# 2023 Mountain Caribou Census

# CENTRAL SELKIRK MOUNTAINS

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## Introduction

Woodland caribou (*Rangifer tarandus caribou)* in southeastern British Columbia are a unique ecotype of caribou distinguished from other woodland caribou by their winter diet consisting almost exclusively of arboreal lichens. This trait allows them to inhabit the deep snow wet belt of the Columbia Mountains. These caribou are often referred to as "mountain caribou" and were classified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Designatable Unit 9 (DU-9) Southern Mountain Caribou (COSEWIC 2014). Due to their low and, over the longer term, decreasing populations and shrinking and fragmented distribution, these caribou are considered endangered in the United States. In Canada, they are listed as endangered by COSEWIC, threatened under the Federal Species at Risk Act (SARA), and are provincially red-listed (species at risk of extinction or extirpation) by the British Columbia Conservation Data Centre.

Caribou were once distributed in a contiguous fashion throughout the Monashee, Selkirk and Purcell Mountains of southeastern British Columbia (Stevenson and Hatler, 1985; Spalding, 2000). In recent decades the distribution has declined to several sub populations, one spanning the Central Selkirk Mountains, the northwest Purcell Mountains, the Duncan Valley and the upper Beaver Valley of Glacier National Park. This grouping was called the Central Selkirk sub population by Simpson et al. (1997), one of 13 sub populations of mountain caribou within southern British Columbia. Based on telemetry data Wittmer et. al. (2005) revised this into 18 sub populations which included dividing the Central Selkirk sub population into the Nakusp and Duncan units. However since 2010 caribou had been consistently sighted in between the Duncan and Nakusp blocks and were not technically part of either. In the 2010 and 2012 census reports they were included with the Nakusp block (DeGroot, 2010; DeGroot and Furk 2012). As of the 2014 report we have returned to the convention of Simpson et al. (1997) and using the term "Central Selkirks" for the sub population without division into the Duncan and Nakusp blocks (DeGroot, 2014).

The earliest research on caribou in this area began in 1992. Twenty three caribou were fitted with VHF radio collars from 1992 – 2003 (Hamilton, 2008). Since 1993, 31 censuses have been completed, all in late winter when the caribou are consistently in the open forest at high elevations. The sub population declined dramatically between 1997 and 2002 with estimates going from 254 to 139, respectively (Table 2). There was a period of stability from 2002 to 2012. Since 2012 the population has declined steadily to today's critically low numbers. Since 2017, we have maintained active GPS collars in the population. More recently, several key management actions have been implemented including predator control which is now in its 4$^{th}$ year, recreation disturbance mitigation in the helicopter skiing and snowmobile sectors and maternal penning which started in spring 2022.

## Study Area

The Central Selkirk sub population boundaries are described as the area bordered to the west by Arrow Lake; to the east by Kootenay and Duncan Lakes but including all of the Duncan Valley and

the upper ends of adjacent drainages in the Purcell Mountains north of Duncan Lake; to the south by the Nakusp – New Denver – Kaslo highway; and extending north to Glacier National Park (Figure 1). However, during this census, only the Nakusp block was completed. The north side of Lardeau Creek, Mohawk Creek and Great Northern Mountain areas were also excluded from the survey given the unlikely hood of locating caribou on these ranges.

