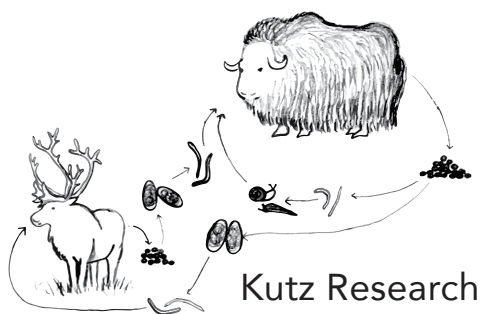


MUSKOX AND CARIBOU HEALTH MONITORING PROGRAM

ACTIVITY UPDATE JUNE 2022



Photo: X. Fernandez Aguilar



UNIVERSITY OF CALGARY
FACULTY OF VETERINARY MEDICINE

Update prepared by the Kutz Research Group

MUSKOX AND CARIBOU HEALTH MONITORING PROGRAM

Activity Update June 2022

Introduction

I am excited to introduce our Summer 2022 research update bulletin. Despite the challenges of COVID-19, our collaborative research with communities, governments, industry, and academia has been able to continue on. We attribute this to the strong relationships and trust that we have among this group of wonderful people! With travel restricted, the members of the Kutz Research Group has been desperately missing their northern friends and the beautiful landscape; we are so glad that things are beginning to open up!

In this bulletin, we share with you the various projects that are currently underway and introduce you to several new Kutz Lab members. Almost all of these projects rely heavily on the community-based wildlife health monitoring programs and Traditional Knowledge interviews in Ulukhaktok, Ekaluktutiak, and Kugluktuk. What is exciting is that, through the perseverance and dedication of many people in the communities, governments, the outfitting industry, and the university, we have been able to maintain these programs over several years, and even through COVID. This means that we are generating invaluable long-term datasets that are providing us so much information on how the caribou and muskoxen are doing. The combination of Inuit knowledge, harvester-based sampling, and some targeted studies is ensuring that knowledge and data generated by community members are available at the co-management table.

The Kutz Research Group would like to thank all those who have been involved in planning, guiding, implementing, analyzing and interpreting these studies. We also thank those who have supported so many different aspects of the work, from the harvester on the tundra, to the administrators in the office and the technicians in the laboratory. You're all essential to the success of the program!

Best,

Susan Kutz

Susan Kutz,

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Healthy Animals and Healthy Communities
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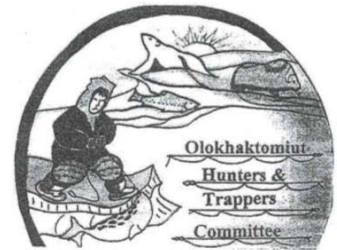
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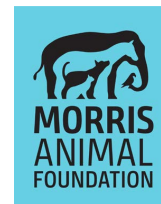
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Association of Canadian Universities for Northern Studies



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Nunavut General Monitoring Plan
Nunavummi Tamainni Takuurivangnikkut Parnaiyautaan
Plan de surveillance générale du Nunavut

