Yukon

SR-25-04

# Aishihik Caribou Herd Interim Project Report

## Population Estimate 2023

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Government of Yukon
Fish and Wildlife Branch
**SR-25-04**

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# Executive summary


- The Government of Yukon, in collaboration with the Champagne and Aishihik First Nations, conducted a mark-resight population survey on the Aishihik caribou herd, north of Haines Junction, Yukon from 6–13 October 2023. This work is part of a five-year project to update the status and current population estimate of the Aishihik caribou herd.
- This project began in 2022 with a fall rut composition survey and early winter collar deployment, but prior to that, the Aishihik herd had been the focus of relatively intense monitoring since the early 1990s. The last population survey was conducted in 2009, which estimated 2,044 animals.
- We delineated 25 survey blocks in the herd range based on terrain features, and GPS radio-collared animals served as the "marked" animals. Three discrete resight surveys were conducted via helicopter with three separate crews. The animals were also classified as calves, cows, immature and mature bulls on the last resight session.
- Results of the composition survey indicated a sufficient calf recruitment ratio of 25.6 calves per 100 cows, and a productive adult sex ratio of 38.3 bulls per 100 cows.
- The 2023 population estimate of the Aishihik herd is **1,912 (95% CI = 1,596–2,292)** animals.
- The estimated population size of 1,912 animals lies within the confidence intervals of the previous two population estimates, suggesting the herd may be stable. This is supported by recent trends in fall calf recruitment.
- This project continues to collect information on herd distribution and demographics, which will be summarized in a final project report.

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# Introduction

The Aishihik caribou herd (ACH) is part of the Northern Mountain (NM) population of woodland caribou (*Rangifer tarandus caribou*), which are currently listed as a species of Special Concern under the federal *Species at Risk Act*. Community members first observed a decline in the herd's numbers in the 1980s, prompting the development of a recovery plan with a post-recovery target of 2,000 animals (Champagne and Aishihik Traditional Territory Fish and Wildlife Planning Team, 2017). The Aishihik herd has been monitored over the long-term and is used as an indicator of productivity for other Yukon herds. The herd is currently managed through permit hunting and was previously tracked with VHF collars from 1991 to 1998 and again from 2000 to 2003.

Several important questions remain regarding the herd's apparent distributional overlap with the neighbouring Kluane and Klaza caribou herds. There is some debate about whether animals east of Aishihik Lake constitute a functionally distinct group or herd. Currently, our understanding of the herd's seasonal distribution is limited. The herd's distribution has important implications for population management, including harvest regulation, effects assessment and regional land-use planning.

This interim project report summarizes the results of the mark-resight population survey conducted from 6–13 October 2023. The purpose of this survey was to update the herd's status and population estimate, which will inform harvest management and land-use decisions in the area. Further reporting, including an analysis of location data, will be produced once the collaring program has concluded.

## Management and monitoring history

The Aishihik caribou herd was the focus of a major government recovery program from 1992 to 1997 and was one of the herds selected for a long-term monitoring effort. The herd decreased from about 1,500 animals in 1981 to 785 animals by 1991, while the neighboring Kluane herd declined from approximately 400 to 200 animals during the same period. In 1992, the Wolf Conservation and Management Plan established conditions for conducting aerial wolf reduction programs, which resulted in a substantial reduction in wolf numbers (69% to 83%) over a five-year period. This effort was part of a large-scale controlled experiment aimed at examining the responses of caribou, moose and sheep populations in the Aishihik area to reduced wolf numbers (Hayes, et *al.* 2000). The Aishihik herd's response to the reduction was a halting of the population decline and resulting increase in size, while demonstrating a sustained increase in annual calf recruitment.

The Government of Yukon conducted annual composition surveys on this herd from 1990 to 2014, 2017, 2021 and 2022 and conducted population surveys in 1997 and 2009. In 1997, the herd was estimated

to have 1,150 animals (Hayes, *et al.* 2003); however, in 2007, 1,475 animals were seen during a fall composition survey suggesting that the herd size had likely increased. Results from the 2009 population survey indicated there were 2,044 caribou in the Aishihik herd (95% CI = 1,724–2,507), just slightly higher than the population goal of 2000 animals. Since the wolf control program in the Aishihik area ended in 1998, the herd has experienced a declining trend in recruitment. From 2011 to 2017, the 5-year running average of calf recruitment (15 calves per 100 cows) was below the recommended 20–25 calves per 100 cows set out in the *Science-based guidelines for management of Northern Mountain caribou in Yukon*. This low recruitment has created uncertainty regarding the population's stability (Environment Yukon, 2016). Adding to this uncertainty, the Aishihik herd has not been monitored using collars since 2003, and we have observed apparent shifts in relative abundance in different portions of the Aishihik range.

## Harvest

Between 1990 and 1992, all caribou hunting was prohibited in the ranges of the Aishihik and Kluane herds due to concerns about rapidly declining population numbers (Yukon Fish and Wildlife Branch, 1994). Prior to this, estimated licenced harvest of the Aishihik Caribou Herd (ACH) ranged from 67 caribou in 1982 to 29 caribou in 1989, representing approximately 30% of all woodland caribou harvested annually (Farnell, 1991).

The licenced harvest of the Aishihik herd is managed under a Permit Hunt Authorization, with 32 permits allocated to licensed Yukon resident hunters. Of these, 24 permits are allocated in the western portion of the herd's range (GMS 5-14, 5-15, 5-19, 5-27 and 5-29 to 5-41) and eight are allotted in the eastern portion (5-42 to 5-48). Also, three outfitters are allocated a portion of the Aishihik caribou harvest. From 2002 to 2023, the average licensed harvest was 8.5 caribou per year; however, this does not include harvest by First Nation hunters (Figure 1).

