

## **Moose Monitoring Wildlife Research Permit Application– Additional Information**

*Note: Because the Wildlife Research Permit application form requests that text sections be limited to < 100 words, more information is provided here, should any Indigenous Government Organizations want to review the proposed project and activities in more detail.*

### **Project Title: Moose research and monitoring in the Mackenzie and Tłı̄chq Highway study areas**

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### **Rationale:**

In this past, ENR has monitored moose using population surveys in selected areas, which provides information on abundance (how many moose or the density of moose) and in some surveys, the sex ratio of male to female moose. We lack basic information in the NWT on moose movement behavior, habitat selection, how moose use areas burned by wildfire, and how moose interact with other herbivores such as boreal caribou and wood bison. We have heard many questions from community members about how moose are influenced by the presence of bison and boreal caribou, and how moose influence those species. In particular, we have heard concerns from communities that increases in the wood bison population and expansion of their range could negatively impact boreal caribou and moose, either through direct competition for resources or through increased predation.

In collaboration with Laval University, ENR has secured funding through Sentinel North to study food web dynamics and apparent competition between boreal caribou, moose and bison. To build movement models to study inter-specific interactions and predator-prey dynamics in this system, this project requires simultaneous movement data for all of these species within the same study area to look at how these species interact in space and time. Funding was secured to deploy collars on wood bison in 2020-21, and black bears in 2021-22, and ENR has ongoing collar-based monitoring programs for boreal caribou and wolves. Funding to deploy collars on moose has been secured for 2022-23.

Monitoring moose is an important part of the Sentinel North food web dynamics study, and will allow this study to directly address these questions by studying the interactions, habitat use, and influences on other species in the boreal caribou-wood bison-**moose**-wolves-black bear food web.

The moose collars will also be used to help validate (detectability correction) new aerial survey methods (high resolution photos and infrared) that will be tested in the Sentinel North study area by Phil McLoughlin (University of Saskatchewan) in spring 2023. Community members and IGOs have often encouraged ENR to seek out new monitoring methods that reduce disturbance of wildlife, and this survey method, if effective, could provide a way to survey multiple species in one survey.

The Tłı̄chq Highway is a new development within the study area. It was constructed in 2019-2021 and opened for all-season travel in November 2021. The Tłı̄chq Highway may have negative effects on moose such as: direct habitat loss, sensory disturbance and related behavioral impacts, barriers to movement, habitat fragmentation, increased predation, and increased hunting pressure resulting from

increased access. This project will provide location and movement data to help evaluate these impacts on moose, similar to studies of boreal caribou.

Habitat disturbance-mediated apparent competition is thought to be the primary cause of boreal caribou declines across Canada. Natural and human disturbances can create favourable habitat conditions for herbivores like moose and bison, as well as omnivores such as black bears. Increases in herbivores can lead to increases in predators such as wolves, in turn leading to increased predation on boreal caribou. There are questions about whether apparent competition is at play in the NWT, given the NWT system is less productive than southern boreal caribou ranges. Data on the movements, abundance, and habitat use by moose, together with other species in this food web, will contribute to evaluating whether apparent competition is causing declines in boreal caribou in the NWT.

This program will provide information in response to concerns by the Wek'èezhìi Renewable Resources Board regarding moose abundance and re-directed harvest efforts due to declines in barren-ground caribou. The program will be integrated with ongoing Departmental monitoring programs for boreal caribou, wolves, bison, and black bears. It will also link to moose population surveys and the collection of moose age structure information obtained from teeth aging of harvested moose in the North Slave and South Slave Regions.

## **Objectives**

Deploy up to 20 collars on adult female moose in the study area, collect samples, and monitor moose to:

- Investigate how moose use habitat in relation to boreal caribou and bison, and how these species influence each other (Do moose use habitat differently if bison are present?, for example. Sentinel North project)
- Use moose location data, along with other information, to model and predict the distribution and abundance of moose in the future as the climate and habitat changes (Sentinel North project)
- Investigate moose habitat use in relation to areas burned by wildfire
- Investigate impact of Tłı̄ch̄o Highway on moose movements and habitat use
- Help validate new aerial survey methods (high resolution photos and infrared) that will be tested in the study area, and provide detectability correction factor for moose in ENR aerial surveys
- Determine timing and cause of death for adult female moose
- Learn more about moose health (e.g. winter tick; samples collected can be screened for pregnancy, pathogens, chronic stress, contribute to knowledge about moose diet, etc.)
- Determine calving and twinning rates of moose in the study area

## Time Period:

Collar deployments will likely occur in March 2023, after other ENR aerial surveys provide reconnaissance data for moose locations. Monitoring GPS collar data, investigating stationary collars and other program work may occur throughout the year. Twinning surveys, if funding permits, will occur

in late May or early June and/or autumn. Calf recruitment surveys will occur in Feb or March of 2024 and subsequent years, concurrent with boreal caribou recruitment surveys.

