

# Appendix A. Current Status of Boreal Caribou

## A-1. Population Trend

### *Western Science*

Boreal caribou population trend is monitored within two study areas that overlap with the Wek'èezhì region (A-1), and results from the past 8-9 years indicate that populations are generally increasing in both areas (Table A-1, Table A-2).

GNWT-ECC has aimed to establish and maintain an annual sample size of 30 adult females fitted with GPS collars in each study area. Annual survival rates of collared female caribou, as well as spring classification surveys used to estimate calf:cow ratios conducted in February or March each year, are used to estimate annual rates of population change ( $\lambda$  = adult female survival/[1-female calf recruitment]) following Latham et al.'s (2011) modification of Hatter and Bergerud's (1991) equation. Annual survival rates and annual rates of population change ( $\lambda$ ) are calculated based on a "caribou year" that runs from April 1 to March 31. For example, for the 2020-21 "caribou year" annual survival rates are calculated between April 1, 2020, and March 31, 2021. The spring classification surveys conducted in February or March 2021 provide the female calf recruitment rates used to calculation of population trend for the 2020-21 "caribou year". The 'bboutools' (Dalgamo et al. 2025) and 'bbouretro' (Boulanger et al. 2025) packages for R statistical software (R Core Team 2025) were used to generate estimates of annual rates of population change ( $\lambda$ ) and predicted population change over time, along with measures of uncertainty. The 'bboutools' package uses a Bayesian framework for generating predictions, whereas the "bbouretro" package estimates  $\lambda$  using the traditional methods.

In response to the EA for the Tłıchq Highway project, GNWT-ECC initiated a boreal caribou population monitoring program in the Wek'èezhì region focused on the Tłıchq Highway corridor in March 2017, with the deployment of 20 GPS collars on adult female caribou. Additional collars were deployed in subsequent years to replace collars scheduled to drop off, any mortalities, any premature collar releases, and to bring the target sample size up to 30 collars.

As of the end of the 2024-25 "caribou year" (March 31, 2025), there were 44 active GPS collars in the North Slave Tłıchq Highway study area; however, 16 collars were scheduled to drop off on April 01, 2025.

Table A-1 and A-2 provide the annual adult female survival rate, calf:cow ratios and population trend index ( $\lambda$ ) for the first 8 years of the monitoring program. To date, ECC has observed high annual female survival rates (generally >0.90) and an increasing population trend ( $\lambda > 1$ ) in all years, with the lowest population trend indices in 2021-22 and 2024-25.

**Table A-1.** Adult female survival and calf:cow ratios from the North Slave Tłıchǫ Highway study area, which are used together to estimate the annual population trend, or lambda ( $\lambda$ ). A value of 1.0 indicates a stable population; a value less than 1 indicates a declining growth rate; a value higher than 1 indicates an increasing growth rate.

<b>Year (April 01-March 31)</b>	<b>Adult Female Survival</b>	<b>Calf:cow ratio</b>	<b>Population trend (lambda [<math>\lambda</math>])</b>
2017-18	0.95	32.6 : 100	1.10
2018-19	1.00	37.2 : 100	1.19
2019-20	0.97	26.2 : 100	1.09
2020-21	0.96	30.9 :100	1.11
2021-22	0.89	27.3 : 100	1.01
2022-23	0.92	33.1 : 100	1.07
2023-24	0.92	34.2 : 100	1.07
2024-25	0.91	23.7 : 100	1.01

A collar-based boreal caribou monitoring program was also initiated in the Mackenzie Bison Sanctuary area (hereafter referred to as the Mackenzie study area) by GNWT-ECC South Slave region in 2015 with the deployment of 9 collars on adult females (A-1 and Figure A-3). The sample size was increased to 30 collars between 2017 and 2025. Adult females collared within the South Slave region portion of this study area move frequently between the South Slave and North Slave GNWT administrative regions. The western limit of this study area is defined by Highway 3 and is monitored separately from the North Slave Tẖcẖ Highway study area because there have been very few crossings of Highway 3 by collared caribou. An increasing population trend has generally been observed in this study area each year from 2016 to 2025 (Table A-2, Figure A-2).

