Ekwǫ̀ Nàxoède K'è

Boots on the Ground

2018 Results

Tłı̨chǫ
Traditional Knowledge
and Land Use Study

Dedats'eetsaa:
Tłı̨chǫ Research & Training Institute
www.research.tlicho.ca

2019

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2018 Results

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Tłı̨chǫ Yatìì

Placenames

Kokètì	Contwoyto Lake
Deèzàatì	Point Lake
Ek'atì	Lac de Gras
Ek'adìì	Island on Lac de Gras
Ewaànıt'ıtì	Courageous Lake
Nǫdìikahtì	Mackay Lake
Ets'àitì	Rawalpindi Lake
Łiwets'aɔòats'ahtì	Lac de Sauvage

Geography

Ekwo Nǫɔokè	Caribou Water crossing (any place animal can swim across)
Ekwo Naɔokè	Caribou Water crossing (a place caribou *always* swims across)
Tataa	Land between water bodies
Whatàa	Esker
Hozi	Barrenland
Hozìı shìa	Low hill/ mountain on barrenland
Daka	High points
Kw'ia	Stands of trees (black spruce) on barrenland
Tì	Lake/water
Ta	Water
Deh	River
Taiɔaa	Meandering river
Dehti	River lake (a lake in the flow of a river)
Dı	Island
Tł'à	Bay
tł'ą̀ą	Beach
Tabàa	Lake shore
Tı k'abàa	Shoreline (walking by the shoreline)
Nàłeèzheà	Caribou calving grounds
Dechı̨laa	Treeline
Chik'e	North
Sazi	South

Animals

Ekwǫ̀	Caribou
Hozii Ekwǫ̀	Barren-ground caribou
Koketi ekwo	Bathurst caribou herd
Sahtì Ekwǫ̀	Bluenose-east caribou herd
Tontsi	Woodland caribou
Ekwǫ̀ łexè k'eɔàa	Caribou herd

Ekwǫ̀ akwe etłee	Caribou leader / lead caribou
Tsia	Caribou calf
Wedzia	Small sized bull caribou
Wedzıì	Bull caribou
Yèagoa	young bull caribou; 3- year old
Yèagocho	Bull caribou, second largest male
Wedzıìhcho	Large male caribou
Nadeèzhǫ	Older bull caribou
Dets’e	Mature Cow caribou
Dets'èa	Young cow caribou
Ts'ìda	Immature cow caribou (1-2-year-old)
Ts'ìdaa	young caribou (2 or 3 years old)
Nadeɔà	Migrating caribou
Nıį̀ zaa	Caribou migrating towards the forest in the fall
Nadèezoǫ	Caribou migrating to the calving grounds
Ekwǫ̀ Nàxoède K’è	In the migration of caribou
Ekwǫ̀ Edè	Caribou antlers
Ekwǫ̀ keè	Caribou tracks
Ekwǫ̀ ek’a	Caribou fat
Dìga	Male wolf
Digats’e	Female wolf
Diga woza	Wolf son/children
Diga nade	Wolf family
Diga eɔoo	Wolf den
Sah dek'oo	Grizzly bear
Hozìı edzıe	Muskox
Didi	Ground squirrel
Kw’ıh	Mosquito
Behk’òts’ı̨ą	Arctic tern
Tatsǫ̀ / Hatsǫ̀	Raven
Det’ǫcho	Eagle
Ets’imbaa	Arctic fox

Weather

Nı̨hts’ı	Wind
Chǫh	Rain
Ihli xe choc at’I	Freezing rain
Eezhii	Thunder
Nı̨hts’ı nàtsoo	Strong wind
Nàetsı̨ / nàɔetsı̨	Weather sign
Nı̨hts’ık’oò	Wind clouds
K’ozıı naets’ı	Wind blows under the clouds
Wetaı̨ts’ıı	Wind swirl in between the tall puffy cumulus clouds
Hodzıı	Bad weather conditions
Ekwǫ̀ nı̨hts’ı k’è k’eɔà	Caribou follow the wind

Executive Summary

Ekwǫ̀ Nàxoède K'è is a Bathurst caribou monitoring program based upon the Traditional Knowledge (TK) of Tłı̨chǫ and Inuit indigenous elders and harvesters. The new name for the program, Ekwǫ̀ Nàxoède K'è, replaces its previous name Boots on the Ground. Ekwǫ̀ Nàxoède K'è was chosen by the Tłı̨chǫ program advisors, and means "*in the migration of caribou*," and everything that relates to them. The objectives are to monitor the conditions of Bathurst caribou herd on the summer range, focusing on four key indicators: (1) habitat; (2) caribou; (3) predators, and (4) industrial development.

During fieldwork in July and August 2018, the Ekwǫ̀ Nàxoède K'è program watched the Bathurst caribou summer range for six weeks. Overall, the Bathurst caribou showed signs of being healthy. Due to the cold and wet summer, many caribou, especially bulls, became fat earlier in the season due to less insect harassment and good forage conditions. Of the thousand of caribou observed, a low number (13) of caribou were injured. Fewer calves than during previous years were observed. Of the 52 groups of caribou observed with cows, 38 groups had few or no calves, while 14 groups had a normal or high amount of calves. By contrast, we observed several herds with large proportions of yearlings (one-year-old caribou who are not yet mature enough to have calves) which correlate with the high numbers of calves observed in 2017. Observations during the upcoming field season will show whether or not the calf abundance has increased as yearlings mature.

Other wildlife observations include 16 wolves, 10 grizzly bears, three wolverines and 22 eagles. No direct predation on caribou was observed, but wolves and eagles were seen in close proximity to caribou herds. One eagle was seen flying towards a calf, attempting to chase the calf, but the chase was unsuccessful and quickly ended. More eagles were observed this summer than in the past two years. One wolf was observed waiting at a *naɔokè*, ready to attack if a caribou arrived. All predators were healthy with no injuries or health issues noted.

Tłı̨chǫ and Inuit harvesters observed indications of climate change throughout the three years of the Ekwǫ̀ Nàxoède K'è program. Continued observations of climate change are: 1) melting eskers; 2) disappearance of summer snow, and 3) the appearance and consistent increase of the bald eagle; a new predator of barren-ground caribou. During July, the monitors observed herds engage in new types behaviour: moving in circles and standing in water to minimize the heat and insect harassment. According to the monitors, these new behaviours are *"new habits to cope with climate change and the high insect harassment.*" Watching the Bathurst summer range, the monitors emphasized the significance of the *ekwò naɔokè* between Kokètì and Fry Inlet to sustain a healthy regional ecosystem, and how the presence or absence of indigenous people on the caribou habitat alters inherent balances in the ecosystem. Based on three years of watching the caribou on the Bathurst summer range, the program outlines the following four recommendations.

Recommendations

1) establish a legislatively-grounded protected area for Bathurst caribou habitat associated with *ekwò naɔokè* between Kokètì and Fry Inlet;
2) support continuation of land-based activities such as wolf harvesting on the barren-ground caribou core use area;
3) encourage territorial and Canadian government to uphold their climate change commitments; to reduce the impacts of arctic warming on wildlife, people and the land, and;
4) increase awareness of status and management of barren-ground caribou to promote recovery of the Bathurst herd.

Foreword

This project was conducted by the Dedats'eetsaa: Tłı̨chǫ Research and Training Institute (TRTI). TRTI brings together academic, government, non-governmental organizations (NGOs), and corporate and local Tłı̨chǫ organizations to collaborate on research in social, cultural, environmental, health, and wellness concerns for the Tłı̨chǫ. The mandate of TRTI is to advance the study of Tłı̨chǫ lands, language, culture, and way of life through the promotion of research and its use in education, training, planning, and monitoring purposes.

TRTI pursues its mandate by promoting research projects and activities involving elders and youth; developing and training Tłı̨chǫ researchers; developing and using indigenous research design and appropriate community methodologies; publishing work in a variety of media including online at www.Tłı̨chǫ.ca; contributing to the Tłı̨chǫ Digital Database of oral history, maps, photographs, video, and other documentary resources; reviewing proposed research submitted for licensing through the Aurora Research Institute; and providing support and assistance to approved research projects while promoting collaboration with academic and corporate partners. For more information on TRTI initiatives and programs please visit http://www.research.Tłı̨chǫ.ca.

Introduction

Ekwǫ̀ Nàxoède K'è (Boots on the Ground) is a Bathurst caribou monitoring program based upon the Traditional Knowledge (TK) of Tłı̨chǫ and Inuit indigenous elders and harvesters. The program is a collaboration between the Tłı̨chǫ Government, Government of Northwest Territories-Environment and Natural Resources (GNWT-ENR), the Wek'èezhìi Renewable Resource Board (WRRB) and Dominion Diamond Mines ULC (DD). Funding was provided by Tłı̨chǫ Government, DD and the GNWT-Cumulative Impact Monitoring Program[1] (CIMP).

The program commenced in the summer of 2016, and has conducted six weeks of fieldwork each summer in 2016, 2017, 2018, and will be conducting fieldwork each summer and fall until 2021 or longer. The objectives are to monitor the conditions of Bathurst caribou herd on the summer range, focusing on four key indicators: (1) habitat; (2) caribou; (3) predators, and (4) industrial development.

This annual report present results from the third field season of summer 2018. It provides the context and background of the program, and specifically:

- **The TK framework, "We Watch Everything," and field-based methodology, "Do as Hunters Do,"** which represent a holistic monitoring approach and details involved in recording knowledge in the field;
- **Results from the third field season of summer 2018;**
- **A new discussion;** including (1) a new analysis on the current status of herd health and composition; (2) the significance of ekwò naɔokè (caribou watercrossings) for regional cultural and biological diversity; (3) indigenous people's vital role in ecosystem sustainability; and (4) the effects of climate change on habitat and caribou behaviour,

[1] This article is Project CIMP94 of the Government of the Northwest Territories Department of Environment and Natural Resources, Northwest Territories Cumulative Impact Monitoring Program. CIMP coordinates, conducts and funds the collection, analysis and reporting of information related to environmental conditions in the NWT. More info can be found at: http://www.enr.gov.nt.ca/en/services/cumulative-impact-monitoring-program-nwt-cimp

- **Recommendations;** the program introduces four recommendations: 1) establish a Bathurst Caribou Habitat Protected Area; and 2) support the continuation of land-based activities; 3) that territorial and Canadian government commit to climate change action, and 4) increase awareness of the status and management of barren-ground caribou to promote recovery of the declining herds.

Changes from the Previous Year

Fulfilling our mandate to continuously add or improve to the traditional knowledge collected regarding the Bathurst caribou and its habitat, and the methodology employed to collect, analyze, and present Traditional Knowledge, this year's report differs from the 2017 report in several aspects including:

- **New infographics** of field methodologies and TK framework.
- **Results and Discussion:** an assessment on the current status of herd health and calf composition and an updated discussion on results from continuous seasons of TK monitoring.
- **Recommendations:** the program introduces three recommendations; based on input from the monitoring team, after three years of watching the herd in its habitat.

As a work in progress this report is not intended to provide final conclusions, but rather paint a picture in time and space of conditions in the monitoring area and provide context for evidence and interpretations of observations gathered to date. For information about monitoring activities and results from 2016 and 2017, please consult the reports on TRTI website http://www.research.Tłı̨chǫ.ca.

Ekwǫ̀ Nàxoède K'è: New Program Name

The new name for the program, Ekwǫ̀ Nàxoède K'è, replaces its previous name, Boots on the Ground. Ekwǫ̀ Nàxoède K'è was chosen by the Tłı̨chǫ program advisors, and means "In the migration of caribou," and everything that relates to them. "In the migration," starts in late-summer, once the caribou leave the calving ground towards their summer range near Kokètì, followed by their fall range closer to the treeline, their winter habitat below the treeline, and finally, in late spring, as the caribou return to their calving grounds. "In the Migration" refers to their entire trail network—all of the trails they follow to all of their homes throughout all of the seasons.

Photo 1: 2018 Field Team: Jimmy Mantla, Russell Drybones, Petter Jacobsen, Leon Ekendia, Tyanna Steinwand, Mercie Koadloak, John Franklin Koadloak, Roy Judas, and Joe Lazare Zoe.

For Tłı̨chǫ people, "In the Migration" is important because without migration we don't have caribou; people know where the caribou go in fall and where they go in winter; once caribou are on the trail people know where they are. By using the name Ekwǫ̀ Nàxoède K'è for our caribou monitoring program, we acknowledge that we try to observe caribou in their migration and that we engage in the migration of caribou as well.

Teams

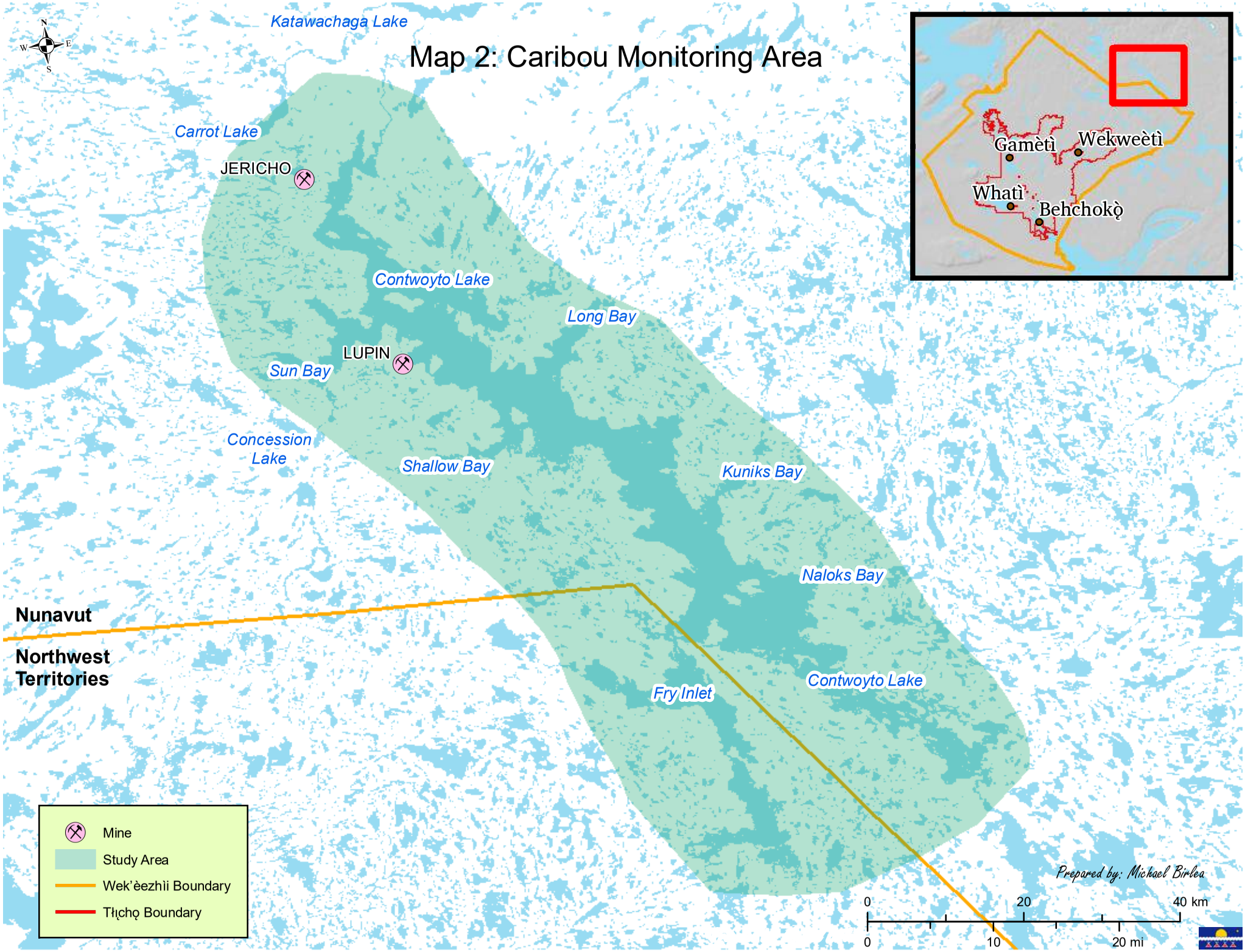
The monitoring program occurs over a six-week duration in which two teams of six monitors (Teams A and B, respectively) conduct their field work in successive three-week shifts. Each team consists of one elder, a younger hunter, a hunter/safety person, two local guides and a TK researcher. Selection to the teams is based on knowledge of the study area and suitability to this TK program, fitness for duty, and a person with a Wilderness Safety Certificate who can provide first aid and wildlife safety. This safety position is also chosen based on his/her knowledge of caribou and on-the-land skills. The TK researcher (research team) is the group of TK researchers who have been involved in the design, field implementation and refinement of the contents of this report. The TK researcher in the field documents observations using a participatory research approach and methods adapted from anthropological models.

Bathurst Caribou Monitoring Area and Timeline

The monitoring area is geographically focussed at Kokètì (Contwoyto Lake) and Fry Inlet, and the surrounding land within one day's walking distance from these lakes (Map 2), on the Bathurst caribou summer range.

The Tłı̨chǫ name for Contwoyto Lake is Kokètì, translated as "empty campsite lake," in reference to the many camps erected on this lake throughout history. Kokètì is at the northernmost extent of Tłı̨chǫ traditional land use, and is an area shared by the Tłı̨chǫ and Inuit people for caribou hunting in summer and fall, fur trapping in winter, and as a trade route between the two cultures. Inuit and Tłı̨chǫ have a long history of meeting at historical caribou hunting locations. Kokètì is accessible by canoe and floatplane

Map 1: Range of the Bathurst caribou herd, based on satellite-collared cows between 1996 and 2008 (Chen *et al* 2014).


Map 2: Caribou Monitoring Area
Katawachaga Lake
Carrot Lake
JERICHO
Contwoyto Lake
Long Bay
LUPIN
Sun Bay
Concession Lake
Shallow Bay
Kuniks Bay
Naloks Bay
Nunavut
Northwest Territories
Fry Inlet
Contwoyto Lake
Gamètì
Wekweètì
Whatì
Behchokǫ̀
Mine
Study Area
Wek'èezhìi Boundary
Tłı̨chǫ Boundary
Prepared by: Michael Birlea
0
20
40 km
0
10
20 mi

during the summer; and in the winter months by snowmobile from Kugluktuk or winter ice road to Yellowknife. The Tibbitt-Contwoyto Winter Road (TCWR Joint Venture) is built from Yellowknife through Kokètì for mining resupply. There are currently two non-active mines (Lupin and Jericho) in the monitoring area, and several mines south of the area (Ekati, Diavik, and Gahcho Kuè) as well as numerous abandoned exploration camps scattered across the landscape.

Our monitoring was continuous over a six-week period between July 16th and August 27th 2018. Specific monitoring locations within the study area were determined using the harvesters' traditional knowledge and Bathurst caribou GPS collar data provided by GNWT-ENR. This monitoring area was chosen due to its ecological significance for caribou, and several under-researched factors in this region that may affect caribou health, behaviour and migration within its summer ranges.

Kokètì is located southwest of Bathurst Inlet and the calving grounds used by the Bathurst herd since the mid 1990s. The areas around the lake are central to the post-calving and summer range of the Bathurst caribou (Map 1). In July, during the post-calving aggregation, the herds of cows from the calving grounds mix with the bulls to form large herds numbering thousands of individuals. This area is therefore ecologically significant for caribou, during migration from their calving grounds and as the herds travel regularly between Kokètì and Ek'atì (Lac de Gras). Kokètì runs approximately northwest to southeast, bisecting the post-calving summer range. At its widest point, the lake is approximately 19 kilometres wide; numerous eskers, moraines, and islands form *nǫɔokè* (water crossings) that caribou use to cross the lake. The elongated shape of the lake creates a number of *nǫɔokè* that caribou use to cross the lake, and established *ekwǫ̀ etǫ* (caribou trails) used by caribou annually. Hunters typically wait for caribou at these locations.

Climate and Vegetation

The study area is entirely within the Arctic Tundra climatic zone (Environment Canada, 1998) and is classified as a tundra biome (Map 3). The climate of this region is characterized by long winters and short summers, with an average growing season of 50 to 60 days and average temperature range between -34°C in the winter and 3 to 12°C in the summer. Average precipitation, including melting snow, is variable but typically amounts to between 10 and 40 centimetres.

Map 3: The monitoring area is located approximately 385 km north of Yellowknife and between the Northwest Territories and Nunavut, Canada.

The region is within the Laurentian Plateau (Canadian Shield), an area dominated by exposed Precambrian igneous and high-grade metamorphic rocks. Surface expression derives from glacial processes; the area is defined by undulating to hummocky terrain, with eskers, low hills and rocky outcrops overlooking numerous waterbodies, sediment basins, and wetlands. A layer of permafrost consisting mostly of gravel and finer material exists just below the surface. This semi-permeable layer is covered by a layer of organics, soil, or bare parent material. The most common soil order of the study area is cryosolic soil formed in either mineral or organic material with permafrost within one to two meters to the surface (CSSC, 1993).

Due to the permafrost layer, water is retained in the upper portion of the ground. This phenomenon has contributed to the formation of wetland habitat and the retention of water near or around the surface, creating conditions for the development of shallow-rooted low shrubs, sedges, mosses, grasses, flowers, and lichens. Wildlife of the area include herbivorous mammals such as caribou, muskox, arctic hares, squirrels, lemmings and voles, and carnivorous mammals such as grizzly bears, artic foxes, wolverines, and wolves, and a wide variety of migratory bird and fish species.

The Tłı̨chǫ

The traditional territory of the Tłı̨chǫ is vast, and the network of hunting trails extends far into every corner of their lands. The four Tłı̨chǫ communities of Behchokǫ̀, Whatì, Gametì and Wekweètì are located in the boreal forest, and our land stretches far north of the treeline into the tundra, where many caribou hunting grounds are located. The traditional land-use areas of the Tłı̨chǫ lie within the boundary known as "*Mǫwhì Gogha Dè Nı̨ı̀tłèè,*" which was outlined by Chief Mǫhwhıì during the negotiations of Treaty 11 in 1921 (Helm 1994). The traditional land consists of the area between Great Slave Lake and Great Bear Lake, from the Horn Plateau in the southwest, and as far north as the Coppermine River and Contwoyto Lake.

On August 4, 2005, the Tłı̨chǫ Agreement—the first land, resource, and self-government agreement in the N.W.T.—came into effect. This Agreement was signed by the Tłı̨chǫ and the Government of Canada, and established the Tłı̨chǫ Government's full powers and jurisdiction over 39,000 square kilometres of Tłı̨chǫ lands, wildlife and resources. The Tłı̨chǫ Agreement not only created the Tłı̨chǫ Government, but also set its mandate to preserve, protect and promote Aboriginal and Treaty rights and way of life—including culture, language, heritage, lands, economy and resources—for all Tłı̨chǫ today and for future generations to come. The significance of the Agreement is that the Tłı̨chǫ people have ownership of 39,000 km^2 of land surrounding the four Tłı̨chǫ communities, including surface and subsurface rights to the area. The Agreement guarantees participation in the Wek'èezhìı Renewable Resource Board and the Wek'èezhìı Land and Water Board, the co-management boards governing the resources within Wek'èezhìı. The Tłı̨chǫ have their own lawmaking power over all Tłı̨chǫ citizens, including aspects of education, child and family services, income support, social housing, and other services.

Methodology

"We Watch Everything" Traditional Knowledge Framework

> *Certainly, Kluane people do not switch between their empirical knowledge of moose population and their non-empirical understandings of moose as other-than-human persons. The two are inseparable for them, each informing the other and imbuing it with meaning (Nadasdy 2003: 112).*

Ekwǫ̀ Nàxoède K'è is an applied interdisciplinary research project that bridges observations of a biological nature with the cultural knowledge of local hunters (see Figure 4 for an overview of methodology). We adopt a biocultural approach to emphasize the Tłı̨chǫ as well as Inuit knowledge (Inuit Qaujimajatuqangit - IQ) of the ecosystem in which they live. Biocultural approaches explore the link between biological and cultural diversity, and their interdependency with one another. The environment we live in has shaped our thoughts, actions and customs as much as humans have shaped the environment (Pilgrim and Pretty, 2010). A growing body of evidence suggests that global decreases in biodiversity are expressed in both biological and cultural terms. Furthermore, in this context, indigenous knowledge of ecological systems plays a key role in understanding reductions in animal abundance and distribution (Pretty et al, 2009; Pilgrim and Pretty, 2010). Our framework of research is based upon two methodologies developed over the course of the program, named, respectively, "We Watch Everything" and "Do as Hunters Do." Figure 1 and 2 illustrate the relationship and components of our methodology.

We Watch Everything is a theoretical framework of Traditional Knowledge research founded upon participatory ethnographic research and a set of theoretical concepts shaping the way information is collected, analyzed and interpreted. The use of language, indigenous ontology and perspectives on nature form the pillars of the framework.

Language of Nature

Words and concepts within one's language set the mental maps which enable meaning and understanding to take place within the human brain. As knowledge of nature and of natural interactions is culturally situated and derives from the environmental adaptations of the culture that gave it its meaning,

Photo 2: Esker island on southeast shore of Kokètì.

humans' experiences of nature are tied to their cultural interpretations. Using this notion, the idea that a universal truth of nature exists is avoided in favour of viewpoints based on cultural perspectives. Within different cultures and languages, a process in a physical environment may have quite different meanings. Furthermore, their response towards these processes might also be quite different depending on the pre-existing ideas and values within one's culture. The ideas and beliefs one holds of the environment direct one's actions towards nature (Ingold 2000; Sharp and Sharp 2015). Underlying the principle of "We Watch Everything" is an indigenous perspective on nature, and specifically that of Tłı̨chǫ and Inuit program participants. We let indigenous language and cultural practices related to caribou direct the monitoring so that their perspective on nature permeates the research program.

Developing a traditional knowledge environmental monitoring framework required that we recognize and adapt the values and ideas within the indigenous ontology. We use the term "strive" to describe the process of translating and interpreting Tłı̨chǫ words and concepts into English, because words and cultural connotations related to nature often do not have direct parallels between the two languages. The interpretation of Tłı̨chǫ words and of their knowledge of nature requires awareness of cultural relativism and extensive efforts from both researchers and elders to ensure mutual comprehension. Concepts are explained using a common language and denominators established during the course of the research. An example is the entry from the field journal recorded on the first year of the program, July 19th, 2016. After observing three muskoxen for over an hour, both the Tłı̨chǫ elder and Inuit harvester came to the agreement that they were "friends."

When the researcher enquired as to the curious use of the word, the elder Moise Rabesca explained that their behaviour, posture, and the way they related to each other indicated a long-term association. The muskoxen "grew together," and now they were inseparable. From an ecologist's point of view, it would have been easy to discount the initial use of the word "friends" as a shallow characterization of muskox behaviour. Yet, such a notion would have failed to understand the depth of the hunter's empirical knowledge about muskoxen and the concept being presented. The elder understood the association between muskoxen intimately because "if you kill one, the others will not let you go near the body. So, if you only need one, you'll need to take the other two" (Moise Rabesca). This knowledge of muskoxen behaviour was accumulated during numerous hunts and passed over from generation to generation across centuries of life on the land. Far from being shallow, it derived from an extensive and empirical set of observations conducted over a long period of time and specific to that area. This form of knowledge allowed the hunters to thrive in the arctic landscape. The statement also evoked times before the advent of firearms, and the ease in which hunters can now take the life of animals, whereas in the past each caribou or muskox had to be killed at close range, and often at great personal risk.

