Community-driven program to monitor muskoxen, caribou and their predators on Victoria Island, Nunavut

Interim Report, April 29, 2022

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Summary

The project "Community-driven program to monitor caribou, muskoxen, and their predators on Victoria Island, Nunavut" (NGMP project # 19EC66) led by the Ekaluktutiak Hunters and Trappers Organization has completed its second year. The Kutz Research group (University of Calgary) has received and processed 48 of the 56 caribou and muskox kits collected in 2019-21. Lab analyses for these kits are about 75% complete. Additional caribou kits from the 2021-22 season arrived in early April 2022 and will be processed over the coming months. Notable results to date include an apparent decrease of stress level in DU caribou over the last year and a constant presence of the zoonotic bacterium *Brucella* in both species. A more detailed analyses will be provided in the next community bulletin and annual report.

Future work includes the completion of the pending analyses and the processing of the kits recently received. The collaboration between Ekaluktutiak Hunters and Trappers Organization and the Kutz Research group has also resulted in a successful grant on emerging diseases from the Canada Inuit Nunangat-UK grant as well as a grant from National Geographic to assess how the community-based wildlife health monitoring program has operated during COVID-19.

Introduction

The Ekaluktutiak Hunters and Trappers Organization in collaboration with Polar Knowledge Canada was successful in obtaining funding from the Nunavut General Monitoring Plan (NGMP) to carry out the 'Community-driven program to monitor caribou, muskoxen, and their predators on Victoria Island, Nunavut' (NGMP project # 19EC66) in the community of Ekaluktutiak during the years 2019-22.

The program aims to collect baseline knowledge and track change in the health and population dynamics of muskoxen and Dolphin and Union caribou around the community of Ekaluktutiak. The program is overseen in the community by the HTO with support from Matilde Tomaselli and Ian Hogg from Polar Knowledge Canada.

As part of the monitoring program, sample kits are made available to community harvesters and sent to the Kutz Research Group at the University of Calgary for analysis. In addition to specific samples, the kits also contain a datasheet used to record important information on the animals sampled or observed. Harvesters can also use the kits to collect any abnormal tissue they encounter in a harvested animal. This serves as a passive health surveillance system to detect possible health concerns in the muskox and caribou populations.

Below we present the preliminary results from sample and data analyses to date. Note that these analyses are ongoing and these are not the final results.

Update as of April 2022

Sample kits collected:

As of March 2022, 48 sample kits (32 DU caribou and 16 muskoxen) have been shipped to the University of Calgary. Eight additional kits have been collected but were not part of the shipment. The project monitor updated the database with the kits received and the information on the forms up until March 2021. Additional kits were shipped on April 2022 and will be processed this summer.

Datasheet:

When the harvester is able to observe the herd and can provide information on herd size and the number of young animals, this can give us really important insight into the population structure and what it might mean for the herd. As an example, below is a plot showing how the number of calves and yearlings observed in the DU caribou herd changes over time (Figure 1). There is a high proportion of calves observed in fall (after calving) and fewer calves observed in spring (just

before calving). **In the past years, it seems that the proportion of calves in fall fluctuates around 15-20% of the total number of DU caribou observed at the time.**

The plot also shows that some seasons have very broad confidence intervals. This happens when there were only a few observations available and highlights the importance of having every datasheet fully completed. It is important to note that the observations in Figure 1 are from sample kits collected in all three communities harvesting DU caribou (Ekaluktutiak, Kugluktuk, and Ulukhaktok).

