

# **Population Status of Central Mountain Caribou Herds in British Columbia, and Response to Recovery Management Actions**

**2019**



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## 1.0 Background

The South Peace region of British Columbia contains several caribou herds (Figure 1) that have been declining rapidly over the past few decades, and one herd (Burnt Pine) has recently been extirpated (Seip and Jones 2016). First Nations traditional knowledge and reports by early explorers indicate that historically, caribou were abundant in the South Peace (West Moberly First Nations 2009).

Caribou that occur south of the Peace River (i.e., not including the Graham herd) have been classified as Central Mountain caribou by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2011). As recently as 20 years ago there were at least 672 Central Mountain Caribou in British Columbia. By 2015 the estimated number of Central Mountain caribou in British Columbia had declined to 248 - 263 (Seip and Jones 2016).

The decline in numbers of caribou in the South Peace region resulted in them being nationally listed as Threatened in 2003. In April 2014, COSEWIC re-evaluated the status of Central Mountain caribou and recommended they be classified as Endangered due to ongoing population declines.

The immediate (proximate) cause of the decline in Central Mountain caribou is excessive predation, primarily by wolves (Seip and Jones 2016). It is generally believed, however, that the underlying cause of increased predation is industrial landscape change, which created conditions that increased wolf abundance and enabled wolves to be more effective at killing caribou. Over the long term, protection and restoration of habitat will be necessary to re-establish self-sustaining populations of Central Mountain caribou, and prevent local extirpation as observed for the Burnt Pine population (Figure 2).

Unfortunately, recovery of disturbed caribou habitat is a lengthy process that takes decades. During that time, the habitat remains unsuitable for the survival of caribou and caribou herds will continue to decline in the absence of recovery actions. If populations of Central Mountain caribou are to be maintained in the interim, immediate and more direct measures are required to reduce the excessive level of predation. If caribou habitat is not protected and restored to pre-disturbance conditions, predator management will have to be used as a permanent solution to maintain caribou herds in this area.

Since 2014, the West Moberly and Sauteau First Nations have been conducting a maternal penning project in the Klinse-Za herd (formerly Moberly and Scott East herds) to capture and hold pregnant adult female caribou in a pen throughout the calving period to protect newborn calves from predators (McNay et al. 2016, 2019). Results from the first year indicated that calves could be successfully produced and protected within the pen, but when calves were released back to the wild they experienced very high mortality from wolf predation. It appears that maternal penning is only successful if it is accompanied by intensive wolf reduction.

To halt the decline of Central Mountain caribou, the Government of British Columbia approved a wolf reduction program in 2015. The objective of the program is to reduce the number of wolves within and adjacent to the ranges of four threatened caribou populations (Klinse-Za, Kennedy Siding, Quintette and Narraway - Figure 2). The response of caribou populations to reduced wolf numbers is being monitored

by evaluating the survival rate of radio-collared adult caribou, conducting calf recruitment counts, and conducting annual population counts. In addition to wolf reduction, West Moberly First Nations and Saulneau First Nations have continued the maternal penning project for the Klinse-Za caribou herd. The Kennedy Siding caribou herd is also being provided with supplemental feed during the period that caribou are using low-elevation winter range (Heard and Zimmerman 2016, 2017 and 2018).

The purpose of this report is to update the status of Central Mountain caribou herds in British Columbia as of 2019, and to evaluate the response of the herds to the different recovery management actions.

## **2.0 Wolf Reduction (Winter 2017 – 2018)**

### **2.1 Klinse-Za, Quintette and Kennedy Siding removals**

A total of 116 wolves were killed by aerial gunning within or immediately adjacent to target caribou ranges (Figure 2). Eleven wolves were radio-collared at the beginning of the program to assist in locating packs for subsequent removal. There were also four radio-collared wolves remaining from the previous year. All of the wolves killed outside range boundaries had been previously located within caribou ranges.

There were 44 aerial wolf removals associated with the Quintette treatment area, 59 associated with the Klinse-Za area, and 13 associated with the Kennedy Siding area (Figure 2).

At the end of the winter 2018, there was little evidence of any wolves remaining inside the target caribou ranges. The Ministry estimated that there were only 10 wolves remaining across all target ranges at the end of March, and that the reduction efforts had removed 92% of the initial population with a remaining density of 0.6 wolves/1000 km<sup>2</sup>. Based on results from previous years, this level of removal was expected to result in significant population growth in all three herds over the upcoming year.

The relatively high number of wolves present inside these caribou ranges at the beginning of winter 2017-2018, despite significant removals over the previous three years, suggests that wolf population recovery continues to occur as soon as wolf reduction stops.

The number of wolves removed in each year is as follows:

- Winter 2014 - 2015: 57 wolves
- Winter 2015 - 2016: 201 wolves
- Winter 2016 - 2017: 103 wolves
- Winter 2017 – 2018: 116 wolves

The initial wolf population estimate prior to wolf reduction was 208 individuals, and each subsequent year following reduction efforts, the wolf population recovers to approximately 50–60% of that level.

## 2.2 Narraway removals

Winter 2017-2018 was the first year of wolf removals in South Narraway. Fourteen wolves were removed, which represented a 74% removal rate, and resulted in a remaining wolf density of 3.1 wolves/1000km<sup>2</sup>.

## 3.0 Central Mountain Caribou Populations Status

### 3.1 Quintette Population

**Population Census:** An aerial census of the high-elevation winter range for Quintette caribou was conducted on April 8<sup>th</sup> and 9<sup>th</sup>, 2019. A route following alpine and subalpine habitat was flown by helicopter within the entire high-elevation winter range (Figure 3a), with the exception of the Mt. Crum area, which is very rugged and rarely has caribou present during late winter. This area has not been included in previous censuses, except in 2013, when radio-collar data indicated presence of collared caribou. The flight route was recorded using a handheld GPS.

Survey conditions were good with clear skies, however, there was no new snow and only partial snow cover in the high-elevation winter range. Four observers (including the helicopter pilot) searched for caribou and tracks along the flight route without prior knowledge of where radio-collared caribou were located (Figure 3a). When caribou were located the animals were counted and classified into adults and calves. Locations were recorded on a GPS and the group was scanned with the radio-telemetry receiver to determine if any radio-collared caribou were in the group (Figure 4b).

During the survey there were seven caribou with functioning radio-collars within the high elevation winter range. The proportion of those collared caribou located during the survey was used to calculate the sightability for the high elevation census area. There were also five radio-collared caribou outside the census area boundaries; one in lowland forest to the east and four in the more rugged mountains to the west which are identified as high elevation summer range. The four caribou in the mountains had been captured and radio-collared just two weeks prior to the survey, so they had not had time to become randomly mixed into the census area. Therefore, those four caribou were not used to calculate sightability for the entire herd range. After completing the survey of the high elevation winter range, the radio-collared caribou that had been missed were located with radio-telemetry, counted and classified. The total number of adult caribou and calves, the number of collared caribou in each group, and the method of detection, are presented in Table 1.

**Minimum and Total Counts:** The total number of caribou counted during the population census was used to provide an account of the minimum number of caribou in the Quintette population.

