COMPOSITION OF THE BEVERLY HERD IN MARCH AND APRIL 1982

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ABSTRACT

From 30 March to 8 April 1982, the spring distribution of the Beverly caribou herd was mapped and ground classification counts were conducted to estimate calf survival to one year of age. Most caribou occupied a narrow band of winter range between 107°30'W and 109°30'W longitude from Noman Lake in the north to just south of the NWT-Saskatchewan border. Caribou did not begin to aggregate or undertake major directional movements toward the calving ground during the study period.

We classified 3244 caribou from 35 groups. Most mature bulls were in small scattered groups south of the other herd components. Of 2483 caribou over 1 year old, 29% were male and 71% were female. From the ratio of 43 ± 1.4 (X ± SE) calves per 100 females over 1 year old, and assuming an initial calf production of 69 calves per 100 females (Parker 1972) and female survival from June 1981 of 93% (Heard and Calef 1979), 57% of calves born in June 1981 and 81% of calves alive in November 1981 were alive in April 1982. This indicates that overwinter calf survival was excellent. We found 20 ± 0.8 yearlings per 100 cows over 2 years of age. After we incorporated the unrepresented male segment of the Beverly herd, we estimated that calves and yearlings composed 21% and 9% of the population, respectively. We observed 0.3 wolves per hour flown. Caribou use of lake ice as a mineral lick is reported.

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INTRODUCTION

In order to effectively manage barren-ground caribou (Rangifer tarandus groenlandicus) populations, the Department of Renewable Resources, Government of the Northwest Territories, requires information about herd size and structure. Estimates of the number of breeding females on calving grounds is the index of population size used to monitor the status of populations (Heard 1981). The proportion of calves in a herd helps to explain observed trends in herd size and provides a qualitative index of herd health and its potential for growth. Caughley (1974) states that age ratios cannot be interpreted without additional information. While we agree with his arguments in theory, we recognize that in practice age ratios are usually correlated with population growth rates (Alexander 1958). We believe that the primary reason for this is that overall adult mortality is relatively constant from year to year.

The objectives of this study of the Beverly caribou herd were:

1. to determine over winter calf survival and recruitment, and
2. to assess wolf abundance and predation.

METHODS

Preliminary information on the distribution of Beverly caribou in late February and early March 1982 was provided by the Department of Northern Saskatchewan (Kowal pers. comm.). From 8 to 13 March, the senior author and Bernie Bergman (Wildlife Officer, Department of Renewable Resources, Fort Smith) confirmed the preliminary information.

From 30 March to 8 April 1982, from the base camp at Porter Lake, NWT, we conducted reconnaissance flights in a Cessna 185 aircraft and determined the percentage of calves in the population. Lawrence Cheezie represented the Fort Smith Hunters' and Trappers' Association and acted as a third observer. We chose sampling locations where the number of caribou and the rate and predictability of their movements would maximize sample size.

From the ground we identified the sex and age of each caribou in a group. When necessary, Cheezie herded animals past the observation point by slowly walking around the caribou between the herd and the lake shore. Caribou were viewed through a 25 or 40 power spotting scope. Unless the penis was visible, sex identification was based on the presence or absence of a vulva. Age categories were calves (9 month old animals), yearlings (21 month old animals), cows, young bulls, and adult bulls. Calves were distinguished by their small body size and rounded skull profile. Yearlings were intermediate sized animals with a straight skull profile. Young bulls were small bodied males with at least one hard antler, while adult bulls were large and bald. We recorded the number of antlers possessed by the cows and young bulls. Results were recorded in a notebook.

To avoid duplicate classification of groups, sampling areas were changed daily. All caribou in a group had to be classified for that data to be incorporated into the analysis. To calculate the ratio of calves to females over 1 year old, the female yearling and cow components were combined. We used cluster sampling procedures (Cochran 1977: 64-68 and 150-156) to estimate the proportion and associated variance of the calf to 1+ female, yearling to 2+ cow and 1+ bull to 1+ female ratios.

