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

by

James A. Young
&
Nicola L. Freeman

Wildlife Branch
Ministry of Water, Land and Air Protection
Cariboo Region

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ABSTRACT

As part of ongoing monitoring, the Itcha-Ilgachuz and Rainbow Mountains caribou herds were surveyed aerially 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/km^2. 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/km^2. 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

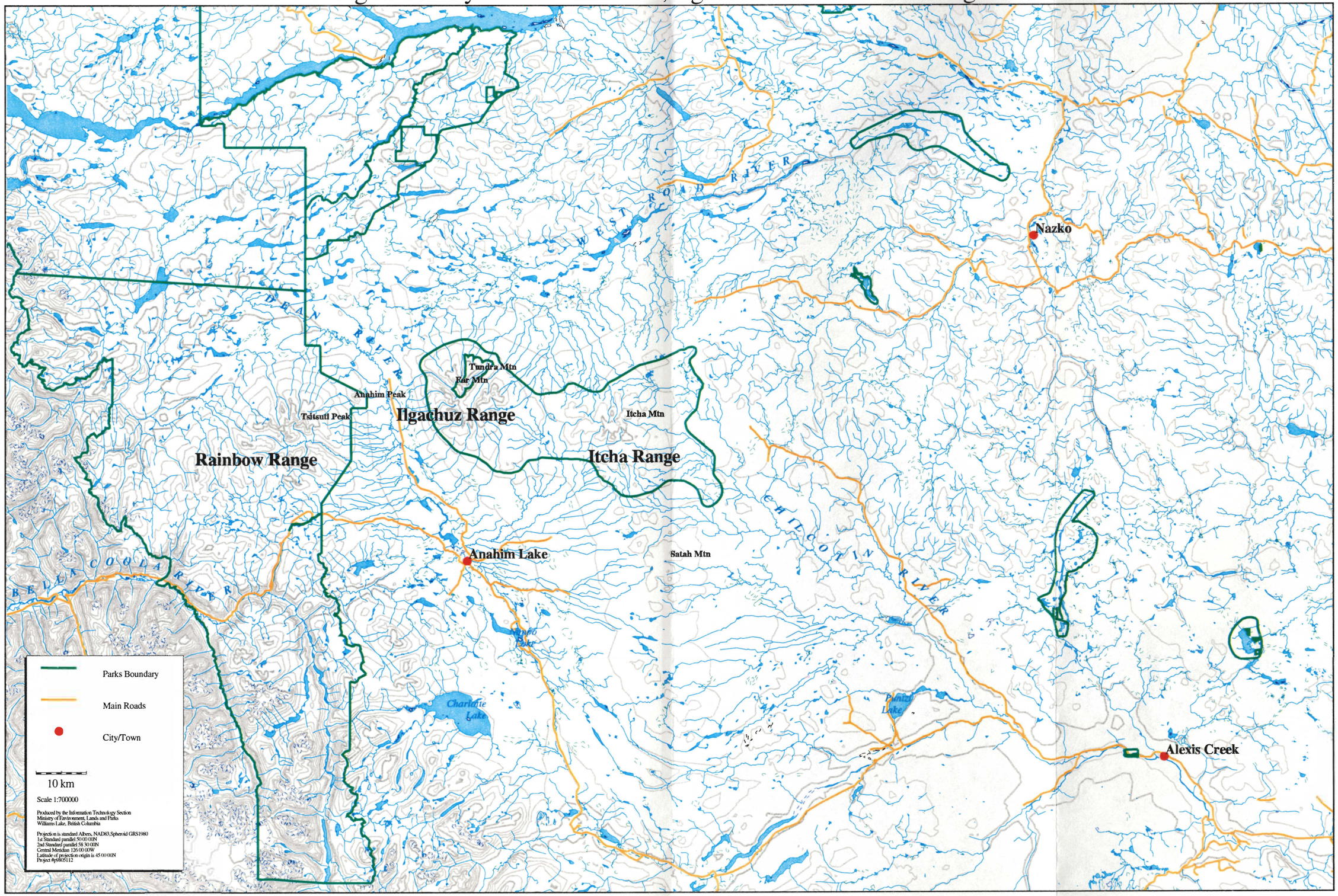
Caribou (*Rangifer tarandus caribou*) from the Itcha-Ilgachuz Mountains Herd and Rainbow Mountains Herd share a common winter range in some years, thus for management purposes they are considered two herds of the same population (Hatler, 1987). Aerial caribou population surveys were completed in June 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 km^2 and 4,409 km^2, respectively.

Fig 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:

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

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, . . ., 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 (ρ=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.

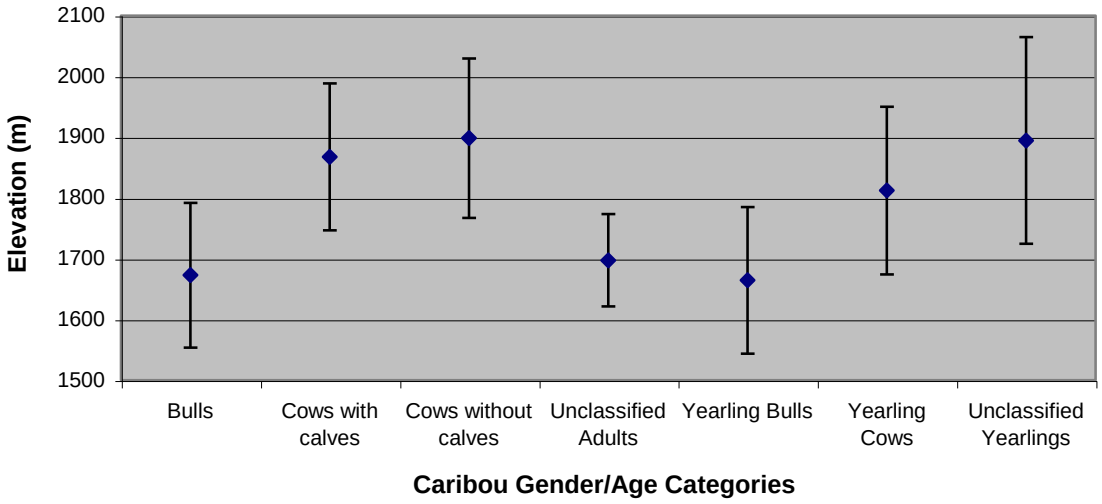


Figure 2. Average elevation of caribou population segments with 95% confidence intervals in June 2000.

