Adaptive Strategies of Woodland Caribou -

a progress report to the Canadian Wildlife Service

attention:

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by

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INTRODUCTION

This report is being submitted to the Canadian Wildlife Service to fulfill contractual obligations for funding gratefully received in 1978 - $ 2500 which was used for transportation, equipment and one salaried assistant. This support was totally expended on a 5 week study of rutting behavior of caribou in northern British Columbia. Hence this progress report will mainly emphasize results from this period of my studies. This year, 1978, represented the second year of an ongoing project to study comparisons in behavior, morphology and physiology of woodland caribou Rangifer tarandus caribou. The results of this project will form the basis of my doctoral dissertation at the University of Calgary in 1981. For an outline of the work accomplished in 1977, the reader is referred to Bergerud and Butler 1978, and for work accomplished prior to the start of this thesis in 1977 see Bergerud and Butler 1975.

I am studying adaptive strategies of woodland caribou. By investigating variation between populations in behavior, morphology and physiology, this study proposes to examine the adaptations that have allowed these animals to exploit different habitat types. This subspecies has successfully existed over a wide range of habitat types inlcuding lakestate forest, boreal forest, subalpine and tundra. My study areas constrast in food availability, predation pressure (including mammalian predators and harrassing insects), climatic factors, terrain (escape habitat) and population density.

METHODS

Behavior:

Herds are observed during the calving season to gain quantitative and qualitative data on maternal and calf behavior. The frequency and duration of calf play, sucking behavior and the percent time spent resting and grazing by maternal cows are measured. The selective use of habitat by cow - calf pairs is being studied, as well as spatial relationships with other sex-age classes.

Caribou are observed during the fly season in order to compare fly avoidance behavior employed by animals in different habitats and between different sex-age classes. Quantitative measurements (leg stomps, tail flicks, body shakes etc.) are made in order to assess the level of harassment individuals receive from mosquitoes (Culicidae), blackflies (Simulidae), warble flys (Oedemagena) and nose bot flys (Cephanomyia).

Herds are monitored during the rut and prerut periods. Quantitative measurements are made on the frequency and duration of fights between males, threats, and display behavior. Length of courtship is measured. It is expected that the vigour with which males perform in the rut is influenced by the opportunity for social contact, weather and nutrition. The structure of breeding herds is expected to vary under different habitat regimes, sex ratios and population densities.

All reactions to human-related disturbances (e.g. flushing distances, time to resumption of "normal activities") are recorded, as well as reactions to potential predators and other ungulate species.

Morphology:

Where possible, a tagging and measuring program has been set up. This program is now in operation on the Slate Islands. Where this has not been feasible, attempts have been made to obtain data from hunter killed caribou. Body measurements and weight are taken. Antlers are measured and sketched. Variations in body color, patterns and shade are described, and hair length measured from the lower neck edge, frome between the shoulder blades and on the mid- flank. Weights and measures of cast antlers are recorded when found. Skull measurements are taken when dead material is available.

Physiology:

Hair samples are being collected and will be analyzed as an index of animal condition. Blood and saliva samples are taken from live captured animals, or freshly killed animals when available. Blood is analyzed for chemical composition and hematological parameters. For dead animals, fat content of the femur is analyzed. Back fat depth is measured and the fat surrounding the kidneys is weighed to obtain a kidney fat index. Percent pregnant females is determined by udder counts at calving time. Fecal samples are collected to evaluate parasitic load.

Environmental Factors;

Weather is recorded by the use of hydrothermographs, amomometers and raingages. Snow depth measurements are taken. The phenology of vegetative sprouting and flowering is noted for each study area. Where possible, notes on the same species have been taken for each population: caribou food speices are given preference. Sampling of

vegetative types for community description is achieved by meter square plots and line transects where time allows. Study areas have been chosen so as to represent extremes in food abundance, habitat type and climate. Hence measurements of food availability, although on a gross level, should show significance between populations.

RESULTS

Field work for this project was started in May 1977 with a calving study on the Spatsizi herd in northern British Columbia. This was followed by a fly season and rutting study on the same herd. The field work for 1977 has been partially summarized in a report to British Columbia Parks Branch (a copy has already been forwarded to the C.W.S.).

The 1978 field season began with a calving and fly season study on Buchans Plateau, Newfoundland, as well as some calving observations on the George River herd in Labrador. This was followed by another rutting study on the Spatsizi herd (B.C.) which was almost entirely financed by the C.W.S. grant and which shall be the main topic of this progress report.

