

ARCTIC WATCH and the KUTZ RESEARCH GROUP

ACTIVITY UPDATE June 2023



Photo: Weber Arctic



UNIVERSITY OF CALGARY
FACULTY OF VETERINARY MEDICINE

Update prepared by the Kutz Research Group

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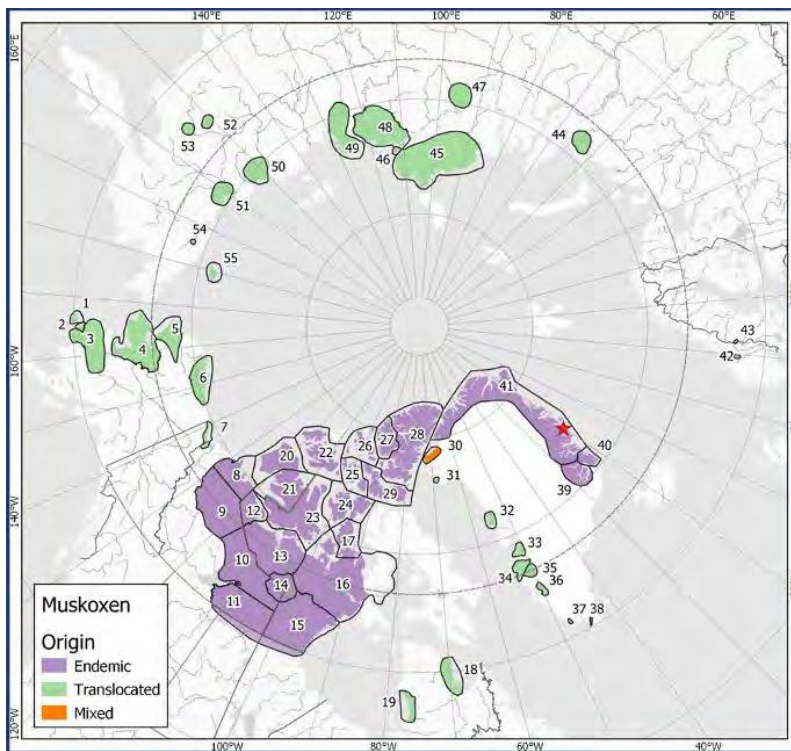
 <https://vet.ucalgary.ca/contact-us/susan-kutz>

UMINGMAK, AN ICE AGE RELIC



Photo: S Kutz

Tundra muskoxen, *Ovibos moschatus*, or “Umingmak” in the Inuit language, are icons of the Arctic that capture the imagination like no other, and that hold immeasurable intrinsic value. With their long robes of guard hair protecting a uniquely adapted undercoat or “qiviut,” muskoxen are an essential component of the Arctic ecosystem and remain a vital cultural and subsistence resource for arctic peoples and communities.



Global distribution of muskoxen (from Cuyler et al. 2020).



Ancestors of these awe-inspiring animals are thought to have crossed the Bering land bridge to inhabit North America about 90,000 years ago. Groups of muskoxen survived the Ice Age by inhabiting ice-free zones called “glacial refugia.” When the ice receded, they spread out to populate lowland plains and river valleys of what is now the Canadian Arctic, Greenland, and Alaska.

In addition to surviving bottlenecks caused by the Ice Age, muskoxen also persevered through near-extirpation in the early 1900s caused by over hunting for the European fur trade. While still here with us now, the future of these majestic animals remains uncertain.

