

Muskox and Caribou Health Monitoring Program

ACTIVITY UPDATE SEPTEMBER 2018





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Introduction

The Muskox and Caribou Health Research Program is a collaborative program among universities, communities, industry, and territorial and federal government agencies. The program was initiated in 2008 in response to the apparently changing health status of muskoxen. At that time, the muskox lungworm, *Umingmakstrongylus pallikuukensis,* was detected in muskox samples submitted from a community hunt on southwest Victoria Island; this suggests a range expansion of the parasite towards the north. In addition, the bacterium *Erysipelothrix rhusiopathiae* was identified for the first time in muskoxen and was implicated in multiple severe die-offs in muskox populations from Banks and Victoria Island in 2009-2013.

In response to these health changes, we launched a collaborative, multifaceted research program with the aim of understanding the general health of muskoxen in this region. The program has grown and evolved over the years and strives to bring traditional, local, and scientific knowledge together to better understand the health of muskoxen and caribou.

The research that we've accomplished to date has only been possible because of the amazing collaboration among communities, governments, universities, and the qiviut and sport hunting industries. We thank all the individuals and organizations that have contributed to this work and look forward to working with you further. In the following pages, you will see a brief overview of the various projects that are currently underway as well as contact information for the researchers involved.

Please feel free to contact me about the overall project and with any questions or concerns you may have.

Best,

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Incisor breakage in muskoxen

What's the issue?

Good teeth are essential for the health and survival of muskoxen. Animals that cannot feed correctly are more susceptible to diseases, predation or starvation. As part of our muskox health monitoring program, we have collected and examined **the lower jaws of 162 harvested muskoxen**. We found that the most frequent issue is **breakage of the front teeth** (incisors) and that muskoxen on Victoria Island have more broken incisors than the animals on the mainland.

What are the causes?

We don't know yet why there is such a high occurrence of incisor breakage in Victoria Island muskoxen. Possible causes are:

- vitamin/mineral deficiencies or imbalances
- changes in vegetation resulting in mechanical breakage (especially during the winter – if there is less snow in winter to insulate the plants, they might be frozen particularly hard resulting in damage to the incisors)
- genetic: e.g., increased occurrence of animals with misaligned teeth which are more likely to break

What's next?

We did CT-scans on 80 jaws (a technique similar to X-ray) and are currently examining the scans to try to find what could be the cause of incisor breakage. We also plan to do other tests such as trace mineral and micro-hardness analyses.



CT-Scan of a muskox jaw. This technique allows to examine the jaw from all angles.



Difference in incisor breakage in muskoxen from the mainland and Victoria Island.

Research conducted by Fabien Mavrot (fabien.mavrot@ucalgary.ca)

Measuring stress in muskoxen

What are we doing?

When an animal is stressed, it releases stress hormones, also known as glucocorticoids. The short-term release of these hormones enables the animal to escape from life-threatening situations and is essential for survival. Conversely, repeated or long-term release of these hormones, over weeks to months, may have negative effects on reproduction, survival, and immunity. Thus, stressed animals are more likely to get sick and may have reduced reproductive success. Measuring the stress levels of muskoxen can consequently give us information about the general health status of the animals or the populations. Stress hormones, such as cortisol, are incorporated into the feces, guard hairs and qiviut, and the levels measured represent, respectively, the stress experienced by the animal during a few days and months.

Results from **150 qiviut samples** collected in the communities of Cambridge Bay, Sachs Harbour, Kugluktuk, Ulukhaktok and Paulatuk between 2013 and 2016 showed a high variability in stress levels among individuals with cortisol levels ranging from 3.51 to 48.92 pg/mg. The sex of the animals, along with the season and year the samples were collected, all had an effect on qiviut cortisol levels. Concentrations were higher in males than females, summer levels were lower than fall and winter, and levels increased from 2013 to 2015 (see figure).

What's next?

An additional 138 giviut samples and 195 fecal samples collected in 2016-2018 by hunters from Kugluktuk, Ulukhaktok, and Cambridge Bay are currently being analyzed. We will then begin to evaluate how giviut and fecal stress hormone levels are related to other measures of the health of individual animals, such as body condition or infection intensity of both gastrointestinal parasites and lungworms. We will also further study the



hormonal response to stress in an experimental trial on captive muskoxen in collaboration with the University of Alaska, Fairbanks. Finally, traditional, local, and scientific knowledge will be gathered to gain a better understanding of the stressors affecting muskoxen and their health. For this, group interviews will be conducted in with local hunters and community members in Kugluktuk. The ultimate goal of this project is to determine if qiviut cortisol levels can be used as an indicator of individual and/or population health.

