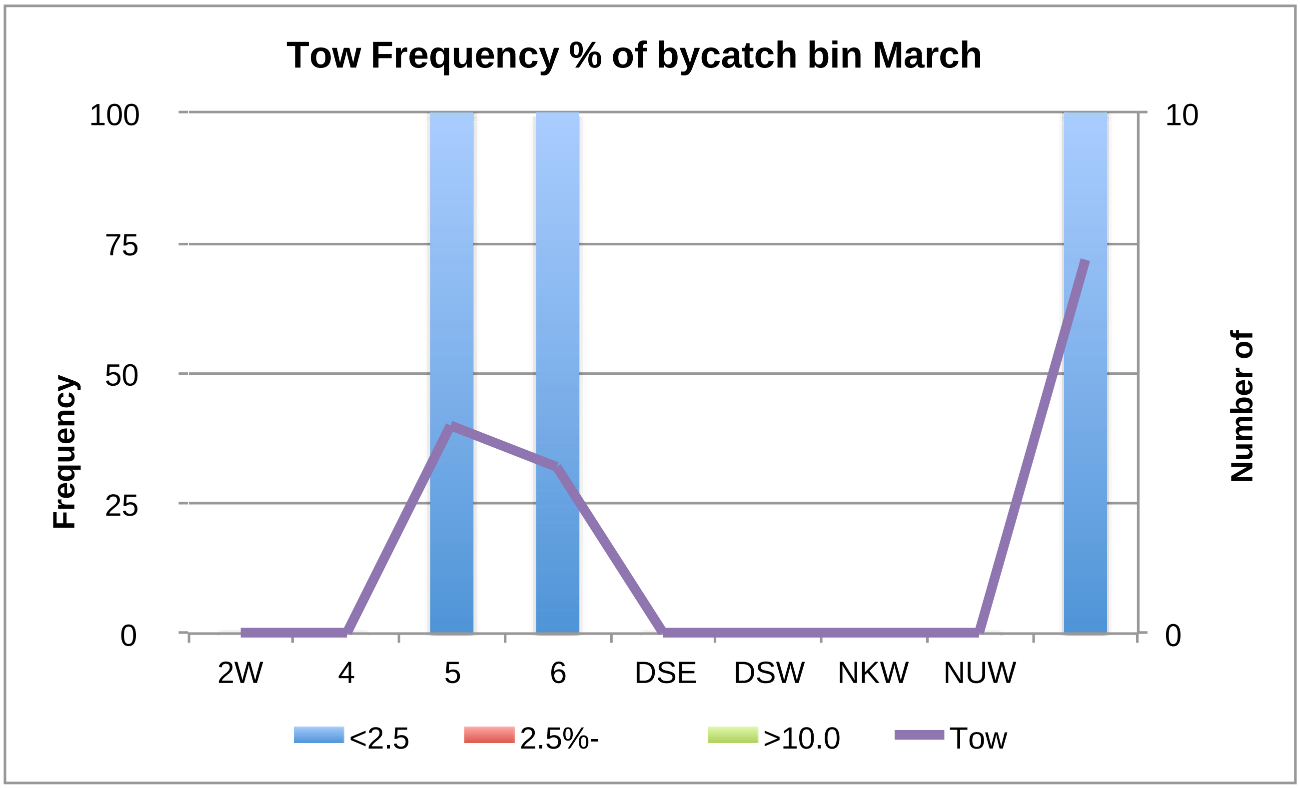
March

4						
5	523,250	1,194	0.2%	40	0	0
6	281,323	204	0.1%	32	0	0
DSE						
DSW						
NKW						
NUW						
	Total 804,573	**1,398**	**0.2%**	**72**	**0**	**0**

March

Redfish bycatch in shrimp fishery8 | Pisces Consulting Limited

Are	Shrimp (kg)	Redfish (kg)	Redfish	Tow Frequency <2.5%	Tow Frequency 2.5%-10.0	Tow Frequency >10.0
2W						



April

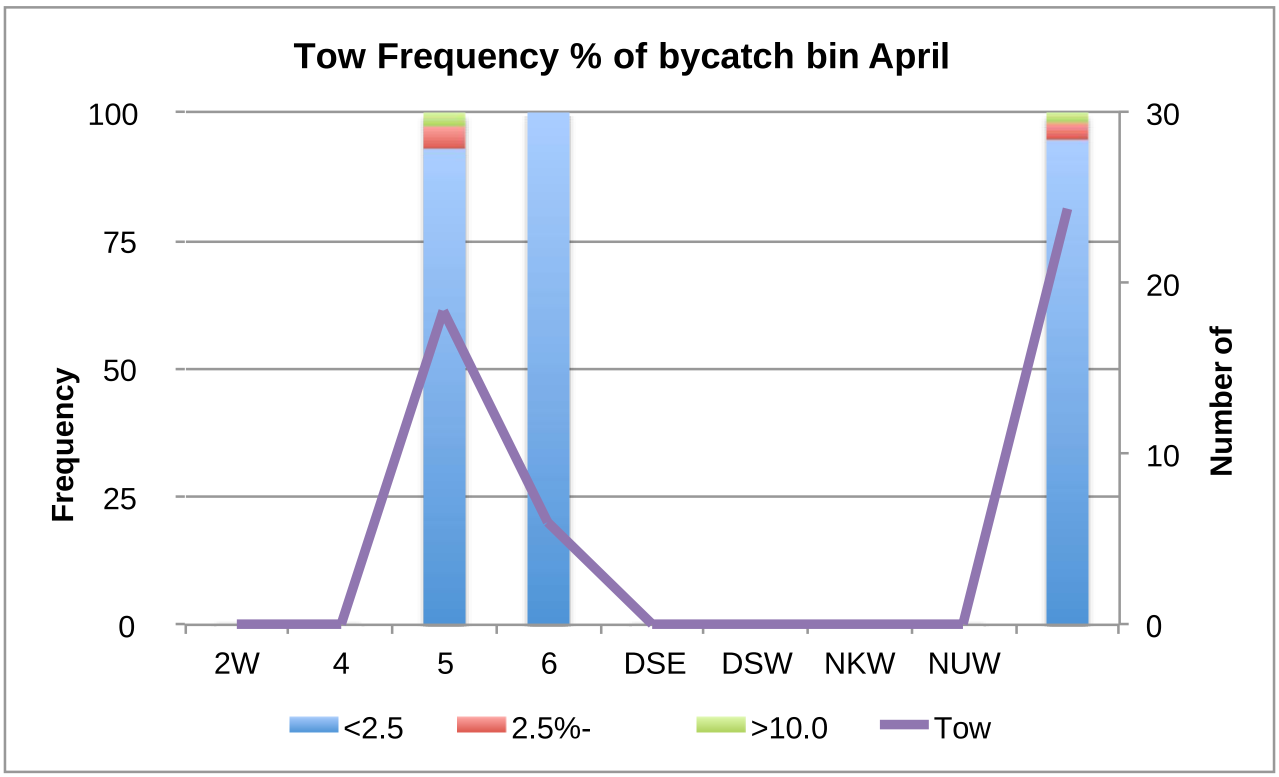
4						
5	1,658,582	13,011	0.8%	171	8	5
6	628,124	814	0.1%	60	0	0
DSE						
DSW						
NKW						
NUW						
	Total 2,286,706	**13,825**	**0.6%**	**231**	**8**	**5**

April

Redfish bycatch in shrimp fishery9

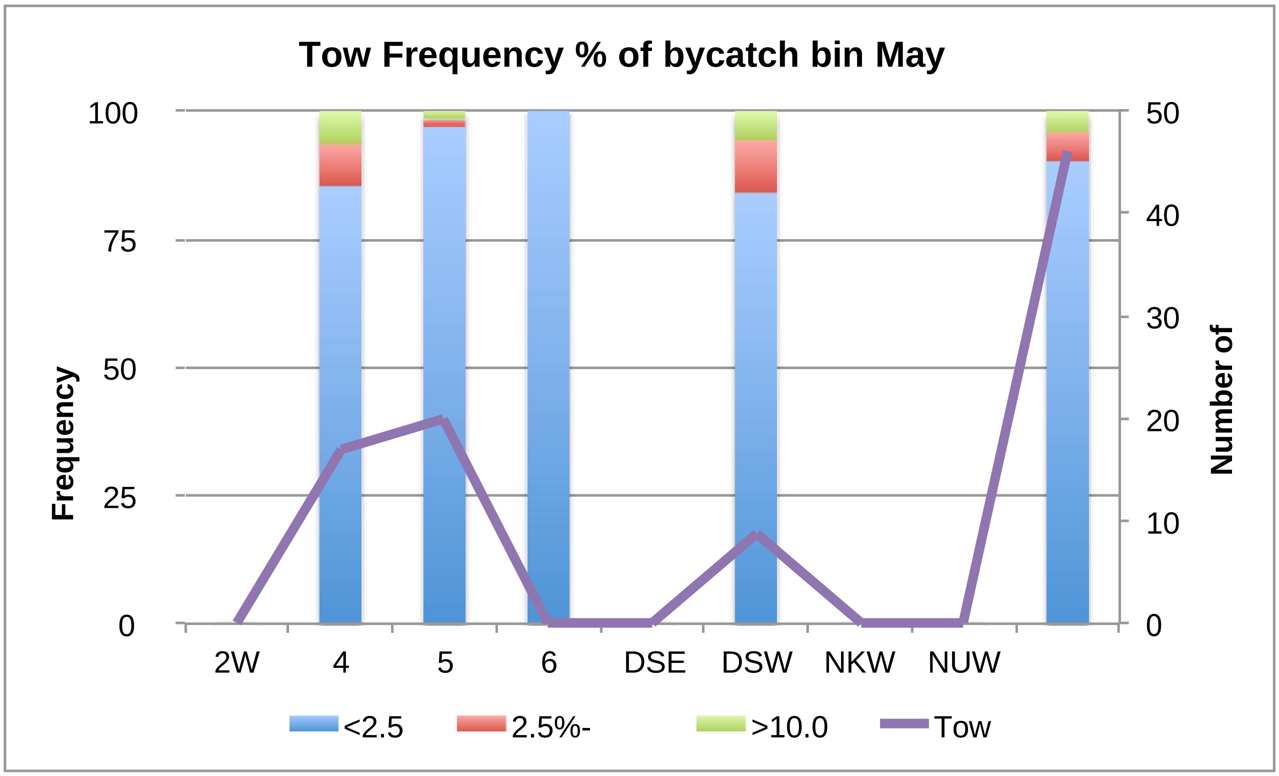
Pisces Consulting Limited

Are	Shrimp (kg)	Redfish (kg)	Redfish	Tow Frequency <2.5%	2.5%-10.0	>10.0
2W						



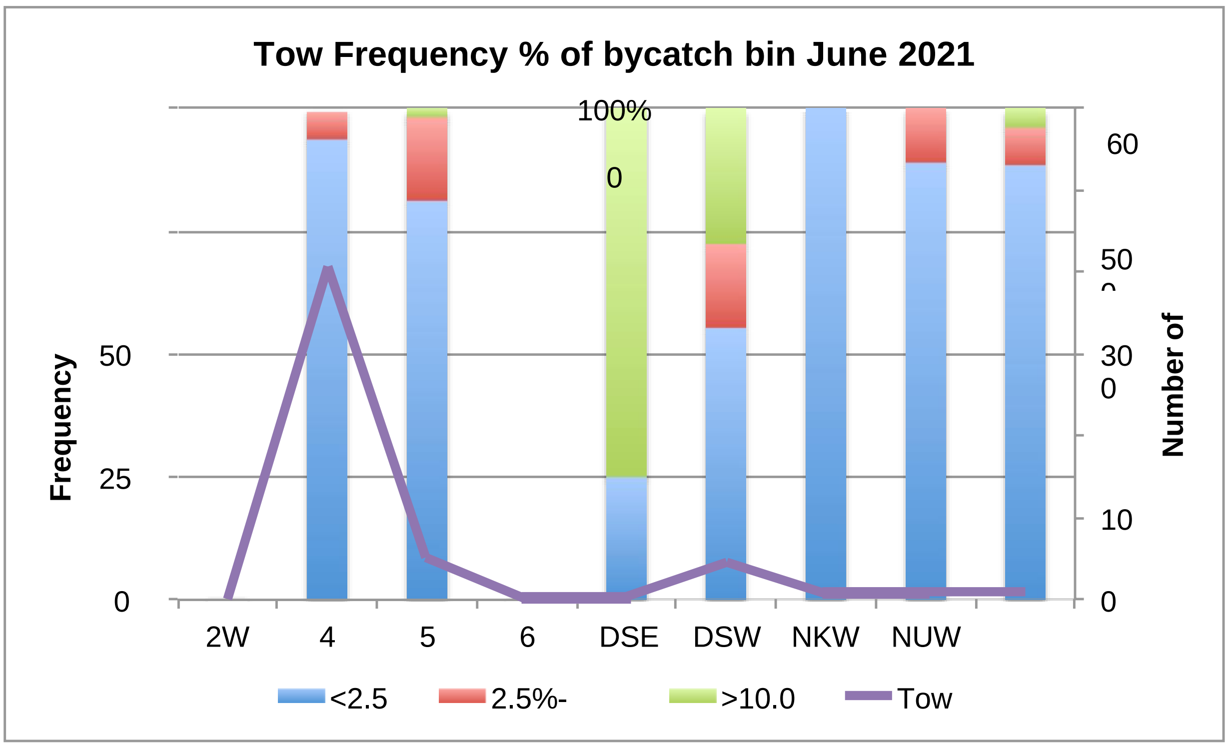
May

Area	Shrimp (kg)	Redfish (kg)	Redfish %	Tow Frequency <2.5%	2.5%-10.0%	>10.0%
2W						
4	1,352,628	24,749	1.8%	146	14	11
5	1,438,228	13,337	0.9%	194	3	3
6	5,020	1	0.0%	1	0	0
DSE						
DSW	520,452	7,553	1.5%	74	9	5
NKW						
NUW						
Total	**3,316,328**	**45,640**	**1.4%**	**415**	**26**	**19**

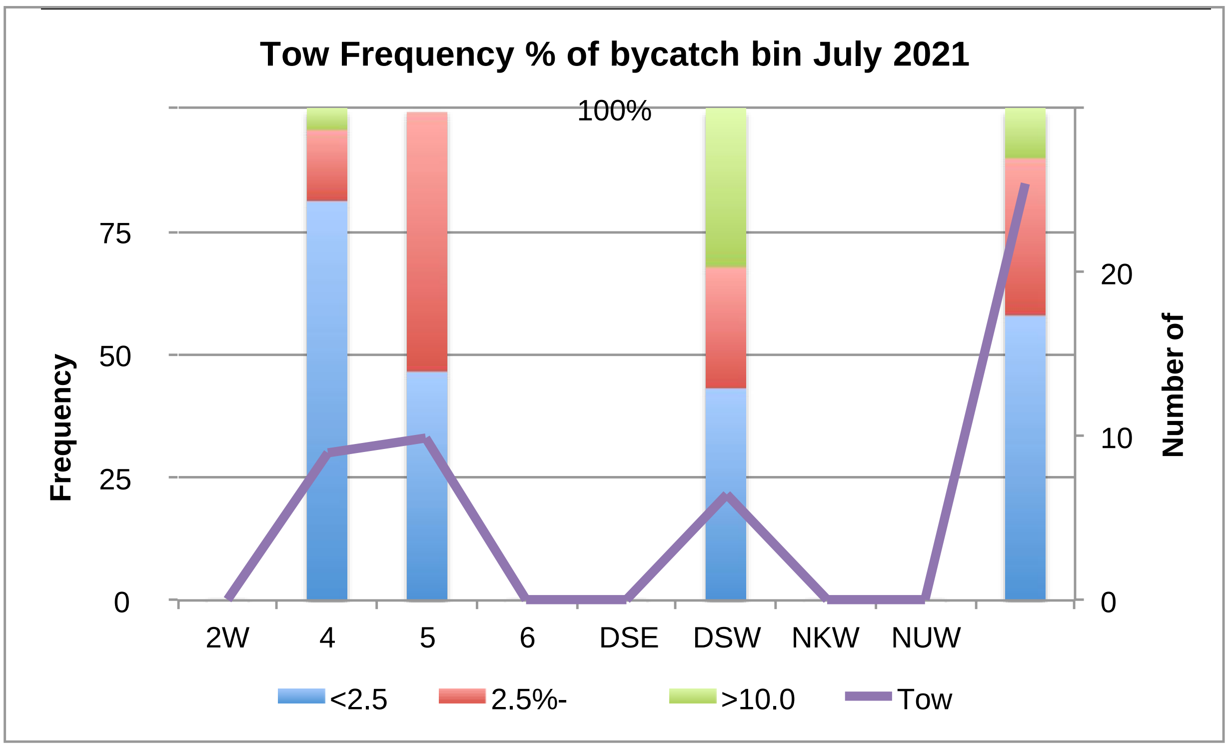


June

Area	Shrimp (kg)	Redfish (kg)	Redfish %	Tow Frequency <2.5%	2.5%-10.0%	>10.0%
2W						
4	3,248,266	29,872	0.9%	380	22	4
5	366,341	4,754	1.3%	43	9	1
6						
DSE	580	560	96.6%	1	0	3
DSW	257,279	12,800	5.0%	26	8	13
NKW	31,615	350	1.1%	6	0	0
NUW	59,028	160	0.3%	8	1	0
Total	**3,963,109**	**48,496**	**1.2%**	**464**	**40**	**21**



Are	Shrimp (kg)	Redfish (kg)	Redfish	Tow Frequency <2.5%	2.5%-10.0	>10.0
2W						
4	673,933	11,887	1.8%	73	13	4
5	925,809	21,469	2.3%	46	52	1
6						
DSE						
DSW	293,618	22,871	7.8%	28	16	21
NKW						
NUW						
Total	**1,893,360**	**56,227**	**3.0%**	**147**	**81**	**26**



SUBMISSION TO THE

NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: **Decision:** **Recommendation: X**

Issue: Total Allowable Catch levels for Northern Shrimp (*Pandalus borealis*) for the 2022 season in Shrimp Fishing Area 0

Northern shrimp (*Pandalus borealis*)

Background

A 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) (see map at Appendix 1).

Where this fishery occurs adjacent to the NSA, a recommendations on the Total Allowable Catch (TAC) for P. borealis in SFA 0 is requested from the Nunavut Wildlife Management Board (NWMB).

The fishery in SFA 0 operates according to 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, where an interim TAC of 250t was set with no final TAC decision. No catches have been recorded since the onset of this fishery. Nunavut access to the SFA 0 fishery is via the Qikiqtaaluk Corporation's offshore licence, and through 50% ownership of the offshore Unaaq licence.

In April 2021, the NWMB made a recommendation to the Minister to change the Conditions of Licence (CoL) to permit Nunavut sub-allocation holders access to the SFA 0 Northern Shrimp competitive fishery. Given this request, the Department of Fisheries and Oceans sought views from existing competitive fishery access holders for Northern shrimp in SFA 0 regarding a possible expansion. Based on feedback received, the Department determined in October 2021 that further discussions on a possible expansion in SFA 0 would be beneficial. This issue was tabled at the Northern Shrimp

Advisory Committee (NSAC) and the opportunity to submit written comments was also provided by the Department.

The NWMB's recommendation from 2021 sought expanded access to the SFA 0 Northern shrimp fishery, including enterprises that currently have Nunavut sub-allocations, including Arctic Fishery Alliance (AFA), Baffin Fisheries Coalition (BFC), Cumberland Sound Fisheries Ltd. (CSFL), and Qikiqtaaluk Corporation (QC). It was expressed that expansion of this fishery to Nunavut enterprises previously excluded from SFA 0 would provide increased access and opportunity for Nunavut-based fisheries development.

The Department deems the recommendation of the Board to increase the access in SFA 0 to be still active, as a decision has not yet been made. Based on this, and input received from stakeholders, the Department will seek a decision from the Minister in 2022.

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). A competitive TAC of 500 t, if fully taken, would result in an exploitation rate index of 40% (2008) to 70% (2006) based on the observed biomass at that time. Based on the biomass indices from 2006 and 2008, if the historic 500t TAC were set and fully taken in 2022, 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 and current biomass levels and recruitment status remain uncertain. The area is not currently fished and based on the observed biomass, future prospects for a fishery are limited. Should industry express interest in fishing in this area, requests for science advice can be considered. There are no plans for future surveys at this time.

Recommendation

It is recommended that the TAC for SFA 0 be rolled over at 500 t for 2022.

In terms of allocations, the Department will present two general options to the Minister for decision in 2022, these being the following: 1) maintaining allocations solely to the offshore fleet; or, 2) expanded access that includes Nunavut sub-allocation holders along with existing entrants.

Summary of Request

In order to ensure NWMB advice may be fully considered as part of 2022 management decisions for the SFA 0 fishery, the Department is requesting from the Board:

1) Recommendation on the TAC for SFA 0.

The Department also offers an opportunity to adjust or re-submit the recommendation regarding expanded access in SFA 0 for 2022.

Prepared by: Fisheries Resource Management, Fisheries and Oceans Canada

Date: May 18, 2022

Appendices

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)

SUBMISSION TO THE

NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: **Decision: X**

Issue: Baffin Island Caribou Total Allowable Harvest

Background:

- The first island-wide survey of Baffin Island caribou occurred in March 2014, and the results indicated there were very few caribou on Baffin Island. The population was estimated to be 4,652 caribou (3,462–6,250). The current total allowable harvest (TAH) is 250 caribou, including up to 25 females.
- To balance harvesting pressure, the GN has recommended that the Qikiqtaaluk Wildlife Board (QWB) allocate tags in proportion to the number of caribou in an area based on the 2014 abundance estimate and composition survey findings.
- In the absence of telemetry data, the next abundance survey for Baffin is a large undertaking and significant funds are required to complete such a survey making such a survey difficult to schedule with competing wildlife research priorities across Nunavut.
- The Government of Nunavut (GN) Department of Environment (DOE) has been working with Hunters and Trapper Organizations (HTOs) to identify methods to reduce the overall survey area required for the next Baffin survey and to understand Baffin caribou regional movements. During these discussions, the use of collaring was identified as an effective method in which the distribution of caribou and their movements between different regions across Baffin could be observed and used to reduce survey study area size and cost.
- A regional approach to abundance surveys, based on telemetry (collaring), is a more cost-effective, precise, and sustainable approach requiring the monitoring of caribou movements up to and during regional survey efforts.
    - The existence of spatially separated and geographically distinct subpopulations of caribou on Baffin Island is suggested by both Inuit Qaujimajatuqangit (IQ) and past scientific analyses. We have yet to find clear genetic differences in caribou across Baffin Island.
    - A regional survey area (example: North Baffin, South Baffin, Central Baffin, etc.) will allow more frequent abundance surveys due to substantially reduced costs and lower risk of incompletion than an island-wide survey.
- The DOE planned to expand the GPS satellite telemetry caribou collaring program in the spring of 2022. The DOE received an email from the QWB a few days before the program was set to begin requesting the program be cancelled expressing unanimous opposition from Baffin Island HTOs based on perceived risks of spreading COVID-19 to caribou.

- The DOE has completed caribou composition surveys each year since 2015, excluding 2020, and reports have been distributed to co-management partners.
- Communities have expressed concern over illegal harvesting of caribou on Baffin Island resulting in a harvest greater than the Total Allowable Harvest (TAH). This has an unknown impact on the recovery of Baffin caribou. The extent of illegal harvesting could greatly impact the determination of the sustainable harvest level, possibly prolonging herd recovery. All illegal harvesting is investigated when reported to the DOE Operations Section.

Current Status:

- Results from 2015-2021 composition surveys suggest good productivity and a potentially increasing population trend in some areas, particularly in regions of South Baffin (Figures 1-5). Hall Peninsula and Meta Incognita Peninsula (Figures 1 and 2) showed indices of high productivity and increasing minimum counts, suggesting an increasing trend.
- Composition surveys were completed between March 19, 2022 and April 8, 2022 in South Baffin. Approximately 70 hours of helicopter flights were completed during this period. Results are currently being analyzed and the final report will be distributed to all co-management partners in summer 2022. Preliminary minimum counts have been included in this submission and suggest a continued increasing trend in some parts of Baffin Island (Figures 1 and 2).
- Increase in productivity and minimum counts were recorded within the Meta Incognita Peninsula strata, and Hall Peninsula within South Baffin regional strata.
- Similar positive indicators of increasing abundance of South Baffin caribou have been reported by hunters from South Baffin, who are starting to see more caribou closer to communities.
- There have been minimal reports of wolves on Baffin Island and no observation of wolves during composition surveys since a single wolf was observed in North Baffin in 2017. This low number of predators on Baffin Island is likely aiding in the observed increases in abundance due to reduced calf and adult mortality.
- Without a current abundance survey the DOE is unable to quantify any changes in island-wide abundance that may be occurring, but the DOE notes that there are positive signs of population growth being identified by composition surveys and observations of increased caribou numbers by communities, particularly in South Baffin.
- The DOE believes that based on these positive signs a conservative increase to the TAH represents a low risk to Baffin Island caribou population sustainability.
- There are risks associated with increasing the harvest including unquantified illegal harvest, unconfirmed movement patterns between regional areas (composition survey areas), seasonal variation in productivity, disease, and unknown adult survival rates. However, with appropriate management tools including abundance surveys and associated telemetry program, and continued composition surveys, the GN believes the risk of a small harvest increase may be sustainable.

Consultation:

- DOE planned in-person consultations for September 2021. At the request of the co-management partners due to lack of available accommodations these consultations were postponed. Consultations were also planned for early January 2022 but were postponed due to travel restrictions associated with COVID-19.

- The DOE planned consultations by teleconference on February 1 and 2, 2022 to receive feedback from HTOs prior to the NWMB February 2022 submission deadline. The DOE received a request from QWB on January 28, 2022, to postpone the teleconference consultations until later in February; the DOE agreed to the QWB request for a delay.
- The Baffin Regional Biologist and Technician completed consultations by teleconference with members of North Baffin HTOs on February 15, 2022, and South Baffin HTOs on February 16. 2022. Nunavut Tunngavik Incorporated (NTI), Qikiqtaaluk Wildlife Board (QWB) and Nunavut Wildlife Management Board (NWMB) were invited to the meetings as observers and given an opportunity to address concerns at the end of the meetings after HTOs had completed providing input and asking questions.
- A consultation summary report has been provided to the NWMB for their regular meeting (RM002-2022) in June 2022.

