

**SUMMARY OF THE 2000 POST CALVING AND RUT SURVEYS
AND THE 2001 LATE WINTER SURVEY FOR THE ITCHA,
ILGACHUZ AND RAINBOW MOUNTAINS, CARIBOO REGION**



photo by Nicola Freeman

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ABSTRACT

As part of ongoing monitoring, the Itcha-Ilgachuz and Rainbow Mountains caribou herds were surveyed aurally three times in an effort to determine population trends, sex ratios, and calf recruitment. The post calving survey completed on June 20, 21 and 22, 2000 observed a total of 2224 caribou; 1139 cows, 692 calves, 272 bulls, 38 yearling cows, 59 yearling bulls; 12 unsexed adults and 12 unsexed yearlings. The observed percent calves was 31.1% in the Itcha-Ilgachuz Herd and 33.3% in the Rainbow Herd. No significant differences in elevation use were observed among adult cows, cows with calves, yearling cows or unsexed yearlings. There were also no significant differences among adult bulls, yearling bulls and unclassified adults; however elevation use by the male caribou groups was significantly different from that used by the female caribou groups. The 2000 rut survey on October 31 and November 1 observed 731 caribou; 398 cows, 130 calves, 52 mature bulls, 68 immature bulls and 83 unclassified caribou. The observed calves/100 cows and bulls/100 cows in the Itcha-Ilgachuz Herd were 33/100 and 32/100, respectively. In the Rainbow Herd the observed calf/100 cow ratio was 31/100 and the bull/100 cow ratio was 23/100. The late winter survey on March 15 observed 529 caribou, all of which were in forest habitats. The Itcha-Ilgachuz Herd calf percentage was estimated at 15.3% and the Rainbow calf percentage was estimated at 16.7%. The Itcha-Ilgachuz Herd appears to be stable to increasing, with adequate calf recruitment and an increasing bull to cow ratio: the estimated population is 2000 caribou with a density of 0.20 caribou/km². The Rainbow Mountains Herd showed greater calf recruitment numbers and a relatively high bull to cow ratio compared to recent years: the estimated population was 125 animals at a density of 0.028 caribou/km². Further studies coupled with population modelling will be necessary to confidently produce a long-term caribou strategy as required by the Cariboo-Chilcotin Land Use Plan (CCLUP).

Key Words: Itcha-Ilgachuz Mountains, Rainbow Mountains, *Rangifer tarandus*, northern caribou, post calving survey, rut survey, sex/age ratios, calf recruitment, mark/resight estimates, bull harvest

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INTRODUCTION

Caribou (*Rangifer tarandus caribou*) from the Itcha-Ilgachuz Mountains Herd and Rainbow Mountains Herd share a common winter range in some years, thus for management purposes they are considered two herds of the same population (Hatler, 1987). Aerial caribou population surveys were completed in June and October of 2000 and in March 2001 throughout the Itcha, Ilgachuz and Rainbow Mountains. These surveys contribute to developing a long-term caribou strategy as outlined in the Cariboo-Chilcotin Land Use Plan (CCLUP). Planned timber harvesting in mature pine forest surrounding the Itcha-Ilgachuz Mountains will significantly decrease the available terrestrial and arboreal lichens foraged upon by caribou in winter months. Reduced winter habitat may impact the abundance and composition of the caribou population; therefore, population monitoring is required to provide a benchmark, as planned logging continues to expand throughout much of their range. The post calving survey attempted to measure the relative abundance of the breeding female component and early calf production. The rut survey estimated sex composition and summer calf survival. The late winter survey compared the proportion of forest and alpine-dwelling cows with calves as well as overall calf recruitment. Observations of radio-collared caribou provided a sightability index for the post calving survey and an additional measurement of calf production through the survey period. Future surveys of the same area in combination with previous data will provide quantifiable population trends to aid wildlife managers.

We wish to thank Pat Dielman, Lara Roorda, Chris Schmid, Glen Davidson, and Chris Hamilton for serving as observers during the surveys. Michaela Waterhouse provided statistical advice and performed the Duncan Multiple Range test and Scheffe's test. Debbie Cichowski provided her unpublished population survey data from the mid-1980's. Project funding was provided by Forest Renewal British Columbia (FRBC) in cooperation with Tolko Industries Ltd.

SURVEY AREA

The Itcha, Ilgachuz and Rainbow Mountain Ranges are situated in a plateau region of mature lodgepole pine (*Pinus contorta*) forest interspersed with wetlands and meadows within Management Units 5-10, 5-11 and 5-12 of the Cariboo Region (Figure 1). Once active volcanoes, the mountains now contain gently rolling alpine areas chosen by caribou for calving and rutting. All alpine areas are protected; Tweedsmuir Provincial Park surrounds the Rainbow Mountain Range and the Itcha and Ilgachuz Mountain Ranges now lie within the newly protected Itcha-Ilgachuz Provincial Park. The survey area is within the Western Chilcotin Uplands Ecosection and is characterized by two biogeoclimatic zones at the higher elevations; the Alpine Tundra zone and the Engelmann Spruce Subalpine Fir, very dry, very cold sub-zone. The total area known to be inhabited by the Itcha-Ilgachuz caribou herd and Rainbow Mountains caribou herd is 10,042 km² and 4,409 km², respectively.

Figure 1. Survey Area of the Itcha, Ilgachuz and Rainbow Ranges

METHODS

Aerial surveys were completed in a Bell 206 Jet Ranger utilising the total count technique (Resource Inventory Committee 1997). The surveys were restricted to high strata habitats where, under the proper conditions, animal sightability is high. This included the Itcha Flats wetland complex, alpine and adjacent parkland habitat and the larger wetlands between the Itcha and Ilgachuz Mountains. Mountain complexes were flown in a counter clockwise manner to allow observers on the left side of the aircraft to scan the open habitat for caribou. The observer in the back right-hand seat provided additional coverage when necessary, particularly in the flatter terrain. Several of the wider ridges required more than one pass (see flight maps for details). Radio-collared caribou not observed during the systematic survey were subsequently searched out and recorded separately. In this way, caribou numbers visually observed each year could be compared directly, and data collected from all radio-collared caribou could still be gathered and used for separate purposes.

The post calving survey flights on June 20 and 21 (Itcha and Ilgachuz Mountains) and June 22, 2000 (Rainbow Mountains) included Pat Dielman (navigator), Nicola Freeman, Chris Schmid and pilot Tom Arduini. Low-lying morning fog and cloud deteriorated to rain in the afternoon of June 20, resulting in the survey being completed on June 21. Clear sunny conditions prevailed for the remainder of the Itcha-Ilgachuz and Rainbow Mountain portion of the survey. Flight time totalled 17.2 hours. Caribou were classified into the following categories; cow, calf, yearling cow, bull, yearling bull, unsexed adult and unsexed yearling. UTM coordinates were recorded for each group of animals to digitally produce flight maps and elevation groupings.