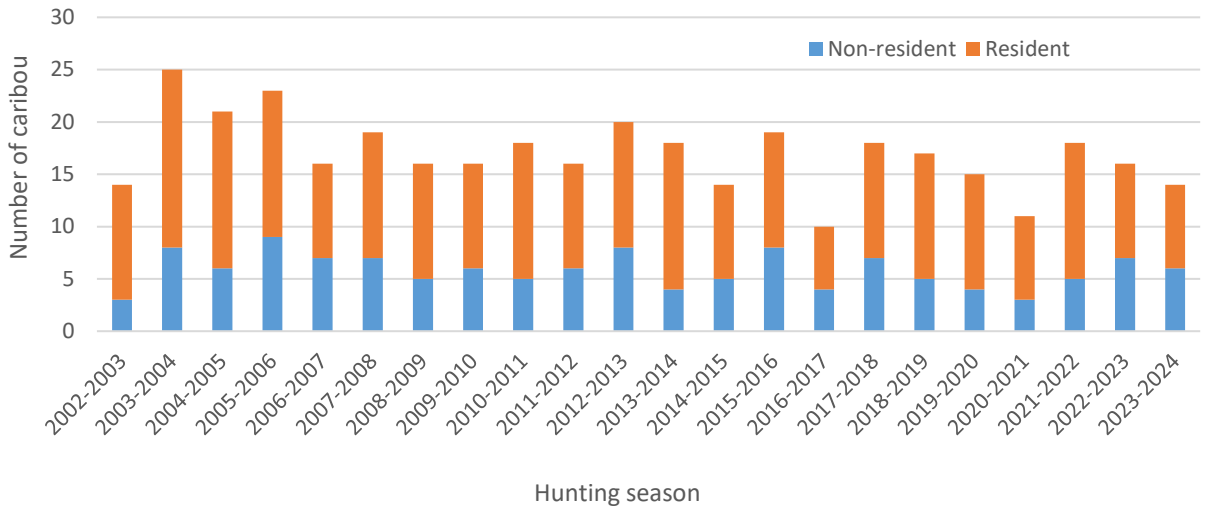


**Figure 1. Total reported licensed harvest of caribou of the Aishihik herd from 2002–2023.**

## Study area

The Aishihik herd's range is situated within the Ruby Ranges ecoregion of the Boreal Cordillera ecozone, which is characterized by the Kluane Plateau in the west and the lower Lewes Plateau to the east. This region has one of the driest climates in the Yukon (Yukon Ecoregions Working Group, 2004). The area has numerous mountains and is dissected by rivers in some places, with much of it above treeline. The mean elevation is around 1,200 m above sea level. White spruce (*Picea glauca*) and willow (*Salix* spp.) dominate forested areas below the treeline, with a moss or ground shrub understory. Broad swaths of shrubs dominate the subalpine (Yukon Ecoregions Working Group, 2004). Mean annual temperature in the region ranges between -3 to -7°C, with cooler temperatures in the west. Mean January temperatures range from – 30 to -35°C. Mean July temperatures range from 7 to 12°C. In addition to caribou, the area provides habitat for moose, sheep, wood bison, deer and a variety of migratory birds. It also supports large predatory species, including wolves, grizzlies and black bears (Yukon Ecoregions Working Group, 2004).

The Aishihik caribou herd ranges north of Haines Junction and the Alaska Highway, with its core area roughly centred on Aishihik and Sekulmun Lakes (Figure 2). It extends north to the Nisling River, east to Kirkland Creek, and northwest of Talbot Arm on Kluane Lake to Swanson Creek. The current annual range will be updated once the ongoing collaring is complete; however, preliminary collar locations indicate a portion of the herd is distributed farther east towards Little Buffalo Lake and farther south to the foothills above Haines Junction. Neighbouring caribou herds include the Klaza herd to the north, overlapping with the Kluane herd to the west, and the Ibex herd to the southeast, across the Alaska Highway. The Aishihik caribou herd range is in the Traditional Territories of the Champagne and Aishihik, Little Salmon Carmacks, Kluane, and White River First Nations.

The Aishihik Road provides year-round access via off-road vehicle (ORV) and snowmobile use across the central portion of the herd's range. Numerous resource exploration roads and ORV trails originate from this road, providing access to camps, lakes and alpine areas. Placer mining roads and associated trails near the Upper Jarvis River and Gladstone Creek allow access to the southwestern portion of the herd's range. ORV-supported hunting in game management subzones in the East Kluane area is restricted to designated routes. The eastern portion of the Aishihik herd's range lies near the North Klondike Highway, particularly near Little Buffalo Lake, southwest of Carmacks. The Mount Nansen mining road, located between the North Klondike Highway and the Nisling River, provides access to the northeastern extent of the herd range.

Aishihik Village, a small CAFN community that is used more frequently in summer, is located at the north end of Aishihik Lake, and is the only human settlement within the herd's range. Cabins and guide-outfitter camps are also sporadically dispersed across the range. Trapping and hunting are common in the area, and bison hunting, which takes place between September and March, is a popular winter activity in the region. Trapping and hunting activities are typically conducted by snow machine, making winter trails common throughout the area.