Recommendations:

- The GN advises a cautionary approach to increasing the harvest as any increase may negatively impact recovery of Baffin Island caribou in some regions.
- Based on the observed increase in abundance by communities, positive trends in productivity identified through calf:cow ratios between 2015 and 2021, and positive increases in minimum counts in some areas over the same period, and low numbers of predators, the Department of Environment is recommending a conservative increase to the TAH.
- Based on current scientific information, a conservative increase of 30 male only caribou (representing a new Total Allowable Harvest of 280 caribou, and up to 25 females) would represent an acceptable low risk to this herd's sustainability.
- The GN has taken into consideration the technical advice and all available IQ. In the interests of our collaborative efforts in wildlife co-management, we recognize, support and recommend that the NWMB accept the proposal made by the QWB during the February 2022 Consultation, of an annual TAH increase of 50 tags per year whereby each year the increase is reconsidered based on new IQ and scientific information.
- The GN further recommends that the QWB allocate these proposed increases to areas showing demonstrated positive trends in abundance indices.
- The GN recommends the additional 50 tags be made up of 25 male and 25 female caribou.
- Due to the risks associated with these increases, the GN commits to meeting face to face with Baffin communities annually and as required, to develop a strategic research plan to quantitatively assess regional abundance of Baffin Island caribou to ensure that any negative impacts to Baffin Island caribou recovery can be identified and actioned quickly.
- These recommendations are being proposed with a known higher level of risk that could negatively impact and prolong recovery. The GN would like to request the unanimous support of the Board and co-management partners for increased research and increased harvest monitoring during the herd recovery.

- The GN also requests the QWB and HTOs to work with our Conservation Officers to address concerns of illegal harvesting to support the long-term sustainability of this caribou herd.

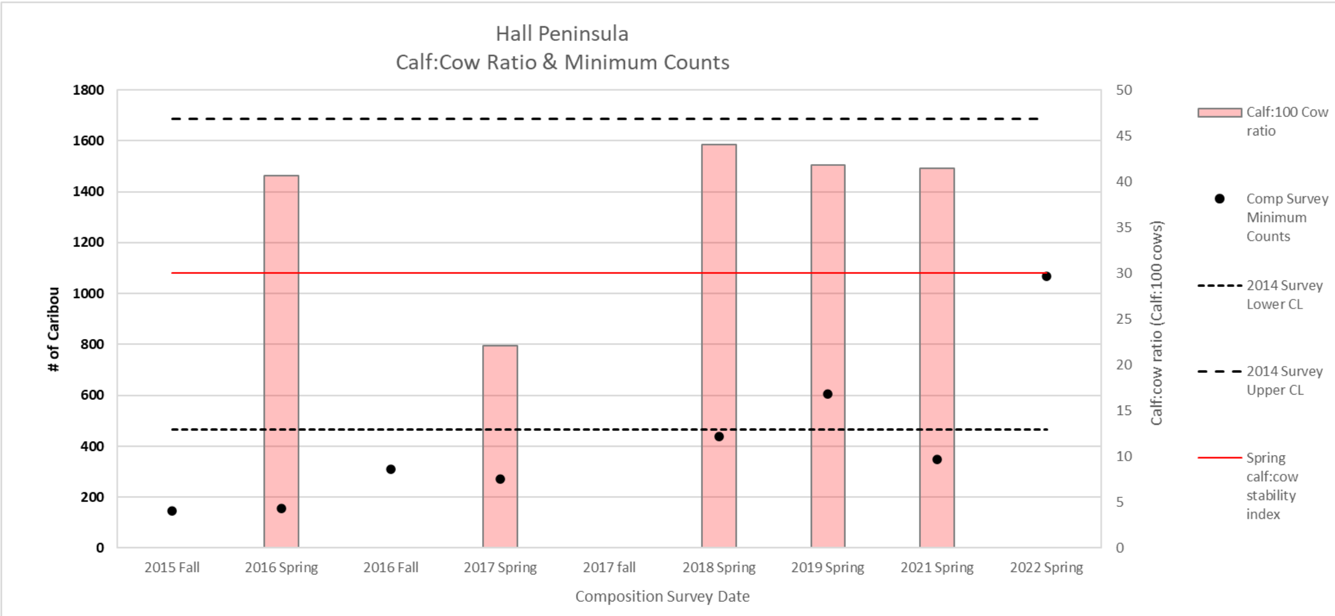


Figure 1. Hall Peninsula, as stratified in the 2014 Baffin Island abundance survey, spring calf:100 cow ratio 2015-2021 (right vertical axis, grey fill) and composition survey minimum counts (left vertical axis, black fill). *2022 spring minimum counts are preliminary.

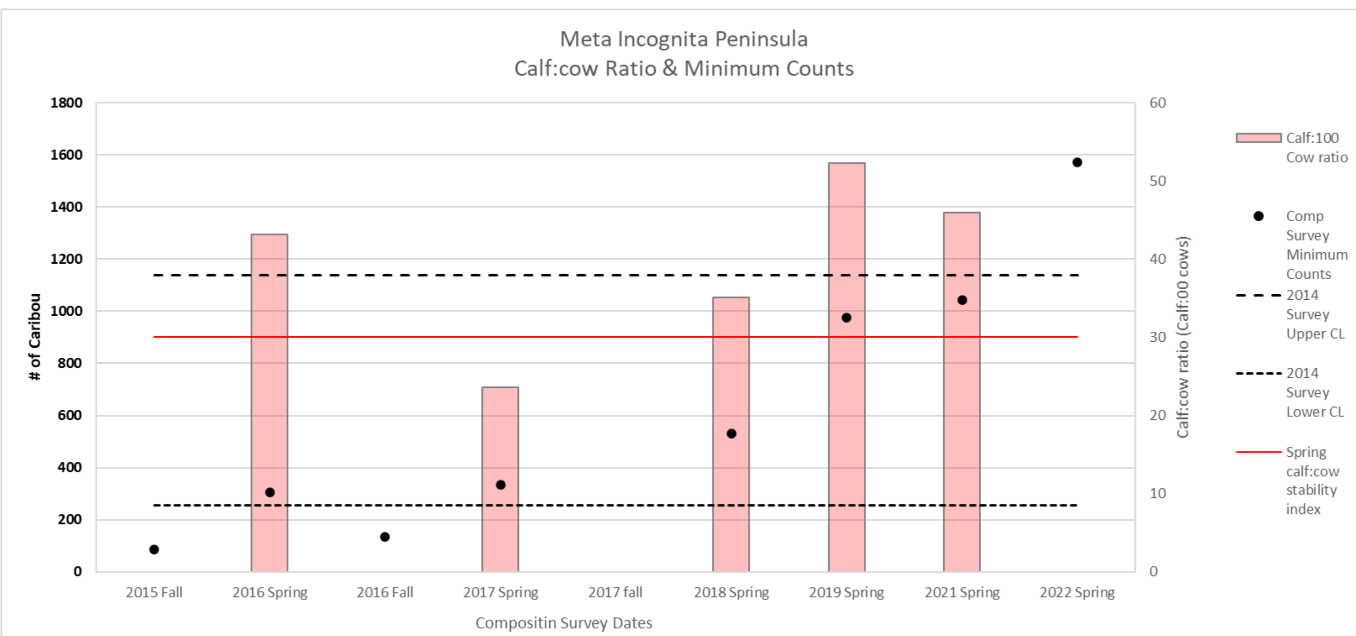


Figure 2 Meta Incognita Peninsula, as stratified in the 2014 Baffin Island abundance survey, spring calf:100 cow ratio 2015-2021 (right vertical axis, grey fill) and composition survey minimum counts (left vertical axis, black fill). *2022 spring minimum counts are preliminary.

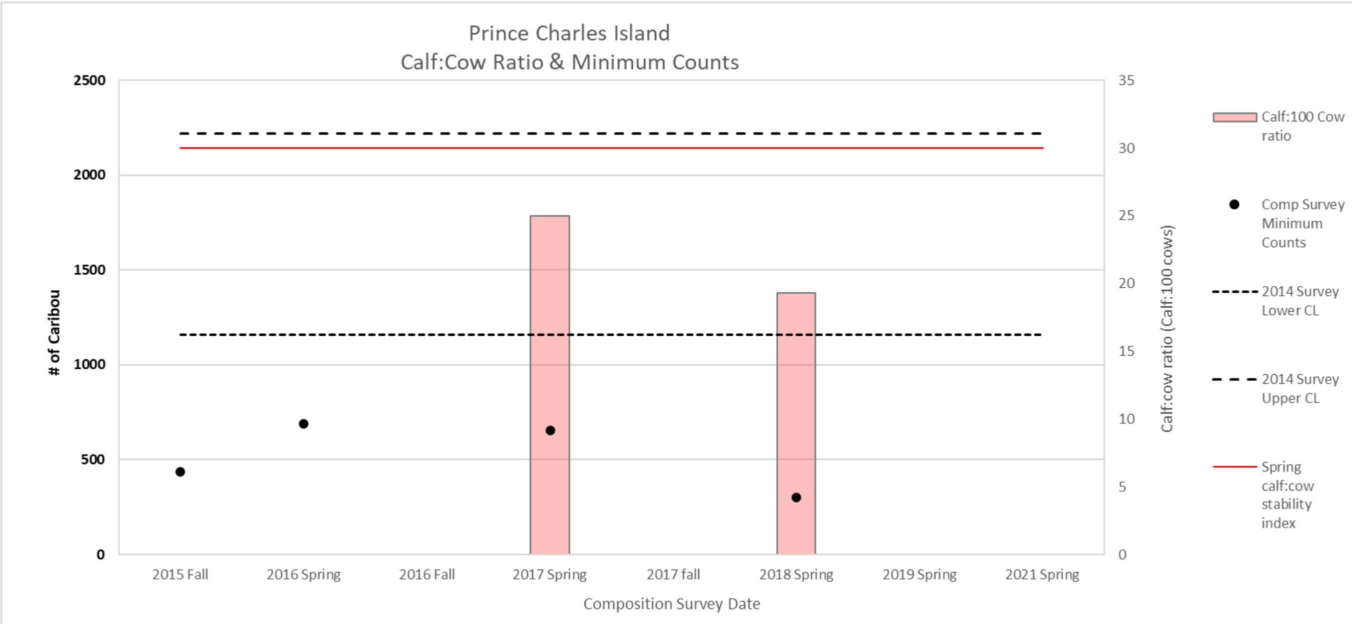


Figure 3 Prince Charles Island, as stratified in the 2014 Baffin Island abundance survey, spring calf:100 cow ratio 2015-2021 (right vertical axis, grey fill) and composition survey minimum counts (left vertical axis, black fill).

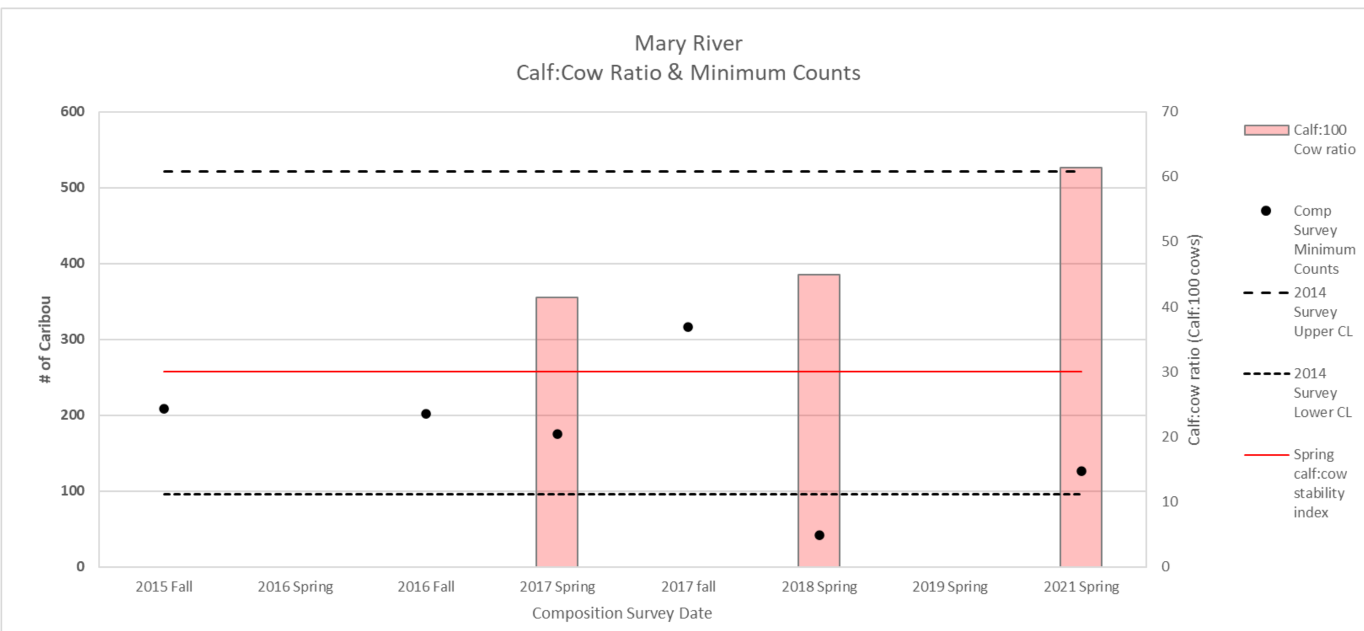


Figure 4 Mary River, as stratified in the 2014 Baffin Island abundance survey, spring calf:100 cow ratio 2015-2021 (right vertical axis, grey fill) and composition survey minimum counts (left vertical axis, black fill).

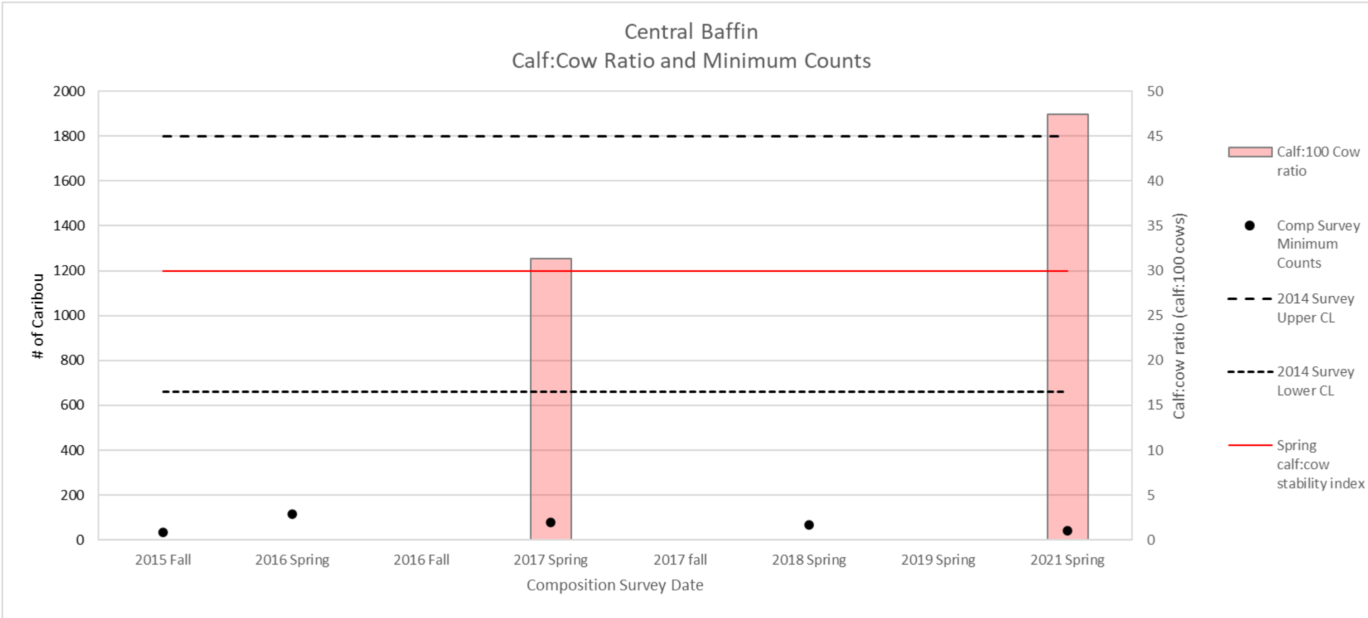


Figure 5 Central Baffin, as stratified in the 2014 Baffin Island abundance survey, spring calf:100 cow ratio 2015-2021 (right vertical axis, grey fill) and composition survey minimum counts (left vertical axis, black fill).

SUBMISSION TO THE

NUNAVUT WILDLIFE MANAGEMENT BOARD (NWMB)

Regular Meeting No. RM 002-2022

FOR

Information: ☐ Decision: ☒

Issue: *Proposed 10-Year Program to Increase the Total Allowable Harvest (TAH) for Baffin Island Caribou (BIC), 2022-2032*

Background:

Assertion of Primacy of Inuit Systems of Wildlife Management in Decisions in Nunavut

In December 2020, the Qikiqtaaluk Wildlife Board (QWB) adopted the position to assert that the Nunavut Agreement, a constitutionally protected treaty between the Inuit of Nunavut and the Crown of Canada, provides primacy to Inuit Systems of Wildlife Management with respect to decision-making processes and outcomes regarding wildlife and wildlife harvesting by Inuit. This primacy extends to Inuit Qaujimajatuqangit (IQ) because IQ is the basis for Inuit Systems of Wildlife Management. In this context, "primacy" refers to what comes first and remains most important. Inuit Systems of Wildlife Management are specifically recognized in sub-section 5.1.2(e) of the Nunavut Agreement. Other sections of Article 5 of the Nunavut Agreement point out the special rights and effective roles that Inuit have in wildlife management and harvesting in Nunavut. Science and scientific wildlife management are not mentioned in Article 5 of the Nunavut Agreement. The QWB asserts that any wildlife management plan, recommendation, decision or other measure established or implemented regarding caribou or other wildlife in Qikiqtaaluk Region needs give primacy to Inuit rights, Inuit Systems of Wildlife Management, and Inuit Qaujimajatuqangit. This view is supported by both the Nunavut Agreement and the United Nations Declaration on the Rights of Indigenous Peoples.

Inuit System of Long-term Management of Caribou on Baffin Island

Since time immemorial, Inuit on Qikiqtaaluk (i.e., Baffin Island and nearby islands) have known about and managed the long-term population caribou cycles that occur over the lifetime of an elder, or about 70-90 years. Children are taught by elders that if there are many caribou in their young years, there will be very few caribou when they have children of their own to feed, but if they live to become elders, there will be many caribou again. Inuit know and recognize many more specific signs of shorter-term changes that predict how the caribou population will change in local areas and across the island in the near future throughout the 70-90-year cycles.

During each phase of the long-term cycle, Inuit have harvest management strategies that are stated very simply, but include a huge amount of knowledge and deep understanding of the factors and processes that cause, regulate and affect each phase. For example:

"Snow is no problem unless there have been too many caribou for too long."

This statement reflects Inuit understanding that the amount of lichen food for caribou in winter is a major factor in the growth and decline phases of caribou populations on Qikiqtaaluk, and that over time, caribou can deplete their lichen food resources when there has been "too many caribou for too long". Lichens have no roots and grow very slowly. If caribou find ample lichen after digging through snow, they can maintain their strength and dig through deep, hard snow. If they do not find ample lichen, they become weaker, cannot get enough food, move to other areas, feed in riskier areas like cliff faces, become more susceptible to wolf predation, and produce fewer calves that may not survive, resulting in gradual but dramatic declines in abundance and distribution over about 15 years in one phase of the cycle. When there have been "too many caribou for too long" and while lichen food resources have not yet recovered, males can be important for the entire population because, with their heavier and stronger bodies, they may break through hard surface snow and sometimes ice when digging craters for feeding. Thereby, males can enable females and calves to expand the craters started, so they too can access more food during winter.

The decline phases of the long-term cycles are all very normal and predictable for Qikiqtaaluk caribou. In the late 1990s and early 2000s after decades of too-many caribou, Inuit across Qikiqtaaluk started to see signs of impending decline, and predicted the next great decline phase of the long-term cycle.

The QWB and southern Qikiqtaaluk HTOs called for an IQ-based management plan for the decline phase expected by Inuit during 2005 – 2020. Based on Inuit Qaujimajatuqangit and elders' predictions, the plan was developed but not implemented. The QWB also called for development of a similar IQ-based plan for northern Qikiqtaaluk but this was not undertaken.

Based on Inuit Qaujimajatuqangit and Inuit observations of caribou in many areas, the long-term cycle has now entered a new critical phase that requires a major change from the current harvest management strategy that is being used by the GN because the depleted lichen food for caribou has not had time to replenish itself. Caribou have the potential to increase in abundance faster than depleted lichen can grow.

The GN has managed the caribou for immediate maximum population increases ever since 2015. By limiting harvesting to mainly males and a few females, the caribou may increase in some years, but they will potentially eat as much lichen food as grows each year but the lichen is already depleted. The GN's strategy could keep the caribou's food in an over-eaten, depleted condition for many years, perhaps perpetually depleted so that the abundant Qikiqtaaluk caribou population of the 1970s – 2000s may not return.

In the 1950s and 1960s, Inuit intentionally managed caribou using a very different strategy, one that applies again today! Even though there were few caribou in the 1950s, Inuit elders knew that:

> *"We had to keep harvesting the caribou. The land needed to rest."*

In the 1950s and 1960s, important Inuit elders knew that there had been *"too many caribou for too long"* in previous decades, and caribou abundance declined, as Inuit had predicted in the 1930s and 1940s because they did not have enough lichen to eat. They knew that "*the land had to rest"* with a low abundance of caribou maintained by Inuit for one or two decades in the 1950s and 1960s. That harvest strategy allowed the caribou's slow-growing winter food, lichen, to recover in large amounts over large areas again, so it could support great abundances of caribou seen in later decades.

The great abundance of caribou on Qikiqtaaluk from about 1970 to the early 2000s was not an unexplainable accident. It occurred because of the Inuit System of Caribou Management, intentional harvesting by Inuit near local communities, camps and elsewhere during previous decades.

This Inuit System of caribou management, based on Inuit Qaujimajatuqangit, must be enabled and implemented again today over the next 10-20 years, so that the critical food of caribou, lichen, may recover to sufficient quantities to support the next great abundance of Qikiqtaaluk caribou. Consistent with all of the principles of conservation in the Nunavut Agreement, this Inuit System will:

- Maintain the natural balance of lichen-caribou-Inuit ecological system that has existed since time immemorial
- Protect caribou winter habitats
- Maintain a vital, healthy caribou population capable of sustaining Inuit harvesting into future decades
- Restore and revitalize a depleted population of caribou and their habitat over the long term.

Consultation:

After consultations with the HTOs, in 2018, 2019 and 2020 the QWB proposed modest increases in the 2015 Total Allowable Harvest (TAH) for Baffin Island caribou. The NWMB did not approve any of these requests, although a minor adjustment in the harvest of females was allowed in 2020.

The 2021 Annual General Meeting of the QWB discussed the above IQ and the Inuit System of Baffin Island caribou management, with advice and input from staff of NTI. Most HTO delegates recommended that, as soon as possible, the allocations for their communities should double and possibly more. That would require an increase in the TAH from 250 to 500 in one year.

The QWB Executive subsequently approved a more modest, longer-term proposal that remains consistent with the Inuit System of caribou management based on:

"The land needs to rest."

Recommendation:

The QWB Executive recommends to the Nunavut Wildlife Management Board (NWMB) that the NWMB approves and implements the following Inuit System of caribou harvest management on Baffin Island starting on July 1, 2022:

1. a) An initial increase of the Total Allowable Harvest (TAH) for Baffin Island caribou of 100 on July 1, 2022 for a total of 350 caribou;

b) A second increase of the TAH for Baffin Island caribou of 75 on July 1, 2023 for a total of 425 caribou;

c) Then subsequent annual increases of the TAH for Baffin Island caribou of 50 in each of the next 8 years to reach a total of 825 on July 1, 2031.

2. Adjust the Non-Quota Limitation until the maximum harvest of females will be about 50% females of the annual TAH by July 1, 2031, in the following way:

   a) On July 1, 2022, the increase of the TAH will be composed of a maximum of 50 females for a total of up to 75 females;

   b) On July 1, 2023, the increase of the TAH will be composed of a maximum of 40 females for a total of up to 115 females; and

   c) Then annually until July 1, 2031, the increase in the TAH will be composed of a maximum of 37 females until a total of 411 females may be harvested during the harvest year 2031-2032.

3. Until at least June 30, 2032, the Basic Needs Level for Inuit will equal the entire annual TAH.

4. The QWB will reassess the schedule of increases in the TAH after five years (in 2027) to determine if subsequent annual TAH and NQL increases should change, based on all available information. The GN will be consulted in this reassessment process. If a change in the subsequent TAHs and NQLs is warranted, the QWB will make a proposal to the NWMB for any recommended changes.

5. The QWB will base annual HTO allocations on the following factors:

   a) previous three-year average harvest for each community,
   b) less any over-allocation harvesting,
   c) plus a portion of the next year's annual TAH increase and any under-harvest of the TAH,
   d) and any other adjustments that the QWB Executive determines to be appropriate.

6. To assess the success and sustainability of this Inuit System, the QWB and HTOs will undertake the following:

   a) Each year by about June 30, each HTO Board will inform the QWB Director of Wildlife as to whether the abundance and distribution of caribou in their area have been increasing, stable or decreasing during the previous year.

   b) The combined information from all 10 HTOs will be assessed annually by the QWB Executive to help determine if the method for allocating the TAH should be continued or modified.

   c) The QWB and HTOs will undertake additional annual non-invasive science- and IQ-based community monitoring of caribou winter distributions and abundances.

   d) The QWB and HTOs will initiate monitoring of caribou-lichen food resources, similar to methods used by reindeer herders in Alaska, as soon as possible.

e) The QWB and HTOs may use additional monitoring methods (e.g., snow distributions and conditions) as needed and available.

7. During 2031-2032, the QWB will assess whether or not the TAH may be eliminated on July 1, 2032, or if the TAH and NQL changes should be continued or modified in future, based on all available information. The GN will be consulted during this assessment process. The QWB will make a proposal to the NWMB for any recommended changes.

Prepared by: Michael Ferguson and Kolola Pitsiulak, Qikiqtaaluk Wildlife Board

Date: May 6, 2022

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Department of Environment
Avatiliqiyikkut
Ministère de l'Environnement

Consultation with Hunters and Trappers Organizations on Baffin Island Caribou

Teleconference

February 15 & 16, 2022

John Ringrose, Baffin Regional Wildlife Biologist
Department of Environment
Government of Nunavut
Pond Inlet, NU

Executive Summary

Government of Nunavut (GN), Department of Environment (DOE) representatives conducted consultations with Hunters and Trappers Organizations/Associations (HTOs) in the Baffin region with north and south Baffin communities, on February 15 and February 16, 2022, respectively.

The intent of this round of consultations was to ensure HTOs were informed on the results of caribou composition surveys from 2021 as well as the Harvest Health Monitoring program on Baffin Island. DOE presented upcoming research programs including a telemetry-based collaring program, continued composition surveys, continued health monitoring and a discussion on Total Allowable Harvest and community observations. DOE solicited input from the HTOs and co-management partners regarding potential changes to the current TAH and non-quota limitations. The feedback collected during this round of consultations will aid the GN in future research planning and monitoring for Baffin Island caribou as well as any potential recommendations to the Nunavut Wildlife Management Board (NWMB) for changes to the harvest of Baffin Island caribou.