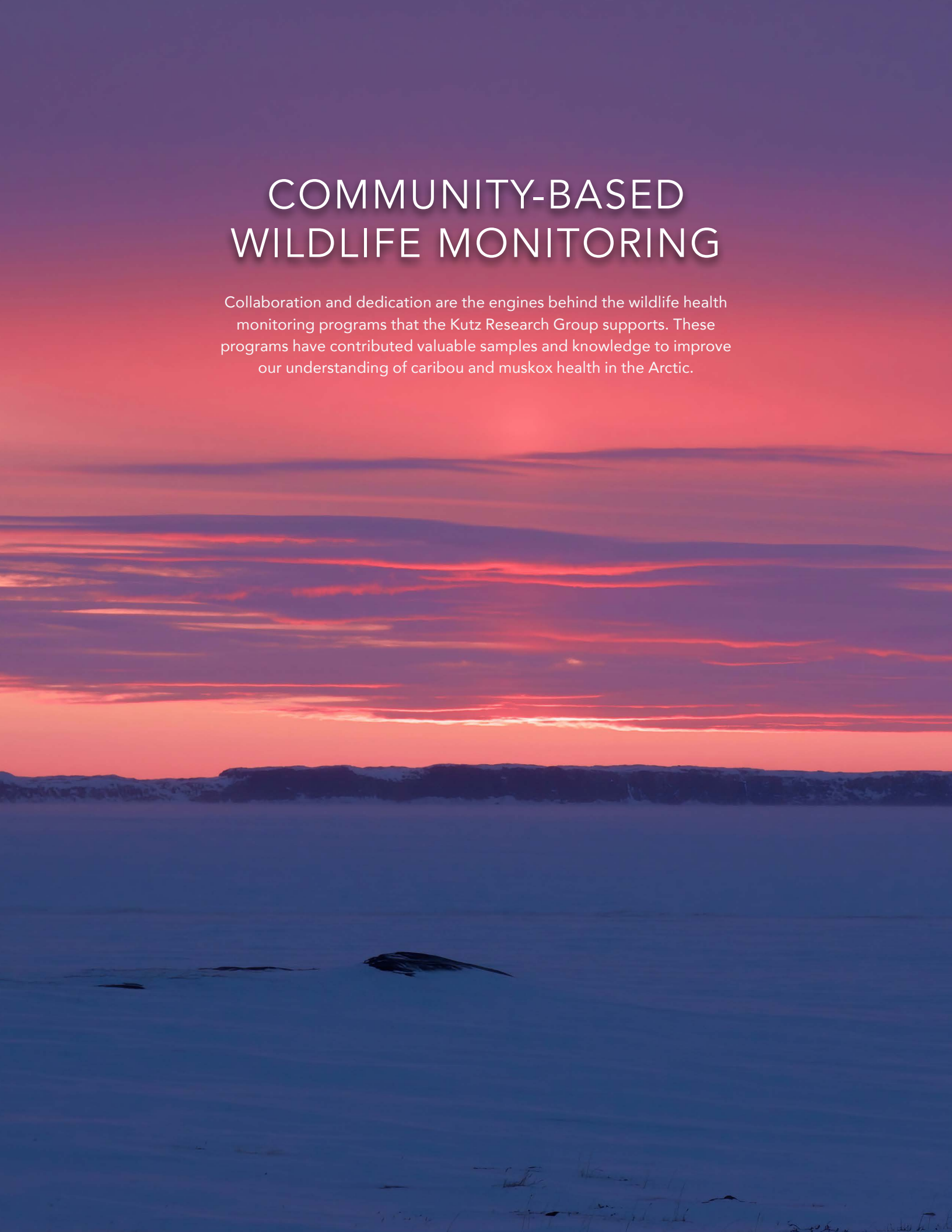


Environment and Climate Change Canada

Environnement et Changement climatique Canada

COMMUNITY-BASED WILDLIFE MONITORING

Collaboration and dedication are the engines behind the wildlife health monitoring programs that the Kutz Research Group supports. These programs have contributed valuable samples and knowledge to improve our understanding of caribou and muskox health in the Arctic.



Caribou Health Monitoring and Research

Our research group continues to make interesting and exciting progress in a range of projects related to caribou.

**XAVIER FERNANDEZ AGUILAR
WITH COMMUNITIES AND PARTNERS**

Dolphin and Union Caribou Health Monitoring

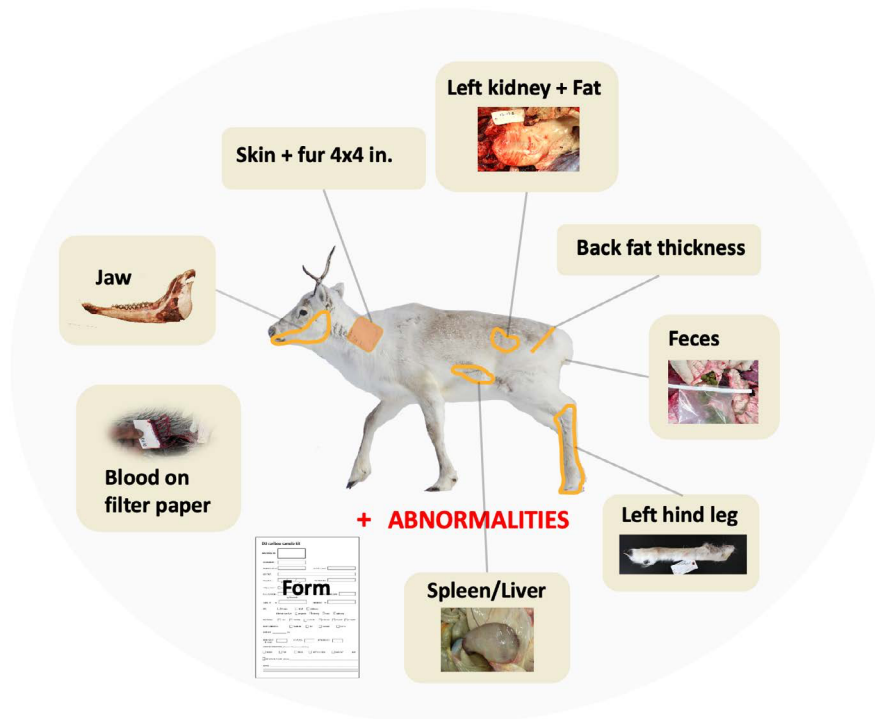


What are we doing?

