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# Chisana Caribou Herd Population Estimate 2022

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Government of Yukon
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# Summary


- We report the results of the 2022 survey of the Chisana caribou population, which ranges in both the Yukon and Alaska. 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.

- On 14 October 2022, we conducted a collaborative survey to estimate the composition and size of the Chisana caribou herd. Partner agencies included the Government of Yukon Department of Environment, the Alaska Department of Fish & Game, and US National Park Service (Wrangell-St. Elias National Park).

- We classified 538 caribou to estimate the herd's composition. We estimated an adult sex ratio of 51.1 bulls per 100 cows and a recruitment ratio of 20.8 calves per 100 cows. The long-term trend (3-year rolling average) for fall calf recruitment and the adult sex ratio is 16.7 calves per 100 cows and 46.3 bulls per 100 cows, both of which are indicative of a stable herd.

- The 2022 estimated population size is 582 (90% confidence intervals [CI] = (557–706)). Compared to previous estimates this is somewhat lower; however, the confidence intervals overlap with previous estimates from 2003–2013 and composition values, indicating the herd likely remains stable.

- The most recent calf recruitment trends (16.7 calves per 100 cows, based on 3-year moving average) also indicate the herd may be stable, which supports the interpretation of the 2022 population survey results.

- The 2022 population survey results provide an updated status for the herd to inform decision-making in the renewed *Management Plan for the Chisana Caribou Herd*. The Plan also outlines several monitoring objectives to inform herd status, including annual composition surveys and population estimates every three to five years.

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# Introduction

The Chisana caribou herd (CHCH) is part of the Northern Mountain (NM) population of woodland caribou, which are currently listed as Special Concern under the Canadian federal *Species at Risk Act*. This report summarizes the results of a fall population survey of the CHCH, conducted on 14 October 2022. This survey's purpose was to estimate the herd's composition, abundance, distribution, and population trend. This survey provides an updated population estimate to better inform decision-making related to the herd.

## Management and monitoring history

Concerns for the Chisana caribou herd, whose range is bisected by the border with the Yukon and Alaska, has resulted in a high degree of monitoring and management collaboration between partners in both Alaska and Yukon over many years. In the late 1970s the herd was estimated at 1,000 animals (Kellyhouse 1980). Favourable conditions led to an increase to about 1,900 animals by 1988 (Kellyhouse 1990). However, after this time the herd declined considerably and almost all harvest was stopped by 1994. Weather and predation were assumed to be the primary causes for the perceived decline (Farnell and Gardner 2002).

An intensive recovery effort began in 2003, which involved a captive rearing program that attempted to stop the decline in the herd's size. Management authorities in both Alaska and the Yukon closed the herd to harvest due to this decline. Given the substantial resources devoted to management of the herd, there is considerable interest in its status. An international Chisana Caribou Herd Management Plan was developed in 2012, which recommended that the herd be managed to maintain a stable or increasing population (Chisana Caribou Herd Working Group 2012). Frequent monitoring via annual composition surveys (rut counts) was also recommended amid regular population surveys. The frequency of monitoring for this herd is higher than for most other herds in the Yukon.

### Harvest

In 2012, harvest of the herd resumed in Alaska, with an average of 1.3 animals harvested annually from 2012 to 2022. In Yukon, a licenced harvest has not been implemented, despite the *Wildlife Regulations* being amended to remove the "*Specially Protected*" designation for Chisana caribou in 2014. Kluane and White River First Nations have the right to harvest caribou; however, both governments have continued a voluntary moratorium on Chisana caribou harvest resulting in no subsistence harvesting of the herd by their citizens. The harvest restrictions in the Yukon are to provide the potential for herd growth.

## Study area

The transboundary Chisana caribou herd is located on the border between southwestern Yukon and southeastern Alaska. On the Alaska side, the Chisana herd ranges over state-owned land and within the boundaries of the Tetlin National Wildlife Refuge (TNWR) and the Wrangell-St. Elias National Park and Preserve (WSEPP). On the Yukon side, the herd ranges west of the Donjek River, within the Kluane Wildlife Sanctuary (KWS) and Asi Keyi Natural Environment Park (AKNEP), and within Crown land north of the White River. The Chisana range also overlaps with two Yukon First Nation traditional territories, White River First Nation (WRFN) and Kluane First Nation (KFN). The survey area for the 2022 population survey was defined by the herd's fall rut distribution, based on VHF and GPS locations from about two weeks prior to the survey, and fall survey locations from 2006 to 2021.