This report attempts to summarize the comments made by participants during the consultations.

Preface

This report represents the Department of Environment's best efforts to accurately capture all of the information that was shared during consultation meetings with the Hunters and Trappers Organizations of Kimmirut, Qikiqtarjuaq, Pangnirtung, Iqaluit, Kinngait, Sanirajak, Igloolik, Arctic Bay, Pond Inlet and Clyde River.

The views expressed herein do not necessarily reflect those of the Department of Environment, or the Government of Nunavut.

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Report Purpose and Structure

This report is intended to collate and summarize comments, questions, concerns and suggestions provided by the HTOs in response to the presentation (Appendix).

The following communities and organizations were consulted on February 15th and 16th, 2022.

-Arctic Bay, Ikajutit HTO, February 15, 2022
-Clyde River, Nangmautuaq HTO, February 15, 2022
-Igloolik, Igloolik HTO, February 15, 2022
-Pond Inlet, Mittimatalik HTO, February 15, 2022
-Sanirajak, Hall Beach HTA, February 15, 2022
-Iqaluit, Amaruq HTO, February 16, 2022
-Kinngait, Aiviq HTO, February 16, 2022
-Kimmirut, Mayukalik HTA, February 16, 2022
-Pangnirtung, Pangnirtung HTA, February 16, 2022
-Qikiqtarjuaq, Nattivak HTA, February 16, 2022

Representatives from the DOE, the Nunavut Wildlife Management Board (NWMB), Nunavut Tunngavik Inc. (NTI), and the Qikiqtaaluk Wildlife Board (QWB) attended each of the consultations.

Purpose of Consultations

In order to make up for multiple postponed in-person consultations over the past two years, the DOE, as represented by John Ringrose, Baffin Regional Wildlife Biologist, and Christopher Mutch, Baffin Regional Wildlife Technician, arranged two separate but similar meetings on February 15 and 16, 2022. The co-management organizations; NWMB, NTI, and QWB were also invited to attend on both days as observers. The purpose of these meetings was to allow the DOE to present the results of the previous years research programs to the Baffin HTOs, answer any questions about the results and seek input from the HTOs regarding proposed research for Fiscal 2022-2023. HTOs were asked to provide recent observations of any changes in abundance in their respective hunting areas and how this may relate to increased harvest opportunities for the communities. The DOE intends to use this input in combination with existing scientific data in designing any future submissions to the NWMB regarding changes to the TAH for Baffin Island caribou. All HTOs attended and all co-management partners were represented during these meetings.

Format of the Meeting

The meetings were held virtually via Microsoft Teams and tele-conference during the days of February 15th and 16th, 2022 (see agenda below). Baffin Regional Wildlife Biologist, John Ringrose, and Baffin Regional Wildlife Technician Christopher Mutch co-chaired the meeting. John led the presentation and Christopher took the minutes. Lack of HTO representation on the morning of February 15th led to postponement until 1pm that afternoon. HTOs had previously confirmed their intent to participate. A power outage in Iqaluit briefly interrupted the meeting on the afternoon of February 15th for approximately 20 minutes as NWMB, NTI and the Iqaluit based interpreter (Innirvik Support Services Ltd.) were all disconnected until the power was restored.
Each consultation started with the presentation of results from the past years research programs including health monitoring, composition surveys and collaring in North Baffin. The presentation

then focused on upcoming research that was occurring in the 2021/2022 fiscal year and proposed additional caribou collaring in central Baffin.

The HTOs were then invited to ask all questions, raise concerns, or provide advice.

After the HTOs had exhausted all questions the presentation continued with the discussion of Total Allowable Harvest (TAH) and once again invited comments, observations, questions and advice from HTOs.

After the presentations, questions/discussion continued until no further questions were raised by HTOs. Following the HTOs questions and comments, the co-management partners were provided any remaining time to respond to any questions or comment on the presentation. All organizations accepted the opportunity to participate.

Meeting Agenda

February 15, 2022

8:45 am	Settle in
9:00 am	Opening Prayer, introductions
9:10 am	GN Research Presentation- updates from last year
10:00 am	**Health Break**
10:15	GN presentations-Upcoming research
11:00	HTO Input- Clyde River, Pond Inlet, Arctic Bay, Igloolik, Sanirajak
12:00 pm	**Lunch Break**
1:00 pm	GN Presentation-Support needed
1:30 pm	GN presentation- Harvest update/TAH discussion
3:00 pm	**Health Break**
3:15pm	HTO Input- Sanirajak, Igloolik, Arctic Bay, Pond Inlet, Clyde River
4:45 pm	Co-management partner comments/questions. **Time permitting"
5:00 pm	Wrap up

*Morning was postponed until 1pm due to lack of HTO representation.

February 16, 2022

8:45 am	Settle in
9:00 am	Opening Prayer, introductions
9:10 am	GN Research Presentation- updates from last year
10:00 am	**Health Break**
10:15	GN presentations-Upcoming research
11:00	HTO Input- Qikiqtarjuaq, Pangnirtung, Kimmirut, Iqaluit, Kinngait
12:00 pm	**Lunch Break**
1:00 pm	GN Presentation-Support needed
1:30 pm	GN presentation- Harvest update/TAH discussion
3:00 pm	**Health Break**
3:15pm	HTO Input- Kinngait, Iqaluit, Kimmirut, Pangnirtung, Qikiqtarjuaq
4:45 pm	Co-management partner comments/questions. **Time permitting"
5:00 pm	Wrap up

Summary by Community

February 15th – North Baffin

The North Baffin meeting was scheduled to begin at 9:00 am but by 9:45am, Nangmautaq HTO (Clyde River) was the only HTO represented on the call. A representative from Hall Beach Hunters and Trappers Association (Sanirajak) attempted to join the call but was unsuccessful. Due to the lack of representation, it was decided by all parties to postpone the start of the meeting until 1pm.

At 1:20 pm the meeting began with all HTOs and co-management partners present. The GN presented the results of the North and South Baffin Composition survey, Harvest Health Monitoring and North Baffin Collaring. There were very few questions regarding the results of the previous work that was completed. The focus of the feedback from the North Baffin communities was very pro-research. The majority of suggestions from HTOs were focused on how to continue or expand the work we are currently doing but also find ways to lessen the impacts or disturbance to the caribou. There was a lot of support for the use of drone technology or snowmobiles during surveys to mitigate the disturbance and impacts on caribou. While HTOs were very supportive of the completed and proposed research, there were suggestions from NWMB to revisit animal handling procedures to better align with cultural values. The following is a brief description of each HTOs' input. This summary does not include every comment made but serves as a synopsis of the discussion.

Hall Beach HTA (HBHTA)

- Expressed concern about the unregulated harvest of Wager Bay caribou, specifically on the Melville Peninsula by hunters from Arctic Bay and Pond Inlet.
- Requested abundance survey of the Melville peninsula with direct input from Igloolik and HBHTA in the planning, implementation and reporting.

Igloolik HTA

- Concern about the low numbers of caribou on the Melville Peninsula.
- Very interested in the collar data and what we will learn from it.
- Would like to see more transparency in the research process, more communication and more community involvement.
- Expressed support for collaring but wanted to make sure that we share the data in a responsible way to protect the caribou from hunters unfairly targeting the caribou's known locations.
- One representative said; "It makes it easier to harvest caribou when you should be actively looking for them. Instead of going on a computer and finding where they are. It makes it too easy. This data should be shared but it should be shared with care, that you don't give out all the information where the caribou are for the caribou's sake."

Ikajutit HTO

- Would like to have some survey work in their area.
- Very interested in using drones to minimize the disturbance of caribou during surveys.
- Would like to see greater exchange of information between organizations.

Mittimatalik HTO

- In recent years there were very caribou near the community and no bulls. When the numbers are low the bulls are hard to find. Now they are starting to see the bulls return to the area.
- They would also like to see surveys designed to minimize the disturbance of caribou.
- The use of snowmobiles was suggested, and they support Ikajutit HTO's suggested use of drones.

Nangmautaq HTO

- Would like to see more work done in their area.
- Supports collaring.
- Supports the use of drones and snowmobiles for surveys.
- Supports collaring as a tool to build towards the next abundance survey.

After all HTOs had a chance to ask all of their questions and provide as much input as they desired, the co-management partners were given the floor.

NTI

- Repeatedly expressed concern that caribou abundance on Baffin Island is very low.
- Expressed concerned about the negative impacts of collaring when population is low.
- Expressed concern about creating smaller management zones and the hypothetical imposition of a moratorium by the GN.
- Expressed a desire to an "Inuit only" meeting with all present parties except the GN and NWMB.

QWB

- Expressed concern regarding possible transmission of COVID-19 from humans to caribou during proposed collaring program in South Baffin.
- Echoed NTI's concerns regarding smaller management zones and a hypothetical moratorium.
- Also expressed a desire to have an "Inuit only" meeting that didn't include the GN to discuss the presentation.

NWMB

- Suggested that the GN revisit animal handling procedures to better align with Inuit cultural values.
- Suggested that the GN could better incorporate traditional knowledge and Inuit Qaujimajatuqangit (IQ) in the design and execution of research programs by working with Inuit groups to develop defined procedures for the collection and implementation of IQ.

February 16th – South Baffin

The South Baffin meeting had all HTOs present in the morning and began at 9:30am. All co-management partners were represented when NTI joined the meeting at 9:40am. The GN presented the same material as on February 15th and solicited the HTOs for feedback and input. Multiple HTOs expressed internal capacity issues in response to their ability to monitor the harvest and assist in GN research programs. There was an obvious spirit of collaboration between HTOs and co-management partners with multiple HTOs commenting in support of statements made by other HTOs.

Nattivak HTA

- Requested the areas between Qikiqtarjuaq and Pangnirtung and Qikiqtarjuaq and Clyde River to be surveyed.
- Requested that any TAH changes be made sooner than later.

Pangnirtung HTA

- Concerned that South Baffin is recovering faster than North Baffin.
- Would like to see separate management zones so that South Baffin can have more tags now and not be bound to the recovery in North Baffin.
- Supports Nattivak's request for a survey between the two communities.
- One representative said; "If we just count South Baffin caribou can we have more tags in South Baffin. If we were on our own could we increase the quota for South Baffin only?".
- Although previously unsupportive of collaring programs due to community concerns, the board has committed to revisiting the program with their membership.

Mayukalik HTA

- Would like twice as many tags (+35).
- Reported seeing more caribou close to town, but less on the trail to Iqaluit.
- Would like more survey work towards Resolution Island.
- Community filled its quota in 8 hours this year.

- One representative said; "…feels there are lots of caribou near the points of these areas (near Resolution Island) where there is less hunting".
- Expressed concerns about obtaining caribou meat either through the harvest or by purchasing.
- One representative said; "It's hard to get caribou even to order it. Its hard to find caribou meat, even purchasing from other regions. Its hard even for the other regions to deliver on purchasing caribou meat too. Hard to get caribou meat all around."

Amaruq HTO

- Stated that managing the harvest is very difficult and takes a lot of effort.
- Approximately 2000 members and only 43 tags.
- Would like to see any increase but feel double the quota (+43) would be a good start in Iqaluit.
- Would like to challenge the GN legally for the sole responsibility to manage caribou allocations.

Aiviq HTO

- Very adamant that they need a new Conservation Officer in Kinngait.
- Would like to see their TAH doubled (+25).
- One representative stated; "The system that we have now people don't share. Only the people in the household are eating the catch. The system we have there isn't enough caribou meat to share."
- Expressed concern that managing their own harvest puts the HTO board members in the public spotlight and open to criticism from their membership.
- A representative said; "Some members follow the rules, and some don't".
- Without a Conservation Officer in town, the board is forced to deliver the GN's programs without adequate support.

After all HTOs had a chance to ask all of their questions and provide as much input as they desired, the co-management partners were given the floor.

NWMB

- Responded to questions from HTOs about the regulatory submission process.

NTI

- Expressed concern about the handling of wildlife (i.e. collaring) and the potential spread of COVID-19 from humans to caribou.
- Expressed displeasure with the meetings format.
- Expressed the desire to have an "Inuit only" meeting after the conclusion of these meetings to discuss the material.

QWB

- Expressed similar concern as NTI regarding collaring during COVID-19 pandemic.
- Repeatedly expressed disapproval of the meetings format and repeatedly asked for more time to speak on behalf of the groups that were present in the meeting.

- Stated their legal position that; Inuit systems of wildlife management are the primary tool for wildlife management in Nunavut.
- QWB would like the TAH for Baffin Island to increase by 50 annually for the next 10 years to 750 in 2032.
- Repeatedly stated that the community allocations are derived from the basic needs level of each community and not based on the relative abundance of caribou around the community.

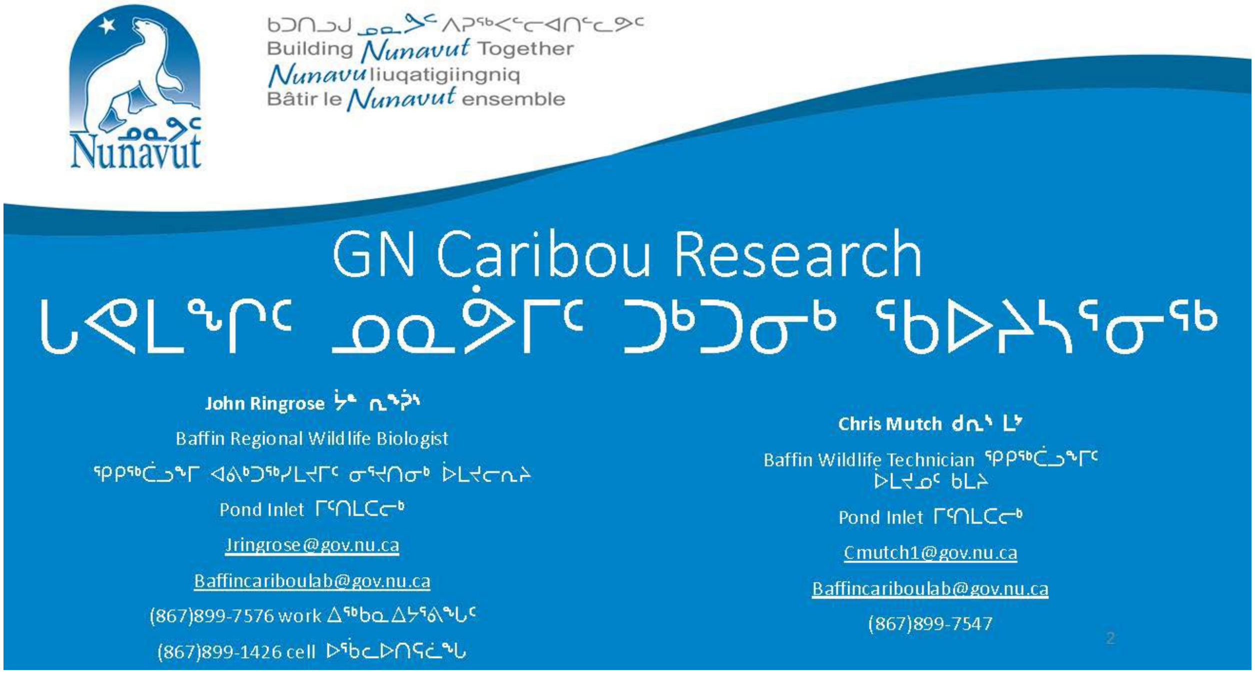
Conclusions

The main areas of concern or discussion from most HTOs during the meetings were focused on increased involvement in the GN research programs, methods to reduce impact on caribou from research and generally supportive of research. HTOs from South Baffin identified that community members were beginning to observe increased caribou numbers. These comments were expressed by Iqaluit, Kinngait and Kimmirut. In contrast the HTOs from North Baffin did not make similar statements.

Co-management partners identified the need to incorporate IQ into wildlife research programs including incorporating Inuit cultural values into wildlife handling protocols and issues with the amount of time provided during the meetings.

QWB and NTI raised concerns about handling of wildlife because of risks associated with COVID-19. HTOs did not raise these concerns during the meetings.

Appendix



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Baffin Regional Wildlife Biologist
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(867)899-7547
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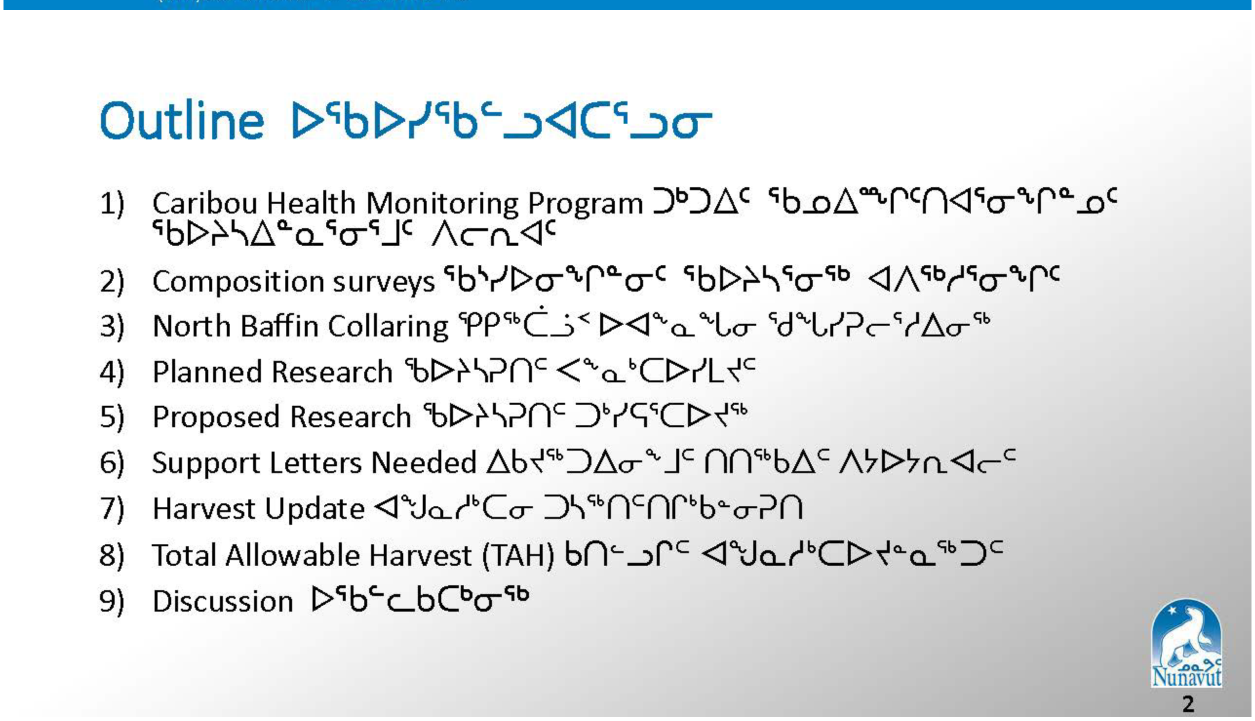


Outline ᐅᖃᐅᓯᖃᕐᓗᐊᑕᕐᓗᓂ
1) Caribou Health Monitoring Program ᑐᒃᑐᐃᑦ ᖃᓄᐃᙱᑦᑎᐊᕐᓂᖓᓄᑦ ᖃᐅᔨᓴᐃᓐᓇᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᑦ
2) Composition surveys ᖃᔅᓯᐅᓂᖏᓐᓂᑦ ᖃᐅᔨᓴᕐᓂᖅ ᐊᐱᖅᓱᕐᓂᖏᑦ
3) North Baffin Collaring ᕿᑭᖅᑖᓗᑉ ᐅᐊᓐᓇᖓᓂ ᕋᖓᓯᕈᓕᕐᓱᐃᓂᖅ
4) Planned Research ᖃᐅᔨᓴᕈᑎᑦ ᐸᓐᓇᒃᑕᐅᓯᒪᔪᑦ
5) Proposed Research ᖃᐅᔨᓴᕈᑎᑦ ᑐᒃᓯᕋᕐᑕᐅᔪᖅ
6) Support Letters Needed ᐃᑲᔪᖅᑐᐃᓂᕐᒧᑦ ᑎᑎᖅᑲᐃᑦ ᐱᔭᐅᔭᕆᐊᓪᓚᑦ
7) Harvest Update ᐊᖑᓇᓱᒃᑕᓂ ᑐᓴᖅᑎᑦᑎᒋᒃᑲᓂᕈᑎ
8) Total Allowable Harvest (TAH) ᑲᑎᓪᓗᒋᑦ ᐊᖑᓇᓱᒃᑕᐅᔪᓐᓇᖅᑐᑦ
9) Discussion ᐅᖃᓪᓚᑲᑕᒃᓂᖅ
Nunavut
2

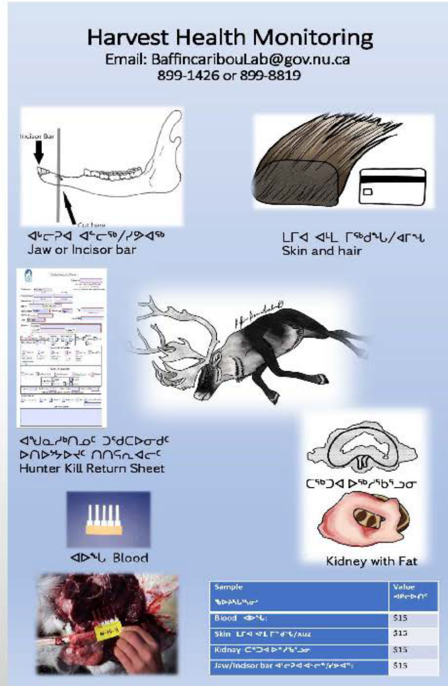
1) Caribou Health Monitoring Program
ᑐᒃᑐᐃᑦ ᖃᓄᐃᙱᑦᑎᐊᕐᓂᖏᓐᓄᑦ ᖃᐅᔨᓴᐃᓐᓇᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᑦ

Samples collected from hunters to determine health of caribou

ᖃᐅᔨᓴᒐᒃᓴᑦ ᓄᐊᑕᑦ ᐊᖑᓇᓱᒃᑎᓂ ᖃᐅᔨᓇᓱᒃᖢᑎᒃ ᖃᓄᐃᓐᓂᖏᓐᓂ ᑐᒃᑐᑦ

Partnered with Northern Contaminants Program in North Baffin

ᐱᓕᕆᖃᑎᖃᕐᖢᑎᒃ ᐅᑭᐅᖅᑕᖅᑐᒥᑦ ᓱᕋᔪᓐᓄᑦ ᐱᓕᕆᐊᒍᑦ ᑕᐃᑲᓂ ᐅᐊᓐᓇᖓᓂᑦ ᕿᑭᖅᑖᑉ



3

1) Caribou Health Monitoring Program
ᑐᒃᑐᐃᑦ ᖃᓄᐃᙱᑦᑎᐊᕐᓂᖏᓐᓄᑦ ᖃᐅᔨᓴᐃᓐᓇᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᑦ

Samples provided by Mittimatalik hunters to GN/Northern Contaminants (needed 20 samples from 1 hunting location)
ᖃᐅᔨᓴᕈᑏᑦ ᑐᓂᔭᐅᓚᐅᖅᑐᑦ ᑖᒃᑯᓇᙱᑦ ᒥᑦᑎᒪᑕᓕᒃ ᐊᖑᓇᓱᒃᑎᓂᑦ ᑖᒃᑯᓄᖓ ᒐᕙᒪᖏᓐᓄᑦ ᓄᓇᕗᑦ/ᐅᑭᐅᖅᑕᖅᑐᒥᑦ ᓱᕋᔪᓐᓄ ᐃᖅᑲᓇᐃᔭᕐᕕᐅᔪᓄᑦ (ᐱᔭᕇᖅᑲᓚᐅᖅᑐᑦ 20 ᖃᐅᔨᓴᒐᒃᓴᓂᒃ ᑖᒃᑯᓇᙱᑦ 1 ᐊᖑᓇᓱᒃᕕᐅᔪᖅ ᐃᓂᒥᑦ)

Sample type ᖃᐅᔨᓴᒐᒃᓴᖅ ᖃᓄᐃᑑᕐᒪᖔᑦ	# provided ᐅᓄᕐᓂᖏᑦ ᑐᓂᔭᐅᔪᖅ 2020-2021	2021-2022 ***
Blood ᐊᐅᒃ	2	36
Skin and hair ᒪᒥᐊ ᐊᒻᒪᓗ ᒥᖅᑯᖏᑦ	2	37
Kidneys with fat ᑕᖅᑐᑦ ᑐᓐᓄᖃᕐᖢᑎᒃ	1	34
Jaw/ incisor bar and front teeth ᐊᒡᓕᒐᐊ/ᓯᒍᐊᖓ ᐊᒻᒪᓗ ᓯᒍᖓᖏᑦ ᑭᒎᑦ	1	29
Liver ᑎᖖᒍ	2	35
Musde/meat ᓄᑭ/ᓂᕿ	2	34
HKRS	180	45

Caribou hunting was done in most South Baffin communities by the time support letters were provided
ᑐᒃᑐᓇᓱᒃᑕᕆᓂᓚᐅᕐᑐᐃᑦ ᕿᑭᖅᑖᓘᑉ ᓂᕆᐊᓃᑦᑐᓄᑦ ᓄᓇᓕᖕᓄᑦ ᑎᑎᖅᑲᑖᕐᒪᑕ ᐃᑲᔪᖅᑐᐃᖕᓂᖕᒧᑦ

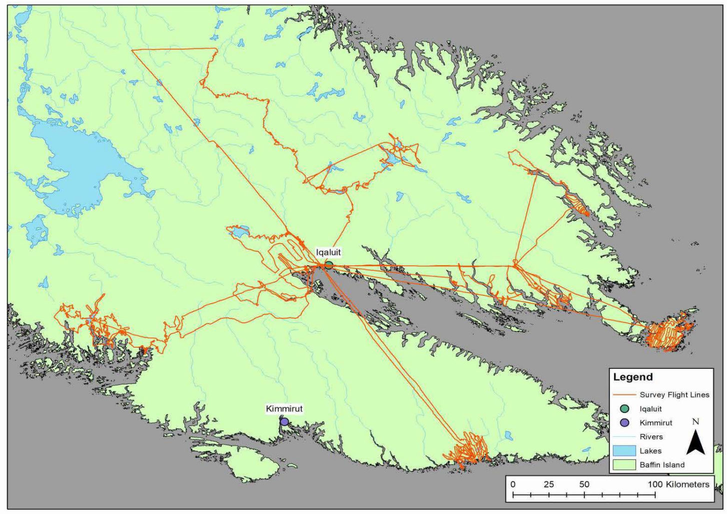
Analysis identified increase in mercury compared to 1992.
ᕿᒥᕐᕈᑎᓪᓗᒋᑦ ᓇᑯᓇᐃᕙᓚᐅᖅᑐᑦ ᓴᕕᕋᔭᒃ ᐃᒪᐃᔮᖅᑐᒥ 1992–ᒥ ᑕᑯᓪᓗᒋ.