Health monitoring for the Dolphin and Union caribou herd started in 2015 with the aim to better understand the health of these unique caribou.

This collaborative program involves the communities of Kugluktuk, Cambridge Bay, and Ulukhaktok, as well as the governments of Nunavut and the Northwest Territories, and the University of Calgary.

Samples are provided by caribou hunters (who submit sample kits; see graphic below) and through Government of Nunavut animal capture programs. Xavier is analyzing these samples to obtain more detailed information on how the herd is doing and possible causes of its downward trend in population numbers.



Sampling kit that hunters use to collect samples from Dolphin and Union caribou. There are slight modifications depending on the different projects from each community. Any tissues that look abnormal are also collected and sent to the lab for testing. (Graphic: X. Fernandez Aguilar and Kutz Research Group)

What are we finding?

In recent years, the Dolphin and Union caribou herd has rapidly declined. During this period, information gathered from the health monitoring program indicates that most animals were in good shape (not skinny) in early spring, and most females were pregnant.

These findings indicate that this recent decline was likely caused by problems related to survival, not issues with breeding. Samples from the early years of the program (closer to 2015) also showed higher stress, continued presence of brucellosis (a contagious disease that can affect reproduction), and declining trends in other disease agents (e.g., pestivirus, herpesvirus, or the bacterium *Erysipelothrix rhusiopathiae*).

Why does this work matter?

Our collaborative monitoring program is generating unprecedented health information about the Dolphin and Union caribou herd. This is helping scientists and communities to better understand the challenges these and other caribou face in the changing Arctic, to guide future work, and to build knowledge towards proactive management.



ANDREA HANKE AND HARVESTERS

Traditional Knowledge of Dolphin and Union Caribou

What are we doing?

Andrea is interviewing harvesters to document what they know about the Dolphin and Union caribou herd. We ask about distribution (*Where do you see the caribou?*), abundance (*How many caribou do you see?*), and health (*How are the caribou doing?*).



From right to left, Joe Allen Evyagotailak, Allen Kudlak, John Kapakatoak, and another harvester in Kugluktuk marking locations on a map. (Photo: A. Hanke)

Alongside their stories, harvesters answer using visual tools (e.g., piles of dried beans to indicate caribou abundance) and maps.

This helps us learn about what is going on with the herd, how today's caribou status connects with what has happened in the past, and how we can connect the Traditional Knowledge from these interviews with other documented information (other Traditional Knowledge and western science).

What are we finding?

- 1. Caribou status:** From interviews in 2003, Kugluktuk-based harvesters saw fewer caribou than before, a shift in where caribou were located, and noticeably more diseased animals in the late 1990s and early 2000s. In contrast, Ekaluktutiak-based harvesters saw a stable caribou population in 2003. This suggests that early signs of a Dolphin and Union caribou decline were seen by Kugluktukmiut but not by Ekaluktutiakmiut in 2003.

From interviews in 2018-2019, Kugluktuk-based harvesters saw fewer animals, noted an eastern shift in the western boundary of where they saw caribou, had a harder time getting to the caribou (reduced accessibility), and saw increased signs of disease in caribou. This suggests that harvesting ranges change to enable continued access to caribou, which may influence reports on how many caribou harvesters see. As well, the combination of harvester reports on abundance, distribution, access to caribou, and signs of disease give insight into *how* caribou population status changes over time.

- 2. Best practices:** We found that Kugluktuk- and Ekaluktutiak-based knowledge of the Dolphin and Union caribou herd differs across seasons, years, and a broad spatial range. This means that decision-making for this herd must draw on Traditional Knowledge from across the herd's range to best reflect and address the caribou population.

We also found that harvesters' personal experiences and background form the lenses through which they know caribou. This means that connecting Traditional Knowledge to the caribou population requires that we learn as much about the interviewed harvesters as we do about the caribou.

Why does this work matter?

These findings give information on the Dolphin and Union caribou population status and how it has changed over time. This is crucial for decision-making bodies, especially so today because of the high level of conservation concern about this herd.