Spatsizi:

A tent camp was flown in by helicopter on September 17,1978 to Caribou Mountain, approximately 10 miles north of Coldfish Lake in Spatsizi Wilderness Park, This area was chosen as a traditional rutting ground, having a small, but constant herd of caribou appearing on its slopes in the fall. A daily foot search for groups of caribou was made within a 5 mile radius of camp. During the peak of the rut (Oct. 8 - 14) caribou were concentrated too far from base camp and a fly camp was

used. Camp was removed by helicpter on October 17. The primary method of data collection was simply through observation with a spotting scope. Every effort was made not to disturb the caribou as this interferred with observations and, on most days, there would be little chance of finding another group to observe.

Weather

The weather was fairly agreeable from Sept. 17 to 26, with six sunny clam days during this period. Between Sept. 27 and Oct. 14 there was only one sunny day and most days had 100 percent cloud cover, accompanied by strong winds between October 9 and October 15. No measurable amount of rainfall fell, but there were light snowfalls on seven days and a 4 inch (10 cm) snowfall on October 13. Snowmelt occured fairly quickly below 6000 feet. A havy fog was present on a couple of days. The maximum and minimum recorded temperatures were +13 C (56 F) and -8 C (+18 F) at 5100 feet (1550 meters) elevation.

This amounted to much less snowfall on the ground than was observed during a comparable period and elevation at the same area in 1977. The importance of this is that last year, groups of caribou could be located by tracking, whereas this year, they could not.

Distribution

The hills were named (see Fig. 1) for easy field reference. From my limited observation posts, the initial concentrations appeared to be on the southwest slopes of the Tulik area. Then, a shift occurred, east to west across Jocko, Charlie, and Baker. By the start of the rut, the largest groups were seen further west on Able and Between Able and Blackjact. Note however, that there were still other, smaller groups

spread out over the plateau at this time. Single animal sightings invariably represented lone large or medium bulls, and increased as the rut approached (Table 1). See Figure 2 also.

Groups of caribou generally appeared to move at least a kilometer or more daily in the pre-rut period. The herd was most stabilized during the peak of the rut, when for three consecutive days one large group moved less than one kilometer. During this time individuals and small fractions of the group were seen to leave the main herd and return to it either within the day, or the next day.

Census

Maximum counts on any one day from the ground tallied 132 caribou (Sept. 20). Not all the land surface could be seen though, so it is reasonable to expect several missed groups.

I drew the antlers of all large males encountered daily, and recognized 29 large males. Table 1 shows that 14.6% of the herd was large males. Hence, the population may be estimated by 14.6/100 = 29X. X = 199 caribou.

Fish and Wildlife Branch flew over Caribou Mtn. counting caribou on October 7 and saw 156 caribou. In comparing notes, I find that they did not record an additional 15 caribou (14, 1, 1,) that I saw at the time of the flight from the ground, thus the total minimum caribou seen that day = 156 + 16 = 172. I believe it reasonable to assume that several other small groups may have been missed from both ground and air parties on Oct. 7, and that the number of caribou on the plateau may well have been around 200.

This represents a density of .32 caribou/ km^2 (.83/mi^2), a low figure especially when it is considered that these animals are considered aggregated at this time of year, and cover a larger area during the winter. Past counts of the herd were 433 in 1973 and 348 in 1977 (Bergerud 1978). The herd is clearly declining.

Sex Ratio (Table 1)

The sex ratio of 1 male to 3.3 females is biased by the ease of classifying adult males by their large antlers, whereas females were sometimes recorded as unknowns when their rump patches could not be checked out. Neither antler shape nor body coloration could be used to separate females from young males. The greater mobility of stags during the rut also results in a greater frequency of sightings when compared to other sex age groups. The ratio 1: 3.3 is only slightly deviated from the expected sex ratio in caribou of 1:2. The ratio of small antlered males (30 cm and under (12 inches)),to medium 31 cm - 50 cm (13 to 20 in.) and large males over 50 cm (21 in.) was 21:12:67. This is a high ratio of mature stags to small stags (male calves not included). Small males include yearlings and probably all two year olds. Medium stags are probably three years old and large stags, four years or older. The paucity of younger stags probably reflects several years of poor recruitment.