**Table A-2.** Adult female survival and calf:cow ratios from the Mackenzie study area, which are used together to estimate the annual population trend, or lambda ( $\lambda$ ). A value of 1.0 indicates a stable population; a value less than 1 indicates a declining growth rate; a value higher than 1 indicates an increasing growth rate.

<b>Year (April 01-March 31)</b>	<b>Adult Female Survival</b>	<b>Calf:cow ratio</b>	<b>Population trend (lambda [<math>\lambda</math>])</b>
2016-17	0.91	40.7 : 100	1.09
2017-18	0.86	32.0 : 100	1.00
2018-19	0.93	52.5 : 100	1.17
2019-20	0.97	46.0 : 100	1.19
2020-21	0.98	33.1 : 100	1.14
2021-22	0.93	22.5 : 100	1.03
2022-23	0.97	37.2 : 100	1.15
2023-24	1.00	42.4 : 100	1.21
2024-25	0.86	24.0 : 100	0.97

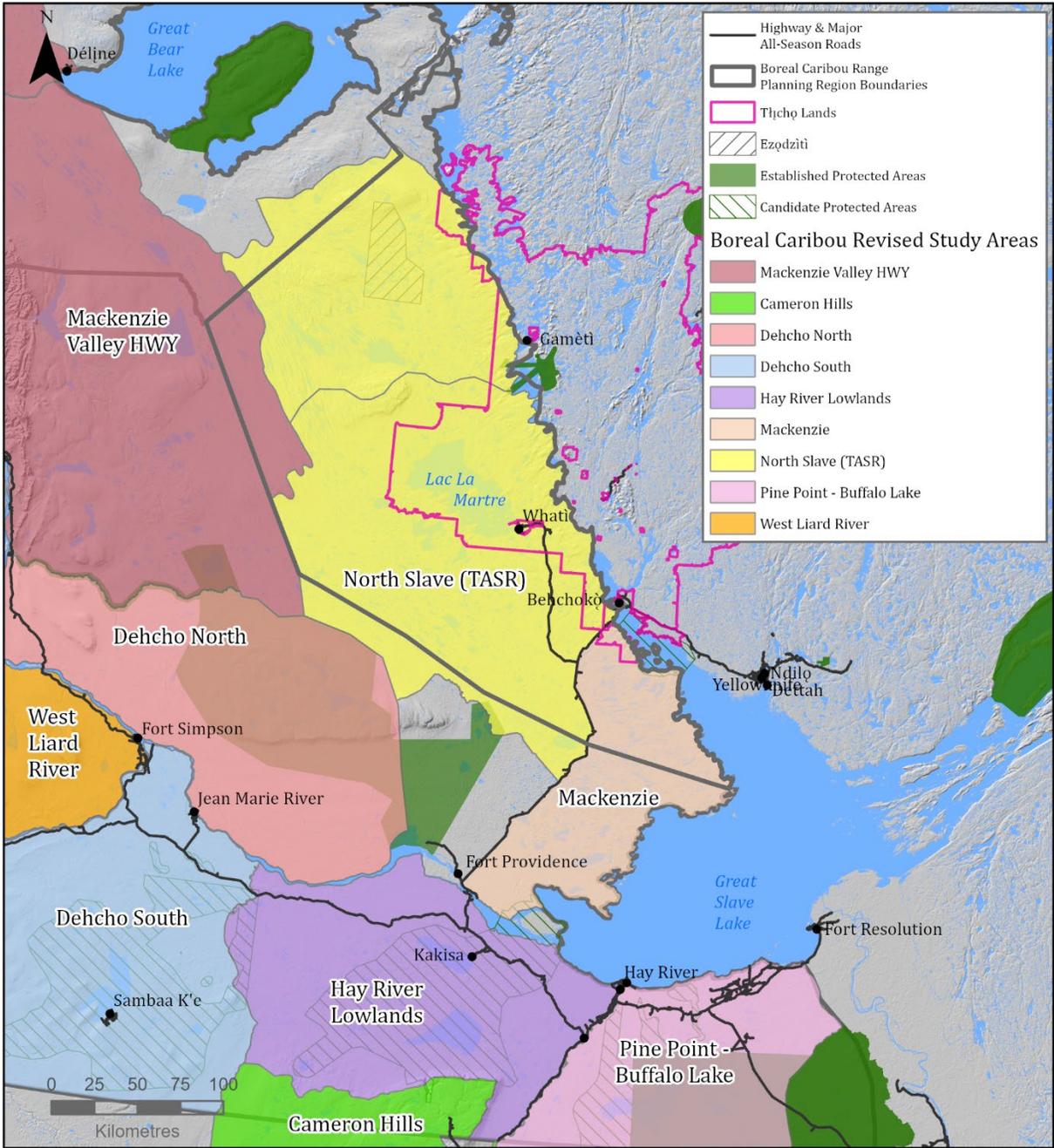
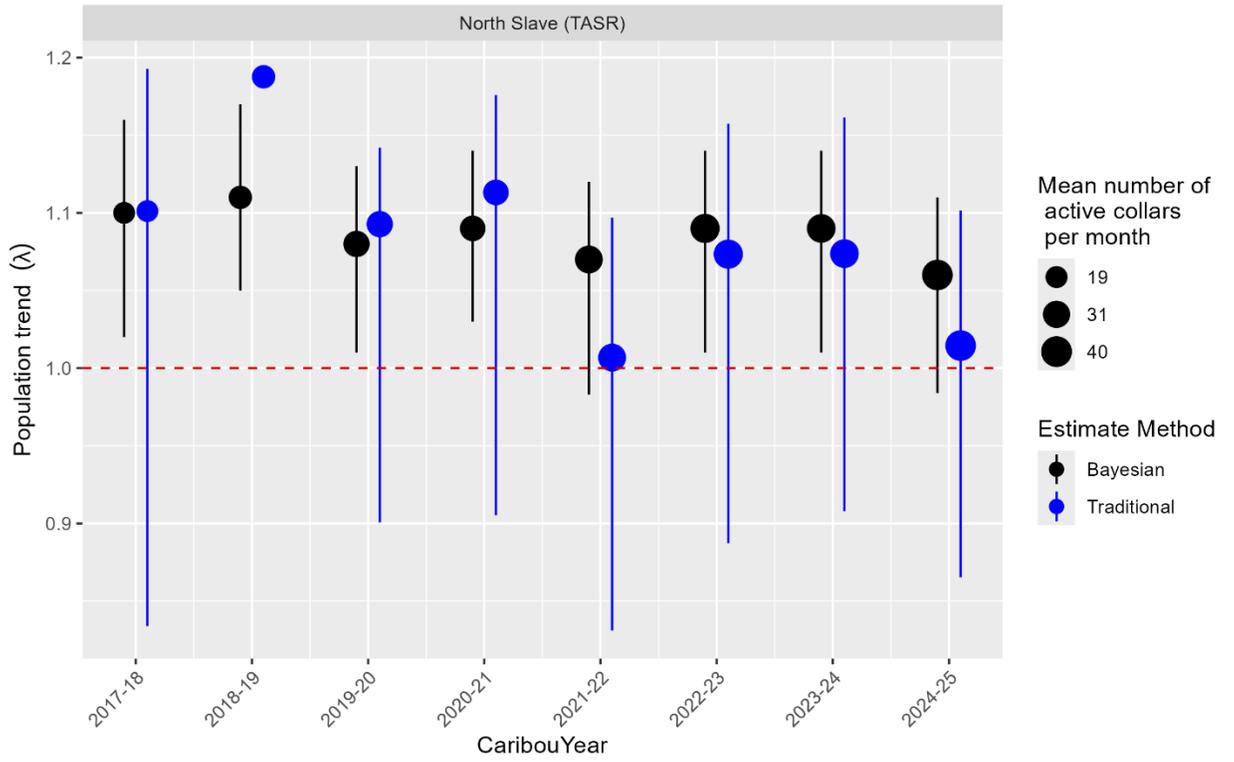
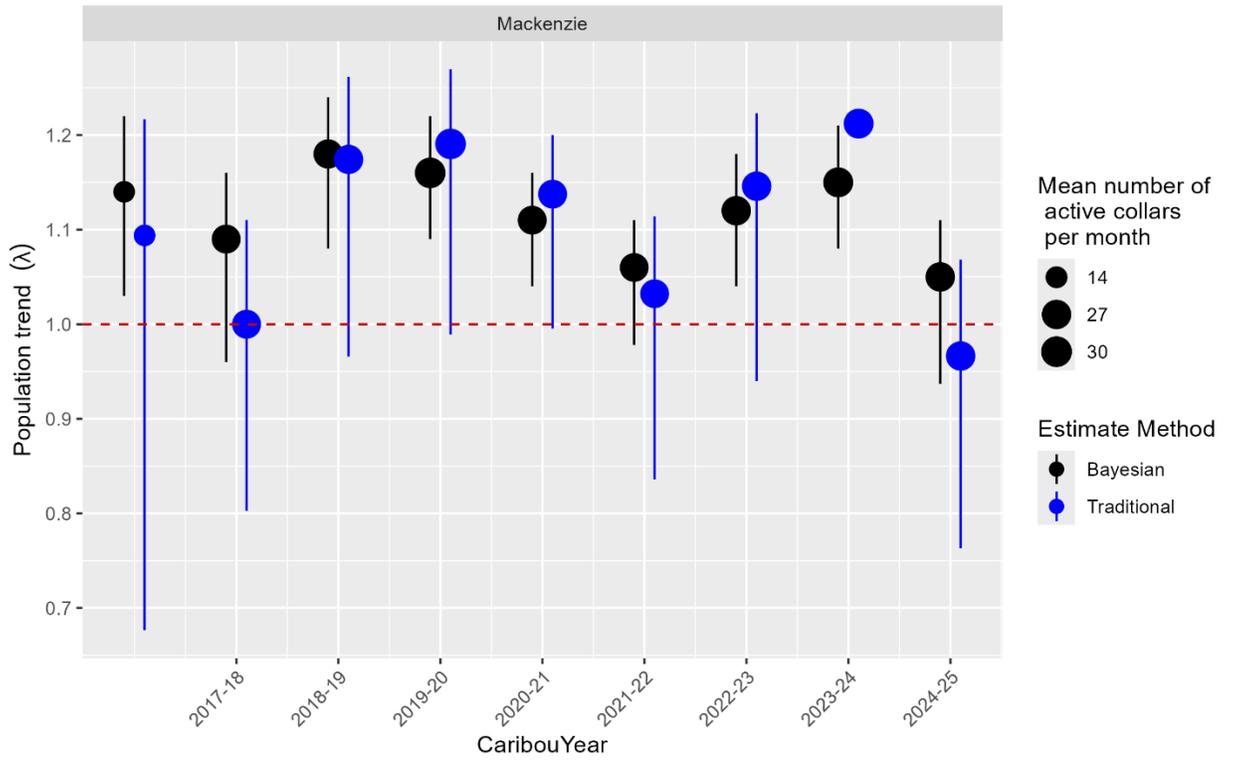