Copper levels could cause reproductive issues…but small sample size.
ᑳᓄᔭᐃᑦ ᖁᑦᑎᖕᓂᖏᑦ ᐊᑲᐅᙱᓕᐅᕆᑕᐅᑐᐃᓐᓇᓇᐊᓕᒃ ᕿᑐᕐᖏᐅᕆᑎᓂᑦ… ᑭᓯᐊᓂ ᑭᒥᖏᕈᓗᖏᑦ ᖃᐅᔨᓴᒐᒃᓴᑐᑦ.

4

2) 2021 Composition Survey-South Baffin
ᖃᔅᓯᐅᓂᖏᓐᓂᑦ ᖃᐅᔨᓴᕐᓂᖅ ᐊᐱᖅᓱᕐᓂᖏᑦ

Year	2021								
Season	Spring								
Location	North	Central	Prince Charles Island	Central Baffin + Prince Charles Island	South (Meta + Hall +Loks Land)	Meta Incognita Penninsula	Hall Penninsula	Loks Land	Hall + Loks Land
Calves Observed	55	not completed	not completed	not completed	379	220	58	100	159
Cows Observed	87				805	480	140	183	324
Calves/100 Cows	63				47	46	41	55	49
Yearlings Observed	6				158	92	44	22	65
Bulls Observed	44				392	248	108	36	130
Bulls/100 Cows	N/A				N/A	N/A	N/A	N/A	N/A
Bull + Cows	131				1197	728	248	219	454
Adults + Yearlings Observed	137				1355	820	292	241	519
Total Observed (Calves, Yearlings and Adults)	192				1734	1040	350	341	678



5

2) 2021 Composition Survey-North Baffin
ᖃᔅᓯᐅᓂᖏᓐᓂᑦ ᖃᐅᔨᓴᕐᓂᖅ ᐊᐱᖅᓱᕐᓂᖏᑦ

Year	2021								
Season	Spring								
Location	North	Central	Prince Charles Island	Central Baffin + Prince Charles Island	South (Meta + Hall + Loks Land)	Meta Incognita Penninsula	Hall Penninsula	Loks Land	Hall + Loks Land
Calves Observed	55	not completed	not completed	not completed	379	220	58	100	159
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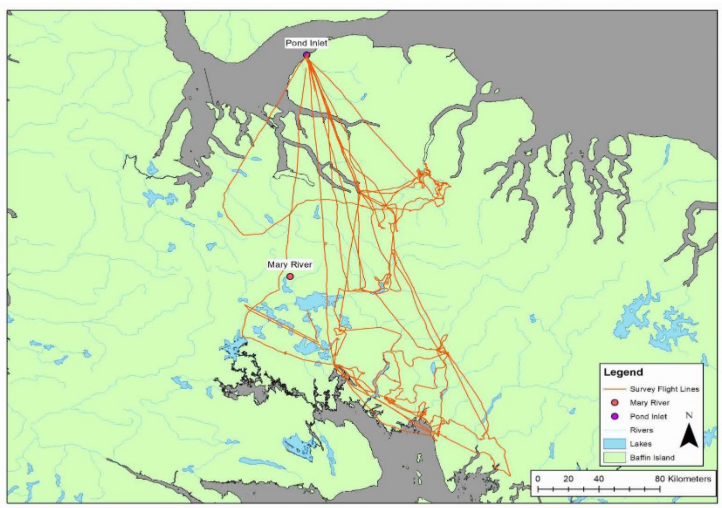

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3) North Baffin Collaring ᕿᑭᖅᑖᓘᑉ ᐅᐊᓐᓇᖓᓂ ᖁᖓᓯᕈᓕᕐᓯᐃᓂᖅ

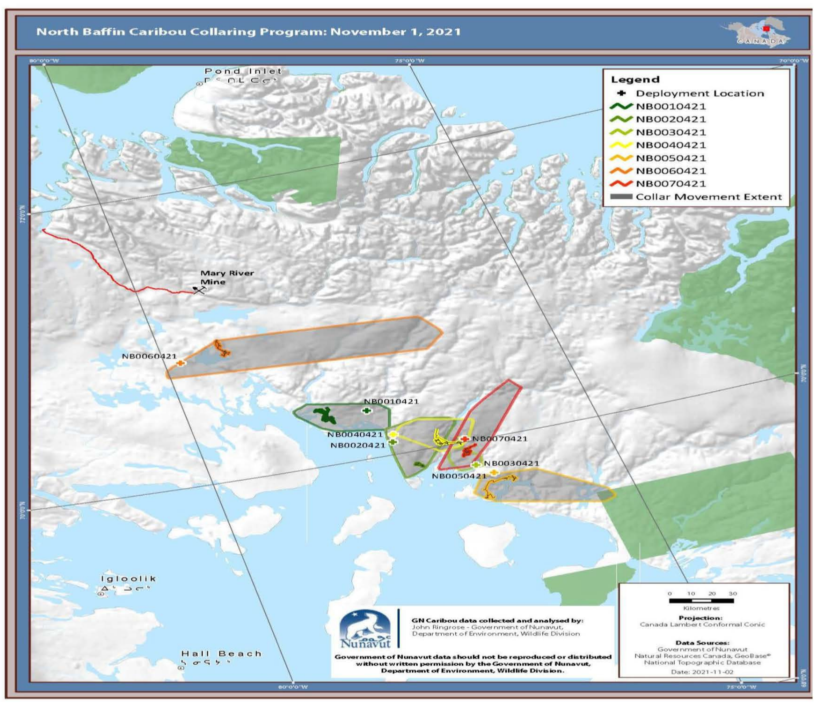
Planned on deploying 15 collars on adult female caribou ᐸᓐᓇᒃᑕᐅᓯᒪᔪᑦ ᖁᖓᓯᕈᓕᕐᓯᔪᒪᓪᓗᑎᒃ 15-ᓂᑦ ᐊᕐᓇᓪᓗᒃᑲᓐᓂ

Put 7 collars on female caribou in one day ᐃᓪᓕᕆᓯᓗᑎᒃ 7-ᓂᑦ ᖁᖓᓯᕈᕐᓂᑦ ᐊᕐᓇᓪᓗᒃᑲᓂ ᐅᓪᓗᕐᒥ ᐊᑕᐅᓯᕐᒥᑦ

Could not put any more on due to weather ᖁᖓᓯᕈᓕᕐᓯᐃᒃᑲᓂᕈᓐᓇᐃᓪᓕᓚᐅᕐᑐᑦ ᑐᒃᑐᓂ ᓯᓚ ᐱᔾᔪᑕᐅᓪᓗᓂ

We would like to put the remaining 8 collars on ᖁᖓᓯᕈᓕᕐᓯᔪᒪᔫᒍ ᐊᒥᐊᒃᑰᓚᐅᕐᑐᓂ 8-ᓂᑦ

7



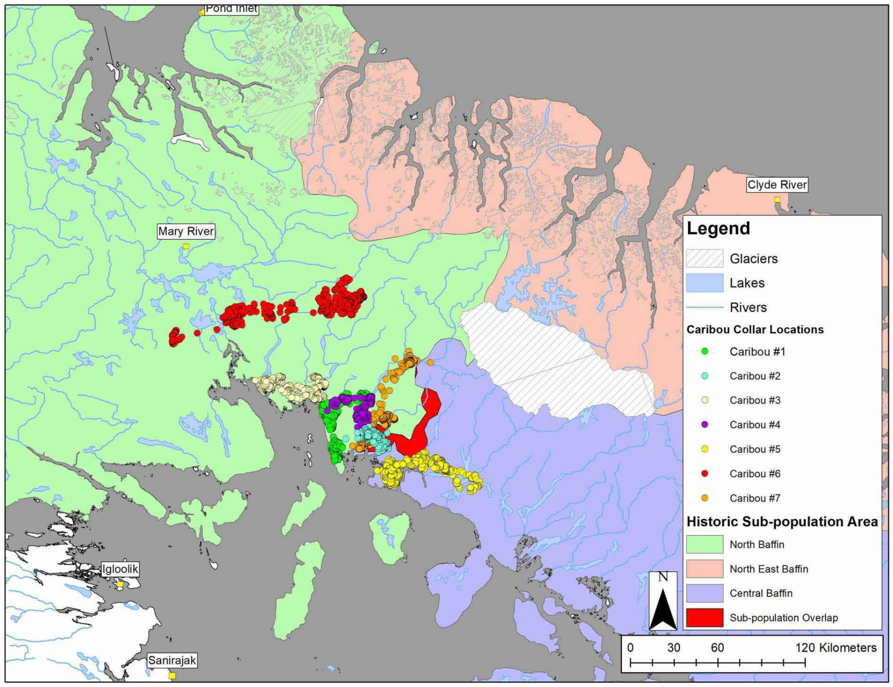
3) North Baffin Collaring ᕿᑭᖅᑖᓘᑉ ᐅᐊᓐᓇᖓᓂ ᖁᖓᓯᕈᓕᕐᓯᐃᓂᖅ

8

3) North Baffin Collaring ᕿᑭᖅᑖᓘᑉ ᐅᐊᓐᓇᖓᓂ ᖁᖓᓯᕈᓕᕐᓯᐃᓂᖅ

Results support IQ and what we expected

ᖃᐅᔨᓴᕈᑎᕕᑦ ᐃᑲᔪᖅᑐᐃᔪᑦ ᐃᓄᐃᑦ ᖃᐅᔨᒪᔭᑐᖃᖏᑦ ᐊᒻᒪᓗ ᓂᕆᐅᒋᓚᐅᕐᑕᕗᑦ



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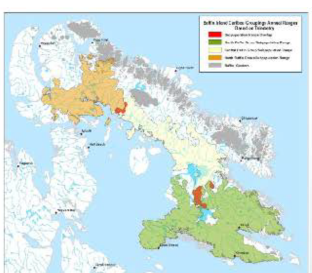
4) Planned research ᖃᐅᔨᓴᕈᑎᑦ ᐸᓐᓇᒃᑕᐅᓯᒪᔪᑦ

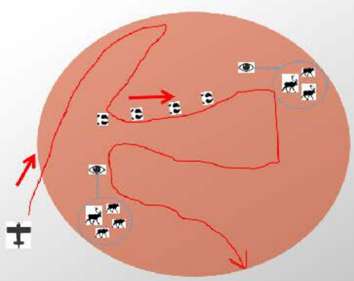
Health Monitoring Program (with support letters from HTOs)

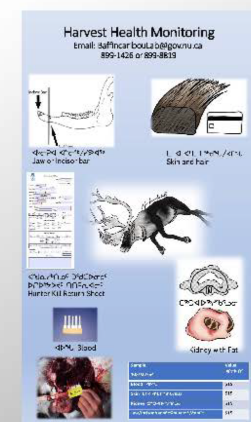
ᕿᓄᐃᖕᒋᑦᑎᐊᕐᓂᖏᓐᓄᑦ ᖃᐅᔨᓴᐃᓐᓇᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᖅ (ᐃᑲᔪᖅᓱᖅᑕᐅᓂᕐᒧᑦ ᑎᑎᖅᑲᑦ ᑖᒃᑯᓇᙵᑦ ᐊᖑᓇᓱᒃᑐᓕᕇᑦ ᐊᒻᒪᓗ ᒥᑭᒋᐊᕐᓂᐊᖅᑏᑦ ᑎᒥᖁᑎᖏᓐᓂᑦ)

Composition surveys in Spring 2022 (Location depends on funding)

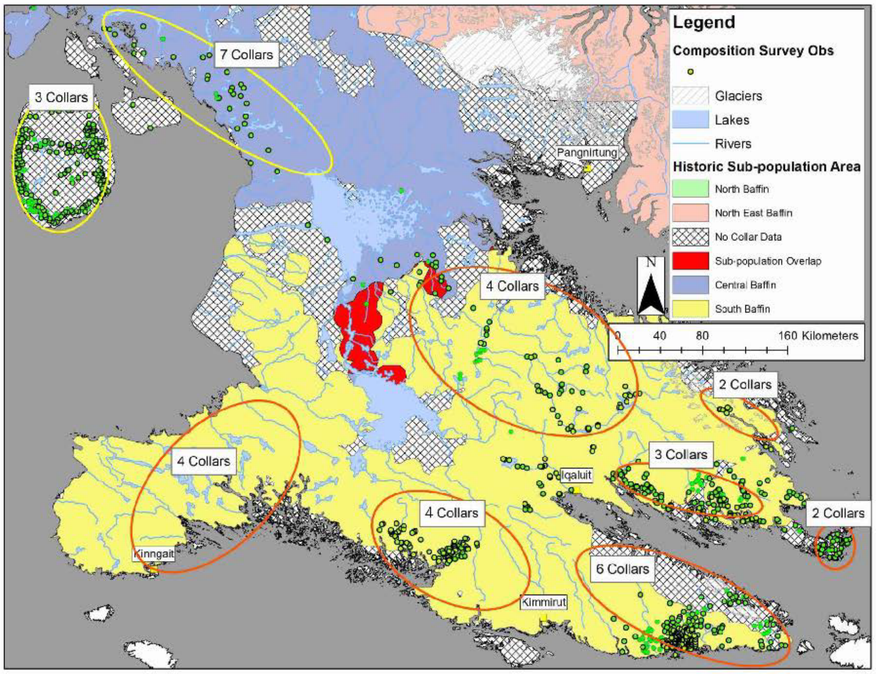
ᕿᓄᐃᓕᖓᓂᖏᓐᓄᑦ ᖃᐅᔨᓴᕐᓃᑦ ᑕᐃᑲᓂ ᐅᐱᕐᖓᒃᓴᖓᓂᑦ 2022 (ᓇᓃᓐᓂᖓ ᒪᓕᖕᓂᐊᖅᑐᑦ ᑮᓇᐅᔭᖃᖅᑎᑕᐅᓂᖏᓐᓄᑦ)







10

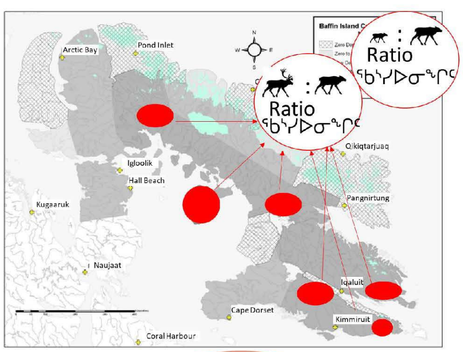


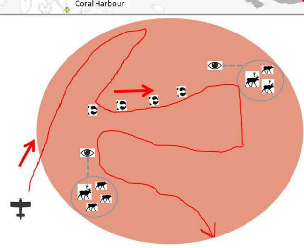
4) Planned research ᖃᐅᔨᓴᕈᑎᑦ ᐸᓐᓇᒃᑕᐅᓯᒪᔪᑦ

Collaring in South Baffin delayed until March/April 2022
ᖁᙱᓯᕈᓕᕐᓯᐃᓂᖅ ᕿᑭᖅᑖᓗᒃ
ᓂᒋᐊᓂ ᑭᖑᕙᖓᐊᖅᑕᐅᔪᑦ
ᒫᑦᓯ/ᐊᐃᐳᓕ 2022-ᒧᑦ

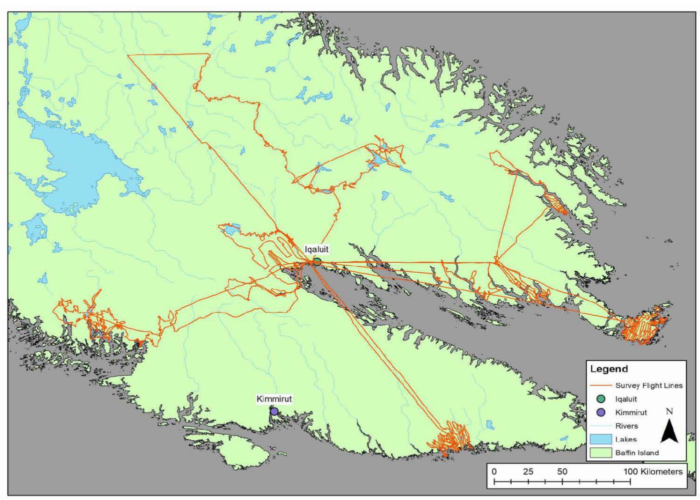
Include HTO participation
ᐃᓚᓕᐅᑎᓗᒋᑦ ᐊᖑᓇᓱᒃᑐᓕᕆᔨᒃᑯᑦ
ᐃᓚᐅᓂᖏᑦ

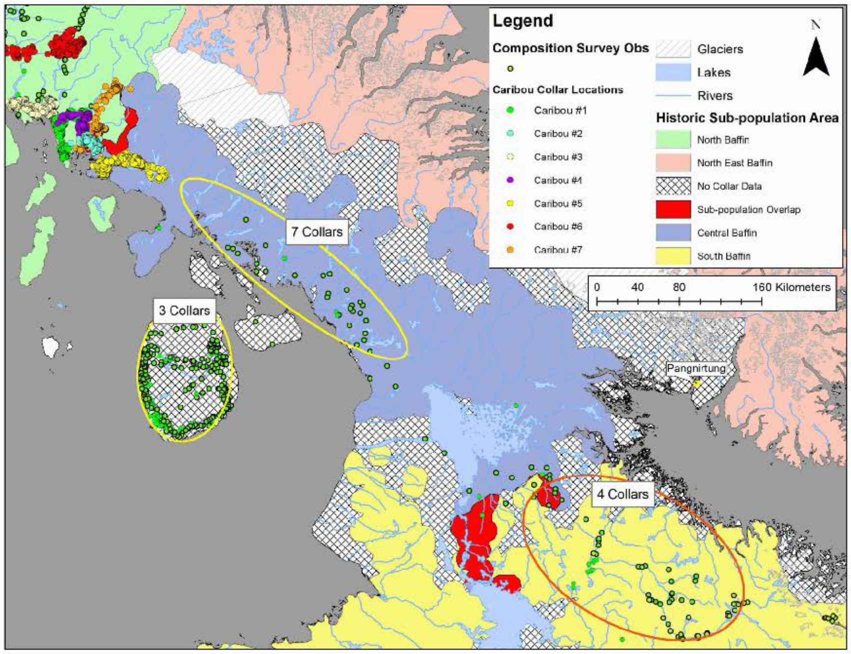
4) Planned research ᖃᐅᔨᓴᕈᑎᑦ ᐸᓐᓇᒃᑕᐅᓯᒪᔪᑦ





Composition Survey-South Baffin
ᖃᔅᓯᐅᓂᖏᓐᓂᒃ ᖃᐅᔨᓴᕐᓂᖅ ᐊᐱᖅᓱᕐᓂᖏᑦ





5) Proposed research ᖃᐅᔨᓴᕈᑎᑦ ᑐᒃᓯᕋᕐᑕᐅᔪᖅ

1)Finished before May 1 because of calving ᐱᐊᓂᒃᑕᐅᓯᒪᓂᐊᖅᑐᖅ ᑎᑭᖅᑳᖅᑎᓐᓇᒍ ᒪᐃ 1 ᐱᔾᔪᑕᐅᓪᓗᓂ ᓄᕐᕋᐅᕐᓂᖅᑎᓐᓄᑦ

2)Collar life - 4.5 years ᕿᖓᒐᓯᕈᐃᑦ ᐋᑐᑎᕐᑲᕐᓂᐊᖅᑐᑦ – 4.5 ᐊᕐᕌᒍᓄᑦ

3) 6 waypoints per day (or more) 6 ᓄᖅᑲᖅᑕᕐᕕᐅᓂᐊᖅᑐᑦ ᐅᓪᓗᖅ ᐊᑐᓂ (ᐅᑉᐹᔫᓐᓃᑦ ᐅᖓᑖᓄᑦ)

4)Includes drop-off ᐃᓚᐅᓪᓗᓂ ᑕᐃᑯᙵᖅᑕᐅᓂᖅᑎᑦ

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6) Support Letters Needed ᐃᑲᔪᖅᓯᐃᓂᕐᒧᑦ ᑎᑎᖅᑲᑦ ᐱᔪᓐᓇᐅᔪᒪᔪᑦ

1) Health Monitoring Program (Northern Contaminants Program) ᖃᓄᐃᙱᑦᑎᐊᕐᓂᖅᑎᓐᓄᑦ ᖃᐅᔨᓴᐃᓐᓇᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᖅ (ᐅᑭᐅᖅᑕᖅᑐᒥᑦ ᓱᕈᔾᔪᓄᑦ ᐱᓕᕆᐊᖅ)
2) Composition surveys 2023 ᖃᔅᓯᐅᓂᖅᑎᓐᓂᑦ ᖃᐅᔨᓴᕐᓂᖅ ᐊᐱᖅᓱᕐᓂᖅᑎᑦ 2023
3) South/Central Baffin Collaring ᓂᒋᐊᓂᑦ/ᕿᑎᐊᓂᑦ ᕿᑭᖅᑖᓗᑉ ᕿᖓᒐᓯᕈᓕᖅᓱᐃᓂᖅ

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7) 2021-2022 Harvest Update

As of January 10, 2022

Community ᓄᓇᓕᒃ	Tags Used ᓂᕕᖓᒌᑦ ᐊᑐᖅᑕᐅᔪᑦ	Tags Available ᓂᕕᖓᒌᑦ ᐊᑐᐃᓐᓇᐅᔪᑦ	Female Harvest ᐊᕐᓇᓪᓗᕐᓂᒃ ᐊᖑᓂᒃᑐᑦ
Arctic Bay ᐃᒃᐱᐊᕐᔪᒃ	13	19	7 of 5
Clyde River ᑲᖏᖅᖢᒑᐱᒃ	21	31	2 of 2
Igloolik ᐃᒡᓗᓕᒃ	12	10	0 of 2
Iqaluit ᐃᖃᓗᐃᑦ	43	43	3 of 2
Kimmirut ᑭᒻᒥᕈᑦ	35	35	0 of 2
Kinngait ᑭᙵᐃᑦ	15	21	2 of 4
Pangnirtung ᐸᓐᓂᖅᑑᖅ	36	35	2 of 2
Pond Inlet ᒥᑦᑎᒪᑕᓕᒃ	37	34	3 of 3
Qikiqtarjuaq ᕿᑭᖅᑕᕐᔪᐊᖅ	0	19	0 of 2
Sanirajak	2	4	0 of 1
Baffin Total ᕿᑭᖅᑖᓗᒥ ᑲᑎᑯᕆᑦ	214	250	19 of 25

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8) Total Allowable Harvest (TAH) ᑲᑎᖕᒍᕆᑦ ᐊᖑᓇᓱᒃᑕᐅᔪᓐᓇᖅᑐᑦ

Current TAH 250 (up to 25 females) ᒫᓐᓇ ᑐᒃᑐᑕᐅᓇᓱᒍᓐᓇᕐᑐᑦ 250 (25 ᐊᕐᓇᓪᓗᒃᑲᐃᑦ)

Composition surveys show some positive signs in some areas ᖃᐅᔨᓴᕐᑎᕕᓂᑦ ᐃᓚᖏᓐᓂᑦ ᐱᐅᔪᓂᑦ ᓴᖅᑭᓯᒪᓕᕐᑐᑦ ᐃᓚᖏᓐᓂᑦ

Hunters are reporting seeing more caribou close to Iqaluit, Kimmirut and Kinngait ᐊᖑᓇᓱᒃᑏᑦ ᑕᑯᓂᖅᓴᐅᖃᑦᑕᓕᕐᑐᑦ ᑐᒃᑐᓂ ᖃᓂᑦᑐᓂᑦ ᐃᖃᓗᐃᓐᓄᑦ, ᑭᒻᒥᕈᒻᒧᑦ ᑭᙵᕐᓄᓗ

GN plans to submit a request to increase TAH to NWMB ᓄᓇᕗᑦ ᒐᕙᒪᒃᑯᖏᑦ ᓇᒃᓯᐅᑦᔨᓂᐊᕐᑐᑦ ᑐᒃᓯᕋᐅᒥ ᐊᓯᔾᔨᕐᑎᕐᓴᖑᓂ ᐊᖑᓇᓱᒃᑕᐅᕙᒃᑐᓂᑦ ᓄᓇᕗᒻᒥ ᐆᒪᔪᓕᕆᔨᕐᔪᐊᒃᑯᑦ ᑲᑎᒪᔨᖏᓐᓄᑦ

there are risks to increasing TAH ᐊᑦᑕᕐᓇᖅᑐᕐᑕᓕᒃ ᐃᓚᒋᐊᕆᓂᖕᒥᑦ ᐊᖑᓇᓱᒃᑕᐅᔪᓐᓇᕐᑐᓂᑦ

16

9) Discussion ᐅᖅᑲᑦᓚᑲᑕᒃᓂᖅ

17

Extra Information

18

Survey types and Methods

ᖃᐅᔨᓴᖅᑕᐅᔪᑦ ᑭᓲᓂᖏᑦ ᐊᒻᒪ ᖃᐅᔨᓴᕈᓯᑦ

Two Main Types of Caribou Surveys

- **Abundance**- The number of caribou
- **Composition**- The ratio of bulls, cows, calves and calf survival
  - Fall surveys are best for Bull:cow ratio and a benchmark for over-winter calf survival trends
  - Spring Surveys are for calf over-winter survival

ᒫᕐᕉᑦ ᐊᔾᔨᒌᙱᑦᑐᑦ ᑐᒃᑐᐃᑦ ᖃᐅᔨᓴᖅᑕᐅᔪᑦ

- **ᑐᒃᑐᖃᕐᑎᐊᖅᑐᓕ** ᑐᒃᑐᐃᑦ ᖃᑦᓯᐅᓂᖏᑦ
- **ᖃᓄᐃᓕᖓᓂᖓ-** ᖃᑦᓯᐅᓂᖏᑦ. ᐸᖕᓂᑦ, ᓄᕐᖄᑦ, ᓄᕐᖃᐃᑦ ᐊᒻᒪ ᓄᕐᖃᐃᑦ ᐆᒪᔪᑦ
  - ᐅᑭᐊᒃᓴᒃᑯᑦ ᖃᐅᔨᓴᖅᐸᒃᑐᑦ ᐊᑕᐅᓵᖑᒍᑦ ᐸᖕᓂᕐᓄᑦ: ᓄᕐᖄᑦ ᖃᑦᓯᐅᓂᖏᓐᓂᒃ ᐊᒻᒪ ᐊᐅᓯᖅ ᐊᓂᒍᖅᑎᓪᓗᒍ ᓄᕐᖃᓚᐅᖅᐸᓪᓚᐊᔪᑦ
  - ᐅᐱᕐᙵᒃᑯᑦ ᖃᐅᔨᓴᖅᑕᖅᑐᑦ ᓄᕐᖄᓄᑦ ᐅᑭᐅᒃᑯᑦ ᐊᓇᒃᓯᒪᔪᑦ

Baffin Island Caribou **Abundance** last completed in 2014

ᕿᑭᖅᑖᓗᖕᒥ ᑐᒃᑐᐃᑦ. **ᐊᒥᓲᓂᖏᑦ** 2014–ᒥᑦ ᑭᖑᓪᓕᖅᐹᒥ ᐱᐊᓂᒃᑕᐅᓚᐅᖅᐳᖅ

Composition Surveys completed 2015 -2019.