Research conducted by Juliette Di Francesco (juliette.difrancesco@ucalgary.ca)

Erysipelothrix in Arctic Wildlife

What's the issue?

Erysipelothrix rhusiopathiae is a bacterium that is suspected to have caused multiple sudden deaths of muskoxen on Banks and Victoria Islands and Alaska from 2009-2013. Caribou are also affected by this bacterium. Our goal is to better understand how animals get *Erysipelothrix* and what it does to muskox and caribou populations.

How widespread is it? Since when is it here?

To answer those questions, we analyzed blood samples of caribou and muskoxen collected over 40 years across North America to see if the animals were exposed to *Erysipelothrix*. We have tested **779 muskoxen** and **3,190 caribou**.

What did we find?

We found that *Erysipelothrix* was already present in muskoxen and caribou since at least the 1970's.

It is widespread in North America: almost every herd had positive animals. But there were great differences in how many animals were in contact with the bacterium from yearto-year and between different regions. In general, *Erysipelothrix* seems to have increased in recent years and we think it may have effects on caribou and muskox populations.





What's next?

With the help of the samples collected by local harvesters, we are continuing to monitor the bacterium in the Arctic. In our future research, we hope to be able to understand why *Erysipelothrix* is more common now than it was in the past and to better assess its impact on caribou and muskox populations.

Research conducted by Michele Anholt (<u>rmanholt@gmail.com</u>) and Fabien Mavrot (<u>fabien.mavrot@ucalgary.ca</u>)

Muskoxen, caribou, and a fox found dead on Prince Patrick Island, summer 2017

What's the issue?

In July 2017, three adult muskoxen were found dead at the same location on Prince Patrick Island.

We investigated the carcasses and concluded that the animals died from an infection with the bacterium *Erysipelothrix rhusiopathiae*. We also found *Erysipelothrix* in nine additional nearby carcasses (2 other muskoxen, six Peary caribou and one Arctic fox).

Molecular analyses of the isolated *Erysipelothrix* bacteria showed that all animals were infected **with the same strain of the bacterium**. In addition, the bacterium isolated during the 2017 die-off on Prince Patrick Island is very closely related to the *Erysipelothrix* strain found in muskox carcasses on Banks and Victoria Islands in 2009-2013.

Why is it important?

Erysipelothrix has been linked to both muskox and caribou mortalities in past years. In particular, the multiple die-offs on Banks and Victoria Islands in 2009-2013 raised concern about the possible impact of *Erysipelothrix* on muskox populations. The results from this investigation show that *Erysipelothrix* is still circulating in the Arctic and causing disease in caribou and muskoxen.



Carcasses of three muskoxen and one Peary caribou investigated on Prince Patrick Island. Erysipelothrix was found in all animals.



Locations of known muskox die-offs in the Canadian Arctic since 2009. "Erysip. positive" indicates die-offs where Erysipelothrix was detected in the carcasses.



Isolation of the bacterium Erysipelothrix on a culture plate. The brown-yellowish spots are colonies of Erysipelothrix growing on the red culture medium.

Investigation conducted by Fabien Mavrot (fabien.mavrot@ucalgary.ca)

Muskox qiviut as a tool to monitor population health and trends

What's the issue?

Monitoring populations is time-consuming, expensive and difficult in remote areas of the Arctic. Because of this, it is important to find new ways to monitor wildlife populations in collaboration with hunters and others. The aim of this project is to see if mineral levels in hair of muskoxen can predict the future population trends: such a tool will have great value to guide co-management of muskoxen.

What's the rationale?

The use of hunter-based sampling can important provide information on population health and trends that may not always be available from direct population surveys. Trace minerals are things like copper, zinc, calcium and other elements that animals get from their food. These minerals are critical for an animal's health, affecting their resistance to disease, growth and reproduction. We are testing if the mineral status in hair can serve as an indicator of population health and if it can be used to predict future population trends.



How do we do it?

This project is a collaboration of researchers, wildlife biologists and First

Nations, Inuit and Metis community members. A key piece of our work is using hunter-based collected samples from the Community-Based Wildlife Health Monitoring Program in the Inuvialuit and Kitikmeot regions. Through this program, hunters collect hair, blood and fecal samples, which will be analyzed to provide information on hair mineral levels, overall health, pregnancy, parasites and diseases and more. This will allow us to evaluate the relationship between trace mineral concentrations in hair samples and individual and population health and trends.

