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PARSNIP CARIBOU RECOVERY TRIAL – REPORT ON ACTIVITIES DURING 2008-2009

R.W. Steenweg, D.C. Heard and M.P. Gillingham
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ABSTRACT

Mountain caribou (*Rangifer tarandus caribou*) are endangered across their range and the primary proximate cause of mortality is predation. In the Parsnip study area, mountain caribou select for high-elevation habitats, while moose (*Alces alces*) densities are highest in valley bottoms and along the Parsnip River plateau. Wolves (*Canis lupus*) spend most of their time in these valley bottoms, but occasionally make forays to high-elevation areas where caribou are present. The Parsnip Caribou Recovery Project is testing an intermediate-term approach to caribou recovery. By liberalizing moose hunting regulations we are examining whether hunters will reduce moose numbers and decrease the moose population densities, thus supporting a smaller wolf population and reducing the predation impacts on caribou. This project was initiated by the Ministry of Environment in 2005/2006 with moose density surveys conducted in the Parsnip (treatment) and Wolverine (control) areas in December 2005 and January 2006. In 2006, moose hunting quotas were increased and have been subsequently maintained at higher than pre-2006 levels. To evaluate the effectiveness of this approach, moose, caribou and wolf populations have been monitored since 2006/2007. This report documents activities and results during the reporting period of 1 April 2008 through to 31 March 2009. The moose population was estimated to be 1800 moose with a sex ratio of 48 bulls:100 cows and a calf-cow ratio of 21 calves:100 cows. Four collared moose died during 2008/2009: 2 were shot by hunters and 2 died from unknown causes. The caribou population was estimated to be 184 caribou (95% CI 159-243) with 12% calves. Over-winter calf survival is high and much higher than over-summer calf survival. One collared caribou has died due to unknown, but non-wolf-related causes. Three collared wolves have died; one was shot by a hunter, one was kicked by a moose and one died of unknown causes. Preliminary analyses of telemetry data suggest that wolves spent little time at caribou-selected elevations from June to September (7-13% of time/month) and are virtually absent during snow-covered months (≤3%). Investigation of GPS-point clusters suggest that predation by wolves on caribou is low and much time spent by wolves at higher elevations may still be spent hunting moose.

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1.0 INTRODUCTION

Mountain caribou (*Rangifer tarandus caribou*) are the southern most of 2 ecotypes of woodland caribou within the Williston Reservoir Watershed. They reside almost exclusively in the interior wet belt of British Columbia (BC) (Heard and Vagt 1998), ranging from the central BC Rockies to the northern tip of Idaho. Mountain caribou are listed federally as threatened (COSEWIC 2002) and are provincially red-listed (BC Conservation Data Centre 2008). The current population estimate is approximately 1907 caribou with 12 of the 16 sub-populations at >50% risk of extirpation within 20 years (Hatter 2006).

Predation is the primary proximate cause of caribou mortality (Bergerud and Elliot 1986, Seip 1992, Hatter 2000, Wittmer et al. 2005a,b). Common predators include: grizzly bears (*Ursus arctos*), wolves (*Canis lupus*), cougars (*Felis concolor*), wolverines (*Gulo gulo*) and golden eagles (*Aquila chrysaetos*); wolves have been singled out as a major predator (Wittmer et al. 2005b). Increased densities of moose (*Alces alces*), deer (*Odocoileus* spp.), and elk (*Cervus canadensis*) have occurred due to increases in the abundance of early seral-stage forests resulting from logging (Hatter 1950, Wallmo 1969, Spalding 1992, Rempel et al. 1997, Rettie and Messier 1998). This has in turn created a larger prey base for predators such as wolves and cougars, increasing their densities (Messier et al. 2004). This shift in predator numbers is thought to have increased the opportunistic preying of caribou by wolves and cougars.

Caribou recovery may require management action at 3 separate temporal scales (Seip 2005). In the short-term, predator control and/or caribou transplantations may be needed to augment smaller more at-risk herds in southern BC. At the largest time scale, landscape management of early seral-stage forests is needed to reduce the densities of primary prey for caribou-predators. The Parsnip Caribou Recovery Project is testing an intermediate-term approach to caribou recovery. By liberalizing moose hunting regulations we are examining whether hunters will reduce moose numbers and decrease the moose population densities, thus supporting a smaller wolf population and reducing the predation impacts on caribou.

