

ARCTIC WATCH and the KUTZ RESEARCH GROUP

ACTIVITY UPDATE June 2022



Photo: X Fernandez Aguilar



UNIVERSITY OF CALGARY
FACULTY OF VETERINARY MEDICINE

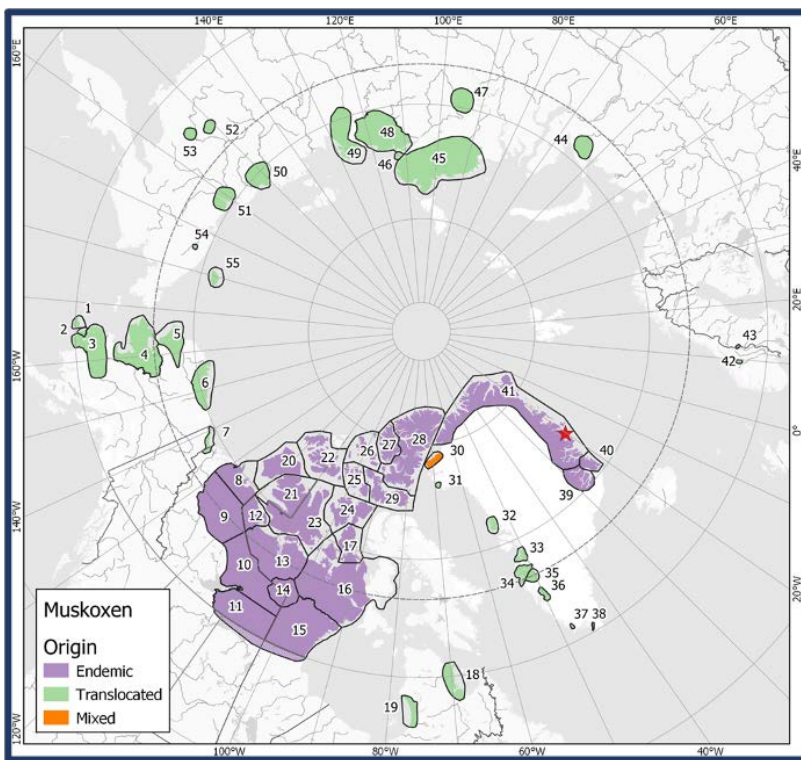
Update prepared by the Kutz Research Group

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.

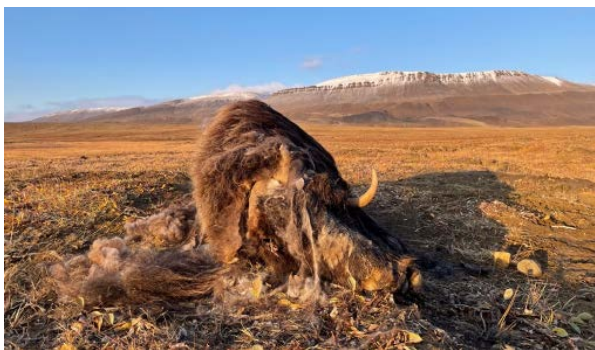
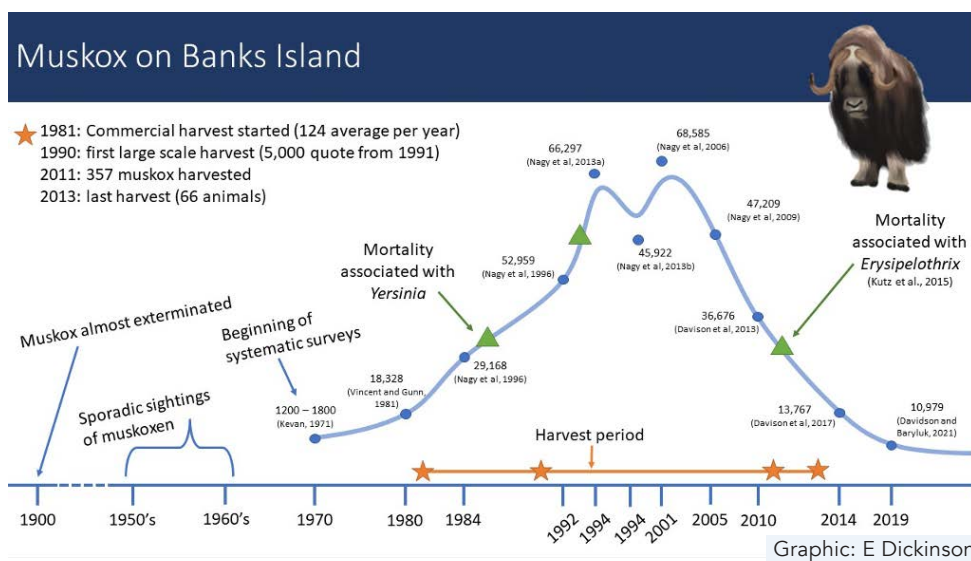
In addition to surviving bottlenecks caused by the Ice Age, muskoxen also persevered through near-extirpation in the early 1900s caused by over hunting for the European fur trade. While still here with us now, the future of these majestic animals remains uncertain.

