

ARCTIC WATCH

and the KUTZ RESEARCH GROUP

RESEARCH UPDATE November 2022

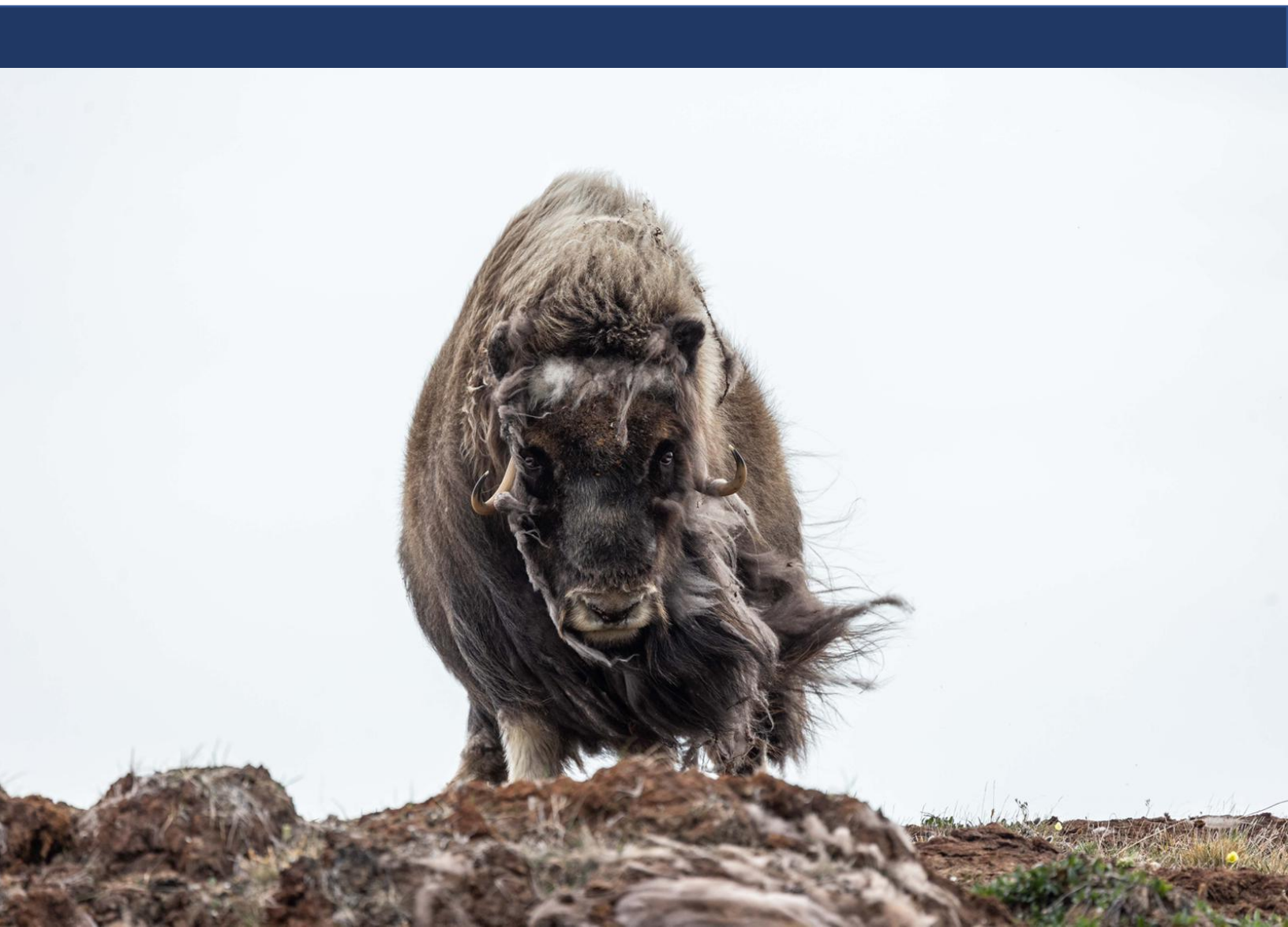


Photo: Mark Williams



UNIVERSITY OF CALGARY
FACULTY OF VETERINARY MEDICINE

REPORT PREPARED BY THE KUTZ RESEARCH GROUP

SUMMARY

Dr Susan Kutz and Dr Eleanor Dickinson travelled to Arctic Watch Wilderness Lodge on **July 1-8th 2022** for a week of discussions and research about the health of muskoxen on Somerset Island. Dr Kutz returned for a second week **August 6-10th** to continue the work. The intent was to follow up and expand the research conducted in 2021, with a focus on adding to our baseline knowledge of the status of the Somerset Island muskox population. Our main aims were as follows:

1. Document the muskox population near the lodge (count animals and classify by age/sex)
2. Sample muskoxen feces, test for parasites and stress
3. Collect qiviut to test for trace elements to add to baseline samples from 2021 and to test animals from a broader area of the island
4. Search for any carcasses or remains, and take samples to determine clues to death
5. Pilot-sample lemmings to investigate their role in transmitting pathogens
6. Survey the flying and terrestrial insect diversity.

In total, 66 qiviut and 26 fecal samples were collected from three groups of muskoxen within a 25-kilometer radius of Arctic Watch Wilderness Lodge, and from other muskoxen groups sampled opportunistically in the Creswell Bay area. Two carcasses were also sampled to determine clues to cause of death. As part of a larger biodiversity monitoring program, we collected insects from two locations near the lodge. Flying insects were collected using two Malaise traps and pan traps were used to collect terrestrial insects. We also piloted a lemming trapping project, and caught one adult female lemming.

Similar to findings from 2021, muskoxen had high levels of *Dictyocaulus* infection, and were also infected with gastrointestinal parasites. Muskoxen had relatively low levels of copper and selenium, which are important for reproduction and immunity. Trace element levels were generally similar between the Arctic Watch area and Creswell Bay, although some differences were observed. No underlying abnormalities were observed in the carcasses.

This work was supported by:



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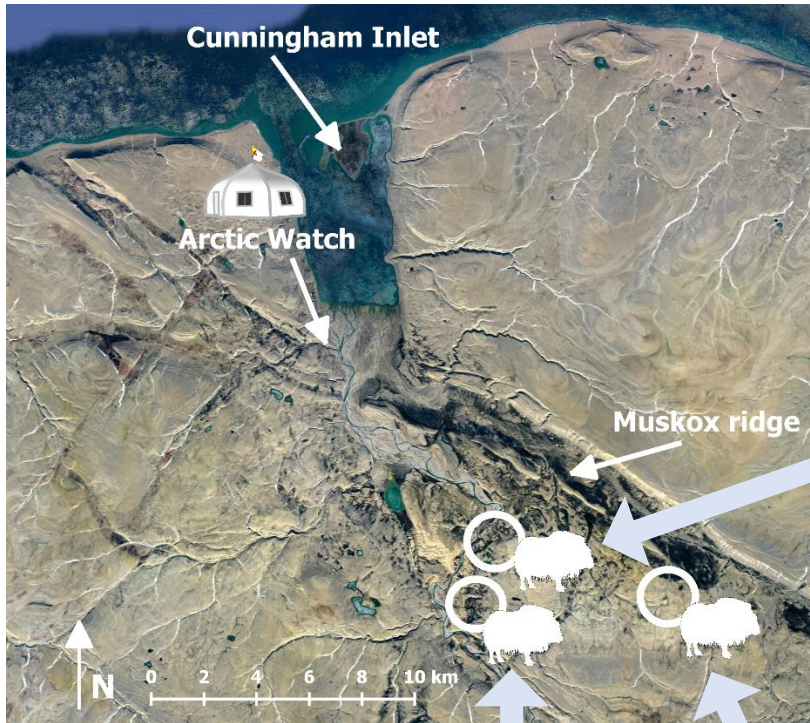
The Ransanz Family

Thank you to the Arctic Watch staff and guests for your help this summer, with a special thanks to:

Cail Smith, Mark Williams, Dave Allcorn, Caroline Menzies, Pam and Steve Smalley, Sheri Weichel, Kim Kawaguchi, Bernard Leroux, Bob Disbrow, Marie and Tom, Alex and Chris.

Thank you to Leila Knoll, McCaide Wooten and Jawad Afzali in the laboratory; and Angie Schneider, James Wang, and Hadjira Hamou for providing laboratory support.

