

**SUMMARY OF THE 1995 POST CALVING AND RUT SURVEYS AND THE 1996
LATE WINTER SURVEY FOR THE ITCHA, ILGACHUZ AND RAINBOW
MOUNTAINS, CARIBOO REGION**

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SUMMARY OF THE 1995 POST CALVING AND RUT SURVEYS AND THE 1996 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 21 and 22 observed a total of 1466 caribou; 681 cows, 450 calves, 229 bulls, 71 yearling cows and 35 yearling bulls. The observed calf/100 cow ratio was 70/100 in the Itcha-Ilgachuz herd and 31/100 in the Rainbow herd. Yearlings/100 cows were observed at 16/100. 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 18 and 19 observed 438 caribou; 279 cows, 80 calves, 30 medium bulls and 49 mature bulls. The observed calf/100 cow and bull/100 cow ratio in the Itcha-Ilgachuz herd were 40/100 and 23/100, respectively. In the Rainbow herd the observed calf/100 cow ratio was 13/100 and the bull/100 cow ratio was 36/100. The March late winter survey observed 314 caribou; 172 in forest and 142 in alpine habitat. The Itcha-Ilgachuz herd calf percentage was estimated at 21% and the Rainbow calf percentage was assumed to be 11%. 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. As such, aerial caribou population surveys were completed in June and October of 1995 and in March of 1996 over 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). Plans of timber harvesting in the mature pine forests surrounding the Itcha-Ilgachuz Mountains will eliminate 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 the caribou population range. The post calving June survey attempted to measure the relative abundance of the breeding female component and early calf production. The October rut survey estimated the sex composition and summer calf survival. The March late winter survey compares the proportions of forest and alpine-dwelling cows with calves as well as the overall calf recruitment. Future surveys of the same area and the previous results will provide quantifiable population trends to aid wildlife managers.

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 the 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 in the newly protected area designated by the CCLUP. The survey area is within the Western Chilcotin Uplands Ecosection and is characterized by two biogeoclimatic subzones at the higher elevations; the Alpine Tundra zone and the Engelmann Spruce Subalpine Fir, very dry, very cold subzone.

METHODS

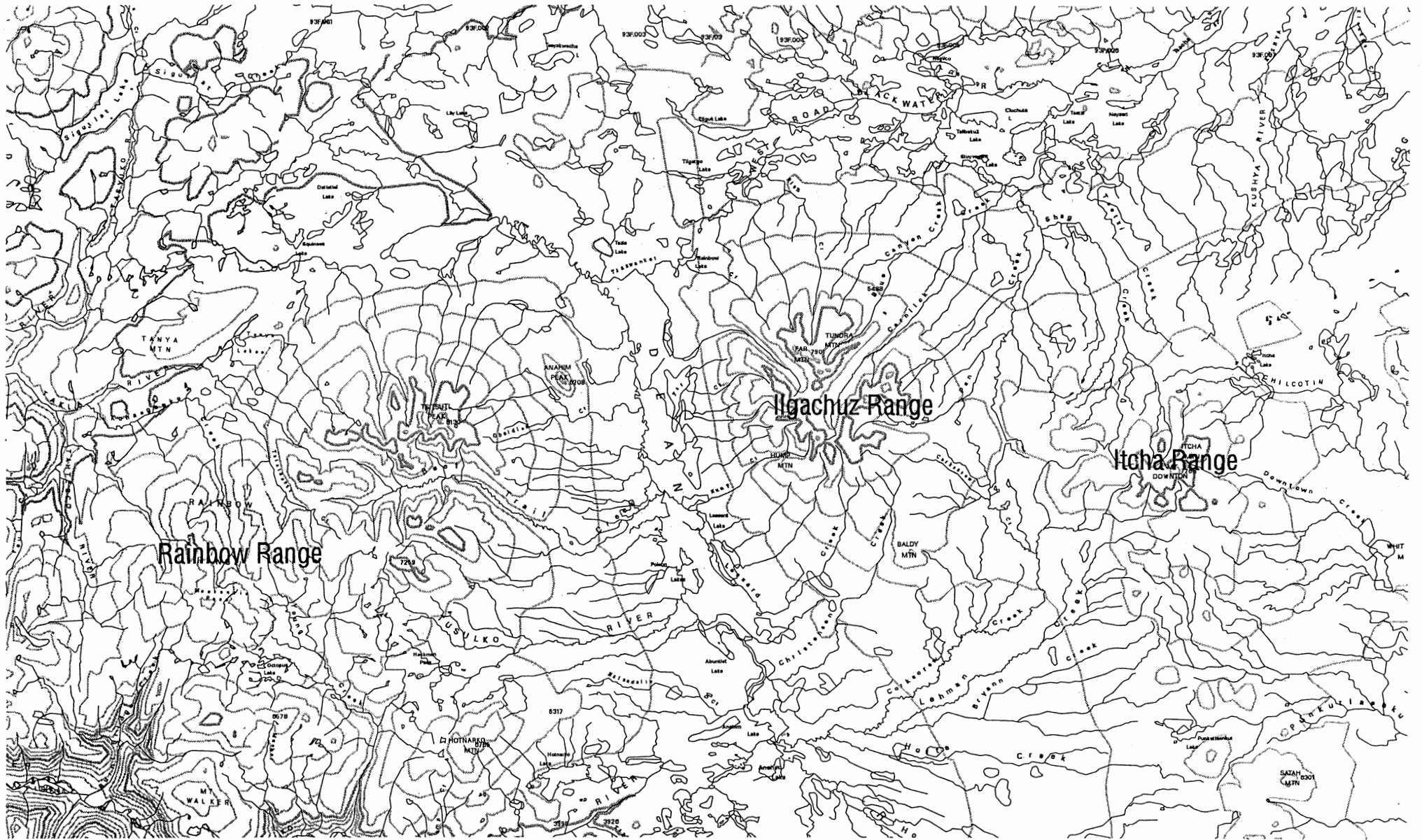
Aerial surveys were completed in a Bell 206 Jet Ranger utilizing the total count technique (Simpson et al 1993). The surveys were restricted to high strata habitats, where under the proper conditions, animal sightability is high. This included the Itcha Flats wetland complex, alpine and adjacent parkland 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).

