SUMMARY OF THE 1996 POST CALVING AND RUT SURVEYS AND THE 1997 LATE WINTER SURVEY FOR THE ITCHA, ILGACHUZ AND RAINBOW MOUNTAINS, CARIBOO REGION

by
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SUMMARY OF THE 1996 POST CALVING AND RUT SURVEYS AND THE 1997 LATE WINTER SURVEY FOR THE ITCHA, ILGACHUZ AND RAINBOW MOUNTAINS, CARIBOO REGION

Abstract: The Itcha, Ilgachuz, and Rainbow Mountains caribou population was surveyed aerially three times in an effort to determine population trends, sex ratio, and calf recruitment. The post calving survey completed on June 27 and 28 observed a total of 1400 caribou; 648 cows, 358 calves, 204 bulls, 71 yearling cows, 100 yearling bulls and 19 unsexed yearlings. The observed calf/100 cow ratio was 55/100 in the Itcha-Ilgachuz herd and 57/100 in the Rainbow herd. Cows with calves were found at higher elevations than cows without calves, with yearling and adult bulls being found at the lowest elevations. The October rut survey on October 29 and 30 observed 819 caribou; 585 cows, 135 calves, 61 medium bulls and 38 mature bulls. The observed calf/100 cow and bull/100 cow ratios in the Itcha-Ilgachuz herd were 26/100 and 16/100, respectively. In the Rainbow herd the observed calf/100 cow ratio was 9/100 and the bull/100 cow ratio was 24/100. The April late winter survey observed 288 caribou; 244 in forest and 44 in alpine habitat. The Itcha-Ilgachuz herd calf percentage was estimated at 17% and the Rainbow calf percentage was assumed to be 3%. The bull/cow and mature bull/medium bull ratios in the Rainbow herd were higher than the Itcha-Ilgachuz herd. The Itcha-Ilgachuz herd appears to be stable, with an adequate calf recruitment but a low bull to cow ratio. Further studies coupled with population modeling will be necessary to confidently produce a long-term caribou strategy as required by the CCLUP (Cariboo-Chilcotin Land Use Plan).

INTRODUCTION

Caribou (*Rangifer tarandus caribou*) from the Itcha-Ilgachuz Mountains herd and the Rainbow Mountains herd in some years share a common winter range, thus for management purposes, they are considered two herds of the same population (Hatler, 1987). As such, aerial caribou population surveys were completed in June and October of 1996 and in April of 1997 throughout the Itcha, Ilgachuz, and Rainbow Mountains. These surveys will contribute to developing a long-term caribou strategy as outlined in the Cariboo-Chilcotin Land Use Plan (CCLUP). Planned timber harvesting in the mature pine forests surrounding the Itcha-Ilgachuz Mountains will significantly decrease the availability of terrestrial and arboreal lichens foraged upon by caribou in the 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 June survey measured the relative abundance of the breeding female component and early calf production. The October rut survey estimated the sex composition and summer calf survival of each herd. The April late winter survey compared the proportion of forest and alpine-dwelling cows with calves as well as estimated overall calf recruitment. Observations of radio-collared caribou provided a sightability index in June and an additional measurement of calf production through the survey period. Future surveys of the same area and previous results will provide quantifiable population trends to aid wildlife managers.

We wish to thank Pat Dielman, Rick Page, Lara Webster and Robin Hoffos for serving as observers during the surveys. Michaela Waterhouse provided statistical advice and performed the Duncan's Multiple Range Test. Debbie Cichowski provided her unpublished population

survey data from the mid-1980's. Funding for this project was provided by Forest Renewal British Columbia (FRBC).

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 and are 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.

