# Ekwǫ̀ Nàxoède K'è

## 2019 Results

**Tłı̨chǫ**
**Traditional Knowledge**
**and Land Use Study**

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

2020

# Ekwǫ̀ Nàxoède K’è - Boots on the Ground

---

## 2019 Results

# 2019 Results

**2019 Field Team:** John Franklin Koadloak, Mercie Koadloak, Russell Drybones, Leon Ekendia, Bobby Nitsiza, Roy Judas, Mike Simpson, John B. Zoe, Joe Lazare Zoe, Eva Mantla, Peter Huskey, Jimmy P Mantla, Nora Ekendia, William Apples, Archie Zoe, Albina Nitsiza, Jasmine Blackduck, JJ Simpson, Petter Jacobsen, John Nishi and Camilia Zoe Chocolate.

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

**2017 Field Team:** Joe Lazare Zoe, Russell Drybones, Narcisse Rabesca, Petter Jacobsen, Roy Judas, Leon Ekendia, Tyanna Steinwand, Mercie Koadloak, John Franklin Koadloak.

**2016 Field Team:** Michel Louis Rabesca, Moise Rabesca, Sean Richardson, Archie Black, Petter Jacobsen, Domenico Santomauro, Leon Ekendia, Roy Judas, and Jorgen Bolt (Kugluktuk HTO).

**Program Advisors:** Joseph Judas, Joe Rabesca, Michel Louis Rabesca, Tammy Steinwand- Deschambeault and John B. Zoe.
**Communication Advisors:** Rachel MacNeil and Dawn Ostrem
**Research Team:** Tyanna Steinwand, Domenico Santomauro, Camilia Zoe Chocolate John Nishi and Petter Jacobsen.
**GIS technician:** Terrell Knapton-Pain and Michael Birlea
**Principal Investigator:** Petter Jacobsen

## Disclaimer and Copyright



Tłı̨chǫ Government
P.O. Box 412
Behchokǫ̀, NT
Canada, X0E 0Y0
Telephone: 1-867-392-6381
Facsimile: 1-867-392-6389
Photos: J.J. Simpson, John Nishi, Petter Jacobsen, Tyanna Steinwand and John Franklin Koadloak.

# Table of Contents



# Tables



# Figures

## Maps



## Photos

# Tłı̨chǫ Yatıì

## Placenames

| | |
|---|---|
| Kokètì | Contwoyto Lake |
| Kwıìdlìachı̨ı̨ | Fry Inlet (slingshot handle lake) |
| Deèzàatì | Point Lake |
| Ek'atì | Lac de Gras |
| Ek'adìı | Island on Lac de Gras |
| Ewaànıt'ııtì | Courageous Lake |
| Nǫdìikahtì | Mackay Lake |
| Ets'àitì | Rawalpindi Lake |
| Łiwets'aɔòats'ahtì | Lac de Sauvage |

## Geographical Terminology Useful for Caribou Monitors

| | |
|---|---|
| Ekwo Nǫɔokè | Caribou Water crossing (any place animal can swim across) |
| Ekwo Naɔokè | Caribou Water crossing (a place caribou *always* swims across) |
| Tataà | Land between water bodies |
| Whatàa | Esker |
| Hozìı | Barrenland |
| Hozìı Deè | Barrenland; farthest out, "Big barrens" |
| Hozìı shìa | Hill or mountain on barrenland |
| Sih / shih | Hill or mountain |
| Daka | High points |
| Ts'ıwìı | Stands of trees (black spruce) on barrenland |

| | |
|---|---|
| Tì | Lake/water |
| Ta | Water; prefix of a word to do with water |
| Deh | River |
| Taiɔaa | Meandering river |
| Dehti | River lake (a lake in the flow of a river) |
| Dı | Island |
| Tɬ'à | Bay |
| tɬ'ą̀ą | Beach |
| Tabàa | Lake shore or beach |
| ɔehdah | A point of land |
| ʔehdahkw’o | Peninsula |
| Tı k'abàa | Shoreline (walking by the shoreline) |
| Wha | Sand: prefix to do with sand / or a pole |
| Nałeezee | Caribou calving grounds |
| Dechɻlaa | Treeline |
| Chɻk'è | North |
| Sazhɻ/ sazɻ | South |
| k'àbatsǫ̀ǫ̀ | East |
| dą̀ą̀ | West |

## Wildlife Terminology Useful for Caribou Monitors

| | |
|---|---|
| Hozìı Ekwǫ̀ | Barren-ground caribou |
| Kokètì ekwǫ̀ | Bathurst caribou herd |
| Sahtì Ekwǫ̀ | Bluenose-east caribou herd |
| Tǫdzıì | Woodland caribou |
| Ekwǫ̀ łexè k’eɔàa | Caribou herd |
| Ekwǫ̀ akwe etłee | Caribou leader / lead caribou (any sex) |
| Ts’ìda akwe etłee | Cow leader |
| Wedzıa | 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 |
| Tsıa | Caribou calf |
| Ts'ìdaa | Young caribou (2 or 3 years old) |
| Ekwǫ̀ Nàxoèdee K’è | In the migration of ekwǫ̀ |
| Nadeeɔà | Migrating caribou |
| Ekwo na da dii | Caribou left behind during migration: “caribou that go half way” |
| Nììzaa | 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 |
| Ekwo eto | Caribou trail |
| Ekwǫ̀ ek’a | Caribou fat |
| Dìga | Male wolf |
| Dìga dets’è | Female wolf |
| Dìgazha/ Dìgaza | Wolf pup/ pups |
| Dìga wozaa /wezaa | Wolf litter |
| Diga eɔoo | Wolf den |
| Dìga nàdè | Wolves family, community / wolves living together |
| Dìga nàdèe k'è | Wolf habitat |
| Sahcho | Grizzly bear |
| Hozìı edzıe | Muskox |
| Nǫ̀gha | Wolverine |
| Didi | Ground squirrel / barrenland squirrel |
| Dedìı | Moose |
| Kw’ıh | Mosquito |
| Behk’òts’ı̨ą | Arctic tern |
| Tatsǫ̀ gah | Raven |
| Hatsǫ̀ga | Crow |
| Ti tso | Loon |
| Det’ǫcho | Eagle |
| Ets’imbaa | Arctic fox |

## Executive Summary

Ekwǫ̀ Nàxoède K'è (Boots on the Ground) is a *Kokètì ekwǫ̀* (Bathurst caribou) monitoring program based upon the Traditional Knowledge (TK) of Tłı̨chǫ and Inuit indigenous elders and harvesters. The objectives are to monitor the conditions of *Kokètì ekwǫ̀* herd on the summer range, focusing on four key indicators: (1) habitat; (2) *ekwǫ̀* conditions; (3) predators, and (4) industrial development. In 2019, the program watched the *Kokètì ekwǫ̀* summer range over a nine weeks period, from July 3rd to September 10th.

The monitoring teams observed a total of 214 *ekwǫ̀* groups that included a total number of 15,613 *ekwǫ̀*. The sightings represent more of a relative abundance and is not a population estimate, as many of the same groups of *ekwǫ̀* were seen on consecutive days. The overall calf:cow ratio was 31 calves per 100 cows (i.e., 0.307 ± 0.056 SE)., based on 89 groups out of the 214 groups that were used to estimate an overall calf:cow ratio. This estimate indicates a *low* calf:cow ratio, because it suggests that by summer less than one-third of the breeding-aged females had a calf. The low number is a continuation of a negative trend observed since 2018.

Overall, the *ekwǫ̀* observed were in good health, exhibiting signs of good fitness throughout the summer months, as this past summer habitat conditions were characterized as "ideal conditions for *ekwǫ̀*." The lush and productive vegetation, due to consistent rain and soil moisture resulted in plentiful, high-quality forage. Foraging undisturbed by insects on abundant vegetation, bulls were observed gaining fat reserves earlier in the season—in mid-July. Bulls had short tails and levelled backs—signs of fat animals— and grew dark-coloured, large and wide, palmate antlers, in early July, which monitors say happened earlier than in previous years. Few injuries were noted; only 0.2% of the caribou counted were injured.

For the first time, *dedìı* (moose) were observed at *Kokètì.* Eight groups of *dedìı* were observed on separate occasions for a total of 18 *dedìı*. Other wildlife observations include 23 *det'ǫcho* (eagles), 10 s*ahcho* (grizzly bears), three *nǫ̀gha* (wolverines), and a record number of 31 *dìga (wolves)*, including seven pups. This was the highest number of *dìga* observed of all monitoring seasons. In July, *dìga* were sighted almost every second day, travelling either singly or in pairs. Several chases on *ekwǫ̀* were observed by *dìga*, although none were successful. The denning location on the eastern shore of Kokètì increased to two active dens, each occupied with *dìga* pups.

Based on four years of watching the *Kokètì ekwǫ̀* summer range, the program outlines four recommendations.

**Recommendations**

1) protect caribou by establishing a *Kokètì Ekwǫ̀* Habitat Protected Area;
2) support *dìga* hunting by indigenous harvesters on the barren-ground caribou core use area;
3) advance actions on climate change—urge territorial and Canadian governments to commit to climate change action, and;
4) continue zero harvest of the *Kokètì ekwǫ̀* to promote recovery of the declining 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-based 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

> *"We are doing this for the future of our children. We are not only doing it for ourselves, but for the children who are coming along after us."*
>
> Leon Ekendia

Started in 2016, the *Ekwǫ̀ Nàxoède K'è* caribou monitoring program (formerly called Boots on the Ground), has brought Tłı̨chǫ people to the ancestral *hozìı ekwǫ̀* (barren-ground caribou) harvesting locations on *hozìıdee* (barrenland). The basecamp at *Kokètì* (Contwoyto Lake*)*, located in the northernmost region of Tłı̨chǫ traditional territory, is on the summer range of the *Kokètì ekwǫ̀* (Bathurst caribou) herd; the place where *hozìı ekwǫ̀* bring their newborn calves to spend the summer.

The most recent *Kokètì ekwǫ̀* calving ground survey, conducted by Government of Northwest Territories-Environment and Natural Resources (GNWT-ENR) in 2018, estimated a total of 8,200 *ekwǫ̀*; a 98% decline since its estimated highest recorded population numbers of 480,000 in the 1980s. As the herd continues its steep decline, the Tłı̨chǫ Government continues its monitoring efforts on the *Kokètì ekwǫ̀* based on the traditional knowledge of Tłı̨chǫ and Inuit indigenous elders and harvesters. The monitoring objectives are to examine the conditions of individual *Kokètì ekwǫ̀* as well as the health of the herd in general, on its summer range, focusing on four key indicators: (1) habitat; (2) *ekwǫ̀* condition; (3) predators, and (4) industrial development. The program is a collaboration between the Tłı̨chǫ Government, GNWT-ENR, the Wek'èezhìi Renewable Resource Board (WRRB) and Dominion Diamond Mines ULC (DD). Funding was provided by Tłı̨chǫ Government, DD, GNWT-ENR and the GNWT-Cumulative Impact Monitoring Program[1] (CIMP).

Through *Ekwǫ̀ Nàxoède K'è*, Tłı̨chǫ travel to their ancestral harvesting locations, where we reconnect to cultural places and *ekwǫ̀*. This allows people "go back to the original source to remember" (John B. Zoe) the stories, language, traditional knowledge and ways of life, and maintain the relationship with the land and animals. We apply the Tłı̨chǫ research methodology, "We Watch Everything" to study current environmental conditions, cumulative impacts to *ekwǫ̀* health and population numbers, and examine the *ekwǫ̀* life cycle firsthand. The research methodology "Do as Hunters Do" is formed around traditional ways of traveling the land. In and around Kokètì, we travel the land by boat and on foot to key geographical features known as *ekwǫ̀ nǫʔokè* (*ekwǫ̀* water crossings), where elders have always anticipated *ekwǫ̀* herds' arrival. The monitors sit in position, in the same way a traditional hunting party would have done, to wait, and watch the *ekwǫ̀* and their habitat. Using traditional hunting methods as wildlife monitoring methods, and traditional hunting locations as monitoring places, we conduct research by doing what the ancestors did successfully to survive the harsh sub-arctic environment from time immemorial. The program presents monitoring results to regional decision makers, such as the Tłı̨chǫ Chiefs, GNWT-ENR and WRRB, to apprise them of the current environmental situation and present possible management solutions to reverse the decline.

This report presents a combination of results from the program's 2019 field season. It also delivers a trend analysis of four years' monitoring the *Kokètì ekwǫ̀*, from 2016-19, including:

[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

- **Results from 2019 field season;**
- **Trend Analysis from 2016 to 2019;**
  - analysis of calf abundance
  - weather conditions, vegetation and *ekwǫ̀* health
  - summary of wolf observations
- **Recommendations:** the program posits four recommendations: 1) protect caribou by establishing a *Kokètì Ekwǫ̀* Habitat Protected Area; and 2) support wolf hunting by indigenous harvesters on the barren-ground caribou core use area; 3) advance actions on climate change—urge territorial and Canadian governments to commit to climate change action, and 4) continue zero harvest of the *Kokètì ekwǫ̀* to promote recovery of the declining herd.

For information about monitoring activities and results from 2016, 2017 and 2018, please consult the reports on TRTI website https://research.tlicho.ca/research/bootsontheground.

Photo 1: Team C and the Candela Collective film crew. Sept. 7th, 2019. Top left: Vince Arvidsson, Mike Simpson, Russell Drybones, Samantha Drybones, John Nishi, Nora Ekendia, Leon Ekendia, Roy Judas, Joe Lazare Zoe, Petter Jacobsen, Eva Mantla, J.J Simpson, Rob Massie. Bottom left: Devon Cooke, Jimmy P. Mantla, John B. Zoe, Peter Husky, Mercie Koadloak, John Franklin Koadloak, Chad Galloway.

Photo 2: Team A and Team B, July 31st 2019. From left: Russell Drybones, Eva Mantla, Petter Jacobsen, John Franklin Koadloak, Roy Judas, Leon Ekendia, J.J. Simpson, Albina Nitsiza, Bobby Nitsiza, Mathieu Dumond, Joe Lazare Zoe, Archie Zoe, Camilla Zoe-Chocolate.

## Name Change

The name of 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 *ekwǫ̀*." The phrase makes reference to the caribou's entire trail network—all of the trails they follow to all of their "homes" throughout the seasons. For Tłı̨chǫ, the phrase "In the Migration" is important and is not just a word. Without migration there are no *ekwǫ̀*. Tłı̨chǫ survival, traditionally, has depended on knowing

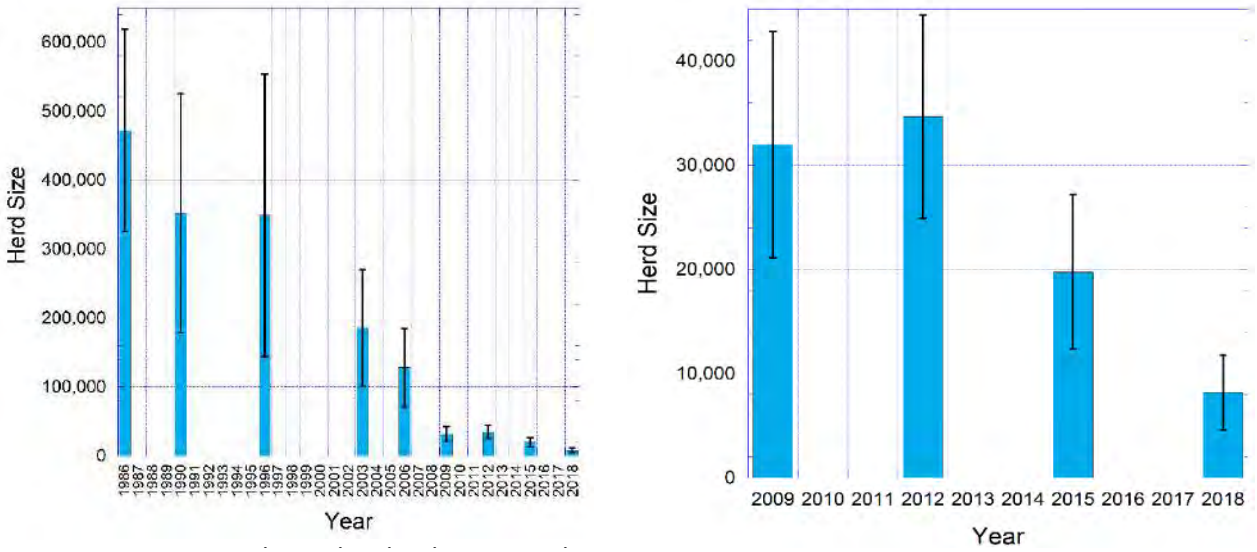
where the *ekwǫ̀* go in fall and where they go in winter; once *ekwǫ̀* are on the trail people know where they are; thus, everything we know about *ekwǫ̀* comes from *Ekwǫ̀ Nàxoède K'è*—In the Migration. *Ekwǫ̀ Nàxoède K'è* also acknowledges that we try to observe *ekwǫ̀* in their migration and also, that we too engage in the migration of *ekwǫ̀*.