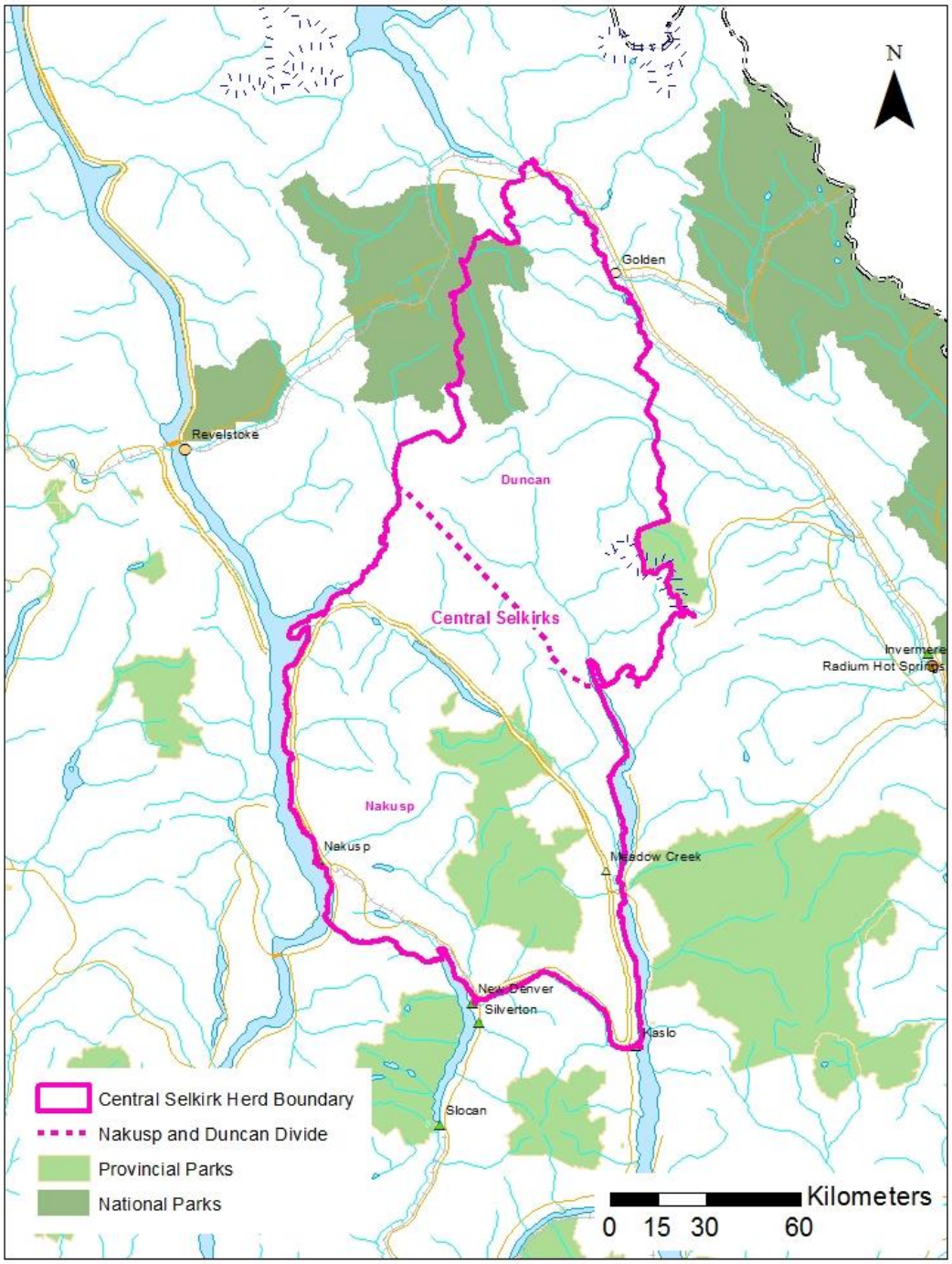


**Figure 1**. Central Selkirk sub population boundary as per Simpson et al. (1997). The divide reflects the Duncan and Nakusp blocks as described by Wittmer et al. (2005).

## Survey Methods

Standard survey protocols for mountain caribou (Resources Inventory Committee, 2002) were followed. This involved flying by helicopter at an elevational contour near treeline (1900 – 2200 m elevation) over all suitable caribou habitat in the area mentioned above. Attempts were made to conduct flights within a few days of a new snowfall so that recent tracks are visible but older tracks are covered up.

The helicopter was a 206B Jet Ranger owned by High Terrain Helicopters and expertly piloted by Roman Sookorukoff. Observers were Dave Lewis, Thomas Hill and Aaron Reid.

When caribou tracks were observed they were followed until the animals were detected. High resolution (3000 X 2008 pixel) photos of the groups of caribou were taken with a Nikon D50 digital SLR camera with a Nikon 70 – 300 mm zoom telephoto vibration reduction lens. Photos were later analyzed on a computer monitor to verify classification. For this report classification is reported to adults and calves. Caribou tracks were only recorded if the caribou that made the tracks were not observed in the immediate area.

Flight paths and caribou locations were recorded as Universal Transverse Mercator (UTM) coordinates using North American Datum 1983 (NAD83). Snowmobile, ski and other large mammal tracks including wolverine were also recorded. The ski and snowmobile track records were limited to one per upper basin, which are usually 1 – 2 km across at the flight elevations.

### Population Estimate and Composition

To estimate population size we used a standard mark-resight survey design using GPS collared caribou and helicopter (Bell 206) to correct for sightability. We modified the mark resight technique slightly in that we did not search and locate missed collars during the day of census. A population estimate with 95% confidence intervals was calculated using the Lincoln-Petersen equation (White 1996) based on the survey count and collars detected.

