WILDLIFE INFOMETRICS INC.

POPULATION ECOLOGY

Abundance and Distribution of Woodland Caribou in the Wolverine and Chase Recovery Plan Areas

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ABSTRACT

We conducted calf recruitment surveys (June and November) and a total-count population survey (February) of woodland caribou in the Wolverine and Chase recovery plan areas. For the population survey, we stratified land >1300m elevation into sample units ranging in size from 550 to 1530 km^2 and attempted to survey all units within the typical wintering area of each herd. We authoritatively sampled land <1300m by surveying areas that we knew had a high likelihood of being occupied by caribou. We accounted for 19 of 20 radio-collared caribou known to be in the survey area for detection correction factors of 0.97 and 0.31 for high- and low-elevation sampling strata, respectively. We observed 85 groups of caribou and a total of 675 individuals for estimated populations of 349 and 628 in the Wolverine and Chase recovery planning areas, respectively. For the Wolverine and Chase areas, calf recruitment was estimated in late winter at 14 and 18%, respectively. Earlier estimates of calf recruitment indicated that most mortality of calves in the Wolverine herd occurred during calving while the Chase calves suffered a significant amount of mortality during summer. Calves appeared to remain relatively free of mortality during winter months.

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INTRODUCTION

Background

Woodland caribou (*Rangifer tarandus caribou*) are threatened of becoming locally extirpated throughout the Southern Mountains National Ecological Area (SMNEA) in British Columbia (BC) and are of special concern throughout the Northern Mountain National Ecological Area (NMNEA) (COSEWIC 2002). Population declines in many herds (Bergerud 1974; Thomas and Gray 2001; MCTAC 2002) and reduction in the range of caribou since the early 1900's (Spalding 2000) have contributed to their current status. Because BC is a signatory on the National Accord for the Protection of Species at Risk[1], the status of caribou is a significant conservation issue in the province (MCTAC 2002; BCFPB 2004). Their decline could be due to an increasing inability to avoid predators (i.e., habitat fragmentation and increased road density), loss of winter food supply, loss of alternative habitats, illegal kills, disturbance / displacement of caribou due to human activities, or a combination of these factors. In the past several years, the decline of the caribou populations has created debate, prevented industrial development, and cost millions of dollars attempting to recover herds.

Estimates of caribou population size and other population parameters are fundamental to understanding and mitigating the decline. Regular assessment of populations therefore, is necessary to demonstrate, for example, sustainable forest management. The estimates provide feedback on the state of key forest values, objectives, indicators, proximity to resource targets, and the efficacy of sustainable management. Outcome of this work is therefore expected to contribute to: the confirmation of standard protocols for estimating caribou populations, our ability to compare population status of different herds, efforts toward conservation of caribou, and sustainable balances in the supply of timber and northern caribou resource values.

Several caribou herds are located, fully or partially, in the Mackenzie Timber Supply Area (TSA). Since the Wolverine and the Chase herds also occur within the SMNEA, and are part of a larger study on mitigation of predation risk (McNay and Giguere 2008), these herds were considered a priority for conducting annual population surveys. Previous population estimates were 375 for the Wolverine and 561 caribou for the Chase (Giguere and McNay 2007) herds (Table 1). We interpret results of historic surveys to indicate that the Wolverine and Chase herd sizes were stable where ambiguity of the estimates (Table 1) comes primarily from the challenges associated with implementing methods to conduct accurate surveys.

Objective and Expected Outcomes

Our objectives were, for each herd, to provide estimates of percent calves in the population (i.e., calf recruitment surveys) at time periods following: (1) neonatal mortality and (2) summer-time mortality and, in late winter (i.e., late-winter survey), to estimate (3) minimum total count; (4) population composition; and (5) population size.

[1] See the Environment Canada web site at www.ec.gc.ca/press/widl_b_e.htm

Table 1. Selected population parameters from previous surveys of caribou in the Wolverine and Chase herds of north-central British Columbia.