The rut survey flights on October 31 and November 1, 2000 included Pat Dielman (navigator), Nicola Freeman, Chris Hamilton and pilot Tom Arduini. Flight time totalled 13.1 hours in good visibility conditions. Two flights, totalling 2.2 hours, were attempted on October 24 and 25 but were cancelled due to low-lying cloud and deteriorating weather conditions. Due to time and weather constraints all collared caribou were not located during the Itcha-Ilgachuz portion of the rut survey; a completion flight to check for their calf survival was done on December 8, 2000 with crew Nicola Freeman (navigator), Pat Dielman, Glen Davidson and pilot Tom Arduini. This follow-up totalled 4.9 hours of flight time. Caribou were classified as mature bulls, immature bulls, cows and calves. Due to the difficulty of classifying large groups of caribou, both male and female yearlings were included in the cow classification.

The late winter survey flights on March 15, 2001 included Nicola Freeman (navigator), Pat Dielman, Lara Roorda and pilot Tom Arduini. Flight time totalled 6.3 hours in moderate conditions of high-overcast clouds. Forest areas were searched using radio-telemetry to locate groups containing radio-collared females. Animals were classified as either adults or calves; those caribou unable to be classified due to visibility difficulties associated with large groups in forested areas were recorded as unclassified.

Caribou not delegated to a specific category due to large group size or visibility difficulties encountered during the surveys were counted as unclassified caribou; however, when possible, yearlings and adults were distinguished from each other and counted separately as unsexed adults and unsexed yearlings. Unclassified animals were removed from the sample for calculations of percent calves and percent bulls. Yearlings were not included in calculations of post calving bull/cows ratios.

Elevation use by caribou gender/age groups was analysed with a non-parametric one way ANOVA using the statistic program SAS. Tests for significant differences in variate distribution included Scheffe's test and the Duncan Multiple Range test.

Estimates of cow caribou abundance were derived using the Joint Hypergeometric Maximum Likelihood Estimator (JHE) and the NOREMARK computer statistical package by Gary White (1996). The JHE is an extension of the Peterson Method (White & Garrot 1990) used in previous population reports and is now the Resource Inventory Committee (RIC) standard method for mark recapture estimates in closed populations with only one sighting occasion. A sighting occasion is an attempt to view animals in a population, keeping track of the number of marked and unmarked animals observed. This model assumes that individual marked animals have the same probability of sighting as every other individual within the population on a given occasion.

The joint maximum likelihood estimator of mark-resight is the value of N that maximizes the likelihood:

$$f(N | M, n_i, m_i) = \prod_{i=2}^{k+1} \frac{(M/m_i) \times [(N-M) / (n_i - m_i)]}{(N/n_i)}$$

Where n_i and m_i are the total number of animals observed and the number of marked animals observed, respectively, on sighting occasion i , $i=2, \dots, k+1$. The number of available marked animals located within the survey area at the time of the i^{th} sighting, are defined as M . Computerised optimization is required to find N , the estimated population size. The 95% confidence interval is constructed directly from the likelihood. As such, estimates of the lower and upper confidence bounds are the values of N that produce values of the log likelihood which are 2 units less than the value of the log likelihood at the maximum (White & Garrot 1990). With this type of confidence interval the lower confidence bound is never estimated at a value less than the minimum number of animals known to exist.

Over the years statistical methods have been adjusted to reflect changing standards and to provide the most useful results for management. Some minor errors have occurred in previous progress reports and have subsequently been corrected; where numbers or values differ from previous reports, estimates found in the most recent report, 2000-2001 in this case, should be considered most reliable. Methods utilized in this report reflect our current understanding of the most appropriate techniques for data analysis.

The following attributes, adapted from Simpson et al. (1993), were used to classify individual animals:

Class III Bulls: large, heavy beamed antlers
(Mature Bull) antlers often have many points and palmated brow tine
body size
testicles or penis sheath
lack of vulva patch

Class II Bulls: antlers larger than females and smaller than Class III
(Medium Bull) body size
testicles or penis sheath
lack of vulva patch

Cows: small antlers
black vulva patch
presence of calf or yearling
short face for yearlings

Calf: body size
dark bodies
lack of antler development
proximity to adults

RESULTS

Post Calving Survey

A total of 2224 caribou were observed on the June 20, 21 and 22 flights; 1139 cows, 692 calves, 38 yearling cows, 59 yearling bulls, 12 unsexed yearlings, 12 unsexed adults, and 272 bulls (Table 1 and Appendix 1). The observed calf to 100 cow ratio in the Itcha-Ilgachuz Herd was 60.6/100 and the bull to 100 cow ratio was 23.9/100. Both the observed calf/100 cow ratio and the bull/100 cow ratio were higher in the Rainbow Herd at 67.9/100 and 25.0/100, respectively. In the Itcha-Ilgachuz area there were 7.64 yearlings/100 adult caribou; this ratio was greater at 8.57 yearlings/100 adults in the Rainbow Mountains area.

Table 1. Caribou Observed June 20, 21 and 22, 2000 within the Itcha, Ilgachuz and Rainbow Mountains.

Mountain Range	Total Caribou	Cows (>1yrs)	Calves	Bulls (>1yrs)	Yrlg.-Cows	Yrlg.-Bulls	Unsexed Yrlgs.	Unsexed Adults
Itcha	613	279	162	141	16	23	3	7
Ilgachuz	1536	832	511	124	21	35	8	5
Rainbow	57	28	19	7	1	1	1	0
Itcha-Ilgachuz	2167	1111	673	265	37	58	11	12
Itcha-Ilgachuz-Rainbow	2224	1139	692	272	38	59	12	12

Average elevations of each age/sex group during the post calving surveys ranged from 1664m to 1898m (Figure 2). Each encountered group was appointed one elevation regardless of group size, which ranged from 1 to 73 caribou; overall mean group size was 30 caribou (N=130). In past surveys group size has varied considerably giving rise to the possibility that the data may be weighted by the occurrence of large groups, resulting in non-normality; hence, small groups at different elevations may be under-weighted due to the presence of large bands of caribou. To account for this, elevation data was ranked and a significant difference among the age/gender categories was observed ($\rho=0.0001$). The distribution of the variates was compared with Scheffe's test, a conservative non-parametric analysis of variance (one way ANOVA) using the statistics program SAS. Sample sizes were deemed large enough to be representative of each category, thus all categories were analysed separately (Figure 2); yearlings have been lumped together in previous years due to small sample sizes or large numbers of unsexed yearlings. Scheffe's test found no significant differences in elevation use among adult cows, cows with calves, yearling cows or unsexed yearlings. No significant differences were observed among adult bulls, yearling bulls and unclassified adults; however the elevation band used by male caribou groups and unsexed adults was significantly different from that used by the female caribou groups and unclassified yearlings (Appendix 2). A difference was observed between the results of Scheffe's test and Duncan's Multiple Range test: the latter found yearling cows at significantly lower elevations than the adult cows with calves, however this difference was not significant with the more rigorous Scheffe's test.