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).

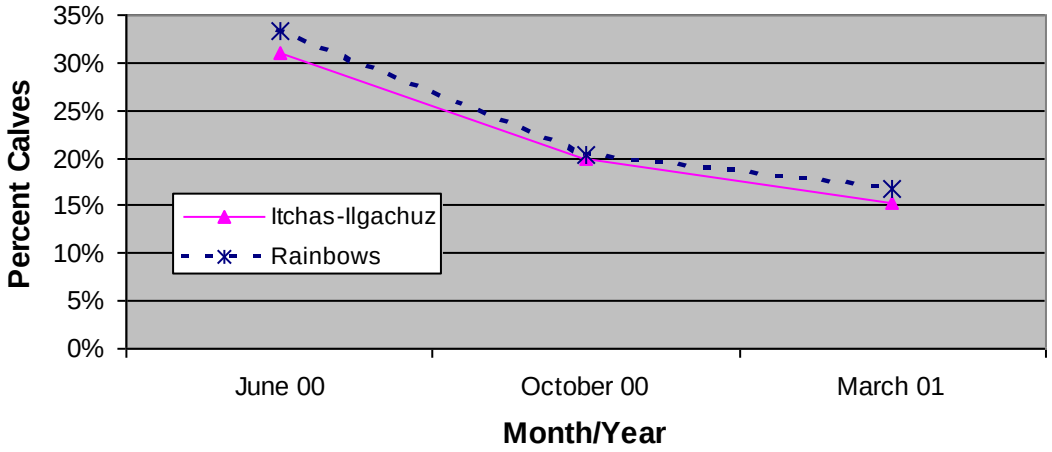


Figure 3. Calf percentage observed in the post calving, rut and late winter population surveys of the Itcha-Ilgachuz and Rainbow Mountains Herds.

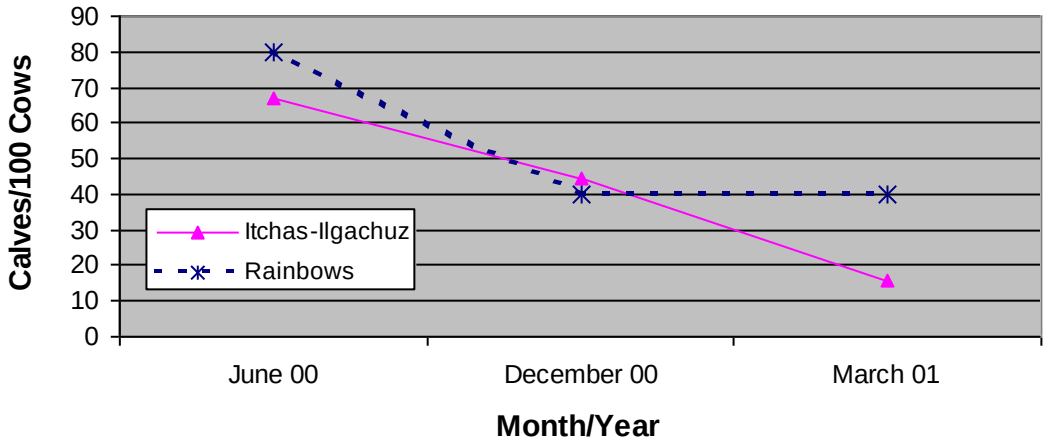


Figure 4. Calves/100 cows observed for radio-collared caribou in the post calving, rut and late winter population surveys of the Itcha-Ilgachuz and Rainbow Mountains Herds.

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.

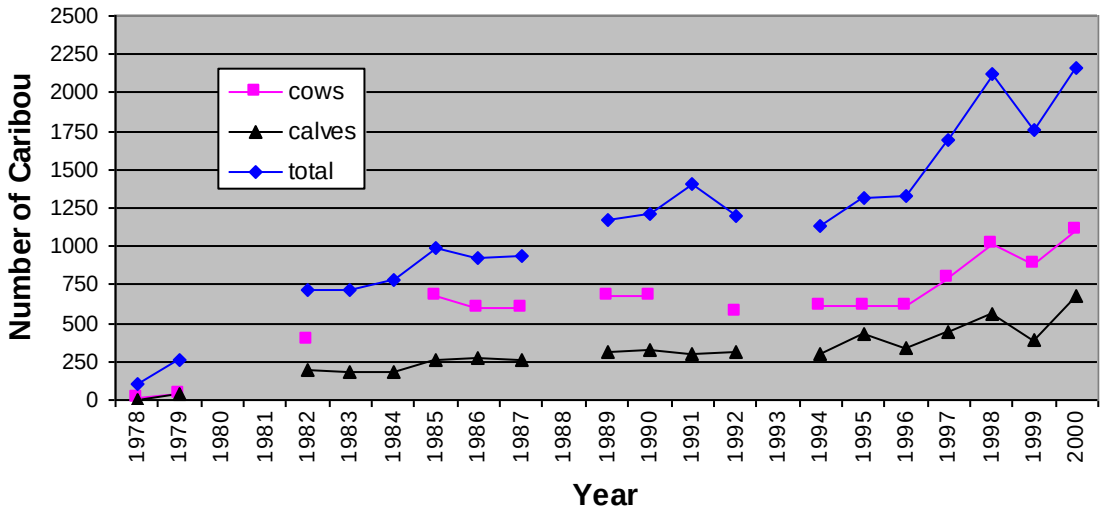


Figure 5. Summary of caribou post calving surveys for the Itcha-Ilgachuz Mountains Herd.

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/km^2; 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).

