

**Finlayson Caribou Herd  
Population Estimate  
2022**

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# Finlayson Caribou Herd Population Estimate 2022

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## Executive Summary

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- We report the results of the 2022 survey of the Finlayson caribou population. This survey builds upon those conducted with the same methodology in previous years. Results are intended to provide information on the current size of the population.
- During 22 February to 3 March 2022, we conducted a stratified random block survey to estimate the population size and trend of the population. We used survey blocks consistent with the previous six population estimates to stratify the study area via fixed-wing aircraft. We then flew an intensive census survey to count and classify animals via helicopter within two days of survey stratification.
- The 2022 estimated population size is 3,359 (95% confidence intervals [CI] = (3,085–3,634). This is considerably higher than the 2017 estimate of 2,712 (95% CI = 2,454–2,970, representing a 24% increase in the population size over the past five years.
- A key result from our survey is that the population has grown since the last survey in 2017, marking the first time since 1990 that the Finlayson Caribou Herd (FCH) has not exhibited a decreasing population trend.
- The most recent calf recruitment trends (24 and 26 calves per 100 cows, based on 5 and 10-year moving averages, respectively) indicate the herd may be stabilizing or increasing, which supports the 2022 population survey results.
- The population size is possibly an overestimate due to the limitations of applying this survey methodology on caribou. As such, a precautionary approach would be to consider that the real population size is likely closer to the lower 95% confidence interval of 3,085 animals. Nonetheless, the survey results are directly comparable to all past population estimates of the herd and are indicative of herd growth.
- We recommend 1) continuing annual fall recruitment surveys of the herd to monitor population trends and 2) continuing to use available information to regularly update the herd population model to predict future population size and trends, and 3) exploring novel methods to estimate population size in the next five years.

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## Introduction

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The Finlayson caribou herd (FCH) is part of the Northern Mountain (NM) population of woodland caribou, which are currently listed as Special Concern under the federal Species at Risk Act. This report summarizes the results of a late winter population survey of the FCH, conducted from 22 February to 3 March 2022. The purpose of this survey was to estimate the abundance, distribution, and population trend of the herd.

This information will be used to assess the population status and the harvest pressure on the herd. With development projects such as the Kudz Ze Kayah mine proposed to occur within the herd's range and ongoing interest in mineral exploration, there are concerns about cumulative effects and the long-term persistence of Finlayson caribou. The purpose of this survey is to get an updated population estimate to better inform decision-making related to the herd. Conservation and effective management of this herd is a priority given its cultural and subsistence value for the Kaska First Nations.

## Background

Beginning in the late 1970s, the FCH was thought to be declining due to levels of adult mortality (both natural and harvest) that far exceeded the calf recruitment rate, thus pushing the herd into a decline. This observation was supported by local people, who indicated that there were fewer caribou than in previous years (Farnell and McDonald 1986). At this time the herd was estimated at approximately 2,000 animals; however, no formal counts or studies had been carried out.

In response to concerns the herd was declining, the Department of Environment initiated an intensive population recovery program and management study in the FCH's range to look at the effects of predator population reduction on the recovery of caribou and moose populations. From 1983 to 1989, an annual aerial wolf control program was carried out in the FCH range. During this time wolf numbers were reduced by approximately 85% from pre-control numbers. The herd grew from an estimated 2,000 animals in 1982 to nearly 6,000 animals in 1990.

Following wolf control (1990 to 1998), we conducted aerial surveys and monitoring of caribou, moose, and wolf populations and found that wolf numbers rebounded to numbers comparable to pre-control estimates, within 4 to 5 years. A population census in 1996 showed the herd had declined to approximately 4,500 animals. During this time, there was interest in the community to maintain the herd at post-wolf control numbers. In 1998, on the recommendation of the Yukon Fish and Wildlife Management Board, the Department of Environment implemented a Permit Hunt Authorization (PHA) regulation for licenced resident hunters. Additionally, outfitters were placed on quota. In 1999, we completed another census and the herd was estimated at 4,130 animals. Eight years later, in 2007, the herd was estimated at 3,077 animals.

Composition surveys, which provide an indication of herd demographics (e.g., number of calves and bulls per 100 cows) have been conducted annually, and six population estimates have provided information on population size and trend.

Between 1982 and 1987, 52 VHF radio collars were deployed on the FCH, with at least 20 relocations per collar (Farnell et al. 2008). This provided data on adult female survival rates and seasonal distribution patterns. Collaring was not continued on the FCH as it did not receive support from community partners. In particular, in respect of some of the Kaska First Nation's beliefs about collaring animals, the Department of Environment has not collared individuals from the Finlayson caribou herd since the 1990s, and thus continues to apply the adapted stratified random block (SRB) methodology to survey this herd (described below).