- i) **Within the high elevation winter range**, there were 48 caribou observed without the use of telemetry (minimum count), and 7 caribou counted using telemetry, therefore, the total count was 55 (Table 1);
- ii) **Outside of the high-elevation winter range**, 33 caribou were counted with the use of telemetry;

- iii) **Total count for the entire Quintette caribou range**, a total of 88 animals were observed (Table 1). This is an increase compared to 2018, when 67 animals were counted.

**Population Estimate:** A sightability correction factor based on the number of collared caribou observed without the use of radio-telemetry was used to estimate the true population size within the high-elevation winter range, and within the entire Quintette caribou range.

The percent sightability is calculated as the number of active collars found divided by the number of active collars in the search area. Then, the population estimate is calculated as the minimum count divided by the percent sightability. The population estimate for Quintette caribou was thus:

- i) Within the high-elevation winter range:
  - a. 6 of 7 functioning radio collars (86%) were found without the use of telemetry (Table 1);
  - b. Correcting for sightability results in a population estimate of 56 ( $48/0.86$ ) caribou in the high-elevation winter range.
- ii) For the entire Quintette range (within and outside the high-elevation winter range):
  - a. 6 of 8 functioning radio collars (75%) were found during the survey (four newly deployed collars were not included in the total collar count to avoid bias);
  - b. Correcting for sightability results in a population estimate of 64 caribou ( $48/0.75$ ) for the entire Quintette range;
  - c. The total count was 88 animals (55 in HEWR and 33 outside of the survey area). Even though the corrected population estimate indicates 64 animals, the total count provides the best indication of population size for 2019, since the animals were directly observed. This total count will be used to assess population trends.

**Caribou Distribution:** Of the 55 caribou observed in the high-elevation winter range (Figure 3b, Table 1):

- 43 were in the Bullmoose/Chamberlain/Reesor/Spieker area
- 5 were in the Collier/Crum area
- 7 were in the Terminator/Roman Mountain area,

This distribution confirms a reduction in the number of caribou in the Terminator / Quintette / Roman / Babcock area since 2002. In three censuses conducted between 2002 and 2013, that area contained between 34-50 caribou, representing 22-32% of the population. This portion of the population has declined in recent years, likely in response to increased mining activity in the high-elevation range. Following the mining expansion in 2011, caribou appeared to abandon the alpine winter range and began wintering in low-elevation forests where they experience increased exposure to wolf predation.

The low number of caribou in the Terminator / Quintette / Roman / Babcock area suggest that caribou in the Bullmoose and Collier area have a better potential for the recovery of the Quintette population. The 24 individuals observed on Bullmoose Mountain and Mount Chamberlain represent 27% of the current Quintette population (minimum count of 88 in 2019). Concerns are still warranted for this portion of the population, as telemetry locations of the four radio-collared individuals found on

Bullmoose Mountain indicated that they spent the past winter in close proximity to the proposed Sukunka coal mine (Figure 4).

**Table 1. Population census and calf recruitment survey details for Quintette caribou, April 2019**

| General Location                      | Adults    | Calves    | Total     | Number of collars | Detection method** |
|---------------------------------------|-----------|-----------|-----------|-------------------|--------------------|
| <b>Survey Area - HEWR</b>             |           |           |           |                   |                    |
| Bullmoose Mountain                    | 7         | 2         | 9         | 2                 | Visual             |
| Bullmoose Mountain                    | 5         | 0         | 5         |                   | Visual             |
| Mount Chamberlain                     | 6         | 4         | 10        | 2                 | Visual             |
| Mount Reesor / Mount Spieker          | 9         | 3         | 12        | 2                 | Visual             |
| Mount Reesor / Mount Spieker          | 1         | 0         | 1         |                   | Visual             |
| Mount Spieker                         | 4         | 2         | 6         |                   | Visual             |
| Mount Collier / Mount Crum            | 4         | 1         | 5         |                   | Visual             |
| The Terminator / Roman Mountain       | 7         | 0         | 7         | 1                 | Telemetry          |
| <b>TOTAL - Survey area</b>            | <b>43</b> | <b>12</b> | <b>55</b> | <b>7</b>          |                    |
| <b>Outside Survey Area</b>            |           |           |           |                   |                    |
| Sukunka Peak*                         | 9         | 3         | 12        | 1                 | Telemetry          |
| Hook Lake*                            | 5         | 2         | 7         | 1                 | Telemetry          |
| Boone Taylor Peak*                    | 5         | 3         | 8         | 1                 | Telemetry          |
| Boone Taylor Peak*                    | 1         | 0         | 1         | 1                 | Telemetry          |
| Thunder Mountain                      | 3         | 2         | 5         | 1                 | Telemetry          |
| <b>TOTAL - Outside survey area</b>    | <b>23</b> | <b>10</b> | <b>33</b> | <b>5</b>          |                    |
| <b>TOTAL - Entire Quintette range</b> | <b>66</b> | <b>22</b> | <b>88</b> | <b>12</b>         |                    |

\* Found in High Elevation Summer Range – collar newly deployed, not included in collar count to avoid bias

\*\* Detection method was defined as “Visual” when caribou were observed without using telemetry

**Adult Mortality:** Nine radio-collared adult female caribou were monitored in the Quintette herd between March 2018 and March 2019. This relatively low sample size was due to multiple radio collar failures throughout the year. During that period, two cows died, one of unknown causes and the other due to predation (predator species unknown). This indicates an annual adult mortality rate of 22%.

**Calf Recruitment:** During the aerial census, a total of 22 calves and 66 adults were counted, which corresponds to 33 calves/100 adults. Calves represented 25% of the total population.

Assuming that 60% of the adult caribou were female (as per the results from the Kennedy Siding herd photo census, see Section 3.2), this would correspond to 22 calves/40 adult females, or 55 calves/100 adult females. If half of the calves are female, there would be 27.5 female calves/100 adult females.



**Population trend:** Prior to the start of the wolf reduction program in 2015, the population estimate within the high-elevation winter range had declined from 166 in 2008, to 98 in 2013. The total count declined from 173 to 100 during the same period (Table 2). This represents a decline of almost exactly 10% per year. The decline continued, and by the next complete census in 2016, the population estimate in the high-elevation winter range was down to 41, with a total count of 33 (Table 2).

The results from the 2016 to 2019 censuses illustrate the response of caribou to the wolf reduction program: total counts and population estimates increased in the high elevation winter range and in the entire range (Figure 5), with peaks occurring in 2018. From 2018 to 2019, the Quintette herd population increased by 19% (74 to 88; Table 2).

**Conclusion:** The increase in the population size for the high-elevation winter range between 2016 and 2019 represents a growth rate of 11% per year. The annual growth rate for the entire population was 12.4% per year. If the herd continues to grow at 12.4% annually, the population in the high-elevation winter range could reach 100 caribou in five years.

## 3.2 Kennedy Siding Population

**Adult Mortality:** A total of 7 functioning radio-collars were monitored in the Kennedy Siding herd between March 2018 and March 2019. No radio-collared caribou died, resulting in an annual adult mortality rate of 0%.