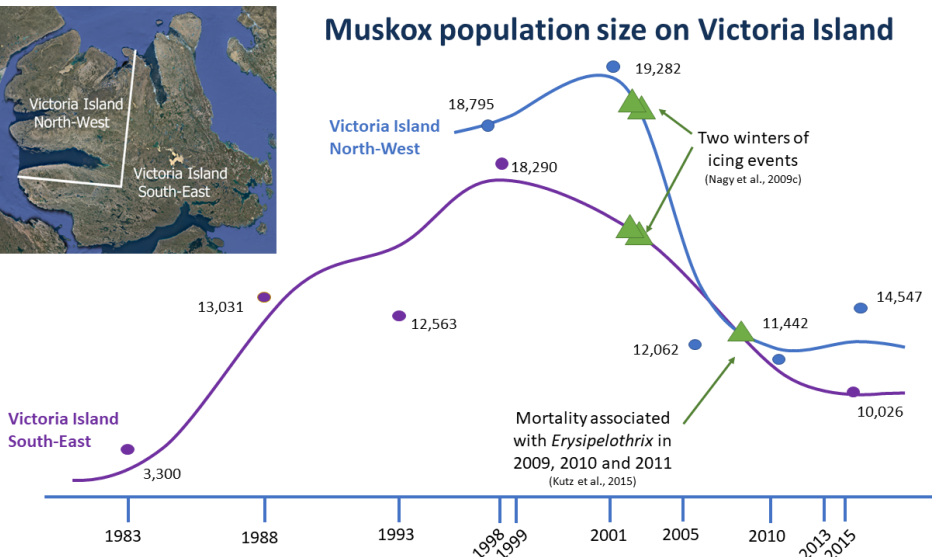
Muskox Population Declines: The Worry Today

At present, the total number of naturally occurring muskoxen is estimated at less than 100,000. Prior to 2010, the populations on Banks Island (#20 on map above) and Victoria Island (#21 & 23) in the western Canadian Arctic archipelago were the two largest in the world. Both these have suffered devastating mortalities from emerging diseases and severe icing events. While their combined numbers topped 110,000 in the early 2000s, recent scientific surveys and Traditional Knowledge indicate that this total has plummeted to fewer than 30,000 animals (declines exceeding 75%).

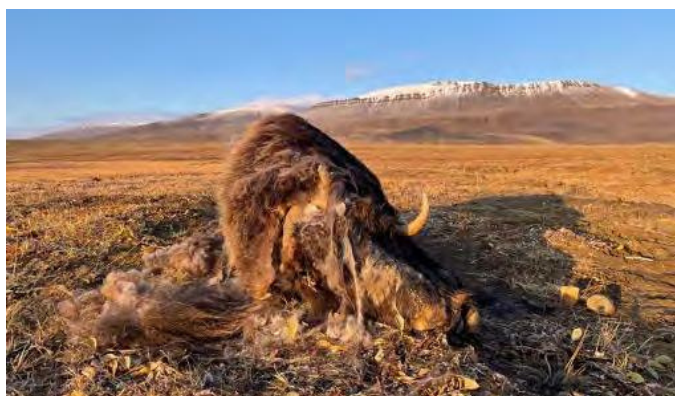
In the eastern Arctic, alarms rang in the summer of 2021 when a nature film crew discovered an unusually high number of dead muskoxen on Ellesmere Island (#28 on map). Further mortalities occurred the following year, including on the neighbouring island, Axel-Heiberg (#27 on map). These areas are known as the garden of the Arctic and are important areas for muskoxen. The status of most other island muskoxen is unknown due to limited capacity to do population surveys.

If muskoxen survived historically, why the concern now?

The small muskox populations that exist today signal **a limited gene pool**. In fact, muskoxen currently have less genetic diversity than the cheetah, which is teetering on extinction. Limited genetic diversity means muskoxen may have trouble adapting to imminent environmental changes and threats.



Graphic: E Dickinson



Muskox carcass discovered on Ellesmere Island, 2021.
(Photo: S Kutz)

Yet, climate change is here now; the arctic ecosystem upon which all northern wildlife depend is rapidly becoming more fragile before our eyes.

Climate warming is chipping away many past “norms” of arctic habitat and conditions, and placing all life forms under new stresses. As the Arctic heats up, insects and parasites are able to shift northward, and seasonal cycles of forage plants shift, too. These are just some of the subtle yet impactful changes that can affect animals’ health and reproduction.