RESULTS

Distribution and Movements

Extensive aerial surveys by the Saskatchewan Department of Renewable Resources in March 1982 indicated that, except for several thousand Beverly caribou in the Black Lake-Selwyn Lake area of northeastern Saskatchewan, most of the herd occupied an area bordered by Noman Lake and the Thoa River to the north and south, respectively, and Powder and Manchester lakes to the west and east. respectively (Fig. 1, Kowal pers. comm.). Scattered groups occupied a narrow band south of the Thoa River to just south of the NWT-Saskatchewan border between 107°30'N and 109°30'W. On 29 March we found most caribou in the area bordered by Boomer, Tejean, Person, and Porter lakes (Fig. 1). Most caribou were in widely spaced groups of 20-50 animals. This area received little fresh snow for several weeks prior to our arrival and was heavily tracked. Most large trails in the middle of lakes were more dispersed near the shorelines. From these observations we concluded that no major aggregation or extensive northward movements to the calving ground had started. Observations by Don Thomas (pers. comm.) and Jack van Camp (pers. comm.) also supported our description of the Beverly herd's distribution. On 8 April we observed scattered caribou and more extensive trails in the Broomfield Lake area (Fig. 2), suggesting that a minor northward movement was occurring. Observations from 30 March to 8 April and especially from a 3 April reconnaissance flight south to Whirlwind and Brazen lakes indicated that most mature bulls were

