Review of the Management and Monitoring of Kǫk’èetì Ekwǫ̀ (Bathurst Caribou)

Report

PREPARED FOR

Wek’èezhìi Renewable Resources Board

DATE

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EXECUTIVE SUMMARY

Bathurst caribou (Kǫk'èetì Ekwǫ̀ in Tłı̨chǫ Yatıì) are a barren-ground caribou which are a culturally significant northern species for First Nations, Inuit and Métis. The herd size and range size have decreased significantly over the years, dropping from a survey number of about 470,000 (in 1986) to 8,200 individuals (in 2018) and is estimated to be 6,240 individuals (in 2021). The herd is at a critically low status and is managed collaboratively in the Northwest Territories, including by the Wek'èezhìı Renewable Resources Board (referred to as "the WRRB" or "the Board" hereafter), the Tłı̨chǫ Government, and the Government of the Northwest Territories (GNWT). Additionally, the Tłı̨chǫ Agreement directs how Kǫk'èetì Ekwǫ should be managed within Tłı̨chǫ lands in the Wek'èezhìı region.

The GNWT and Tłı̨chǫ Government submit management proposals to the WRRB to propose management and monitoring actions. The WRRB then provides recommendations (which Parties can accept, reject or vary) and determinations (which Parties must follow) to implement management and monitoring actions. In 2024, the WRRB commissioned ERM Consultants Canada Ltd. (ERM) to conduct an external review of the management proposal process and the suite of management and monitoring actions that have been proposed by Parties to date. ERM's review focused on six areas of inquiry, considering information from documents, a small set of interviews, input from Board staff, and ERM's wildlife expertise.

Overall, our findings conclude that the Board and Parties have increased dialogue and collaboration and strengthened relationships since the first joint management proposal process (2010), increasingly consider traditional knowledge alongside scientific knowledge, and make sound proposals and determinations and recommendations for Bathurst caribou management and monitoring. We identify some improvements that the Board and Parties can make to support continuous improvement of the current process and the management and monitoring actions to further strengthen Bathurst caribou management and monitoring. Below is a summary of key findings and recommendations.

Area of Inquiry	Key Findings and Recommendations
A) To determine whether the WRRB process (including the Reasons for Decision Reports) for review of management proposals is efficient, effective, and gives equal consideration for science and traditional/community knowledge.	• The WRRB process has evolved over time to be effective and efficient by strengthening collaborative working relationships among Parties, including by adopting informal engagement mechanisms, such as the Technical Working Group. The process has considered traditional/community knowledge as it has become available over time. • There are opportunities for Parties to improve the effectiveness and efficiency of the process by clarifying the roles of parties, increasing engagement with other Indigenous groups, communicating how input is used, using a central mechanism to track the completion of actions, reviewing timelines in the process, and validating recommendations prior to their finalization.
B) To determine whether the WRRB's determinations and/or recommendations are appropriate for managing Kǫk'èetì Ekwǫ.	• Recommendations and determinations have generally been appropriate for managing the herd in an evolving context. Developing short- and long-term recommendations particularly on habitat could support meeting management goals. • The Board should work with Parties to monitor actions and validate recommendations in future Reasons for Decision reports. Implementing the Adaptive Co-management Framework is a key next step.
C) To determine whether the management proposals that have been submitted to the WRRB from Parties to the Tłı̨chǫ Agreement have proposed effective management and monitoring actions for Kǫk'èetì Ekwǫ.	• Proposed management and monitoring actions have been effective in responding to the state of the herd and are known to work for other caribou and ungulate populations, however, the herd has continued to decline. • Parties should incorporate more habitat-based measures and low disturbance monitoring and track the outcomes over time to determine if actions are effective in meeting the short-term objective.
D) To determine whether traditional/community knowledge has been adequately used in Kǫk'èetì Ekwǫ management proposal submissions.	• As capacity of Indigenous governments and organizations (namely Tłı̨chǫ Government) has increased over time, so has the availability and consideration of traditional knowledge in management proposals, though dialogue in the Technical Working Group is still science-heavy. • Parties should better document how they consider traditional knowledge from all Indigenous groups and how traditional knowledge informs Bathurst caribou management and monitoring.

E) To determine whether there are any redundancies in current Kǫk'èetì Ekwǫ monitoring actions, and if there are any alternatives or improvements to current monitoring actions that could be made.	• The GNWT is following a standard approach for aerial survey techniques as they are similar across jurisdictions, with most following the same six steps that the GNWT uses. • There is a balance between collecting data more frequently and disturbance to the herd. There are some redundancies in conducting photo censuses and composition counts through using two fixed wing and helicopters on the calving ground. • The WRRB may wish to discuss with the GNWT whether a reduced frequency of monitoring (e.g., every 3 years) would provide enough data for herd management, and whether using fewer aircraft over a longer period would result in less disturbance to caribou and cost for similar data quality.
F) To determine whether the potential impacts of emigration have been accurately described and used to inform management and monitoring actions.	• Emigration is not directly reported by the GNWT to inform management and monitoring actions but is accounted for in population counts. • The potential impacts of emigration have been accurately described and used to inform management and monitoring actions and ERM does not have any recommendations at this time.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

Bathurst caribou, known as Kǫk'èetì Ekwǫ̀ in Tłı̨chǫ Yatìì, are a barren-ground caribou which are a culturally significant northern species for First Nations, Inuit and Métis. The Bathurst range has historically spanned across southern and central Northwest Territories (NWT), to Bathurst inlet in Nunavut, and sometimes into Saskatchewan[1]. Both the herd size and range size have decreased over the years. The herd is managed collaboratively in the NWT by the Wek'èezhìı Renewable Resources Board (referred to as "the WRRB" or "the Board" hereafter), the Tłı̨chǫ Government, the Government of the Northwest Territories (GNWT), and other Indigenous Governments and Organizations; and in Nunavut by the Government of Nunavut, the Nunavut Wildlife Management Board, Nunavut Tunngavik Incorporated and other Inuit organizations; as well as Northern Saskatchewan (Athabasca Denesuline). The Tłı̨chǫ Agreement directs how Kǫk'èetì Ekwǫ̀ should be managed within Tłı̨chǫ lands in the Wek'èezhìı region.

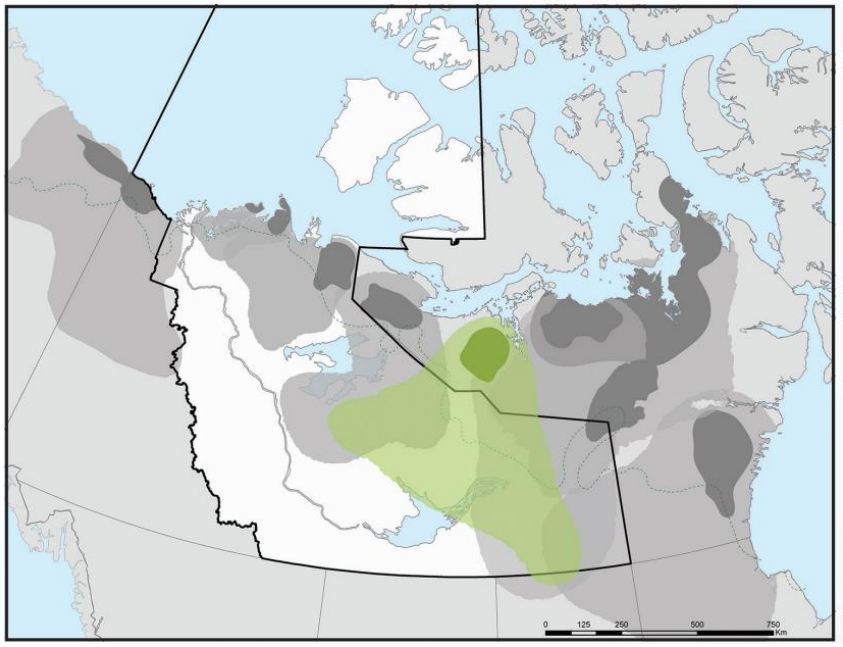

Figure 1 Historical barren-ground caribou range (grey) and calving grounds (dark grey) and Bathurst caribou range (light green) and calving grounds (dark green). *Credit: Government of the Northwest Territories*

Presently, the herd is classified at ***critical low status*** (<30,000 individuals) which means that strong management actions are required to support the herd's recovery[2]. Since 2015, the harvest of the herd has been limited to zero and various management and monitoring actions have been proposed and actioned through a management proposal review process facilitated by the WRRB. In 2024, the WRRB commissioned an external review to help the Board inform future management and monitoring actions for Bathurst caribou, as well as other herds and species.

[1] Barren-ground caribou in the NWT: Bathurst herd (GNWT)
[2] https://www.gov.nt.ca/ecc/en/services/barren-ground-caribou/bathurst-herd

This report provides the results of the external review and recommendations on the future management and monitoring actions for Bathurst caribou. The results and recommendations may also be useful in informing management and monitoring actions for other caribou herds and species that are collaboratively managed in a similar way. This report contains the following sections:

2. REVIEW SCOPE AND METHODS

The focus of the external review is to assess whether the joint management proposal process, including recommendations and determinations made by the WRRB and actions proposed by Parties, is working well and where there are opportunities to improve future management and monitoring actions. The following areas of inquiry (determined by the WRRB) are addressed:

A) To determine whether the WRRB process (including the Reasons for Decision Reports) for review of management proposals is efficient, effective, and gives equal consideration for science and traditional/community knowledge.

B) To determine whether the WRRB's determinations and/or recommendations are appropriate for managing Kǫk'èetì Ekwǫ.

C) To determine whether the management proposals that have been submitted to the WRRB from Parties to the Tłı̨chǫ Agreement have proposed effective management and monitoring actions for Kǫk'èetì Ekwǫ.

D) To determine whether traditional/community knowledge has been adequately used in Kǫk'èetì Ekwǫ management proposal submissions.

E) To determine whether there are any redundancies in current Kǫk'èetì Ekwǫ monitoring actions, and if there are any alternatives or improvements to current monitoring actions that could be made.

F) To determine whether the potential impacts of emigration have been accurately described and used to inform management and monitoring actions.

This review is informed by three key sources of information as shown in Figure 2 below:

1) Key documents shared by the WRRB (between 2009 and 2022) (see Appendix A for document list).
2) Interviews (four) with key informants including Parties to the Tłı̨chǫ Agreement (GNWT and Tłı̨chǫ Government) and one external Indigenous Nation (see Appendix B for interview questions). In addition, the WRRB provided 'gap filling' information after reviewing the first draft of the report.
3) Knowledge and application of management and monitoring practices in place for other caribou herds (via ERM wildlife expertise).

We synthesized and analyzed key inputs to develop key findings and recommendations for each area of inquiry.

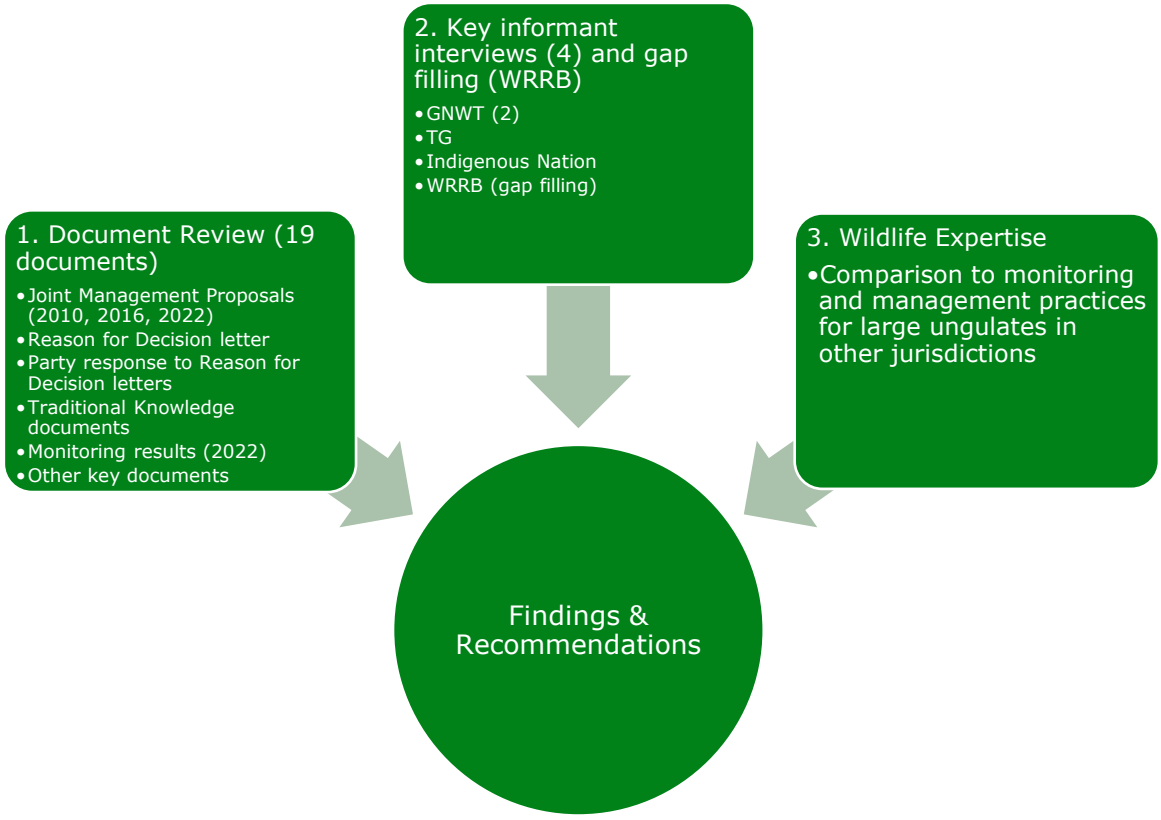

Figure 2: External review process

3. BACKGROUND AND HISTORY

CURRENT STATE OF THE HERD

There are 14 subpopulations of barren-ground caribou in Canada, with only two subpopulations currently increasing in population size (COSEWIC 2016). Over the past 30 years, the Bathurst herd has gone from a survey number of about 470,000 (in 1996) to 8,200 individuals (in 2018) and is estimated to be 6,240 individuals (in 2021) (WRRB 2024; Adamczewski et al. 2023). The Bluenose-East and Bathurst herds started to decline in 2009. The Beverly herd size has seen a decline from 136,600 to 103,400 between 2011-2018 (Beverly and Qamanirjuaq Caribou

Management Board 2024). The Bluenose-East herd declined from about 120,000 individuals in 2010 to 19,000 individuals in 2018[3].

Despite similarities in management actions between these herds, the Bathurst herd has experienced greater declines, indicating the need for increased understanding of the cause of decline through strategic monitoring and management actions. Calf to cow ratios, an indication of herd health, remain low, as seen through GNWT's calving ground surveys. It is challenging to estimate a reliable Bathurst herd population because of emigration to the Beverly herd.

THE WRRB

The WRRB is a wildlife co-management authority established under the Tłı̨chǫ Agreement to perform wildlife management functions related to wildlife, forest, plant and protected areas management in Wek'èezhìı. The Board shares responsibility for the monitoring and management of the Bathurst herd with Parties[4] to the Tłı̨chǫ Agreement. Any party to the Tłı̨chǫ Agreement proposing a wildlife management action in Wek'èezhìı must submit a management proposal to the WRRB for review (Tłı̨chǫ Agreement Section 12.5.1). The WRRB must consult with anybody with authority over that wildlife species, both inside and outside Wek'èezhìı, prior to making a determination or recommendation. The WRRB is an institution of public government, which makes decisions based on consensus and works in collaboration with Indigenous and public governments and other wildlife management authorities, Indigenous organizations and stakeholders. The WRRB is bound by the Tłı̨chǫ Agreement if it is contemplating any limitation to Tłı̨chǫ citizens' harvesting. The WRRB has sole responsibility for making a final determination with respect to the total allowable harvest (TAH) for Wek'èezhìı only for the purposes of conservation (Tłı̨chǫ Agreement Section 12.5.5). Parties are responsible for implementing and enforcing the actions to which they agree.

HISTORY OF JOINT MANAGEMENT OF BATHURST CARIBOU

The first joint management proposal was submitted by the GNWT and Tłı̨chǫ Government in 2010, followed by one in 2016, 2019 and 2022. It was the WRRB's recommendation that the Parties

[3] Barren-ground caribou in the NWT: Bluenose-East herd (GNWT)

[4] Parties to the Tłı̨chǫ Agreement: the Tłı̨chǫ Government, the Government of the Northwest Territories and the Government of Canada

submit joint management proposals and form a Technical Working Group in 2010 to improve coordination of proposal management actions.

The WRRB put in a harvest limitation in 2010 and closed the harvest in 2015 as per the proposed action by Parties. The GNWT conducted a series of calving ground surveys to monitor the herd, though the 2024 calving ground survey was not supported by the WRRB due to anticipated disturbance to the sensitive Bathurst herd.

The Tłı̨chǫ Government developed several traditional knowledge programs and reports over this time (2010 to 2022) to better understand the herd. The Ekwǫ̀ Nàxoèhdee K’è (ENK or Boots on the Ground) program started in 2016 and has been growing to better inform proposed management actions. Despite the implementation of management actions, the Bathurst herd has continued to decline and emigrate to the Beverly herd. The Bluenose-East herd has started to rebound. Figure 3 below shows the timeline of Bathurst caribou management beginning with the submission of the first management proposal.

Bathurst Caribou Management Timeline

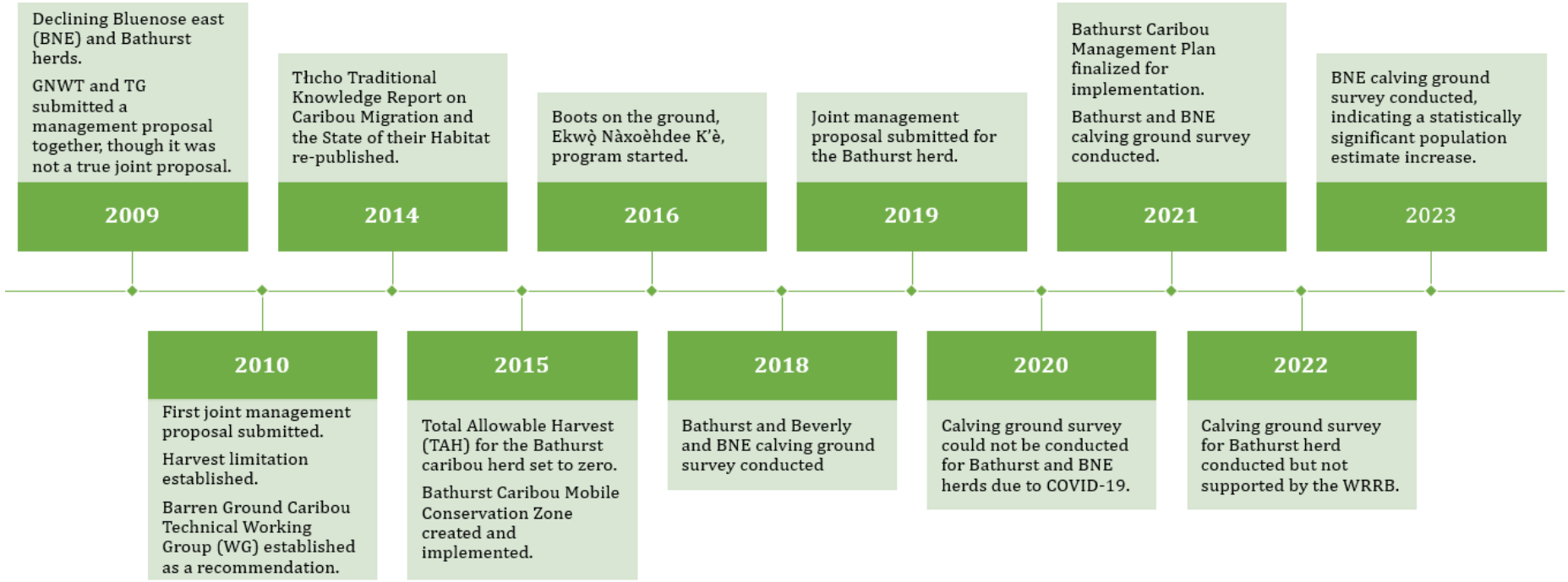

Figure 3: Timeline of Bathurst caribou management

CURRENT MANAGEMENT OF THE HERD

The Bathurst Caribou Advisory Committee (consisting of 14 governments and organizations from the NWT, Nunavut and Saskatchewan representing communities that have traditionally interacted with the Bathurst herd) developed a Bathurst Caribou Management Plan (BCMP) in 2021[5]. The BCMP builds off the Bathurst Caribou Range Plan (BCRP) developed in 2019[6]. The BCMP states the following goals:

- **Harvest:** Ensure harvest levels are sustainable and caribou are conserved over time.
- **Habitat & Disturbance:** Manage land use and disturbance to caribou so that the herd is conserved within its natural range.
- **Predators:** Reduce the impact of predators on caribou based on the best available information, and reflecting Indigenous values and laws.
- **Research & Monitoring:** Learn more about Bathurst caribou and their habitat.
- **Communication & Education:** Educate people about Bathurst caribou conservation, respectful harvesting and land use.