## The Silent Crisis - Kokètì Ekwǫ̀ Decline

In 2018, the NWT Conference of Management Authorities (CMA) listed the *hozìı ekwǫ̀* (barren ground caribou) as *Threatened* in the Northwest Territories, based on a 2017 assessment by the Species at Risk Committee (SARC 2017). The CMA listing *threatened* means that the barren ground caribou species in NWT is declining and there are threats that could cause the entire species to disappear in our children's lifetime. Furthermore, the listing states that "barren ground caribou is likely to become endangered in the NWT if nothing is done to reverse the factors leading to its extirpation or extinction" (SARC 2018).

For the *Kokètì ekwǫ̀*, the most recent calving ground survey, conducted in June, 2018, estimated the total herd population to be 8,207 *ekwǫ̀* (Adamczeski et al. 2019, Government of the Northwest Territories and Tłı̨chǫ Government Joint Proposal on Management Actions for the Bathurst Ekwǫ̀ (Barren-ground caribou) Herd: 2019 – 2021). The previous survey, in 2015, estimated the herd population to be 19,769. (Boulanger et al. 2017). A comparison between the two surveys indicates that the herd has more than halved over the past three years—a decline of 58 per cent. The main contributors to the continued and precipitous decline are low survival rate for adult female *ekwǫ̀*, and poor reproduction rates of the herd, which include low survival rate for calves (Government of the Northwest Territories and Tłı̨chǫ Government Joint Proposal on Management Actions for the Bathurst Ekwǫ̀ (Barren-ground caribou) Herd: 2019 – 2021).

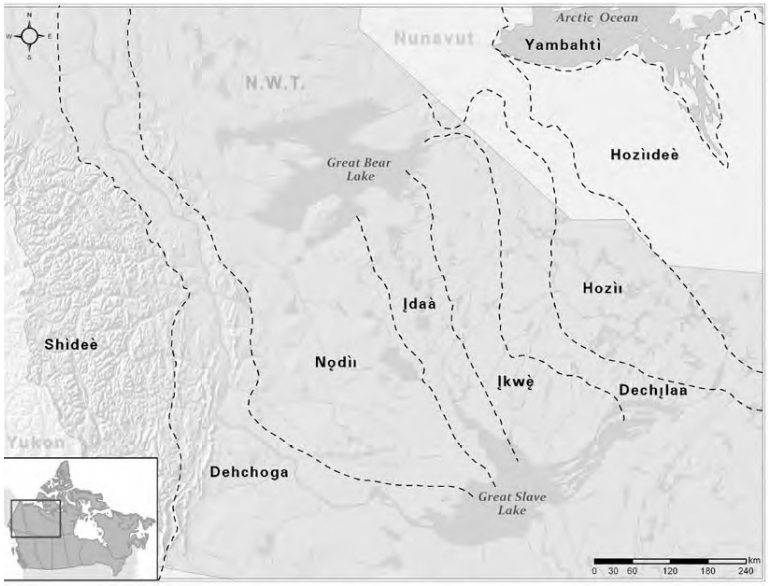
Between 2009 and 2018, the *Kokètì ekwǫ̀* population declined by 74 per cent. This dramatic rate of decline for the *Kokètì ekwǫ̀* herd meets the criteria for being *endangered*, according to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2015). If current trends continue, the Bathurst herd will meet the criteria for *critically endangered*. In such a scenario, the herd "may not recover for decades to a size that could sustain a meaningful level of hunting" (TG - GNWT Joint Management proposal for Bathurst *Ekwǫ̀* 2019).




Source: Government of the Northwest Territories and Tłı̨chǫ Government Joint Proposal on Management Actions for the Bathurst Ekwǫ̀ (Barren-ground caribou) Herd: 2019 – 2021.

## Ekwǫ̀ Nàxoède K'è Monitoring Area and Timeline

The Tłı̨chǫ name for Contwoyto Lake is *Kokètì*, translated as "empty campsite lake," in reference to the many camps erected around this lake throughout history. *Kokètì* is located at the northernmost extremity of Tłı̨chǫ traditional land use and is situated in *Hozìıdee* (map 1), described as "big barrens" (Andrews 2011). *Hozìıdee* is shared by the Tłı̨chǫ and Inuit people for harvesting *hozìı ekwǫ̀* 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 *hozìı ekwǫ̀* hunting locations.



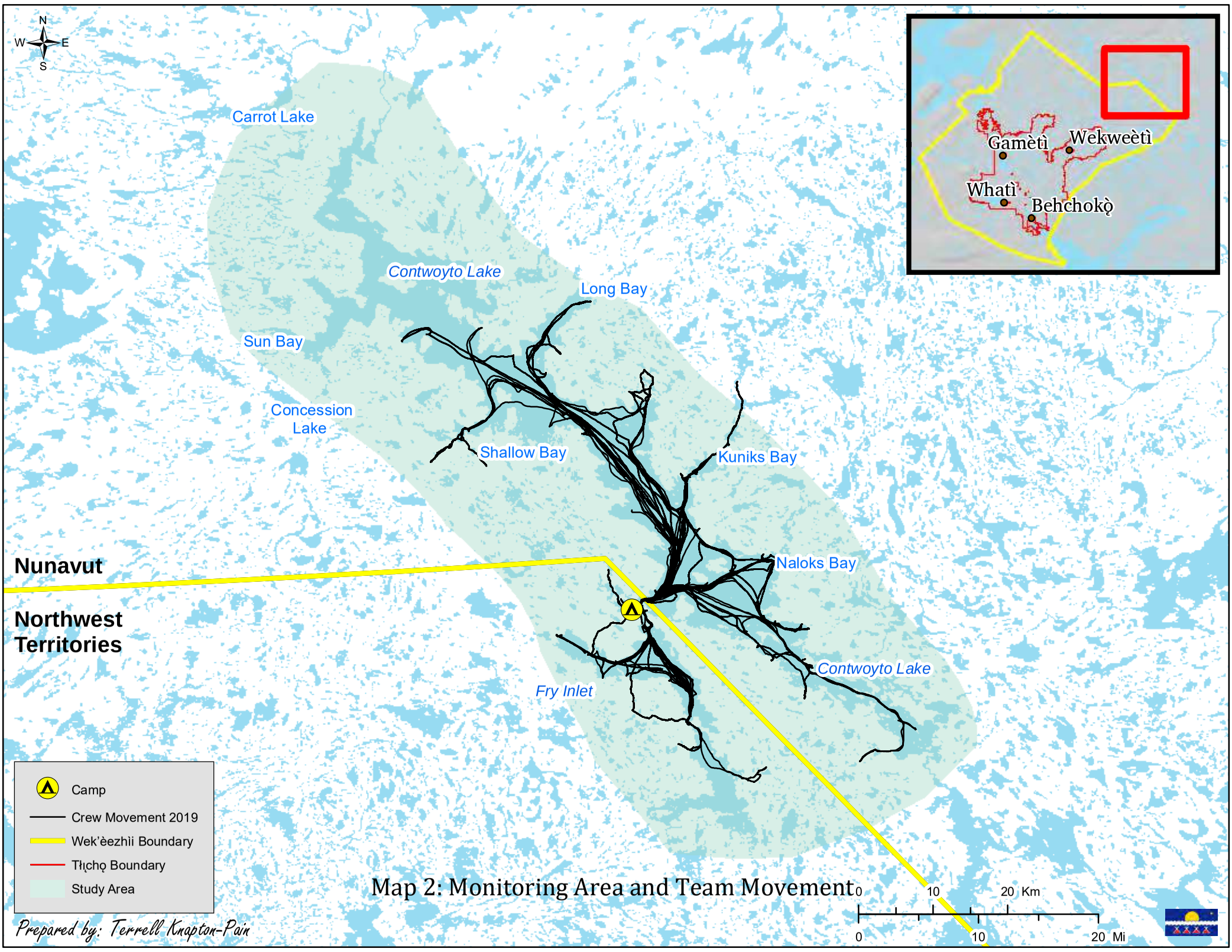

Map 1: Tłı̨chǫ Landscape Units. Source: Andrews 2011

The ekwǫ̀ monitoring area is geographically focused around *Kokètì* (Contwoyto Lake), Kwìdlìachɻ̨ (Fry Inlet), and the surrounding land within one day's walking distance from these lakes (map 2). Our monitoring was continuous over a nine-week (57 days) period between July 3rd and September 10th, 2019. The teams travelled the lakes by boat and walked inland to get into close proximity to the *ekwǫ̀* herds. Over the 57 field days, the teams traveled 3,241 kilometres by boat and walking, and spent 325 hours moving and watching wildlife (Table 1). Specific monitoring locations within the study area were determined using the harvesters' traditional knowledge and *Kokètì ekwǫ̀* GPS collar data provided by GNWT-ENR every second day.

Table 1: Total study time and spatial movement of teams.

| 2019: Total On-Ground Time and Movement | |
|---|---|
| Field work period | 9 weeks – 57 days |
| Kilometres travelled by boat and foot | 3,241 |
| Total hours moving and observing | 325 |
| Hours travelled by boat and foot | 171 |
| Hours of wildlife observation | 154 |

The monitoring area was chosen due to its ecological significance for *ekwǫ̀*, and several factors in this region that may affect *ekwǫ̀* health, behaviour and migration within its summer ranges. *Kokètì* is located southwest of Bathurst Inlet, home to the Bathurst herd calving grounds.


N
W
E
S
Carrot Lake
Contwoyto Lake
Long Bay
Sun Bay
Concession Lake
Shallow Bay
Kuniks Bay
Naloks Bay
Contwoyto Lake
Fry Inlet
Nunavut
Northwest Territories
Gamètì
Wekweètì
Whatì
Behchokǫ̀
Camp
Crew Movement 2019
Wek'èezhìi Boundary
Tłı̨chǫ Boundary
Study Area
Map 2: Monitoring Area and Team Movement
0
10
20 Km
0
10
20 Mi
Prepared by: Terrell Knapton-Pain

The areas around *Kokètì* are central to the post-calving and summer ranges of the *Kokètì ekwǫ̀* (Map 3). In July, during post-calving aggregation, herds of cows and calves move from the calving grounds and mix with the bulls to form large herds numbering thousands of individuals. The cows bring their newborn calves to the feeding areas around Kokètì, where the calves can grow strong and feed properly prior to fall migration and the onset of winter.


Map 3: Range of the Bathurst caribou herd, based on satellite-collared cows between 1996 and 2008 (Chen *et al* 2014).

*Kokètì* runs approximately northwest to southeast, bisecting the post-calving summer range in two and providing a low rolling landscape with optimal habitat and refuge from biting insects, who can't stand the high winds sometimes coming off the lake. At its widest point, the lake is approximately 19 kilometres wide, and numerous eskers, moraines, and islands form *nǫɔokè* (water crossings) that ekwǫ̀ use to cross the lake. The elongated shape of the lake creates a network of *nǫɔokè* along both eastern and western shores of the lake that creates corresponding *ekwǫ̀ etǫ* (ekwǫ̀ trails) dug deep into the ground as the *etǫ* are used every summer. *Kokètì* is accessible by canoe and floatplane during the summer; in the winter months it is reached by snowmobile from Kugluktuk or via 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 active mines south of the area (Ekati, Diavik, and Gahcho Kuè) as well as abandoned exploration camps scattered across the landscape.

Photo 3: John Franklin and Mercie Koadloak. September 9th, 2019 (J. Nishi)

Photo 4: Mercie Koadloak, Leon Ekendia, Petter Jacobsen, Camilia Zoe-Chocolate and Russell Drybones, July 2019.

## Teams

The monitoring program spanned 57 days, during which time three teams of six monitors (Teams A, B and C respectively) conducted approximately three-week shifts (table 2). Each team consisted of one elder, a younger hunter, one youth, a hunter/safety person, two local guides, a cook, and a TK researcher. Selection of the teams is based on knowledge of the land and suitability to this Program, as well as fitness for duty and Wilderness Safety Certification for the wildlife safety team member. The TK researchers (research team) are the group of TK researchers who have been involved in the design, field implementation and refinement of the contents of this report. The TK researchers document observations and traditional knowledge using participatory research and a combination of methods tailored from biology and anthropology.

Table 2: Field time per team

| | Field Time | | |
|---|---|---|---|
| | Start | End | # Days |
| Team A | 12-Jul | 31-Jul | 19 |
| Team B | 31-Jul | 21-Aug | 21 |
| Team C | 21-Aug | 9-Sep | 19 |

Photo 5: Mercie Kaodloak, Joe Zoe, Roy Judas, Camilia Zoe-Chocolate, J.J Simpson, Archie Zoe and Mathieu Dumond at basecamp, Kokètì, Aug 11th, 2019 (J.F. Koadloak).

Photo 6: Bobby Nitsiza and Albina Nitsiza as cook and wildlife monitor, at basecamp, Kokètì, July 31st 2019 (J.F. Koadloak).

## Hozìıdee: Climate and Vegetation

The study area is situated entirely within *hozìıdee*, referring to the region beyond hozìı (barrenland); a place without trees and only low growth shrub vegetation (Andrews 2011). The area is classified as a tundra biome and is in the Arctic Tundra climatic zone (Map 4) (Environment Canada, 1998). 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 three to 12°C in summer. The region is located within the Laurentian Plateau (Canadian Shield), an area dominated by exposed Precambrian igneous and high-grade metamorphic rock. Surface expression derives from glacial processes; the area is defined by low rolling hills, sandy esker systems and rocky outcrops overlooking numerous waterbodies, rivers and wetlands. A layer of permafrost, within one to two meters of the surface, consists mostly of gravel and finer material. This semi-permeable layer is covered by a layer of organics, soil, and vegetation (CSSC, 1993).


Map 4: The monitoring area is located approximately 385 km north of Yellowknife and between the Northwest Territories and Nunavut, Canada.

Due to the permafrost layer, water is retained in the upper portion of the ground. This phenomenon has contributed to the formation of wetlands and the retention of water near or around the surface, creating conditions for the development of shallow-rooted low shrubs, sedges, mosses, grasses, lichen and numerous tundra flowers. Wildlife in *hozìıdee* include herbivorous mammals such as *ekwǫ̀*, muskox, arctic hares, ground squirrels, lemmings and voles, as well as carnivorous mammals such as grizzly bears, arctic 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 ancient, as is the network of hunting trails extending 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 *hozìıdee*, where many of the *ekwǫ̀* hunting grounds are located. The traditional land-use areas of the Tłı̨chǫ lie within the boundary known as "*Mǫwhì Gogha Dè Nı̨ıtłèè,*" 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 Kokètì.

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 square kilometres 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 natural 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

*Ekwǫ̀ Nàxoède K'è* is an applied interdisciplinary research project that bridges observations on biological indicators with the cultural knowledge of local hunters. We use this "biocultural approach" to emphasize the Tłı̨chǫ and Inuit knowledge (*Inuit Qaujimajatuqangit—IQ*) of the ecosystem we live in. Biocultural approaches explore the link between biological and cultural diversity, and their interdependency with one another (Pretty *et al.*, 2009; Pilgrim and Pretty, 2010). Our framework of research is based on two methodologies developed over the course of the program, named, respectively, "We Watch Everything" and "Do as Hunters Do." Figure 4 and 5 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

Knowledge of nature is culturally situated and derives from the environmental adaptations of the culture that gave it meaning. Our human experiences of nature are thus tied to their cultural interpretations. Using this notion, the idea that there is a "universal truth of nature" is avoided in favour of viewpoints based on cultural perspectives. Seen through two different cultural lenses, a single process in a physical environment may have two (or more) quite different meanings. Furthermore, a person's response towards environmental processes will depend on his or her pre-existing ideas and values within their culture. The 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. Indigenous language and cultural practices related to caribou direct the monitoring, and indigenous perspectives on nature permeate the research program. Developing a traditional knowledge environmental monitoring framework requires that we recognize and

Photo 7: Elder Joe Lazare Zoe, from Gametì, has shared his knowledge of the land to the *ekwǫ̀* monitors at Kokètì since 2017 (C. Zoe-Chocolate)

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—thus, aspects of meaning are inevitably lost in translation. The interpretation of Tłı̨chǫ words and their relationship to nature requires awareness of cultural relativism and extensive efforts from both researchers and elders to ensure mutual comprehension.

Photo 8: Joe Lazare Zoe making himself into a caribou; communicating to *the ekwò* herd. August, 2019 (C. Zoe-Chocolate)

An example is an incident recorded in the field journal on 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 inquired as to the curious use of the word, elder Moise Rabesca explained that the muskoxen' behaviour, postures, and the way they related to each other indicated a long-term association. The muskoxen "grew together," and now they were inseparable. To a casual listener, the use of the word "friends" may initially be thought of as a shallow characterization of muskox behaviour because a cursory interpretation and may not recognize the inherent challenges of communicating concepts and sharing knowledge across different languages and ways of knowing. More importantly, acquiring an accurate interpretation must be grounded in mutual respect for and acknowledgement of the depth of the hunter's experience and 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 harvesters to thrive in the arctic landscape. The statement also evoked knowledge from 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.