1.1 Project Background

This project was initiated by the Ministry of Environment in 2005/2006 with moose density surveys conducted in the Parsnip (treatment) and Wolverine (control) areas in December 2005 and January 2006. In fall 2006, moose hunting quotas were increased in the Parsnip study area and have been subsequently maintained at higher than pre-2006 levels. To evaluate the effectiveness of this approach to caribou recovery, we have maintained collars

on caribou and moose in order to monitor their populations. Wolves have been collared with VHF and GPS-collars in order to analyze wolf movements into caribou habitat and assess the diets of wolves.

1.2 Project Objectives

The overall objectives of the Parsnip Caribou Recovery Project are unchanged from 2007/2008 (Gillingham et al. 2008): our work focuses on assisting with the recovery of threatened caribou populations in the Southern Mountains National Ecological Area by evaluating the feasibility of increasing the Parsnip Caribou Herd population by reducing moose numbers in the area (using increased hunter harvest), which would result in fewer wolves and less predation on caribou. Specifically, the project is designed to:

- evaluate the feasibility of increasing the population of the Parsnip mountain caribou herd by reducing wolf predation through a reduction in area moose numbers;
- significantly increase caribou numbers, adult survival, and calf recruitment in the Parsnip mountain caribou herd relative to previous population parameters and a control population; and
- assist with the recovery of threatened caribou populations in the Southern Mountains National Ecological Area (the Recovery Plan objective is to increase caribou numbers in the Hart and Cariboo Mountains to >2000).

1.2.1 Goals for 2008/09

For the reporting period of 1 April 2008 through to 31 March 2009, our specific goals were:

- determine caribou and moose population size and composition;
- capture animals as necessary to maintain a collared sample of caribou and wolves;
- monitor moose hunter kill and make any necessary adjustments to hunting quota;
- monitor wolf movements, including forays to caribou habitat, denning site locations, GPS clustered kill sites, and investigation of these locations in the field; and
- investigate wolf diet through scat collection and isotope analysis of hair and blood samples from wolves

2.0 METHODS

Throughout the year, all VHF and GPS collars on moose, caribou, and wolves were monitored for survival. During January-March, Ministry of Environment personnel collared

wolves and caribou with VHF and GPS collars in order to increase the number of collared animals and replace collars that were dropped, lost or had been removed from animals that have died.

2.1 Moose

In order to encourage an effective moose-harvest rate by hunters, the 2008 moose-hunting quota in the Parsnip study area was changed from 2007. In an attempt to reduce crowding and increase hunter efficiency, the cow season was split and lengthened, the open calf season was lengthened, and the bull season was split and lengthened in selected WMU subzones. The total number of permits remained the same.

The 23 moose radio-collared moose were monitored for survival every 3 months by fixed wing (Guardian Aerospace, Vanderhoof, BC). Due to high survivorship, no further collaring was needed during this reporting period. To estimate moose density, sex and cow-calf ratios, an aerial moose survey was conducted between 11-16 December 2008 following a stratified-block design also used in previous surveys in this area (Gasaway et al. 1986, Heard et al. 1999, Walker et al. 2006). Radio-collared moose were used to estimate the sightability correction factor during this mark-resight survey (Bartmann et al. 1987). Collared-moose mortalities were investigated in the field to determine cause of death.

2.2 Caribou

As of 1 April 2008, 17 caribou had VHF collars in the Parsnip study area. Radio-collared caribou were monitored every 2 weeks by fixed-wing aircraft for survival (Guardian Aerospace, Vanderhoof, BC). Between January and February 2009, an additional 8 VHF collars were deployed on female caribou by the Ministry of Environment using a net gun from a Bell 206 helicopter (Altoft Helicopters, Prince George, BC).