Recovery Planning Area	Year	Total Counted	Calves/100 Cows	Calves/% of Pop.	Bulls/100 Cows	Reference
Wolverine	1989	214 [b]	26	16	34	Hatler 1989
	1996	204[b]	19	10	68[c]	Wood 1996
	1999	91	31	14	74[c]	Hengeveld and Wood 2000
	2000	115[a]	14-15	07	42	Zimmerman et al. 2000
	2001	134 [a]	26-30	12	62[c]	Zimmerman et al. 2001
	2002	152 [a]	44-58	24	44	Zimmerman et al. 2002
	2004	205 [a]	31-44	19	46	Wilson et al. 2004
	2007	356 [a]	34	15	66	Giguere and McNay 2007
Chase	1993	397 [b]	34	17	51	Corbould 1993
	2000	127 [a]	19	12	32	Zimmerman et al. 2000
	2001	174 [a]	34-37	16	76[c]	Zimmerman et al. 2001
	2002	225 [a]	38	12	68[c]	Zimmerman et al. 2002
	2007	431 [a]	31	14	72	Giguere and McNay 2007

a – attempted full counts (assuming current recovery planning areas)
b – relatively severe winter weather compared to average
c – suspect ratio of males to females which could alter the calf/100 cow estimate

STUDY AREAS

Our surveys occurred within the overlap between the Mackenzie TSA, in north-central BC and the RPAs identified for caribou at risk within the SMNEA. The TSA is located within the Omineca sub-region and includes all of the Mackenzie Forest District (Figure 1). The Williston Reservoir, with its major drainages, is one of the dominant physiographic features of the TSA. The drainages lie within the Omineca Mountains, flanking the west side of the Rocky Mountain Trench in north-central BC being fed by headwaters in rugged, mountainous terrain. Valley bottoms and mid-slopes of the three herd areas were described by Meidinger and Pojar (1991) as being dominated by relatively cool and dry, or cool and moist macroclimates of short growing seasons leading to boreal ecosystems of white and black spruce (Picea glauca and P. mariana). Cold temperatures dominate the climate with average daily temperatures below freezing for half the year and three-quarters of the annual precipitation falling as snow. Large-scale and frequent wildfires were characteristic prior to fire control policy (Delong 2002). Common in these ecosystems are large, relatively flat areas of well-drained fluvial deposits, which in combination with frequent and large fires gave rise to large areas of even-aged lodgepole pine (Pinus contorta) dominated forest stands. Generally, a cold moist macroclimate with long, cold winters characterize upper slopes where Engelmann spruce (P. engelmannii) dominates.

Wolverine Herd

The Wolverine RPA is 844,313 ha, ranging in elevation from 676 to 2134 m in rolling high-elevation foothills, and includes four major watersheds of the Omineca, Manson, Klawli, and Germansen Rivers. It is roughly bounded in the north by the headwaters of Goat, Nina, and Big Creeks, in the west by Takla, Tsayta, and Indata lakes, in the south by Tchentlo and Chuchi lakes, and in the east by Sylvester and Gaffney creeks, and the eastern slopes of the Wolverine Mountain Range. At low- to mid-elevations, the area is dominated by a Boreal White and Black Spruce zone (BWBSdk1 the specific subzone