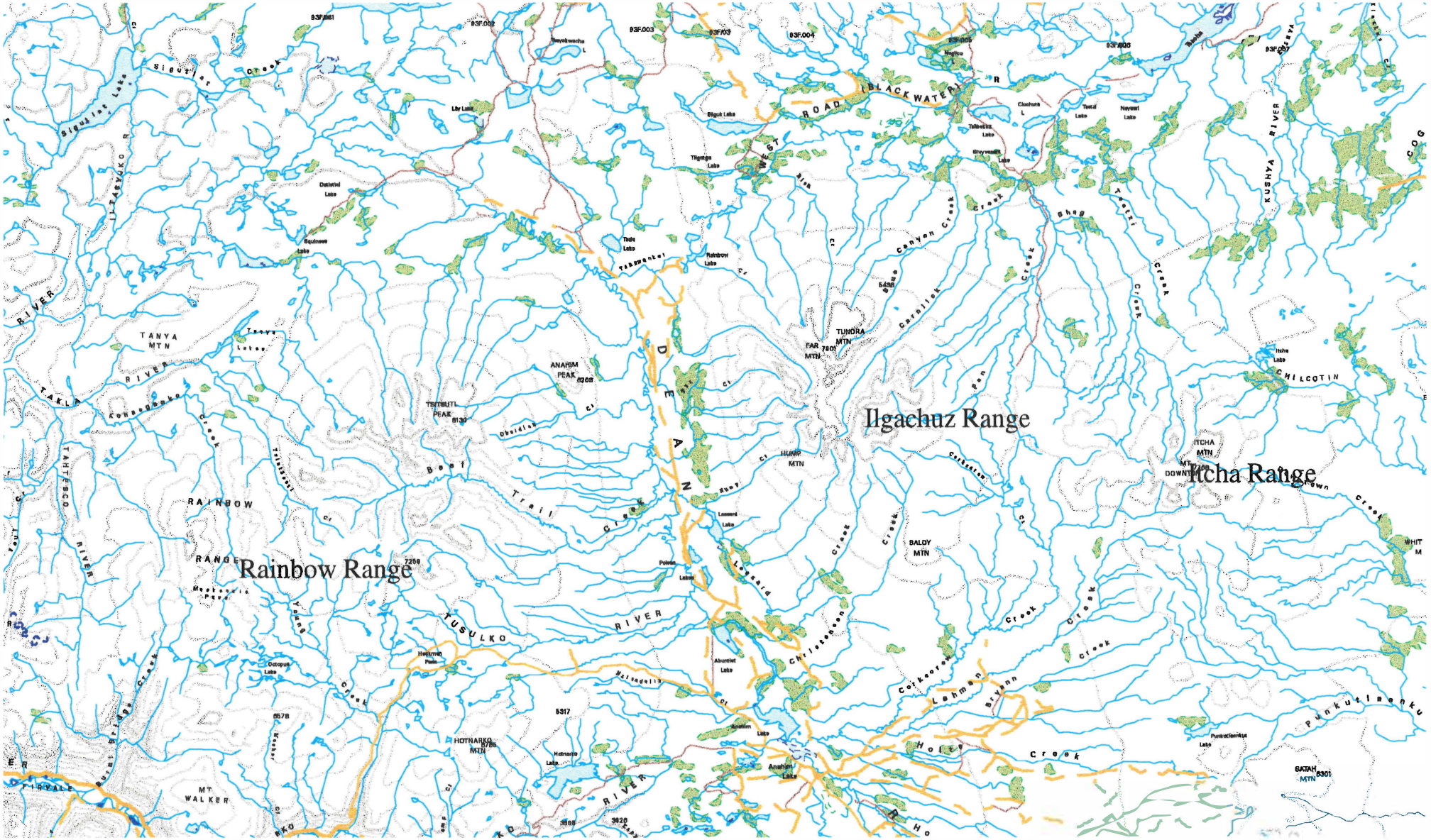
METHODS

Aerial surveys were completed in a Bell 206 Jet Ranger utilising the total count technique (Simpson et al. 1993). 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 so that observers on the left side of the aircraft could 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 larger plateaus 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 non-visually observed radio-collared caribou could still be gathered and used for separate purposes.

The post calving survey flights on June 27 and 28 included pilot Tom Arduini, Jim Young (navigator), Pat Dielman, and Rick Page. Flight time totaled 15.4 hours in high overcast and mild conditions. Caribou were classified into the following categories; cow, calf, yearling cow, yearling bull, or bull. UTM coordinates were recorded for each group of animals to digitally produce flight maps and elevational groupings.

The rut survey flights on October 29 and 30 included pilot Tom Arduini, Jim Young (navigator), Pat Dielman, Robin Hoffos and Ryan Loveridge. Flight time totaled 12.4 hours in clear but cool conditions. Caribou were classified into the following categories; class III Bull (mature bull), class II (medium bull), cow and calf. Due to the

Figure 1. Survey Area



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Projection is Universal Transvers Mercator, Zone 10
Projection DATUM is NAD83

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Kilometres 10 0 10 20 30 40 Kilomètres

Project #p9805112

difficulty of classifying large groups of caribou, both male and female yearlings were included in the cow classification.

The late winter survey flights on April 1 and 2 of 1997 included pilot Tom Arduini, Jim Young (navigator), Lara Webster and Ryan Loveridge. Flight time totaled 13.4 hours and the conditions were windy and high overcast with temperatures around freezing. Alpine and forest areas were searched using radio-telemetry to locate groups containing radio-collared females. Animals were classified as either adults or calves.

Population estimates were derived using the Peterson Method (White and Garrott, 1990). The total number of animals in the population (N) was estimated using the equation:

$$N = [(n+1)(M+1)/(m+1)] - 1$$

M is the total number of collared caribou, n is the total number of caribou counted during the survey, and m is the number of collared caribou counted during the survey. The estimate of unbiased variance was:

$$var(N) = (M+1)(n+1)(M-m)(n-m)/(m+1)^2(m+2)$$

and the 95 % confidence intervals for the population estimate N was calculated as:

$$N +/- 1.96 [var(N)^{0.5}]$$

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 adult

RESULTS

Post Calving Survey

A total of 1400 caribou were observed on the June 27 and 28 flights; 648 cows, 358 calves, 71 yearling cows, 100 yearling bulls, 19 unsexed yearlings, and 204 bulls (Table 1 and Appendix 1). The observed calf to 100 cow ratio in the Itcha-Ilgachuz herd was 55/100 and the bull to 100 cow ratio was 33/100. The observed bull to 100 cow ratio was lower in the Rainbow herd at 5/100, while the calf to 100 cow ratio was slightly higher at 57/100. The overall yearling to 100 cow and bull to 100 cow ratios were 29/100 and 31/100, respectively.

Table 1. Caribou Observed June 27 and 28, 1996, within the Itcha, Ilgachuz and Rainbow Mountains

Mountain Range	Total Classified	Cows (>1yrs)	Calves	Bulls (>1yrs)	Yrlg.-Cows	Yrlg.-Bulls	Unsexed Yrlgs.
Itcha	702	286	148	158	35	62	13
Ilgachuz	625	320	186	44	33	36	6
Rainbow	73	42	24	2	3	2	0
Itcha-Ilgachuz	1327	606	334	202	68	98	19
Itcha-Ilgachuz-Rainbow	1400	648	358	204	71	100	19

On average, bulls were observed at the lowest elevations in the post calving surveys at approximately 1650 m, and cows with calves were observed at the highest elevations at approximately 1870 m (Figure 2). When the groups were compared with a Duncan's Multiple Range Test, the bull population could not be included due to its non-normal distribution. Cows with calves and cows without calves were not significantly different from each other within this test, but both groups were significantly different from the yearling cow and the yearling bull components of the population (Appendix 2).