**Calf Recruitment:** Heard and Zimmerman (2018) used motion-sensitive cameras placed at feeders from September to January to identify all the individual caribou in the Kennedy Siding herd based on antler configuration and other body characteristics. They reported a total of 77 caribou, including 36 adult cows, 23 adult bulls (60% of adults were females), and 18 calves (11 females and 7 males). This represents 23% calves in the population, 30 calves/100 adults, and 50 calves/100 adult females.

**Population Trend:** The total count of caribou in the photo census increased from 65 in 2018 to 77 in 2019, resulting in a 22.2% population growth rate after adjustment for human caused mortalities. In 2017-2018, the annual growth rate adjusted for human-caused mortalities and calf recruitment rate were much lower (3.2% and 16.1 calves/100 adults, respectively), which may have been due to a lower level of wolf removal that year.

Calf recruitment over the past four years with wolf reduction appears to be associated with the number of wolves removed from the Kennedy Siding range (Table 2; Figure 6).

**Table 2. Number of wolves removed from the Kennedy Siding range, 2014-2019**

| Wolf Removal Period       | Number of Wolves Removed | Year      | Photo Census Survey           | Number of Caribou <sup>1</sup> | Calves/100 Adult Females | Non-Adjusted Growth Rate | Adjusted Growth Rate <sup>2</sup> |
|---------------------------|--------------------------|-----------|-------------------------------|--------------------------------|--------------------------|--------------------------|-----------------------------------|
| Winter 2014 - Spring 2015 | 2                        | 2015-2016 | October 2015 - January 2016   | 50 (1)                         | 19.2                     | 2.0%                     | 6.4%                              |
| Winter 2015 - Spring 2016 | 24                       | 2016-2017 | September 2016 - January 2017 | 63 (0)                         | 67.7                     | 26.0%                    | 28.6%                             |
| Winter 2016 - Spring 2017 | 6                        | 2017-2018 | August 2017 - January 2018    | 65 (2)                         | 28.1                     | 3.2%                     | 3.2%                              |
| Winter 2017 - Spring 2018 | 11                       | 2018-2019 | August 2018 - January 2019    | 77 (0)                         | 50                       | 18.5%                    | 22.2%                             |

<sup>1</sup> Number of caribou observed in the Fall; number in bracket is the number of animals removed from the subsequent year's annual growth rate calculation to adjust for human-caused mortalities.

<sup>2</sup> Annual Growth Rate adjusted for human caused mortalities, from Fall to Fall.

In addition, lower calf recruitment in 2017-2018 could be partly due to a high proportion of non-breeding yearlings in the Kennedy Siding caribou population. There were seven female calves in the 2016-2017 population. If all seven calves survived to become yearlings, only 25 of the 32 females classified as adults would be old enough to produce calves. Under this assumption, the number of calves/100 adult females would increase from 28.1 to 36.0, which is still well below the 2016-2017 rate. This result further supports the likelihood that wolf reduction has the largest effect on calf recruitment.

Although the ongoing supplemental feeding program is likely improving the nutritional status of the caribou, and may be providing some benefit to the herd (Heard and Zimmerman 2018), it did not result in a positive population response in the absence of effective wolf reduction in 2014-2015 (Heard and Zimmerman 2016; Heard and Zimmerman 2018).

### 3.3 Klinse-Za (formerly Moberly/Scott) Population

The Klinse-Za herd is the subject of a maternal penning project led by West Moberly First Nations and Sauteau First Nations in association with Wildlife Infometrics Inc. The following results are summarized from McNay et al. (2019).

**Maternal Penning:** In March 2018, 12 adult female caribou were captured and put into a maternity pen. Ten of these females were pregnant; one pregnancy failed, and the other 9 produced calves. All 9 calves survived until they were released back into the wild with the 12 adult cows in July 2018. Ten of the 12 females and 7 of the 9 calves survived to March 2019. Therefore, the 12 cows in the maternity pen recruited 58 calves/100 adult females into the population.

**Calf Recruitment:** A total of 81 caribou (34 cows, 27 bulls, 9 unknown, and 11 calves – including 4 free-ranging calves and 7 penned calves) were counted during a survey conducted in March 2019. Thus, calf recruitment rate was 13.6% in the total population, 18 calves/100 adults, and 32 calves/100 adult females.

The recruitment rate for calves born in the wild was 29 calves/100 cows (7 free ranging cows with 2 calves), which was much lower than for calves born in the pen (58 calves/100 cows).

**Adult Mortality:** A total of 19 radio-collared adult females (12 from the pen and 7 from the wild) were monitored through the year. Two cows died, which represents an annual adult mortality rate of 10.5%. Causes of death included grizzly bear predation and avalanche.

**Population Trend:** Following adjustments based on assumed and known mortalities, number of animals observed during surveys, and number of new calves, the estimated population size for the Klinse-Za herd was 81 caribou in 2019. This is an increase from the population estimate of 66 caribou in 2018, and represents an annual growth rate of 22.7%. Although the combination of maternal penning and wolf control has improved both adult and calf survival resulting in an increasing population, it will be important to reassess the cost-benefit of maternity penning as the Klinse-Za population grows.

**Conclusion:** For the 3 herds located in the South Peace wolf reduction area (Quintette, Kennedy Siding, and Klinse-Za), the population increased from 205 to 247 over the past year, which represents an annual growth rate of 22%.

### 3.4 Narraway Population

The Narraway caribou population is very difficult to inventory because they winter at low densities in low elevation forests. The population comprises two different subgroups, Bearhole-Redwillow and South Narraway.

#### 3.4.1 Bearhole-Redwillow Subgroup

The Bearhole-Redwillow herd is a small remnant herd of caribou that winter in low-elevation boreal forest. This herd experienced a sharp decline between 2008 and 2017. Monitoring was limited to maintaining a few radio-collared caribou to provide information on adult mortality, calf recruitment and minimum population size, but in Fall 2017, the final two radio-collars stopped transmitting. By 2018, there were no remaining radio-collared caribou, so it was no longer possible to monitor population parameters.

Although the herd is believed to be close to extirpation, there were some caribou sighted by the public in the Blackhawk Lake area during Winter 2018. To assess caribou presence, a large-scale sampling program for caribou fecal DNA included sampling locations within the Bearhole-Redwillow range. Results showed that there are still a few remaining caribou within this area, but there is no easy way to monitor their numbers. Further, five Quintette caribou had travelled to this range during the sampling program, and their telemetry locations overlap with sampling locations, suggesting that some of the

samples collected in Bearhole-Redwillow actually came from Quintette caribou. Because this herd is outside the wolf reduction treatment areas, Bearhole-Redwillow caribou are expected to experience a high adult mortality rate (22.2%), and a low calf recruitment rate (9.5 calves/100 adults), as indicated by the averaged population metrics between 2007 and 2014.

#### **3.4.2 South Narraway Subgroup**

The South Narraway herd also experienced a major decline over the past decade, but government biologists from Alberta continue to maintain a small sample of radio-collared caribou in that subgroup. Minimum counts for those caribou in recent years have ranged in the 20's to 30's, and 38 caribou were counted during the winter of 2018-2019.