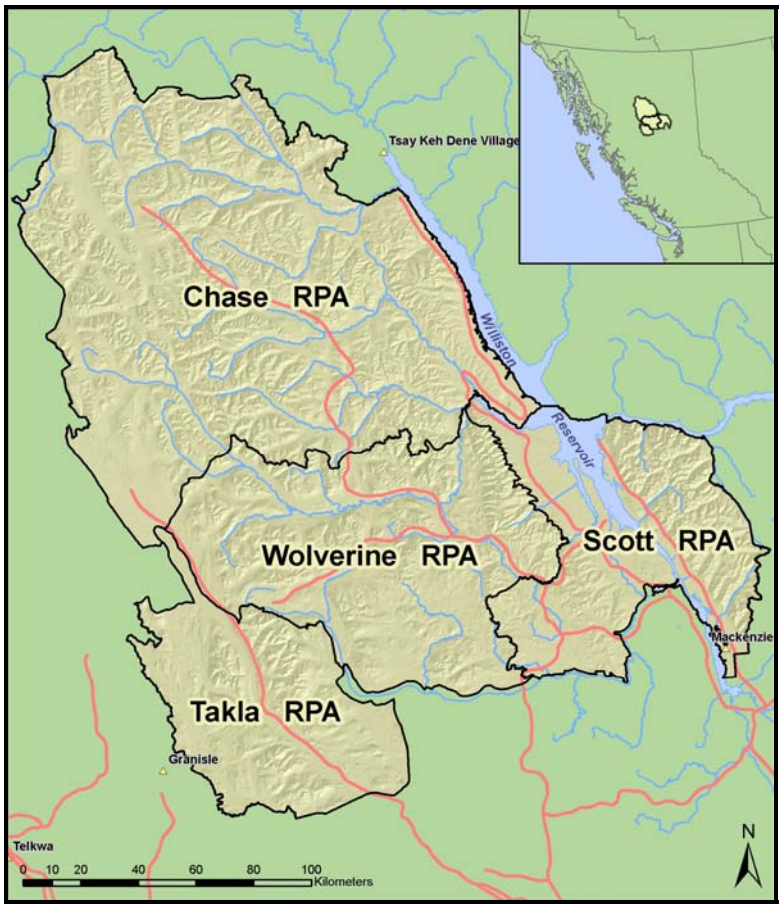

Figure 1. The Chase, Wolverine, Takla, and Scott caribou herd Recovery Planning Unit (RPA) boundary areas in the north-central British Columbia. Wolverine and Chase Caribou herds were the ones surveyed during February 2008.

variant), two of the Sub-Boreal Spruce subzone variants (SBSmk1 and SBSmk2), and an Engelmann Spruce-Subapline Fir zone (ESSFmv3 the specific variant) dominates the mid- to high-elevations. The Alpine Tundra (AT) prevails above tree line.

Chase Herd

The Chase RPA is 1,733,039 ha situated in steep mountainous terrain ranging in elevation from 671 to 2466 m, and has three major watersheds including the Ingenika, Osilinka, and Mesilinka Rivers. It is roughly bounded in the north by the most northerly portion of the Finlay River, in the west by Thutade, Sustut and Driftwood rivers, in the south by Ominicetla Creek, back end of Osilinka River, headwater of Wasi and Flegezand creeks, and in the east by the Williston Reservoir. At low- to mid-elevations, the area is dominated by the BWBSdk1 and SBSmk2 subzone variants, and at mid- to high-elevations the ESSFmv3 subzone variant predominates. The Alpine Tundra (At) prevails above the tree line.

METHODS

Calf Recruitment Surveys

We relied on relocations of radio-collared, female caribou to find aggregations of post-calving maternal groups during late spring and early fall. Survey techniques and data collection protocols adhered to BC Resource Inventory Standards Committee guidelines for aerial ungulate inventories (BC MSRM 2002). The survey was conducted using a Bell 206 helicopter with an experienced pilot. The crew members accompanying the pilots consisted of one navigator and two observers (in the back). Animals were classified according to the level two classifications standards (BC MSRM 2002). For each observation the following was recorded: project name, study area, crew name, survey and census type, date, general location, general weather conditions, animal identification if marked, species, observation time, group number, group size, gender (if possible), age class, if calf observed belong to a marked animal (if calf present), activities, location type, UTM co-ordinates, habitat type, approximate sinking depth in snow (if present), snow cover, and other marked animals in the group (if present). The telemetry data form was used for calf recruitment surveys since it was based on re-locating all radio-collared female caribou. Any caribou observed between re-locations of radio-collared females were also recorded as part of the survey. A standard telemetry data form was amended to allow for entry of the female and calf information.

Late-winter Survey

We conducted the late-winter survey of caribou populations simultaneous with two other field activities: (1) the capture or re-capture of caribou and wolves and (2) a reconnaissance of modeled High Elevation Winter Range; the latter was an evaluation of habitat quality for caribou. These three activities were conducted simultaneously to maximize efficiency in the use of helicopter support while minimizing disturbance to wildlife.

Sample Units and Sample Stratification

The sample units were adopted from previous surveys (Giguere and McNay 2007) (Figure 2). Delineation of high elevation range within sample units was based on BEC coverage and included all alpine and parkland zones. The units were an arbitrary accumulation of high elevation ranges bounded by one or several drainages, which made logical breaks between units. The arbitrary choice for these unit boundaries was based on general knowledge of animal ranges, which we have acquired over several years of data collection. The rationale for the sample units was based in part on minimizing the possibility of animal movement between units and in part on establishing a reasonably constant effort of approximately 2-3 hours per unit. Selection of sample units was conducted in a manner that would allow for progressive surveys over successive years to cover the entire portion of the Mackenzie TSA south of Tsay Keh and north of Mackenzie.