## Study area

The summer and fall ranges of the FCH are primarily located on alpine plateaus south of Finlayson Lake. However, a portion of the herd uses a widely-scattered group of alpine blocks north of the Robert Campbell Highway, ranging close to the Northwest Territories border (Map 1).

The herd's winter range is located north of the Pelly Mountains and east of the community of Ross River, on both the north and south sides of the Robert Campbell Highway. It is a lowland forested area where there are abundant ground lichens under relatively open black spruce, white spruce, and lodgepole pine forests. The mountains create a snow and rain shadow effect by intercepting the predominant weather systems from the southwest. The low snow cover and abundant ground lichens in the core winter range are typical of Yukon woodland caribou winter ranges. The core of the spring, summer/post-calving, and fall range of this herd in the Pelly Mountains overlaps a mineral belt that has undergone exploration over the past 20 years.

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## Methods

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The methods used for the 2022 Finlayson caribou herd survey were consistent with the methods used in the six previous surveys conducted in 1986, 1990, 1996, 1999, 2007, and 2017. The method is an adaptation of a stratified random block (SRB) survey first developed for moose and adapted for mountain caribou in the Yukon (Farnell and Gauthier 1988). Survey blocks ( $n = 214$  covering an area of  $6,778 \text{ km}^2$ ) were the same as those in the 2007 and 2017 surveys.

### Stratification

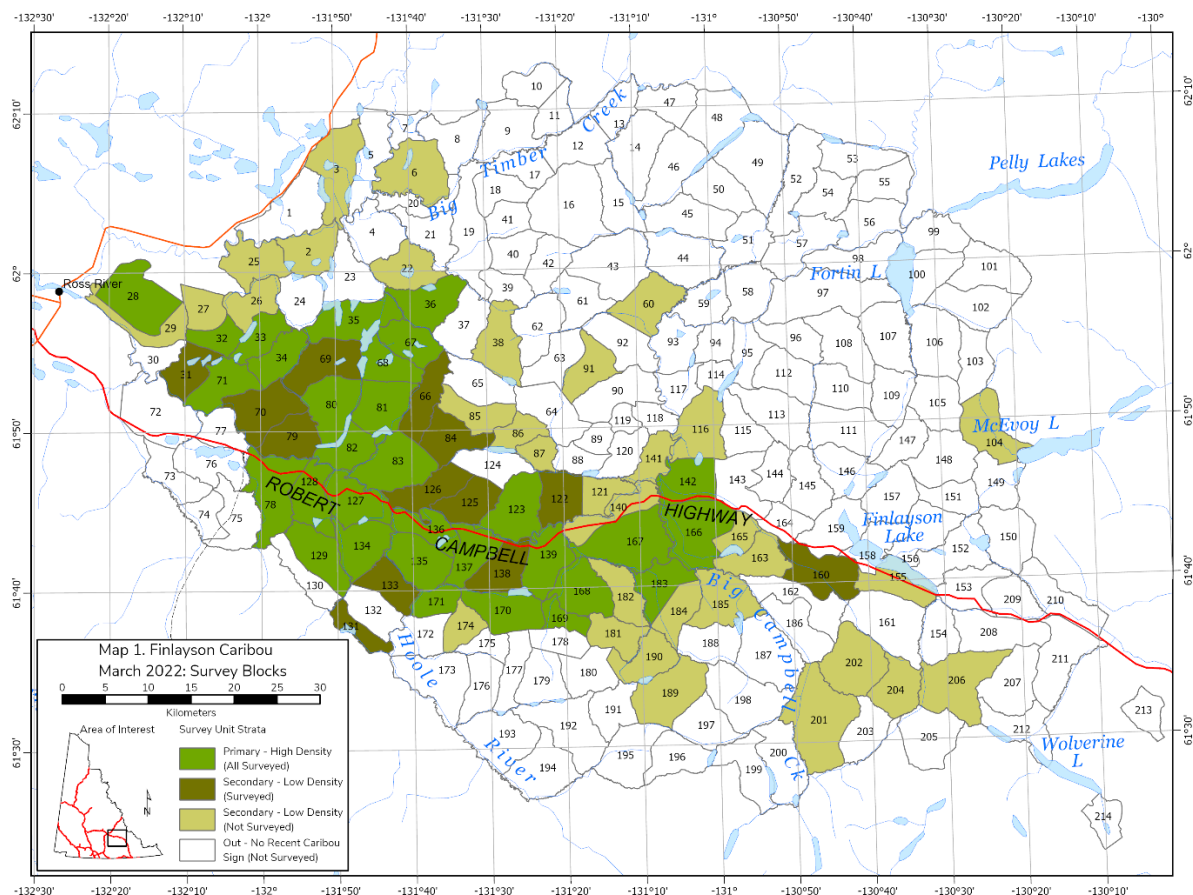
The size of the study area precludes survey crews from intensively flying the entire area, thus the SRB method first requires stratification of the entire study area to identify high, low, and undetected use areas (Map 1). From 22 to 25 February 2022, experienced observers (Traci Morgan (YG), Alex Beatty (YG), and Alain Fontaine (EDI)) flew in a Cessna 206 fixed-wing aircraft (Great River Air) through each of the survey blocks looking for caribou or fresh sign of caribou. The survey was timed to occur after recent snowfall, allowing for good distinction between recent (fresh) sign and older caribou tracks and feeding craters. Survey conditions were ideal throughout the duration of the stratification, with primarily clear, sunny skies and recent snowfall that allowed for good tracking. Based on the results of the stratification survey, blocks were assigned to one of three categories:

- i. Primary (high use) – at least 12 caribou seen and/or abundant fresh sign;
- ii. Secondary (low use) – less than 12 caribou seen, and/or limited fresh sign, or
- iii. Out – no caribou and no fresh sign.

The stratification resulted in 31 blocks identified as primaries, 46 as secondaries, and 137 as out, representing  $1016$ ,  $1421$ , and  $4342 \text{ km}^2$ , respectively (Table 1).

**Table 1. Results of the Finlayson caribou herd stratification survey conducted in February 2022.**

Stratification	Number of blocks	Total area ( $\text{km}^2$ )
High use	31	1,016
Low use	46	1,421
Out (no use/not detected)	137	4,342



**Map 1. Survey blocks from the 2022 Finlayson caribou population survey. All blocks were flown during the stratification portion of the survey, while all primary blocks were intensively surveyed during the census, and a random selection of secondary blocks were also intensively surveyed.**

## Census

As soon as logistically feasible, following completion of the stratification survey, a helicopter-based census survey was conducted to intensively count and classify caribou in all high use and a selection of low use blocks. Two helicopters (Jet Ranger Bell 206B and Long Ranger Bell 206L, Capital Helicopters), with three observers each, flew from 27 February to 3 March 2022. Two helicopters were used simultaneously to minimize the chance that caribou might move between survey blocks. Observers included both Environment Yukon staff (Traci Morgan, Alex Beatty, Jaylene Goorts, Kyle Russell, and Ryan Benson) and representatives from BMC (Alain Fontaine – EDI Environmental Dynamics Inc. and Dorothy Dick – Ross River Community Facilitator). Blocks were intensively surveyed by flying ~400 m wide transects across the entire block. Weather conditions were fair to good with largely overcast skies, but high cloud ceilings.

Total survey time was approximately 48 hours. On average, survey intensity was 2.06 minutes/km<sup>2</sup>. After the census survey was complete, crew members and the caribou biologist jointly reviewed all observations (including composition data) made during the census to ensure accuracy of observed groups. Error can arise during the survey resulting from groups being counted twice, as animals may move between neighbouring blocks during



the census, or groups may be observed in a neighbouring block while flying the edges of surveyed blocks. Any duplicate observations were removed from the analysis.

**Table 2. Observed caribou during the 2022 census survey of the Finlayson caribou herd.**

Stratification	# blocks surveyed	Surveyed area (km <sup>2</sup> )	Caribou observed	Caribou/km <sup>2</sup> (SE)
High use	31	1,016	2,193	2.160 (0.455)
Low use	14	413	120	0.291 (0.108)
<b>Total</b>	45	1,429	2,313	1.619 (0.342)

## Data Analysis

Caribou abundance was analyzed using strata-specific approaches for the high and low use blocks. Once the abundance was estimated for each strata, it was summed to derive the total population estimate. Variances for each step of the analysis were approximated using the delta method (Powell 2007).

The methodology to account for missed animals during the 2022 survey was the same approach used in 2017. Resources were not available to conduct separate sightability surveys to develop a correction factor to account for missed animals in the surveyed blocks. However, sightability correction trials (N=43) have been conducted for the herd during several previous surveys (1986, 1990, 1996, and 1999), and data from those sightability trials were used to generate a correction factor for the 2022 survey. A logistic regression model using data from all available sightability trials was fitted accounting for year by treating it as a random effect (using `melogit` command in Stata 14.2). The estimated coefficient (on the logit scale) from the model was 1.238 (SE=0.212) which is equivalent to a 0.776 (SE = 0.037) sightability rate (i.e., 77.6% of the total number of animals in the population were observed), which is also the same as a correction factor (i.e., multiplier) of 1.289 (SE = 0.061). Data to develop separate correction factors for high and low use blocks were unavailable.

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## Results

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### Population Estimate

With all high use blocks surveyed during the census, the total number of caribou observed in them can be directly adjusted by the estimated correction factor. The only source of uncertainty (i.e., variance) for this step is associated with the variance of the correction factor itself. A total of 2,827 (SE = 134) caribou were estimated in high use blocks.