During winter 2019, the Alberta government deployed 2 collars in South Narraway, and conducted a fecal DNA survey for the entire Narraway range (Bearhole-Redwillow and South Narraway). Results from this survey are expected to provide a more accurate population estimate.

### **3.5 Non-treatment herd: Graham Population**

The Graham herd lives in the Rocky Mountains north of the Peace River (Figure 1) and is not part of the Central Mountain caribou designatable unit. It is currently being monitored as the “no wolf reduction” control situation for the South Peace wolf reduction program.

Between March 2018 and March 2019, 4 of 21 collared adult females died, which represents an annual adult mortality rate of 19%. This is 50% decrease in mortality compared to 2018 (40% mortality rate), although no wolf reduction has been implemented in this range.

In April 2019, the entire range was searched for caribou via aerial survey. A total of 76 caribou were counted, including 40 cows, 23 bulls and 11 calves. This represents 14.5% of calves in the population, and a calf recruitment rate of 17.5 calves/100 adults and 28 calves/100 adult females. Considering that survey conditions were not ideal because of lack of snow, it is likely that groups and single animals were missed during the count. The high mortality and low calf recruitment rate still warrant concerns as they are indicative of a population decline.

## 4.0 Population Status Summary for Central Mountain Caribou, 2019

The observed or estimated number for Central Mountain caribou populations in British Columbia in 2019 are indicated in Table 3.

**Table 3. Observed or estimated number of caribou in Central Mountain populations in 2019**

| Range              | Number of caribou |
|--------------------|-------------------|
| Kennedy Siding     | 77                |
| Klinse-Za*         | 81*               |
| Quintette          | 88                |
| South Narraway     | 38                |
| Burnt-Pine         | Extirpated        |
| Bearhole-Redwillow | Unknown           |
| Total              | 284               |

\* Population estimate based on assumed and known mortalities, number of animals observed during surveys, and number of new calves

Survey results indicate that caribou populations in the Klinse-Za, Kennedy Siding and Quintette ranges have stopped declining and started to increase in response to population management actions (Figure 7; Table 4).

**Table 4. Observed or estimated number of caribou in Klinse-Za, Kennedy Siding and Quintette since the implementation of wolf reduction**

| Year | Number of caribou |
|------|-------------------|
| 2019 | 246               |
| 2018 | 205               |
| 2017 | 192               |
| 2016 | 166               |
| 2015 | 192               |

The South Narraway subgroup did not appear to decline over the past year (based on the minimum number of animals observed), but has been declining over the past decade. The initiation of a wolf control program in the South Narraway range in 2017-2018 may reverse that decline. The Bearhole-Redwillow subgroup, along with the Burnt-Pine population, may now be functionally extirpated.

## **5.0 Wolf Reduction (Winter 2018 –2019)**

A total of 61 wolves were removed from within or immediately adjacent to caribou ranges (Figure 8), 51 by aerial shooting, and 10 by ground trapping.

Twelve wolves from different packs were radio-collared to assist in finding the packs for subsequent removal. Wolves removed outside caribou ranges were tracked to those locations from within the ranges. There were 32 wolves removed from the Klinse-Za area, 11 from Kennedy Siding area, and 18 from the Quintette area.

At the end of the control program in spring 2019, it was estimated that there were 18 wolves remaining in caribou ranges, with a removal rate of 77% and a remaining density of 1.1 wolves/1000 km<sup>2</sup>. This density is below the target density of 3 wolves/1000 km<sup>2</sup>, which could help minimize wolf recovery rates.

## **6.0 Summary of Management Actions and Recommendations**

1. The Quintette population is showing a high calf recruitment (25% of calves in the population), and the number of animals observed increased from 74 to 88 from 2018 to 2019. In the high-elevation winter range, growth rate was 11% annually from 2016 to 2019, and 12.4% for the entire population.
2. The Kennedy Siding population is showing a high calf recruitment (23% of calves in the population), and experienced a 22.2% growth rate over the past year. This growth rate can be attributed to a level of wolf control that was higher than the previous year, which contributed to 100% adult female survival and to the high calf recruitment rate indicated above.
3. The Klinse-Za population experienced a growth rate of 22.7% from 2018 to 2019. Calf recruitment in the pen was twice as high as in the wild. Although the combination of maternal penning and wolf control has improved both adult and calf survival, it will be important to reassess the cost-benefit of maternity penning as the Klinse-Za population grows. Further, calf recruitment in the wild is still low considering the number of wolves removed, so other wildlife management actions need to be considered to allow a sustained increase in population.
4. For the 3 populations located in the South Peace wolf control area (Quintette, Kennedy Siding, and Klinse-Za), the number of caribou increased from 205 to 246 over the past year, which represents a growth rate of 22%. Between 2016 and 2019, these populations increased from 166 to 246, which represents an annual growth rate of 14%.

5. The Graham population, which is currently the non-treatment area, showed a 19% adult female mortality and a proportion of 14.5% calves in the population in 2019. Although these numbers represent improvements compared to 2018, they indicate that the population is still declining.
6. The Bearhole-Redwillow subgroup no longer contains any radio-collared caribou so it is not currently possible to monitor its population trend. The Alberta government is conducting a fecal DNA study to assess current population size, whose results will direct future monitoring and management actions. One limitation of the study is that a few Quintette caribou travelled to Bearhole-Redwillow and were likely included in the collected samples.
7. The South Narraway minimum population count was very close to the 2018 count, but this subgroup has experienced an ongoing population decline over the past decade. Wolf reduction was expanded to include the low- and high-elevation winter range in 2018. Wolf recovery following reduction efforts has been low, so conducting bi-annual wolf reduction should be considered.
8. Although wolf reduction and maternal penning appear to reverse the decline in Central Mountain caribou herds, there are some significant concerns to be recognized:
  - i) Following the three effective years of wolf control, 81 caribou were added to the population. Based on the 15% decline prior to wolf reduction, an estimated 64 caribou would also have been lost in the absence of wolf control. This indicates that since 2016, a total of 145 caribou were added to the population, and 420 wolves were killed to achieve those results.
  - ii) Population management techniques are very expensive. The current wolf control program costs approximately \$400,000 per year, and maternal penning costs about 600,000\$ per year.
  - iii) Although the current program appears to be resulting in population recovery, and is effectively preventing extirpation of Central Mountain caribou herds within wolf reduction areas, it is not leading to self-sustaining caribou populations. Additional management actions that seek to provide optimal habitat conditions and to manage primary prey are needed to reach this goal.

## 7.0 Acknowledgements

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Scott Schilds and Hillary Morgan assisted with the Quintette population census; Inge-Jean Hansen and Scott Schilds assisted with the Graham recruitment survey.