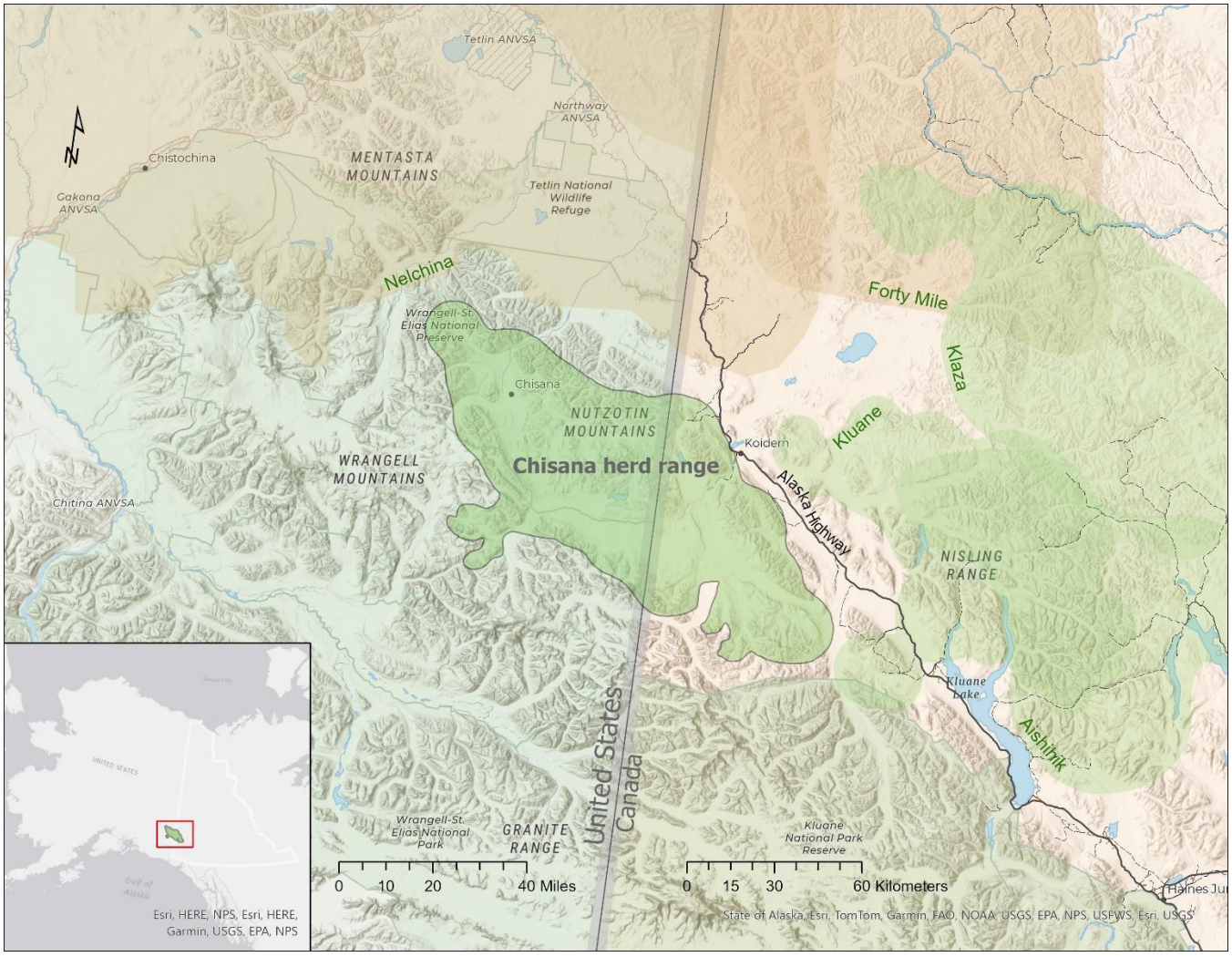


**Figure 1.** Study area for the 2022 Chisana caribou herd population survey.

# Methods

The methods used for the 2022 CHCH survey were consistent with those used in the five previous surveys conducted in 2003, 2005, 2007, 2010, and 2013 (Adams 2003; Adams and Roffler 2005, 2007; Hegel et al. 2013, 2016), with one difference being the use of GPS satellite collars in addition to VHF radio-collars as marked individuals in the herd. There were two components to the survey: 1) a fixed-wing reconnaissance survey using telemetry to determine the status (alive or dead) and general location of all collared animals to guide search efforts for the formal survey, and 2) the formal survey which involved the fixed-wing crew using telemetry to search for, locate, and determine the size of all marked (collared) groups, while the Yukon and Alaska helicopter crews flew concurrently to locate and classify groups within the survey area without using telemetry (to prevent bias in the sightability estimate).