Survey Techniques

Survey techniques and data collection protocols adhered to BC Resource Inventory Standards Committee guidelines for aerial ungulate inventories (BC MSRM 2002). The total count survey was conducted using two Bell 206 helicopters with experienced pilots

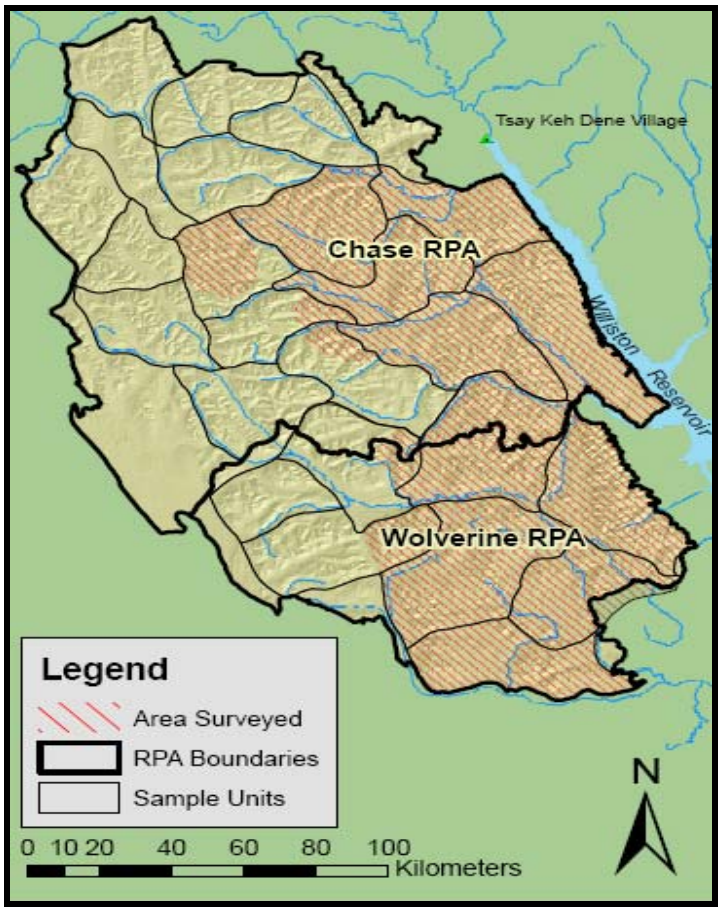

Figure 2. The Wolverine and Chase caribou herd Recovery Planning Unit (RPA) boundary areas with their associated sample units and surveyed areas conducted February 2008 in the north-central British Columbia.

in rugged mountainous terrain during winter. One of the helicopter was exclusively conducting caribou census where as the second helicopter concentrated the effort on capturing the required number of caribou and wolves. When not capturing animals, the capture crew was conducting census survey. The crew members accompanying the pilots consisted of one navigator and two observers (in the back) for each helicopter. Inexperienced crew members were well-trained prior the survey and at all time were grouped with experience crew members. The navigators used lap top computers with ArcView® (Environmental Systems Research Institute, Redlands, California) and DNR Garmin ArcView extensions[2] to navigate during the survey and record flight lines. This allowed us to ascertain our exact position inside each sample unit, to insure full coverage of the unit, and to provide a means for estimating sampling effort (Figure 3).

Aerial radio-telemetry, for marked animals in the survey areas, was conducted from a fixed-wing aircraft prior to the survey, confirming locations for the marked animals. Bad weather when conducting the fixed-wing flight resulted in several missing locations for most of the caribou inhabiting the Wolverine Range. This situation increased the overall

[2] http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRGarmin/DNRGarmin.html

time to conduct the survey in order to confirm the location of marked animals. During the survey, only the navigator was aware of the location of radio-collared caribou. Identification of radio-collared caribou by the observers could then be used as an estimate of the ability to detect caribou in general.

High-Elevation Range

The high-elevation portions of each sample unit were surveyed following contour-based flight lines working upwards in elevation from tree-line unless unfavorable winds were encountered (Figure 3, A). In relatively gentle terrain with very good visibility, we increased the distance between flight lines (500-800 m) otherwise, in conditions of steeper slopes or lower visibility; flight lines were between 100 and 400 m. Aircraft speed varied from 40-100 mph depending on relative visibility and terrain of each flight line. Height-above-ground ranged from 50-200 m and depended on openness, tree density, and safety of the crew.

Low-Elevation Range

The low elevation range was surveyed for the most part by following lakes, wetlands/meadows, and rivers normally occupied by caribou to verify their absence based on lack of tracks or foraging sign. We also focused attention on a few modeled ranges that have been traditionally used by caribou. If caribou tracks or foraging were observed, then more effort was spend to try to find animals (Figure 3, B).