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 last summer when a nature film crew discovered an unusually high number of dead muskoxen on Ellesmere Island (#28 on map). The status of most other island muskoxen is unknown due to limited capacity to do population surveys. Mainland populations seem to have fared better recently, but numbers are small.

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.



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.

So ... it’s no surprise that scientists and other wildlife experts are on edge about muskox declines. Disease and a host of other factors can affect muskox health and survival, and the Kutz Research Group, together with our many collaborators, is conducting studies to help grasp the bigger picture of what causes mortality events and, more generally, identify the risks to muskox populations in our changing Arctic.

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.

In 2021, Arctic Watch invited our group to visit Somerset Island and explore opportunities for research. We are now on our way to establishing a long-term muskox health research program.

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.

Thankyou

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 2021 and 2022: Exciting Muskox Ecosystem Research Begins

In 2021, Weber Arctic invited Dr. Susan Kutz, a Canada Research Chair in Arctic One Health, to their Arctic Watch Wilderness Lodge on Somerset Island to develop ecosystem-based research on muskoxen. 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 early July 2021, Susan and colleague Dr. Karin Orsel visited the camp on Somerset to explore opportunities for learning more about muskox health and ecology.

Preliminary studies included:

- 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

These initial studies produced some interesting findings that will direct 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 future work seeks to understand how common this lungworm is, 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. No slugs were found in 50 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.

However, we suspect that the cold temperatures during our visit could have prevented slugs from being caught. We plan to repeat and expand this survey work.