To estimate caribou abundance in the low use blocks, observed caribou numbers in each survey block were first converted to densities based on the area of the surveyed blocks. This observed density was then applied to all (surveyed and unsurveyed) low use blocks to obtain an overall estimate of caribou abundance (N = 413, SE = 26) in the low use stratum, uncorrected for sightability. Subsequently, this uncorrected abundance estimate was adjusted for sightability using the estimated correction factor. The total, corrected, abundance of caribou in the low use blocks was 532 (SE = 42).

Summing the abundance estimates of the high and low use blocks yielded an overall estimate of 3,359 (SE = 140, 95% CI = 3,085–3,634) animals (Table 3). Variance associated with each strata was approximated using the delta method for the total abundance estimate.

**Table 3. Estimated abundance, corrected for sightability, of the Finlayson caribou herd, February/March 2022.**

Stratification	N	N X SCF <sup>2</sup>	SE	95% Confidence Interval <sup>3</sup>
High use	2,193	2,827	134	2,564–3,089
Low use	413 <sup>1</sup>	532	42	450–615
<b>Total</b>	<b>2,606</b>	<b>3,359</b>	<b>140</b>	<b>3,085–3,634</b>

<sup>1</sup> Total caribou derived by applying the average density of caribou in surveyed low use blocks to both surveyed and unsurveyed low use blocks and multiplying by the survey block area.

<sup>2</sup> Total caribou (N) multiplied by the SCF (sightability correction factor) of 1.289

<sup>3</sup>Variances for strata-specific and total abundance estimates were calculated using the delta method.

### Herd Composition

During the survey, observed caribou were classified into calves, cows, or bulls when possible. Of the 2,313 animals observed, 2,019 were classified (Table 4). Composition ratios from the March 2022, October 2021, and 2022 fall composition surveys are provided in Table 4. Values from all surveys were similar; however, given the larger sample size of classified individuals from the March 2022 survey (Table 4) and that it directly represents the population during the time of the population estimate, its values were used to provide an estimate of the current composition of the herd (Table 5).

**Table 4. Composition ratios of the Finlayson caribou herd obtained during surveys in October 2021, February/March 2022, and October 2022.**

Survey	Calves per 100 cows	Percent calves	Bulls per 100 cows	Number of caribou classified
October 2021	20.4	12.2	46.4	704
February/March 2022	18.2	9.6	47.1	2,019
October 2022	23.5	13.9	47.5	411

**Table 5. Estimated composition of the Finlayson caribou herd, February/March 2022.**

Herd size	Calves (% of herd)	Cows (% of herd)	Bulls (% of herd)
3,359	323 (9.6)	1,778 (52.9)	1,258 (37.5)