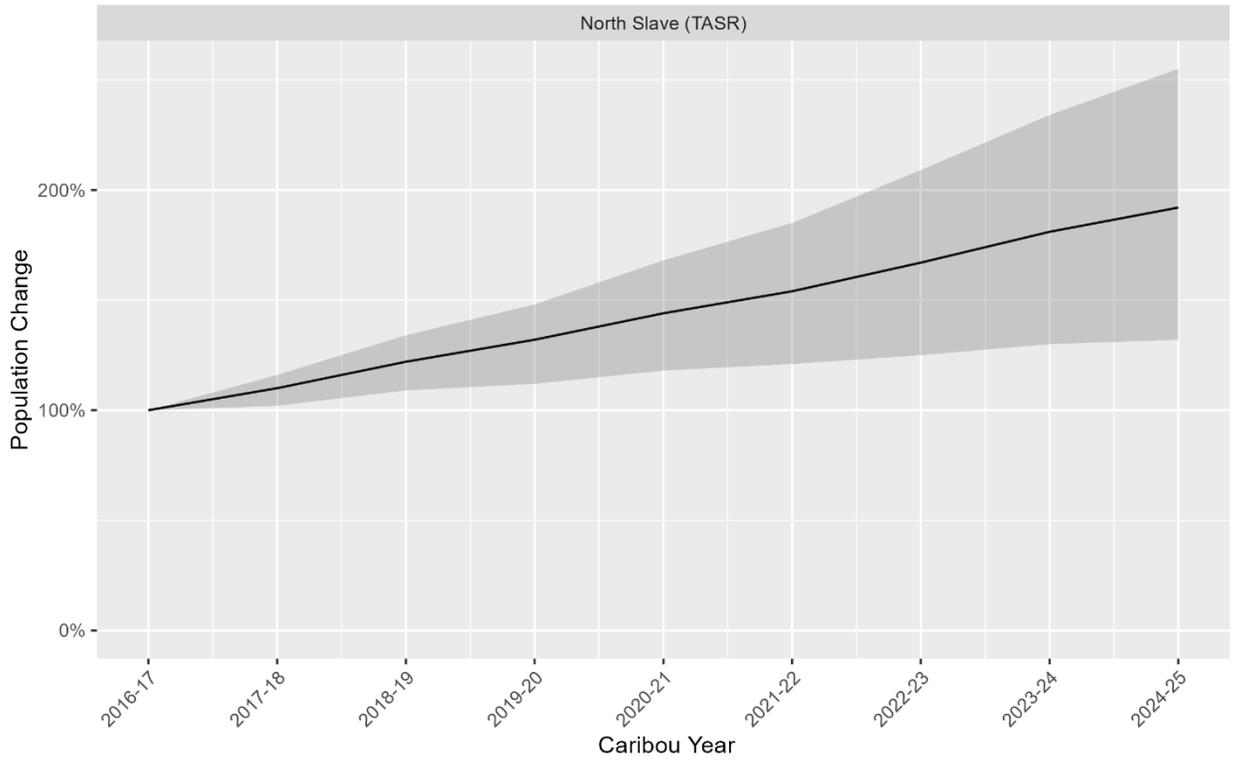
Figure A-1. Boreal caribou monitoring study areas in the Wek'èezhì and Southern NWT regions.