The survey area for the 2023 population survey focused on known rutting areas within the Aishihik herd range. These areas were identified through historical monitoring and inventory work conducted in the 1980s and 1990s and were further confirmed by more recent fall composition surveys (conducted in 2020 and 2021), GPS collar locations (from November 2022 onwards), and local knowledge. Many of the known rutting areas were located on the broad, rolling plateaus to the east and southeast of Aishihik Lake, including areas north of Quamie Lake, west of Long Lake and Incised Creek. Survey blocks were also situated between Aishihik and Sekulmun Lakes, extending down to the confluence of the Aishihik and West Aishihik Rivers. Additionally, the mountainous terrain around Sekulmun Lake was included, roughly bounded in the north by Dwarf Birch Creek, in the west by Gladstone Lakes, and to the south by the confluence of the Jarvis River and McKinley Creek.

The total survey area covered 7,810 $km^2$, within which 28 survey blocks were delineated across the herd's range. Survey blocks ranged in size from 111 $km^2$ to 562 $km^2$ and were designed to follow natural terrain features whenever possible (Figure 2). Additionally, the survey blocks were strategically placed to encompass the distribution of GPS-collared caribou (marks), ensuring that these caribou were available for detection during the survey.

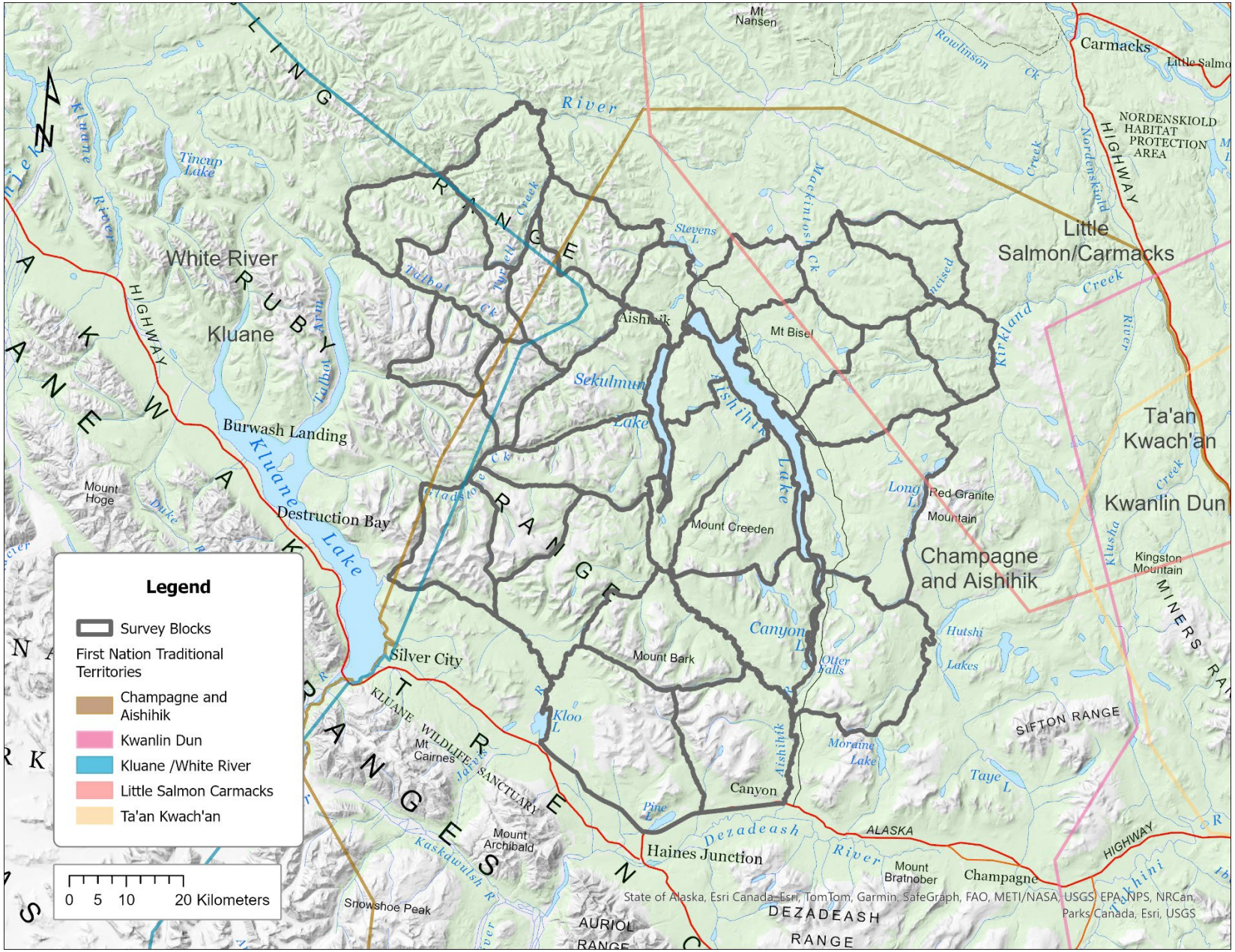


**Figure 2. Aishihik caribou herd 2023 mark-resight population survey area and blocks.**

# Methods

## Collaring activities

Forty caribou were captured using a helicopter (A-Star), net-gun and a three person capture crew in November 2022, February 2023 and March 2023. All collars were fitted with unique colour-number combination visibility-band to allow for the field identification of individuals (Figure 3).

The captured caribou were fitted with Vectronic Aerospace Survey Iridium-2D collars, programmed to take a GPS location every 5 hours 50 minutes. These location data are transmitted via the Iridium satellite to the Vectronic Inventa web service, which provides daily locations to Fish and Wildlife Branch biologists. The collars were also equipped with timed drop-off mechanisms that were set to release 200 weeks from deployment. At the start of the population survey, there were 37 active caribou collars in the Aishihik caribou herd, with three collared animals having already sent mortality signals prior to the survey. The collars were generally well distributed across the study area, with approximately six collars located east of Aishihik Lake, 15 between Aishihik and Sekulmun Lakes, and the remaining 16 west of Sekulmun Lake.

