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CHISANA CARIBOU CENSUS – 15-16 OCTOBER 2005

LAYNE G. ADAMS and GRETCHEN H. ROFFLER, U.S. Geological Survey - Alaska Science Center, 1011 East Tudor Road, Anchorage, Alaska 99503 (layne_adams@usgs.gov)

RESULTS SUMMARY

-Population estimate: 694 caribou (90% CI = 656-733)

-Sex/age ratios:

-22.6 calves/100 cows (15.3 calves/100 cows with pen cows and calves excluded)

-75 male calves/100 female calves or 57% female calves (51 males/100 females or 66% females with pen calves excluded)

-45.9 bulls/100 cows

34% small, 34% medium, 32% large

Estimated herd composition: 412 cows; 93 calves; 189 bulls = 694 caribou

METHODS

On 15 and 16 October 2005, we conducted a census of the Chisana Caribou Herd with Rick Swisher (Robinson R44 helicopter pilot) and Harley McMahan (Piper PA18 Supercub pilot). Our goal was to estimate herd size with a measure of precision utilizing a procedure to correct for sightability bias related to group size, and corroborate a similar census conducted in October 2003. Prior to the census, we determined the distribution of 98 radiocollared females > 1 year old. We delineated a survey area that included the region inhabited by all the radioed caribou with a reasonable buffer. During the census, we used the helicopter to search, without the aid of radiotelemetry, all the upland, non-forested habitats within the survey area. Caribou groups we encountered were classified (cows, calves by sex, bulls by 3 size classes) and we determined the occurrence of marked individuals within groups. Simultaneously, the Supercub located radiocollared caribou to determine their locations and group sizes. Periodically through the survey, we compared notes among the 2 aircraft to determine marked caribou groups that were missed by the helicopter crew, and those groups were then located and classified from the helicopter. As the survey progressed, the Supercub did a cursory search outside the boundary of the survey area to ensure that we did not miss any concentrations of caribou that was not well represented by the radiocollared cows.

With information on marked groups seen by the helicopter crew and those missed, we determined the relationship between sightability and group size via logistic regression. With that relationship, we could then correct for unmarked groups missed during the survey to arrive at an estimate of total caribou in the survey area. To make that correction, we divided the group size of each unmarked group by the associated sighting probability (e.g. a group of 1 had a sighting probability of 0.47, so each unmarked group of 1 accounted for $1/0.47$ or 2.1 caribou [1 observed + 1.1 missed] in the total estimate). Further, using a jackknife procedure (Manley, B.F.J. 1991. Randomization and Monte Carlo methods in biology. Chapman and Hall, New York), we estimated the variance associated with the herd size estimate and calculated confidence limits. The jackknife procedure entailed sequentially dropping each of the marked groups from the logistic regression and recalculating the sightability relationship with the remaining $n-1$ locations, where n = number of marked groups. The resulting n sightability curves were applied

to the survey data and the variability among the resulting population estimates was used to estimate the variance following methods described by Manley (1991).

On 15 October, we surveyed areas including, Braye Plateau, Sonya Creek, Ophir Creek, Flat Creek, Willow Creek, Bryan Creek, Solo Creek, and the North Fork of the White River (Fig. 1). As we were running out of time that day, we chose to exclude an area northwest of the Solo Flats, roughly centered on Slipper Lake, because only a single radiocollared caribou was observed from the Supercub in the area. On 16 October, we surveyed areas in the headwaters of the Generec River including upper Kletsan Creek, Natazhat Glacier, Klutlan Plateau, Brooke Creek, the western Klutlan Glacier, Count Creek, upper St. Clare Creek, Bull Creek and uplands south of Teepee Lake and west of the middle fork of Wolverine Creek (Fig. 1). We were aware of radioed caribou in the Skolai Pass area from previous radiotracking, but did not have sufficient time to include that area in our survey. The area surveyed included 1,470 km² and we spent 12.47 hours (not including ferry time to and from the survey areas) engaged in survey activities for a survey rate averaging 0.5 minute/km². Weather conditions during the survey were generally excellent, but snowcover varied from no snow in some low elevation areas to complete coverage at higher elevations. Most of the survey area had adequate snowcover, but mottled backgrounds from low snowcover and exposed brush made for challenging survey conditions in some areas. The region had received fresh snow about 6 days prior to the survey so we were able to focus our effort on areas with fresh caribou tracks and give only cursory coverage to large areas without tracks. Further, clear skies through the survey provided good lighting for spotting caribou groups throughout most of each day, although light conditions began to deteriorate by about 1700 as the sun began setting.

