2023

Decision-support Tools to Assess Cumulative Effects on the Cape Bathurst, Tuktoyaktuk Peninsula, Bluenose-West, and Bluenose-East Herds of Barren-ground Caribou in the Northwest Territories

PROJECT SUMMARY REPORT

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Environnement et Changement climatique Canada

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- Sahtú Renewable Resources Board;
- Wek'èezhìı Renewable Resources Board;
- Wildlife Management Advisory Committee (NWT);
- Gwich'in Renewable Resource Board;
- Department of Environment and Climate Change, Government of the Northwest Territories;
- Parks Canada; and
- Canadian Wildlife Service, Environment and Climate Change Canada.

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1. PROJECT PURPOSE AND RESEARCH INTERESTS

1.1. Purpose

The purpose of this project is to collaboratively develop decision-support tools that will help northern decision-makers review, explore, and learn about the cumulative effects of landscape changes (e.g., climate and wildfire), project development (e.g., all-season roads and mineral exploration and development), and management practices (e.g., harvest levels) on habitat quality and population dynamics of the Cape Bathurst, Tuktoyaktuk Peninsula, Bluenose-West, and Bluenose-East herds of barren-ground caribou in the Northwest Territories.

This project can address a number of key research and monitoring questions relevant to communities and northern decision-makers, such as:

- How can current and future land use, wildfires, climate change, and management practices affect barren-ground caribou habitat and demography?
- How can management practices (e.g., harvest levels) contribute to sustaining barren-ground caribou habitat and populations in the presence of land use and environmental change?
- What are the most effective ways of communicating with communities and northern decision-makers regarding the cumulative impacts of land use, wildfires, climate change, and management practices on barren-ground caribou habitat and populations?
- What are the key questions (i.e., hypotheses) and knowledge gaps that should be prioritized for monitoring and research in the near future?

1.2. Addressing Northern Recommendations and Research Needs

This project addresses important recommendations and priority research questions that have been identified in the following barren-ground caribou documents:

1) Advisory Committee on Cooperative Wildlife Management (ACCWM)'s 2022 Action Plans for Bluenose-West, Bluenose-East, and Cape Bathurst under the *Taking Care of Caribou: CB, BNW and BNE Barren-ground Caribou Herds Management Plan*.
    - Map and track landscape disturbance (action B2.1); and
    - Mitigate impacts and communicate with stakeholders/decision makers (actions C2.1-C2.5, C3.1, C3.2).
2) Conference of Management Authorities (CMA)'s *Recovery Strategy for Barren-ground Caribou in the Northwest Territories*.
    - Increase capacity among communities and Indigenous partners to participate equally and meaningfully in the conservation of barren-ground caribou, and share tools and ideas to support their participation (approach 1.7);
    - Update or develop population models using current information (approach 3.2); and
    - Assess cumulative impacts of natural and human-caused landscape change on barren-ground caribou and their habitat (approach 3.4).

2. PROJECT APPROACH

2.1. Study Area

The study focused on the annual range of the Cape Bathurst, Tuktoyaktuk Peninsula, Bluenose-West, and Bluenose-East herds of barren-ground caribou. However, landscape simulations covered a broader area, which included the Northwest Territories and Kitikmeot region of Nunavut (Figure 1).