The BCMP is a collaborative effort that focuses on a long-term management framework and recovery recommendations for the sustainable management of the Bathurst herd. Whereas the BCRP primarily focuses on and addresses the "*issues related to cumulative human land disturbance*" and provides context to assess cumulative impacts on the Bathurst caribou during project specific review processes.

Parties describe management goals in the short- (a) and long- (b) term in the 2022 management proposal as follows:

a) To halt the Bathurst herd's decline and promote recovery.

b) To enable sustainable caribou harvesting that addresses Indigenous community needs (caribou levels) across this herd's range. Within Wek'èezhìı, to allow the exercise of Tłı̨chǫ rights to harvest caribou throughout Mǫwhì Gogha Dè Nıı̨tłèè.

[5] https://www.gov.nt.ca/ecc/en/services/barren-ground-caribou/bathurst-caribou-management-plan
[6] https://www.gov.nt.ca/ecc/sites/ecc/files/resources/bathurst_caribou_range_plan_2019_-_plan_pour_laire_de_repartition_des_caribous_de_bathurst_2019.pdf

While the management objective (a) has not been met, the rate of decline is lower and there have been some improvements in demographic indicators.

4. REVIEW FINDINGS AND RECOMMENDATIONS: AREAS OF INQUIRY A-D

A) WRRB PROCESS FOR REVIEWING MANAGEMENT PROPOSALS

Area of Inquiry A

To determine whether the WRRB process (including the Reasons for Decision Reports) for review of management proposals is efficient, effective, and gives equal consideration for science and traditional/community knowledge.

To respond to this review question, it is important to understand the WRRB's process for reviewing management proposals. A simplified process diagram is included in Appendix C and available on the Board's website.

Management proposals submitted by Parties (GNWT, Tłı̨chǫ Government, and Government of Canada - though the Government of Canada is not normally involved in caribou management) must include rationale for proposed actions and details for implementation. There must be evidence and results of Tłı̨chǫ citizen involvement and consultation with all authorities with responsibility for the herd and any affected communities. The WRRB provides a template for management proposals that Parties may use for their submission. These proposals are submitted to the WRRB, which posts them to the management proposal page on the WRRB website for an initial comment period of at least one week. The WRRB considers proposals and public comments to decide on a Level 1, 2 or 3 review (Figure 4), which may lead to online consultation or in-person public hearings where external parties may intervene. Public consultation by the WRRB includes meeting with communities (if warranted by the level of review) and considering information provided by Indigenous groups to ensure the best available traditional knowledge can inform WRRB recommendations. The WRRB consults and engages with all organizations they determine would be affected by the proposed management actions (e.g., those within the herd's traditional range, those who have equal consideration for harvest, etc.). Tłı̨chǫ Government and the GNWT may conduct consultations and reflect this input in their management proposals for consideration by the WRRB.

The WRRB makes determinations and recommendations on management and monitoring actions. This information is communicated to Parties through a Reasons for Decision report. Parties respond to this report indicating whether they accept, vary, or reject recommendations with accompanying rationale; determinations must be implemented.

While external to the formal management proposal review process, the Technical Working Group for barren-ground caribou (referred to as the "Working Group" or WG hereafter) was initiated in 2011 based on a Board recommendation to share traditional and scientific knowledge and to help inform Bathurst and Bluenose-East caribou management proposals. The Working Group consists of the WRRB, Tłı̨chǫ Government, and the GNWT.

The Working Group is in the process of developing an adaptive co-management framework to assess the monitoring data that becomes available throughout the year and use it to reassess the implementation success of management and monitoring activities. The Board raised in their 2019 and 2022 Reasons for Decision reports that some actions from previous management proposals remain incomplete, and they requested that Parties provide a rationale and timeline for the completion of previously accepted actions.

Views on efficiency and effectiveness of the process

Generally, we heard from interviewees that the WRRB process for review of management proposals is working well because of the strengthened relationships among Parties over time. Interviewees identified some opportunities for improvement related to the written elements of the process. These views are elaborated on in the following sub-sections.

What works well

Informal mechanisms and activities support an effective and efficient review process.

- Parties felt that the Board's recommendation to form a Working Group and submit joint management proposals have allowed them to think through actions with their respective expertise rather than submitting different or conflicting actions that the Board would have to spend time sorting through to make recommendations. Over time, the WG has improved trust between Parties and increased coordination on actions early on. The WG enables information sharing between parties beyond specific proposed actions / recommendations that helps promote greater understanding of the broader context of caribou management. It has also helped increase dialogue on traditional knowledge among Parties, though we heard that there needs to be more focus on the interplay between the health of caribou and the health of people.

- Parties mentioned that bilateral meetings between Tłı̨chǫ Government and GNWT are another mechanism that has improved communication through the management proposal review process. Parties expressed that they have developed good working relationships to allow for bilateral conversations on coordinating a response to the Board's Reasons for Decision report.

Information sharing by Parties on caribou research and monitoring.

- We heard that new information on caribou is communicated between Parties in a timely manner.
- One interviewee commented that presentations made about caribou have been accessible and tailored to the audience (e.g., the GNWT Wildlife TED Talks).

Opportunities to improve

Reducing the amount of written communications: We heard from Parties that there is an opportunity to make the process more efficient by having a dialogue on proposed Board recommendations before they are finalized, as it will reduce the amount of back and forth through written comments.

- Part of the review process includes written comments on actions where Parties felt there is a lot of back and forth (e.g., responding to the Board's Reasons for Decision report). One Party suggested that it would be more efficient to discuss the Board's proposed recommendations to clarify the intent of specific recommendations, consider the feasibility of recommendations, and identify which Parties are best suited to action recommendations prior to finalization of the Board's Reasons for Decision reports.

Considering a suitable overall timeline for all the steps required to prepare high quality management proposals: We heard from Parties that there is a short timeline between when population numbers are ready (November) and when WRRB requires management proposals to inform the next harvesting season (January).

- Population studies conducted by the GNWT are a key driver of timelines to complete proposals. We heard that trend analysis and data from the GNWT is often released in November, which provides less time for Parties to draft a high-quality proposal in time for proposals to be presented at Board meetings and aligned to regulatory approval timelines for harvesting season (regulations under the NWT *Wildlife Act* are in place from July 1 to June 30). Parties find this process to be rushed and would like more time. In 2024, GNWT and TG requested an extension to submit joint management proposals for both the

Bluenose-East and Bathurst herds, which the WRRB granted. The deadline to submit was August 1, 2024 (Bluenose-East) and December 2024 (Bathurst).

Increasing consultation and engagement with other Indigenous groups on the management proposal review process: Some interviewees thought that the consultation and engagement process by the Board when reviewing management proposals, including Reasons for Decision reports, could involve more direct engagement with communities.

- We heard from the Board that consultation and engagement via public hearings can be extensive based on the level of review; however, the Board may not be able to reach every community through in-person consultation and engagement under the timelines. One interviewee felt that the knowledge and perspectives of Indigenous nations other than the Tłı̨chǫ Government have less weight in the review process given that Tłı̨chǫ Government is a self-governing nation, which reduces the effectiveness of the process. Increasing ways to build relationships with Indigenous groups, including those outside the Wek'èezhìı area who are impacted by the Board's recommendations, would support a more effective review process since the Board may be able to conduct more targeted, meaningful consultation and engagement during the review.

Designing and facilitating public hearings to enable collaboration: We heard that public hearing processes (which can feel adversarial) should mimic the dialogue and collaboration that Parties have established through other collaboration mechanisms.

- Due to their formality, public hearing processes can feel adversarial, rather than collaborative. One Party identified that there is an opportunity to strengthen the public hearing process to ensure that everyone is comfortable and feels heard. Promoting dialogue and collaboration through the public hearing process will enable Parties to build on the foundation of relationships and trust that they have built up over time.

Using a central mechanism to track the completion of accepted actions: We heard that there is no central mechanism for all Parties to track the status of accepted or varied actions.

- One Party was uncertain if and how the Board is tracking recommendations. They commented that they were not sure if all actions need to be completed and if so, which ones are remaining. The Board commented that they are internally tracking the completion of recommendations.

Directly communicating outcomes of management proposal review processes to interested members of the public: We heard from one external party, that for those who

provide comments during WRRB processes, they would like direct communication on the results of review processes.

- External parties have a limited role in the process, especially if it is a Level 1 review, but the results are still useful for them to be aware of since it impacts the broader management of Bathurst caribou. We heard that the notification system does not work well for them given the volume emails they receive and that they would appreciate more direct or accessible communications.

Communicating the roles of Parties in caribou management to Indigenous communities and the public: We heard that the mandate of Parties could be better communicated to the public to improve understanding of how caribou are managed and by whom.

- One interviewee commented that the public may not understand the roles of the WRRB and the GNWT in wildlife management decision-making. There are different understandings on who is the decision-making authority. The Board clarified that the WRRB can make determinations that the GNWT would have to adhere to, but they are not the ultimate decision-making authority. There is an opportunity for the Board and Parties to strengthen communications to the public on caribou management roles which could be done through various mechanisms e.g., newsletter or direct engagement.

Consideration of traditional knowledge

Consideration of traditional knowledge in the WRRB process

Over time, traditional knowledge has been become more available from 2009 to 2022 through the establishment of formal programs such as the Boots on the Ground program, which started in 2016 (see Figure 3). The document review of the Board's recommendations over the past three management proposals indicates that the Board collects traditional/community and scientific knowledge through various sources (including public hearings, written submissions, and direct community engagement) to inform determinations and recommendations. Table 1 below presents a summary of the consideration of traditional knowledge across management proposals and provides an assessment of the equal consideration of scientific and traditional knowledge. The recommendations follow the format of presenting "Indigenous Evidence" and "Scientific Evidence" to inform determinations and recommendations in the 2010 and 2016 management proposals, sometimes using direct quotes from elders and knowledge holders, which helped explain the importance of the relationship between ekwǫ̀ and Tłı̨chǫ people, baselines, and current state of ekwǫ̀.

Table 1: Summary of the consideration of scientific and traditional knowledge

Knowledge considered	2010 (Level 3 review)	2016 (Level 3 review)	2022 (modified Level 1 review)	Overall assessment of equal consideration of knowledge
Scientific knowledge	• Presents scientific evidence.	• Presents scientific evidence, including from hearings.	• Presents limited scientific evidence.	2 of 3 management proposals (2010 and 2016) present detailed scientific evidence, 1 of 3 management proposals (2022) present limited scientific evidence.
Traditional knowledge	• Presents limited Indigenous evidence and traditional knowledge. • Presents Indigenous evidence from the Tłı̨chǫ more generally and not specific to recommendations. • Presents public engagement comments and the Board's analysis, though limited to the North Slave Métis Alliance (NSMA).	• Presents detailed Indigenous evidence and Traditional knowledge about caribou from Tłı̨chǫ, Yellowknives Dene First Nation (YKDFN). • Łutselk'e Dene First Nation (LKDFN) and NSMA from public hearings and for specific recommendations. • Use of direct quotes from elders and communities for recommendations related to harvesting, monitoring of harvest and predator management.	• Presents limited Indigenous evidence and traditional knowledge.	1 of 3 management proposals (2016) present detailed Indigenous Knowledge, and 2 of 3 management proposals (2010 and 2022) present limited Indigenous knowledge.

Views on the equal consideration of scientific and traditional knowledge

The Board considers available traditional knowledge and scientific evidence to inform recommendations and determinations.

- The Board's recommendations and determinations consider both scientific knowledge and traditional knowledge, based on what is available. Detailed traditional knowledge and scientific evidence were both included in 2016 (Level 3 review Reasons for Decision report). For example, the Board's recommendation to not conduct the reconnaissance survey in 2022 considered traditional knowledge and values to "leave the caribou alone" and scientific knowledge to reduce herd surveys, illustrated consideration of traditional and scientific knowledge together (when available) to drive management and monitoring actions that are best for the recovery of the herd. The availability of traditional knowledge and the capacity of traditional knowledge holders to engage and be engaged by the Board impacts the traditional knowledge that is available for the Board to consider.

There is an opportunity to strengthen documentation of how traditional knowledge informs the Board's recommendations and determinations.

- There is different traditional and community knowledge about wolf management and the mobile conservation zone, and it is unclear how traditional knowledge informed recommendations on these two management actions. While the Board sometimes presents traditional knowledge evidence linked to its recommendations, it is sometimes unclear in its Reasons for Decision reports how it considers multiple sources of traditional knowledge. One interviewee identified two examples where multiple sources of traditional knowledge indicated different actions for predator management and the mobile conservation zone. This interviewee was uncertain on how the Board uses these different inputs to inform its recommendations.

Recommendations

The Board should continue to use a mix of both formal and informal mechanisms to lead an efficient and effective review process.

- The Board should consider whether it communicates its recommendations in draft form to the Working Group prior to finalizing its Reasons for Decision to ensure understanding of the Board's intent with the recommendations. This action may better inform the written response from Parties on accepting, rejecting or varying recommendations, and ultimately a more efficient review process.

- Establish and implement the adaptive co-management framework to track continuous improvement of accepted recommended actions and to support the assessment of the success or failure of management actions.
    - Collectively tracking actions and their success can provide Parties with a line of sight on the suite of recommendations underway and those that are pending. It can also help course correct recommendations as needed and support Parties in advancing completion of actions, and would improve efficiency, and the types of recommendations the Board considers moving forward.
    - As part of establishing the framework, determine roles and responsibilities of Parties in implementing the framework e.g., who would track actions and how. It is also important to ensure that Parties understand the importance of their participation and this process.

Ensure that Reasons for Decision reports clearly describe how different knowledge informs recommendations, particularly when there are multiple information sources.

- Consider producing a what we heard report or summarizing input succinctly in one section of the Reasons for Decision report, including: who provided input, the nature of their input and how that was considered in the Board's determinations and recommendations.
- When possible, complement existing mechanisms for communicating this information with Indigenous groups (i.e., email notification systems on Reasons for Decision reports) with direct outreach (e.g., phone calls, touch point meetings with updates) to improve information accessibility, maintain trust, and build relationships.

Parties should develop a graphic that illustrates roles and responsibilities of different parties in caribou management.

- Greater awareness and understanding of roles and responsibilities in caribou management will support more efficient review processes in the future when the Board makes recommendations and determinations.

B) APPROPRIATENESS OF RECOMMENDATIONS AND DETERMINATIONS

Area of Inquiry B

*To determine whether the **WRRB's determinations** and/or **recommendations are appropriate** for managing Kǫk'èetì Ekwǫ.*

WRRB's Determinations and Recommendations

Table 2 below summarizes the types of determinations and recommendations made by the Board for each of the three management proposals and what we heard in interviewees about the overall appropriateness of recommendations and determinations. Table 3 provides an assessment of the ability of determinations and recommendations to meet the short-term objective and the rationale provided by Parties for rejecting or varying any determinations and recommendations. Following these tables, we provide the findings on appropriateness drawing from the aforementioned information sources and wildlife expertise. Appendix D provides a more comprehensive list and description of the determinations and recommendations (D/R) with an assessment of their appropriateness from a wildlife expertise perspective.

Table 2: Summary of types of determinations and recommendations across management proposals and interviewee views

2010	2016	2022	Interviewee Views (across management proposals)

• Harvest targets, ratios and management
• Suite of monitoring recommendations (scientific and traditional knowledge based)
• Conservation / TK education programs
• Adaptive co-management, including performance metrics for management
• Calving ground protection
• Landscape change monitoring
• Land use planning
	• Total allowable harvest and mobile conservation zone
	• Monitoring data communication
	• Suite of monitoring recommendations (scientific and traditional knowledge based)
	• Land use planning
	• Landscape inventory, protection and performance metrics
	• Conservation / TK education programs
		• Monitoring:
		  ○ Assess emigration
		  ○ Reduce information gaps
		  ○ Calving ground survey design and coordination, including not to conduct a reconnaissance survey
		• Plain language communications of proposal and calving ground survey
			We heard the following were appropriate:
			• Determinations made based on total allowable harvest
			• No harvest/hunting zone, though there are opportunities to improve the zone (number of collars and rules around it)
			• Improve understanding of emigration to inform management and monitoring actions
			We heard the following are not appropriate:
			• Collaring of bulls and cows
			• **Mobile conservation zone area:** harvesting takes place on the ice roads (not always covered by the

2010	2016	2022	Interviewee Views (across management proposals)
• No focused wolf control • Implementation of monitoring and management Tłı̨chǫ knowledge and research program	• Consultation • Traditional knowledge research / studies • Wolf management, including abundance feasibility study • Grizzly management • Bathurst Caribou Range Management Plan		mobile zone) where it is easy to mistake Bathurst for Beverly caribou. The zone also falls outside the jurisdiction of the Board, which impacts their consultation and engagement activities. • **Predator management program design:** there is conflicting knowledge and insufficient evidence for predator (wolf) management effectiveness (given other factors influence population decline e.g., grizzly as predators of greater concern). There is also limited enforcement of this program and reporting back of results (though communications on results are planned).

Table 3: Evaluation of appropriateness of determinations and recommendations

Ability of Determinations and Recommendations to meet the short-term objective	Rationale provided by Parties for rejecting or varying Determinations and Recommendations
2010	
In 2010, the latest Bathurst herd population estimate was 32,000 animals (from 2009), down from 186,000 six years before, an 80% decline. The WRRB made a total of 60 recommendations, which were generally appropriate for contributing to the overall short-term objective of "*To halt the Bathurst herd's decline and promote recovery*". The measures to reduce harvest and predation and focus resources on trying to better understand what may be affecting caribou were appropriate given the rapid decline of the herd and the need for prompt, bold action before the herd could, reasonably, disappear. Direct management measures sought to reduce overall harvest and predation on the Bathurst herd by halting commercial, outfitting and resident harvest and set harvest limits in a timely manner, including:	**Varied:** • D/R to be addressed through the long-term management plan • Different views of Parties on harvest ratios and Indigenous harvest targets than the Board • Implementation timeline for Tłı̨chǫ research and monitoring program adjusted for 2011 • Monitoring recommendations require clarification on methods • Continue current approach for surveys and reporting • Existing work being done e.g., cumulative effects assessment **Rejected:**

Ability of Determinations and Recommendations to meet the short-term objective	Rationale provided by Parties for rejecting or varying Determinations and Recommendations
• Cutting harvest rates to zero for commercial harvesting (2), outfitters (3), and residents (35). • Set harvest limits for Bathurst caribou with preference for males (7,8,9,10,11), and report harvest (40). • Halt Ahiak caribou harvest in We'èezhìi to prevent incidental harvest of Bathurst caribou (23). • Predator management (wolf) (52, 53). • Enforcement and compliance (60). • Working with neighbouring jurisdictions to manage harvest (22, 25) and protect calving range (47) and manage caribou during calving and post-calving (48). • Clarify the positions of ENR and TG on reinstatement of outfitting (4) and resident (6) harvest (46). The fall and wintering ranges of the Bathurst, Bluenose-East and Ahiak caribou overlap in many years, so the current location of the Bathurst herd and its degree of overlap are important to understand so as to identify appropriate management zones and	• Land use planning is the responsibility of Canada and the GNWT and not the Tłı̨chǫ Government who has their own plan for Tłı̨chǫ lands

Ability of Determinations and Recommendations to meet the short-term objective	Rationale provided by Parties for rejecting or varying Determinations and Recommendations
allow people to harvest caribou from other herds while protecting the Bathurst herd. • Identify fall and winter range for Bathurst (12, 13), Bluenose-East (19, 20) and Ahiak caribou (26, 27). At the time, it was not well understood what had caused the decline of the Bathurst caribou and there were different, vocal, advocates for different theories explaining the decline. The WRRB sought to improve the state of knowledge for what may be affecting the Bathurst herd and develop understanding of the herd from both science and traditional knowledge and share this information with the public: • Set up monitoring using scientific and traditional knowledge methods (28) for spring calf survival (29), health (30), birth rate (31), fall calf survival (32), herd size (33), pregnancy rate (38), density of cows on the calving ground (39), habitat (37, 50, 51), wolf abundance and condition (34, 35).	