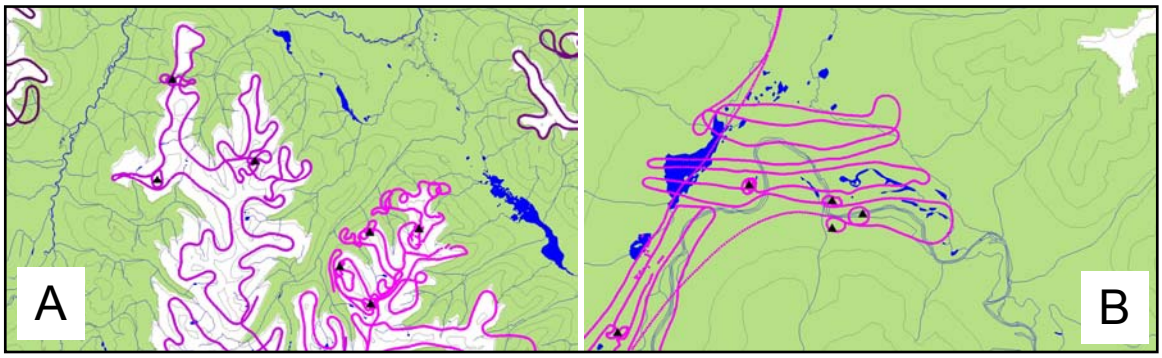

Figure 3. An example of a flight path taken during a survey at high- and low-elevation (A and B, respectively) of selected woodland caribou herds during February 2008 in north-central British Columbia. Elevation contours (grey) are 200 m intervals and ▲ represent caribou observations.

Subalpine Range

In addition to conducting surveys in these two range types, we also located and counted radio-collared caribou if they were using subalpine (i.e., below alpine but above low-elevation range) habitats. We could not asses the results from this range in the same way as the rest of the survey because we were biased to known radio-collared animals and the rest of the range was characterized by closed-canopy forests that were not amenable to detecting untagged caribou.

Data Collection

During the survey, if animal tracks were observed before the animal, effort was spent following them until the animal(s) was sighted. In most of cases, once animals were sighted, the pilot attempted to hover in close proximity but only long enough so animals could be counted and classified with minimal harassment. Animals were classified according to the level two classifications standards (BC MSRM 2002). We did not use level three classifications because most mature bulls had lost their antlers by the time of the survey. Groups were considered to be separate if they were at least 150 m apart, occurred in different habitats, or displayed different group characteristics or behaviors. Marked animals (i.e., ear-tags or collars) were noted and identified. After completing the sample unit, radio telemetry was used to determine if any radio-collared caribou within the survey unit were missed by the observers.

For each observation the navigator recorded, study area surveyed, crew names, aircraft type and speed, survey and census type, date, start and end time for each flight line, UTM coordinate at start and end for each flight line, general location and description of the sample unit, general weather conditions, observation time, UTM co-ordinates, animal identification if marked, marking descriptions (e.g., radio-collar color, ear tag number and color), approximate sinking depth in the snow, and status of detection (whether marked animals were observed or missed during the survey). One of the observers recorded the detailed count and classification for each group of animals observed, including species, group size, gender (if possible), and age class. The second observer recorded habitat features, including slope, aspect, elevation, and habitat type.

Population Estimate

A sightability correction factor (*scf*), for high- and low-elevation ranges was calculated as the sum of all radio-collared caribou observed (without the use of telemetry) divided by the sum of all radio-collared caribou that were located (both with and without the use of telemetry) in each range type. Due to generally low sample sizes, we pooled all *scf* estimates from past surveys to calculate a range-specific, weighted average *scf*. The *scf* was applied to the total number of observed caribou in each range. The total estimated population was the sum of the range-specific results added to the number of caribou incidentally observed while tracking radio-collars in subalpine range.

RESULTS

Calf Recruitment Surveys

Total number of animals observed in the survey during calving was lower by comparison to both the early-fall and late-winter surveys, totaling only 49 and 84 animals in the Wolverine and Chase areas respectively. Recruitment of calves following the neonatal mortality period was low (18%) in the Wolverine area but remained higher (27%) in the Chase area (Table 2). Recruitment in both areas continued to drop through the summer months to 13% in the Wolverine and 18% in the Chase area.