If marked groups were missed by helicopter crews during the formal survey, the fixed-wing crew communicated the location of the missed group to the helicopter crews so they could locate and classify them. Groups only located using telemetry were identified on the data sheets. Observed groups were classified into calves, cows, or bulls. The Yukon and Alaskan management agencies classify bulls into different categories: immature or mature in the Yukon, and small, medium, or large in Alaska. To summarize the data for adult sex ratios, small bulls were categorized as immature bulls and medium and large bulls were categorized as mature bulls.

## Collaring activities

Animals in the Chisana herd have been regularly monitored with radio-collars since the 1980s, with both Yukon and Alaskan governments collaboratively maintaining collars. Up to 2020, only VHF radio-collars had been deployed on Chisana animals, requiring regular aerial relocation surveys to monitor locations. In 2019, the US National Park Service purchased 21 Telonics GPS satellite-collars, which provide daily locations of animals, further improving our understanding of herd distribution and movement.

Twenty-one GPS satellite-collars were deployed on female caribou throughout the Chisana herd range by Government of Yukon staff between April 2020 and February 2021 via helicopter (A-Star), net-gun, and a three-person capture crew. The Alaska Department of Fish and Game also deployed 30 VHF radio-collars on Chisana animals between October 2020 and February 2021. All collars were fitted with unique colour-number combination visibility-bands to enable field identification of individuals. By the time of the population survey (October 2022), four mortalities of GPS satellite-collared and three VHF radio-collared caribou had occurred, resulting in 43 active collars in the herd.

## Data analysis

Marked groups missed by the helicopter crews during the formal survey provided data to evaluate detectability of groups. A suite of logistic regression sightability models were developed using data from both the fixed-wing and helicopter portions of the formal survey. The fixed-wing portion provided sizes of all marked groups in the herd, while the helicopter survey provided composition data of all observed groups (both marked and unmarked). The sightability model was then applied to all groups (both marked and unmarked) observed by the helicopter crew to adjust numbers for detectability. The sum of these adjusted numbers thus represents the estimated herd size. The analysis was conducted using the 'Sightability Model' package (version 1.5.1; Fieberg 2012) for the statistical software R (version 3.5.3; R Core Team 2022). The sightability correction factor and associated standard error (SE) were calculated using equations provided by Steinhorst and Samuel (1989).

We assumed collared individuals were randomly distributed within the herd and used marked groups (as opposed to marked individuals) as the response variable unit. For the analysis, a '1' represented a marked group observed by the helicopter crew, while a '0' was a marked group not observed by the helicopter crew (but was observed by the fixed-wing crew). The probability of observing a marked group was modeled as a function of predictor variables that may have affected sightability: group size and survey crew (Yukon or Alaska). We used Akaike's Information Criterion difference ($\Delta_i$ $AIC_c$; Akaike 1973) adjusted for small sample sizes ($AIC_c$; Burnham and 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).

# Results and Discussion

A fixed-wing Piper PA18 Supercub flew the initial reconnaissance survey on 30 September to locate and confirm the status of all collared individuals. Both the Yukon and Alaskan parts of the herd range were covered, and the crew located all marked individuals. This data was used to provide a general location to guide search efforts during the formal survey.

For the formal survey, both Yukon and Alaska helicopters crews and the fixed-wing crew flew on 14 October 2022. The survey was timed to allow for adequate snow coverage, with snowfall occurring on 12 and 13 October. The new snowfall provided excellent conditions for tracking and spotting animals. A Robinson R44 helicopter was used by the Alaskan crew and an A-Star (AS350 B1) helicopter was used by the Yukon crew. Total survey time for the Alaskan crew was 5 hours and 40 minutes, and 7 hours and 30 minutes for the Yukon crew. The Piper PA18 Supercub fixed-wing crew located all 43 marked (collared) individuals in 21 groups. The helicopter crews located 18 of the 21 marked groups (ranging from 1–7 marked individuals per group), observing 37 of 43 marked individuals (**Table 1**).