Percent calves

The percent calves (6.3%) is low and similar to last year's figures for this area. This low percent, after the first week of observations, is fairly constant, so that there is no indication of does with calves arriving on the plateau later or earlier than other sex-age classes. One lame calf was seen (1/35 x 100 = 2.9%). This is a conservative figure as some calves were only seen briefly and lameness may have been missed. Some females were seen with obvious udders and no calves, indicating calf death in the last three weeks. (All calves seen were still closely associated with their mothers, so early separation of pairs cannot explain uddered females without calves).

Date	Total females	with calf	obvious udder, no calf	very small udder
Sept. 18	10	0	3	not counted
Oct. 3	16	1	3	4
	26	1	6	

This indicates an ongoing loss of calves through August and September

BEHAVIOR:

Onset of Rutting Behavior:

All large males had shed their velvet and most were well polished at the start of the study on September 17. The herd wtill showed some sexual segregation as some male only groups were seen the first few days of the study. Sparring matches between large males (the engaging of each other's antlers without pushing) occurred occasionally until at least October 10th, at the start of the rut. The first vigorous "fight" between large males was seen when two groups approached each other on October 1. Large males showed intolerance of small males from September 23 onwards, by chasing them frequently.

Most females had shed their velvet by Oct. 1, see Table 2. As expected no change in female behavior was detectable as the rut advanced except for the increasing tolerance of the courting stag's presence shown by estrous females during pair tending, seen on October 9 and 10, when the first copulations were seen.

Group size (Table 3) was not correlated with the advance of the rut. The largest aggregation (107, approximately half the herd), was seen at least a week before the rut started. However, the frequency of singles increased as the rut advanced due to the wanderings of large mature stags between

groups. No singles were ever classified as females or calves.

Dominance behavior:

Between large Males:

Males recognizable by antler characteristics were given names for purposes of identifying them repeatedly in the recording of behavioral interactions. The resulting diagram (see Fig. 3) of the dominance order appears to have elements of a linear hierarchy. The confusion between E, Hutchinson and Raspberry reflects change in status as the rut progresses.

Fights commonly occurred when two groups met which had been grazing some distance apart. These averaged out to 2.2 fights per 5 hour period spent watching groups with 2 or more mature stags (at an average of 9 stags seen per five hour period), from Sept. 23 to Oct. 15. This is almost double the number of fights per five hour period recorded by other observers in Newfoundland (1.2 fights/day, average of 8 stags seen per day) (Bergerud 1974). See Table 4. Chases (not including those following a fight) were the least common interaction between large males.

Between small males:

Sparring was by far the most common interaction between small males (see Table 5). No serious fights were seen between small males. Avoidance behavior was not recorded in small males as no attempt was made to determine dominance subordinance relations between individuals. Their paucity of antler points did not facilitate individual recognition on my part.

Between small and large males

No cases were observed where a small male dominated one of a larger class, or where a medium male dominated a large male. However, within the large male class, males of different antler sizes sparred, fought, threatened, chased and avoided each other, but with one exception, the larger of the two always maintained dominance. Chase was by far the most frequent interaction between different class males, and the least frequent of different size males within a class. See Table 6.

Between females

The most frequent interaction between females represented a frontal approach (see Table 7). Over half (68%) of female-female interactions were threats only; 12.5% involved chases and 18.8% involved physical contact. This is a conservative figure for threats. Because of their less conspicuous nature, subtle threats may go unrecorded whereas high profile interactions such as chases are always observed. Note that no rearing and flailing was observed - a common summer interaction between females.

Female yearlings were identified in 2 of the 32 interactions. The hypothesis that older females, or larger size increases rank was unsupported by my data. In 4 of 7 cases females with smaller antlers dominated females with larger antlers. One female yearling dominated an adult female and one adult female dominated a yearling. The frequency of female- female interactions was calculated by determining the pair minutes between interactions. This was found to be 1 interaction per 72 minutes.

Between females and small males

Females appeared to be dominant over small males in half (50%) of the observations obtained (n = 16). No antler body or leg body contact

was observed. Antler - antler contact involved 26.3% of these interactions. Females threatened small males (5:1) more often than the reverse. Small males chasing females outnumbered females chasing males by 5: 2.

Cow - Calf behavior

All calves seen were closely associated with maternal females. Suckling attempts by calves were only 50% successful (n=10). Mean duration of suckling events was 25 seconds. A male calf accompanying an estrus female was tolerated by the mature tending stag. Another mature stag (Γ) was seen to attempt mounting a suckling female calf.

Maternal females did not appear to have a preference for group size (see Table 8).