Ability of Determinations and Recommendations to meet the short-term objective	Rationale provided by Parties for rejecting or varying Determinations and Recommendations
• Develop traditional knowledge and scientific conservation education programs (42, 43). • Reporting results (41, 44) and consultation plan (58, 59). The WRRB also identified that the Bluenose-East herd was declining and that management actions were needed. Given the slower rate of decline, less extreme measures were appropriate: • Halt commercial, outfitted and resident harvest of Bluenose-East (14) and set harvest targets (15, 16, 17, 18). Based on the continued decline of the Bathurst herd, it could be argued that the Board decision to allow a limited harvest of 300 caribou, 80% males was incorrect and a total ban on harvest of the Bathurst herd along with further prohibitions on the area where harvest can occur would have been more appropriate. However, at the time, it was not clear whether harvest had caused the decline. The existing proposed measures implemented were agreed to by managers with the GNWT and Tłı̨chǫ Government as	

Ability of Determinations and Recommendations to meet the short-term objective	Rationale provided by Parties for rejecting or varying Determinations and Recommendations
appropriate and there was severe public backlash against the existing prohibitions.	
2016	
In 2016, the latest census of the Bathurst herd determined that there were 20,000 caribou, a decline of 40% since the last Board recommendations in 2010 and a decline of 90% in 13 years since 2003. The continued declines behoved the board to take additional measures beyond those already in place from 2010, which were appropriate to address the short-term objective of "*To halt the Bathurst herd's decline and promote recovery*". Recommendations included improved communication of monitoring results, which is appropriate in development of co-management strategies, and public understanding and buy-in are critical for success:	**Varied:** • Ongoing work of Parties, approach Board suggested was adjusted e.g., public education efforts timeline, habitat and protection through Bathurst Range planning process • Improving effectiveness and efficiency of studies e.g., combining suggested traditional knowledge research given they are interconnected • Leveraging the Working Group rather than directing to individual Parties for collaboration e.g., for predator management (wolf) • Ongoing work by others that Parties can connect with as appropriate e.g., predator management (grizzly) study given

Ability of Determinations and Recommendations to meet the short-term objective	Rationale provided by Parties for rejecting or varying Determinations and Recommendations
• Increase public education (3) and communicating monitoring results (2, 7B) The Board also updated some of the caribou management recommendations based on learning since 2010, particularly related to managing harvesting in the fall and wintering ground when multiple herds overlap, in additions to increased participation in management by communities: • Updates to the management zones on the fall and winter grounds (1) • Continued predator control (wolf) through a community-based program (4, 5) The Board identified additional questions since 2010 that are important for conservation of the Bathurst caribou and was explicit that traditional knowledge and western science would be collected and used on each topic:	presence in Nunavut; land use planning given it is a separate, longer process • Right-sizing monitoring actions to feasibility of Parties to implement e.g., provide updates on *new* information through air and ground surveys of mobile zone

Ability of Determinations and Recommendations to meet the short-term objective	Rationale provided by Parties for rejecting or varying Determinations and Recommendations
• Continued collection and inclusion of traditional knowledge on caribou relationship to people (2B), grizzly bear predation (3B, 4B), stress of collaring (5B). The Board recommended updating management plans to codify and direct management efforts, which is appropriate given the level of management required to meet the objectives of stopping the Bathurst decline. The Board also recommended updating monitoring plans and having specific indicators and thresholds for action which are appropriate recommendations for modern, transparent management plans: • Update land use plans (9B, 10B) and complete management plans for the Bathurst Range Plan (11B), Bathurst Management Plan (12B) and a fire management plan (18B). • Standardize management and monitoring plans for industry to monitor effects of development (17B). • Update monitoring programs, including whether annual reconnaissance is required (6B), climate effects on summer and winter forage (19B, 20B), update the inventory of	

Ability of Determinations and Recommendations to meet the short-term objective	Rationale provided by Parties for rejecting or varying Determinations and Recommendations
landscape change (16B), and establishing indicators and thresholds (8B, 21B). Finally, where the Board had questions on how to proceed, it recommended the GNWT and Tłı̨chǫ Government investigate options for management of caribou and provide information to inform the Board's decisions: • Identify which Conservation Area approach will be used to protect caribou (13B). • Investigate and report on the use of offsets for compensate for habitat loss (15B). • Identify how to protect water crossings and land bridges (14B).	
2022	
By 2022, the Bathurst herd had dropped to 6,240 animals, a 70% decline since the last recommendations and a 97% decline in 20 years. Appropriate measures to monitor and manage the herd	**Varied:** • Time constraints for Parties to collaborate e.g., monitoring survey design

Ability of Determinations and Recommendations to meet the short-term objective	Rationale provided by Parties for rejecting or varying Determinations and Recommendations
were in place, and the Board focused on filling gaps and refining monitoring requirements. The Board continued to highlight communications with the public, which is appropriate for a co-management system, and one that relies on public understanding and participation to be successful: • Develop a plain language summary of monitoring programs (6) The Board made recommendations to balance the needs of collecting data to understand the herd with public concerns about disturbing caribou: • Cancel the 2022 calving ground survey (2) • Collaborate with Government of Nunavut on Beverly herd surveys (5) The Board held technical assessments to address questions about the herd and to determine if the best methods are being used to gather suitable data for the herd: • Conduct a technical assessment of 'emigration' (1).	• Ongoing work by partners e.g., calving ground surveys conducted by Government of Nunavut • Directing the appropriate Party e.g., Tłı̨chǫ Government is not responsible for June 2022 aerial reconnaissance survey **Rejected:** • Need to collect data to support recovery e.g., conduct June 2022 aerial reconnaissance survey, with minimal disturbance

Ability of Determinations and Recommendations to meet the short-term objective	Rationale provided by Parties for rejecting or varying Determinations and Recommendations
• Hold a technical workshop to discuss emigration, herd overlap and population surveys (3). • Use the Adaptive Co-Management Framework to reduce gaps in monitoring (4).	

Views on appropriateness of determinations and recommendations

Recommendations and determinations have generally been appropriate for managing the herd in an evolving context:

- We heard the Board is making decisions as best they can given that many factors are out of their control e.g., emigration and recovery of the herd despite implementation of the right actions. Though, there are opportunities for more regular review of the Board's recommendations to help adapt to evolving factors on a more regular basis
- The Board identified communication with communities and the Board as important in all three years of recommendations (2010, 2016 and 2022) which is appropriate given how important caribou are to community members, the level of disruption that harvest restrictions have on community members rights, and the need for public participation for effective co-management and conservation measures in the field.
- The Board imposed bold management measures that ended commercial and public harvest and limited community harvest to very low levels. The Board addressed the issue of the Bathurst herd having overlapping fall and winter ranges with the Bluenose-East and Beverly herds in a novel manner with the mobile protection zones. While we heard differing views on the design of the zone, it is considered an effective management action, though there may be opportunities to enhance its design and implementation with input from more partners.
- The Board recommended the completion of several management and monitoring plans, including Bathurst Range Plan, Bathurst Plan, land use plans, industrial management and monitoring plans, as well as a Fire Management Plan. These plans are key for implementing the Board's mandate of stopping the Bathurst caribou decline and promoting its recovery.
- The Board identified biology and policy research priorities to better understand the herd decline and directed the GNWT and Tłı̨chǫ Government to research these priorities, updating priorities and closing gaps in knowledge over time with subsequent recommendations. Throughout, the Board highlighted the need to collect traditional knowledge and science on research questions and directed the collection and understanding of traditional knowledge from community members and elders about caribou.

Some recommendations and determinations could be enhanced to more effectively work toward meeting the short-term objective and support implementation:

- **Public outreach:** The Board has highlighted reporting in each of its recommendations (2010, 2016, 2022) but some interviewees indicated that they would like to see more information and communication from the Board and governments implementing management actions - GNWT and Tłı̨chǫ Government. Interviewees also expressed that they wanted to hear more about how the Board considers different inputs to inform their recommendations and determinations for specific management approaches i.e., the mobile zone and predator management. The Board could consider recommending a regular newsletter be provided to community members. For example, the Alaska Department of Fish and Game (ADFG) produces a series of newsletters for each of the principal herds called Caribou Trails that provides traditional knowledge, monitoring results and rationale behind management measures. The Board could also improve communication of their mandate and authority to help bring people along (as mentioned in Area of Inquiry A). Given inputs from some interviewees did not accurately describe existing and potential actions for the Board, there is a need to provide more information on what the Board can and cannot do and why e.g., while the WRRB has authority in Wek'èezhìı only, the GNWT has written the regulation to apply to Bathurst caribou wherever they are in the NWT.
- **Monitoring success of management actions:** It is not clear if there is direct monitoring of management actions, such as how successful the Mobile Core Bathurst Caribou Conservation Area has been and whether harvest has stopped on the Bathurst herd. This could include an assessment of whether harvesters are aware of the Mobile Core Conservation Area, its current location and whether harvesters are avoiding this area, or using the area, mistakenly or intentionally. We heard from interviewees as well that there is a need to track completion of and ensure accountability and/or follow-up of recommendations e.g., implementing the adaptive co-management framework (the Board and Parties recognize that the adaptive co-management framework has not yet been established, which means it cannot be used to track whether they are meeting the short-term objectives for caribou recovery on an ongoing basis).
- **Monitoring and reporting enforcement:** In 2010, The Board recommended that the GNWT "develop and implement an effective and continuing enforcement and compliance program (Recommendation 60). In 2016, the Board recommended that Tłı̨chǫ Government "consult with Tłı̨chǫ communities, by March 2017, to ensure Tłı̨chǫ laws are implemented with respect to ɔekwǫ́ harvesting practices to maintain the Tłı̨chǫ way of life and their relationship with ɔekwǫ́" (Recommendation 1B). The Board could investigate whether these

recommendations to manage, monitor and enforce harvesting rules have been effective or if harvest of the Bathurst herd has continued.

- **Improve clarity on the Board's intent with the recommendation:** We heard that the Board could elaborate on recommendations by providing more detail and how they propose the Party could implement recommendations (conducting traditional knowledge monitoring to assess winter forage by September 2018 was referenced as an example).
- **Ensure that Parties indicated for each determination and recommendation are appropriate.** A recommendation was varied to omit the Tłı̨chǫ Government (2022) as they are not involved in monitoring surveys. We heard from Parties that the GNWT and Tłı̨chǫ Government specialize in the roles they play and in the activities they conduct e.g., GNWT does the science, indicating that the Tłı̨chǫ Government does not need to be mentioned in recommendations relating to monitoring surveys. However, an interviewee indicated that it is helpful for the Parties to weigh in on actions for the other Party so that they could influence each other's responses.
- **Offer an opportunity to discuss recommendations prior to finalization to ensure clarity and consider feasibility:** We heard from one interviewee that they would like an opportunity to discuss the Board's proposed recommendations before they are finalized. Discussion will enable Parties to gain clarity on the intent of recommendations and the Parties best placed to action recommendations and how. For example, recommendations for land use planning, aerial monitoring of the mobile conservation zone, and conducting multiple traditional knowledge studies may be appropriate for Bathurst caribou management and monitoring, but there may be more support from Parties if they are brought along in the process i.e., framing and implementation. While the Board's mandate is to make the best recommendations for managing the herd, it is best practice in wildlife management to consider the people and processes involved in wildlife management and monitoring. Parties will need to shift how they work together to effectively reflect the spirit of co-management in a way that brings together western science and traditional/community knowledge where appropriate.
- **Enhance mobile protection measures by building knowledge on emigration:** The Board provided some recommendations specific to habitat in 2016 though one Party expressed that they would like to see more proactive recommendations related to Protected Areas. There are different views among wildlife management bodies on the effectiveness of Protected Areas compared to mobile measures e.g., the Nunavut Planning Commissions prefers Protected Areas whereas Inuit Associations, similar to the GNWT,

prefer mobile measures. From a wildlife expertise perspective, mobile measures are the most relevant given they align with the mobility of the herd. Building knowledge on the reasons for emigration would support more effective mobile measures.

- **Develop short- and long-term habitat level approaches to management and monitoring:** Using existing data on habitat quality and quantity to inform recommendations on establishing caribou-specific conservation approaches (e.g., Recommendation #13B-2016) and protecting habitat quality and quantity from forest fire (Recommendation #18B-2016) are appropriate as they will support recovery of the herd. However, the recommendations on land use planning may not help meet the short-term objective given the process to develop a land use plan would take a long time. The Board could consider developing recommendations that span across the short- and long-term and they could discuss the framing and implementation with Parties and other partners to develop buy-in to these approaches.
- **Enhance incorporation of the broader context of caribou management in determinations and recommendations:** There is an opportunity for the Board to bring together other commitments and ongoing work for caribou management and monitoring e.g., BCMP recommendations and principles to ensure recommendations are not duplicative of the ongoing work of other partners like Government of Nunavut. A more consolidated approach to management and monitoring would lead to more recommendations and determinations being accepted and create buy in from partners.

Recommendations

Consider the whole system of caribou management and monitoring to develop a suite of recommendations that would support the short- and long-term objectives.

- Discuss the broader management approach for caribou (e.g., predator management in the NWT and Nunavut, habitat quantity and quality, climate change etc.) in the Working Group to align on short- and long-term recommendations e.g., targeted consultation and discussion on the mobile zone and predator management, approach to monitoring to reduce disturbance but also learn more about emigration to guide future management and monitoring, landscape approaches that include long-term plans for developing land use plans etc.
- Ensure recommendations build on ongoing work of Parties and other partners.

- Draw on existing data that contain linkages to caribou habitat quality and quantity and changes over time such as yearly fire tracking or burned areas, revegetation tracking, and insect emergence dates.

Strengthen engagement and communications on the current approach for the mobile zone, predator management, and monitoring measures to build understanding of these approaches.

- Conduct regular bilateral engagement with partners to develop stronger relationships among wildlife managers which will ultimately support a more efficient review process.

Consider the feasibility of determinations and recommendations to support effective implementation.

- Building on the recommendation in Area of Inquiry A, a validation session with Parties through the WG will provide the Board an opportunity to refine recommendations prior to finalizing, which may lead to less recommendations being rejected.
- The Board may consider developing a prioritization method that considers feasibility of implementation of recommendations to acknowledge the capacity of Parties to implement them. The recommendations that seem unrealistic for Parties to implement could be separately captured and directed to the Board and Parties to collectively advance through alternative ways.

Track and enforce actions to strengthen the Board's recommendations in response to future management proposals.

- Tracking and enforcing actions will support the Board in identifying whether actions have been effective to adjust future recommendations and determinations.

C) EFFECTIVENESS OF PROPOSED ACTIONS

Area of Inquiry C

*To determine whether the **management proposals** that have been submitted to the WRRB from Parties to the Tłı̨chǫ Agreement **have proposed effective management and monitoring actions** for Kǫk'èetì Ekwǫ.*

For the purpose of this review, effective management actions are those that maintain or improve the herd and habitat. Effective monitoring actions are those that provide data to improve

understanding of the herd and habitat, preferably with low levels of disturbance to the herd and habitat.

Table 4 below summarizes management and monitoring actions that have been proposed by Parties in the 2010, 2016, and 2022 management proposals. Management actions are listed first and monitoring actions second. We clustered actions by theme and provided an assessment of their overall effectiveness, as defined above. The full list of actions is provided in Appendix E.

Table 4: Summary of actions and assessment of their overall effectiveness in meeting the short-term objective.

Actions	Assessment of the overall effectiveness
Management Actions	
Hunter harvest • Eliminate resident hunter harvest. • Bull and Cow harvest limitations. • Eliminate commercial meat and outfitting tags. • Close harvest of Bathurst caribou until next photographic survey (2018). • Total Allowable Harvest (TAH) for the Bathurst herd remain at zero (0) in the Northwest Territories, as determined by the WRRB in 2016 and maintained in 2019 (WRRB Determination #1-2019).	• Effective as it contributes to halting the Bathurst herd's decline and promoting recovery. • Currently the herd is in "the critically low" below 30,000 individuals as outlined by the BCMP so harvest is at zero until the herd reaches numbers that can sustain low levels of harvest.
Predator management • Increase removal of wolves through hunter and trapper incentives, with focus on Bathurst winter range in early winter.	• Effective short-term solution as it contributes to halting the Bathurst herd's decline and promoting recovery. • Predator management is a common short-term management action in both woodland

Actions	Assessment of the overall effectiveness
• Develop and implement coordinated wolf removal programs on winter range, with mobile wolf-hunter camps in winter Bathurst range. • Develop wolf management approach with hunters and communities. • ENR will lead a review of wolf monitoring methods in the NWT and carry out a feasibility assessment of predator management options to increase caribou survival rates. • A comprehensive Tłı̨chǫ Government-GNWT joint wolf management proposal approved for 5-year period.	and barren-ground caribou ranges to increase calf-survival. • The literature suggests that targeted wolf removals in the area of concern help sustain any positive responses by the ungulate population(s) (McLaren 2016). **Commentary from interviews:** • We heard from one interviewee that predator management is not effective because caribou harvest is the more pressing concern.
Mobile conservation zone • The mobile Bathurst conservation zone, within which no caribou can be harvested. • Continuation of the Mobile Core Bathurst Caribou Conservation Area to maintain Total Allowable Harvest of zero. • The Tłı̨chǫ Government has developed and implemented the Ekwò Harvest Monitoring Program in the winter of 2021 to share information with Tłı̨chǫ harvesters	• Implementing a mobile conservation zone (i.e., a protection zone that moves with the herd) is an effective management action similar to the Mobile Protections Measures used in the Kitikmeot. Unlike most protected areas, the mobile zone adapts to the movement of the caribou, is reflective of caribou behaviour, and offers adaptive protection; not just one that is based on landscape features or a designated geographic area. **Commentary from interviews:** • We heard from some interviewees that this approach is not entirely effective given there is limited information on how well the

Actions	Assessment of the overall effectiveness
using the winter road for caribou harvest outside of the Mobile Zone.	zone is working and whether it is being enforced or not. No harvest on winter roads would be more effective given it is hard to tell between Bathurst and Beverly in the mobile zone.
Habitat and land use • In 2016, the Board directed the GNWT to complete the Bathurst Caribou Range Plan that focuses on the amount and quality of habitat on the Bathurst Range. This Plan provides advice for regulators on amount of disturbance on the range and whether additional mitigations for project are required. • Land use plans are discussed by the Board in 2016 and 2022, but Tłı̨chǫ Government and the GNWT ultimately rejected the recommendation because the land use area was outside of the Board's jurisdiction.	• Completing the Bathurst Caribou Range Plan helped set development guidelines for different zones in the Bathurst range which provided regulators with a clear image of how much habitat has been used and by what types of land use. As such, this recommendation was successful in advancing the range plan by providing the correct information to caribou managers.
Education • Hunter education on sound hunting practices including limiting wounding losses and wastage, reliable harvest reporting. • Increased public education on the status and management of caribou herds	• While hunter education is a reliable method to improve understanding of potential losses to the herd and how to minimize them, there is no documentation on the outcomes of this program e.g., improved understanding of hunters to determine whether this program has been effective in practice.

Actions	Assessment of the overall effectiveness
Monitoring Actions	
Calving ground population surveys • Estimate of breeding cows from calving ground photo survey • Numbers (density) of 1+ year old caribou on annual calving grounds reconnaissance surveys • Estimate breeding cows and extrapolated herd size from fixed-wing reconnaissance survey west and east of Bathurst Inlet at or near the peak of calving; and a corresponding helicopter/ground-based composition survey	• The calving ground aerial population surveys are effective at providing population estimates of the herd with appropriate error estimates to allow for determining whether the population is decreasing or increasing in size. An ineffective program would be one that provided a poor estimate of the number of caribou through systematic errors in field methods or counting and/or large error terms so that no statistical comparison between subsequent surveys would be possible. Therefore, these surveys are effective in providing the correct data to managers.
Composition surveys • Several types of composition surveys which have been conducted – cow productivity during calving ground surveys, cow productivity during summer, sex and calf:cow ratio during fall rut survey and calf:cow ratio in late winter.	• Caribou herds can have very low recruitment rates (new calves successfully entering the population). Understanding the recruitment rate and its drivers is important for herd management. For instance, if recruitment is very high but the population is declining, adult survival due to harvest or wolves may be the problem. If recruitment is very low, it is important to determine if that is due to low pregnancy and calving rate in females (which may be related to body condition) or calf survival, which can be affected by factors such as weather and wolf predation. • The composition surveys being conducted by the GNWT are being conducted using

Actions	Assessment of the overall effectiveness
	commonly used methods and are effective at providing managers with the data required to see whether the herd is likely to grow or decline.
Condition assessment • Caribou condition assessment/pregnancy rate. • Caribou condition assessment from summer Tłı̨chǫ Ekwò̧ Nàxoèhdee K'è Program.	• As discussed above, caribou condition and pregnancy rates are important to understand so that the mechanism of herd decline or growth can be understood. Low body condition or pregnancy could be due to forage availability and quality, weather, snow conditions, parasites or other factors. This monitoring action contributes to the short-term objective "To halt the Bathurst herd's decline and promote recovery".
Community-based monitoring • Numbers of cows and bulls taken by all hunters. • Wolf numbers from hunter reports.	• Community-based monitoring contributes to the understanding of losses that the herd may face due to harvest or wolves and thus allows for more reliable estimates of population. • However, there is limited reporting available to base conclusions on whether this is an effective monitoring technique for halting the herd's decline and promoting recovery.
Predator reduction surveys • Literature review of wolf management and monitoring in NWT and NU.	• Predator reduction surveys are considered effective because they provide information on whether the wolf control program is working to reduce the wolf population to target levels.