ᖃᓄᐃᓕᖓᓂᖏᑦ ᖃᐅᔩᓴᓂᓚᐅᖅᐳᑦ 2015 -2019.

19

How do we determine how many caribou there are?

1) Pick where to fly on Baffin Island

ᖃᓄᖅ ᐋᖅᑭᒃᓱᖅᑕᖅᐱᑕ ᖃᑦᓯᓂᒃ ᑐᒃᑐᖃᕐᓂᖅᑕᐅᔪᓂᒃ?

1) ᓂᕈᐊᖅᓱᑎᒃ ᓇᐅᒃᑯᑦ ᖃᖓᑕᓂᐊᕐᓂᖏᓐᓂᒃ ᕿᑭᖅᑖᓗᒃᑯᑦ

ABUNDANCE**

ᐊᒥᓲᓂᖏᑦ**

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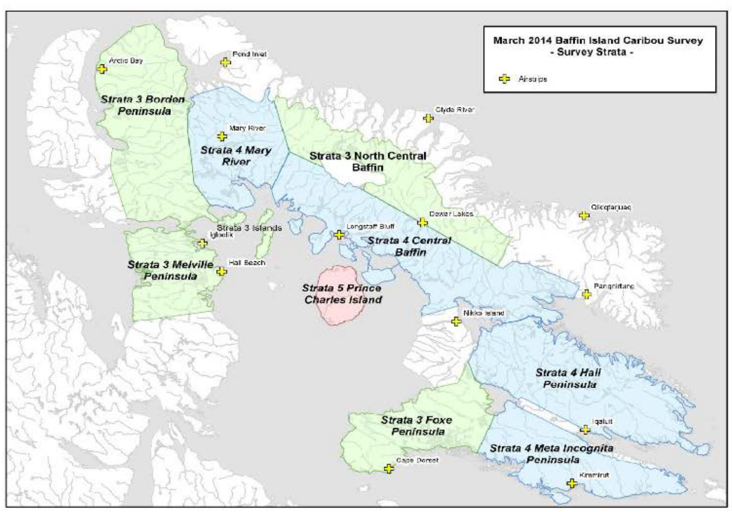
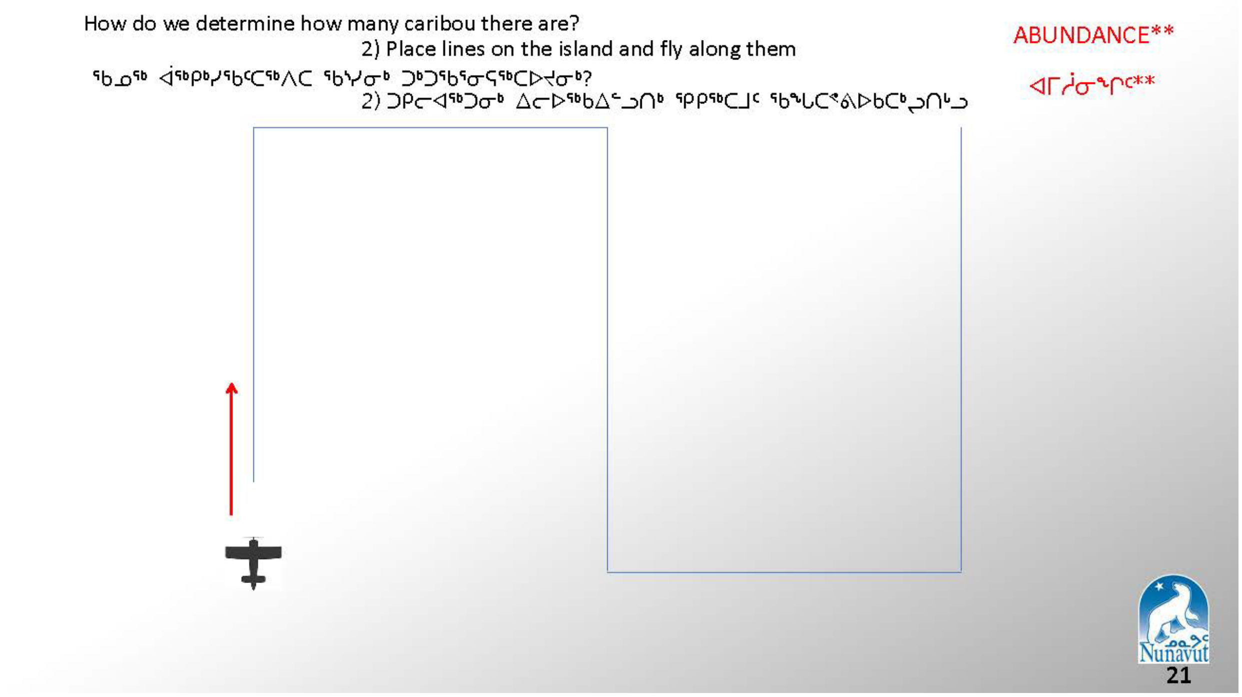
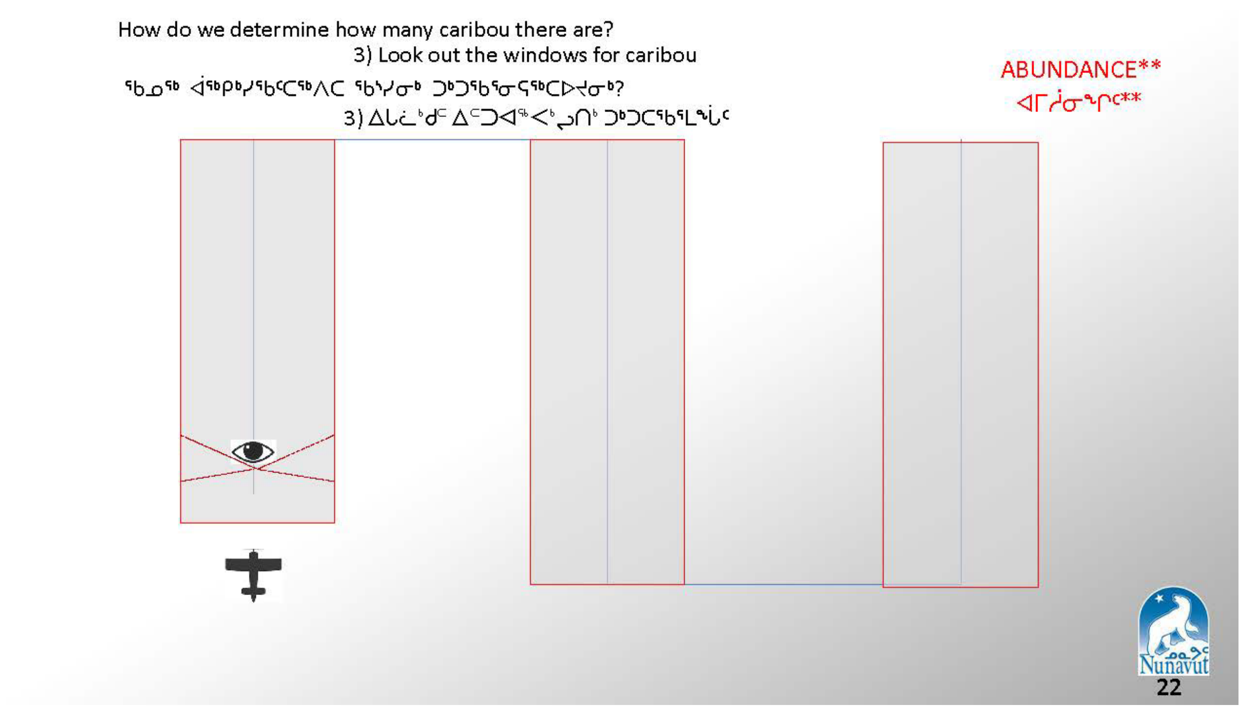
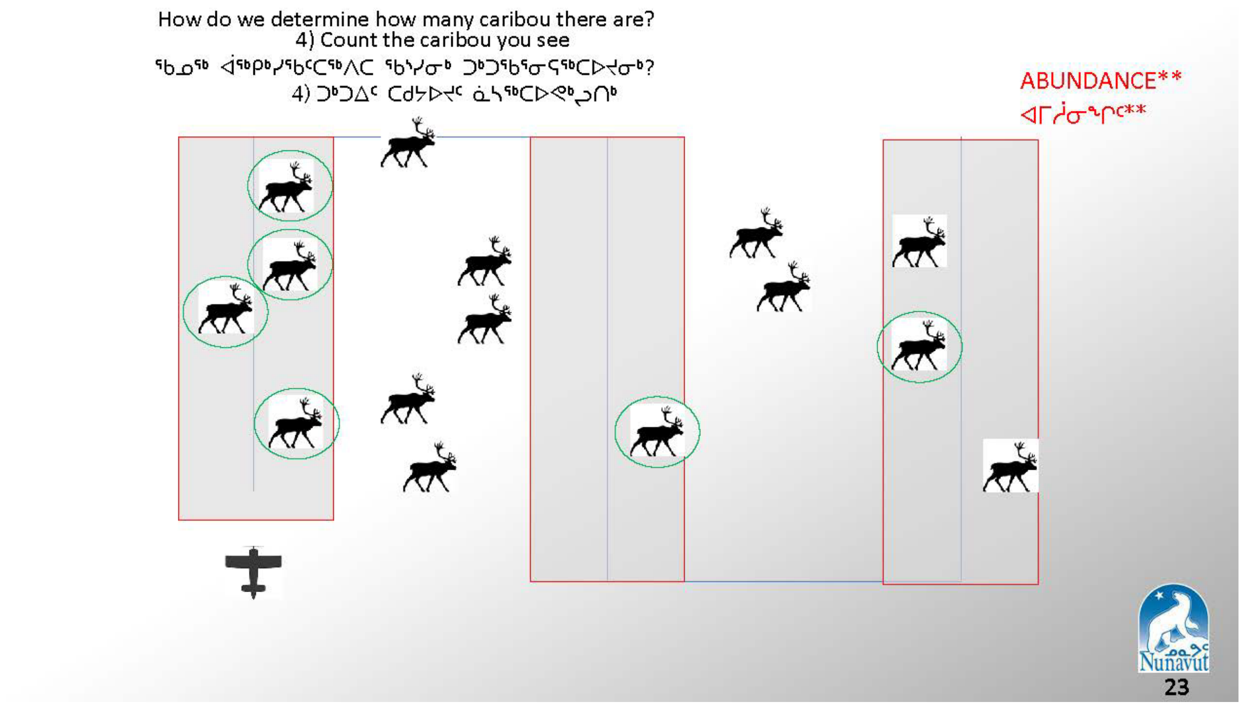
+

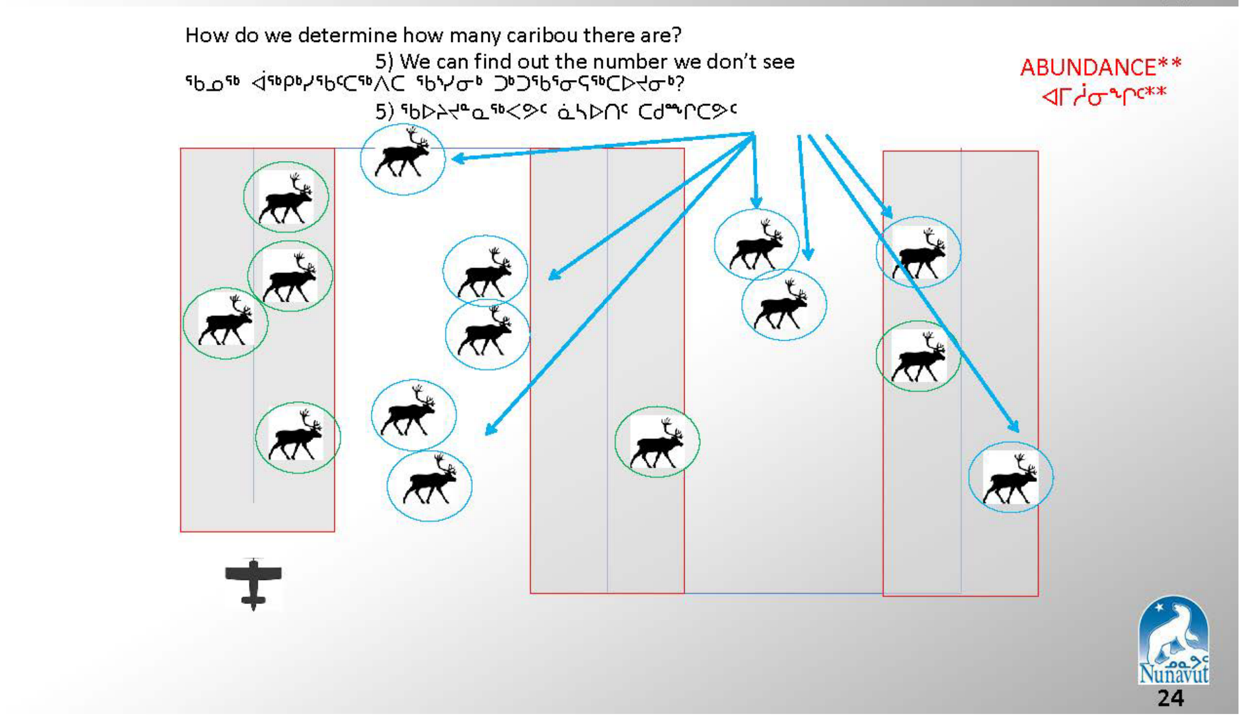


20


How do we determine how many caribou there are?
2) Place lines on the island and fly along them
ᖃᓄᖅ ᐋᖅᑭᒃᓯᖃᑦᑕᖅᐱᑕ ᖃᔅᓯᓂᒃ ᑐᒃᑐᖃᕐᓂᕋᖅᑕᐅᔪᓂᒃ?
2) ᑐᑭᓕᐊᖅᑐᓂᒃ ᐃᓕᐅᖅᑲᐃᑉᓗᑎᒃ ᕿᑭᖅᑕᒧᑦ ᖃᖓᑕᕝᕚᐅᑲᑕᒃᑯᑎᒡᓗ
ABUNDANCE**
ᐊᒥᓲᓂᖏᑦ**
21


How do we determine how many caribou there are?
3) Look out the windows for caribou
ᖃᓄᖅ ᐋᖅᑭᒃᓯᖃᑦᑕᖅᐱᑕ ᖃᔅᓯᓂᒃ ᑐᒃᑐᖃᕐᓂᕋᖅᑕᐅᔪᓂᒃ?
3) ᐃᒐᓛᒃᑯᑦ ᐃᑦᑐᐊᖅᐸᒃᑯᑎᒃ ᑐᒃᑐᑕᖃᕐᒪᖔᑦ
ABUNDANCE**
ᐊᒥᓲᓂᖏᑦ**
22

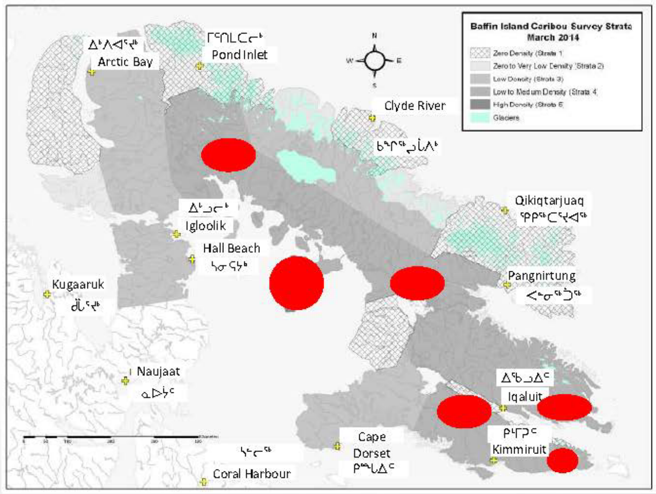

How do we determine how many caribou there are?
4) Count the caribou you see
ᖃᓄᖅ ᐋᖅᑭᒃᓱᖃᑦᑕᖅᐱᑕ ᖃᔅᓯᓂᒃ ᑐᒃᑐᖃᕐᓂᕋᖅᑕᐅᔪᓂᒃ?
4) ᑐᒃᑐᐃᑦ ᑕᑯᔭᐅᔪᑦ ᓈᓴᖅᑕᐅᕙᒃᖢᑎᒃ
ABUNDANCE**
ᐊᒥᓲᓂᖏᑦ**
Nunavut
23


How do we determine how many caribou there are?
5) We can find out the number we don't see
ᖃᓄᖅ ᐋᖅᑭᒃᓱᖃᑦᑕᖅᐱᑕ ᖃᔅᓯᓂᒃ ᑐᒃᑐᖃᕐᓂᕋᖅᑕᐅᔪᓂᒃ?
5) ᖃᐅᔨᓴᓐᓇᖅᐸᕗᑦ ᓈᓴᐅᑎᑦ ᑕᑯᙱᑕᕗᑦ
ABUNDANCE**
ᐊᒥᓲᓂᖏᑦ**
Nunavut
24

We know how many caribou there are. (ABUNDANCE)
How many bulls (Immature, Mature), cows, calves, etc?
ᑐᒃᑐᐃᑦ ᖃᔅᓯᐅᓂᖏᓐᓂᒃ ᖃᐅᔨᒪᔭᕗᑦ. (ᐊᒥᓲᓂᖏᑦ)
ᖃᔅᓯᐅᕙᑦ ᐸᖕᓂᑦ (ᓄᕋᐃᑐᑦ, ᐸᖕᓂᑦ), ᓄᕋᐃᑦ, ᓄᕋᓛᑦ ᐊᓯᖏᓪᓗ?

COMPOSITION**
ᖃᓄᐃᓕᖓᓂᖓ**

1) Locate main groups of caribou (HTO direction)
1) ᕿᓂᕐᓗᒋᑦ ᑐᒃᑐᐃᑦ ᑲᑎᙵᔪᑦ (ᐊᖑᓇᓱᒃᑐᓕᕆᔨᒃᑯᑦ ᑎᓕᐅᕆᔪᑦ)

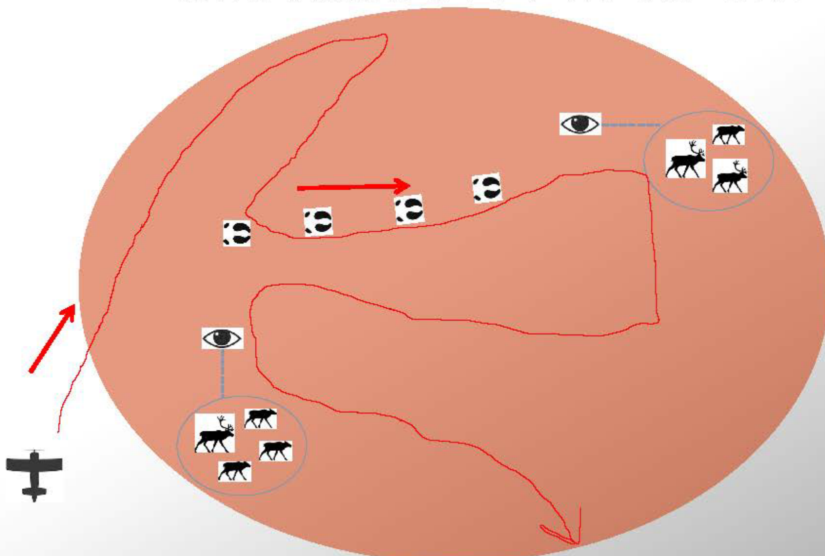


25

How many bulls (Immature, Mature), cows, calves, etc?
ᖃᔅᓯᐅᕙᑦ ᐸᖕᓂᑦ (ᓄᕋᐃᑐᑦ, ᐸᖕᓂᑦ), ᓄᕋᐃᑦ, ᓄᕋᓛᑦ ᐊᓯᖏᓪᓗ?

COMPOSITION**
ᖃᓄᐃᓕᖓᓂᖓ**

2) Fly to the area and search for tracks or caribou
2) ᑕᐅᕗᓇ ᖃᖓᑕᒃᑕᒡᓗᑎᒃ ᑐᒥᖏᓐᓂᒃ ᐅᕙᓘᓐᓂᑦ ᑐᒃᑐᓂᒃ ᕿᓂᕐᓗᑎᒃ



26

ᑲᑐᑎᓗᒍ ᓄᓇᕗᑦ ᐱᓯᖅᑲᐸᓪᓚᐊᑎᓪᓗᒍ
Building Nunavut Together
Nunavu liuqatigiingniq
Bâtir le Nunavut ensemble

ᐊᕙᑎᓕᕆᔨᒃᑯᑦ
Department of Environment
Avatiliqiyikkut
Ministère de l'Environnement

BAFFIN ISLAND CARIBOU COMPOSITION SURVEY

Spring 2021

Final Report

John Ringrose, Regional Wildlife Biologist
Department of Environment
Government of Nunavut
Pond Inlet, NU

Executive Summary

Barren-ground caribou (Rangifer tarandus groenlandicus) occur across Baffin Island and are distributed roughly into north, south and central groupings across Baffin, and ancillary Islands. Local hunters, trappers, and community members began to suspect a decline in the Baffin Island caribou population in the mid to late 1990s. In February and March of 2014, the Government of Nunavut, Department of Environment (DOE), conducted aerial surveys on Baffin Island, Melville Peninsula and surrounding islands, to estimate the number of caribou on Baffin Island. The 2014 survey effort estimated 4,652 (95%CI=3,462-6,250; SE=702.79; CV=0.15) adult and yearling caribou across Baffin Island and ancillary islands. This finding confirmed a major decline of caribou on Baffin Island from the estimates of caribou in the 1990s based on Inuit Qaujimajatuqangit.

The 2014 survey results and community-based observations led to the establishment of an eight-month moratorium beginning on January 1, 2015. Following a round of intensive consultations with all Baffin Island communities, and a letter submitted for decision to the NWMB, recommending the establishment of a TAH of caribou be established on Baffin Island, a decision was reached to establish a Total Allowable Harvest (TAH) of 250 male caribou.

Since the 2014 survey, the DOE has conducted fall and/or spring aerial composition surveys from 2015 to 2021 as a means to monitor productivity and relative densities of caribou across Baffin Island. The objectives of these monitoring indices were to:

1) Estimate the overall composition of the subpopulations including the north Baffin grouping, south Baffin grouping, and central Baffin grouping (Figure 1); i.e., what proportion of the population are young bulls, old bulls, cows, yearlings, and calves.
2) Estimate the trajectory of abundance of the three main groupings of the Baffin Island caribou population, based on demographic composition. Using spring composition results, determine through a comparison between fall composition results, and where possible, similar tundra-wintering barren-ground subpopulations, if an index of calf productivity (measured as calves per 100 cows) suggests an increasing or decreasing population trend.
3) Monitor the proportion of bulls in the population to ensure that the bull only harvest is not reducing bulls to a proportion that could interfere with breeding (rutting) success.
4) Build a database with which to estimate the current population trend through demographic modeling, utilizing all demographic composition data to project a trend from the 2014 population estimate.
5) Provide information for discussions regarding management actions (including TAH) and monitoring plans and intensity.

In the spring of 2021, we classified 1,734 and 192 caribou (bulls, cows, yearlings, and calves) in south and north Baffin Island, respectively. Calf:cow ratios for south Baffin varied from the lowest ratio of 41 calves:100 cows on Hall Peninsula to the highest ratio of 55 calves:100 cows on Loks Land, suggesting good productivity in south Baffin in the spring of 2021. The calf:cow ratio for north Baffin was 63 calves:100 cows. All regions combined or separated, produced ratios within or above the suggested 30 calves per 100 cow baseline for taiga-wintering populations. However, there is risk associated with using baseline values from taiga-wintering populations to identify population trend in tundra-wintering caribou.

Introduction

Baffin Island caribou are of the barren-ground subspecies, *Rangifer tarandus groenlandicus*. This subspecies can be further divided into two separate ecotypes: taiga wintering and tundra wintering. Baffin Island caribou generally remain on Baffin Island and ancillary Islands year-round and therefore are of the tundra wintering ecotype. Tundra wintering caribou generally occur in small groups and vary widely in their migratory behaviour. This can make surveying more difficult as the animals tend to be distributed unevenly across the landscape and occur in smaller groups than the taiga wintering ecotypes, particularly when their abundance is low.

There has been some scientific research conducted on Baffin Island caribou, however, many of these previous studies occur at relatively small spatial scales due to the remoteness and high cost associated with conducting research on Baffin Island. Fortunately, there is a wealth of Inuit Qaujimajatuqangit (IQ) that depicts the long-term population and distributional trends for the region. Due to the lack of quantitative data available, historical population estimates of caribou on the island are largely speculative. Telemetry studies (2008-2011) in North Baffin along with past survey findings, IQ studies (Ferguson, 1993; Ferguson and Gauthier, 1992; Ferguson and Messier, 1997; Ferguson et al 1998), and an island-wide collaring program from the late 80s to early 90s, point to the existence of potential sub-populations on the island (Figure 1). When all previous telemetry collar data was analyzed by Campbell et al. (2015) there is evidence that subpopulation structure exists on Baffin Island, but it has been determined that long-term spatial analysis is required to delineate subpopulations. Instead, spatial affiliations are referred to as “groupings” until further information is collected. Due to variation in habitat use and distribution at different population levels, further research is required to delineate specific groupings and/or subpopulations across Baffin Island. To aid in identifying the presence of these subpopulations, the DOE initiated a GPS telemetry program in North Baffin beginning in March 2021.