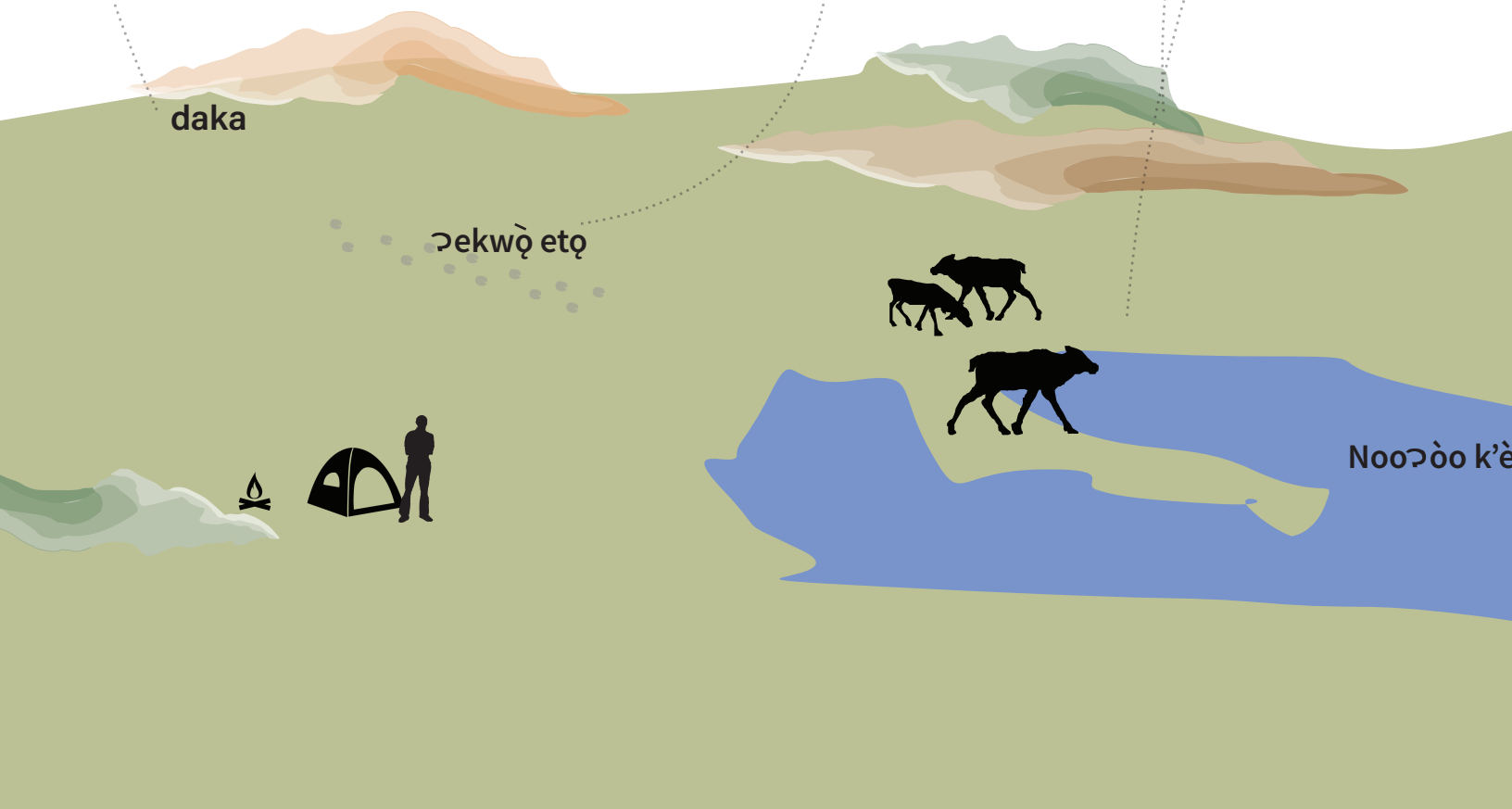
The Muskox example illustrates our approach following the elders' teachings and way of interpreting the land to understand concepts, as opposed to classifying knowledge using Euro-Canadian standards. There is no word in English that closely resembles the connection described by the elders; however, through careful cultural interpretation and aided by the elders themselves, we can glimpse into a different worldview of interactions, one that is as ancient as the people who first hunted caribou in the landscape of Kokètì.

FIELD METHODOLOGY: DO AS HUNTERS DO

Ekwǫ̀ Nàxoède K'è: Boots on the Ground is a **participatory action research** project modeled after a traditional caribou hunt. Members of the hunting party travel on the barrenlands to find caribou together, collectively experiencing and sharing knowledge. We use traditional knowledge of our Elders to tell us the best places to observe caribou in the ecosystem, or dè. Our methods include:

METHODS

- Using traditional hunting methods to find and observe caribou
- Ethnography, through interacting with Elders as junior researchers
- Using modern technology to observe and document caribou
- Recording observations as detailed field notes
- Integrating traditional Tłı̨chǫ language, knowledge and concepts

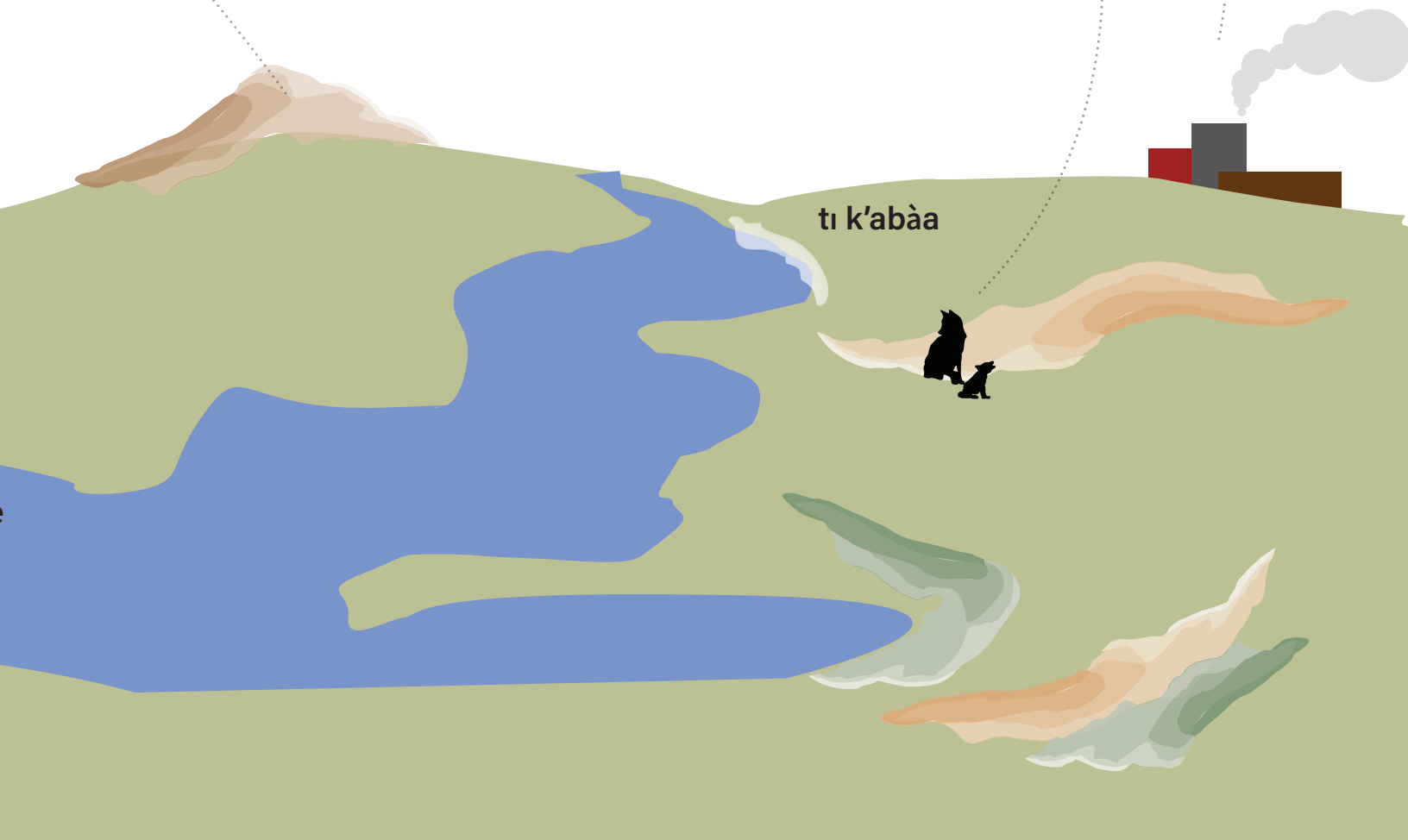


"WE WATCH EVERYTHING"

Our approach to monitoring can be summed up in the words of one of our Elders: "We watch everything." Our monitoring indicators have been founded on Elders' knowledge of caribou and scientific monitoring indicators. Some of the indicators that we use to evaluate the situation of the caribou year after year are:

INDICATORS

- Habitat and environment such as weather, insects, vegetation
- Caribou health, weight, hide colour, posture, injuries, cow-to-calf ratio
- Industrial and human disturbance such as visible presence, scent, and noise, and associated changes in behaviour
- Predators, location of dens and territory, kill sites



Land-based Theoretical Concepts

To achieve an indigenous perspective, the program employs Tłı̨chǫ words and cultural perspectives deeply ingrained in Tłı̨chǫ ontology. We call these perspectives theoretical concepts. In practice, while such concepts are abstract, they have a very concrete physical manifestation into the day-to-day thinking of Tłı̨chǫ hunters. An example is the concept of *dè*. *Dè* has a broader meaning than "land," because it refers to a whole ecosystem or environment; "however, where the word ecosystem is based on the idea that living things exist in association with non-living elements, the Dogrib term *dè* expands the meaning of "association" to encompass the knowledge that everything in the environment has life and spirit" (Legat, Zoe & Chocolate, 1995). *Dè* is not an independent object "out there," existing separate from culture and our daily lives, but rather is an all-encompassing, holistic system, of which indigenous culture is an integral part. As Allice Legat explained, "*dè* includes everything because all entities are in the state of existing and have spirit" (2012: 79). Surrounding the concept of *Dè* we defined four key theoretical concepts underlying the program's traditional knowledge framework. These are sentience, interdependence, communication, and time immemorial (see Figure 3).

Acting upon the principles of sentience, interdependence, communication and time immemorial, team members perform individual and collective rituals. One of the simplest and yet most powerful of these is "pay the land." Paying the land is done to neutralize our passage and become aware of our dependence on nature as human beings. This ritual involves simple acts of placing tobacco, or other valuable objects, in the water upon one's first arrival to a place. Other rituals are propitiatory in nature and performed to ask for safety. "Feeding" the fire is a ritual performed collectively to mitigate ones' presence and ask for safe passage and for harmony to be maintained. The *Nı̨hts'ı whìle agowedee* ritual is performed to calm down the wind. A fire is made of a small raft and accompanied with specific words is set to drift with the wind on a lake. The purpose is to communicate with the wind, to ask for safe passage or for the wind to calm.

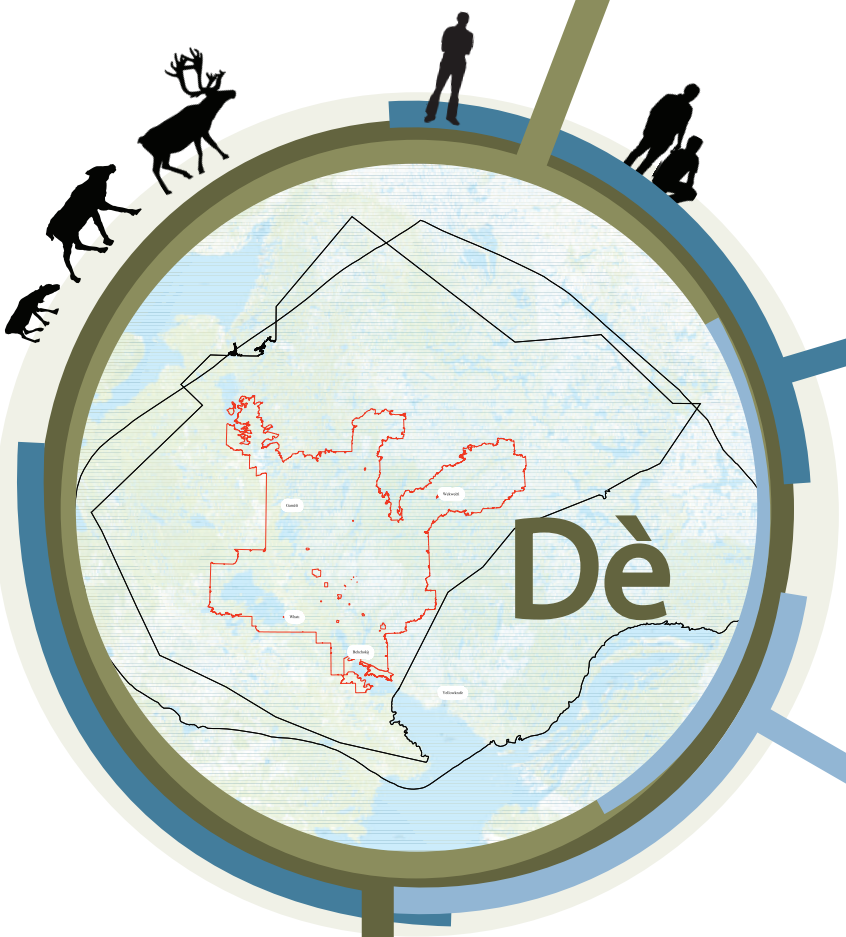
Through such actions, the team communicates and engages with the land on a social level; "the land, then, is a living entity with powers that should be respected if harmony is to be maintained" (Legat 2008: 37). During such engagement, the land is comparable to ones' parents, who provide everything for the people's sustenance. Tłı̨chǫ use the word *Dè Gogha Nàeǫ̀ı̨* ("the land shows favour to us") to understand how the land feels about our presence.

Photo 3: Joe Zoe and Mercie Koadloak fillet lake trout and char. The teams utilize local resources and fish is a stable diet.

TRADITIONAL KNOWLEDGE FRAMEWORK

SENTIENCE

We acknowledge diverse forms of communication between beings in dè, which may be unfamiliar to Western perspectives. Spiritual communication is legitimate knowledge that informs of the presence and abilities of animals and natural elements. We accept that knowledge revealed through spiritual communication is valid and can be used as hunters have always used it.



TIME IMMEMORIAL

We recognize that we engage with an ancient land. Since time immemorial, the people have focused their attention on knowing the seasonal rhythms of sentient animals and geographical and climatic details throughout their land. We recognize that we follow an ancient tradition of walking the same trails, watching the same caribou herd and using the same hunting locations as people have always done.

RESPECT

We recognize all beings, such as caribou, fish and birds, as sentient, intelligent beings capable of communication, memory and personal agency. Furthermore, inanimate beings, such as the wind, are also sentient and can act on choices and influence other beings. We engage in a social relationship with animals and the elements (living and nonliving) when we travel on the land. By respecting the land and water when we camp or travel, through small acts such as paying the water, we follow the elders' teachings and engage with dè as hunters have done since time immemorial.

INTERDEPENDENCE

Humans, caribou and living and nonliving elements of the land live in a dynamic interdependent relationship. For the Tłı̨chǫ, dè is not separated into the biological, social or supernatural spheres, as it is in Western concepts. We recognize the interdependent relationships of all beings and elements of the land.

Field Methods: "Do as Hunters Do"

"Do as Hunters Do" is the practical implementation of the "We Watch Everything" methodology framework. The name was chosen because our research emulates traditional indigenous caribou hunting in the barrenlands (no real hunting occurred during the program). Using a participatory action research (PAR) approach, members of the "hunting party" travel to specific locations on the barrenlands to find caribou together, collectively participating, experiencing, and sharing knowledge. Using a PAR approach, the researchers become part of the "hunting team" under the direction of the elders and the local harvesters, as traditionally done in Tłı̨chǫ culture. This form of PAR research can be defined as a process of self-investigation shaped by collective decision-making among the team members.

The essence of "Do as Hunters Do" is the recognition that a TK monitoring program does not need to develop new methods; rather, it should learn from and adapt to the cultural practices developed, since time immemorial, by experienced indigenous harvesters to sustain their communities in the arctic environment. In order to comfortably live in the Arctic, Tłı̨chǫ and Inuit hunters developed sophisticated ways of looking at the landscapes surrounding them and locating animals as well as other sustenance sources. These were incorporated as effective tools within our research framework.

Overview of "Do as Hunters Do" Methods

The "Do as Hunters Do" field data collection process unfolds through a set of techniques and concepts that are specifically related to the landscapes of Kokètì. These techniques combine the Traditional Knowledge of harvesters with elements of anthropology and science and consist of using hunting locations for observations and the use of hunting techniques for monitoring.

Hunting Locations as Methods of Observation

The program makes use of *nǫɔokè* and *tataa* to understand how and where caribou herds will travel over the vast barren landscapes. By relying on these concepts, along with the collar information provided by ENR, the teams can place themselves in the best location prior to the arrival of the herds. Caribou monitoring and the recording of TK is inextricably related to the Tłı̨chǫ concept of land. Located in the barrenlands (tundra) region of the Northwest Territories and Nunavut, the vast subarctic prairies surrounding Kokètì are dominated by granitic outcrops, glacial outwash, eskers, moraines, and other landscape features created by continental glaciation. We considered such geomorphological features, as well as cultural associations to identify locations where caribou travel, feed, rest or move at certain times of the year. By conducting observations from the key locations described below, we document information about the factors affecting the herd.

Observations at *Nǫɔokè*

Nǫɔokè (watercrossings) are the closest points of contact between land across waterbodies, used by caribou to cross the numerous large lakes dotting the tundra. *Nǫɔokè* is a Tłı̨chǫ term for water crossings; it literally means "swim across", and a *nǫɔokè* can be any place that caribou or any other animal use to swim across. Tłı̨chǫ also use the more specific term *naɔoke* to refer to a place where *caribou always* cross, such as the crossing between Kokètì and Fry Inlet. As part of our methodology, waiting at these crossings allows the researchers to "Do as Hunters Do" and therefore:

- Observe animals in close proximity.
- Observe herd dynamics.

- Observe the behaviour of predators who are following or waiting for caribou herds.
- Determine the relative importance of attributes such as the presence of sand, rocks, and prevalent winds for caribou choice of crossing.

Nǫɔokè are crucial to understanding caribou migration. Local harvesters, sensing the landscape "as caribou would," developed expertise in identifying *nǫɔokè*, and know which *nǫɔokè* will be used by studying the details of the crossing, including, but not limited to: topography; surface materials; underwater hazards, and so on. Old campsites often reveal the location of the main *naɔokè,* as they were established by hunters to easily reach the caribou crossing without interrupting the herd's movement. The Ekwǫ̀ Nàxoède K'è program employs the same knowledge of geography and uses the old hunters' campsites close to crossings, to avoid further interrupting caribou movement.

Caribou are good swimmers, and often enter the water as a means to escape from predators or insect harassment. Their outer guard hairs are hollow and provide excellent flotation, while their wide hooves can transport them quickly forward. *Nǫɔokè* refers to the interface between water, land, and caribou movement. When the herds travel over the vast land, they need to walk around large waterbodies on their migration routes. But at times they prefer to swim across water bodies rather than walk the long way around. In those circumstances, they often enter the water at the point of shortest distance to the other side, although, as pointed out by the elders, other factors, such as the presence of large boulders or perceived hazards, may influence the herd's decision to cross.

Observations at *Tataa*

Tataa is another important word to understand caribou migration. It refers to caribou movement relative to water bodies, and literally means "in the midst of waters" (Whaèhdôö Nàowoò Kö 2002:21). The large lakes and numerous water bodies encountered on the migration routes create obstacles that the herds must travel around. A *tataa* is a channel of land between lakes—a land bridge that allows caribou to cross large lakes along their migration routes. A *tataa* can refer to either a small channel of land, such as the one between *Ek'atì (Lac de Gras)* and *Łiwets'aɔòats'ahtì* (Lac de Sauvage), or a larger land crossing, such as the one between *Nǫdìikahtì* (Mackay Lake) and *Ewaànıt'ıtı (Courageous Lake)*, or between *Ek'atì* and *Nǫdìikahtì*. The concept of *tataa* is also used by the elders to refer to a migration route, for example *Ek'atì tataa*. This *tataa* refers specifically to "land bound by Ekati [and Ewaànıt'ıtı and Nǫdìikahtì]" (Whaèhdôö Nàowoò Kö 2002:21). Used in various situations, the concept of *tataa* has several meanings depending on the context in which it is used. Observations at *tataa* include:

- Detailed understanding of caribou migration on local and regional scales.
- Details of herd dynamics.
- Migration patterns in relation to industrial infrastructure.
- Dynamics between predators and caribou migration.
- Details of migration routes in relation to valuable feeding grounds.

Follow *Ekwo Eto* (Caribou Trails)

Observations related to caribou trails include:

- Caribou forage and diet.
- Looking for fresh or older tracks. Direction and time of track demonstrate patterns of movement.
- Predator behaviour.

- Cow-calf relationships.
- Estimates of the number and health of injured animals falling behind, and their interaction with predators.

Ekwo eto are numerous and interspersed throughout the northern landscape. The location and significance of caribou trails is recorded to help locate animals across the land, determine animal distribution, and document caribou behaviour.

Follow *Tı K'abàa* (Shorelines)

The analysis of *tı k'abàa* is essential to understand both n*ǫɔokè*, constraints on movement, and presence of predators. By observing local shorelines, researchers can:

- Understand how *tı k'abàa* are used in the context of n*ǫɔokè* and *tataa.*
  - Observe animal signs in soft material such as sand.
  - Observe predators, since they usually walk along shorelines to smell anything that comes downwind from the lake.
  - Observe and record the locations of "white shores," where caribou hair, dispersed by the herd during swimming, accumulates on the beach, giving the impression of snow or white foam.

Observations from *Daka* (high points)

Daka (high points) across the landscape such as *hozìı shìa* (hills on barrenland) and *what'àa* (eskers) were extensively used by the team to choose the direction of travel, locate features such as favourable pastures rich in lichen and other forage, track the progression of predators and other species, and as points of observation with limited insect harassment. Elevation points are useful to:

- Gain an understanding of caribou movement over various types of landscape features.
- Understand insect harassment and the factors affecting its intensity such as wind speed and weather.
- Assess vegetation quality and caribou forage areas.

Photo 4: Teams watching and walking the esker around Kokètì.

Hunting Techniques as Methods of Observation

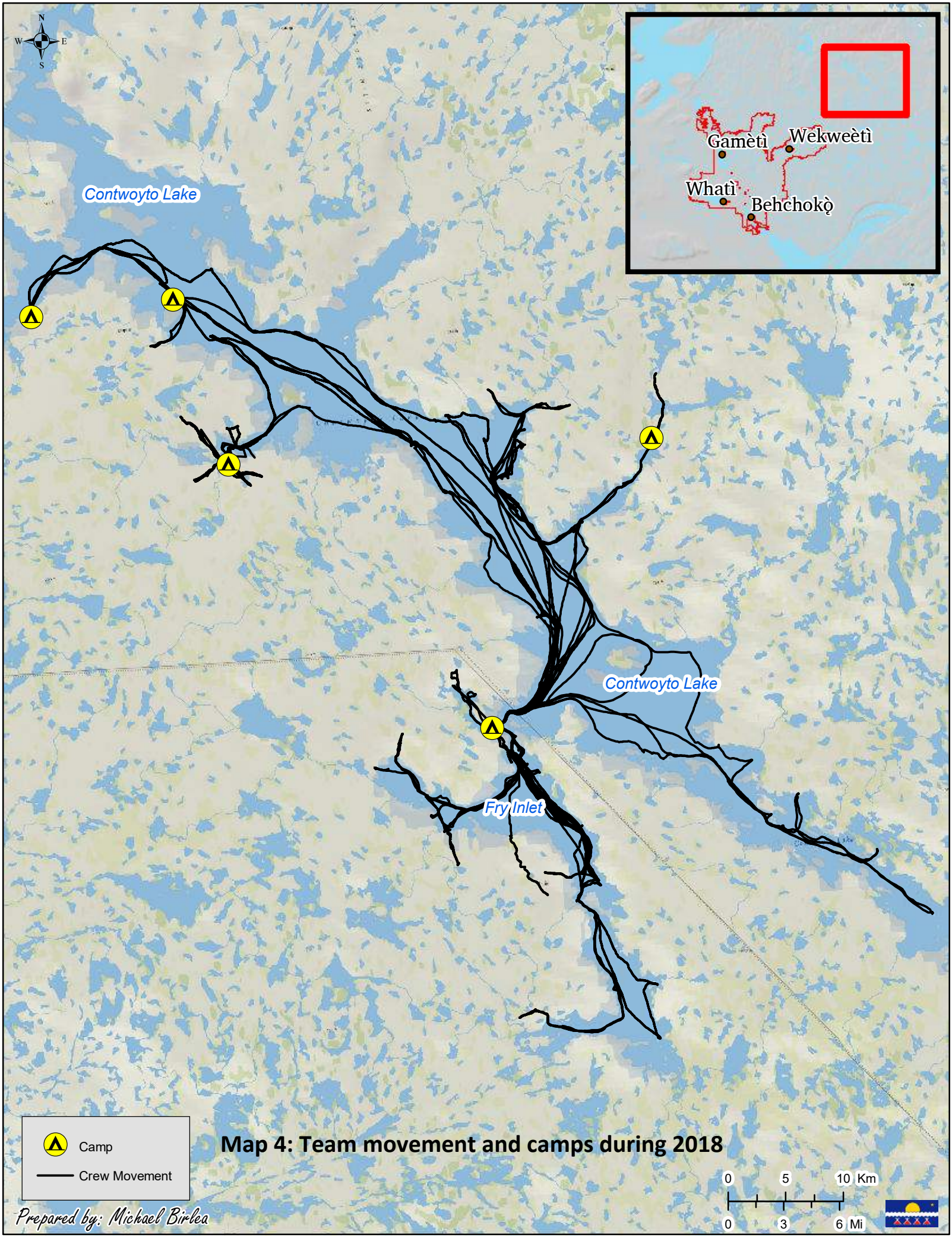
The location of our main camp, close to the *naɔokè* (water crossing) between Kokètì and Fry Inlet (see Map 4), in Northwest Territories, was located at the northernmost range of Tłı̨chǫ land use. In times past, people travelled by birch bark canoes and later with canvas canoes along the waterways from their settlements south of the treeline to this location purely for caribou hunting. They followed shorelines by boat, then beached at known caribou water crossings. Families set their camps short distances from the crossings, so as not to disturb the potential movement of caribou. From camp, hunters walked to high points or eskers, where they waited and watched for any movement on the land surrounding the crossing. The waiting could take days, or weeks. Once animals were seen, the hunters would wait close by in their canoes. Along the shoreline, the women would often sit and wait behind boulders or in the low bushes, the *kwea* (dwarf birches). Once a herd started to swim across, the hunters would allow the first group to make their way through. Once the first herd had passed and made their scent marks on the trail, the hunters knew more caribou would follow. As the following herds entered the water and started swimming, the hunters would approach in their canoes to spear or shoot animals in the water. This strategy allowed hunters to approach their prey closely and select the animal they wanted to harvest. Once caribou were killed, the women would appear from their hiding places to butcher and process the meat. The killing was usually the first and easiest step in the long and strenuous process of preparing the meat and transporting it back to communities, sometimes hundreds of kilometres away.

Since the introduction of colonial government policies and settlement into communities, Tłı̨chǫ land-use has decreased in its geographical extent and intensity. Additionally, the advance of technologies, such as the airplane and snowmobile, have made transportation easier, but simultaneously, discontinued long and arduous travel by canoe and dog teams. And thus, the use of the traditional trail system into the areas farther away from the settled communities has diminished along with the use and opportunities for intergenerational transfer of knowledge associated with places along the traditional routes.