Table 1. Observation data used for developing the sightability models and the 2022 population estimate of the Chisana caribou herd.

| VARIABLE | VALUE |
|---|---|
| Number of collared animals in the herd | 43 |
| Number of collared animals in the survey area | 43[a] |
| Number of marked groups in the herd | 21 |
| Number of marked groups in the survey area | 21 |
| Number of marked groups in the survey area observed by the helicopter crew | 18 |
| Total number of animals observed by the helicopter crew (does not include missed groups) | 514 |

a: This is the number of collars used to develop the sightability model

## Population estimates

Four candidate sightability models were fit using the observed and unobserved group data. Using $AIC_c$, the two top-ranked models accounted for 74% of the $AIC_c$ weight (Table 2). The model with the lowest $AIC_c$ value included group size as a covariate, with the null model (constant sightability) ranked second. Since the difference between the two models ($\Delta_i$ $AIC_c$) was ≤2.00, both models could be considered equally plausible (Richards 2005; Symonds and Moussalli 2011); however, the group size model was selected to represent sightability. The final 2022 population estimate for the Chisana herd is 582 (90% CI: 557–706) animals (Table 3).

Table 2. Candidate sightability models for the 2022 Chisana caribou population estimate with model selection values.

| SIGHTABILITY MODEL | Rank | K[a] | AICc | Δi AICc | AICc weight |
|---|---|---|---|---|---|
| Group size | 1 | 2 | 19.32 | 0.00 | 0.38 |
| Null[b] | 2 | 1 | 19.44 | 0.12 | 0.36 |
| Group size + survey crew | 3 | 3 | 21.20 | 1.88 | 0.15 |
| Survey crew | 4 | 2 | 21.76 | 2.44 | 0.11 |

a: Number of model parameters including the intercept; b: A null model (i.e., intercept only) with no covariates was fitted as a comparison against the other models.

Table 3. Parameter estimates for the top candidate sightability model (Table 2) and resulting population estimate for the 2022 Chisana caribou population survey.

| MODEL PARAMETER ESTIMATES | | | POPULATION ESTIMATE | | |
|---|---|---|---|---|---|
| **Parameter** | **Estimate** | **SE** | **Estimate** | **90% CI** | **SE** |
| Intercept | 0.286 | 1.095 | 582 | 557–706 | 33 |
| Group size | 0.116 | 0.091 | | | |

Table 4. Comparison of Chisana caribou population survey parameters and results, 2003–2022.

| PARAMETER | 2003[b] | 2005[c, d] | 2007[d] | 2010[e] | 2013[f] | 2022 |
|---|---|---|---|---|---|---|
| Population estimate | 720 | 706 | 766 | 682 | 701 | 582 |
| 90% confidence interval[a] | 606–833 | 646–792[a] | 719–823[a] | 622–832[a] | 639–763 | 557–706 |
| Group size coefficient | 0.166 | 0.175 | 0.178 | 0.060 | 0.132 | 0.116 |
| Number of marks in the herd | 39 | 97 | 138 | 96 | 71 | 43 |
| Number of marked groups used to estimate the sightability model | 30 | 45 | 30 | 28 | 22 | 21 |
| Number of marked groups observed in the survey area | 20 | 35 | 25 | 22 | 17 | 18 |
| Average size of marked groups | 15.3 | 10.6 | 21.5 | 17.9 | 24.8 | 17.8 |
| Size range of marked groups | 1–54 | 1–34 | 1–65 | 4–58 | 1–254 | 2–48 |
| Proportion of marked animals located inside survey area | 1.00 | 0.92 | 0.96 | 0.97 | 0.97 | 1.00 |
| Total number of caribou observed | 603 | 646 | 719 | 622 | 631 | 540 |

a: If applicable, the lower limit of the confidence interval is truncated at the minimum number of animals known to be alive in the herd during the survey years; b: From Adams (2003); c: From Adams and Roffler (2005);d: From Adams and Roffler (2007); e: From Hegel et al. (2013); f: From Hegel et al. (2016).