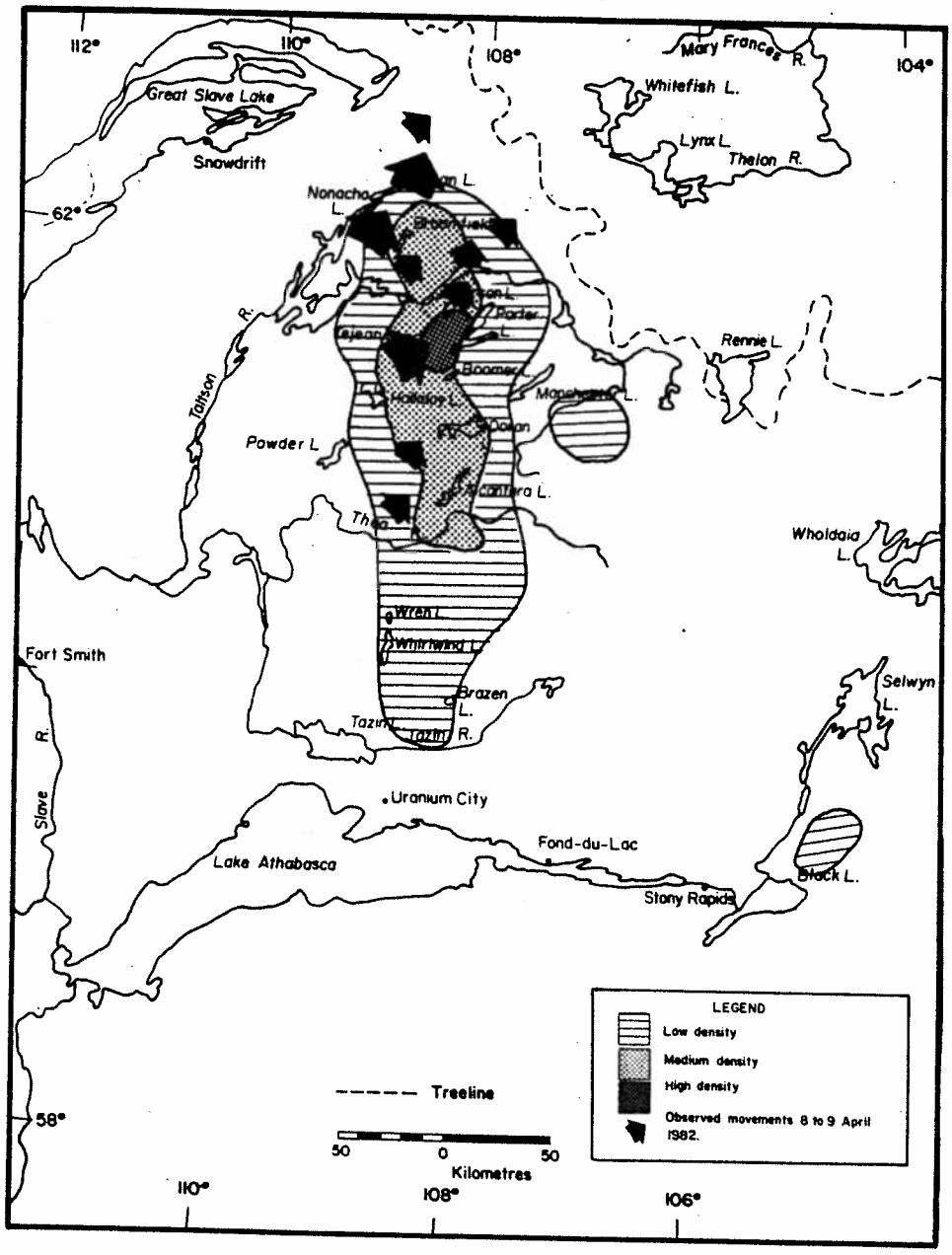

Figure 1. Distribution of the Beverly caribou herd, 29 March to 8 April 1982.