The Ekwǫ̀ Nàxoède K'è program has sought to revive ancient traditions and trails by applying similar techniques and concepts. Observations from the *daka* (hilltop) such as *hozìı shìa* (hills on barrenland) and *what'àa* (eskers) were the main tools applied by the team to locate caribou. Hiking eskers to observe the land from its highest point was performed daily. In the early mornings, the team hiked to a high point close to camp to look for recent animal activity, direction of fresh tracks or circling ravens. At numerous high points dotting Kokètì, we found archeological evidence of previous hunting activity. Tent stone circles (Photo 5) were found at many of the high points along eskers. Previous hunters had set their tents at these best locations to spot caribou. At other eskers, we found arrowheads (Photo 5). Advised by local hunters, our main camp was established approximately two kilometres north of the main *naɔokè*. The camp location had been used for centuries by Tłı̨chǫ and Inuit. One kilometre west of the main camp was a long, tall esker, stretching in a north-south direction, where we could do as hunters have always done, and watch the land for animal movement surrounding the *naɔokè*.

Waiting

The *"Do as Hunters Do*" methodology is based on foot movement over the land and waiting at strategic places, such as at higher elevations with a viewpoint or known *nǫɔokè*; places where caribou are expected to migrate. As caribou herds are constantly moving, it is necessary to meet them on their travels, and hunters have identified the best locations to run into them. They regularly travelled to these locations and simply waited. By doing as hunters do, and including waiting in our methodology, we engaged with the


N
W
E
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Gamètì
Wekweètì
Whatì
Behchokǫ̀
Contwoyto Lake
Contwoyto Lake
Fry Inlet
Camp
Crew Movement
Map 4: Team movement and camps during 2018
0
5
10 Km
0
3
6 Mi
Prepared by: Michael Birlea

land and became active participants in the research. From an anthropological perspective, there are numerous research benefits related to waiting for prey for prolonged periods of time. Waiting provided time for casual conversation about research topics, the land and culture.

It also provided an opportunity to feel and become acquainted with the land. Every day, the team sat on the high esker west of the camp for hours, watching, listening, and feeling the weather. Sitting on the esker between two and eight hours each day, in morning, midday and evenings, we had the opportunity to experience weather systems moving over us, feel the shifting wind, the rain and the cold, and—delightfully—the heat of the sun once the clouds cleared. Living in close contact with the land fosters a connection with elements of *dè* that goes beyond ordinary observations. As a traditional knowledge framework, we recognize that knowledge is at times revealed through "dreaming." Sitting in silence on the esker, watching for hours on the barrenland, one can close their eyes and drift into a dreaming state while the other team members continue watching.

In Tłı̨chǫ, the word to dream— "*nate*"—is the same word as to foresee ("*nate*"— pronounced "NAH-te") (Helm 1994, Goulet 1994). As the Tłı̨chǫ language reveals, one can foresee a situation by dreaming, just as in the dream the land and animal spirits can communicate with the dreamer. We use the word "dreaming" for the lack of a better English term and following the practice of other scholars when describing this action among the Dene (Helm, Goulet, Legat). It is important to recognize this potential and engage with the environment as people have done for generations while waiting for caribou on the eskers.

Waiting is therefore intended as a vigilant watch, a state of mind in which the team members engage personally with the landscape. Such prolonged personal engagement with the daily weather conditions, physical movement over various terrains and close encounters with local animals, shapes the mental state of each team member, and thus the overall team's ability to monitor caribou. In waiting, the hunter naturally acquires a great deal of knowledge about his local situation. Expending large amounts of time on the land was an essential part of our methodology, critical for our ability to conduct research and record information.

Photo 5: From left to right: tent stone circle on *what'àa* (esker); iron arrow point; ivory scraper or arrowhead.

Time

The *"Do as Hunters Do"* methodology requires ample time due to its ground-based approach. Time is required, for example, to adjust to the daily and seasonal weather patterns. Weather decides everything on the barrenlands; the wind and waves direct all movements and actions; thus, plans get delayed and remade constantly. The most appropriate tool we can employ is time, implemented by waiting and watching. A long-term approach is necessary to get more than momentary observations, and to fully understand the life of caribou on the land. Long-term monitoring, defined in terms of years of repeated research periods, allows the researcher and the hunters to discern ecological patterns.

Walking

Walking is simultaneously the slowest form of transportation and the most intimate form of movement over any landscape. As a research method, walking provides the team with the time necessary to watch for details and identify clues of presence left behind by animals. The teams walked between five and 20 kilometres per day. After 40 days of field work this year, we had covered 1,814 kilometres by foot and boat. The long walks into the surrounding landscape from camp were made from *daka (high point)* to *daka*, from one high point to the next, often following eskers (photo 7). As we reached a *daka*, such as an esker or hilltop, we would sit, watch over the surrounding landscape, and wait. If no animal movements were seen for one to three hours, we proceeded to the next *daka*, and continued watching. This is the same method as hunters use when hunting for caribou on the barrenlands in the fall.

Walking along the caribou trails proved a valuable method for monitoring and an intimate understanding of the landscape, and therefore invaluable insights into animal behaviour. By walking caribou paths, we identified the herd's preference for types of terrain during migration, as well as the types of terrain avoided, which vegetation was foraged, and signs of other animals or predators in the vicinity of the herds. Walking is also the least intrusive form of monitoring, as no permanent marks remain and no excessive noise is made. As animals, we humans do leave a mark of scent, by rubbing our rubber and leather boots or clothes against rocks or vegetation. As directed by the elders and the harvesters, we took care to never walk directly through any caribou trails for two to three days after a herd had used them, to avoid disrupting the caribou scent on the trails, in case other herds would follow in their footsteps.

Photo 6: Tyanna Steinwand, Leon Ekendia, Russell Drybones and Roy Judas on esker by Fry Inlet, August 2018. Photo: Chad Galloway.

LANGUAGE AND THE LAND

We believe that using traditional Tłı̨chǫ words for land and concepts helps us root our work in the Tłı̨chǫ culture and traditional knowledge that guides our activities.

Dè

Dè can be translated as ecosystem, but with a broader meaning that includes the notion that everything in the environment relates to each other, and all things have life and spirit. Everything we observe is part of dè.

Daka

Elevation points across the landscape, such as hozıı shıà (hills) and what'àa (eskers). They help researchers understand:

- Landscape
- Herd movement
- Insects
- Wind and weather
- Vegetation quality

ɔekwǫ̀ etǫ

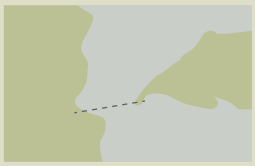
Caribou trails, which are interspersed across the barrenlands. These help researchers to find caribou and to document:

- Caribou forage and diet
- Predator behaviour
- Cow-calf relationships
- Injured animals that fall behind and their interaction with predators

Nooɔòo k'è

Closest points of contact between land across water, used by caribou to cross lakes. Waiting at no'oke helps researchers observe:

- Caribou up close
- Herd dynamics
- Predator behaviour
- The importance of geological features and winds for caribou crossings



Tı k'abàa

Shorelines along bodies of water in the barrenlands. These areas help researchers understand movement of caribou and predators, and to observe:

- How caribou move across no'oke
- Animal signs in soft land
- Predator behaviour
- "White shores," where hair lost by swimming caribou gathers, giving the impression of snow or foam.

Monitoring Indicators: *"We Watch Everything"*

Monitoring is based on the periodic assessment of key indicators, which were developed using an interdisciplinary approach. Based on the holistic Tłı̨chǫ concept of *"We Watch Everything,"* the elders highlighted several related elements to be included for an analysis of caribou and habitat assessment. The resulting list of criteria guiding our research include: (1) habitat; (2) caribou; (3) predators, and (4) industrial development.

Indicator 1: Habitat

- Daily weather pattern (temperature, wind direction, humidity, barometric pressure)
    a. Caribou behaviour in response to weather
    b. Daily insect activity in response to weather
- Caribou and predator behaviour in response to weather/ insect activity
- Conditions of vegetation and caribou forage
- Effects of environmental changes on habitat and caribou

Indicator 2: Caribou

Caribou health

- Unhealthy: skinny; bony; fatigued
- Healthy: normal conditions. No bones visible on rump and back. Layer of fat shows on the neck and back, and back to rump. Look at tail: if it's short, then the animal is fat and healthy

Hide color

- Unhealthy: discoloured; patchy
- Healthy: nice color; no patches. In July: white colored hide (shed winter coat in June- July); August: darker color and shorter hair (new winter coat is coming)

Walking posture

- Unhealthy: walking with lagging head
- Healthy: prancing, or normal posture; head straight or slightly down when walking

Injured animals

- Number of caribou injured in the herd
- Types of injuries
- Signs of disease

Calves

- Cow-to-calf ratio
- Number of cows without calves
- Number of twins: sign of a healthy herd, as the cow is healthy enough to support two calves—demonstrates cows have not been under stress, and good habitat quality

Indicator 3: Predators

- Number, signs of and location of caribou predators
- Relationship between caribou and predators

Indicator 4: Industrial Development

- Caribou behaviour and movement affected by visible presence, noise, scent from industrial infrastructure and activities

Recording Knowledge

We chose to adopt a participatory action research approach as the overarching framework for documentation during the field program. Participatory action research is a research approach emphasizing a close working relationship between the lead researchers and program participants, evolving research questions, and fact-finding through collective efforts. Contrary to other forms of investigation, participatory approaches democratize knowledge production and decision-making, and foster opportunities for empowerment for those involved (Legat 2012). The ability to become engaged as a team through participatory research (*"Do as Hunters Do"*) enables researchers to learn and explore emotional, spiritual and cultural transformations. Taking a participatory approach provides opportunities for learning ways of knowing that are uncommon to western thought. The purpose of taking a personal experiential approach and using naiveté as experiential tool allows the researchers to be open to other cultural ways of interpreting, perceiving and knowing the world (Young and Goulet 1998). Such an approach is necessary to focus on the emic, the "insiders", voice and actively avoid biased interpretations. Therefore, fieldwork not only entails the collection of information, but is a totalizing experience that engages the whole being of the participants (Okely 1992).

A note should be made on our description of animals in this report. As outlined in *"We Watch Everything*: A Methodology for Boots-on-the-Ground Caribou Monitoring" (TRTI 2016), the program "recognize[s] animals as sentient beings with personal autonomy and the ability to communicate, hold memory, and accrue knowledge" (TRTI 2017:9). In this view—and implicit to the descriptions in this report—a sentient animal *chooses* specific strategies, and an animal *knows*; for example, caribou *know* weather will change. Furthermore, the report follows the Tłı̨chǫ tradition of addressing animals in a similar manner to people. For example, a bear is described as *him*, or a caribou leader as *she*. Or, a caribou cow with calf is addressed as a *mother,* or a yearling as *sister*, depending the relational context

Qualitative Techniques

Documentation of TK occurs during monitoring sessions throughout the day, including discussions in the mornings and evenings. Having a TK researcher enables the team to record information through casual conversations and individual sessions with the elders.

Photo 7: Jimmy Mantla, Joe Zoe and Roy Judas walking along esker island, southwest shore of Kokètì.

We follow standard Tłı̨chǫ Research and Training Institute (TRTI) methodology for traditional knowledge research (Tłı̨chǫ Research and Training Institute 2012, 2013, 2015 and 2016). This documentation technique applies to both the open-ended and semi-structured methods.

Field Notes Protocols

Field notes protocols were created to provide consistency between the researchers' observations. Table 1 provides an overview of the information collected by the researcher each day.

ITEM	**DESCRIPTION**
WEATHER (from Kestrel mobile weather station)	
Temperature:	Humidity:
Wind Speed:	Wind direction
Weather Notes: *describe daily weather*	
Weather/Insect: *describe insect harassment in relation to weather and wind speed*	
Weather/wildlife: *describe wildlife activity in relation to weather*	
WILDLIFE OBSERVATION NUMBER	
Number of animals:	Species:
Description: *describe animal activity, including location, behaviour, signs, and method and location of observation.*	
TK NOTES	
Title: *key word used for content analysis, i.e. caribou hunting on* Kokètì	Description: *Describe elder's knowledge*
END OF DAY SUMMARY	
Km travelled:	Total time of observation:
No. of animals: totals	Key Tłı̨chǫ words/concepts:
Highlights for the day:	

Table 1: Template for observations.

The template provides consistency to the daily observations and experience of the team. The recording is completed in a field journal, using Rite-in-the-Rain™ waterproof writing equipment. A designated number is assigned for each new observation. The template systemizes the recording, while the notes themselves are flexible and open-ended, to allow for different durations of each observations, and adjusting to the nature of the elders' descriptions. The note-taking is conducted throughout the day by the researcher, in accordance with explanations made by elders.

At the end of each day, the daily totals are tabulated into a master sheet saved in a shared drive. Photographs and spatial data in the form of tracks and waypoints are saved in separate folders, one for each day of fieldwork. Spatial data daily totals are analyzed each evening by the lead researcher to identify gaps in spatial coverage of areas, update team progresses, and identify new areas to present to the group for discussion. A morning meeting is held to discuss the previous day's observations and plans for the day's monitoring activities and locations.

Researchers and Elders

Personal knowledge, including the lead researcher's western academic, professional background can become a source of bias when working with indigenous peoples' knowledge of the land. It is often necessary for the researcher to undergo a process of acknowledging his or her own limitations, recognizing personal points of view and opinions, in order to avoid judgmental approaches and appreciate the differences between cultures and personal backgrounds. We define this process as maintaining naiveté, described as the skill of the researcher to be a novice, someone who genuinely wants to learn a new culture (Russel 2006). In this program, the relationship between the elder and the researcher is akin to that of an elder and a junior hunter and can be summarized into the role of teacher and participant-observer. From the researcher's perspective, participant-observers are insiders who participate, observe and record aspects of the life around them, in this case the TK of elders and harvesters.

Techniques for eliciting and documenting information are often based on the personal characteristics of each elder. Each elder has a different knowledge set and different ways of expressing him or herself. Some elders elaborated more than others and chose to communicate in long monologues. During such conversations, it is better to adapt to the characteristics of the elder and sit and listen without interrupting, rather than interrupt with a series of questions (Jacobsen 2011).

This method follows the cultural characteristics of learning among the Dene and Tłı̨chǫ cultures, in which knowledge is transferred mainly through personal observation, experience and storytelling, rather than solely by direct question-and-answer (Legat 2012; Goulet 1998). The Tłı̨chǫ and other Dene and Inuit peoples share similar cultural attributes related to learning that differ from those of Euro-Canadian societies. The elder wants the researcher to learn in the same ways that they learn, preferably through personal experience and observation (Legat 2012, Goulet 1998, Guedon 1988, Ridington 1988). The use of direct questions often yields useful information and descriptive stories of the land, but open-ended conversations in which the elders take the role of teachers and explain the areas they feel important from their own experiences on the land are usually the most successful and insightful. This method of research is more in-tune with Tłı̨chǫ traditional forms of teaching and, thus, enhances the research process.

Analysis

The complex methodology of the TK program—combining ecological observations with cultural knowledge about landscapes—requires a multidisciplinary data analysis approach. Information collected in field journals during the pilot season were gathered using PAR and ethnographic documentation, and analyzed using content analysis, a technique that systematically categorizes and describes written, spoken, or visual forms of communication. This method was chosen as the primary technique of data analysis because it allows for qualitative text interpretation, while providing a framework for data analysis that can be employed for the duration of the multi-year program.

The field journals captured specific observations of wildlife and statements made by elders and monitors during daily observations and team meetings. Content analysis of the recorded field data was completed by TK researchers using standard TRTI research analysis methodology (Tłı̨chǫ Research and Training Institute 2012, 2016, 2017). Content analysis consisted of developing categories and identifying sub-themes and codes within each category. The categories parallel the monitoring focus of habitat and environment, caribou, predators and industrial development, while the emerging sub-categories and codes often cross between the categories. We approach content analysis using both quantitative techniques, for specific observations, and qualitative techniques for recorded TK statements.

The monitoring indicators were delineated prior to and during the field season. We identified main categories from the statements collected in the journals. The statements were divided into categories (i.e. caribou) and sub-categories (i.e. caribou migration). These categories were coded using keywords selected from the elders' statements; this way, each category was imbued with meaning and personal stories from the elders' lived experiences on the land. These were subsequently divided into sub-categories as required to provide the necessary definition to each topic (i.e. caribou health). The result of content analysis are tables of statements, from which inferences about trends, patterns, and correlations can be made.

Additional statements collected by the researchers relate to team experiences, often of multi-day events, as well as experiences of weather systems or recurring animal observations. By using the ethnographic and PAR format of data gathering, the researchers were able to observe and live each phenomenon from the point of view of the subject of the study, and document traditional knowledge. In TK research, it is often challenging to include knowledge that is shared privately between elder and researcher, as some types of knowledge are only shared in certain situations and to certain people. For example, knowledge of grizzly bears would not be discussed openly among team members in the field. Or, knowledge of spiritual aspects of caribou migration can/will only be shared to certain people. This form of knowledge often escapes the boundaries of theoretical classifications and categories. Therefore, in employing content analysis as the sole analytical technique, the researcher risks losing the depth and intensity of the lived experience as part of the "hunting team." As an attempt to avoid this, we combined content analysis with qualitative descriptions of experiences.

Finding Caribou

The main challenge for monitoring caribou is finding caribou. In general, caribou migrate southwest, from their calving grounds, in early July, toward the general area of Kokètì and Fry Inlet, and remains in the area throughout July and August. However, at a finer scale, the herd's movements are very unpredictable; different valleys, shorelines or specific *nǫɔokè* may be used in one season and not another. In our field program, the knowledge of the team's harvesters and scientific radio collar data received every two days allowed us to locate the herds and position ourselves in the right location.

Collar Data

Collar information provides a specific geographic location of male and female caribou. Every second day, GNWT-ENR biologists provided collar information over satellite phone. The collar information provides the exact location of caribou at a specific time every fourth day. The challenge for the program is knowing where the herds are during the four days in between. Following the movement south from the calving grounds, a post-calving aggregation happens in July; from that time, caribou spread out in larger herds. During the aggregation, the animals gather in large groups and move with purpose at a fast pace. If a herd is located on one side of a lake on the day we receive the collar information, it might have moved to the opposite side of the lake by the next day. Or one herd might split into two herds and move different ways.

Local Knowledge

Since herds can move long distances each day, local knowledge was necessary to identify where to best position ourselves to intercept caribou before they moved to areas inaccessible by our transportation methods. Building camp near frequently used *nǫɔokè* and waiting is the traditional and most efficient way to ensure meeting caribou. Local knowledge identified which locations would be best suited to have a

semi-permanent camp. John Franklin Koadloak, who has lived most of his life on *Kokètì*, pointed out the best camp locations, and where to go by boat and foot to meet the herds. His detailed local knowledge of geography and topography, by land and water, was vital for our team to best position itself.

We learned that the success of the program is dependent on following exactly what local harvesters and elders have always done on the lake: travel similar routes; set camp at the same historical campsites and walk the same trails. The act of monitoring became an act of trying to position oneself at places where one anticipates caribou will move through. In Tłı̨chǫ, *Kokètì* literally means empty campsite lake, and refers to the many old campsites that have been made at the lake over time. These campsites were chosen for a purpose; namely, for protection from wind or proximity to hunting locations. The program used the same sites for the same reasons.

Research Equipment

The nature of our monitoring technique, *"Do as Hunters Do,"* necessitates that research is conducted by boat and on foot; walking and watching the land. Daily movement on foot limits the amount of equipment it is possible to carry, while, at the same time, facilitates for a direct method of recording. The main piece of equipment used by the team is binoculars. While watching wildlife, the researcher records the observations on a field note book and by photo and video documentation. Photos and videos are captured using a DSLR camera with interchangeable lenses. Daily weather measurements are conducted with Kestrel mobile weather station. Additionally, all team movement and key environmental and cultural locations are marked on a GPS. At the end of each day, all files from the GPS and the digital camera are uploaded and backed up on a laptop, along with notes on total wildlife observations, kilometres traveled and times spend watching and being on the land for each day. Daily communication to headquarters is done with Garmin Inreach, using the tracking mode, uploaded every hour of team movement for safety purposes. A satellite phone is used to communicate caribou collar locations every second day. An Iridium Go, satellite device, is used to send photos and files to/from the field camp to headquarters. All electronic equipment is powered by the sun. In camp, we have portable solar panels which charge up a large battery that provide electricity to the electronic research equipment.

Photo 8: Jimmy P. Mantla, Joe Zoe and Roy Judas waiting out a storm on an island while moving camp.

EKWǪ̀ NÀXOÈDE K’È: BOOTS ON THE GROUND

HOW WE WORK

"Do As Hunters Do"
Field Methodology

"We Watch Everything"
Traditional Knowledge
Framework

Continually building knowledge of the Bathurst Caribou Herd

We provide information to stakeholders to inform their decisions and activities:

- Tłı̨chǫ Chiefs
- Tłı̨chǫ and other Indigenous land users
- Land use planners
- Federal and territorial government
- Researchers and scientists

Results

The two teams camped in the study area for a total of 40 days (six weeks), divided into two shifts of three weeks each. Table 2 summarizes the total monitoring time and distances travelled on foot and by boat.

Total On-Ground Time and Movement	
Field weeks	6
Field days	40
Hours travel by boat and foot	135
Hours of wildlife observation	89
Total hours moving & observing	223
Kilometres travelled by boat and foot	1,814 km

Table 2: Total study time and spatial movement of teams.

Over the course of 40 days, the two teams observed approximately 38,886 *Kokètì ekwǫ̀* (Bathurst caribou*/Rangifer tarandus groenlandicus*) in 141 groups of caribou (map 5). The number of caribou observed represent an approximate number based on participants' observations. This is not a total population count. Same caribou herds were observed on multiple occasions at different times and have been counted twice.

The teams also recorded other wildlife, including 10 *sah dek'oo* (grizzly bears*/Ursus arctos*), 16 *dìga* (wolf*/Canis lupus*), 22 *det'ǫcho*/bald eagle, three nǫ̀gha*/wolverine,* several *hozìı edzıe* (muskox*/Ovibos moschatus*), *didi* (arctic ground squirrel*/Spermophilus parryii*) and numerous avian species. These include the long-tailed jaeger (*Stercorarius longicaudus)*, sandhill crane (*Antigone canadensis)*, short-eared owl (*Asio flammeus*), northern pintail (*Anas acuta),* and common eider (*Somateria mollissima*), as well as other species of migratory birds and waterfowl typical of the region. Table 3 summarizes the number of large mammals observed during the study. Location of all observations of caribou, wolf, bear and eagles can be found in Map 5.

Total Mammals Observed	
Kokètì ekwǫ̀ / caribou	38,886 (approximate number; not population count; many herds seen multiple times and counted repeatedly)
Sah dek'oo / grizzly bears	10
Dìga / wolves	16
Det'ǫcho / bald eagle	22
Nǫ̀gha */ wolverine*	3

Table 3: Observations of large mammals.

Indicator 1: Habitat

This indicator describes caribou habitat from a holistic perspective, including information about vegetation, forage and weather conditions, and overall information about the arctic landscape, including ecological interactions and environmental changes observed during the course of the field program.

In general, caribou forage on the summer range around Kokètì and Fry Inlet was described as of "good" and "normal" quality by the harvesters (photo 10). Drier vegetation and poor-quality, crunchy lichen, were only observed for three days during a short period of warm dry weather from July 24th to the 26th. The high frequency of rain showers throughout July and August drenched the ground and the vegetation became moist and the quality improved. Some flat-lying areas became flooded from heavy rains in August (photo 9). The caribou forage remained correspondingly of good quality throughout July and August and caribou were observed to be feeding heavily. Consequently, fat bulls were observed earlier in the season, in mid-July, as the heavy rains and winds deterred bothersome insect activity, and the caribou had more time to graze peacefully on the lush vegetation. Blueberries and cloudberries ripened two weeks later than in 2017, due to unseasonably cold late-summer temperatures and less sun exposure. When the berries did ripen, however, they were more plentiful, likely due to the higher rainfall amounts in July and August, and the fact that there was more snow cover over the previous winter. Details of daily habitat observation can be found in Appendix 1.

Photo 9: Heavy rain flood some low-lying areas. Shallow Bay, August 12th, 2018.

Photo 10: Lichen in good conditions, eastern shore Contwoyto lake, July 23rd, 2018.

Indicator 2: Caribou

We observed 141 groups of caribou with a total estimate of 38,886 animals. (This is not a herd population count; many herds were observed multiple times and counted repeatedly). The herds were observed between July 19th and August 27nd, following migratory routes and water crossings around Kokètì and Fry Inlet (see Map 5). Caribou were seen almost every day throughout the six-week monitoring period. Observed group sizes ranged from one to 10,000 caribou. A majority of the larger herds—over 1,000 animals—were observed between the 11th and 18th of August. Individual animals or small herds were frequently observed throughout the six-week monitoring period.

Caribou Observations

July 19th, Kuniks Bay, eastern shore of Kokètì

Tracks: Caribou tracks were found in the sand along the shoreline, on the south side of the *naɔokè* in Kuniks Bay. Ten or more animals passed by here one to two days previously. Older caribou tracks, over a week old, cover the whole beach. Tracks were also found going south over the muskeg and sedges, away from the *no'oke*.

One caribou carcass, young bull: In the dwarf birch bushes, five metres from the shoreline, on the south side of the *no'oke*. The carcass appears to have sat since the fall of 2017; there are marks from small rodents chewing on antlers and bones over winter. The caribou was likely killed by wolves waiting at the *no'oke*; many white bone pieces are scattered around the kill site.

One calf jaw bone: Appears to be two to three years old. The calf was possibly killed by wolves at the *no'oke*.

July 20th, North of Kuniks Bay, eastern shore of Kokètì

Two caribou bulls: The antlers are visible on both animals. They are walking along the skyline, into a northwest wind. They are too far to see more details.

Seven caribou: Walking on skyline on hills. The animals follow the scent trail of earlier herds to the *no'oke*, where a white wolf was lying in wait.

July 21st, south of Kuniks bay

Two caribou yearlings: One-year-old females, south of Kuniks bay *no'oke*.

They are walking rapidly south along caribou a trail left by earlier herds. The yearlings look healthy. They are shedding their winter coats.

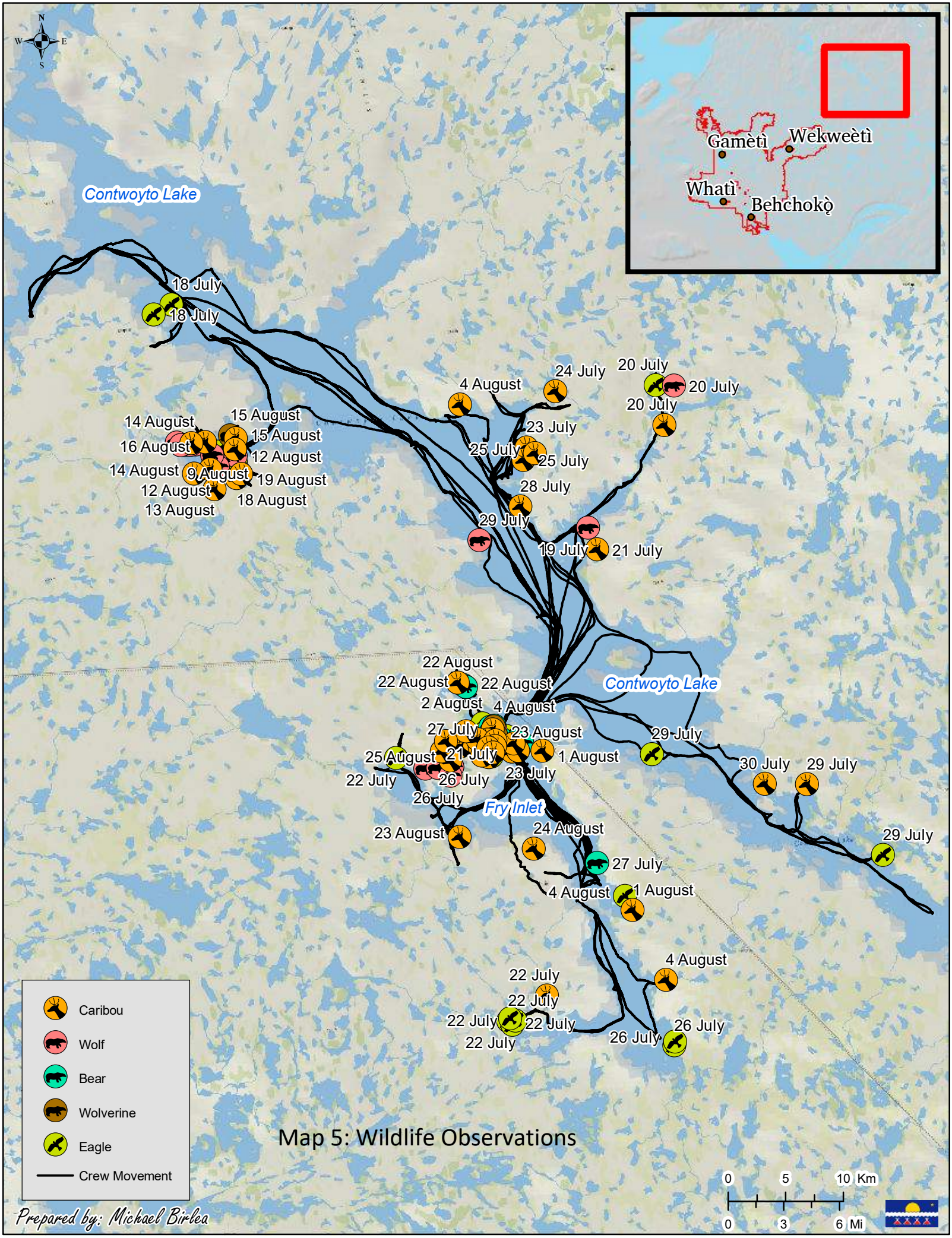
July 21st, Naɔokè between Kokètì and Fry Inlet

Tracks, caribou herd: Fresh tracks in sand at the *naɔokè*, western shore of Fry Inlet. Tracks are from earlier today or from the previous night. There are more tracks in the sand, left by a large herd, over a week ago.