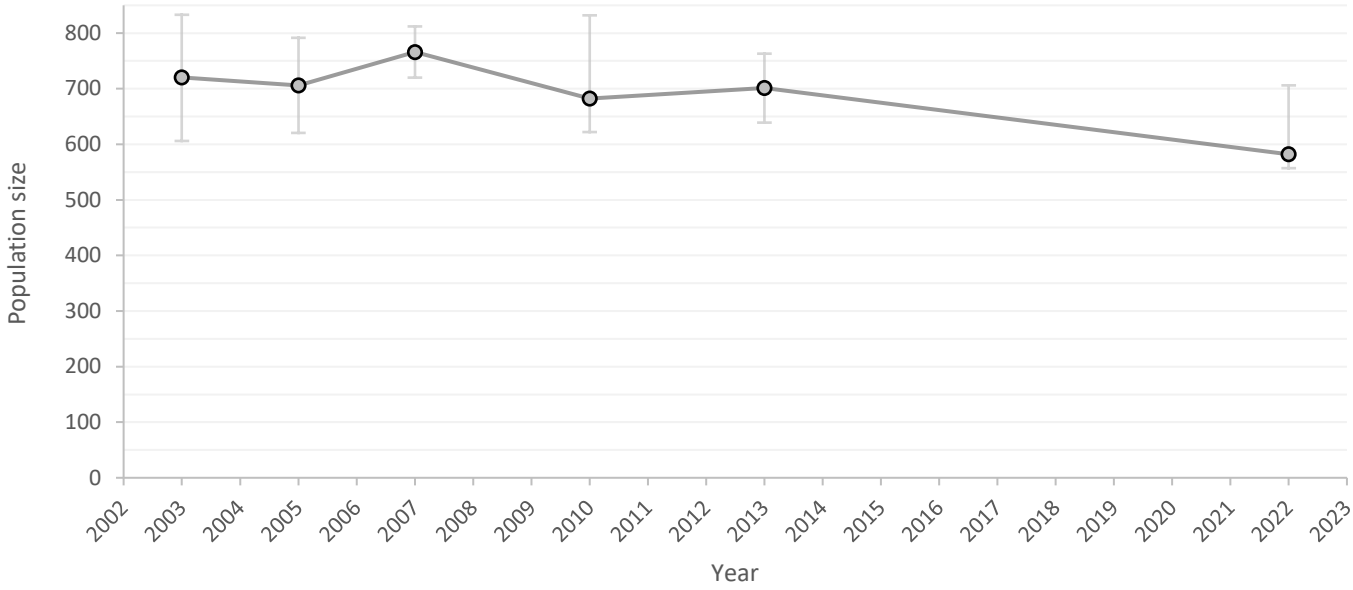


Figure 2. Chisana caribou herd population estimates with 90% confidence intervals, from 2003 to 2022.

## Herd composition

Of the 540 animals observed, 538 were classified (Table 5). The fall calf recruitment index was 20.8 calves per 100 cows, while the adult sex ratio was 51.1 bulls per 100 cows. Based on herd composition data (Table 5), there were an estimated 70 calves, 173 bulls, and 339 cows in the herd in October 2022. The long-term trend (3-year rolling average) for fall calf recruitment and the adult sex ratio is 16.7 calves per 100 cows and 46.3 bulls per 100 cows (Figure 3), respectively, both of which are above the minimum thresholds identified in the Plan (15 calves per 100 cows and 35 bulls per 100 cows, respectively; Chisana Caribou Herd Working Group 2012).

Table 5. Composition ratios and estimated composition of the Chisana caribou herd obtained during the October 2022 population estimate survey.

| | | | | |
|---|---|---|---|---|
| **COMPOSITION RATIOS** | **Calves per 100 cows** | **Percent calves** | **Bulls per 100 cows** | **# caribou classified** |
| | 20.8 | 12.1 | 51.1 | 538 |
| **ESTIMATED HERD COMPOSITION** | **Herd size** | **# Calves** | **# Cows** | **# Bulls** |
| | 582 | 70 | 339 | 173 |