For this census, missing collars were located and group size and composition was verified on a second flight. Typically, missed collar verification is completed on the same flight to avoid double counting individuals. In the Central Selkirks we were able to modify the mark-resight survey slightly due to several unique circumstances. First, the remaining cows in this small population were in distinct geographically isolated groups at the time of survey and currently a high proportion of adult cows in the population are collared (i.e. 78%). Secondly, the day of survey two of the larger groups were located in heavy timber on a steep slope which made observing individuals challenging. Allowing the caribou time to regroup and move to higher more open terrain provided us better opportunity to verify groups size and composition on a second flight. In addition, a high level of confidence in group composition was necessary to ensure capture success during the maternity pen capture in the subsequent weeks.

### Population Growth and Survival

Estimating Lambda using the Recruitment-Mortality (RM) equation:

The following equations originated from Hatter and Bergerud 1991 and DeCesare et al. 2012 and were then modified for caribou by Serrouya et al. 2018.

$\lambda = (S / (1 - RRM)$ *(*Hatter and Bergerud 1991*)*

$R_{RM} = (CC / 2)/(1+ CC /2)$ (Equation 3, in DeCesare et al. 2012)
$CC = PC / PAF$
$PAF = (PAFOA * PA) / 100$
$PA = 100 - PC$
$PAFOA = (100 / (BC + 100)) * 100$

Where λ is the finite rate of change (Caughley 1977), S = adult female survival, PC = percent calves from the total population, CC = calf to cow ratio, BC = bull to cow ratio, PAF = percent adult females of the population, PAFOA = percent adult females of the adults.

For the Central Selkirks the *BC* is not known, but we assume based on analysis of census photographs that the BC is close 70 per 100 cows.

To calculate annual survival, we used methods from Trent and Rongstad 1974 and a biological year from April 1 to March 31.

## Results

The census was conducted February 23 and 24, 2023. The survey conditions were favorable with significant snowfall, which erased old tracks, occurring 3 days prior followed by high overcast conditions with no precipitation. The second flight to confirm missed collars and confirm group composition was completed on March 9, 2023.

During the February census a total of 21 caribou were observed, which included 9 out of 11 collared animals. The population estimate was 25 (95% CI 21-30). After the second flight, the total observed caribou or minimum known number alive was 25 caribou. This includes 6 calves (5 penned and 1 wild). Including both wild and penned calves surviving to 10 months of age, calves were 24% of the population.

On February 23 the total flying time was 6.5 hours including ferry to Nakusp from Nelson. On February 24, the total flying time was 6 hours which included ferry from Nelson. The total flying time was 12.5 hours with approximately 7.3 survey hours which was comparable to the last survey of 7.6 hours in 2021. The total flying time for the second flight, on March 9, 2023, including ferry was 2.7 hours.

Snow water equivalent at the nearest snow pillow sites, St. Leon Creek (1822 m elevation) was at 76% of the mean for late February (BC Ministry of Environment, 2023).