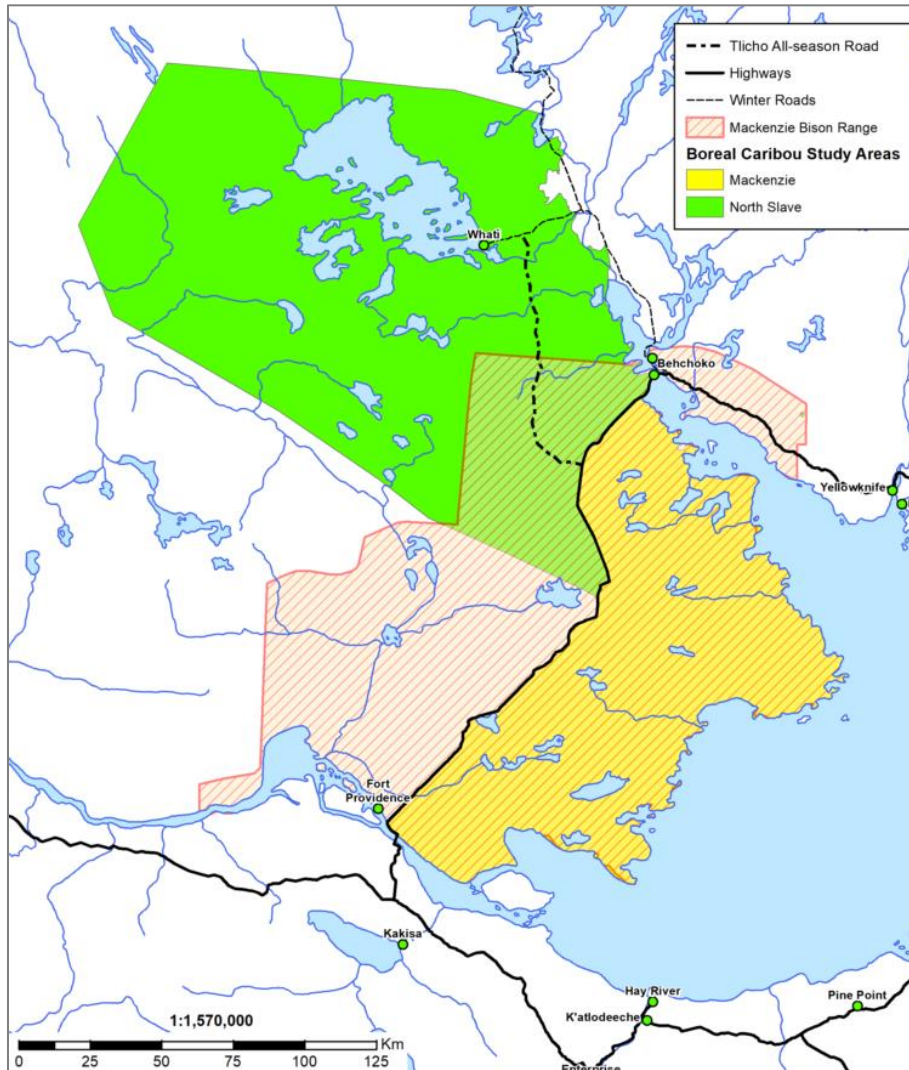


Figure 1. Map of the proposed study area (Mackenzie bison range and boreal caribou Mackenzie and North Slave (Tłı̄ch̄o All-Season Road) study areas.

**Methods:**

Up to 20 GPS collars will be deployed on adult female moose to monitor the movements, habitat use, and responses of these moose to disturbance (e.g. roads, wildfires, timber harvest) and other species (bison, boreal caribou). Collars will transmit GPS locations to satellite and will have a breakaway device that drops the collar on the ground at a pre-determined time (up to 5 years).

ENR will follow established protocols and the conditions of the Wildlife Care Committee permit for capture and handling of moose during collar deployment. In British Columbia, over 500 adult female moose have been collared since 2012, and we will use the knowledge gained from that program when

deploying collars. An experienced helicopter pilot and dart gunner will be used to conduct the collaring operation. The capture crew (gunner and animal handler) will have experience with chemical immobilization, collecting biological data and deploying collars.

Moose will be darted from a helicopter. Aerial pursuit of individual moose will be kept short ( $\leq 1$  min of running), and will be terminated when the target animal show signs of fatigue (stumbling, open mouth breathing). All drug delivery will be done by a team member with current training and experience in wildlife immobilization, or under the direct supervision of experienced personnel. Drugs used will be approved by the Wildlife Care Committee. Following British Columbia, the recommended current immobilization drug is BAM II (a commercially premixed combination of butorphanol, azaperone and medetomidine) reversed with atipamezole and naltrexone. With these drugs, induction is predictable, most moose show effects within 2-3 minutes and are “out” in an average of 6-8 minutes, and after the reversal drug is administered most recoveries occur within 4-10 minutes with the moose going from “out” to walking or running away. Animals that have been drugged should not be eaten within 45 days. After 45 days the drug is fully metabolized and no longer present in the animal. All collared moose will be ear tagged with a tag marked “Call before you eat” and an ENR phone number to call for more information.