200 caribou: Only 50 animals visible at first—the rest of herd remains behind a small hill (and appear later). The herd consisted of mostly cows, and fewer bulls. Most of the animals are yearlings. There are several dry cows (without calves) and several large bulls with large antlers. Very few calves are visible in the herd; only three are sighted. Most animals still have their full winter coat, though some are shedding. All animals look healthy and show no apparent injuries. The herd moves rapidly together. It walks inland from the shoreline, feeding in the muskeg on grasses and lichen. The herd then lies down in the muskeg, among the dwarf bushes, 50 metres in front of monitoring team. The herd then walks along the shore, stops and rests directly in front of us. There is no wind, and insect harassment is high: bulls are scratching their backs with their antlers. The animals are shaking their bodies continuously. Some are lying down, then getting up to shake the insects off their bodies.

At one point all of the caribou in the herd lie down—only their antlers are visible above the vegetation. Cows lie down on the outside of the herd. In this formation, the herd does not appear to be as bothered by the mosquitoes. Some caribou plant their noses in the vegetation to prevent mosquitoes from entering their nostrils.

The herd rest for one hour and 30 minutes, lying down 100 metres from the shoreline. They then walk north along the eastern shoreline of Fry Inlet to the *naɔokè*.


Gamètì
Wekweètì
Whatì
Behchokǫ̀
Contwoyto Lake
Fry Inlet
18 July
18 July
14 August
16 August
14 August
12 August
13 August
15 August
15 August
12 August
9 August
19 August
18 August
4 August
24 July
20 July
20 July
20 July
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25 July
25 July
28 July
29 July
19 July
21 July
22 August
22 August
22 August
2 August
4 August
27 July
23 August
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23 August
24 August
27 July
4 August
1 August
29 July
30 July
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29 July
4 August
22 July
22 July
22 July
22 July
22 July
26 July
26 July
Caribou
Wolf
Bear
Wolverine
Eagle
Crew Movement
Map 5: Wildlife Observations
Prepared by: Michael Birlea
0
5
10 Km
0
3
6 Mi

The herd swims from east to west across the *naɔokè*, in one tight unit, traversing the island at the centre of the channel. The herd crossed as a tight unit, following the cow leader. The cows swam first, accompanying the few calves in the herd, and the bulls followed at the rear. The slight wind and current from north give the herd a helpful tailwind. The cow leader reaches the other side in one minute and 30 seconds, and walks up onto the sand after emerging from the water. On the beach, she pauses to sniff the ground a few times, before walking rapidly along the sand beach. The rest of the cows follow. They stop to shake and pieces of their winter coats fall off. The bulls followed in the rear of herd. One collared cow was observed. Half of the bulls have black antlers (a sign of fat and healthy animals).

One cow and one calf: Swim across the *naɔokè* a few minutes after the main herd. The cow swims first and calf follows its mother. On the other side, they stop to shake the water off their coats, then walk rapidly to catch up with the main herd.

July 22nd, southwest of Fry Inlet

Tracks, caribou herd: Fresh tracks are spotted in the sand over a large esker, left on the previous day. There are several calf tracks, as well as several bulls, marked by the deeper imprints made by a heavy animal. The tracks follow the wide sandy esker from west to east. The esker is approximately 200 metres wide and the tracks cover the entire width of the esker, and travel its entire length. The esker extends for approximately 15km in a J-shape, from east to north.

Approximately 500 caribou: Walk along the skyline north of the bay on the west side of Fry inlet. The herd walks in a west-northwest direction into a northwest wind. They are too far away to see details. More caribou are spotted below the skyline. The herd walks slowly into the wind while grazing on the hilltop.

July 23rd, Naɔokè between Kokètì and Fry Inlet

90 caribou: The herd swims across the *naɔokè* on Fry Inlet as one tight unit, from east to west in the same path as the previous herd After crossing the naɔokè, this herd walks slightly further south than previously observed herds, over the sand beach and up the hill. After a short pause, the caribou continue down from the hill and onto main trail through the mud by a small lake and up a sloping hill west of the *naɔokè*.

This herd is comprised of approximately 2/3 cows, 1/3 bulls and approximately 10-15% calves.
Animals in the herd are healthy; there are no visible injuries. The herd keeps up a fast pace and must be strong to maintain this pace over long distances. The herd walks in one tight unit, following same trail as previously-observed herds: between two small, narrow lakes, up a sandbar, along an esker to the skyline and then over the hills, and out of our sightline—it is the same path as all herds we have observed travelling for the past three years in this location.

July 23rd, eastern shore of Contwoyto Lake, near Campsite Bay.

500 caribou: On a hillside near Campsite Bay. The herd moves towards the lake in a northerly direction, inland from the lake shore.

The herd is comprised of 50% cows and 50% bulls. Normal amount of calves in the herd – "lots of calves". Calves are healthy, and many are weaning from their mothers. Many calves have a reddish-coloured hide. The animals in the herd are healthy. Several bulls have big, healthy, black antlers; a few have grey and light-grey antlers. It is early in the season to see such large antlers, and this can be interpreted as a sign of good health. Bulls are fat with "nice, round rump."

Some cows are skinny, but "it's not their time to get fat yet." One yearling is skinny. Most animals still have their winter coats. The stomachs on the caribou appear large, both from eating well in the lush vegetation and because of their thick, winter coats. From a distance, the herd looks light grey and white—the colour of their winter coats.

Four animals are injured: Two bulls in the front leg, one cow in the back leg, and one calf in the back leg. The mother of the injured calf walked back for her calf when the herd started walking. Two minutes later she returned with her injured calf, and the two walked at the back of the herd together.

No wind and extreme insect harassment; the animals are constantly moving. The herd begins to move in a large circle, gathering in one tight group and circling clockwise (photo 11). Then herd moves north along the shoreline and continues to circle in one tight group. This time in counter-clockwise direction. The herd continues to move in a circle, then move south along the shoreline again, down the slope towards the lakeshore.

Photo 11: 500 caribou herd walking in a large circle, July 23rd, 2018.

Many animals enter the shallow water in a small bay to cool down (photo 12). "They're cooling off their feet in the cold water." While the other caribou in the herd stand above the shoreline in a small depression, where the animals stand in the wet, cold muskeg. The herd is grouped together in one tight unit, presumably to minimize insect harassment. Some animals are pushing their way to the open water. The caribou on outside of the tight herd is constantly twitching. The caribou who retained their winter coats appears to suffer less from the mosquitoes. One cow stands with her nose and face into the vegetation and breathes through the dwarf birch bushes to prevent the insects from entering her eyes and nostrils. Many cows are standing in the water, drinking. The bulls shake their antlers to evade mosquitoes and blackflies, and arch their necks to scratch their backs with their antlers.

Photo 12: Caribou herd standing in shallow water to cool off. July 23rd. 2018.

Suddenly something scares the herd and all of the caribou flee to the edges of the bay. All the animals' halt, looking at each other, for couple of minutes before returning to the water and the wet muskeg in the bay. Three times this occurs; something scares them and they flee, then return. The monitoring team can see no real source of what scares them. Once the herd return to lakeshore, several bulls push their way down into the water. The bulls are on the south side and centre of herd, and cows are on the north side and outer parts of the herd.

Again, something suddenly startles them and the herd splits in two and they run to opposite sides of the bay. A few minutes later, they slowly return to water, and cohere as one group. Many cows and their calves are lying down resting, on the side of and in midst of large herd. One cow has hard antlers, with no velvet. This is the same antler she had last winter.

After almost two hours of standing in the bay, the herd slowly exits and stretches out along the shoreline and hillside above the water. All the vegetation where the herd had been resting is trampled. The water is brown and muddy and full of white hair where the herd was wading. Large clumps of hair are scatted over the water and along the shoreline.

The herd move slowly, and animals are feeding well on grasses and sedges, making loud snorting sounds. Several animals snort and blow loudly, trying to clear mosquitoes and blackflies from their noses. The herd moves up from water to a shelf above the lakeshore, and is engulfed by swarms of mosquitoes (Photo 13). We hear continuous sounds of snorting and blows from the caribou's noses. When they walk, the mosquitoes and blackflies swarm and envelop the herd. The monitors say that they have *"never seen that much mosquitoes follow a herd*." The herd starts to move in circles, around and around. *"Just like they dance; dance in circles"*.

The herd walks up the hillside and move rapidly north, close to the monitoring team. Then it continues north, at the same pace, along the eastern shore of Kokètì. While walking, we hear the sounds of their hooves clicking, as well as loud thrums from the many animals walking over the ground.

Photo 13: Caribou herd engulfed by mosquitos. July 23rd, 2018.

July 24th, Campsite Bay, eastern shore of Kokètì

One caribou, female yearling: Healthy animal, no injuries. Winter coat is on, and falling off. She is walking by herself on a high hill, in a northeast direction.

1,000 caribou: Large caribou herd, on hilltops east of Campsite Bay. The herd is mostly comprised of cows; there are fewer bulls. Most of the bulls stand in the centre of herd or on top of the hill. High and normal amount of calves in the herd. The calves are healthy, and eating well on the hillside. Their hides are mainly light brown in colour. Four caribou are injured: two cows in the front leg, one cow injured, one bull injured.

The large herd walks slowly along the skyline. The herd is walking westward into 25km/h northwest winds, and down from the skyline. They walk at a slow pace, grazing as they go. The large herd stops on the west side of the hilltop and remains there grazing peacefully in the wind, which deters insects. Many animals are spread out over a large area, lying down to rest, while others stand around, grazing. The herd appears very peaceful, compared to previous days marked by low winds, high temperatures and high insect harassment. The herd grazes peacefully for hours on the hilltop. Almost every animal face uphill in an easterly direction, with wind hitting their backs and rumps.

At eight o'clock p.m., the sun starts to set and the wind decreases to 10km/h westerly. Insect harassment increases rapidly, as the blackflies appear, especially in the wind shades, in places where the wind is sheltered. Suddenly, the herd groups together, facing into the wind. The caribou from the hilltop move to the centre of the herd, forming one large herd grouped tightly together. The herd moves downslope, into the wind. The Tłı̨chǫ monitors said "Nitsi ninda:" the herd walks into the wind to get away from insects, and to smell potential predators or danger ahead.

Two cows lag behind; limping severely and slowly, but slowly, they catch up with the herd. One injured bull also limps behind as the herd moves downhill. The bull has a dark new coat and dark-coloured antlers. Eventually they catch up with the herd.

The herd walks downhill, and then turns around when it reaches a rocky area and returns uphill. Then it doubles back again, and the whole herd group together and move in a circle on the hillside; from right to left, circling up and down the hillside; "*same as the Tłı̨chǫ drum dance, always go right to left*" said one monitor. Eventually, the leader moved southwest alongside the hill. The insect harassment is extreme in the wind shades. The blackflies fill the air. (The monitoring team have difficulties observing through the thick fly cover: photo 14).

Photo 14: Roy Judas observes a 1000 caribou herd, through a cloud of blackflies, July 24th, 2018.

The herd walks south along a narrow green area in between boulder fields, but becomes surrounded by rocky areas. The caribou group together and pause on a flat shelf on the side of the hill, then some animals walk slowly and carefully through the rocky areas, and the rest follow. The herd walks uphill again, and back to the side of hill where the monitoring team first observed them.

From two p.m. to eight p.m., the herd grazed peacefully in the 25 km/h wind on the hillside. Once the sun started to set, after 8pm, the wind decreased, the insect activity increased and the herd immediately changed its behaviour by grouping together, walking into the wind and moving together in a circle.

July 25th, eastern shore of Kokètì, south of Campsite Bay

700 caribou: The herd composition is approximately half cows and half bulls. High and normal calf population. Half of the calves have shed their winter coats and are growing new hides. Most of the yearlings have lost their winter coats, and are growing new coats as well; they appear mainly black in colour. The herd stands on a plateau, roughly 200 metres up from a long sand beach. It then walks down to the beach and some of the herd enters the water, while the rest of the animals stand on the beach. The animals remain on the beach or in the water for 15 minutes, facing into the northwest wind coming off the lake, then walk inland and north along the shore. One cow leader walks rapidly at the front of herd, and the rest follow in one tight group. The herd crests a ridge, and moves out of our sight, into a valley. This herd passes a 500 caribou herd, standing in water, and moves toward a third herd standing on a plateau above the lake.

One bull with an injured back leg is spotted one kilometre south of the 700 caribou herd standing close to the shoreline on a small peninsula. He is grazing in muskeg, possibly resting until his leg has healed.

500 caribou: Large caribou herd stands in the water close to a shoreline (photo 49), on the south side of a small bay, on the eastern shore Kokètì. The animals are too far away to see in detail. The entire herd stands still in the water for one hour and 50 minutes; the herd was standing in this position prior to our observation and could possibly been there for hours. The animals stand in the shallow water, wading up to their knees and stomachs. They stand tight together, most animals are still, simply looking down and cooling off in the cold water.
The temperature is 22 Celsius degree with a 12 km/h breeze; an elder says, "*herds stay in the water for longs times, to cool off their bellies*."

Photo 15: Cows and calves in the 300 caribou herd, July 25th, 2018.

300 caribou: Mainly cows and calves, fewer bulls in the herd. All animals are healthy. Many of the bulls have black and dark grey antlers: a sign of good health. Many bulls have shed their winter coats, and wear dark brown or black-coloured new summer coats. There are two injured animals: one cow, and one calf has injured its front right leg.

The herd feeds on grasses on the flat ground (photo 15); it is comprised of mainly cows and calves. Shortly after we saw this herd, the first herd of 700 animals, which we observed earlier, walked up the hill and the two herds merge together. The large herd walks into a small valley down to a pond. Some animals enter the water to stand on the rocks, drinking water. The animals walk around as they feed on the green grasses and lichen growing in the muskeg by the water. Some bulls push their way through the herd to the water. All the animals in the herd move into a close, tight unit on the east side of the pond to access the slight wind coming from west across the pond. The herd is lying down right in front of monitoring team.

Low wind means insect harassment is very high by the flat ground around the water. Three cows walk into the water and stand on rocks with water up their ankles. They constantly twitch from insect harassment. The cows stomp their hooves, splashing water, and one cow twitches her head up and down, lowering her head to the water. Then the animals stand still looking down. The caribou on the outside of the herd are constantly shaking and twitching their bodies. Most animals by water stand facing east, with their rumps facing into the wind. "*If herd don't go down to big lake, they go to lakes on top of hills lying down by the cold water.*" The herd rests for almost an hour by the small pond.

A large low-pressure system with dark clouds, increasing north winds and cold air, pushes over us from the north. Two cows walk around on the high ground above the herd, watching the landscape, while the rest of the herd rests. Suddenly, the whole herd rises and quickly walks north around the side of the pond. First, a few animals walked on south side of the lake, close to the monitoring team, and then the majority of the herd walks in a long line on the north side of lake, and continues in a northerly direction.

Simultaneously, the herd of 500 caribou standing in the water, moves. The whole herd walks deeper into the water and starts to swim straight across the inlet in the lake (photo 16), towards the herd by the pond. Watching the scene, one monitor said, "*must be an experienced cow leader, because she swam right across the lake; an inexperienced cow leader would walk around [the bay]"*. The herd swims across the lake and walks rapidly uphill on the other side. It continues toward the hilltop in a northerly direction

Photo 16: 500 caribou herd swam straight across the bay, July 25th, 2018.

toward the other herd. Later, the herds merge as they walk along the east shore of Kokètì. When the weather changed, the two herds moved simultaneously.

July 26th, northwest of Fry Inlet

Three caribou: Walking along the skyline, on the hills southwest of the Fry Inlet camp. They are too far to see details. They walk in a northwest direction into a northwest wind. The animals walk down below the skyline, and out of our sight.

July 27th, northwest of Fry Inlet

Two caribou: Walking along ridge, along flat ground into the strong 20km/h northwest wind. They are too far away to see details. There are no insects in the strong wind; the caribou graze peacefully, walking back and forth along the ridge.

One two-year-old caribou bull: Straight antlers, no full-curl antler and no back-scratchers. (After three years old, bulls grow backscratchers on the antlers). The bull appears to be healthy, with visible fat reserves accumulating on its lower back and rump: "really healthy caribou," "nice shape, fat rump." The bulls are apparently eating well on the side of the esker and are becoming fat by the end of July. This bull has a new brown summer coat, with a brown-coloured back and black stomach. There are still a few white winter coat hairs on its back. It is starting to grow a white-coloured mane around its neck. There are noticeable white birthmark stripes on the side of his dark-brown stomach. (The birthmarks stripes are identical to the stripes of the mother).

The bull grazes on top of an esker, 500 metres west of Fry Inlet camp. It then walks to northwest side of esker, near the lakeshore, and lays down five metres from lakeshore, with its back into 20km/h northwest wind. There are no insects. The bull stands up but freezes, alert and looking straight forwards, for 25 minutes; "he is sleeping" noticed the monitors. He faces away from the wind with his back and rump into the wind. He then walks up the esker, toward the monitoring team, stops, and sniffs the air downwind from us. He walks around us, up to the high ground above us and watches at us for 10 minutes. He then circles around us three times: walking along the ridge of the esker, then walks below and downwind from us. We stand still, watching him, as he circles around us for half an hour (photo 17). Eventually, he walks upwind from us, lies down in the sand on the side of esker, looks at us, and lowers his head, resting. We retreat, to leave him in peace, while he continues to watch us.

Photo 17: A two-year-old caribou bull on esker by Fry Inlet camp, July 27th, 2018.

Possibly, the bull has been chased by a wolf and he rests on the high ground by the esker, and near the (potential) safety of humans. The bull is possibly tired after four days of very high insect activity, and can now rest in the strong wind without insect harassment. The bull continues to rest in the sand on side of the esker for 45 minutes, then walks down to flat side of the esker, and continues grazing.

July 28th, Campsite Bay, eastern shore of Kokètì

One caribou bull: An injured bull lies down in muskeg 10 metres from the water. This is the same bull as observed in same spot four days earlier, on July 25th. The injured bull has remained in the same location on the peninsula for four days, where he has been resting and healing his injured leg. He will likely remain in this same location for several days until his leg is fully healed. The antlers, dark brown in colour, are the only visible part of the caribou, who is lying down in the yellow muskeg.

July 29th, eastern shore, south end of Kokètì

1,000 caribou: The herd walks rapidly in south direction for a long distance. The animals appear to be healthy, as none lag behind the main group. The herd is comprised of mostly bulls and fewer cows. Most of the cows walk in the front half of the herd, and most of the bulls walk in rear half. Hundreds of antlers are visible against the bright horizon when they walk along the skyline. The herd is too far away to see details individual animals. The herd walks rapidly south, along the eastern shore of Kokètì, on the south side of the lake. The herd follows the flat ground closer to the shoreline while migrating quickly; it then walks inland, up from the shoreline and into the higher hills. Close to the hilltop, the herd spreads out over a larger area, grazing and walking slowly uphill. "*Its cold, so they stay inland away from lake*," says a monitor. As the wind calms down to 7 km/h westerly, the insect harassment increases. The herd walks to higher ground to find refuge in the wind on top of hills inland from the lake.

July 30th, eastern shore, south end of Kokètì

150 caribou: This herd walks south along the shoreline, along the eastern shore of Kokètì. The herd walks out on a point by the shoreline, then stops, turns around and starts walking in a circle. The whole herd walks around and around in a circle. "They go in a circle to avoid mosquitoes." Bulls, as well as a few calves are on the inside, where there are fewer mosquitoes, and the cows walk on the outer part of herd. The herds walk further out on the peninsula, then turn back and continue walking south along the same trail as 1,000-animal herd observed on the previous day.

At the front of the herd, before the main group, walk seven cows with no calves (photo 18). There are mostly cows and very few calves in the herd, with fewer bulls. There are many dry cows in the herd. Half of herd is comprised of yearlings; the cows and bulls are not mature enough to have calves yet, which is probably the reason why there are few calves in herd. All of the animals appear healthy, with no visible injuries and no animals are lagging behind; "*good shape animals*." Most of the animals have shed their winter coats. All of the animals run quickly—a sign of good health. "*They leave no one behind, they go together in one group. One full house!*".

Photo 18: Seven cows without calves walk in front of herd, east shore Contwoyto lake, July 30th, 2018.

There is high insect harassment on the flat ground by lake shore, where the herd is walking over the flat muskeg. The herd picks up speed. It follows the same trail as the herd from the previous day.

July 31st, northwest of Fry Inlet

One cow, one calf: Walking along ridge into the wind in a northwest direction. The two caribou graze as they walk. They appear healthy, not limping and there are no visible injuries. Earlier in the day, the monitoring team observed fresh tracks in the sand at the naɔokè, and we conclude that they likely were made by this cow and calf. They must have swum across *naɔokè* and walked northwest, following the trail of previous herds.

August 1st, peninsula between Fry Inlet and Kokètì

One caribou, cow: She grazes quietly, then lays down on peninsula between Fry Inlet and Kokètì. The cow has no calf. Too far to see details.

One caribou, bull: Walking back and forth along the skyline into a 40km/h wind, grazing peacefully. He appears healthy and is not limping. Too far to see details.

One caribou, bull: Following same trail as the bull we spotted earlier in the day. He walks uphill along the ridgeline, into the wind, then over the hill and out of our sight. He appears to be healthy and is not limping.

Two caribou, cows: No calves. They are grazing peacefully on the peninsula between Fry Inlet and Kokètì, *"Just grazing peacefully, no bugs*." They are wearing dark, new summer hides. The two caribou walk 100 metres apart, then merge together, grazing. Two muskoxen walk towards them, but then stop, and the two caribou move into a small valley to the northeast, avoiding the muskox.

300 caribou: The herd walks over the hills above the eastern shore of Fry Inlet. It grazes along the hillside, moving into the strong northwest wind, then walks north into the valleys along the eastern shore. The herd appears on the skyline, moving along the hillside, down into a valley (and out of our view) toward the lakeshore.

The monitoring team waits by the *naɔokè*, but no animals appear. We travel south by boat along the eastern shore of Fry Inlet, but see no animals. Most likely, the herd did not want to swim across the *naɔokè* due to high waves and strong winds.

August 4th, Campsite Bay, eastern shore of Kokètì

Six caribou: Four cows and two bulls. All animals are yearlings and there are no calves. The caribou appear healthy, with no visible injuries. They graze and walk into wind, along the north shore of Campsite Bay. One young bull makes grunting sounds while he walks close to our camp.

August 4th, northwest of Fry Inlet

Two caribou, cow yearlings: The yearlings are small in size, with long legs and small, stumpy antlers. Healthy animals, they do not have fat reserves but are not skinny. They have no visible injuries and dark new summer coats. One yearling has white and black birthmark stripes on its side. They walk up and around an esker feeding on grass and lichen. The two caribou split up. One yearling slowly walks back and forth on the sand bar on one side of the esker, then lay down in sand resting. The other caribou move to

the muskeg behind the esker. After two hours of observation, the monitoring team leaves the area, and the yearling remains, laying down and resting in the sand.

Photo 19: Caribou herd swimming across naɔokè between Kokètì and Fry Inlet. Cow leader swims in front of herd, August 4th, 2018.

400 caribou herd: The herd swims across the *naɔokè* between Kokètì and Fry Inlet, from east to west, along the migration route of all previous observed herds. One cow leader swim first (photo 19), followed by other a cow, followed by cows in rows of two, followed by more cows in several rows of six (photo 20), then numerous rows of mixed cows and bulls. The herd is comprised of more bulls than cows. The caribou are mostly yearlings and very few calves are visible. The first 25 cows in the herd have no calves. "Not much calves, mostly yearlings." The cows mainly lead the herd while the bulls walk in the rear. All animals are healthy. Every animal swim quickly, and no animals are lagging behind while swimming. There are no visible injuries as the herd emerges from the water.

Unlike several other cow leaders that traversed the *naɔokè* before, this cow leader bypasses the island, where the herds usually walk across; instead, the leader takes the herd straight to the west shore of *naɔokè*. A few caribou seem to want to swim to the island, but the cow leader is determined to get to the western shore as quickly as possible—perhaps seeking the fastest route to safety, as the monitoring team's boat is slowly approaching from the north. The herd swims together in one tight unit—at the forefront swims the leader and four cows; the rest of the herd swims side by side in rows. The swimming of the herd sounds like a river gushing downstream, interspersed with the grunts, mostly of the bulls, as they swim.

The herd exits from the water in a rocky area, and makes its way very slowly up the shore through the rocks. A large group gathers as the first animals make it to the top the rocks. Back on dry ground, they

Photo 20: 400 caribou herd swimming across naɔokè between Kokètì and Fry Inlet, August 4th, 2018.

shake the water off their hides and run west up the hills west of the *naɔokè*, towards the usual migration route, where all herds walk.

Four caribou: three cows, one bull; all yearlings and no calves. These caribou arrive at the eastern side of *the naɔokè* five minutes after the herd, following the usual migration route to the crossing. Healthy and strong animals, they are neither fat nor skinny. Two cows are wearing dark new hides, and one cow still wears her white winter coat.

They approach the *naɔokè*, then stop and run back and forth along shoreline. They seem to be distressed by high insect harassment. They look for a good spot to swim across, but seem unsure of where to enter the water. The yearlings are two years old and probably do not know the route but only follow the scent tracks from the herd ahead of them. First, one cow enters the water and starts to swim across, then another cow follows, while the others are hesitant to cross. The cows swim to the island in the centre of the crossing, and run across. The two cows stop several times to look back for their "friends," the cow and bull, but the cow and bull still linger on the eastern side of crossing. They appear scared and unsure of where to go, and continue to run along the shore. The two cows run to the next crossing, then look back again for their friends; they then enter the water, swim across to the west side of the crossing, and run up hill. "*They can wait for a bit, but they can't wait forever, they have to go,*" said one monitor. The cow and bull still lingered on the eastern side, afraid to cross, when monitoring team left.

The water at the *naɔokè* is full of white caribou hair from the herds swimming across. White hair from their winter coats sheds from the caribou as they swim across the *naɔokè.*

August 4th, southeast shore of Fry Inlet
One caribou cow: She is walking by herself along the skyline into the wind. Too far to see details.
She follows the trail of herds that walked through this location one day ago.

August 5th, northwest of Fry Inlet
One caribou cow: She walks along the skyline by herself into a northwest wind. Too far to see details.
The cow walks along same trail as the herd from yesterday, over the ridge and out of our sight.