Actions	Assessment of the overall effectiveness
• Reporting from Wekweètì and Gamètì community trappers/hunters. • Reporting from NWT residents and guide-outfitters who hunt wolves.	
Radio collars • Increasing number of collars	• Increasing the number of collared caribou (particularly cows) is an effective monitoring action to provide information on cow location, herd emigration, and cow survival. These data are used to implement the mobile conservation zone, understand losses due to emigration and directly measure survival of adult females, which is a key driver of population change.
Monitor environmental conditions • Monitor for indices of range condition, drought index, and warble fly index.	• Trends in environmental indices may help explain underlying drivers of change in adult female body condition, pregnancy rates and calf survival, which are key to understanding the drivers of population change and to informing management actions.

Management proposals have resulted in some consistent monitoring activities which is important for caribou monitoring.

- The population and composition are conducted consistently over time using the same methods for each survey, which is effective as it allows for accurate monitoring of the herd.

Proposed monitoring actions are considered effective in gathering information needed to support management of the herd, but the cumulative effects of disturbance from multiple aerial surveys is not effective.

- Surveys for wildlife in the tundra environment with today's technology invariably use aircraft for reconnaissance, survey and transport for ground surveys. There is a trade-off between having better and more frequent data and the costs and degree of disturbance and stress that the aircraft cause to wildlife. Survey intervals for caribou and reindeer vary in different jurisdictions – from every 2 years to every 4-6 years. Ultimately, if the data can be used to implement new management measures, then it may be worthwhile to collect, but if they are not valuable in informing management then a lower frequency may be acceptable.
- When considering composition surveys, strategies to combine surveys to reduce frequency and reduce variation will increase effectiveness and have the potential to reduce stress caused by multiple surveys (Boulanger 2021).

The proposed actions in the 2010 and 2016 management proposals are based on tested methodology but it is challenging to assess their effectiveness given the continued decline of the herd.

- The management actions currently used for the Bathurst herd (setting total allowable harvest to zero, predator control and active policing of no-harvest areas where the herd is located) are considered effective for the Bathurst herd because 1) they are the major actions that can be applied, 2) they are known to work for other caribou herds and other ungulate populations (deer, moose, etc.) in North America and the circumpolar. Generally, predator management is effective in the short-term depending on the size of the herd and cause of decline. However, we heard from one interviewee that harvesting pressures is a more pressing concern for this herd. More information is necessary to monitor and understand predator populations (wolf and grizzly) and whether harvest is continuing on the herd. Understanding other predators like grizzly bear is also important to compare effectiveness of targeting wolves specifically. While predation by grizzly bear occurs outside the Wek'èezhìı and the NWT, which is outside the WRRB's authority, it is best practice to consider the whole ecosystem dynamics of prey and predator to effectively manage Bathurst caribou. For instance, to include known predation by grizzly bear in any population models for the herd to estimate likely decline or recovery rate.
- There is limited evidence available to assess whether the current implementation of management actions has resulted in improvement of the herd e.g., mobile conservation zone and predator management. There is no other herd that is also declining where management measures are not being implemented, therefore, it is challenging to determine whether management measures are effective without this comparison to a

control. It is difficult to evaluate the effectiveness of each management measure separately since several management measures were applied at the same time. Also, external factors (such as habitat change due to climate change causing shrubification of the tundra, increasing forest fires and increased parasites, which are not yet well understood) may impact the effectiveness of these actions (i.e., the herd may continue to decline).

The 2022 management and monitoring actions are considered to be more effective than in 2010 and 2016 because they responded to the herd's status.

- While the Bathurst herd continued to decline from 2016 to 2022, more novel management and monitoring actions were presented in the 2022 Joint Proposal which we consider to be more effective at managing and monitoring caribou such as adaptive co-management strategies and coordinated survey efforts between jurisdictions and herds.

Proposed actions do not address habitat protection, habitat quantity and quality, or climate change, which are critical factors for caribou management.

- Herd decline could be attributed to changes in habitat such as climate change and resulting increased fires on the winter range, shrubification on the summer range, increased insect loads, and/or new diseases from the south. Infrastructure development may also alter habitat quality. These changes can impact caribou movement and forage availability and ultimately the health and survival of the herd. However, these pressures are also felt by other large Arctic herds (Central Arctic Herd, Bluenose-West, Beverly and Qamanirjuaq) and these herds have not experienced the precipitous decline of the Bathurst herd.
- There are also few examples of very small caribou herds (e.g., Bathurst is approximately 6,000 animals) and how they recover to a large size – so it is not clear if a long period of low population and poor recruitment should be expected, or whether recruitment and herd growth should be rapid, as it was in the 1970s and 80s.
- In 2019 GNWT introduced the Bathurst Caribou Range Plan which addresses cumulative land disturbance across the Bathurst herd range and provides context in which climate change can affect and be incorporated into caribou range and habitat management strategies.

Recommendations

Leverage technology and artificial intelligence for surveys which would support low disturbance monitoring.

- Investigate whether there is the potential to use technology to replace some surveys that require low level flight, such as high elevation drones or camera traps that could provide comparable data but reduce disturbance to the herd.

Incorporate caribou habitat quantity and quality in monitoring and management actions proposed by the Tłı̨chǫ Government and GNWT.

- Parties should consider developing or using existing regional ecological status reports such state of vegetation plans, land use types by ecozone etc. to inform management and monitoring actions.
- Actions that track cumulative effects on landscape change, climate change, predator behaviour and harvest and using other similar tools would support better understanding of the herd to inform monitoring and management actions.
- Work collaboratively with land use planners and habitat or landscape managers to build alignment between regional landscape conservation approaches and caribou management in the Wek'èezhìı, building upon the Bathurst Range Plan (2019). Land use planning on its own is not effective given the time it takes to establish a land use plan, though its importance in supporting habitat management should not be undermined because it takes longer to complete.

Communicate the outcomes of actions on an ongoing basis to improve effectiveness of future proposed actions.

- Communicate the evaluation of the predator management program reporting on the mobile conservation zone publicly in an accessible way to support better understanding of effectiveness of actions and to inform more effective actions in the future.
- Consider a newsletter as used by the ADFG to communicate the results and next steps.

D) ADEQUATE USE OF TRADITIONAL KNOWLEDGE IN MANAGEMENT PROPOSALS

Area of Inquiry D

To determine whether ***traditional/community knowledge has been adequately used*** *in Kǫk'èetì Ekwǫ* ***management proposal submissions.***

Adequate use of traditional knowledge for the purpose of this review means that all available traditional knowledge was used to inform the proposed management and monitoring actions.

Traditional knowledge in Management Proposals

Traditional knowledge is referenced in management proposals in different ways, most which originates from the Tłı̨chǫ:

- Direct quotes from the Boots on the Ground (Ekwǫ̀ Nàxoèhdee K'è or ENK) report developed by the Tłı̨chǫ (e.g., 2022 proposal)
- Direct quotes from elders from different Indigenous groups
- Reference to the Tłı̨chǫ evidence base (e.g., traditional knowledge collected from elders through various means or shared with the Board)

Ways in which traditional knowledge was brought in to inform management proposals include:

- Elders: quotes, regular interactions, targeted engagement
- Regional workshops: with some elders and hunters (e.g., on wolves)
- Consultations with Indigenous leaders and communities
- Direct references to the ENK report
- Observations from the ENK program on habitat, foraging, fitness etc. providing background information
- Inter-governmental (Indigenous) meetings (YKDFN, LKDFN, NWTMN, NSMA)

The traditional knowledge mentioned relates to:

- The relationship between migration and behaviour of humans
- Linkages to stressors
- Linkages to traditional way of life
- Respect through knowledge of Bathurst caribou
- Respect by knowing how to discard caribou
- Migration patterns over time
- Annual cycle
- Spring and fall routes
- Vegetation and foraging behaviour in relation to migration

Traditional knowledge was referenced in proposed management and monitoring actions related to:

- Harvest targets over total allowable harvest
- Maintaining sites that are important to caribou

- Impacts of hunting on herd decline which informed education and awareness programs on best hunting practices

As capacity of Indigenous governments and organizations (namely Tłı̨chǫ Government) has increased over time, so has the availability and consideration of traditional knowledge in management proposals:

- We heard that traditional knowledge on Bathurst caribou has been more accessible since 2009 to better inform management actions, particularly given to the establishment of the Boots on the Ground program in 2016 and increased capacity to obtain traditional and community knowledge. One interviewee commented that there has been an increased blending of traditional and community knowledge and western science over time e.g., determining calf-cow ratios, harvest target approach etc. with more recognition of traditional knowledge.
- While this program was further established at the same time as the last management proposal (2022), there is more documentation of traditional knowledge in the 2016 management proposal compared to the 2022 proposal.
- The nature of the 2022 management proposal was different given it was a modified Level 1 review compared to the other management proposals (reviews with public hearings) which impacts the amount of information that needs to be compiled from traditional and western knowledge.

Traditional knowledge from the Tłı̨chǫ Government seems to be most available and therefore most heavily relied upon in management proposals:

- The Tłı̨chǫ Government is a self-governing nation with relatively more resources than other Indigenous nations to establish traditional knowledge programs, including the Boots on the Ground program, and regular traditional knowledge reports. The Boots on the Ground program established in 2016 creates an evidence base of traditional knowledge that is paramount to the adequate inclusion of traditional knowledge in the management proposal process.
- Knowledge differs among Indigenous groups, and it is important to ensure that the knowledge of all groups that are within or impacted by actions in the Wek'èezhìı can be included in management proposals as best practice for wildlife co-management. During interviews, we heard about an example where one Indigenous group could not see how

their traditional and scientific knowledge had been used in management proposals to inform management actions, particularly the predator management program and the implementation of the mobile conservation zone. Without this transparency on how input is used, it can lead to the perception that Parties weigh certain knowledges (either science or the traditional knowledge of one Indigenous group) differently which may not be appropriate.

While dialogue about traditional knowledge among Parties has increased, dialogue is still science-heavy in the technical Working Group:

- We heard that WG expertise and dialogue is weighted more heavily on biology. The GNWT is not seen to be effectively fulfilling its consultation and engagement responsibilities, which creates a perception that traditional knowledge is not adequately considered. One interviewee shared that they felt that WRRB expertise is also science-heavy and that the Board could encourage more conversation about traditional knowledge in the technical Working Group.

Recommendations

Ensure management proposals consider and reflect all best available traditional knowledge from other Indigenous group (in addition to the Tłı̨chǫ) and document how it informed Bathurst caribou management and monitoring.

- The Tłı̨chǫ Government has a great knowledge base and access to resources to build this knowledge. However, it is best practice to consider other Indigenous knowledges in the context of Bathurst caribou management given their wide geographic range and interactions with other Indigenous peoples. While the Tłı̨chǫ Government has its own program and approach for traditional and scientific knowledge collection and sharing, the GNWT should also have an appropriate approach to considering traditional knowledge beyond relying on the Tłı̨chǫ Government. The current approach of sending a letter describing the proposed actions to Indigenous governments and organizations (as mentioned in Area of Inquiry A) as the only consultation mechanism is not best practice for ensuring that all best available traditional knowledge was used to inform proposed actions.
- Parties could collaboratively evaluate the best way forward for increasing the incorporation of traditional and community knowledge by both Parties. Some options based on what we heard and our expertise are provided below:

- The GNWT may want to consider increasing their capacity to engage with traditional knowledge alongside western science by connecting their learnings from other Indigenous groups about caribou to management proposals more directly. More information and different forms of communication may be needed at a community level.
- Parties can document from whom traditional knowledge was collected or shared (even if shared outside of the formal management review process) and how it was used to inform management actions to demonstrate it is adequately considered, especially when there are conflicting inputs e.g., setting the mobile conservation zone and predator management. This recommendation is not about sharing what traditional knowledge was collected but rather the process.
- The Technical Working Group has supported increased dialogue on traditional knowledge as mentioned in Area of Inquiry A. There is an opportunity to expand the scope of this WG, or develop an alternative setting that includes traditional knowledge holders and western scientists from both Parties (such as a traditional knowledge sub-group) and explores how to bring together traditional knowledge with western science for caribou monitoring and management.

5. REVIEW FINDINGS AND RECOMMENDATIONS: AREAS OF INQUIRY E-F

E) REDUNDANCIES IN CURRENT MONITORING ACTIONS AND ALTERNATIVES

Area of Inquiry E

To determine whether there are any ***redundancies in current*** *Kǫk'èetì Ekwǫ* ***monitoring actions****, and if there are any* ***alternatives or improvements*** *to current monitoring actions*

The GNWT monitors the populations of several caribou herds: Bathurst, Bluenose East, Bluenose West, Cape Bathurst, and Tuk Peninsula herds. Here we describe the current methods used by the GNWT to monitor the population size of these herds with a focus on the Bathurst herd.

The WRRB requested that ERM review the GNWT methods within the context of similar monitoring programs for large ungulates elsewhere. ERM reviewed aerial-based population surveys for ungulates who collectively breed (where they move together into a calving ground) in a variety of circumpolar regions (for caribou) and Africa (for other migratory ungulates). The objective was to

describe survey methods and how they are similar or differ from caribou surveys conducted by GNWT.

Based on our findings we identify if there are any redundancies in current monitoring actions and identify any alternatives or efficiencies for the current approach.

GNWT Aerial Survey Methods

The following section summarizes the GNWT approach to population monitoring, based on the 2021 Bathurst caribou calving ground survey report (Adamczewski et al. 2022). This report describes a six-step process to estimate population size using calving ground surveys of breeding females and estimation of sex ratios (composition) (Adamczewski et al. 2022) using following the steps:

1. **Identify the calving ground** – Locations of collared females were used to determine the extent of the of the calving ground based on previous years and the year of survey and locate the highest density of collared animals.
2. **Aerial reconnaissance** – An aerial reconnaissance was conducted with a fixed wing aircraft to define the extent of the calving ground, stratify the area into high, medium and low-density blocks, and conduct approximate composition surveys.
3. **Aerial photo survey of high-density blocks** – An aerial survey was conducted of high-density areas, with a high flight elevation (300 m) and downward-facing camera. Two fixed-wing aircraft were used for photo transects.
4. **Aerial visual surveys of remaining blocks** - Visual surveys along transects in medium and low-density blocks were conducted using fixed-winged aircraft at low elevation, with four observers and two data recorders.
5. **Composition surveys** – Composition surveys were conducted during the calving ground survey, as well as during spring (March), summer (July) and fall (October) rut.
    a. Composition surveys were conducted by helicopter to estimate the numbers of breeding and non-breeding females on the calving ground (Adamczewski et al. 2022). Groups of <30 caribou classified from the helicopter. For groups >30 caribou the helicopter lands 100-200 m away and the survey crew classifies the herd using a spotting scope (Adamczewski et al. 2022).
    b. Spring composition surveys occur March using a helicopter to identify groups of caribou, that are then surveyed from the ground (Cluff et al. 2016, Adamczewski et al. 2024).

c. Summer and fall rut composition surveys occur in July and October, using the same methods as spring surveys (Adamczewski et al. 2020, 2024a, 2024b; Cluff et al. 2016). All individuals in an aggregation are classified. Reporting of composition numbers are total numbers of classified caribou encountered.

6. **Population estimation** - Population estimation is based on counting caribou in photos, using double observers and estimating error using a mark-recapture method, with corrections made from the composition data and potential emigration to the Bathurst herd using a Lincoln-Petersen mark-recapture estimator based on the known number of collared caribou.

Nunavut

The Government of Nunavut (GN) is responsible for population estimates for several herds, including large herds such as the Beverly, Ahiak and Qamanirjuaq and smaller herds such as the Lorillard, Dolphin and Union and Wager Bay herds. Using methods for the Qamanirjuaq herd as an example (Campbell et al. 2023), surveys are very similar to those conducted by the GNWT:

1. Collars were used to identify the calving ground.
2. An aerial reconnaissance was used to stratify the calving ground into high, medium and low-density blocks.
3. Aerial photo census was then completed in areas of high caribou density.
4. Aerial visual double observer surveys were completed in areas of lower caribou density.
5. Composition surveys were completed during calving to estimate the numbers of breeding and non-breeding females, using a helicopter that follows the visual survey transects. Composition surveys were completed by using collars to locate aggregations of caribou, which is then classified as well as the area within 20 km in each cardinal direction, and then surveys repeated for each collar.
6. Jolly's Method II for unequal sample sizes was used to analyze visual data (Jolly 1969, Norton-Griffiths 1978).

Comparison with NWT

- The methods used for caribou population surveys in Nunavut are almost identical to those in the GNWT and there is often an overlap of personnel and data analysts.

Yukon

The Porcupine caribou herd covers an area that extends into Alaska, the Yukon and the Northwest Territories. The governing agencies form the Porcupine Caribou Technical Committee which is responsible for the monitoring and management of the herd. The Fortymile herd is also managed and monitored collectively by the Yukon Government and the ADFG. To estimate the size of the Porcupine and Fortymile herds, aerial direct count extrapolations have been used since the 1970s. Surveys are conducted every 2 to 3 years during late June or early July, to correspond with post-calving and the emergence of insects (FCHMC 2020, PCTC 2018, 2019). The methods include:

1. Large aggregations of caribou were identified from GPS and radio telemetry.
2. Photographs of the large aggregates of caribou were taken from fixed-winged aircraft to be counted later. Photos were orthorectified to correct image distortions and align image with the terrain which results in a consistent scale across the entire images. The Yukon Government worked with the ADFG and the Canadian Wildlife Service to count caribou in photos.
3. Caribou found outside of large groups were visually counted and added to the total counts and the estimates are rounded to the nearest caribou.
4. Composition surveys were conducted from helicopter during the post-calving period and mid-October where up to 200 caribou are classified around each radio-collared caribou. Composition surveys classify the number of bulls per 100 cow caribou (PCTC 2018, 2019).
5. Abundance estimations followed the Rivest et al. 1998 method that accounts for: 1) the number of caribou counted in each group; 2) the number of radio-collared caribou in the photographed groups; and 3) the number of radio-collared caribou in the population being estimated.

Other monitoring completed regularly for the herd includes estimation of parturition rates based on GPS collar data and movement rates.

Comparison with NWT

- The Porcupine herd is surveyed every two to three years for population size which is consistent with the surveys of the Bathurst herd by the GNWT (every 3 years).
- Unlike GNWT that define photo stratum and visual blocks before calving flights, methodology in the Yukon focuses on finding aggregations around collared individuals during the post-calving and then photographing each grouping.
- Yukon classifies their herds during October where composition is reported as a ratio per 100 cow caribou.

Quebec

The province of Quebec has two barren-ground herds that have been monitored in the Nord-du-Québec and Labrador regions since the 1970s; Leaf River herd and the George River herd (Taillon et al. 2016, Brodeur et al. 2021). Population counts occur every two years during post-calving in early summer but otherwise follow methods like those used by GNWT (Valkenberg et al. 1984, Nagy 2009):

7. Identifying aggregations of caribou using GPS collars.
8. Aerial reconnaissance to identify aggregations of caribou and extent of the herd post-calving.
9. Photo surveys of large groups of aggregated caribou from fixed-wing aircraft with handheld cameras from a height of between 110 and 330 m in elevation and approximately 20% overlap between successive frames.
10. It does not appear that visual surveys are conducted.
11. Composition surveys are conducted in November (George River) and October (Leaf River). Aggregations are first identified from helicopter and then large groups are classified on the ground and smaller groups classified from the air.
12. Abundance estimations follow the Rivest et al. 1998 that takes into account 1) the number of caribou counted in each group; 2) the number of radio-collared caribou in the photographed groups; and 3) the number of radio-collared caribou in the population being estimated.

The Quebec government also monitors calf birth mass and adult body condition.

Comparison with NWT

- Quebec surveys caribou every two years, which is more frequently than most herds that are surveyed by the GNWT (every three years).
- The timing and methods are slightly different, with Quebec surveying during the post-calving period, while GNWT surveys are generally during the calving period. During the calving period, the females are spread out evenly on the calving ground and they do not move very quickly. However, during the post-calving, females and their calves (and some males) aggregate into large groups of >5-10,000.
- Where GNWT define photo stratum and visual blocks before calving flights, methodology in Quebec focuses on finding aggregations around collared individuals and then photographing each grouping.
- The data that results from these surveys record sub-samples of the population. Both estimate the total population size, in relation to collared animals.

- Quebec classifies their herds during November and October where composition is reported as a ratio per 100 cow caribou as opposed to total counts like GNWT do.

Alaska

Alaska supports over 30 herds of caribou – several large barren land herds such as the Western Arctic, Central Arctic, Fortymile, Mulchatna, Nelchina and Porcupine herds and several smaller herds that use barren land and mountainous terrain. The ADFG list several core activities in their monitoring program for caribou, including:

1. Capture and deploy GPS collars, and take pathogen samples during capture,
2. Population counts,
3. Estimate growth rate of various herds,
4. Estimate annual mortality rates from radio-collared females,
5. Estimate allowable harvest,
6. Estimate annual parturition rate from radio-collared females,
7. Estimate peak of calving from radio-collared females,
8. Estimate late June calf-to-cow ratios of radio-collared females and early calf survival collected by aerial surveys in a fixed wing,
9. Conduct annual fall composition surveys to estimate bull-to-cow and calf-to-cow ratios.