A caribou calf count was performed by helicopter on 28 October 2008 to estimate the cow-calf ratio and compare over-summer and over-winter calf survival. During this survey (Figure 1), we listened for all radio-collared caribou from a Bell 206 Helicopter (Altoft Helicopters, Prince George, BC), visually located them, and recorded group size and composition. Caribou pregnancy rate is assumed to be high, as it has been shown to be high across their entire range (92.4% ± 2.24, n=134; Wittmer et al. 2005b).

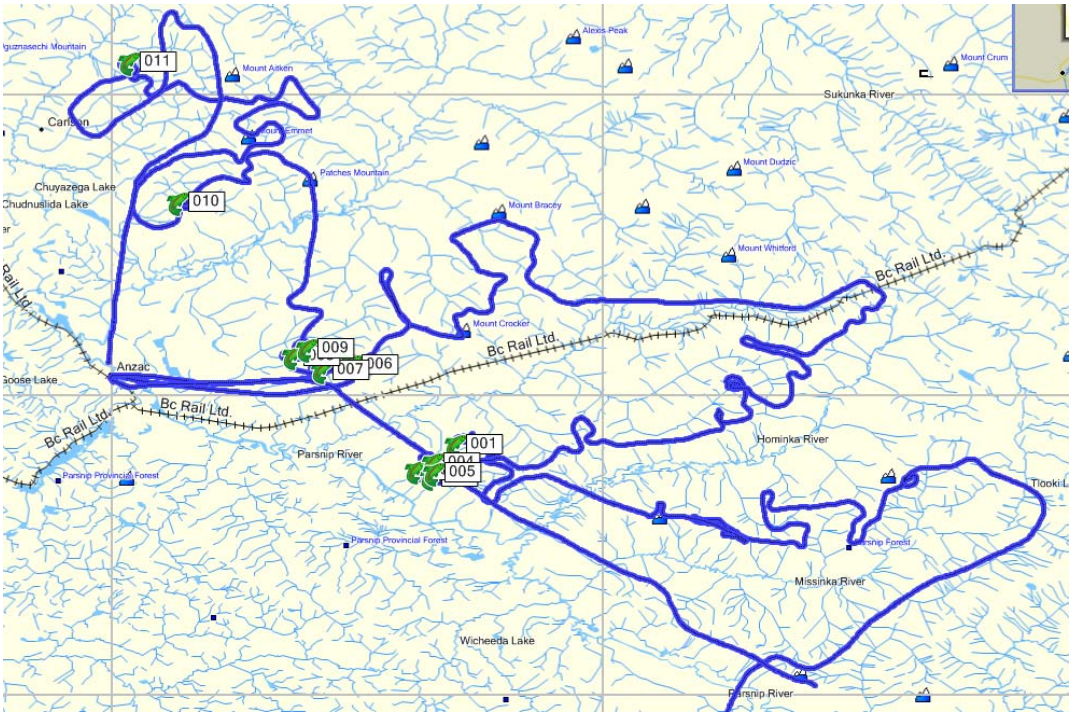

Figure 1. Flight line of 28 Oct 2008 caribou calf-count in Parsnip River study area, BC. Waypoints (numbered rectangles) show collared caribou that were visually located.

A spring caribou census was performed as part of the greater BC Mountain Caribou Recovery Implementation Plan (Seip 2005). The purpose is to estimate the total caribou population within the study area and estimate the cow-calf ratio. Following the standard protocol for mountain caribou census (Wittmer et al. 2005a), we surveyed all subalpine habitat in the study area by helicopter on 26, 27, and 29 March 2009 (Figure 2). When caribou tracks were found in the snow, the surrounding area was intensively searched to locate and count all caribou. As with the moose survey, the proportion of collared caribou found, was used as a sightability correction factor. To estimate the total population, we used the joint hypergeometric maximum likelihood estimator (Bartmann et al. 1987) in program NOREMARK (White 1996).