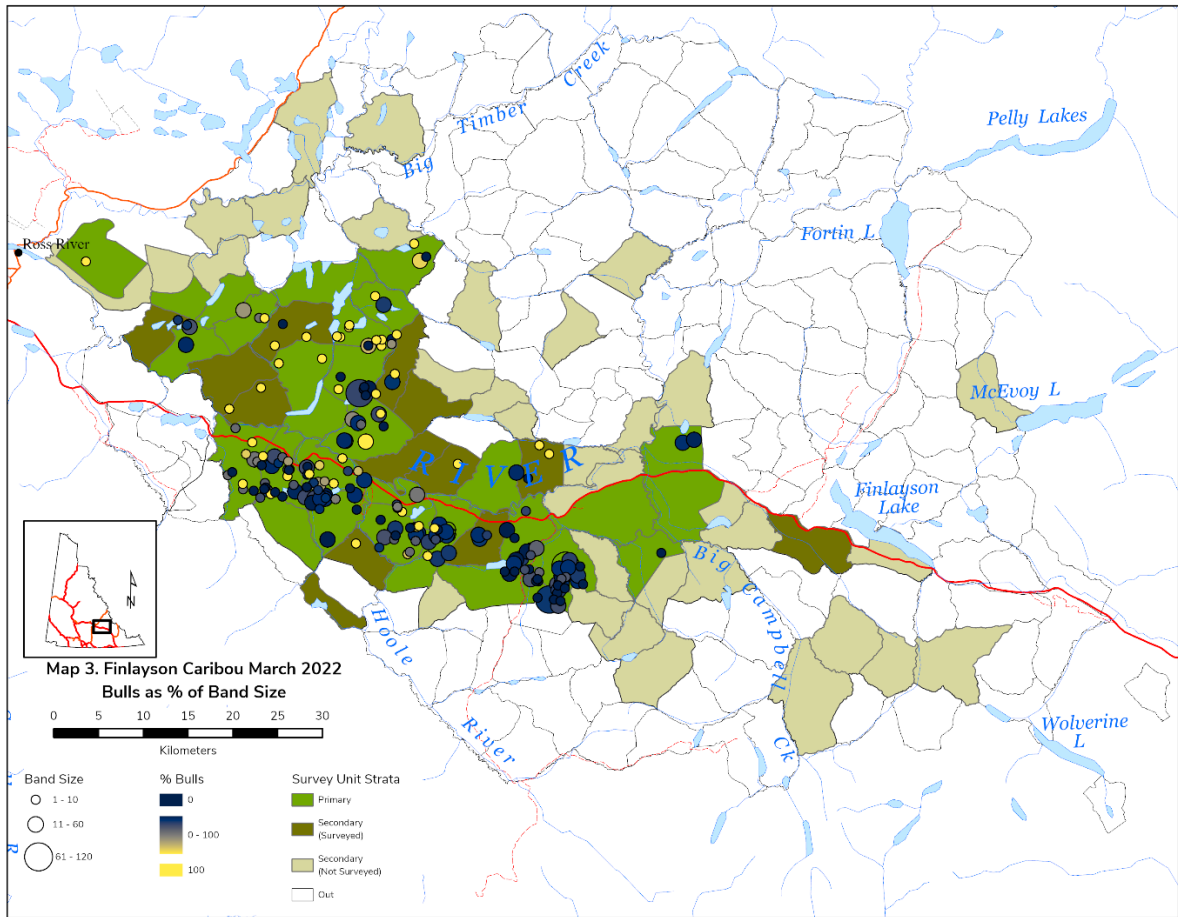
## Animal Distribution

During the 2022 stratification survey, there was a largely continuous distribution of animals and/or tracks observed in blocks southeast of Ross River, resulting in those blocks being considered high or low use (Map 1). This differs from the 2017 survey, where an isolated group of animals was observed in block 28, and based on GPS collar locations on animals in the neighbouring Tay River herd, these animals were considered to be Tay River animals and the block was subsequently removed from the census analysis. Given the observation of relatively continuous distribution of caribou and/or tracks through the western blocks and the lack of locations from collared Tay River animals in the area, these groups were included for the census and analysis.

Distribution of Finlayson animals during the 2007 and 2017 censuses was similar, with concentrations of animals around Finlayson Lake and north and south of the Robert Campbell Highway in the Caribou Lakes area. This was considered to be a departure from distributions observed during previous surveys (1986, 1990, 1996, and 1999), where most animals were found south of the Pelly River and the Robert Campbell Highway, near Caribou Lakes, with very few near Finlayson Lake. This historic distribution was largely analogous to the observations from the 2022 survey, with few caribou observed in the Finlayson Lake area, and most caribou concentrated south of the highway in the Caribou Lakes area (Map 2).

This observed shift in winter range over the years could be a result of various factors including changes in snow cover and/or season-specific range use tactics, where animals that display less fidelity to winter ranges have higher rates of survival due to the ability to avoid wolves by making winter locations less predictable (Lafontaine et al. 2017).

Sex-specific differences in late winter distribution were notable (Map 3), with bull-dominated groups (>50% bulls) more prevalent north of the Robert Campbell Highway and concentrated more on the western side of the study area. Bull-dominated groups were typically smaller in size, ranging from 3 to 22 individuals (average = 7 individuals). Cow-dominated groups (<50% bulls) were located primarily south of the Highway, with further distribution towards the eastern part of the study area. Cow-dominated groups ranged in size from 1 to 73 individuals (average = 13 individuals). Four groups of unclassified caribou were excluded from this summary.



**Map 3. Distribution of bull caribou, as indicated by percent of bulls in each observed group, during the 2022 Finlayson population survey.**

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## Discussion

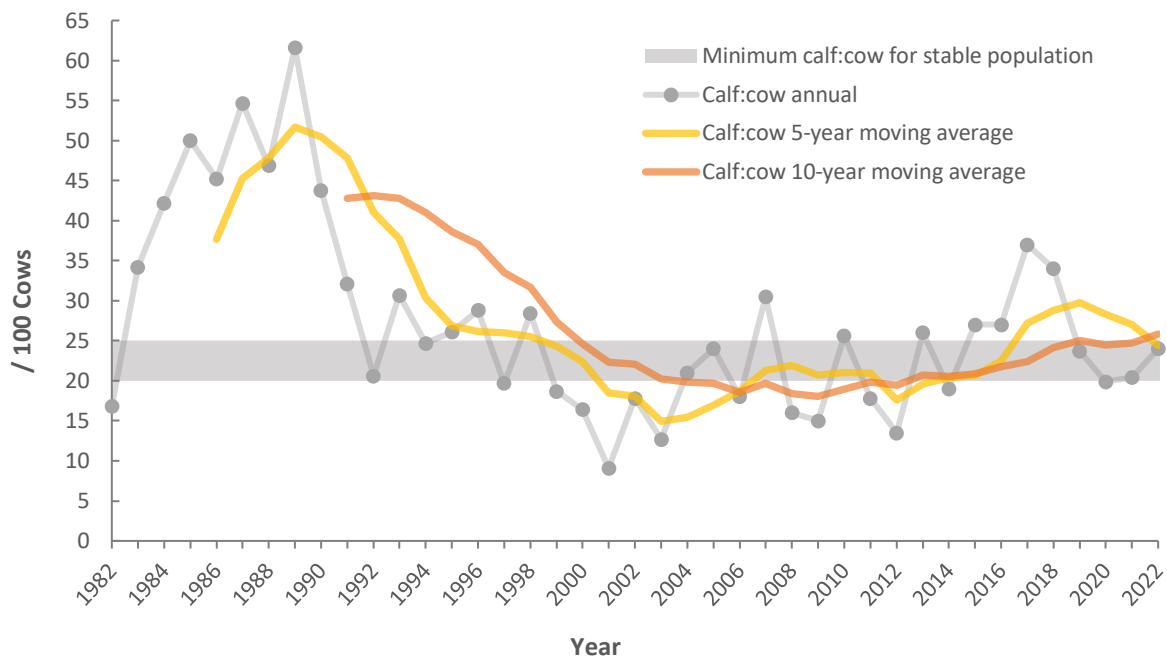
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### Composition Trends