Disturbance Behavior

See Table 9. No attempt was made to systematically approach groups for disturbance data purposes.

MORPHOLOGY

As no capture program was undertaken at Spatsizi in 1978, the only morphological data available was from cast antlers found during walking, and from estimates of antler dimensions on living animals.

Calf antlers:

Mean estimated antler height for calves in 1978 was 12.7 cm (5 in.). See Table 10. All calf antlers were spikes. This represents an unexceptional growth. Male calves in other herds, i.e. George R., Labrador, occasionally produce forks in their first summer, (pers. files).

Female antlers:

Estimates of antler height of living adult females gave a mean of

33 cm. (13 in.) (n=26). Mean height of antlers of females accompanied by calves was 28 cm. (11 in.) (n=6). Mean number of antler points for all females was 6.2 and for females accompanied by calves 4.3. This may suggest that females who were barren, or lost their calves early in the spring subsequently had a better energy balance than their counterparts whose calves survived. No unantlered females were seen. Average length of cast female antlers collected from calving ground 54 km (33 miles) south of the study area were 37.3 cm (14.7 in.) (n= 18).

This may be compared to antlers collected from the George R. Herd in Labrador where mean height was 41.5 cm (16.4 in.) (n=22) from parturient females, and 41.2 cm (16.2 in.) (n=18) on cast female antlers from previous years.

Male antlers :

Cast male antlers and antlers on skulls were measured in the field. Mean length burr to tip of main beam was 101.4 cm (40 in.) (n=41). Mean weight for intact antlers was 2.8 kg per antler (n=14). Table 11 shows male antler statistics for three areas in northern British Columbia, Buckinghorse being approximately 40 km (25 miles) shouth of the study area, and Level Mtn. being 225 km (140 miles) to the northwest.

PHYSIOLOGY

No blood samples were secured this fall as no capture program was undertaken. Freshly deposited fecal samples were collected and frozen to be analyzed for parasites. Laboratory results have not yet been received for this collection. Several prior blood samples taken from this area in 1977 showed negative results for brucellosis.

Summary

A rut study conducted in northern B.C. on Caribou Mtn. indicated an estimated herd of 200 caribou ranging over a 240 square miles area (622 km^2) with a sex ratio of 1 male to 3.3 females and 6.3 % calves. Behavioral data on dominance, courtship and cow-calf relationships was obtained. Morphological data collected was limited to a collection program of antlers. Fecal samples were collected for parasitic analysis.

References:

Bergerud, A.T. 1974. Rutting behavior of Newfoundland caribou. in The behaviour of ungulates and its relation to management. ed. V. Geist and F. Walther. I.U.C.N. pub. 24. Morges Switzerland.