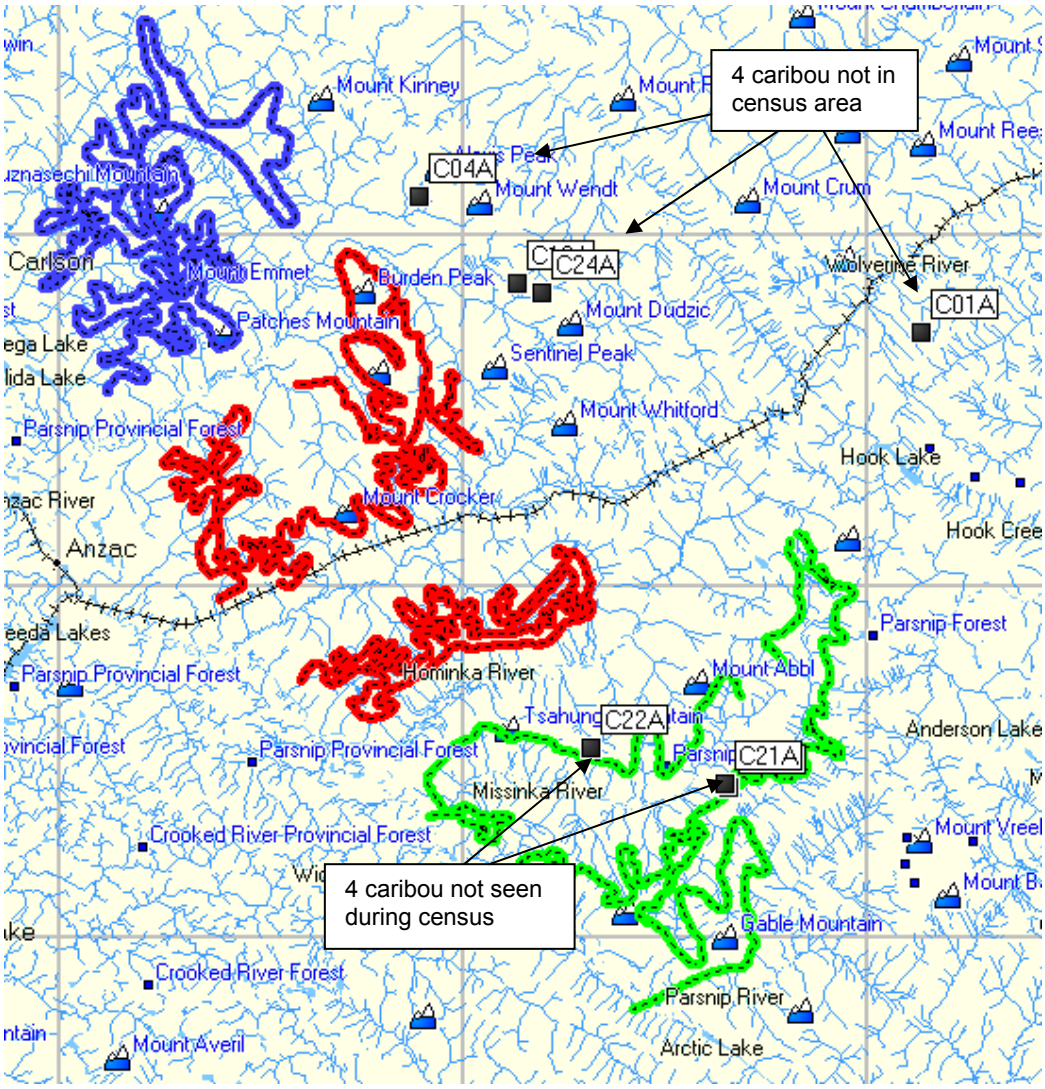

Figure 2. Flight line of Mar 2009 caribou census in Parsnip River study area, BC. ■ indicates the locations of 8 caribou that were not observed during the census. Note that not all tracks were successfully recorded. Note also that the waypoints for C21A and C22A represent the locations of two caribou each.

2.3 Wolves

As of 1 April 2008, 11 collared wolves were known to be in the study area (2 GPS, 9 VHF). From January to March 2009, 7 wolves were captured and collared in the study area by the Ministry of Environment (3 GPS, 4 VHF). All wolves were located by a Bell 206 helicopter, immobilized using Telezol and fitted with telemetry collars.