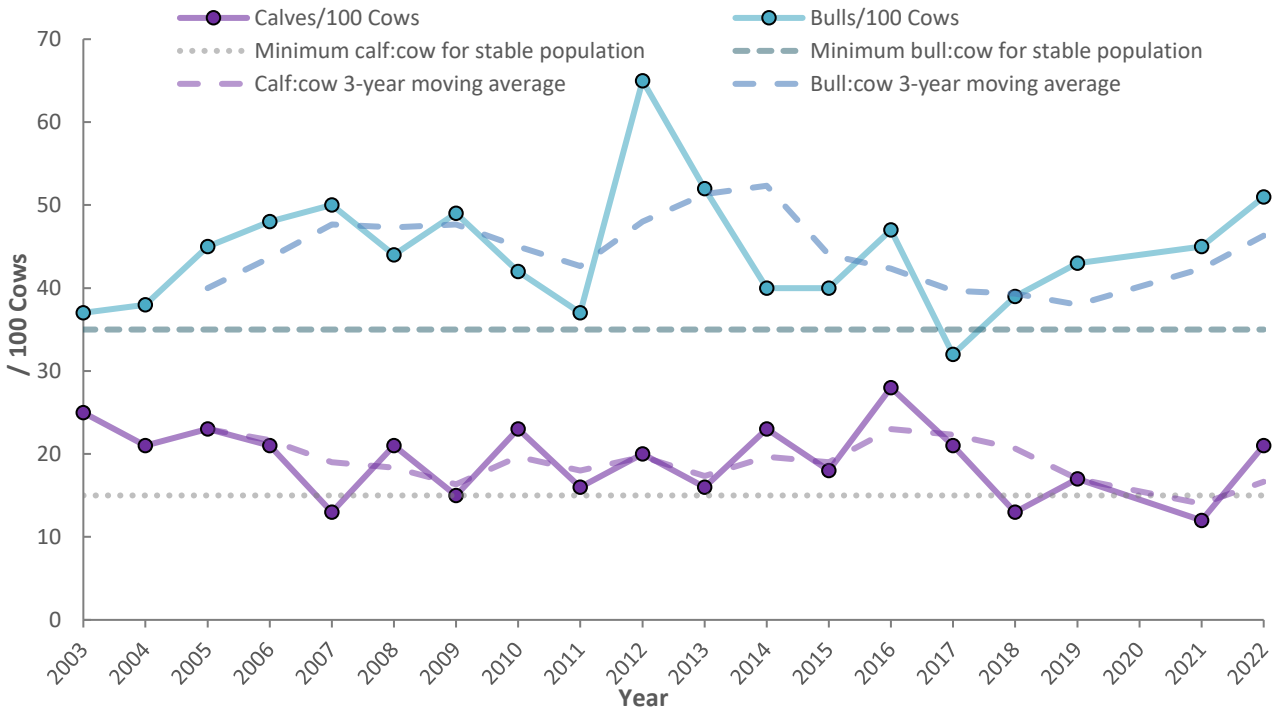


Figure 3. Number of calves and bulls per 100 cows observed during Chisana caribou herd composition surveys from 2003 to 2022 (no survey took place in 2020).

## Distribution

Caribou groups were distributed evenly on both sides of the border, with 19 groups totalling 281 animals in Alaska, and 20 groups totalling 259 animals in Yukon (Figure 4). In the Yukon portion of the range, caribou were in atypical densities and locations relative to rut counts over previous ten years. More animals were located on Sergerent Plateau (and further into the interior mountains to the east), with less caribou on Klutlan Plateau than in previous years (Figure 4). On the Alaska side caribou distribution was like what is observed in early October. Most groups were located near Beaver Lake and upper Beaver Creek, Carl Creek, Ophir Creek and Flat Creek. As in past years, a small group of caribou were found on Euchre Mountain.