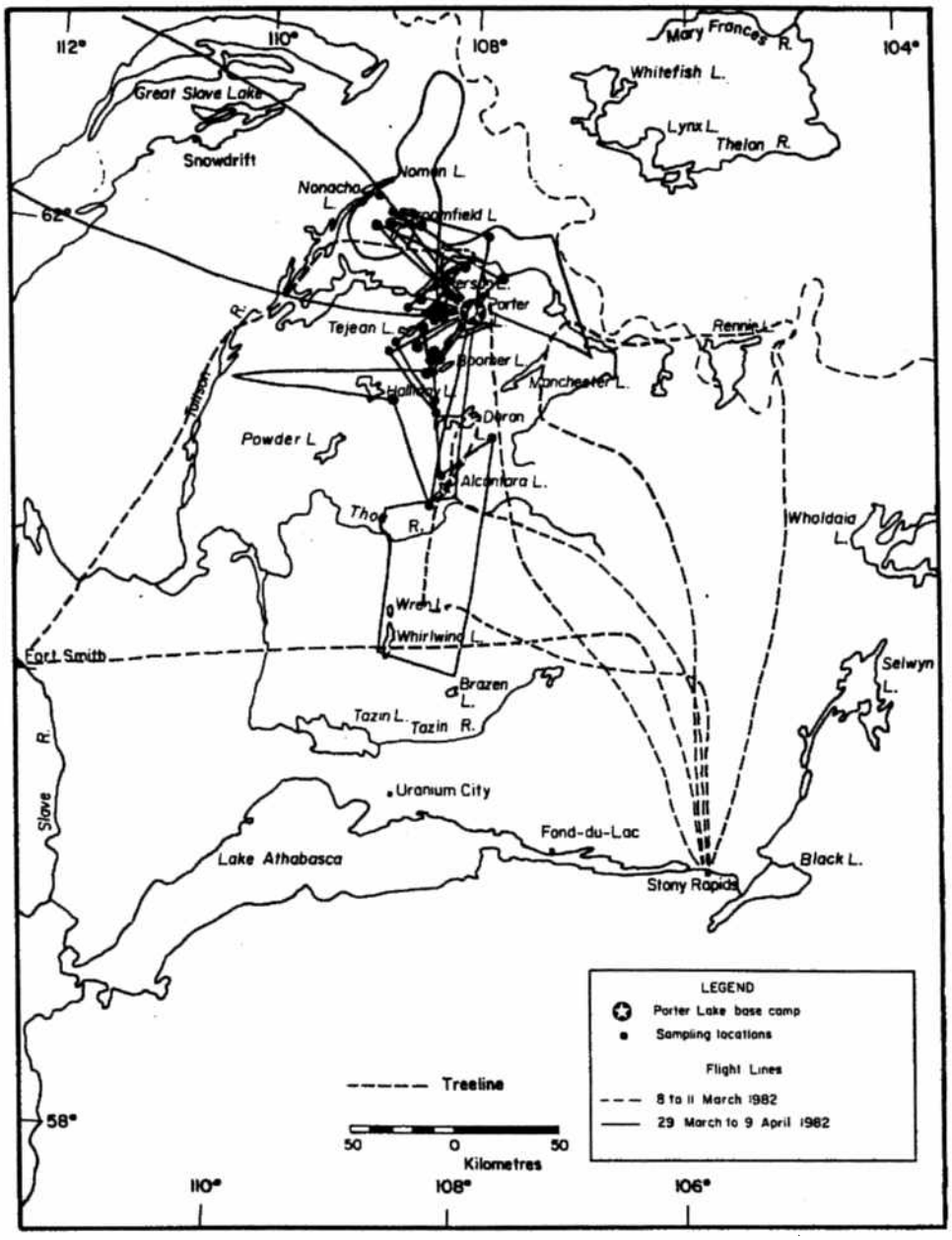

Figure 2. Flight lines during the 1982 spring classification study of the Beverly caribou herd.

in small scattered groups between the Thoa River and the NWT-Saskatchewan border, south of the other herd components.

Classification Counts

We classified 3244 caribou from 35 groups during 9 days between 30 March and 8 April 1982 (Table 1). The mean group size was 93 ± 14 ($\bar{X}$ ± SE) caribou and ranged from 11 to 371. Age and sex composition was 49.6% cows, 23.4% calves, 15.4% young (antlered) bulls, 1.8% mature (unantlered) bulls, 4.6% male yearlings, 4.9% female yearlings, and 0.3% yearlings of unknown sex. We assumed that the sex ratio of 11 unsexed yearlings was the same as the 308 classified; therefore, 155 (49%) were males and 164 (51%) were females, giving a ratio of 95 yearling males:100 yearling females (Appendix A). Of 555 bulls over 2 years old, 498 (90%) were immature and 57 (10%) were mature.

The sample contained 23% calves or 43 ± 1.4 calves per 100 females over 1 year old and 10% yearlings or 20 ± 0.8 yearlings per 100 cows over 2 years old (Appendix A). Survival of calves from June 1981 to April 1982 was 57%, assuming an initial calf production of 69 calves per 100 females (Parker 1972) and female survival from June 1981 of 93% (Heard and Calef 1979, Appendix A). Using Gunn's (1984) observed fall 1981 ratio of 51 calves per 100 females, we estimated that 81% of calves alive in November 1981 were alive in April 1982 (Appendix A).

We assumed that the observed sex ratio of 40 ± 1.6 (1+) males:100 (1+) females (71% females) was not representative of the herd's composition and that Gunn's (1984) fall 1981 estimate of 64% females is accurate, and revised our calculations to

Table 1. Number of Beverly caribou classified by area in March and April 1982.