Once immobilized, the following will be done for each moose:

- The anesthesia will be monitored and vital signs will be assessed throughout the handling period (blood pressure, blood oxygen level, breathing rate, body temperature, reflexes) to determine plane of sedation.
- Supplementary oxygen may be administered
- Record the collar identification number, ear tag number, capture location (latitude and longitude), duration of chase and handling time, sex, body condition rating, estimated age, animal stress rating, average snow depth and snow condition, and any pertinent information pertaining to observations of the health of the animal
- Collect blood (approximately 25 mL of blood, typically from the cephalic vein in the foreleg), hair (in coin envelope, pulled from between shoulders), and fecal samples (approximately 50 g of feces (a handful) from the rectum or deposited on the snow)
- Winter tick hair loss will be documented and associated ticks collected
- Fasten the radio collar around the neck and place the ear tag in the ear
- Take digital images of the teeth and the full body of the moose with the collar or ear tag ID clearly visible.

The recovery of the moose will be monitored from a distance until it is moving and the capture crew will leave the area in the helicopter. Post-capture monitoring of the GPS collared animals will be done using satellite-transmitted location data.

**Other surveys:** Calf production will be determined by assessing pregnancy rates collected from blood serum during the capture of cows each year of the study and by assessing the movement rates of GPS-collared cows.

Twinning rates and calf survival will be determined from aerial classification surveys (funding dependent).

Ten-month calf recruitment will be determined from aerial classification surveys in late winter 2024. The survey will be conducted by helicopter with a crew consisting of a pilot, a navigator and a classifier who will count and classify the number of calves and adults associated with collared moose and other moose observed during the survey. Recruitment will be expressed as the ratio of calves per 100 adult cows.

Mortality investigations will be done whenever possible when a collar becomes stationary.

#### Data analysis

GPS collar data will be used to obtain descriptive information about moose distribution, movements, habitat use and home range size and configuration during and after the calving season. Statistical models of habitat selection and movements by moose will also be developed from GPS data. For example, we will use Step Selection Functions (SSFs) to better understand moose movements. SSFs compare observed and random steps (i.e., the linear segment between successive locations at 1-h intervals) based on their characteristics, such as land cover type (e.g., meadow, open conifer forest, closed conifer forest), end points, distance to the nearest road, and the distance and direction relative to areas heavily used by bears, caribou or bison. Our previous research shows that such movement analysis can reveal how different species interact with one another, how they move with respect to human infrastructure, and how habitat characteristics determine their distribution. Models will thus inform on areas prone to human-wildlife conflicts, such as vehicle collisions. Moreover, Step Selection Functions will provide the basic information needed to develop predictive models of animal distribution.

Graduate students at Laval University, under the supervision of Dr. Daniel Fortin and Dr. Jerome Simon-Morin, will use data collected in this project to develop and test models that predict spatial patterns that arise from plant-prey-predator-human interactions. They will build mechanistic models that account for fine-scale movement decisions leading to animal distribution on the landscape, and use these fine-scale models to predict larger-scale observed patterns of distribution and abundance. To achieve this, the researchers involved will develop and implement new techniques in quantitative applied ecology related to space use, food-web dynamics, network theory and statistical methods. These models will be used to evaluate and compare areas of different food-web complexity across the boreal forest, including in the NWT, Saskatchewan, and Quebec.

#### **Current Consultation:**

Ongoing consultation will continue with communities (Deh Gáh Got'îê First Nation, Fort Providence Métis Council, Tłı̄chq̄ Government, Wek'èezhì Renewable Resources Board, North Slave Métis Alliance and Yellowknives Dene First Nation) through this application for a wildlife research permit. An information sheet regarding the larger Boreal Forest Food Web Dynamics project funded by the Sentinel North (Sentinelle Nord) project, referred to above, has been sent to the above communities/ Indigenous Government Organizations. ENR shared information on the Sentinel North project and the idea of moose collaring with representatives of the Fort Providence Tri-Council at a meeting in Fort Providence on July 30, 2021. This project was also raised conceptually to the Mackenzie bison working group during meetings held in winter 2021-22. Information on the Sentinel North project and the idea of collaring moose was also presented to the Tłı̄chq̄ Tłı̄ Deè Committee on May 1, 2022 (in Behchokq̄) and to the TASR Corridor Working Group on June 13, 2022 (in Whatì).

**Future Community Consultation:**

This wildlife research permit application will be provided to the Tłıchǫ Government, Wek'èezhì Renewable Resources Board (WRRB), Yellowknives Dene First Nation, North Slave Métis Alliance, Fort Providence Métis and Deh Gáh Got'îê First Nation for review. We would be happy to meet with consulted groups in-person or virtually to discuss this proposal if requested.

**Opportunities for Local Participation:**

Community observers will be invited to participate in the late winter aerial composition survey, if the crew is able to use an A-Star helicopter, which is a larger machine.

**Management or Recovery Plans:**

ENR is developing a moose management plan, and this data will contribute valuable information on moose.