The post calving survey flights on June 21 and 22 included pilot Tom Arduini, Jim Young (navigator), Pat Dielman, and Chris Schmid. Flight time totaled 12.7 hours in sunny and mild conditions. Adequate observing conditions allowed caribou to be classified as either cows, calves, yearling cows, yearling bulls, or bulls. UTM coordinates were recorded for each group of animals to digitally produce flight maps and elevational groupings.

The rut survey flights on October 18 and 19 included pilot Tom Arduini, Jim Young (navigator), Pat Dielman and Tony Bowser. Flight time totaled 11.5 hours in partly cloudy conditions and temperatures around freezing. Visibility was poor to moderate and there was a light gusting wind. Caribou were classified into the following categories; Class III Bull (mature bull), Class II (medium bull), cow and calf. 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 13 and 15 of 1996 included pilot Tom Arduini, Jim Young (navigator), Pat Dielman and Lara Webster. Flight time totaled 13.4 hours and the conditions were very windy and high overcast. Alpine and forest areas were searched using radio-telemetry to locate groups containing radio-collared females. Animals were classified as either adults or calves.

Figure 1. Survey Area



Scale 1:450 000 - Échelle 1/450 000

Kilometres 10 0 10 20 30 40 Kilomètres

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

- | | |
|-----------------------------------|---|
| Class III Bulls:
(Mature Bull) | large, heavy beamed antlers
antlers often have many points and palmated brow tine
body size
testicles or penis sheath
lack of vulva patch |
| Class II Bulls:
(Medium Bull) | antlers larger than females and smaller than Class III
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

The June 21 and 22 flights recorded 1466 caribou; 681 cows, 450 calves, 229 bulls, 71 yearling cows, and 35 yearling bulls (Table 1 and Appendix 1). The observed bull (>1yrs)/100 cow ratio in the Rainbow herd was 38/100, slightly higher than the 33/100 observed in the Itcha-Ilgachuz herd and the overall population value of 34/100. The calf/100 cow ratio was 31/100 and the calf percentage was 15% in the Rainbow herd, lower than the 70 calves/100 cows and the 32% calves observed in the Itcha-Ilgachuz herd. The overall calf/100 cow and yearling/100 cow ratios were 66/100 and 16/100, respectively.

Table 1. Caribou Observed June 21 and 22, 1995, Within the Itcha, Ilgachuz and Rainbow Mountains

Mountain Range	Total Classified	Cows (>1yrs)	Calves	Bulls (>1yrs)	Yrlg. Cows	Yrlg. Bulls
Itcha	369	159	104	72	19	15
Ilgachuz	952	450	324	129	33	16
Rainbow	145	72	22	28	19	4
Itcha-Ilgachuz	1321	609	428	201	52	31
Itcha-Ilgachuz-Rainbow	1466	681	450	229	71	35

On average, cows with calves were found at the highest elevations at approximately 1950 m (Figure 2). Cows without calves were found lower than cows with calves and yearling and adult bulls were found at the lowest elevations. According to the Duncan's Multiple Range Test, the elevational differences between all groups were significant, except for bulls compared to yearling bulls (Appendix 2). This was supported by an Apriori Contrast test.