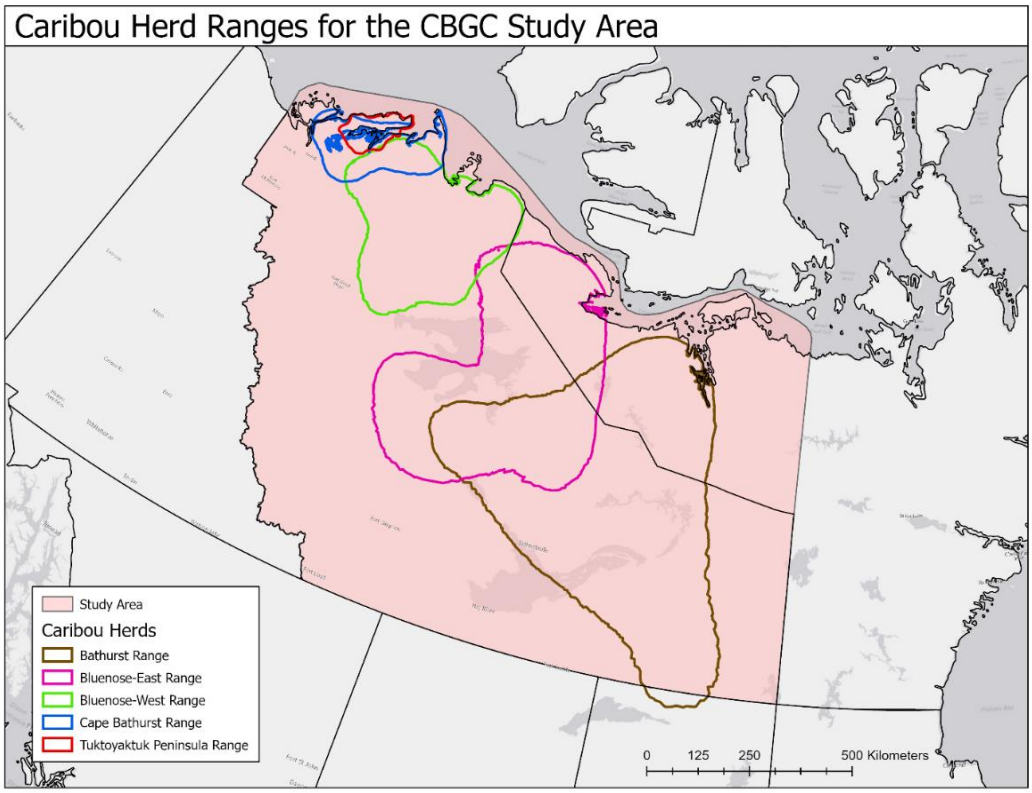

Figure 1. Annual ranges of barren-ground caribou herds and extent of landscape simulations.

2.2. Indigenous Names for Barren-ground Caribou

It is important to note that Indigenous knowledge holders do not define herds of barren-ground caribou or distinguish between them following scientific protocols and rationale (i.e., by calving ground affiliation). Barren-ground caribou in these regions may include:

- Tuktuvialuk (Inuvialuktun, Siglitun dialect)
- Vadzaih (Teetł'it and Gwichya Gwich'in)
- ʔedə (K'áhsho Got'ı̨ne, Dela Got'ı̨nę)
- Neregha (North Shore) Goʔekwę́ (Délı̨ne Got'ı̨ne)
- ʔehdaı̨la ɔekwę́ (Délı̨ne Got'ı̨ne)
- Sahtı ɔekwǫ̀ (Wek'èezhìı, Tłı̨chǫ Region)

Tuktuvialuk, vadzaih, and ɔedə refer to barren-ground caribou without a specific herd association. In the Sahtú or Great Bear Lake region, Délı̨nę Got'ı̨nę use the term ɔekwę́ to refer to barren-ground caribou, while neregha goɔekwę́ refers to caribou encountered on the north shore of Great Bear Lake in Bluenose-West habitat. ʔehdaı̨la goɔekwę́ refers to barren-ground caribou usually encountered in the ʔehdaı̨la area, corresponding to habitat of the Bluenose-East herd. In the Tłı̨chǫ region, barren-ground caribou encountered in the range of the Bluenose-East Herd is called sahtı ɔekwǫ̀.

2.3. ALCES Online

This project used the ALCES (**A L**andscape **C**umulative **E**ffects **S**imulator) Online simulation tool. ALCES Online is a land-use model that supports land-use and natural resource decision making by 1) simulating the consequences of land-use changes and natural disturbances over time, and 2) simulating population dynamics to explore the response of wildlife populations to changing landscapes, climate, and mortality factors (Figure 2). ALCES Online has been used in numerous studies (e.g., Carlson et al. 2019 and Rempel et al. 2021). In the NWT, ALCES Online was used to explore

northern mountain caribou population dynamics in the Mackenzie Mountains for the ʔehdzo Got'ı̨nę Gots'ę́ Nákedı – Sahtú Renewable Resources Board through a project funded by NWT CIMP #178 (Stelfox et al. 2019).

An ALCES Online User Guide is available for download at https://alces.ca/media/files/420.pdf.