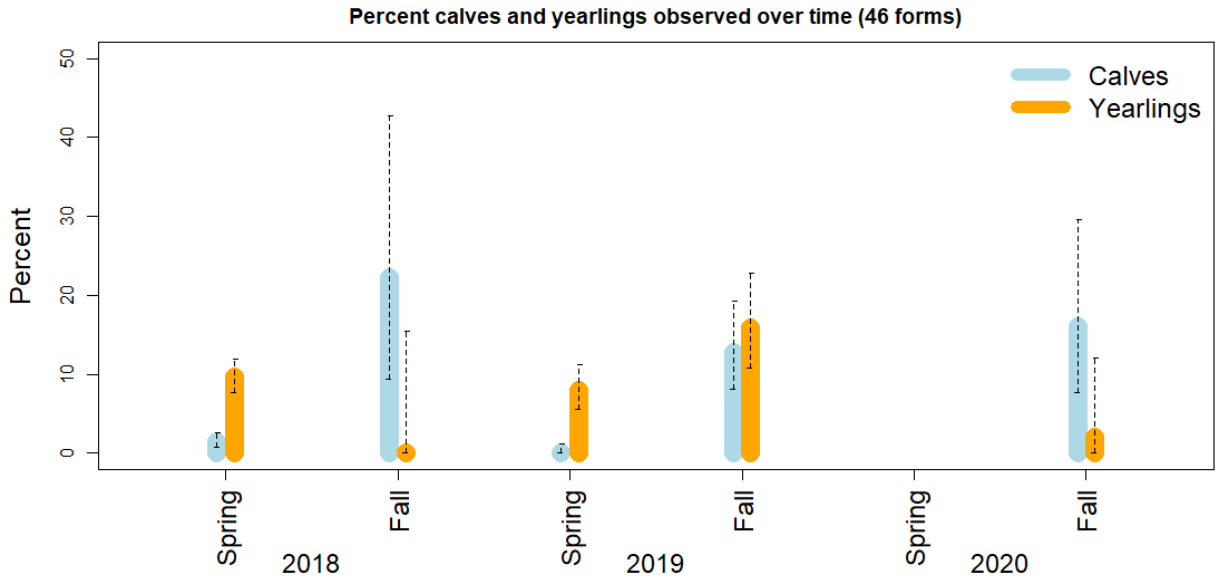

Figure 1: Proportion of calves and yearlings of total animals observed for Dolphin and Union caribou and recorded on the sample kit forms in Ekaluktutiak, Kugluktuk, and Ulukhaktok. Calves and yearling proportions are shown for spring (April to June) and fall (September to December).

Another important piece of information on the sample kit form is the body condition. By recording it, we can compare the information from year to year and across different populations. We use two different complementary measures for body condition: the backfat and the assessment made by the harvester (skinny, not bad, fat, or very fat). The backfat is a reliable metric if it is measured in the same way by all harvesters. The assessment of the harvester takes into account the harvester's experience and traditional knowledge about what would be expected for that season or age of the sampled animal. Backfat measures and harvester's assessments thus provide different, yet complementary measures of body condition.

In figure 2, we show the results of both the harvester assessment recorded on the sample kit datasheet and the results of the kidney fat index measured in our lab. On the upper panel, the body condition documented by the harvester is shown on the vertical axis and is qualitative

(ranging from skinny to very fat). The horizontal axis represents the timeline starting in 2017. The black circles represent which body conditions were reported for each month (a larger circle means that more harvesters reported an animal in this body condition category). The probability of a caribou being in a better condition than "skinny" is shown by the red lines for females (continuous) and males (dotted). Finally, the community where the data was collected is shown at the bottom of the chart as colored lines. **Note: the results presented here are from all sample kits and forms collected in Ekaluktutiak, Kugluktuk, and Ulukhaktok until 2019.**

It is also important to note that the body condition score assessed by hunters was removed from the data sheet of DU caribou sample kits in Ekaluktuktiak and thus this information could not be added for the years 2020-21. This is particularly relevant when assessing the DU caribou herd as the information from animal sampled in three communities (Ekaluktuktiak, Kugluktuk, and Ulukhaktok) are complementary and should be ideally collected in a standardized way. After discussing with the HTO, we agreed that the body condition should be put back on the data sheet.