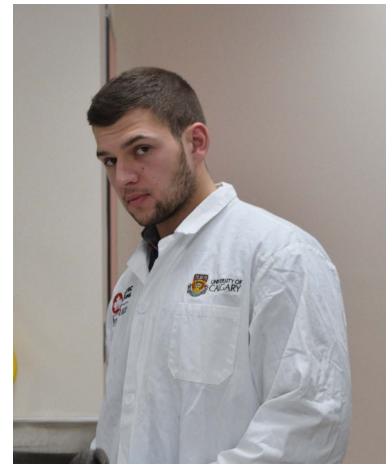
Our findings may also help improve the interpretation of community-based Traditional Knowledge for population-level decisions. The suggested best practices offer guidance to those interested in connecting Traditional Knowledge from multiple communities, and to population status for a species of interest.

FILIP RAKIC

Hair as a Monitoring Tool in Bluenose-East Caribou

What are we doing?

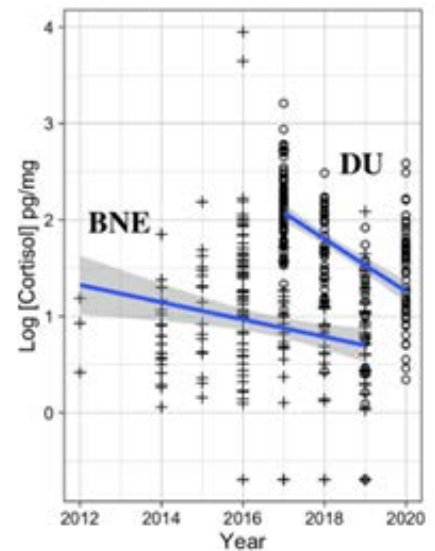
Filip is looking at whether caribou hair, which is easily collected, stored, and transported, can be used to evaluate two biomarkers of health: cortisol concentration in the hair and trace element concentrations in the hair. The samples he's analyzing were collected by Kugluktuk-based hunters in 2017-2019, and by Government of the Northwest Territories animal capture programs.



What are we finding?

Body location matters: Results differ depending on the body area where the hair sample is from. For future, consistently sampling from the rump would give us more consistent data to detect trends in caribou health measures.

Changes with time: Hair testing has shown changes in cortisol and trace element levels over time. Cortisol (a measure of stress) seems to be declining in the Bluenose-East and Dolphin and Union caribou herds (see the blue lines for BNE and DU in photo).



Why does this matter?

Hair may be a good tool for understanding long-term trends in caribou nutrition or stress. We hope these findings inspire other monitoring programs to include rump hair in their sampling protocols, as this could shed light on how caribou diet and stress may be changing.

**ELEANOR DICKINSON AND
CHINYERE NWAFOR-OKOLI**

Effects of Gastrointestinal Parasites on Body Condition and Reproduction in Caribou and Muskoxen

What are we doing?

Eleanor and Chinyere are working to understand how abomasal (stomach) worms affect caribou and muskoxen. They are looking at muskox samples collected during a 1999 commercial harvest on Banks Island, and caribou samples collected during scientific work (Greenland Institute of Natural Resources) on two separated West Greenland caribou populations known to have different worm types. Eleanor and Chinyere are measuring worm numbers, body condition, and reproduction (pregnancy and lactation/calf at heel).