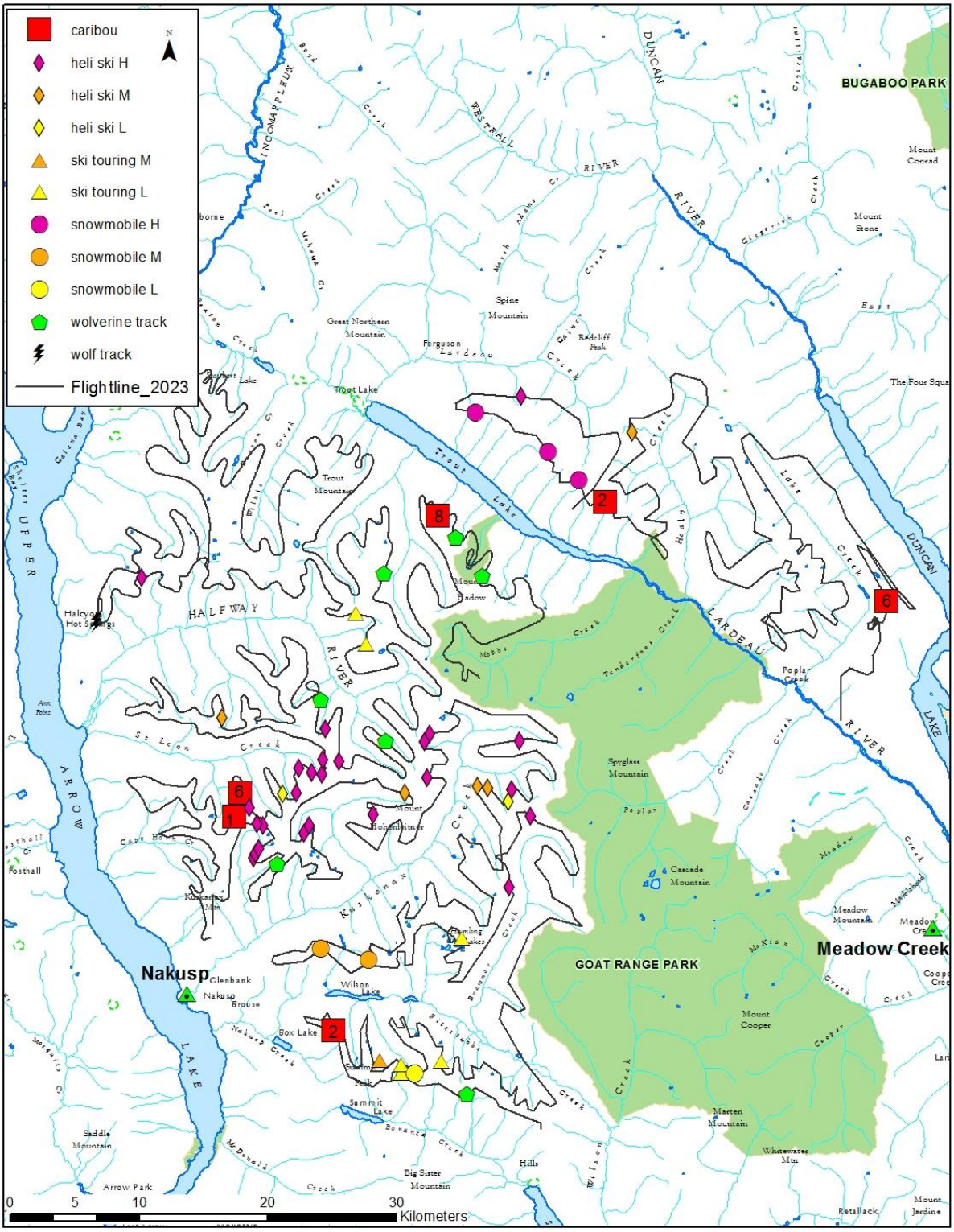


**Figure 2.** Flight lines, caribou sightings, and locations of snowmobile tracks, ski tracks, and tracks from other wildlife from the 2023 census. Regarding ski and snowmobile tracks, 1-5 tracks is classed as low, 6 – 10 as medium, and >10 as high. Caribou numbers are (MNK) minimum known alive combined flight observation counts from Feb 23-24 and March 9, 2023.

**Table 1**. 2023 Central Selkirk caribou census results. Coordinates are given in UTM projection, Zone 11, NAD 83. Caribou observations are reported as MNK based on the two flights February 23-24 and March 9, 2023.

| Date | Location | Caribou Observations | | | Easting | Northing |
|---|---|---|---|---|---|---|
| | | Adult | Calves | Total | | |
| 23-Feb-23 | American Creek | 2 | 0 | 2 | 466103 | 5601205 |
| 23-Feb-23 | St. Leon Creek | 1 | 0 | 1 | 447373 | 5580035 |
| 23-Feb-23 | St. Leon Creek | 4 | 2 | 6 | 448135 | 5581772 |
| 23-Feb-24 | Harlow | 1 | 1 | 2 | 452960 | 5562560 |
| 23-Mar-09 | Lake Creek | 5 | 1 | 6 | 499800 | 5590203 |
| 23-Mar-09 | Bigger Creek | 6 | 2 | 8 | 479136 | 5600502 |

