Nîkanêse Wah tzee

Ensuring Caribou Futures

ANNUAL REPORT

Pen Operations and Effectiveness

2024 Summary Report

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REPORT SUMMARY

The Klinse-Za caribou herd in northern British Columbia, part of the endangered Central Mountain population of caribou (*Rangifer tarandus caribou*), declined from over 200 animals in the mid 1990's to approximately 36 animals in 2013. Due to unsustainable levels of predation, the herd was predicted to be functionally extirpated within a decade. To halt this decline, West Moberly First Nations and Saulteau First Nations instigated an emergency recovery program. The recovery actions include the reduction of wolf density, which started in 2013, and maternity penning, which began in 2014. In the years since, the combination of maternal penning and wolf reduction has helped stop the steep population decline and create a positive population trajectory. The Klinse-Za caribou herd is estimated at 187 animals as of March 2025, and the 3-year growth rate was 1.18. Herein we summarise the maternal penning operation, effectiveness monitoring, and outreach/extension completed over the last year.

ACKNOWLEDGEMENTS

We would like to acknowledge the support provided by the approximately 22 individuals (helicopter pilots, veterinarians, government biologists, First Nations Guardians, and contract biologists) during the capture and transport of adult cows that has occurred each March, from 2014 to the present. This team performs the delicate job of handling each caribou professionally and as humanely as possible. The 2024 Pen Guardians should be especially congratulated and genuinely thanked for their continued support of this project and to the caribou. More than anyone else, the Pen Guardians personally make a difference in caribou recovery with each day that they spend monitoring the cows and calves in the pen. Their dedication to the caribou and to the contribution that caribou make to Indigenous Peoples way of life is something they demonstrate and care about strongly. We especially thank Chief Wilson (WMFN) and Chief Paquette (SFN) for their continued, unwavering support for the recovery of caribou in their traditional territories. In addition, we also acknowledge the remarkable efforts of the Lands staff, Tamara Dokkie (WMFN), Gloria Morris (WMFN), Naomi Owens-Beek (SFN), Teena Demeulemeester (SFN), and Jessica Eastman (SFN).

Our partners include Biodiversity Pathways, Saulteau First Nations, Treaty 8 Tribal Association, West Moberly First Nations, Wildlife Infometrics, Yellowstone to Yukon, Aski Reclamation LLP, BC Ministry of Water, Land and Resource Stewardship, BC Parks, and EcoSpur Environmental. We would especially like to thank Wildlife Infometrics. With the retirement of Scott McNay and Line Giguere in 2024, their passion, knowledge, and dedication to the Klinse-Za Caribou will always be held in the highest regard. This report was built upon a template developed through Wildlife Infometrics' previous documentation, with significant contributions from Scott McNay, Line Giguere, and Landon Birch.

Finally, this project could never have happened without the financial and in-kind support from a long list of sponsors; we thank each sponsor for their support and willingness to work with us to make the maternity pen project a success: Anglo American, BC Hydro, Canadian Natural Resources Ltd., Enbridge, Environment and Climate Change Canada, Fish and Wildlife Compensation Program (FWCP), Habitat Conservation Trust Foundation (HCTF), MiTACS, Mitsubishi Corporation, University of British Columbia, Arramat Project (University of Alberta), Braiding Knowledge, Canada, and University of Alberta. This Project is also funded in part by the

Fish and Wildlife Compensation Program (FWCP). The FWCP is a partnership between BC Hydro, the Province of B.C., Fisheries and Oceans Canada, First Nations and public stakeholders formed to conserve and enhance fish and wildlife impacted by the construction of BC Hydro dams.

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INTRODUCTION

The Klinse-Za caribou (*Rangifer tarandus caribou*) are part of the Central Group of Southern Mountain caribou in British Columbia (BC) and are listed as Threatened under Schedule 1 of the federal *Species at Risk Act* (Environment Canada 2014). Klinse-Za caribou inhabit the combined extent of what was historically referred to as the Moberly caribou herd and a portion of the Scott caribou herd, east of the Williston Reservoir (Figure 1). These herd areas were combined for management purposes because caribou in the eastern portion of the Scott became less associated with the western portion of their historic range after the creation of the Williston Reservoir and are more recently associated with the Moberly caribou after the initiation of maternal penning (this project) in that area.

Spalding (2000) summarized the recorded observations of caribou and caribou killed in the area around Moberly Lake in the late 1800s and early 1900s and suggested that caribou were plentiful. West Moberly First Nations Elders spoke of a "sea of caribou" and referred to them as "bugs" on the landscape (WMFN 2009). However, by 1997, there were only 191 caribou in the Moberly area (TERA 1997) and by 2013, there were only 36 caribou in the entire Klinse-Za area; 16 caribou in Moberly and 20 caribou in the eastern portion of the Scott (Seip and Jones 2015). More details on the demographic history of Klinse-Za caribou can be found in McNay et al. (2022). With the functional extirpation of the adjacent Burnt Pine caribou herd around 2012, the rapid decline of caribou numbers in the Klinse-Za was seen by local First Nations (hereafter, the Nations) as an indication that Klinse-Za caribou would also be extirpated unless aggressive population management was undertaken. The Nations began ground-based wolf removal in 2013 and maternal penning in 2014 (see a more detailed account of Indigenous-led efforts to recover Klinse-Za caribou in Lamb et al. (2022)). Both programs have been successful at temporarily averting the extirpation of Klinse-Za caribou by reducing adult female mortality and increasing juvenile recruitment, thereby providing for a steady annual growth in the population (Serrouya et al. 2019, McNay et al. 2022).

These population management strategies have helped the Klinse-Za population climb above at least one estimate of the minimum viable size of 120 (NCTAC 2004). However, the herd remains below the population goal established as part of a Recovery Action Plan for the Klinse-Za herd (McNay et al. 2013), and at the Central Group level, the South Peace Northern Caribou are far below the 1,200 animal population objective recommended to be met by 2023 (Aitkens 2013). In 2024, we recommended the continuation of the maternal penning project (McNay et al. 2023) with the objectives to: 1) protect adult and calf caribou by reducing mortality of pregnant cows and their newborn calves through the calving period, 2) monitor the effectiveness of the pen at improving demographic outcomes, and 3) provide community extension and reporting about the project. Based on extensive reviews of demographic evidence and in consideration of First Nations' cultural and ecological goals for their traditional territory, we have continued to work towards these objectives in the 2025/26 penning season.

The project is conducted under a BC Wildlife Act permit granting authority to the Nîkanêse Wah tzee Stewardship Society to capture and hold caribou in a maternity pen and to protect penned caribou against predators (Permit FJ22-682329; valid March 2022 – Sept 2026) and conduct effectiveness monitoring surveys (PermitFJ22-655188; valid March 2022-April 2026). A Special Use Permit under the Lands Act (S26316) was granted to Wildlife Infometrics Inc., in 2017, for

the construction of the maternity pen protection facility on public land. The newly built Linfitt caribou maternity pen is within the Klinse-Za Park, and therefore, we are currently operating under the approval from BC Parks.