Table 2. Composition of woodland caribou groups observed during population surveys (PN – post neonatal mortality, PS – post summer mortality, and LW – late winter) conducted within the Wolverine and Chase caribou herd areas in north-central British Columbia.

Herd	Survey - Strata	Groups	Adult Male	Adult Female	Adult Unknown	Juvenile	Calf	Unknown	Total	Bulls/100 Cows	Calves/100 Cows	% Calves[a]
Wolverine	PN	**16**	**1**	**20**	**18**	**1**	**9**	**0**	**49**	**5**	**45**	**18**
	PS	**26**	**41**	**95**	**11**	**1**	**23**	**2**	**173**	**43**	**24**	**13**
	LW - Alpine	35	82	157	0	0	41	2	**282**	**52**	**26**	**15**
	LW - Sub-alpine	13	11	28	8	0	7	4	**58**	**39**	**25**	**13**
	LW - Low elevation	0	0	0	0	0	0	0	**0**	**NA**	**NA**	**NA**
	LW- Total	**48**	**93**	**185**	**8**	**0**	**48**	**6**	**340**	**50**	**26**	**14**
Chase	**PN**	**16**	**8**	**33**	**14**	**6**	**23**	**0**	**84**	**24**	**70**	**27**
	PS	**19**	**47**	**94**	**15**	**1**	**34**	**2**	**193**	**50**	**36**	**18**
	LW - Alpine	23	53	99	1	0	33	1	**187**	**54**	**33**	**18**
	LW - Sub-alpine	4	1	15	1	0	4	0	**21**	**7**	**27**	**19**
	LW - Low elevation	10	27	53	19	0	23	5	**127**	**51**	**43**	**19**
	LW- Total	**37**	**81**	**167**	**21**	**0**	**60**	**6**	**335**	**49**	**36**	**18**
Total	**PN**	**32**	**9**	**53**	**32**	**7**	**32**	**0**	**133**	**17**	**60**	**24**
	PS	**45**	**88**	**189**	**26**	**2**	**57**	**4**	**366**	**47**	**30**	**16**
	LW - Alpine	58	135	256	1	0	74	3	**469**	**53**	**29**	**16**
	LW - Sub-alpine	17	12	43	9	0	11	4	**79**	**28**	**26**	**15**
	LW - Low elevation	10	27	53	19	0	23	5	**127**	**51**	**43**	**19**
	LW- Total	**85**	**174**	**352**	**29**	**0**	**108**	**12**	**675**	**49**	**31**	**16**

[a] % Calves does not include "Unknown" animals.

Late-winter Survey

Field Survey

The survey, conducted over a total area of 88 km^2, occurred in the Wolverine herd area February 17-20 using 15.3 hours of helicopter support and in the Chase herd area February 20-24 using 21.9 hours. We used 4.9 and 3.6 hours in the Wolverine andChase areas respectively, to search for radio-collared animals in the subalpine range. Mean survey effort for high- and low-elevation ranges in each sample unit of the Wolverine area was 0.86 min/km^2 (se = 0.42, n = 4) and 0.10 min/km^2 (se = 0.02, n = 2), respectively (Table 3). Mean survey effort for high- and low-elevation ranges in each sample unit of the Chase area was 0.56 min/km^2 (se = 0.15, n = 5) and 0.82 min/km^2 (se = 0.50, n = 2), respectively (Table 3).

Table 3. Sampling effort used to estimate populations for selected woodland caribou herds during a survey conducted February 2008 in north-central British Columbia.

Herd	Range	Herd Area (km^2)	Area Surveyed (km^2)	Number of Sample Units	Total Survey Time (min)	Average Effort min/km^2 (se, n)
Chase	High		2,300	5	794	0.56 (0.15, 6)
	Low		2,800	2	304	0.82 (0.50, 3)
	Total	13,000	5,100	7	1,098	
Wolverine	High		800	4	546	0.86 (0.42, 7)
	Low		2,900	2	80	0.10 (0.02, 3)
	Total	12,600	3,700	6	626	
Total		**25,600**	**8,800**	**13**	**1,724**	

Snow depths in the Wolverine herd ranged from 70-140 cm at valley bottom, to 95-101 cm at mid-slope positions, and 0->195 cm in alpine. In the Chase herd, the snow depths ranged from 44-96 cm at valley bottom, to 93-96 cm at mid-slope positions, and 0->195 cm in alpine. For both herds, alpine snow conditions depending on the relative exposure to prevailing winds for both herd areas. The structure of the snow pack at low- and mid-elevation was generally soft and powdery without layers or hard crusts. Only thin crusts occurred at the snowpack surface which reflected recent, milder weather. At high elevation, the snow was hard and compacted from strong wind. Crusted surfaces usually occurred on southern aspects exposed to the sun. In general since October, the snow depth accumulated on a regular basis without significant periods of clear weather.