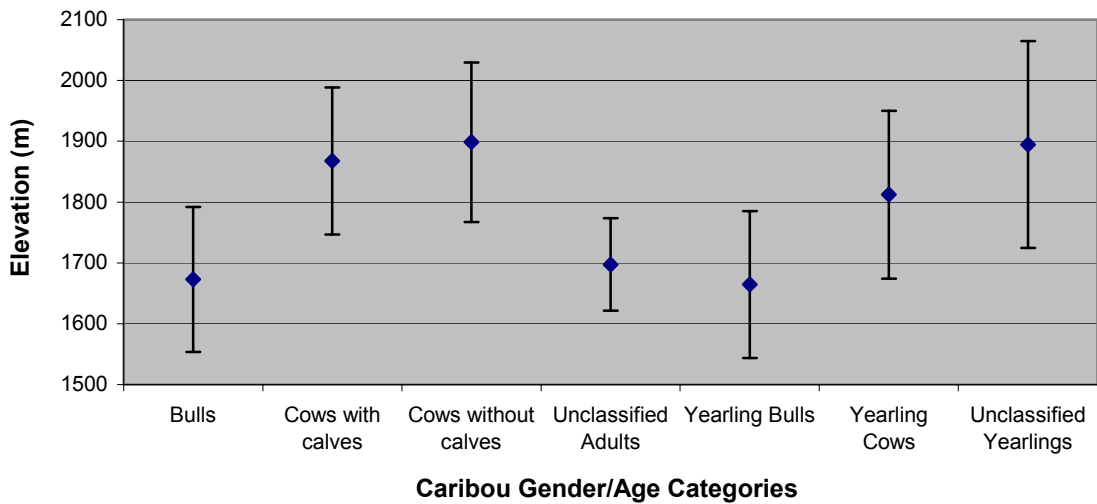


Figure 2. Average elevation of caribou population segments with 95% confidence intervals in June 2000.

October Rut Survey

A total of 731 caribou were observed during the October 31 and November 1, 2000 rut survey flights; 398 cows, 130 calves, 52 mature bulls, 68 immature bulls, and 83 unclassified adults (Table 2 and Appendix 3). Yearling caribou were included within the cow classification. The observed calf/100 cow ratio in the Itcha-Ilgachuz Herd was 32.9/100 and in the Rainbow Herd the ratio was 31.4/100. There were 128.6 mature bulls/100 immature bulls and 22.9 bulls/100 cows in the Rainbow Herd compared to 70.5 mature bulls/100 immature bulls and 31.7 bulls/100 cows in the Itcha-Ilgachuz Herd.

Table 2. Caribou observed on October 31 and November 1, 2000 within the Itcha, Ilgachuz and Rainbow Mountains.

Mountain Range	Total Seen	Cows	Calves	Mature Bulls	Immature Bulls	Unclass.
Itcha	505	258	81	33	51	82
Ilgachuz	118	70	27	10	10	1
Rainbow	108	70	22	9	7	0
Itcha-Ilgachuz	623	328	108	43	61	83
Itcha-Ilgachuz-Rainbow	731	398	130	52	68	83

Late Winter Survey

A total of 529 caribou were observed during the late winter survey on March 15, 2001 (Table 3 and Appendix 4). From previous population surveys and radio-telemetry information, the caribou in the alpine on the north side of the Ilgachuz Mountains and in the Anahim Lake area were assumed to have calved in the Rainbow Mountains. The caribou on the northern slopes and in the forests to the north, south and east of the Itcha Mountains were assumed to have calved in either the Itcha or Ilgachuz Mountains. The Itcha-Ilgachuz Herd calf percentage was observed at 15.3% and the Rainbow Herd calf percentage was observed at 16.7%. The overall calf percentage was 15.5%. Areas on the north side of the Rainbow or Ilgachuz Mountains and the alpine in the Itcha Mountains were not searched.

Table 3. Caribou observed March 15, 2001 in the Itcha, Ilgachuz and Rainbow Mountains and surrounding areas.

Caribou Herd	Mountain Range	Habitat Type	Total	Adults	Calves	Unclass.
Itcha-Ilgachuz	Itcha	Alpine	0	0	0	0
	Itcha-Ilgachuz	Forest	489	309	56	124
		Total	489	309	56	124
Rainbow	Rainbow	Alpine	0	0	0	0
	Ilgachuz	Alpine	0	0	0	0
	Rainbow-Ilgachuz	Forest	40	30	6	4
		Total	40	30	6	4
Itcha-Ilgachuz-Rainbow	Combined	Alpine	0	0	0	0
	Combined	Forest	529	339	62	128
		Total	529	339	62	128

Annual Calf Survival Trend

The calf percentage in the Itcha-Ilgachuz Herd dropped from 31.1% in June to 20.0% in October 2000. By March 2001, the calf percentage decreased to 15.3%. The calf percentage for the Rainbow Herd started in June at 33.3%, dropping to an observed 20.4% in October and then 16.7% in March (Figure 3). A similar trend was evident in the calf/100 cow ratio of the relocated radio-collared animals. In the June survey, 4 of the 5 radio-collared cows in the Rainbow Herd had calves. Two of the 5 cows were observed with calves in the October and March surveys. In the Itcha-Ilgachuz Herd, 14 of 21 had calves in the June survey, 8 of 18 had calves in December, and 3 of 19 had calves in March (Figure 4).