1. DOCUMENT THE MUSKOCX POPULATION NEAR THE LODGE



GROUP ONE

JULY A group of 3 muskoxen near the horseshoe of Cunningham River.

Composition: male >4 yrs, male 4-5 yrs, female >4 yrs

AUGUST Likely the same group. The female had left the group, and >4yr had male joined.

Composition: 3 males >4 yrs



GROUP TWO

JULY A group of 13 muskoxen further south from the first group.

Composition: 2 males >4 yrs, 6 females >4 yrs, 2 yearlings, 3 calves. One calf notably smaller than the other two, with significant lameness.

AUGUST A male had left the group and a female had joined.

Composition: 1 male >4 yrs, 7 females >4 yrs, 1 male 3 yrs, 2 yearlings, 3 calves, 1 animal unknown. Smaller calf was still slightly lame but otherwise looked healthy.

Notes: Peat sample collected - these animals are digging up the peat; not sure if they are eating it, it is very "woody".

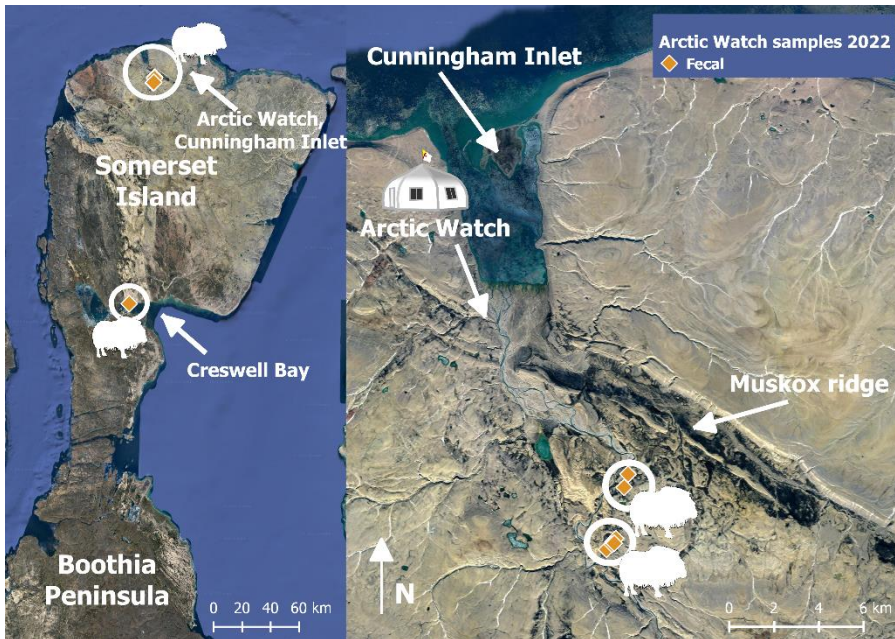
GROUP THREE

AUGUST Four adult males on the plateau west of the Horlack River.

Composition: 4 males >4 yrs



2. PARASITES AND STRESS IN SOMERSET ISLAND MUSKOXEN



Fecal samples were collected from all groups of observed muskoxen, including groups one, two and three, plus a fourth group which were observed by guests and staff near Creswell Bay.

Group one = 5 (July) + 2 (August)
Group two = 8 (July) + 8 (August)
Creswell group = 3 (July)
Total = 26

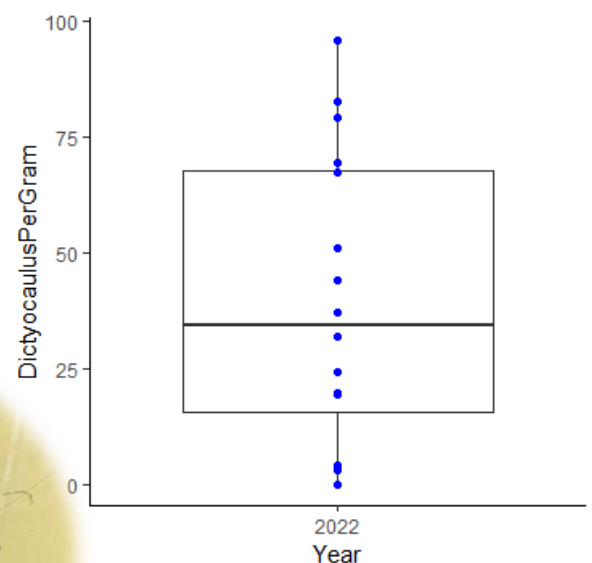
The species and number of parasites were recorded in feces, using fecal floats and Baermann tests. Feces were tested for cortisol, which is used to measure stress. A subsample of each fecal sample will also be stored in our archives.