STUDY AREA

The Klinse-Za herd area is approximately 5,501 km^2 and is located in the Rocky Mountains of northern BC. The herd area is bounded in the north by the Peace Arm of the Williston Reservoir, in the south by Highway 97, to the east by lowland agricultural areas around Moberly Lake, and to the west by the Williston Reservoir (Figure 1).

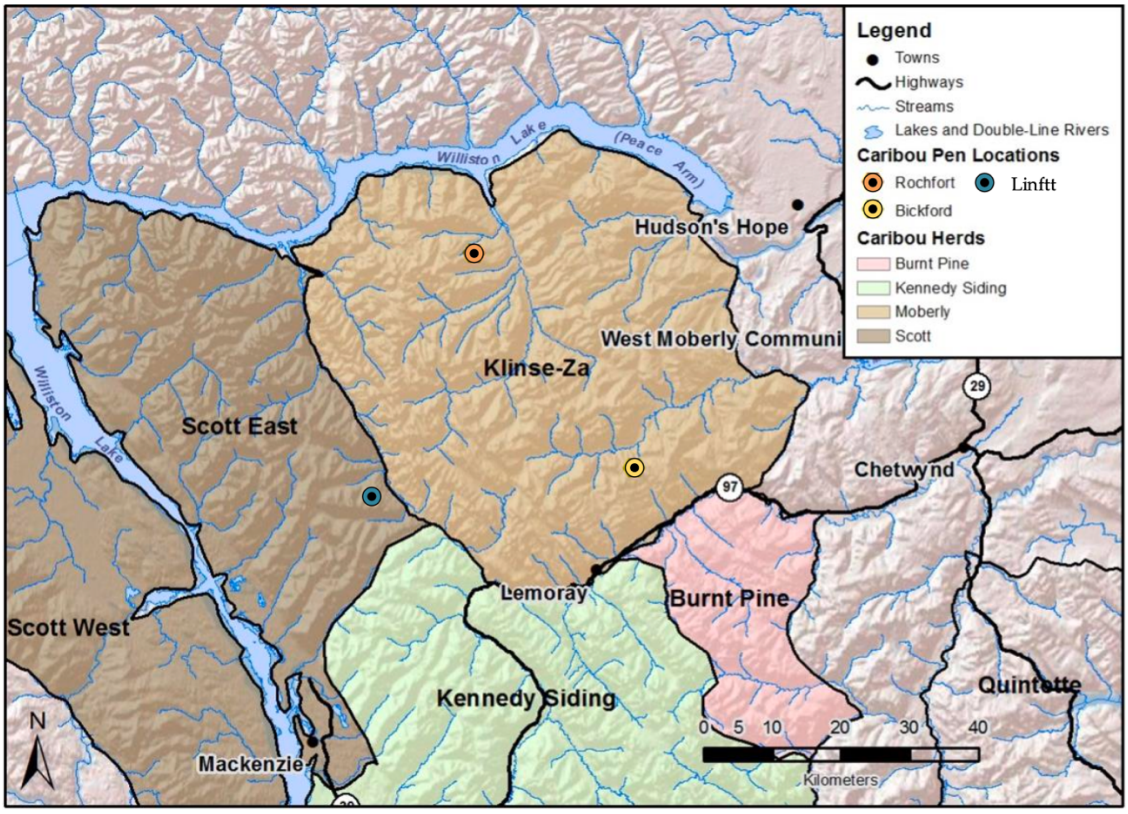

FIGURE 1. LOCATION OF THE KLINSE-ZA CARIBOU POPULATION RANGE AND THREE MATERNITY PENS IN NORTHERN BRITISH COLUMBIA. THE LINFITT PEN WAS CONSTRUCTED IN SUMMER 2024 AND IS THE ACTIVE MATERNAL PEN FOR THE PROJECT.

The original Klinse-Za maternity pen, in operation from 2014-2017, was located on Mt. Bickford, about 11 km north of Highway 97, along the Fisher Creek resource road, 50 km west of Chetwynd, in northern BC (Figure 1). The pen was located at ~1200 m asl in a natural subalpine meadow that caribou historically used during the calving period (Jones et al. 2004). This maternity pen was decommissioned in the spring of 2018, and the pen operation was moved to Mt. Rochfort (Figure 1). The decision to move the pen was proactive to reduce disease risk and impacts to natural forage from repeated use within the pen. For the 2022 to 2024 penning seasons, we returned to the original Bickford penning site, where the vegetation had recovered substantially. We built a new and larger pen on the same site with the plan to run the pen operations for three more years at that location – more details about the build are provided in (Spencer 2022). In September 2024, we built the third

Klinse-Za maternity pen up along the Callazon Creek FSR, 82 km west of Chetwynd, in northern BC (Figure 1).

METHODS

PEN OPERATIONS

The Klinse-Za maternity pen design drew extensively from the Chisana caribou herd maternity pen in the Yukon (Farnell 2009, Adams et al. 2019) and in the Little Smokey herd in Alberta (Smith and Pittaway 2011). We have also improved and added to these designs after eleven years of operation. The new 14 ha pen at Linfitt consists of a fence made of geotextile fabric, attached to a single strand of vinyl-coated cable hung at 3-4 m above the snowpack and tightened around trees to act as a visual barrier. The bottom of the fence is secured with soil piled on a one-meter-long skirt of excess geotextile fabric at the ground level. The geotextile fence is fortified by a 1.5 m high, 6-strand electric fence placed approximately 0.5 m away and along the exterior perimeter of the geotextile. A second, 2m high, six-strand electric fence is placed ~3 m away from the other fence to establish multiple electric barriers to deter predators. Before pen operations each year, crews re-establish access to the pen site, inspect the pen's condition, and undertake any necessary repairs.

We collect terrestrial forage lichens (*Cladina* sp., *Cladonia* sp., *Stereocaulon* sp., *Cetraria* sp.) in large mesh bags to prevent moulding and hang them to dry indoors until fed to the caribou the following spring. Details of the collection and storage techniques undertaken for the first year of collections were provided by Robin et al. (2013). Lichens are fed to penned caribou on a schedule that allows a slow change in diet away from natural forage to a commercial pelleted ration (see Appendix A for the pellet composition). The lichen collection task is now primarily carried out by West Moberly and Saulteau First Nations (Ritcher, 2024).

We conduct cow captures, collaring, and transport to the pen each year in mid-March using experienced crews following Resource Inventory Standards Committee (RISC) protocols. The operation is under veterinarian supervision, and monitoring is conducted by First Nation Guardians. Details on capture and translocation methods and other operational protocols are provided in Sittler et al. (2017). We collar penned cows with a GPS-enabled Iridium Satellite transmitter emitting a Very High Frequency (VHF) signal (model Survey-2D Iridium Collar; Vectronics Aerospace GmbH, Germany). We capture penned calves 2-3 days after birth. An expanded dataset was collected through calf collaring, but we discontinued this aspect of the project in the 2024/25 penning season. Since the data collection is now complete, we no longer find it necessary to collar calves. Instead, we collect a genetic sample and apply an ear tag to each calf. This allows us to identify them both while in the pen and during future population surveys. Collars used for adults meet animal care guidelines for weight restrictions, all weighing less than 4% of the animal's body weight. The average lifetime of GPS collars used on adult caribou cows is four years, with a fix rate of five locations per day, and a transmission frequency of approximately once per day.