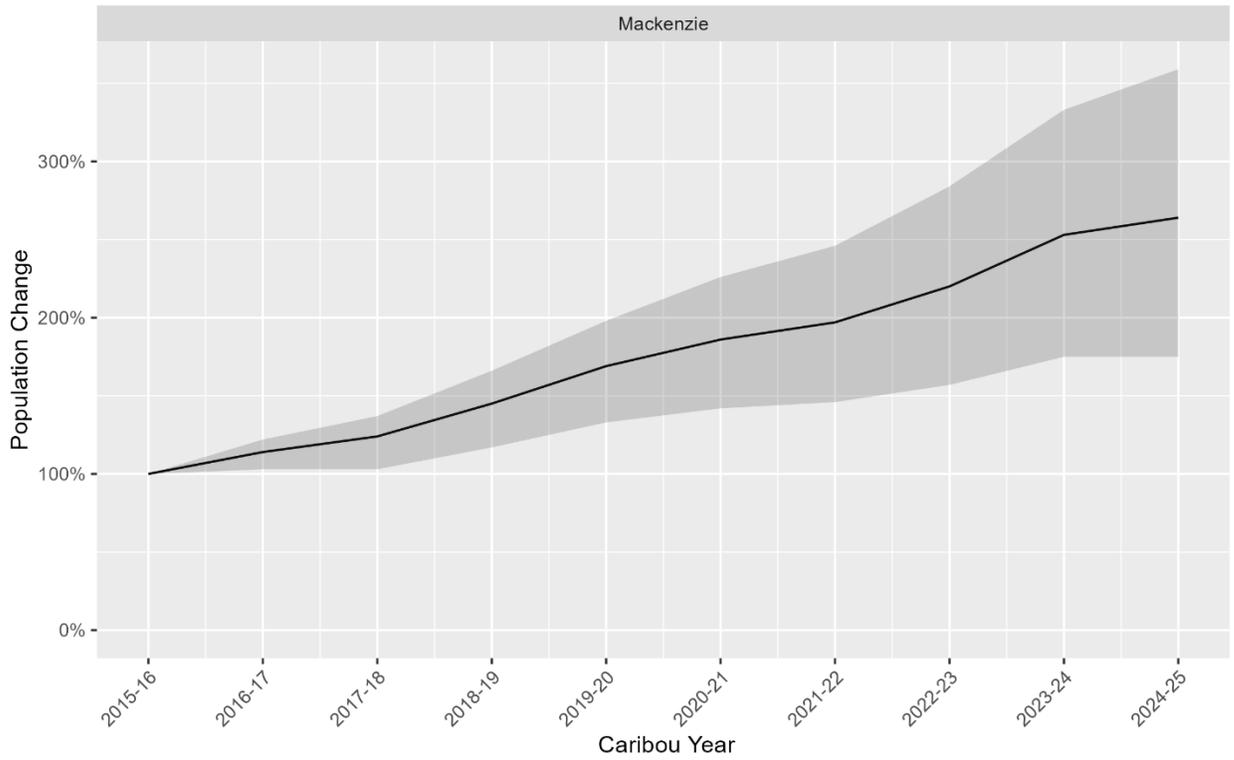
a)