These objectives are common to Alaska and the GNWT programs, although the population counts are conducted using slightly different methods (ADFG 2024). Population counts for caribou in Alaska use a photo census approach for a total population count during the post-calving period. This is described as a "modified aerial photo direct count technique" following Davis et. al. 1979. These are conducted during the post-calving period in hottest part of the summer in early July when the heat and insects drive caribou to congregate into large mixed-sex groupings. The same method is used for both barren land caribou in the larger herds in the north of the State and mountain caribou elsewhere in the State (Harper 2009, 2013; Porcupine Caribou Technical Committee 2019; ADFG 2021).

The steps in the population survey process include:

1. Tracking the location of the herd through GPS collars.

2. Reconnaissance surveys using small spotter planes such as Cessna and Supercub to identify the locations of aggregations.
3. Photos surveys are conducted by fixed-wing aircraft using a downward facing digital cameras of large aggregations at 300 m elevation (1,000 ft.) and photos by hand-held cameras.
4. Visual counts are made of smaller aggregations from aircraft.
5. Composition surveys are conducted at peak rut, usually around mid-October to take advantage of the presumed mixing of bulls, cows, and calf caribou (Harper 2009). Collared caribou are used to identify groups from fixed-wing aircraft. Groups of 100 and 200 caribou surrounding the collared animals (up to a three-mile radius) are classified as cows; calves; and small, medium, or large bulls using a cluster sampling scheme (Cochran 1977). Results are reported similarly to NWT with ratios of bulls:100 cows and calves:100 cows (Harper 2009 ,2013; Lenart 2021, Porcupine Caribou Technical Committee 2019).
6. Population estimation follows the Rivest method (Rivest et al. 1998) which estimates error by 1) how collared caribou distribute among groups of known size and assumes that collared caribou randomly distribute themselves and 2) estimates the chance that a collar is in a group of caribou that was counted.

Comparison with NWT

- In general, Alaska uses very similar methods to those used by the GNWT, except the Alaskans are attempting a total count during the post-calving, as opposed to a calving ground count.
- Both jurisdictions use GPS collars and spotting planes to identify the areas to be surveyed, however Alaskan spotter planes tend to be separate smaller planes while the GNWT uses the photo-reconnaissance planes for these surveys.
- The data that results from these surveys is slightly different, with Alaska collecting a nearly complete total count, while GNWT sub-samples the population. Both then estimate the total population size, although the analysis approach is different because of the underlying difference in methods.
- Both jurisdictions conduct composition surveys; Alaska during the late calving period and during fall, while GNWT surveys during the calving period.
- Both jurisdictions estimate female survival and calving area using collar information.

Greenland

The Greenland Institute of Natural Resources has been conducting aerial surveys to monitoring native west Greenland caribou (*Rangifer tarandus groenlandicus*) and genetically mixed feral-semi-domestic reindeer (*Rangifer tarandus tarandus*) since the 1990s (Cuyler et al. 2001, 2005, 2010). The monitoring of caribou populations in Greenland is challenging due to the geographical features that isolate many coastal subpopulations. These subpopulations are often confined to smaller areas than their North American counterparts, due to natural barriers such as fjords, glaciers, steep mountains, and the surrounding ocean. Additionally, the vastness of Greenland creates logistical obstacles in wildlife monitoring and conservation efforts in the region (Cuyler et al. 2001). The most reliable way to survey caribou has been to conduct transect surveys with a helicopter:

1. Surveys occur in March, when variability in caribou group size and movement has been found to be low.
2. Stratified random strip-transects were generated and based on prior year data of caribou density for each survey region.
3. Survey locations were based on previous year's surveys, but groups of caribou are located using locations of collared female caribou in each herd.
4. Transects of 7.5 km in length and 600 m wide were flown at an altitude of 150 m and conducted with three observers, two count caribou on the left side of the helicopter and one on the right with manual clickers.
5. Composition surveys for herd structure and recruitment data were collected simultaneously with population counts. Transects of 2 km in length were selected to maximize the number of caribou that can be sexed and aged. These transects were flown in a zigzag pattern over areas with high caribou density. Sex determination was based on visible characteristics: the presence or absence of a vulva and/or a urine patch on the caribou's rump.
6. Abundance was estimated using the density of animals per transect calculated as the ratio between animals counted and area searched using the Jolly (1969) methods (Cuyler et al. 2010; Poole et al. 2013).

Correction calculations are accounted for different correction factors in each stratum and bootstrapping method to include variance of a correction factor (Effron & Tibshirani 1993, Cuyler et al. 2010).

Comparison with NWT

- Surveys in Greenland are conducted in March when movement rates of caribou are low, instead of calving or post-calving for the GNWT.
- Stratified random strip-transects are used in Greenland and generated before surveys are completed.
- Conducting composition surveys in March in Greenland provides an estimate of how many calves reach 1 year old, but does not provide a calving rate, as calving grounds or fall rut surveys do that are used by the GNWT.

Norway

In Norway, reindeer are unique as many coastal subpopulations are isolated in smaller areas to that of North American counterparts, due to glaciers, steep mountains and the sea and thus possible to census on foot. For example, reindeer in Svalbard are generally counted through distance sampling conducted along transect lines or from point locations:

1. Collars have been used on female Reindeer to determine locations before the counts, to help reduce double-counting with these techniques (Moullec et al. 2017 and 2019).
2. Transects were walked by two observers.
3. When an animal or group of animals were seen a GPS location was taken.
4. Distance was then measured to the animal or cluster of animals of interest and group size was estimated
5. For total population counts, every animal visible was counted along transects that are repeated during each season (Le Moullec et al. 2017).

When a comparison was made between these two techniques, total counts generally had higher precision estimates to that of distance sampling, however there was not statistical difference between the two for estimating abundance (Moullec et al. 2017).

Comparison with NWT

- Norway has much smaller subpopulations of reindeer than that of North American Caribou and the reindeer dispersal is restricted by the terrain. As such, distance sampling on the ground is an appropriate method, but would be difficult to transfer to the Canadian Arctic.

Russia

Few documents on Russian survey methods have been translated to English, however some literature suggests that to monitor total abundance of reindeer herds, aerial surveys have been

the most common method since the 1970s (Baskin 2005). Within hunting management units, snow tracking was also used to calculate general numbers in regions (Baskin 2005). Post-calving aggregation photography method has been reported during the 1970s and 80s (Baskin 2005, Petrov et al. 2020). Visual surveys from aircraft were common before the 2000s (Baskin 2005). Starting in the 2000s the use of handheld GPS units improved visual survey population estimates.

Post-calving aggregation photography and visual surveys as outlined in the CircumArctic Rangifer Monitoring and Assessment (CARMA) Network have been referenced in Russian literature, however, it is unclear the specific methodology used (Gunn and Russell 2008). Information accumulated through Taimyr Reindeer Migration Reanalysis (TAMARA) project outlined survey methodology used in that part of Russia (Petrov et al. 2020), including:

1. Population surveys were completed mid to late July, presumably in the post-calving or early summer when caribou are in large aggregations.
2. Reconnaissance flights with five observers were used to find aggregations of reindeer and then preliminary visual estimates were recorded.
3. Flights followed 10-20 km transects across the reindeer concentrations that were detected in reconnaissance flights where groups larger than 1,000 animals were photographed, lower densities of animals were visually counted. Aircrafts flew ~300 m above the ground and at a low speed (150-180 km/hour).
4. Specific statistics could not be found but based on the following, "'population density' method (calculation of population density based on selected aerial images and extrapolation)" and the use of Gunn and Russell 2008 manual, could be they used a similar technique to what is used in Alaska and Canada; the Lincoln-Petersen Index applied to radio telemetry (Russell et al.1996).

Comparison with NWT

- Russia appears to conduct population counts during the post-calving or early summer, using cameras and visual surveys, which is similar to the methods used in Alaska and Quebec.
- The detailed methods, methods for estimating error and actual precision are difficult to determine due to the lack of source material.
- It is unclear if Russia completes compositional surveys.

Africa

Population counts are conducted for large mammals in a variety of African countries. Wildebeest populations are similar to caribou in that many populations are migratory, have a well-defined calving ground and aggregate into very large groups post-calving. ERM has reviewed population counts in three areas: Serengeti Park, Tanzania, Kruger Park, South Africa, and Kenya.

Serengeti Park, Tanzania

Aerial Point Surveys for wildebeest and other antelope (Grant's Gazelle, zebra, etc.) follow very similar methods to those used by the GNWT, partly due to the location of the surveys on the Serengeti plains where there is minimal tree cover and wildebeest can be counted from directly above (TAWIRI 2023). During February, wildebeest congregate on the Serengeti plains, calve and then by March have collected into large post-calving aggregations. Methods include:

1. Satellite collars were first used to identify the calving area.
2. Reconnaissance flights were then conducted by fixed wing aircraft in the two days preceding the photo census to identify the area to be flown. Reconnaissance flights conducted equipment tests and developed a calibration for elevation by comparing the elevation of the camera with observed height of cones on the ground (later used to estimate calf height).
3. Aerial photo survey flights occurred at 300 m / 100 knots along transects above the calving ground (30 transects in 2023).
4. In total a coverage of approximately 4-5% is achieved with the Aerial Point Survey, which is quite low compared to the total counts in Alaska and the 10% conducted by the GNWT.
5. Composition surveys were conducted from the ground along road transects in the post-calving period.
6. Wildebeest in photos were counted three times by volunteers and a population estimate calculated using Jolly's Method II (Jolly 1969).

Kruger Park, South Africa

Similar to the Serengeti, Kruger National Park has conducted population census on various migratory animals since the 1960s, using aerial counts and ground counts. Fixed-wing aerial counts outlined by Joubert (1978-1986) were used during the 1980s which used a rear seat observer method (Norton-Griffiths 1973, Eiselen 1994, Lamprey et al. 2020). The method followed the following steps:

1. The park was separated into eight census districts then further separated into census blocks.
2. One census block was surveyed at a time using a strip transect method where each transect is uniquely identified and having a width of 800 m.
3. In each strip transect, animals were counted by four observers, two on each side of the fixed-winged aircraft.
4. Each strip transects acted as a sample unit and used in Jolly's Method II (Jolly 1969) to estimate population numbers of target species.

After 1998, aerial line-transect sampling using fixed-wing aircraft and Distance analysis replace "total" count methods (Kruger et al. 2008, Botha et al. 2008). This method involves:

1. Kruger National Park was divided into East to West transects.
2. Surveys were flown with a fixed wing aircraft (~76 m above the ground) fitted with a frame structure outside each window, which was calibrated to give four distance classes: A = 0–50 m, B = 50–100 m, C = 100–200 m and D = 200–400 m.
3. Two observes on either side of the aircraft recorded counts of animals within the frame structure. Coverage of the surveys have varied between 15%- 28% coverage of the park between 1990s and 2006 (Kruger et al. 2008).

The switch in methodology to distance sampling was largely based on known visibility biases resulting from the failure of observers to detect all individuals. An audit of the survey data 1981 and 1993 (Redfern et al.2022) reported that older data included unmeasured, systematic errors and so was limited in its utility for research and management questions (Krugar et al. 2008, Redfern et al. 2022).

Kenya

Kenyan parks use a variety of method, with fixed-wing visual counts being the most common:

1. A fixed-wing aircraft followed a systematic flight pattern of transects, aligned to a spatial grid-system.
2. Two to four rear seat observed counted animals within sample strips defined on each side of the aircraft.
3. Observation data was then coupled with the Jolly II analysis for unequal sized sample units (Jolly 1969).

Lamprey et al. (2020) reported that these methods missed, for example, 60% of giraffe and 66% of the large antelope herds. Improvements to technology has provided the opportunity to update this long-term methodology with the first oblique-camera count by Lamprey et al. 2020, including:

1. Using a fixed-winged aircraft with two high-resolution camera systems were mounted at a 45° angle on the right-side of the aircraft. The cameras were set up to capture a strip transect standard to the previous census width (130-150 m).
2. Cameras were obliquely corrected to capture animals that use trees for shade in the height of day.
3. Cameras automatically operated for 4 hours and images were captured at a 2 second interval to provide 46% overlap.
4. All photos were geo-referenced using UTM coordinates and linked to GPS tracking log.
5. The images were then interpreted for species numbers in a laboratory.

The oblique camera-counts generate population estimates that were significantly higher and more consistent than those derived from RSO counts. The surveys increase the national population estimate for Uganda Kob by 77% (Lamprey et al. 2020). While the authors of this study acknowledge that the traditional methods used in Africa compared to census populations are still valid, the oblique camera method is a significant step in the evolution of more accurate and automated wildlife counting.

Comparison with NWT

- Photo census techniques are used in Africa for high density survey blocks, with lower density blocks or areas using visual surveys.
- African census used a slightly smaller aircraft Cessna 206, compared to a Cessna Caravan but fly at similar speeds but at a lower altitude 76 m compared to 120 m above land.
- Both GNWT and most censuses completed in Africa use sub-population counts that are then extrapolated to determine estimated population size.
- Composition flights are not as common in Africa.

Central Asia and Mongolia

Central Asia supports extensive areas of steppe ecosystem, home to several species of migratory antelope such as Saiga antelope (*Saiga tatarica*) and Mongolian gazelle (*Procapra gutturosa*). As outlined by the International Union for the Conservation of Nature Saiga antelope report states

that "*Counts made using appropriate methods (aerial surveys with strip sampling in Kazakhstan, ground surveys with distance sampling in Mongolia) enable precision of the count to be estimated, and reduce, but do not eliminate, bias*" (IUCN SSC Antelope Specialist Group 2023).

Early abundance monitoring in Uzbekistan and Mongolia utilized ground sampling techniques, with transect sampling with off-road motor vehicles, for counting Saiga in protected areas (Lushchekina et al. 1999; IUCN SSC Antelope Specialist Group 2023). Aerial surveys are more commonly conducted now to estimate population numbers, for the now 2.4 million Saiga (Okhotzooprom and Abdrakhmanov 2023; Altyn Dala Conservation Initiative 2024). Survey methods include:

1. Surveys occur in late April and early March, which is the post-calving season for Saiga.
2. Aerial reconnaissance surveys identify aggregations of Saiga and classify the densities into high, medium and low.
3. Aerial surveys using a helicopter survey the three strata at increasing effort (closer survey lines) with increasing density.
4. Counts of groups are conducted by observers or hand-held SLR cameras and then later counted on a computer; there does not appear to be any downward facing photo surveys. Counts are reported in heads of Saiga per square kilometre (Serikbayeva et al. 2023)
5. For ground-based distance sampling, density estimates used Thoman et al. 2010 methodology where the effective area surveyed is the product of double the effective strip half-width and the transect length.
6. Seasonal ground-based monitoring at annual post-calving sites are conducted to determine sex ratios and number of calves per female (CMS 2021).
7. The abundance estimate is calculated by multiplying the density by the surface area of the study area. Encounter rate variance is estimated empirically using replicate transect lines (Buuveibaatar 2015).

There have been many challenges with political climate, the remoteness and sparse human population, along with the challenging terrain that have made ungulate species particularly hard to monitor in Central Asia (Singh and Milner-Gullan 2011). Aerial survey using helicopter strip transects have been used regularly for Saigas in Kazakhstan but have not translated into Central Asia (Okhotzooprom and Abdrakhmanov 2023; Altyn Dala Conservation Initiative 2024). Satellite imagery has also been explored as a tool for counting and tracking Saiga populations (Rozhnov et al., 2014). Additionally, participatory monitoring methods have been used in countries like Kazakhstan and Uzbekistan to engage local communities in Saiga conservation efforts (Danielsen et al., 2009; Kuhl et al., 2009; Singh and Milner-Gullan, 2011).

Comparison with NWT

- Methods for estimating populations of ungulates are generally similar between Central Asian Steppe and those methods used by GNWT – conducting a reconnaissance on the then aerial transects with photography and visual counts.
- Ground-based composition counts are also used.
- Although very different landscapes exist between central Asia and NWT, the idea of participatory monitoring and community involvement in isolated communities is a case study that could lend well to the remote communities of NWT and the Arctic at large.

The GNWT is following a standard approach for aerial survey techniques as they are similar across jurisdictions, with most following the same six steps that the GNWT uses:

1) Identify calving ground from collars
2) Conduct an aerial reconnaissance to stratify the survey area
3) Aerial photo surveys
4) Aerial visual surveys
5) Composition counts
6) Statistical estimations.

- The principal differences between groups surveying open country (no trees) is whether the surveys are conducted 1) as a sub-sample of the population during calving when females are spread out on the calving range (NWT, Nunavut, Serengeti, and Kruger) or 2) as a total count during post-calving when animals are grouped into large aggregations with a mixture of males and females (Yukon, Alaska, Quebec, Russia).
    - Both timing and methods have their advantages, but it is beyond the scope of this review.
    - Note that once a survey technique has been adopted, it is advantageous to stay with that technique to allow for easier comparison between surveys and population modeling.
- All jurisdictions used collar data to identify the potential survey area (whether that's calving or post-calving) if the collar data is available.

- Reconnaissance surveys were flown in all jurisdictions – sometimes by smaller aircraft (e.g., Alaska).
- Researchers are using a variety of methods for composition surveys at different times of year – this was one of the largest sources of variability between methods in different jurisdictions. Approximately two thirds of jurisdictions conduct composition surveys during calving/post-calving surveys, with the remainder typically surveying during the fall rut.
- Statistical methods across jurisdictions typically include using Jolly's Method II (Jolly 1969) or the Rivest method (Rivest et al. 1998), however, the GNWT uses several semi-custom methods for estimating population sizes.

There are some redundancies in conducting photo censuses with multiple aircraft and multiple composition counts.

- Photo censuses are the dominant methodology for counting ungulate populations – in both calving and post-calving survey types.
- Hand-held photos are also used of particularly large groups during post-calving surveys. Most surveys use a fixed wing aircraft for photo census. Most jurisdictions in the Arctic use one plane for calving ground surveys, but the GNWT use two aircraft for photo census on the Bathurst calving ground, which may be redundant.
- In addition, visual surveys with rear-seat observers in fixed-wing aircraft are frequently employed, particularly in lower density survey blocks or environments.

There are redundancies in conducting composition counts.

- The GNWT conducts aerial and ground-based composition counts (ratio of males to females to calves) during years with aerial population counts of the Bathurst herd (every three years), as well as late winter composition surveys in most years since 2000.
- There may be trade-offs to consider when selecting a methodology. For example, the availability of data and the cost and disturbance to animals for composition counts.

The GNWT uses a series of semi-custom statistical analyses which may be redundant but further review is needed.

- The GNWT's statistical methods are advancements on traditional methods to estimate and control various sources of variation – from observer bias to error in composition data and error due to emigration.
- It is beyond the scope of this review to conduct a detailed statistical assessment of the GNWT's methods, which makes it challenging to assess whether these are redundant at this time.

Recommendations

Based on the exploration of alternative methods for counting ungulates, we have identified several opportunities to reduce redundancies in surveys conducted by the GNWT that would improve effectiveness and efficiency:

Consider whether population survey frequency needs to be changed using scientific and traditional knowledge lenses:

- The survey frequency of caribou herds varies greatly from every two years for the Porcupine herd in Yukon, every three years for Bathurst, and up to four to six years for herds in Alaska and other herds in NWT. Surveys can disturb caribou but provide valuable information on population size that cannot currently be gathered practically by other means in tundra environments. Survey frequency is therefore a balance between the need for data and the costs and disturbances to the animals. However, for context, surveys every three years, is within the frequency bounds used by other jurisdictions.

Reduce the number of aircraft:

- Using one fixed wing aircraft would result in less disturbance to caribou and costs to GNWT while maintaining similar data quality. There is an opportunity for the WRRB to discuss this approach and its implications with GNWT.

Consider eliminating composition counts:

- Composition counts offer a good way to estimate if the population is growing or declining (from the calf:adult ratio) without having to do a full population count – and as such offer a lower-cost and lower-disturbance option to track population trajectories. Values of calves:100 cows do not vary considerably from year to year, so this is a survey that may not be required every year.

Consider a review of statistical analysis approaches for estimating populations:

- The WRRB or GNWT may wish to consider a separate statistical review of current statistical methods.

F) EMIGRATION: ACCURATE DESCRIPTION AND INFORMING ACTIONS

Area of Inquiry F

*To determine whether the **potential impacts of emigration have been accurately described** and **used to inform management and monitoring** actions.*

The Western science tradition has been to name caribou herds based on the location of their calving ground, e.g., Bathurst caribou calve near Bathurst Inlet. Many barren-ground herds have overlapping summer, fall and winter ranges but are defined by their calving range location. Emigration occurs when a female switches to the calving ground of another herd – either temporarily or permanently. This can conceivably occur where the winter grounds of two herds overlap and Bathurst females follow the females of another herd (e.g., Beverly herd) to their calving grounds. It is also possible for females to switch herds for one year and then return to their original herd's calving ground the following year.