Group no.	Date	Location	Cows no. of antlers 0	1	2	Calves	Yearlings M	F	?	Young bulls no. of antlers 0	1	2	?	Mature bulls 0	Total
1	30 March	61°37'N, 108°30'W	1	1	19	9		1		5	1				37
2	30 March	61°26'N, 108°51'W		1	34	11	1	3		2		7		3	62
3	30 March	61°18'N, 108°26'W			16	12	1	1			1	6	1	3	41
4	30 March	61°28'N, 108°29'W	1	3	137	79	4	3	3	1	3	51		4	289
5	31 March	61°43'N, 108°32'W		1	20	15	4	1	1		1	5	1	1	50
6	31 March	61°50'N, 108°14'W	6	8	188	88	18	16	4	2	1	39		1	371
7	31 March	61°45'N, 108°27'W			26	13						5			44
8	31 March	61°41'N, 108°44'W	1		26	14	3	5			3	10		1	63
9	1 April	61°27'N, 108°32'W	6	6	35	21	7	8				18			101
10	1 April	61°26'N, 108°33'W	1		27	9	1	3	1		3	15		1	61
11	1 April	61°25'N, 108°32'W	1	2	33	13		2	1	2	2	1			57
12	1 April	61°15'N, 108°40'W	3	2	4	10	1					8		7	35
13	1 April	60°51'N, 108°30'W	2	1	16	9	5	3			1	7			44
14	2 April	61°31'N, 108°28'W	4	1	83	64	10	8			1	37		3	211
15	2 April	61°30'N, 108°30'W	3	4	101	35	10	10			6	20		3	192
16	2 April	61°35'N, 108°28'W	2	4	45	20	2	4				10		1	88
17	2 April	61°36'N, 108°27'W			26	33	11	7			3	11			91
18	2 April	61°28'N, 108°30'W			3	4	2					2			11
19	3 April	61°07'N, 107°45'W	2	2	16	8		3			4	11			46
20	3 April	60°55'N, 108°17'W		3	20	12	5	2			3	11		3	59
21	3 April	61°14'N, 108°22'W	6	4	40	24	3	14			1	7		2	101
22	3 April	61°30'N, 108°47'W	2	1	23	13	4	2				10		3	58
23	4 April	62°05'N, 108°39'W	8	2	70	27	5	12				21		2	147
24	4 April	62°05'N, 108°44'W			23	11	5	5			1	13			58
25	4 April	62°05'N, 108°41'W	6	8	101	48	16	11			1	36		3	230
26	4 April	62°01'N, 107°56'W	1	3	29	3	1					3			40
27	5 April	61°37'N, 108°26'W	1		14	2	2	2				4			25
28	5 April	61°43'N, 108°19'W	1	1	52	33	3	7			2	9			108
29	5 April	61°49'N, 108°12'W		1	48	23	5	2		1	3	4		1	88
30	5 April	61°52'N, 108°07'W	2	2	48	20	5	5	1			10		3	96
31	5 April	62°02'N, 108°48'W	5	3	64	45	12	12			1	34		5	181
32	6 April	61°48'N, 107°42'W	4	1	33	11	1	2				1		1	54
33	6 April	62°02'N, 108°28'W	2	1	20	5	2	2				5			37
34	6 April	62°01'N, 108°42'W			12	4				1	1	5			23
35	8 April	62°11'N, 108°54'W	2		18	13	1	2				3		6	45
Totals			73	66	1470		150	158	11	14	43	439	2		
Total			1609			761	319			498				57	3244

incorporate the unrepresented male segment (Appendix A). Our revised estimate is 21% calves and 9% yearlings.

Wolf Observations

We observed 14 wolves in eight groups (mean group size = 1.8, range 1-3) in 47.6 hours of flying time, or 0.3 wolves per hour flown (Table 2). We counted five locations where wolves had killed caribou (Table 3). We examined two carcasses, both of which were mature caribou (based on tooth wear), in good condition (based on the appearance of marrow fat), and the meat was completely consumed.

Caribou Use of Lake Ice as a Mineral Lick

We observed caribou cratering on several lakes in the Alcantara Lake area between 2 and 4 April. On 3 April we observed approximately 30 caribou cratering over two areas (roughly 10 m x 10 m) of Alcantara Lake (Fig. 1) about 150 m from shore. The caribou allowed us to approach to within approximately 75 m before moving away. The caribou had cratered down to the lake ice, which was a brown-yellow colour and which tasted "minerally". Analysis of concentrations of calcium and magnesium indicated that the ice was very "hard", containing 220 mg/l $CaCO_3$ and greater concentrations of sodium (18 mg/l) and potassium (12 mg/l) than normally found in sea water. We did not analyze the ice for the presence of other molecules or elements. Caribou immediately returned to the existing craters after we left the area. The caribou appeared to be using the lake ice as a mineral lick.