2.3.1 GPS-Collar Data

During the course of the year, GPS-collar data from 3 wolves were downloaded (W11A, W18A, W19A). Movements of GPS and VHF-collared wolves were analyzed using ArcMap (ESRI 2008). Pack home ranges were calculated as a 95% Minimum Convex Polygon using Hawth Tools (Beyer 2004). These points were also graphed relative to caribou-selected elevations. Caribou-selected elevation was based upon the caribou habitat-selection model created for the Parsnip caribou herd (Jones 2007). Elevations were extracted for each wolf telemetry location using PCI (PCI Geomatics 2008).

Locations from one wolf, W19A, allowed for analysis of clustered GPS locations to pinpoint the denning and kill sites of the Anzac wolf pack. To locate the natal den and rendezvous sites, GPS points were analyzed visually (Spatial Viewer, unpublished program by M. P. Gillingham). The denning area was approached from the Anzac river to collect hair, scat and bone samples. The Parsnip herd caribou very rarely venture below 1100 m elevation (Jones 2007). We used a very conservative minimum elevation of 1050 m for cluster investigation. We attempted to visit all higher-elevation clusters of GPS waypoints (potential caribou kill-sites) from 1 June to 23August 2008 using the following criteria for GPS point clusters: 3 or more fixes (not necessarily consecutive) within 75 m of each other, and all points were above 1050 m elevation. When possible, clusters were accessed from the ground, however, due to the remoteness of many clusters, we approached most clusters by helicopter, biasing our sample of potential kill sites for those in or near open-vegetated areas. We also opportunistically visited some lower-elevation clusters of >3 points.

2.3.2 Diet Analysis

Wolf-diet analysis is being approached by two complimentary techniques: isotope analysis and scat analysis. Tissue samples have been taken from radio-collared wolves when captured by the Ministry of Environment. They include: hair, red blood cells, plasma and whiskers, to give isotope signatures of diet during summer, 3 months before sampling, 7-10 days before sampling and life-time, respectively. In order to supplement this sample, we set barb-wire hair snags throughout the study area through mid-July to mid-August to collect wolf hair. The protocol was based upon hair-snag methods used across North America for bears as modified for wolves by Dave Latham (Pers. Comm., Latham 2009). Fifteen sites were set, checked 3 times and then taken down. Each site consisted of bait (road kill deer, rotten fish or rotten beaver, one each session, respectively) surrounded by 2 strands of barbed wire nailed to trees at 30 and 60 cm height. When a wolf came to investigate the bait, an animal was forced to crawl under or between the barbed wire stands and leaves hair on the

barbs, allowing us to passively sample its DNA. Samples are being analyzed through the Mountain Caribou Recovery Project at the UBC Okanagan Laboratory.

2.3.3 Tower Telemetry Pilot Project

We piloted a telemetry protocol in order to supplement the GPS data. To record when and how often wolves make forays to high-elevation caribou-selected habitat, we placed 4 telemetry towers in alpine areas surrounding the Anzac river drainage. This pack was chosen because it had the most collared wolves in the pack (1 GPS, 3 VHF). Each tower was equipped with 4, 5-element yagi antennas, a telemetry receiver-logger (Lotek SRX_400, Newmarket, ON), a 100-watt solar panel with voltage regulator, a 96 amp-hour, closed-cell gel battery (Deka, East Penn Mfg. Co. Inc., Lyon Station, PA) and a Parmak solar-powered electric fence surrounding the tower (Model DF-SP-LI, Parker-McCrory Mfg. Co., Kansas City, MO). The receivers scanned for all wolf and caribou frequencies every 10 min and recorded the antenna it was heard with. Towers were set up in early August and downloaded in late August and September. Receivers were set to a lower gain during September because receiver memories were too full to record for the entire full month when downloaded in late August.

3.0 RESULTS AND DISCUSSION

3.1 Moose

Since 1 April 2008, 4 of 23 collared moose have died, while 19 remain collared in the study area. Two were shot by hunters in the fall and 2 died during fall and winter due to unknown causes. Their collars will be recovered in summer 2009.