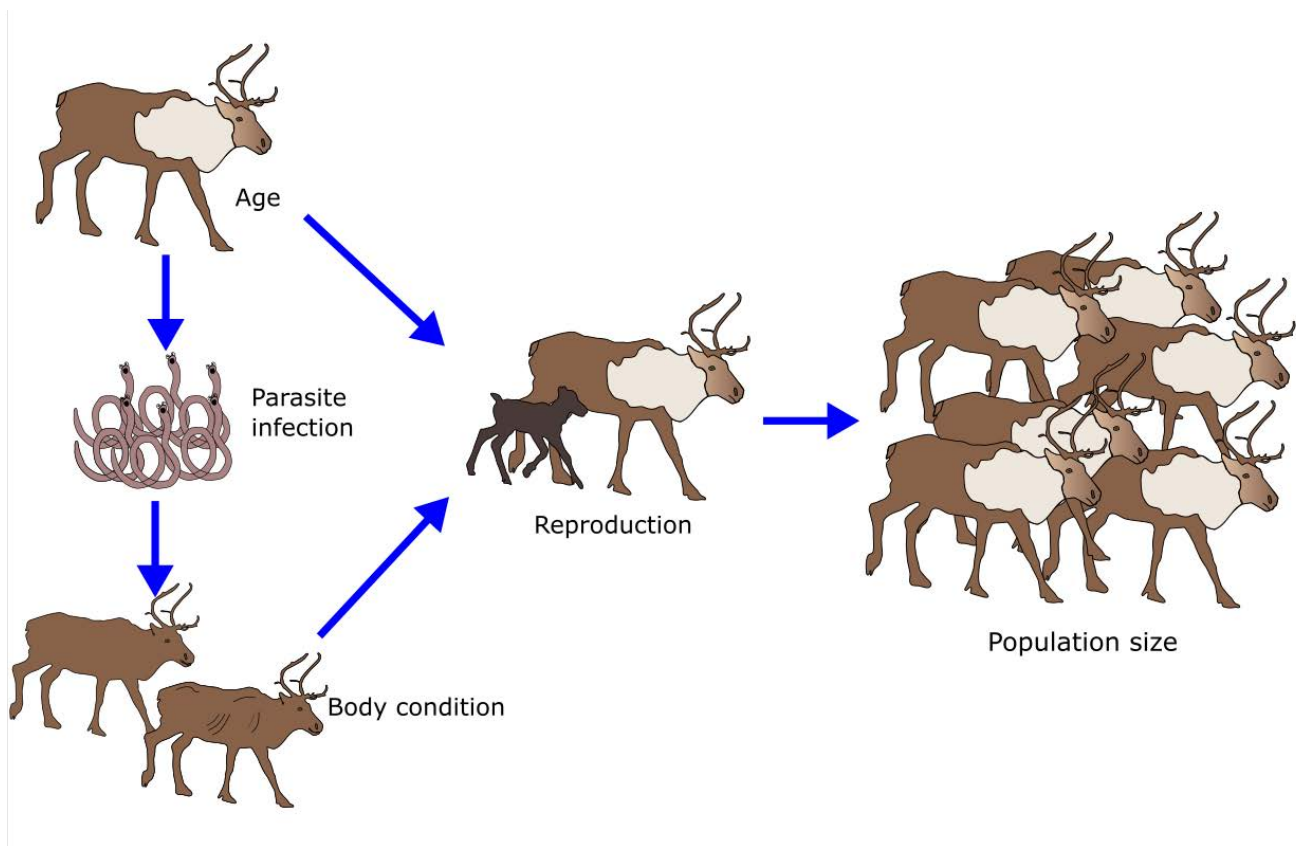
What are we finding?

We are finding that animals with more of these parasites have poorer body condition, but the worms do not *directly* affect their pregnancy rates. Individuals with better body condition are more likely to be pregnant, though.

This suggests that abomasal worms affect reproduction indirectly through body condition.

Also, the effects of these worms vary depending on which type/species an animal has. For some types, we have found no connection between presence of the parasite and a mother caribou having a calf at heel. For other types, we found that these two things were connected.

Worm species have different timing for transmission and for development in the stomach. This explains the variations we are seeing.



Parasite infections in caribou can lead to lower body condition and can reduce reproduction rates. Ultimately, this leads to changes in population size and population growth rates. (Graphic: E. Dickinson)

Why does this work matter?

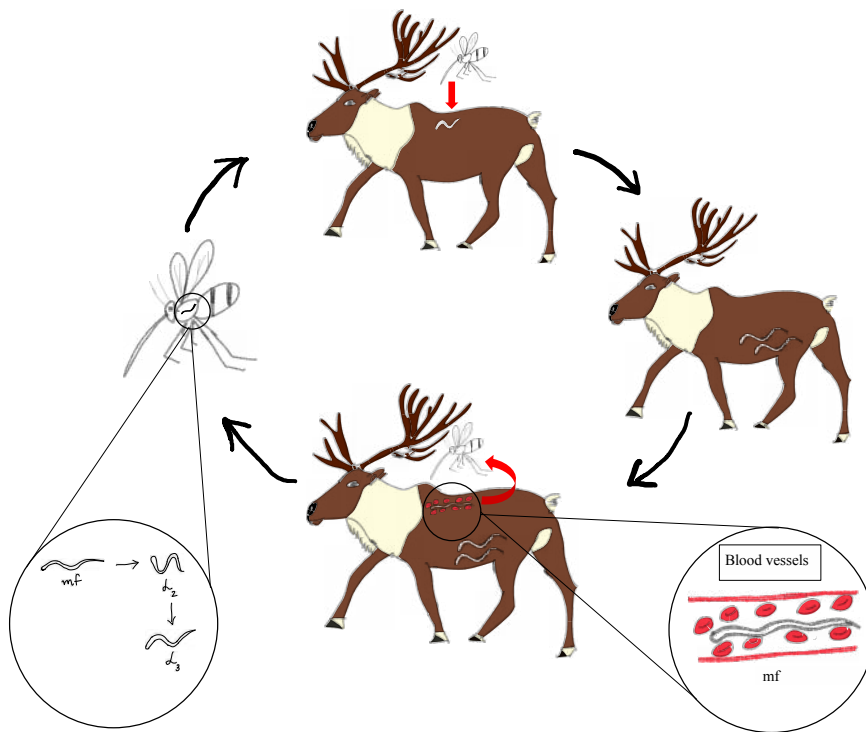
Stomach worms and other parasites can have subtle but important effects on wild animals, such as changes in body condition and pregnancy rates. Climate warming may also create conditions where parasite populations can expand, which can place greater infection pressure on animals. This research will help us better understand these effects and how abomasal worms may influence population dynamics in caribou and muskoxen.