A. FECAL BAERMANN TEST FOR LUNGWORM LARVAE

Dictyocaulus was found in 15 out of 16 fecal samples in July (94% prevalence), and the results of the Baermann's suggest heavy loads in muskoxen (mean per gram = 39.4). Larvae were also found in 7 out of 18 samples in August. However, because these samples were frozen and observed larvae were dead, these counts are not an accurate estimate of parasite abundance.

High infection loads of this parasite can impact the health of muskoxen. Further research is needed to understand the transmission of *Dictyocaulus* and the effects of climate change on transmission.

No other lungworm species were detected.



The number of *Dictyocaulus* larvae per gram of feces in muskoxen on Somerset Island.

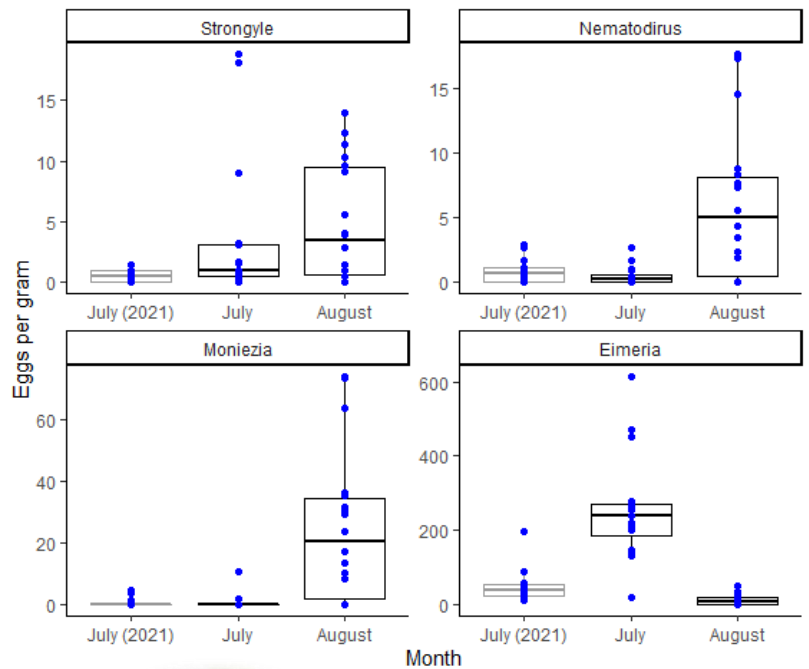
B. FECAL FLOATS FOR PARASITE EGGS

This method looks for the eggs of parasites that are found in the stomach and intestines. They are important because they can cause inflammation in the digestive tract which leads to diarrhoea and weight loss.

Muskoxen were generally infected with *Eimeria* sp., *Nematodirus* sp., and Strongyle type eggs. *Marshallagia* was present in three samples in August 2022 (mean eggs per gram = 0.73). Prevalence of *Moniezia* sp. was lower in July 2021 = 21% and 2022 = 19% compared to August (2022 = 72%).

Infection intensity for *Eimeria* sp. was lower later in summer, whereas it was higher for *Moniezia* sp., *Nematodirus* sp. and *Strongyle* sp. eggs.

* NUMBERS OF EGGS ARE NOT DIRECTLY COMPARABLE BECAUSE SAMPLES WERE FROZEN IN 2021 AND AUGUST 2022, WHICH WOULD DESTROY SOME EGGS OR LEAD TO HIGHER OBSERVED INTENSITIES (IN THE CASE OF *NEMATODIRUS*)