Four caribou: One bull walks first along the skyline, while three caribou follow approximately one kilometre behind the bull. The caribou walk along the same trail as all of the other herds from the *naɔokè* across Fry Inlet up to the hills in a northwest direction. The caribou all have dark new summer coats, except for one with a white winter coat. No visible injuries.

August 6th, northwest of Fry Inlet
Three caribou: One bull and two cows.; one cow is a yearling. They all have dark, new summer coats, and all appear healthy. None are limping and there are no visible injuries. They walk quickly up into the hillside. The caribou are grazing and walking slowly into strong northwest wind. They enjoy the cold and windy weather with no insects, and can now feed well along the flat ground without insect harassment. "*Caribou starting to get fat now*".

August 8th, northwest of Fry Inlet
One bull: Walking slowly on top of the esker. He looks healthy. He forages in the valley on top of the esker. He has a dark-coloured hide and a white beard. His coat looks smooth and uniform in colour. He walks around slowly, eating leaves and dwarf birch. He hides in the little valleys on the esker.

August 9th, northwest of Fry Inlet
One bull: The same caribou as yesterday, foraging on esker, on north side of the Fry Inlet camp. He swims across the water, then swims back across to the camp side. It takes him only a few minutes to swim across. He walks to the point to decrease the length of his swim, then swims across the lake.
Two caribou: Walking west of Fry Inlet camp.

August 10th, northwest of Fry Inlet
One bull: same bull that has been walking around the area since August 8th.

August 11th, northwest of Fry Inlet
One bull caribou. The same bull that has been in the area since august 8th.
Two caribou, walking to the west of us.
Four caribou, walking in an easterly direction from Fry Inlet camp. Two bulls—one mature and one yearling—one cow and one calf. The caribou are walking and grazing, west of camp.

August 12th, Shallow Bay, western shore of Kokètì
One caribou cow: healthy. The cow walks quickly around the plateau on the top of the esker. Probably she is running from the bugs.
Three groups of caribou: 3,000 caribou (south), 420 caribou (east), 1000 caribou (west).

August 13th, Shallow Bay, western shore of Kokètì
Three bulls, walking in a northerly direction along the skyline.
20 caribou: the caribou are walking on flat ground, in an area with few rocks.
100 caribou west of monitoring team.
Seven caribou: six cows and one calf
100 caribou: (photo 21) headed northwest, away from the wind. The herd is comprised of 40-50 percent yearlings, and three calves. When we first spot them, they are spread out over an area of 800m long then reconvene and move behind a hill to the northwest of us.
20 caribou; no calves in the herd. The herd walks in a southeast direction
Seven cows.
Seven bulls: yearlings. Walking northeast of us.
300 caribou. Some of them have smooth coats; some are patchy.
1,000 caribou: few injured and a few calves.

Photo 21: Caribou cows by Shallow Bay, August 13th.

Eight cows, all healthy. They walk around, watching the landscape and "scoping out" the area before the rest of the herd.
60 caribou: no calves in herd. They swim across a river.
One cow
2,000 caribou
470 caribou

August 14th, Shallow Bay, western shore of Kokètì
13 caribou, walking on ground southwest of us.
18 caribou: two calves in the herd.
Seven caribou.
20 caribou: 16 yearlings, two calves and two cows. The herd is grazing, and there is no insect harassment.
Six caribou: Four yearlings, one cow, one calf). The caribou are walking into the wind.
26 caribou. There are strong winds and no insect harassment for the herd.
Four caribou: one cow has very noticeably white/light antlers.
40 caribou: The caribou are all healthy. The hides are a mix of dark and light colours, and the antlers are small. The herd is walking 50m from monitoring team, watching us. They seem to spook themselves. They check us out and move away. They retreat through a relatively flat area, with sloping hills, and few rocks.
Six yearlings
1500 caribou: One-third of the herd is comprised of calves. The herd walks towards Sun Bay.
Eight caribou: four cows and four calves. The group walks north of the monitoring team's camp.

August 15th, Shallow Bay, western shore of Kokètì
2,000 caribou: the herd swims east across the inlet, at 5:30 a.m. On the opposite shore, they walk northeast, back to where they came from. There are mostly bulls in the herd.
14 caribou: 10 cows with four calves.
46 caribou. An eagle flies toward a calf in the open. The calf runs to its mother. "*Never used to get eagles here now it's another predator*." "*Seen more eagles this year than last year. They hang around the caribou and follow them when they swim*."
119 caribou: 14 calves, 40 percent yearlings, mostly young cows (photo 22). The caribou are walking in the wet grass, close to the lake.
1,500 caribou: herd walking into the wind.
Four cows: herd has new summer coats.
Seven caribou; one calf.
20 caribou: herd walking in vegetation and avoiding the rocky areas.
20 caribou.
26 caribou; one calf in the herd. Animals in the herd look healthy.
Three caribou: one cow; two calves.
10,000 caribou; the large herd is walking east.
3,000 caribou: the herd is walking into the wind, and walking in vegetation to avoid rocky areas.
13 caribou.

Photo 22: Young caribou cows run by Shallow Bay, August 15th.

August 16th, Shallow Bay, western shore of Kokètì
30 caribou; 25 percent calves in the herd.
50 caribou: the herd walks towards us.
Nine caribou: six cows, three calves. the group walks into the west wind.
Six caribou: all bulls, laying down, resting in the vegetation.
33 caribou: mostly cows in the herd. They walk towards us.
Three caribou: all bulls; they look healthy.
11 caribou.
15 bulls headed towards the lake shore.
100 caribou: one-third bulls, one-third cows, one-third calves.

August 17th, Shallow Bay, western shore of Kokètì
20 caribou: two bulls and two calves in the herd. They walk in the direction of the Lupin mine.
One caribou: healthy.
400 caribou: the herd was walks close to Lupin mine.
Three caribou: one calf.
10 caribou: five young bulls and five cows; one injured caribou.
Nine caribou: one bull in the herd.

August 18th, Shallow Bay, western shore of Kokètì
One caribou: bull.
Three caribou: bulls.
One caribou: one bull, healthy. The bull is walking from the north.
Three caribou: two cows and one calf. The caribou are healthy. They are walking in an easterly direction.
Six caribou: two cows and four bulls.
Three caribou: bulls.
200 caribou: walking westward.
30 caribou: one cow injured, left front leg. Cow limps when walking.
150 caribou.
100 caribou.
21 caribou.

August 19th, Shallow Bay, western shore of Kokètì
11 caribou: all cows, healthy.
Two caribou: all bulls, healthy.

500 caribou: "lots of calves" in herd.
30 caribou: nine cows in herd. they walk on a hilltop southeast of monitoring team.
Six caribou.
500 caribou.
Seven caribou: five cows and two calves.

August 20th, Shallow Bay, western shore of Kokètì
Two caribou: two bulls bedded down in the tall grass on a point.
Five caribou: cow yearlings. They have healthy summer coats. Three of the caribou look smaller than the other two.
30 caribou: three calves, one female with a satellite collar. No bulls.

Photo 23: Caribou cow yearling run along hillside, Shallow Bay, August 19th.

10 caribou: One calf. The caribou are healthy. The herd walks south, away from the wind. There are no bugs in the strong wind. They walked in a semi-rocky area. Two caribou swims in the same spot as previous herds swam across before, across a 10m long no'oke.

August 21st, northwest of Fry Inlet
One caribou: one bull standing out on a point.

August 22nd, northwest of Fry Inlet
11 caribou.
Two caribou.
4 caribou: all healthy-looking bulls.

August 23th, northwest of Fry Inlet
Nine caribou: healthy bulls. They have smooth, new summer coats. They walk close to shore, then move further inland, grazing as they move, in a southeasterly direction.
40 caribou.
Eight caribou: bulls with big antlers, walking and grazing along the shore; no insect harassment.
50 caribou: walking in a southwesterly direction on the flat ground.
Three caribou: two bulls and one cow walking southward.

150 caribou: the herd is on a hill.
Two caribou: young bulls.
One caribou: young and healthy bull with a new summer coat.
One caribou: young healthy cow with new summer coat.

August 24th, northwest of Fry Inlet
2,000 caribou: Mostly cows and fewer bulls in herd. Half of the herd are yearling cows. 18 calves in the herd. No injuries. North wind and sunny day. The herd was eating lichens and resting.

August 25th, northwest of Fry Inlet
1,000 caribou: walking in a northerly direction.
50 caribou: the herd was grazing and slowly moving westward, across from camp.

Photo 24: Bull with new and old coat, and various stages and colored antlers, northwest of Fry Inlet, August 23rd.

August 26th, northwest of Fry Inlet
150 caribou: no calves in herd. Healthy animals. They are running on a ridge to the northwest.
300 caribou.

August 27th, northwest of Fry Inlet
130 caribou: herd walks on flat ground across from camp. No insect harassment; herd walking and grazing.

Indicator 3: Predator Observations

During the 40 days of fieldwork, we observed 16 wolves, 10 grizzly bears, three wolverines and 22 eagles. We observed no direct attacks on caribou of any predator. But wolves and eagles were observed in close proximity to caribou herds. One eagle was seen flying towards a calf, apparently attempting to chase the calf, but the eagle was unsuccessful and the chase quickly ended. More eagles were observed this summer than in the past two years. One wolf was observed waiting at a *no'oke*, ready to attack if a caribou arrived. Pieces of a young bull caribou carcass, left over from the previous fall, were scattered in the bushes by the crossing, and a jawbone of calf was found, indicating successful caribou kills by wolves at the *no'oke*. This year, three wolverines were observed, compared to zero observations of wolverines during the previous two years. All predators were healthy with no injuries or health issues noted.

Wolf Observations

During the course of the program sixteen wolves and one active wolf den were observed. One wolf was seen at the entrance of the wolf den; but the wolf sensed the monitoring team and disappeared underground without reappearing. Other wolves and pups were likely in the den and not observed by the team. Two groups of wolves were observed—a pack of four animals on August 14th and a pack of five wolves on August 26th. Other wolves observed were solitary.

Most wolf observations occurred on the eastern shore of Contwoyto Lake, close to the *nǫɔokè* between Kokètì and Fry Inlet and in the Shallow Bay area toward the Lupin mine. Concurrent to these observations, large herds of caribou were migrating through these locations. Wolf activity was also observed at a caribou *no'oke*: one wolf was seen hiding in bushes on a *nǫɔokè,* seemingly waiting for a kill, and fresh tracks were observed at other *nǫɔokè*.

<u>July 18th, western shore of Contwoyto Lake, east of Lupin mine</u>
One wolf track, along a sand beach on the western shore, two km north of old cabins. The tracks were likely made on the previous day, before the rain.

<u>July 19th, south side of Kuniks Bay.</u>
One wolf: healthy female, one year old. Completely white with thick fur, a fat body and big belly.
She waits in the dwarf birch bushes by the shoreline of the *nǫɔokè* on the south side of Kuniks Bay (photo 28). A wolf can wait for days, until next herd comes swimming across. This wolf likely knows when caribou are coming and is waiting for the next herd to pass through.
One caribou carcass, in the dwarf birch bushes near the sand beach on the *noɔokè (photo 26)*. The carcass has likely been there since the fall of 2017. It is a young bull. Small rodents have chewed on the antlers and bones over winter. White bone pieces are scattered around. The marrow is gone from the bone. **One jaw from calf.** The jaw is from two to three years ago (photo 25).

Photo 25, left: Joe Zoe holding a jaw bone of caribou calf by a naɔokè in Kuniks Bay, July 19th.

Photo 26, right: Joe Zoe inspecting a caribou carcass of a young bull, by nǫɔokè in Kuniks Bay, July 19th.

July 20th, north of Kuniks Bay.

One fresh wolf track, found in the sand, north of camp, likely made on the previous night. One track goes south, and second track goes north direction. One wolf made both tracks. It walked to check out our camp last evening/night, then walked back.

One wolf track, in sand beach on south side of lake.

One wolf: white fur. The head is visible, sticking up from its den in a sand bar. Its white ears stick up; it is watching us. It goes back down into its den after few minutes. The wolf does not re-emerge; it is too windy for the pups to be outside.

The wolf den is 800 metres east of the esker we watch from. The den sits on the south side of a long, narrow sand bar, oriented in a north-to-south direction. This is the second year the monitoring team has observed activity in this den. The den is dug into ground from the top, on the south side of the sand bar. Piles of sand are visible next to the den. From den, there is a good view of the low-lying area around the sand bar.

July 29th, north end of Fry Inlet

One wolf: female, with white winter fur. She swims across the water between the island north of the peninsula, east of our camp, to the mainland (photo 27), south of camp. We pursue the wolf to scare her off; she swims to shore, shakes the water off her fluffy coat, and runs up the small hill to the top of the esker. At the top, she stops, turns, and looks at us in the boat. She then quickly turns and runs down the other side, and out of our view.

Photo 27: Female wolf swims across lake, Fry Inlet, July 29th.

Photo 28: Young female wolf by noɔokè in Kuniks Bay, July 19th.

It is likely there is a male in the surrounding area, and possibly a den. The male and female share hunting responsibilities: one wolf stays in den while the other goes hunting, so the pups are never left alone.

July 29th, west shore of Contwoyto lake

One wolf, male, with pure, white fur over his whole body and face (photo 30). There is no discolouration around his eyes, indicating that he is a young wolf. (As wolves get older, the fur around their eyes starts to get discoloured.) The wolf is sleeping on the rocks by the shoreline on a point, west shore of Contwoyto Lake, when the sound of our boat motor wakes him up. He arises and walks sleepily up the hill from shore.

The wolf stops to pee, turns to look at us while peeing, then continues to walk lazily toward the top of hill. "*Lazy wolf*" says John Koadloak.

July 31st, naɔokè between Kokètì and Fry Inlet
Wolf kill: one yearling caribou. On shoreline by a small lake, opposite from the *naɔokè*. The yearling was killed by a wolf in the spring of 2018, before the ice melted. There are bones by the shoreline, washed up from the actual kill site on the ice.

One wolf track, discovered in the sand on the *naɔokè*. They are fresh from today (photo 29). The wolf walked eastward and swam across the *naɔokè*. *"No caribou visible, so its walking and looking around*," says Joe Zoe. These wolf tracks move alongside caribou tracks, in the sand on the *naɔokè*. The caribou tracks belonged to one cow, and one calf. The tracks were likely made on the previous day. The cow and calf walked westward. The caribou tracks precede the wolf track, and move in an opposite direction to the wolf. First, the cow and calf swam across *naɔokè* and walked west, then, the next day, the wolf swam across the *naɔokè* and walked eastward.

August 12th, Shallow Bay, west shore Kokètì
One wolf with white fur walking to the east. Too far to see details.
One wolf: healthy animals with gray/white fur came close to the cabin at Shallow Bay, during the night.

Photo 29: Fresh wolf tracks going east across naɔokè, and caribou tracks going west across naɔokè between Kokètì and Fry Inlet, July 31st.

Photo 30: Young male wolf, west shore Kokètì, July 29th.

August 14th, Shallow Bay, western shore of Kokètì
Four wolves: walking westward south of the Lupin mine tailings pond. Too far to see details.

August 18th, Shallow Bay, western shore of Kokètì
One wolf: 2-year-old with white fur, spotted on a muskox kill site.

August 26th, northwest of Fry Inlet
Five wolves, walking north of the monitoring team. Too far to see details.

Bear Observations

Ten grizzly bears were observed during the six-week monitoring period. All of the bears were observed near Fry Inlet and around Shallow Bay, on the western shore of Contwoyto Lake. The bears were not observed in direct contact with caribou, but were present in the general area of caribou water crossings.

July 27th, southeast shore of Fry Inlet
One grizzly bear. A large, fat male bear (photo 31). His fur is light brown on top and darker brown underneath. He walks slowly along the shoreline, seemingly searching around on the ground, possibly for a ground squirrel. He lies down on ground on his back and rolls around to scratch his back. Only the legs are visible, sticking up in the air. He gets up and walks around. When he sees the monitoring team, he runs to the shore to get closer; then stops, stands up and looks at us. He walks slowly down to the water to watch us as closely as possible. He then walks slowly along the sand beach, sits down, then rises again and walks away

Photo 31: Male bear sitting down on beach looking at the monitoring team in the boat, southeast shore Fry Inlet, July 27th

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August 6th, naɔokè between Kokètì and Fry Inlet
Tracks: one grizzly bear. They are fresh from this morning, in the sand at the *naɔokè*. They move in an east to west direction. The bear swam across the *naɔokè* and walked west along the south side of the crossing, along the caribou trail.

August 7th, northwest of Fry Inlet
One grizzly bear comes close to our camp at Fry Inlet.

August 8th, northwest of Fry Inlet
One grizzly bear: a large male is spotted on top of the hill at 4:00 a.m. He was northwest of the Fry Inlet camp on the previous day. A monitor fires his rifle; the bear runs away.

August 9th, peninsula between Kokètì and Fry Inlet
Two grizzly bears: large. An eagle flies in close vicinity around the bears.

August 10th, northwest of Fry Inlet
One grizzly bear: walking around our camp near Fry Inlet.

August 11th, northwest of Fry Inlet
One grizzly bear: the bear is eating berries on a sand bar southwest of the Fry Inlet camp.

August 14th, Shallow Bay, western shore of Kokètì
One grizzly bear: the large bear is observed southwest of monitoring team.

August 21st, northwest of Fry Inlet
One grizzly bear: a young blond bear (photo 32) with black legs runs toward our camp as we move back to Fry Inlet from the Shallow Bay camp. The bear had torn through a canvas tent that we left up at Fry Inlet.

Photo 32: Young blond bear on side of esker by Fry Inlet, August 21st.

August 22nd, northwest of Fry Inlet
One grizzly bear: the same bear from August 21st.
One grizzly bear, spotted in the area by the "dinosaurs back" rock formation

August 27th, northwest of Fry Inlet
One grizzly bear: the bear visits our kitchen tent in the Fry Inlet camp at night. A monitor shoots a rifle, and the bear runs away.

Eagle Observations

During our six-week monitoring period, 22 eagles were observed. The majority of the sightings were bald eagles, with only one confirmed golden eagle observation; other eagles could not be identified as they soared too high to be seen clearly. Although their preferred habitat typically consists of open water areas supporting large numbers of waterfowl and fish, the bald eagle summer range is typically limited to the

northern forested reaches. First observed in 2005, by local resident on Kokètì, bald eagles are now a presence and a new predator of caribou calves. One eagle was observed flying after a calf in an open area. The frightened calf ran to the security of its mother and the eagle aborted its attack.

No nests were observed, but a juvenile and an adult eagle were observed in close vicinity to a tall building at the Lupin mine site, where the extra-large stick nests this species requires during the breeding nest season could be built and possibly be located. Many eagles were observed soaring high over the migrating caribou herds, and especially around the *naɔokè*, where animals could possibly get injured during a crossing. Other eagles were observed sitting on high rocks by the water surveying the landscape for fish. Most observations were solitary except in one instance, when four eagles were observed circling in the air and descending in one location, most likely on a carcass. Overall, more eagles were observed this summer than in the previous two years.

July 18th, by John Koadloak's camp, western shore of Kokètì
One eagle: juvenile bald eagle, white and brown in colour, with a brown-coloured head. It flies low over the ground to the peninsula west of John Koadloak's camp. It sits on a high point on the peninsula, then flies off in the direction of the Lupin mine site.
One eagle, flying high over the Lupin mine site. These two eagles were seen in the vicinity of the Lupin mine site. Perhaps there is an eagle's nest on one of the Lupin mine site buildings.

July 19th, by Long Bay, eastern shore of Kokètì
One eagle, flying over a point on the eastern side of Kokètì. Too far to see details.

July 20th, north of Kuniks bay, eastern shore of Kokètì
One eagle: bald eagle, seen soaring up from the esker complex. It circles higher and higher. Our approach probably frightened it. This eagle is spotted at the same location as an adult and juvenile bald eagle were observed in 2017.

July 22nd, western shore of Fry Inlet
One eagle, sitting on a boulder by the lakeshore, in the west bay of Fry Inlet. It sits on a rock for over an hour; when the monitoring team walks away, the eagle is still sitting on the boulder.

July 22nd, Southwest of Fry Inlet
Four eagles: two pairs of eagles fly high above the ground. Two eagles land below the sandbar/esker, approximately one kilometre west of us. Then two other eagles land in the same spot. It is possible they are feeding on a carcass. It is not possible to observe them behind the sandbar/esker.

July 23rd, northwest of Fry Inlet
One eagle, soaring high above a caribou herd. The herd walks north rapidly. The eagle flies away, over the hills, returns after few minutes, then fly over the hills north of us.

July 26th, southern end of Fry Inlet
One bald eagle, at end of Fry Inlet, sitting on a rock.
One bald eagle: juvenile. Too far to see details while its flying. Seagulls chase the eagle, trying to scare it away.

July 29th western shore, south end of Kokètì

One golden eagle: large, with brown feathers. The eagle sits on a boulder on the shoreline on the side of an esker island. It watches over the shallow, clear water. It flies away from the boulder, west toward the mainland, when we approach on foot. A hawk then flies up and attempts to attack the eagle while it flies. The eagle doesn't respond to the hawk, which attacks six times; the eagle continues flying seemingly unperturbed. The eagle lands on the opposite shoreline.
The eagle takes flight again, and two hawks continue to attack the eagle. The eagle responds by soaring higher and higher in circles. The hawks fly even higher than the eagle, then turn and flies downwards, attacking the eagle. The eagle flips to its side, and the hawks flies higher again, then turns and attacks downward on the eagle, again and again. One last time, one of the hawks flies high into the clouds, then stops, turns and then attacks at high speed straight towards the eagle. The hawk hits the eagle hard; the eagle tumbles, then finds its balance and flies in a straight line southward, away from hawk. The eagle flies higher and higher, soaring in circles that move further and further from the monitoring team. After the attach, both hawks fly back to the shoreline.

One bald eagle, sitting on a boulder by the shoreline of a small island, in the south end part of Contwoyto Lake. The white head is visible from a distance; there are dark brown feathers on body. The eagle flies off when we approach by boat.

August 2nd, northwest shore of Fry Inlet
One bald eagle: white head, with a dark brown body. It sits on the side of an esker, facing waters by the narrows between two eskers.

August 4th, Fry Inlet
One eagle, flying high over the *naɔokè* between Kokètì and Fry Inlet. Too far to see details.
One eagle, flying high over the shoreline along the eastern shore of the south end of Fry Inlet. Too far to see details.

August 9th, Shallow Bay, western shore of Kokètì
One eagle, observed across from Shallow Bay camp. The eagle sits beside two grizzly bears.

August 11th, Shallow Bay, western shore of Kokètì
One bald eagle, flying close to the Shallow Bay camp.

August 15th, Shallow Bay, western shore of Kokètì
One eagle, flying towards a calf in the open. The calf, frightened, ran to its mother. The eagle was later observed sitting on the ground.

August 21st, northwest shore of Fry Inlet
One eagle, flying

August 27th, northwest shore Fry Inlet
One eagle, flying above the Fry Inlet camp

Wolverine Observations

The monitoring teams made three separate observations of wolverines. On two occasions, a wolverine was observed at close range, 10-20 metres away; the animals did not notice the team until we were very close by.

August 4th northwestern shore of Fry Inlet

One female wolverine: light brown—almost white—fur on back (photo 33), with a lighter brown upper body and dark brown on her underside. She has a dark-coloured face and nose, with light brown over her eyes and head. She walks towards our camp without noticing us; we watch her. Twenty metres from our tent, she sniffs the ground. When she finally notices us, she runs toward the esker, stopping a few times to look back. We shoot a bear banger, and the wolverine runs straight up the over esker and out of our sight. "*Lots of power,*" says a monitoring team member.

Photo 33: Wolverine near Fry Inlet camp on August 4th

Photo 34: Wolverine by Fry Inlet, August 23rd.

August 15th, Shallow Bay, western shore of Kokètì

One wolverine, observed near a caribou gut pile, left behind by outfitters who hunted caribou in Nunavut.

August 23rd, northwest shore of Fry Inlet

One wolverine, attempting to catch a squirrel under a rock. The wolverine jumps back and forth to the sides of the rock. We are approximately 10 metres from him (photo 34).

Indicator 4: Industrial Development

The monitoring team did not spend time in vicinity of the mine sites during the summer. Attempts were made to enter the valley north of the Jericho mine site, where caribou migration was observed the previous year (2017), but strong winds made crossing the lake not feasible. The team observed the remains of mining and exploration activity by the numerous and ever-present surveys sticks left scattered on the land, over large areas surrounding the mines and exploration sites.

Mines and Exploration Camps

In the monitoring area, there are two mines: The Lupin mine and the Jericho mine. Lupin is located along the northwest shore of Contwoyto Lake, while Jericho is located at the northern end of Contwoyto Lake. Both mines are in care and maintenance mode, meaning that there is no ongoing mining activity, but a small crew is stationed there to maintain the infrastructure. Both mines have active gravel roads in their vicinity. Each mine has an operational gravel airstrip with flights to southern locations.

There is one abandoned exploration camp in our monitoring area. The camp sits in the east end of Long Bay, on the northeast shore of Contwoyto Lake. The camp consists of two run-down cabins situated on a sandy esker above the lakeshore. The mining company left several refrigerators, oil barrels, wires, and rusty metal equipment scattered over the sandy esker in what now looks more like a garbage dump, spilling into the lake. The camp is located directly in the path of the caribou migration route, which follows the eastern shoreline of the Contwoyto Lake and on a *tataa*, a land crossing, between two lakes.

Survey Sticks and Drilling Rods

The valleys around the northeast and northwest side of Contwoyto Lake contain thousands of survey stakes. Every 25 meters, a stick has been driven into the ground, which, over time, has fallen and/or shifted with the wind and water. We walked the valleys and stepped over hundreds of stakes (photo 36). As an example, in the valleys around the exploration camp in Long Bay, east shore of Contwoyto Lake, there are over 11,000 survey stakes, according to the local residents at Kokètì. These smaller survey sticks made of wood are approximately 50 centimetres long and the larger survey marker sticks are one metre long. Local Inuit were hired by the exploration companies to set the sticks in the 1970s and 80s. According to the local Inuit, mining companies have left many of the drill rods at the exact drill site for future reference in case in case minerals were found in the core samples. The rods are usually sticking out about 4' long (photo 35) while others of smaller size stand a few inches out of the ground, causing a potential danger to animals and hunters on snow machines.

Photo 35: Drilling rod left in the ground north of Lupin mine.

Photo 36: Survey stick left on the ground, close to Lupin mine.

Discussion

In this section we provide a qualitative description to the field observations, connecting conversations and themes discussed among the harvesters to describe the current state of caribou and the land, as observed during the course of the program and their life on the land.

The following sections discuss themes that proceed naturally from our observations on the land: 1) the importance of *ekwò naɔokè* for regional cultural and biological diversity; 2) how the presence of indigenous people on the land is vital for ecosystem sustainability; 3) the effects of climate change on barren-ground caribou behaviour; and 4) a summary of Bathurst caribou observations. The list of themes is a continuation of discussion items based on the 2017 Results report and should be read as an ongoing conversation.

Complementing the discussion of the themes are recommendations based on conversations with harvesters after three years watching the Bathurst herd on its summer range. Over the course of their lifetimes, the experienced harvesters have seen Bathurst caribou populations, range, and behavior change profoundly. The need to go beyond passive monitoring and promoting the return of a healthy population is felt within communities as a need to restore the connection with caribou. The recommendations are: 1) protect caribou habitat by establishing a Bathurst Caribou Habitat Protected Area; 2) support land-based cultural activities; 3) recommend that territorial and Canadian government continue to uphold their commitments to decrease emissions contributing to climate change, and 4) increase awareness of the status and management of barren-ground caribou to invert the dramatic decline of the Bathurst herd.

Ekwo Naɔokè: Where People and Caribou Meet

"Ekwo naɔokè is the main place to go in this area."