RESULTS

During the survey, we counted 599 caribou including groups observed during the helicopter survey and marked groups missed by the helicopter but subsequently classified (Table 1). In addition, we classified an additional 47 caribou outside the survey area including a group of 43 with 6 radioed cows in Skolai Pass classified on 12 October, a single radioed cow west of Flat Creek in the area excluded late on 15 October, and a group of 3 with 1 radioed cow in a forested area along St. Claire Creek. The total of 646 caribou included 381 cows (334 wild, 47 pen), 88 calves (38 males, 50 females; 51 wild, 37 pen), 173 bulls (59 small, 59 medium, 55 large) and 4 adults that were not classified because they were missed during the survey and had joined with caribou from at least 2 groups that had been previously classified by the time we tried to classify the missed group.

Of the 98 radioed caribou, 89 were in the survey area, 8 were out of the survey area as described above, and 1 individual was inadvertently dropped the day of the survey but had been seen the previous day with other caribou observed during the survey. We tallied 70 groups in the survey area including 45 that had radioed caribou in them and an additional 25 unmarked groups.

We observed 35 of the marked groups during the helicopter survey and missed the remaining 10 groups. Sightability was significantly correlated with group size (Fig. 2; $\text{logit}(p) = -0.280 + 0.175 \cdot \text{Group Size}$; $G_I^2 = 5.88$, $P = 0.015$). For example, a single caribou had a 47% chance of being observed by the helicopter crew, whereas a group of 20 had a 96% chance. Sightability was improved in 2005 compared to the 2003 census (Fig. 2).

We arrived at an estimate of 647 caribou (90% CI = 609-686) in the survey area. We added the 47 caribou that we knew of outside the survey area for a population estimate of 694 caribou (90% CI = 656-733). The estimate may be somewhat conservative because we

accounted for all the marked groups within the estimate but do not account for unmarked groups that were outside the survey area, particularly in the vicinity of the large, marked group in Skolai Pass. However, because of the high number of radioed animals in the population and the lack of additional caribou detected by cursory searching with the Supercub outside the periphery of the survey area, we suspect any bias is minimal. The 2005 estimate was slightly lower than the estimate of 720 caribou (90% CI = 606-833) in 2003. The 2005 confidence interval was substantially smaller than in 2003 (Interval length/estimate = 12% and 32%, respectively) primarily as a result of the greater sample of marked animals (89 vs. 39 in survey area, respectively) and the higher sightability during the 2005 survey (Fig. 2).

To determine the calf:cow ratio for the entire herd it was necessary to first calculate ratios for pen animals and wild animals separately, then extrapolate the wild ratio to the estimated wild population. We classified 334 cows and 51 calves excluding those from the pen for an estimated 15.3 calves/100 cows in the wild. This ratio extrapolated to an estimate of 365 wild cows in the herd accompanied by 56 calves. With the 47 cows and 37 calves from the pen added in, we arrive at a ratio of 22.6 calves:100 cows for the herd overall. Given that the pen females would have contributed calves equally to the wild sample if not for the captive rearing, we estimated that 30 calves, or 32% of the 2005 recruits, constituted the contribution of calves from the captive rearing effort.

In our survey we noted 50 female calves and 38 male calves, including 16 and 21 of each sex, respectively, from the pen sample. Given that breakdown, we estimated that the 56 wild calves included 37 females and 19 males. It is noteworthy that the sex ratio of wild calves favored females, while the pen sample favored males and that the sex ratios differed significantly between the 2 categories ($\chi^2 = 4.80$, $P = 0.029$).

The adult sex ratio (45.9 bulls:100 cows) was indicative of an increasing trend since about 1998 and the adult sex composition has returned to levels noted before the population decline. The bull component of the herd was essentially equally divided among the 3 size classes.

We estimated that the herd was composed of 412 cows, 93 calves and 189 bulls based on the population estimate and sex/age ratios. The estimated number of cows is about 7% lower than the estimate from 2003 (444 cows), whereas the number of bulls has increased by 16% from the 2003 estimate (163).

OPERATIONAL CONSIDERATIONS

The approach we have applied seems to work well for the Chisana Herd given the high number of radiocollars and the relatively restricted distribution in mid-October. The greatest challenge is to have adequate sightability given the transition from no snow to winter conditions that occurs at this time of the year. You simply cannot know whether conditions are adequate until you get out there. We seem to do pretty well with less than ideal snowcover if the sky is clear; the combination of mottled snow and flat lighting, as experienced in 2004, result in poor sightability.