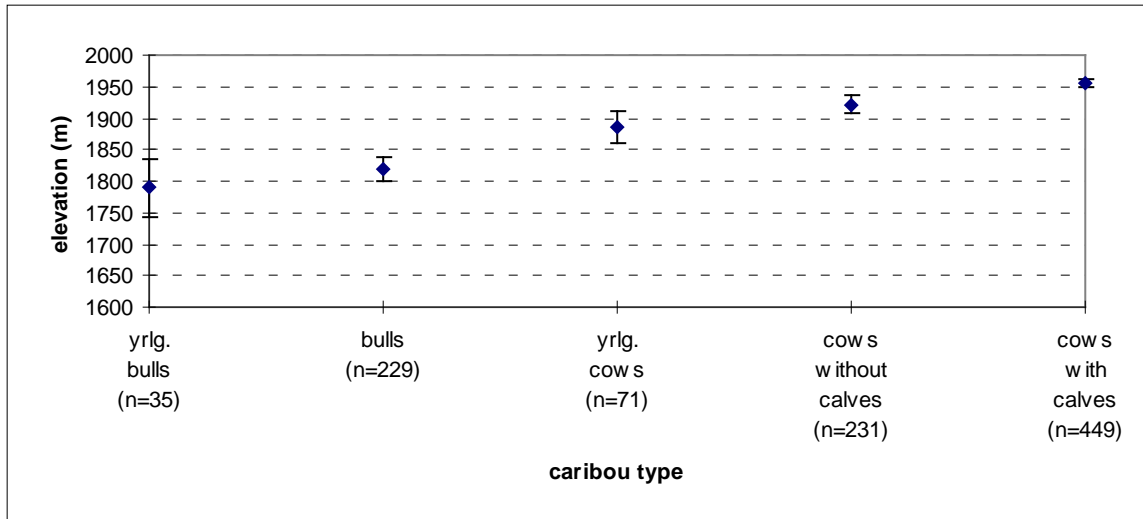


Figure 2. Average elevation of caribou population segments with 95% confidence intervals, in June 1995

October Rut Survey

During the October 18 and 19 flights a total of 438 caribou were observed; 279 cows, 80 calves, 30 medium bulls, and 49 mature bulls (Table 2 and Appendix 3). Yearling caribou were included within the cow classification. The observed calf/100 cow ratio was 29/100 and the percentage of calves was 18%. There were 13 calves/100 cows and 9% calves in the Rainbow herd, while the Itcha-Ilgachuz herd had 40 calves/100 cows and 25% calves. Overall, the observed bull/100 cow ratio was 28/100 and there were 163 mature bulls for every 100 medium bulls, however, the mature bull to 100 medium bull ratio was 291/100 in the Rainbow herd compared to 89/100 in the Itcha-Ilgachuz herd. The bull/100 cow ratio was also lower at 23/100 in the Itcha-Ilgachuz herd than the 36/100 observed in the Rainbow herd.

March Late Winter Survey

A total of 314 caribou were observed during the late winter surveys on March 13 and 15 (Table 3 and Appendix 4). Assuming caribou on the north side of the Ilgachuz Mountains calved in the Rainbow Mountains and caribou on the north side of the Itcha Mountains calved in either the Itcha or Ilgachuz Mountains, the majority of the alpine observations were from the Rainbow herd and all of the forest observations were from the Itcha-Ilgachuz herd. Of the 172 located in forest, 20% were calves, compared to 15% of the 142 located in alpine. The Itcha-Ilgachuz herd calf percentage was 21% and the Rainbow herd calf percentage was 11%. Telemetry re-located 15 of 20 radio-collars in the forest and 7 of 8 in the alpine. Although searched, no caribou were observed on the north side of the Rainbow Mountains in the alpine.