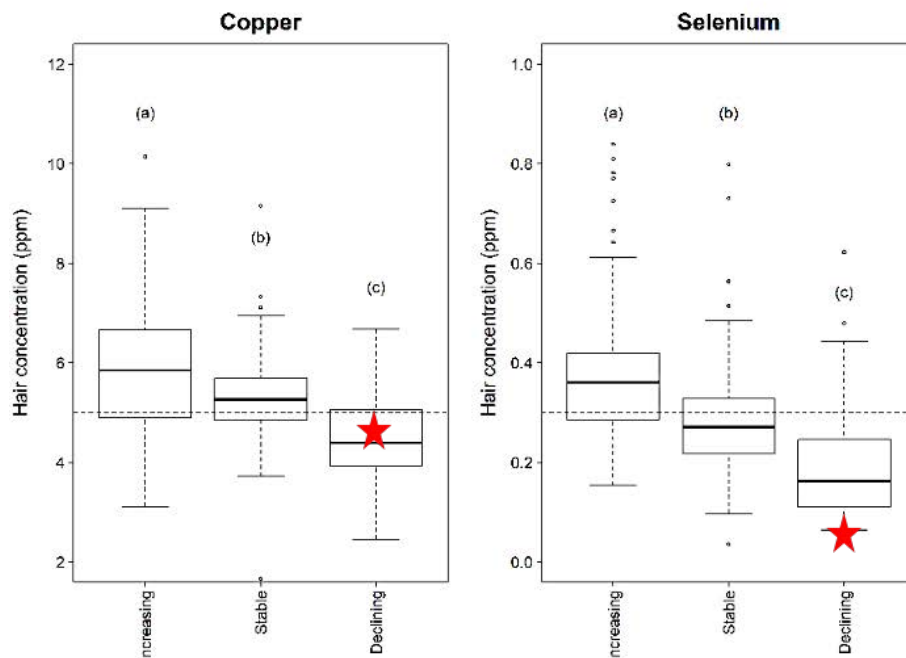


3. Fecal pellets showed higher levels of **stress hormones in calves** compared to older muskoxen; stress hormone levels in adult feces were comparable to those measured in other muskox populations.



4. 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 very low. Selenium is a key nutrient for health and plays important roles in critical body functions, including reproduction and immunity.



Trace mineral levels in free-ranging muskox populations relative to if the population is increasing, stable, or decreasing (unpubl. data, Mosbacher, Kutz et al.).

Red stars indicate Somerset Island qiviut values from 2021 (average levels: copper 4.79 ppm, selenium 0.09 ppm).



Remains showed jaw abnormalities (circled in red) that suggest health issues, not normal decay or weathering: Bony swelling in a lower jaw (left) and loss/resorption of the bone that anchors molars in an upper jaw (right). (Photos: S Kutz)

5. 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.

What's next ...

Members of the Kutz Research Group are returning to Arctic Watch Wilderness Lodge in summer 2022 to find out more about the presence and effects of the lungworm *Dictyocaulus*, trace mineral deficiencies, and skeletal/dental abnormalities in muskoxen.

We will also continue to monitor flying-insect diversity and any insect range shifts that may be occurring, as these could be clues to potential disease introduction and spread.



Malaise trap for catching flying insects

Ellesmere Island 2021: Urgent Investigation of Muskox Mortalities

Last summer, 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, bleeding from the nose, and at least one sick/staggering bull who they'd found dead the next day.

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



Investigation:

- **20-plus muskox carcasses** were sighted August 3-22, 2021; the team accessed 10 of these
- animals were generally in **good body condition with thick hair coats and healthy teeth**; only one showed signs of predation
- **post mortems (autopsies)** were done where possible
- **samples** were collected for testing: tissues for bacterial culture, swabs (nasal, anal, other as needed), blood on filter paper, and qiviut

Findings:

These types of analyses of wild animal specimens take time and some of this work is ongoing; tests are usually done across various labs that have different expertise, and as parts of diverse multi-year research projects.

However, the most important finding so far is that **the dead muskoxen were positive for the bacteria *Erysipelothrix rhusiopathiae*, which was likely the direct cause of death.**

The potential impacts of this infection at the muskox population level are very concerning. Work conducted by the Kutz Research Group on muskox health since 2008 has detected several emerging pathogens of high concern, some of which also can infect people (zoonotic). These include *E. rhusiopathiae*, which has caused large-scale die-offs of muskoxen, with concomitant population declines of greater than 75% on Banks Island and Victoria Island in the western Arctic archipelago.

This new finding of *E. rhusiopathiae* 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.



What It All Means: The Big Picture for Arctic Muskoxen

While the 2021 mortalities on Ellesmere Island constitute a separate muskox health event, they definitely add urgency to the need for more information. This is the fourth documented outbreak of *E. rhusiopathiae* in arctic island muskoxen to date.

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 do raise concerns and we look forward to learning more.

The causes of abnormal jaws/teeth (i.e., possible impacts on health and nutrition) need to be followed up. The findings of high-level lungworm infection, and very low selenium are also of concern.

And, finally, we are interested to understand any changes in insect biodiversity that might link to pathogen introduction/transmission as well.

We look forward to seeing you and sharing our findings in 2022!



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