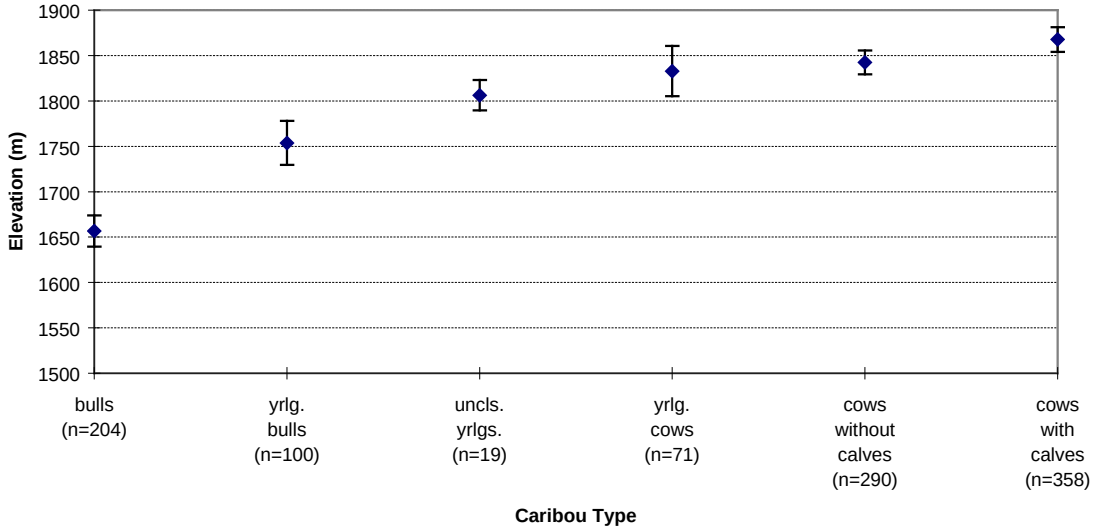

Figure 2. Average elevation of caribou population segments with 95% confidence intervals, in June 1996

October Rut Survey

A total of 819 caribou were observed on the October 29 and 30 rut survey flights; 585 cows, 135 calves, 61 medium bulls, and 38 mature bulls (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 26/100 and in the Rainbow herd the ratio was 9/100. The observed bull/100 cow and mature bull/100 medium bull ratios were higher in the Rainbow herd than in the Itcha-Ilgachuz herd. There were 91 mature bulls/100 medium bulls and 24 bulls/100 cows in the Rainbow herd compared to 55 mature bulls/100 medium bulls and 16 bulls/100 cows in the Itcha-Ilgachuz herd. Overall, there was 16% calves or 23 calves/100 cows, 17 bulls /100 cows, and 62 mature bulls/100 medium bulls.

Table 2. Caribou Observed October 29 and 30, 1996, within the Itcha, Ilgachuz and Rainbow Mountains

Mountain Range	Total Classified	Cows	Calves	Medium Bulls	Mature Bulls
Itcha	534	379	99	37	19
Ilgachuz	158	111	27	12	8
Rainbow	127	95	9	12	11
Itcha-Ilgachuz	692	490	126	49	27
Itcha-Ilgachuz-Rainbow	819	585	135	61	38

March Late Winter Survey

A total of 288 caribou were observed during the late winter surveys on April 1 and 2, 1997 (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 in the alpine on the north side 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 17% with a ratio of 19.9 calves for every 100 adult caribou. The Rainbow herd calf percentage was observed at 3% with a ratio of 2.9 calves for every 100 adults. The overall calf percentage was 13%. Telemetry re-located all 26 radio-collars. There were no calves with the adult caribou observed in the alpine. Although searched, no caribou were observed in the alpine on the north side of the Rainbow Mountains.

Table 3. Caribou Observed April 1 and 2, 1997, within the Itcha, Ilgachuz and Rainbow Mountains

Caribou Herd	Mountain Range	Habitat Type	Total Classified	Adults	Calves
Itcha-Ilgachuz	Itcha	Alpine	2	2	0
	Itcha-Ilgachuz	Forest	215	179	36
		Total	217	181	36
Rainbow	Rainbow	Alpine	0	0	0
	Ilgachuz	Alpine	42	42	0
	Rainbow-Ilgachuz	Forest	29	27	2
		Total	71	69	2
Itcha-Ilgachuz-Rainbow	Combined	Alpine	44	44	0
	Combined	Forest	244	206	38
		Total	288	250	38

Annual Calf Survival Trend

In the Itcha-Ilgachuz herd, the calf percentage dropped to 18% in October from 25% in June. By April, the calf percentage was slightly lower at 17%. The observed calf percentage in the Rainbow herd was higher than the Itcha-Ilgachuz herd during the June post calving survey at 33%. However, in October the Rainbow herd contained only 7% calves and by April it was down to 3%. A similar trend is evident in the calf/100 cow ratio of the relocated radio-collared animals. In the June survey, 4 of the 6 radio-collared cows in the Rainbow herd had calves. However, 0 of 7 and 0 of 8 had calves in the October and April surveys, respectively. In the Itcha-Ilgachuz herd, 13 of 21 had calves in the June survey, 5 of 23 had calves by October, and 2 of 19 had calves in April.

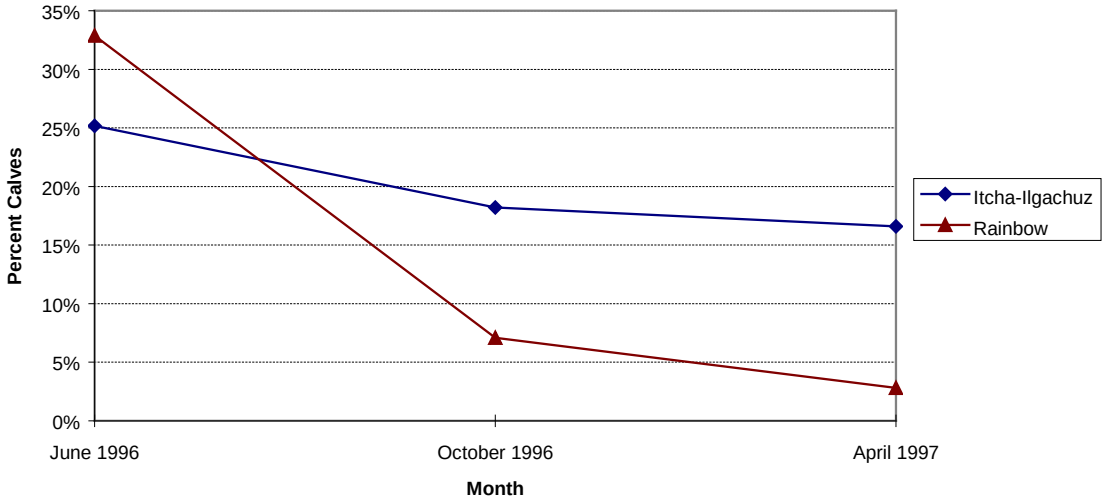

Figure 3. Calf Percentage Observed in the Post Calving, Rut and Late Winter Population Surveys of the Itcha-Ilgachuz and Rainbow Mountains Herds