Our sample area for the Wolverine and Chase herds covered approximately 29% and 39%, of the total recovery planning areas, respectively. Most effort was spent in higher elevation winter range (Table 3). In the Wolverine area, little effort was spent at low elevation because other crews working simultaneous to us (i.e., animal capture crews) did not observe caribou or caribou tracks in that habitat. One exception to this occurred at the west end of Germansen Lake where tracks of approximately eight caribou appeared to be 4-6 days old. Caribou tracks of about the same age were also observed in wetlands 200-400 m further west but were estimated to be from only a few caribou. The Blue Lake area, one of the most known used areas by caribou during winter, was repeatedly flown by the capture crew. No tracks were observed on any of the lakes and wetlands, nor on the Omineca River. Further more, results from the pre-survey fixed-wing flight indicated that none of the 16 radio-collared caribou were using range at low elevation. In the Chase area, the pre-survey fixed-wing flight revealed that 2 of 13 radio-collared caribou were using the low elevation winter range. During the survey of the Chase area, most effort was spent in range at high elevation (Table 3). However, we did spend more effort (relative to that in the Wolverine area) to survey range at low elevations in locations where: (a) capture crews had observed caribou tracks and (b) where we expected to observe caribou based on past survey results. The effort spent in low elevation range confirmed the presence of caribou at 2 different locations, the Carina/Tomias Lakes and Helicopter Lake, where we encountered 2 of the 13 radio-collared caribou (i.e., 15% of the total caribou observed in the Chase). One more collared caribou was also found at lower elevation however, we believe the caribou was located moving from one range to another. No other survey of low elevation range revealed the presence of Caribou.

We located 85 groups of caribou totaling 675 individuals (Table 2) distributed throughout the wintering areas (Figure 4). The ratio of caribou bulls to cows for the Wolverine was 50:100 and 49:100 for the Chase (Table 2). The ratio of caribou calves to cows, and calf recruitment, was 26:100 and 14% in the Wolverine area and 36:100 and 18% in the Chase area, respectively (Table 2). Group sizes varied from single caribou (2 groups in Wolverine) to 30 caribou (one observation in each herd). In the Wolverine area, there were 5 groups >15 animals while 4 groups >15 were observed in the Chase area.

Population Estimate

The weighted average *scf* was .96 and .31 for high- and low-elevation range respectively (Table 4). When applied to the total number of animals observed, the population estimates were 349 and 628 caribou for the Wolverine and Chase RPAs, respectively.

DISCUSSION

The most caribou seen while surveying herds in north-central BC in recent years (i.e., since 2000) was in the order of 400 animals (during the 2007 survey). Prior to that