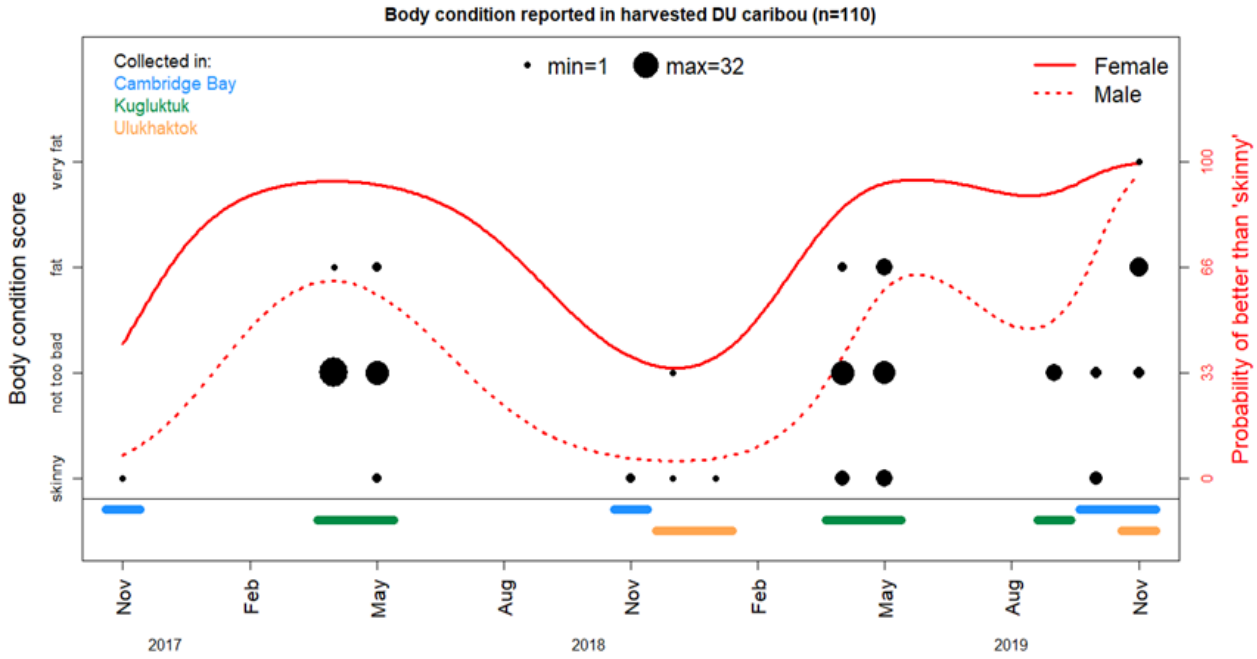

Figure 2: Body condition of Dolphin and Union caribou assessed by the harvesters on animals sampled in Ekaluktutiak, Kugluktuk, and Ulukhaktok.

Sample Analyses

Although 56 kits were reported as collected, only 48 kits were shipped down to Calgary so far. For muskoxen, lab analyses have been completed for parasitology, *Brucella* and *Erysipelothrix* serology, metatarsal measurement, *Besnoitia* examination, pregnancy, kidney and bone

marrowfat assessment, and corticosterone in feces. For caribou, analyses have been completed for parasitology, *Brucella, Erysipelothrix*, *Toxoplasma*, Herpes virus, and Pestivirus serology, kidney fat assessment, cortisol in feces, and cortisol in hair. In addition, genetic analyses were also performed on DU caribou muscle samples to evaluate the ecotype of the sampled animal. This is particularly relevant as there have been discussions about Barren-ground and Peary caribou mixing together with DU caribou and possibly responsible for changes in migratory behavior of the herd.