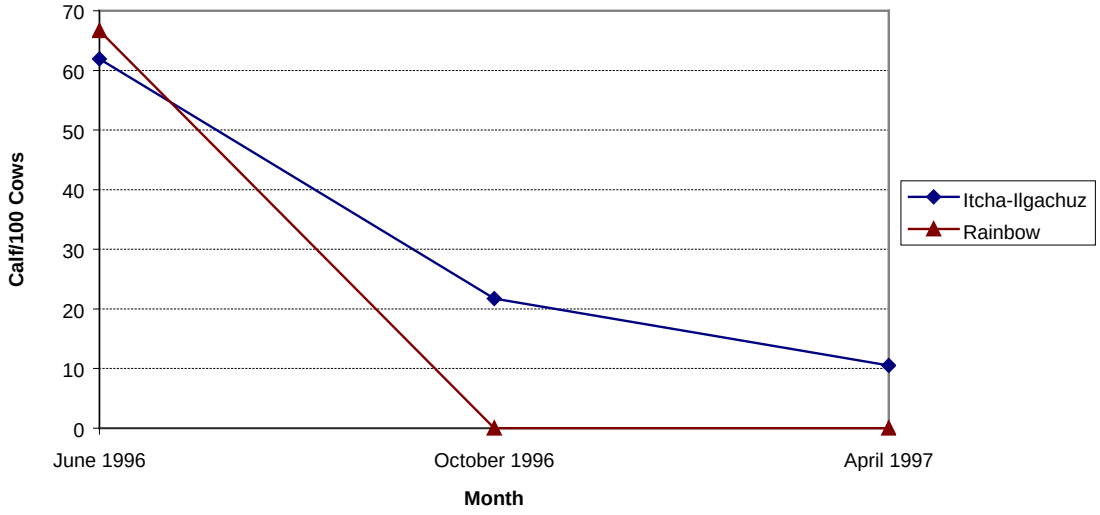

Figure 4. Calves/100 Cows Observed in the Post Calving, Rut and Late Winter Population Surveys of Radio-Collared Caribou in the Itcha-Ilgachuz and Rainbow Mountains Herds

Survey Costs

Helicopter rental costs totaled $25,058.59 for all surveys. Wildlife staff committed 25 person days for pre-planning, surveys and report completion.

DISCUSSION

Compared to the 1995 survey, less total animals were observed in the 1996 June post calving survey (1466 in 1995) and lower calf production was observed in the Itcha-Ilgachuz herd (70 calves/100 cows in 1995; Loveridge and Young, 1997). However, lower numbers were due to the incomplete survey of the Rainbow Mountains, as the total count for the Itcha-Ilgachuz herd was slightly higher (1321 in 1995). A lone wolf was also seen in the alpine on the north side of the Ilgachuz Mountains during the census.

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). Post calving surveys indicate the caribou herd has remained stable during the late 1980's and early 1990's (Figure 5). The herd is currently estimated at 1500 animals (post season) with healthy calf production and a stable breeding female component.

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 has been recently estimated at 150 animals and has appeared to remain relatively stable since the mid 1980's with a high bull to cow ratio (only 2 bulls were observed in the 1996 survey because a known area of bull congregation was not surveyed). Despite this year's incomplete survey, more calves were observed in the Rainbow herd compared to the previous year's census, possibly reflecting lower predation or increased calf production (Figure 6).

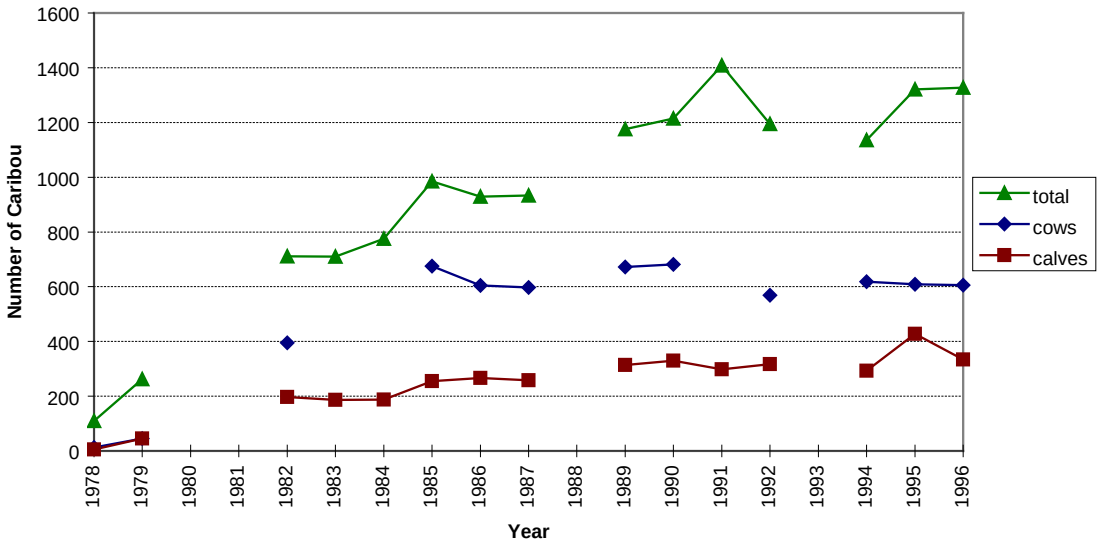

Figure 5. Summary of caribou post calving surveys for the Itcha-Ilgachuz Mountains herd

During the June survey two year and older females 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 (Bergerud 1983), the results overestimated the number of reproducing females.

When the yearling/100 adults ratio from the June 1996 survey was compared to the March 1996 calf/100 adults rations, there was good correlation. For the Itcha-Ilgachuz herd the March survey observed 27.1 calves per 100 adults while the June survey observed 22.9 yearlings per 100 adults. The Rainbow herd survey in March observed 12.5 calves per 100 adults while the June survey results showed 11.4 yearlings per 100 adults. These findings suggest that the results from the June survey may be adequate to estimate the previous year's recruitment if seasoned observers are utilised that are able to differentiate yearlings from adults.