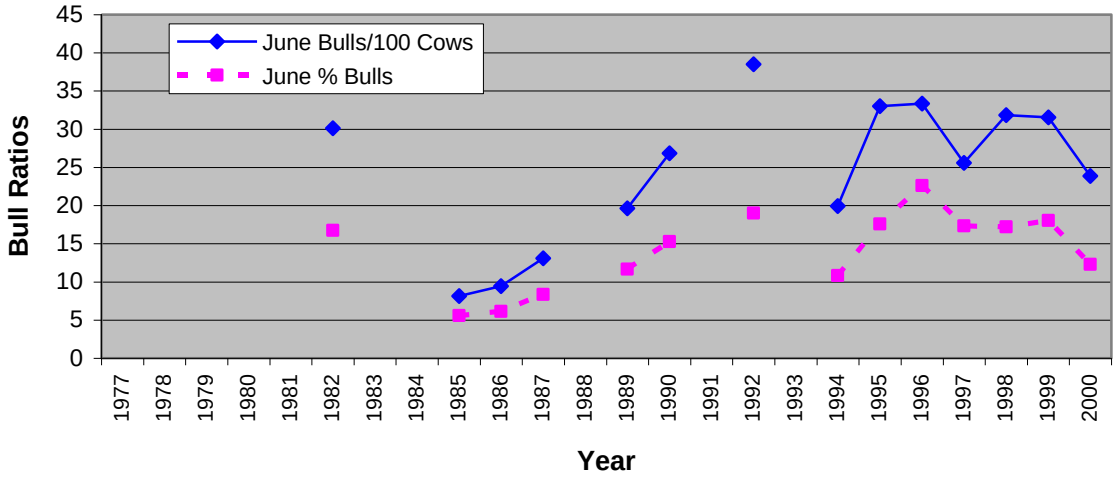


Figure 6. Summary of post-calving bull ratios for the Itcha-Ilgachuz Mountains Herd for all years (1984 and 1991 omitted due to many unclassified animals and small sample size, respectively).

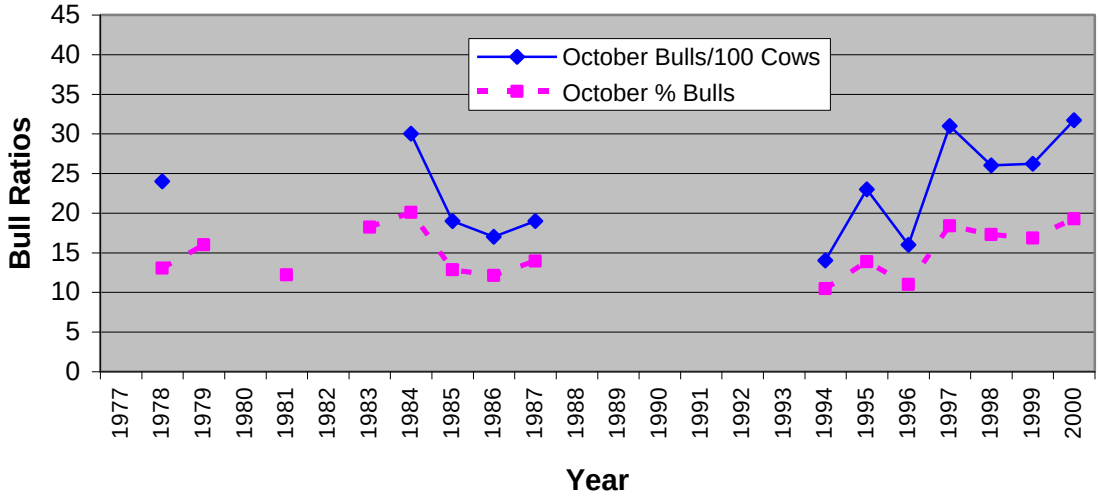


Figure 7. Summary of caribou rut surveys for the Itcha-Ilgachuz Mountains Herd detailing observed bull ratios for all years (1979, 1981 and 1983 estimates are minimums as there were numerous unclassified caribou, which may have included immature bulls, for these surveys).

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/km^2 and has appeared to remain stable since the mid 1980's with a relatively high mature bull to immature bull ratio (Figure 8).

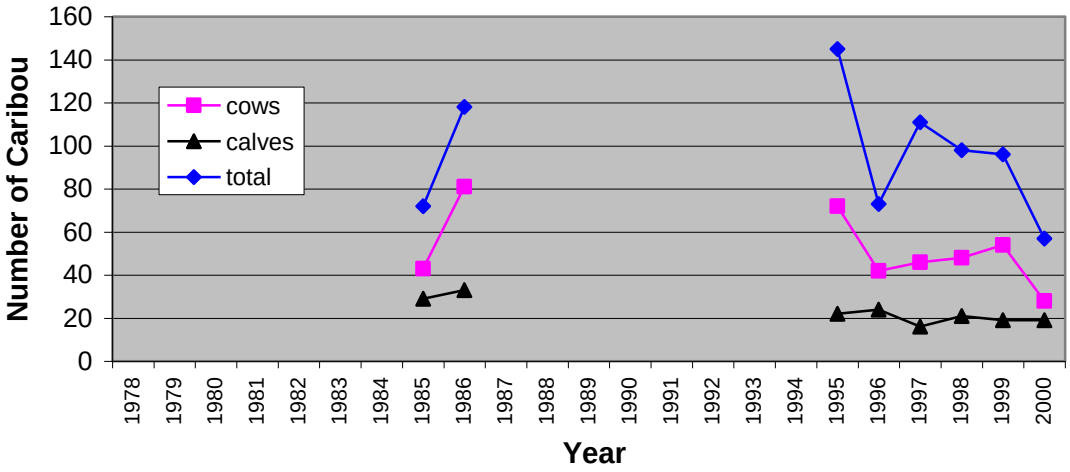


Figure 8. Summary of caribou post calving surveys for the Rainbow Mountains Herd.

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 yrlg./100 adults	March calves/100 adults	June yrlg./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.

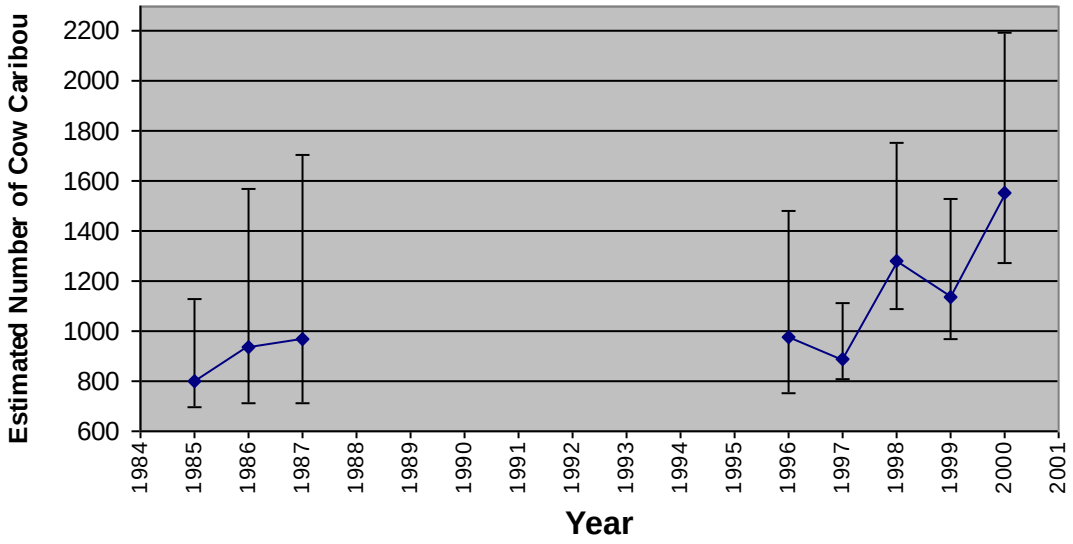


Figure 9: Estimated number of cow caribou in the Itcha-Ilgachuz Herd, post calving, and 95% confidence limits using collared animals to correct for sightability. Estimates in the 1980's included cows and yearlings, while 1996-00 data included only cows (1985-87 estimates; Cichowski unpubl. data).