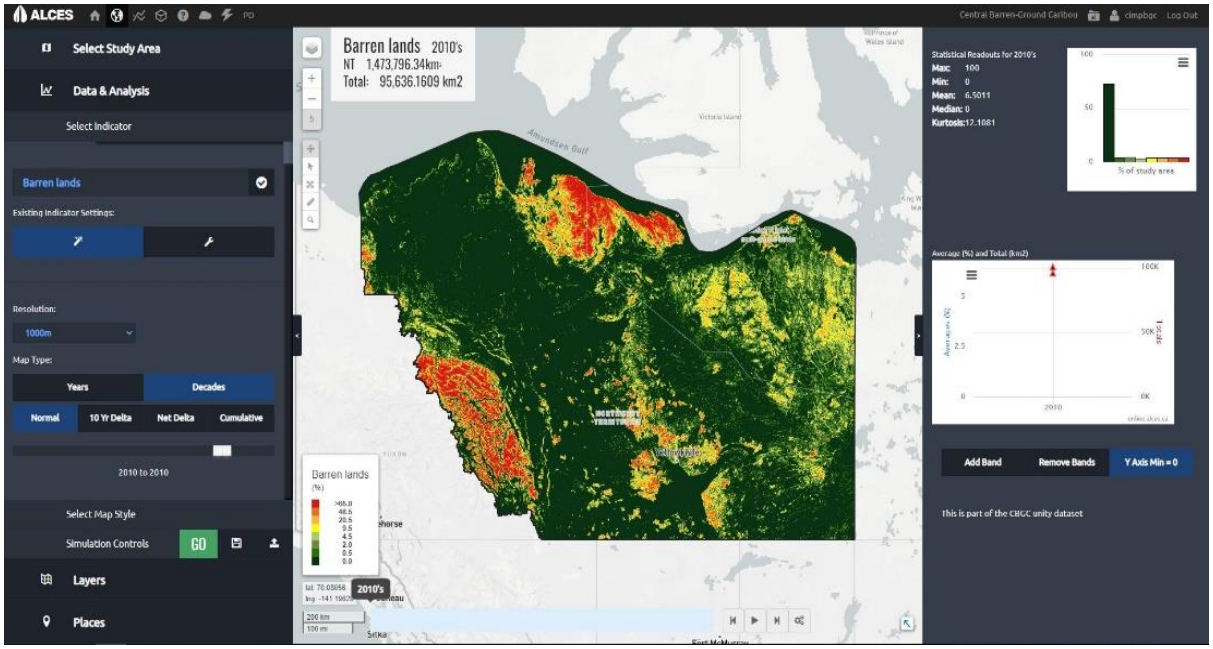

Figure 2. Screenshot of ALCES Online showing the percentage (%) cover of barren lands within the study area.

2.4. Partner Priorities

In fall 2020, project partners were interviewed to define priority areas regarding modeling and incorporating Indigenous knowledge. Key priorities that were discussed are:

- Habitat quality and critical habitat areas
    - Knowledge about caribou landscape
- Understanding predators and impacts of predation
- Climate change
    - Seasonal snow condition on caribou
    - Seasonal snow condition on harvester access
    - Long term effects on habitat, vegetation, and landscape
    - Wildfires
    - Changes to critical habitat areas
- Total Allowable Harvest (TAH) / How to regulate harvest
    - Levels of harvest
    - Harvest law / Who decides harvest
    - How Indigenous Knowledge is integrated into herd level status determination
- Impacts of development projects
    - Inuvik-Tuktoyaktuk Highway
    - Mackenzie Valley Highway
    - Oil and gas development
    - Poaching off of the Inuvik-Tuktoyaktuk Highway
- Caribou and the mixed economy – role of caribou in Indigenous economy
- Information for range planning and recovery strategies

3. BARREN-GROUND CARIBOU DECISION SUPPORT TOOLS

Three main decision support tools were created with this project to aid researchers and decision-makers assess the cumulative effects of natural and human disturbances on the habitat quality and population dynamics of the Cape Bathurst, Tuktoyaktuk Peninsula, Bluenose-West, and Bluenose-East herds of barren-ground caribou in the Northwest Territories and Kitikmeot region of Nunavut. These decision support tools are the landscape change model, population dynamics model, and Indigenous knowledge summaries (Figure 3).