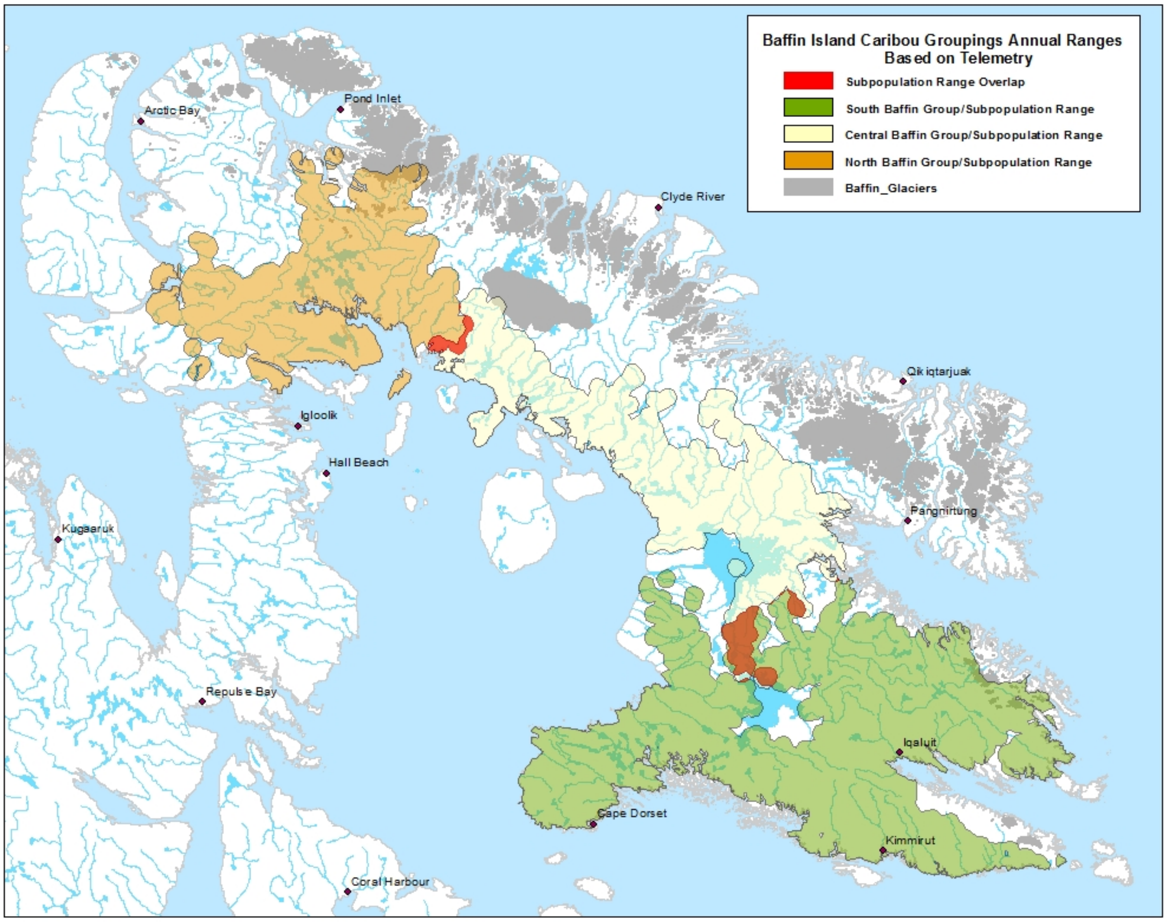


Figure 1. Caribou grouping annual range delineation based on telemetry studies from 1987 to 1994 (primarily South Baffin), and 2008 to 2011 (North Baffin). Polygons created utilizing a kernel analysis (See methods) of telemetry point data collected for 107 collars (North=35; Central = 17; South = 55). Excerpt from Campbell et al. 2015. Used to delineate survey area during composition studies.

Local hunters, trappers, and community members began to detect declines in the caribou population on the island in the mid to late 1990s (Jenkins et al 2012; Ferguson, 1993; Ferguson and Gauthier, 1992; Ferguson et al. 1998). In February/March 2014, the Government of Nunavut, Department of Environment (DOE) conducted aerial surveys across Baffin Island, Melville Peninsula, and surrounding islands to estimate the abundance and general distribution of caribou. Aerial surveys were conducted in February and March of 2014 using a combined double observer pair and distance sampling method (Campbell et al, 2015). This survey estimated the number of caribou within different geographic locations, including: 1) North Baffin Island 2) South Baffin Island 3) Baffin Island in its entirety 4) Baffin Island and its ancillary islands, and 5) Baffin Island and northern Melville Peninsula. A total of 1,157 Caribou were observed during the survey, 50 caribou in 8 groups in North Baffin, 347 in 104 groups in South Baffin, 557 caribou in 164 groups on Prince Charles Island, and 31 caribou in 7 groups on Melville Peninsula (Campbell et al. 2015). From these results, it was estimated that 315 (95% CI=159-622; SE=109; CV=0.35) caribou were in North Baffin, 2,734 (95% CI=1,777-4,207; SE=607; CV=0.22) caribou in South Baffin (including Foxe Peninsula and Central Baffin), 1,603 (95% CI=1,158-2,220; SE=250; CV=0.16) caribou on Prince Charles Island, and 220 (95% CI=88-551; SE=101; CV=0.46) caribou within northern Melville Peninsula, yielding a

Baffin wide estimate of 4,872 (95% CI=3,462-6,484; SE=712.23; CV=0.15) caribou. Campbell et al. (2015) also re-analyzed results from surveys flown in North Baffin in April 2009, and South Baffin in 2012, and found no statistically significant change in abundance between these and the 2014 surveys.

As a result of the low abundance of caribou on Baffin Island estimated in 2014, an eight-month moratorium was put in place on January 1, 2015. Following this moratorium, a Total Allowable Harvest (TAH) and a non-quota limitation (NQL) of a male-only harvest (250 TAH) was implemented by the Nunavut Wildlife Management Board (NWMB) in 2015. The annual caribou harvest season on Baffin Island is open from July 1- June 30. If the annual TAH (Table 1) is achieved prior to June 30 the season is ultimately closed and no additional harvest allowed. During the 2015/16, 2016/17, 2017/18 and 2018/19 harvest seasons the harvest was restricted to male-only. However, females were harvested illegally in each season. Starting in the 2019/20 season, the non-quota harvest restrictions were modified to allow harvest of up to 25 female caribou (cows) without calves. Communities are further allocated a set TAH for each harvest season by the Qikiqtaaluk Wildlife Board (QWB).

Table 1. Seasonal harvest allocations and caribou harvested by season and region.

Year	TAH	Harvest Allocation			Caribou Harvested			Total Caribou Harvested	Females Harvested*
		North Baffin[1]	Central Baffin[2]	South Baffin[3]	North Baffin[1]	Central Baffin[2]	South Baffin[3]		
2015/16	170	50	60	60	42	71	74	187	19**
2016/17	250	67	92	91	56	87	90	233	10
2017/18	250	66	90	94	52	88	92	233	14
2018/19	250	66	90	94	54	89	93	236	7
2019/20	250	63	89	98	58	75	118	251	18
2020/21	250	63	76	98	68	80	99	247***	21
2021/22	250	67	84	99	N/A	N/A	N/A	N/A	N/A

* Females harvested are included in the "Total Caribou Harvested"
** 5 of the females harvested are suspected and not confirmed
*** not including 9 additional suspected harvests.
[1]North Baffin allocation divided between communities of Pond Inlet, Igloolik, Arctic Bay and Sanirajak (Hall Beach). Sanirajak had an allocation of zero for 2019-2021.
[2]Central Baffin allocation divided between communities of Clyde River, Pangnirtung and Qikiqtarjuaq.
[3]South Baffin allocation divided between communities of Iqaluit, Kimmirut and Kinngait (Cape Dorset).

Since the 2014 survey the DOE has conducted fall and/or spring aerial composition surveys from 2015-2021, excluding spring of 2020, as a means to monitor productivity and relative densities of caribou across Baffin Island. The objectives of these monitoring indices were to:

1) Estimate the overall composition of the subpopulations, including the north Baffin grouping, south Baffin grouping, and central Baffin grouping (Figure 1); i.e. what proportion of the population are young bulls, old bulls, cows, yearlings, and calves.
2) Estimate the trajectory of abundance of the three main groupings of the Baffin Island caribou population based on demographic composition. Using spring composition results, determine through a comparison between fall composition results, and where possible, similar tundra-wintering barren-ground subpopulations, if an index of calf productivity (measured as calves per 100 cows) suggests an increasing or decreasing population trend.

3) Monitor the proportion of bulls in the population to ensure that the bull only harvest is not reducing bulls to a proportion that could interfere with breeding (rutting) success.
4) Build a database with which to estimate the current population trend through demographic modeling, utilizing all demographic composition data to project a trend from the 2014 population estimate.
5) Provide information for discussions regarding management actions (including TAH) and monitoring plans and intensity.

Methods

Surveys were conducted in the spring of 2021 (March 18-April 9) on Baffin Island, Nunavut. Weather and logistical constraints limited the extent of surveying to key areas where a greater chance of caribou encounters were suspected based on past telemetry studies, surveys, and IQ for the spring season (Figures 2 & 3). Surveys were conducted using a Eurocopter AS350 B2 rotary wing aircraft, and a survey crew consisting of a biologist, wildlife technician, an observer, and a pilot. Study areas were selected based on previous aerial surveys and telemetry programs, and information gathered from hunters from each of the Baffin communities during consultations conducted in 2012, 2013, 2014, and 2015 (DOE 2013, 2014, 2015a, 2015b; Jenkins and Goorts 2013). Study areas were surveyed using two to three transects evenly spaced, bisecting appropriate habitat, or until tracks were observed. The method relied on tracking groups and/or individual caribou until they were sighted; however, visual sighting methods were used when tracking was either difficult or not possible. Once tracks were observed, they were followed until the group was located. Once a group was located and individuals identified, transects through the study area would be tightened up to 1 to 2 km apart to take advantage of clustering behaviour observed during previous survey and tracking studies where many caribou groups were observed in small geographic clusters during late winter and spring. Once sighted, caribou would be classified into 5 categories; 1) Cow (based on the presence of a visible vulva patch), 2) Calf (based on body characteristics), 3) Yearling (based on body characteristics), 4) Mature Bull (based on absence of vulva patch, body characteristics and antler size) and 5) Young Bull (based on absence of vulva patch, body characteristics and antler size). When possible, image stabilizing binoculars were used to reduce approach distances as much as possible to limit disturbance to animals. In cases where groups could not be located due to fuel and/or weather-related issues, and where time allowed, tracking was resumed the following day or after refuelling, where possible.

Observations were record by hand and waypoints taken for each group using a Garmin 78S. Daily flight track logs were recorded using a Garmin 78s and a Garmin Montana 610 (as a backup). Priority was given to cow and calf observations; however, bulls were recorded when possible. Although preference was given to caribou observations, predators were documented when observed.

Results

We flew a total of 38.4 hours in South Baffin from March 18-23, 2021 and 31.6 hours from March 30 to April 9, 2021 in North Baffin (Table 2). The South Baffin crew consisted of John Ringrose (GN), Amelie Roberto-Charron (GN), Christopher Mutch (GN), and Jason Aliqatuqtuq (Nunavut Tunngavik Incorporated). The North Baffin crew consisted of Nathan Ootoova (Mittimatalik HTO), Gordon Carl

(Panorama Helicopters) John Ringrose (GN) or Chris Mutch (GN). The aircraft used was an A-Star B2 helicopter piloted by Daniel Belanger of Panorama helicopters in South Baffin and Glen Sibbeston in North Baffin. Flights were focused in similar locations to previous spring and fall surveys (Figures 2 & 3).

Survey dates, flight hours and conditions

Table 2. Survey dates and general flight locations in south and North Baffin during spring composition surveys in 2021.

Date	**Location** (general)	**Flight Hours**
	South Baffin	
March 18, 2021	Iqaluit local	6.3
March 19, 2021	Bond Inlet	8.4
March 20, 2021	No flight due to weather	
March 21, 2021	Loks Land	7.8
March 22, 2021	Hall Peninsula	8.2
March 23, 2021	McKeand River Valley	
March 24, 2021	No flight due to weather	
March 25, 2021	Markham Bay	7.7
	Total	*38.4*
	North Baffin	
March 30, 2021	Short flight due to weather	0.2
March 31, 2021	No flight due to weather	
April 1, 2021	Mary river	6.6
April 2, 2021	No flight due to weather	
April 3, 2021	Mary River/Steensby Inlet	6.0
April 4, 2021	No flight due to weather	
April 5, 2021	Coats Inlet (weather delay)	3.0
April 6, 2021	Southeast of Pond Inlet	8.0
April 7, 2021	South of Pond Inlet (weather delay)	2.7
April 8, 2021	No flight due to weather	
April 9, 2021	Steensby Inlet	5.1
	Total	*31.6*

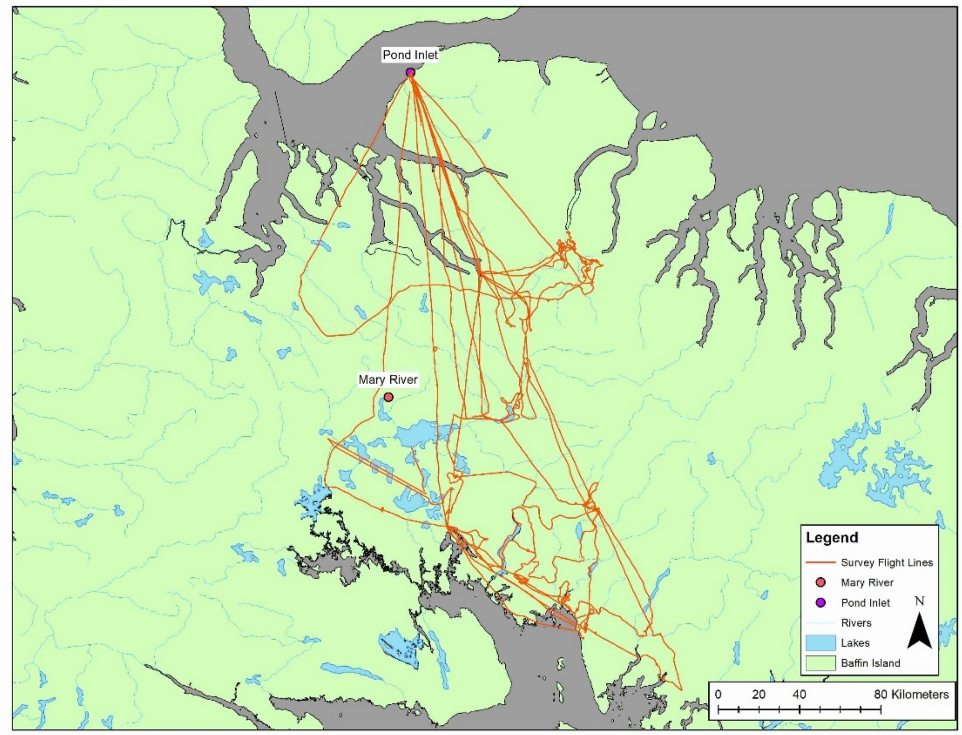


Figure 2. Composition survey flight lines in North Baffin in spring 2021.

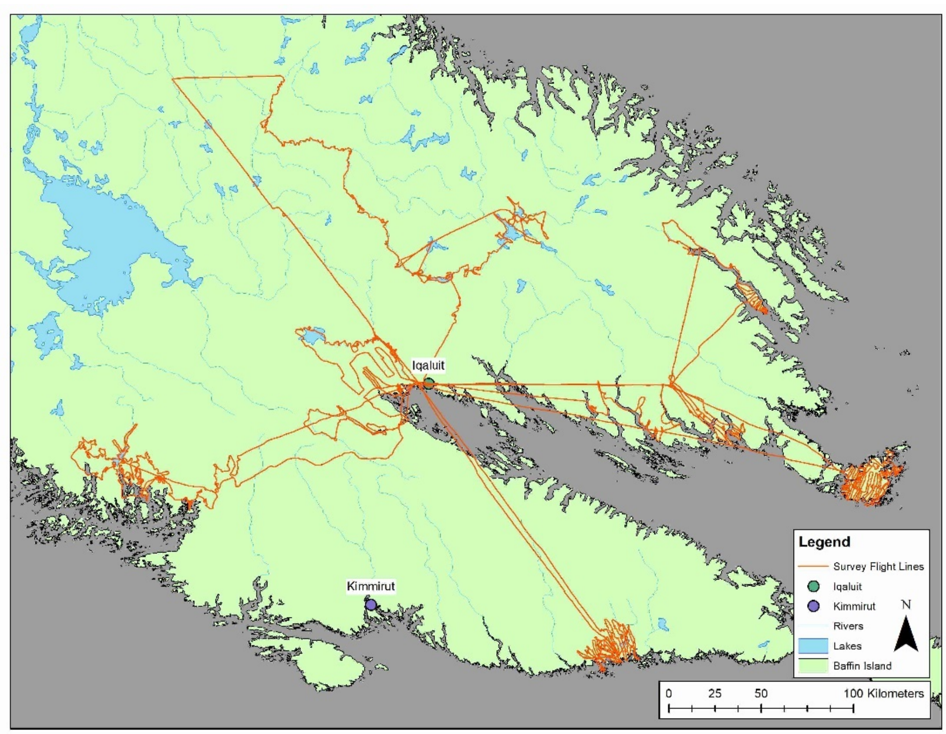


Figure 3. Composition survey flight lines in South Baffin in spring 2021.

Across the South Baffin survey area, we observed a total of 1,734 caribou and in the North Baffin survey area we observed a total of 192 caribou (bulls, cows, yearlings and calves) (Table 3). The southern survey areas were further divided into Lockland, Hall Peninsula and Meta Incognita Peninsula. The purpose of this further division was to identify regional variation in the demographics and total number of caribou observed in each area. Search effort was focused on locating cow and calf caribou and not maximizing the number of total individuals therefore the number of caribou observed is not representative of the overall population size. No wolves or wolf tracks were observed.

Calf to Cow Ratio

In South Baffin, calf to cow ratios varied from 41 calves:100 cow in Hall Peninsula to 55 calves:100 cow in Loks Land. When all regions of south Baffin were combined the ratio was 47 calves:100 cow. In north Baffin there were 63 calves:100 cows (Table 3).

Bull to cow Ratio

No bull to cow ratio was calculated for this survey due to preference given to locating calves and cows. Surveys completed in the fall are most effective in determining bull to cow ratios because of aggregation and mixing of the sexes at this time.

Table 3 Number of observed caribou by sex/age group during Baffin Island composition surveys in South and North Baffin 2021

Year	2021								
Season	Spring								
Location	North	Central	Prince Charles Island	Central Baffin + Prince Charles Island	South (Meta + Hall +Loks Land)	Meta Incognita Penninsula	Hall Penninsula	Loks Land	Hall + Loks Land
Calves Observed	55	not completed	not completed	not completed	379	220	58	100	159
Cows Observed	87				805	480	140	183	324
Calves/100 Cows	63				47	46	41	55	49
Yearlings Observed	6				158	92	44	22	65
Bulls Observed	44				392	248	108	36	130
Bulls/100 Cows	N/A				N/A	N/A	N/A	N/A	N/A
Bull + Cows	131				1197	728	248	219	454
Adults + Yearlings Observed	137				1355	820	292	241	519
Total Observed (Calves, Yearlings and Adults)	192				1734	1040	350	341	678

Discussion

Calf to Cow Ratio

Calf ratios can be used to indicate the likely population trend and help ensure effective management actions are used during population increases or declines. Calf recruitment is an important factor in the rate and success of population growth (Boulanger and Adamczewski 2015). It is important to compare the observed calf ratios to baseline values to determine the population trajectory. There has been little research conducted on tundra wintering caribou and as a result there is no baseline value that exists for either calf:cow ratio or bull:cow ratio for this ecotype. However, we believe until a baseline is developed for Baffin Island caribou, it is reasonable to use the baselines for taiga wintering barren-ground caribou. It has been suggested that calf:cow ratios in barren-ground caribou in the Northwest Territories can be as high 70-90 at calving, 50-70 in the fall and 30-50 following winter when populations are stable or increasing (Adamczewski et al. 2009; Tobey 2001; Gunn et al 2005).

Ratios in South Baffin, whether combined or further separated by area, were within 30-50 calves:100 cow, which suggests a stable or increasing population. Although these ratios are commonly used to indicate population trend, there is an inherent amount of risk associated with using baseline values from different populations.

Calf:cow ratios can be extremely valuable to wildlife managers when combined with multiple additional sources of information such as survival rates, Cow:Calf ratios from different seasons, distribution, harvest rates and overall population change. For example, with this information the impacts of harvest and what amount of harvest a population can withstand without declining can be determined. Unfortunately, much of this information is currently unavailable for Baffin Island.

Limitations of the data

All types of wildlife surveys have limitations in their power to predict changes to abundance or long-term trends. Composition surveys are limited in their ability to predict short-term trends when multiple factors, such as increases in disease or overharvesting, are influencing the population structure. These same surveys, over the longer term can provide a useful index of population trend, offering a useful tool with which to determine the most effective timing of abundance estimates. Composition surveys on Baffin Island were separated by survey region (possible subpopulations), and without definitive delineations of subpopulations, it is higher risk to manage populations or base management decisions on trends at this scale. These types of long-term trends are more useful as an index to advise abundance survey frequency and timing. Identified trends must be taken with caution as sampling is completed within a relatively small geographic area. There are many factors that contribute to population growth and decline in addition to calf survival and demographics. Therefore, in order to accurately predict population growth or decline, it is important to use results from these surveys in conjunction with other sources of data, such as local knowledge, IQ and regular reconnaissance and abundance surveys.

The impact of predation is expected to be low at this time due to the limited observations or reports of wolves from hunters.

One observation of particular interest is that in recent years, locating caribou the spring has been generally easier on Meta Incognita Peninsula than on Hall Peninsula. It is unclear is this reflects a distributional shift between these areas or an increase in abundance in one region and a decrease in the other. The impacts of shifts in distribution or changes in regional abundance can be identified using a combination of telemetry programs and abundance surveys.

Consultation progress

Due to travel restrictions associated with the COVID-19 pandemic in 2020 and early 2021 there were minimal in-person consultations conducted prior to this survey. Once finalized, this report will be provided to communities and in-person consultations are expected in the Fall of 2021.

Management implications and next steps

Long-term management of Baffin caribou relies on the active participation of all co-management partners. Current information gaps exist for Baffin caribou and are needed to ensure a quick and successful recovery. Although the GN has initiated a GPS collaring program on Baffin Island, there is a current lack of data available to identify changes in distribution. As previously mentioned, the adequacy of the observed calf:cow ratios to indicate population trend is unknown. However, the composition surveys and the information collected as a result is invaluable and adds to our knowledge of Baffin caribou. To assess the adequacy of Calf:cow ratios, results from composition surveys must be combined with the results of the next abundance survey. A second quantitative abundance estimate can be used to identify the change in abundance since the first estimate in 2014. Maintaining a consistent harvest and reporting regime between estimates and documenting calf:cow ratios will help identify the impact of harvest over this period.

Although composition survey results may indicate a stable or increasing population trend, it is important to use these results in combination with IQ, distribution data, and complete another abundance survey to validate the composition survey trends and ensure a successful population recovery is occurring. After a new abundance survey is completed an assessment can be made of the accuracy of the NWT baseline values as an indicator of calf productivity for Baffin Island. Once assessed the composition surveys may be a stronger tool that can be used for future management.

Support provided

Hunters and Trappers Organizations (HTOs) provided valuable local knowledge and locational information that contributed to the success of this survey. A special thanks to Jason Aliqatuqtuq from Nunavut Tunngavak Inc. (NTI) and our pilot Daniel Belanger. Financial support was provided by Nunavut Wildlife Management Board (NWMB). In-Kind and logistical support was provided by DeBeers.

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SUBMISSION TO THE
NUNAVUT WILDLIFE MANAGEMENT BOARD
JUNE 2022

<u>FOR</u>

Information: **Decision: X**

Issue: Decision required regarding possible plans for consultation in Nunavut and possible decision-making regarding the potential addition of the Sei Whale to the List of Wildlife Species at Risk on the *Species at Risk Act* (SARA).

Background:
As per 3.5 of the Harmonized Listing Process, the Department of Fisheries & Oceans (DFO) is informing the Nunavut Wildlife Management Board (NWMB) of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessment results and a DFO intent to consult on the Sei Whale (*Balaenoptera borealis*) (Atlantic population) (Figure 1).

Sei Whale
The Sei Whale is a large whale that occurs off Nova Scotia, Newfoundland, and Labrador. The population was greatly reduced by whaling that ended in 1972. Systematic surveys of Canadian Atlantic waters in 2007 and 2016 recorded few animals. The current population is likely fewer than 1,000 mature individuals, perhaps only a few hundred or less, and below its size at the end of whaling.

The species is grey in colour, with a variable white region on its underside. These areas may appear mottled, with grey or white circular scars caused by various predators or parasites. Both the lower left and right jaws are dark in colour. The dorsal fin is tall and slender. The average size for adults is 15 m and 19 tonnes. They may live to 60 years of age, and may be the fastest of the marine mammals, capable of short bursts in excess of 55 km/hour. They feed on zooplankton like other right whales. The Sei Whale is often confused with the more common Fin Whale.

The Sei Whale was considered by COSEWIC in May 2003 and placed in the Data Deficient category. COSEWIC re-examined the Sei Whale (Atlantic population) and designated it Endangered in May 2019.

Figure 1: Image of the Sei Whale (*Balaenoptera borealis*) (© NOAA 2019).

Significance

The third largest whale species after the Blue and Fin Whale, Sei whales are one of the most poorly understood of all baleen whales. Although they were heavily hunted in the modern whaling era, their current distribution, migration patterns and behaviour are not well studied. Because the Sei Whale is rarely found near shore, it is not the primary target of whale watching operations. Sei Whales do not seem to have been an important resource for coastal Indigenous groups in Canada, although the species likely has a significant ecological role.

Distribution

Sei whales are found in all the oceans of the world and make seasonal migrations from low-latitude wintering areas to high-latitude summer feeding grounds. While the locations of the wintering grounds are relatively unknown, Sei Whales are found in the summers in the Labrador Sea, off Newfoundland, and on the Scotian Shelf and Slope and at least some individuals are present in these waters in the fall, winter and spring. There is one confirmed offshore sighting in southern Baffin Bay (Figure 2), but no records of the species being nearshore.

Threats and Limiting Factors

Current threats to Sei Whales include the noise from seismic surveys, shipping and military exercises, vessel strikes, and entanglement in fishing gear. Insufficient access to prey may limit the productivity of Sei Whale populations.

Requirements for Consultation and Approval

Article 5.2.34 (f) of the Nunavut Land Claims Agreement states that the NWMB shall, at its discretion, approve the designation of rare, threatened or endangered species. As well, Section 27 (2) (c) of the SARA requires that before making a recommendation as to whether or not to add a species at risk to Schedule 1, the Minister must consult the Board for species found in an area in respect of which the Board is authorized by a land claims agreement to perform its functions.

Given that Sei Whale are extremely scarce in the Davis Strait area, it would seem probable that Sei Whale are similarly rare visitors to Nunavut waters and are far offshore from Baffin Island and the Nunavut Settlement Area. However, because there is a possibility they may occasionally venture into the area co-managed by NWMB, DFO is seeking the Boards expectation for consultations, if any, for this species.