Table 2. Number of wolves observed in the vicinity of the Beverly caribou herd, 8 March to 4 April 1982.

Date	No. of wolves	Location	Comments
10 March	3	59°43'N,106°25'30"W	On Fontaine Lake.
11 March	3	60°16'30"N,105°06'W	West of Ingalls Lake, feeding on abandoned carcasses.
11 March	1	61°36'N,106°08'W	On Taltson R., west of Rennie Lake.
11 March	2	61°09'N,106°37'30"W	South of McCann Lake.
31 March	1	61°31'N,108°22'W	Dark grey - south of Porter Lake.
3 April	1	61°04'N,108°27'W	West of Alcantara Lake.
3 April	2	60°30'N,108°41'W	Cream coloured - on Wren Lake.
4 April	1	61°54'N,107°33'W	White - northeast of Porter Lake.

Total = 14 wolves in 8 groups, mean = 1.8, range = 1-3.

Observed 5 wolf-killed caribou.

Hours flown on survey = 47.6.

Wolves observed per hour flying time = 14/47.6 = 0.3 wolves/hour.

Table 3. Description of wolf-killed caribou found in April 1982.

Date	Location	Comment
5 April[1]	62°04'30"N,108°41'W	North of Broomfield Lake - did not examine from the ground, but carcass appeared to be consumed.
5 April[1]	62°04'N,108°41'W	Old female based on antler development and tooth wear. Carcass completely consumed. Bone marrow white and firm.
5 April[1]	62°04'N,108°41'W	Middle aged, based on tooth wear. Unantlered. Carcass completely consumed. Bone marrow white and firm.
6 April	62°19'N,108°49'W	Small Lake north of Noman Lake - did not examine. Two kills here about 200 m apart.

1 The kills were not present on 4 April, therefore, were made within the previous 24 hours.

DISCUSSION

Distribution and Movements

Barren-ground caribou cows frequently form large aggregations numbering in the hundreds or thousands prior to migrating northward to the calving grounds in the spring (Kelsall 1968, Parker 1972). Our observations indicate that no similarly large aggregations had formed and no northward migrations had occurred by 9 April. This is consistent with previous observations. Beverly caribou usually begin their spring migration in late April and the vanguard of cows reach the treeline by the first week in May (Darby 1978, Kelsall 1968). On 27 April 1978 Robert Decker (pers. comm. in Darby 1978) observed 80-100,000 caribou aggregated west of Sid Lake, approximately 52 km northwest of the treeline. At the observed rate of migration of 6 km per day (Darby 1978) these cows probably were at the treeline on 20 April. Spring migration was several weeks later in 1979, with the vanguard of cows reaching the treeline about 11 or 12 May (Darby 1980). In the past 2 years, migrating Beverly cows have been well out onto the barrens by late April 1980 (Darby pers. comm. in Cooper 1981) and the first week in May 1981 (Decker pers. comm. in Clement 1982).

Reports from trappers of thousands of caribou on the barrens in the Williams Lake area in February and March (Fig. 1, Black and Leubert pers. comm.) suggest that a segment of the Beverly herd either wintered on the barrens or migrated prior to our study. Previous reports of tundra wintering areas for the Beverly herd

described the use of the Pelly-Garry lake area and the lower Thelon River from 1940 to 1950 (Banfield 1954) and an area between Beverly and Pelly lakes in 1954-1955 (Loughrey 1955). Unfortunately, we received Black and Leubert's report after returning from this study and were unable to determine the size and composition of that component of the herd.

The northernmost taiga wintering concentrations of caribou consisted largely of cows and calves, while most mature bulls remained in the southern areas of occupied range; similar to 1981 observations of spring Beverly herd distribution (Elliott and Decker 1981) and consistent with general observations of winter distribution of barren-ground caribou (Kelsall 1968, Parker 1972).