In the course of the fiscal year 2021-22, several barriers delayed the processing of the samples and the completion of the analyses: first the backlog from the previous fiscal year due to the COVID-19 pandemic and subsequent closure of the University and partner labs delayed sample analyses. In addition, we have modified several of our protocols (qiviut sorting, leg and jaw processing) and in some cases, had to run pilot studies to validate our new methods (e.g. quantifying cortisol in muskox hair using both qiviut and intermediate guard hair instead of qiviut only). Some issues with lab equipment for the hair mineral analyses also needed to be addressed before the analyses could be ran. Finally, the discovery of a *Brucella* case in a sampled kidney from an apparently healthy muskox from Ekaluktutiak (see Passive surveillance section in this report) has also forced us to change our workflow and biosafety procedures, slowing some of the sample processing.

Table 1: Summary of lab analyses conducted and still pending for the 48 received sample kits of muskoxen and DU caribou.

Analyses	Muskox	DU caribou
Coprology	Completed	Completed
***Besnoitia* examination**	Completed	Completed
Serology *Brucella*	Completed	Completed
Serology *Erysipelothrix*	Completed	Completed
Serology Herpes virus	Pending	Completed
Serology Pestivirus	Pending	Completed
Serology *Toxoplasma*	Pending	Completed
Metatarsal measurements	Completed	Completed
Bone marrow fat	Completed	Pending
Kidney fat	Completed	Completed
Jaw examination	Completed	Pending
Fecal stress hormones	Completed	Completed
Hair stress hormones	Pending	Completed
Pregnancy	Completed	Pending
Hair trace minerals	Pending	Pending

What follows is a preliminary summary of some of the analyses that have been completed. When summarizing trends over time, we included results from previous years of monitoring, and in the case of DU caribou, we also considered all DU caribou samples collected in Ekaluktutiak, Kugluktuk and Ulukhaktok.

Figure 3 shows the measured corticosterone for muskoxen sampled around Ekaluktutiak. Fecal corticosterone is an indicator on how stressed the animal was in the days/weeks before it was sampled. Exposure to different stress factors is known to vary a lot depending on the season, the age, and the sex (for example, muskox bull might be more stressed than juveniles or females during the rut). Therefore, it makes sense to control for those factors when considering the results. In addition, we separated our results between muskoxen from Victoria Island or the Kent Peninsula on the adjacent mainland. This distinction is important as we have indications that the animals on the mainland have different health and population trend than on the island. This adds to the complexity of the analyses and means we need more samples to be able to interpret the results of corticosterone analyses correctly.

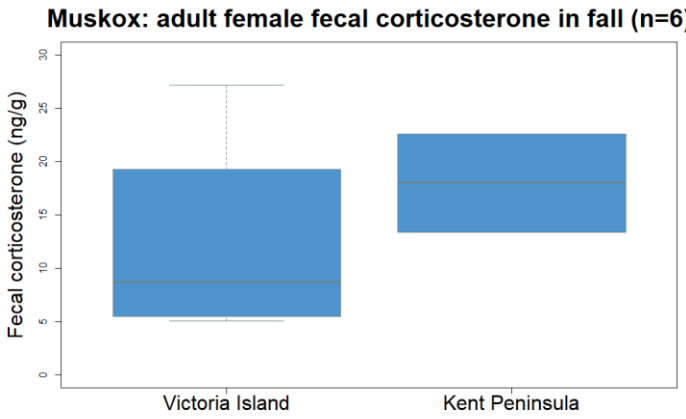

Figure 3: Level of fecal stress hormone (corticosterone) in adult female muskoxen sampled in fall on around Ekaluktutiak. Results are presented for animals sampled on Victoria Island (left) and the Kent Peninsula on the mainland (right).

Cortisol level in the hair is an indicator on how much stress the animal was exposed to when the hair was growing. When considering all DU caribou sampled since 2015 in Ekaluktutiak, Kugluktuk and Ulukhaktok, the level of cortisol in the hair seems to have decreased in the past years, indicating less stress.