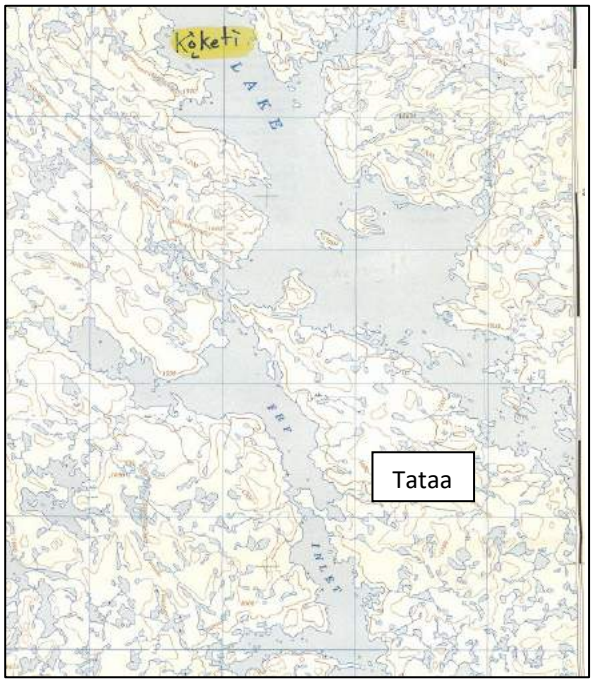
The *ekwò naɔokè* (caribou watercrossing) between Kokètì and Fry Inlet contains a narrative of "sacred geography," or, more precisely, a location where the topography of land and water connect people and caribou. Caribou, who migrate across the land; and people, who travel by water.

Photo 37: Herd of caribou swimming across naɔokè between Kokètì and Fry Inlet, July 2016.

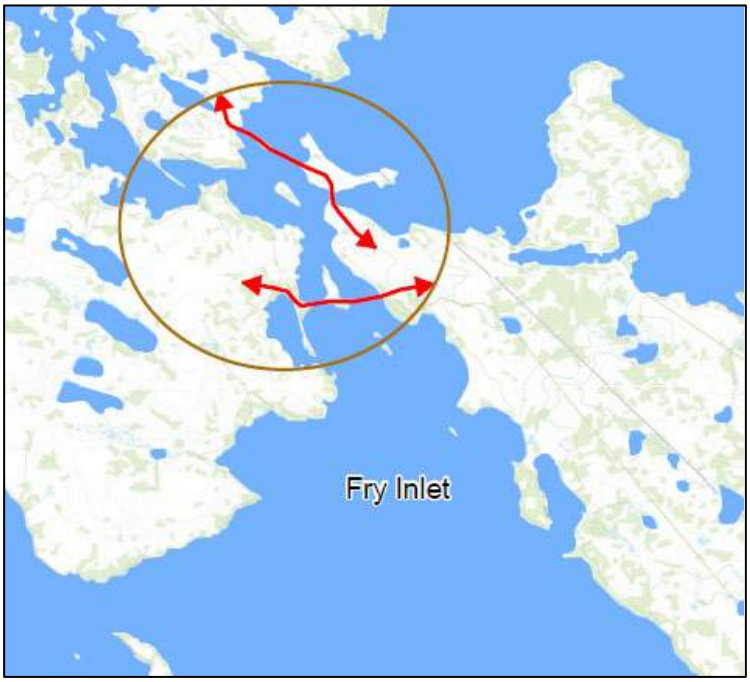
Understanding this *naɔokè* is an attempt to understand the complex interplay between culture, biology and ecological forces at a single, unique location. This *naɔokè* is *specific*: here, the water, the land, the animals and people intersect. Because of this complex interplay, this *naɔokè* has become a central stage for the entire regional ecosystem; the events that happen here drive the cultural and biological diversity of many species—including humans—throughout the entire region.

In a land where water is as prevalent or more prevalent than land, humans and animals alike must adapt their travel, and accrue knowledge and innate understanding of where to go and where not to go. In the winter snow cover and ice make the numerous waterbodies ideal travel corridors. In summer and fall, Tłı̨chǫ families travel north by boat on the waterways to reach the barrenlands; these journeys are often lengthy and challenging, with numerous portages to transport one's gear and canoes on foot. At the same time, caribou travel from the northern reaches of their range in a southerly direction over the land formations. Hundreds of caribou herds travel south from the calving grounds in the barrenlands toward the treeline, to stay within the forest for the winter months. On their long migration, the caribou herds must navigate a land containing thousands of large water bodies.

To help them navigate, they follow *tataa*. *Tataa* is a Tłı̨chǫ word meaning "land in midst of water." *Tataa* are migration corridors that lead the herds between lakes and to specific areas embedded in caribou memory, such as rich feeding grounds. T*ataa* help us understand the directional movement of caribou in relation to land formations and water bodies. While *tataa* inform caribou movements on the land, caribou inevitably need to cross rivers and lakes and prefer to cross where the distance between land formations is the shortest, at nǫɔokè, which is the safest and fastest way to cross water. *Nǫɔokè* is a Tłı̨chǫ term for water crossings; it literally means "swim across", and a nǫɔokè can be any place that caribou or any other animal use to swim across. While there are numerous *noɔokè* in the migration routes used by caribou, the crossing between Kokètì and Fry Inlet (map 7) is a specific place that *caribou always* use, and thus Tłı̨chǫ elders use the precise term *naɔokè*. The narrative of the *naɔokè* becomes alive at specific periods of the



Map 6: *Tataa* between Kokètì and Fry Inlet.



Map 7: *Naɔokè* between Kokètì and Fry Inlet.

year; the time when people traveling over water arrives at this *naɔokè* to meet with caribou traveling over land at an exact anticipated time and location.

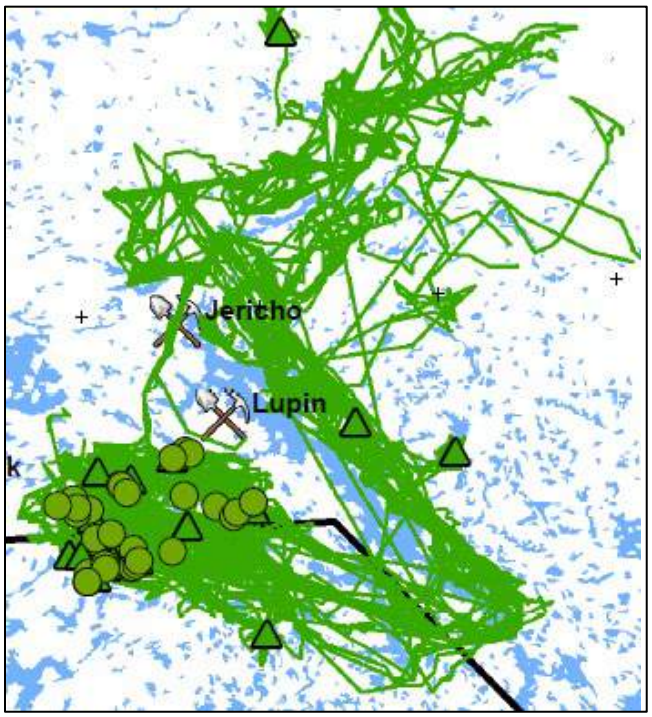
On Land: Caribou

Caribou follow a pattern. During the three years of the Ekwǫ̀ Nàxoède K'è program, the herds observed rely on the same trail system every summer to circumvent the large lakes. During the ice-free summer months, the large Kokètì with its many inlets and islands provides relief from heat and insects. Movements along the lake vary at the micro scale but tend to follow consistent patterns at the landscape level. Following the post-calving migration, from the calving grounds, the herds prefer to travel south along the eastern shoreline of Kokètì, cross west over the chain of islands that link the two waterbodies, or along the south end of the lake and follow the *tataa* (land bridge), between Kokètì and Fry inlet (Map 6).

This *tataa* provides valuable feeding grounds for the herds. Herds are often observed feeding extensively along the long flat slopes or lying down in the muskeg while feeding and resting, before moving again. The shorelines provide both good forage and relief from biting insects in the breeze coming off the large lakes. The *tataa* is shaped like a funnel which leads animals naturally to the crossing (map 7). After watching herds swim across the *naɔokè*, one of the monitors—a harvester—said,

> *"nǫɔokè is a short crossing; everywhere else is far distance. It's shallow, short, with sand bottom, so they can walk fast up from the water."*

Once the herds swim across, they follow the same trail every year. Never have the teams observed any alterations to the route; the caribou leaders know the migration route from the *naɔokè*: up the hills from the lakeshore, in between two small narrow lakes, over the sandbar, along the esker, and over the rolling hills in a northwesterly direction. All herds observed over the past three years at this location have followed this trail. Furthermore, each year the leaders teach this migration route to their "youth," the yearlings and calves.



Map 8: Congregation of cows and bull caribou northwest of the *naɔokè*, between Kokètì and Itchen lake in mid-August. The map shows movement of Bathurst caribou based on collar locations from the end of June to August 14th, 2017. Green dots represent cow caribou; Green triangles: bull caribou. Source: GNWT ENR

The *naɔokè* between Kokètì and Fry Inlet is the main migration route for the caribou herds migrating around Kokètì on their summer range. The crossing acts as an intersection along the "road" that leads to specific valleys with good pastures northwest of Kokètì.

Northwest of the *naɔokè* is the feeding area between Kokètì and Itchen lake, where the caribou cows—the mothers—bring their newborn calves every summer. During July and August, the cow leader usually keeps the herds in these valleys for weeks to feed and rest in the wind. The calves are one to two months old and spend weeks in this area to eat well and grow strong (see caribou collar location in Map 8). Generally, the area is described as a vast open landscape with flat rolling hills, and little shelter from the wind, which reduces insect harassment. John Koadloak explained, "the area where the large herds are now, between Kokètì and Itchen Lake, is a lush and green area consisting of rolling hills, with good feeding grounds; a good place to congregate. Further south, towards Yamba Lake, is much rockier and hilly, so where the herds are now [is] perfect for them." Map 8, above, shows the mass congregations of herds northwest of the naɔokè between Kokètì and Itchen lake.

On Water: People

Water travels along the easiest path between rock formations, forming rivers and lakes. These rivers and selected paths between lakes were explored and travelled by Tłı̨chǫ consistently over millennia, creating an extensive physical and cultural trail network between the vast open barrenlands and the southern forests. The traditional Tlicho caribou hunting economy depends on seasonal movement, which, essentially, relies on a deep knowledge of a specific area's topography, water movement and animal behaviour throughout all of the seasons. Knowledge of the seasonal patterns and interconnections within these elements is essential for success in the hunting economy.

Photo 38: Tłı̨chǫ canoers along the waterways to the barrenlands and Gotsokatì (Mesa Lake), August 2016.

For thousands of years, the ancestors studied and engaged in the seasonal interconnected cycles of all animals on the land to know, precisely, the location and timing to acquire the necessary resources to support one's family each day of each season in the subarctic environment. Explaining the depth of knowledge and time spent to understand the ecological processes within one's traditional territory, anthropologist Wade Davis (2009) writes,

> Imagine for a moment if all the genius and intellect of all the generations that have come before you had been concentrated on a single set of tasks, focused exclusively on knowing a particular piece of ground, not only the plants and animals but every ecological, climatic, geographic detail, the pulse of every sentient creature, the rhythm of every breath of wind, the patterns of every season (David 2009: 157).

The harvesting economy is, in essence, a knowledge-based economy; a harvester must have an in-depth place-based understanding and personal knowledge of the routines of each animal species, their movement and behaviour throughout the seasons, and their relation to the pulse of seasonal meteorology and hydrology in the geological corridors that are safest and easiest to travel for ones family. Such a knowledge base is only gathered by extensive personal experience traveling the land and listening to and learning from elders' teachings and stories. Thus, while in camp one often hears elders say, "*the more campfires you share, the more knowledge you have*."

Photo 39: Herd of caribou walking up from the naɔkè between Kokètì and Fry Inlet, July 2016.

During the first field season at Kokètì, elder Michel Louis Rabesca shared many stories of Tłı̨chǫ cultural practice of traveling to Kokètì for caribou harvesting; all the way from Behchokǫ, families travelled by canoe to the important *naɔkè* between Kokètì and Fry Inlet. The main canoe routes are from Behchokǫ along the Kwitì Tili (Mowhi trail) to the barrenland, or from Wekweètì, to Beatì (Winter lake), to Ezhootì (Jolly Lake), to Ewaànıt'ıtì (Courageous lake), to Ekati and north to Kokètì. Or another route from Gametì (photo 38), to Gotsokatì (Mesa lake), to Deèzàatì (Point lake) and to Kokètì. Tłı̨chǫ hunting groups and their families would travel as far as it took to find caribou. If no animals were encountered, the people continued further north, eventually reaching Kokètì, with its well-known caribou watercrossings. "Further south, the lakes do not have such big crossings. Here, this *naɔkè* on Kokètì, is the main big crossing," Rabesca explained. This important *naɔkè* has been known and frequented by harvesters for countless generations, and, of course, it is the reason the monitoring team has placed its camp there.

In Tłı̨chǫ, Kokètì means "empty campsite lake." When walking its shores, its name becomes clear by the presence of the numerous campsites around the lake. The long-term occupation of this place resulted in virtually every bay and inlet around the lake being an archeological site. On both the north and south sides of the *naɔkè* between Kokètì and Fry Inlet there are several archeological sites, both occupied by tent rings placed in strategic places with good view of the caribou crossing. Additional archeological sites can

be found along the eskers, including tool-making sites. Whether by the lakeshore or in the soft substrata of eskers, archeological sites in this region are closely linked with caribou migration routes and traditional harvesting locations. After spending time at the *naɔkè*, one of the monitors—a harvester—said,

> *"if you got no bullets, this is the place to kill caribou. Big rocks on west side of crossing on the sand beach, where people can hide and hunt caribou with spear, bows and arrows at close range."*

The numerous Dene and Inuit cultural sites around the lake are a testament to the long-term occupation and the importance of the many inlets and *nǫɔkè* on the lake; it is a place where people and caribou meet. At certain specific times of the year, the caribou, moving over land formations, travel south from the calving grounds. At the same times, people travel by canoe on to reach the barrenlands at the time of the approaching movement of caribou; to meet them at the *naɔkè*.

Biodiversity

Caribou are a keystone specie. Bears, wolves, wolverines, foxes and eagles are linked to their presence either as primary predators or through ecological association. As primary predators, wolves play a key role in the life of caribou. They are often seeing denning or travelling near a water crossing, knowing that caribou will, at one point, enter the narrow funnel. There, a kill can be made with less effort than attempting to hunt one down on open ground.

On July 19th, the team observed a young female wolf positioned strategically, hiding amongst the dwarf birches as close as possible to the shoreline by a *nǫɔkè* in Kuniks Bay (photo 40), on Kokètì's eastern shore. Fresh caribou tracks could be observed in the sand, and the wolf was likely anticipating further caribou to swim across the *nǫɔkè*, thus positioning herself at the closest point to make a kill when the animals would walk up from the water, where they usually make a brief stop to shake water from their hair.

Photo 40: A young female wolf hiding in the bushes waiting for caribou to cross at a nǫɔkè, Kuniks Bay, July 19th.

Photo 41: Caribou tracks cover the beach at the naɔkè between Kokètì and Fry Inlet

On July 31st, we observed fresh wolf tracks on the sand at the *naɔokè* between Kokètì and Fry Inlet (photo 29). The wolf walked eastward and swam across the *naɔokè*. Two sets of caribou tracks were also observed: a cow and calf, swimming across and walking in a westerly direction. At the *naɔokè*, the caribou arrived first and walked west; then, a few hours later, the wolf appeared and walked east. "*No caribou visible, so [the wolf] is walking and looking around*," explained an elder. A few days later, on August 6th, the team noticed the fresh tracks of a grizzly bear in the sand at the *naɔokè*. The bear swam across and walked west from the crossing, following the well-worn caribou trail. We had noticed a bear—most likely the same one, nine days earlier— walking along the shoreline, south of the *naɔokè*. The very existence of naɔokè and the constancy of caribou movement through the crossing maintains other animal populations, which ensures the region's healthy biodiversity and generates a resilient ecosystem.

Historical Layers

Over time, the seasonal movement and interconnection between Dene, Inuit, caribou and various animal species have created layers of culture and history at these locations, as they have been used every year for millennia. Such layers are only glimpsed in the physical trails and the tent rings visible on the landscapes. Its true depth can, however, be only experienced trough traditional knowledge and living on the land with harvesters for a period of time. Only then one can understand the implicit histories of each place; places that make up the cosmology and the collective history of several peoples.

During the countless caribou hunts, and now over the course of this program, as these places are revisited the people's generational stories are retold here, time and again, so that the collective history of the land is kept alive. And each time these places are revisited, new events emerge, and new stories are created, adding further layers of cultural significance. Over time, many of these sites have become spiritual places for some people, as they come to these camps as their ancestors did to communicate with dè.

Photo 42: Joe Zoe and Roy Judas by an archeological site near the naɔokè between Kokètì and Fry Inlet.

Recommendation 1: Protection of Caribou Habitat

The Ekwǫ̀ Nàxoède K'è program recommends establishing a Bathurst Caribou Protected Area (BCPA) associated with the *ekwò naɔokè* (watercrossing) between Kokètì and Fry Inlet. We recognize that portions of the ekwò *naɔokè* are within Nunavut. Accordingly, we recommend that the BPCA be established within the Wek'èezhìi boundary in NWT, south of Kokètì, and if possible extended through interterritorial agreements.

Potential regulatory pathways for the BPCA include approval by the Tłı̨chǫ Government, and work with GNWT departments to establish a Protected Area through the Territorial Protected Area Act (Bill 38). It is important to note that this Ekwǫ̀ Nàxoède K'è recommendation provides specific rationale and context to Recommendations 3 in the Bathurst Caribou Range Plan (BCRP) detailed below,

BCRP Recommendation 3: Using appropriate legislative tools, define the level of protection within an area specified around priority water crossings and land bridges as identified through TK and/or community direction. The legislative tools should allow for boundary adjustments when TK, science and other land users identify changes in caribou distribution and range use (2018: 38).

The rationale for the establishment of a BCPA stems from the program's elders and harvesters experience on the Bathurst summer range. The caribou habitat within the proposed BCPA associated with the *ekwò naɔokè* performs multiple ecological and cultural functions that impact the entire region. At the regional scale, with the exception of the calving grounds, this area is vital for the Bathurst caribou herd.

After calving, the cows bring the calves to the summer and fall range southwest of Kokètì for the calves to forage sufficiently prior to winter. The proposed BPCA contains mostly undisturbed caribou habitat with important forage areas for the calves on the summer range. Thus, the BCPA is a critical migration corridor between calving grounds and winter range. The Bathurst herd has shown a high degree of fidelity to the BPCA, and caribou spend a good part of the year in this area following calving. Fidelity has not shifted despite the recent dramatic decreases in numbers of both the Bathurst herd; the BPCA continues not only to be frequented yearly, but will likely acquire increased importance as key habitat as barren-ground caribou numbers decline and further development occurs in and around their range.

The establishment of the BPCA is a proactive measure of habitat conservation for caribou; this measure is necessary to build resilience in the face of challenges such as climate change and anticipated development in the next decades. The program's elders and participants state that to recover the Bathurst caribou, the herd need places where disturbance is minimal. A protected area is required to maintain resilient socio-cultural and environmental systems.

Indigenous Peoples Vital to Ecosystem Sustainability

"If more people were on the land, we would have more caribou."

These words, spoken by a local harvester, describing the historical caribou hunting sites on Kokètì, speak to the ancient relationship within which, we, through the Ekwǫ̀ Nàxoède K'è program, engage. The statement links cultural diversity with the biological diversity of caribou and demonstrates the importance of continuing cultural practices on the land, maintaining the connections between people, caribou and the *dè*. At one of our evening debriefing meetings, the harvester continued: "caribou and people are happy to see each other" and

> *"when people are on their hunting grounds, more caribou come; when there are no people on the hunting grounds, the caribou herds pass right through."*

Implicit in these words is an understanding of the land as a social-environmental system; a complex network of social relationships, involving both the biotic and the abiotic landscapes: land, water, animals and peoples. Until a few decades ago, many Inuit and Dene families stayed and harvested caribou at the numerous harvesting locations around Kokètì, such as at many *ekwò* nǫʔokè. When people were present and hunting at these locations, the caribou would pass by and then come back again. The herds would not simply walk by and move on; instead *"they came back to people.*"

The removal of people from the land and into communities has had significant ecological consequences. According to the harvester, the caribou notice the absence of people at the traditional camp sites around Kokètì, and the herds pass right by, instead of remaining at the locations. Thus, the abundance of caribou is linked to the presence of people on the land through the interdependent relationship between people and caribou. Simply stated by a harvester, *"now families are gone; no more caribou.*"

Photo 43: Roy Judas near hunting blinds on a caribou migration trail, Kuniks Bay.

This knowledge of caribou behaviour demonstrates a new (though ancient) understanding of the social abilities and personal agency of caribou, individually and as a herd. When the elder says, *"caribou are not here, because people are not here,*" he speaks to the central understanding that people and caribou are connected and have responsibilities toward each other. As such, both can be emotional toward each other

and react to action of respect or disrespect. Many obligations follow the caribou hunter and the animal "knows" the actions of people who interact with their bodies. An elder emphasized that

> *"if you take care of my [the caribou's] body, I [the caribou] will be back next year," and "if you don't, and one bone is missing, I won't be back next year."*

By talking as the caribou, the elder tries to portray the world from its viewpoint and speak to the younger generations about the importance of following cultural protocols that have been in place since time immemorial. "*You have to look after them good, don't hit them with a stick, and use everything, every bone,*" said the elder, emphasizing the importance of respect. The caribou "know" who treat them respectfully; and consequently, who they should enter into a relationship with. The relationship starts when the caribou "*give*" themselves to the hunter, and continues when reciprocal behaviour, following cultural protocol, is conducted by the hunter. According to the elder, the caribou tells a hunter, "*if you follow me, I am not the only one,*" meaning that a caribou informs a respectful hunter of the presence of other caribou. "*If you hunt for caribou, don't look for them. Just go to a hill to look, they will come to you,*" elaborated another harvester. He continued by describing how his grandparents hunted: "*a hunter goes with a big parka to top of the hill. Sit there all day, and look and watch for caribou. Then caribou will come.*" The harvester continued,

> *"I never go search for caribou, just go to a hill to look, [and] caribou will come. I never sneak up on them. Just stand there, and they walk right up to me. I just take my time, once I see one I want, I shoot. If you rush, and don't act right, they know and won't come."*

Some persons are truly connected to the land and animals. The local harvesters refer to such a connection as being *"fixed*;" some "persons are '*fixed*' to caribou or another animal. For example, if such a person would pass on (i.e. die), the animal "fixed" to the person would know and feel compelled to visit the area. The same phenomenon is observed for fish, or natural elements such as weather systems. "*Some persons hold such connection to land elements or animals and can be connected to various animals such as ptarmigan, wolves, beaver, birds or caribou,*" explained one harvester. Another harvester spoke about his connection to the raven:

> *"sometimes I talk to the raven in Tłı̨chǫ, I ask him where are the caribou, he will drop a rock or point to where the caribou are with his beak or wings."*

These statements from harvesters working on the Ekwǫ̀ Nàxoède K'è program reveal a hidden world of social connection between species interacting on the land. In this context, one of the simplest and yet most powerful rituals to connect with the land is to "*pay the land*." Paying the land is done to neutralize our passage and make us aware of our dependence on nature as human beings. This ritual involves the simple act of placing tobacco, or other valuable objects, in the water upon one's first arrival to a place. Paying the land is a humbling act that puts individuals into the right state of body and mind to be respectful. Concurrently, it is an act of giving back and thank in advance the beings giving themselves up for one's survival. By being respectful, a person neutralizes one's passage on the land and maintains the ancient relationship between people and other beings on the land.

Other rituals are propitiatory in nature or performed to ask for safety, such as "feeding the fire" and the "*nı̨hts'ı whìle agowedee"*, where the purpose is to communicate with the land and to ask for safe passage.

Through such rituals, people communicate and engage with the land on a social level; "the land, then, is a living entity with powers that should be respected if harmony is to be maintained" (Legat 2008: 37). During such engagement, the land is comparable to ones' parents, who provide everything for the people's sustenance. Tłı̨chǫ use the word *dè Gogha Nàeǫ̀ı̨* ("*the land shows favour to us*") to express how the land feels about our presence. Engaging with beings in a social-environmental system means that there are no arbitrary limitations to the social communicative abilities of animals; rather, the concept of sociality is not limited to humans only but includes all beings, biotic and abiotic. Thus, being a harvester means that one can hunt a prey, but within the hunting process there is a relationship that needs to be maintained. One harvester reminded us of the reason for continuing to be a harvester: *"I hunt because it's a connection.*"

Wolf Hunters and Wolves

The attempt in recent decades by colonial government policies to remove the permanent presence of people from the land has altered established sustainable balances in the social-environmental system in which people and animals coexisted for millennia. The Dene and Inuit harvesters lived as a part of the ecosystem since time immemorial, and, as harvesters, have a central role in creating a balance in the relationship between people, wolves and caribou. In the last century, significant shifts have been altering the northern social-environmental system. Because of numerous current and historical policies forcing assimilation of indigenous peoples into non-indigenous society, the permanent presence of peoples on the land has declined. A consequence of the colonial government's attempt to remove the people from the land is imbalances in the complex social-environmental system.

One of the effects is an alteration of the balance that predators (humans included) have maintained with caribou populations. The local harvesters described the resulting situation as *"the wolves took over after the hunters left.*" Furthermore, *"people kept wolf population in balance and the caribou population in balance*." The unknown and indirect consequence of colonial government policies by removing the permanent presence of indigenous peoples—the apex hunter—off the land, is more available space and less harvesting of predators, such as wolves. *"Now all winter long, we see wolves almost everyday*," reported the residents at Kokètì.

In recent winters, the barren-ground caribou herds (Bathurst, Bluenose-east and Beverly-Ahiak herds) stayed within, or north of, the treeline on the barrenland for most of the year, including winter. The presence of the caribou on the central barrenland throughout summer and winter creates a steady supply of meat for the wolves. The wolves can travel far distances in days, and the ready availability of herds on the barrenland provides caribou meat in relatively close proximity throughout the year. "*Wolves hang around caribou all the time. They follow the herds all winter, all the time,*" said one elder. Furthermore, during summer, when wolf pups are growing, they prefer to eat the meat from calves. Reflecting on his past observations the elder explained, "*for wolf pups, it is good to eat the soft meat from calves.*"

According to the local Inuit residents at Kokètì, there are many wolves present on the barren-ground caribou summer range. Additionally, "*there is not enough money to sell wolves. If the price increased, I would hunt more*," said one harvester. In this light, the statement "*if more people were on the land, we would have more caribou*" assumes additional ecological significance as fewer people on the land means more wolves preying on caribou. The harvesters at Kokètì hunt wolves around their camp throughout winter and, subsequently, several groups of caribou come and stay around their camp during winter.

These statements by harvesters, who engage in the traditional land-based economy throughout their entire lives, speak to the vital role that the cultural practices of indigenous peoples have in sustaining a balanced and healthy ecosystem.

Recommendation 2: Support Traditional Land-based Activities

The Ekwǫ̀ Nàxoède K'è program recommends supporting traditional land-based activities as a mean to achieve two key objectives:

1) From a socio-ecological perspective, re-establish traditional harvesting practices promotes respect for the land in order to restore a balance between species, and ensure that the traditional knowledge and cultural practices are transferred between generations.
2) The harvesting of fish, plants and medicine gathering, subsistence hunting of local animal species, fur trapping and an increased wolf harvesting on the Bathurst caribou core range can directly help the land and specifically recover the caribou herds declining in numbers.

Wolf hunting in particular is an important conservation measure for the rapidly declining Bathurst caribou herd. Supporting the traditional harvesting of predators is consistent with both objectives described above. The Ekwǫ̀ Nàxoède K'è program supports the Enhanced North Slave Wolf Harvest Incentive program by GNWT-ENR. The incentive is a way to support the traditional economy and generate income through wolf harvesting. By increasing wolf and fur trapping on the herd range, we can diversify the economy and reduce reliance on industry.