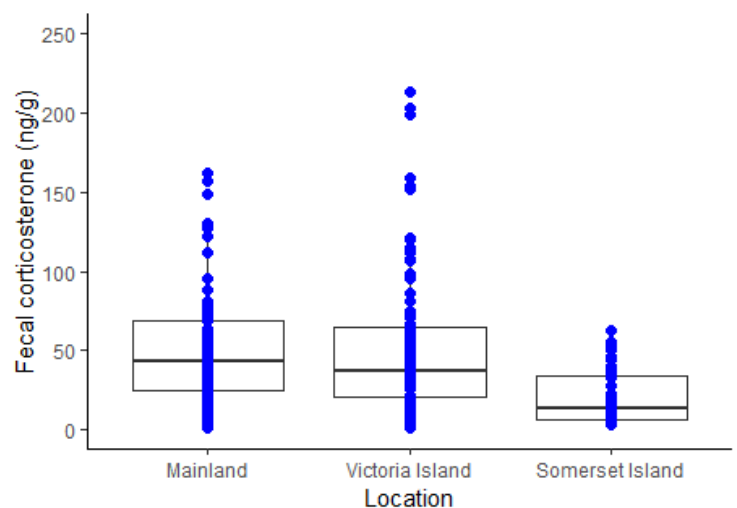
The number of eggs per gram of faeces of different species of stomach and intestine species in muskoxen on Somerset Island in 2021 and 2022.

C. FECAL CORTICOSTERONE FOR STRESS LEVELS

In 2021, fecal pellets showed higher levels of stress hormones in calves compared to older muskoxen; stress hormone levels in adult feces were comparable or lower to those measured in other muskox populations.

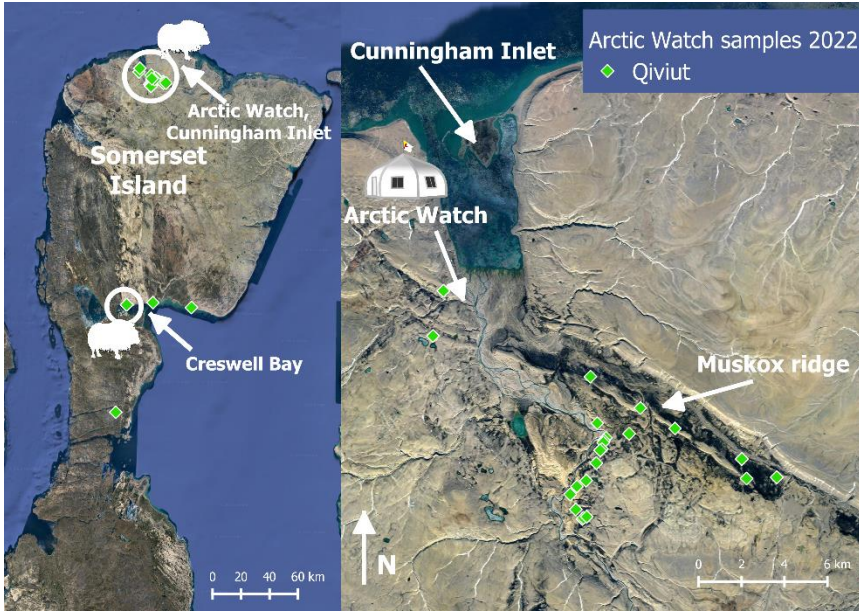
Corticosterone indicated similar or lower stress levels in 2022 compared to 2021.

* A NUMBER OF SAMPLES IN 2022-A AND 2022-B CAME BACK BELOW THE LIMIT OF DETECTION.



The concentration of corticosterone in muskoxen groups sampled on mainland and Victoria Island in the Kitikmeot, Nunavut, and Somerset Island

3. COLLECT QIVIUT TO TEST FOR TRACE ELEMENTS



Qiviut was collected opportunistically on the tundra, and close to the three groups of muskoxen observed.