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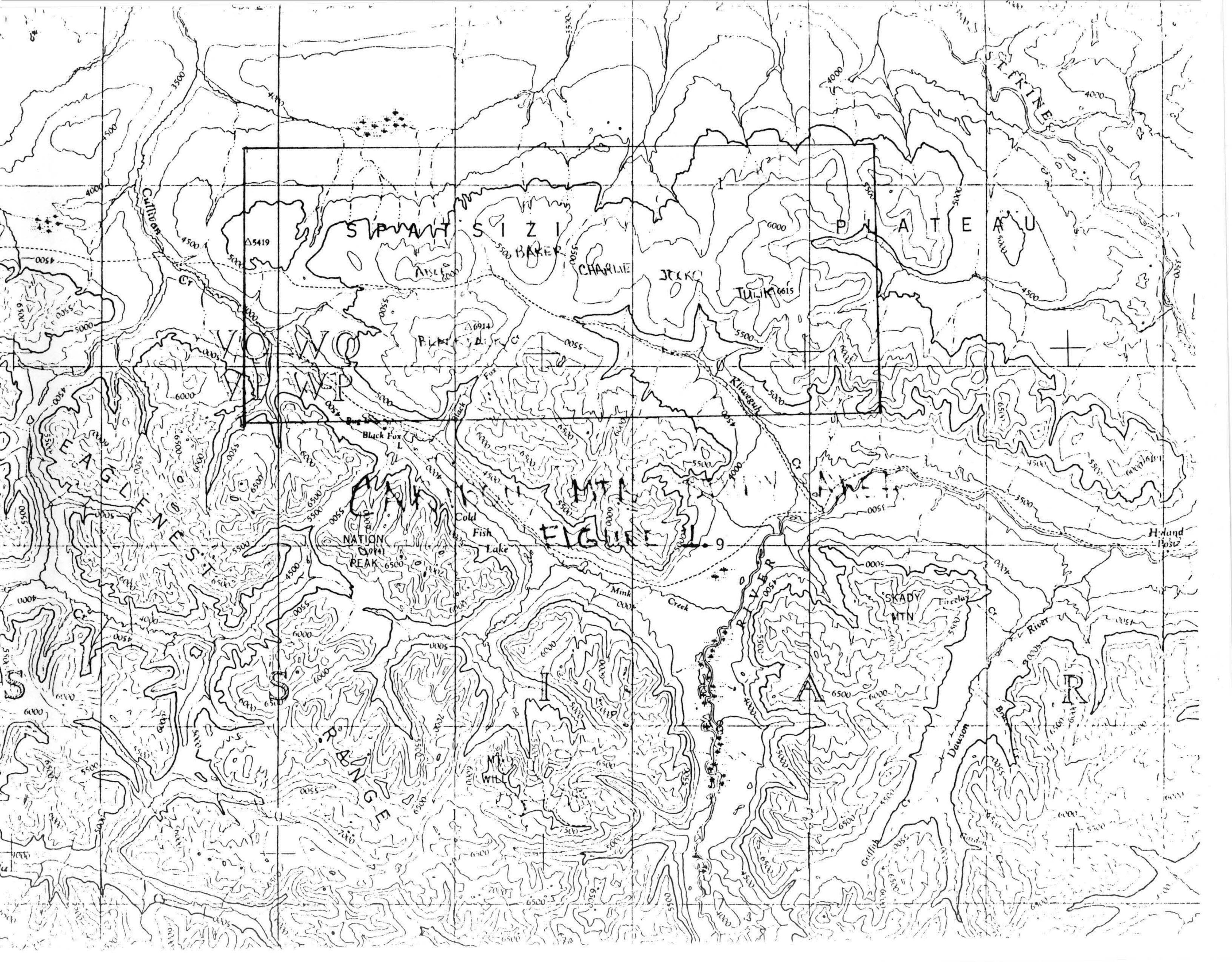
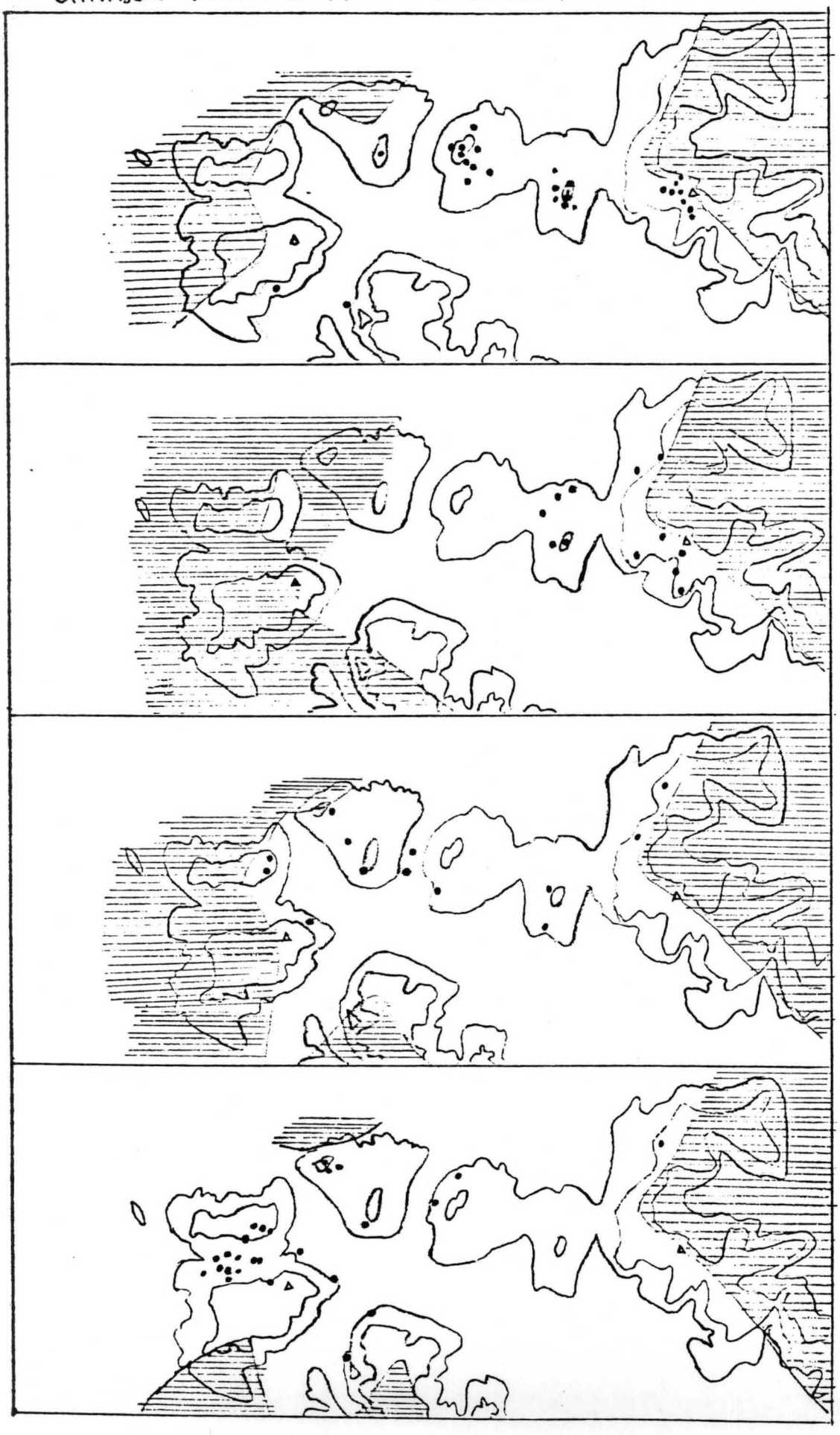