Pen Guardians are present at the pen with the caribou 24 hrs/day from the time of initial capture in mid-March to the release of cows and calves in early August. Two Pen Guardian crews staff the pen in weekly shifts (one crew from Saulteau First Nation and one from West Moberly First

Nation). The Pen Guardians are supported by professional biologists and veterinarians who are on call to address any issues that may arise with the pen itself or the penned caribou. Pen Guardian responsibilities during monitoring are to: 1) feed caribou twice daily, 2) visually assess the penned caribou for injuries, and signs of nutritional or behavioural distress, 3) identify when cows start calving, 4) look for compromises to the pen structure, 5) search for signs of predators, 6) take any corrective actions that may be necessary regarding any observations made, and 7) log all observations and/or corrective actions daily (Appendix B). As part of the monitoring protocol, the Pen Guardians record the amount of feed (lichen and commercial pellets) provided to caribou and note the quantity of feed left over after each feeding. If no food is left, the provided ratio is increased. In 2019, after observing caribou experiencing ingestion difficulties, we amended the feeding protocol to mitigate the chance of caribou choking on pelleted rations. We did this by putting blocks of wood in the feed troughs and feeding smaller amounts more frequently, both strategies were designed to help reduce the rate of feed intake.

We release penned cows and calves from the pen each year with a 'soft' release. In the days leading up to the release, the Pen Guardians gradually move the feeding troughs towards the section of the pen wall chosen as the release point. On the date of release, which occurred on July 30th, 2024, the Guardians opened two 20 m sections of the geotextile fabric at the release points, and the cows and calves left the pen in their own time.

EFFECTIVENESS

We assess the effectiveness of penning operations based on the following:

- Sufficient amounts of forage lichen are in storage to initiate feeding immediately after capture
- Cow mortality as a direct result of capture, transport, or operation of the pen is minimized, and all mortalities are discussed with the provincial wildlife veterinarian to ensure the highest level of animal care is taken
- More than 25% of the adult cow population is protected in the pen
- No major breach in the integrity of the maternity pen structure occurs while in operation
- No predators gain access to the inside of the maternity pen while in operation
- Successful removal of predators that threaten to compromise the integrity of the pen
- Caribou health is maintained while they are in the pen
- Caribou are able to calve safely and with minimal disturbance
- Release of penned caribou is conducted without incident
- Recording of daily observations at the pen is consistently completed by the Pen Guardians (Appendix B)

Any deviation from the above measures and targets triggers a review to discuss causes, solutions, and protocol improvements.

We assess the effectiveness of using a maternity pen to protect adult and calf caribou based on the following expectations (or predictions):

- Pregnancy and parturition rates – penned cows should have pregnancy and parturition rates that are not significantly lower than the rates observed for the free-ranging population. Pregnancy was assumed if the optical density of blood pregnancy-specific protein-B (PSPB) was ≥ 0.21. Blood samples are taken as part of the regular health

sampling routine during capture (Sittler et al. 2017). Parturition was assessed daily in the pen during calving

- Cow and calf survival – penned cows and their calves should have higher survival rates than cows and calves in the free-ranging population. This was measured as the number of radio-collared cows (free-ranging and penned) surviving annually and the number of calves/100 cows surviving in mid-March (i.e., still in their first year)
- Most mortalities are identified through an accelerometer-based mortality signal that is sent to researchers from the satellite collar, which triggers the field investigation. For animals without satellite collars, we determine survival status from the pattern of VHF beeps and field investigate any mortality signals heard during aerial telemetry surveys
- Population growth – population growth rates should be positive, and the number of cows assumed to be reproductive from the previous year (i.e., now ≥34 months old at the time of the March survey) should be increasing. Unless otherwise known from marks (ear tags or collars), we assume all non-calf females to be of reproductive status because yearling cows (i.e., 1.8 year old's) have demonstrated a high pregnancy and parturition rate, and we are unable to distinguish 2.8-year-old cows from yearling cows in March

If one or more of these expectations are not met upon year-end project review, we will initiate a more thorough investigation into the operational details and demographic data of the penning project.

We acknowledge that population demographics (i.e., population size, population growth rate, adult survival rates, and calf recruitment) estimated from monitoring data are confounded by other simultaneous recovery efforts, such as predator removal. For that reason, we take precautions to stratify demographic observations between radio-collared animals that are taken to the pen and ones that are not (i.e., free-ranging). We infer demographic parameters for penned caribou from the daily monitoring records taken during the penning period. After penned animals are released, we monitor both the previously penned and free-ranging caribou with a total population survey in late February or early March.

Each year, we collar free-ranging, adult female caribou to maximize the chance that there is at least one active collar in each group of caribou found during the population survey conducted in March. Doing so increases the likelihood of an accurate minimum total count by telemetry methods. However, the preferred method for estimating the population size (N) involves a blind survey without telemetry. This method relies on a standard mark-recapture model, specifically the Lincoln-Peterson estimator, outlined as follows (McClintock and White 2009):

$$N = m_1 n_2 / m_2$$

where N is the population estimate, m_1 represents the number of collared caribou in the population before the survey, n_2 is the total number of caribou (both collared and uncollared) observed during the blind survey without the use of telemetry (i.e., the sample), and m_2 is the count of collared caribou found in the sample. If any collared animals are known to be using habitat below the alpine and subalpine zones, we deviate from the mark-resight survey and use telemetry to locate the collared caribou and to obtain a minimum count of any caribou associated with them. The latter data contribute to the minimum number of caribou observed but not to the Lincoln-Peterson population estimate. The standard deviation of the population estimate was calculated as:

$$SD^{1} = sqrt(((m_1+1)*(n_2+1)*(m_1- m_2)*(n_2- m_2)) / (((m_2+1)^2)*(m_2+2)))$$

where m_1, m_2, and n_2 are as described above. Confidence intervals (95%) for the estimate were calculated as:

$$CI^{1} = 1.965 * SD$$

Where CI is one side of the 95% confidence interval for the estimated N.

We also calculated estimates of average annual per capita growth rates (i.e., $[N_{\text{last year}} - N_{\text{current year}}] / N_{\text{last year}}$) since the beginning of the project and for the last three years as the geometric means and standard deviation of the growth for those two time periods.

EXTENSION AND REPORTING

We pursued a variety of extension and reporting outlets to make sure that a broad audience was well informed about the maternity pen project, including the following: regular internal and external meetings and presentations, digital and other media updates (web pages, Facebook, newspaper articles, media filming), engagement with schools, First Nation communities, technical and annual reports, information for extension outlets, and informal periodic newsletters.

RESULTS

PEN OPERATIONS

Terrestrial forage lichen was collected in September 2023 (n = 400 bags) for storage in advance of the 2024 pen operations.