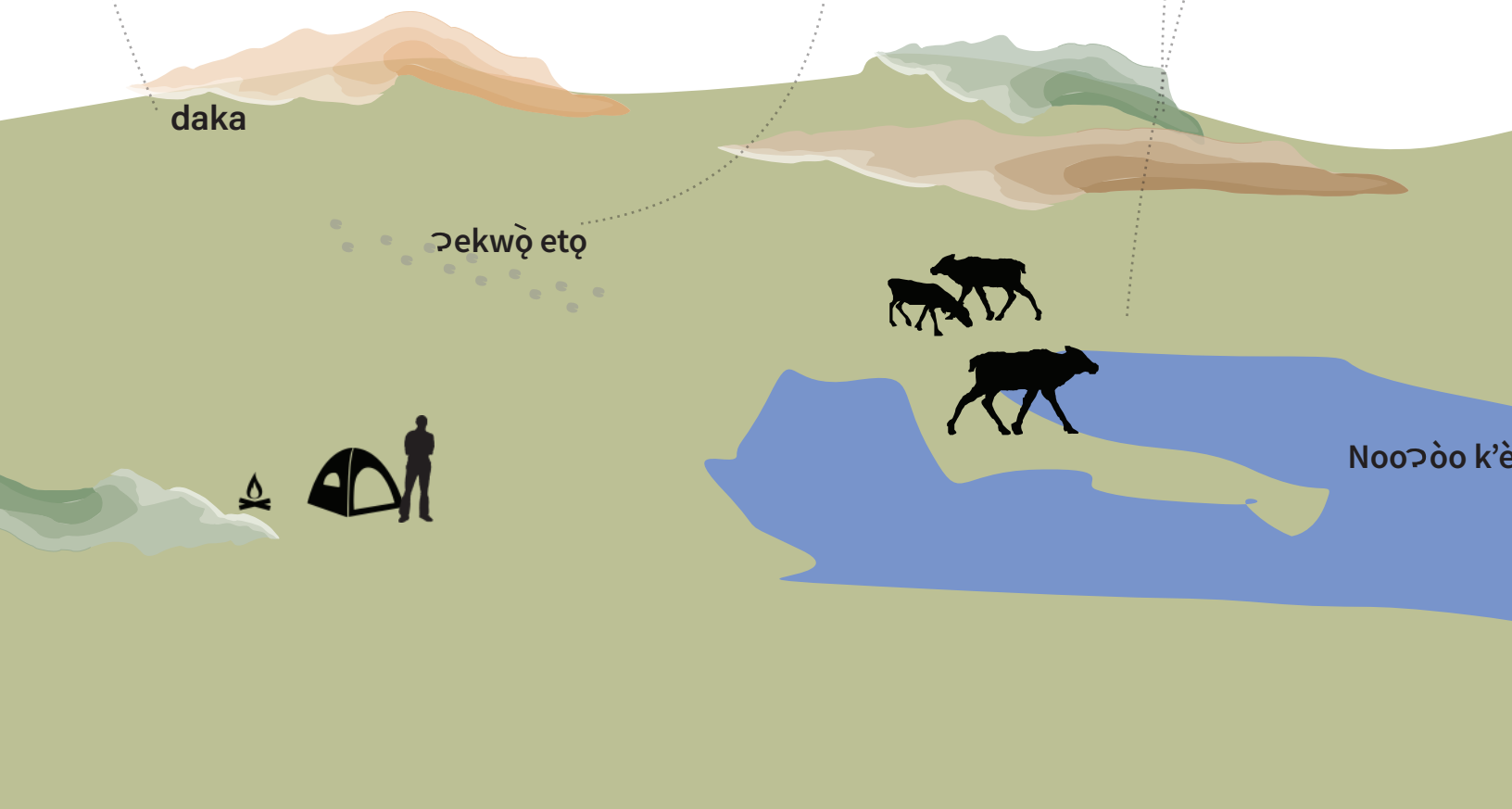
The muskox example illustrates our approach following the elders' teachings and way of interpreting the land to understand concepts, as opposed to classifying knowledge using Euro-Canadian standards. There is no word in English that closely resembles the connection described by the elders; however, through 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

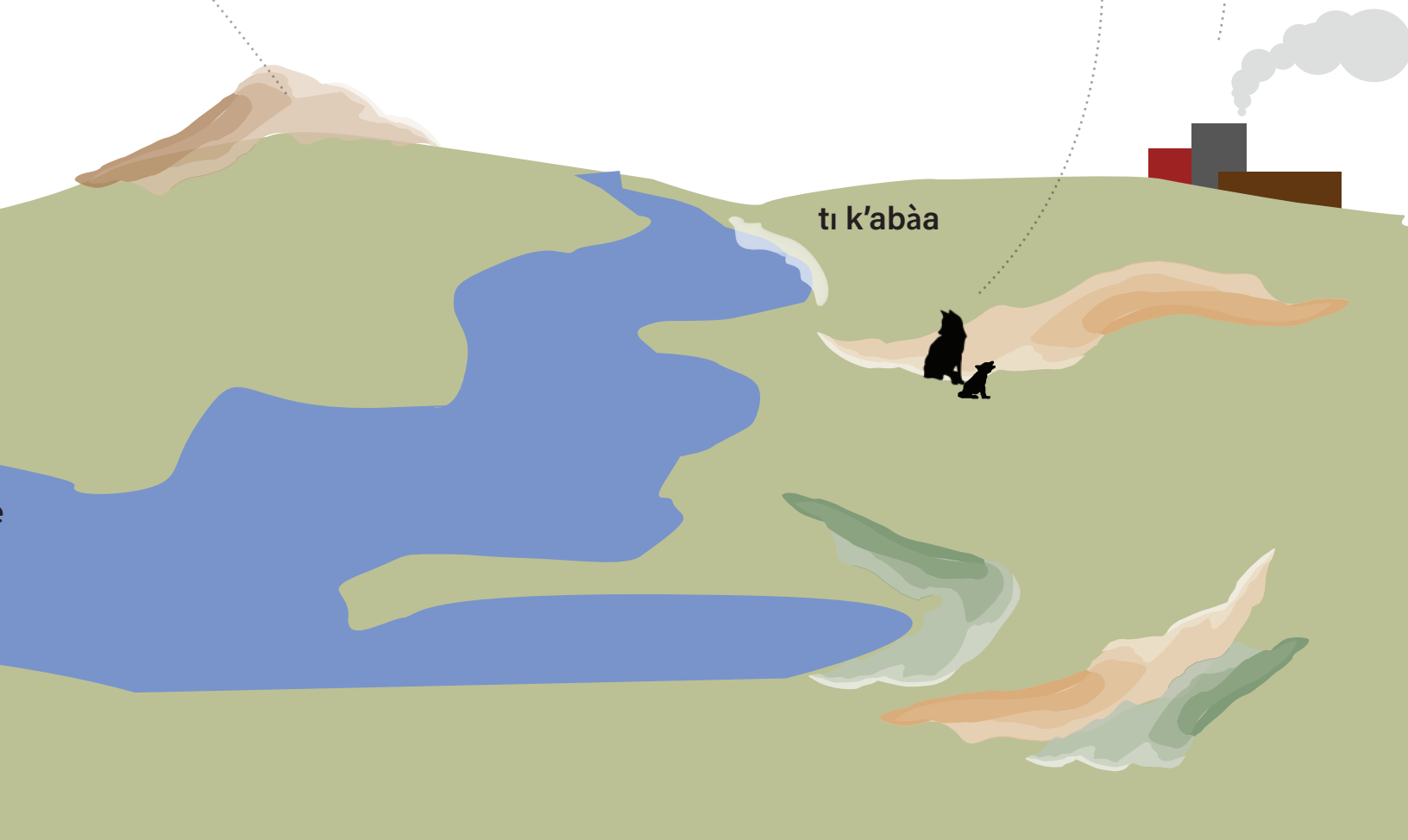


# "WE WATCH EVERYTHING"

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. While such theoretical concepts are abstract, they have a very concrete physical practice in the day-to-day thinking of Tłı̨chǫ harvesters. 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 explains, "*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 6).

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 (photo 9). 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 spoken then 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.

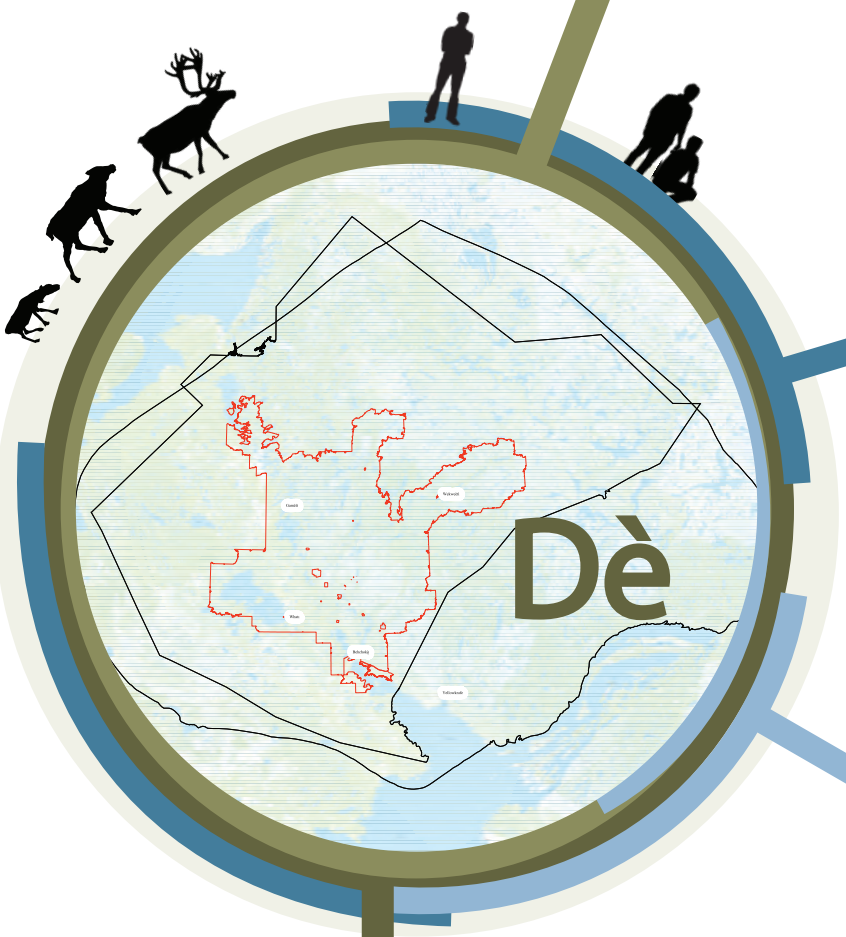
Through such actions, the team communicates and engages with the land on a social level; "the land, then, is a living entity with powers that should be respected if harmony is to be maintained" (Legat 2008: 37). During such engagement, the land is comparable to ones' parents, who provide everything for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

Photo 9: Feeding the Fire ceremony held every Friday. July, 2019 (P. Jacobsen)

# 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" framework. "Do as Hunters Do" is a useful memetic English phrase that helps to emphasize that our research methodology emulates traditional indigenous caribou hunting in the barrenlands, although 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 food 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 anthropological and ecological science and consist of using hunting locations for observations and the use of hunting techniques for monitoring.

### Hunting Locations as Places of Observation

The program makes use of traditional hunting locations, such as *nǫɔokè* and *tataa* to understand how and where caribou herds travel over the vast barrenland. By relying on these concepts, along with the *ekwǫ̀* collar information provided by ENR, the teams place themselves in the best location prior to the arrival of the herds. E*kwǫ̀* monitoring and the recording of TK is inextricably related to the Tłı̨chǫ concept of land. Located on the barrenlands (tundra) region of the Northwest Territories and Nunavut, the vast subarctic landscapes surrounding Kokètì are dominated by rocky outcrops, eskers, rolling hills, and other geographic features created by continental glaciation. We consider the landscape, as well as cultural history to identify locations where *ekwǫ̀* 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 *ekwǫ̀* 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 *ekwǫ̀* or any other animal use to swim across. Tłı̨chǫ also use the more specific term *naɔoke* to refer to a place where *ekwǫ̀ always* cross, such as the crossing between *Kokètì* and *Kwìdlìachı̨̀*. As part of our methodology, waiting at these crossings allows the researchers to "Do as Hunters Do:"

- Observe animals in close proximity (within 10-50m).

- Observe dynamics of *ekwǫ̀* movements, behaviors, and interactions.
- Determine patterns of movement based on direction and age of tracks.
- Observe the behaviour of predators who are following or waiting for caribou herds. Predators 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.
- Estimate the number and health of injured animals falling behind, and their interaction with predators.
- Determine the relative importance of landscape attributes, such as the presence of sand, rocks, and prevalent winds, in caribou choice of crossing.

*Nǫɔokè* are crucial to understanding caribou migration. Local harvesters, sensing the landscape "as caribou would," developed their 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 excellent 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 floatation, 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.

Photo 10: Peter Husky and Joe Zoe at *ekwò nǫɔokè*. Sept., 2019 (J. Nishi)

## Observations from *Daka* (high points)

*Daka* (high points) across the landscape such as *hozìı shìa* (hills on barrenland) and *what'àa* (eskers) are extensively used by the team to monitor caribou, locate features such as favourable habitats 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 *ekwǫ̀* 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 *ekwǫ̀* forage areas.
- Observe predator behaviour and movement patterns

### Observations at *Tataa*

*Tataa* is another important word to understand *ekwǫ̀* migration. It refers to *ekwǫ̀* movement over land formations 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 *ekwǫ̀* 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'aɔ̀ats'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* help researchers and participants to determine:

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

## Hunting Techniques as Methods of Observation

The location of our main camp, close to the *naɔ̀kè* (water crossing) between *Kokètì* and *Kwìdlìachǫ̨* in Northwest Territories, was located at the northernmost range of Tłı̨chǫ land use. In the 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 *ekwǫ̀* hunting. They followed shorelines by boat, then beached at known *ekwǫ̀* water crossings. Families set their camps short distances from the crossings, so as not to disturb the potential movement of *ekwǫ̀*. 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 *ekwǫ̀* 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 *ekwǫ̀* were killed, the women would appear from their hiding places to butcher and process the meat. The killing was usually the first and relatively 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 introduction and use of motorized transportation technologies, such as the airplane, snowmobile, and outboard motors have made travel 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* (hilltops) such as *hozìı shìa* (hills on barrenland) and *what'àa* (eskers) are the main tools applied by the team to locate caribou. The task of hiking eskers to observe the land from its highest points 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 11) were found at many of the high points along eskers. Previous hunters set their tents at these best locations to spot *ekwǫ̀*. At other eskers, we found arrowheads (Photo 11). Advised by local hunters, our main camp was established approximately two kilometres north of the main *naɔokè*. This location has been used for centuries by Tłı̨chǫ and Inuit. One kilometre west of the main campsite, there is a long, tall esker, stretching in a north-south direction, where we did as hunters have always done: wait and watch the land for animal movement surrounding the *naɔokè*.


Photo 11: From left to right: tent stone circle on *what'àa* (esker); iron arrow point; ivory scraper or arrowhead found on eskers (P. Jacobsen).

## Waiting

The *"Do as Hunters Do*" methodology is based on walking 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 *ekwǫ̀* herds are constantly moving, it is necessary to meet them on their travels, and hunters have identified the best locations to meet 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 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 sufficient time for in-depth conversations about the land, the culture, and the research topics.

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 (photo 13). 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. Spending large amounts of time on the land (three weeks per team) was an essential part of our methodology, critical for our ability to conduct research and record information.

Photo12: Waiting and watching from the esker: Jimmy P. Mantla, Leon Ekendia, John Nishi and Russell Drybones, Aug 23rd 2019 (J.J. Simpson).

Photo 13: Joe Lazare Zoe and Petter Jacobsen in dreaming mode on the esker, Sept. 6th 2019 (J. Nishi)

## 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 over 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 57 days of field work, we had covered 3,241 kilometres by foot and boat (table 1). The long walks into the surrounding landscape were made from *daka (high point)* to *daka*, from one high point to the next, often following eskers. 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.

# 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 indicators to be included for an analysis of caribou and habitat assessment. The resulting list of monitoring indicators include: (1) habitat; (2) *ekwǫ̀*; (3) predators, and (4) industrial development.