APARNA THOMAS

Insect-borne Parasitic Diseases in Caribou of the Canadian Arctic

What are we doing?

Setaria and *Rumenfilaria* are abdominal (stomach) worms known to cause disease in reindeer (the same animal species as caribou) in Europe, but have not yet been studied in North American caribou. Aparna will be investigating the presence and distribution (locations and range) of these parasites.



Life cycle of *Setaria* and *Rumenfilaria*: Adult worms live in the animal's abdomen. They produce microfilaria (baby worms) that enter the bloodstream. When a biting insect takes blood from the caribou, it also may suck up these microfilaria. Once inside the insect, the microfilaria grow to an infective stage and when the insect then bites another caribou, the worm is injected into the animal's body tissue. It then migrates to the abdomen/rumen and grows into an adult worm. (Graphic: A. Thomas and Kutz Research Group)

Caribou get these worms from biting insects (see life cycle drawing).

Aparna is working with samples from the Government of the Northwest Territories and community-based monitoring programs.

She will test blood samples from barrenground caribou (Bluenose-East, Bluenose-West, Bathurst, and Beverly herds), from boreal woodland and northern mountain caribou of the Northwest Territories, and from the migratory Dolphin and Union herd.

What are we finding?

Stay tuned! Aparna is just beginning her studies with the Kutz Research Group. She hopes that through screening blood samples from 2012 to 2022, she will be able to discover where these worm species are found (which herds) and if they are increasing in abundance.

Why does this work matter?

Climate change is affecting the Arctic much faster than other parts of the world. This favours increased numbers of parasites and diseases transmitted by insects. *Setaria* and *Rumenfilaria* don't infect humans, but these worms can infect caribou and cause illness.

Learning more about these parasites will add to the knowledge decision-makers need to protect endangered caribou, and thereby the wellbeing of northern communities that depend on caribou for food security and culture.

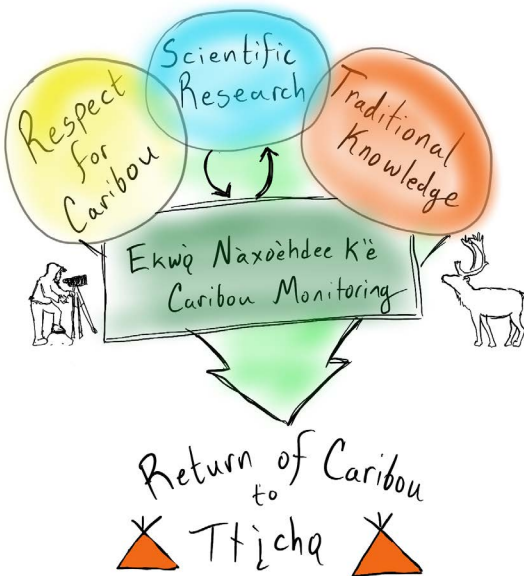


BENJAMIN PADILLA WITH TŁIČHŦ GOVERNMENT AND EKWŦ NÀXŦEHDEE K'È

Bathurst Caribou Health and Population Trends

What are we doing?

Ben is working with collaborators to braid western scientific knowledge with TłičhŦ Traditional Knowledge, as we seek to better understand the roles of parasites and pathogens in caribou health, and in population declines of the Bathurst caribou herd in the Northwest Territories and Nunavut.



In early 2022, Ben organized and co-lead two main meetings: a caribou population modeling workshop with project collaborators, and a knowledge-sharing workshop with TłičhŦ Elders and harvesters. Our goals were to better understand the different worldviews and values behind each knowledge system, and to develop new approaches for noninvasive ways to monitor caribou health.

You can read more about the workshop and what we learned in a blog post Ben wrote.

<http://benpadilla.weebly.com/blog/ekwo-natseti-respect-for-caribou>



(Diagram: B. Padilla)



Group photo from the “We Watch Everything” knowledge-sharing workshop in spring 2022, Yellowknife, NWT. (Photo: A. Aleuy)

What are we finding?

Brainstorming with the Tłıchǫ community and the Ekwò Nàxoèhdee K'è caribou monitoring program produced a new visual guide to caribou health that will be used in the field (see a page of the guide below). This guide will help to collect more detailed observations of Bathurst caribou health, and will help inform demographic models.