Arctic Watch: Taking Action as Arctic Animals Face a New World

In essence, the fundamental framework of life for muskoxen, caribou, and all northern species is changing; the Arctic is rapidly morphing into a new world for all its inhabitants, animal and human.

The Kutz Research Group's work focuses on this intertwined and shifting arctic world. Disease, unprecedented rates of climate change, and a host of other factors are affecting the health and survival of muskoxen. The Kutz Research Group, together with our many collaborators, is dedicated to understanding the threats to muskox survival and developing solutions to ensure this iconic species persists for generations to come.

In 2021, Arctic Watch invited the Kutz Research Group to visit Somerset Island and explore opportunities for research. We have now established a long-term muskox health research program, and are exploring the exciting new research opportunities at Arctic Watch.

The Kutz Team is tremendously grateful to Arctic Watch and all our valued sponsors, collaborators, and partners for your support. All of you are helping all of us learn all we can about how to preserve arctic wildlife and the environment they need to survive and thrive.

Thank you

We hope these updates will bring you up to speed on some exciting and interesting projects that are underway and planned for future.

Photo: X Fernandez Aguilar

**"All of you are helping all of us learn
all we can ...
to preserve arctic wildlife and the
environment they need ..."**

Arctic Watch and Kutz Research Group: Exciting Muskox Ecosystem Research Continues

Dr. Susan Kutz, a Canada Research Chair in Arctic One Health, began working with Weber Arctic in 2021 to develop ecosystem-based research on muskoxen at Arctic Watch Wilderness Lodge on Somerset Island. In addition to interest in health indicators for the animals themselves, Arctic Watch staff had been noticing changes in flying/biting insect diversity. Since such insects can be vectors (transmitters) of disease, it was important to ensure that the research included ways to investigate them.

In 2023, we are launching our longterm research program in partnership with Weber Arctic to learn more about muskox health and ecology.

These exploratory studies include:

- collecting fresh muskox **feces** to study parasites and stress
- collecting shed **hair (qiviut) samples** to study nutrition, specifically trace minerals
- investigating previous muskox **skeletal remains** to learn more about causes of death
- surveying for **slugs** (intermediate hosts of parasites) in the environment
- trapping and identifying **flying insects** present

Initial studies produced some interesting findings that has directed future work:



1. High level of infection with the parasitic lungworm, *Dictyocaulus*. While this “nematode” has caused death in young muskoxen elsewhere, little is known about this worm.

Our upcoming work seeks to understand how common this lungworm is, how its abundance changes over summer, how it might be affected by climate change, and how it affects muskoxen.

Interestingly, we did not detect another parasite, the muskox lungworm *Umingmakstrongylus*, which is common on the western Arctic mainland and has recently expanded its range to Victoria Island.



2. Fecal pellets showed generally low levels of stress; stress hormone levels in adult feces were comparable or lower to those measured in other muskox populations.



3. Qiviut had lower levels of selenium and copper than what has been observed in muskox populations that are stable or increasing.

In particular, we found that levels of the trace mineral selenium were lower than any other population we have tested. Selenium is an essential trace nutrient required for growth and reproduction. Low levels can result in weak calves and is associated with poor doing populations.

4. Discoveries on the land revealed muskox skeletons with several jaw abnormalities. We are not certain yet what may be causing this; however, it may be linked to trace mineral deficiencies.

Remains showed jaw abnormalities that suggest health issues, not normal decay or weathering: e.g. loss/resorption of the bone that anchors molars in an upper jaw (circled in red). (Photo: S Kutz)



5. No slugs were found in capture bowls. Slugs are the intermediate hosts of the muskox lungworm *Umingmakstrongylus*, so absence of slugs would explain why we didn't detect this parasite.

We plan to repeat and expand this survey work throughout the full summer.



6. In total, 131 species of insect were recorded on Somerset Island in 2021. Species included crane flies, muscids, fungus gnats, non-biting midges, predatory insects, parasitoids, spiders, non-parasitic mites and springtails.

No mosquitoes or biting flies were found.