CAPTURE

We surpassed our desired goal for the number of penned cows, penning 40% of the adult cow population (n = 21 cows of an available 50 reproductive cows (including yearlings) in one 5-day session in March 2024. 15 of the 21 reproductive cows had previous pen experience as a reproductive adult, leaving 29 reproductive cows free-ranging outside the pen, 22 of which were adult cows.

PENNING SEASON

No predators gained access to the pen, and the pen structure itself was not compromised in any way during the pen operation in 2024. Throughout the penning season, Pen Guardians observed minimal predators and/or predator signs. Black bears were the main predator species observed, with several individuals being observed over the year. Two black bears were seen on trail cameras walking between the two electric fences, but did not breach the geotextile barrier to access the pen. The bears' behaviour appeared to be more curious in nature than predatory. In response, Pen Guardians increased the frequency of predator patrols from twice daily to four times per day. For the 2025 penning season, we have engaged an electric fencing expert, Jeff Marley of Margo

[1] Standard deviation and confidence intervals for the estimated N were calculated following methods found at https://kevintshoemaker.github.io/NRES-470/LAB7.html

Supplies, to assess if there are modifications we can make to our electric perimeter fencing design to reduce breaches.

There was one issue related to the ingestion of food by penned caribou. One adult cow died eight days after capture due to a combination of pneumonia, likely a previous condition that was exacerbated by the stress of capture, and ruminal acidosis, a sudden and severe drop in rumen pH. The incident was reviewed internally and with feedback from the Provincial Veterinarian and contract wildlife veterinarians who support the project operations. Additional feeding interventions were implemented for the remainder of the transition from lichen to pellets. The ultimate cause of death remains uncertain, with both pneumonia and feed-related complications considered proximate causes.

Under the guidance of the provincial veterinarian, clostridium vaccines and a booster were administered to the penned caribou for the first time. Clostridium is a naturally occurring, soil-based bacterium. A cow was lost in both 2022 and 2023 post-calving in the pen, with clostridium believed to be a potential factor in each case. Due to the frequent use of the Bickford pen and lowering snow conditions, there was suspected to be an increased risk of clostridium infection and death post-calving for both cows and calves. These incidents spurred the decision to introduce vaccination as an added layer of protection against the bacteria. By way of example, clostridium vaccination are standard practice for cattle health across Canada. The initial vaccination dose was given at the time of capture, followed by a booster on April 12, 2024. This timing was chosen to ensure the booster was administered three to four weeks before calving, providing passive protection to the newborn calves. Following these actions, no cows died during calving.

CALVING

Blood PSPB levels indicated that 20 of the 20 penned cows with samples were pregnant (range: 0.537 – 0.733). One captured cow did not get a blood sample taken. The cow that died shortly after capture was pregnant, and 3 other pregnant cows had abortions before calving. One cow that aborted was 2 years old, and the other two were approximately 5 years old. It is not unexpected for a young cow to abort her first pregnancy. Necropsy results from one of the other stillborn calves indicated a small hole in the calf's skull. The increased pressure inside the skull, due to hydrocephalus, may have caused the calf to be stillborn.

On May 14, 2024, a free-ranging cow (C372K) was 'captured' and brought into the pen. This cow had previously been in the Bickford maternity pen in both 2022 and 2023. She was visibly pregnant and was seen walking between the two electric fences for several days before the Pen Guardians were able to open a door to allow her to safely and voluntarily enter the pen. We took this course of action due to the risk of her calving between or near the electric fences, which could have posed a threat of injury or predation. Three days later, she gave birth to a healthy male calf. She will not be included in the below metrics, as we knew she was pregnant when we decided to let her in the pen, creating a non-random sample while the other caribou captured for the pen are theoretically chosen at random. The Pen Guardians transitioned this cow's diet from lichen to pellets outside the pen to minimize disruption to the feeding schedule of caribou already inside.

Excluding the caribou who entered the pen (C372K), 17 pregnant cows delivered a calf, born between May 13th to June 3rd, 2024. The successful parturition of penned, pregnant cows alive at the time of calving was 85% (n=17/20). There were 18 calves born (12 ♂, 6 ♀), with one caribou giving birth to a set of twins. One of the twin calves died 5 days after birth, which is not unexpected. Given the death of one twin calf, the observed post-partum calf survival in the pen at the end of July was 95% (n=18/19). This statistic includes both twins and the calf born to the cow who entered late, since this statistic represents the post-partum calf survival rate. The total proportion of calves per cow at the end of the penning period was 85% (n=18/21); the latter discounting the one cow that died before release but accounting for the 3 cows that had abortions, the caribou who entered the pen late and her calf, as well as the one calf that died shortly after birth.

There was no population survey conducted in the summer of 2024, therefore, the number of wild calves born and then surviving until March 2025 is unknown.

RELEASE

On July 30th, 2024, we released 21 cows and 18 out of the 19 calves that were born in the pen. All daily observation sheets for the penning period (n = 141 days) were properly completed and filed. An example of a completed sheet is presented in Appendix B. There were very few unplanned visits made by members of the public to the Mt. Bickford site during penning. All visitors were informed of the need for minimal disturbance to the penned caribou, and all of them congenially agreed to keep disturbance to a minimum.

LINFITT PEN BUILD

As per our recommendations in the 2024-25 Annual Report (McNay et al. 2024), a new pen site was built in the fall of 2024 for the 2025-26 penning season. This new pen site is located up the Callazon Creek FSR at ~1090m asl, and the 14ha pen is the largest to date. This site was specifically chosen to initiate the spread of caribou across the entire herd range and hopefully recruit caribou to relocate into the Scott East area post-capture.

EFFECTIVENESS

SURVEY RESULTS

Sex & Age Structure – In the March 2025 population survey, we observed 15 calves from the 21 penned cows. Three calves born in the pen were not ear-tagged. Two out of the 15 pen calves seen on the survey have been inferred to be pen calves as they were at the heel of a pen cow who had a calf that was not ear-tagged and was the correct sex. The third tagless pen calf could have been seen and not identified during the survey. We observed 15 calves from the 29 free-ranging cows (the 16 collared cows, 4 marked cows, plus 9 unmarked cows), for a total of 30 calves from 50 cows, an overall ratio of 0.6 calves/cow (Table 1). Calves made up 17% of the total observed population, and the bull-to-cow ratio was 69 bulls: 50 cows (1.38:1).

Minimum Count – We observed 50 adult female cows, 69 adult males, 30 juveniles (14 ♂, 16 ♀), and 30 calves (18 ♂, 12 ♀), for an overall minimum count of 179 caribou (Figure 2 and Table 2).

Population Estimate – The population estimate using the mark-resight approach was 187 (CI = 11.42):

- There were 48 marked caribou in the population (m_1) at the time of the survey

  - 41 GPS collared adult caribou (5 bulls + 20 penned cows + 16 free-ranging cows)
  - 7 GPS/VHF collared calf caribou
- 45 collars were found without the use of telemetry (m_2) for sight ability in the survey, equal to 94%
- The total number of caribou seen without telemetry was 175 (n_2), so the estimate of caribou in the survey unit was 187 (N = (48*175) / 45) ± 11.42.
- 2 collars were located using telemetry (Table 2), and while doing so, we counted a total of 4 additional caribou (Table 2).