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.

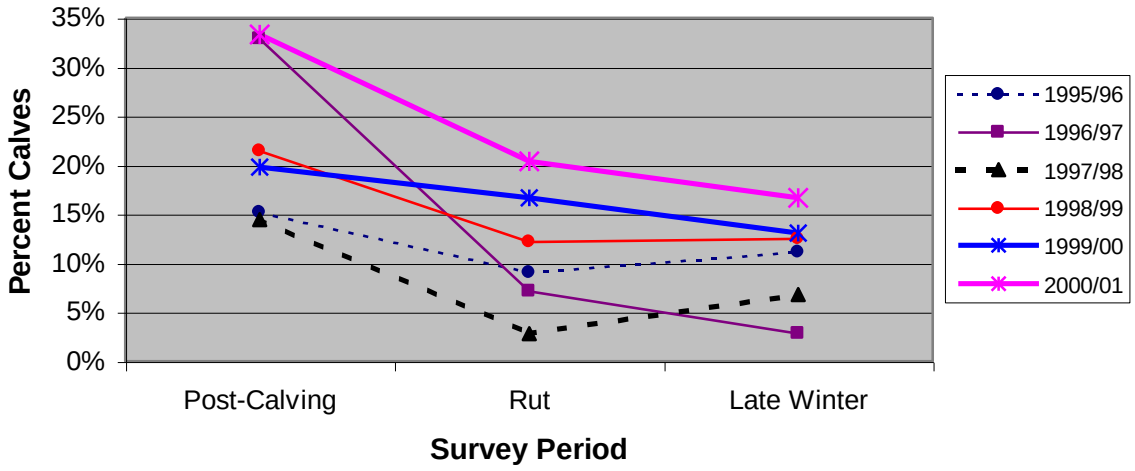


Figure 10. Summary of observed caribou calf survival for the Rainbow Mountains Herd during the last six caribou years, 1995-2001.

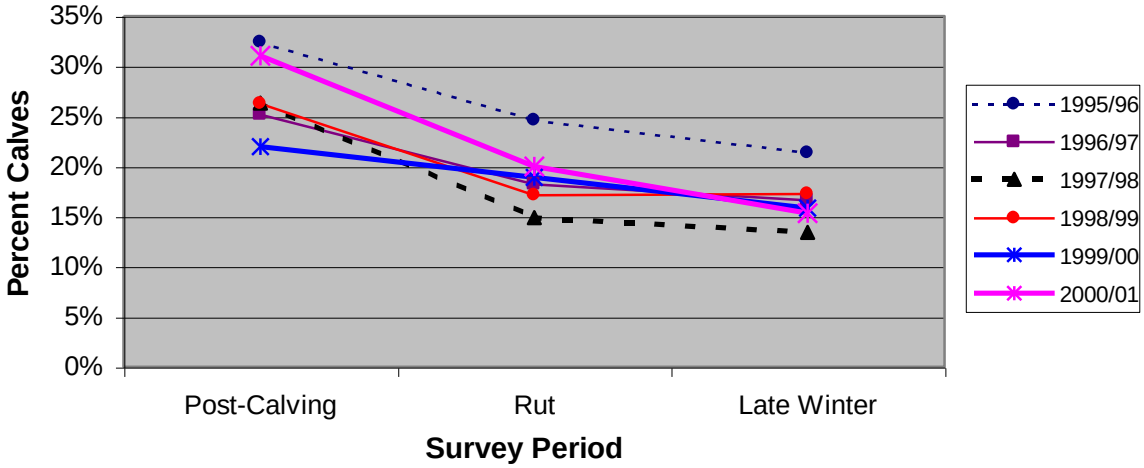


Figure 11. Summary of observed caribou calf survival for the Itcha-Ilgachuz Mountains Herd during the last six caribou years, 1995-2001.

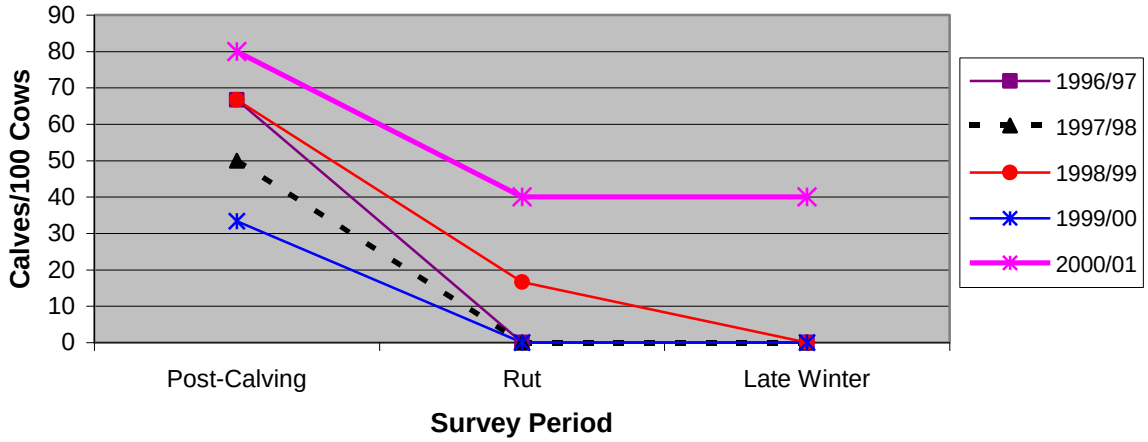


Figure 12. Calf survival ratios of radio-collared cows in the Rainbow Mountains Herd from post-calving, rut and late winter surveys (1996-2001).