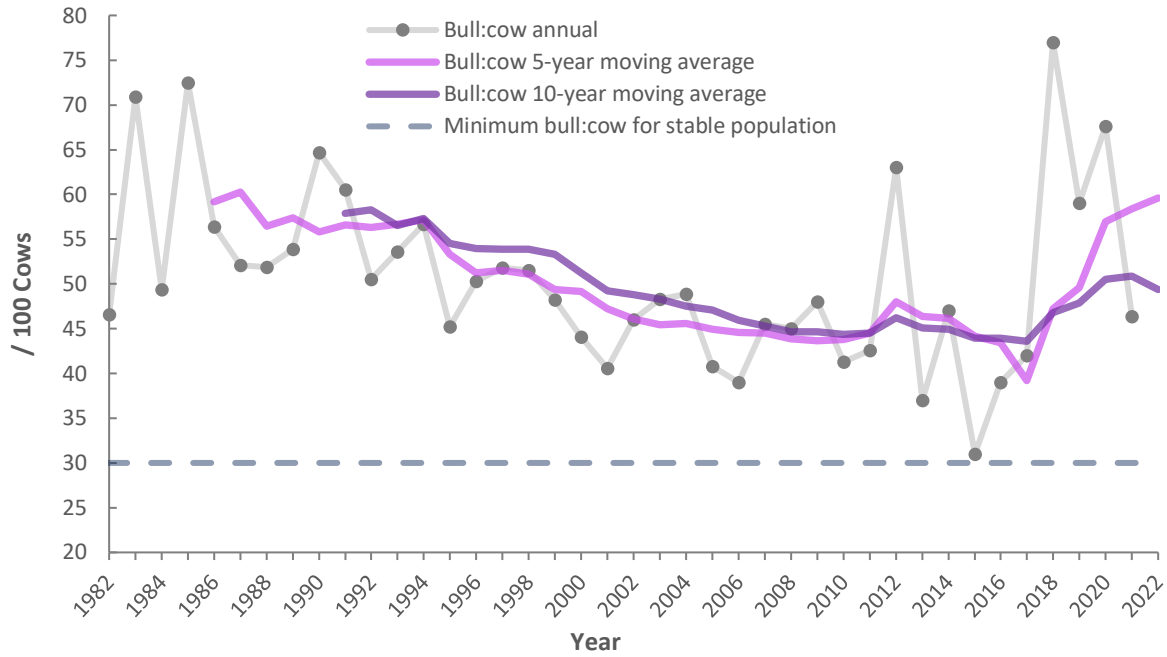
Composition trends are annually variable, so characterizing herd trend based on a single year of recruitment is not a sound management practice. Herd trend is normally based on at least 5 and preferably 10 years of regular calf recruitment monitoring as it takes several years of information to capture the full variability in observed annual recruitment rates. A stable population growth rate for Northern Mountain caribou in the Yukon generally requires an average fall recruitment level of 20–25 calves per 100 adult cows and an adult sex ratio of 30 bulls per 100 cows (Environment Yukon 2016).

Composition surveys completed on the herd from 1982 to 2022 indicate variable recruitment rates (Figure 1); however, the long-term trends (5 and 10-year moving averages) roughly track with the observed decline in population from 1990 to 2017 (Figure 1). The most recent calf to cow trends (24 and 26 calves per 100 cows, based on 5 and 10-year moving averages, respectively; Figure 1) indicate the herd may be stabilizing or increasing, which supports the 2022 population survey results.