Connected with this, Ben's work on a computer model is beginning to show links between caribou body condition and reproduction.

Noticed poor body condition?

Take a closer look at...



- Examine the ribs & hips
How visible are these structures?
- Scan the whole caribou. Focus on the head, legs, hooves, and hair coat
Are there any abnormalities there?

Noticed strange walking?

Take a closer look at...



- When the caribou is standing still
Is the weight evenly distributed?
- When the caribou is moving
Are they taking very long or short steps?
Is there head bobbing when they walk or run?

Noticed something strange around the head?

Take a closer look at...



- Do they have trouble feeding?
- What is their body condition?
- Examine the mouth
Are there any scabs around the lips?
- Examine the head
Are there any bumps, scabs, or wounds?
Are the antlers broken or uneven?

Noticed something strange with the hair or coat?

Take a closer look at...



- Scan the whole caribou
Are they losing hair?
Is their skin bumpy or scarred?
Are there warbles visible under the coat?



A page from the *Caribou Health Field Guide* developed by University of Calgary veterinary student Kaitlyn Dornstauder and Ben Padilla.

Why does this work matter?

Over the past 30 years, the Bathurst caribou herd has dropped from more than 400,000 animals to only 5,000, a stunning decline that has alarmed local communities and management agencies.

The roles of parasites and disease in caribou declines are not well understood. By using both Traditional Knowledge and western scientific knowledge, Ben's research will help in planning the management and conservation of barren-ground caribou. It will also help ensure that local Indigenous communities have access to caribou as a cultural and subsistence resource.

Muskox Health Monitoring and Research

Our research team also has several interesting muskox projects underway.

REGINA KROHN AND OLIVIA HEE

Qiviut as a Monitoring Tool for Muskox Minerals

What are we doing?

We are working to discover whether muskox qiviut (the inner wool of the haircoat) can be used as a monitoring tool for important trace minerals, and to help guide co-management decisions.

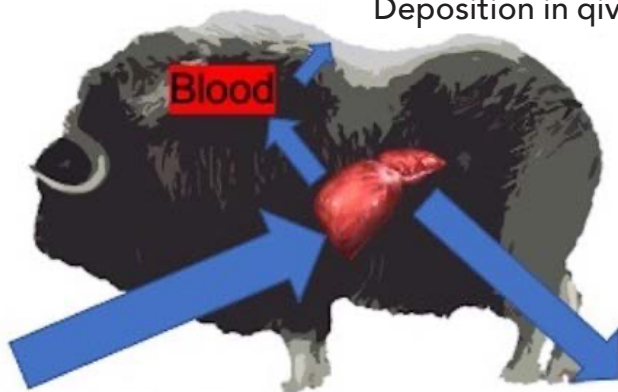
Muskox populations on Victoria Island have experienced recent declines, whereas the population on the adjacent mainland in Kugluktuk appears to be stable. Deficiencies of trace mineral levels may be involved.

Trace minerals (e.g., copper and selenium) are important for immunity, growth, and reproduction. Animals absorb these from vegetation and soil they take in by mouth. Levels of these minerals are typically measured in blood or organs (liver and kidney). Trace minerals are also deposited in growing hair (see graphic below), so qiviut may provide a useful way to monitor them.



During qiviut growth (Apr-Nov)

Deposition in qiviut



Trace metal intake through vegetation

Excretion

Trace mineral deposition in qiviut during the hair-growing season: Nutrients are metabolized in the liver and breakdown products are circulated in the bloodstream. Trace minerals in the blood are then deposited into organs and the growing qiviut. Some excess trace minerals are excreted in the feces. (Graphic: R. Krohn)

What are we finding?

Olivia Hee has just joined the Kutz Research Group to work on trace minerals in muskoxen. She will be using information gathered from harvested animals to see whether there is a relationship between pregnancy and different trace mineral levels.

Why does this work matter?

Climate change is altering the Arctic ecosystem, including the food on which caribou and muskoxen depend. This can affect trace mineral uptake by these animals. This research will expand our knowledge about using qiviut as an indicator of trace mineral and heavy metal status for muskoxen. We are excited about qiviut's potential to contribute to long-term conservation efforts for an important northern species.



ERICA SUITOR

Tooth Breakage in Muskoxen

What are we doing?

Erica is working on determining the ages of muskoxen based on tooth eruption patterns (how teeth develop/appear over time) and analysis of cementum (a hard material that covers the tooth root). Her goal is to develop an accurate aging protocol for muskoxen based on teeth. In addition, she will investigate differences in tooth breakage between mainland and island muskox populations.