We spent about 34% more time during the 2005 census compared to the 2003 census and could have easily used more time. Given the distribution of caribou, an additional 3-4 hours would have allowed us to do a better job within the survey area, as well as include the Skolai Pass area in the census. In the future it would be worthwhile to plan for about 16 hours total spread over 2.5 – 3 days, given a similar distribution of caribou to this year. Fuel at the Boundary Lake camp greatly improved our efficiency on the Canadian end of the herd's range.

During the first day of the survey we made a tactical error in that we started well to the east to include a single marked group at Braye Plateau in the survey area, then surveyed a large expanse that ended up having no caribou in it. As a result we were short of time near the end of the day and had to excise a portion of the survey area near the main concentrations of caribou. Also, we surveyed areas with quite a few caribou late in the day with less than ideal lighting. Further, in an attempt to improve efficiency, we surveyed the main Beaver Creek drainage as we came and went for fuel at Chisana, which added to some confusion when we tried to locate and classify groups that we missed in that area because of movements over the course of the day. It would have been much better to first focus on the areas west of Sonya Creek where most of the caribou were congregated and to survey at area in a systematic fashion during the portion of the day with the best lighting (930 – 1630 approximately). Once the concentrations of caribou were covered, then the outlying areas could have been added as time allowed.

We chose to keep track of radiocollars we observed in groups mainly from reading the marking collars. It ended up not being a good idea, particularly in the vicinity of the pens where some groups had up to 10 radios. It is very easy to make mistakes reading the marking collars, leading to quite a bit of confusion over who had been missed. In the future, the observations of marked animals should be corroborated with radiotelemetry.

ASSOCIATED DATA FILE

Chisana Census Data – October 2005.xls

Table 1. Results of Chisana census during 15-16 October 2005

				Cows	Calves		Bulls			Uncl.	Total					
	gno	date	Time		M	F	S	M	L	Ad.		Location	Radios (freq)		marked?	seen?
1	1	12	1719	23	7	7	4	2	0	0	43	skolai pass	1625,1800,1980,2840,2950,2980		1	out
2	1	15	1023	10	0	1	1	3	2	0	17	braye plat	0530		1	1
3	2	15	1143	12	0	0	1	2	1	0	16	w sonya cr	0330,0601		1	1
4	3	15	1201	12	0	1	1	0	4	0	18	flat cr mth	0590,1420		1	1
5	4	15	1202	9	0	0	0	2	1	0	12	flat cr mth			0	1
6	5	15	1207	25	0	1	4	4	1	0	35	willow cr mth	0410,0499,0830		1	1
7	6	15	1211	5	0	1	2	1	0	0	9	willow cr mth			0	1
8	7	15	1218	0	0	0	0	0	2	0	2	calif lake			0	1
9	8	15	1301	11	1	1	1	2	0	0	16	s beaver lk	0611		1	1
10	9	15	1305	4	0	0	0	0	0	0	4	s beaver lk			0	1
11	10	15	1308	8	0	0	2	0	0	0	10	funshoot mtn			0	1
12	11	15	1313	0	0	0	0	0	2	0	2	black hill			0	1
13	12	15	1316	15	0	1	1	3	0	0	20	black hill			0	1
14	13	15	1327	0	0	0	0	0	1	0	1	ophir cr			0	1
15	14	15	1329	0	0	0	0	0	2	0	2	ophir cr			0	1
16	15	15	1334	10	0	1	1	1	1	0	14	ophir cr	1130		1	1
17	16	15	1341	4	0	2	2	1	1	0	10	ophir cr	0540		1	1
18	17	15	1344	1	0	0	0	0	0	0	1	ophir cr			0	1
19	18	15	1359	11	0	2	1	2	4	0	20	ophir cr	0430,2870		1	1
20	19	15	1421	1	1	0	0	1	0	0	3	divide cr	3270		1	0
21	20	15	1444	5	0	0	0	0	0	0	5	flat cr	0580,3760		1	1
22	21	15	1506	5	1	1	0	1	0	0	8	shotgold cr	2160		1	1
23	22	15	1511	0	0	0	0	1	0	0	1	shotgold cr			0	1
24	23	15	1523	0	0	0	0	0	2	0	2	n fork white			0	1
25	24	15	1615	2	0	1	0	2	0	0	5	ophir cr	1750		1	0
26	25	15	1623	7	0	0	0	0	1	0	8	solo lake	0110		1	1
27	26	15	1640	11	0	1	4	1	2	0	19	solo lk hills	1170,1525		1	1
28	27	15	1643	2	0	0	0	0	0	0	2	solo lk hills	0511		1	1
29	28	15	1656	8	0	0	0	2	1	0	11	solo lk hills	0210		1	1
30	29	15	1708	1	0	0	0	0	0	0	1	w flat cr flats	0310		1	out
31	30	15	1717	10	0	0	3	2	1	0	16	s funshoot mt			0	1
32	31	15	1725	0	0	0	0	0	5	0	5	s funshoot mt			0	1