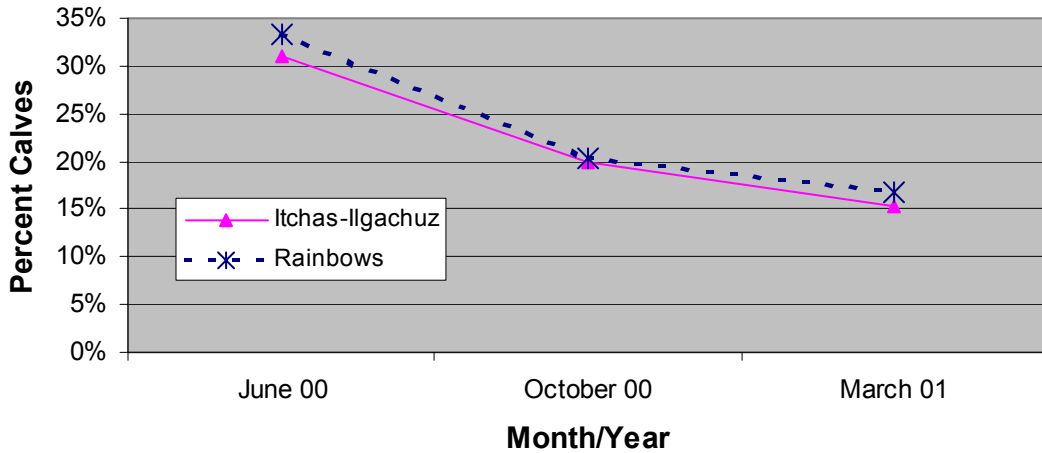


Figure 3. Calf percentage observed in the post calving, rut and late winter population surveys of the Itcha-Ilgachuz and Rainbow Mountains Herds.

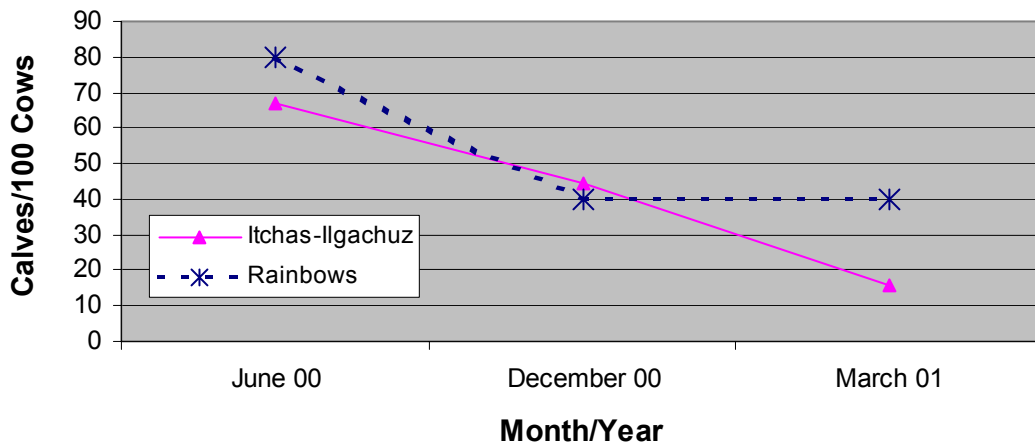


Figure 4. Calves/100 cows observed for radio-collared caribou in the post calving, rut and late winter population surveys of the Itcha-Ilgachuz and Rainbow Mountains Herds.

Survey Costs

Helicopter rental costs totalled \$30,297.76 (or 43.7 helicopter hours) for all surveys. Wildlife staff committed 25 person days for pre-planning, surveys and report completion.

DISCUSSION

More caribou were observed in this year's post calving survey (2224) than in the previous year and numbers appear to be increasing (1466 in 1995, 2219 in 1998, 1850 in 1999; Loveridge and Young, 1997, Young and Roorda, 1999 and Young and Freeman, 2001). The Itcha-Ilgachuz 2000 June calf/100 cow ratio of 61/100 was greater than previous highs in 1997 and 1998, 56 calves/100 cows and 55 calves/100 cows, respectively. The 2000 post calving Rainbow Herd ratio of 68 calves/100 cows was substantially greater than ratios previously seen; this may be due to fewer caribou being visually detected and counted during the survey when compared to other years (Appendix 5). An observed ratio of 35 calves/100 cows in 1999 and 1997 was lower than the 44 calves/100 cows observed in 1998. Post-calving surveys indicate that the Itcha-Ilgachuz Herd remained relatively stable during the late 1980's and early 1990's (Figure 5). There appears to have been an increase in caribou numbers over the past six years, likely due to actual increases and better overall sightability.

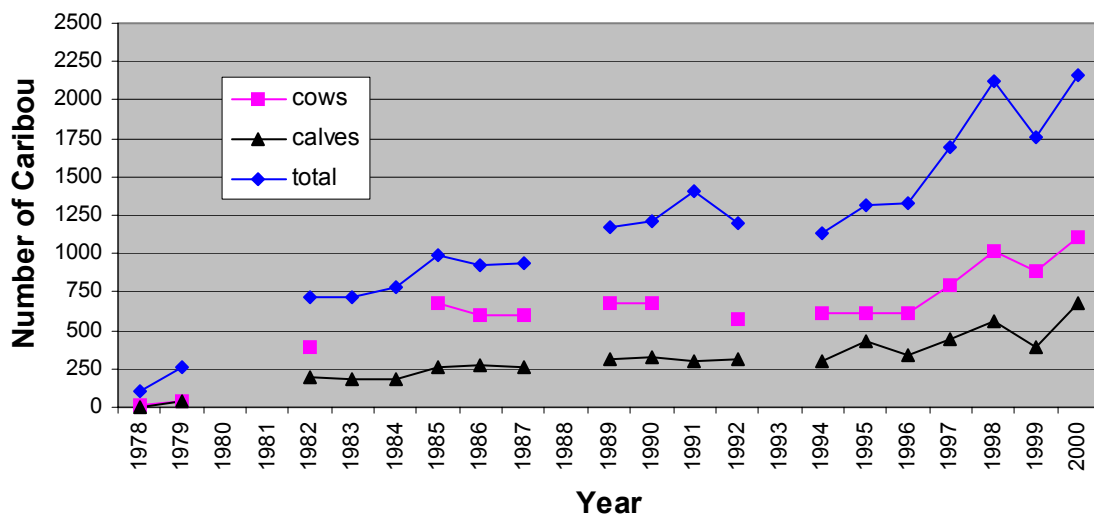


Figure 5. Summary of caribou post calving surveys for the Itcha-Ilgachuz Mountains Herd.

Bergerud (1978) counted 310 caribou in the Itcha and Ilgachuz Mountains in 1973, and suggested there was a maximum of 400 animals in the herd during the mid 1970's. During the late 1970's and early 1980's, surveys undertaken by regional wildlife staff observed a dramatic increase in caribou numbers (Smith and Hebert 1986). The Itcha-Ilgachuz Herd is currently estimated at 2000 animals (post hunting season) with a density of 0.20 caribou/km²; surveys have observed healthy calf production, a stable breeding female component and a relatively stable bull/100 cow ratio. Between 1995 and 1999 post calving surveys observed bull/cow ratios ranging between 31 and 33 bulls/100 cows, with the exception of 1997 which had a ratio of 25.6 bulls/100 cows. In 2000, a ratio of 23.9 bulls/100 cows was observed. All years surveyed, except for the 38.5 bulls/100 cows recorded in 1992, were below the provincial target of 35 bulls/100 cows for post

season estimates (Figure 6). There may be an unaccounted-for sightability bias during rut surveys, resulting in lower bull/cow ratios being observed in October (Figure 7).