TABLE 1. PARAMETERS USED TO EVALUATE THE EFFECTIVENESS OF A MATERNITY PEN TO PROTECT CARIBOU COWS AND THEIR CALVES FROM MARCH TO AUGUST, KLINSE-ZA CARIBOU POPULATION, NORTHERN BRITISH COLUMBIA, 2024-2025.

		Caribou cohort	
	Data Stratum	Penned	Free-ranging
(A) Natal and Survival Rate (a)	Number of radio-collared adult cows	20	16
	Number of radio-collared adult males	0	5
	Number of radio-collared yearlings	0	7
	Number of collared mortalities	1	6
	Number of collared yearling mortalities	0	0
	Collared adult survival	0.95	0.79
	Collared adult mortality (pen & free-ranging pooled)	15%	
	Pregnancy	1	
	Parturition (b)	0.86	
	Calf / cow next March (c)	0.71	0.37
	Number added to population (d)	14	
(B) Population Survey	Number of cows		50
	Number of males		69
	Number of unknown adults		0
	Number of yearlings		30
	Number of calves		30
	Total (observed)		179
	Total (estimated from mark-resight)		187
	Total (calculated from known births and deaths) (e)		182
	Known immigration		0
	Known emigration		0
	Calves / cow		0.6
	Calves (% of population)		17%
	Bull:Cow		1.38:1

a - unless noted otherwise, calculations in this section are based on collared animals only
b - 18 calves were observed from 21 pregnant, penned cows. This calculation does not include one pregnant penned cow that died prior to calving, 1 account for the twin calves, and includes the cow who entered the pen prior to calving
c – calculated separately for penned and free-ranging caribou as the number of calves seen divided by total number of live collared cows
d – calculated as the number of penned calves in March2025 – number of known non-calf death from the pen 2024/2025
e – calculated as N2024 + number of calves in March2025 – number of known no -calf deaths 2024/2025

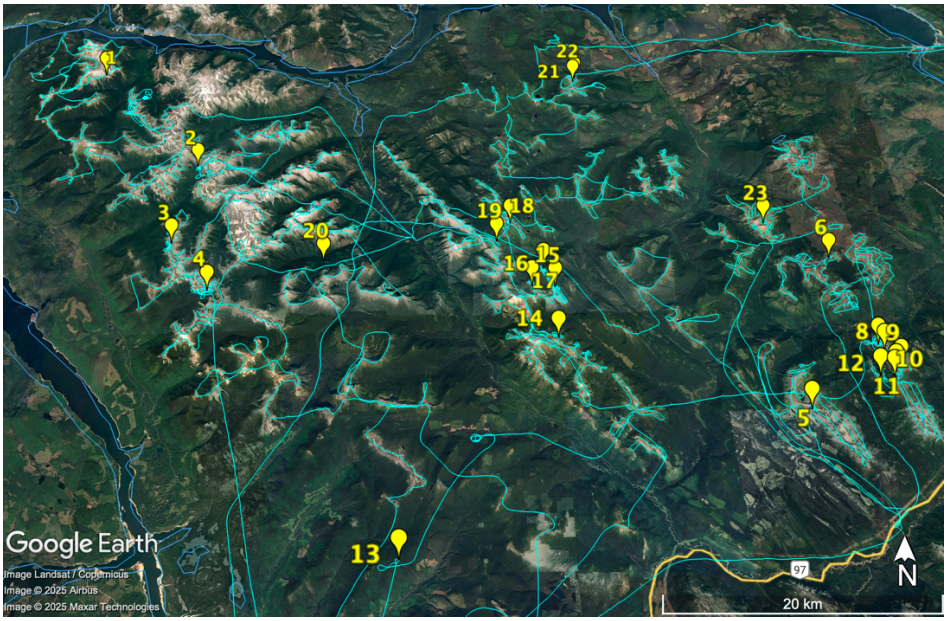

FIGURE 2. FLIGHT LINES (BLUE) AND OBSERVATIONS (YELLOW) OF CARIBOU GROUPS MADE DURING AN AERIAL SURVEY OF THE KLINSE-ZA CARIBOU POPULATION IN NORTHERN BRITISH COLUMBIA, MARCH 2025. CARIBOU GROUP SIGHTINGS (YELLOW) ALIGN WITH OBSERVATIONS (OBS.) PRESENTED IN TABLE 2.

TABLE 2. OBSERVATIONS OF CARIBOU, GROUP NUMBERS, AND SEX/AGE CLASS IN THE KLINSE-ZA CARIBOU POPULATION IN NORTHERN BRITISH COLUMBIA, MARCH 2025. OBSERVATIONS (OBS.) ALIGN WITH THOSE IN FIGURE 2.

Obs.	Observation Type	Adult male	Adult female	Juvenile male	Juvenile female	Penned calf	Free-ranging calf	Total
1	Telemetry		1				1	2
2	Visual	1	1		3		1	6
3	Visual		4				1	5
4	Visual	3						3
5	Visual	2	1			1		4
6	Visual	2	1			1		4
7	Visual	1	5	2	1	3	1	13
8	Visual	3	5		1	1		10
9	Visual	4	3	2	3	1		13
10	Visual	2	6	4	1	2	3	18
11	Visual	6						6
12	Visual	3						3
13	Telemetry	1	1					2
14	Visual	5						5
15	Visual	2	1		1		1	5
16	Visual	4	2	2	2	1	1	12
17	Visual	4	4	1	1	2	2	14
18	Visual	6	3	1		1	1	12
19	Visual	3						3
20	Visual	7						7
21	Visual	4						4
22	Visual	3	8	2	3		3	19
23	Visual	3	4			2		9
Total		69	50	14	16	15	15	179

Population Trend - The Klinse-Za population trend in the past year has had positive growth similar to the previous years since maternal penning and removal of wolves began in 2013 (Table 3). The population growth rate (Nt/Nt-1) observed in the March survey was 1.18. The 3-year geometric mean of per capita growth (1.18) in 2025.