SPATSIZI PLATEAU
EAGLENEST RANGE
SKADY MTN
NATION PEAK
BAKER
CHARLIE
TULIK
Cold Fish Lake
Black Fox L
Mink Creek
Kliweguh Cr
Dawson
Cullivan Cr
River
Fox Cr

CARIBOU DISTRIBUTION - FIGURE 2



SEPT 18-20 •
SEPT 21-24 •

1 dot = 1 group

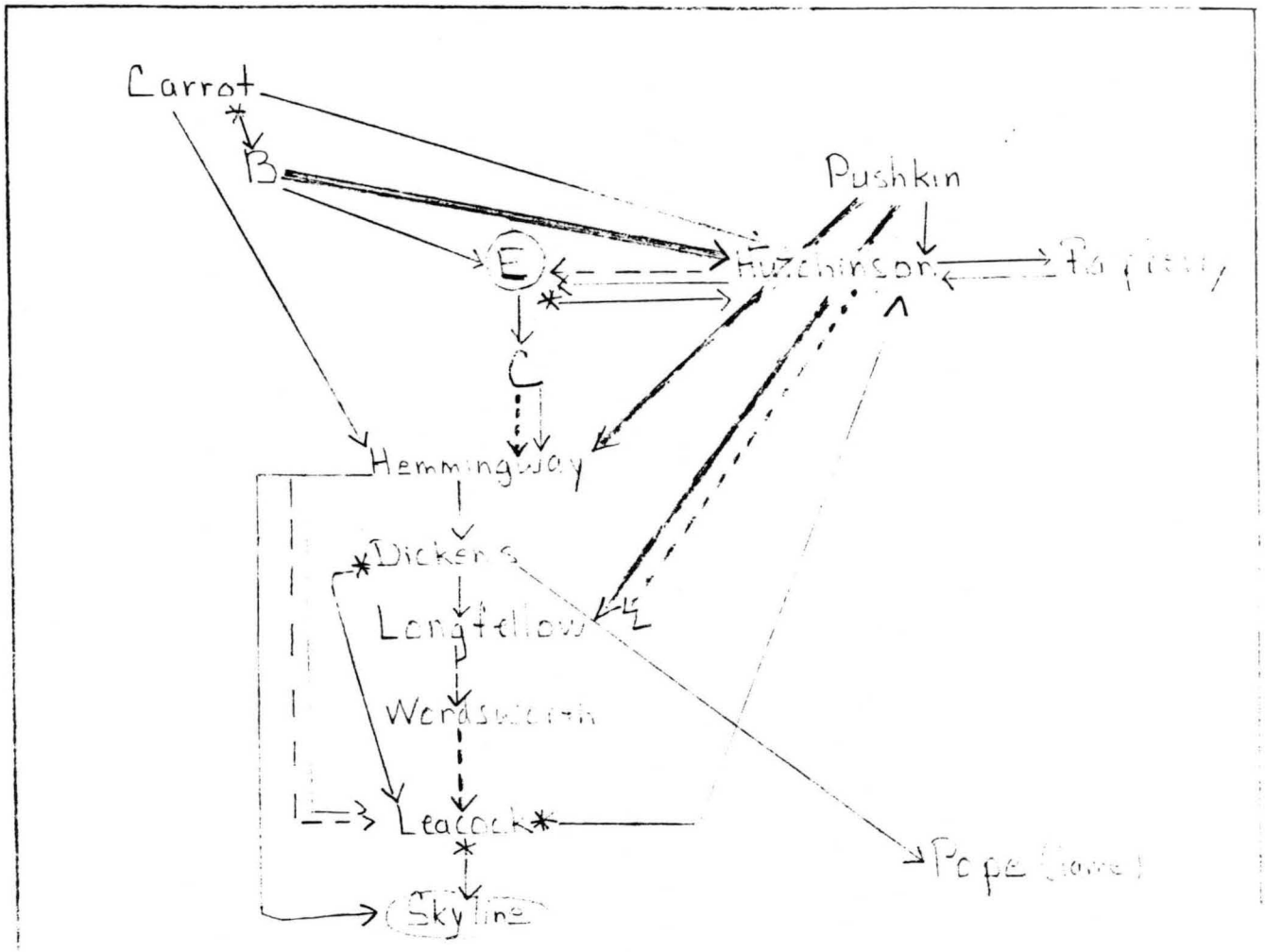
shaded area not surveyed

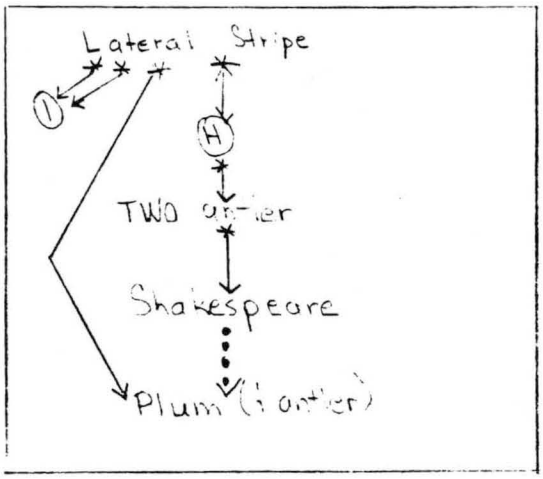
SEPT 25-27 •
SEPT 28-OCT 1 •

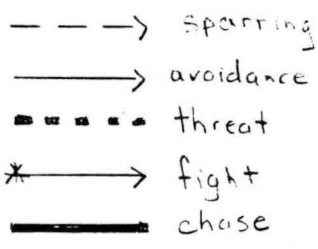
OCT. 2-4 •
OCT. 5-8 •

OCT. 9-11 •
OCT. 12-15 •

FIGURE 3. DOMINANCE BEHAVIOR AMONG LARGE MALES







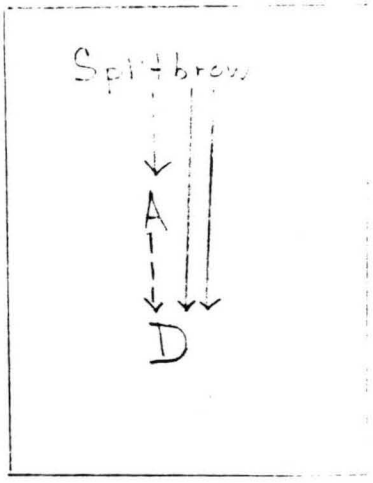


Table 1: SEX RATIO

Date	Total	Males			Females	Calves
		Large	Medium	Small		
Sept. 18	4	4				
18	11	1			10	
20	2	2				
20	3	1			2	
22	4				4	
23	43	4	1	4	29	5
24	40	4	1	4	29	2
24	3				3	
24	5				5	
24	9	4			5	
Oct. 1	23	6		2	14	1
1	40	8	1	4	22	5
1	18	2			13	3
3	107	18	2	3	77	7
4	55	5	2	4	43	1
4	2	2				
4	3	1			2	
4	1	1				
4	1	1				
5	3	1			1	1
7	14	1			13	
7	1	1				
7	1	1				
7	3	1			2	