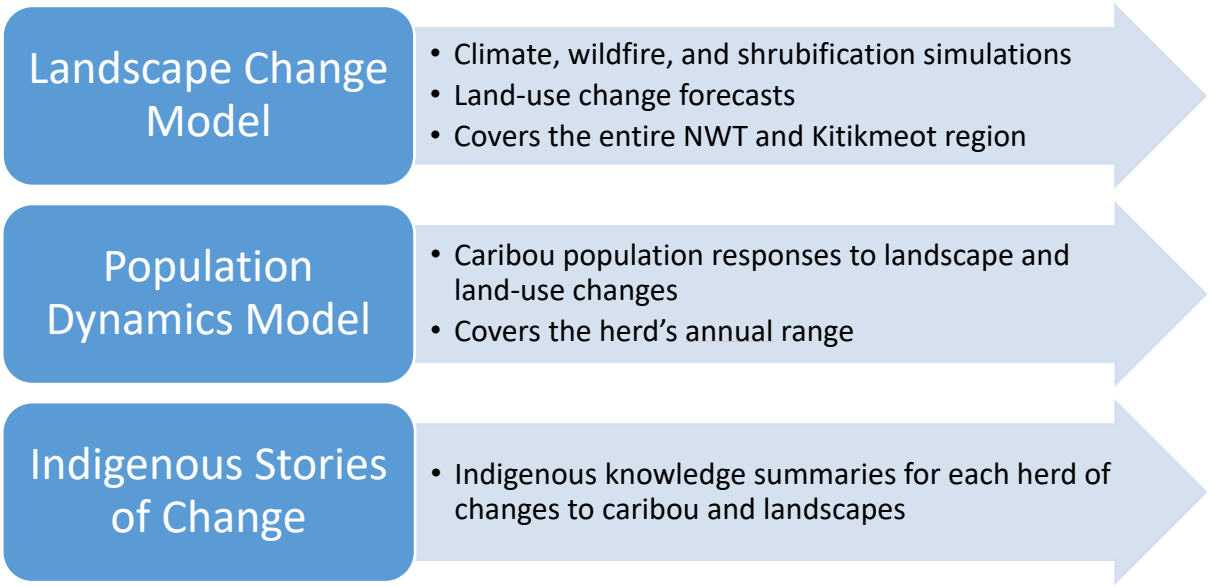

Figure 3. Illustration of the three main decision support tools developed as part of this project to aid researchers and decision-makers in the Northwest Territories and Kitikmeot region of Nunavut.

3.1. Landscape Change Model

The landscape change model was set up to simulate current (2010-2020) and future (2020-2060) vegetation changes to the landscape by forecasting changes in climate (i.e., temperature and precipitation), wildfires, and shrubification (hereafter the climate change landscape scenario), as well as human land-use (hereafter the land-use landscape scenario; Figure 4). Detailed information on the parametrization of the landscape change model can be found in Appendix A and B.

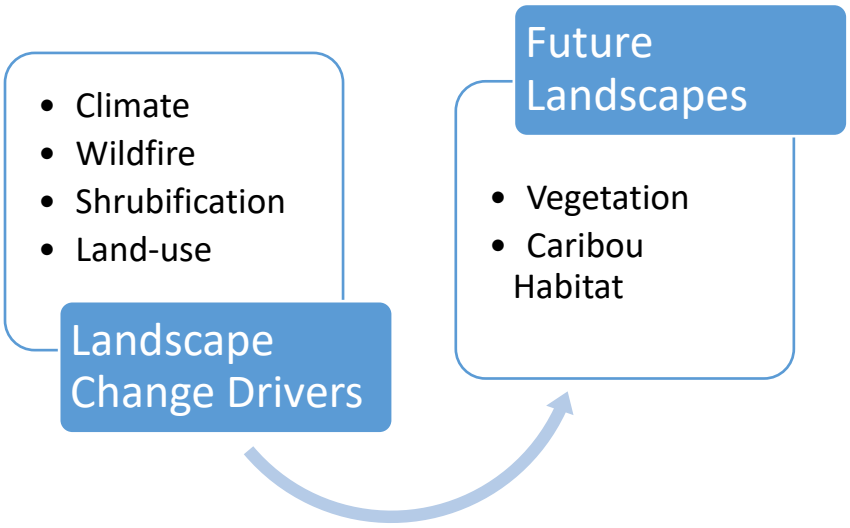

Figure 4. Illustration of the relationship between landscape change drivers and future landscapes.

Case Study Results – Climate and Landscape Change Scenarios

Some of the key results of the climate change model simulations are:

- Land-use footprint increased over the next 40 years (2020-2060), mainly due to mineral exploration and activity in the Slave Geological Province;
- Based on a RCP8.5 scenario[1], climatic parameters (i.e., temperature and precipitation) increased with climate change across the study area;
- Wildfire increased with climate change in the forested portion of the study area (i.e., south of the treeline). Shrubification occurred in the western portion of the study area where tundra ecoregions were projected to shift towards taiga ecoregions (i.e., forested areas);
- Barren-ground caribou habitat quality was more sensitive to wildfire and climate change than land-use because these drivers affected a larger portion of the study area.