Opportunistic samples = 15 (July) + 3 (August)
 Group one = 10 (July)
 Group two = 10 (July) + 4 (August)
 Group three = 1 (August)
 Creswell group = 5 (July)
 Known carcass = 4 (July) + 2 (August)
 Total = 66

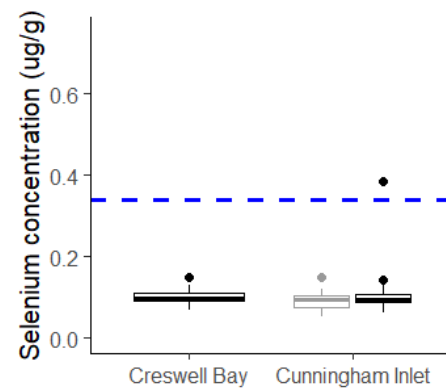
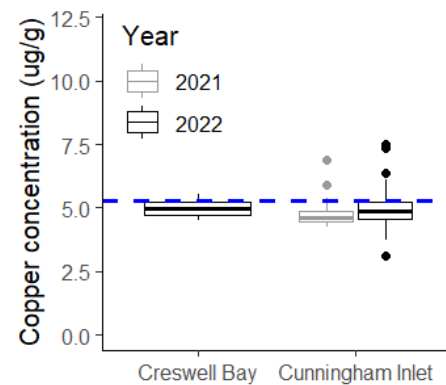
The qiviut was analysed for trace element levels. A subsample of qiviut will also be stored in our archives.

A. TRACE ELEMENT LEVELS ON SOMERSET ISLAND

Trace elements can give us an insight into the health and nutritional status of populations.

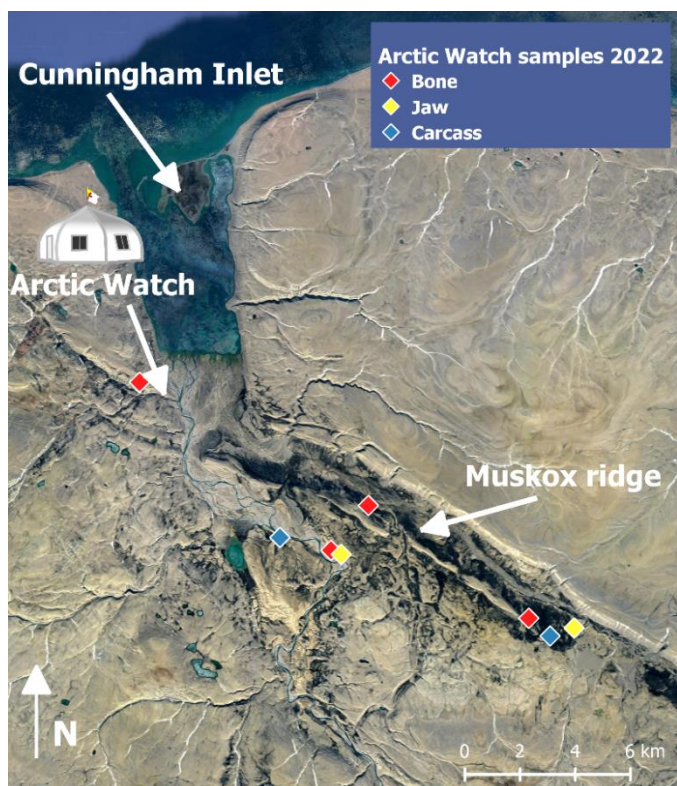
From samples collected in 2021 and 2022, we found that levels of the trace mineral copper were similar to what has been found in declining populations and selenium levels were very low. Selenium and Copper are key nutrients for health and play important roles in critical body functions, including reproduction and immunity.

There was no difference in copper or selenium levels between the two years, or the two sampling areas. Levels of some elements were lower in Creswell Bay samples, specifically cobalt, iron, and calcium, while sodium was lower in Cunningham Inlet samples. There were no other differences in elements between the two years, except sodium, which was higher in 2022 compared to 2021.



Trace mineral concentrations of Copper and Selenium in muskox qiviut collected on Somerset Island in 2021 and 2022. The horizontal line shows threshold levels associated with 40% calf recruitment in free-ranging muskoxen from Greenland (Mosbacher, et al. 2022).

4. DETERMINE HEALTH AND POTENTIAL CLUES TO DEATH FOR CARCASSES OR REMAINS OF MUSKOXEN



Muskoxen remains and carcasses were opportunistically sampled in the vicinity of Arctic Watch. This is to better understand the cause of death, including testing for specific diseases that are linked to mortality in muskoxen. E.g. *Erysipelothrix* which has caused large scale mortalities on Victoria, Banks and Ellesmere Islands.