33	32	15	1726	9	1	0	3	2	0	0	15	willow cr	2890	1	1
34	33	15	1732	2	0	0	0	0	0	0	2	willow cr	2850	1	1
35	34	15	1739	0	0	0	0	1	2	0	3	u bryan cr		0	1
36	35	15	1755	12	0	0	1	0	1	0	14	u bryan cr	0570,0660,1720	1	1
37	36	15		1	0	0	0	0	0	4	5	flat creek	0860	1	0
38	37	15		4	1	0	0	1	0	0	6	ophir cr	0690	1	0
39	1	16	935	3	1	0	0	0	0	0	4	w klutlan gl	2790	1	1
40	2	16	936	4	0	1	0	0	0	0	5	w klutlan gl	0890,3310	1	1
41	3	16	951	2	0	1	0	1	0	0	4	w klutlan gl		0	1
42	4	16	956	4	0	5	0	0	1	0	10	w klutlan gl	0419,0670,0920,1280	1	1
43	5	16	1024	15	2	1	1	0	1	0	20	e brooke cr	0250,0810,0840,2135,2550,3050	1	1
44	6	16	1054	1	0	0	0	0	0	0	1	natazhat gl	2800	1	1
45	7	16	1110	3	1	2	4	0	0	0	10	u big boundary	0950,2880,3410	1	1
46	8	16	1116	1	1	1	1	1	0	0	5	s pens	0800	1	1
47	9	16	1203	11	4	3	1	2	0	0	21	klutlan plat	0090,0370,0480,0710,0850,0910,1930,2421,2820,3700	1	1
48	10	16	1213	9	3	2	0	2	0	0	16	klutlan plat	0390,0790,3031	1	1
49	11	16	1220	6	0	0	1	1	1	0	9	klutlan plat	1230,3170	1	1
50	12	16	1225	2	0	0	1	0	0	0	3	klutlan plat		0	1
51	13	16	1226	1	1	1	0	0	0	0	3	klutlan plat	2860	1	1
52	14	16	1229	0	0	0	0	1	0	0	1	klutlan plat		0	1
	15	16										NO GROUP			
53	16	16	1249	2	0	1	0	0	0	0	3	boundary cr	0880,1010	1	0
54	17	16	1253	6	0	0	0	0	2	0	8	boundary cr	0700,1840,2910	1	0
55	18	16	1302	4	0	0	0	0	0	0	4	boundary cr	0550,0620,1310	1	0
56	19	16	1335	2	1	0	1	1	0	0	5	se teepee lk		0	1
57	20	16	1351	3	1	0	1	0	0	0	5	wolverine cr		0	1
58	21	16	1354	10	2	3	1	0	3	0	19	wolverine cr	1120,2925	1	1
59	22	16	1425	4	1	1	1	0	1	0	8	st clare cr	0010	1	1
60	23	16	1440	4	1	0	0	1	1	0	7	st clare cr		0	1
61	24	16	1450	5	1	2	1	1	1	0	11	st clare cr	0120,2960	1	1
62	25	16	1505	0	0	0	0	0	1	0	1	count cr		0	1
63	26	16	1507	1	1	0	0	1	1	0	4	count cr		0	1
64	27	16	1508	0	0	0	1	0	0	0	1	count cr		0	1
65	28	16	1510	5	1	1	1	0	2	0	10	count cr	1950	1	1
66	29	16	1524	1	0	0	0	1	0	0	2	count cr		0	1

67	30	16	1526	5	0	0	1	2	1	0	9	count cr	0141,1780	1	1
68	31	16	1530	5	1	0	2	1	0	0	9	e klutlan gl	3625	1	1
69	32	16	1540	5	1	0	2	2	0	0	10	e klutlan gl	0041	1	1
70	33	16	1543	5	0	2	2	0	0	0	9	e klutlan gl	0830	1	0
71	34	16	1545	7	2	0	1	4	2	0	16	e klutlan gl	0240,0290,0650,1615	1	0
72	35	16	1622	4	0	1	2	0	0	0	7	mt byron	1190	1	0
73	36	16	1625	1	0	1	1	0	0	0	3	st clare cr	0820	1	out
				381	38	50	59	59	55	4	646				

Fig. 1. Survey area and groups of caribou observed during the 15-16 October 2005 census of the Chisana Caribou Herd. “Marked” groups included ≥ 1 radiocollared female and “observed” groups were seen during the initial helicopter survey without the aid of radiotelemetry.