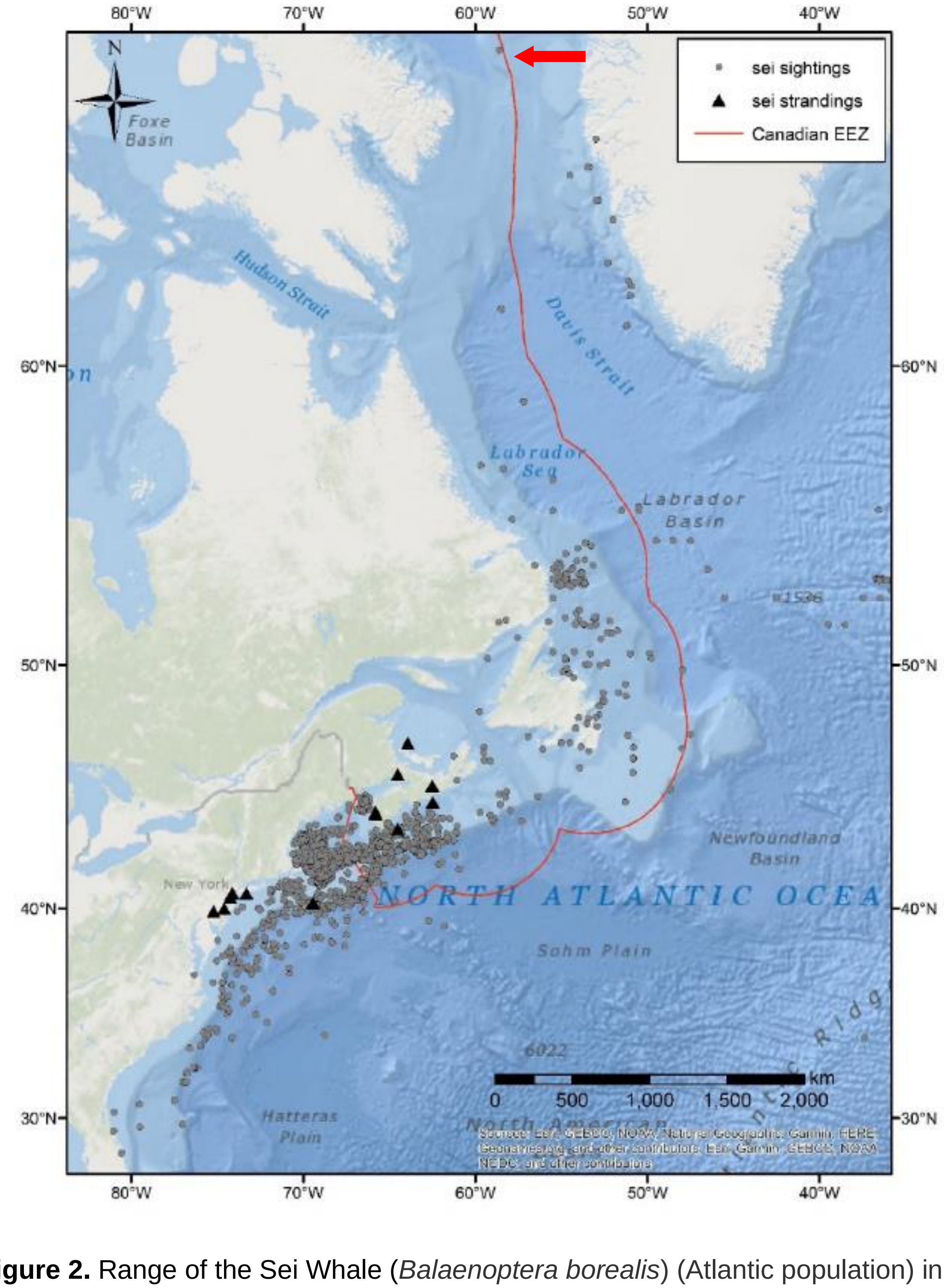

Figure 2. Range of the Sei Whale (*Balaenoptera borealis*) (Atlantic population) in northern waters (from COSEWIC 2019). Single confirmed sighting in south Baffin Bay is indicated by red arrow.

Consultation and Approval:
If the NWMB deems it to be appropriate, DFO could consult with communities identified by the Board for any information on sightings and their opinion on listing the Sei Whale. These consultations would ensure that any listing decision is made in full consideration of the views of Inuit and would be used by the Minister to decide whether to recommend legal listing of the Sei Whale.

If NWMB deems consultations to be appropriate, once completed, DFO would provide the Board with a summary of the community consultations for the Sei Whale. At a later date we would inform the Board what the Minister plans to recommend to the Governor-in-Council with regards to listing. At that time DFO would ask the Board whether or not it wishes to express an opinion on listing.

Prepared by:

Sam Stephenson, Species at Risk Biologist, DFO, Ontario & Prairies Region, supporting the Arctic Region, Winnipeg

Date:

March 29, 2022

SUBMISSION TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD JUNE 2022

FOR

Information: X **Decision:**

Issue: Information regarding plans for consultation and decision-making regarding the possible addition of the Beluga Whale, Eastern High Arctic – Baffin Bay population, to the List of Wildlife Species at Risk on the *Species at Risk Act* (SARA).
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Background:
As per 3.5 of the Harmonized Listing Process, the Department of Fisheries & Oceans (DFO) is informing the Nunavut Wildlife Management Board (NWMB) of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessment results and a DFO intent to consult on the Beluga Whale, Eastern High Arctic – Baffin Bay population.

The Eastern High Arctic – Baffin Bay population of Beluga Whale
The Beluga Whale, Eastern High Arctic – Baffin Bay population, was seriously overexploited in West Greenland and declined considerably – possibly by as much as 50% – over the period 1981-1994. It was assessed as Special Concern by COSEWIC in 2004. Since that time, there has been less hunting pressure in Greenland, and harvests are now likely sustainable and the population appears to have stabilized and may be growing. However, there is concern that increased vessel traffic facilitated by climate change is changing the nature of the acoustic habitat of this population. COSEWIC has determined that the population may fit, or is close to fitting, the criteria for Threatened.

In August 2010, following consultations and discussions with the NWMB, a decision was made to not list the Eastern High Arctic – Baffin Bay population of Beluga Whale. The recommendation not to list was made to the Governor in Council in March 2013. During consultations, it was stated that overharvesting in Greenland needed to be addressed further and that the stock was showing signs of recovering, so there was little point in listing the population in Canada. While there have been improvements in lowering the Greenland harvest, in November 2020, this population was again assessed as Special Concern by COSEWIC. There is currently some uncertainty over the population size which was estimated at 21,213 in 1996.

Distribution
The Eastern High Arctic – Baffin Bay population occupies a distinct geographic region in the summer that is separate from other beluga. Beluga from this population summer exclusively in the Canadian Arctic Archipelago, primarily near Somerset Island, and along the northeastern coast of Baffin Island. Wintering animals are found in two main areas: along the west Greenland coast and the North Water

Polynya spanning Canada and Greenland. Figure 1 shows the known summering and wintering areas of the Eastern High Arctic – Baffin Bay population as well as the migration routes between these areas. Information on the distribution and movements of the belugas in the Eastern High Arctic – Baffin Bay population comes from aerial surveys, satellite-tagging, and Traditional Knowledge.

Requirements for Consultation and Approval

Article 5.2.34 (f) of the Nunavut Land Claims Agreement states that the NWMB shall, at its discretion, approve the designation of rare, threatened or endangered species. As well, Section 27 (2) (c) of the SARA requires that before making a recommendation as to whether or not to add a species at risk to Schedule 1, the Minister must consult the Board for species found in an area in respect of which the Board is authorized by a land claims agreement to perform its functions.

Consultation and Approval

DFO is planning to consult with Hunters and Trappers Organizations in Nunavut adjacent to the distribution of the Eastern High Arctic – Baffin Bay population of Beluga Whale to ensure that any listing decision is made in full consideration of their views. Comments received will be used by the Minister to decide whether to recommend legal listing of the Beluga Whale, Eastern High Arctic – Baffin Bay population. A consultation summary will be provided to the NWMB when consultations are complete.

Approval

After public consultations have been completed, DFO will provide the Board with a summary of the community consultations for the Beluga Whale, Eastern High Arctic – Baffin Bay population. At a later date we will inform the Board what the Minister plans to recommend to the Governor-in-Council with regards to listing. At that time, the Board will be asked whether or not it wishes to express an opinion on listing.

Prepared by:

Sam Stephenson, Species at Risk Biologist, DFO, Ontario & Prairie Region, supporting the Arctic Region, Winnipeg

Date:

March 29, 2022

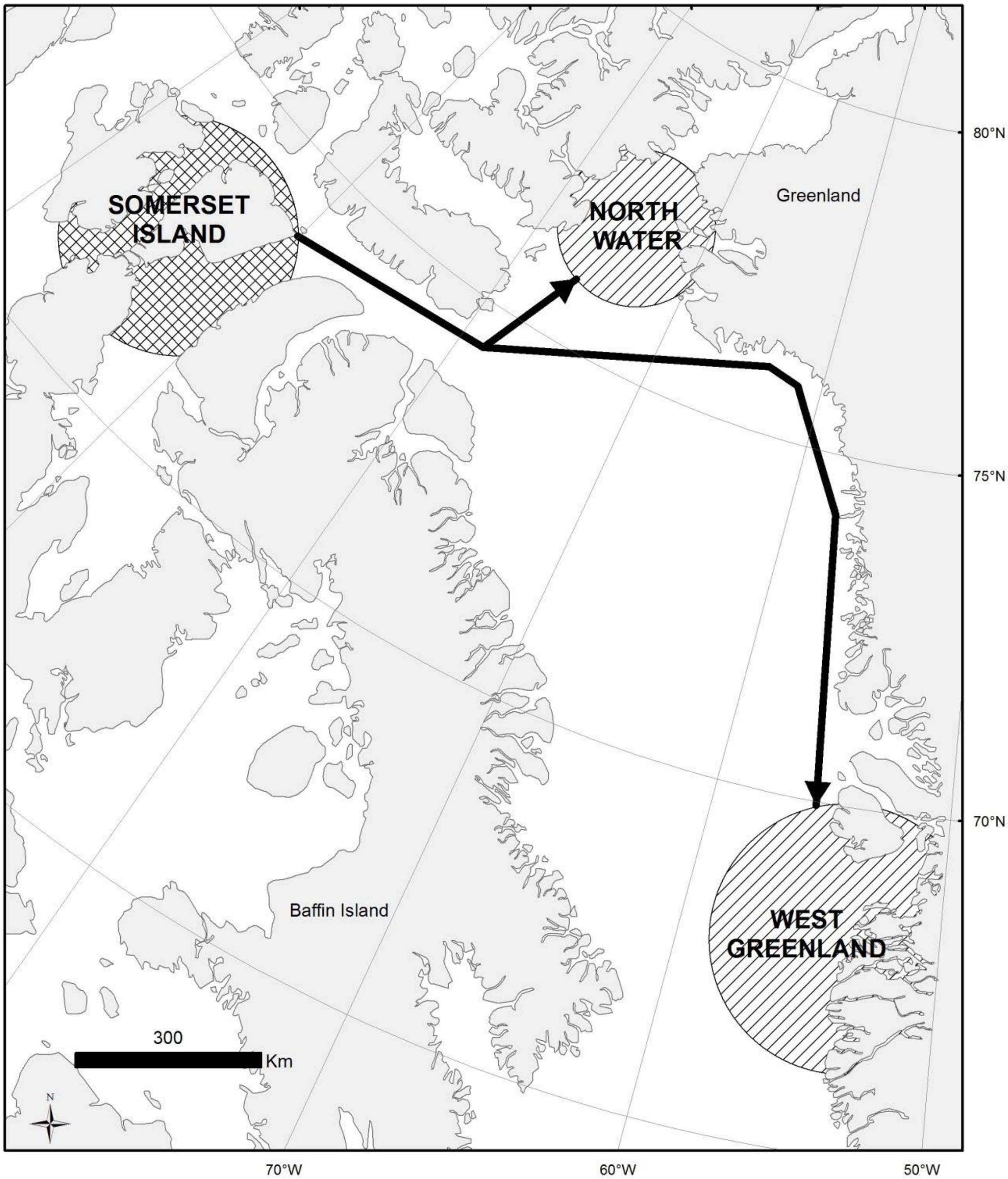


Figure 1. General distribution of Eastern High Arctic – Baffin Bay Belugas showing approximate summering grounds (double-hatched area) around Somerset Island in Canada, the two main wintering grounds (hatched areas) in the North Water and along the West Greenland coast, and the migratory route used in the spring and autumn. Reprinted from Ferguson and Hansen (2018).

SUBMISSION TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD June 2022

For

Information: **X** Decision:

Issue: Bowhead Carcass Update, Kitikmeot Region

Potential Issue(s) or impact(s):

- Between 1 October 2020 and 14 April 2021, 11 bowhead whales (*Balaena mysticetus*) were discovered dead onshore in the Gulf of Boothia, near the community of Kugaaruk, Nunavut.
- The cluster of mortalities in a relatively short time span and small geographic area was disconcerting to local hunters and prompted an investigation by Fisheries and Oceans Canada.
- Carcasses were attended by local Inuit and tissue samples from eight whales were collected to investigate potential causes and extent of mortalities.
- Possible causes for these mortalities include starvation (poor body condition), unusual weather events, harmful algal blooms, infectious disease, anthropogenic activities such as contaminants, and killer whale (*Orcinus orca*) predation.

Provincial / Territorial / International communications necessary / completed

- DFO has updated co-management organizations and Regional Communications as information becomes available.
- Alaska has recorded bowhead Unusual Mortality Events in the past and provided recommendations on response measures.
- A report summarizing results of analyses was provided to the International Whaling Commission in April 2022.

Science Response:

- **Satellite imagery:** To investigate the extent of the stranding event, satellite images were used to search for carcasses that may not have been found by local hunters.
- **Age analysis:** Skin samples were sent to UCLA Health Sciences as part of a collaboration to determine an epigenetic clock age for bowhead whales. Results indicate that six out of eight sampled whales were subadults, under the age of 20 years.
- **Contaminants:** Blubber samples from bowhead whales harvested before the mortality event (n=6, 2008-2020) or found stranded during the event (n=6, 2020), as

well as narwhals harvested in the same region were analyzed for 209 PCB congeners.
Concentrations of PCBs in the bowheads ranged from 14.1 to 129.7 ng/g wet weight and were not considered a health risk to either the whales or human consumption. The total PCB concentrations detected in individuals found stranded during the mortality event were in the same range as those harvested before the event.

- **Condition:** Blubber anatomy and composition from stranded bowheads were compared to harvested whales to test if mortalities were related to emaciation. Harvested whales had larger adipocytes and a higher proportion of lipid than whales found dead, suggesting stranded whales may have been in suboptimal nutritional condition.
- **Histopathology and disease screening:** Blubber and skin samples from seven of the stranded whales were sent to the Animal Health Center (Abbotsford, BC) where they were processed by conventional histology techniques. Muscle samples were also screened for the protozoal parasite, *Toxoplasma gondii*, while blubber and skin samples were screened for Brucella spp. and morbillivirus.
  Tissue from one stranded whale suggested emaciation or suboptimal nutritional condition. No evidence of *Brucella* spp, Morbillivirus or *T. gondii* were detected.
- **Climatic events:** Wind and sea ice data for 2020 was compared with typical conditions and no evidence of unusual weather events prior to the mortality event was found. However, lower wind speeds than average and later ice formation was noted. In comparison to historic conditions, the reduction in sea ice in autumn 2020 was extensive and would have afforded killer whales greater access to the region.
- We conclude that although no definitive cause of the bowhead whale mortalities was identified, killer whale predation appears to be the most likely proximate cause. A contributing factor in the strandings may have been an interaction between poor body (nutritional) condition and predisposition to predation.

Media Attention:

- Some media attention in November 2021 when the first whales were observed, but none since.

Next Step(s):

- Future research will include analysis of drone-collected images from the larger population to assess body condition, reproductive history from baleen plates, population modeling to determine carrying capacity, and modeling of physical factors to associate future whale health within a larger environmental context.

Prepared by:
Steve Ferguson and Brent Young, DFO Science, Winnipeg

Date:
21 April 2022

SUBMISSION TO THE

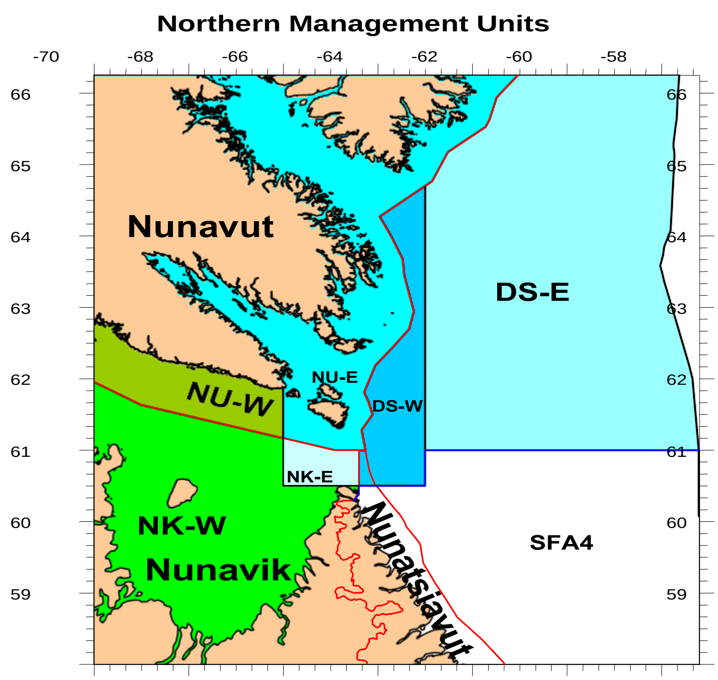
NUNAVUT WILDLIFE MANAGEMENT BOARD AND
NUNAVIK MARINE REGION WILDLIFE BOARD

FOR

Information: X **Decision:** **Recommendation:**

Issue: Baffin Fisheries request to Carry Forward of 250 mt of *Pandalus borealis* in the Northern Shrimp Fishery in the Eastern Assessment Zone, Nunavut-East from 2021/22 to 2022/23 fishing season

Map:
Blue areas – Eastern Assessment Zone
Green areas – Western Assessment Zone



Northern shrimp (*Pandalus borealis*)

Striped shrimp (*Pandalus montagui*)

Background

Two shrimp species (*P. borealis* and *P. montagui*) occur in the Northern shrimp fishery that takes place in the Davis Strait and eastern Hudson Strait. This fishery is managed according to two distinct stock assessment zones, the Western Assessment Zone (WAZ) and the Eastern Assessment Zone (EAZ) (Appendix 1).

While allocations are provided annually for commercial fishing, season bridging of quota is regarded as a useful operational flexibility in the WAZ and EAZ shrimp fisheries that allows for additional opportunities to catch allocations in full, without compromising the sustainability of the resource.

Collectively, season bridging in the shrimp fisheries refers to 1) borrowing from the following year's quota to be fished in the current year; and 2) transferring some of the current year's unused quota to be caught in the following year (carry forward). Under the current bridging protocols in the EAZ, up to 350t is available for carry forward for Nunavut and 20t for Nunavik allocations, to be fished by July 31 of the following year. Quota that is not caught by this date will remain unfished.

Up until the beginning of the 2020/21 season, season bridging provisions in the EAZ applied only to the Davis Strait management units where *P. borealis* is the directed fishery. In July 2020, following a decision from the Nunavut Wildlife Management Board , season bridging for northern shrimp allocations was extended to include the Nunavut-East (NU-E)/Nunavik-East (NK-E) management units (Appendix 2).

The 350t carry forward provision for Nunavut entities is split between Davis Strait West(DSW)/NU-E (140t) and Davis Strait East (DSE) (210t). Each of these limits is further split among the quota holders based on their initial allocation share. For 2021/22, the limits on carry forward were established as follows:

Table 1 : Breakdown of Nunavut Carry forward limits:

DSW/NU-E (140t)	DSE (210t)
BFC (35%) = 49t	BFC (57%) = 120t
QC (35%) = 49t	QC (28.5%) = 59.5t
CSPF (15%) = 21t	CSPF (14.5%) = 30.5t
AFA (15%) = 21 t	

On April 12, 2022 Baffin Fisheries (BFC) requested to the Department that it be permitted a 250t carry forward of *P. borealis* be from fishing year 2021/22 to 2022/23 in fishing area EAZ, sub-area NU-E and NK-E, based on allocations (Appendix 3). The basis for this request is the Minister's decision on the 2021/22 Total Allowable Catch (TAC) for these management units (Appendix 4) which was communicated close to the point when ice conditions prevented the prosecution of the fishery.

The Department has also received a requests from Makivik Corporation to be permitted to exceed the current limits prescribed in the bridging (carry forward) provisions for the shrimp fisheries in DSW/NU-E/NK-E area.

Preliminary catch data indicates that approximately 50% (478t) of the overall *P. borealis* TAC (948t) in the NU-E/NK-E area was harvested during the 2021-22 fishing season. Following the established protocols, the limit of the collective quota carry-forward of DSW/NU-E for Nunavut entities from the 2021/22 fishery to the 2022/23 season 140t is and split as per Table 1.

BFC was provided access to an interim quota of approximately 186t in the NU-E/NK-E as of March 24, 2021. BFC received an additional 186t of interim quota access as of September 24, 2021 for a total of 371.7t. While BFC had access to interim quotas much earlier in the year, they did not request this access be added to their licence until November 12, 2021. On November 12, 2021, BFC transferred out 100t of its quota leaving a quota of 271.7t available on its licence for the 2020/21 fishery. Other allocation holders requested their access to the NU-E/NK-E area be added to their licence earlier in the year and were able to harvest 465t in area during the 2021/22 season.

While the final TAC decision was for this area was not made until January 2022, BFC had access to 87% of their final quota as of September 24, 2021 yet only harvested just under 12t (3%) and transferred another 100t (27%) of its NU-E/NK-E interim access in the 2021/22 season.

Science Considerations

The *P. borealis* stock in the EAZ is in the Healthy Zone of the Precautionary Approach (PA) Framework.

Collectively, season bridging will result in an increased exploitation rate, especially if carry forward and borrowed quota is fished in the same year. The access to season bridges provides allocation holders with increased flexibility to aid in business planning, better prosecute the fishery and adjust to resource availability and market fluctuations. Limits on bridging (carry-forward and borrowing) are in place to assist in ensuring the sustainability of the fishery.

Despite the recent reduction in the estimate of the fishable biomass and the spawning stock biomass in 2021 for the EAZ stock, *P. borealis* remains in the healthy zone of the PA Framework, and as such DFO Science does not foresee negative consequences of allowing carry-forwards as prescribed for the stock.

Next Steps

BFC had access to fish nearly 43.5% of their overall quota as of March 24, 2021 and 87% as of September 24, 2021 (371.7t) in the NU-E/NK-E area. As noted, BFC transferred 100t and only harvested approximately 12t of its access. Season bridging aims to enhance socioeconomic outcomes of the shrimp fishery, but must be balanced with sustainability considerations. The allowance for a carry forward of NU-E/NK-E P. borealis allocation was first instituted at the end of the 2019/20 season, so the scheme is in its early stages which aligns with a cautious approach.

The Department recognizes that industry has requested further discussion occur regarding the current season bridging approach and whether allowances are appropriate. At this time it is recommended that the process currently in place be followed for this season but DFO is open to further discussions with harvesters to determine if modifications may be warranted. Given the above, it is recommended that the season bridging (carry-forward) provisions in place for DSW (including the NU-E/NK-E) for the 2021/22 season continue to be applied as established. This same approach would be in place for any other allocation holder requesting carry-forwards. Additionally, the Department recommends that BFC be limited to carry forward a total of 49t of P. borealis in the NU-E/NK-E area which can be fished during the first 120 days of the fishery (between April 1 – July 31, 2022).