3.2. Population Dynamics Model

The population dynamics model was set up to simulate how barren-ground caribou populations may respond to changes in landscape composition, land-use, and harvest levels. Multiple inputs were derived to parameterize the population dynamics model: initial population (based on recent caribou surveys), seasonal ranges, seasonal habitat models for each herd, fecundity rates and mortality rates, effect of climate on vital rates, and harvest rates. These inputs were applied in combination with the landscape change model to simulate seasonal population dynamics for each herd. Detailed information on the parametrization of the population dynamics model can be found in Appendix A.

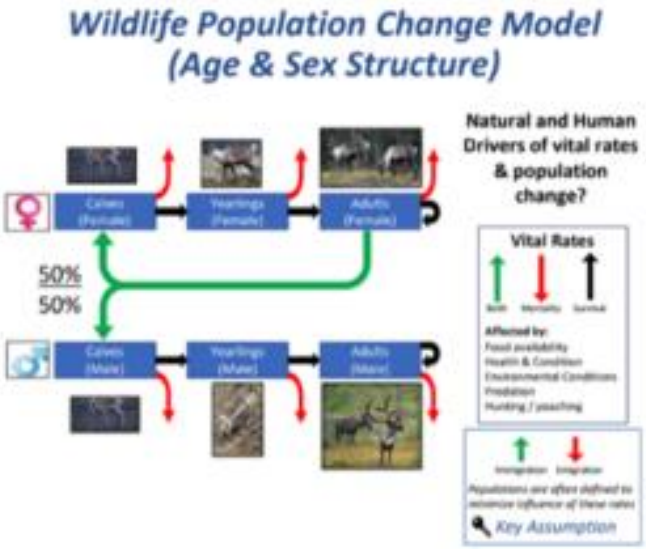

Figure 5. Age and sex structure of the population dynamics model used in ALCES.

Case Study Results – Population Dynamics Model Scenarios

Case study analyses of the population dynamics of the Cape Bathurst, Tuktoyaktuk Peninsula, Bluenose-West, and Bluenose-East herds of barren-ground caribou revealed useful insights into the sensitivity of caribou populations to variation in habitat, natural mortality, human harvest, and climate change.

[1] *"The Representative Concentration Pathways (RCPs) describe four different 21st century pathways of greenhouse gas (GHG) emissions and atmospheric concentrations, air pollutant emissions and land use. […] They include a stringent mitigation scenario (RCP2.6), two intermediate scenarios (RCP4.5 and RCP6.0), and one scenario with very high GHG emissions (RCP8.5). Scenarios without additional efforts to constrain emissions lead to pathways ranging between RCP6.0 and RCP8.5."* (Intergovernmental Panel on Climate Change [IPCC] 2023; https://ar5-syr.ipcc.ch/topic_futurechanges.php).

- Conditions that contribute to relatively large and stable barren-ground caribou populations include:
    - Relatively low year-to-year variation in climatic parameters (i.e., temperature and precipitation) and forage production;
    - Minimal loss of caribou habitat quality or areas associated with climate change; and
    - Low rates of human harvest.
- Conditions that contribute to reduced and highly variable barren-ground caribou populations include:
    - High variation in climatic conditions and forage production;
    - Incremental loss of caribou habitat associated with climate change; and
    - High rates of harvest.

3.3. Indigenous Knowledge Summaries

Indigenous knowledge from Inuvialuit, Gwich'in, Sahtú Dene, Métis, and Tłı̨chǫ regions on the Cape Bathurst, Tuktoyaktuk Peninsula, Bluenose-West, and Bluenose-East herds of barren-ground caribou were compiled to create Indigenous knowledge summaries for each of herd. We conducted a limited literature review intended to summarize Indigenous perspectives and observations on the trends and factors affecting caribou populations, habitat, and health from recent, publicly-available, written sources. For more information, please refer to Appendices C and D of the Summary Report.

Information from these sources were categorized into seven categories of human and natural factors defined for this project:

- Predators and competitors;
- Wildfires;
- Climate and climate change;
- Caribou health;
- Land use development;
- Harvest and harvest practices; and
- Governance.