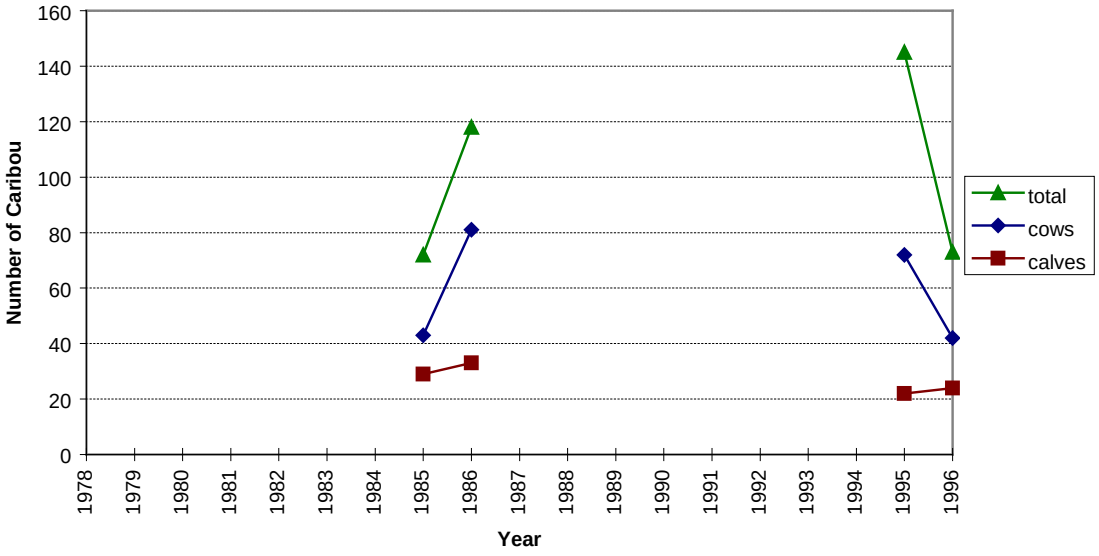

Figure 6. Summary of caribou post calving surveys for the Rainbow Mountains herd (incomplete survey in 1996)

Sightability corrections were made to the survey information from 1985-87 and 1996 to estimate total cow numbers in June within the Itcha-Ilgachuz herd (Figure 7). The data from the 1980's included yearlings with the cow count, thus these numbers overestimated the female breeding population. The 1996 estimate included only adult cows and excluded bulls, yearlings, and calves. Although these differences make it difficult to directly compare the data between the late 1980's and 1996, it indicates the same stable population as Figure 5.

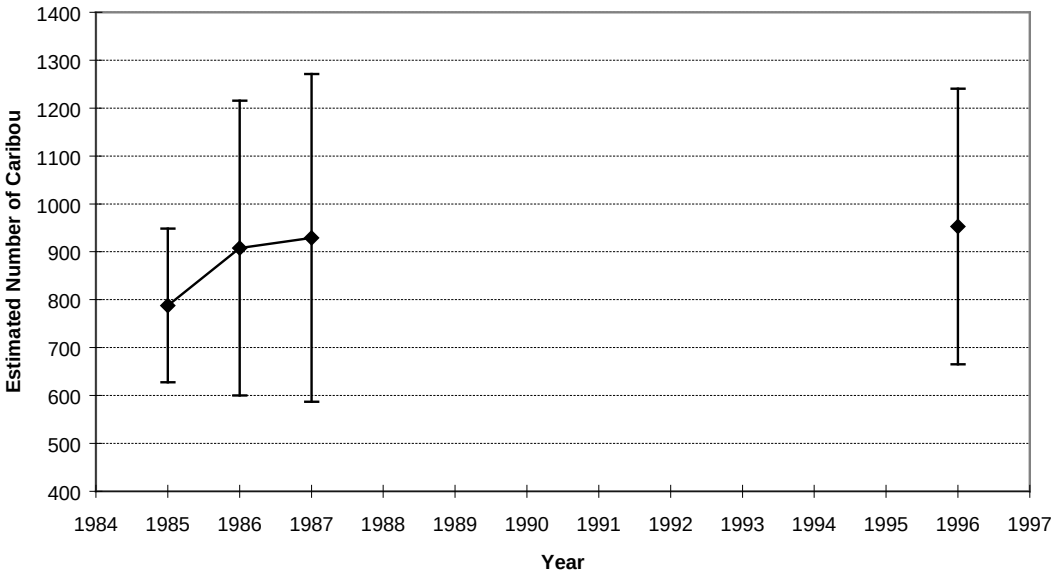

Figure 7: Estimated number of cow caribou in June and 95% confidence limits using collared animals to correct for sightability. Estimates in the 1980's included cows and yearlings, while in 1996 included only cows (1985-87 estimates; Cichowski unpubl. data).

The annual migration to the spring calving grounds in the alpine is an anti-predator strategy by caribou to distance themselves from predators and alternative prey. By distancing themselves from other prey, the predator search time is increased making it less energetically favorable to subsist on a diet of caribou. Cows and calves are the most vulnerable segment of the population during calving, and therefore will seek out the highest elevations. Bulls are the last to migrate, choosing instead to feed on higher quality forage found at lower elevations.

Bull numbers in the Itcha-Ilgachuz herd appear to be decreasing and are below the provincial target of 35 bulls/100 cows. Only 16 bulls/100 cows were observed in the October rut survey compared to 23/100 observed in 1995 and the 1994 estimated ratio of 25/100 (Young 1997). It should be noted, however, that over 200 bulls were seen during the June survey, giving a bull to cow ratio of 33 bulls/100 cows at that time. Although we have limited information on the effects of sustenance hunting on this population, there is some speculation that compulsory reporting, required since 1995, is not as effective as compulsory inspection in obtaining accurate harvest values. Between 1985, the year the mature bull season was implemented, and 1994, the last year of compulsory inspection, the average annual harvest was 29 bulls (Appendix 5), comparatively higher than the Hunter Sample results for 1995 (4) and 1996 (16). Low bull ratios can also be partially attributed to high calf recruitment from 1995, which resulted in numerous yearlings being included in the cow classification which further biased the proportion/100 cows ratios and indicated a large decline of bull numbers between 1995 and 1996 based on rut survey results.