Extensive incisor tooth breakage in a muskox jaw from Victoria Island (left), compared with incisors showing normal wear in a muskox jaw from the mainland (right). (Photos: Kutz Research Group)

What are we finding?

Erica's tooth-aging work is in progress, with results expected in 2023.

Interestingly, preliminary studies show more tooth breakage and abnormalities in island populations of muskoxen (Cambridge Bay and Ulukhaktok) compared with some mainland populations (Kugluktuk and Norman Wells).

Erica will be looking at and reporting on factors (e.g., age, sex, year, and location) that may be related to tooth breakage. This should help us begin to understand what are the main causes of tooth damage in Canadian muskoxen.

Why does this work matter?

Ensuring that we can age muskoxen accurately for animals older than 4 years will give greater understanding of the age structure of these populations, and will ensure consistent aging in both lab work and fieldwork.

Arctic mammals need strong teeth so they can eat well and maintain good nutrition and health for survival and reproduction. When teeth become worn or broken, the decline in chewing efficiency can cause poor body condition and other health problems that can affect survival and population status.

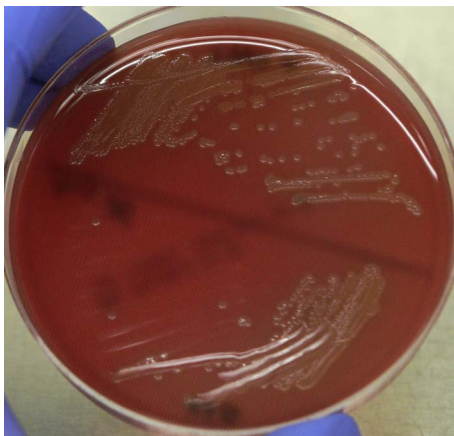
VINEESHA SERU

Victoria Island Muskoxen and *Erysipelothrix rhusiopathiae*

What are we doing?

Erysipelothrix rhusiopathiae is a bacterium that can cause death in muskoxen and other animals. Not all *E. rhusiopathiae* bacteria are exactly the same; different strains cause different severity of sickness depending on the makeup of their genetic material (DNA).

Using tissue samples, Vineesha is working to learn the specific makeup of the entire DNA from *E. rhusiopathiae* strains that have infected muskoxen and other wild and domestic animals. Using this method, known as “whole genome sequencing,” she can identify genetic differences among the strains and connect the dots to the severity of disease that each strain caused. In other words, she can look at which strains had which outcomes, and then review the genetic results to identify certain DNA codes (“virulence traits”) that are responsible for severe outcomes, such as death.



Erysipelothrix colonies growing in blood agar culture (left), and the real-time PCR machine used to detect and identify these bacteria from samples (right). (Photo: Kutz Research Group)

What are we finding?

So far, Vineesha has found that the same strain of *E. rhusiopathiae* has caused muskox mortalities across various arctic Islands, including the most recent outbreak on Ellesmere Island in 2021.

Why does this work matter?

Erysipelothrix infection in muskoxen is associated with significant population declines on Banks Island and Victoria Island, and its recent detection on Ellesmere Island is of great concern. As Vineesha continues her work, we may find unique genetic differences that are responsible for causing widespread muskox mortalities in the Arctic Archipelago.

FABIEN MAVROT

New Teaching Material on the Kutz Lab Website

Thanks to an NSERC PromoScience grant, our team has been able to bring science into classrooms in the communities of Kugluktuk and Ulukhaktok since 2017.



Fun is a priority during the hands-on science that the kids do in class. (Photo: Kutz Research Group)

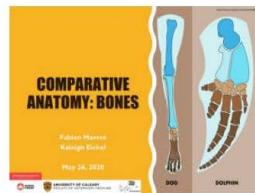
We use a mix of presentations, hands-on activities, and on-the-land teaching to introduce young community members to our research and spark interest in science and wildlife monitoring.

In 2021, our summer veterinary student Kaleigh Eichel compiled some of the interactive lessons that we've done in the northern classrooms over the years. We have mapped this material onto the 2019 school curricula for the Northwest Territories and/or Alberta to illustrate how these lessons and experiences can complement existing curriculum requirements.

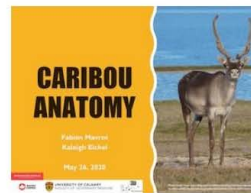
All presentations and lesson plans are available here: <https://people.ucalgary.ca/~kutzrg/TeachingMaterials.html>



Anatomy Module



Presentation
Lesson Plan



Presentation
Lesson Plan

Ecology Module



Presentation
Lesson Plan



Presentation
Lesson Plan





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