Table 1 - continued

Date	Total	Large	Medium	Small	Females	Calves
Oct. 8	1	1				
8	11	1	1		9	
9	86	8	2	3	67	6
9	1	1				
10	89	10	1	1	71	6
11	1	1				
11	1	1				
11	1	1				
11	1	1				
11	2	1			1	
12	37	2	1	4	27	3
12	6	1			4	1
12	1	1				
12	1	1				
13	7		1		6	
13	13		1	2	9	1
13	1	1				
13	47	1	4	1	39	2
15	1	1				
15	4	1			2	1
15	2				2	
Totals	710	104	18	32	511	45
Percents		14.6	2.5	4.5	72.0	6.3

Sex Ratio: 511/(104 + 18 + 32) = 3.3

TABLE 2. DATES OF VELVET SHED BY FEMALES

Date	Total females	Velvet intack	Velvet shedding	Freshly shed - red	Polished
Sept. 18	8	5	2	1	0
20	4	3	0	0	1
23	23	8	9	0	6
24	31	15	2	0	14
Oct. 1	18	1	0	2	15
3	17	3	2	3	9
5	1	0	0	0	1
7	2	0	0	1	1
12	33	0	2	0	31

TABLE 3. GROUP SIZE

Date	N	Range of group size	$\bar{X}$
Sept. 18 - 20	17	1 - 28	9.7
21 - 23	7	3 - 100	28.9
24 - 26	10	3 - 40	11.5
27 - 29	4	11 - 50	22.0
Sept. 30 - Oct. 2	3	18 - 40	27.0
Oct. 3 - 5	2	4 - 107	55.5
6 - 8	3	1 - 14	6.3
9 - 11	13	1 - 89	17.5
12 - 14	16	1 - 47	10.3

TABLE 4. LARGE MALE INTERACTIONS

	Spar	Fight	Chase	Avoid	Threat
Observations	19	16	5	18	8
Percent	28.8	24.2	7.6	27.2	12.1
Per 5 hours	1.5	2.2	.7	2.4	1.1

TABLE 5. SMALL MALE INTERACTIONS

	Spar	Chase	Threat
Observations	31	1	2
Percent	91.2	2.9	5.9

TABLE 6. DIFFERENT CLASS MALE INTERACTIONS

	Spar	Fight	Chase	Avoid	Threat
	1 L-S[1].	1 M-S	25 L-S 17 L-M	4 L-S 2 L-M	9 L-S
total observations	1	1	42	6	9
percent	1.7	1.7	71.2	10.2	15.3

1. L-S = large male dominated small male in interaction, M-S = medium male dominated small male, etc.

TABLE 7. FEMALE - FEMALE INTERACTIONS

NO CONTACT			CONTACT		
Frontal threats	other threats	chases	antler/ antler	antler/ body	leg/ body
18	4	4	3	3	0
56.3%	12.5%	12.5%	9.4%	9.4%	0%

Table 8. PERCENT CALVES VERSUS GROUP SIZE

	Group sizes					
	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100	100 +
Mean % calves	6.0	1.1	8.2	-	6.9	6.5
Sample size	19	3	5	0	2	1

Table 9. DISTURBANCE BEHAVIOR

RESPONSE CLASS	SOURCE OF DISTURBANCE				
	human sitting still	human standing	human walking	aircraft	other caribou running
A	1	1	1	1	1
B	2	1	2		
C		2	4	1	1

Class A: group appears to perceive stimulus but grazing is not interupted and the herd does not change position relative to the stimulus.

Class B: grazing is interupted, individuals may assume alert postures and the herd may shift by walking.

Class C: grazing stops. alert postures are followed by trotting or running.

TABLE 10. CALF ANTLERS

Date	Sex	Antler height (inches) Left	Right
Sept. 23	m	11	8
23	-	6	4
23	f	10	10
24	-	3	3
24	-	6	4
Oct. 1	-	0	0
1	f	4	3
1	m	6	6
3	f	6	4
5	-	6	6
9	m	4	4
9	m	10	10
12	m	4	4
	Total	76	66
	Mean =	5.1	(12.7 cm)

TABLE 11. MALE ANTLERS

	Caribou Mtn.	Buckinghorse	Level Mtn.
	(centimeters)		
Total length (n)	101.4 (41)	105.7 (37)	102.1 (35)
Smallest diameter	15.6 (40)	15.2 (28)	15.9 (51)
Weight (grams)	2780 (14)	3300 (33)	-
Number of points	12.8 (37)	12.9 (38)	13.4 (26)