Supporting on the land activities is a way to maintain cultural transmission of knowledge and cultural practices from older to younger generations of harvesters, and generate income through wolf harvesting. This program recommends that all levels of government provide funding for on-the-land programs, which allow people to engage in cultural practices, indigenous languages, and a traditional way of life on the land.

Climate Change and Caribou Summer Range

Tłı̨chǫ and Inuit harvesters have observed striking evidence of climate change throughout the three years of the Ekwǫ̀ Nàxoède K'è program. The 2017 report noted several changes to caribou behavior concurrent with climate change. In the 2018 field season, researchers and participants followed up on previous years' observations and noted further indications of climate change in the form of: 1) melting landforms; 2) disappearance of summer snow, and 3) the appearance and consistent increase of the bald eagle; a new predator of barren-ground caribou. The effects of these ecological changes on caribou behaviour are discussed below.

A Melting Landscape

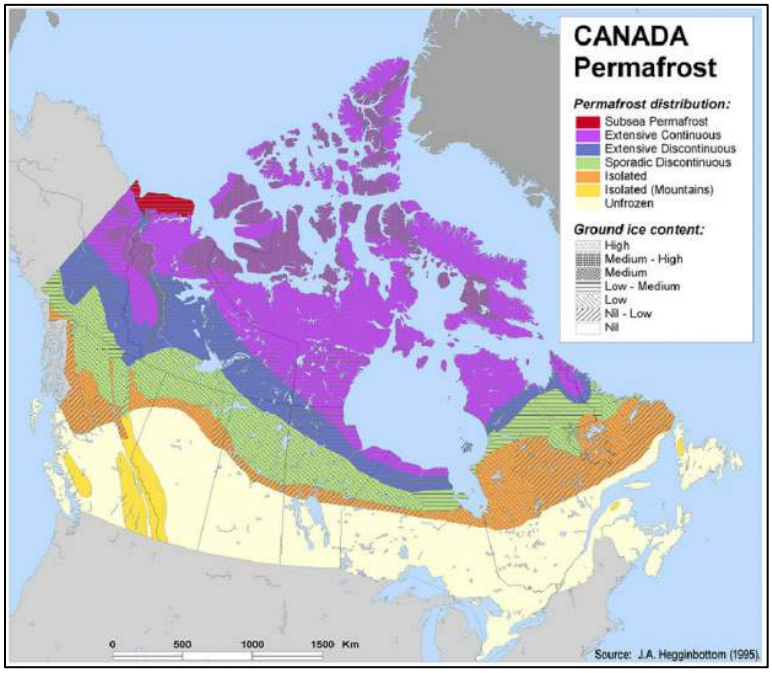
The warming trends accelerating the melt of Arctic ocean ice in recent years also had terrestrial effects in the circumpolar regions where permafrost is continuous. Over the course of the years, the teams observed such changes while walking the land in the form of collapsing landforms, as eskers, and changes in surface water. Where ice previously upheld the sandy, pebbly structure of land features such as eskers, the melt of underlying permafrost results in deflating or entire collapse of eskers, which in time will slowly change the tundra landscape as sinkholes form, esker dissolve and adjacent lowlands turn into swampy grounds.

The effects of permafrost thaw are visible on several eskers throughout the barrenlands, and the thaw is much faster on eskers located close to large lake shores or on sandy eskers facing directly into the sun. The eskers are often wide and flat on top with gradual sloping sides, transitioning from sand and pebbles on top to vegetation on the surrounding lowlands. As the permafrost thaws, the eskers' internal ice melts and drains, thus forming sinkholes, often several metres deep. These sinkholes are typically marked by a small pond or pool of water forming in the centre, as more ice melts and rainwater gathers (Photo 44).

Several deep sinkholes have been observed on eskers on the southwest side of Fry Inlet. Additionally, permafrost thaw is visible on the slopes of eskers, which due to the melting underlying ice are collapsing, creating steep cliffs or edges instead of smooth, sloping hillsides. In the lowlands immediately adjacent to the eskers, permafrost thaw has created ponds of cold water, similar to runoff from a melting glacier, as the water runs directly from channels of thawing ice within the eskers. The landscape surrounding these eskers are slowly changing and turning into muddy and swampy grounds. In turn, swampy grounds result in changes to the composition of vegetation, and the availability of forage for caribou.

Photo 44: Melting esker on eastern shore of Kokètì, and sinkholes forming on esker southwest of Fry Inlet.

The long-term effect of the warming trend is the overall shrinking or collapse of the long and winding esker that characterizes the landscape of the barrenlands. Streams flowing under eskers, from the internal permafrost thaw, are also capable of collapsing an entire esker. In places where esker systems hold lakes, such collapse could drain entire lakes and flood surrounding lowlands.



Map 9: Map of Canadian permafrost. As global temperatures rise faster in the arctic regions causing the melting of continuous permafrost, landscapes, vegetation, and ecological interactions associated with them are altered.

Caribou herds, and other species, often follow eskers along their migration routes. They prefer sandy eskers, as the sand and pebbles provide easier walking, and often, individual animals seek out the top and sides of an esker, which provide relief from insect harassment and a refuge from and viewpoint for predators. According to elder Joe Zoe, "*caribou like to walk in sand and along the sandbars. The sand cleans out dirt and mud from their hooves. And the sand files down their hooves.*" Furthermore, esker systems constitute valuable habitat for local animals besides caribou, such as bears, wolves, ground squirrels and foxes, who raise their offspring in dens they build into esker systems. The collapse of eskers and the melting of the tundra can have profound effects on landforms, animals, and biotic and abiotic relationships between organisms.

Spring Melt

During first week of July 2018, the lake ice on Kokètì was still firm and solid, even onto the shoreline. But by the end of the second week, the ice had begun to break up and candle. (Candling is a condition of rotting ice, whereby previously unbroken ice forms long, parallel crystals that eventually break apart and melt into water.) The monitoring program start date was delayed two weeks, due to the fact that the floatplane had no open water on which to land. By July 15th, the ice had broken up, and on July 16th, the monitoring team was able to land by floatplane. The ice condition this year was similar to "normal," as observed in previous decades, when ice cover remained on the large lake until mid or late July.

In the program's first two years, 2016 and 2017, the entire lake and its numerous inlets were ice-free by late June. During those two years, higher than normal temperatures, occurring earlier than usual in June, melted the ice at a faster rate than normal and the timing of the spring melt was approximately two weeks

earlier than usual. In 2018, the temperatures remained cool for most of July, and the ice melted more slowly than it had in the previous two years.

Summer snow

During summer, the arctic landscape is dotted with patches of snow covering crevasses and steep slopes where snow or ice accumulates over winter. According to the elders, this summer snow typically remained as late as mid-August, and, at times, year-round, in sheltered locations. In recent years, average temperatures in May and June have been higher, and most of the snow has melted by the end of June. During the first year of the program, in 2016, the monitors observed no snow patches around Kokètì. In 2017, one snow patch was located on a steep rocky slope north of the lake, but the snow melted by mid-July.

In 2018, snow patches covered the landscape around the lake during mid-July. On July 18th, we observed 22 snow patches on hills to the north and on the northeast side of Kokètì, from our viewpoint by John Koadloak's outpost camp. Throughout July, we observed snow in various locations around the lake. On August 3rd, a few snow patches were still visible in crevasses and steep slopes, and they remained until mid-August. The summer snow, which melted slowly due to stable cool temperatures, fed steady meltwater to vegetation on the flat ground below. The summer snow melt, combined with frequent rain showers throughout the summer, creating moist conditions for good caribou forage.

Effects of Climate Change on Caribou Behavior

The weather during July and August was mostly cold and wet and generated little noticeable insect activity. However, a few hot days encouraged high insect activity. From July 23rd to the 27th, a high-pressure system remained over the central barrenlands, bringing high temperatures, low wind and subsequent heavy insect harassment, which affected both the caribou herds and the monitoring team. During these days, several large (~1,000 animal) herds, were located along the eastern shore of Kokètì, mainly around Campsite bay.

The herds were relatively stationary in the bay during these warm days, moving back and forth along the shoreline and into surrounding low hills. The shoreline of the large lake provided opportunities to escape heat and harassment from insects, mosquitoes and blackflies. Individual caribou would stand in cool muskeg and/or water and bask in the gentle breeze coming off of the water. On hot days, with high temperatures, low wind and very high insect activity, the monitors noted two strategies used by the herds to minimize the heat and insect harassment: circular movement and standing in water.

Circular Movement

On July 23rd, the team observed a herd of ~500 caribou by the shoreline of Campsite Bay. The herd walked slowly in a northerly direction along the shoreline; then they gathered in one large group and started to walk in a large circle, moving clockwise. The herd moved further north along the shoreline, then circled again *en masse*, this time in a counter-clockwise direction. There was no wind coming off the lake, and the insect harassment was extreme. The herd moved to the shoreline, where some animals walked into the water while the rest remained in a depression of wet muskeg by the shoreline. After one hour and 50

minutes resting by the shore, the herd walked onto a flat ledge above the lakeshore. As the herd walked, the animals were engulfed by swarms of mosquitoes.

Mosquitoes and blackflies were so numerous that they seemed to envelop the herd like a dust cloud while it moved through the muskeg (Photo 45). One monitor said that he had "never seen that much mosquitoes follow a herd." As a response, the herd grouped tightly together and slowly began to move together in a large circle, moving and progressing faster and tighter. Most of the bulls were in the centre of the herd, while most of the cows were walking on the outer parts of the circle. The resulting wind and dust discourage insects and provided temporarily relief to caribou, albeit short-lived, and with large energy expenditure for the caribou. The monitoring team heard the loud snorting sounds of animals attempting to blow mosquitoes and blackflies out of their nostrils, while the caribou were walking in circles. This was the first recorded observation of this type of behaviour during the program, and the first time Tłı̨chǫ elders and harvesters had observed such behaviour. Upon his first time seeing this behaviour, a monitor exclaimed, "*just like they dance; dance in circles!*".

Photo 45: "Clouds" of mosquitos and blackflies harass the herd, July 23rd.

On July 24th, the monitors watched, for almost six hours, as a herd of 1,000 caribou walked and grazed peacefully on a hillside into the 25 km/h west wind (photo 46). The herd had congregated on the hilltops inland from the eastern shore of Kokètì. The strong west wind coming off the large lake prevented mosquitoes and blackflies from harassing the herd. We saw caribou laying down, resting and feeding peacefully on the hillside. Compared to the two previous days of intense insect harassment and herd activity, it was a relief to see the herd at peace.

However, that peace was short-lived. At eight p.m., when the sun began to set and the wind died rapidly to 10 km/h, the blackflies returned and the herd behaviour changed immediately. As soon as the insects emerged from the vegetation, lichen and grasses, the caribou herd grouped together and walked down the hillside, into the remaining wind. Halfway down the hill, the herd stopped, turned and walked back up the hill. As they reached the top, they turned and walked down again, and again the caribou moved around and around, from right to left, in a large circle on the hillside. One monitor noted, "*same as the Tłı̨chǫ drum dance, always go right to left.*" Eventually, a lead animal took charge and walked southwest along the hillside, and toward the monitoring team. The herd walked along the hillside, following the leader, but an impassable large boulder field to the south halted their movement. They stopped at one point, grouped tightly together, then moved back up the hillside, to the original location where they were resting before the wind died and the blackflies came out.

Photo 46: Herd resting and feeding peacefully on hilltop, July 24th.

On July 30th, the monitoring team observed a herd of 150 caribou walking along the eastern shoreline of Kokètì. The herd walked through a patch of muskeg and onto a small peninsula. There, it grouped together and started the circular movement; around and around, counter-clockwise. Most of the bulls and calves were observed on the inside of the tight group, where fewer mosquitoes can access, while most of the cows seemed to walk on the outer rings of circle. The herd circled further and further out on the peninsula, and it looked like it might swim across the lake. Instead, it turned back and continued south through the flat muskeg, inland from the lakeshore. The herd followed the same caribou migration route as the herd the previous day.

These three instances of circling behaviour, observed over three days, were the first known observations of such behaviour in caribou. Permanent Kokètì residents John and Mercie Koadloak said that they had never seen such behavior in caribou prior to the summer of 2018. On the three occasions, the bulls were in the centre of circle where fewer insects could penetrate, while most of the cows were on the outside of the circle. As well, the animals still wearing their thick, white winter coats were walking on the outside of the group. The monitors theorized that the observed behaviour is an example of *“new habits to cope with climate change and the high insect harassment.*” It was noted by the monitors that such large congregations of animals moving so quickly over rugged terrain can be dangerous for the calves as they can get trampled on, leading to possible death or injuries and, later on, easier prey.

The caribou circling behaviour we observed demonstrates the delicate interplay between wind, insect activity and herd behaviour. Instantly, after the wind decreased, blackflies appeared and the herd reacted by grouping together and beginning their circular movement. Using weather monitors, the team noted that at wind speeds upwards of 10 km/h, insects are deterred; in 14 to 18 km/h insects cannot fly. Below these thresholds, and in the absence of precipitation, insect activity increases immediately and harassment of warm-blooded creatures—monitoring team included—ensues.

Herds Standing in Water

On July 23rd, the team observed a 500-caribou herd on the eastern shore of Kokètì. After the herd’s circular movement episode, as described above, the caribou walked down to the shoreline. Half of the herd entered the water while the rest of the animals stood in the wet, cool muskeg in a small depression above the lakeshore (photo 47). While watching the caribou in the water, one elder said, “they’re cooling off their feet in the cold water.” During the warm day, the herd entered the water and stood submerged to the knees, keeping their stomachs in the water to cool down.

Photo 47: Herd standing in water to cool down, July 23rd.

The herd rested in the water by the lakeshore for one hour and fifty minutes. Some animals—mainly bulls—were pushing their way to the water, while several cows stood in the water, drinking. The caribou on the outside of the tight herd were constantly twitching from the insect harassment. One cow stood with her nose and face into the vegetation and breathed through the dwarf birch bushes to prevent the biting insects from flying into her eyes, nose and ears. The bulls were shaking their antlers to evade the mosquitoes and blackflies and leaning their heads back to scratch their backs with their antlers. After the herd walked from the shoreline, the vegetation, lichen and grasses, were trampled down, while the water in the small bay was completely brown and muddy. Large patches of white caribou hair, falling off their winter coats, were scattered over the water and along the shoreline.

On July 25th, the monitoring team observed a 500-animal herd. All of the caribou in herd were standing in the water, submerged to their knees and stomachs, off a peninsula in a bay on the eastern shore of Kokètì (Photo 49). The temperature was 22 degrees Celsius and there was a 12 km/h wind; it was a warm and sunny day. We observed the herd standing quietly in the water, close to the shoreline, for one hour and 50 minutes. The herd was already in the water prior to our arrival and was possibly standing there for a long time before that. The animals seemed to be cooling down their bodies. One elder said, "*herds stay in the water for long times to cool off their bellies.*" The lake ice had thawed only ten days earlier and the water temperature was still quite cool, providing some relief from the summer heat. Most animals in the herd were not moving, but simply looking down, standing still and cooling off in the cold water. Three animals wandered off to the east, then returned and retook their positions in the group, standing still in the cold water.

At the same time, the monitoring team observed, at close range, another large caribou herd, of approximately 1,000 animals. This herd was standing in a tight group on the eastern side of a small pond (photo 48) on the high ground above the lake. One of the monitors, a local harvester, said, *"if herd don't go down to the big lake, they go to lakes on top of hills lying down by the cold water.*" Three cows from the herd walked into the pond and stood with water up to their legs among the rocks along the shoreline. The three cows constantly twitched from the insect harassment, then stomped their hooves multiple times to splash water up. One cow flicked her head up and down several times, and then lowered it again to the water. After a bout of constant twitching and splashing, the animals stopped and simply stood still, looking down. The cows seemed to be in obvious discomfort from the insect harassment.

There was very little wind on the flat ground by the pond and the insect harassment was intense. Caribou on the outside of herd were constantly shaking and twitching their bodies to slough off the mosquitoes

and blackflies. The herd grouped tightly together on the eastern side of a small lake to be exposed in the west breeze coming across the small pond. Most animals by the water stood facing east, with their rumps facing into the wind.

Photo 48: 1,000-animal herd grouped together by small pond, July 25th.

Photo 49: 500-animal herd standing in water for hours, July 25th.

Ekwǫ̀ akwe etłee - Caribou Leaders

After almost an hour standing by the pond, two cows walked up on a higher cliff above the herd, while the rest of the herd rested. North of the monitoring team, a large, low-pressure system, bringing dark clouds, a rapidly increasing north wind and cold air were approaching. The two cows walked around on the high ground above the herd, watching the landscape. Suddenly, both herds—the 500 animals standing in the water and the 1,000 animals near the small pond, moved from their resting locations at the exact same time. The bigger herd stood up and quickly walked north around the side of the pond. At first, a few

animals walked on the south side of the lake, close to the monitoring team, but the majority—and eventually the whole herd—walked in a long line on the north side of lake.

Simultaneously, the 500-caribou herd, standing in the water, simply walked straight into deeper water and swam directly across the inlet, from the peninsula to the eastern shoreline (Photo 16), toward the larger herd we were watching. One of the monitors said, *"that must be an experienced cow leader, because she swam right across the lake; an inexperienced cow leader would walk around [the bay]*." The herd swam across and walked rapidly uphill from the lake. They passed the monitoring team and moved toward the hilltop in a northerly direction toward the other herd. Later, the herds merged as they walked along the eastern shore of Kokètì. When the weather changed, the two herds synchronized.

The two cows walking on the high ground above the large herd apparently assessed the approaching weather system and decided to move their herd further north. They seemed to communicate with the cow leader in the 500-caribou herd, who was standing in the water, and so the experienced *ekwǫ̀ akwe etłee* (caribou leader) led her group straight into the deep water and across the inlet; a shortcut, to quickly

follow the other herd on the high ground above the lake. The harvesters explained that "*when the weather change, ekwǫ̀ akwe etłee communicate with each other on where and when to go*." The synchronized movement of the two caribou herds demonstrates the fascinating depth of the knowledge expressed by caribou, and specifically for *ekwǫ̀ akwe etłee*. *Ekwǫ̀ akwe etłee* recognize animals moving across the landscape —humans included—and communicate with each other over long distances (TRTI 2016).

One member of the monitoring team—an elder—observing the two herds' synchronized movement, explained that the leader communicates with her mind, using "*one spot on front of their mind, that's how they communicate; the writing on front of the antler. No one knows what those lines means. The priest tried to read [the lines], but he couldn't understand it, only God knows*." Photo 50 shows the writing on the front of the caribou skull.

Photo 50: An elder shows the "writing" on a caribou skull.

The transmission of knowledge for the entire herd occurs between adjacent cow leaders. A herd's behavior, then, signals to other groups across the landscape events happening in that location. Tłı̨chǫ traditional knowledge, documented in the Tłı̨chǫ Research and Training Institute TK study, "We live here for Caribou" (2016: 36), uses the term *ekwǫ̀ wınì ıłè zǫ lanì,* referring to the wisdom of caribou, to explain such observations. The term means, *"all caribou have one mind;*" and indicates the ability of herds separated by kilometres to *"know"* the actions taken by other groups. The term also includes the sensory capacity of caribou to detect weather changes and conditions on their trail (TRTI 2016: 36).

The Bald Eagle: A New Predator on the Bathurst Summer Range

According to the traditional knowledge of current residents of Kokètì, bald eagles (*Haliaeetus leucocephalu*) were never seen in or around the lake prior to 2005. To our knowledge, the first recorded observations of bald eagles in the area occurred in the summer of 2005.

In 2018, the teams saw a total of 22 eagles; seven were confirmed bald eagles, while most eagles were observed soaring high and so identification was almost impossible. Only one eagle was confirmed to be a golden eagle. The first observation of a bald eagle on July 16th was a juvenile eagle flying toward the Lupin mine. Another eagle was observed flying high over the mine site, possibly related to the juvenile first observed. An eagle family group could potentially build a nest on the tall buildings at the site. Another juvenile was also observed near Fry Inlet on July 26th.

The open barrenland landscape around Kokètì is characterized by extensive aquatic and fish habitats, with a general lack of tall vegetation and/or vertical cliffs. This environment is not an ideal bald eagle breeding habitat becauseeagles prefer to build their nests in tall vegetation—such as trees—often as early as February, in more southern environments. The terrain surrounding Kokètì lacks tall trees and—for the most part—tall cliffs, and is characterized by lower arctic climatic conditions, which often see no waterbody surface melt until late June. A warming climate, earlier snow melt, and therefore the earlier availability of open water and more prey have the potential to create new opportunities for bald eagles in the area. The frequency of new observations and the IQ of local Inuit, which says that eagles have never existed here imply that the new appearance of bald eagles in the area shows an expansion of its summer range.

Photo 51: Bald eagle on lake ice eating scraps of caribou hide. Kokètì, July 2nd 2018.

Prior to observations of bald eagles at Kokètì, the northernmost border of the breeding range and most of the summer range was thought to generally follow the treeline from the northwestern corner of the Northwest Territories to the southern border of Nunavut and the NWT. The repeated observation of juvenile bald eagles over the past two years strongly indicates that the bald eagle may have moved its breeding range north of the treeline, and much further north onto the barrenland.

Expansion of the bald eagle on the summer range and possibly further north to the post-calving ground of the barren-ground caribou adds a new predator for the barren-ground caribou. On the Bathurst range, a new predator adds pressure to an already direly stressed herd. The remaining questions are how far north their summer and breeding range expanded and how extensive bald eagles prey on barren-ground caribou calves.

Recommendation 3: Climate Change Commitments

The results from three years of TK monitoring of the Bathurst caribou summer range have identified and documented substantial effects of climate change on caribou habitat: permafrost thaw resulting in melting eskers; the disappearance of summer snow patches, couple with early spring melt; the northward expansion of new species; and changes to caribou behaviour which include prolonged periods of cooling down in water; circular movements of herds; and continuous running to avoid excessive insect harassment.

The Ekwǫ̀ Nàxoède K'è program recommends that Canada and the Government of the Northwest Territories continue to uphold their national and international climate change commitments, including but not limited to the United Nations Framework Convention on Climate Change Paris Agreement (2018). The goal of the Paris Agreement is to keep global temperatures from rising more than two degrees Celsius. However, Canada's arctic is predicted to warm at twice the rate as the rest of the world, and irreversible effects of climate change are projected to intensify. For Canada's barren-ground caribou herds it is critical that actions are taken immediately to reduce further impacts on caribou habitat.

The use of a multi-level approach considering the rights of indigenous and all northern people will be key features of any successful resilience strategy. Such approach includes reducing carbon dioxide emissions to decrease arctic warming, maintain carbon storage areas intact, and reduce climate-related effects on the land, wildlife and people.

Bathurst Caribou: Summary of Observations

We observed 141 groups of caribou with a total estimate of 38,886 animals. (This is not a herd population count; many herds were observed multiple times and counted repeatedly). The herds were observed between July 19th and August 27nd, following migratory routes and water crossings around Kokètì and Fry Inlet (see Map 5). Caribou were sighted almost every day throughout the six-week monitoring period. Observed group sizes ranged from one caribou to large herd estimated at ~10,000 caribou. A majority of the larger herds, i.e., herds ≥ 1,000 animals, were observed between the 11th to the 18th of August. Individual animals or small herds were frequently observed throughout the six-week monitoring period. (See graph 1).

Of the 141 groups observed, 117 groups were considered good quality observation where caribou were relatively close and observers watched the caribou for sufficient time to make accurate annotations on herd composition, behavior and health. The remaining 24 group observed were lower quality observations primarily due to distance, which was up to several kilometers away; which was too far to make accurate estimations and assessments. The 24 low quality observations comprised an estimated 28,325 caribou and had an average group size of 1,180 animals; these observations represented most of the caribou seen (73%). In comparison, the 117 good quality observations had an average group size of 90 caribou and comprised 10,561 caribou (or 27% of the total numbers observed).

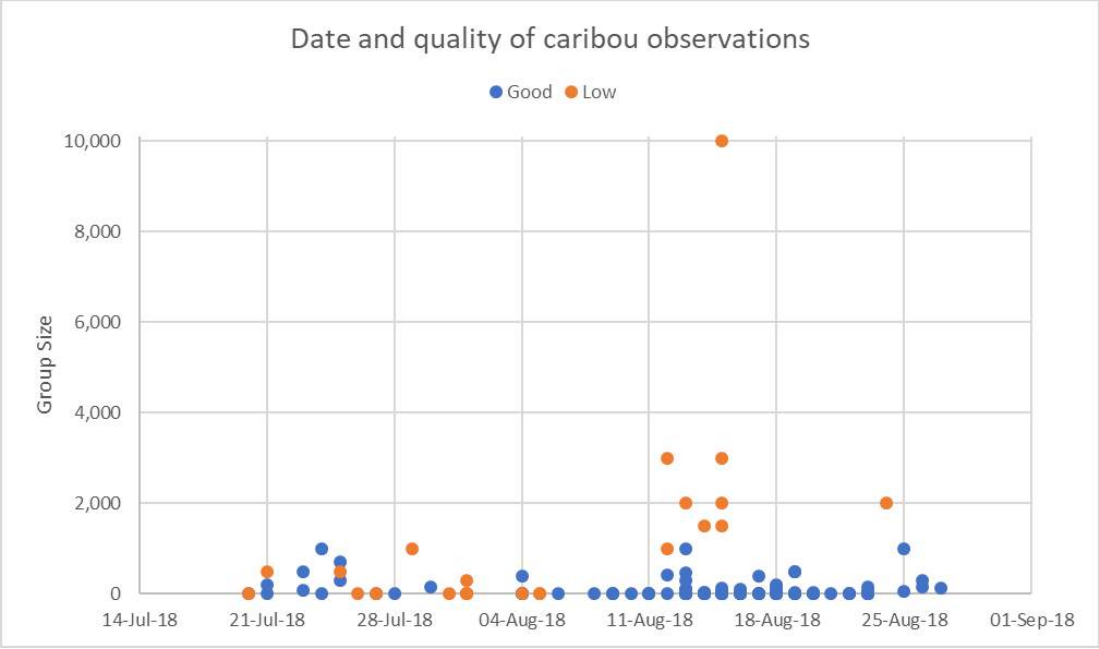


Figure 6: Date and quality of caribou observations

Herd Composition: Calf-to-cow ratio

Of the 117 good quality observations, 52 groups (a total of 5742 caribou) had at least one mature cow by which we can estimate a calf-to-cow ratio of the groups observed.

- Of the 52 groups, a majority of the groups observed (20 groups) did not have calves. These groups were characterized by comparatively small group sizes from single animal to 150, and comprised 5.5% of caribou observed (323 animals).

- 18 groups had a low number of calves. These 18 groups were 39.2% of the caribou observed (2253 animals).
- Seven groups were classified as having a normal number of calves. Based on the estimated number of caribou, these seven groups comprised 47.5%, most of the caribou observed (2,726 animals).
- Seven groups had a high abundance of calves. These groups comprised 7.7% of the caribou observed (441 animals). On August 15th, we observed one cow with two calves, possibly twins.

In summary, a majority (38 groups) of the 52 caribou groups observed had few or no calves, while 14 groups had normal to high numbers of calves. However, the 14 groups comprised 55.2% of the caribou observed and the 38 groups comprised 44.8%.

Relative Calf Abundance *	No. of Groups Observed	Percent (%) of Groups	Average Group Size	Minimum Group Size	Maximum Group Size	Total Caribou Observed	Percent (%) Caribou Observed
None	20	38.5%	16	1	150	323	5.6%
Low	18	34.6%	125	3	1,000	2,253	39.2%
Normal	7	13.5%	389	3	1,000	2,726	47.5%
High	7	13.5%	63	3	300	441	7.7%
Sum	52	100.0%				5,743	100.0%

* To estimate the amount of calves in the herd observed (relative calf abundance), the caribou groups were ranked based on the following criteria:
High: 1:1 cow to calf ratio - when every cow has a calf - and when 1 out of 10 cows has twins.
Normal: 2/3 of cows have calves and approximately 1/3 dry cows.
Low: 1/3 of cows have calves and approximately 2/3 dry cows
None: no calves in herd.