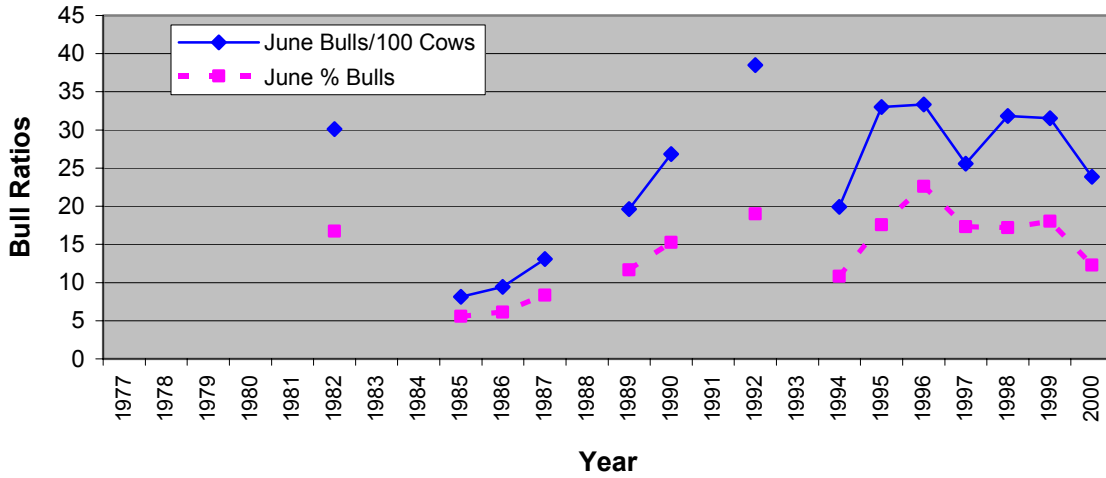


Figure 6. Summary of post-calving bull ratios for the Itcha-Ilgachuz Mountains Herd for all years (1984 and 1991 omitted due to many unclassified animals and small sample size, respectively).

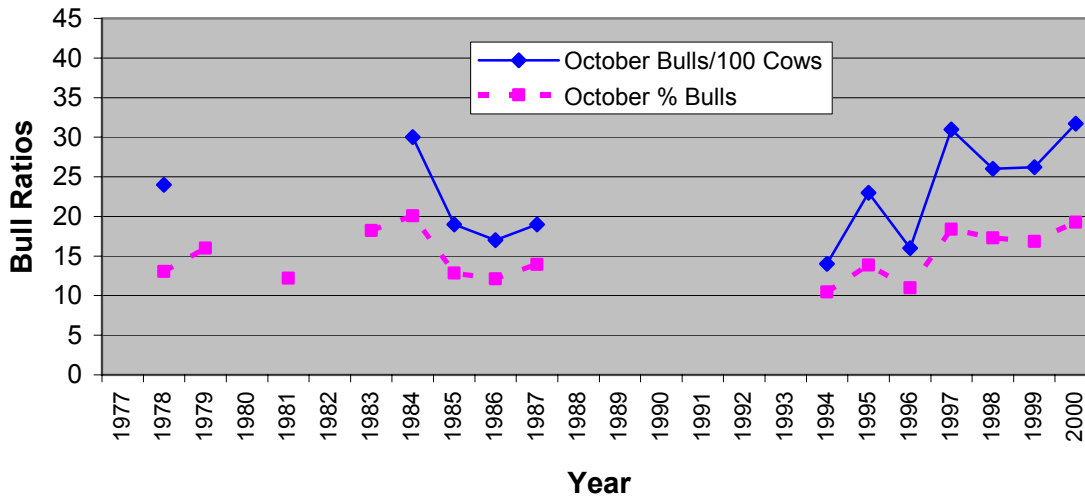


Figure 7. Summary of caribou rut surveys for the Itcha-Ilgachuz Mountains Herd detailing observed bull ratios for all years (1979, 1981 and 1983 estimates are minimums as there were numerous unclassified caribou, which may have included immature bulls, for these surveys).

Ritcey (1956) estimated 100-150 caribou in the Rainbow Mountains in 1956 after seeing 68 while walking during the summer. Bergerud (1978) estimated the Rainbow Herd likely peaked in the late 1960's at 200-300 animals after he observed only 41 caribou during a survey in 1977. There have been few complete surveys in the Rainbow Mountains, but the Rainbow Herd is now estimated at about 125 animals with a density of 0.028 caribou/km² and has appeared to remain stable since the mid 1980's with a relatively high mature bull to immature bull ratio (Figure 8).

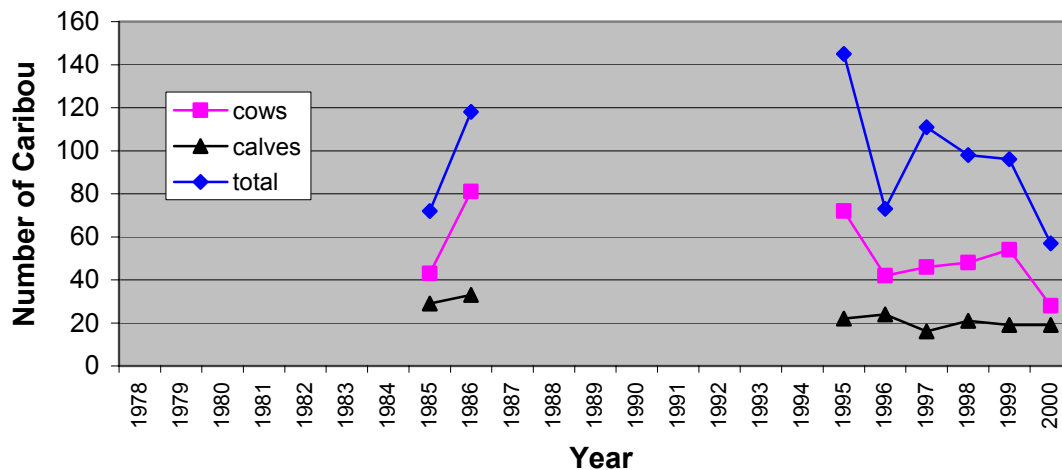


Figure 8. Summary of caribou post calving surveys for the Rainbow Mountains Herd.

During the post calving survey females, two years and older, were included in the cow component during classification. As most two-year old caribou do not bear young and many three-year olds are not parous the results overestimate the number of reproducing females (Bergerud 1983).