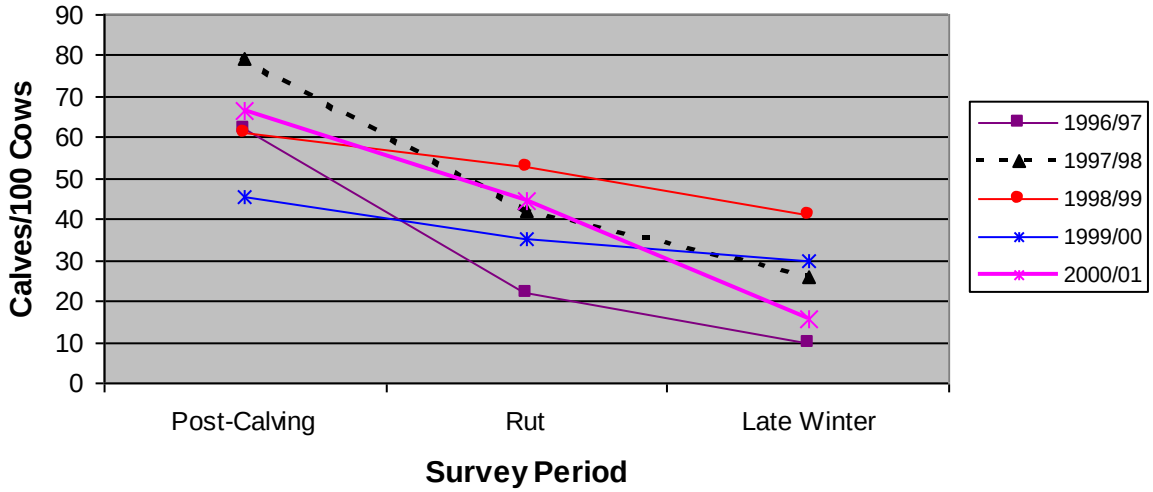


Figure 13. Calf survival ratios of radio-collared cows in the Itcha-Ilgachuz Mountains Herd from post-calving, rut and late winter surveys (1996-2001).

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

APPENDIX 1: POST CALVING SURVEY RESULTS

ITCHA MOUNTAINS CARIBOU SURVEY - JUNE 20, 2000

Sighting	Easting	Northing	Total	Cows	Calves	Bulls	Yrlg. Cows	Yrlg. Bulls	Unclass. Adults	Unclass. Yrlg.
1	3 87 248	58 47 117	7			5		2		
2	3 87 479	58 48 190	6			6				
3	3 87 745	58 51 864	17	1		13	1	2		
4	3 84 220	58 47 454	10			10				
5	3 82 482	58 48 619	9			7		2		
6	3 81 321	58 48 805	42			32		10		
7	3 80 990	58 51 352	3			2		1		
8	3 79 316	58 49 792	7			7				
9	3 82 478	58 47 023	2			2				
10	3 78 409	58 45 000	19			18		1		
11	3 76 067	58 45 472	8	4	4					
12	3 76 253	58 44 057	7			5		2		
13	3 75 436	58 43 580	11	4		4				3
14	3 74 848	58 46 606	19	12	7					
15	3 74 203	58 46 648	9			7		2		
16	3 74 107	58 45 199	4	3			1			
17	3 75 251	58 42 904	2	1	1					
18	3 75 363	58 41 640	6	3	3					
19	3 73 731	58 42 046	3	3						
20	3 73 114	58 40 867	31	17	14					
21	3 71 703	58 41 245	10	6	4					
22	3 71 572	58 40 876	5	3		1	1			
23	3 69 681	58 42 067	3	3						
24	3 69 915	58 41 582	17	5		3	5		4	
25	3 70 000	58 40 361	38	21	16		1			
26	3 60 041	58 40 219	35	19	16					
27	3 69 401	58 41 826	2	1			1			
28	3 69 466	58 42 756	3	3						
29	3 67 367	58 43 214	12	6	6					
30	3 66 015	58 45 346	25	15	9		1			
31	3 65 361	58 43 177	11	7	4					
32	3 65 862	58 43 119	26	16	8	2				
33	3 65 862	58 43 119	23	14	9					
34	3 67 384	58 42 696	3	2	1					
35	3 67 278	58 40 560	5	3	2					
36	3 67 042	58 40 740	12	7	5					
37	3 67 844	58 39 705	30	18	11		1			
38	3 69 131	58 39 709	3	1		1	1			
39	3 71 540	58 39 598	69	43	26					
40	3 71 795	58 39 115	5	5						
41	3 74 059	58 35 155	4	3			1			
42	3 73 359	58 38 166	10	6	4					
43	3 74 812	58 40 037	19	10	9					
45	3 73 140	58 36 011	6	6						
46	3 76 928	58 30 031	5			2			3	
47	3 76 229	58 37 836	3	2			1			
48	37 77 576	58 38 306	2	1			1			
49	3 78 238	58 37 861	4	2		2				
50	3 80 242	58 37 288	4			4				
51	3 80 255	58 38 267	2	1	1					
52	3 78 301	58 38 549	2	1	1					

ITCHA MOUNTAINS CARIBOU SURVEY - JUNE 20, 2000

Sighting	Easting	Northing	Total	Cows	Calves	Bulls	Yrlg. Cows	Yrlg. Bulls	Unclass. Adults	Unclass. Year.
53	3 80 078	58 40 696	1			1				
54	3 79 807	58 41 371	2			2				
56	3 75 702	58 41 940	2	1	1					
61	3 63 633	58 35 416	6			5		1		
Total Caribou			**631**	**279**	**162**	**141**	**16**	**23**	**7**	**3**