The Finlayson herd has demonstrated relatively high adult sex ratios from 1982–2022, with annual values never dropping below 31 bulls per 100 cows (Figure 2). Current 5 and 10-year moving averages are 60 and 49 bulls per 100 cows, respectively (Figure 2), indicating that the herd is typified by relatively high adult sex ratios that allow for ample breeding opportunities.



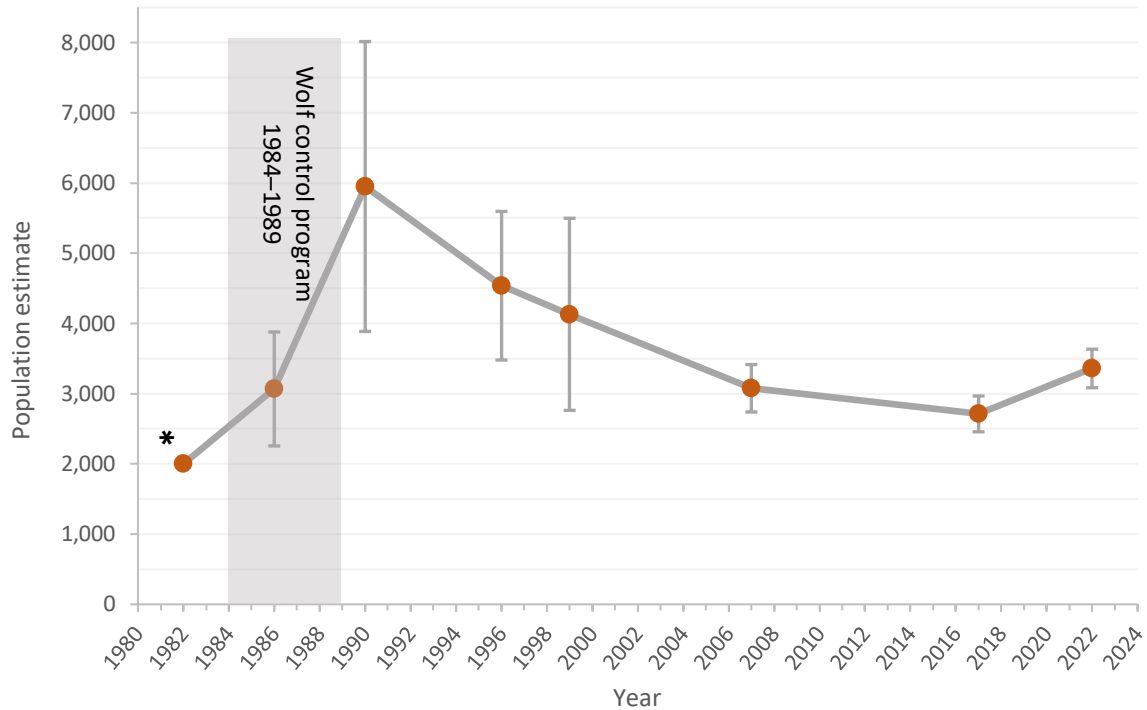
**Figure 1.** Annual and 5 and 10-year moving averages for calf recruitment (calves per 100 cows) in the Finlayson caribou herd, 1982–2022.



**Figure 2. Annual and 5 and 10-year moving averages for adult sex ratios (bulls per 100 cows) in the Finlayson caribou herd, 1982–2022.**

### Population Trends

Based on the results of the 2022 census, the Finlayson caribou herd is likely stable or increasing, marking the first time since 1990 that the herd has not exhibited a declining trend (Figure 3). The population peak in 1990 and the subsequent observed decrease in herd size is difficult to evaluate demographically due to the manipulation of the wolf population in the area from 1984–1989 (Farnell et al. 2008). The 2022 estimated population size (3,359; 95% CI = 3,085–3,634) is substantially greater than the 2017 estimated population size (2,712; 95% CI = 2,454–2,970), using the same methodology (Table 6). This represents an additional 647 caribou since 2017, which amounts to a 24% increase in population size in the past five years (Figure 3).



**Figure 3.** Population estimates, with 95% confidence intervals, of the Finlayson caribou herd, 1982–2022. \* The 1982 population estimate was based on expert opinion.

**Table 6.** Population estimates and associated rates of increase for the last three Finlayson caribou censuses, 2007–2022.

Census year	Population estimate (95% CI)	Lambda <sup>1</sup>	SE	95% CI
2007	3,077 (2,885–3,269)	0.964	0.011	0.942–0.986
2017	2,712 (2,454–2,970)	0.987	0.006	0.976–0.998
2022	3,359 (3,085–3,634)	1.044	0.013	1.018–1.070

<sup>1</sup>Rate of increase from previous census survey (e.g., for census year 2007, lambda represents the rate of increase from 1999 to 2007). A value of 1 is indicative of a stable population, less than 1 is considered decreasing, and above 1 is considered increasing.