In some cases, females from a declining population may join a larger herd at their calving range, thus subsuming one herd into another. There are reports that this is what happened to the Beverly herd as it declined and ultimately joined the Ahiak caribou to calve in the Queen Maude Gulf area (Adamczewski et al. 2015).

The WRRB would like ERM to describe monitoring methods for emigration by other jurisdictions and compare to how this is being monitored and reported by the GNWT.

Several academic studies have reported observations of caribou "switching" herds since the 1980s, but sample sizes of collared females to study have typically been low (Davis et al. 1986; Person et al. 2007; Roffler et al. 2012, Adamczewski et al. 2015).

Studies of herd "switching"

Alaska

Alaska has 32 herds and some of the largest exists on the North Slope, an area of tundra extending south from the Arctic Ocean. This area is home to four large herds that exhibit large spatial overlap, particularly in the fall and winter, as well as very little genetic separation (Person

et al. 2007). In a 15-year study of over 80 satellite and GPS-collared caribou Person et al. (2007) monitored individuals form Teshekpuk caribou herd (TCH), to determine if individuals exhibited emigration. Emigration was defined as individuals who were collared within 50 km of Teshekpuk lake and were found in the calving grounds of the Western Arctic Herd (WAH) or the Central Arctic Herd (CAH) in subsequent calving seasons. There was an apparent emigration rate of 6.9%, where one male and five female TCH caribou joined the breeding populations of the WAH (2) and CAH (4).

In the late 1990s and early 2000s Rolffer et al. (2012), monitored movement of 70 collared female caribou from the Nelchaina and Mentasta herds. Over a seven-year period, females were monitored for evidence of switching to the other herd's calving ground by calculating the 95% utilization distribution during the calving season. The percent overlap of each of the herd's breeding range was then calculated, and then individuals were located by aerial radiotelemetry every four to six weeks throughout the year. Of 48 collared Mentasta female caribou, only one emigrated (changed calving areas).

Prichard et al. (2020) studied the movements and distribution of female caribou 2003-2015 from the WAH, CAH, Teshekpuk Caribou Herd (TCH) and Porcupine Caribou Herd (PCH). The study was interested in how often individual caribou from one herd are associated with, or migrate into, another herd, how frequently caribou in each of the four herds move between one another, how long do individuals stay with a different herd once they switch and how much overlap occurs between the seasonal ranges of the herds. Location data was used to calculate a metric of herd interchange (MHI) and switching was recorded if a female MHI value followed a different herd for four weeks. The Metric of Herd Interchange (MHI) is based on two components: the Herd Range Component (HRC) and the Adjacent Caribou Component (ACC). For each week of the year, a Utilization Distribution (UD) surface is calculated using Kernel Density Estimation (KDE) for each herd. These UD values are then converted into density contour isopleths, which measure caribou density within a herd—values close to zero indicate high density, while values close to one indicate low density. The HRC is calculated for each caribou location by comparing isopleth values for two herds, determining the relative probability of a caribou belonging to one herd versus another.

The Adjacent Caribou Component (ACC) for each caribou location was calculated by determining the distance to the nearest caribou from each herd each week. This is based on the mean distance of the nearest 20% of radio-collared caribou to each herd, using a percentage to avoid biases from differing collar numbers across herds. This method ensures an adequate sample size while accounting for herds with large or dispersed distributions. Values close to 1 indicate a high probability of the caribou being with its original herd, while values close to 0 suggest a low

probability relative to an alternate herd. The MHI was calculated as the mean of the HRC and ACC, with each component receiving equal weight. If an individual had a mean MHI below a set cut point that individual was assigned to another herd. To examine herd overlap and inter-herd movements, the proportion of each of the other three herds' Utilization Distribution (UD) within the 75% isopleth of a given herd for each week (across all years) was calculated. This metric measured the extent of overlap in herd ranges throughout the year, defined by the proportion of animals from adjacent herds rather than just the overlapping area.

The percentage of caribou locations assigned to other herds ranged from 0.9% to 8.7% for females across the four herds. The highest inter-herd movement rates were observed in the two smaller herds (TCH at 6.8% and CAH at 8.7%) which could suggest that there may be a tendency of caribou to join larger groups or move to areas of higher caribou density. Most movements were to adjacent herds, with minimal movement to non-adjacent herds. The TCH and the CAH had the highest rates of inter-herd movements, whereas the PCH did not have any locations outside of its own herd range for the first seven years of the data (Prichard et al. 2020). Most switching occurred in spring migration (May) and calving and post-calving (June and July) as well as deep winter (December-February).

NWT

In a preliminary report for the WRRB, Gurarie et al. (2024) examined the annual extent of seasonal range overlap between the largest herds in the NWT: Bathurst, Bluenose East, and Beverly herds. In this study male caribou were retained in the data and the total caribou locations were not disclosed, only the total number or collared individuals per herd per year. Using a Volume of Intersection (VI) Statistic which looks at the shared volume of overlap of kernel densities, the study looked at VI indices for each year, across herd and individuals and then considered seasonality and looked at intra-herd overlap across the entire year (Gurarie et al. 2024). The study reported that Bathurst caribou had high VI winter overlap with the Bluenose East herd during 2006-2013 and high VI winter overlap with the Beverly herd in 2021. Overall, VI overlap among herds decreased during spring (calving) and summer as herds went to their separate calving grounds and were higher in fall-winter.

Caribou occur in large groups in the summer, likely to avoid per-capita insect harassment (Gurarie et al. 2024). Both papers reported greater overlap between herds in the winter. One may argue that the inclusion of 281 male caribou in the Gurarie et al. 2024 paper may influence the level of overlap, due to the different life histories and behaviour of male caribou, compared to Prichard et al. 2020 who only retained female caribou.

Both papers provide useful insight into herd switching and how to measure it. However, Gurarie et al. (2024) screened out emigration from the Bathurst to the Beverly herd so there is a data gap in available information on switching between these herds. One important caveat is that a long time period should be used when studying switching. Prichard et al. (2020) reported that some female caribou returned to their initial herd after 300 days of being with a different herd and a few caribou, specifically from the smaller herds, stayed with a different herd for over two years before returning to their initial herd.

As part of their population estimation, the GNWT tracks how many collared female Bathurst caribou are west of Bathurst Inlet (in their calving grounds) and east of Bathurst Inlet (in the Beverly/Ahiak calving grounds) (Adamczewski et al. 2022). These data are used to calculate the true population size of the Bathurst caribou. However, yearly values of switching are not provided in the population estimation reports provided for review.

Emigration is not directly reported by the GNWT to inform management and monitoring actions but is accounted for in population counts.

Where studies have been conducted, herd switching appears to be a relatively common occurrence between adjacent herds, perhaps particularly those with a high level of seasonal range overlap, and particularly between small herds or from small herds to large herds. The statistical tools to define switching also appear to be well developed. The GNWT does not appear to report separately the rate of emigration but accounts for emigration and herd switching in their population counts. For instance, when calculating the total Bathurst population size Adamczewski et al. (2022) used collar location to account for the proportion of Bathurst females that were calving with the Beverly herd east of Bathurst Inlet.

Recommendations

ERM determines that the potential impacts of emigration have been accurately described and used to inform management and monitoring actions and does not have any recommendations at this time.

6. CLOSING

The Board and Parties have improved collaboration and their working relationships to support more effective and efficient caribou management. Regular engagement through the Working Group, and some engagement with other affected parties has helped incorporate different perspectives and knowledge. There are some opportunities to further evolve the management proposal process to strengthen working relationships among Parties, the Board and other Indigenous groups. There may be trade-offs in the efficiency and effectiveness of the process based on choices to be more inclusive of more Indigenous groups and to be more transparent with recommendations by the Board and responses from Parties, which the Board and Parties should consider together with this report.

While the Board considers all best available scientific and traditional and community knowledge, capacity of Parties and the Board and the availability of knowledge limit how effectively these can be considered in the review process. While consultation and engagement with different Indigenous groups occur, more transparency and clarity on how Parties consider traditional knowledge will assist Indigenous governments and organizations on understanding how their input is used.

From an external perspective, the recommendations by the Board and proposed actions by Parties have been sound. There is room to improve the clarity and intent of recommendations and consider a comprehensive set of monitoring and management actions that address the herd's population size as well as the herd's habitat. Improving understanding of the causes of population change and emigration is critical to ensuring the implementation of the right set of management and monitoring actions.

From a process perspective, we observe that using an adaptive management framework to track and adjust recommendations, will support an ongoing approach to assess the impact and effectiveness of monitoring and management actions.

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APPENDIX A: DOCUMENT LIST

The following documents, identified by the WRRB and validated by ERM, were used to assess the areas of inquiry.

Table 5: List of documents reviewed

#	Source	Description
1	(2010) Re: Recommendation Report – Revised Joint Proposal WRRB	2010 Report on a Public Hearing & Reasons for Decisions Report
2	(2010) WRRB Public Hearings Adjournment – Revised Joint Proposal on Caribou Management Actions in the Wek'èezhìi	2010 Joint Proposal Submission on Caribou Management Actions in Wek'èezhìi
3	(2010) Re: Recommendation Report – Revised Joint Proposal ENR & TG	2010 Recommendation Report from the GNWT Department of Environment & Natural Resources and the Tłı̨chǫ Government
4	(2016) Joint Management Proposal for Bathurst Caribou	2016 Joint Management Proposal Submission on Caribou Management Actions in Wek'èezhìi
5	(2016) Response to WRRB's Reasons for Decision Related to Joint Proposal for the Management of the Bathurst (Barren-ground caribou) Herd	Government Response to WRRB's 2016 Reasons for Decision Report
6	(2016) WRRB Recommendations #1-2016 and #2-2016 from Decision Report on Bathurst Herd (May 26, 2016)	Government Response to WRRB's 2016 Recommendations from Reasons for Decision Report

#	Source	Description
7	(2016) Response to WRRB's Reasons for Decision Related to Joint Proposal for the Management of the Bathurst (Barren-ground caribou) Herd, Part B	Government Response to WRRB's 2016 Reasons for Decision Report
8	(2016) WRRB Reasons for Decision Final Report, Part A – Bathurst Caribou Herd	WRRB's 2016 Reasons for Decision Report, Part A
9	(2016) WRRB Reasons for Decision Final Report, Part B – Bathurst Caribou Herd	WRRB's 2016 Reasons for Decision Report, Part B
10	(2022) Joint Management Proposal for Kǫk'èetì (Bathurst) Ekwǫ̀ Herd	Government Response to the WRRB's 2022 Joint Management Proposal Submission
11	(2022) Wek'èezhìi Renewable Resource Board Joint Management Proposal	2022 Joint Management Proposal Submission
12	(2022) Estimates of Breeding Females & Adult Herd Size and Analyses of Demographics for the Bathurst Herd of Barren-ground Caribou: 2021 Calving Ground Photographic Survey	2022 Calving Ground and Survey Report
13	(2022) WRRB Recommendations – Kǫ̀k'èetı ekwǫ̀ (Bathurst Caribou) Herd	Government Response to WRRB's 2022 Recommendations
14	(2022) Re: Joint Management Proposal for Kǫk'èetı (Bathurst) Ekwǫ̀ Herd	Government Response WRRB's 2022 Joint Management Proposal
15	Ekwǫ̀ Nàxoèhdee K'è 2022 Results	2022 Bathurst Caribou Monitoring Report

#	Source	Description
16	Bathurst Caribou Management Plan	Bathurst Caribou Management Plan
17	Caribou Migration and the State of their Habitat: Tłı̨cho Knowledge and Perspectives on ekwò̠ (Barrenland Caribou)	Tłı̨cho Traditional Knowledge Report on Caribou Migration and the State of their Habitat (2014)
18	(2008) Barren-Ground Caribou Management in the Northwest Territories: An Independent Peer Review	Alberta Research Council Independent Review of the GNWTs Barren-ground Caribou Program 2009
19	2024 Draft Rules for Management Proposals	Draft Rules for Management Proposals

APPENDIX B: INTERVIEW QUESTIONS

PARTIES

1) What is your role in WRRB's process for reviewing management proposals?
2) What works well in the Board's process?
3) Are there any opportunities to improve the efficiency and/or effectiveness of the Board's process?
4) Do you think WRRB's determinations and/or recommendations have been appropriate for managing Bathurst Caribou? Why or why not? Please consider the recommendations that governments rejected or varied and why, and the effectiveness of recommendations that were accepted.
5) How could WRRB's determinations/recommendations be improved?
6) How effective are the management and monitoring actions proposed by your organization and/or other Parties to the agreement: not effective, somewhat effective, effective? *Please provide a rationale for your response.*
7) How have you used traditional/community knowledge in management proposal submissions?

8) Do you think traditional/community knowledge has been adequately used by Parties to the Tlicho Agreement? Why or why not?

8) Do you have any additional comments or thoughts that we haven't discussed?

EXTERNAL INTERVIEWEES

1) What is your role in WRRB's process for reviewing management proposals?
2) What works well in this process?
3) Are there any opportunities to improve the efficiency and/or effectiveness of the process?
4) Do you think WRRB's determinations and/or recommendations have been appropriate for managing Bathurst Caribou? Why or why not? Please consider the recommendations that governments rejected or varied and why, and the effectiveness of recommendations that were accepted.
5) How could WRRB's determinations/recommendations be improved?
6) How effective are the management and monitoring actions proposed by your organization and/or other Parties to the agreement: not effective, somewhat effective, effective? *Please provide a rationale for your response.*

7) Do you think traditional/community knowledge has been adequately used by other Parties to the Tlicho Agreement? Why or why not?
8) Do you have any additional comments or thoughts that we haven't discussed?

APPENDIX C: THE WRRB'S MANAGEMENT PROPOSAL REVIEW PROCESS

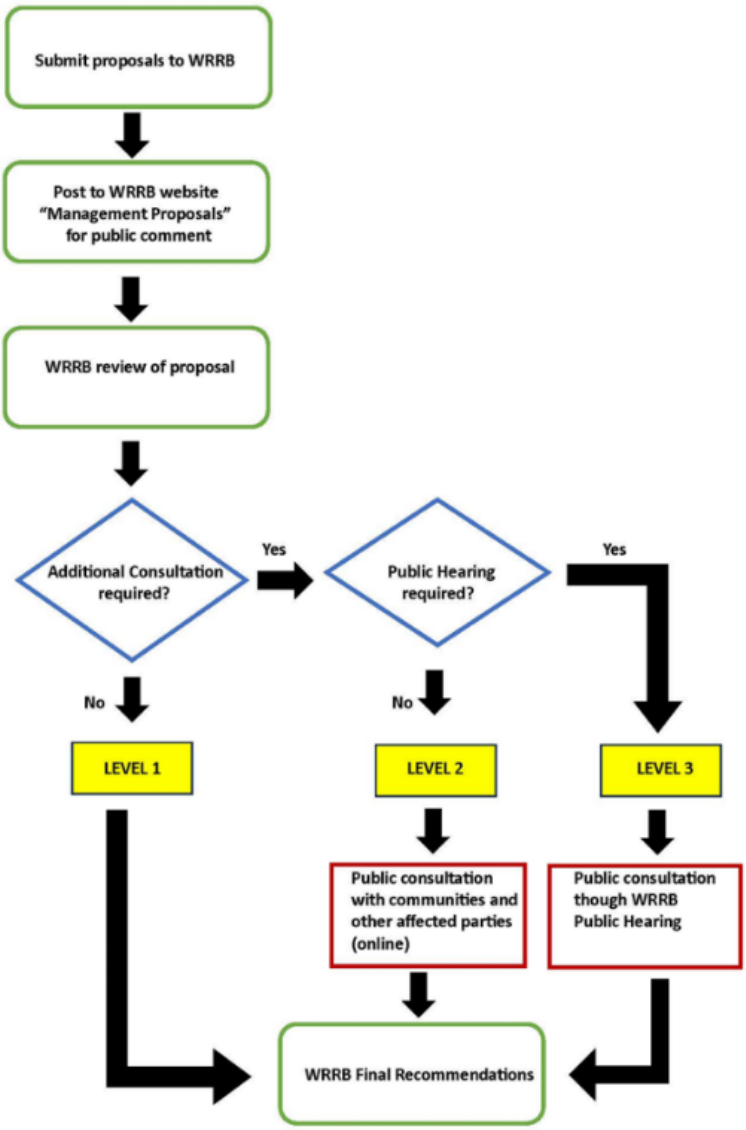

Figure 4: The WRRB's management proposal review process

APPENDIX D: WRRB RECOMMENDATIONS AND DETERMINATIONS

Table 6: Appropriateness of Management Proposal Recommendations and Determinations

#	Year	Recommendation	Appropriateness (Y/N)
2010			
1	2010	The Board recommends that the Tłı̨chǫ Government and ENR report annually on the overall success of the harvest target approach in meeting the objectives of effective collaborative management and the long-term recovery of the Bathurst caribou herd	Y
2	2010	The Board recommends that all commercial harvesting of Bathurst caribou within Wek'èezhìi be set to zero for the 2010/11, 2011/12 and 2012/13 harvesting seasons.	Y
3	2010	The Board recommends that all outfitted harvesting of Bathurst caribou within Wek'èezhìi be set to zero for the 2010/11, 2011/12 and 2012/13 harvesting seasons.	Y
4	2010	The Board recommends that ENR and Tłı̨chǫ Government, prior to the next survey of the Bathurst caribou herd, provide the Board and make public their positions with regard to the reinstatement of outfitting within Wek'èezhìi	Y
5	2010	The Board recommends that all resident harvesting of Bathurst caribou within Wek'èezhìi be set to zero for the 2010/11, 2011/12 and 2012/13 harvesting seasons.	Y
6	2010	The Board recommends that ENR and Tłı̨chǫ Government, prior to the next survey of the Bathurst caribou herd, provide the Board and make public their positions with regard to the reinstatement of resident harvesting within Wek'èezhìi. In developing this position, the Governments will review, assess, and implement, where conservation permits, a limited-entry draw system to facilitate the reinstatement of resident harvesting at the earliest opportunity.	Y
7	2010	The Board recommends the establishment of a harvest target of 300 Bathurst caribou per year for the 2010/11, 2011/12 and 2012/13 harvesting seasons	

#	Year	Recommendation	Appropriateness (Y/N)
8	2010	The Board recommends allocating the annual harvest target of Bathurst caribou between Tłı̨chǫ Citizens and members of an Aboriginal people with rights to hunt in Môwhì Gogha Dè Nîîtåèè as follows: • Tłı̨chǫ Citizens – 225 • Members of an Aboriginal people with rights to hunt in Môwhì Gogha Dè Nîîtåèè - 75	Y
9	2010	The Board recommends the harvest of Bathurst caribou should target an 85:15 bull/cow harvest ratio, i.e. the annual harvest of Bathurst caribou cows should be less than 45.	Y
10	2010	The Board recommends that if the Tłı̨chǫ Government and/or ENR have information to suggest that the harvest of Bathurst caribou has or will in the near future exceed the harvest target of 300 by 10% or more, then regulations should be put in place to close all harvesting in areas occupied by the Bathurst herd. If the harvest of Bathurst caribou exceeds the targets of 300 caribou by greater than 10%, the Board reserves the right to reconsider its recommendations and implement a TAH.	Y
11	2010	The Board recommends that if the Tłı̨chǫ Government and/or ENR have information to suggest that the harvest of Bathurst caribou has or will or in the near future materially exceed 45 cows, then regulations should be put in place to close all harvesting in areas occupied by the Bathurst herd. If the harvest of Bathurst caribou materially exceeds the targets of 45 cows, the Board reserves the right to reconsider its recommendations and implement a TAH.	Y
12	2010	The Board recommends that ENR should, in discussion with the Tłı̨chǫ Government and other Aboriginal groups, identify and make public, prior to the annual fall hunt, areas within which the harvest will be attributed to the Bathurst caribou herd. The Board and public should be advised of any changes to these areas made necessary by movements of the caribou.	Y

#	Year	Recommendation	Appropriateness (Y/N)
13	2010	The Board recommends that ENR should, in discussion with the Tłı̨chǫ Government and other Aboriginal groups, identify and make public, prior to the annual winter hunt, areas within which the harvest will be attributed to the Bathurst caribou herd. The Board and public should be advised of any changes to these areas made necessary by movements of the caribou.	Y
14	2010	The Board recommends that all commercial, outfitted and resident harvesting from the Bluenose-East caribou herd within We'èezhìi be set to zero for the 2010/11, 2011/12 and 2012/13 harvesting seasons.	Y
15	2010	The Board proposes the establishment of a harvest target of 2800 Bluenose-East caribou per year for the 2010/11, 2011/12 and 2012/13 harvesting seasons. The annual harvest target and its allocation should be finalized in discussions between the existing wildlife co-management boards and Aboriginal governments in the Sahtu, Dehcho and Tłı̨chǫ. The Tłı̨chǫ Government should determine distribution of the allocation within Tłı̨chǫ communities.	Y
16	2010	The Board recommends the harvest of Bluenose-East caribou should target an 85:15 bull/cow harvest ratio, i.e. the annual harvest of Bluenose-East caribou cows should be less than 420.	Y
17	2010	The Board recommends that if the Tłı̨chǫ Government and/or ENR have information to suggest that the harvest of Bluenose-East caribou has or will in the near future exceed the target by 10% or more, then regulations should be put in place to close all harvesting in areas occupied by the Bluenose-East herd.	Y
18	2010	The Board recommends that if the Tłı̨chǫ Government and/or ENR have information to suggest that the harvest of Bluenose-East caribou has or will or in the near future materially exceed 420 cows, then regulations should be put in place to close all harvesting in areas occupied by the Bluenose-East herd.	Y