Table 2. Caribou Observed October 18 and 19, 1995, Within the Itcha, Ilgachuz and Rainbow Mountains

Mountain Range	Total Classified	Cows	Calves	Medium Bulls	Mature Bulls

Itcha	170	98	46	15	11
Ilgachuz	90	62	18	4	6
Rainbow	178	119	16	11	32
Itchas-Ilgachuz	260	160	64	19	17
Itcha-Ilgachuz-Rainbow	438	279	80	30	49

Table 3. Caribou Observed March 13 and 15, 1996, Within the Itcha, Ilgachuz and Rainbow Mountains

Mountain Range	Habitat Type	Total Classified	Adults	Calves
Itcha	Forest	172	138	34
	Alpine	25	17	8
	Total	197	155	42
Ilgachuz	Forest	0	0	0
	Alpine	117	104	13
	Total	117	104	13
Rainbow	Forest	0	0	0
	Alpine	0	0	0
	Total	0	0	0
Itcha-Ilgachuz-Rainbow	Forest	172	138	34
	Alpine	142	121	21
	Total	314	259	55

Annual Calf Survival Trend

The percentage of calves observed in the Itcha-Ilgachuz herd during the June post calving survey was more than double the percentage found in the Rainbow herd (Figure 3). Only 15% of the observed caribou in the Rainbow herd were calves compared to 32% in the Itcha-Ilgachuz herd. Both herds had a large decline in calf numbers through the summer with an observed percentage of 9% in the Rainbow herd and 25% in the Itcha-Ilgachuz herd in October. In March, a smaller percentage of the total number of caribou observed in the Itcha-Ilgachuz were calves, down to 21%, while more of the Rainbows' sightings were calves, up 2% to 11%. Overall, for the entire Itcha, Ilgachuz and Rainbow Mountains population, the total calf percentage dropped more from June to March than the Itcha-Ilgachuz herd calf percentage, down to 18% from 31%, but this may be in part due to the smaller sample of caribou observed in the Itcha-Ilgachuz Mountains during the October and March surveys.

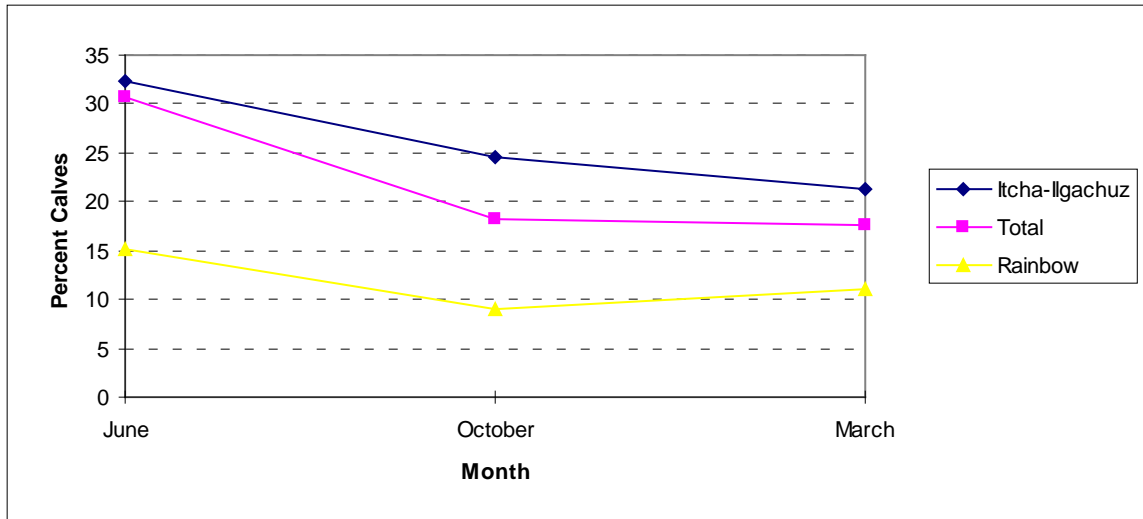


Figure 3. Calf percentage observed in post calving, rut and late winter population surveys of the Itcha-Ilgachuz and Rainbow Mountains herds

Survey Costs

Helicopter rental costs totaled \$21,383.18 for all surveys. Wildlife staff committed 25 person days for pre-planning, surveys and report completion.

DISCUSSION

The result from the June post calving survey of 1466 animals is the largest total count to date. The inclusion of the Rainbow Mountains herd, estimated at 150 animals, in the survey resulted in the large survey count. The 1991 post calving survey, which occurred in mid July, was the largest count of the Itcha-Ilgachuz herd. The delayed survey resulted in a larger proportion of bulls than usual being observed, however, several large groups were encountered making it difficult to classify all but calf caribou. After a dramatic increase in the late 1970's and early 1980's, the Itcha-Ilgachuz herd is currently estimated at approximately 1500 animals and is considered stable (Figure 4). Few complete surveys have been undertaken on the Rainbow herd. However, it would appear that this herd has too, remained relatively stable, since the mid 1980's (Figure 5).