Two out of 18 examined DU caribou legs (11.11%) had detectable *Besnoitia* cysts on the metatarsal bone. None of the examined muskox legs (0/14) had visible *Besnoitia* cysts. *Besnoitia* is a typical parasite of caribou that forms cysts under the skin, around the eyes, on the testicles and on the membrane covering the bones. It is usually not associated with disease although some individuals can present symptoms such as hair loss, swollen eyelids and in rare cases, poor body condition and general health. The parasite has also been reported in muskoxen.

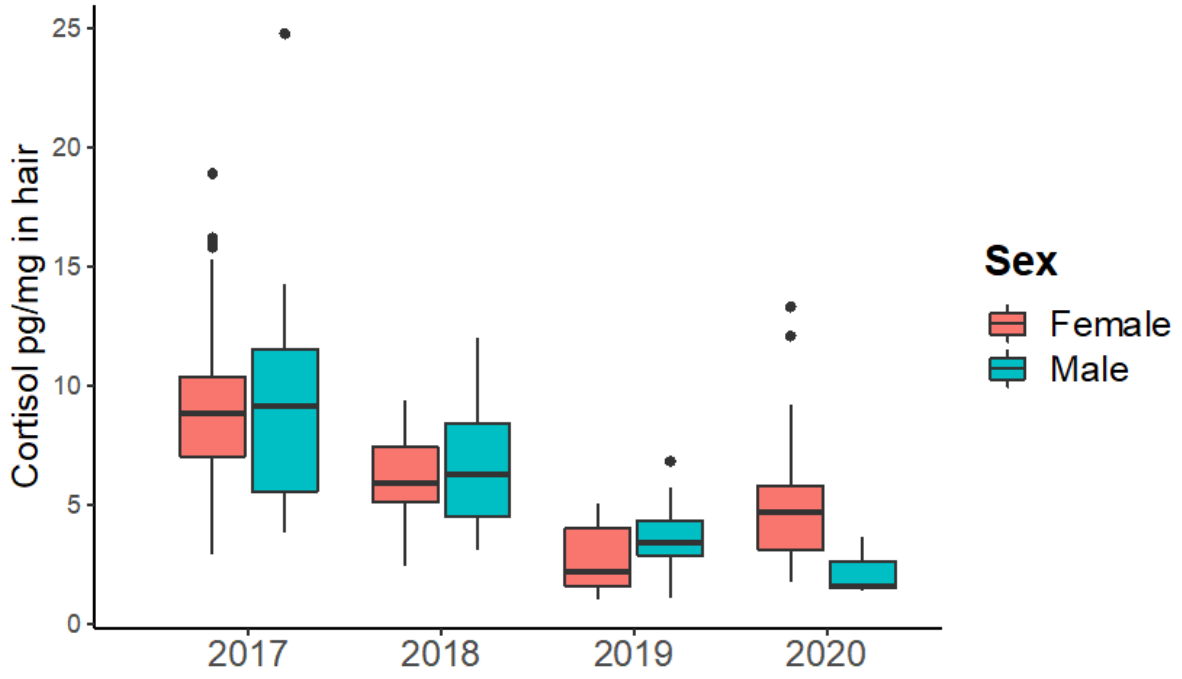

Figure 4: Cortisol hair level measured in DU caribou sampled in Ekaluktutiak, Kugluktuk, and Ulukhaktok.

For animals sampled around Ekaluktutiak in 2019-21, only one caribou out of 29 had parasite larvae (most likely the lungworm *Varestrongylus eleguneniensis* or *Parelaphostrongylus andersoni)* that could be detected in the fecal sample. In contrast, lungworms (*Umingmakstrongylus pallikuukensis* and *V. eleguneniensis)* were detected in almost all (13/14) muskox fecal samples analyzed, although most were with a low count of parasites (Figure 5). Lungworms are not dangerous to people but might reduce the overall health of heavily infected animals.