### Indicator 1: Habitat

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

### Indicator 2: *Ekwǫ̀*

*Ekwǫ̀ 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 colour*

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

*Walking posture*

- Unhealthy: limping, or 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*

- Calf-to-cow 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 *ekwǫ̀* predators
- Relationship between *ekwǫ̀* and predators

### Indicator 4: Industrial Development

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

## Finding Caribou

The main challenge for monitoring *ekwǫ̀* is finding *ekwǫ̀*. In general, *ekwǫ̀* migrate southwest, from their calving grounds west of Bathurst Inlet, in late June/early July, toward the general area of *Kokètì* and *Kwìdlìachǫ̨̀*, and remain in that area throughout July and August, and into September. However, at a finer scale, the herd's movements are very unpredictable; different valleys, shorelines or specific *nǫ̀ɔokè* may be used in one season and not another. Following the movement south from the calving grounds, a post-calving aggregation happens in July; after that, *ekwǫ̀* spread out in larger herds. During the aggregation, the animals gather in large groups and move rapidly, with purpose. 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 in several different directions. 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.

Photo 14: Russell Drybones plotting *ekwǫ̀* collar location on grid map over monitoring area, in base camp. August, 2019 (J. Nishi)

Photo 15: Russell Drybones and Petter Jacobsen receiving *ekwǫ̀* collar location over Inreach and plotting on grid map in the field. July, 2019 (C. Zoe-Chocolate)

## Collar Data

Collar information provides a specific geographic location of male and female *ekwǫ̀*. Every second day, GNWT-ENR biologists provide collar information to the TG's GIS technician, who plots the info onto a grid map of our monitoring area. The info from the grid map is communicated to the team researcher, over satellite phone or as a text message using a Garmin Inreach device, who plots the collar data on a grid map in base camp (photo 14 and 15). The collar information provides the location of collared *ekwǫ̀* at a specific time approximately every second day. The challenge for the program is knowing where the herds are throughout the days in between.

## 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 and Mercie Koadloak, who have lived most of their lives on *Kokètì*, pointed out the best camp locations, and where to go by boat and foot to meet the herds. Their detailed local knowledge of geography and topography, by land and water, was vital for our team's ability to best position itself.

We learned that the success of the program is dependent on doing, as close as possible, 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 task of monitoring became an act of trying to position oneself at places where one anticipates *ekwǫ̀* 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.

# Recording Knowledge

We chose to adopt a participatory action research approach as the overarching framework for documentation during the field program. The participatory action research approach emphasizes a close working relationship between the lead researchers and program participants, developing research questions and fact-finding strategies through collective efforts. Contrary to other forms of investigation, participatory approaches help democratize knowledge enhancement and decision-making, and foster opportunities for empowerment for those involved (Legat 2012). The ability to become engaged as a team through participatory action research (*"Do as Hunters Do"*) enables researchers to learn and explore emotional, spiritual and cultural transformations. Taking a participatory action 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 an 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 "insider's"—voice and actively avoid biased interpretations. Therefore, fieldwork not only entails the collection of information, but is a totalizing experience that engages, as far as possible, the whole being of the participants (Okely 1992).

A note should be made on our description of animals in the program. 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 program 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 *ekwǫ̀* cow with calf is addressed as a *mother,* or a yearling as *sister*, depending the relational context.

## Qualitative Techniques

Documentation of TK occurs during wildlife observations throughout the day, including the daily team 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. 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 3 outlines the information collected by the researcher each day. Table 4 outlines information collected during each wildlife observation. The templates provide 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 elder and monitors qualitative descriptions. The note-taking is conducted throughout the day by the researcher, in accordance with explanations made by elders.

Table 3: Template for daily recording.

| | |
|---|---|
| **WEATHER: recorded morning, midday, evening** (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/insect activity* | |
| | |
| **DAY TOTALS: recorded end of each day** | |
| Km travelled: | Total observation time: |
| No. of animals: totals | Total travel time: |
| Tłı̨chǫ words/concepts: | Total time: |

A morning safety meeting is held to discuss the previous day's observations and plans for the day's monitoring activities and locations, and any other potential camp issues. At the end of each day, the daily totals are tabulated into a master sheet saved in a shared drive, and photographs and spatial data in the form of tracks and waypoints are saved in separate folders, on the field computer. Daily totals and team movements are analyzed each evening by the researcher and team to discuss monitoring progress and to identify new locations to monitor, for discussion at the following morning meeting.

Table 4: Template for wildlife observations

| # | Code | Description in the field journal |
|---|---|---|
| | No | Observation number. Start at 001. |
| 1 | Start/ end time of observation | hh /mm |
| 2 | Weather | Temp, wind speed and direction, humidity, barometric pressure, cloud cover, insect activity, general. |
| 3 | Species/ # of individuals (or estimated group size)/ sex of animals | Describe the amount and sex ratio among the species observed |
| 4 | Calf – cow ratio | 0-10 score: number of calves per every 10 cows. Try to look at 5 - 10 groups of ten cows and count/record # of calves. |
| 5 | Animal health | Condition and fatness (cows/bull: skinny, average and fat). Three areas to look at: 1) neck, back and area above shoulders, 2) ribs, 3) hips and base of tail. (*try to get broadside pictures of caribou in different health categories).* Notes on hair coat, injuries, walking posture and behaviors |
| 6 | Animal Movement, behaviour | Describe where is the animal coming from and going, describe its behaviour |
| 7 | Qualitative Description | Qualitative description of the observations provided by the elder and group. |
| 8 | Location (waypoint number) | Physical description of local area. Note: vegetation, geography-topography: water-land. |
| 9 | Distance from observer | Metres or yards (use range finder) |
| 10 | Habitat | Describe habitat types and conditions/quality of the habitat and caribou forage provided by the elder and group. |
| 11 | Tłı̨chǫ words | Record Tłı̨chǫ words for animals, habitat, weather, landscape or other observation |
| 12 | Confidence/ Quality of observation | Yes or No.<br>Why? Notes on challenges: weather, visibility, other |
| 13 | Photographs or video footage | Describe/ short notes on photos or video footage taken |

## 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 different knowledge 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

Photo 16: John Nishi, Petter Jacobsen, John Franklin Koadloak and Russell Drybones reviewing photos and videos of *ekwǫ̀* observation at basecamp. September, 2019 (J.J Simpson)

environment, *ekwǫ̀*, 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. We identified main categories from the statements collected in the journals. The statements were divided into categories (i.e. *ekwǫ̀*) and sub-categories (i.e. *ekwǫ̀* 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.

## 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 a more 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 spent watching and being on the land. Daily communication to headquarters is done with Garmin Inreach, using the tracking mode, uploaded every hour of team movement for safety purposes. The Garmin Inreach and satellite phone are 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 use portable solar panels, which charge a large battery pack to store surplus power, to provide electricity to the electronic research equipment.

## 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

# 2019 Field Season

The teams observed a total of 214 *ekwǫ̀* groups (Bathurst caribou*/Rangifer tarandus groenlandicus*) and the total number of *ekwǫ̀* observed was 15,613 individuals. The total individual count represents the cumulative sum of all ekwǫ̀ in groups seen by the field teams. The group sizes ranged from a single animal to an estimated 2,500 ekwǫ̀. The ekwǫ̀ groups and individuals observed were not, however, discrete; on many occasions the same groups of *ekwǫ̀* were seen on consecutive days. Thus, wildlife groups and individual sightings represent a relative index of abundance and not a population estimate.

Table 5 summarizes the groups of wildlife observed.

Table 1. Wildlife groups observed

| | Caribou | Muskox | Moose | Wolf | Grizzly Bear | Wolverine | Eagle | Bald Eagle | Golden Eagle | Peregrine Falcon |
|---|---|---|---|---|---|---|---|---|---|---|
| Team A | 59 | 0 | 7 | 9 | 0 | 1 | 4 | 2 | 3 | - |
| Team B | 73 | 5 | 1 | 0 | 5 | 0 | 4 | 1 | - | - |
| Team C | 82 | 5 | 0 | 7 | 5 | 0 | 1 | 3 | - | 1 |
| | 214 | 10 | 8 | 16 | 10 | 1 | 9 | 6 | 3 | 1 |

In total, the teams observed 279 animal groups over 57 field days. On average, the teams had 4.8 encounters with animal groups per day. All wildlife observations were recorded, as follows:

- *Hozìı edzıe* (muskox*/Ovibos moschatus*), were the next most abundant wildlife species observed. Ten groups were spotted, comprising 101 individuals. Group size ranged from one individual to 23 muskoxen, and calves were observed in three groups: a) three calves in a herd of 23; b) one calf in a herd of ten, and c) three calves in a herd of 20.
- We observed 18 moose in eight discrete groups from mid-July to August.
- A total of 31 individual *dìga* (wolf*/Canis lupus*) were recorded in 16 distinct observations.
- *Sahcho* (grizzly bears*/Ursus arctos*) were seen 10 times during the mid and latter parts of the field season.
- A group of 3 *nǫ̀gha (*wolverine*/ Gulo gulo),* likely an adult female with two subadults, was observed in late July.
- D*et'ǫcho* (eagle) were consistently observed throughout the field season by the three teams, with a total of 23 individuals seen on 18 occasions; five pairs were seen and the remaining 13 sightings were of single eagles.

Table 6: summarizes how many animals observed per species.

Table 2. Cumulative totals of individual animals observed in 2019 field season

| | Caribou | Muskox | Moose | Wolf | Grizzly Bear | Wolverine | Eagle | Bald Eagle | Golden Eagle | Peregrine Falcon |
|---|---|---|---|---|---|---|---|---|---|---|
| Team A | 6,956 | 0 | 16 | 17 | 0 | 3 | 6 | 2 | 4 | - |
| Team B | 6,336 | 54 | 2 | 0 | 5 | 0 | 4 | 2 | - | - |
| Team C | 2,321 | 47 | 0 | 14 | 5 | 0 | 1 | 4 | - | 2 |
| | 15,613 | 101 | 18 | 31 | 10 | 3 | 11 | 8 | 4 | 2 |

# 2019 Observations

## *Dedìı* (Moose) Observations

For the first time during the monitoring program, *dedìı* were observed at *Kokètì*. Eighteen animals, in eight separate groups, were sighted. The groups ranged in size from one individual to four moose and comprised a mix of bulls, cows, yearlings and calves, although cows were most prevalent. The observations occurred in the early and mid-part of the field season, between July 16th and August 12th, on both the eastern and western sides of Kokètì. On two occasions, *dedìı* were observed swimming across the channel between *Kokètì* and *Kwìdlìachǫ̨̀* (photo 17). This is the first known observation of *dedìı* in this area, and first observation by any Inuit full-time resident at *Kokètì*. The monitors explained that *dedìı* likely walked northeast from *Deèzàatì* (Point Lake) to *Kokètì*, following the lakesides and river valleys where sufficient forage, such as willows and dwarf birch, can be found.

Photo 17: First observation of *dedìı* (moose) by *Kokètì,* July, 2019. (P. Jacobsen)

## Indicator 1: Habitat

Summer is a key season for caribou. Adults need to eat growing plants in order to regain body mass lost in the winter and spring, so they are in prime condition for the fall breeding season. Bulls need to grow muscle and antlers, and accumulate fat for the rut and to survive the coming winter. For adult females, summer grazing conditions are also crucial for meeting their nutritional demands to regain muscle and store fat on their bodies as well as for continuing production of energy-rich milk for their calves. For calves, the nutrition they get from nursing from their mothers is obtained from green vegetation through the summer, and young subadult caribou need nutrition from green plants to reach adult body size and sexual maturity.

### Weather and Vegetation

Summer habitat conditions and *ekwǫ̀* forage around *Kokètì* and *Kwìdlìachǫ̨̀* were characterized as very good to excellent, largely because the vegetation was lush and productive, owing to consistent rain and soil moisture, resulting in plentiful, high-quality forage (photo 18). Abundance of flowers, berries and mushrooms—three indicators of good summer growing conditions—were noted. Throughout the summer months, the high frequency of rain showers drenched the ground and the vegetation remained moist. In July, low ground became flooded from heavy rains, as colder temperatures and a continuous cloud cover delayed thawing frozen ground until later in July, when water absorbed into the soil.

Photo 18: "Ideal conditions for *ekwò.*" *Ekwò* herd feeding, undisturbed by insects, in excellent forage, July 23rd, 2019. (P. Jacobsen)

The first part of July was considered "springtime" around *Kokètì*. By mid-July (July 15th), the hard-packed snow along hillsides and eskers had just melted, revealing the dry and brown-coloured dwarf birch, willows and grasses, which had not yet started actively growing. Numerous snow patches covered the bottoms of sloping hills throughout July, providing a steady flow of water to vegetation in low-lying areas. The many pools of water and higher water levels in lakes and ponds provided suitable habitat for insect populations. Mosquito and blackfly activity in wind-sheltered and low-lying areas, especially on calm July evenings, was considered extreme by the monitors (Figure 8). Insect harassment seemed more intense on calm days in July compared to the two previous years. However, the calm days were few because windy and colder weather conditions were prevalent. In general, the largest groups of caribou were seen in mid-July to early August, which coincided with a general pattern of highest insect activity (Figure 8). By mid-August, insect activity was much lower and we only saw caribou groups of fewer than 500 animals.

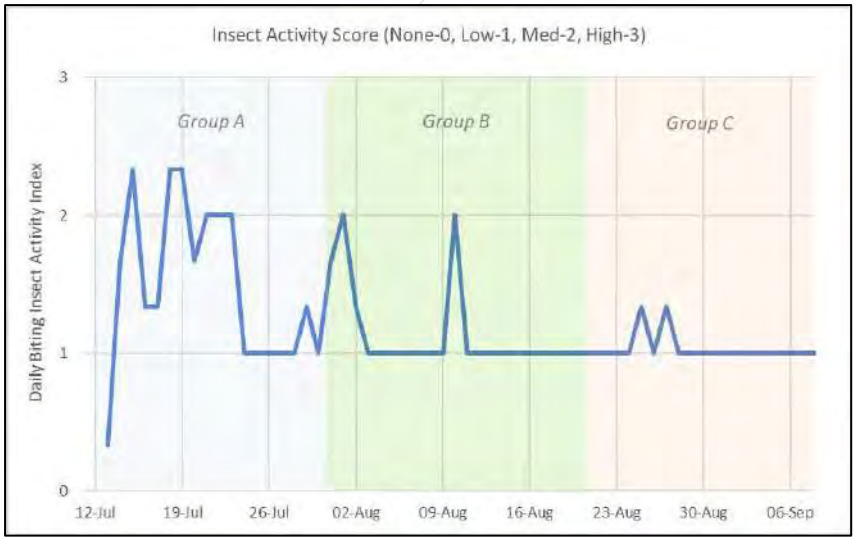



Figure 8: Trend in daily insect activity for 2019 field season. Daily index was a mean of three scores taken in the morning (~0900h), afternoon (~1430h), and evening (~2030h).

Photo 19: In July, an abundance of flowers on the tundra landscape; left: Labrador Lousewort, centre: Northern Labrador Tea, right: Cloudberry flowers. Weather-Station Island, Kokètì. (P. Jacobsen)

Consistently cool temperatures, rain and strong winds throughout June and in July slowed the growth of grass in the places where snow had recently melted. In other low-lying areas, the frequent rain maintained a moist and healthy bed of lichen and dwarf birch, and once grasses and sedges started growing, the vegetation remained rich and fresh, proving plentiful forage for *ekwǫ̀*. The frequent rain provided good growth conditions for tundra flowers, which were more abundant in July than observed in previous years. In some locations, such as the eastern shore of *Kokètì* and on islands, the flowers covered the tundra landscape. In particular, the sloping hills on Weather-Station Island, in the centre of *Kokètì*, was covered in white tundra cloudberry flower and Labrador tea flowers (photo 19). Mushrooms are another good indicator of summer precipitation and overall growing conditions on summer caribou habitat. Generally, mushroom abundance in late summer and fall is related to overall summer rainfall amounts and timing. Under summer drought conditions, mushroom abundance is expected to be low or absent. When available, mushrooms are selected and frequently eaten by caribou (photo 20) because they can be a relatively high source of protein during the late growing season (Boertje 1990, Launchbaugh and Urness 1992, Inga 2007).

Photo 20: Left, *female ekwò* eating a mushroom, August 2019 (C. Zoe-Chocolate); right*: ekwò* bull eating a large mushroom, Aug. 24th, 2019 (photo from video by J.J. Simpson).

As an exploratory exercise, monitors counted mushrooms within three transects at a site immediately west of the field camp (photo 21). The 250 square metres transects (125m x 2m) were marked with wooden stakes, and all mushrooms were recorded by size class. Total mushroom counts ranged from 16 to 52, and most mushrooms had a cap size of less than two inches. Based on the transect counts of mushrooms that had a cap size of greater than two inches (*i.e.*, an estimated minimum bite size for a caribou), we estimated that there were between 80 and 280 mushrooms per

Photo 21: Russell Drybones, Mike Simpson, and John Nishi measuring mushroom cap size and counting mushrooms within a 250 m2 transect (J. J. Simpson).

hectare.

There was an abundance and variety of berries in August and early September (photo 22), which reflected the amount of good precipitation and growing conditions throughout the summer. Bog bilberries (*Vaccinium uliginosum*), bog cranberries *(V. vitis-idaea),* crowberries (*Empetrum nigrum*), alpine bearberries *(Arctostaphylos alpine)*, and cloudberries *(Rubus chamaemorus)* were among the most plentiful species.