TABLE 3. POPULATION SIZE, ANNUAL POPULATION GROWTH RATE, AND 3-YEAR GEOMETRIC MEAN

Year	Minimum count	Population estimate	Population count	Population growth rate (lambda)	3-Year geometric mean
2013	36	NA	36		
2014	40	NA	40	1.11	
2015	42	NA	42	1.05	1.08
2016	54	NA	54	1.29	1.14
2017	61	NA	61	1.13	1.15
2018	66	NA	66	1.08	1.16
2019	81	NA	81	1.23	1.14
2020	85	NA	85	1.05	1.12
2021	101	101	101	1.19	1.15
2022	114	111	114	1.13	1.12
2023	132	127	132	1.16	1.16
2024	159	154	159	1.20	1.16
2025	179	187	187	1.18	1.18

EXTENSION AND REPORTING

During the 2024-2025 fiscal year, we expanded the maternity penning project through both local and broader outreach efforts. The Nîkanêse Wah tzee Stewardship Society connected with the Saulteau First Nations community by hosting a booth at their open house on June 18, 2024. In addition to this community engagement, more technical presentations were delivered at the following venues:

- July 17, 2024 - Aseniwuche Winewak First Nations
- October 27, 2024 - Healing the Land conference
- January 1, 2025 - Braiding Knowledges Canada
- February 12, 2025 – BC Parks

Field tours of the pen site were conducted

- June 21, 2024 - HCTF
- June 29, 2024 – Mackenzie Community Arts Council
- July 10, 2024 – BC Parks
- July 16, 2024 – BC Government Biologists
- July 18, 2024 – Aseniwuche Winewak Nation and Nîkanêse Wah tzee Stewardship Society Board of Directors members
- July 23, 2024 – Aski Reclamation
- July 27, 2024 – West Moberly First Nation

Due to the collaborative nature of this project between West Moberly First Nations and Saulteau First Nations; we hold regular internal meetings and written communications. Ten meetings took place between April 2024 and March 2025 (240417, 240515, 240619, 240717, 240828, 240925, 241023, 241209, 250129, and 250226) and three written newsletters were shared with close project supporters and stakeholders (240403, 240717, and 241127).

Annual reporting has been completed and sent to sponsors of the project. A caribou survival analysis is underway and a paper for peer-review is being drafted for submission by the end of the year.

DISCUSSION

The Klinse-Za caribou population decline has been arrested through recovery actions (maternity penning and wolf removal) during the past 11 years. The population trajectory has been positive since the implementation of the management measures began, and there has been an observed population growth of 143 animals. While there has been an overall increase in animals, we consider the stable/increasing population trend to still be dependent on recovery actions – without these measures, the population would not be likely to continue increasing. Habitat loss, via disrupted disturbance-meditated apparent competition, is likely the underlying cause of this population decline, and the loss has not been sufficiently addressed to discontinue the management measures.

There were eight known caribou mortality events this past year. There was one known calf death in the pen, with one twin calf dying five days after birth. One adult cow death that was potentially pen-related and six adult cow deaths in the wild. Of the six adult cow deaths in the wild, two cow deaths seemed to be related to natural causes, and another two cows died from the combination of injuries and predation. The last two mortalities were bulls, the first bull mortalities since collaring males in 2021. Both bulls' deaths are assumed to be related to rutting-caused injuries and exhaustion, with detailed necropsy results to come.

Over the 11 years (2014-2024) of penning and 167 capture events, we have had one death directly related to a net-gunning incident during capture (<0.5%). Four other mortalities have occurred shortly after capture in March, and their deaths were thought to be linked to capture (n=2) or pen-related effects (n=2, see Table 4). Health-related causes of death shortly after capture are believed to be linked to capture myopathy or the stress of capture exacerbating existing diseases such as pneumonia. Acceptable rates of capture-related myopathy from net gunning are typically <5% and ideally are 2% or less. Large-scale studies of capture myopathy from net gunning medium-sized ungulates such as mule deer, white-tailed deer, pronghorn, and bighorn sheep report myopathy rates between 1.4-10% (Firchow 1986, Webb 2008, Jacques 2010, Wagler 2021, Van de Kerk 2020). For larger-bodied animals, Wittmer 2004 reported direct capture myopathy rates of <1% for the southern group of mountain caribou, while Carpenter and Innes 1995 reported moose with direct and immediate post-release capture myopathy was ~8%. Our project falls within these acceptable limits for free range capture, with three out of the five direct and post capture deaths related to capture-specific causes (1.8% of the 167 captures).

TABLE 4. SUMMARY OF DIRECT AND INDIRECT CAPTURE MORTALITIES FROM THE 167 CARIBOU CAPTURED FOR THE MATERNAL PEN FROM 2014-2024. HEALTH-RELATED CAUSES OF DEATH ARE ASSUMED TO BE LINKED TO CAPTURE MYOPATHY AS THESE OCCUR SHORTLY AFTER CAPTURE (~ WITHIN 2 WEEKS).

Mortality Summary			
Date	**Caribou**	**Cause**	**Capture or Pen related**
2016-03-26	C351K	Health-related	Likely capture
2019-03-20	C360K	Choking (feed transition)	Pen
2020-03-10	C348S	Net-gun injury	Capture
2022-06-12	C439S	Likely Clostridium	Pen
2023-06-20	C356K	Likely Clostridium	Pen
2023-03-15	C482K	Health-related	Capture
2024-03-24	C525S	Health-related and feed transition	Pen

While the risks and acceptable rates of capture myopathy are well known, there is less known about temporarily holding wild caribou in captivity for ~5 months as we do in the pen. Throughout our now more than a decade of maternal penning there have been multiple lessons that have led to improvements in husbandry approaches. Two notable risks of captivity have emerged—the feed and the risk of clostridium infection. We have had mortalities related to choking on feed pellets (2019) and the timing of feed transition (2024). In response to the 2019 mortality, we switched feed suppliers and started including small wood blocks in feeding troughs to reduce the rate at which caribou can consume the food. We had two adult cows die in 2022 and 2023, one in each year, from a possible clostridium infection. Although we can not conclusively determine this to be the cause, we took proactive efforts through vaccinating the penned cows at capture, followed by a booster before calving. This mitigation effort paid off with a successful calving season in 2024.

The one pen calf that died and three miscarriages add to the growing understanding of the spectrum of unexplained deaths from apparent miscarriages through the first two trimesters, pre- and full-term stillborn calves in the last trimester, and those that die soon after birth. Over the past 11 years, we have seen a number of these observations both in and out of the pen. Such deaths are not unexpected in the cattle industry, but they were not our focus at the beginning of the penning project. We have investigated these deaths more in depth via detailed necropsy and laboratory analyses of samples (Dubman et al., 2024). No consistent causes of death have emerged.

Despite wolf removal efforts, free-ranging calves continue to die from predation by either bears or wolverines, with the specific cause seemingly dependent on the timing of snow melt. However, the number of free-ranging calves born annually is now double what it was at the beginning of the program, and we think that growth is potentially contributing to increasingly greater survival rates of the free-ranging cohort. We are investigating this in more depth and will be reporting out on the observations through a focused, separate manuscript. The overall increase of adult females in the herd since the beginning of maternity penning was originally slow due to a skewed birth ratio towards male calves. Other factors that could contribute to such uneven population growth in early years include a higher mortality of relatively older adult females, compared to the mortality rate of the relatively young males added to the population. The young males in the population may not have been exposed to the same mortality pressures that older, more mature bulls naturally undergo (e.g., accidents from fighting in the rut, energy drain during the rut leading to a higher susceptibility

to predation, or subsequent exposure to other mortality factors, etc.) but we expect this may begin to occur which, if it does, could limit population growth in future years. The skewed birth ratio of early years is now beginning to turn in favour of females, we think, because the age structure of the reproductive population is much younger (i.e., older cows giving birth to mostly male calves and the opposite for younger cows).