Classification Counts

The mean (weighted) sex ratio observed in April 1982 (40 ± 1.6 [1+] males per 100 [1+] females) was not significantly ($t=1.46$, $P>0.1$, two tailed test) lower than the weighted fall estimate of 57 ± 22 (1+) males per 100 (1+) females (assuming 50:50 yearling sex ratio, Gunn 1984). We feel that the lower 1+ male:1+ female ratio reflects undersampling of the mature bull component of the Beverly herd, which was scattered throughout southern portions of the occupied range, rather than a change in the herd's sex ratio.

The spring 1982 calf:1+ year old female ratio of 43 ± 1.4 ($\bar{X}$ ± SE) per 100 was above the mean value (27) from 1978-1981 classification studies (Table 4) and was significantly ($t=8.99$, $P<0.001$, two-tailed test) greater than the spring 1981 ratio of 21 ± 1.8 per 100 (Elliott and Decker 1981).

Table 4. Spring calf and yearling ratios from the Beverly caribou herd, 1978 to 1982.

Timing	Calves:100 1+ year old females (± SE)	Yearlings: 100 cows (± SE)	Source
1978	41	17	Heard and Decker 1980.
1979	18	30	Heard and Decker 1980.
1981	21 ± 1.8	8 ± 1.2	Elliott and Decker 1981.
Mean	27	18	
1982	43 ± 1.4	20 ± 0.8	This study.

The mean (weighted) spring 1982 yearling:cow ratio of 20 ± 0.8 per 100 was above the mean (18) from 1978-1981 studies (Table 4) and was significantly ($t=8.267$, $P<0.001$, two-tailed test) greater than the spring 1981 ratio of 8 ± 1.2 per 100 (Elliott and Decker 1981). The spring 1982 yearling:cow ratio (20 ± 0.8 per 100 cows) was not significantly greater ($t=1.137$, $P>0.20$, two tailed test) than that estimated in November 1981 (16 ± 6.0 per 100 cows, Gunn 1984). An over winter increase in yearling:cow ratios suggests that sampling error or biases are incorporated into one or both estimates. It also suggests that either yearling survival was exceptionally good, or female survivorship declined. We have no evidence that supports the second possibility.

Thomas (1983) reported that Beverly cows were in better condition in March 1981 and 1982 than in March 1980. This

suggests that 1981 and 1982 winter range conditions were relatively favourable. Increased calf and yearling counts in spring 1982 relative to 1981 may reflect low wolf abundance on the winter range. Elliott and Decker (1981) observed a much greater density of wolves in April 1981 (1.95 wolves per hour flown; n=40 hours) than we observed in April 1982 (0.3 wolves per hour flown; n=47.6 hours).

As we felt that we undersampled the mature bull component of the Beverly herd, we used Gunn's fall 1981 (Gunn 1984) estimate of 64% females over 1 year old and incorporated the unrepresented bulls into our calculations. After incorporating the bulls, calves and yearlings composed 21% and 11% of the herd, respectively.

Wolf Abundance

The number of wolves observed per hour flown is a crude estimate of relative wolf abundance. Our observations of 0.3 wolves per hour is much lower than Elliott and Decker's (1981) observation of 1.95 wolves per hour from 1-13 April 1981.

The relatively low number of wolves taken during the winter of 1981-1982 by NWT and Saskatchewan residents trapping on the winter range (Bergman pers. comm.) also indicates that there were few wolves associated with the Beverly herd.

RECOMMENDATIONS

The Department of Northern Affairs' cabins at Porter Lake were well situated relative to the Beverly herd distribution in April 1982. They provided a comfortable operations base and we recommend their continued use given similar caribou distributions.