ILGATCHUZ MOUNTAINS CARIBOU SURVEY - JUNE 21,2000

Sighting	Easting	Northing	Total	Cows	Calves	Bulls	Yrlg. Cows	Yrlg. Bulls	Unclass. Adults	Unclass. Year.
1	3 45 771	58 42 409	4	2	2					
2	3 47 634	58 42 548	13	8	5					
3	3 46 106	58 40 071	3					3		
4	3 48 334	58 40 250	3	2			1			
5	3 48 743	58 41 176	2				1	1		
6	3 48 796	58 42 835	3	2	1					
7	3 50 807	58 41 583	4			4				
8	3 52 268	58 40 618	8			6		2		
9	3 52 904	58 34 834	3			3				
10	3 52 904	58 34 834	9			7	1	1		
11	3 55 665	58 37 813	42			32		10		
12	3 55 565	58 38 995	10	6			3	1		
13	3 57 313	58 38 137	22			19		3		
14	3 58 247	58 38 403	13			9		4		
15	3 59 639	58 38 807	4			4				
16	3 58 335	58 42 247	1							1
18	3 55 517	58 40 587	2						2	
19	3 50 458	58 42 431	8			4	1	3		
20	3 51 809	58 43 766	22	12	10					
21	3 49 219	58 44 777	2	1	1					
22	3 47 462	58 46 433	88	55	33					
23	3 48 744	58 46 455	4	2	2					
24	3 50 048	58 47 327	58	32	26					
25	3 56 218	58 49 201	1					1		
26	3 52 510	58 46 477	1							1
27	3 52 600	58 47 659	1	1						
29	3 51 530	58 48 873	6	4	2					
30	3 49 972	58 49 556	2	1	1					
31	3 45 950	58 44 270	3	3						
32	3 45 035	58 44 820	47	29	18					
33	3 43 659	58 46 018	4	2	2					
36	3 48 543	58 50 520	13	4		1	4	1	3	
37	3 49 843	58 49 216	4	3	1					
38	3 43 364	58 45 197	2	1	1					
39	3 42 064	58 46 852	1	1						
40	3 42 064	58 46 852	17	8	9					
41	3 40 374	58 45 709	1	1						
42	3 43 277	58 44 651	2	1	1					
43	3 42 423	58 44 413	19	10	9					
44	3 43 668	58 43 427	23	14	7		2			
45	3 44 502	58 43 890	4	2	2					
46	3 42 731	58 41 425	2	1	1					
47	3 46 454	58 50 690	21	13	8					

ILGATCHUZ MOUNTAINS CARIBOU SURVEY - JUNE 21,2000

Sighting	Easting	Northing	Total	Cows	Calves	Bulls	Yrlg. Cows	Yrlg. Bulls	Unclass. Adults	Unclass. Year.
48	3 47 050	58 52 297	20	7		11	1	1		
49	3 43 810	58 50 883	16	8	8					
50	3 43 925	58 51 192	13	9	2					2
51	3 45 893	58 52 200	23	11	11		1			
52	3 46 778	58 54 226	5	3	2					
53	3 45 041	58 54 517	14	7	5		2			
54	3 46 210	58 55 036	2	1	1					
55	3 45 765	58 55 658	1	1						
56	3 44 673	58 55 841	23	12	11					
57	3 44 687	58 56 793	14	1		10		3		
58	3 43 980	58 51 853	12	8	2		2			
59	3 43 980	58 51 853	30	17	13					
60	3 43 213	58 53 654	135	80	54		1			
61	3 43 880	58 53 947	58	46	12					
62	3 43 880	58 53 947	37	25	12					
63	3 42 873	58 55 778	44	29	15					
64	3 43 212	58 56 718	434	260	156	14				4
65	3 41 321	58 53 187	72	41	31					
72	3 38 516	58 50 253	5	3			1	1		
73	3 39 924	58 49 559	76	42	34					
Total Caribou			**1536**	**832**	**511**	**124**	**21**	**35**	**5**	**8**

RAINBOW MOUNTAINS CARIBOU SURVEY - JUNE 22, 2000

Sighting	Easting	Northing	Total	Cows	Calves	Bulls	Yrlg. Cows	Yrlg. Bulls	Unclass. Adults	Unclass. Year.
1	3 10 750	58 46 534	5	3	2					
2	3 09 946	58 49 394	5	3	2					
4	3 09 519	58 45 000	11	7	3					1
7	3 03 255	58 43 538	5	3	2					
12	3 15 802	58 37 352	14	7	7					
16	3 07 161	58 87 065	1	1						
17	2 98 171	58 34 318	3	2		1				
21	2 94 206	58 28 781	1			1				
22	2 94 926	58 30 005	2			1		1		
23	2 97 767	58 30 559	4			4				
24	2 99 283	58 32 155	2		1		1			
25	3 12 931	58 31 905	4	2	2					
Total Caribou			**57**	**28**	**19**	**7**	**1**	**1**	**0**	**1**

Total Caribou for the Itcha Mountains								
631	**279**	**162**	**141**	**16**	**23**	**7**	**3**
Total Caribou for the Ilgachuz Mountains								
1536	**832**	**511**	**124**	**21**	**35**	**5**	**8**
Total Caribou for the Rainbow Mountains								
57	**28**	**19**	**7**	**1**	**1**	**0**	**1**
Total Caribou for the Itcha and Ilgachuz Mountains								
2167	**1111**	**673**	**265**	**37**	**58**	**12**	**11**
Total Caribou for the Itcha, Ilgachuz and Rainbow Mountains								
2224	**1139**	**692**	**272**	**38**	**59**	**12**	**12**

APPENDIX 2: RESULTS OF STATISTICAL TESTS ON GENDER/AGE AND ELEVATION

SCHEFFE'S TEST

Gender/Age Group	Mean Observed Elevation	Ranked Mean	N	Scheffe Grouping/Significance	
Cows with Calves	1898 meters	936.92	690	A	
Yearlings Unclassified	1895 meters	890.88	12	A	
Cows without Calves	1868 meters	843.42	448	A	
Yearling Cows	1812 meters	718.82	38	A	
Adult Unclassified	1697 meters	322.10	12		B
Bulls	1673 meters	359.33	272		B
Ýearling Bulls	1664 meters	313.36	59		B

Degrees of Freedom: 1524
Alpha: 0.05
Minimum Significant Difference: 325.79
Critical Value of F: 2.10452

DUNCAN'S MULTIPLE RANGE TEST

Gender/Age Group	Mean Observed Elevation	Ranked Mean	N	Duncan Grouping/Significance		
Cows with Calves	1898 meters	936.92	690	A		
Yearlings Unclassified	1895 meters	890.88	12	A	B	
Cows without Calves	1868 meters	843.42	448	A	B	
Yearling Cows	1812 meters	718.82	38		B	
Adult Unclassified	1697 meters	322.10	12			C
Bulls	1673 meters	359.33	272			C
Ýearling Bulls	1664 meters	313.36	59			C

Degrees of Freedom: 1524
Alpha: 0.05

Number of Means:	2	3	4	5	6	7	
Critical Range:		179.8	189.4	195.7	200.4	204.1	207.1