b)



c)



d)

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**Figure A-2. a-b)** Estimated population trend of boreal caribou ( $\lambda$ ) observed within the North Slave Tłı̨chǫ Highway and Mackenzie study areas based on Bayesian and ‘Traditional’ methods (see Figure A-1 for study area boundaries). Lambda ( $\lambda$ ) values  $>1$  indicate an increasing population trend. Point sizes are proportional the mean number of active collars monitored per month during each ‘Caribou Year’. Vertical lines represent 95% credible intervals [Bayesian] and 95% confidence limits [Traditional] around the estimates.

**c-d)** Predicted population growth based on annual lambda ( $\lambda$ ) estimates from Bayesian models expressed as a percentage of the initial (unknown) population size in each study area. The grey area around the trend line represents the uncertainty around the predicted trend.

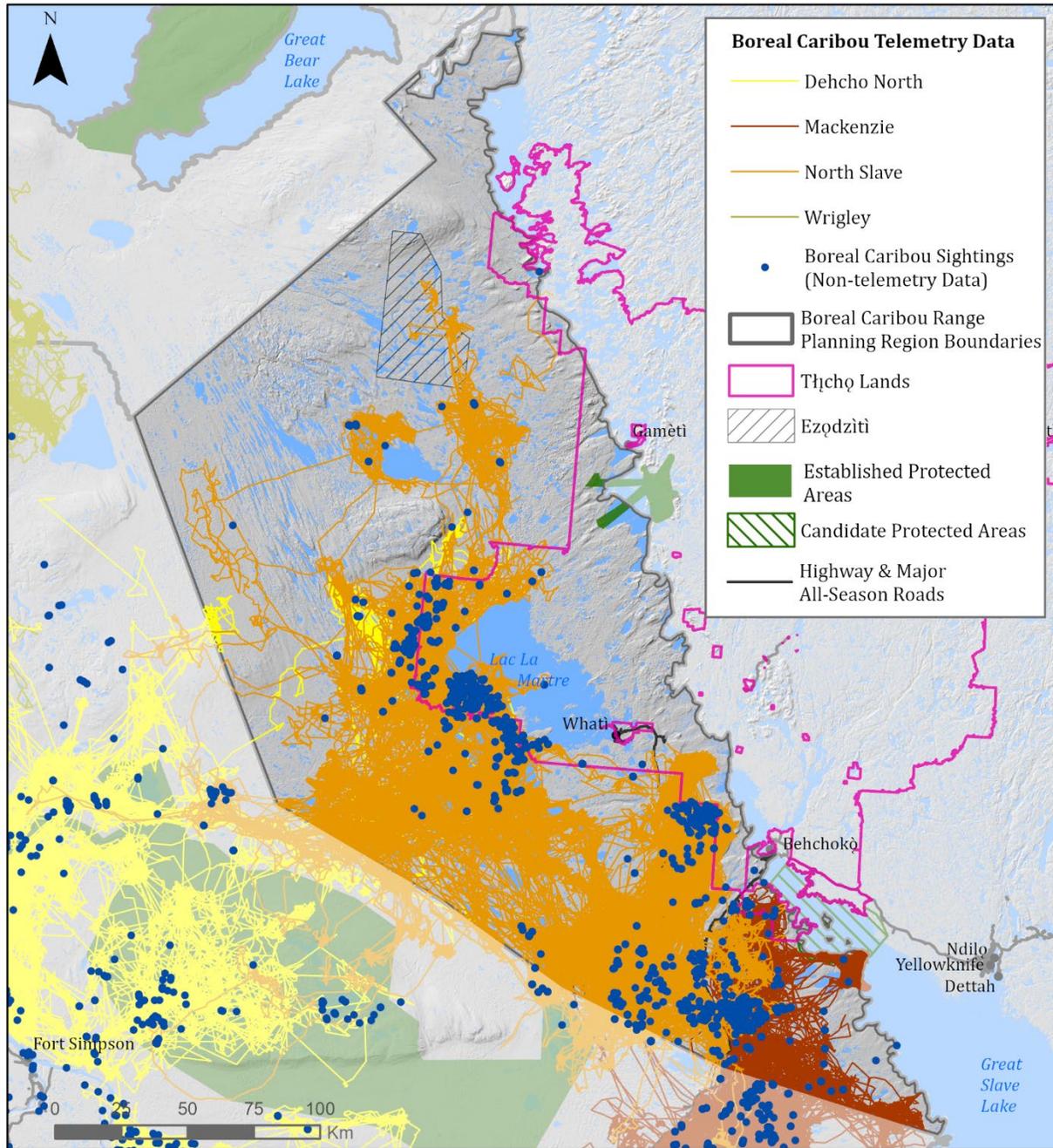
## A-2. Boreal Caribou Abundance

Boreal caribou are particularly challenging to enumerate through aerial surveys because they occur at low densities, are dispersed in small groups, and typically inhabit mature coniferous forests where they are difficult to detect due to canopy cover (DeMars et al. 2015). Previous abundance estimates for boreal caribou in the NWT have been largely based on extrapolations of observed or expected densities of caribou. Prior to 2020, within the North Slave region, GNWT-ECC conducted a boreal caribou occupation survey in November 2004, and documented boreal caribou observations during moose and bison aerial surveys conducted between 1998-2004. The boreal caribou occupation survey conducted in 2004 yielded a density estimate of 2.62 boreal caribou/100 km<sup>2</sup> from an effective survey area of 726 km<sup>2</sup> (Hillis and Cluff 2005). Density estimates based on incidental sightings of boreal caribou from moose and bison aerial surveys conducted between 1998 and 2004 yielded density estimates between 0.17 to 3.44 boreal caribou/100 km<sup>2</sup> (Hillis and Cluff 2005) but should be considered less reliable than density estimates from dedicated boreal caribou surveys. A density of 1.3 caribou/100 km<sup>2</sup> was used by GNWT-ECC in 2012 to estimate a population size of 612 boreal caribou in the North Slave region (ENR 2012a, cited in SARC 2012).

More recently, GNWT-ECC conducted a two-phase aerial survey to estimate population abundance of boreal caribou within the North Slave Tłı̨chǫ Highway study area between February 19 and March 2, 2020 (Boulanger et al. 2025). Within the 21,071 km<sup>2</sup> study area, a total of 414 boreal caribou (218 cows, 122 bulls, and 66 calves) in 73 groups were seen and an additional 163 boreal caribou (97 cows, 37 bulls, and 26 calves) in 31 groups were