Collared caribou in the herd continue to provide valuable insights into their current distribution. Preliminary location data suggests that the Aishihik herd may consist of two relatively independent groups: an east and a west group. The East group ranges east of Aishihik Lake, with boundaries defined by the Alaska Highway to the south and the North Klondike Highway to the east. During the winter, they occupy areas southwest of Carmacks, around the Buffalo Lakes and Nisling River, with a few individuals crossing the Nisling River into the Klaza range. In the summer and fall, they inhabit the hills and plateaus just east of Aishihik Lake.

The West group ranges between Aishihik and Sekulmun Lakes, and west of Aishihik Lake between Sekulmun and Kluane lakes, extending from the Alaska Highway to Dwarf Birch creek in the north. Some individuals from this group move farther west and mix with the neighbouring Kluane herd during the winter. Additional location data over the next couple of years will help clarify how these East and West groups interact and identify any management and monitoring implications that may need to be addressed. However, to date, there has been little mixing between the two groups.

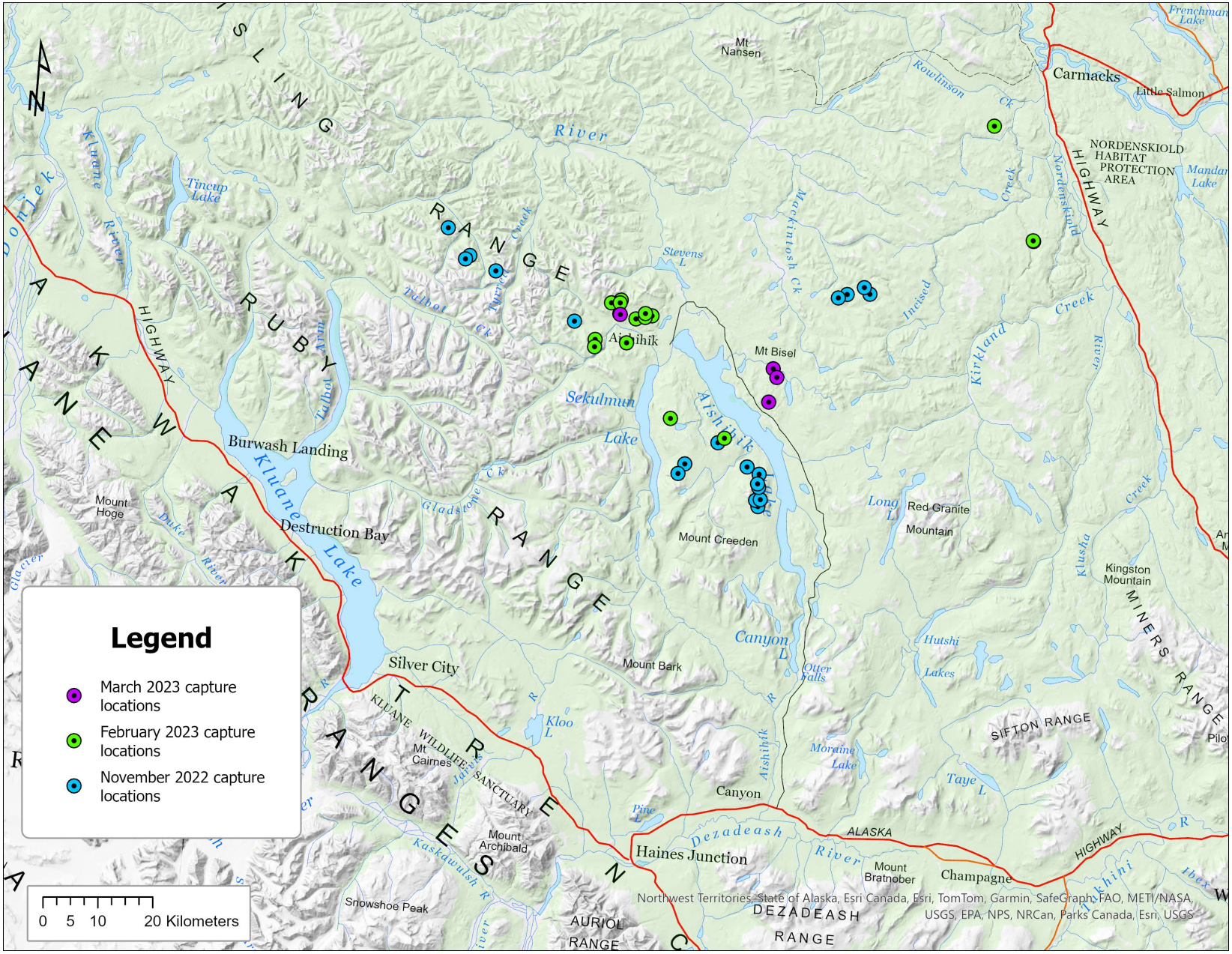


**Figure 3. Aishihik caribou herd collar deployment locations, November 2022 to March 2023.**

## Survey methods

A mark-resight survey technique was employed to estimate the number of caribou in the Aishihik caribou herd. In this method, collared caribou served as 'marks', and the proportion of marked to unmarked caribou observed during the survey provided an estimate of the total population size. Three separate resighting sessions, each lasting three days, were conducted using either a Bell 206 Long ranger or an A-Star helicopter, with unique crews, from 6 to 13 October 2023. The study area was divided into 25 survey blocks, based on fall rut locations from previous surveys, collar locations and terrain features to guide survey efforts (Figure 2). To ensure equal survey effort across blocks, each crew was allocated a proportion of the total survey time based on block size, and the number of groups observed in the blocks during previous fall rut surveys. Each survey block was flown by every crew.