**Table 2.** Caribou census results for the Central Selkirk sub population from 1996 to 2023. Data source: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/wildlife/wildlife-data-information 1974 – ongoing – Caribou – Population Assessment – Central Selkirks – Kootenay Region

| Central Selkirk | Observed (+Tracks) | Calves (%) | Number Collared | Collars Observed | Calculated Estimate | 95% CL |
|---|---|---|---|---|---|---|
| 1996 | 208 (224) | 11.1 | 13 | 12 | 225 | 209-293 |
| 1997 | 222 (231) | 8.1 | 22 | 23 | 254 | 244-293 |
| 1999 | 177 (194) | 7.3 | 17 | 14 | 214 | 187-289 |
| 2002 | 93 (97) | 17.2 | 9 | 6 | 139 | 104-264 |
| 2004 | 70 (86) | 18.6 | 0 | 0 | NA | NA |
| 2005 | 75 (94) | 21.3 | 0 | 0 | NA | NA |
| 2006 | 74 (87) | 27 | 0 | 0 | NA | NA |
| 2007 | 68 (88) | 14.7 | 0 | 0 | NA | NA |
| 2008 | 96 (102) | 13.5 | 0 | 0 | NA | NA |
| 2010 | 84 (92) | 14.3 | 0 | 0 | NA | NA |
| 2012 | 87 (89) | 10.3 | 0 | 0 | NA | NA |
| 2014 | 50 (53) | 16 | 0 | 0 | NA | NA |
| 2015 | 44 | 11.4 | 0 | 0 | NA | NA |
| 2016 | 35 | 5.7 | 0 | 0 | NA | NA |
| 2017 | 29 | 6.9 | 0 | 0 | NA | NA |
| 2018 | 31 | 12.9 | 8 | 8 | 31 | 31-38 |
| 2019 | 25 | 4.2 | 5 | 5 | NA | NA |
| 2020 | 26[a] | NA | NA | NA | NA | NA |
| 2021 | 28 | 7.1 | 9 | 9 | NA | NA |
| 2023 | 25 | 24 | 11 | 9 | 25 | 21-30 |

[a] 2020 survey reports a minimum known number alive based on combining a partial census with capture observations (Reid 2020).

## Discussion

The 2023 census used a total count survey method similar to past surveys. We used GPS collars on 7 adult females and 4 ten month old calves (n=11) to correct for sightability during the survey using the Lincoln-Peterson mark resight analysis (White 1996). During the survey we observed 9 of 11 collars (82%). Since GPS collar deployment began in 2017 we have had 100% sightability of collars during survey (Reid 2018, 2019, 2021). Reduced sightability for this survey was influenced by steep slopes and forest cover for two of the larger caribou groups located on survey. With 9 of 11 collars observed, a total of 21 caribou were counted. With mark-resight correction the current population estimate of the Central Selkirks is 25 (95% CI 21-30) caribou, which is the lowest population estimate to date.

In 2017, we began GPS collaring caribou in Central Selkirks to monitor adult survival. In the first 2 years of monitoring, 2018 and 2019, survival was 0.87 and 0.85, respectively. During that period several collars were lost to cougar predation. Predator management for both wolf and cougar began in 2020 to mitigate adult female predation. Since 2020, there has been no mortalities on collared caribou from either wolf or cougar. During the first two years of predator management, 2020 and 2021, we had 100% adult female survival based on GPS collars (n=8). Annual adult female survival is reported by biological year (i.e. April 1 – March 31). Unfortunately, two adult females were lost to grizzly predation in spring and summer of 2022 and the third mortality occurred within the maternity pen due to complications during calving (McLeod et al. 2023). In 2022, annual adult female survival dropped to 0.68.

Recruitment was heavily influenced by the first year of material penning and calves born in the pen were included within the following recruitment and population lambda calculations. A total of 6 calves (5 penned and 1 wild) were observed during the census. This resulted in calf recruitment of 24% on the known number of caribou alive, which is the highest level of recruitment documented since 1996. More details on the results of maternal penning can be found in McLeod et al. 2023. Despite successes with recruitment in 2022, the population estimate for the Central Selkirks of 25 (95% CI 21-30) caribou is at a historic low. The population change (λ) from the 2021 census to this census is 0.89 (Caughley 1977) suggesting continued population declines. Lambda for the 2022/23 (biological year) is calculated using the following Recruitment-Mortality equation:

Given that PC = 24, $S$ = 0.68, and assuming that the unknown $BC$ is 70, then:

$PAFOA$ = 100 / (70 + 100) * 100 = 58.8
$PA$ = 100 – 24 = 76
$PAF$ = 76 * 58.8 / 100 = 44.688
$CC$ = 24 / 44.688 = 0.537
$R$RM = (0.537 / 2)/(1+ 0.537 /2) = 0.212
λ = (0.68 / (1 – 0.212) = 0.86

Despite a lambda of 0.86 in 2022/23, there is high expectation that lambda will be positive for 2023/24. This expectation is based on the maternity pen's success in increasing calf survival and the hope that predator management can continue to mitigate cougar and wolf mortalities.

## Acknowledgements

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