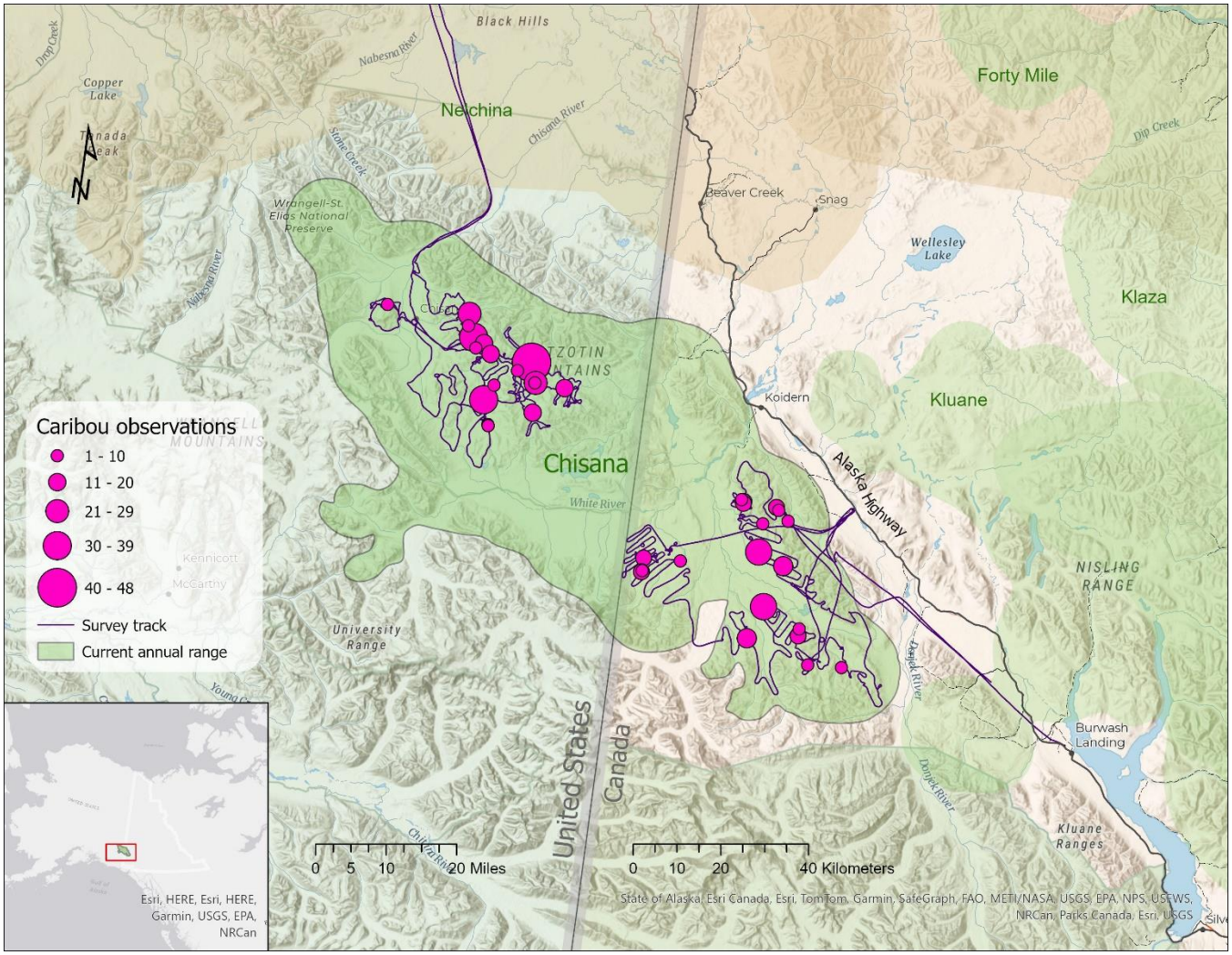


Figure 4. Observations of caribou groups and flight tracks from the formal portion of the Chisana caribou herd population survey, 14 October 2022.

## Management Implications

When examining the six population estimates from 2003 to 2022, and their degree of uncertainty (i.e., confidence intervals), the trend is unclear (**Figure 2**). This result is difficult to interpret, due to the length of time between the 2013 and 2022 population surveys compared to the time between surveys from 2003–2013. Between 2003 and 2022, population estimates of the herd ranged from a low of 582 animals during the 2022 population survey to a high of 766 animals during the 2007 survey; however, overlapping confidence intervals suggests that corresponding population estimates are not significantly different from one another. Additionally, herd trend can be inferred from long-term composition values, which have been indicative of a stable trend during this period (**Figure 3**). Based on the consideration of all results, the herd can be considered stable; however, continued monitoring will ensure the herd status is regularly evaluated to detect change.

The 2022 population survey results provide an updated status for the herd to inform decision-making in the renewed *Management Plan for the Chisana Caribou Herd*. The Yukon's Department of Environment, Kluane First Nation, White River First Nation, the Alaska Department of Fish and Game, the United States Fish and Wildlife Service and the United States National Park Service, as parties to this plan, are collaboratively developing the renewed plan to provide a common goal, objectives, and strategies to guide herd management and conservation in both Alaska and the Yukon.

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