Photo 22: Abundance of berries the Bathurst caribou summer range; left Cloudberry *(Rubus chamaemorus)*, right; Mercie Koadloak picking berries, Aug. 21st, 2019 (Photos by J. Nishi and J.J. Simpson).

## Summer Snow Patches

The winter of 2018-2019 brought more snowfall than previous years, according to the local residents at *Kokèt*ì. The increased snows, once melted, increased water levels in the lakes, and provided ample moisture for vegetation. The Inuit residents stated that plants and vegetation "greened-up right away" after snow melt. The forage conditions became ideal for caribou adults and the calves in late June and

July, as the ground was moist, vegetation was lush, and wind and cool temperatures kept biting insect harassment low. Numerous snow patches remained on the ground all summer, since the cool temperatures remained during summer months. From Weather-Station Island, in the centre of *Kokètì*, monitors reported that they had "never seen that much snow [in summer]," and counted more than 20 snow patches covering hills along the eastern shore in July. Meltwater from snow patches provides a steady stream to low-lying areas and moistens the vegetation there. "Snow patches are good for caribou food," explained the monitors. Build up of ice overflow alongside a river was visible on the eastern shore of *Kokètì*. The monitors had not observed ice overflow along the river during any previous years' monitoring. But during the first three weeks of July, numerous ice pans were floating on *Kok*ètì. The ice pans made the surrounding area cooler when wind came in from the lake. The northern, deeper part of the lake, contained ice until the fourth week of July.

### Permafrost Melt

The permafrost melt was visible on numerous eskers around *Kokètì*. As the eskers' internal ice melts, fresh meltwater can be seen flooding vegetation in adjacent lowlands. In some cases, small streams of fresh meltwater feed into neighbouring lakes and ponds. The melt is also evident by the appearance of holes on top of eskers (photo 23) and the collapse of eskers' sides. The melting and collapse of eskers are a continuous, ongoing event that the monitors observe every summer while walking the landscape around *Kokètì*.

Photo 23: Joe Zoe by sinkhole forming on top of esker, west shore Kokètì, August 2019 (C. Zoe-Chocolate)

## Indicator 2: Ekwǫ̀

The teams reported a total of 214 *ekwǫ̀* groups observed (Figure 9), with group sizes ranging from a single animal to an extensive group of 2,500 (estimated). The total number of *ekwǫ̀* overall was 15,613. The *ekwǫ̀* groups and individuals observed were not discrete; on many occasions the same groups of *ekwǫ̀* were seen on consecutive days. Thus, the sightings of *ekwǫ̀* groups and individuals is more representative of a relative abundance and is not a population estimate.

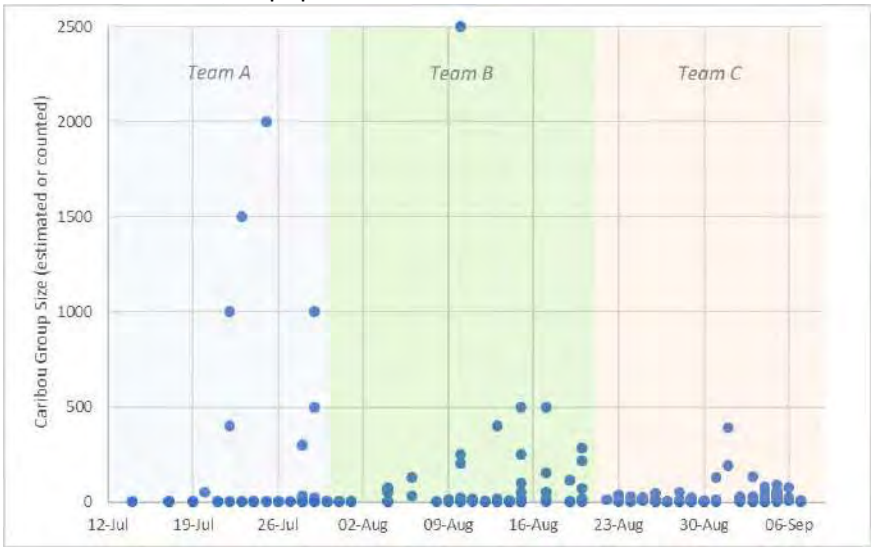



Figure 9: All caribou groups observed in July, August and September.

## Ekwǫ̀ Calf Abundance and Calf: Cow Ratios

Of the 214 *ekwǫ̀* groups observed by the field teams, 89 groups were used to estimate an overall calf:cow ratio (Figure 10). These 89 *ekwǫ̀* groups were selected based on the criterion that at least one adult female caribou was observed within the group. The overall calf:cow ratio was 31 calves per 100 cows (i.e., 0.307 ± 0.056 SE). This estimate indicates a *low* calf:cow ratio, because it suggests that by summer less than one-third of the breeding-aged females had a calf.

Photo 24: Cows, calves and young bull, 17th Aug 2019 (J.J. Simpson)

The 89 *ekwǫ̀* groups in which monitors classified cows and calves varied in size throughout the field season (Figure 10). The average size was 88, and on average, the groups consisted of 12 cows and four calves. Caribou group sizes observed by teams A and B were the most variable from mid-July to mid-August with three observations of large groups estimated to comprise 1,500, 2,000, and 2,500 caribou respectively. In the latter part of the field season, observed group sizes were smaller; from mid-August to the first week of September, *ekwǫ̀* groups classified by team C ranged in size from one individual to 58 animals.

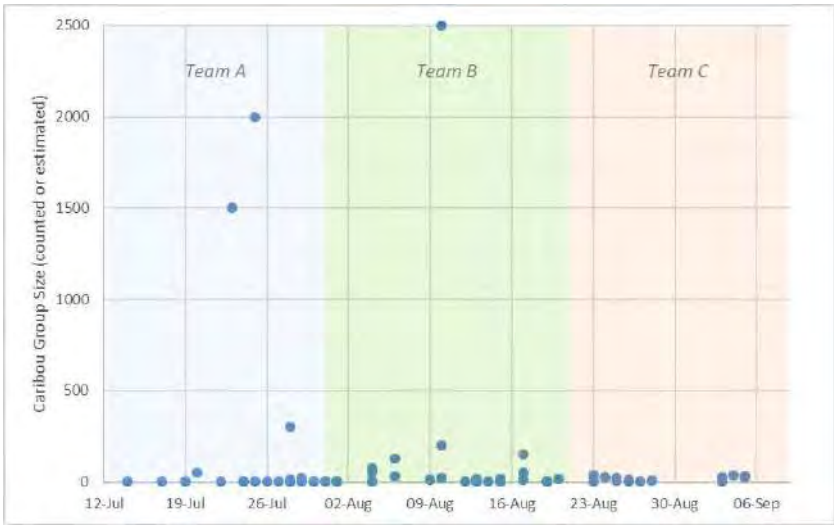



Figure 10. The 89 groups used to estimate calf:cow ratio. These were groups in which observers classified at least one adult female.

As Figure 10 demonstrates, calves were not widely observed in the *Kokètì* area until July 23rd and 25th, when Team A observed its two largest groups of approximately 1,500 and 2,000 *ekwǫ̀* respectively. In those two large groups, team A classified 106 and 128 cows and estimated calf:cow ratios of 0.14 and 0.12 (i.e., 14 and 12 calves per 100 cows) respectively (Figure 11). Several days later, on July 28th, team A saw nine caribou groups ranging in size from two to 300 animals, in which they classified at least one cow. In those groups, the proportion of calves to cows ranged from 0 to 0.75 (i.e., 0 to 75 calves per 100 cows). Thereafter, teams B and C consistently observed calves in *ekwǫ̀* groups, with calf:cow ratios ranging from zero to one (Figure 11). There were two notable exceptions, where the calf: cow ratios were 2.0 and 1.2

respectively, in observed group sizes of three *ekwǫ̀* (two calves, one cow) and 24 *ekwǫ̀* (seven calves, six cows) (see observation 50 and 74 in Data Appendix A).

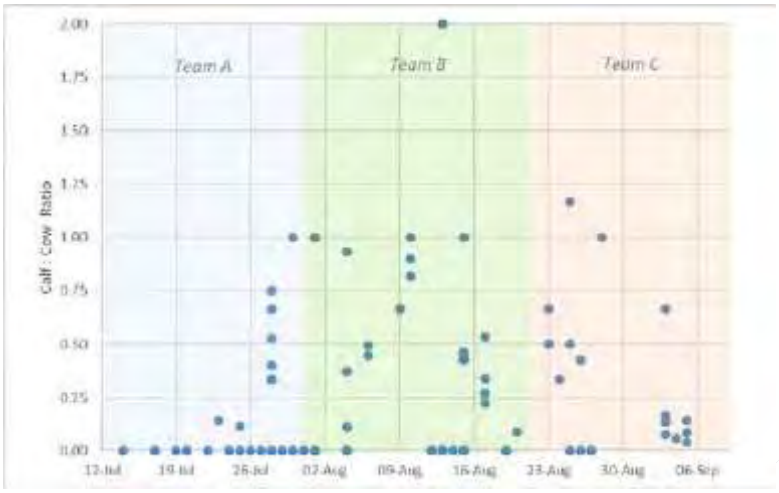



Figure 11: Calf-to-cow ratios of caribou groups observed during 2019 field season. These 89 observed groups were used to estimate overall calf:cow ratio.

There was no correlation between the number of females classified within a group and the observed calf:cow ratio (Figure 12), which suggests that the proportion of calves seen in a group was not influenced by the number of adult females within that group. The lack of correlation suggests that the teams' observations of calves were not influenced or biased by the number of cows seen in a group.

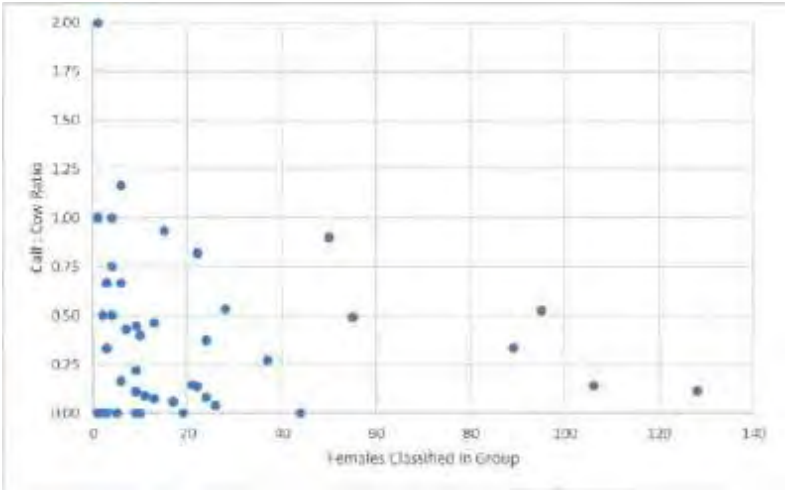



Figure 12. Relationship between observed calf:cow ratio (expressed as a proportion of calves to cows) and the number of cows classified within a group.

## Ekwǫ̀ Health

The field teams made notes on health in 118 *ekwǫ̀* groups (55%) of the 214 total groups seen. The remaining groups were too distant to make detailed health observations. The monitors reported seeing *ekwǫ̀* in good health, exhibiting signs of good fitness throughout the summer, as this past summer provided "ideal conditions for *ekwǫ̀*." With high winds and abundant, high-quality forage, *ekwǫ̀* fed well, undisturbed by biting insects. Consequently, bulls were observed gaining fat reserves earlier in the season—in mid-July—because *ekwǫ̀* had time to graze peacefully on the lush vegetation. Bulls had short

tails and levelled backs—signs of fat animals—in July. The bulls grew dark-coloured, large and wide, palmate antlers, in early July, which monitors say happened earlier than in previous years. The large, palmate antlers are a sign of good foraging conditions (photo 25). Monitors explained that in other summers, when conditions are warm and dry, with high insect harassment, the bulls' antlers grow less. The monitors noted how pleasing it was to watch *ekwǫ̀* foraging peacefully in the wind, not having to expend energy in moving continuously to escape biting insects, as was observed in 2016 and 2017.

Photo 25: Healthy *ekwò* and bulls with large antlers grazing peacefully in lush vegetation, July 23rd, 2019 (P. Jacobsen)

## Injured Animals

Monitors noted that 14 of the 118 *ekwǫ̀* groups on which health observations were made had at least one animal that was injured. Most noticeable was a limp in the caribou's gait and was attributed to a leg injury. There were 10,752 caribou in those 118 groups, and 21 individuals seen with leg injuries. The overall proportion of injured caribou was 0.2% of the caribou counted or estimated for groups where caribou health was noted.

Of the 21 injured caribou, six were bulls, four were cows, two were calves, one was a yearling, and eight were not classified into an age category. Monitors noted that, of the ten caribou with injured legs, eight had an injured front leg, and two had an injured hind leg.

## *Ekwǫ̀* collars

The Department of Environment and Natural Resources (ENR) maintains a sample of satellite-collared cows and bulls on the Bathurst *ekwǫ̀* herd to monitor its seasonal movements. Geographic locations of the collared caribou are provided by ENR approximately every second day to the field teams, who use the information to plan the daily trips to look for *ekwǫ̀* in the Kokètì area.

Three collared caribou cows were observed in larger groups on two occasions during the 2019 field season (Photographs 26). The condition, behaviour, and gait of these three collared cows seemed to be normal and healthy. However, we noted that for two cows, the collars were situated with the metal battery case on the top of the neck (photo 27). Since we were only able to watch those caribou for a relatively short period, we were not able to see whether the collar re-positioned so that the heavier battery case was hanging along the bottom of the neck, which we assumed is ideal, or preferable. We do not know whether

the observed position of the collars (*i.e.*, with the battery cases riding on the top of the neck), affects the collared caribou differently or whether the transmission of locations to satellites is affected, but the TG will discuss this further with ENR and WRRB biologists.

Photo 26: Group of several hundred caribou observed at nǫɔokè on Sept 1st, 2019, which included two collared cows as seen on right side of frame (photos from video by J. Nishi)

Photo 27: One collared cow observed on August 24th, 2019 (J. Nishi)

# Indicator 3: Predator Observations

During the 57-day field season, we observed 28 *dìga* (wolves), 23 *det'ǫcho* (eagles), ten individual *sahcho* (grizzly bear), and three *nǫ̀gha* (wolverine). The three *nǫ̀gha* were observed by team A in late July, and were likely an adult female with two subadults. The other field teams did not observe *nǫ̀gha*. We observed several direct attacks and chases on *ekwǫ̀* by *dìga*. No chase by *det'ǫcho*, *nǫ̀gha* or *sah dek'oo* were observed on *ekwǫ̀*. All predators appeared healthy with no injuries or health issues noted.

## Dìga Observations

Thirty-one individual *dìga* were observed in 16 discrete observations. *Dìga* pups were seen on four separate occasions for a total of seven pups of the year. In July, Team A observed *dìga* almost every second day for a total of 17 *dìga*, either single or in pairs. No *dìga* were observed by Team B during first three weeks of August. However, Team C had seven encounters with *dìga*; a total of 14 *dìga* observed, including a pack of four *dìga*, during the last week of August and first week of September.

The *dìga* observations occurred all around *Kokètì* and *Kwìdlìachɻ̨*, where the teams walked. Concurrent to these observations, many groups of *ekwǫ̀* were migrating through these locations. Several chases on *ekwǫ̀* were observed by *dìga*, although none were successful. On July 23rd, Team A observed a young male *dìga* conduct a three-minute continuous chase after a large, 1,500 animal herd. The chase was unsuccessful and the herd walked slowly away once the *dìga* stopped the chase.

On August 27th, the fresh partial skeletal remains of a recently killed young bull *ekwǫ̀* were found on the rocky shoreline of a lake (Photo 28). Although it was not possible to determine a cause of death, it was apparent from signs of chewing and crushing of the skull and various bones that a large carnivore had been consuming the remains. Since we saw a pair of adult *dìga* within 2.5 kilometers of the kill site, we thought the *ekwǫ̀* had likely been killed by *dìga* (photo 30). The right side of the *ekwǫ̀* skull had been mostly chewed, exposing the brain cavity; the premaxilla was absent and the nasal bones were largely

missing; and one side of the lower jaw was missing with pieces missing from the remaining jawbone. The ends of the main antler beams had been chewed and the antler velvet had been stripped.

In September, when *dìga* pups were observed, the pups were travelling with adults and not at den sites; the pups' coats were similar to adults and their relative body sizes were about half to two-thirds the size of adults. Of the three September sightings of *dìga* pups, single pups accompanied a single adult on two occasions (September 5th and 7th, respectively). The third observation (September 6th) was of two adults and two pups pursuing a group of nine *ekwǫ̀*.