We also recommend that greater time and money resources be allocated to future surveys. We did not have sufficient resources to search the barrens for early-migrating caribou and reports suggest that we may have missed a large segment of the herd. We were also unable to extensively sample southern portions of the occupied range, and for this reason we feel we undersampled the mature bull segment of the Beverly herd. A longer study period would allow researchers to sample closer to the start of spring migration, preferably after large aggregations had formed, thereby increasing the efficiency of the study.

To increase the probability of obtaining classification counts that accurately represent all herd components, we recommend that researchers maximize the variety of sample locations rather than obtain a large sample from few locations.

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PERSONAL COMMUNICATIONS

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Appendix A. Calculations.

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1. Sex ratio of unclassified yearlings

classified yearlings 158 females:150 males

% females = 158/(158+150) = 51% females

% males = 150/(150+158) = 49% males

assume sex ratio of 11 unclassified yearlings is the same as those classified.

11 unclassified yearlings x 0.51 = 6 females

11 unclassified yearlings x 0.49 = 5 males

Total yearling sex ratio = 158 + 6 females/(150 + 5 males)

= 164/155

% females = 164/(164+155) = 51% females

% males = 155/(155+164) = 49% males

or 155/(164x100) = 95 males:100 females

2. Sex ratio of animals over one year old

1609 cows + 57 bulls + 498 young bulls + 319 yearlings
= 2483 1+ animals

1+ males = 57 bulls + 498 young bulls + 155 yearling males
= 710

1+ females = 1609 cows + 164 yearling females
= 1773

% 1+ males = 710/(710+1773)
= 29%

% 1+ females = 1773/(1773+710)
= 71%

sex ratio = (710/1773)x100
= 40 ± 1.6, 1+ males:100 1+ females (calculation of proportion and variance based on cluster sampling procedures, Cochran 1977: 64-68 and 150-156).

3. Percentage calves and ratio of calves to 1+ females

761 calves/3244 caribou classified
= 23% calves

(calves/(cows+female yearlings) x 100)
= 43 ± 1.4 (X ± SE) calves:100 females (Cochran 1977)

4. Percentage yearlings and ratio of yearlings to 2+ cows

319 yearlings/3244 caribou classified
= 10%
(yearlings/cows x 100)
= 20 ± 0.8 (X ± SE) yearlings:100 cows (Cochran 1977)

5. Survival of calves from birth to April

assume a) initial calf production of 69 calves/100 cows (Parker 1972) and

b) female survival from June 1982 of 93% (Heard and Calef 1979)

Y cows in June x 0.93 = 100 cows in April

Y = 100/0.93 = 108, therefore 108 June cows = 100 April cows

69 calves/100 cows x 108 = 75 calves in June per 108 cows

thus

75 calves in June decreased to 43 calves in April indicating (43/75) x 100 = 57% survival.

6. Survival of calves from November 1981 to April 1982

Assume a) 51 calves/100 cows in November (Gunn 1984)

b) adult female mortality from November 1981 to April 1982 = 0.71%/month (Heard and Calef 1979) x 5 months = 3.6%. Therefore, 96.4% survival.

Y cows in November x 0.964 = 100 cows in April

Y = 100/0.964 = 104, therefore, 104 November cows = 100 April cows.

51 calves/100 cows x 104 = 53 calves in November per 104 cows

thus

53 calves in November decreased to 43 calves in April indicating (43/53) x 100 = 81% survival.

7. Correction for unrepresented male segment

Gunn (1984) found 57 1+ males:100 1+ females (64%) in fall 1981.

57/100 x 1773 1+ females = 1011 1+ males

but we found 710 1+ males, therefore, add 1011-710 = 301 males

total caribou = 3244 + 301 (1+ males) = 3545

a) corrected % calves = 761/3545 = 21%

b) corrected % yearlings = 319/3545 = 9%

Appendix B. Cost of April 1982 Beverly classification counts.

Item	(x $1,000)
41.5 hours Cessna 185	7.4
Fuel purchase	2.0
Fuel caching	2.9
Casual wages	0.6
Maps	0.2
Film	0.2
Camp supplies and equipment	0.5
Total	13.8