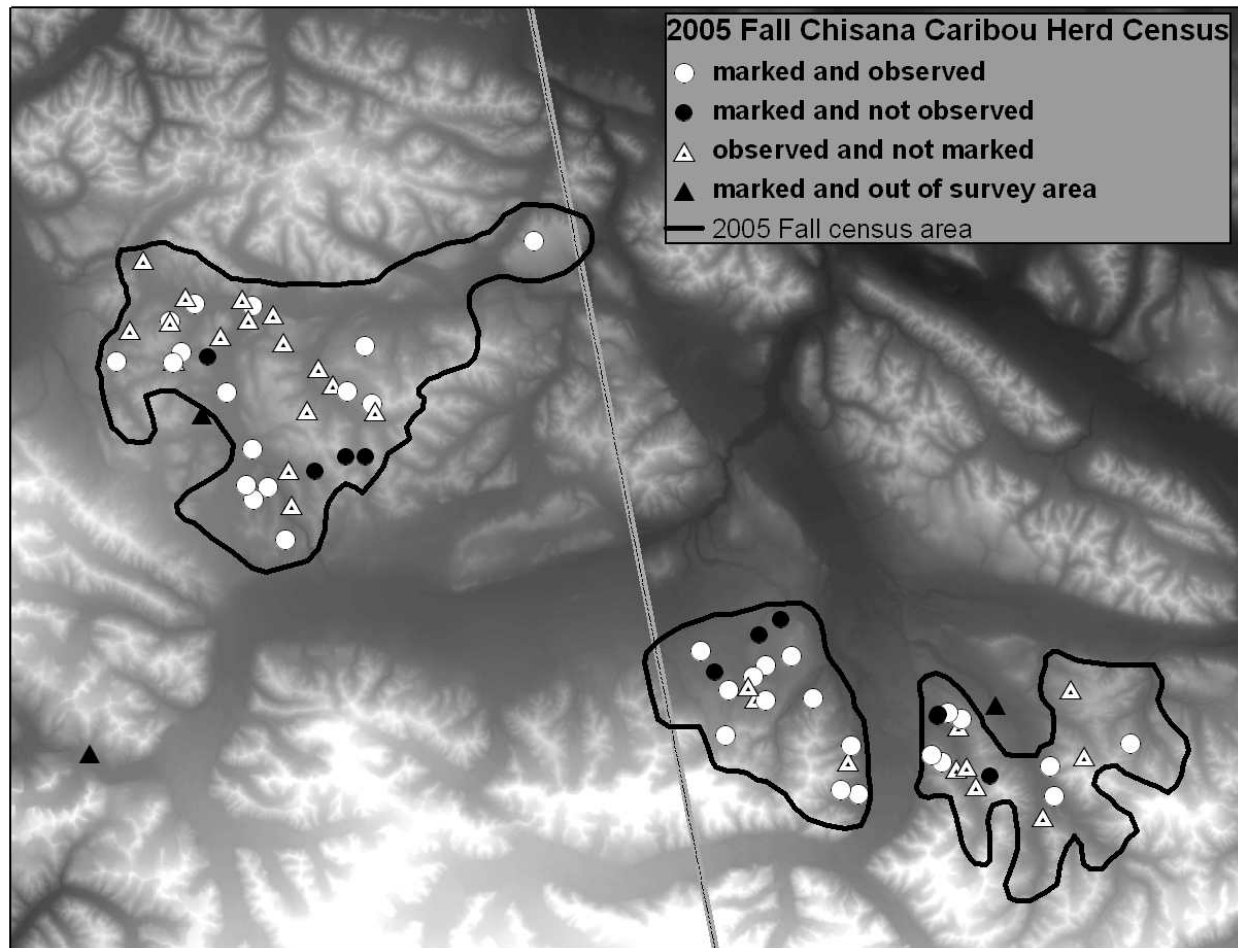


Fig. 2. Sighting probability relative to group size for the 2005 Chisana Caribou Herd census (solid line), based on 45 groups that included radiocollared females > 1 year old. Squares at 0 (10 groups not seen during the survey) and 1 (35 groups seen) are the raw data for the logistic regression ($\text{logit}(p) = -0.280 + 0.175 \cdot \text{Group Size}$; $G_I^2 = 5.88$, $P = 0.015$). Sighting relationship for the 2003 census (dashed line) is provided for comparison.