APPENDIX 3: OCTOBER RUT SURVEY RESULTS

ITCHA FLATS AND MOUNTAINS CARIBOU SURVEY- NOVEMBER 1, 2000

Sighting #	Easting	Northing	Total	Cows	Calves	Mat. Bulls	Imm. Bulls	Unclass.
1	366373	5839367	1					1
2	369898	5845046	5	3			2	
3	368692	5844113	7	6			1	
6	375787	5830059	4	2	2			
7	378065	5831387	11	5	2	2	2	
8	377935	5831182	11	6	3	1	1	
9	380237	5831722	9	3	2	2	2	
10	382607	5831883	7	5	1		1	
11	380543	5832364	18	10	1	1	2	4
12	376773	586549	2	1	1			
13	381467	5838509	21	11	2	1	7	
15	381577	5838329	4	3	1			
16	381007	5841023	32	22	5	2	3	
17	377797	5841155	17	12	5			
18	379273	5841910	11	10	1			
19	376769	5845251	3	3				
20	378192	5846078	21	16	4		1	
24A	377431	5850406	25	13	6	1	5	
25	381380	5851718	1	1				
26	328200	5852735	3	1	1	1		
27	390656	5849345	34	18	4	5	7	
28	391248	5849841	30	19	8	2	1	
29	387063	5847560	7	7				
30	387336	5846914	9	6	1	1	1	
31	388470	5845645	2	1		1		
32	388827	5845352	1	1				
33	390196	5843937	16	8	6	1	1	
36	390766	5837228	15	2	2			11
37	391082	5836389	13	7	2	1	3	
38	391073	5836177	9	5	2		2	
39	391668	5835540	2	1	1			
40	391544	5835298	3	2	1			
41	392691	5834188	6					6
42	393508	5834230	12	6	3	3		
43	392968	5834938	10	5	1	2	2	
44	392716	5834516	28	21	3	3	1	
45	393133	5834609	10	8	1		1	
46	393481	5833546	61	8	8		5	40
47	394055	5831167	24		1	3		20
TOTAL			**505**	**258**	**81**	**33**	**51**	**82**

ILGACHUZ MOUNTAINS CARIBOU SURVEY –NOVEMBER 1, 2000

Sighting #	Easting	Northing	Total	Cows	Calves	Mat. Bulls	Imm. Bulls	Unclass.
2	353769	5835775	7	3	2	2		
3	353549	5836813	9	5	1	1	2	
5	356855	5838025	8	4	2	1	1	
7	353738	5841826	9	8	1			
8	51307	5842616	35	21	7	2	5	
9	351885	5842482	4	2	2			
11	353250	5842986	11	7	3			1
13	354730	5849858	5	3	1	1		
17	342259	5856521	6	4	2			
18	342874	5855225	4	2	2			
20	341068	5854598	4	1	1	2		
21	340518	5854460	4	3	1			
22	340524	5853561	12	7	2	1	2	
TOTAL			**118**	**70**	**27**	**10**	**10**	**1**

RAINBOW MOUNTAINS CARIBOU SURVEY – OCTOBER 31, 2000

Sighting #	Easting	Northing	Total	Cows	Calves	Mat. Bulls	Imm. Bulls	Unclass.
1	317827	5842802	13	8	5			
2	316310	5846179	56	38	9	4	5	
3	315591	5848446	22	13	5	3	1	
6	304278	5846000	17	11	3	2	1	
TOTAL			**108**	**70**	**22**	**9**	**7**	**0**

Total caribou for the Itcha Flats and the Itcha and Ilgachuz Mountains

	623	**328**	**108**	**43**	**61**	**83**

Total caribou for Itcha Flats, and the Itcha, Ilgachuz and Rainbow Mountains

	731	**398**	**130**	**52**	**68**	**83**

APPENDIX 4: LATE WINTER SURVEY RESULTS

FOREST AND ITCHA-ILGACHUZ MOUNTAINS CARIBOU SURVEY – MARCH 15, 2001

Sighting#	Easting	Northing	Total	Adults	Calves	Unclassified	Collared female	Caribou Home Range
14	332323	5831287	15	10	1	4	150.522	Rainbow
15	332053	5832493	8	7	1		150.701/150.441	Rainbow
16a	332271	5834465	10	8	2			Rainbow
16b	322000	5833951	5	4	1		150.602	Rainbow
17	331425	5834751	2	1	1		150.500	Rainbow
1	397054	5822431	22	15	7		150.754	Itcha-Ilgachuz
2	405000	5818203	35	24	6	5	150.464	Itcha-Ilgachuz
3	404883	5814871	30	14	3	13		Itcha-Ilgachuz
4	404646	5814877	6	4	2		150.731/150.807	Itcha-Ilgachuz
5	406613	5810391	30	27	3			Itcha-Ilgachuz
6	407200	5810193	42	35	7		150.826/150.561	Itcha-Ilgachuz
7	395206	5811780	4	4			150.549	Itcha-Ilgachuz
9	388621	5815084	8	7	1		150.641	Itcha-Ilgachuz
10	392867	5812648	20	16	4			Itcha-Ilgachuz
11	392903	5812484	10	10			150.181	Itcha-Ilgachuz
12	397967	5807338	24	20	3	1	150.659	Itcha-Ilgachuz
13	390305	5803168	48	11	2	35	150.816	Itcha-Ilgachuz
18	360718	5828493	4	2	2		150.531	Itcha-Ilgachuz
19	378960	5821529	18	16	2		150.671	Itcha-Ilgachuz
20	369797	5816964	16	15	1		150.581	Itcha-Ilgachuz
21	376120	5791726	15	7	3	5		Itcha-Ilgachuz
22	375668	5790912	20	19	1		150.470	Itcha-Ilgachuz
23	395243	5799537	3	3			150.321	Itcha-Ilgachuz
24	374104	5791134	17	15	2		150.571	Itcha-Ilgachuz
25	369605	5785883	15	10	5			Itcha-Ilgachuz
26	368715	5784845	5	5				Itcha-Ilgachuz
27	361943	5783967	7	7			150.612	Itcha-Ilgachuz
28	376200	5789300	7	7				Itcha-Ilgachuz
29	376365	5789572	65			65		Itcha-Ilgachuz
30	397125	3798361	18	16	2		150.681	Itcha-Ilgachuz
TOTAL			**529**	**339**	**62**	**128**		