Only 31 calves/100 cows were observed in the Rainbow herd, indicating lower than normal early calf survival when compared to past surveys of the Itcha-Ilgachuz herd, possibly attributed to predation (due to sightings of a wolf and a grizzly with two yearlings in the area during the survey). The calf/cow ratio was higher than normal in the Itcha-Ilgachuz herd, but this is partly attributed to yearlings not being included as part of the cow component during classification, which was the case during surveys prior to 1992.

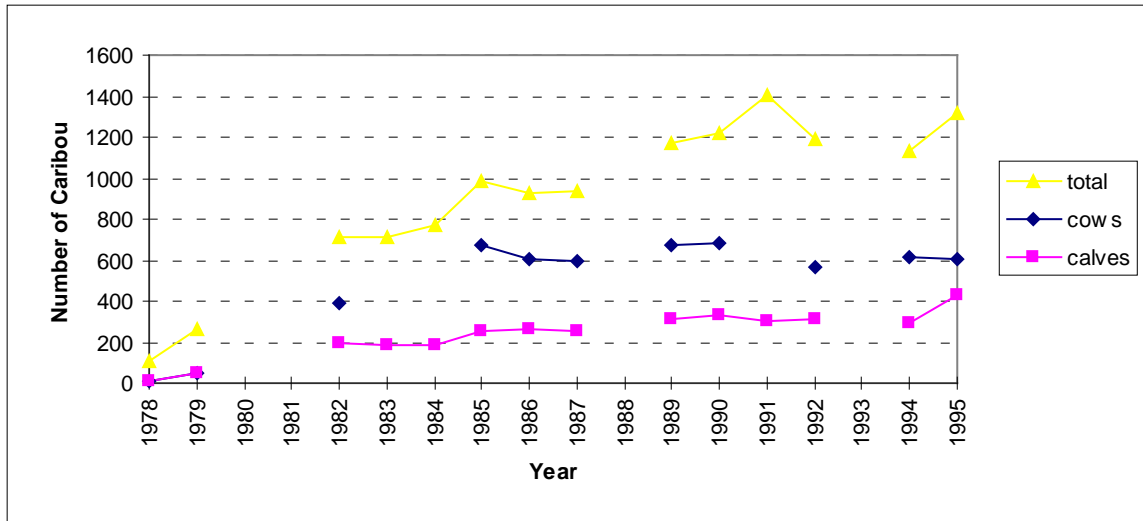
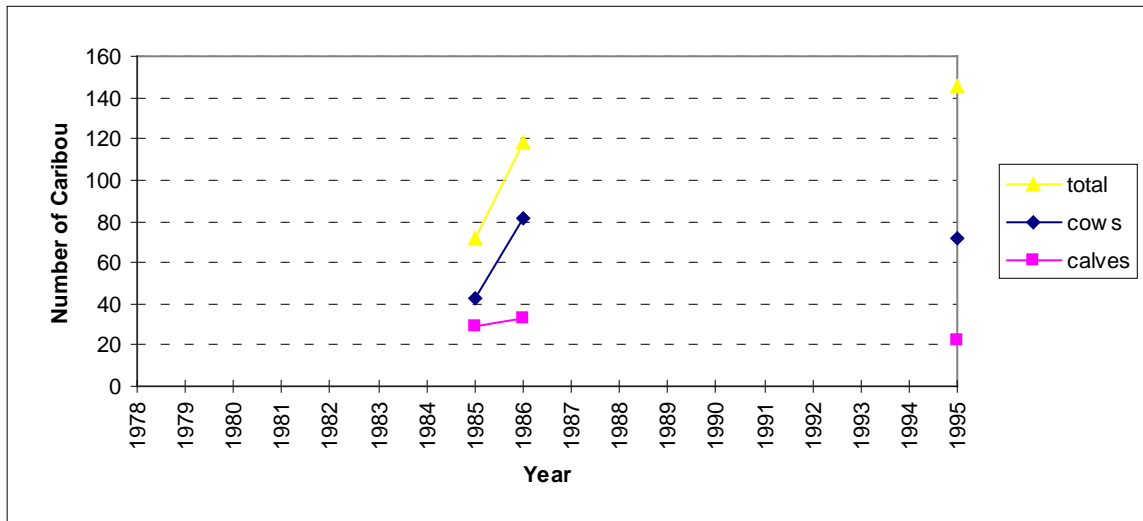


Figure 4. Summary of caribou post calving surveys for the Itcha-Ilgachuz Mountains herd



Figure

5. Summary of caribou post calving surveys for the Rainbow Mountains herd

The annual migration to the alpine spring calving grounds is an anti-predator strategy by caribou to distance themselves from predators. 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. Summer mortality of calves is often still high, and though the pregnancy rate can be as high as 97% (Seip & Cichowski 1996), less than 20% may survive the summer months.