When the yearling/100 adult ratios from June 1996-1998 surveys were compared to the March 1996-1998 calf/100 adults ratios, there was generally good correlation (Table 4). The exception being a substantial drop in the estimates from March 1998 to June 1998 in the Rainbow Herd. In 1999 and 2000 the Itcha-Ilgachuz and Rainbow ratios decreased from March to June with poorer correlation. Results from recent June surveys may have become less accurate due to the need to survey more animals in large groups within approximately the same time frame as earlier surveys. The results imply that in at least the most recent June surveys, some yearlings have been misclassified as adult bulls or cows. Generally these findings suggest that the results from the June surveys may be adequate to estimate the previous year's recruitment if seasoned observers, able to differentiate yearlings from adults, are utilized.

Table 4. Caribou calves and yearlings/100 adults for March and June in the Itcha-Ilgachuz and Rainbow Mountains Herds.

Year	Itcha-Ilgachuz Herd		Rainbow Herd	
	March calves/100 adults	June yr/100 adults	March calves/100 adults	June yr/100 adults
1996	27.1	22.9	12.5	11.4
1997	19.8	20.4	2.9	3.3
1998	15.5	13.0	7.3	2.7
1999	20.8	11.1	14.0	9.6
2000	20.0	7.6	15.3	8.6

Sightability corrections were made to the survey data from 1985-1987 and 1996-2000 to estimate total cow numbers in June within the Itcha-Ilgachuz Herd (Figure 9). Data from the 1980's included yearlings in the cow count and, therefore, overestimated the female breeding population. The 1996-2000 estimates included cows two years and older, and excluded bulls, yearlings, and calves. Although these differences make it difficult to directly compare the data between the late 1980's and the 1990's, it indicates the same generally stable to increasing population trend as found in Figure 5.

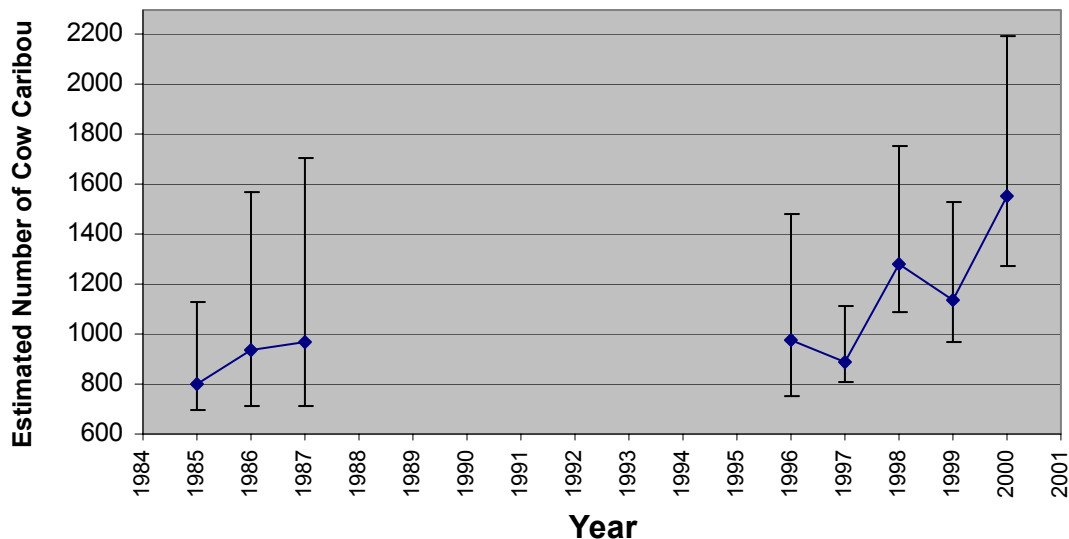


Figure 9: Estimated number of cow caribou in the Itcha-Ilgachuz Herd, post calving, and 95% confidence limits using collared animals to correct for sightability. Estimates in the 1980's included cows and yearlings, while 1996-00 data included only cows (1985-87 estimates; Cichowski unpubl. data).

Aggregation of caribou in late spring and early summer may introduce bias into the population estimate derived from the post-calving survey results. When sighting probability is a function of group size, such that larger groups of caribou have a greater probability of being sighted than smaller groups, bias of the estimate may occur as a

result of violating the assumption of independent observations (Neal et al. 1993, Samuel et al. 1987). The potential for overestimation increases with aggregation; however, Neal et al. showed that relative confidence interval length did not change regardless of whether animals grouped or whether increasing group size increased the probability of being observed.

The annual migration to the alpine spring calving grounds is thought to be an anti-predator strategy by caribou to distance themselves from predators. By distancing themselves from other prey types, predator search time is increased making it less energetically favourable to subsist on a diet of caribou. Cows and calves are the most vulnerable segments of the population during calving and therefore tend to seek out the highest elevations. Bulls are often the last to migrate, choosing instead to feed on higher quality forage found at lower elevations. Elevation use of adult bulls and yearling bulls was significantly different from the adult cow, adult cow with calf, and yearling cow categories during the June survey. The average elevation of caribou locations in the June 2000 survey was 1859m, lower than previous years (1947m and 1917m in 1998 and 1997, respectively). Data from the Environment Canada weather stations at Lunch Lake (approximately 90m SE of Anahim Lake) and Kleena Kleene (65km SE of Anahim Lake) showed temperatures 1.1°C below normal for the month of May 2000 (Table 5). April 2000 temperatures were considered normal for the area.

Table 5. Average monthly temperatures at Lunch Lake and Kleena Kleene weather stations for April and May 1996-2000 (normal temperatures calculated from 1980-1992).

Year	Location	April Avg Temp. (°C)	April Normal Temp. (°C)	May Avg Temp. (°C)	May Normal Temp. (°C)
1996	Lunch Lake	4.4	3.4	5.7	7.7
1996	Kleena Kleene	4.5	3.6	5.9	7.8
1997	Lunch Lake	3.5	3.4	8.3	7.7
1997	Kleena Kleene	3.9	3.6	8.8	7.8
1998	Lunch Lake	3.3	3.4	11.3	7.7
1998	Kleena Kleene	3.9	3.6	11.7	7.8
1999	Lunch Lake	incomplete	3.4	5.2	7.7
1999	Kleena Kleene	3.0	3.6	6.2	7.8
2000	Lunch Lake	3.4	3.4	6.6	7.7
2000	Kleena Kleene	3.6	3.6	6.7	7.8

In 1996, bull numbers in the Itcha-Ilgachuz Herd appeared to be decreasing (16 bulls/100 cows in the October rut survey) based on post season rut surveys (Figure 7); however, the following year noted an increase in bull numbers to 31.1 bulls/100 cows. In 1998 and 1999 ratios were fairly consistent at 26.4 and 26.2 bulls/100 cows respectively (Table 6). The 2000 rut survey continued this trend with an observed 31.7 bulls/100 cows.

