

Implications of the first collaborative non-invasive DNA surveys for boreal caribou in British Columbia

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History of Boreal Caribou Monitoring in British Columbia

British Columbia's boreal caribou ranges fall within the traditional lands of the Treaty 8 First Nations who have long expressed a desire to recover boreal caribou to self-sustaining levels. From the late 1990s to 2012, BC conducted telemetry studies that were restricted to single small ranges or portions of larger ranges. From 2013 to 2018, aerial surveys were conducted to calculate calf recruitment, and adult females were collared to assess survival. This allowed to assess population trends, but not to obtain population estimates as sightability is low in forested habitat.



Caribou Group

Photo Credit: Agnès Pelletier, © Province of BC

Boreal caribou are still monitored as part of the BC Caribou Recovery Program in collaboration with Fort Nelson First Nation. The number of collars originally tracked in 2013-2014 (171), had decreased to 54 by 2018-2019 (Paterson 2022), and thanks to an increase in capture effort since, there are now 130 active collars in BC boreal caribou ranges.

The BC government has made multiple commitments to Treaty 8 Nations regarding caribou recovery, including providing current demographic information. As part of this commitment, it was essential to find a solution to provide accurate population estimates for boreal caribou.

Non-invasive Capture-mark-recapture DNA Surveys

In 2021, Fort Nelson First Nation, Prophet River First Nation, Doig River First Nation, Blueberry River First Nation, and the BC government collaboratively implemented non-invasive DNA CMR surveys in boreal ranges. This technique involves collecting fecal pellets that are located at cratering sites, and genotyping them to obtain individual genetic profiles. An individual is considered "recaptured" when its genetic profile is identified across two or more sampling sessions (Hettinga et al. 2012; Goode et al. 2014; McFarlane et al. 2020). Each identified individual capture's history is then used to run CMR statistics and estimate population size.



Photo Credit: Agnès Pelletier, © Province of BC

Methods

Flights and Observations

Flight crew were mainly composed of provincial and partner Nations' governments representatives, partner Nations' community members, and students. A limited number of days included volunteer and independent biologists. For each range, three sampling sessions were implemented 3-4 weeks apart between December and February. Transects were flown with 2 to 3 helicopters during each sampling session, with each crew searching for signs of caribou activity (i.e., craters, tracks, beds, mineral licks, and live animals). When any such observation was made, the helicopter attempted a landing so that samples could be collected at the identified site.



L to R: Jordan Turcotte (FNFN), Agnès Pelletier and Rayelle Sowers. Photo Credit: © Brad Whitford (used with permission)



L to R: Bryan Pyle (BRFN) and Shawn Harding (DRFN) collecting samples

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Fecal Pellet Collection, Storage, and Shipping

At each site, the number of caribou was estimated based on the amount of tracks, craters, and beds or on the number of live animals observed. When possible, we collected a number of samples representing 1.4 times the estimated number of animals to correct for an expected 30% of duplicates.

During sample collection, pellets frozen together were prioritized over scattered pellets to ensure that each sample would represent a single individual. Pellets found at the surface of the snow were also prioritized over ones buried in snow to ensure the highest possible DNA quality. All samples that had more than 20 pellets were split into 2 sample bags prior to shipping so that an original would be saved in case issues occurred during shipping. Sample bags were placed inside heavy duty 100qt coolers layered with icepacks to maintain their integrity and shipped to a lab for analyses.



Collected samples

Photo Credit: Agnès Pelletier, © Province of BC

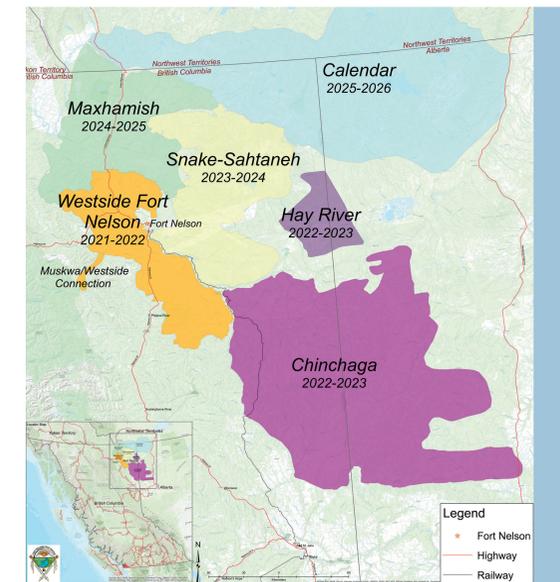
Sampling Results

Westside Fort Nelson 2021-2022

The first DNA survey for boreal caribou in BC was implemented from 2021 to 2022 in the Westside Fort Nelson range, in collaboration with Fort Nelson First Nation and Prophet River First Nation. The Westside Fort Nelson caribou range is the smallest of the BC boreal ranges, and thus was well suited for a pilot project. The survey area also included the Muskwa-Westside connection, an Area of Interest identified by Fort Nelson First Nation where caribou have been shown to migrate from low elevation boreal habitat into mountain habitat for calving. In total, 393 samples were collected from 47 sites by 16 crew.

Chinchaga and Hay River 2022-2023

The second DNA survey for boreal caribou in BC was implemented from 2022 to 2023, in collaboration with Doig River First Nation, Blueberry River First Nation, and the Government of Alberta. BC crew members collected samples on their side of the Chinchaga range, while AB crew members collected samples on the AB side of the Chinchaga range as well as in the Hay River Area of Interest. In Chinchaga-BC, 631 samples were collected from 81 sites by 33 crew; in Chinchaga-AB, 738 samples were collected from 71 sites by 12 crew; in the Hay River Area of Interest, 292 samples were collected from 26 sites by 12 crew.



Map 1: DNA survey areas 2021-2026

Year	Range	# of sites	# of samples
2021-2022	Westside Fort Nelson	47	393
2022-2023	Chinchaga-BC	81	631
2023-2023	Chinchaga-AB	71	738
2022-2023	Hay River	26	292

Table 1: Sampling data from Westside Fort Nelson, Chinchaga, and Hay River

Expected Results

Through this work, we expect to not only provide robust population estimates of BC boreal caribou ranges, but also to i) characterize genetic patterns at a fine spatial scale; ii) provide information on kinship and parentage, and iii) identify movement patterns described in indigenous traditional knowledge (Leech et al. 2016a; Leech et al. 2016b) via genetic tools.

We also hope to optimize samples by branching out into other types of chemical analyses and to assess disease risk.

Conclusion & Next Steps

The collaborative surveys described in these projects have led to multiple Nations taking part in caribou monitoring. As the project roll-out continues in other ranges, some of the surveys will become Nation-led.

This is a one-of-a-kind project in BC with a multi-year, multi-partner approach. The population estimates will complement the recruitment information from aerial surveys, and the associated genetics data will provide a more accurate picture of the status and movements of boreal caribou in BC, which will help inform future actions that will support boreal caribou recovery.