After the summer of 1995, mortality left only 9% calves in the Rainbow herd, below the minimum suggested by Bergerud (1992) of 15-16% to balance the natural mortality of adults to maintain population stability. The Itcha-Ilgachuz herd appeared to have a healthy calf percentage of 25%, even with the observation of a pack of five wolves in the Downtown Meadows area

during the fall survey. The 23 bulls/100 cows ratio after the hunting season remains well below the provincial target of 35/100.

Although the reported harvest of 10 bulls in 1995 was lower than the average of 29 over the last 12 years (Appendix 5), we have limited information of the impact of sustenance hunting on this population. The long term effects of hunting on the bull population were noticeable when comparing the bull to cow ratio of the Itcha-Ilgachuz herd with the unhunted Rainbow herd. In the Itcha-Ilgachuz Mountains, where mature bulls are hunted, the less than one to one ratio of mature bulls to medium bulls illustrates the skewed bull age structure and adult sex ratios. In the Rainbow herd, the ratio was almost 3:1 mature bulls to medium bulls. The mature bull season in the Itcha-Ilgachuz Mountains was introduced in 1985 to reduce the number of bulls shot annually. In 1994, the estimated post-season bull to cow ratio of 25 bulls/100 cows in the Itcha-Ilgachuz herd was of concern (Young 1997) and the 1995 observations do not suggest an increase. During rut surveys, however, animal groups can be too large to classify completely resulting in female and male yearling caribou being included in the cow component and proportions/100 cows being biased downwards. There is also no method of determining the amount of mixing between the Itcha-Ilgachuz herd and the Rainbow herd, which enjoys a healthy bull to cow ratio.

Results of the late winter surveys indicate a greater proportion of calves with the caribou wintering in the forest than those in the alpine, suggesting a higher survival of calves in the Itcha-Ilgachuz herd. Alpine surveys in March are biased to survival of calves from the Rainbow herd, which usually winters in the alpine on the northside of the Rainbow and Ilgachuz Mountains, and do not necessarily give an accurate trend of survival of calves from the Itcha-Ilgachuz herd which are usually at lower elevations in forested habitat and not normally observed without the aid of telemetry. During this year's March survey, however, there were groups of caribou in the alpine from both the Rainbow and the Itcha-Ilgachuz herds. It was assumed that the animals in the alpine on the north side of the Ilgachuz Mountains, with a calf percentage of 11%, were from the Rainbow herd, and the caribou in the alpine on the north side of the Itcha Mountains, with a calf percentage of 32%, were from the Itcha-Ilgachuz herd. Overall, the 1996 survey found a greater proportion of cows with calves in the forest reflecting the high calf mortality experienced in the Rainbow Mountains the previous summer. The decrease in mortality rate following the summer is expected, as the calves become less vulnerable to predation with increased size throughout the winter. It should be noted that a lone wolf was observed following one of the groups of caribou observed in the alpine of the Itcha Mountains during the March survey. Population modeling will be required to determine the options necessary to maintain the population size of 1500 animals and achieve a higher bull/cow ratio. Surveys will also have to continue to monitor the effects of future logging impacts and to contribute to a long-term caribou strategy as required by the CCLUP by 1999.