Photo 28: A recently-killed *ekwǫ̀* bull (~three to four years old *ekwǫ̀*) found along a rocky shoreline of an inland lake at the southwest end of Kokètì, August 27th, 2019 (J. Nishi)

## Dìga Dens

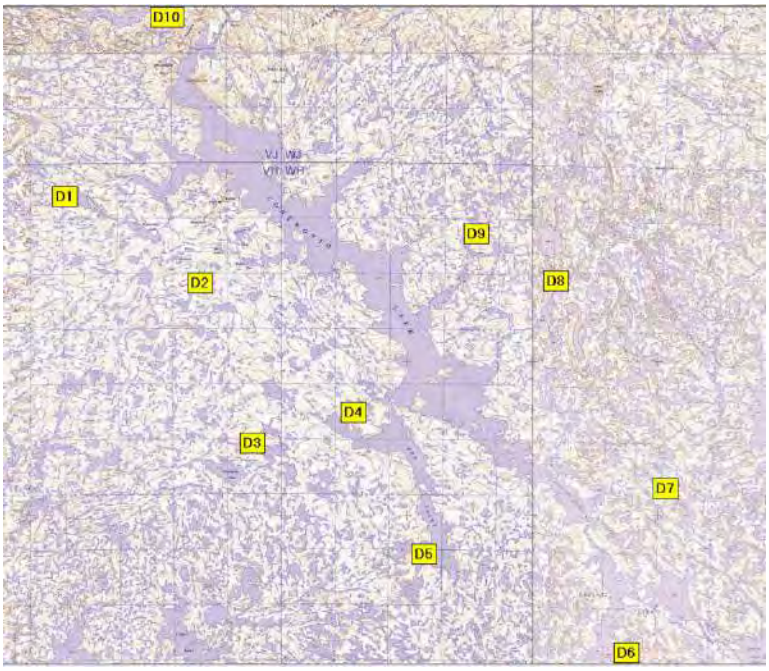
The wolf den location, seen on the eastern shore of *Kokètì* in July (number D9 on Map 4), had increased to two active dens occupied with *dìga woza* (wolf pups). The female *dìga* in the first den sensed the monitoring team and disappeared underground with her pups without reappearing, while the second den had three pups (photo 29). All pups were healthy, appeared well-fed and monitors noted pups had "lots of muscles." The white female *dìga*, the mother, stood approximately at a 500-metre distance, communicating by barks and howls to her pups, while the monitoring team observed. The father *dìga* was in the nearby hills searching for *ekwǫ̀*. Eventually, the mother abandoned the den site and joined the *ekwǫ̀* hunt with the father.

The newly-established den was most likely formed by a *dìga* that had been raised in a den close by, as the female *dìga* generally choose to build a new den sites in sandbars close to their mothers. The den was dug into the top of a small sandbar with multiple entrances. The first *dìga* den has been active for the three years since we started monitoring, but most likely it has been active for many years prior to that. The regular frequency of *ekwǫ̀* movement alongside the eastern shore of *Kokètì* throughout the summer makes the den location suitable for raising *dìga* pups.

Photo 29: Three *dìga woza* (wolf pups) at an active den site, Kuniks Bay, eastern shore, *Kokètì*, July 17th, 2019 (P. Jacobsen)

Photo 30: Adult *dìga* flanking field monitors to get a better look, August 27th, 2019 (J. Nishi)

John Koadloak marked locations of ten previously-used *dìga* dens known to him around Kokètì on a large map wall with a three kilometer-by-three kilometre grid. Those general locations were marked on a digital 1:250,000 scale topographic map (map 5) as potential future search areas.




Map 5: Locations of previously occupied wolf den sites around *Kokètì* were drawn on a large map by J. F. Koadloak and digitized on to 1:250,000 scale topographic maps.

## Det'ǫcho Observations

During our nine-week monitoring period, 23 *det'ǫcho (eagle)* were observed on 18 occasions. Of the 23 individuals seen, eight were bald eagles and four were golden eagles. The 18 *det'ǫcho* sightings included five pairs, comprised of a single pair of golden eagles on July 28th, and two pairs of bald eagles on the August 10th and September 7th, respectively. The other three *det'ǫcho* pairs were not distinguished to species. The remaining 13 sightings were of single *det'ǫcho* including two and four golden and bald eagles respectively, with seven single *det'ǫcho* observations not confirmed as they soared too high for visual identification.

No nests or juveniles were observed this field season, in contrast to previous seasons, in which juveniles were sighted. Many *det'ǫcho* were observed soaring high over *ekwǫ̀ noɔokè*, looking out for *ekwǫ̀* who might have injured themselves during a crossing, or for fish, who could be easily detected in the shallow waters. Other *det'ǫcho* were observed sitting on high rocks near the water, surveying for fish. No observation of chases on *ekwǫ̀* calves were observed. One bald eagle was observed at a beach, near a *nǫɔokè*, where it had caught several lake trout that it was feeding on and another bald eagle was observed attempting to catch eggs from a seagull's nest. In 2018 and 2019, we observed more *det'ǫcho* than in the previous two years. The bald eagle summer range is typically limited to the forest landscape and does not reach into the barrenland. First observed in 2005 by local residents on *Kokètì*, bald eagle are now a permanent presence and a new predator/scavenger on the Bathurst summer range.

## Sahcho Observations

Individual *sahcho* (grizzly bears) were seen ten times during the mid and latter parts of the field season, in late August and early September, and were not seen in July. *Sahcho* observed were in good condition as evidenced by their coats and rounded bodies (Photograph 32). It was apparent by the high concentration of berries found in scat that bears were taking advantage of the abundant berry crop (Photograph 31). No *sahcho* activity was seen in vicinity of *ekwǫ̀* and no attempted chases on *ekwǫ̀* were observed.

In late evening on August 30th, an adult *sahcho* breached the camp's electric perimeter fence (which was not activated at the time) and accessed fish remains from a plastic kitchen waste bin located beside the field camp's tent frame. The bear was immediately hazed from camp by several people using bear bangers and gun shots, and the fence was activated. The following day an adult *sahcho* —likely the same bear from the previous evening—was seen in the late afternoon 0.5km west of camp and hazed with multiple bear deterrents and gun shots, whereupon it travelled several kilometres further west and bedded down. The next day (August 31st) an adult *sahcho* (likely the same individual) was seen walking north along the skyline of the raised ridge 0.5km west of camp. The bear proceeded down to the lake shoreline and swam at least 500 meters, hazed by multiple gun shots, once it reached the shore north of camp. Upon reaching shore, the bear quickly ran northward up a small hill and out of site. There were no further sightings of *sahcho* within one kilometre of camp for the rest of the field season.


Photo 31: Fresh *sahcho* scat with high berry content, August 23rd, 2019 (J.

Photo 32: A large *sahcho* observed west of camp, August 31st, 2019 (J.J. Simpson)

# Indicator 4: Industrial Development

The monitoring team found hundreds of survey sticks scattered over the land over hundreds of square kilometres—remains of mineral exploration activity in the area. On the western shore of *Kokètì*, four kilometres inland from Shallow Bay, we observed litter from exploration activity. Along with several steel posts (photo 35) protruding from the ground, an empty hydrochloric acid container (photo 33) was left on the ground. The container was empty, but its acid content could have spilled and contaminated nearby environment.


Photo 33: Hydrochloric acid container left on the ground, Shallow Bay, Kokètì. July 16th, 2019 (P. Jacobsen)

In Shallow Bay, on the eastern shore of *Kokètì*, we observed an old *ekwǫ̀* skull wrapped in steel wire (photo 34). The wire was an electrical wire, normally used as bear protection fence around exploration camps. The location of the skull is a few kilometres from the south end of Lupin mine site. Likely the *ekwǫ̀* entangled itself into the wire prior to its death. This was the same skull found by the monitoring team in 2017.

Photo 34: *Ekwǫ̀* skull and steel wire. Shallow Bay, Kokètì, July 16th 2019 (P. Jacobsen)

Photo 35: Steel post protruding from ground. Shallow Bay, Kokètì. July, 2018 (J. Franklin Koadloak)

# Discussion: 2016-2019 Trends

Four years of monitoring the *Kokètì ekwǫ̀* herd has provided insight into the multifaceted interconnections between *ekwǫ̀*, its habitat, its predators, and weather patterns. These connections have revealed demographic trends and behaviours utilized by *ekwǫ̀* in response to rapidly changing conditions in their summer and fall habitat. From 2016 to 2019, the teams have steadily increased the monitoring and search effort each year (Table 7) which has resulted in improved and more frequent wildlife observations.

Table 7: Monitoring Efforts, 2016-2019

**MONITORING EFFORTS 2016-2019**

| | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|
| CARIBOU MONITORS | 8 | 10 | 10 | 25 |
| FIELD DAYS | 26 | 40 | 40 | 57 |
| DISTANCE TRAVELLED | 481 km | 1186 km | 1784 km | 3240 km |
| MONITORING HOURS | 140 | 207 | 218 | 325 |

## Calf Abundance 2016-2019

Monitors observed changes in calf abundance for summer months, from 2016 to 2019 (table 8). The two first years (2016-2017), calf abundance was recorded qualitatively, and were characterised as positive years, in which herds carried a normal and high amount of calves. While in 2018 and 2019, a declining trend was observed with a *low* amount of calves in the monitored herds. In this context, high calf abundance represented groups where generally every cow had a calf, normal represented groups in which approximately two thirds (2/3) of cows had calves, and low described groups where only one third (1/3) of the cows had a calf.

Table 8: Trends of monitoring indicators, 2016-2019.

**INDICATORS OVER TIME**

| | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|
| WEATHER, VEGETATION | Warm, Dry | Mix dry/wet | Wet, windy | Wet, windy |
| HEALTH | Normal, many injured | Normal | Early fat, bulls healthy | Early fat, bulls healthy |
| CALF ABUNDANCE | Normal, high | Normal, high | Normal, Low | Low |
| WOLVES OBSERVED | 1 | 18 | 16 | 31 |

In the summer of 2016, monitors saw caribou groups with normal and at times high calf abundance. In 2017, most cows were accompanied by calves, resulting in nearly a one-to-one calf-cow ratio in observed caribou groups. By the summer of 2018, however, this positive trend had changed: monitors saw fewer calves with calf abundance considered to be normal and low for most of the *ekwǫ̀* seen (Table 9). Observations of *ekwǫ̀* where cows had a high abundance of calves represented less than 8% of the *ekwǫ̀* observed. Most *ekwǫ̀* cows observed had normal and low abundance of calves, and cows that had no calves represented less than 6% of the *ekwǫ̀* observed. Yearlings were noted to be abundant in many *ekwǫ̀* groups, suggesting normal-to-high survival rates of calves born in 2016 and 2017.

Photo 36: Calves nursing from their mothers. July 21st 2017, Fry Inlet (P. Jacobsen).

While these observed demographic patterns may be influenced by a number of factors (including predation), the high calf abundance in 2016 and 2017 may result in an increase in the number of young breeding-aged (3-years old) females in 2019-2020, which may in turn, contribute to more calves in the upcoming seasons. However, this trend is countered by low calf abundance in 2018 and 2019, when the declining trend continued, resulting in most *ekwǫ̀* groups carrying few or no calves at all.

Table 9: Relative calf abundance in caribou groups observed in summer 2018

| Relative Calf Abundance* | No. of Groups Observed | Average number of caribou in Group | Min Group Size | Max Group Size | Total Caribou Observed | Percent (%) Caribou Observed |
|---|---|---|---|---|---|---|
| None | 20 | 16 | 1 | 150 | 323 | 5.6% |
| Low | 18 | 125 | 3 | 1,000 | 2,253 | 39.2% |
| Normal | 7 | 389 | 3 | 1,000 | 2,726 | 47.5% |
| High | 7 | 63 | 3 | 300 | 441 | 7.7% |
| Sum | 52 | | | | 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 one out of every 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.

In comparison to previous summers, where relative calf abundance in *ekwǫ̀* groups was assessed qualitatively (2016 and 2017) or ranked categorically (2018), in summer 2019 we adopted a more empirical approach for assessing calf abundance. For small groups of fewer than 20 to 50 *ekwǫ̀*, monitors classified and counted cows and calves and most other individuals. For larger groups, monitors would scan across the group and count groups of 10 cows and the associated number of calves to another team member who recorded those observations in a field notebook. Alternatively, when large groups were observed at water crossings sites, caribou would often approach or emerge in single file allowing Monitors to identify and call out classified animals to a nearby team member to record the observations.

In 2019, the monitoring teams observed a total of 214 *ekwǫ̀* groups of which 89 observations were used to estimate an overall calf:cow ratio. Based on the sample of 89 caribou observations, we estimated an overall calf:cow ratio of 31 calves per 100 cows (i.e., 0.307 + 0.056 SE); this would be considered low, because it suggests that by summer less than one-third of breeding-aged females had a calf (figure 13).

During summer 2018, we observed a high number of yearlings (calves born in 2016 and 2017) and we anticipated that summer of 2019 would show an increase in calf abundance as those yearlings matured and became able to have offspring. That was not the case as the negative trend continued with low numbers of calves observed, similar to observations in 2018. However, if many of the female calves born in 2017 survive, they likely became pregnant during fall 2019 and we can expect them to have calves in summer 2020.

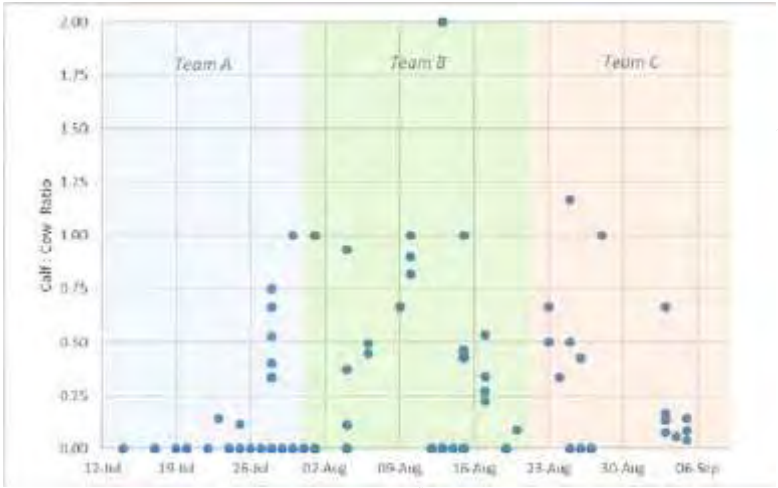



Figure 13: Calf:cow ratios of *ekwò* groups observed during 2019 field season. These 89 observations were used to estimate calf:cow ratio.

## Combining Weather Conditions, Vegetation and Ekwǫ̀ Health

Summer weather conditions, including trends in temperature, wind speed and precipitation, have direct and indirect influences on *ekwǫ̀* health and fitness for the coming months of the rut and the long winter migrations. Summer weather influences plant growth and forage quality, which, in turn, influences *ekwǫ̀* nutrition and growth. Similarly, summer weather conditions influence insect abundance, which influences *ekwǫ̀* foraging behavior. These relationships, between weather, vegetation, insects and *ekwǫ̀*, are, however, often non-linear and with short and long-term consequences. For example, the adverse effects of a "bad year" or a "good year" of weather could possibly have effects on *ekwǫ̀* population changes the following year, or even longer.

Warm and dry conditions in July and August typically result in dry vegetation, making lichen and moss "crusty" (TRTI 2017). Warm weather also brings consistent harassment of *ekwǫ̀* by biting insects. On warm

Photo 37: Herd standing on ridgeline facing into wind to avoid the high biting insect harassment. July 11th, 2017 (P. Jacobsen).

days with low wind, biting insects will cause *ekwǫ̀* to aggregate in large groups of several hundreds or thousands. The *ekwǫ̀* aggregate to reduce insect harassment and will be constantly walking and running along the higher ground (photo 37) or by shoreline where there is slightly more wind to avoid being bitten. But while continuous running solves the problem of insect bites, it detracts from valuable feeding time, and individuals are unable to start building up fat reserves by foraging. Warm summer temperatures have another detrimental effect on herds by melting summer snow patches. These patches, usually covering north-facing hills and crevasses, provide relief from the heat and insect activity on hot, calm days. On the other hand, thawing from these patches helps to moisten vegetation and create better forage for *ekwǫ̀* (TRTI 2017).

Warm, dry conditions were prevalent in 2016; long periods of little rainfall and high temperatures resulted in dry, "crusty" vegetation. *Ekwǫ̀* were observed to be in "normal" body condition, but were unable to build up fat reserves in July, which was understandable due to the high amount of biting insect harassment. The following year—2017—was similarly warm and dry except for periods of rain and cold temperatures. During a few of that season's heat waves (especially in August, where temperatures at *Kokètì* reached 30 degrees Celsius) *ekwǫ̀* forage was dry and crusty. Overall, however, monitors said the forage was of "good and normal" quality throughout July and August, and had been made "moist and fluffy" from the rain and wind.

Photo 38: Herd grazing by shoreline of Fry Inlet among clouds of mosquitoes among the herd, luminated by the setting sun. July 20th, 2017 (P. Jacobsen).