Within each survey block, crews concentrated their efforts on subalpine and alpine habitats, which were assumed to have a high probability of caribou occurrence. When a group of caribou was located, the number of marked and unmarked animals was recorded, and a waypoint was recorded using a handheld GPS unit. Marked animals were identified by their unique vis-bands, when possible. In rare cases, where crews could not confirm a vis-band number (e.g., only one number was visible), telemetry was used to confirm the unique radio frequency of the collar. Telemetry was used exclusively for this purpose, as using it to locate collared individuals would have violated the assumptions of the mark-resight methodology. During the third resighting session, animals were also classified as calves, cows, or immature and mature bulls to estimate herd composition.

A population estimate was derived for the entire study area; however, as mentioned earlier, preliminary location data from collared animals suggests there may be significant separation between those located east of Aishihik Lake and those found between and west of Aishihik and Sekulmun Lakes. To better understand the implications of this apparent distribution on harvest allocation, we also made an anecdotal estimate of the size of each distinct group, which will be henceforth referred to as the West and East groups.

## Data analysis

To estimate the population size for the Aishihik herd, the analysis was conducted using Program MARK (ver. 10.1). A mixed logit-normal modeling approach was employed, as the herd's range was considered geographically closed, and marks were individually identifiable. This model accounts for individual heterogeneity in resighting probabilities by treating each animal as a random effect. However, if this parameter was not supported during model selection, the data was considered to lack individually identifiable marks, and it was fixed at zero (McClintock B. , 2018).

A set of four candidate models were evaluated using the survey data (Table 1). We used Akaike's Information Criterion difference ($\Delta_i$ $AIC_c$; Akaike, 1973) adjusted for small sample sizes ($AIC_c$; Burnham & Anderson, 1998) and Akaike weights ($AIC_c w_i$) to select the model(s) with the fewest predictor variables that explained the greatest variation in the data (i.e., the most parsimonious model). All models with a $\Delta$i $AIC_c$ of ≤2.00 were considered equally plausible (Richards, 2005, Symonds & Moussalli, 2011).

**Table 1. Mark-resight candidate models fitted to the resighting survey data to estimate the abundance of the Aishihik caribou herd.**

| Model | Description |
|---|---|
| $N$ p. σ=0 | Constant p across all resighting sessions, σ fixed at zero |
| $N$ $p_t$ σ=0 | Different p for each resighting session, σ fixed at zero |
| $N$ p. σ. | Constant p across all resighting sessions, σ as a random effect |
| $N$ $p_t$ σ. | Different p for each resighting session, σ as a random effect |

# Results and discussion

Throughout the survey, the weather was sunny or partly cloudy, with good visibility. However, despite postponing the survey due to a lack of snow, there was little to no snow on the ground in most survey blocks for all three resight sessions, which made spotting and tracking caribou particularly challenging. All 37 active collars were available in the survey blocks for the duration of the survey, except for one collared individual who was unavailable during Sessions 1 and 2 but was present during Session 3. This availability was determined by examining GPS locations after the surveys were completed. Crews were unaware of which marked animals were present in a block during their survey, and no telemetry equipment was used to locate animals, as this would have biased the resighting rates upwards (Figure 4).

## Population estimate

Resighting rates (i.e., recapture probability), based on data in Table 2. were 0.56, 0.39, and 0.57 for Sessions 1, 2, and 3, respectively. The selected model for the Aishihik herd included a session-dependent resighting probability across sessions, and the parameter for individual heterogeneity fixed at zero (Table 1, Table 3.). All candidate models had a $\Delta$i $AIC_c$ <2.00, making them equally plausible. To determine the final model, the one resulting in the smallest confidence intervals ($N\ p_t\ \sigma=0$) was selected. The final 2023 population estimate for the Aishihik herd is **1,912 (95% CI: 1,596–2,292)** animals (Table 4.).

The top model included a time-dependent parameter for resighting probability, suggesting there may have been differences among resight sessions. These differences could be attributed to varying survey conditions across sessions and resight rates, with Session 2 exhibiting a slightly lower resight rate compared to Sessions 1 and 3 (Table 2). Individual heterogeneity was not included in the model as a random effect, indicating that there were no significant differences among marked individuals that made them more difficult to detect. A further examination of the individual encounter histories (i.e., which marked animals were observed across resight sessions) revealed that a moderate proportion (14%) of the same available marked animals were missed by every session, supporting the decision to fix the individual heterogeneity parameter to zero.