CONCLUSIONS

- During the 1995 post calving survey a total of 1466 caribou were observed which included 681 cows, 450 calves, 229 bulls, 71 yearling cows and 35 yearling bulls. The observed calf/100 cow ratio was 70/100 in the Itcha-Ilgachuz herd and 31/100 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 1995 October rut survey a total of 438 caribou were observed which included 279 cows, 80 calves, 30 medium bulls and 49 mature bulls. The observed calf/100 cow ratio was 40/100 in the Itcha-Ilgachuz herd and 13/100 in the Rainbow herd. The observed bull/100 cow ratio was 23/100 in the Itcha-Ilgachuz herd and 36/100 in the Rainbow herd.
- During the March late winter survey a total of 314 caribou were observed which included 172 in forest and 142 in alpine habitat. The Itcha-Ilgachuz herd calf percentage was estimated at 21% and the Rainbow herd calf percentage was estimated at 11%.
- 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 sightability correction factors 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 21 1995								
Sighting #	Easting	Northing	Total in Group	# Cows	# Calves	# Bulls	# Yrlg. Cows	Yrlg. Bulls
1	378022	5836380	23			15	3	5
2	379038	5837782	6	3		1	2	
3	376852	5839584	2	1		1		
4	376058	5839395	2	1	1			
5	376002	5840739	4	2	2			
6	380941	5848695	34			27	1	6
7	381453	5848490	5			5		
8	390510	5849555	1	1				
9	376155	5845855	8	4	4			
10	375111	5844651	6			4		2
11	373908	5842966	2	1	1			
12	374364	5843620	44	25	16		3	
13	371977	5843213	2	1	1			
14	370234	5842064	6	3	3			
15	370020	5840794	5	5				
16	368372	5841083	1			1		
17	365915	5845168	52	28	21		3	
18	365562	5843805	4	3			1	
19	370720	5840412	2	1	1			
20	372082	5839911	4	2	2			
21	373631	5836644	123	71	47		5	
22	374987	5835433	6	1		4		1
23	373757	5833216	11	6	5			
24	375377	5833461	4			3	1	
25	359352	5840530	4			4		
26	358584	5835828	8			7		1
Total Caribou			369	159	104	72	19	15
ILGACHUZ MOUNTAINS CARIBOU SURVEY - JUNE 21								
Sighting #	Easting	Northing	Total in Group	# Cows	# Calves	# Bulls	# Yrlg. Cows	Yrlg. Bulls
27	345934	5841834	2	1	1			
28	347608	5842391	3	2			1	
29	348450	5841916	3	3				
30	350220	5842653	93	54	34	1	4	
31	348539	5842614	4	3	1			
32	349540	5842542	2			2		
33	351262	5845416	22	5		11	3	3
34	347924	5846343	5				5	
35	348322	5846466	2	1	1			
36	348842	5846541	4	2	2			
37	352237	5847844	3	1			2	
38	351602	5847715	18	9	9			
39	351661	5849616	13	6	5		2	
40	351381	5850397	5	2		3		
41	351074	5850318	10	5	2	1	2	
42	350858	5850228	105	62	42	1		

Sighting #	Easting	Northing	Total in Group	# Cows	# Calves	# Bulls	# Yrlg. Cows	Yrlg. Bulls
43	346456	5847290	2			1		1
44	346444	5845832	22	11	11			
45	345038	5844112	12	7	5			
46	345080	5849324	4	2	2			
47	346896	5850512	26	13	13			
48	347761	5851551	4	2	2			
49	347671	5852288	24	1		18	3	2
50	346191	5851700	9	2		5	1	1
51	345557	5850872	9	3		3	3	
52	344833	5849684	31	16	14	1		
53	344852	5850272	2	1	1			
54	347167	5854472	74	42	32			
55	346143	5854076	2	1	1			
56	345247	5853481	12	7	5			
57	345529	5855289	4	2	2			
58	344121	5852752	2			2		
59	343804	5852682	8			6		2
60	344181	5852156	30			28		2
61	342804	5853734	2			2		
62	343122	5853842	7	1		6		
			1	1				
63	343088	5854180	36	3		28	2	3
64	342571	5854890	16	3		9	2	2
65	342203	5852196	2	1	1			
66	342959	5850210	9	5	4			
67	343938	5849496	72	42	30			
68	343307	5847740	4	2		1	1	
69	342418	5847033	9	5	4			
70	341939	5846520	98	49	49			
71			2	1	1			
72	342006	5848237	63	37	24		2	
73	341356	5848989	10	5	5			
74	341349	5846732	49	28	21			
75	343000	5841040	1	1				
Total Caribou			952	450	324	129	33	16
RAINBOW MOUNTAINS CARIBOU SURVEY - JUNE 22 1995								
Sighting #	Easting	Northing	Total in Group	# Cows	# Calves	# Bulls	# Yrlg. Cows	Yrlg. Bulls
76	309318	5844176	3	2	1			
77	304747	5844036	6	3	3			
78	301907	5844615	1			1		
79	302963	5843689	4	1		2	1	
80	303418	5843504	4	2	2			
81	303819	5843668	2	1	1			
82	300059	5842452	4			4		
83	301345	5840785	2	1	1			
84	302014	5839759	8	5	3			
85	310463	5844635	9	6		1	2	