The maternal pen is an invasive management action, but it is working to increase the population size of Klinse-Za caribou. Even in light of the capture and pen-related mortalities discussed above, the survival of adult females and calves is higher due to the pen. In other words, it's riskier for the Klinse-za caribou not to be penned, then to be penned.

Our calculated population estimate (187) is presumably quite accurate given the observed minimum count of 179 animals and that we saw 45 out of the 48 collared caribou without telemetry (94% sight ability).

CONCLUDING THOUGHTS

We think that maternity penning, although an intrusive management measure, is highly effective when used in conjunction with other management practices in cases similar to the Klinse-Za caribou. Wolf removal and maternal penning averted imminent herd extirpation in the Klinse-Za herd in 2014, and to present day, has brought the herd to a population estimate of 187. Maternal penning is unlikely to have the same return on investment in caribou populations that are less at risk of extirpation – where less invasive management measures such as habitat recovery and predation removal may be effective enough.

Specific to penning operations, pen areas should be large enough to accommodate a large number of reproductive females, at least 25%, and located where a 'soft release' allows animals to return to their alpine habitat with relative ease. That said, in such emergency situations as the Klinse-Za (i.e., steeply declining, small populations), sponsors appear willing to support maternity penning as a recovery measure, whereas we speculate they might not be as willing to support other recovery measures to the same level. Given the current demographic statistics, there appears to be sufficient rationale to continue the maternity pen operation in the Klinse-Za. As the population has grown, we have been successful at keeping pace with penning ~50% of adult cows and avoiding diminishing returns from the pen. At some point in the future, we will end up penning <50% of the adult females and will continue to address the viability of the pen based on demographic contributions.

RECOMMENDATIONS

We recommend continuing maternity pen operations in 2025 based on the demographic parameters presented here. In addition to our regular and well-established penning and effectiveness monitoring protocols, we will be undertaking the following progressive actions during the 2025-26 operations:

- Continue efforts to monitor the health of individual caribou with specific attention to how maternity penning may influence the overall health of the population.
- Vaccinate against clostridium infections at capture, followed by a booster before calving.

- Begin activities to decommission the Bickford pen site to set the vegetation trajectory on a path towards pre-penning conditions.
- Assess possible correlates of calf sex ratio in Klinse-Za Pen, and perhaps other pens (Nakusp, Revelstoke, and Chisana)
- Continue to work towards a long-term future for Klinse-Za caribou, which includes habitat restoration activities (linear and polygonal) and science on the effects of these actions on the predator-prey community

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APPENDIX A. Commercial Caribou Pellets

15% CARIBOU PELLETS
(For Caribou)

INGREDIENTS:

Barley, Wheat, Corn
Faba beans, Soybean meal
Molasses
Canola oil
Limestone, Salt, Dical
HP Mineral Mix(Wheat, Millrun, Canola oil, Copper Sulfate, Zinc Oxide, Calcium Carbonate, Iodine, Manganeous Oxide, Selenium, Cobalt)
HP Fortifier(Wheat, Millrun, Canola oil, Copper Sulfate, Zinc Oxide, Calcium Carbonate, Iodine, Manganeous Oxide, Iron Sulfate, Calcium Pentothenate, Selenium, Santoquin, Biotin, B-Traxim, Niacin, Folic Acid, Vitamin A, Vitamin B1, Vitamin B2, Vitamin B6, Vitamin B12, Vitamin D, Vitamin E, Vitamin K3)
Vitamin A, D, E, Vitamin E
Choline chloride
MAG OX, Dyna-Mate

INGREDIENTS: A list of ingredients used in this feed may be obtained by the manufacturer or registrant.

This feed contains added selenium at 0.4 mg/kg.

GUARANTEED ANALYSIS: Crude Protein (min) 15.0%; Crude Fat (min) 2.0%; Crude Fibre (max) 6.0%; Calcium (act) 1.00%; Phosphorus (act) 0.90%; Sodium (act) 0.25%; Potassium (act) 0.83%; Magnesium (act) 0.20%; Sulfur (act) 0.20%; Iron (act) 400 mg/kg; Iodine (act) 1.3 mg/kg; Copper (act) 25 mg/kg; Manganese (act) 100 mg/kg; Zinc (act) 191 mg/kg; Cobalt (act) 0.40 mg/kg; Vitamin A (min) 15,000 I.U./kg; Vitamin D (min) 2,000 I.U./kg; Vitamin E (min) 100 I.U./kg; Thiamin (min) 5.3 mg/kg; Riboflavin (min) 8.2 mg/kg; Niacin (min) 72 mg/kg; Vitamin B_6 (min) 14 mg/kg; Biotin (min) 0.28 mg/kg; Pantothenate (min) 28 mg/kg; Choline (min) 1,500 mg/kg; Folate (min) 4 mg/kg; Vitamin B_{12} (min) 0.02 mg/kg.

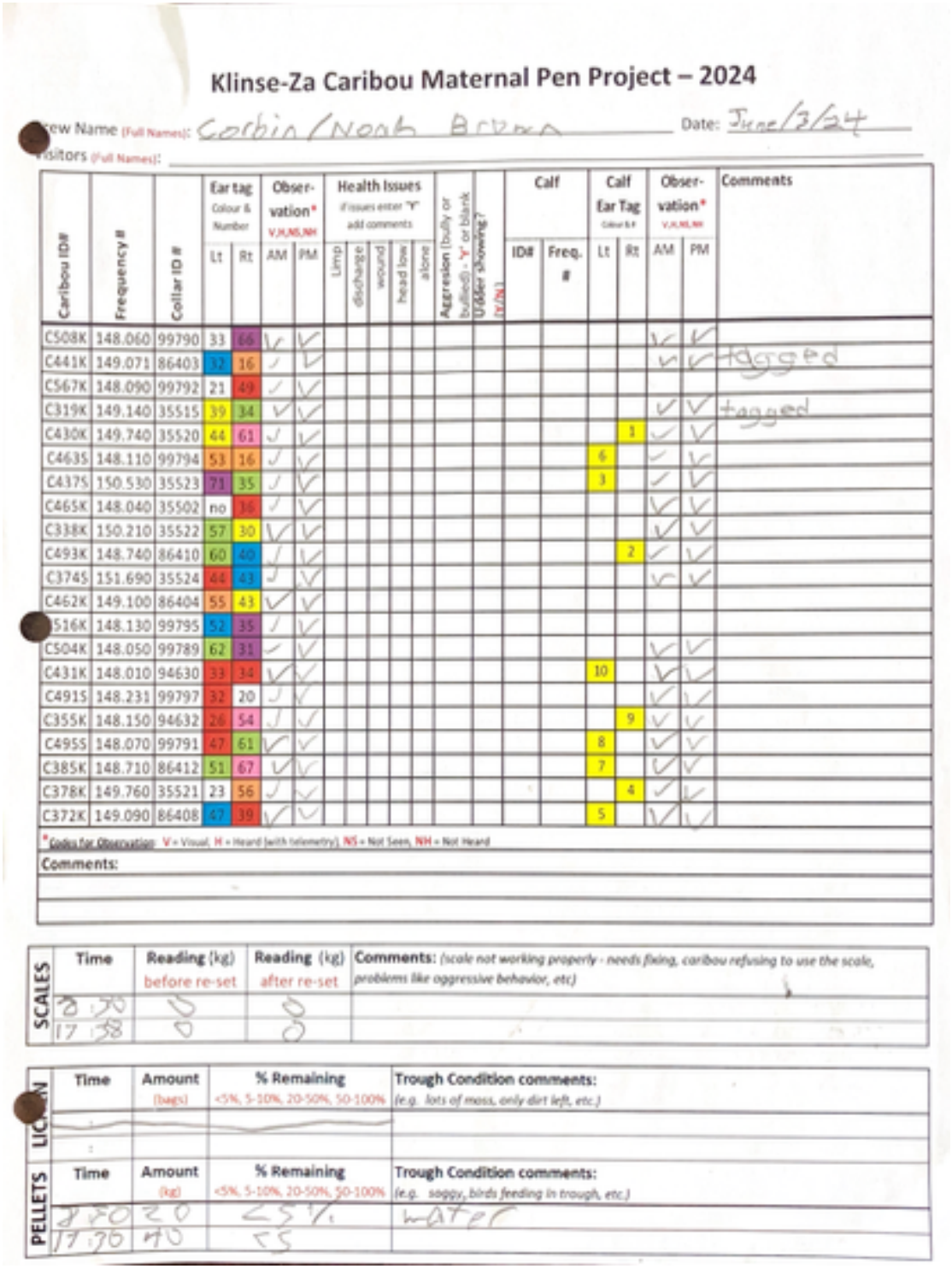
FEEDING INSTRUCTIONS: Feed Caribou Pellets to Caribou when they are on tundra. Provide Hi-Pro Mineral and salt free choice and provide fresh water.