There is presently no method of determining the amount of mixing between the Itcha-Ilgachuz herd and the Rainbow herd, and therefore a small bias must be considered. The unhunted Rainbow herd enjoys a healthy bull to cow ratio as there was almost a 1:1 ratio of mature bulls to medium bulls. This value is down from nearly 3:1 in 1995, but is higher than the observed Itcha-Ilgachuz herd ratio of 62 mature bulls/100 medium bulls. The 1996 sample size of mature and immature bulls (n=23) for the Rainbow Mountain herd was almost half of that observed in 1995 (n=43) while the 1996 sample size (n=76) for bulls in the Itcha-Ilgachuz herd was more than double that of 1995 (n=36). The variable and small sample sizes may have influenced changes in observed ratios from year to year.

Only 9% of the Rainbow herd caribou observed in the October rut survey were calves, indicating a recurrence of the hypothesized predatory influence experienced the previous year. By the late winter survey in April, only 3% of the caribou observed from the Rainbow herd were calves, below the minimum suggested by Bergerud (1992) of 15-16% to balance the natural mortality of adults to maintain population stability. The calf percentages from the Itcha-Ilgachuz herd followed a more healthy trend, with 25% observed in the October survey and 17% observed in the late winter survey. Surprisingly, no calves were observed with the caribou found in the alpine of either the Itcha or Ilgachuz Mountains. The decrease in mortality rate following the summer is expected, as calves become less vulnerable to predation with increased age and size. Similar trends in calf percentages were observed with the radio-collared females in the late winter survey, however, groups containing radio-collared animals made up the majority of caribou that were observed.

The loss of winter habitat from clearcut harvesting will reduce the amount of winter forage available to caribou. The indirect effects of timber harvesting, such as increased poaching or human disturbance from access development, and increases in predator numbers from changes to habitat, may negatively affect caribou populations. Concerns have also been raised about the ecological impacts of fire suppression. Surveys will have to continue to monitor the effects of logging and to contribute to a long-term caribou strategy as required by the CCLUP by June of 2000. Population modeling will be required to determine the options necessary to maintain the population size and achieve a higher bull/cow ratio.

CONCLUSIONS

- During the 1996 post calving survey a total of 1400 caribou were observed which included 648 cows, 358 calves, 204 bulls, 71 yearling cows, 100 yearling bulls and 19 unsexed yearlings. The observed calf/100 cow ratio was 55/100 in the Itcha-Ilgachuz herd and 57/100 in the Rainbow herd. Cows with calves were found at higher elevations than cows without calves, with yearling and adult bulls being found at the lowest elevations.

- During the 1996 October rut survey a total of 819 caribou were observed which included 585 cows, 135 calves, 61 medium bulls and 38 mature bulls. The observed calf/100 cow ratio was 26/100 in the Itcha-Ilgachuz herd and 9/100 in the Rainbow herd. The observed bull/100 cow ratio was 16/100 in the Itcha-Ilgachuz herd and 24/100 in the Rainbow herd.

- During the 1997 April late winter survey a total of 288 caribou were observed which included 244 in forest and 44 in alpine habitat. The Itcha-Ilgachuz herd calf percentage was estimated at 17% and the Rainbow herd calf percentage was estimated at 3%.

- The Itcha-Ilgachuz and Rainbow Mountains caribou population appears to have remained relatively stable in recent years at its present level.

- The calf recruitment in the Itcha-Ilgachuz herd appears to be sufficient in balancing the adult natural mortality.

- The Itcha-Ilgachuz herd bull/100 cow ratio is 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 sightablility correction factor and monitoring of calf survival amongst collared females within the population.

- Population modeling should be undertaken to predict the consequences of maintaining the present harvest strategy on bull/cow ratios.

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APPENDIX 1: POST CALVING SURVEY RESULTS									
ITCHA MOUNTAINS CARIBOU SURVEY- JUNE 27 1996									
Sighting #	Easting	Northing	Total in Group	# Cows	# Calves	# Bulls	# Yrlg. Cows	# Yrlg. Bulls	# Uncls. Yrlgs.
1	377709	5838657	3	2			1		
2	377020	5840846	2	1	1				
3	377849	5841560	25	14	3	2	3	2	1
4	376150	5844292	14	6	4		4		
5	377831	5844874	3			1	1	1	
6	381927	5848024	31			24		7	
7	382641	5847337	31			27		4	
8	389385	5851852	10			7		3	
9	387191	5848504	6			6			
10	388840	5846323	2			2			
11	391729	5849708	2			2			
12	388290	5851769	50			44		6	
13	388433	5850175	11			11			
14	376052	5843727	1			1			
15	375361	5844700	2	2					
16	374328	5845670	11	7	4				
17	374388	5844520	4	4					
18	375020	5844120	5				3	2	
19	373482	5840855	33	20	11	2			
20	374321	5843231	5				4	1	
21	372289	5845614	5	3	2				
22	371122	5844467	6	2		2	1	1	
23	370844	5843777	2					2	
24	370047	5843865	9			6		3	
25	370084	5845669	2			2			
26	371054	5841063	10	9			1		
27	368697	5840150	7			1		6	
28	365257	5844106	12	2			9	1	
29	366985	5842656	54	28	21	1	4		
30	369493	5839940	234	145	76	1			12
31	372516	5834083	3					3	
32	373009	5833912	4			3		1	
33	377093	5831658	2			1		1	
34	378018	5830298	1			1			
35	374476	5831320	2	1	1				
36	378685	5833046	2	1	1				
37	378993	5834107	2			2			
38	378691	5834629	18	11	7				
39	379533	5835862	6			4		2	
40	379406	5836187	9			5		4	
41	378206	5836444	4					4	
42	376702	5837621	2	1	1				
43	377137	5838350	31	17	12		2		
44	378333	5837025	6					6	
45	379788	5836581	1					1	
46	379261	5838082	13	8	2		2	1	
47	376933	5838731	4	2	2				
Total Caribou			**702**	**286**	**148**	**158**	**35**	**62**	**13**