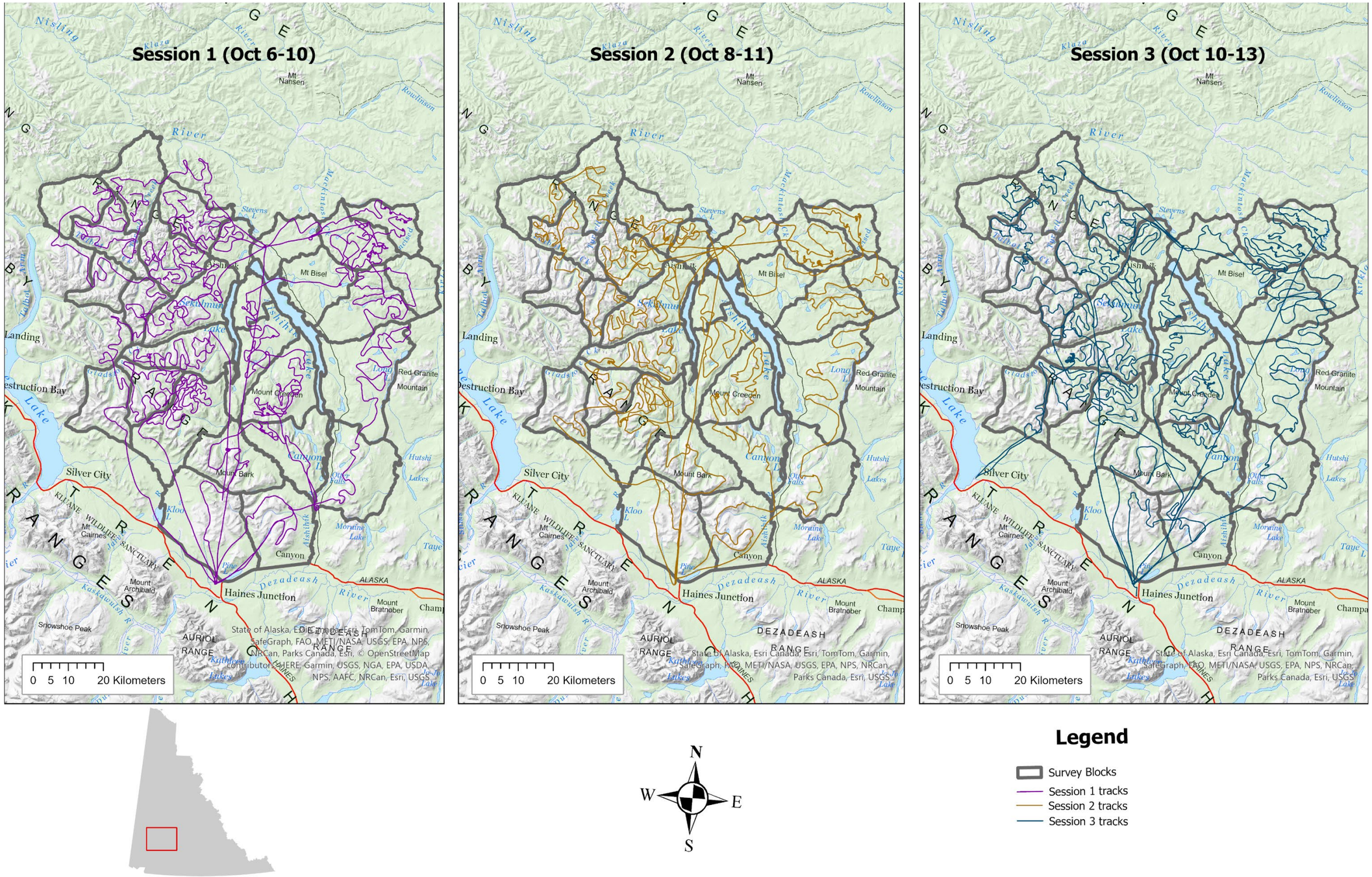


**Figure 4. Flight lines from all three sessions of the 2023 mark-resight population survey of the Aishihik caribou herd.**

**Table 2 Mark-resight survey results for the Aishihik caribou herd, 6–13 October 2023.**

| Resight session | Survey effort (hours) | Total marked animals available | Total marked animals observed | Total animals observed | Resighting rate |
|---|---|---|---|---|---|
| **1 (6 October)** | 14.4 | 36 | 20 | 922 | 0.56 |
| **2 (2–4 October)** | 13.9 | 36 | 14 | 835 | 0.39 |
| **3 (4–6 October)** | 13.9 | 37 | 21 | 1,165 | 0.57 |

**Table 3 Candidate models for the 2023 Aishihik caribou population estimate with model selection values.**

| Model | Rank | K[a] | AICc | Δi AICc | AICc weight |
|---|---|---|---|---|---|
| N p. σ=0 | 1 | 2 | 164.297 | 0.000 | 0.333 |
| N p. σ. | 2 | 3 | 164.472 | 0.175 | 0.305 |
| N $p_t$ σ. | 3 | 5 | 165.414 | 1.118 | 0.191 |
| **N $p_t$ σ=0** | **4** | **4** | **165.633** | **1.336** | **0.171** |

*a: Number of model parameters including the intercept.*

**Table 4 Estimates of model parameters of the Aishihik caribou herd from the selected mark-resight model.**

| Top model | Parameter | Value | SE | 95% Confidence Interval |
|---|---|---|---|---|
| N $p_t$ σ=0 | **N** | **1,912** | **177** | **1,596–2,292** |
| | $p_1$ | 0.558 | 0.083 | 0.395–0.710 |
| | $p_2$ | 0.390 | 0.082 | 0.246–0.556 |
| | $p_3$ | 0.570 | 0.082 | 0.409–0.718 |

The previous estimate of the Aishihik herd from 2009 was 2,044 (95% CI=1,724–2,507) animals, derived from a slightly modified version of a mark-resight survey (Neal *et al.* 1993, Gould *et al.* 2005, Skalski *et al.* 2005). Without accounting for missed animals, the total number of animals *observed* (i.e., not estimated) in 2009 was 998, while in 2023, the number was 1,165. The 95% confidence interval of the current Aishihik population estimate overlaps with the 2009 estimate. However, given the high variation in both surveys and the long time between them, it is difficult to draw a clear conclusion regarding the population trend based on these results alone.