CAUTION:
1. Directions for use must be carefully followed.
2. Do not feed in association with another feed containing supplemental selenium.

Individual results from the use of this product may vary due to management, environment, genetics, health and sanitation differences. Therefore, Hi-Pro Feeds does not warrant or guarantee individual results.

Net Weight 20 KG

APPENDIX B. Maternity Pen Daily Records Example



Klinse-Za Caribou Maternal Pen Project – 2024

Crew Name (Full Names): Corbin / Noah Brown Date: June/3/24

Visitors (Full Names):

Caribou ID#	Frequency #	Collar ID #	Ear tag Colour & Number Lt	Ear tag Colour & Number Rt	Observation* V,H,NS,NH AM	Observation* V,H,NS,NH PM	Health Issues (if issues enter "Y" add comments) Limp	discharge	wound	head low	alone	Aggression (bully or bullied) - 'Y' or blank	Udder showing? (Y/N)	Calf ID#	Calf Freq. #	Calf Ear Tag Lt	Calf Ear Tag Rt	Observation* AM	Observation* PM	Comments
C508K	148.060	99790	33	66	V	V												V	V	
C441K	149.071	86403	32	16	V	V												V	V	tagged
C567K	148.090	99792	21	49	V	V														
C319K	149.140	35515	39	34	V	V												V	V	tagged
C430K	149.740	35520	44	61	V	V											1	V	V	
C463S	148.110	99794	53	16	V	V										6		V	V	
C437S	150.530	35523	71	35	V	V										3		V	V	
C465K	148.040	35502	no	38	V	V												V	V	
C338K	150.210	35522	57	30	V	V												V	V	
C493K	148.740	86410	60	40	V	V											2	V	V	
C374S	151.690	35524	44	43	V	V												V	V	
C462K	149.100	86404	55	43	V	V														
C516K	148.130	99795	52	35	V	V														
C504K	148.050	99789	62	31	V	V												V	V	
C431K	148.010	94630	33	34	V	V										10		V	V	
C491S	148.231	99797	32	20	V	V												V	V	
C355K	148.150	94632	26	54	V	V											9	V	V	
C495S	148.070	99791	47	61	V	V										8		V	V	
C385K	148.710	86412	51	67	V	V										7		V	V	
C378K	149.760	35521	23	56	V	V											4	V	V	
C372K	149.090	86408	47	39	V	V										5		V	V	

*Codes for Observation: V = Visual, H = Heard (with telemetry), NS = Not Seen, NH = Not Heard

Comments:

SCALES	Time	Reading (kg) before re-set	Reading (kg) after re-set	Comments: (scale not working properly - needs fixing, caribou refusing to use the scale, problems like aggressive behavior, etc)
	8:20	0	0	
	17:58	0	0	

LICKEN	Time	Amount (bags)	% Remaining <5%, 5-10%, 20-50%, 50-100%	Trough Condition comments: (e.g. lots of moss, only dirt left, etc.)

PELLETS	Time	Amount (kg)	% Remaining <5%, 5-10%, 20-50%, 50-100%	Trough Condition comments: (e.g. soggy, birds feeding in trough, etc.)
	8:20	20	<5%	water
	17:20	40	<5	

DISTURBANCE

Time	Event *	Location **	Comments: *(any actions taken?)*
9:02	vehicle	pen road	drove to cutblock
:			
:			
:			

*Codes for Event: Aircraft – Visitors (expected) – Public (unexpected) – Trucks – Sleds – Quads – Big wind storm – Rainstorm – Tree falling, etc...
**Codes for Location: Camp – Pen – Road (which km?) – Alpine – etc...

PEN PERIMETER WALK-AROUND

Section #	Time	Snow Inside * ✓, X, F	Snow Outside * ✓, X, F	Electric Fences "Inside" * ✓, X, F	Voltage "Inside" (min 6 kV)	Electric Fences "Outside" * ✓, X, F	Voltage "Outside" (min 6 kV)	Geo * ✓, X, F	Veg * ✓, X, F	Comments: *Describe the problem(s) and indicate if it is "Fixed" or not and if not when it will be fixed (hole, wire short, broken wire, vegetation touching the wire tree on the fence, etc.)*
	8:30	✓	✓	✓	9.3	✓	7.4	✓	✓	
	18:00	✓	✓	✓	9.5	✓	8.0	✓	✓	
	:									
	:									
	:									

*Codes: ✓ = Checked & in good standard; X = Need attention; F = Fixed

PREDATOR CONTROL

Time	Species	Sign (Tracks, Scat, Visual)	Location (Pen, Camp, Road, Cutblock)	Actions (what did you do?): Note: if no predators or predator sign seen, WRITE DOWN "No predator sign and no action needs to be taken"
8:30			pen	NO pred signs
18:00			pen	NO pred signs
:				
:				
:				
:				
:				

CAMERA

:				

WEATHER

Time	Max Temp °C	Min Temp °C	Wind *	Precipitation Snow, Rain, Fog, Dry, Windy	Comments:
:				Rain	

*Codes for Wind: 0 = calm, 1 = light air, 2 = light breeze, 3 = gentle breeze, 4 = moderate breeze, 5 = fresh breeze, 6 = strong breeze

GENERAL COMMENTS and OTHER NOTES:

Tagged Last 2 calves
Switched sd cards
Switched battery's on stump cam

Wildlife Infometrics Inc.

Updated March 18, 2024