ILGACHUZ MOUNTAINS CARIBOU SURVEY- JUNE 27 1996									
Sighting #	Easting	Northing	Total in Group	# Cows	# Calves	# Bulls	# Yrlg. Cows	# Yrlg. Bulls	# Uncls. Yrlgs.
48	359631	5845863	1					1	
49	357862	5838478	6			3		3	
50	356097	5838263	1				1		
51	353738	5837067	7			2		5	
Total Caribou			**15**			**5**	**1**	**9**	
RAINBOW MOUNTAINS CARIBOU SURVEY- JUNE 27 1996									
52	311366	5846347	21	11	10				
53	307814	5845421	16	8	8				
54	307518	5845211	8	4	3		1		
55	303372	5847614	2					2	
56	302016	5844759	1				1		
57	301213	5844966	2	1			1		
58	300616	5844141	13	13					
Total Caribou			**63**	**37**	**21**		**3**	**2**	
ILGACHUZ MOUNTAINS CARIBOU SURVEY- JUNE 29 1996									
59	347623	5842081	1	1					
60	346848	5843160	2	1	1				
61	349006	5893060	2	1	1				
62	352599	5841339	1	1					
63	349940	5843733	6	3	3				
64	351968	5843423	11	6	4		1		
65	353970	5845539	9	2			5	2	
66	352966	5845128	15	13			2		
67	351679	5845392	13	8	5				
68	349615	5844916	124	79	40		4	1	
69	350663	5846771	3	1	1		1		
70	350961	5846199	5	3	2				
71	352048	5845677	9	5	4				
72	352337	5847017	3	2	1				
73	351839	5847309	4	2	2				
74	353031	5848768	10	5	5				
75	359423	5849604	10	5	5				
76	359437	5849330	2	1	1				
77	349277	5847827	6	3	3				
78	348971	5848457	8	4	4				
79	348475	5848797	67	40	27				
80	346251	5843610	3	1			2		
81	345209	5844845	1	1					
82	345150	5845806	10	6	3		1		
83	345239	5846067	6				4		2
84	344684	5846051	16	9	4		3		
85	344092	5845499	6	3	3				
86	344940	5849108	39	24	15				
87	348582	5850073	51	24	16	2	6	3	
88	347333	5848633	2	2					
89	347155	5855488	3			2		1	
90	344912	5856316	1	1					

Sighting #	Easting	Northing	Total in Group	# Cows	# Calves	# Bulls	# Yrlg. Cows	# Yrlg. Bulls	# Uncls. Yrlgs.
91	344261	5856335	10			9		1	
92	343806	5853726	6			1	1	4	
93	342889	5856646	1			1			
94	342963	5854794	4			2		2	
95	342664	5853872	2	1	1				
96	341725	5853703	5	2	1		1	1	
97	340789	5854311	1			1			
98	340172	5853995	39	3		21		12	3
99	339838	5852407	2	2					
100	342347	5850010	2	2					
101	343763	5848915	21	11	9		1		
102	342656	5847059	25	16	9				
103	342390	5847528	18	10	8				
104	341846	5848445	2	1	1				
105	341956	5844537	3	2	1				
106	342315	5843489	9	6	2				1
107	346339	5841044	11	7	4				
Total Caribou			**610**	**320**	**186**	**39**	**32**	**27**	**6**
RAINBOW MOUNTAINS CARIBOU SURVEY - JUNE 29 1996									
108	312883	5818569	2			2			
109	313960	5834326	3	2	1				
110	313426	5837183	5	3	2				
Total Caribou			**10**	**5**	**3**	**2**			
Total Caribou for Itcha Mountains									
			702	**286**	**148**	**158**	**35**	**62**	**13**
Total Caribou for Ilgachuz Mountains									
			625	**320**	**186**	**44**	**33**	**36**	**6**
Total Caribou for Rainbow Mountains									
			73	**42**	**24**	**2**	**3**	**2**	
Total Caribou for Itcha and Ilgachuz Mountains									
			1327	**606**	**334**	**202**	**68**	**98**	**19**
Total Caribou for Itcha, Ilgachuz and Rainbow Mountains									
			1400	**648**	**358**	**204**	**71**	**100**	**19**

APPENDIX 2: RESULTS OF DUNCAN'S MULTIPLE RANGE TEST (multiple t-tests)

GROUP	Cows with calves	Cows w/o calves	Yrlg. Cows	Yrlg. Bulls
MEAN ELEVATION	1867.64	1842.45	1830.67	1756.95
SIGNIFICANT DIFFERENCE	A	A	B	C

Degrees of Freedom : 3
P-value : .0001
Type III SS : 1198804.1
F-Value : 26.59
* Bulls were not included in this comparison because they had a non-normal distribution.

APPENDIX 3: OCTOBER RUT SURVEY RESULTS							
ITCHA MOUNTAINS CARIBOU SURVEY - OCTOBER 29 1996							
Sighting #	Easting	Northing	Total in Group	# Cows	# Calves	# Class II Bulls	# Mat. Bulls
1	359607	5842670	6	5	1		
2	359693	5845674	28	20	4	2	2
3	360775	5843329	9	6	3		
4	362400	5841861	15	10	3	2	
5	380379	5842750	23	16	1	2	4
6	379087	5843325	8	6	2		
7	378550	5846152	2	1	1		
8	379660	5845514	27	17	8	0	0
9	381211	5848649	12	10	1	1	
10	381211	5848649	10	7	1	2 (1 CLASS 1)	
11	383870	5847423	5	3	2	0	0
12	394648	5844850	5	3	1	0	1
13	392159	5847836	5	4	1		
14	391493	5848715	9	6	2		1
15	388715	5852634	24	18	4	1	1
16	394287	5853081	11	5	3	3	0
17	398020	5853182	4	3		1	
18	401896	5848171	6	5	1		
19	398399	5854642	78	53	18	4	3
20	387857	5850032	8	6	2		
21	382233	5849048	6	5	1		
22	378357	5850131	92	64	17	8	3
23	375632	5847809	4	4			
24	375122	5848527	3	2	1		
25	373451	5848297	20	12	3	2	3
26	371981	5847587	12	10	1	1	0
27	377051	5846947	2	1	1		
28			5	5			
29	374171	5846117	10	8	1	1	0
30	372742	5845286	39	32	6	1	0
31	368037	5844894	41	28	8	4	1
32	365941	5844438	5	4	1		
Total Caribou			**534**	**379**	**99**	**37**	**19**
ILGACHUZ MOUNTAINS CARIBOU SURVEY - OCTOBER 29 1996							
33	352315	5834402	11	7	4		
34	352681	5835688	3	3			
35	352993	5835937	5	3	1	1	
36	353513	5840476	10	9	1		
37	354307	5843277	23	17	4		2
38	355247	5843073	13	9	2	2	
39	357324	5843580	10	9		1	
40	357993	5842951	7	4	1	1	1
41	354408	5846625	13	11	1		1
42	353398	5848981	21	12	5	3	1
43	353695	5848018	11	7	2	2	