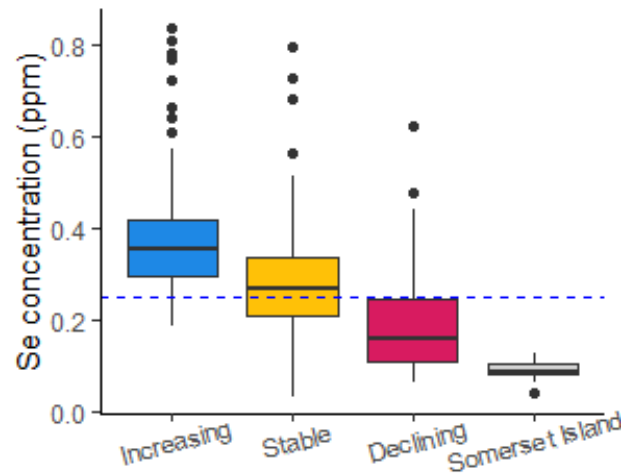
What's next for summer 2023 ...

Members of the Kutz Research Group are returning to Arctic Watch Wilderness Lodge in summer 2023 to expand their **research monitoring the health of muskoxen** on Somerset Island. We will be collecting samples from muskoxen more widely across the island, and throughout the summer to gain a clearer picture of how the muskoxen are doing.

Trace mineral supplementation

Closer to camp we will be trialling the **supplementation of muskoxen** to address the trace mineral deficiencies we have found.

Our main goals are to determine whether it is possible to supplement muskoxen, whether this improves their health and reproduction, and if there are any unintended consequences. If successful, this could be used as a tool to support muskoxen health where minerals levels are low and populations have experienced decline, such as on Victoria Island.



Level of the trace mineral selenium in free-ranging muskox populations relative to if the population is increasing, stable, or decreasing (unpubl. data, Mosbacher, Dickinson, Kutz et al.), compared to levels in muskoxen on Somerset Island.

Parasites and diseases

This year we will also be sending fecal samples back to our lab at the University of Calgary to find out more about the **ecology and transmission of the lungworm, *Dictyocaulus***.

We will continue to **monitor the flying and terrestrial insect diversity** and any insect range shifts that may be occurring, as these could be clues to potential disease introduction and spread. We will also continue to survey for **slugs** and investigate any **muskox skeletal remains**.

Tourism partners

Finally, we want to continue to utilise the local knowledge of Arctic Watch guides and our connection with the guests at Arctic Watch. So, we will also be trying to find out how **partnerships between tourism operators and researchers can contribute to wildlife conservation**, and also how this improves the guest experience.



Muskoxen in the Canadian Arctic: Emerging infectious diseases

Ellesmere Island: Urgent Investigation of Muskox Mortalities

Two years ago, north of Somerset Island, a muskox mortality event occurred on Fosheim Peninsula, Ellesmere Island. By chance, on August 3, 2021 a film crew documenting Arctic wolves came across the disturbing scene of a mother muskox standing over her dead calf. As the next week passed, they proceeded to discover more fresh carcasses of varying age, some in clusters, and with no evidence of predation.

The crew made an urgent distress call to the South. In talking with Dr. Kutz, they described observations of multiple recent or sudden muskox deaths.

Dr. Kutz contacted the Government of Nunavut biologists and organized a plan to investigate as soon as possible. On August 21, she met up with a conservation officer, Tabitha Mullins, in Resolute Bay and they flew on to Ellesmere Island to examine as many of the mortalities as conditions and logistics allowed.

Last summer, in anticipation of another mortality event, Susan and Tabitha along with Government of Nunavut biologists travelled to Ellesmere Island again. There they found fresh mortalities on Ellesmere and Axel-Heiberg Islands, and investigated carcasses from the previous year.



What are we finding?

The samples collected from 2021 and 2022, along with observations in the field, have shown that many of these muskoxen are dying from infections with a **bacteria called *Erysipelothrix rhusiopathiae***.