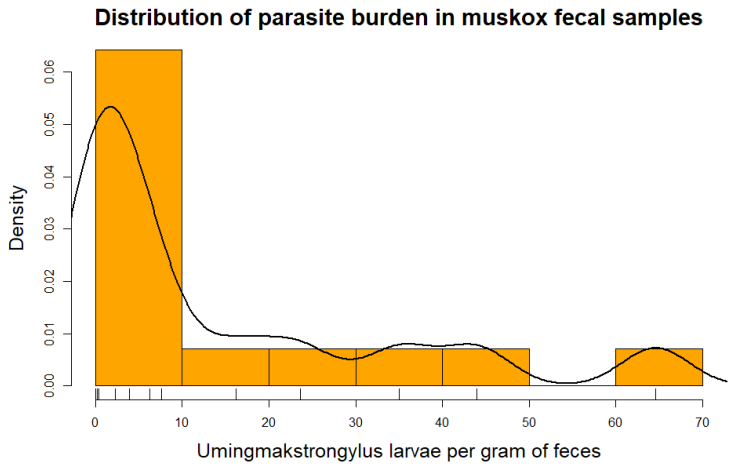

Figure 5: Distribution of burden of the lungworm Umingmakstrongylus pallikukensis *in muskoxen sampled around Ekaluktutiak in 2019-20. The observed distribution is typical of parasitic infection with most samples having a low count of parasites and only a few animals with high counts of parasites.*

We ran blood tests to determine if caribou and muskoxen had been previously exposed to two important pathogens, *Erysipelothrix* or *Brucella*. Among the caribou sampled around Ekaluktutiak in 2019-21, three out of 32 (9.4%) were seropositive (previously exposed) to *Brucella*. For muskoxen, 6.7% (one out of 15) were seropositive. For both species, the proportion of seropositive animals seems to be constant since 2014, although the lower number of samples collected during the COVID pandemic when compared to previous years limits our ability to capture changes in the epidemiology of the disease.

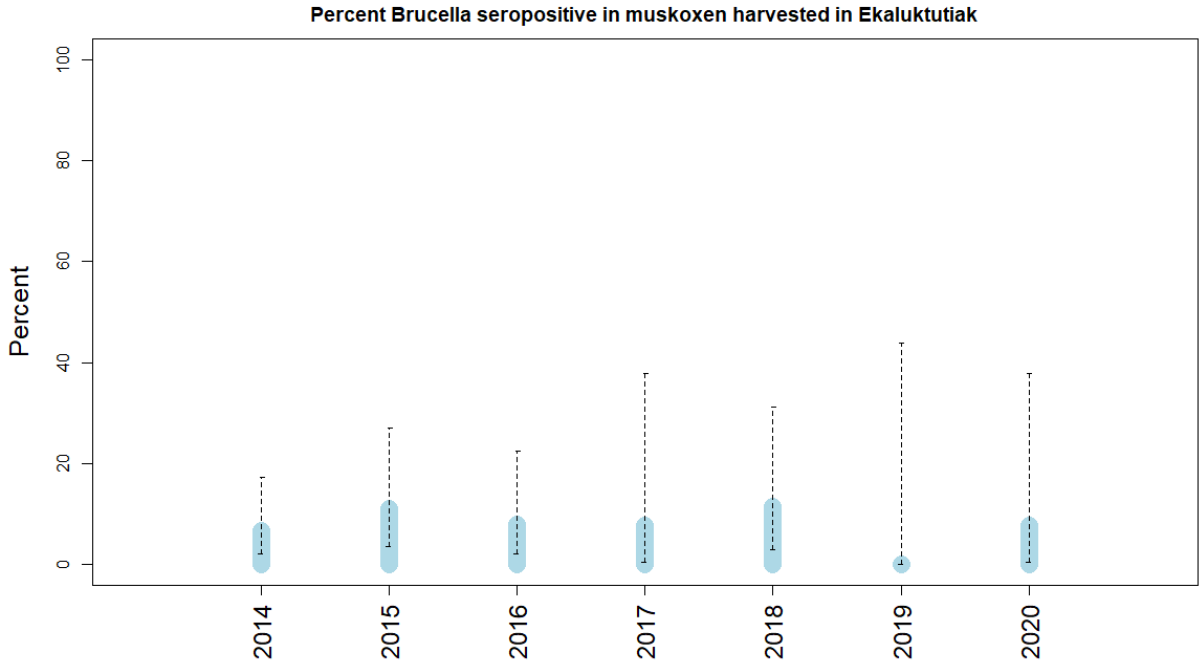

Figure 6: Percentage of muskoxen sampled around Ekaluktutiak that were previously exposed to Brucella*.*