Observations of herd composition during the summer of 2018 were unlike the two previous years. In previous years, the herds contained a high and normal amount of calves. During summer 2018, the majority of the herds observed contained low numbers of calves. The monitors reported a less than normal amount of calves in the smaller herds, and several large herds contained normal numbers of calves.

The herds observed contained a high number of yearlings. The higher proportion of yearlings observed in the herd is the direct result of the amount of calves observed during summer of 2016 and 2017. The calves observed in those years have grown to yearlings this year. These young adults are two- to three-year-old animals who have not yet reached maturity and cannot become pregnant this year. In 2019 or 2020, these young adults will have reached maturity and can become pregnant. The number of herds observed with fewer calves but a higher number of yearlings reflect the observations of the previous two years. Additionally, all the cows in the herd do not always become pregnant and produce a calf each year. Each year, there are a number of females that do not conceive. The local harvester explained;

"every two to three years we see an influx of calves. The cows don't always have a baby every year."

Many of the calves born this year are exposed to injuries when the large herds run over rocky terrain and during watercrossings. Calves are also killed by predators, such as wolves, eagles and bears, as the herds walk from the calving grounds to the summer range. Local harvesters said that predators, such as wolves, hunt many calves during the summer. The harvesters noted that there are a high number of wolves on the summer range, as few people are harvesting wolves in the area anymore.

Photo 52: calves weaning from their mothers during high insect harassment. July 23rd.

Herd Health: Observation Summary

Of the total of 141 caribou group observations, we observed and commented on health of caribou in 36 groups. Of the 36 groups observed, seven groups (19%) had at least one injured caribou, while the other 29 groups (81%) noted that all caribou observed were normal and healthy. In the seven groups where at least one injured caribou was observed, we noted a total of 13 individual caribou (four bulls, three cows, two calves, and four unknown) had an injured leg, which was very evident as they walked. For these seven groups, the sum of caribou observed was 2,541 animals. The average group size was 363 caribou. In the 29 groups of caribou in which observers noted that all caribou were healthy, the average group size was 73 animals and the sum of caribou observed was 2,131.

Appendix 2, contain details of caribou health conditions and observed injuries.

Predicted Health in July and August

We estimated caribou health by assessing: (1) thinness, fatness and overall body condition; (2) coat (pelage) conditions, (3) walking posture and (4) amount and type of injuries. Prior to observations in the field, the team set up descriptions of anticipated caribou health conditions for July and August (TRTI 2017).

Variations exist in relation to the exact timing of post-calving and summer movements, and the statements provided below were used as guiding principles of expected conditions based on the elders' knowledge.

- In July, the animals do not have excessive body fat. During the post-calving movements, caribou congregate in large herds, travelling extensively in relatively high temperatures and spurred on by biting insect harassment. The large herds spend much time walking and running and less time foraging and resting. The herds are mostly grouped together as tight units as they move over the land.

- In August, the large congregations of caribou split into smaller herds. As temperatures and insect harassment decrease, caribou run less, and tend to settle down in areas to properly forage. This is the time when caribou start to accumulate fat. Bulls will start to get fat "*after their bone marrow becomes good*." Large fat reserves start to become visible on their back, from the rump to the neck. In general, when the animal has a short tail, it is an indication that the animal is fat and has larger fat reserves on the upper part of its hind legs and rump. These large fat reserves often become heavy for the animals.

- At the end of August and into September the pace and progress of the migration is influenced by the weather. Caribou know that winter is soon approaching and are actively feeding prior to the rut.

Observed Caribou Health in July and August

We observed the overall health conditions of caribou in relation to the indicators described above. The Bathurst herd showed signs of strong and normal health conditions between July 21st and August 26th. Injuries were the only health issue observed, although few animals, a total of 13, were injured.

In 2018, cold and rainy conditions throughout July and August resulted in low insect harassment and more time for foraging and resting. Resting behavior such as resting into the wind and lying down, and calmly grazing and walking around was noted as occurring earlier due to weather. These resting periods are essential to the animal's fitness. Colder and rainier weather conditions also resulted in bulls gaining fat reserves earlier in the year (immediately following snowmelt) thus anticipating and partly avoiding the period of high- insect harassment, where energy expenditures increase. With the continuous cold temperatures, the bulls had more time to build up fat reserves without the need to continuously run from biting insects. Thus, bulls started to accumulate fat reserves on their rumps and lower back earlier in the season, in mid-July. The bulls were observed to be fat and healthy, and they started to grow large antlers earlier than in other years. Many bulls were also observed with black-coloured antlers, which is a sign of a healthy animal. A harvester stated "*bulls get fat easily this summer, they are more fat compared to last year [2017]*".

Cows were observed to be in normal condition, for the time of year. Unlike bulls, cows were not fat and some cows were observed as *"skinny*," but not undernourished, which is considered normal for the season. The elder noted that its "*not time for [cows] to get fat yet, in August/September they start to get fat."* The dry cows (cows that did not conceive) are usually gaining fat earlier than cows which gave birth.

By August 5th, however, all caribou observed were starting to accumulate some fat reserves, and the elder noted *"caribou starting to get fat now".*

The herds observed all travelled rapidly over long distances, which is a sign of strong health and fitness to be able to maintain such pace over time. During long migrations, the herds were mainly walking as a tight groups, which only dispersed while slowing down to feed in meadows or other preferable forage areas. Herds observed at the naɔokè between Kokètì and Fry Inlet maintained a fast pace from the crossing to the high hills to the northwest.

All the animals were observed to be foraging constantly, except during fast-paced migrations. They appeared stressed only during times of high biting insect harassment. During such times, cows were observed shaking their bodies constantly, stomping their feet in water, and tossing their heads up and down. Bulls were observed using their antlers and feet to scratch their bodies.

Hide Colour

The caribou retain their winter coats into mid-July. The winter coat is characterized as long and bleached-white hair that appears increasing ragged and patchy as it is shed to reveal the summer pelage underneath. The winter coat started to fall off in early July and many animals appeared ragged. Caribou lose their winter coat while swimming, and when they come up on shore, they shake their bodies to lose their winter hair. There are not many large *nǫɔokè* between the calving ground and Kokètì, so the herds do have not many opportunities to shake of their winter hair until this point. Heavy rains will also make the winter hair come off.

From a distance, the herds appeared light grey and white from the colour of their winter coats. It appears that a caribou with its winter coat is less affected by mosquitoes and insects compared to animals with new summer coats. By the last week of July, most bulls had shed their winter coats, and have dark brown or black-coloured new hides. One bull observed on July 27th had lost its winter coat, with only few white hairs sticking out on its back. By the first of August, almost all animals, cows and bulls, had shed their winter coats and appeared to have dark new summer pelage. Several bulls shed their winter coats earlier than the cows and yearlings. The bulls' hides show clear, dark brown pelage underneath their white winter hair. The calves appeared to have healthy and clean hides, and the hide colour varied between reddish-brown and light brown.

On the new and clean summer coat, one can notice the individual characteristics of each animal, such as the white and black stripes on the lower side of the stomach of a female yearling we observed, and the white stripes against the black new hide alongside the stomach on a young bull. These stripes are their birthmarks and the caribou will have the same stripes on its hide as its mother.

Walking Posture

The herds observed walked in tight groups. During migrations, caribou only spread out when the pace slows down over meadows and muskegs, or when the animals collectively stop for brief pauses to feed before continuing to walk. No animals were observed lagging behind the main group, or as being unable to keep up the pace. The same observations were made while the herd swam at nǫɔokè. The caribou

leader waited by the shoreline until most cows, calves and bulls had joined, before entering the water and swimming across herself. While in the water, the group stayed close together, often with cows and calves in the front, and bulls in latter parts. Few individuals, often cows with calf, were observed trying to "catch up" with the group. This occurred often as a calf wandered off and the cow waited for her calf to return. The individuals would eventually catch up with the larger herd. This also occurred during the crossing of *nǫɔokè*, as on July 21st, a cow and calf appeared at the crossing two minutes after main herd and swam as fast as possible to catch up with the group. In other instances, yearlings ran after the herd, and eventually caught up. At times, herds started to walk off while individual animals were not aware, and so were left behind. On August 5th, four yearlings appeared at a nǫɔokè few minutes after the main herd had crossed. The yearlings were strong and healthy, as demonstrated by their fast pace. The yearlings, inexperienced on the migration route, appeared unsure of where exactly to enter the water and ran back and forth on the shoreline instead of entering the water at any spot to reach the other side.

Islands, Peninsulas and Water; a Refuge for Injured Caribou

The potential for injuries during the caribou migration is high and injured animals utilize strategies to heal themselves. Animals can sustain minor injuries to their legs when walking through boulder fields, especially when rocks are slippery from rain, or while walking through submerged rocks at a watercrossing, which is why they prefer sandy bottom. Some animals can sprain their ankles, as dogs do—an injury that will heal itself after a few days or weeks. A caribou with such an injury can chose to settle into an area, such as at a point, peninsula or island—a refuge area close to water, where they will wait until the injury has healed itself. Once the injury is healed, the animal can rejoin the herds. By staying close to water, an injured animal can, if approached by a predator, get into the water and outswim any predator.

Photo 53: bull's antlers visible above the vegetation.

On July 25th, we observed a bull with an injured back leg. The bull was standing by itself approximately one kilometre from the larger herd that was moving north along the shoreline. The bull was standing ten metres from the water out on a small peninsula, on the eastern shore of Kokètì. The bull was grazing and facing away from the monitoring team, who were sitting in a boat at 50 metres distance. The bull had settled in on the peninsula to heal its back leg.

Three days later, on July 28th, the team approached the peninsula again. Only visible above the yellow muskeg was its set of dark brown antlers (photo 53). After a while, we could see the antlers moving—the same bull was alive and well. He had been resting and healing his leg at the exact same location for four days. While observing, a local harvester mentioned that he had observed "*in Sun Bay, a caribou stayed like that [on a peninsula] for three weeks*." The example of this bull, seeking out a safe location to heal himself, demonstrates the personal agency of the animal to know how to heal itself, by minimizing its movement thus possible further injuries to its leg, while staying on a peninsula where the caribou can easily avoid predators by access to the lake.

Recommendation 4: Increase Awareness of Status and Management of Barren-Ground Caribou

The Ekwǫ̀ Nàxoède K'è program recommends that continuing efforts be made to increase awareness among harvesters, communities and the wider public about the status of NWT caribou herds, the need for conservation actions to promote recovery, and how people can contribute to conservation. Information on the status and management of the barren ground caribou herds, and specifically on the Bathurst herd, needs to be provided in appropriate ways and on an on-going basis to harvesters, elders and other community members.

The following actions are recommended to increase public awareness and hunter education:

- Continue to work closely with the communities, and in particular, with schools, to promote Indigenous laws and respect for wildlife. Topics include how to prevent wastage, and harvest of other animals, rather than caribou, for subsistence,
- To use various media channels, posters and road signs to better inform the public about respecting wildlife and wildlife habitat, traditional hunting practices, wastage, poaching and promoting harvest of bull caribou.
- Invite elders to work with the youth to teach cultural protocols towards caribou and the land, including respectful hunting practices, proper meat preparation, and traditional knowledge of caribou.
- To introduce caribou, and related themes such as cumulative impacts, as subjects in regional schools and northern studies programs.

Summary

During fieldwork in July and August 2018, the team members of the Ekwǫ̀ Nàxoède K'è program watched Bathurst caribou herd on their summer range around Kokètì for six weeks. The overall fitness of the herd was noted as good to normal due to a cold and wet summer, which resulted in many caribou—and especially bulls—becoming fat earlier in the season due to less insect harassment and good forage conditions. Of the thousands of animals observed, a low number of caribou (13) were seen injured.

Fewer calves than during previous years were observed. Of the 52 groups of caribou observed with cows, 38 groups had few or no calves, while 14 groups had normal or high numbers of calves. By contrast, we observed several herds with high numbers of yearlings, one-year-old caribou who are not yet mature enough to have calves, which correlates with the high amount of calves observed in 2017. The high number of yearlings suggesting a high rate of survival over the winter of 2017/2018. Observations during upcoming field season will show if the calf abundance has increased as yearlings mature.

Other wildlife observations included 16 wolves, 10 grizzly bears, three wolverines and 22 eagles. No direct predation on caribou was observed; however, wolves and eagles were seen in close proximity to the herds. One eagle was seen flying towards a calf, apparently attempting to chase the calf, but the chase was unsuccessful and quickly ended. More eagles were observed this summer than in the past two years. One wolf was observed waiting at a *nǫʔokè*, ready to attack if a caribou arrived. Three wolverines were observed, compared to zero observations of wolverines during the previous years. All predators were healthy with no injuries or health issues noted.

Tłı̨chǫ and Inuit harvesters observed direct evidence of climate change throughout the three years of the Ekwǫ̀ Nàxoède K'è program. These included: 1) melting landforms; 2) earlier disappearance of summer snow, and 3) the appearance and consistent increase of bald eagles, a new predator of barren-ground caribou calves. In addition, the monitors observed caribou engage in new types behaviour, such as moving in circles and standing in water to minimize heat and insect harassment. According to the monitors, these behaviours are "*new habits to cope with climate change and the higher insect harassment than previously".*

The teams emphasized the significance of the *ekwò naʔokè* between Kokètì and Fry Inlet to sustain a healthy regional ecosystem, and how the presence of indigenous people in caribou habitat has important implications for the prolonged sustainability and balance of caribou populations, predators, and indigenous cultures. Based on the three years of watching the Bathurst summer range, the program set forth four recommendations:

Recommendations

1) protect caribou habitat by establishing a Bathurst Caribou Habitat Protected Area;
2) support land-based activities such as wolf harvesting on the barren-ground caribou core use area;
3) actions on climate change; that territorial and Canadian government continue to uphold their climate change commitments to reduce the impacts of arctic warming on the land, wildlife and people, and;
4) increase awareness of status and management of barren-ground caribou to promote recovery of the barren-ground caribou herds.

Future Research and Monitoring

In upcoming field seasons, the program will continue to monitor:

- health and composition trends of the Bathurst herd,
- the effects of climate change on habitat and caribou behaviour,
- impacts of industrial development on caribou habitat, and
- relationship between caribou, wolves and indigenous harvesters.

We suggest that further research related to caribou decline, required outside of this program, and on specific topics should include:

- Study the link between the decline of caribou and challenges to sustain culture, language and way of life for Tłı̨chǫ and other indigenous peoples.
- Examine the link between the inability to hunt caribou and food security concerns in Tłı̨chǫ and other indigenous communities.
- Research how the loss of the cultural practices associated with harvesting, meat processing and hide preparation, and the loss of opportunities to pass on the knowledge, language and culture to younger generations is affecting the social and cultural trends in northern communities.

In closing, it is important to emphasize the impetus behind the Ekwǫ̀ Nàxoède K'è program. The program has given participants, old and young, the opportunity to live in close contact with caribou for weeks on end and therefore gain important and direct experience with this animal. This program has, however, also been an emotional journey for many harvesters. While happy to see caribou, all felt the visual impact of lower populations number than ever; others felt nostalgia and sadness on the lost opportunity for their kin and youth. On the last day of three weeks following the caribou herds around Kokètì, the researcher asked the elder Joe Zoe if he was happy to see caribou. Joe responded, *"how can I be happy, when my wife and kids back home are hungry."*

Photo 54: Base camp close to naɔoke between Kokètì and Fry Inlet.

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Appendix 1: Observation on Vegetation and Caribou Forage

18th July, John Franklin Koadloak camp, Northwest Contwoyto Lake

- Vegetation shows good condition; not dry, and the previous day's rain has made it moist and soft.
- The grasses in the muskeg and leaves on dwarf willows are bright green, moist and soft.
- The caribou lichen is soft and moist, not crispy and dry.
- Snow patches: Two snow patches are visible on hills on the north and northeast side of Contwoyto Lake. They are located in crevasses and bottoms of steep cliffs and hills; in areas where snow and ice has accumulated over winter.

20th July, Kuniks bay, western shore, Contwoyto Lake

- Vegetation show strong green colour and is moist.
- Most lichen observed remains moist from recent short rain showers.
- On the sloping sides of eskers, the lichen starts to dry up, but in the valleys, and on flat ground the vegetation is moist and good condition.
- Sedges in the muskeg and leaves on dwarf birch bushes are green and in good condition.

July 21st, eastern shore of Fry Inlet

- Overall the vegetation is moist and soft, from recent rain showers.
- Lichen is not dry and crispy. It is soft and very moist.
- "Good feeding for caribou here on east side of Fry Inlet".

July 22nd, southwestern side of Fry Inlet

- Vegetation is green and growing well.
- Lichen is moist and healthy. The lichen grows well with lots of rain and cold temperatures.
- "Good feeding for caribou."
- In sheltered areas and by small streams, the willows and the dwarf birches are growing high: over one metre tall in a few areas on the southwestern side of Fry Inlet.

July 23rd, eastern shore of Contwoyto Lake

- Sedges and grasses are moist and healthy from recent rain.
- Lichen not dry from sun and heat yet.
- Caribou are feeding well on sedges and grasses in the muskeg.
- By the shoreline, the water is brown and muddy from a large caribou herd standing and wading in the shallows. When the herd walks away, the vegetation is trampled and grazed on. The water is full of white hair, from the caribou's shedding winter coats. Large clumps of hair are scatted over the water and all along the shoreline.
- First observation of blackflies

New grass growing; moist from recent rain, eastern shore Contwoyto lake, July 23rd 2018.

July 24th, eastern shore of Contwoyto Lake, north side of bay.

- Strong sun and high temperatures over the previous three days have dried the lichen on the tops of hills.
- Leaves on dwarf willow are green and healthy.
- Strong winds make the vegetation and leaves soft on the hilltop where the caribou eat.

July 25th, eastern shore in Campsite Bay, west side of Contwoyto Lake

- Vegetation is becoming dry from the last four days of sun and high temperatures.
- Four days since the last rainfall and the lichen is dry and crispy.
- The grasses, sedges and leaves on the dwarf birches are still moist and green, and are "good for feeding".
- The blueberries are not ripe yet. In 2017, the blueberries on the eskers were ripe in mid July, in 2018, the berries will ripen two weeks later than in 2017.

July 26th, northwest side of Fry Inlet.

- Five days since rain, and lichen is dry and crispy. The moss is drying up and cracking in patches.
- Leaves on the dwarf willow are healthy and green.
- Birch willows grow throughout this area; they are not ideal forage for caribou, who prefer lichen, grasses and sedges.
- Large weather system moving in from the north. Large, dark clouds, and thunder.
- Mosquito harassment is intense before the thunderstorm. More mosquitoes are more active than the research participants can remember ever having experienced. The mosquitoes landing on the tent sound like rain falling. Intense buzzing around the tent.

July 27th, esker west of Fry Inlet:

- Vegetation healthy after rainfall today and on the previous day.
- Lichen is moist from rain. Not too wet, but soft on eskers and high ground where the caribou bull was grazing.
- Grass, sedges and willows looking healthy after the rain.

Caribou bull feeding well on grass and dwarf birch on esker, west of Fry Inlet. July 27th 2018.

July 28th, eastern shore of Contwoyto Lake, Campsite Bay.

- Vegetation and ground is wet after rain.
- Lichen looks healthy and moist.
- In the muskeg, the grasses and sedges are green and fresh.

July 29th, southern end of Contwoyto Lake

- Vegetation is wet and moist from the rain previous two days' rain, on July 27th and 28th.
- The lichen, grasses and sedges are healthy.
- On the south side of Contwoyto Lake, taller, yellow grass grows on hilltops and eskers. This type of tall grass is not ideal forage for caribou, but other animals, such as muskox, can feed on this type of grass.
- Blueberries are starting to ripen.
- "When caribou eat lichen, they mix eating lichen with grass and sedges."

July 30th, southern end of Contwoyto Lake

- Vegetation looks healthy and moist.
- Lichen is starting to dry up; not crispy.
- On islands south of Contwoyto Lake, the grass grows high and there is not much lichen for caribou to feed on—mostly tall yellow grasses, and not much forage for caribou otherwise.

July 31st, esker west of Fry Inlet

- blueberries are ripe now, alongside and on top of esker.
- Good and moist conditions.
- Grass and leaves on dwarf birch willows are green and healthy looking. Lichen is not crispy.
- Lichen is becoming dry, but not yet crispy; still good feeding for caribou.

August 3rd, Sun Bay, northwest side of Contwoyto Lake

- Several snow patches still visible.
- Cold summer season, lots of water from rain on the land. "This is good for vegetation."

August 4th, western shore of the south end of Fry Inlet. Near rocky *nǫɔokè*.

- Green leaves and grasses; healthy.
- The recent rain has made the vegetation moist and wet.
- "Good feeding for caribou here."
- "They just eat a little bit at a time. They keep eating and eating but just small pieces at a time."

Berries ripe second week of August, August 14th

August 6th, west of *naɔokè*, Fry Inlet.

- Berries on top of esker are completely ripe now after heavy rainfall last night and today.
- Lichen is moist, not dry and crispy.
- Grasses and leaves are green.
- Good feeding for caribou.

August 12th, Shallow Bay, west shore Kokètì

- Vegetation is well hydrated and not dry or crunchy. Due to several days of heavy rain some areas are flooded.

August 13th Shallow Bay, west shore Kokètì

- The vegetation is lush and hydrated from recent rain.
- "Lots of rain this summer".

August 22nd, Fry Inlet camp

- First snow of the season.

Appendix 2: Observations of Injured caribou

Date	Health Comments (Groups with at least one injured caribou)	Herd Composition	Group Size
23-Jul-18	Healthy animals in herd, and healthy calves. Winter coat is on most animals, looks as their bellies/stomachs are big, from eating well and by the thick winter coat. Several bulls have big antlers, mainly black healthy color, other few animals have grey and light grey color. Bulls are healthy body conditions, as they already, early in season, grow big large antlers. Bull are fat, with "nice round rump" - John Koadloak. Some cows are skinny, but it it's not their "time" to get fat yet. One yearling is skinny. Four animals injured: 1 bull injured front leg, 1 cow injured left leg, 1 bull injured front leg, 1 injured calf, back leg. Calves are healthy, and weaning from their mothers. many calves are reddish color hide. Most animals wear winter coat. From a distance, herd look light grey/white color from the color of winter coats. Some has full winter coat, white color coat. Caribou with the winter coat suffer less from mosquitos now. A cow with winter coat is less bothered by insect compared to others around her with less winter coat. 1 cow has hard antlers, with no velvet. This is the same antler that she had last winter.	Herd is mix of 50% cows and 50% bulls. Normal amount of calves in the herd – "lots of calves".	500
25-Jul-18	1 bull: injured back leg. Standing by itself 1km south of main herd close to the shoreline on a small peninsula. Bull rested on peninsula to heal the leg. Half of calves has shed winter coat and developed new hide. Most of yearlings lost winter coat, and grown new coat, appear most black color hide.	Mix of 50% cows and 50% bulls. High and normal calf population.	700
25-Jul-18	All animals healthy. Injuries: 1 cow injured, 1 calf injured front right leg. Bulls are in good health, many bulls with black and dark grey antlers. Many bulls have shed winter coat, and have dark brown, black new hide.	mainly cows and calves.	300
28-Jul-18	Injured bull, seeks refuge on peninsula. He has been resting and healing in the same location for 4 days.	Bull	1
13-Aug-18	a few injured	a few calves	1,000
17-Aug-18	1/10 is injured	5 young bull, 5 cow	10
18-Aug-18	1 injured limping left arm (cow)		30
		Sum	**2,541**
		Average	**363**

Appendix 3: Observations of Caribou Health

Date	Health conditions (Healthy caribou groups)	Herd Composition	Group Size
21-Jul-18	Healthy body conditions. Hide is shedding.	cow yearlings: 2-year-old animals. No calves	2
21-Jul-18	All animals – healthy body conditions. No visible injuries. The herd is healthy, and walk in fast pace. Half of the bulls have black antlers (sign of fat and healthy animals).	Mainly cows, bulls, and yearlings. 3 calves in herd. Most cows without calves.	200
23-Jul-18	Animals in the herd is healthy, and no visible injuries. Herd keep fast pace so must be healthy. The herd walk in fast pace from no'oke and up the hillside. Walk in fast pace straight into northwest wind. Run fast across the meadows. The cow leader is walking a few metres in front of the herd.	Mainly cows in the herd. Fewer bull than cows: 30% bulls – 70% cows. 10-	90
24-Jul-18	Healthy animal, no injuries. Winter coat is on, few pieces of hair has fallen off. "not time for animals to get fat yet". Still early, in august/September they start to get fat" - Joe Zoe.	yearling, cow.	1
24-Jul-18	Calves are healthy, and have light brown color hide. Healthy animals, all eating well on hillside. Most animals in winter coat. 4 inured animals: 1 cow inured front leg, 1 cow injured front leg, 1 cow injured, 1 bull injured	Mostly cows, fewer bull in herd. most bulls in centre of herd or on top	1,000
27-Jul-18	Healthy animal, with fat reserves building up on rump and on lower back. Fat starting to accumulate on its back. Starting to get fat now end of July. He eats good on side of esker. "really healthy caribou", "nice shape, fat rump" John Koadloak. Mostly lost its winter coat, still few white hair on its back sticking out. Starting to grow beard/mane. Brown back, black belly and white mane.White strip on side of the belly, against the dark brown hide. The stripes are his birthmarks. He will have the same stripes as his mother.	bull	1
30-Jul-18	All animals are healthy body conditions, "good shape animals". calves are healthy. Most animals shed their winter coat.No injuries visible. No animals lagging behind as herd moves. All animals run is fast pace, sign of good health. "they leave no one behind, they go together in one group. One full house!" Joe Zoe.	First part of herd: 7 dry cows with no calves, walking ahead of larger group. Many dry cows in the herd. 1/3 bulls and mostly cows, with very few calves. 50% of herds	150
04-Aug-18	Healthy animals, not fat, but not skinny, no injuries, in good shape.	4 cows and 2 bull, yearlings, and with no	6
04-Aug-18	All animals are healthy, everyone swim fast pace, no lagging behind.	More bulls in herd, fewer cows. Mostly yearlings, and very few calves. The first 25 cows in the herd have no calves. "Not much calves, mostly	400
04-Aug-18	Healthy animals, run fast and are in strong shape. No fat, but not skinny, in good normal shape for this time of year. Two cows with dark new hide, and one cow with white winter coat.	3 cows, 1 bull – all yearlings, no calves.	4
06-Aug-18	All healthy animals, no limping, no visible injuries. They walk in fast pace over long distance and up hillside, must be in good shape. New dark summer coat. "caribou starting to get fat now" Joe Zoe.	One bull, two cow: one of the cow is a yearling.	3
08-Aug-18	The caribou looks healthy. He was foraging in the valley on the esker. Dark color hide and white beard. Coat looks smooth, uniform in color	1 bull	1
12-Aug-18	healthy	1 cow	1
13-Aug-18	healthy animals	young bulls	7
13-Aug-18	healthy	cows	8
14-Aug-18	Mix of dark and light caribou. Healthy		40
15-Aug-18	Healthy	1 calf	26
16-Aug-18	healthy	all bulls	3
17-Aug-18	healthy	0 calf	1
18-Aug-18	healthy		1
18-Aug-18	healthy	2 cow and 1 calf	3
19-Aug-18	healthy		11
19-Aug-18	healthy		2
20-Aug-18	healthy summer coat	5 young cows	5
22-Aug-18	healthy	bulls	4
23-Aug-18	healthy	bulls	9
23-Aug-18	summer coat and healthy	young bull	1
23-Aug-18	summer coat and healthy	young cow	1
26-Aug-18	healthy	No calves	150
		Sum	**2,131**
		Average	**73**

Tłı̨chǫ Government
Culture and Lands Protection

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