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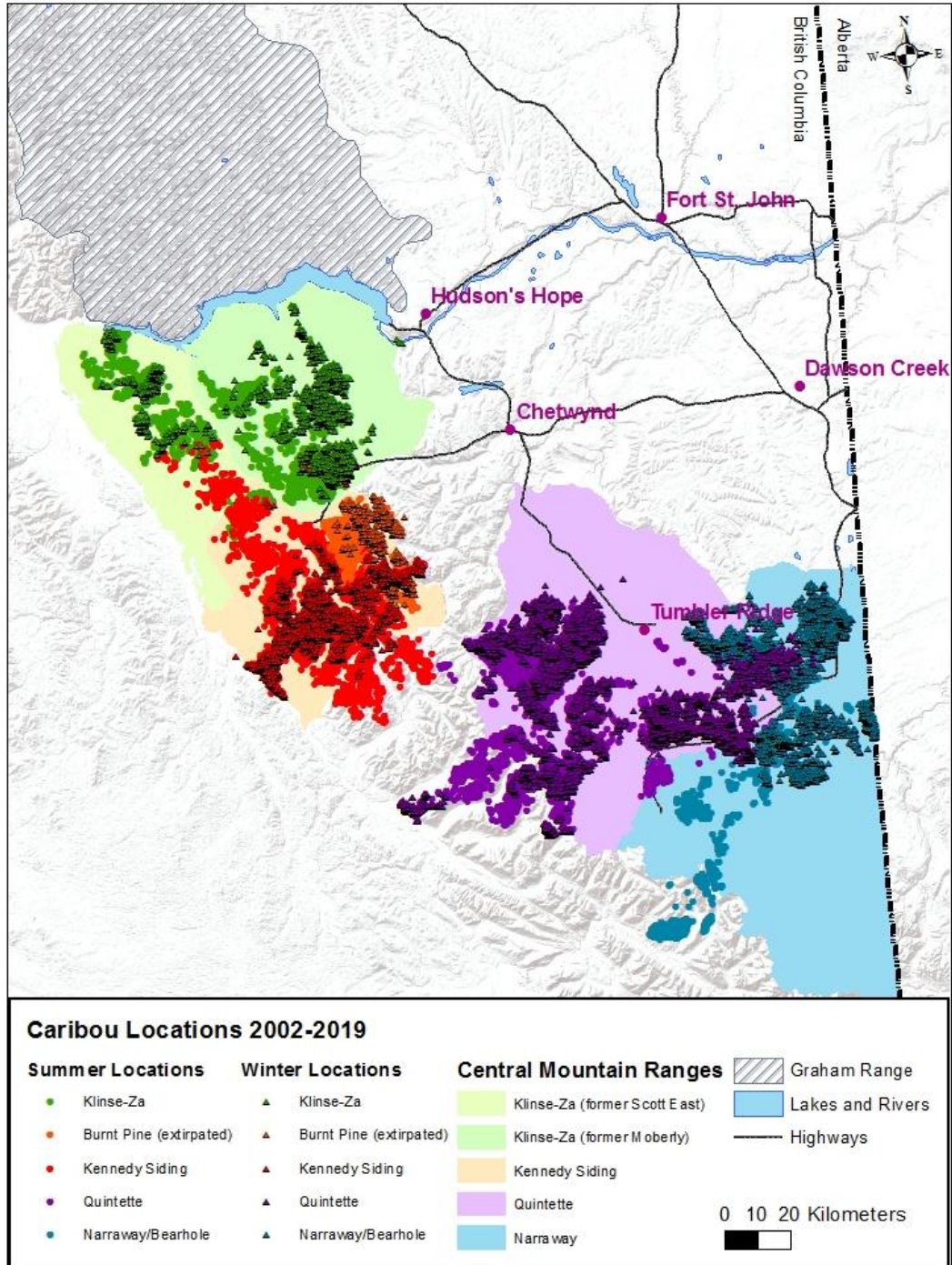
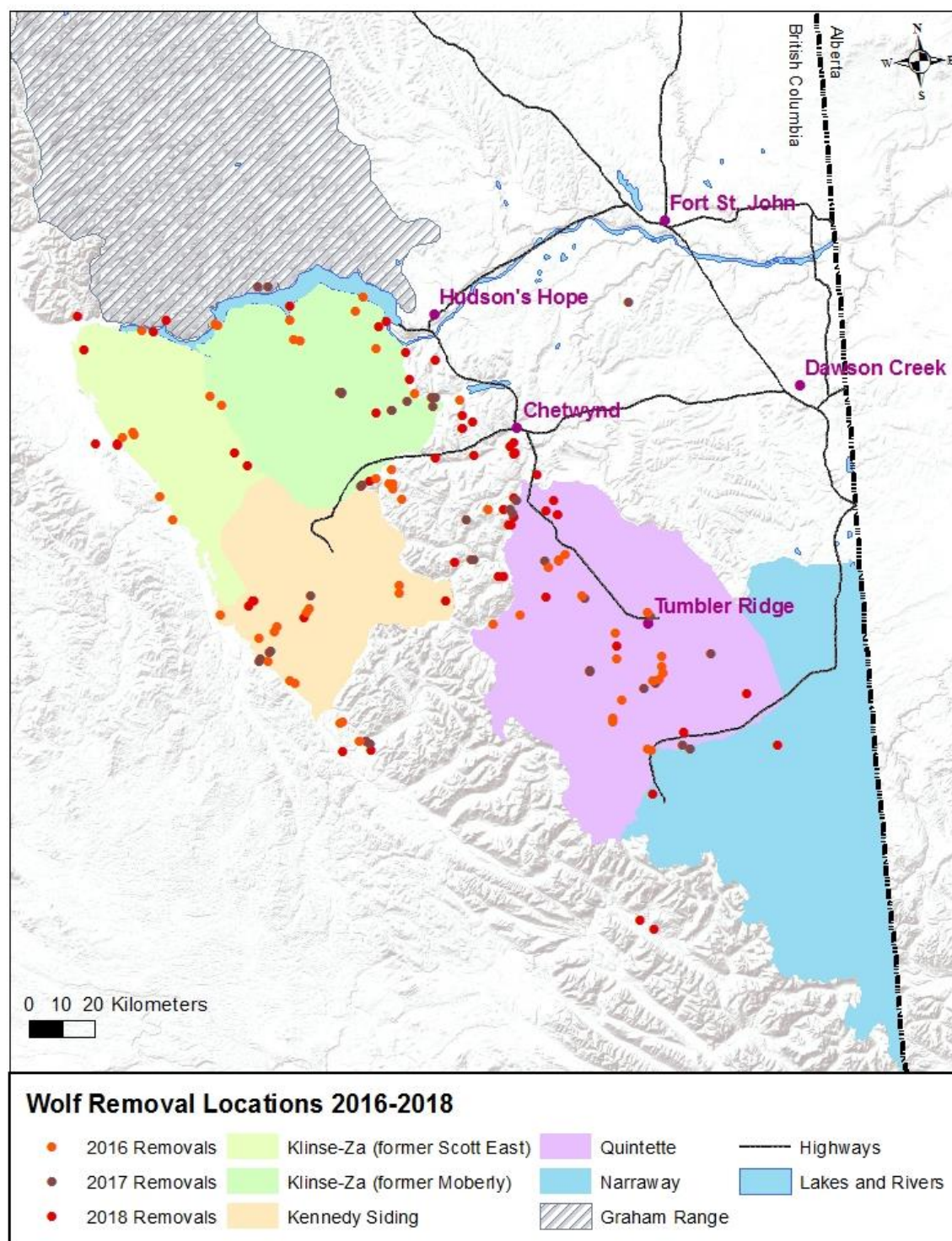
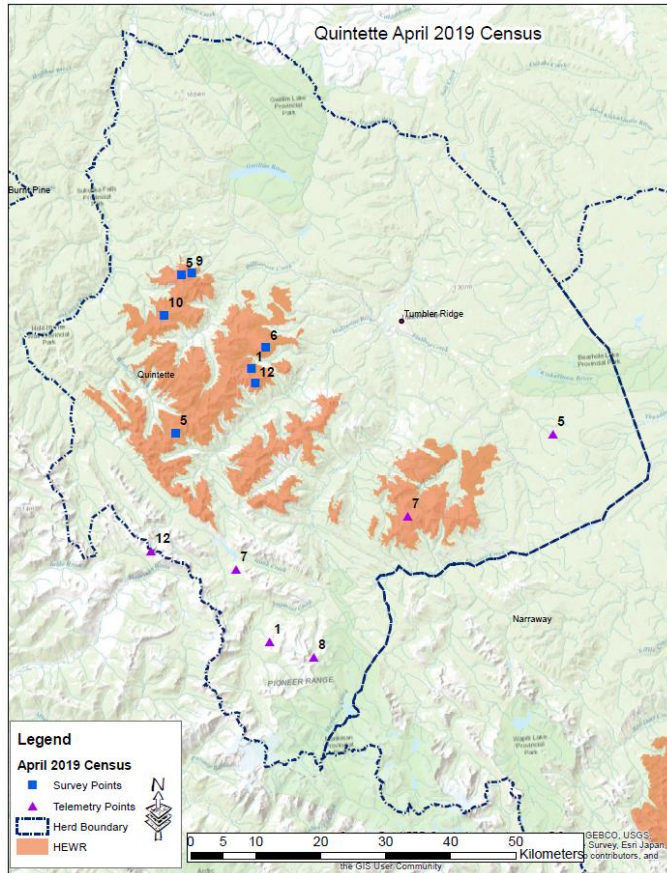