None of the 32 DU caribou sampled around Ekaluktutiak in 2019-2021 was seropositive for the bacterium *Erysipelothrix.* In contrast, 3/14 (21.4%) of sampled muskoxen were seropositive for *Erysipelothrix*. This is particularly important as *Erysipelothrix* was the cause of several large muskox die-offs around Ekaluktutiak in 2009-2013. Yearly variations are apparent (figure 7) with a seroprevalence above 40% in 2019. However, the limited number of samples collected during the pandemic prevent us to infer more on any trend.

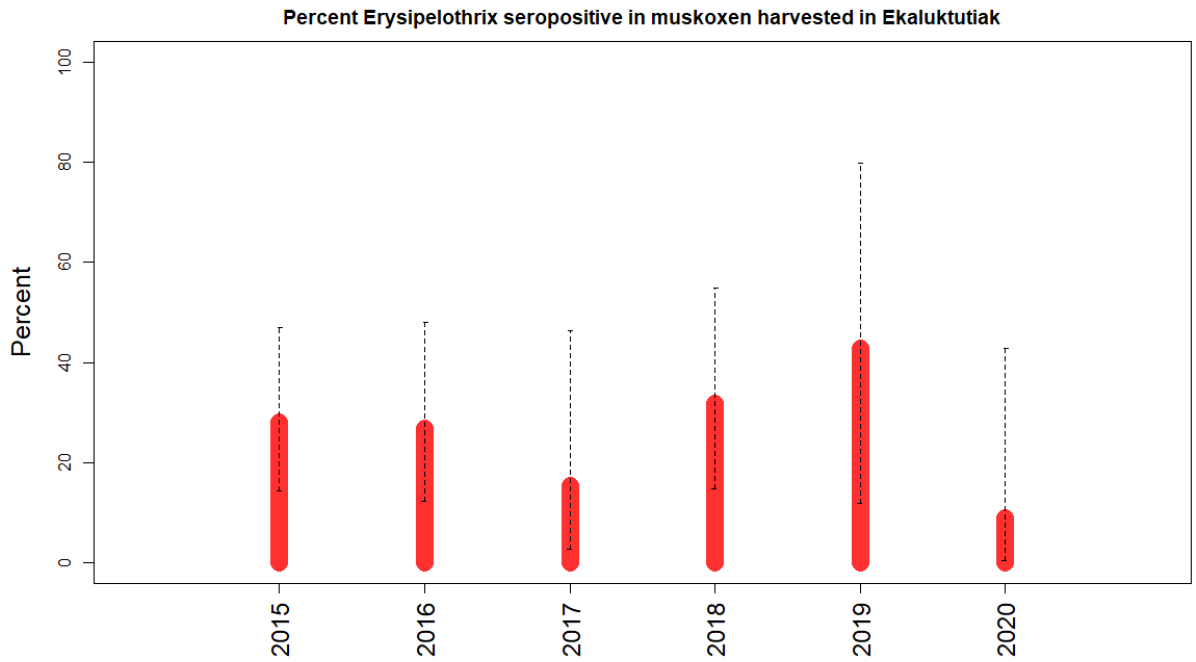

Figure 7: Percentage of muskoxen sampled around Ekaluktutiak that were previously exposed to Erysipelothrix.