In 2022, we also observed several animals with abnormal-looking eyes which may be associated with *Erysipelothrix*.

This new finding of *Erysipelothrix* on Ellesmere Island is highly significant as this pathogen and others are combining with nutritional issues (e.g., trace mineral deficiencies) to threaten the health of muskox populations that have previously thrived.



Victoria Island: Are muskox populations recovering?

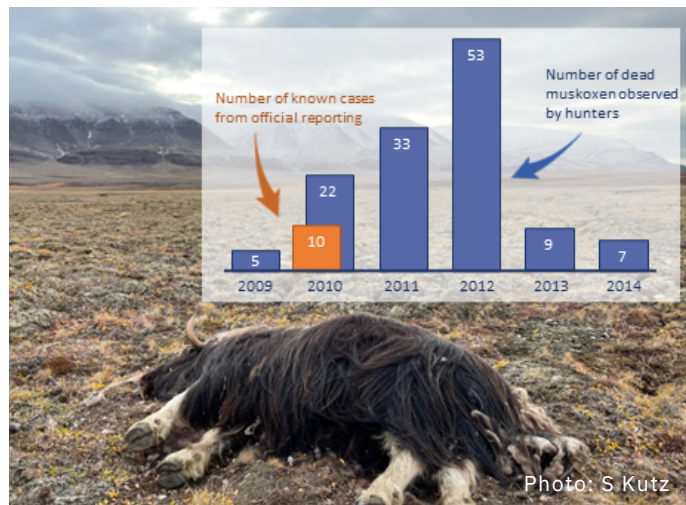
Ellesmere Island was the fourth documented outbreak of *Erysipelothrix* in Arctic island muskoxen to date. The same bacteria was found in dead muskoxen on Banks and Victoria Islands between 2009 and 2014. Inuit harvesters from Ekalututiak (Cambridge Bay) and Ulukhaktok reported numerous unusual muskox deaths between 2009-2014. Animals of all ages and in excellent body condition had died suddenly with no signs of predation. The Traditional Ecological Knowledge of Inuit harvesters was instrumental in the detection and understanding of the disease outbreaks on Victoria Island.

These large scale mortality events of muskoxen over the last decade have resulted in major population declines of what used to be the two largest herds in the world. Caribou, which are also susceptible to *Erysipelothrix*, have suffered enigmatic and dramatic declines over this same time period.

The population declines have negative impacts on Inuit food security. Declines also effect northern economies through loss of guided hunting opportunities and other ecotourism activities.



Photo: F Mavrot



Mortalities of muskoxen on Victoria island observed by Inuit hunters between 2009 and 2014, and the known cases of *Erysipelothrix* through official reporting (Tomaselli et al., 2018).

We are hoping to return to Ekalututiak to repeat interviews with Inuit harvesters 10 years after the initial outbreak. In collaboration with community hunters and trappers committees, we will continue the harvester-based sampling of caribou and muskoxen.

This information and that from over 10 years of harvester-based sampling (subsistence and guided hunts) will be analyzed to determine trends in health indicators (e.g., body condition, pregnancy, group size, stress, disease) of muskoxen and assess if there is evidence of population recovery.

Results will guide effective and pro-active wildlife management to preserve wildlife for generations to come. This is an essential component for ensuring the livelihoods and culture of Indigenous people.

What It All Means: The Big Picture for Arctic Muskoxen

The mortalities on Ellesmere Island add urgency to the need for more information on this bacteria, and the general health of muskoxen populations.

So far, our work with Arctic Watch on Somerset Island suggests no massive die-offs in the muskox population there at this time; however, findings such as high-level lungworm infections and very low selenium, do raise concerns and we look forward to learning more.

With the mortalities and population declines on other islands, the muskoxen of Somerset Island offers a valuable study population to understand natural stressors to muskoxen and their interaction with the ecosystem.

This year we are piloting a proactive approach to supporting muskoxen health through mineral supplementation.

We look forward to seeing you and sharing our research and findings in 2023!



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