The Indigenous knowledge summaries and their accompanying table of results are intended to be used to inform the collaborative development of decision-making with Renewable Resources Boards (RRBs) and the Wildlife Management Advisory Council (WMAC [NWT]) to simulate the cumulative effects of natural and human factors on these four herds of barren-ground caribou.

Case Study Results – Indigenous Knowledge Summaries

Although there are some differences in the magnitude or significance of the cumulative effects thought to be impacting caribou across their range, there is also a high level of consistency in the observations of harvesters from all four regions that encounter these caribou.

- Wolves are increasing in abundance, but grizzly bears and other predators are also having a negative impact on caribou populations;
- In some areas, knowledge holders are seeing new species or species with increasing abundance, such as muskoxen, moose, wood bison, and boreal caribou;
- Evidence of climate change is apparent on the landscape through slumping, erosion, landslides, thawing permafrost, changes in weather, seasonal timings, and vegetation, as well as changes in caribou behavior and movement patterns;

- Harvesters have been reporting healthy-looking caribou from the Cape Bathurst, Tuktoyaktuk Peninsula, and Bluenose-West herds, but it remains difficult to assess overall health/body condition of the Bluenose-East herd as observations are mixed or limited in areas where caribou are not being encountered as much as in the past;
- Land-use has substantial negative impacts on barren-ground caribou, especially road development, mining, oil and gas exploration, noise pollution, chemical and dust pollution, as well as increasing traffic, numbers of harvesters, newer hunting technologies, and some recreational and subsistence infrastructure; and
- In some areas, knowledge holders believe overharvesting is not the main problem leading to barren-ground caribou population declines as people are harvesting fewer caribou today than in previous generations (i.e., harvesting pressure tends to be limited to very localized areas).

4. NEXT STEPS

NWT CIMP #207 has recently received funding by NWT CIMP and Polar Knowledge Canada for the next three years to build upon the current project. The next steps are outlined below.

Purpose

Continue to collaboratively develop decision-support tools with RRBs, WMAC (NWT), and the Bathurst Caribou Advisory Committee (BCAC) that will help them review, explore, and learn about the cumulative effects of landscape changes (e.g., climate and wildfire), project development (e.g., all-season roads and mineral exploration and development), and management practices (e.g., harvest levels) on habitat quality and population dynamics of the Cape Bathurst, Tuktoyaktuk Peninsula, Bluenose-West, Bluenose-East, and Bathurst herds of barren-ground caribou.

Objectives

The objectives of the project are to:

1) Continue to develop collaborative decision-support tools with RRBs, WMAC (NWT), and BCAC that meaningfully braids technical simulation models from western science with the knowledge and expertise on barren-ground caribou from Indigenous people across the NWT and the Kitikmeot region of Nunavut;
2) Explore population level responses of barren-ground caribou herds to multiple factors, such as habitat, mortality, and productivity;
3) Develop comprehensive summaries of publicly available Indigenous knowledge (including Inuit Qaujimajatuqangit) of the Cape Bathurst, Tuktoyaktuk Peninsula, Bluenose-West, Bluenose-East, and Bathurst herds of barren-ground caribou to guide the cumulative effects assessment and provide a background resource for communities, research teams, and engagement; and
4) Facilitate a collaborative process that will build capacity and support ongoing involvement of northern decision makers to further explore questions related to cumulative effects on the five herds of barren-ground caribou.

Project Outcomes

Outcomes of this project (i.e., online decision-support tool, capacity building, synthesis report, and Indigenous knowledge summaries) will improve the capacity of northern decision makers to explore research questions and drivers of caribou population dynamics, as well as test management strategies.

5. REFERENCES

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6. APPENDICES

A. Nishi, J., M. Carlson, and T. Stubbs. 2023. Technical Methods for Barren-ground Caribou Scenario Analyses. Prepared for the Cumulative Effects Assessment of Four Barren-ground Caribou Herds in the NWT project funded by NWT CIMP and Environment and Climate Change Canada. Yellowknife, NT.

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D. Winbourne, J. and T. Stubbs. 2023. Summary Tables: Indigenous Knowledge of Cumulative Effects Impacting the Tuktoyaktuk Peninsula, Cape Bathurst, Bluenose-West, and Bluenose-East Caribou in the NWT. Prepared for the Cumulative Effects Assessment of Four Barren-ground Caribou Herds in the NWT project funded by NWT CIMP and Environment and Climate Change Canada. Yellowknife, NT.

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