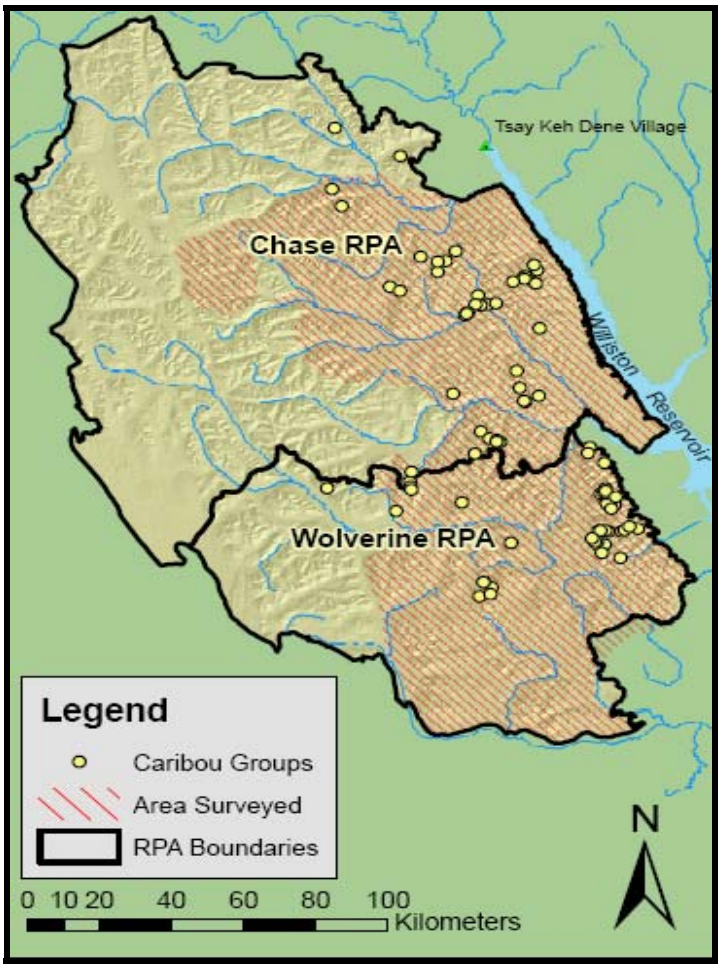

Figure 4. Distribution of woodland caribou groups observed during a population survey conducted February 2008 in selected areas of north-central British Columbia.

observation, the most observed was in the order of 200 animals. In most of the latter surveys, we extended considerable effort (i.e., in excess of 4 or more days and more than 25 hours of helicopter time) to observe 50% or less of the number of caribou observed by Corbould (1993) in 1993. Corbould (1993) reported using less than a day for that survey and covered only a small portion of the Chase caribou herd area. In this survey, we extended twice the effort usually used and covered at least 25% more area than usually covered to obtain counts that are close to those obtained in the previous year but exceed the counts reported in during 2001 through 2006. In 2007, we

Table 4. Caribou census results and population estimate for the Wolverine and Chase herds conducted February 2008 in north-central British Columbia.

Herd	Strata	# Collars	# In Survey Area	# Sighted	# Out of Survey Area	scf	Cumulative scf[a]	# Animals in subalpine	Corrected Total Count[b]	Corrected Density #/1000 km^2
Wolverine	High	16	12	12	4	1.00	1.00	58	349	50
	Low	0	0	0	0	NA	0.17			
Chase	High	11	6	6	5	1.00	0.91	21	628	27
	Low	2	2	1	0	0.50	0.44			
Total	**High**						**0.97**			
	Low						**0.31**			

[a]Cumulative scf was the weighted average of current and past survey data for each study area.
[b]Where the corrected total is the total observed caribou (Table 2) multiplied by the average scf.

concluded that the primary factor responsible for the increase at that time was more to do with severe winter weather (i.e., forcing caribou out of preferred, low elevation range) into more favorable range for inventory, rather than increased effort. However, the weather in this past survey was, by comparison, not particularly severe – note the large number of animals observed at low elevation in the Chase area. In general, the distribution of caribou, for the most part, was consistent with places surveyed in previous years.

Since the initiation of the Omineca Northern Caribou Project in 1999, the largest group size we've recorded in the Chase herd area (either in a population survey or on a telemetry flight) was 65 during the 2001 population survey. In that survey and in the 2002 survey, we saw only 3 groups of caribou >25 and in this survey we only saw two groups >25, one in each area. Corbould (1993) saw six groups larger than 25 animals, the top two being 89 and 54. Since we have been observing caribou in the Chase herd area based on radio-collared animals (i.e., 1999 to present) we have never seen a group exceeding the one seen during the 2002 census (n = 1509 groups observed during telemetry flights).

Our estimate of calf recruitment through the year would indicate a high level of calf mortality in the Wolverine herd area after calving that continued through the summer but subsiding over winter. By comparison, the Chase herd presumeably had less mortality of calves during calving but more during summer and again, calf mortality apparently subsided through the winter period.

Seip (1990) calculated a *scf* of .83 for use to estimate populations in Wells Gray Park and Hatter (2006) reported *scf*s for use in caribou population estimation that ranged from .58 to 1.00 ($\bar{x}$ = .84, se = .02, n = 18). By comparison, our *scf* of 0.97 for high-elevation winter ranges was relatively high but has been relatively consistent over the past few years (Giguere and McNay 2007, McNay and Giguere 2006).

Reported density for these herds ranged from 50/1000 km^2 in the Chase herd to 27/1000 km^2 in the Wolverine herd. Our estimates of density were very close to those of the previous survey. Confidence in previous estimates was relatively high and our current population estimate would fit with the range previously estimated. Although the estimated size of both herds may have increased from the early 2000s, it is apparent from a number of indicators (calf recruitment, group size, population estimates) that the Wolverine herd is faring less well than the Chase.

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