Prepared by: Fisheries Resource Management, Fisheries and Oceans Canada

Date: May 6, 2022

Appendices

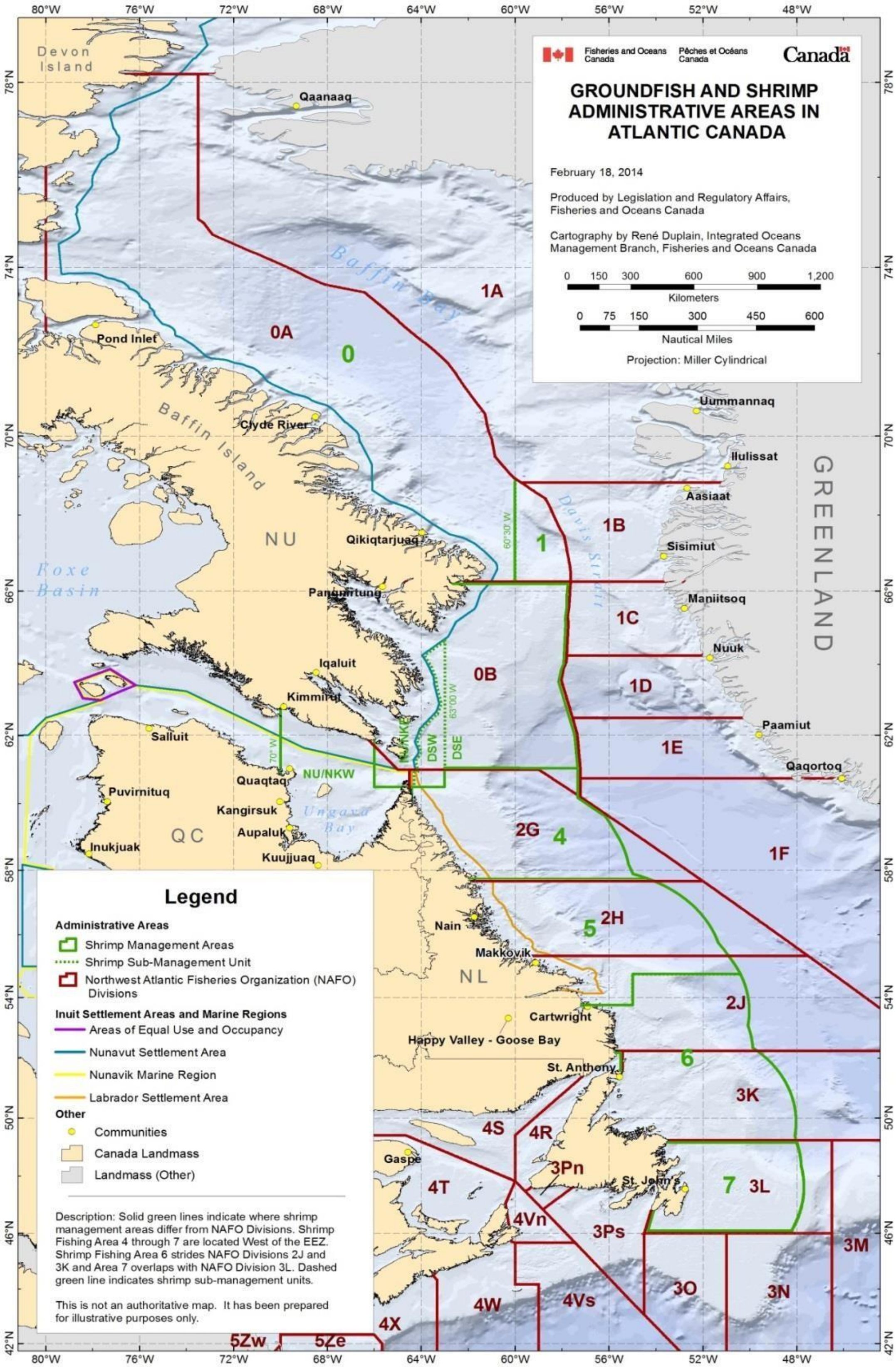
Appendix 1 – Map of groundfish and shrimp administrative areas in Atlantic Canada

Appendix 2 – Season bridging protocol for NU and NK Allocations in the WAZ and EAZ

Appendix 3 – Baffin Fisheries letter requesting carry forward for 2022

Appendix 4 – 2021 Total Allowable Catches for the Eastern Assessment Zone

APPENDIX 1



Fisheries and Oceans Canada
Pêches et Océans Canada
Canada
GROUNDFISH AND SHRIMP ADMINISTRATIVE AREAS IN ATLANTIC CANADA
February 18, 2014
Produced by Legislation and Regulatory Affairs, Fisheries and Oceans Canada
Cartography by René Duplain, Integrated Oceans Management Branch, Fisheries and Oceans Canada
0 150 300 600 900 1,200
Kilometers
0 75 150 300 450 600
Nautical Miles
Projection: Miller Cylindrical
Legend
Administrative Areas
Shrimp Management Areas
Shrimp Sub-Management Unit
Northwest Atlantic Fisheries Organization (NAFO) Divisions
Inuit Settlement Areas and Marine Regions
Areas of Equal Use and Occupancy
Nunavut Settlement Area
Nunavik Marine Region
Labrador Settlement Area
Other
Communities
Canada Landmass
Landmass (Other)
Description: Solid green lines indicate where shrimp management areas differ from NAFO Divisions. Shrimp Fishing Area 4 through 7 are located West of the EEZ. Shrimp Fishing Area 6 strides NAFO Divisions 2J and 3K and Area 7 overlaps with NAFO Division 3L. Dashed green line indicates shrimp sub-management units.
This is not an authoritative map. It has been prepared for illustrative purposes only.
Devon Island
Qaanaaq
Baffin Bay
1A
0A
0
Pond Inlet
Baffin Island
Clyde River
Uummannaq
Ilulissat
Aasiaat
GREENLAND
1B
Davis Strait
1
60°30' W
Sisimiut
NU
Qikiqtarjuaq
Foxe Basin
Pangnirtung
Maniitsoq
1C
Nuuk
Iqaluit
0B
1D
Kimmirut
63°00' W
Paamiut
1E
70° W
Salluit
EN/WNK
DSW
DSE
NU/NKW
Qaqortoq
Quaqtaq
Puvirnituq
Kangirsuk
Ungava Bay
Aupaluk
2G
4
QC
Inukjuak
Kuujjuaq
1F
2H
5
Nain
Makkovik
NL
2J
Cartwright
Happy Valley - Goose Bay
St. Anthony
6
3K
4S
4R
Gaspe
3Pn
4T
St. John's
7
3L
4Vn
3Ps
3M
3O
3N
4W
4Vs
4X
5Zw
5Ze
80°W
76°W
72°W
68°W
64°W
60°W
56°W
52°W
48°W
78°N
74°N
70°N
66°N
62°N
58°N
54°N
50°N
46°N
42°N

APPENDIX 2

Season Bridging Protocol for NU and NK Allocations in the WAZ and EAZ

Carry Forward

WAZ (*P. montagui*)
The Department will make 800t available in the WAZ for carry forward to Nunavut and Nunavik allocation holders annually; sharing of this amount will be consistent with the sharing arrangement established by the Boards.

Currently, based on the 50/50 split, Nunavut and Nunavik will each be able to bridge a total of 400t each. Any carry forward quota not caught by September 30 of the following year will remain unfished.

EAZ - Davis Strait, NU/NK E[1] *(P. borealis)*
350t will be available for carry forward for Nunavut and 20t for Nunavik allocations, to be fished by July 31 of the following year. Quota that is not caught by this date will remain unfished.

Where the *P. borealis* stock is no longer in the Healthy Zone, carry forward amounts are reduced such that:

- If the stock is in the Cautious Zone, original carry forward amounts for Nunavut and Nunavik allocations are reduced by 13% and 26% in the upper- and lower-half of the Cautious Zone, respectively.

- If the stock is in the Critical Zone, no carry forward is permitted.

Borrowing

WAZ (*P. montagui*)
Nunavut and Nunavik shall share a total of 550t annually for borrowing based on sharing arrangements established by the Boards, which is currently 275t each. Requests to borrow quota will be assessed by the Department on a case by case basis in consideration of ice and climate conditions.

EAZ - Davis Strait, NU/NK E[2] *(P. borealis)*
Nunavut and Nunavik entities shall be allowed to borrow a total of 225t and 10t respectively from their following year's allocations, to be fished in the last month (March) of the current fishery.

[1] Subject to the Minister's decision to remove the bycatch designation for *P. Borealis* in NU/NK E.
[2] Subject to the Minister's decision to remove the bycatch designation for *P. Borealis* in NU/NK E.

Table 1. Nunavut and Nunavik allocations available for carry forward and borrow.

Area	**Nunavik**		**Nunavut**	
	Carry forward	**Borrow**	**Carry forward**	**Borrow**
WAZ ***P. montagui***	400t	275t	400t	275t
WAZ ***P. borealis***	*N/A - Bycatch*			
EAZ ***P. montagui***	*N/A - Bycatch*			
EAZ ***P. borealis (Davis Strait NU/NK E[1])***	20t	10t	350t	225t

[1] Subject to the Minister's decision to remove the bycatch designation for *P*. borealis in NU/NK E.

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April 12, 2022

To: The Honourable Joyce Murray
Minister of Fisheries, Oceans and the Canadian Coastguard
Government of Canada

Dear Minister Murray,

Baffin Fisheries requests approval to carry forward 250 m/t of borealis shrimp in fishing area EAZ, sub-area NU/NKE, from fishing year 2021-22 to 2022-23.

DFO's decision on allocations in area NU/NKE was made after the fishing season had ended due to heavy ice, which made further fishing impossible. Therefore, there was no time for consideration of reasonable carry forward provisions for Inuit fishing companies and licence holders in Area NU/NKE.

I believe 250 mt carry forward is equitable, conservative, and in line with the carry forward provisions offered to non-Inuit licence holders in similar shrimp fishing areas. Area EAZ is in the healthy zone, with an established PA framework.

Baffin Fisheries is the only active shrimp fishing company in Eastern Canada or the Arctic without a reasonable carry-forward provision for any of its licences. For unknown legacy reasons, Baffin Fisheries' carry forward allowance is only 49 tonnes, whereas Enterprise Allocation licence holders from the south may carry forward up to 750 tonnes.

We are requesting this carry forward on an interim basis, until DFO has had an opportunity to conduct a full review of carry forward discrepancies between southern licence holders and Inuit licence holders.

Thank you,

On behalf of the Board of Directors of Baffin Fisheries,

David Alexander,

Chairman, Baffin Fisheries

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baffinfisheries.ca

Fisheries and Oceans Canada | Pêches et Océans Canada

January 20, 2022 / 20 janvier 2022

Northern Shrimp Advisory Committee / Comité consultatif de la crevette nordique

2021 Total Allowable Catches (TACs) for the Eastern Assessment Zone (EAZ)

Quotas for Nunavut and Nunavik in the EAZ have been increased by 15 per cent as follows:

FLEET / INTEREST	AREA	TAC (t)
Nunavut Borealis	NU E	758
Nunavik Borealis	NK E	190
Nunavut Montagui	NU E	346
Nunavik Montagui	NK E	148

If you have any questions, please do not hesitate to contact me.

2021 Total autorisé des captures (TACs) pour la Zone d'évaluation est (ZEE)

Les quotas pour le Nunavut et le Nunavik dans la ZEE ont été augmentés de 15 % comme suit:

FLOTTILLE/INTÉRÊT	ZONE	TAC (t)
Nunavut Borealis	NU E	758
Nunavik Borealis	NK E	190
Nunavut Montagui	NU E	346
Nunavik Montagui	NK E	148

Si vous avez des questions, n'hésitez pas à communiquer avec moi.

Todd Williams

Todd Williams
Chair, Northern Shrimp Advisory Committee /
Président, Comite consultatif de la crevette nordique

c.c.: RDGs / DGR
Gordon Goodkey

SUBMISSION TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD May 2022

FOR

Information: X **Decision:**

Issue: Fisheries and Oceans Canada (DFO) Update – Marine conservation initiatives

Background

DFO Marine Planning and Conservation Program (formerly the Oceans Program) focuses on implementation of responsibilities within the *Oceans Act*, using integrated oceans management and marine conservation tools. DFO - Arctic Region, is working with Inuit partners on a number of marine conservation initiatives within and adjacent to Nunavut. These activities include advancement of marine protection measures in Tuvaijuittuq and around Southampton Island and management of existing marine refuges. At the request of the Qikiqtani Inuit Association (QIA) and the community of Sanikiluaq, DFO has also become involved in multi-party discussions on advancing consideration of protection measures in Qikiqtait.

DFO is also advancing marine environmental quality guidelines in support of sustainable development and integrated management, and supporting implementation of recommendations from the Pikialasorsuaq Commission within Sarvariuaq in partnership with the QIA.

Current Status

Southampton Island Area of Interest

- DFO and Kivalliq Inuit Association (KIA) have partnered to advance the Southampton Island Area of Interest for potential designation as a new Marine Protected Area. The Southampton Island Area of Interest encompasses the nearshore waters around Southampton Island and Chesterfield Inlet in the Kivalliq Region of Nunavut. The final boundary of a potential future Marine Protected Area will be based on assessments and consultation.
- The Southampton Island Area of Interest Co-Development Committee (CDC) has representation from Aiviit and Aqigiq Hunters and Trappers Organizations, Irniurviit Co-Management Committee, Government of Nunavut, KIA, and DFO. The CDC met most recently via teleconference in September 2021, to discuss progress on the Marine Protected Area process. A series of additional CDC meetings is being planned for May and June 2022.
- An Inuit Qaujimajatuqangit workshop was held in February 2020 in Rankin Inlet, with five participants from Chesterfield Inlet, eight from Coral Harbour, and one each from KIA and Government of Nunavut. An Inuit Qaujimajatuqangit Workshop Report was

produced. The draft IQ Workshop Report will be reviewed with residents of Chesterfield Inlet and Coral Harbour before being finalized.

- DFO Canadian Science Advisory Secretariat (CSAS) meetings were held in December 2018 in Winnipeg and virtually in August 2020 to develop a Biophysical and Ecological Overview of the Southampton Island Area of Interest. Meeting documents are publicly available on the CSAS website.
- Along with the Inuit Qaujimajatuqangit report and Science documents noted, additional assessments are being conducted: ecological risk assessment, , socio-economic overview, and petroleum potential report. The risk assessment of current and potential future activities will inform the regulatory intent (i.e., proposed management measures). Draft conservation objectives for the area are currently being developed and will be discussed at upcoming CDC meetings.
- DFO will continue engaging with partners and stakeholders throughout the Marine Protected Area establishment process.

<u>Tuvaijuittuq Marine Protected Area</u>

- Since the establishment of Tuvaijuittuq Marine Protected Area by Ministerial Order in August 2019, an assessment to determine the feasibility and desirability of long-term protection in the area has been underway in partnership with Parks Canada, Qikiqtani Inuit Association and Government of Nunavut. In February 2020, a working group was established with members from all parties to implement an agreed-upon work plan. Tuvaijuittuq Working Group advancement of this work is ongoing, with some delays due to COVID 19.
- Face-to-face community consultations in Arctic Bay, Clyde River, Grise Fiord, Pond Inlet and Resolute Bay were planned for fall 2020, and again in 2021, but have been postponed. The Working Group is currently developing ideas for an alternative consultation process and materials for circulation in the new fiscal year. Additional consultations are expected later in the feasibility assessment process to provide communities and stakeholders with opportunities to comment on preliminary results.
- Upon completion of the feasibility assessment and associated consultation processes, a report with recommendations will be submitted the Parties (DFO, PCA, QIA, GN) for review and decision by the Tuvaijuittuq Steering Committee.

<u>Eastern Arctic Marine Refuges</u>

- With the support of co-management partners, fishing industry, and environmental organizations, three eastern Arctic Marine Refuges, fisheries closures under the Fisheries Act were implemented in 2017 also contributing 1.17% to marine conservation.
- These refuges were established to support the conservation of sensitive benthic areas, as well as significant areas of coral and sponge biodiversity.
- DFO monitors compliance with these fishery closures by conducting at-sea patrols and aerial surveillance as well as using vessel monitoring systems.
- Work is currently underway to begin the development of monitoring and long-term management plans with the Marine conservation working group as well as DFO sectors in Arctic and Newfoundland-Labrador region (for Hatton Basin Conservation Area).

- Research projects such as electronic tagging and monitoring of Greenland Halibut, Greenland Shark and skates as well as fisheries surveys continue in and around these Marine Refuges.
- DFO was thrilled to be a partner in the public outreach project 'Guardians of Tariuq' which highlights the eastern Arctic Marine Refuges.

<u>Sarvarjuaq (Pikialasorsuaq) and Qikiqtait</u>

- Pikialasorsuaq means *"Great upwelling"* and is the Kalaallisut (West Greenlandic) name for the North Water Polynya, an important area for many species of marine mammals, birds and fishes. In Canada, it has been named Sarvarjuaq, the "big, open water" in Inuktitut. It has cultural significance and is an important travel route for Canadian and Greenlandic Inuit. These are internationally shared waters by Canada, Greenland and the Kingdom of Denmark.
- Previously, the Inuit Circumpolar Council established the Pikialasorsuaq Commission, which recommended protection of the North Water Polynya, as did the Inuit-Crown Partnership Committee through a joint leaders statement.
- DFO has been working with QIA to advance protection of the Canadian portion of this region, Sarvarjuaq, in alignment with QIA's shared Prospectus for Inuit Stewardship and Blue Economy.
- Additional discussions are ongoing and relate to:
    - How best to provide capacity and support to Canadian Inuit partners and communities;
    - How to collect and incorporate Inuit Qaujimajatuqangit throughout the process;
    - How to effectively communicate Canadian Inuit interests at international discussions with Greenland and Denmark.

- QIA and the community of Sanikiluaq have also shared their interest in marine conservation around Qikiqtait (Belcher Islands) with federal protection measures.
- In August 2021 a funding agreement was signed with QIA that will invest $3.45 million over two years to support launching and development of the Nauttiqsuqtiit Program in the community of Sanikiluaq. The program will provide employment and support Inuit-led research and monitoring to ensure Inuit knowledge informs marine management in Qikiqtait. The Nautiqsuqtiit program was piloted in 2018 and also operates in Arctic Bay, Clyde River, Grise Fiord, Pond Inlet, and Resolute Bay.
- DFO is leading a whole-of-government negotiation of an Inuit Impact and Benefit Agreement (IIBA) with QIA to support Inuit-led marine conservation and management opportunities in the Sarvarjuaq and Qikiqtait areas of Nunavut.
- Formal IIBA negotiations have been underway since December 2021.
- DFO is also working with the GN to explore its involvement in potential protection measures for Qikiqtait and Sarvarjuaq.

<u>Marine Environmental Quality</u>

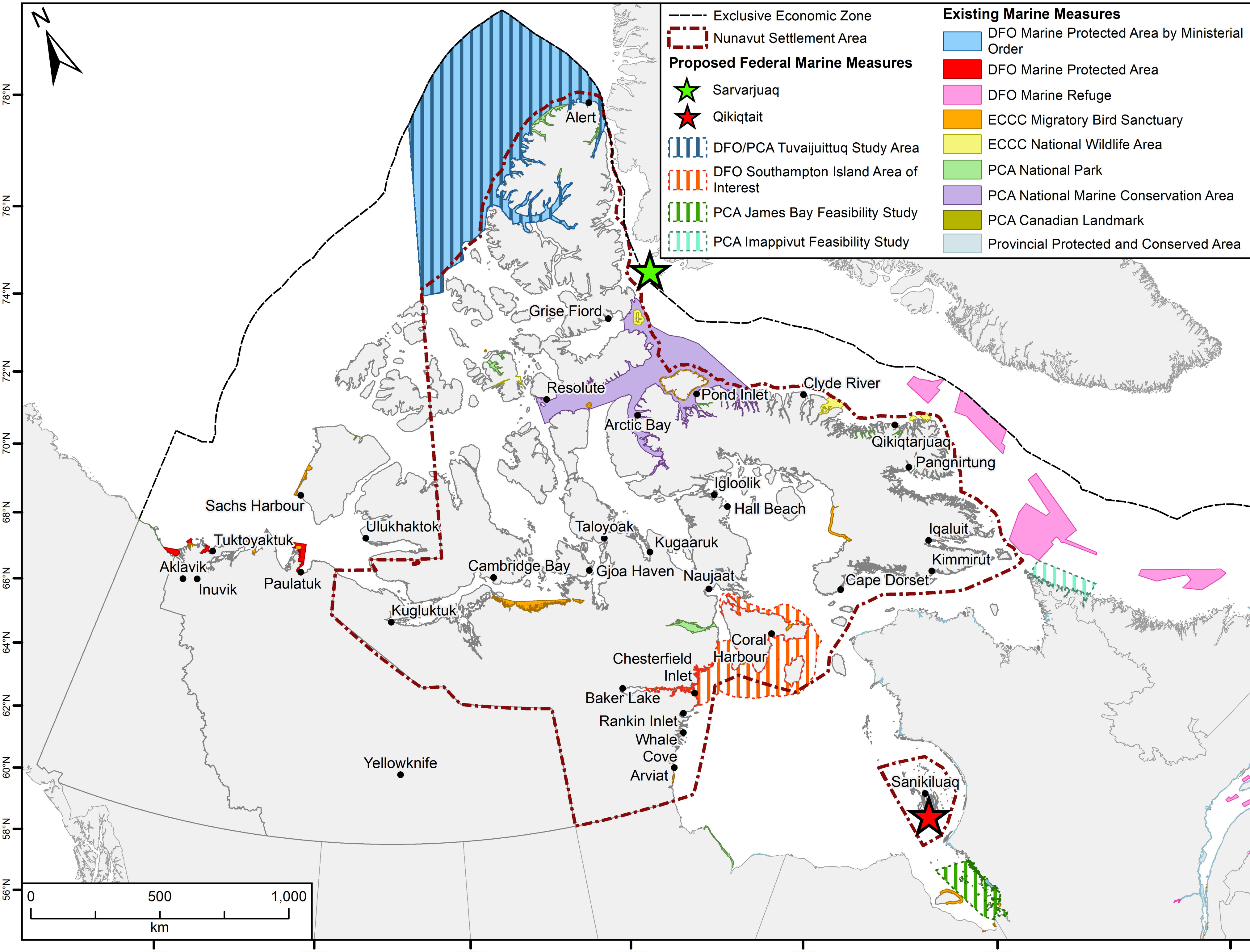
- Recent Oceans Protection Plan (OPP) investments are supporting Marine Environmental Quality (MEQ) programs under the *Oceans Act*. A commitment under

OPP is to focus on mitigating the risk of human caused stressors on the marine environment, including impacts of underwater noise from ships.

- In collaboration with partners, the national MEQ program is working towards developing integrated and evidenced-based tools and strategies to better manage and maintain healthy and sustainable marine, coastal and estuarine ecosystems.
- Nationally, working on development of an Ocean Noise Strategy to coordinate federal efforts in understanding and managing human-induced underwater noise. A discussion document was developed in collaboration with other federal departments and agencies to outline a framework for the strategy and act as the primary mechanism to receive initial feedback from partners, stakeholders, and the Canadian public. A presentation was delivered to the Nunavut Marine Conservation Targets Steering Committee on December 2, 2020.
- Within Nunavut, DFO is working with partners to establish underwater noise baseline data within Frobisher Bay, Arctic Bay, and James Bay.
- Developing an Arctic Pile Driving Protocol for Reducing Risks Caused by Underwater Noise. The draft is complete, it has been filed tested at the Iqaluit Deep Sea Port development site and has been submitted to DFO Science for review.

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

Date: April 14, 2022



Existing and potential future Arctic protected and conserved areas. DFO = Fisheries and Oceans Canada; PCA = Parks Canada Agency; ECCC = Environment and Climate Change Canada

SUBMISSION TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD JUNE 2022

FOR

Information: X **Decision:**

Issue: Department of Fisheries and Oceans Canada – Fisheries Management Operational Updates

Updates:

Marine Mammals:

1) Narwhal

- The 2021/22 narwhal harvest season ended on March 31, 2022. Fisheries and Oceans Canada (DFO) has contacted all Hunters and Trappers Organizations/Associations (HTOs/HTAs) and Government of Nunavut (GN) Wildlife Office staff requesting that 2021/22 narwhal tags be returned to DFO.
- It is very important that both the used and unused tags from 2021/22 along with the Narwhal HTO Harvest Sheet are returned to DFO as soon as possible. Carry-over allocations cannot be finalised until the harvest information from the previous season is returned and analysed by DFO.
- Narwhal tags and information packages for the 2022/23 harvest season are currently being prepared. DFO is working with the Nunavut Narwhal Working Group to finalize decisions on Baffin Bay narwhal allocations and season dates for 2022/23. Once allocation decisions are finalized, tags will be distributed to communities.

2) Walrus

- The Federal Minister of Fisheries and Oceans accepted the Nunavut Wildlife Management Board's (NWMB) decision to approve a total of 64 walrus sport hunts for 2022 (Arviat 4, Coral Harbour 35, Sanirajak 25).
- All 2022 walrus sport hunt outfitters have been notified of their successful applications. DFO will continue to work with outfitters over the next several months to ensure all necessary documentation is received prior to issuing licences and sample kits.
- A Nunavut Walrus Working Group meeting was held on April 5th to begin to review the NWMB Walrus Sport Hunt Interim Policy. DFO remains available to continue these important discussions with the Working Group.

- The Community Based Catch Monitoring program for walrus will continue in 2022.

3) Beluga
- The Cumberland Sound Beluga Working Group continues to meet virtually while COVID-19 impacts the ability to hold in-person meetings.
- In 2022, the Working Group met virtually in February and March. During these meetings the Working Group advanced their goals and objectives for Cumberland Sound Beluga management, discussed ongoing and future science programs in Pangnirtung, and considered projects to increase community engagement.
- The next Working Group meeting will occur via teleconference in May, with hopes to meet in-person this summer or fall.

4) Bowhead
- DFO has been advised of the host communities for the 2022 bowhead harvests in the Qikiataaluk Region (Iqaluit and Igloolik) and the Kitikmeot Region (Taloyoak), and is awaiting advisory on host communities for the Kivalliq Region.
- A Working Group meeting is to be planned to advance development of the draft Integrated Fisheries Management Plan (IFMP) for bowhead.
- Scheduling of engagements has been delayed owing to busy work schedules. Stakeholder engagement is an integral aspect of IFMP development in Nunavut and Nunavik, and advancement of the document will not occur without this input.
- DFO Science has submitted a separate briefing note for this Regular Meeting to provide an update on the bowhead mortalities discovered in 2020.

5) Harvest Reporting
- Staff from the Iqaluit DFO office recently contacted all HTOs/HTAs and GN Wildlife Office staff requesting final 2021/22 harvest updates for beluga, walrus, and narwhal. Reports of total marine mammal hunting mortality (landed and lost) are essential to develop reliable advice on sustainable harvests.
- DFO urges continued reporting of unusual marine mammal occurrences and events for follow up by co-management organizations, such as beached carcass and ice entrapments.
- Timely and accurate reporting is required under the Fisheries Act, Marine Mammal Regulations, and the Nunavut Agreement. It is strongly recommended that co-management organizations emphasize the importance of harvest reporting and monitoring.

Arctic Char

- DFO is in the process of consolidating and finalizing 2021/22 harvest information for Arctic char fisheries across Nunavut in collaboration with fishers, fish plants, and country food stores.
- Interest in both commercial and emerging fisheries for Arctic char continues to be expressed in all three regions of Nunavut, and DFO works closely with co-managers such as fishers, HTOs, and Wildlife Office staff on licencing and collection of samples and data required for stock assessments.

Greenland Halibut (Turbot):

- An on-ice turbot fishery in Cumberland Sound did not occur in 2022. The Pangnirtung fish plant decided not to purchase turbot due to a backlog of fish at the plant.
- The 500 tonne Total Allowable Harvest for this fishery remains available for fishing in the open-water season. DFO will continue to engage the Pangnirtung HTA and Pangnirtung fish plant regarding plans for a summer fishery in 2022.

U.S. Marine Mammal Protection Act Import Provisions

- The U.S. Marine Mammal Protection Act (U.S. MMPA) Import Provisions will come into effect on January 1, 2023. DFO Arctic Region has submitted a total of eight (8) Comparability Finding (CF) Applications that are currently under review (see Table 1).
- Under the U.S. MMPA, fisheries are classified as Export or Exempt based on the likelihood that marine mammal bycatch will occur during the course of fishing operations.
- It was recently brought to the attention of DFO-Arctic that four (4) Arctic fisheries have been re-classified from Export to Exempt (see Table 1). This re-classification will be finalized when the National Oceanic and Atmospheric Administration (NOAA) publishes the official results of the CFs by November 30, 2022.
- Both Exempt and Export fisheries are required to apply for a CF. However, Export fisheries are also required to maintain a regulatory program to reduce marine mammal bycatch that is comparable to those in the U.S., where Exempt fisheries are not.
- At this time, there is no action required. Co-management partners and stakeholders will be provided updates on the status of our CF applications as they become available.

Table 1: List of fisheries in the Arctic Region that have a submitted a Comparability Finding application.

Species	Fishery/Location	Gear Type(s)	Listing
Arctic Char	Cambridge Bay	Fixed gear; Gillnet, Weir	Exempt
Arctic Char	Cumberland Sound	Fixed gear; Gillnet	Exempt
Arctic Char	Nunavut Settlement Area (NSA)	Fixed gear; Gillnet	Exempt
Shrimp	SMU 0, 1, EAZ, WAZ	Mobile gear; Otter Trawl	Exempt
Greenland Halibut	Cumberland Sound Turbot Management Area	Fixed gear; Longline	Export
Greenland Halibut	NAFO Subarea 0, 100 ton	Fixed gear; Longline	Export
Greenland Halibut	NAFO Subarea 0	Fixed gear; Longline, Gillnet	Export
Greenland Halibut	NAFO Subarea 0	Mobile gear; Trawl	Export

Prepared by: Fisheries Management, Arctic Region – Fisheries & Oceans Canada

Date: April 22, 2022