Figure 1. Radio-telemetry locations of caribou ranges in the South Peace region of British Columbia, 2002-2019

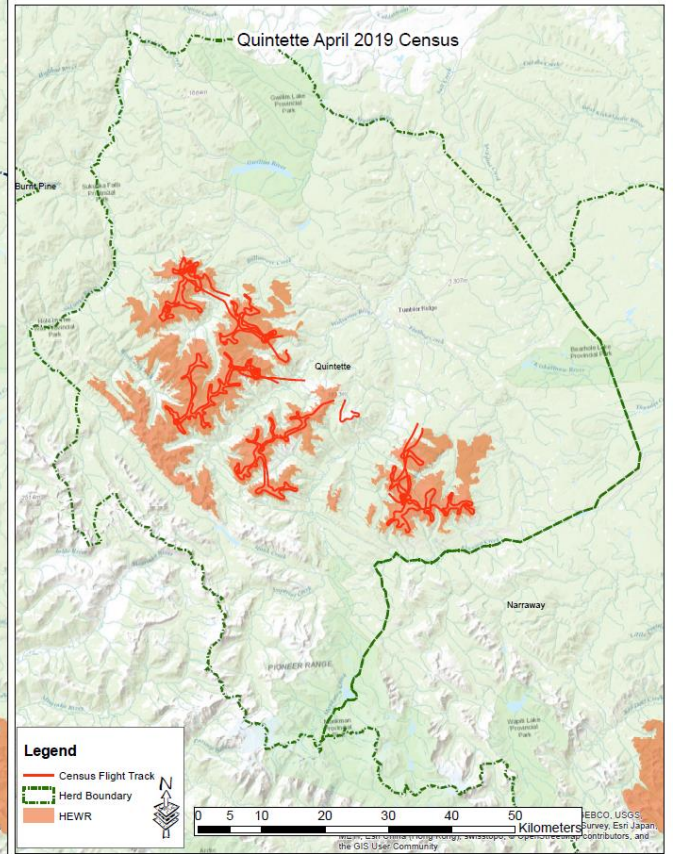


**Figure 2. Wolf removal locations in the South Peace region of British Columbia, 2016-2018**





(3a)



(3b)

**Figure 3. Aerial census route (3a) and locations of caribou groups (3b) observed during the Quintette caribou population census, April 8<sup>th</sup> and 9<sup>th</sup> 2019**