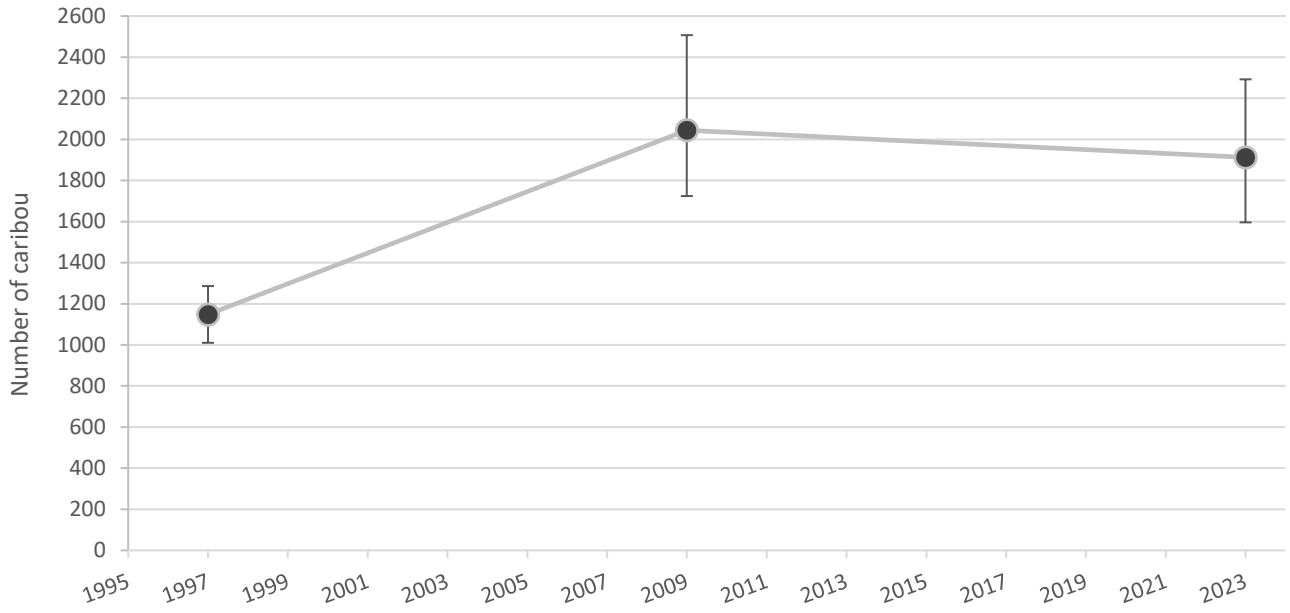


**Figure 5. Population estimates with confidence intervals of the Aishihik herd from 1997 to 2023.**
*Population surveys prior to 2023 were conducted during late winter using a stratified random block methodology (1997) or a modified mark-resight approach (2009). The population estimate in 2023 was conducted during fall rut using a mark-resight methodology.*

## Herd composition

During the third resight session, observed caribou were further classified by sex and age to determine the herd's composition. A total of 1,165 caribou were observed during this session, and all of them were classified (Table 5).

The fall calf recruitment ratio for 2023 was estimated at 25.6 calves per 100 cows which is above the minimum fall recruitment ratio needed for a stable population growth rate (20–25 calves per 100 cows) as outlined in the *Science-based guidelines for management of Northern Mountain caribou in Yukon* (Environment Yukon, 2016). The 2023 recruitment estimate represents an improvement from the previous two years (23.4 and 23.0 calves per 100 cows in 2021 and 2022, respectively). However, in 2024, the estimated recruitment dropped to 20.0 calves per 100 cows, bringing the 4-year running average to 23 calves per 100 cows, (2021–2024; Figure 6), which is considered adequate for a stable population.

The adult sex ratio in 2023 was estimated to be 38.3 bulls per 100 cows, which is above the threshold of 30 bulls per 100 cows to ensure reproduction and maximized genetic diversity (Environment Yukon, 2016). Overall, including the 2024 survey's ratio, the 4-year running average for bulls per 100 cows is 43 (2021–2024; Figure 6). It is important to analyze long-term trends in calf recruitment and adult sex ratios to gain a more comprehensive understanding of the herd's overall trajectory, as annual estimates may fluctuate. Additional composition surveys for this herd are planned in fall 2025 and every other year thereafter.

Fall composition surveys were previously conducted annually from 1990 to 2014 for the Aishihik herd (Figure 6). During this period, fall calf recruitment averaged 26 calves per 100 cows, and adult sex ratios averaged 45 bulls per 100 cows, which supported the conclusion of an increasing or stable herd status, as determined from population surveys in 1998 and 2009 (Figure 5, Figure 6).

**Table 5. Observed composition of the Aishihik caribou herd, October 2023.**

| Survey | Calves per 100 cows | Percent calves | Bulls per 100 cows | Number of caribou classified | Number of caribou unclassified |
|---|---|---|---|---|---|
| **October 2023, resight #3** | 25.6 | 15.6 | 38.3 | 1,165 | 0 |

**Table 6. Estimated composition of the Aishihik caribou herd based on estimated age and sex ratios and population estimates, October 2023.**

| Estimated herd size | Calves | Cows | Bulls |
|---|---|---|---|
| **1,912** | 299 | 1,167 | 446 |