Table 6. Rut survey bulls/100 cows ratios and mature bulls/100 immature bulls, 1995-2000.

Year	Itcha-Ilgachuz Herd			Rainbow Herd		
	Bulls/100Cows	Mat. Bulls/100 Imm. Bulls	% Calves	Bulls/100Cows	Mat. Bulls/100 Imm. Bulls	% Calves
1995	23/100	89/100	24.6%	36/100	291/100	9.0%
1996	16/100	55/100	18.2%	24/100	92/100	7.1%
1997	31/100	115/100	13.5%	27/100	175/100	2.8%
1998	26/100	91/100	17.1%	27/100	300/100	12.1%
1999	26/100	86/100	18.8%	43/100	329/100	16.7%
2000	32/100	70/100	20.0%	23/100	129/100	20.4%

There is no hunting season of caribou in the Rainbow Herd and the male component of the Itcha-Ilgachuz Herd is harvested under a mature bull regulation. We have limited information on the effects of sustenance hunting on this population, and there is some speculation that compulsory reporting, required in 1995-1996, was not as effective as compulsory inspection in obtaining accurate harvest values. Thus, compulsory inspections became required once again in 1997 and more accurate accounts of hunting activity have since been recorded. Between 1985, the year the mature bull season was implemented, and 1994, when compulsory inspection was required, the average annual harvest was 27 bulls (Appendix 6). Estimates from reported harvest values for 1995 and 1996 were 11 and 26, respectively. Annual harvest was 40 bulls in 1998 and 29 bulls in 1999. In 2000 harvest was 34 bulls, representing approximately 1.7% of the entire population.

There is presently no method of determining the amount of mixing between the Itcha-Ilgachuz Herd and the Rainbow Herd, therefore a small bias must be considered when interpreting sex ratios. In the past six years, the Itcha-Ilgachuz Herd ratio of mature bulls to immature bulls has been much lower than the Rainbow Herd (Table 6).

In the mid 1980's greater numbers of bulls were observed during rut surveys than post-calving surveys within the Itcha-Ilgachuz Herd, however overall numbers seen during surveys have roughly doubled since that period (Figures 6 and 7). Although bull numbers have been fairly consistent over the last five years, October results have shown both herds below the provincial target of 35 bulls/100 cows post season during most surveys. The fact that recent post calving bull/cow ratios were substantially higher and the harvest has been relatively low may indicate some sightability bias during the rut surveys. Post calving surveys observe more of the population and appear to provide a better estimate of sex ratios.

Of the Rainbow Herd caribou observed in the 2001 late winter survey 16.7% were calves. This value meets the minimum calf percentage of 15-16% needed to balance the natural mortality of adults and maintain population stability as suggested by Bergerud (1992). In previous years recruitment was substantially lower indicating an hypothesised predatory influence (11.1% in 1996, 2.8% in 1997, 6.8% in 1998, 12.5% in 1999, 13.0% calves in 2000; Figure 10). In the last six years calf percentages were above the 15-16%

recruitment stabilization mark in the Itcha-Ilgachuz Herd for both the rut and late winter surveys, with the 1997 exception of 14.9% and 13.4%, respectively (Figure 11). Similar trends were observed with radio-collared cows (Figures 12 and 13). The decrease in mortality rate following the summer is expected, as calves become less vulnerable to predation with increased body size.

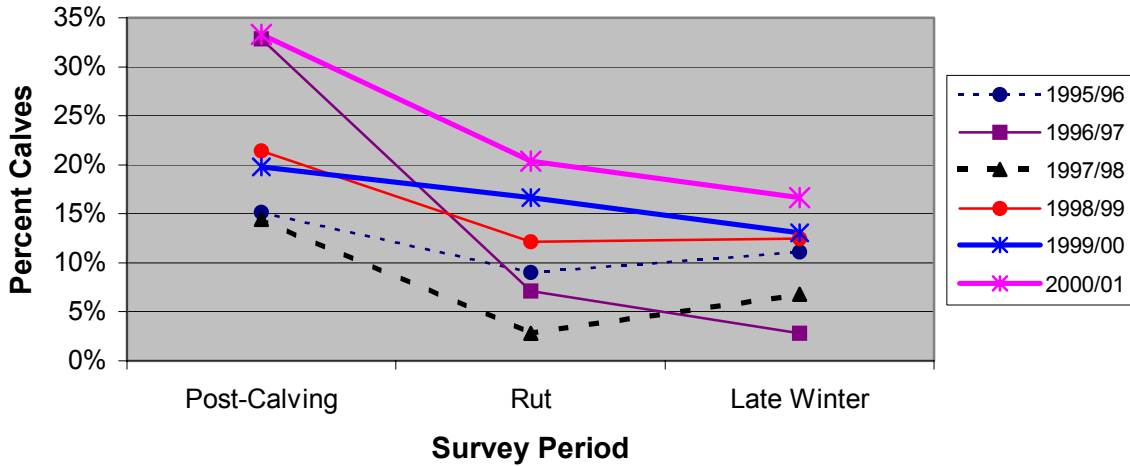


Figure 10. Summary of observed caribou calf survival for the Rainbow Mountains Herd during the last six caribou years, 1995-2001.

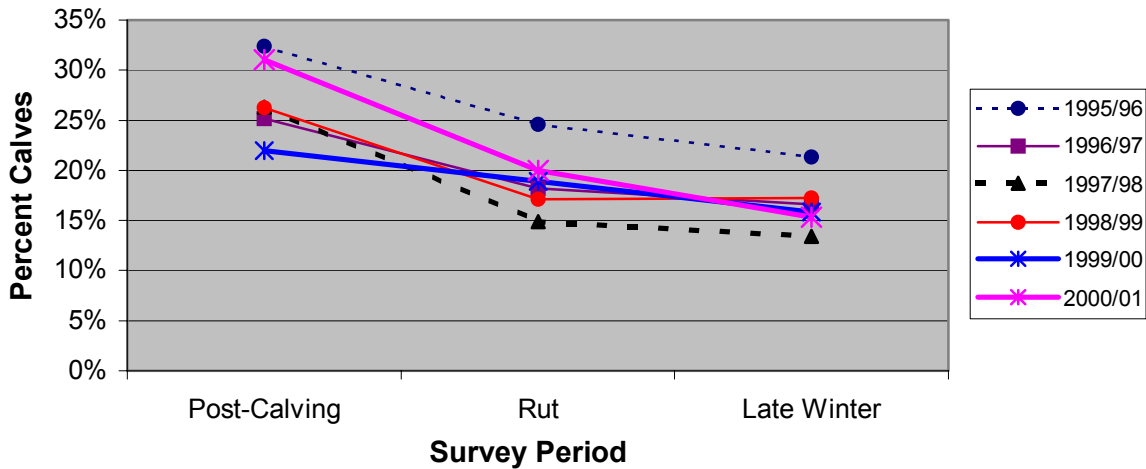


Figure 11. Summary of observed caribou calf survival for the Itcha-Ilgachuz Mountains Herd during the last six caribou years, 1995-2001.