#	Year	Recommendation	Appropriateness (Y/N)
19	2010	The Board recommends that ENR should, in discussion with the Tłı̨chǫ Government and other Aboriginal groups, identify and make public, prior to the annual fall hunt, areas within which the harvest will be attributed to the Bluenose-East caribou herd. The Board and public should be advised of any changes to these areas made necessary by movements of the caribou.	Y
20	2010	The Board recommends that ENR should, in discussion with the Tłı̨chǫ Government and other Aboriginal groups, identify and make public, prior to the annual winter hunt, areas within which the harvest will be attributed to the Bluenose-East caribou herd. The Board and public should be advised of any changes to these areas made necessary by movements of the caribou.	Y
21	2010	The Board recommends that the Tłı̨chǫ Government and ENR do not provide harvester assistance and/or incentives to access the Bluenose-East herd.	Y
22	2010	The Board recommends that the Tłı̨chǫ Government consider negotiating caribou harvesting overlap agreements with Nunavut and the Sahtu region to make certain that existing relationships endure.	Y
23	2010	The Board recommends that all commercial, outfitted and resident harvesting from the Ahiak caribou herd within We'èezhìi be set to zero in order to prevent incidental harvest of Bathurst caribou for the 2010/11, 2011/12 and 2012/13 harvesting seasons.	Y
24	2010	The Board recommends that the Tłı̨chǫ Government and ENR do not provide harvester assistance and/or incentives to access the Ahiak herd.	Y
25	2010	The Board recommends that the Tłı̨chǫ Government consider negotiating caribou harvesting overlap agreements with Nunavut and the Akaitcho region to make certain that existing relationships endure.	Y

#	Year	Recommendation	Appropriateness (Y/N)
26	2010	The Board recommends that ENR should, in discussion with the Tłı̨chǫ Government and other Aboriginal groups, identify and make public, prior to the annual fall hunt, areas within which the harvest will be attributed to the Ahiak caribou herd. The Board and public should be advised of any changes to these areas made necessary by movements of the caribou.	Y
27	2010	The Board recommends that ENR should, in discussion with the Tłı̨chǫ Government and other Aboriginal groups, identify and make public, prior to the annual winter hunt, areas within which the harvest will be attributed to the Ahiak caribou herd. The Board and public should be advised of any changes to these areas made necessary by movements of the caribou.	Y
28	2010	The Board recommends the Tłı̨chǫ Government implement the Special Project, Using Tłı̨chǫ Knowledge to Monitor Barren Ground Caribou of the overall TK Research and Monitoring Program.	Y
29	2010	The Board recommends that ENR and the Tłı̨chǫ Government implement the spring calf survival monitoring action as identified below: • Scientific – Spring composition surveys to determine calf survival should continue. In addition, ENR should explore methods to improve estimation of cow mortality that do not involve large numbers of collars to better inform the interpretation of cow/calf ratios • TK – In listening to the oral narratives of Tłı̨chǫ harvesters, the TK researchers should document the harvesters" observations of the number of calves, cows and bulls along migration routes where caribou fences were once located.	Y
30	2010	The Board recommends that ENR and the Tłı̨chǫ Government implement the health and condition monitoring action as identified below:	Y

#	Year	Recommendation	Appropriateness (Y/N)
		• Scientific – Cows should NOT be harvested specifically for health and condition monitoring. If appropriate per collection methodology, suitable samples from harvested caribou should be collected by Aboriginal harvesters in the community. • TK – In listening to the oral narratives of Tłı̨chǫ harvesters, the TK researchers should document the harvesters" visual appraisals of fitness on hoof and sensory appraisals during skinning, butchering, preparing of meat and hides.	
31	2010	The Board recommends that ENR and the Tłı̨chǫ Government implement the birth rate monitoring action as identified below: • Scientific – Birth rate estimates determined from composition surveys on the calving ground should continue. • TK – In listening to the oral narratives of Tłı̨chǫ harvesters, the TK researchers should document the harvesters" observations of calves, cows and bulls on the barrens in the summer (post-birthing rate).	Y
32	2010	The Board recommends that ENR and the Tłı̨chǫ Government implement the adult sex ratio and fall calf survival monitoring action as identified below: • Scientific – Fall composition surveys to determine adult sex ratio and calf survival should continue. As above, this should be augmented with better estimates of cow mortality to better inform the interpretation of bull/cow ratios. • TK – In listening to Tłı̨chǫ harvesters, the TK researchers should document the harvesters" observations of numbers and behaviour of bulls, cows and calves.	
33	2010	The Board recommends that ENR and the Tłı̨chǫ Government implement the estimate of herd size monitoring action as identified below: • Scientific – A calving ground photo-survey should be conducted in June 2012.	Y

#	Year	Recommendation	Appropriateness (Y/N)
		• TK – In listening to Tłı̨chǫ harvesters, the TK researchers should document the harvesters" observations and their assessment of caribou abundance at key locations.	
34	2010	The Board recommends that ENR and the Tłı̨chǫ Government implement the wolf abundance (den occupancy) monitoring action as identified below: • Scientific – To enhance the ability of managers to assess management actions in the future, appropriate indices of wolf abundance, wolf predation rates and population responses to changing caribou abundance should be developed and implemented. • TK – In listening to the Tłı̨chǫ harvesters, the TK researchers should document the harvesters" observations and their assessment of wolf abundance associated with caribou.	Y
35	2010	The Board recommends that ENR and the Tłı̨chǫ Government implement the wolf condition and reproduction monitoring action as identified below: • Scientific – A carcass collection program and assessment of carcasses collected for physical condition and reproductive status should continue. • TK – In listening to the Tłı̨chǫ harvesters, the TK researchers should document the harvesters" observations of the condition of wolves associated with caribou.	Y
36	2010	The Board recommends that ENR and the Tłı̨chǫ Government implement the wolf harvest monitoring action as identified below: • Scientific – Harvest data from a combination of carcass collection, fur sales, resident harvest questionnaires, and mandatory reporting of nonresident harvests should be collected. • TK – Tłı̨chǫ researchers will manage the collection of Tłı̨chǫ harvest data.	Y

#	Year	Recommendation	Appropriateness (Y/N)
37	2010	The Board recommends that ENR and the Tłı̨chǫ Government implement the state of habitat monitoring action as identified below: • Scientific –Landscape changes, including fires and industrial exploration and development, should be monitored to assess potential impacts to caribou habitat. • TK – In listening to the Tłı̨chǫ harvesters, the TK researchers should document the harvesters" detailed observations of caribou habitat.	Y
38	2010	The Board recommends that ENR and the Tłı̨chǫ Government implement the pregnancy rate monitoring action as identified below: • Scientific – Cows should NOT be harvested specifically for determining pregnancy. • TK – In listening to the oral narratives of Tłı̨chǫ harvesters, the TK researchers should document the harvesters" visual appraisals of pregnancy and pregnancy of any cows harvested.	Y
39	2010	The Board recommends that ENR implement the density of cows on calving ground monitoring action as identified below: • Scientific – Annual calving ground reconnaissance surveys should continue. • TK – As Tłı̨chǫ harvesters have not gone to the calving grounds in the past, there is no suggested action.	Y
40	2010	The Board recommends Tłı̨chǫ Government implement the caribou harvest monitoring action as identified below: • TK – Tłı̨chǫ harvesters should report their caribou harvest to the TK researchers who will manage the harvest data • Scientific – Harvest data should not be collected through a scientific process as Tłı̨chǫ should collect and manage their own harvest data.	Y

#	Year	Recommendation	Appropriateness (Y/N)
41	2010	The Board recommends that ENR and Tłı̨chǫ Government reporting on monitoring results to the WRRB and the general public a minimum of three times per year in April, September and December.	Y
42	2010	The Board recommends that the Tłı̨chǫ Government develop and implement a TK conservation education program to support the relationship and respect Tłı̨chǫ have for caribou. The program should be taught by elders and include: • Tłı̨chǫ rules and their holistic approach to monitoring and managing their relationship with caribou; • The idea of learning by travelling traditional trails so the „land“ can be observed and monitored; and • Information on alternate resources to be harvested when caribou is scarce.	Y
43	2010	The Board recommends that ENR develop and implement a scientific conservation education program to foster an increased appreciation of the resource. The program should be aimed at better harvesting and handling practices, increased knowledge of caribou and their role in the ecosystem, and an enhanced understanding of scientific management practices.	Y
44	2010	The Board recommends that ENR and Tłı̨chǫ Government implement a process of information flow, review and assessment as described above.	Y
45	2010	The Board recommends that the WRRB staff be a full participant in the Tłı̨chǫ – ENR Technical Working group without prejudice to the Board.	Y
46	2010	The Board recommends that criteria be developed by ENR and Tłı̨chǫ Government for assessing success or failure that would indicate when management actions are to be revised, including reinstatement of harvest for residents, outfitters and commercial tags. These criteria should be approved and implemented by the Technical Working Group.	Y

#	Year	Recommendation	Appropriateness (Y/N)
47	2010	The Board recommends ENR continue discussions with the Government of Nunavut for identifying opportunities for calving ground protection	Y
48	2010	The Board recommends ENR and INAC collaboratively develop best practices for mitigating effects on caribou during calving and post-calving, including the consideration of implementing mobile caribou protection measures.	Y
49	2010	The Board recommends Tłı̨chǫ Government work towards development and implementation of a land use plan for Wek"èezhìi, including the consideration of thresholds for industrial land use.	Y
50	2010	The Board recommends that ENR and INAC monitor landscape changes, including fires and industrial exploration and development, to assess potential impacts to caribou habitat.	Y
51	2010	The Board recommends that ENR and Tłı̨chǫ Government assess the need for forest fire control in areas of important caribou habitat.	Y
52	2010	The Board recommends the harvest of wolves should be increased through the suggested incentives, except for assisting harvesters to access wolves on wintering grounds.	Y
53	2010	The Board recommends that focused wolf control not be implemented. If Tłı̨chǫ Government and ENR believe that focused wolf control is required, a management proposal shall be provided to the WRRB for its consideration.	Y
54	2010	The Board recommends that ENR and Tłı̨chǫ Government submit a joint management proposal for wood bison in Wek'èezhìi by the fall of 2011 to substantiate the establishment of zones and quotas made through the Interim Emergency Measure.	Y
55	2010	The Board recommends that ENR and Tłı̨chǫ Government work collaboratively to meet the obligations of Section 12.11 of the Tłı̨chǫ Agreement with support from WRRB staff as needed and a meeting be convened by January 2011.	Y

#	Year	Recommendation	Appropriateness (Y/N)
56	2010	The Board recommends that the Tłı̨chǫ Government increase their capacity to ensure full participation in monitoring and management of caribou.	Y
57	2010	The Board recommends that ENR, Tłı̨chǫ Government and INAC implement its recommendations no later than January 1, 2011. ENR"s Emergency Interim Measures, put into effect on January 1, 2010, should remain in place until then.	Y
58	2010	The Board recommends that Tłı̨chǫ Government and ENR conduct consultations regarding the Recommendations Report prior to January 1, 2011.	Y
59	2010	The Board recommends that ENR and Tłı̨chǫ Government develop a detailed implementation and consultation plan incorporating the WRRB"s recommendations as soon as possible.	Y
60	2010	The Board recommends that ENR develop and implement an effective and continuing enforcement and compliance program.	Y
2016			
1	2016	The Board recommends that TG and ENR come to an agreement on whether the MCBCMZ or Wildlife Management Units Subzones is the most effective way to differentiate between ɔekwǫ́ herds, and then implement the approach with criteria for managing any overlaps between herds, for the 2016/17, 2017/18, and 2018/19 harvest seasons.	Y
2	2016	The Board recommends that TG and ENR provide weekly updates to the WRRB and the general public on aerial and ground-based surveillance of the Bathurst ɔekwǫ́ herds throughout the fall and winter harvest seasons for the 2016/17, 2017/18, and 2018/19.	Y
3	2016	The Board recommends that TG and ENR increase public education efforts and implement ENR's recently developed Hunter Education program in all Tłı̨chǫ communities.	Y
4	2016	The WRRB continues to support the implementation of the Community-based Dìga Harvesting Project, as a training program only, subject to the following conditions:	Y

#	Year	Recommendation	Appropriateness (Y/N)

		• If the project is to be expanded to other Tłı̨chǫ communities, a management proposal must be submitted to the WRRB for review and approval.
		• If the Project is to be expanded in scope, prior to the submission of a management proposal to the WRRB, an index of changing wolf abundance must be available and research on habitat quality and quantity on the Bathurst ɔekwǫ́ herd range must be conducted;
		• TG and ENR must inform the WRRB of the following prior to the start of the Project:
		  ○ How aerial and/or ground-based to disturbance to Bathurst ɔekwǫ́ will be prevented or minimized? How will this potential disturbance be measured, assessed, and mitigated?;
		  ○ How will unintentional or accidental harvest of Bathurst ɔekwǫ́ by the Tłı̨chǫ Dìga harvesters, be prevented? If a Bathurst ɔekwǫ́ is harvested, how will TG and ENR report to the WRRB?; and,
		  ○ How will the facilitation of wolf movements through the wolves' use of skidoo trails be prevented or minimized?;
		• TG and ENR must communicate regularly about the Project with Tłı̨chǫ communities and the WRRB. Specifically, the Board requests an update prior to start up of the Project in December 2016 and a follow-up on the success of the Project in May 2017. As well, TG and ENR must report monthly on the Project, including numbers, age, sex and pregnancy rates of wolves harvested and location of wolf harvest, to the WRRB;
		• The Project must be curtailed or stopped should negative impacts114 to the Bathurst ɔekwǫ́ occur; and,	

#	Year	Recommendation	Appropriateness (Y/N)
		• TG and ENR must establish a threshold or criteria to evaluate the success of the program, i.e. the effectiveness of training a core set of wolf harvesters, the acceptance of the Project by Tłı̨chǫ communities, continued program implementation and reaching the target number of dìga harvested.	
5	2016	The WRRB recommends TG and ENR support a collaborative feasibility assessment of options for dìga management, led by the Board.	Y
1B	2016	The WRRB recommends that TG consult with Tłı̨chǫ communities, by March 2017, to ensure Tłı̨chǫ laws are implemented with respect to ɔekwǫ́ harvesting practices to maintain the Tłı̨chǫ way of life and their relationship with ɔekwǫ́.	Y
2B	2016	The WRRB recommends that TG conduct TK research to define, from the Tłı̨chǫ perspective, types of dìga, their behavior and their annual range, and their relationship with ɔekwǫ́ and people by March 2017.	Y
3B	2016	The WRRB recommends that TG conduct TK research on sahcho predation on ɔekwǫ́, and their relationship with ɔekwǫ́, other wildlife and people by June 2017.	Y
4B	2016	WRRB recommends that TG and ENR conduct a collaborative sahcho biological assessment, following the completion of th ongoing dìga feasibility assessment. The assessment should include summarizing available information on sahcha abundance, movement and diet for the Bathurst ɔekwǫ́ herd's seasonal ranges as well as including TK collected in Recommendation #3B-2016.	Y
5B	2016	WRRB recommends that TG conduct TK research about stress and impacts ɔekwǫ́ and people related to collars and aircraft over-flights by September 2017, which should be considered in determining number of collars deployed in 2018 and beyond.	Y

#	Year	Recommendation	Appropriateness (Y/N)
6B	2016	The WRRB recommends that ENR determine whether reconnaissance surveys should be conducted during non-photo survey years with renewable resource boards, Aboriginal governments and other affected organizations in the NWT and Nunavut prior to conducting the next reconnaissance survey in June 2017.	Y
7B	2016	The WRRB recommends that TG and ENR provide a summary of scientific and TK monitoring data, including harvest and collar mortalities, as soon as available each year, to the BGCTWG.	Y
8B	2016	The WRRB recommends that the BGCTWG prioritize biological monitoring indicators in order of need for effective management and develop thresholds under which management actions can be taken and evaluated. Implementation of this recommendation should be completed by no later than the end of March 2017.	Y
9B	2016	The WRRB recommends that TG refine and implement Tłı̨chǫ Land Use Plan Directives, under Chapter 6 related to ɔekwǫ́ land use and cumulative effects by March 2018.	Y
10B	2016	The WRRB recommends that TG and ENR initiate, develop and implement a land use plan for Wek'èezhìi by March 2019.	Y
11B	2016	The WRRB recommends ENR complete the Bathurst Caribou Range Plan, with an implementation strategy, by March 2018. In the interim, the Board recommends that ENR develop interim thresholds for developments and other human activities within the range of the Bathurst ɔekwǫ́ herd by March 2017.	Y
12B	2016	The WRRB recommends that TG and ENR complete and implement a long-term Bathurst Caribou Management Plan, with associate Action Plan, by March 2018.	Y
13B	2016	The WRRB recommends TG and ENR develop criteria under which the Conservation Area approach in the NWT's Wildlife Act will be used to protect key ɔekwǫ́ habitat by March 2018.	Y

#	Year	Recommendation	Appropriateness (Y/N)
14B	2016	The WRRB recommends that TG and ENR develop criteria to protect ɔekwǫ́ water crossings and tataa from exploration and development activities in the NWT. The criteria should be developed by March 2018 and included in the Bathurst Caribou Range Plan and Tłı̨chǫ Land Use Plan.	Y
15B	2016	The WRRB recommends TG and ENR investigate and report to the WRRB and other stakeholders on the potential use of offsets for ɔekwǫ́ recovery to compensate for losses caused by exploration and development activities by March 2018. A set of criteria should be developed to assess the effectiveness of each type of offset as it is investigated.	Y
16B	2016	The WRRB recommends that ENR continue to refine and update the Inventory of Landscape Change to ensure a comprehensive and standardized database of human and natural disturbance in the NWT.	Y
17B	2016	The WRRB recommends that TG and ENR integrate WEMP and WWHPP objectives and standardize approaches for monitoring the effects of development on ɔekwǫ́ in Wek'èezhìi.	Y
18B	2016	The WRRB recommends that TG and ENR complete and implement a fire management plan with criteria identifying under which the key ɔekwǫ́ habitat is defined as a value-at-risk by March 2018.	Y
19B	2016	The WRRB recommends TG conduct a TK monitoring project with elders to document how climate conditions have affected preferred summer forage and impacted ɔekwǫ́ fitness by September 2018.	Y
20B	2016	The WRRB recommends that TG conduct TK monitoring to assess the quality and quantity of winter forage by September 2018.	Y
21B	2016	The WRRB recommends that the BGCTWG develop monitoring thresholds for climate indicators by March 2017.	Y
2022			

#	Year	Recommendation	Appropriateness (Y/N)
1	2022	Through the Barren-ground Caribou Technical Working Group (BGCTWG), and with the WRRB as lead, TG and GNWT will draft a technical assessment of 'emigration' related to the Kǫk'èetı Ekwǫ̀ herd, beginning in the summer of 2022.	Y
2	2022	TG and GNWT will not conduct the June 2022 aerial reconnaissance survey to (i) assess distribution and separation/overlap of Kǫk'èetı and Beverly Ekwǫ̀ during calving, ii) assess relative abundance of Kǫk'èetı Ekwǫ̀, and (iii) assess sex and age proportions nor the calving ground photo survey for the Kǫk'èetı Ekwǫ̀ herd.	Y
3	2022	TG and GNWT will come prepared to attend a technical workshop and discuss technical monitoring questions, including monitoring survey design in herd overlap areas and calving ground survey frequency and design. WRRB will organize and hold this technical workshop during the summer 2022 with invitations to members of the BGCTWG, Government of Nunavut, and statistical support, as necessary.	Y
4	2022	TG and GNWT, through the BGCTWG, will use the existing Adaptative Co-Management Framework to reduce the gaps in available monitoring information about the Kǫk'èetı Ekwǫ̀ herd, and to allow adjustments to be made if results are not achieved or if conditions change such that a different approach is warranted. Discussions will first occur in August 2022, as per the Framework's timeline, with a summary of findings and discussion developed and shared with partner organizations.	Y
5	2022	TG and GNWT will collaborate and coordinate between the Northwest Territories and Nunavut to conduct calving ground surveys for the Beverly Ekwǫ̀ herd, starting in 2023. This may include sharing costs and personnel to conduct the survey.	Y
6	2022	TG and GNWT will develop a plain language summary of the joint management proposal and the 2021 calving ground survey to assist with communications in the Tłı̨chǫ communities by August 31, 2022.	Y

Table 7: 2010 management proposal recommendations and determinations accepted, varied and rejected

Recommendation topic	Explanation (as applicable)
Accepted	
Harvest • Harvest target approach • Zero commercial and outfitted harvest • Indigenous harvest *Blue-nose East* • *zero commercial, outfitted and resident harvesting* • *ENR to make public, prior to annual fall and winter hunt, areas for BNE hunting and communicate changes to the area as needed due to caribou movement* *Ahiak* • *zero commercial, outfitted and resident harvesting* • *ENR to make public, prior to annual fall and winter hunt, areas for Ahiak hunting and communicate changes to the area as needed due to caribou movement*	Agreement on approach of harvest targets, including for Indigenous harvest, and zero commercial and outfitted harvesting. Agreement on communication of new management zones in which Bathurst caribou herd harvest is limited, though detailed collar information will not be public. *As per changes to Big Game Hunting Regulations*

Recommendation topic	Explanation (as applicable)
Monitoring Recommendations (scientific and TK recommendations) • Spring calf survival • Health and condition • Birth rate • Adult sex ratio and fall calf survival • Estimate of herd size • Wolf abundance (den occupancy) • Wolf condition and reproduction • Wolf harvest • State of habitat • Pregnancy rate • Density of cows on calving ground • Caribou harvest	Agreement on all proposed monitoring actions from TG. Agreement on reporting results publicly at a minimum three times per year in April, September and December. GNWT accepted: • Spring calf survival • Health and condition • Adult sex ratio and fall calf survival • Estimate of herd size • Wolf condition and reproduction • Wolf harvest • Pregnancy rate
Rules based approach • TG implement a TK conservation education program • ENR develop and implement a scientific conservation education program	Agreement on actions, though GNWT suggested for their action they will work with TG.
Adaptive co-management framework • Participation of WRRB in the WG • Criteria to assess success or failure of management actions	No explanation provided
Development, habitat and wildlife management	No explanation provided

Recommendation topic	Explanation (as applicable)
• Identify opportunities for calving ground protection • Monitor landscape changes (forest fire)	
Wolf Management • Increase harvest • No focused wolf control at this time	No explanation provided
Long-term caribou management • GNWT and TG work collaboratively	No explanation provided
Implementation • TG increase capacity • Conduct consultations on Recommendations Report • Develop detailed implementation and consultation plan • GNWT develop and implement effective and continuing enforcement and compliance program	No explanation provided
Varied	
Harvest Making reinstating outfitted and resident harvesting positions public before next survey	To be addressed in a long-term management plan, which along with the next survey will be completed in 2012.