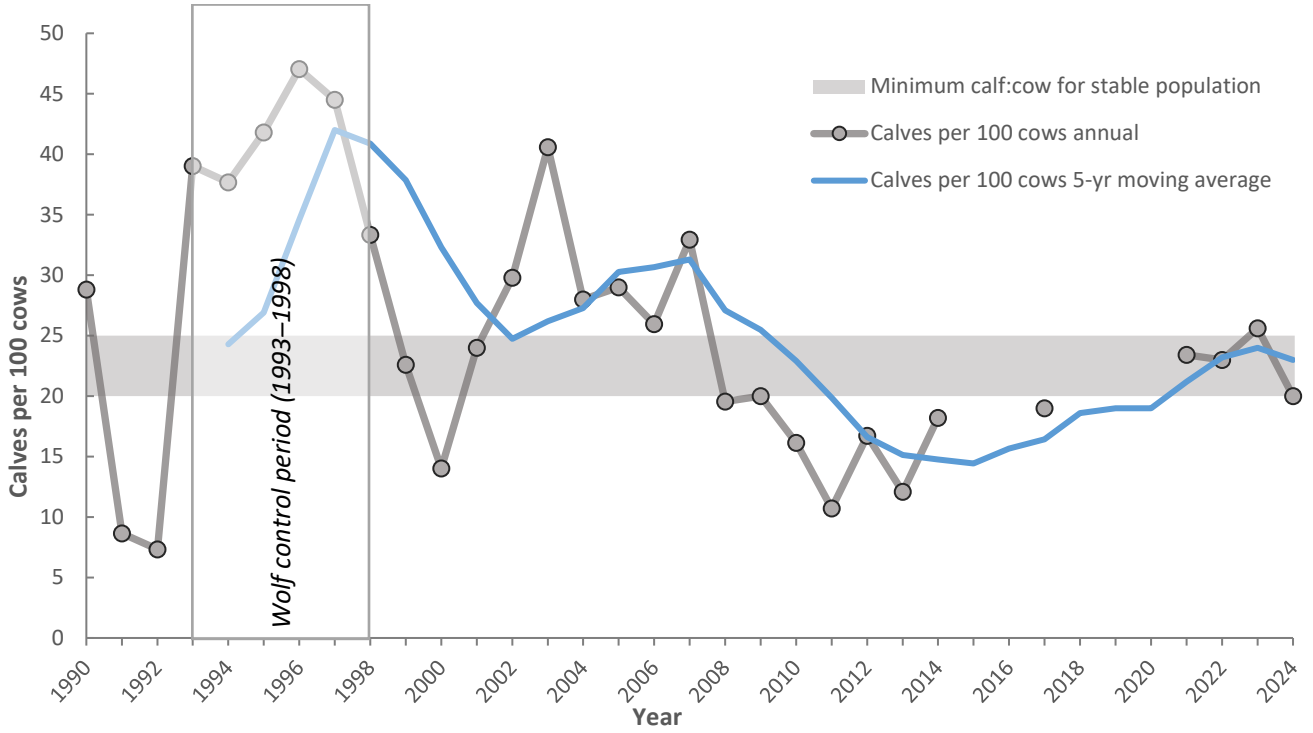


**Figure 6. Measure of recruitment as number of calves per 100 adult cows, and adult sex ratio as number of bulls per 100 adult cows, calculated from composition surveys conducted during fall on the Aishihik caribou herd, 1990–2024.**

*Surveys were not conducted in 2015, 2016 and 2018–2020. The wolf control period is highlighted (1993–1998).*

## Distribution

Caribou groups were primarily distributed across open alpine and subalpine rutting areas, east and west of Aishihik Lake (Figure 4). These groups ranged in size from 1 to 135 individuals, with an average of 18 individuals per group. Caribou were distributed throughout the study area, with the highest concentrations observed on the rolling hills east of Aishihik Lake (east of Mackintosh Creek), between Aishihik and Sekulmun Lakes (south of Lister Creek), and northwest of Sekulmun Lake (Nisling Range). The two largest groups observed, consisting of 116 and 135 animals, were found in the open plateau areas west of Sekulmun Lake and south of Isaac Creek. Smaller groups of caribou were scattered across the study area, typically in open, rolling hills or plateau areas in the east, and high-elevation alpine areas in the west.

Compared to past fall rut surveys dating back to 1990, we have recently observed higher numbers of Aishihik caribou in the central and northeastern portions of their range. In the central range, a greater concentration of rutting animals was noted in the alpine plateaus and bowls near the Mount Credon area, southwest of Aishihik Lake. We also observed caribou that were further to the northeast of their traditionally known rutting range. In contrast, fewer caribou were observed rutting in the mountains west of Sekulmun Lake and north toward the Albert Creek and Porphyry Peak areas, compared to previous years.

Within the study area, caribou were generally located in one of two broad areas: east of Aishihik Lake or between Sekulmun and Aishihik/west of Sekulmun, representing two distinct East and West groups. A minimum of 532 caribou were observed in the East group (with a range of 403-532 across the three resight sessions) and 614 (with a range of 432–614) were observed in the West group. Based on the distribution of collared animals and observations of collared and uncollared caribou during the mark-resight surveys sessions, we estimate approximately 55% (1,052 animals) belong to the West group and 45% (860 animals) belong to the East group.

## Management implications

The mark-resight population survey conducted on the Aishihik caribou herd, north of Haines Junction, Yukon, has provided valuable insights into the distribution, status and population size. The estimated population size of 1,912 animals falls within the confidence intervals of the previous 2009 population estimate, suggesting the herd may be stable. Recent estimates of fall calf recruitment (2021–2024) support this assertion.

This survey was conducted as part of a five-year project aimed at updating knowledge about the Aishihik caribou herd to support informed decision-making about its management. Sustainable harvest rates may be adjusted following the completion of the five-year program and a thorough review of the available data. Similarly, an evaluation of how permits are allocated within the herd range is warranted. Currently, approximately 60% of permits are allocated to Game Management Subzones in the West and 40% in the East, which appears to align well with our current understanding of the herd's distribution. This project will continue into 2025, with further monitoring required to gain a more comprehensive understanding of the long-term trends and dynamics of the herd. A final project report, detailing all available location and demographic data will be produced to provide a complete understanding of the herd's range.

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