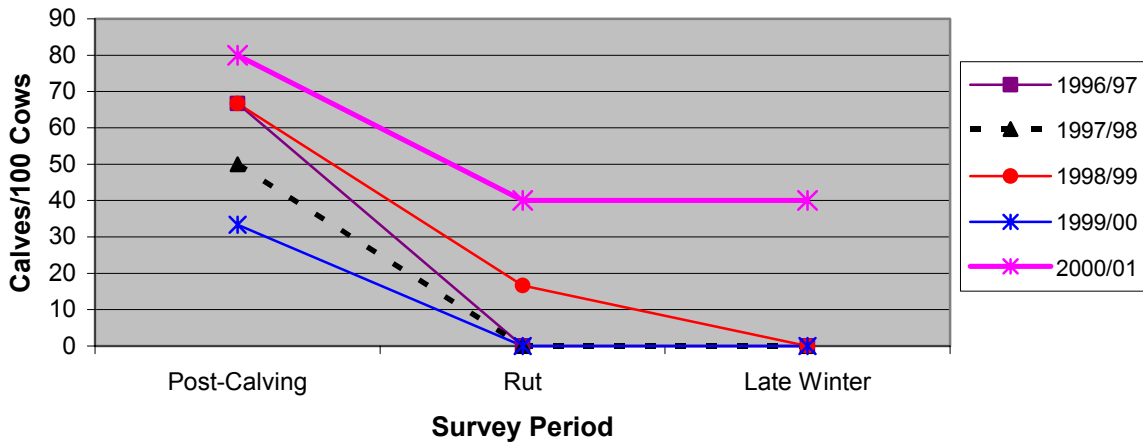


Figure 12. Calf survival ratios of radio-collared cows in the Rainbow Mountains Herd from post-calving, rut and late winter surveys (1996-2001).

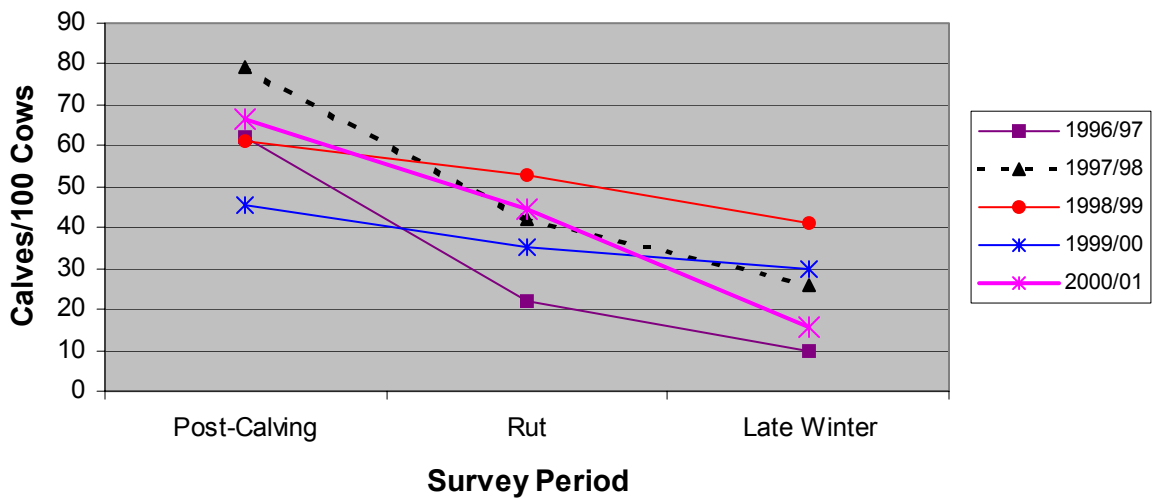


Figure 13. Calf survival ratios of radio-collared cows in the Itcha-Ilgachuz Mountains Herd from post-calving, rut and late winter surveys (1996-2001).

The loss of winter habitat from clear-cut harvesting will reduce the amount of winter forage available to caribou. The indirect effects of timber harvesting, such as increased poaching and human disturbance from access development, and increased predation from changes to habitat, may negatively effect caribou populations. Population modelling will be undertaken to determine options for maintaining the population size and achieving a higher bull/cow ratio.

CONCLUSIONS

- During the 2000 June post calving survey a total of 2224 caribou were observed which included 1139 cows, 692 calves, 272 bulls, 38 yearling cows, 59 yearling bulls, 12 unsexed adults, and 12 unsexed yearlings. The observed calf/100 cow ratio was 60.6/100 in the Itcha-Ilgachuz Herd and 67.9/100 in the Rainbow Herd.
- During the 2000 October rut survey a total of 731 caribou were observed which included 398 cows, 130 calves, 52 mature bulls, 68 immature bulls, and 83 unclassified. The observed calf/100 cow ratio was 32.9/100 in the Itcha-Ilgachuz Herd and 31.4/100 in the Rainbow Herd. The observed bull/100 cow ratio was 31.7/100 in the Itcha-Ilgachuz Herd and 22.9/100 in the Rainbow Herd.
- During the 2001 March late winter survey 529 caribou were observed, all of which were in forested habitats. The Itcha-Ilgachuz Herd calf percentage was estimated at 15.3% and the Rainbow Herd calf percentage was estimated at 16.7%.
- The Itcha-Ilgachuz caribou population appears to be stable to increasing while the Rainbow Mountain population appears to be stable to declining.
- The calf recruitment in the Itcha-Ilgachuz Herd has appeared to be sufficient to balance adult natural mortality in the past six years. The Rainbow Herd shows low calf recruitment rates from 1996-1999; the 2000 rate is higher but this may be due to fewer total caribou observed compared to previous surveys.
- The Itcha-Ilgachuz and Rainbow post season bull/100 cow ratio appears to be below the provincial target of 35 bulls/100 cows.

RECOMMENDATIONS

- Future survey efforts should continue with both spring and autumn surveys conducted within the same year and a late winter survey the following year.
- Surveys should be undertaken every year to take advantage of radio-collared animals. This will allow for development of a sightability correction factor and monitoring of calf survival amongst collared females within the population.
- Population modelling should be undertaken to predict the consequences of maintaining the present harvest strategy on bull/cow ratios.

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APPENDICES