Results from the 2017 census indicated the Finlayson caribou herd had continued its decline since 1990, but at a possibly slower rate than previously observed (i.e., between 1999 and 2007 the growth rate was lower than from 2007 to 2017; Table 6).

The estimated population size in 2022 corresponds to an average annual population growth rate (i.e.,  $\lambda$ ) of 1.044 (SE = 0.013; 95% CI = 1.018–1.070; Table 6). The population estimate and corresponding growth rate suggests that the number of births exceeds the number of deaths in the population, which is supported by the observed recruitment trends over the past 5–10 years (Figure 1). Information on adult female survival (typically derived from satellite collared animals) is not available for this herd, but could help to further support the observed population growth.

Given that the confidence intervals of the 2017 to 2022 growth rate is above 1 (stable population is indicated by a lambda value of 1) and given the bounds of the confidence

intervals from the two population estimates do not overlap, there is high confidence that the herd has increased since 2017.

While the estimated population size we obtained in 2022 is plausible for a growing caribou population, it may be an overestimate. The increase in the annual population growth rate observed in the interval between the 2022 and 2017 surveys (Table 6) suggests that our estimate may be somewhat higher than the actual population size. For example, if we assume a positive growth rate and forecast from the estimated population size in 2017 (2,712 animals), using a lambda of 1.016 (representing the average of the 2017 and 2022 growth rates), the estimated population size in 2022 would be 2,929 animals.

A possible overestimate in population size may be a result of the random selection of secondary (low use) blocks to be surveyed intensively for the census portion of the survey. Surveyed secondary blocks may have contained relatively high densities of caribou compared to those that were not surveyed during the census, thus when those values are extrapolated to the unsurveyed secondary blocks, this inflates the actual number of caribou assumed to be in those blocks. This is a limitation of applying this survey methodology to caribou, as their distribution on the landscape is not uniform. This is evidenced by the observed distribution and group size differences of bull-dominated groups described above – smaller groups of primarily bulls were more broadly distributed north of the Highway in areas somewhat separate from that of larger, cow-dominated groups that were in a more concentrated distribution south of the Highway during the survey (Map 3). Sex-biased distribution differences of caribou during the winter months is well-documented and is believed to be a result of antlered cows gathering in and defending limited, high quality foraging areas to ensure adequate nutrition during their overwinter pregnancy (Shaefer and Mahoney 2001).

A precautionary approach would be to consider that the real population size may be closer to the lower 95% confidence interval of 3,085, which still represents an increase in population size. Despite the aforementioned limitations, the strength of this result and the survey methodology overall, is that it is directly comparable to all previous estimates of the Finlayson herd, thus the observed trend in population size is indicative of herd growth.



### Demographic Model Forecasting

Prior to the 2022 population survey, demographic model forecasts of the Finlayson herd were created using the DG-Sim package for SyncroSim software to forecast future population size and composition. Forecasts ranged from the most recent available census conducted in 2017 to the year 2032 and were run using several scenarios to explore the consequences of varying mortality and harvest rates.

Simulations were first run for a historic calibration period between the 2007 and 2017 population estimates with the goal of estimating the most likely distributions of mortality and harvest rates over that period. Projections were then made using the calibrated historic model to estimate herd size, trend, and composition from 2017 to 2021.

Based on these projections, the model estimated the Finlayson herd was increasing from 2017–2021, with a resulting 2021 population estimate of 3,311 caribou (95% CI = 2,449–4,397) and a herd composition of 57.0% (95% CI = 52.0–62.5) cows, 31.1% (95% CI = 25.6–36.5) bulls, and 11.9% (95% CI = 8.7–15.3) calves. The 2022 population survey results fall within these forecast values (Tables 3 and 5), demonstrating the utility of these models to use monitoring data (i.e., fall composition surveys) to track herd demographic trends over time.

### Next Steps

The 2022 population estimate and long-term calf recruitment trends indicate that the Finlayson caribou herd is growing and is larger than it was in 2017; however, there is some uncertainty regarding the growth rate and the current population size. We recommend continuing annual fall composition surveys to monitor population demographics (e.g., calf recruitment, adult sex ratios) to regularly update the demographic population model to assist in estimating long-term trends in population size and demography, including forecasts into the future under different hypothetical scenarios. Additionally, we recommend exploring novel methods for surveying this herd given the limitations of the SRB methodology for caribou and the inability to use collared animals as marks for mark-resight population surveys applied to all other Northern Mountain herds in the territory<sup>1</sup>.

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<sup>1</sup> In the mid-2000s the Caribou Program updated the survey methodology for estimating mountain caribou populations in Yukon to a more biologically-appropriate mark-resight approach that uses GPS-collared caribou as “marks” in the population and is conducted during the fall rut when animals are concentrated at higher elevations. This approach cannot be applied to the Finlayson caribou herd as collars are not deployed on animals.

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