Recommendation topic	Explanation (as applicable)
Harvest • Indigenous harvest targets and ratio	Equal harvest for Tłı̨chǫ citizens and those outside Wek'èezhìı (agreement between TG and GNWT) Ratio should be 80:20 males:females, based on modelling projections. GNWT and TG to be consulted if TAH to be implemented by the Board.
• *TG consider negotiating caribou harvesting overlap agreements with Nunavut and Sahtu region (BNE) and Akaitcho (Ahiak)*	*TG will consider for Sahtu, there is a boundary agreement with Akaitcho.*
Bluenose-east • *Harvest target of 2800; allocation to be determined through discussions between c0-managmeent boards and Indigenous governments*	*Co-management boards are reviewing the proposed harvest target.*
• *85:15 bull:cow ratio (<420 cows)*	*Agreement on harvesting bulls, but ratio should be 80:20*
• *If harvest expected to exceed by 10% or 420 cows, regulations to be put in place to close all harvesting areas occupied by BNE*	*Wildlife co-management boards and Indigenous governments are reviewing proposed target and will developed a strategy e.g., hunting only males*
Tłı̨chǫ Knowledge Research and Monitoring Program Implementation	Program to be implemented in 2011

Recommendation topic	Explanation (as applicable)
Monitoring Recommendations (see Accepted for details)	Birth rate: clarification on methods, using calving ground photo census first Wolf abundancy (den occupancy): continue with these surveys and propose with TG potential options and costs for wolf monitoring, research and management State of habitat: continuing providing annual report to WRRB and TG on fire activity and explore ways to monitor landscape changes driven by industrial exploration and development. Density of cows on calving ground: continuing surveys in 2011 and 2012. Caribou harvest: GNWT and TG will continue working with harvesters to report harvests.
Adaptive co-management framework • Establishing process for information flow, review and assessment	GNWT and TG would like to see integrated strategy between science and TK information flow, rather than independently as described by the Board.
Development, habitat and wildlife management • Collaboratively develop with INAC best practices for mitigating effects on caribou during calving and post calving e.g., mobile caribou protection • Monitor landscape changes, including fires and industrial	Long-term management plan Existing cumulative effects assessment

Recommendation topic	Explanation (as applicable)
exploration and development to assess impacts to caribou habitat	
Implementation • Implementation timeline: January 1, 2011.	To be incorporated in the implementation plan
Rejected	
Harvest *Bluenose-east* • *TG and ENR will not provide harvester assistant and incentives to access the BNE herd* *Ahiak* • *TG and ENR will not provide harvester assistant and incentives to access the BNE herd*	*Agreement on need for conservation measures, but ENR agreed to construction of a winter road allowing access to BNE herd to reduce pressure on Bathurst herd.* *May be required for ENR to provide some assistance as part of accommodation for limiting harvest of Bathurst herd.*
Development, habitat and wildlife management • Implement a land use plan for Wek'èezhìı, including thresholds for industrial land use	As per chapter 22.5 of the Tłı̨chǫ Agreement, it is the responsibility of Canada or GNWT to develop and implement a land use plan for Wek'èezhìı tribunal

Table 8: 2016 management proposal recommendations and determinations accepted, varied and rejected

Determination / Recommendation topic	Explanation (as applicable)
Accepted	
Harvest • Total allowable harvest (TAH) • Mobile conservation zone	Agreement on TAH = 0 for 2016-2019 MCBCMZ most effective way
Monitoring Recommendations • TG and GNWT provide summary of scientific and TK monitoring data, including harvest and collar mortalities as soon as available to the technical WG	The technical WG has been meeting since 2010 and reviewing updates provided by TG and GNWT.
Land use planning • TG refine and implement Tłı̨chǫ Land Use Plan Directives	Land use planning in Wek'èezhìı is a matter beyond Board jurisdiction, but Tłı̨chǫ intends to refine and implement
Development, habitat and wildlife management • TG and ENR develop criteria to protect water crossings and tata from exploration and development. Develop criteria by March 2018 and include in Range Plan and Tłı̨chǫ Land Use Plan. • TG and GNWT investigate and report to WRRB and other stakeholders on potential use of	There are challenges in defining water crossings so the focus will be on those with a history of use. There is a need to use TK knowledge to develop criteria for habitat protection. ENR has initiated a contract to develop an evaluation framework. TG supports exploration of use of

Determination / Recommendation topic	Explanation (as applicable)
offsets for recovery and to develop criteria to assess the effectiveness of offsets. • ENR continue to refine and update Inventory of Landscape Change to ensure comprehensive and standardized database of human and natural disturbance in the NWT. • TG and ENR integrate WEMP and WWHPP (Wildlife Management and Monitoring Plans) objectives and standardize approaches for monitoring effects of development	community-based monitoring and support for wolf management as possible offsetting. The Inventory is continually being refined. ENR is revising guidelines to help developers produce WWHPPs and WEMPs
Varied	
Education • TG and GNWT increase public education efforts and implement ENR Hunter Education program in all Tłı̨chǫ communities	TG will be initiating public education efforts and will keep the Board informed.
Consultation • TG consult with Tłı̨chǫ communities by March 2017 to	

Determination / Recommendation topic	Explanation (as applicable)
ensure laws implemented with respect to Bathurst caribou harvesting practices	Consultations to be completed by end of March 2017; implementation of Tłı̨chǫ laws are outside of the Board's jurisdiction
Tłı̨chǫ Knowledge Research and Monitoring Program Implementation • TG conduct TK research to define types of diga, their behaviour and annual range by March 2017 • TG conduct TK research on sahcho predation on Bathurst caribou by June 17 • TG conduct TK research on stress and impacts on caribou and people related to collars and aircraft overflights by September 2017	Combine recommendations 2B, 3B, 5B, 19B, 20B in a comprehensive TK study to examine topics together, by September 2018. Combine with above Combine with above
Wolf Management • Support Community-based Diga Harvesting Project as a training program only with conditions: a) Submit management proposal if expanded to other Tłı̨chǫ communities b) Conduct wolf abundance study c) Inform WRRB of minimizing and mitigation	Variance in: b) wolf abundance study feasibility is to be determined collectively d) updates through the technical WG

Determination / Recommendation topic	Explanation (as applicable)
aerial and ground disturbance, preventing unintentional harvest and reporting, minimizing wolf movement through skidoo trails d) Provide updates prior to start-up and after the project and report monthly on wolf harvest details e) Curtail project if negative impacts to Bathurst caribou f) Establish criteria to evaluate success of the program • TG and GNWT support collaborative feasibility assessment of options for diga management led by the Board	GNWT would like to lead, in collaboration with WRRB, TG, YKDFN and NSMA.
Grizzly Management • TG and GNWT conduct a collaborative sahcho biological assessment	NWT Species at Risk Committee is preparing a status report on grizzly bears in NWT. TG and GNWT will engage with Government of Nunavut to discuss current information available on grizzly bears.
Monitoring Recommendations • Weekly updates on aerial and ground-based surveillance	Provide weekly updates on new monitoring information through air and ground patrol about the mobile zone due to budget constraints.

Determination / Recommendation topic	Explanation (as applicable)

• GNWT determine whether reconnaissance surveys should be conducted with other organizations during non-photo surveys years prior to next survey in June 2017
• Technical WG should
  ○ prioritize biological monitoring indicators in order of need for effective management and develop thresholds under which management actions can be taken and evaluated, no later than March 2017
  ○ develop monitoring thresholds for climate indicators by March 20178
• TG conduct TK monitoring projects:
  ○ with elders to document how climate conditions have affected preferred summer forage and impacted Bathurst caribou fitness by September 2018
  ○ to assess the quality and quantity of winter forage by September 2018
	Barren ground Technical Working Group should review the value of the surveys
	
	Current monitoring of Bathurst herd will be reviewed by the WG winter 2016-2017 to assess monitoring priorities (budget may constrain resources).
	
	Linkage between climate indicators and caribou population trend is not well established. ENR requests clarification on what the WRRB means by thresholds for climate indicators.
	
	Combine recommendation with others as indicated for a comprehensive TK study.
	
	Combine recommendation with others as indicated for a comprehensive TK study.

Land use planning	

Determination / Recommendation topic	Explanation (as applicable)
• TG and GNWT initiate, develop and implement a land use plan for **Wek'èezhìı** by March 2019	GNWT will work collaboratively with other jurisdictions for a government-led approach, though the process will take longer than by 2019. This recommendation should be a suggestion as land use planning is beyond the authority of the WRRB.
Long-term caribou management • ENR complete Bathurst caribou range plan with an implementation strategy by March 2018, with interim thresholds for development developed by March 2017 • TG and ENR complete and implement a long-term Bathurst Caribou Management Plan and Action Plan by March 2018	Draft thresholds to be developed for discussion by March 2017 and the Plan and implementation strategy to be completed by March 2018 Ensure this process is inclusive of all parties with an interest in the management of the herd.
Development, habitat and wildlife management • TG and GNWT develop criteria under which the Conservation Area approach in the NWT's *Wildlife Act* will be used for habitat protection by 2018 • TG and ENR complete and implement a fire management plan with criteria identifying when herd habitat would be a value-at-risk by March 2018	ENR and partners through the Bathurst Range Planning Process develop criteria to determine when to protect herd habitat by March 2018. Need to complete range planning to assess whether *Wildlife Act* is the best tool to achieve protection objectives. GNWT is guided by the Fire Management Policy where some herd habitat is classified as a value at risk but it is a lower priority compared to protection of life and property for control of fires.
Rejected	

Determination / Recommendation topic	Explanation (as applicable)
No actions were rejected in this management proposal.	

Table 9: 2022 management proposal recommendations and determinations accepted, varied and rejected

Recommendation topic	Explanation (as applicable)
Accepted	
Monitoring Recommendations • Technical WG, with WRRB leading, TG and GNWT will draft a technical assessment of emigration related to the herd in summer 2022.	Post-calving movements of collared animals resulted in 6 of 34 collared caribou moving further east with Beverly and continuing to associate with Beverly herd.
Adaptive co-management framework • TG and GNWT use existing framework to reduce the gaps in available monitoring information about the herd and allow adjustments if results are not achieved.	Reiteration of commitment to this framework.
Implementation • TG and GNWT will develop a plain language summary of the joint management proposal and 2021 calving ground survey	Materials have been developed.
Varied	
Monitoring Recommendations	

Recommendation topic	Explanation (as applicable)
• TG and GNWT will come prepared to participate in a technical workshop and discuss technical monitoring sessions, including monitoring survey design in herd overlap areas and calving ground survey frequency in summer 2022. • *TG and GNWT will collaborate and coordinate between NWT and Nunavut to conduct calving ground surveys for Beverly herd starting in 2023, may include sharing costs and personnel to conduct the survey.*	Revised to fall / winter 2022 / 2023 since timing for summer 2022 is challenging. *Government of Nunavut is the lead on the calving ground survey for the Beverly herd. TG and GNWT can support Government of Nunavut in their survey efforts if requested. GNWT will conduct a composition survey in fall 2022 on the Beverly range to get a cull:cow ratio.*
Rejected	
Monitoring Recommendations • TG and GNWT will not conduct the June 2022 aerial reconnaissance survey	The herd is continuing to decline and collar data shows significant emigration which has raised the level of concern. Opportunities to gather reliable estimates of the Bathurst herd may become less predictable due to the mixing. GNWT will take steps to ensure minimum disturbance. TG revised to remove them as a responsible Party.

APPENDIX E: PROPOSED ACTIONS IN MANAGEMENT PROPOSALS

Table 10: Summary of proposed actions in 2010, 2016 and 2022 management proposals

Proposed Action	2010	2016	2022
Tagging	• Eliminate all commercial meat tags[ab] • Eliminate all tags for outfitting[ab]	• NA	• NA
Hunter harvest	• Eliminate all resident hunter harvest[ab] • Bull Harvest: ○ Use management tools (see implementation section) to limit to 300 ± 10% Bathurst caribou of which a maximum of 20% (i.e., 60 animals) would be female. Allocation of Bathurst caribou among Tłı̨chǫ communities to be discussed by communities, but preference to Wekweètì is recommended. Allocation within and outside Wek"eezhii to be discussed further with	• Close all harvest of Bathurst caribou until the next photographic survey scheduled for June 2018	• Total Allowable Harvest (TAH) for the Bathurst herd remain at zero (0) in the Northwest Territories, as determined by the WRRB in 2016 and maintained in 2019 (WRRB Determination #1-2019).

Proposed Action	2010	2016	2022
	other Indigenous groups. ○ Interim recommendation to reduce 2010/2011 harvest of Bluenose-East herd by up to 45% of estimated 2009/2010 harvest within Wek“eezhii; (see implementation section for possible tools). The actual target will need to be developed collaboratively following June and July 2010 survey results, analysis of data and discussions with SRRB, WRRB, Nunavut and other user communities. Recommendation not to increase access of Ahiak (and Beverly) caribou by Tłı̨chǫ communities. Harvesters should be encouraged to		

Proposed Action	2010	2016	2022
	select bulls and reduce the proportion of cows in the harvest. Further consultation with BQMB, Saskatchewan and Nunavut is required. • Cow Harvest: ○ Cows should comprise < 20% of the targeted caribou hunt as described above. ○ Interim recommendation to reduce 2010/2011 harvest of Bluenose-East herd to be updated and developed collaboratively following June and July 2010 survey results. Recommendation not to increase hunting of Ahiak (and Beverly) caribou by Tłı̨chǫ communities. Harvesters should be encouraged to hunt primarily		

Proposed Action	2010	2016	2022
	(80%) bulls, and to be consistent with BQCMB objectives and recommendations. Further consultation with BQCMB, Saskatchewan and Nunavut is required.		
Predator management	• Predator management: ○ - Increase removal of wolves through hunter and trapper incentives, and focus on Bathurst winter range in early winter. ○ Develop and implement coordinated wolf removal programs on winter range to ensure that wolf hunting targets are achieved. ○ There may be a benefit to Bluenose-East caribou from increased wolf harvest in Bathurst winter range, due to extensive overlap in some	• Develop wolf management approach with hunters and communities. • Mobile wolf-hunter camps will be established in early or late winter, with the objective of removing wolves from the Bathurst range. • Resident and specialized wolf hunters will also be allowed to access incentives for prime wolf pelts. • ENR will work with other Indigenous groups to promote increased wolf harvest in the Bathurst range. • ENR will lead a review of wolf	• A comprehensive Tłı̨chǫ Government-GNWT joint wolf management proposal to reduce predation on the Bluenose-East and Bathurst caribou winter ranges underwent public review in fall of 2020 and was approved by the WRRB in January of 2021. Details of the program from 2020 and 2021 are provided in annual reports to the WRRB (Nishi et al. 2020, Clark et al. 2021) and posted to the WRRB web-site. The wolf

Proposed Action	2010	2016	2022
	years on winter range of Bathurst and Bluenose- East caribou.	monitoring methods in the NWT and carry out a feasibility assessment of predator management options to increase caribou survival rates.	management program was approved for a 5-year period.
Mobile conservation zone	• NA	• The mobile Bathurst conservation zone, within which no caribou can be harvested, would be continued in 2015-2016	• Continuation of the Mobile Core Bathurst Caribou Conservation Area (also referred to as the 'Mobile Zone') as the means for implementing the TAH of zero for the Bathurst herd. • Continued regular ground-based and aerial surveillance of the Mobile Zone throughout the winter harvest season. • The Tłı̨chǫ Government has developed and implemented the Ekwò Harvest Monitoring Program in the winter of

Proposed Action	2010	2016	2022
			2021 to share information with Tłı̨chǫ harvesters using the winter road for caribou harvest outside of the Mobile Zone.
Habitat and land use	• NA	• NA	• NA
Education	• NA	• Hunter education on sound hunting practices including limiting wounding losses and wastage, reliable harvest reporting. • Increased public education on the status and management of caribou herds	• NA
Calving ground reconnaissance surveys	• Numbers (density) of 1+ year old caribou on annual calving grounds reconnaissance surveys • Estimate of breeding cows from calving	• Numbers (density) of 1+ year old caribou on annual calving grounds reconnaissance surveys • Estimate of breeding cows from calving	• Estimate breeding cows and extrapolated herd size from calving ground photo survey • Estimate breeding cows and extrapolated herd size from fixed-wing reconnaissance

Proposed Action	2010	2016	2022
	ground photo survey	ground photo survey	survey west and east of Bathurst Inlet at or near the peak of calving; and a corresponding helicopter/ground- based composition survey
Composition surveys	• Calf:cow ratio in late winter (March-April); composition survey • Fall sex ratio; composition survey • Cow productivity; composition survey on calving ground in spring (June)	• Fall sex ratio; composition survey (October) • Calf:cow ratio in late winter (March-April); composition survey	• Estimate breeding cows and extrapolated herd size from a helicopter/ground- based composition survey west and east of Bathurst Inlet at or near the peak of calving • Cow productivity from composition survey on calving ground in spring (June) • Cow productivity from early summer composition survey (early/mid July) • Fall sex ratio and calf:cow ratio; composition survey (October)

Proposed Action	2010	2016	2022
			• Calf:cow ratio in late winter (March-April); composition survey
Condition assessment	• Caribou condition assessment/pregnancy rate.	• NA	• Caribou condition assessment from summer Tłı̨chǫ Ekwǫ̀ Nàxoèhdee K'è Program
Community-based monitoring	• Numbers of cows and bulls taken by all hunters. • Wolf numbers from hunter reports	• (Harvest) Numbers of cows and bulls taken by all hunters	• NA
Predator reduction surveys	• Numbers of wolves killed/year • Numbers of wolves seen on den surveys	• Numbers of wolves killed/year • Wolf abundance	• Wolf Harvest on Bathurst range

Proposed Action	2010	2016	2022
Radio collars	• NA	• Cow survival rate (estimated from OLS model, including collar data) • Maintain 50 collars on Bathurst herd (30 cows & 20 bulls, with annual increments)	• Total harvest from this herd by all users groups (numbers & sex ratio) • Maintain up to 70 satellite/GPS collars on herd (50 on cows, 20 on bulls)
Monitor environmental conditions	• NA	• Monitor annual indices of environmental conditions	• NA

[a] Recommended Action for Bathurst Herd in Wek'èezhìi

b Recommended Actions for Adjacent Herds (Bluenose-East and Ahiak)

ERM HAS OVER 160 OFFICES ACROSS THE FOLLOWING COUNTRIES AND TERRITORIES WORLDWIDE

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Ghana
Guyana
Hong Kong
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
Mozambique
The Netherlands
New Zealand
Peru
Poland
Portugal
Puerto Rico
Romania
Senegal
Singapore
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