Sighting #	Easting	Northing	Total in Group	# Cows	# Calves	# Bulls	# Yrlg. Cows	Yrlg. Bulls
86	311321	5844673	1	1				
87	313823	5837884	1	1				
88	310692	5836899	11	7	4			
89	310946	5837322	2	2				
90	304931	5835123	6	3	3			
91	302173	5836453	3	2			1	
92	300448	5833663	4	4				
93	697832	5831049	7	3		1	2	1
94	696804	5832989	3	1	1		1	
95	694951	5830722	1	1				
96	696807	5827574	13	2		7	1	3
97	697503	5829404	5			5		
98	701177	5828867	7	3		1	3	
99	300398	5832278	9	4		2	3	
100	299923	5831986	1			1		
101	301328	5831785	5	2		2	1	
102	303451	5832587	6	2	1		3	
103	305341	5833790	1	1				
104	304876	5832328	6	4	1	1		
105	310794	5831962	2	1			1	
106	311990	5833088	5	5				
107	311185	5832726	2	1	1			
108	313841	5834810	1	1				
Total Caribou			145	72	22	28	19	4
Total Caribou for Itcha & Ilgachuz Mountains								
			1321	609	428	201	52	31
Total Caribou for Itcha, Ilgachuz, and Rainbow Mountains								
			1466	681	450	229	71	35

APPENDIX 2: TWO SAMPLE Z-TEST FOR MEANS		
	<i>cows without calves</i>	<i>cows with calves</i>
Mean	1921.76917	1954.953808
Known Variance	10811.26	6001.536
Observations	230	448
Hypothesized Mean Difference	0	
Z	-4.269846668	
P(Z<=z) one-tail	9.7871E-06	
z Critical one-tail	1.644853	
P(Z<=z) two-tail	4.89355E-06	
z Critical two-tail	1.959961082	

APPENDIX 3: OCTOBER RUT SURVEY RESULTS							
ITCHA MOUNTAINS CARIBOU SURVEY - OCTOBER 18 1995							
Sighting #	Easting	Northing	Total in Group	# Cows	# Calves	# Class II Bulls	# Mat. Bulls
1	386997	5847439	23	12	7	3	1
2	389645	5843167	2	1	1		
3	387794	5847850	9	5	3		1
4	372220	5843444	36	20	10	5	1
5	367038	5843426	17	9	6	1	1
6	369006	5844544	8	5	2		1
7	365890	5839749	3	1		1	1
8	368854	5840161	5	3	1	1	
9	377026	5832191	23	14	7		2
10	378141	5832094	12	10		1	1
11	381036	5831399	5	4	1		
12	377179	5829757	4	2	1	1	
36	391955	5835625	13	8	3	1	1
37	393316	5833950	10	4	4	1	1
Total Caribou			170	98	46	15	11
ILGACHUZ MOUNTAINS CARIBOU SURVEY - OCTOBER 19 1995							
Sighting #	Easting	Northing	Total in Group	# Cows	# Calves	# Class II Bulls	# Mat. Bulls
13	353339	5840728	2	1			1
14	354829	5840802	12	6	3	2	1
15	352782	5845426	2	1			1
16	344505	5855589	17	12	3	1	1
17	340307	5844492	31	21	7	1	2
18	340980	5843706	7	5	2		
19	346825	5841846	1	1			
20	347458	5838321	6	5	1		
21	347525	5837570	5	5			
22	347701	5837433	7	5	2		
Total Caribou			90	62	18	4	6
RAINBOW MOUNTAINS CARIBOU SURVEY - OCTOBER 19 1995							
Sighting #	Easting	Northing	Total in Group	# Cows	# Calves	# Class II Bulls	# Mat. Bulls
23	315360	5847134	1				1
24	305713	5848467	2	1		1	
25	305562	5849745	29	19	4	2	4
26	303034	5848489	14	10	1	1	2
27	303331	5848601	12	6	2	1	3
28	303205	5847723	23	15	4	1	3
29	301382	5846945	15	14			1
30	300801	5846516	10	5		2	3
32	301191	5846122	47	33	2	2	10
31	302030	5845702	15	11	2		2
33	304218	5830578	1				1
34	311198	5831302	8	5	1	1	1
35	303649	5837500	1				1
Total Caribou			178	119	16	11	32

			Total in Group	# Cows	# Calves	# Class II Bulls	# Mat. Bulls
Total Caribou for Itcha & Ilgachuz Mountains							
			260	160	64	19	17
Total Caribou for Itcha, Ilgachuz, and Rainbow Mountains							
			438	279	80	30	49

		Total in Group	# Adults	# Calves			
Total Caribou for Rainbow Mountains							
	Forest	0	0	0			
	Alpine	117	104	13			
	Total	117	104	13			
Total Caribou for Itcha & Ilgachuz Mountains							
	Forest	172	138	34			
	Alpine	25	17	8			
	Total	197	155	42			
Total Caribou for Itcha, Ilgachuz, and Rainbow Mountains							
	Forest	172	138	34			
	Alpine	142	121	21			
	Total	314	259	55			

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	