Sighting #	Easting	Northing	Total in Group	# Cows	# Calves	# Class II Bulls	# Mat. Bulls
44	353316	5847758	11	8	2	1	
45	346350	5855608	3	2	1		
46	342802	5856750	1				1
47	338282	5851267	16	10	3	1	2
Total Caribou			**158**	**111**	**27**	**12**	**8**
RAINBOW MOUNTAINS CARIBOU SURVEY - OCTOBER 30 1996							
48	315826	5847804	28	23	3	2	
49	308808	5850350	17	14	0	2	1
50	305694	5850712	3			2	1
51	305240	5849254	53	38	4	3	8
52	303751	5848636	3			2	1
53	303476	5847402	23	20	2	1	
Total Caribou			**127**	**95**	**9**	**12**	**11**
Total Caribou for Itcha and Ilgachuz Mountains							
			692	**490**	**126**	**49**	**27**
Total Caribou for Itcha, Ilgachuz and Rainbow Mountains							
			819	**585**	**135**	**61**	**38**

APPENDIX 4: LATE WINTER SUVEY RESULTS							
FOREST AND ITCHA-ILGACHUZ MOUNTAINS CARIBOU SURVEY - APRIL 1 AND 2 1997							
Sighting #	Easting	Northing	Total in Group	# Adults	# Calves	Comments	Caribou Home Range
1	413501	5871312	9	8	1	Forest	Itcha-Ilgachuz
2	394652	5861554	11	10	1	Forest	Itcha-Ilgachuz
3	388868	5860776	3	3	0	Forest	Itcha-Ilgachuz
			2	1	1	Forest	Itcha-Ilgachuz
			2	2	0	Forest	Itcha-Ilgachuz
4	371954	5857208	2	2	0	Forest	Itcha-Ilgachuz
			7	6	1	Forest	Itcha-Ilgachuz
			5	4	1	Forest	Itcha-Ilgachuz
			2	1	1	Forest	Itcha-Ilgachuz
			3	3	0	Forest	Itcha-Ilgachuz
			3	2	1	Forest	Itcha-Ilgachuz
			6	4	2	Forest	Itcha-Ilgachuz
5	369882	5855738	3	3	0	Forest	Itcha-Ilgachuz
6	373000	5855885	6	4	2	Forest	Itcha-Ilgachuz
			9	9	0	Forest	Itcha-Ilgachuz
			3	2	1	Forest	Itcha-Ilgachuz
			10	8	2	Forest	Itcha-Ilgachuz
			18	13	5	Forest	Itcha-Ilgachuz
7	372143	5855417	1	1	0	Forest	Itcha-Ilgachuz
8	371900	5853867	8	7	1	Forest	Itcha-Ilgachuz
9	374714	5845800	2	2	0	Alpine	Itcha-Ilgachuz
10	364922	5853930	1	1	0	Forest	Itcha-Ilgachuz
			4	3	1	Forest	Itcha-Ilgachuz
			7	7	0	Forest	Itcha-Ilgachuz
			3	3	0	Forest	Itcha-Ilgachuz
11	365401	5853766	4	4	0	Forest	Itcha-Ilgachuz
12	344800	5854200	29	29	0	Alpine	Rainbow
13	347350	5855630	5	5	0	Alpine	Rainbow
14	343300	5856111	8	8	0	Alpine	Rainbow
15	338750	5820445	5	5	0	Forest	Rainbow
			14	13	1	Forest	Rainbow
			10	9	1	Forest	Rainbow
16	361991	5790616	12	9	3	Forest	Itcha-Ilgachuz
			3	3	0	Forest	Itcha-Ilgachuz
			14	12	2	Forest	Itcha-Ilgachuz
17	387416	5783894	2	2	0	Forest	Itcha-Ilgachuz
			19	16	3	Forest	Itcha-Ilgachuz
18	388765	5807279	3	2	1	Forest	Itcha-Ilgachuz
19	392625	5814704	1	1	0	Forest	Itcha-Ilgachuz
20	399372	5837617	4	3	1	Forest	Itcha-Ilgachuz
21	414061	5832703	7	5	2	Forest	Itcha-Ilgachuz
			8	7	1	Forest	Itcha-Ilgachuz
22	416486	5846490	10	8	2	Forest	Itcha-Ilgachuz

			Total in Group	# Adults	# Calves		
Total Itcha-Ilgachuz Caribou							
		Forest	**215**	**179**	**36**		
		Alpine	**2**	**2**	**0**		
		Total	**217**	**181**	**36**		
Total Rainbow Caribou							
		Forest	**29**	**27**	**2**		
		Alpine	**42**	**42**	**0**		
		Total	**71**	**69**	**2**		
Total Caribou		**Forest**	**244**	**206**	**38**		
		Alpine	**44**	**44**	**0**		
		Total	**288**	**250**	**38**		

APPENDIX 5: ANNUAL BULL HARVEST	
Year	**Number of Bulls Harvested**
1984*	47
1985	17
1986	9
1987	30
1988	29
1989	32
1990	24
1991	52
1992	37
1993	31
1994	24
1995	10
Average	29
Standard Deviation	13
* last year before mature bull season	