Passive health surveillance:

During the processing of muskox kidney samples at the University of Calgary, we discovered one kidney with multiple abscesses. The kidney was sent to the Canadian Wildlife Health Cooperative for diagnostic and was positive for *Brucella*. *Brucella* is a bacterium and can be transmitted to people eating or handling sick animals. In this case the harvester didn't notice any sign of illness in the animal. The Canadian Food Inspection Agency, as well as Public Health Services and the territorial biologist in Nunavut were alerted. However, by the time the harvester was notified, the muskox had already been eaten, without anybody showing signs of infection, fortunately. This finding highlights the importance of maintaining a surveillance system to detect potential Public Health concerns in harvested animals.

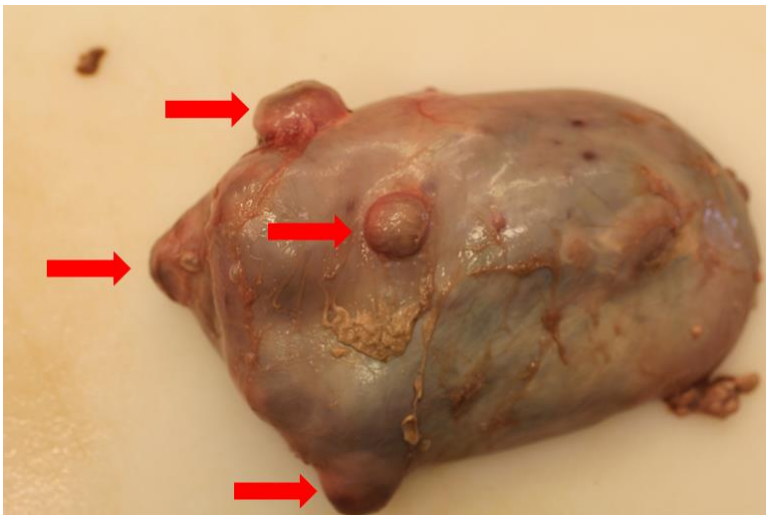

Figure 8: Kidney sample collected on an apparently healthy muskox. Note the multiple abscesses protruding from the surface of the kidney. Bacteriological investigations confirmed that the animal was infected with Brucella *spp., a bacterium that can also infect people.*

Reporting and data ownership:

The general meeting of the Ekaluktutiak Hunters and Trappers Organization did not happen last year, thus we could not present our results there. We did, however, arrange to present the preliminary results of the program to the Ekaluktutiak Hunters and Trappers Organization through a zoom meeting in June 2021. During this meeting we also presented a bulletin on all the muskox and caribou monitoring done by the Kutz Research group in collaboration with the communities and governments in the Kitikmeot and Inuvialuit regions. The EHTO expressed some concern about the *Brucella* results and how they may be used in management.

Future work

The lab analyses of the initial 48 kits as well as those received in April 2022 will be completed by the fall and final data analyses is planned for spring 2023. Preliminary results will be included in the community bulletin in summer 2022 and presented at the next general meeting of the Ekaluktutiak Hunters and Trappers Organization.

In addition to the caribou and muskox health monitoring, the Kutz Research Group facilitated the contact between Doug Clark (USaskatchewan) and the EHTO around a recently funded ArcticNet project on Grizzly bears. Additionally, the EHTO and the Kugluktuk and Ulukhaktok hunters and trappers organizations, together with the Kutz Research Group developed and successfully applied for two grants. The first is from National Geographic to evaluate how COVID-19 impacted the muskox and caribou monitoring program. This project and will help improve the community-based monitoring especially in regard to mobilizing local capacity. The second grant, a Canada-Inuit Nunangat-UK grant, is to fund traditional and scientific knowledge research on the two zoonotic pathogens – *Brucella* and *Erysipelothrix* – in Arctic wildlife.

The results generated by the monitoring program in Ekaluktutiak, together with information from similar monitoring in Ulukhaktok and Kugluktuk will help to better understand the drivers of muskox and caribou health and what it can tell us on the trajectory of the populations. This will ultimately help to guide the co-management of those species.