Total for the Rainbow Mountains Caribou

Forest	**40**	**30**	**6**	**4**
Alpine	**0**	**0**	**0**	**0**
Total	**40**	**30**	**6**	**4**

Total for the Itcha and Ilgachuz Caribou

Forest	**489**	**309**	**56**	**124**
Alpine	**0**	**0**	**0**	**0**
Total	**489**	**309**	**56**	**124**

APPENDIX 5: SUMMARY OF OBSERVED CARIBOU IN POST CALVING, RUT AND LATE WINTER SURVEYS, 1977-2000

POST CALVING SURVEY: ITCHA-ILGACHUZ MOUNTAINS[1]

Year	Date	Total	Cows	Calves	Bulls	Yearling Cows	Yearling Bulls	Unsexed Adults	Unsexed Yearling	Unclassified
1977										
1978	Jun-01	110	13	5						92
1979	Jun-08	262	45	45						172
1980		240								240
1981										
1982	Jun-16	711	395	197	119[2]					
1983	Jun-22	710		186				524		
1984	Jul-07	775		187	107			481		
1985	Jun-18	985	675	255	55					
1986	Jun-25	929	605	267	57					
1987	Jun-18	933	597	258	78					
1988	Jul-26	670	461	161	48					
1989	Jun-23	1175	672	314	132			44		
1990	Jun-27	1215	682	330	183			16	4	
1991	Jul-12	1408		298	16			1094		
1992	Jun-17	1194	569	317	219			41	48	
1993										
1994	Jun-21	1136	618	293	123				102	
1995	Jun-21	1321	609	428	201	52	31			
1996	Jun-27/29	1327	606	334	202	68	98		19	
1997	Jun-20	1689	794	444	203	81	83	37	47	
1998	Jun-20	2121	1012	557	322	4	34	50	142	
1999	Jul-13/14	1754	882	385	278	13	25	72	99	
2000	Jun-20/21	2167	1111	673	265	37	58	12	11	

POST CALVING SURVEY: RAINBOW MOUNTAINS

Year	Date	Total	Cows	Calves	Bulls	Yearling Cows	Yearling Bulls	Unsexed Adults	Unsexed Yearling	Unclassified
1977										
1978										
1979										
1980										
1981										
1982										
1983										
1984										
1985	Jun-18/19	75	43	29	3					
1986	Jun-25/26	122	81	33	4					
1987										
1988										
1989										
1990										
1991										
1992										
1993										
1994										
1995	Jun-22	145	72	22	28	19	4			
1996	Jun-27/29	73	42	24	2	3	2			
1997	Jul-03	111	46	16	30	3		16		
1998	Jun-21	98	48	21	27		1		1	
1999	Jul-21	96	54	19	16	6	1			
2000	Jun-22	57	28	19	7	1	1		1	

[1] Prior to 1994 yearlings were most often grouped with adults

[2] Includes some yearlings

RUT SURVEY: ITCHA-ILGACHUZ MOUNTAINS

Year	Date	Total	Cows	Calves	Mature Bulls[3]	Immature Bulls	Unclassified
1977							
1978	Nov-02	353	190[4]	117	46		
1979	Nov-27	513	36	10	82		385
1980							
1981	Nov-04	475	14	62	58		341
1982							
1983	Oct-15	351			64		287[5]
1984	Oct-25	334	227	40	67		
1985	Oct-18	210	142	31	27		
1986	Oct-10	429	304	73	52		
1987	Oct-21	509	372	66	71		
1988							
1989							
1990							
1991							
1992							
1993							
1994	Oct-17	440	331	63	24	22	
1995	Oct-18	260	160	64	17	19	
1996	Oct-29	692	490	126	27	49	
1997	Oct-20	620	367	84	61	53	55
1998	Oct-19	642	421	110	53	58	
1999	Oct-20	918	588	173	71	83	3
2000	Nov-01	623	328	108	43	61	83

RUT SURVEY: RAINBOW MOUNTAINS

Year	Date	Total	Cows	Calves	Mature Bulls[3]	Immature Bulls	Unclassified
1977							
1978							
1979							
1980							
1981							
1982							
1983							
1984							
1985							
1986	Oct-10	117	66	22	29		
1987	Oct-21	103	76	11	16		
1988							
1989							
1990							
1991							
1992							
1993							
1994							
1995	Oct-19	178	119	16	32	11	
1996	Oct-29	127	95	9	11	12	
1997	Oct-21	106	81	3	14	8	
1998	Oct-20	107	74	13	15	5	
1999	Oct-19	120	70	20	23	7	
2000	Oct-31	108	70	22	9	7	

[3] Mature bull category includes mature and immature bulls from 1978-1987, separate classification began in 1994
[4] Includes animals classified as adults
[5] Includes some yearlings

LATE WINTER SURVEY: ITCHA-ILGACHUZ MOUNTAINS

Year	Date	Total	Adults	Calves	Unclassified
1977	Apr-01	238	106	32	100
1978	Feb-17	59	49	10	
1979					
1980					
1981					
1982					
1983	Apr-18	243	182	61	
1984	Feb-14	63	45	18	
1985	Mar-13	113	89	24	
1986	Mar-18	220	167	53	
1987	Mar-14	155	122	33	
1988	Mar-10	101	84	17	
1989					
1990					
1991					
1992					
1993					
1994					
1995					
1996	Mar-13/15	197	155	42	
1997	Apr-1/2	217	181	36	
1998	Mar 27/28	618	535	83	
1999	Mar-16/17	261	216	45	
2000	Apr-11	360	285	57	
2001	Mar-15	529	339	62	128

LATE WINTER SURVEY: RAINBOW MOUNTAINS

Year	Date	Total	Adults	Calves	Unclassified
1978					
1979					
1980					
1981					
1982					
1983					
1984					
1985					
1986					
1987					
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995					
1996	Mar-13/15	117	104	13	
1997	Apr-1/2	71	69	2	
1998	Mar 27/28	59	55	4	
1999	Mar-16/17	48	43	6	
2000	Apr-11	92	78	12	
2001	Mar-15	40	30	6	4

APPENDIX 6: REPORTED ANNUAL BULL HARVEST

Year	Number of Bulls Harvested
1984 (last year before mature bull season)	47
1985	17
1986	9
1987	30
1988	24
1989	29
1990	21
1991	49
1992	37
1993	31
1994	24
1995*	11
1996*	26
1997	25
1998	40
1999	29
2000	34
Average	**28**
Standard Deviation	**11.1**

*Numbers estimated from reported harvest values