The caribou were considered to be in "normal" health and we saw that a few bulls had started to accumulate fat reserves in early July, which was earlier than in the previous year, but not as early as we would see in the 2018 and 2019 seasons. Although 2016 and 2017 brought warm conditions and periods of dry vegetation, we observed a normal and high amount of calves in the herds (Table 8).

In 2018 and 2019, hot and dry weather trends reversed, and turned cold, wet, and windy—which was optimal for *ekwǫ̀*. Throughout the 2018 monitoring season, the weather was rainy, very windy and continuously cold (below 10 Celsius) except for five days with warm, calm weather in July. Throughout the summer, monitors described the caribou forage as consistently "good" with no dry periods of "crusty" vegetation as seen in 2016 and 2017. Overall, these conditions generated less insect harassment. The herds had more time to feed uninterrupted and thus build up fat reserves without the need to continuously run from biting insects. Resting behavior, such as resting into the wind and lying down, and calmly grazing and walking around, was noted as occurring earlier. For the monitors, these resting periods are essential to the animal's health. Colder and rainier weather conditions help the caribou build fat reserves earlier in the year (immediately after snowmelt), helping them to withstand any periods of high insect harassment, and therefore increased energy expenditure and reduced feeding, should the weather turn warm and dry later in the season. With the continuously cold temperatures of 2018, then, the bulls started to accumulate fat reserves on their rumps and lower back and grew large and dark-coloured

antlers earlier in the season (in mid-July), compared to earlier years. Dark-coloured antlers are considered a sign of strong health by harvesters. During July and August, the Bathurst herd showed signs that it was in strong and normal health. Although weather and forage conditions were favourable for *ekwǫ̀* fitness, however, in summer 2018 we observed a declining trend in calves, and several herds with no calves at all.

The summer of 2019 brought similar weather conditions as the summer before—continuously cold, strong winds and frequent rain showers. The vegetation quality was good and tundra flowers and mushrooms were visibly abundant, as compared to previous years. This was due to the frequent rain showers that soaked the ground. Once again, these were favourable weather conditions for *ekwǫ̀*; insect activity was suppressed and *ekwǫ̀* had more time to feed uninterrupted for longer time periods. The monitors reported healthy *ekwǫ̀* throughout the summer. Bulls were building fat reserves in mid-July and grew large and wide, dark-coloured, palmate antlers (Photo 39) in early July—earlier than in previous years. Monitors noted that large, palmate antlers are a sign of good forage conditions, and the ability for *ekwǫ̀* to continuously feed throughout July, without having to expend undue energy running from biting insects.

While forage conditions were favourable in the summer of 2019, and the herds went into the fall in good physical condition, the majority of herds carried few or no calves at all—a continuing negative trend in calf population from 2018. Interestingly, though the summers of 2018 and 2019 brought favourable weather conditions for vegetation growth—which consequently improved caribou health—those two years also saw declines in calf abundance.

Photo 39: Herd feeding in ideal conditions*, ekwò* bulls with large antler growth on July 23rd, 2019 (P. Jacobsen).

## Dìga and Ekwǫ̀

Over the past four years, observations of *dìga* activity on the summer range has increased. Our monitoring efforts have increased yearly (table 7), which has improved our chances of wildlife encounters. However, the frequency of *dìga* observations during summer months has increased greatly in the same years. In 2016, only one *dìga* was observed and we witnessed no attempted chases of individuals or herds. In 2017, we observed 19 *dìga* mostly on the north and east sides of *Kokètì*, and several predation attempts on *ekwǫ̀*. On July 14th, 2017, two *ekwǫ̀* calves were killed, and on the eastern shore of *Kokètì*, along an esker complex, we observed one active den with four pups. In 2018, 16 *dìga* were observed, and frequent activity was observed close to *ekwǫ̀ nǫʔokè* (water crossings) (photo 40). The *dìga* den on the eastern shore of *Kokètì* was active, although we saw only one female nearby, though there were likely pups hidden inside.

Photo 40: A young female *dìga* emerging from it hiding place at a *nǫɔokè*, waiting for *ekwò* to swim cross, Kuniks Bay, July 19th 2018 (P. Jacobsen).

In 2019, a record number of 31 *dìga*, including seven pups, were observed. This was the highest number of *dìga* observed of all monitoring seasons (bearing in mind our monitoring efforts have also increased from previous years). The den location on the eastern shore of Kokètì (number D9 on Map 4) increased to two active dens, each occupied with *dìga* pups, compared to one active den the two previous years. One den had three pups. In July, *dìga* were sighted almost every second day, travelling either singly or in pairs. This high frequency of *dìga* encounters in July had not been experienced in previous years. In September, packs of four to five animals were observed. Monitors witnessed multiple chases on *ekwǫ̀*, although none of those were successful. On July 23rd, we observed a young male *dìga* pursue a 1,500+ animal herd unsuccessfully. On August 27th, the partial skeletal remains of a recently killed young bull *ekwǫ̀* were found on the rocky shoreline of a lake (photo 28). Although it was not possible to determine a cause of death, it was apparent from signs of chewing and crushing of the skull and various bones that a large carnivore had been consuming the remains. Monitors saw a pair of adult *dìga* within 2.5 kilometers of the kill site, and considered it likely that the *ekwǫ̀* had been killed by *dìga*.

The monitors suggested that a contributing factor to the low calf abundance observed in 2018 and 2019 was the high *dìga* activity observed around Kokètì. It was clear to them that the high *dìga* activity had an impact on the ability of calves to survive their first few months, while they were still unable to outrun the chase of a *dìga*. According to harvesters, barren-ground *ekwǫ̀* herds (Bluenose east, Bathurst and Beverly/Ahiak herds) provide a steady and secure supply of meat for *dìga* throughout the year, as they remain near to and north of the treeline on the central barrens year-round. Although the herds have declined, there are still thousands of *ekwǫ̀* on the land that the *dìga* can hunt.

Photo 41: Joe Zoe holding a jaw bone of *ekwǫ̀* calf found by a noɔokè where the white female *dìga* was hiding, Kuniks Bay, Kokètì, July 19th 2018 (P. Jacobsen)

# Summary

In 2019, three monitoring teams spent 57 days on the *Kokètì ekwǫ̀* summer range in July, August and September. The teams observed a total of 214 caribou groups (estimated total number of *ekwǫ̀* observed was 15,613) of which 89 of the observed groups were used to estimate an overall calf: cow ratio. Based on the sample of 89 caribou observations, we estimated an overall calf: cow ratio of 31 calves per 100 cows (i.e., 0.307 + 0.056 SE); this would be considered low, because it suggests that by summer less than 1/3 of breeding-aged females had a calf. The low number is a continuation of a negative trend observed since 2018.

The overall conditions of caribou forage were characterized as very good to excellent during the summer months, because the vegetation was lush and productive due to consistent rain and soil moisture. An abundance of flowers, berries and mushrooms—three indicators of good summer growing conditions—were observed throughout the summer. Summer snow patches were numerous throughout July, but they melted in August. With high winds and abundant, high-quality forage, considered "ideal conditions for *ekwǫ̀,*" herds fed well, undisturbed by biting insects, and consequently bulls were observed gaining fat reserves earlier in the season—in mid-July—because *ekwǫ̀* had time to graze peacefully on the lush vegetation. The bulls grew dark-coloured, large, wide, palmate antlers, in early July, which monitors say happened earlier than in previous years.

Predator observations included 31 *dìga*, including seven pups, and two active dens were observed. In July, *dìga* were sighted almost every second day, travelling either singly or in pairs. This high frequency of *dìga* encounters in July had not been experienced in previous years. S*ahcho* were seen ten times during the mid and latter parts of the field season, in late August and early September, and were not seen in July. *Sahcho* observed were in good condition as evidenced by their coats and rounded bodies, apparently taking advantage of the abundant berry crop. No *sahcho* activity was seen in vicinity of *ekwǫ̀* and no attempted chases on *ekwǫ̀* were observed. 23 *det'ǫcho* were observed on 18 occasions. Of the 23 individuals seen, eight were bald eagles and four were golden eagles. In 2018 and 2019, we observed more *det'ǫcho* than in the previous two years. No nests or juveniles were observed this field season, in contrast to previous seasons, in which juveniles were sighted. The bald eagle summer range is typically limited to the forest landscape and does not reach into the barrenland. First observed in 2005 by local residents on *Kokètì*, bald eagles are now a permanent presence and a new predator/scavenger on the Bathurst summer range.

Based on four years of watching the Bathurst summer range, the *Ekwǫ̀ Nàxoède K'è* caribou monitoring program makes four recommendations:

**Recommendations**

1) protect caribou habitat by establishing a *Kokètì Ekwǫ̀* Habitat Protected Area;
2) support *dìga* hunting by indigenous harvesters on the barren-ground *ekwǫ̀* core use area;
3) advance 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) Continue zero harvest of *Kokètì Ekwǫ̀* herd, to promote recovery of the barren-ground *ekwǫ̀* herds.

## Continued Monitoring Topics

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

- Health and calf abundance trends of the *Kokètì ekwǫ̀* herd.
- Habitat and forage quality, and the effects of climate change on habitat and *ekwǫ̀* behaviour.
- Increased abundance of *dedìı* (moose) on the barrenland.
- The relationship between *ekwǫ̀*, *dìga* and indigenous harvesters.
- Impacts of industrial development on *ekwǫ̀* habitat.

## Further Research Topics

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

- How does the loss of cultural practices associated with less *ekwǫ̀* harvesting, meat processing and hide preparation affect social and cultural identity in northern communities?
- How does this loss of opportunities to pass on the knowledge, language and culture of the hunt affect the social and cultural identity of younger generations in northern communities?
- How does the inability to hunt *ekwǫ̀* affect food security concerns in Tłı̨chǫ and other indigenous communities?

*Ekwǫ̀ Nàxoède K'è* has given participants, old and young, the opportunity to live in close contact with *ekwǫ̀* and gain direct experience with the land and animals. This program has, however, also been an emotional journey for many harvesters. While happy to see *ekwǫ̀*, all felt the visual impact of lower population numbers than ever; others felt nostalgia and sadness at the lost opportunity for their kin and youth to learn their traditional practices. Elder Joe Zoe summed up the feelings of all on the real implications to his community from the *ekwǫ̀* decline: *"how can I be happy [to see ekwǫ̀], when my wife and kids back home are hungry".*

Photo 42: Basecamp at channel between *Kokètì* and *Kwìıdlìachı̨̀* during the largest gathering of Tłı̨chǫ people at *Kokètì* in over a hundred years, September 3rd, 2019 (J.J. Simpson)

# References

Adamczewski, J. Z., J. Boulanger, H. Sayine-Crawford, J. Nishi, D. Cluff, J. Williams, and L.-M. Leclerc.
2019 Estimates of breeding females and adult herd size and analyses of demographics for the Bathurst herd of barren-ground caribou: 2018 calving ground photographic survey. Manuscript Report No. 279, Department of Environment and Natural Resources, Government of the Northwest Territories, Yellowknife, NT.

Andrews, Tom
2011 "There will be many stories" museum anthropology, collaboration, and the Tlicho. PhD thesis, University of Dundee.

Boertje, Rodney. D.
1990 Diet quality and intake requirements of adult female caribou of the Denali herd, Alaska. Journal of Applied Ecology 27:420-434.

Boulanger, J., B. Croft, J. Z. Adamczewski, H. D. Cluff, M. Campbell, D. S. Lee, and N. C. Larter.
2017 An estimate of breeding females and analyses of demographics for the Bathurst herd of barren-ground caribou: 2015 calving ground photographic survey. Manuscript Report No. 267, Department of Environment and Natural Resources, Government of the Northwest Territories, Yellowknife, NT

Canadian System of Soil Classification (CSSC)
1993 Agriculture and Agri-food Canada. NRC Research Press, Ottawa

Environment Canada
1998 Canada Climatic Regions, Climate Research Division. Environment Canada. Ottawa.

Chen, Wenjun et al.
2014 Assessing the Impacts of Summer Range on Bathurst Caribou's Productivity and Abundance since 1985. *Natural Resources*, 5, 130-145.

Government of the Northwest Territories and Tłı̨chǫ Government
2020 Government of the Northwest Territories and Tłı̨chǫ Government Joint Proposal on Management Actions for the Bathurst Ekwǫ̀ (Barren-ground caribou) Herd: 2019 – 2021 https://www.wrrb.ca/sites/default/files/TG%20ENR%20Joint%20Management%20Proposal%20for%20BATH%202019.pdf

Government of the Northwest Territories.
2019 Bathurst Caribou Range Plan. Environment and Natural Resources, Government of the Northwest Territories, Yellowknife, NT. 86 + iii pp. https://www.enr.gov.nt.ca/sites/enr/files/resources/bathurst_caribou_range_plan_2019_-_plan_pour_laire_de_repartition_des_caribous_de_bathurst_2019.pdf

Goulet, Jean-Guy
1998 Ways of Knowing: Towards a Narrative Ethnography of Experience Amongst the Denè Tha. Journal of Anthropological Research 50(2): 113- 139.

Helm, June
1994 Prophecy and Power among the Dogrib Indians. Lincoln: University of Nebraska Press.

Inga, Berit
2007 Reindeer (Rangifer tarandus tarandus) feeding on lichens and mushrooms: Traditional ecological knowledge among reindeer-herding Sami in northern Sweden. Rangifer 27:93-106.

Ingold, Tim
2000 The Perception of the Environment: Essays in Livelihood, Dwelling and Skill. Routledge: London and New York.

Jacobsen, Petter
2011 Tłı̨chǫ Traditional Knowledge of Climate Change and Impacts for Caribou Hunting: Implications for Traditional Knowledge Research. MA Thesis. University of Northern British Columbia.

Krebs, Charles.J.
1989 Ecological Methodology. Harper and Row, New York

Launchbaugh, K. L., and P. J. Urness.
1992 Mushroom consumption (mycophagy) by North American cervids. Great Basin Naturalist 52:321-327.

Legat, Allice
2008 Walking Stories; Leaving Footprints. In Ingold, Tim and Jo Lee Vergunst, eds: Ways of Walking; Ethnography and Practice on Foot. Ashgate Publishing Company, Burlington.

Legat, Alice
2012 Walking the Land, Feeding the Fire: Knowledge and Stewardship Among the Tåîchô Dene. The University of Arizona Press. Tucson, Arizona.

Legat, Zoe and Chocolate
1995 Tłı̨chǫ Nde: The Importance of Knowing in Environmental Impact Assessment Statement: BHP Diamonds Inc.

Okely, Judith
1992 Anthropology and the Autobiography. Participatory Experience and Embodied Knowledge. In, Okely, Judith and Helen Callaway, eds: Anthropology and Autobiography, pp 1-28. Routledge: London and New York.

Pretty, Jules; Bill, Adams; Fikret, Berkes; Simone Ferreira de Athayde, Nigel Dudley, Eugene Hunn, Luisa Maf, Kay Milton, David Rapport, Paul Robbins, Eleanor Sterling, Sue Stolton, Anna Tsing, Erin Vintinner and Sarah Pilgrim
2009 The Intersections of Biological Diversity and Cultural Diversity: Towards Integration. *Conservation and Society* 7(2): 100-112.

Pilgrim, Sarah and Jules Pretty
2010 Nature and Culture: Rebuilding Lost Connections. Published by Earthscan. London, England.

Russel, Bernard
2006 Social Research Methods: Qualitative and Quantitative Approaches. University of Florida, FL.

Species at Risk Committee (SARC).
2017 Species Status Report for Porcupine Caribou and Barren-ground Caribou (Tuktoyaktuk Peninsula, Cape Bathurst, Bluenose-West, Bluenose-East, Bathurst, Beverly, Ahiak, and Qamanirjuaq herds) (Rangifer tarandus groenlandicus) in the Northwest Territories. Species at Risk Committee, Yellowknife, NT. https://www.nwtspeciesatrisk.ca/sites/enr-species-at-risk/files/bgc_and_pch_status_report_and_assessment_final_apr1117.pdf

Species at Risk Committee (SARC).
2018 Conference of Management Authorities. Consensus Agreement on Listing Barren-Ground Caribou. https://www.nwtspeciesatrisk.ca/sites/enr-species-at-risk/files/consensus_agreement_on_listing_barren-ground_ekwǫ̀_signed_apr1118_0.pdf

Sharp, Henry S, and Karyn Sharp
2016 Hunting Caribou: Subsistence Hunting along the Northern Edge of the Boreal Forest. University of Nebraska

Tłı̨chǫ Research and Training Institute (TRTI)
2018 Results Report, Boots on the Ground caribou monitoring program. Tłı̨chǫ Government. https://research.tlicho.ca/sites/default/files/2018_results_ekwo_naxoede_ke_1.pdf

Tłı̨chǫ Research and Training Institute (TRTI)
2017 We Watch Everything: A Methodology for Boots-on-the-Ground Caribou monitoring. Tłı̨chǫ Government. https://research.tlicho.ca/sites/default/files/we_watch_everything_a_methodology_for_boots_on_the_ground_caribou_monitoring.pdf

Tłı̨chǫ Research and Training Institute (TRTI)
2016 We Live Here for Caribou: Cumulative Impacts Study on the Bathurst Caribou. Tłı̨chǫ Government. https://research.tlicho.ca/sites/default/files/ekwo_zo_gha_dzo_natsede_tk_study.pdf

Tłı̨chǫ Research and Training Institute (TRTI)
2012 Tłı̨chǫ Use and Knowledge of Ewaànıt'ıtı. Tłı̨chǫ Government.