What's next?

This is a new project that started in April 2018. We have started to analyze samples during the fall and winter of 2018 and will, hopefully, have results to report soon. Once validated, we anticipate that hair mineral content will be a useful tool for estimating population health and trends.

Research conducted by Jesper Bruun Mosbacher (jesper.mosbacher@ucalgary.ca)

Hoof abnormalities in muskoxen

What's the issue?

We are seeing abnormalities on the hooves of the animals collected by hunters Kugluktuk, Ulukhaktok, and Cambridge Bay (for example overgrowth or lesions). We know from other species that lameness can have a big impact on the animal's health, fertility, predation risk and survival in general, which all potentially influence the population abundance. Hoof abnormalities may also be an indicator of other abnormalities, stressors, or imbalances in the animal. In this study, we will examine muskox hooves collected by local hunters and identify, describe and evaluate hoof abnormalities in the different study areas.



Hoof abnormalities

What's next?

This is a new project, and still in its early beginnings. We have recently X-rayed all the hooves to identify and evaluate any bone or joint related abnormalities. The next step is a close examination of all the hooves using microscopic and other types of techniques. We hope to determine, what hoof abnormalities are present in the muskox populations. Ultimately, the hoof health will be compared to other health parameters measured on the same individuals, like mineral and stress levels or parasite infection, to see if they are related. We hope the results will tell us more about hoof health in muskoxen and its impact on individuals and populations.



X-rays of muskox hooves.

Expanding health research to the Dolphin and Union caribou herd

What's the issue?

The Dolphin and Union caribou herd is integral to Inuit life, both for culture and subsistence. This herd migrates in the fall and spring backand-forth between Victoria Island and the mainland and is dependent on sea ice for this biannual journey. Preliminary local and scientific knowledge both indicate that this caribou herd is declining and in poorer health than before. Our goal is to expand on this knowledge to better understand the health of the Dolphin and Union caribou herd and understand what factors may be causing it to decline.



What's the rationale?

To help protect this herd, we need to bring everyone together and use everything we know about Dolphin and Union caribou, the environment and the other animals to help protect and care for these animals. To start this process, we need to understand how the Dolphin and Union caribou are doing now and develop better and quicker ways to measure changes in the populations.



How do we do it?

We start conversations between local Dolphin and Union caribou experts in the communities, veterinary medicine specialists and resource managers. Through adaptive comanagement processes, we can incorporate information from all these different knowledge sources as we learn new things to constantly adapt the way we protect the Dolphin and Union caribou. The difficulties with working in any large team is being able to communicate well and trust each other. To help overcome this, we are acknowledging and trying to respect all the different cultures involved in a project like this, and we are starting small to build a good foundation for the future of this program.

What's next?

With the help of the Kugluktuk Hunters' and Trappers' Organization, we'll start by interviewing and working with Dolphin and Union hunters in Kugluktuk. Through individual and group interviews, the goal to is create a collective account of how Kugluktuk hunters see the Dolphin and Union caribou doing. *Are they sick? Are they fat? Are they surviving the winter? Are they surviving the migration?* This September-November I'll be in Kugluktuk, listening and learning from the people who know about Dolphin and Union caribou.

Educational activities in Arctic communities

Thanks to the NSERC: Promoscience Program, we have been able to offer educational activities in the Arctic communities of Kugluktuk (Nunavut) and Ulukhaktok (Northwest Territories). Those activities were organized in parallel with our field work and in collaboration with the local schools. We have delivered presentations on different topics related to wildlife health monitoring but also on ecology and career opportunities in science. We also organized "hands-on" workshops such as animal dissection, looking for parasites in muskox droppings, bone anatomy etc.



With these activities, we hope to directly engage the next generation of community members in science and, ultimately, inspire them to go further and develop the knowledge and skills for monitoring and management of wildlife populations in their rapidly changing environment. So far, the feedback has been extremely positive, and we are looking forward to continuing to bring science in the classrooms!

Many thanks to NSERC PromoScience and the school personnel in Kugluktuk and Ulukhaktok for making this possible.



Dissecting muskox lung to find parasitic lungworms.



Learning caribou anatomy.

Experiment to extract lungworm larvae from muskox feces

Contacts

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