Based on the moose survey, the population estimate is 1800; in 2005 the population estimate was 2800 moose. The density in the north and south portions of the census zone were approximately equal. The sex ratio was 48 bulls:100 cows, which is lower than in previous years; before 2006, the ratio was usually 60-80 bulls:100 cows (Heard, unpublished report). The calf-cow ratio was 21 calves:100 cows which is typical for this area (Heard, unpublished report). Further analysis, hunter success and reporting of moose condition and reproductive status are still being analyzed by the Ministry of Environment in Victoria.

3.2 Caribou

Currently 24 caribou are collared in and near the Parsnip study area; 1 collared caribou died during January 2009. Our kill-site investigation indicates that although the cause

of death is unknown, this was not wolf-related, because there were no wolf tracks or scats and the collar had not been chewed.

During the fall caribou calf count, 12 of 17 collars were heard, with 11 visually located. All caribou were at subalpine elevations closest to the Parsnip (Figure 1). Of those 11 collared caribou, 5 had calves at heel (45 calves:100 cows) (Table 1). A total of 43 caribou were seen, of which 9 were calves (21%). In fall 2007, the calf to collared-cow ratio was 23 calves:100 cows and calves made up 15% of the sample. Consequently summer survival appeared to be higher in 2008 than in 2007.

Table 1. Results of 28 October 2008 caribou calf-count in Parsnip River study area, BC.

Caribou ID	With Calf?	Cows	Calves	Bulls	Total
C15A	y	3	1	0	4
C03A & C06A	y & n	3	2	0	5
C17A	no visual				
uncollared	-	1	1	1	3
C04A	n	2	0	0	2
C12A	n	3	0	0	3
C08A	n	2	0	1	3
C11A & Car002	n & y	5	1	1	7
C13A	n	1	0	0	1
C18A	y	3	1	1	5
C07A	y	5	4	1	10
TOTAL		**28**	**10**	**5**	**43**

During the spring caribou census, we observed 147 caribou, 17 of these were calves (12%) which is similar to the fall calf count of 15%. This suggests that over-winter calf survival was high and much higher than over-summer survival, which was expected, considering we cannot separate over-summer mortality and first-month mortality which is known to be high across caribou herds in BC (Seip and Cichowski 1996, Gustine et al. 2006). Based on telemetry flights, only 20 of 24 collared caribou were in the study area during the census (Figure 2). Of these 20 collared caribou, 16 were seen during the census, resulting in a sightability correction factor of 1.25. The total population estimate was 184 caribou (95% CI 159-243). In 2008, the population estimate was 156 (95% CI 127-260).

Table 2. Results of the March 2009 caribou census in the Parsnip River study area, BC.

Date	Adults	Calves	Total	Collars	COMMENTS
25 March 2009	6	0	6	0	Probably 2 bulls
25 March 2009	4	2	6	0	
25 March 2009	6	0	6	0	At least 2 bulls
25 March 2009	11	2	13	4	C03 C06 C15 C17
25 March 2009	7	2	9	3	CAR033 C25 C26
26 March 2009	10	1	11	1	C23 5 bulls
26 March 2009	6	0	6	0	
26 March 2009	6	2	8	0	
26 March 2009	9	1	10	0	
26 March 2009	6	0	6	2	C20 C12
26 March 2009	2	1	3	0	
26 March 2009	5	0	5	0	
26 March 2009	7	0	7	0	All bulls
26 March 2009	12	1	13	2	C08 C11
26 March 2009	8	0	8	2	C19 Car002
30 March 2009	1	0	1	0	Bull
30 March 2009	10	2	12	1	C18
30 March 2009	4	0	4	0	All bulls
30 March 2009	10	3	13	1	C07
TOTALS	**130**	**17**	**147**	**16**	

3.3 Wolves

During the 2008-2009 reporting period, 3 collared wolves died (W03A, W16A, W15A) from being shot, kicked by a moose and unknown cause, respectively; 1 collared wolf has been re-collared (W18B) and 2 have gone missing (W04A, W19A). There are now a total of 12 wolves collared in the study area (9 VHF, 3 GPS).

3.3.1 GPS-Collar Data

Analysis of GPS and VHF data showed that pack ranges are separate with some overlap at their periphery (Figure 3). A comparison of wolf location elevation and caribou habitat selection showed that wolves spent very little time at caribou-selected elevations (Figure 4). What time was spent, was during snow-free months (June to September: 7 to 13% of time/month), implying that potential wolf predation on caribou was essentially restricted to these months.