Whaèhdôö Nàowoò Kö
2002 Dogrib Knowledge on Placenames, Caribou and Habitat. Dogrib Treaty 11 Council: submitted to the West Kitikmeot Slave Study Society, Yellowknife, NWT.

Data Appendix 1: Sample of 89 *ekwǫ̀* groups used to estimate calf:cow ratio in the 2019 Ekwǫ̀ Nàxoède K'è field season. Tukey's jackknife method (Krebs 1989, p. 494) was used to estimate the proportion of calves.

| No. | Team | Date | Obs # | Total Caribou in Group (count or estimate) | Cows Classified | Calves Classified | Other Caribou |
|---|---|---|---|---|---|---|---|
| 1 | Team A | 14-Jul-19 | 2 | 1 | 1 | 0 | 0 |
| 2 | Team A | 17-Jul-19 | 13 | 1 | 1 | 0 | 0 |
| 3 | Team A | 19-Jul-19 | 18 | 1 | 1 | 0 | 0 |
| 4 | Team A | 20-Jul-19 | 22 | 53 | 44 | 0 | 9 |
| 5 | Team A | 22-Jul-19 | 30 | 1 | 1 | 0 | 0 |
| 6 | Team A | 23-Jul-19 | 33 | 1500 | 106 | 15 | 1379 |
| 7 | Team A | 24-Jul-19 | 37 | 1 | 1 | 0 | 0 |
| 8 | Team A | 24-Jul-19 | 39 | 3 | 2 | 0 | 1 |
| 9 | Team A | 25-Jul-19 | 43 | 2 | 1 | 0 | 1 |
| 10 | Team A | 25-Jul-19 | 44 | 2000 | 128 | 15 | 1857 |
| 11 | Team A | 26-Jul-19 | 47 | 1 | 1 | 0 | 0 |
| 12 | Team A | 27-Jul-19 | 48 | 1 | 1 | 0 | 0 |
| 13 | Team A | 28-Jul-19 | 49 | 2 | 1 | 0 | 1 |
| 14 | Team A | 28-Jul-19 | 51 | 14 | 10 | 4 | 0 |
| 15 | Team A | 28-Jul-19 | 51 | 10 | 6 | 4 | 0 |
| 16 | Team A | 28-Jul-19 | 51 | 6 | 3 | 1 | 2 |
| 17 | Team A | 28-Jul-19 | 53 | 7 | 4 | 3 | 0 |
| 18 | Team A | 28-Jul-19 | 55 | 10 | 9 | 0 | 1 |
| 19 | Team A | 28-Jul-19 | 56 | 4 | 3 | 1 | 0 |
| 20 | Team A | 28-Jul-19 | 59 | 300 | 95 | 50 | 155 |
| 21 | Team A | 28-Jul-19 | 61 | 4 | 3 | 1 | 0 |
| 22 | Team A | 29-Jul-19 | 63 | 21 | 19 | 0 | 2 |
| 23 | Team A | 29-Jul-19 | 63 | 1 | 1 | 0 | 0 |
| 24 | Team A | 29-Jul-19 | 64 | 4 | 1 | 0 | 3 |
| 25 | Team A | 30-Jul-19 | 67 | 3 | 1 | 1 | 1 |
| 26 | Team A | 30-Jul-19 | 69 | 1 | 1 | 0 | 0 |
| 27 | Team A | 30-Jul-19 | 72 | 1 | 1 | 0 | 0 |
| 28 | Team A | 31-Jul-19 | 73 | 1 | 1 | 0 | 0 |
| **No.** | **Team** | **Date** | **Obs #** | **Total Caribou in Group (count or estimate)** | **Cows Classified** | **Calves Classified** | **Other Caribou** |
| 29 | Team B | 31-Jul-19 | 1 | 1 | 1 | 0 | 0 |
| 30 | Team B | 1-Aug-19 | 3 | 2 | 1 | 1 | 0 |
| 31 | Team B | 1-Aug-19 | 4 | 2 | 1 | 0 | 1 |
| 32 | Team B | 1-Aug-19 | 6 | 4 | 3 | 0 | 1 |
| 33 | Team B | 4-Aug-19 | 7 | 73 | 15 | 14 | 44 |
| 34 | Team B | 4-Aug-19 | 8 | 2 | 1 | 0 | 1 |
| 35 | Team B | 4-Aug-19 | 9 | 3 | 2 | 0 | 1 |
| 36 | Team B | 4-Aug-19 | 10 | 51 | 9 | 1 | 41 |
| 37 | Team B | 4-Aug-19 | 12 | 2 | 1 | 0 | 1 |
| 38 | Team B | 4-Aug-19 | 14 | 76 | 24 | 9 | 43 |
| 39 | Team B | 6-Aug-19 | 16 | 127 | 55 | 27 | 45 |
| 40 | Team B | 6-Aug-19 | 17 | 33 | 9 | 4 | 20 |
| 41 | Team B | 9-Aug-19 | 23 | 12 | 3 | 2 | 7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 42 | Team B | 10-Aug-19 | 27 | 24 | 4 | 4 | 16 |
| 43 | Team B | 10-Aug-19 | 30 | 200 | 22 | 18 | 160 |
| 44 | Team B | 10-Aug-19 | 32 | 2500 | 50 | 45 | 2405 |

| No. | Team | Date | Obs # | Total Caribou in Group (count or estimate) | Cows Classified | Calves Classified | Other Caribou |
|---|---|---|---|---|---|---|---|
| 45 | Team B | 12-Aug-19 | 40 | 1 | 1 | 0 | 0 |
| 46 | Team B | 12-Aug-19 | 43 | 3 | 2 | 0 | 1 |
| 47 | Team B | 13-Aug-19 | 45 | 6 | 1 | 0 | 5 |
| 48 | Team B | 13-Aug-19 | 46 | 19 | 3 | 0 | 16 |
| 49 | Team B | 13-Aug-19 | 49 | 1 | 1 | 0 | 0 |
| 50 | Team B | 13-Aug-19 | 50 | 3 | 1 | 2 | 0 |
| 51 | Team B | 13-Aug-19 | 51 | 1 | 1 | 0 | 0 |
| 52 | Team B | 13-Aug-19 | 52 | 7 | 1 | 0 | 6 |
| 53 | Team B | 14-Aug-19 | 56 | 1 | 1 | 0 | 0 |
| 54 | Team B | 15-Aug-19 | 63 | 1 | 1 | 0 | 0 |
| 55 | Team B | 15-Aug-19 | 72 | 2 | 2 | 0 | 0 |
| 56 | Team B | 15-Aug-19 | 73 | 19 | 13 | 6 | 0 |
| 57 | Team B | 15-Aug-19 | 74 | 10 | 7 | 3 | 0 |
| 58 | Team B | 15-Aug-19 | 75 | 5 | 5 | 0 | 0 |
| 59 | Team B | 15-Aug-19 | 77 | 10 | 10 | 0 | 0 |
| 60 | Team B | 15-Aug-19 | 79 | 9 | 5 | 0 | 4 |
| 61 | Team B | 15-Aug-19 | 81 | 2 | 1 | 1 | 0 |
| 62 | Team B | 17-Aug-19 | 84 | 50 | 28 | 15 | 7 |
| 63 | Team B | 17-Aug-19 | 85 | 154 | 89 | 30 | 35 |
| 64 | Team B | 17-Aug-19 | 86 | 51 | 37 | 10 | 4 |
| 65 | Team B | 17-Aug-19 | 87 | 13 | 9 | 2 | 2 |
| 66 | Team B | 19-Aug-19 | 91 | 5 | 5 | 0 | 0 |
| 67 | Team B | 19-Aug-19 | 92 | 3 | 3 | 0 | 0 |
| 68 | Team B | 20-Aug-19 | 97 | 18 | 11 | 1 | 6 |

| **No.** | **Team** | **Date** | **Obs #** | **Total Caribou in Group (count or estimate)** | **Cows Classified** | **Calves Classified** | **Other Caribou** |
|---|---|---|---|---|---|---|---|
| 69 | Team C | 23-Aug-19 | 4 | 5 | 2 | 1 | 2 |
| 70 | Team C | 23-Aug-19 | 5 | 39 | 6 | 4 | 29 |
| 71 | Team C | 24-Aug-19 | 6 | 26 | 3 | 1 | 22 |
| 72 | Team C | 25-Aug-19 | 11 | 10 | 1 | 0 | 9 |
| 73 | Team C | 25-Aug-19 | 12 | 8 | 4 | 2 | 2 |
| 74 | Team C | 25-Aug-19 | 14 | 24 | 6 | 7 | 11 |
| 75 | Team C | 26-Aug-19 | 16 | 12 | 7 | 3 | 2 |
| 76 | Team C | 26-Aug-19 | 17 | 4 | 2 | 0 | 2 |
| 77 | Team C | 27-Aug-19 | 26 | 2 | 1 | 0 | 1 |
| 78 | Team C | 28-Aug-19 | 31 | 10 | 1 | 1 | 8 |
| 79 | Team C | 3-Sep-19 | 53 | 28 | 22 | 3 | 3 |
| 80 | Team C | 3-Sep-19 | 54 | 21 | 13 | 1 | 7 |
| 81 | Team C | 3-Sep-19 | 56 | 5 | 3 | 2 | 0 |
| 82 | Team C | 3-Sep-19 | 57 | 9 | 6 | 1 | 2 |
| 83 | Team C | 4-Sep-19 | 72 | 38 | 17 | 1 | 20 |
| 84 | Team C | 5-Sep-19 | 81 | 11 | 7 | 2 | 2 |
| 85 | Team C | 5-Sep-19 | 82 | 31 | 26 | 1 | 4 |
| 86 | Team C | 5-Sep-19 | 92 | 58 | 1 | 1 | 56 |
| 87 | Team C | 5-Sep-19 | 94 | 32 | 21 | 3 | 8 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 88 | Team C | 5-Sep-19 | 95 | 29 | 24 | 2 | 3 |
| 89 | Team C | 7-Sep-19 | 106 | 4 | 2 | 1 | 1 |

## Data Appendix 2: Summary of other wildlife observations from 2019 Ekwǫ̀ Nàxoède K'è field season.

**Hozìı edzıe / Muskox**

| No. | Team | Date | Obs # | Total Muskox in Group (count or estimate) | Calves |
|---|---|---|---|---|---|
| 1 | Team B | 4-Aug-19 | 13 | 18 | 0 |
| 2 | Team B | 6-Aug-19 | 15 | 23 | 3 |
| 3 | Team B | 7-Aug-19 | 19 | 1 | 0 |
| 4 | Team B | 12-Aug-19 | 44 | 11 | 0 |
| 5 | Team B | 15-Aug-19 | 82 | 1 | 0 |
| 6 | Team C | 27-Aug-19 | 25 | 1 | 0 |
| 7 | Team C | 29-Aug-19 | 37 | 1 | 0 |
| 8 | Team C | 4-Sep-19 | 68 | 10 | 1 |
| 9 | Team C | 4-Sep-19 | 70 | 15 | 0 |
| 10 | Team C | 4-Sep-19 | 77 | 20 | 3 |

**Dedìı / Moose**

| No. | Team | Date | Obs # | Total Moose in Group | Calves |
|---|---|---|---|---|---|
| 1 | Team A | 16-Jul-19 | 7 | 2 | 0 |
| 2 | Team A | 17-Jul-19 | 14 | 4 | 1 |
| 3 | Team A | 18-Jul-19 | 15 | 2 | 0 |
| 4 | Team A | 18-Jul-19 | 16 | 4 | 1 |
| 5 | Team A | 25-Jul-19 | 40 | 1 | 0 |
| 6 | Team A | 25-Jul-19 | 42 | 2 | 0 |
| 7 | Team A | 30-Jul-19 | 70 | 1 | 0 |
| 8 | Team B | 12-Aug-19 | 42 | 2 | 1 |

**Dìga / Wolves**

| No. | Team | Date | Obs # | Total Wolves in Group | Wolf Pups |
|---|---|---|---|---|---|
| 1 | Team A | 17-Jul-19 | 10 | 7 | 3 |
| 2 | Team A | 17-Jul-19 | 11 | 2 | 0 |
| 3 | Team A | 19-Jul-19 | 20 | 1 | 0 |
| 4 | Team A | 22-Jul-19 | 26 | 1 | 0 |
| 5 | Team A | 22-Jul-19 | 27 | 1 | 0 |
| 6 | Team A | 22-Jul-19 | 27 | 1 | 0 |
| 7 | Team A | 23-Jul-19 | 33 | 1 | 0 |
| 8 | Team A | 24-Jul-19 | 38 | 1 | 0 |
| 9 | Team A | 28-Jul-19 | 60 | 2 | 0 |
| 10 | Team C | 27-Aug-19 | 24 | 2 | 0 |
| 11 | Team C | 5-Sep-19 | 78 | 2 | 0 |
| 12 | Team C | 5-Sep-19 | 83 | 1 | 0 |
| 13 | Team C | 5-Sep-19 | 89 | 1 | 0 |
| 14 | Team C | 5-Sep-19 | 93 | 2 | 1 |
| 15 | Team C | 6-Sep-19 | 97 | 4 | 2 |
| 16 | Team C | 7-Sep-19 | 105 | 2 | 1 |

**Sah dek'oo / Grizzly Bear**

| No. | Team | Date | Obs # | Total Bears in Group |
|---|---|---|---|---|
| 1 | Team B | 10-Aug-19 | 26 | 1 |
| 2 | Team B | 11-Aug-19 | 36 | 1 |
| 3 | Team B | 13-Aug-19 | 53 | 1 |
| 4 | Team B | 15-Aug-19 | 67 | 1 |
| 5 | Team B | 20-Aug-19 | 98 | 1 |
| 6 | Team C | 31-Aug-19 | 41 | 1 |
| 7 | Team C | 2-Sep-19 | 49 | 1 |
| 8 | Team C | 5-Sep-19 | 85 | 1 |
| 9 | Team C | 7-Sep-19 | 101 | 1 |
| 10 | Team C | 8-Sep-19 | 107 | 1 |

**Nǫ̀gha / Wolverine**

| No. | Team | Date | Obs # | Total Wolverine in Group |
|---|---|---|---|---|
| 1 | Team A | 25-Jul-19 | 44 | 3 |

**Det'ǫcho / Eagle**

| No. | Team | Date | Obs # | Eagle | Total Eagles in Group |
|---|---|---|---|---|---|
| 1 | Team A | 15-Jul-19 | 5 | Bald Eagle | 1 |
| 2 | Team A | 15-Jul-19 | 6 | Bald Eagle | 1 |
| 3 | Team A | 18-Jul-19 | 17 | Eagle | 1 |
| 4 | Team A | 22-Jul-19 | 28 | Eagle | 2 |
| 5 | Team A | 23-Jul-19 | 35 | Golden Eagle | 1 |
| 6 | Team A | 25-Jul-19 | 41 | Golden Eagle | 1 |
| 7 | Team A | 28-Jul-19 | 54 | Eagle | 2 |
| 8 | Team A | 28-Jul-19 | 51 | Golden Eagle | 2 |
| 9 | Team A | 28-Jul-19 | 54 | Eagle | 1 |
| 10 | Team B | 31-Jul-19 | 2 | Eagle | 1 |
| 11 | Team B | 7-Aug-19 | 20 | Eagle | 1 |
| 12 | Team B | 7-Aug-19 | 21 | Eagle | 1 |
| 13 | Team B | 10-Aug-19 | 33 | Bald Eagle | 2 |
| 14 | Team B | 15-Aug-19 | 69 | Eagle | 1 |
| 15 | Team C | 25-Aug-19 | 15 | Bald Eagle | 1 |
| 16 | Team C | 4-Sep-19 | 71 | Bald Eagle | 1 |
| 17 | Team C | 5-Sep-19 | 88 | Eagle | 1 |
| 18 | Team C | 7-Sep-19 | 102 | Bald Eagle | 2 |

**Peregrine Falcon**

| No. | Team | Date | Obs # | Total Peregrine Falcons in Group |
|---|---|---|---|---|
| 1 | Team C | 27-Aug-19 | 21 | 2 |

**Tłı̨chǫ Government**
Culture and Lands Protection

Sustaining Our Lands, Language, Culture and Way of Life

**Tłı̨chǫ Government**
Box 412
Behchokǫ̀, NT
Canada X0E 0Y0
Phone: (867) 392-6381
Fax: (867) 392-6389

**www.tlicho.ca**