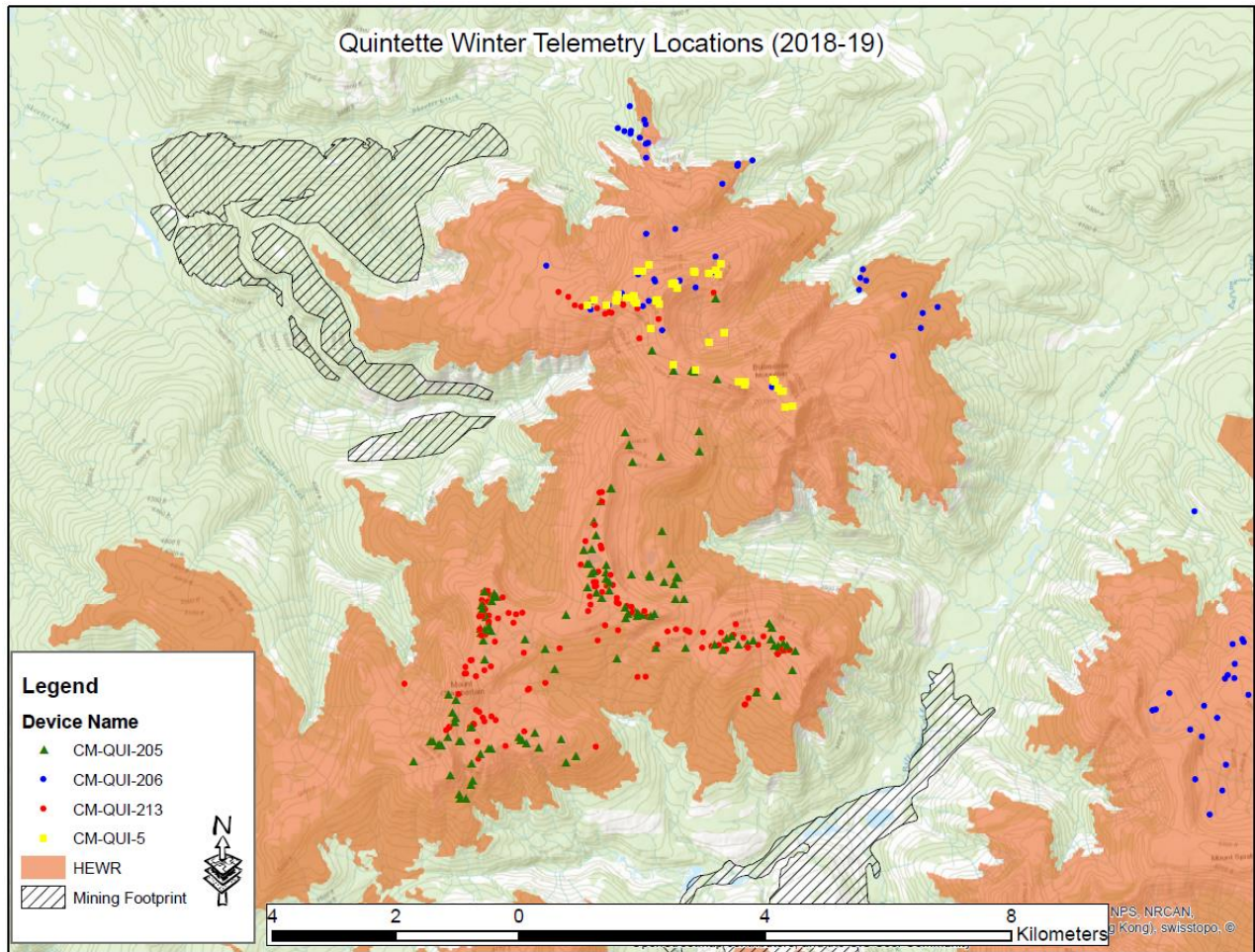
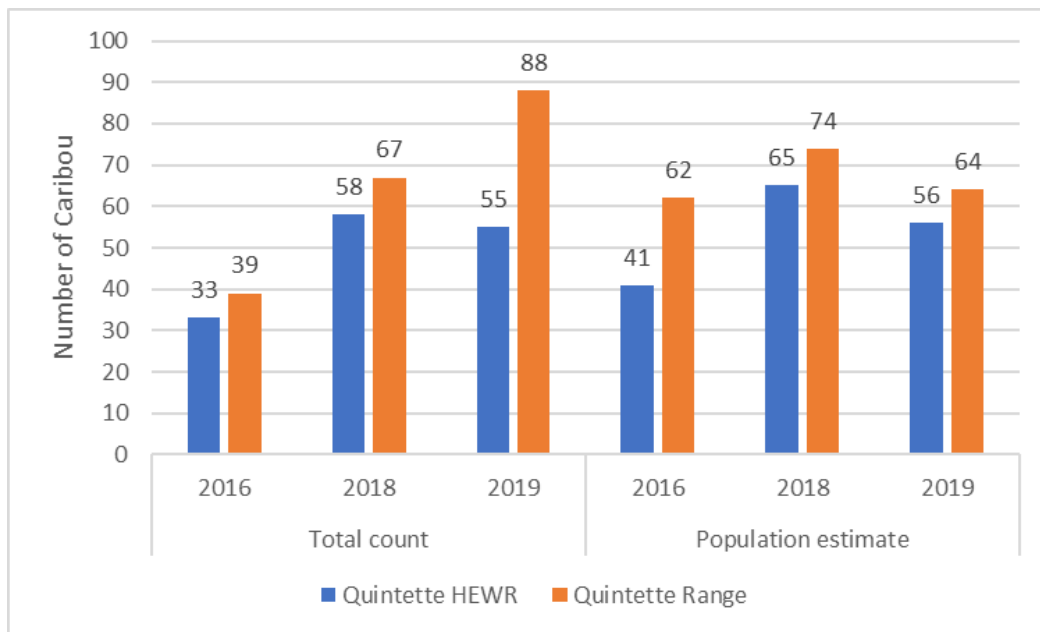


Figure 4. Quintette caribou telemetry locations in relation to the Sukunka coal mine footprint



**Figure 5. Quintette caribou population estimates and total counts from 2016-2019**

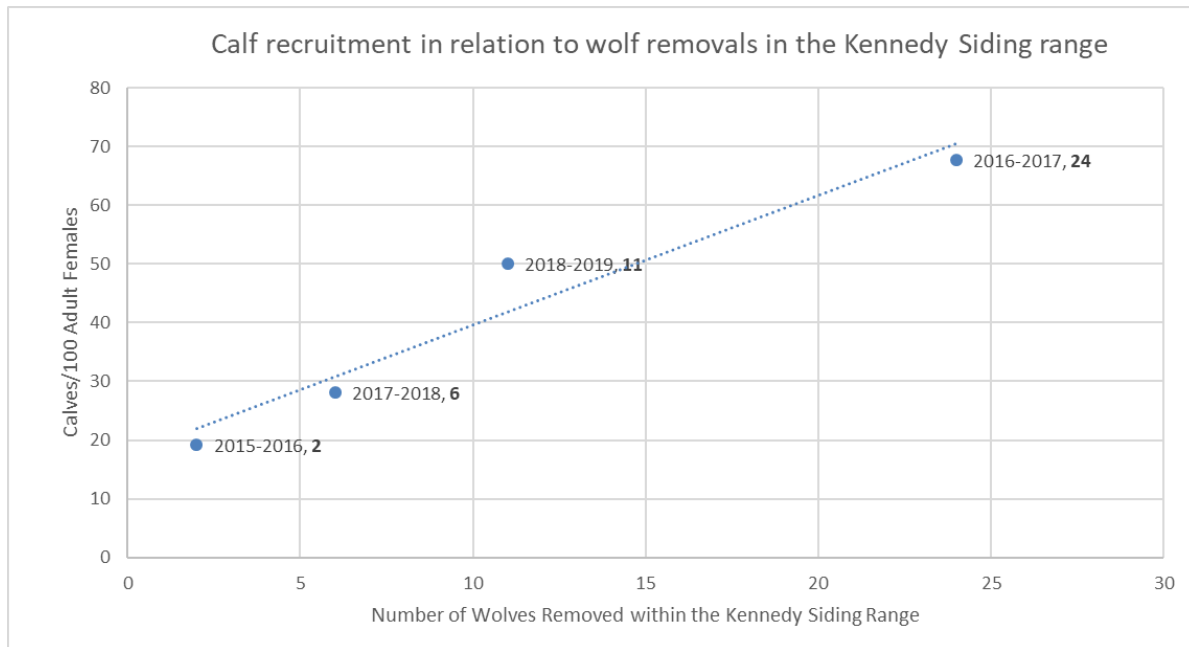
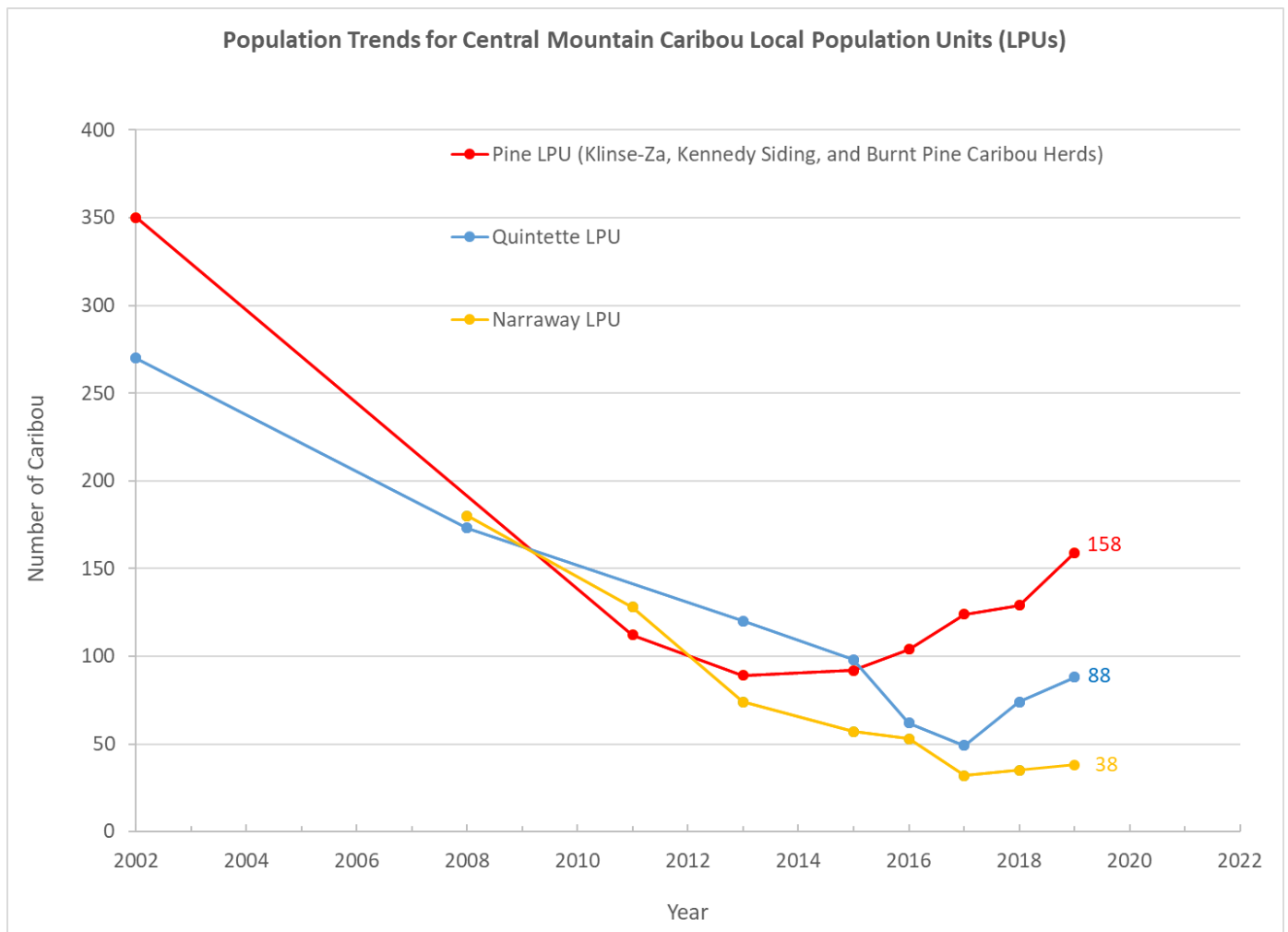