counted inside the study area while using telemetry to locate groups with collared boreal caribou (n=26) that would otherwise have been missed. The total number of boreal caribou counted within the study area was 577, resulting in a minimum density estimate of 2.74 caribou/100 km<sup>2</sup>. After accounting for sightability, using two different methods, estimated caribou abundance within the study area was 965-1,725 individuals, corresponding to density estimates of 4.6 – 8.2 caribou/100 km<sup>2</sup> (Boulanger et al. 2025).

Using these density estimates, and applying them to the Wek’èezhìi range planning area, which is 49,505 km<sup>2</sup>, the extrapolated population size of boreal caribou in the Wek’èezhìi region could be between 1,356 individuals (based on a density of 2.74 caribou/100 km<sup>2</sup>) and 4,059 individuals (based on a density of 8.2 caribou/100 km<sup>2</sup>).

Figure A-3 shows the movement paths of collared boreal caribou from different population monitoring study areas in the Southern NWT and Wek'èezhì regions. It also shows a compilation of observations of groups of boreal caribou recorded during different wildlife surveys (including boreal caribou composition and abundance surveys). It illustrates that there are few data available from collar-based monitoring programs and aerial surveys within the northern part of the Wek'èezhì range planning area because that area has not been a focus for recent monitoring.



**Figure A-3.** Boreal caribou movement paths based on collar data in the North Slave (Tłı̄chǫ Highway) and Mackenzie study areas, and boreal caribou sightings recorded during spring classification and abundance surveys.

## References

- Boulanger, J.B., Hodson, J., Kelly, A.P., Greenblat, A., and Nietfeld, M. 2025. Results of the 2020 boreal caribou abundance survey in the North Slave Region – Tłıchǫ All-Season Road study area. Appendix B in Comprehensive Wildlife Management and Monitoring Plan Report for the Construction Phase of the Tłıchǫ All-Season Road. Government of the Northwest Territories, Department of Environment and Climate Change, Yellowknife, NT. September 2024. 40 pp.
- Boulanger J., Pearson A., and Thorley J. 2025. `_bbouretro`: Traditional Survival, Recruitment and Population Growth Methods\_. R package version 0.1.0, commit a94be482b78cd9ffc987240566b704e29f8067ab, <https://github.com/poissonconsulting/bbouretro>
- Dalgarno S, Thorley J, Boulanger J, Pearson A (2025). `_bboutools`: Boreal Caribou Survival, Recruitment and Population Growth\_. R package version 1.0.0, commit c88f400a2a90bc992d8e82828102bf55163e139b, <https://github.com/poissonconsulting/bboutools>
- R Core Team (2025). `_R`: A Language and Environment for Statistical Computing\_. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>