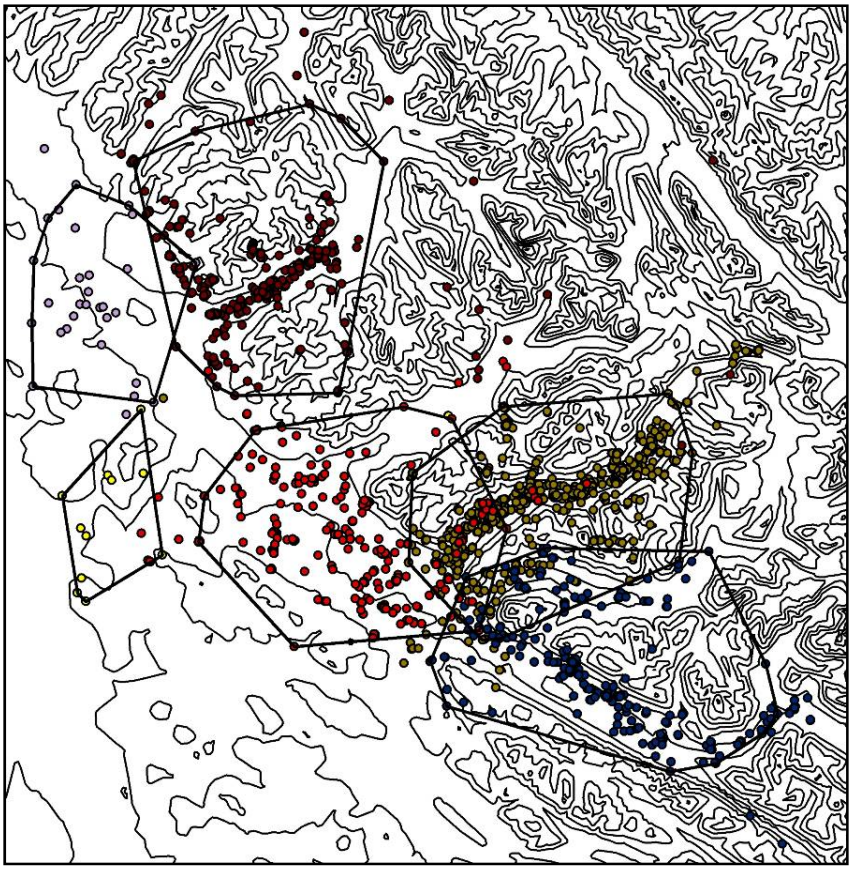

Figure 3. Wolf pack home ranges in Parsnip river study area, BC. 95% Minimum Confidence Polygons are shown with waypoints from VHF- and GPS-collared wolf locations 2007-2009.

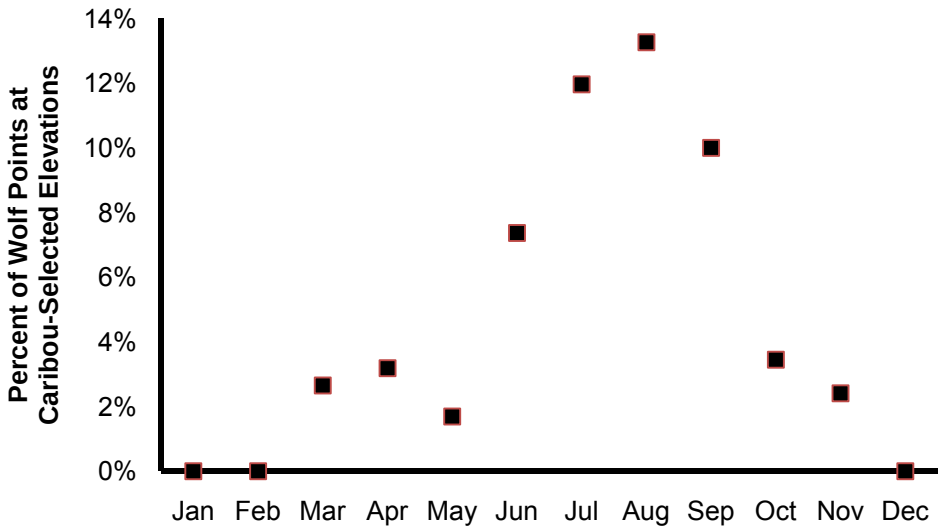

Figure 4: Preliminary analysis of percentage of time wolves spend at caribou-selected elevations throughout the year in the Parsnip river study area, BC. Caribou-selected elevation were based upon the caribou habitat-selection model created for the Parsnip caribou herd (Jones 2007).