Figure 6. Calf recruitment in relation to number of wolves removed in the Kennedy Siding range, 2015-2019 (labels indicate year, and number of wolves removed in bold)



**Figure 7. Population estimates and trends for Central Mountain caribou, 2002-2019.** *The Burnt Pine caribou population was considered extirpated in 2013*



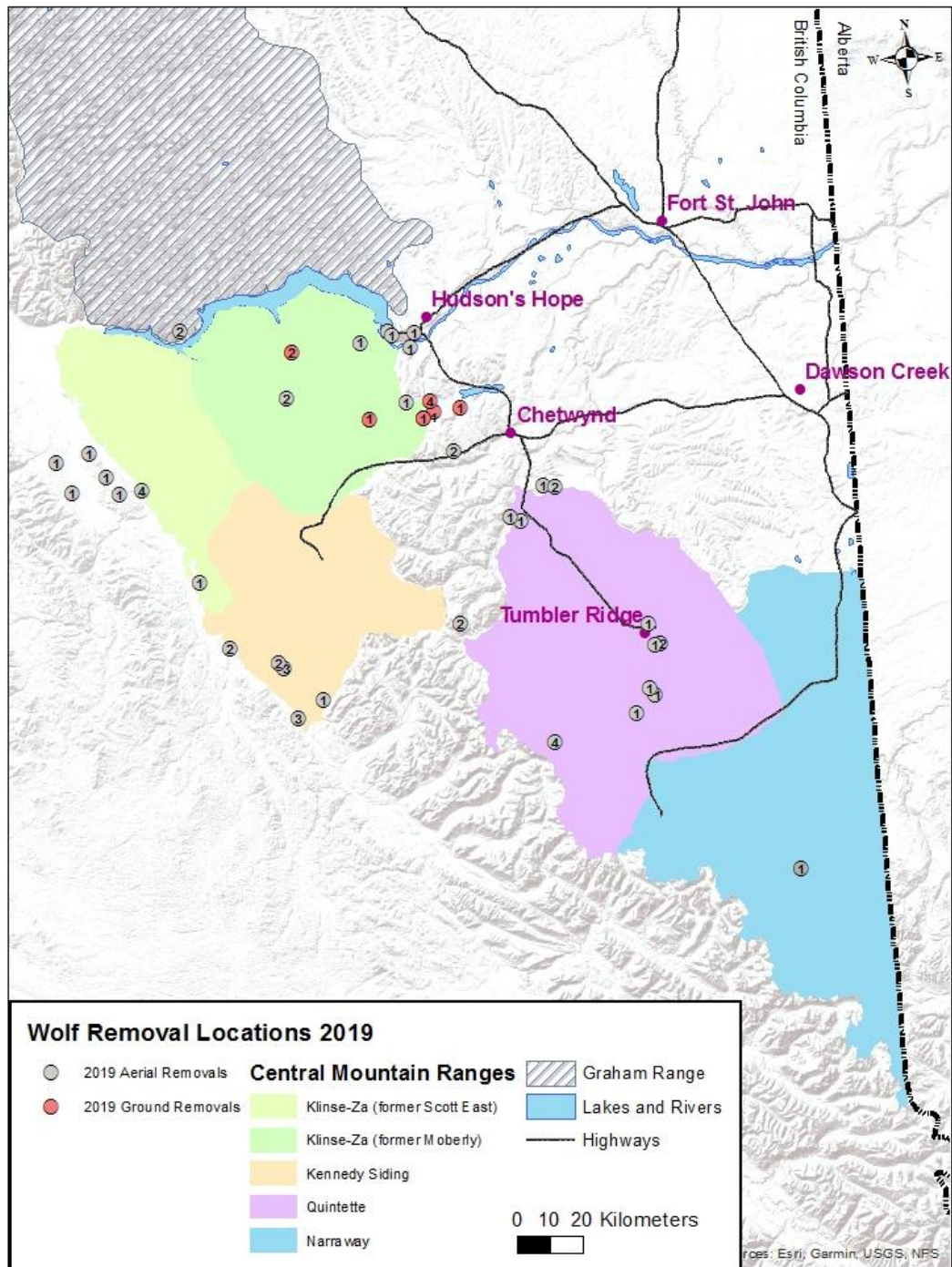


Figure 8. Wolf removal locations in the South Peace region of British Columbia, 2019