Carcass = 2 (August)
Jaw = 4 (July)
Bone = 6 (July)
Total = 12

Remains were examined in the field, bones and/ or jaws samples were collected, to inspect teeth or to determine whether infectious pathogens were present, including *Erysipelothrix*.

A. CARCASSES

I. UNUSUAL FINDING

Time: 12:43, August 8, 2022

Location: 74.023628N, 93.686408W

Description: 1 adult male carcass was found by Nansen Weber in 2021 in the river and pulled out. Found in low lying area near the Cunningham River, east of Sunday Lake. Head, spine, vertebral column, and ribs present, limbs absent. Some skin and fur still attached to skull. Some dried soft tissue remaining on head and neck section of spine. Incisor teeth perfect, all permanent including incisor I4. *Samples:* Mandible for full pathogen culture (including test for *Erysipelothrix*: negative), qiviut and detailed photography.

Erysipelothrix culture = negative

Hair elements = High levels of several elements including calcium, magnesium, iron and cobalt.





II. FRESH CARCASS - WOLF KILL

Time: 17:54, August 9, 2022

Location: 73.991975N, 93.380547W

Description: Adult male was observed the previous afternoon. Carcass observed in the morning. On arrival at the carcass a wolf was observed and there was evidence of a struggle.

Samples: Left metatarsus with hoof, blood from thoracic cavity, heart, lung (cranial and middle left and right lobes), intestine, *Dictyocaulus* adults collected, qiviut.

Notes: Carcass found in sternal position, leaning to the right. Entire musculature of thorax and abdomen and most of pelvis eaten. Left shoulder eaten, left hind intact. Right limbs down side and intact. Head intact, fur on but neck eaten. Intestines and rumen/reticulum pulled out of abdomen. No evidence of dental disease.

Bone marrow fat = 92.5%

Erysipelothrix culture = negative

Hair elements = not outside range observed on Somerset Island (Cu = 4.38 µg/g; Se = 0.10 µg/g), but levels were generally at the lower end for multiple elements.

No underlying abnormalities were detected.

B. JAWS

The observed jaws were all from adult animals, and some (3/5) showed signs of problems not associated with normal decay or weathering. This may be linked to trace element deficiencies.

C. BONES

Bone marrow fat was measured in four bones, and all individuals had good body condition (mean bone marrow fat = 93.8%).

All the sampled bones tested negative for *Erysipelothrix*.



5. PILOT SAMPLE OF LEMMINGS

We are conducting a pilot study on lemmings to determine whether they are involved in the transmission of *Erysipelothrix*. This small mammal shares habitat with muskoxen making it a likely candidate for pathogen transmission or maintenance. Somerset Island is being used as a control site, and compared to sites Victoria and Ellesmere Island where outbreaks of *Erysipelothrix* have occurred in muskoxen.

Lemming traps were set in groups of 40, in four trap lines. Two traplines were set in low wet meadow and the other two were set in dryer upland meadow, with the aim of targeting both collared and brown lemmings. Lemmings were at a low in their population cycle this year, and one adult female lemming was caught.



6. SURVEY THE FLYING AND TERRESTRIAL INSECT DIVERSITY

Two types of insect traps were used to measure insect diversity, malaise traps to target flying insects and pan traps to target crawling insects. One malaise trap and two sets of pan traps were placed 0.5 km north of Arctic Watch lodge, the other malaise trap and two sets of pan trap were set in a meadow roughly 5 km from the lodge, in 2021 and 2022. All traps were collected in after one week at Arctic Watch. In 2022 the malaise traps were maintained by Cail Smith through the summer (only one stayed up for the full summer).

The samples were sent to the **Arctic BIOSCAN** program led by the Centre for Biodiversity Genomics (CBG) at the University of Guelph. Insects identified in the samples represented a whole range of trophic specialisations, including important pollinators in the Arctic. A total of 1833 specimens were analyzed and 61% could be identified. 131 different Barcode Index Numbers (BINs; a proxy for the number of species) were encountered 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, and there were no potential disease vectors. Having two types of traps was valuable because 41% of the BINs were captured in the pan traps and 59% in the malaise traps.

Additionally, we were surveying for the presence of slugs, which can spread the lungworm *Umingmakstrongylus pallikuukensis*. No slugs were found, suggesting that it is unlikely that this lungworm is present in muskoxen in this area of Somerset Island.



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