3.3.2 Kill-site Investigations

All kill-site investigations (clusters of 3 or more GPS points as described above) were for one animal in the Anzac wolf pack. For this animal, 11 GPS-point clusters fit our criteria (3 GPS points within 75 m of each other and above 1050 m elevation). Of these, we were able to investigate 5. Three clusters were moose kills and 2 clusters had no sign of a kill within an arbitrary, but wide, radius of the cluster. Before establishing this criteria for visiting clusters, we investigated the earliest cluster at higher elevations and found a caribou kill (3 points, 100 m apart). The caribou kill was found at 1438 m, the 3 moose kills were at elevations between 1050-1100 m. Moose therefore venture far from the valley bottom (700-800 m in elevation) and there may be some spatial overlap between moose and caribou used habitat. Moose may still be the primary prey that wolves search for at these caribou-used elevations. Though these results suggest that predation of adult caribou by wolves in the Anzac pack may be low, consumption of a caribou calf takes little time and may be missed by GPS-point cluster investigation. All lower elevation GPS-point clusters visited were moose kills.

3.3.3 Diet Analysis

More than 150 scats have been collected from den and road side sites, analysis is ongoing. Isotope lab results for hair and other tissue samples have been received but have not yet been analyzed.

3.3.4 Tower Telemetry Pilot Project

Tower telemetry receivers were set up and recording data for an average of 44 days per tower (range: 37-53). Analysis of the effectiveness of this approach is pending the download of the GPS-collar in the Anzac wolf pack.

4.0 PLANS FOR 2009/10

Caribou and moose populations will continue to be monitored following the 2008-2009 methodology. We do not anticipate any changes in the moose hunting seasons within the study area in 2009. Wolf hair snagging was at a very low financial cost, but high time cost and did not return many additional samples. For 2009/10, we will rely solely on capture for hair and tissue samples. Given the number of moose kill sites found at high elevation GPS-clusters, the elevational criteria is adequately conservative, however the only caribou kill to be found was at a cluster spaced out more than the criteria used to visit clusters (3 points were within 100 m, rather than 75m). Unless logistically constrained, the cluster

searching criteria will be more conservative for 2009/10. This is the last year of this 4-year project. The Final Project Report will be prepared for 15 April 2010.

5.0 EXTENSION

A poster was presented (R.W. Steenweg, M.P. Gillingham and D.C. Heard. Sustaining Mountain Caribou Populations: Investigating Impacts of Alternate-Prey Management on the Parsnip Mountain Caribou Herd, BC) at the Natural Resources and Environmental Science Institute Annual Poster Session, UNBC, on 19 March 2009. Preliminary analyses of pack ranges and wolf movements relative to caribou-selected elevations, as well as an overview of project objectives, were presented.

6.0 ACKNOWLEDGEMENTS

We would like to thank Greg Altoft (Altoft Helicopters), Eric Stier and Travis Mitchell (Guardian Aerospace), Charlie Robson (Yellowhead Helicopters) for their safe and comfortable flying. We also thank Jeremy Ayotte, Vincent Chingee (McLeod Lake Band), Fraser Corbould, Jessica Courtier, Monika Gorzelak, Adam Goulding, Melanie Grubb, Ania Kobylinski, Dale Seip, Glen Watts, Doug Wilson, for help with collaring, field data collection and various other contributions. This project is funded in large, by the Peace-Williston Fish and Wildlife Compensation Program, as well as the Forest Investment Account, with in-kind support from the Ministry of Environment and the University of Northern British Columbia.

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