KAMINURIAK CALVING GROUND SURVEY
5 - 17 JUNE 1988

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ABSTRACT

In June 1988, the number of caribou on the Kaminuriak caribou herd's calving ground was estimated using a stratified transect strip survey where caribou were counted on aerial photographs. The survey resulted in an estimate of 160,000 ± 20,800 (SE) caribou one year old and older on the calving grounds. Based on the reproductive condition of a sample of animals classified from a helicopter, the number of parturient (pregnant and post-partum) females on the calving ground was estimated to be 99,000 ± 29,200, which extrapolates to a total population estimate of 220,000 ± 72,000. Herd size appears to have been stable since 1983.

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INTRODUCTION

Prior to the use of aerial photography, the trend in the size of the Kaminuriak caribou herd was based on visual sample counts along strip transects on the calving ground (Heard 1985). Between 1980 and 1982 there was a major increase in the estimated size of the herd (Heard and Calef 1986). One possible explanation for that increase was that there were errors in the estimated size of the herd based on results from visual surveys. Population estimates based on aerial photography eliminate observer bias and provide a more accurate indication of herd trend. Photographic surveys were conducted in 1983 and 1985. This report describes the results of the 1988 photographic survey of the Kaminuriak herd's calving ground.

METHODS

Reconnaissance flights on 5 June in a Cessna 185 and 7 June in a Cessna 337 were made over the traditional Kaminuriak calving ground (Figure 1). The area covered by those flights was arbitrary, but was based on the location of calving caribou in previous years. On 8 and 11 June, flights were conducted over 20 systematically spaced transects in a Cessna 185 over the entire calving distribution as determined by reconnaissance. Observers counted all caribou except neonates within a 400m strip on each side of the aircraft. Flights were made over transects at 120m above ground level at approximately 150-170 km/hr. End points were determined during the flights when cow densities declined to near zero.

Caribou densities determined from the transect strips were used to delineate areas (strata) of similar density. Between 15 and 17 June those strata were resurveyed using aerial photography. Two thousand two hundred and thirty-three photographs (black and white, 230cm x 230cm XX2405 film) were taken from 600m above ground level to provide an image scale of 1:4000. Photographs had 60% forward overlap. Caribou were counted on the photographic contact prints using a stereoscope.

On 15 and 16 June, the age, sex and reproductive condition of all caribou observed from a Bell Jet Ranger 206B helicopter were recorded as the helicopter flew along lines systematically spaced within each stratum. The helicopter was flown at about

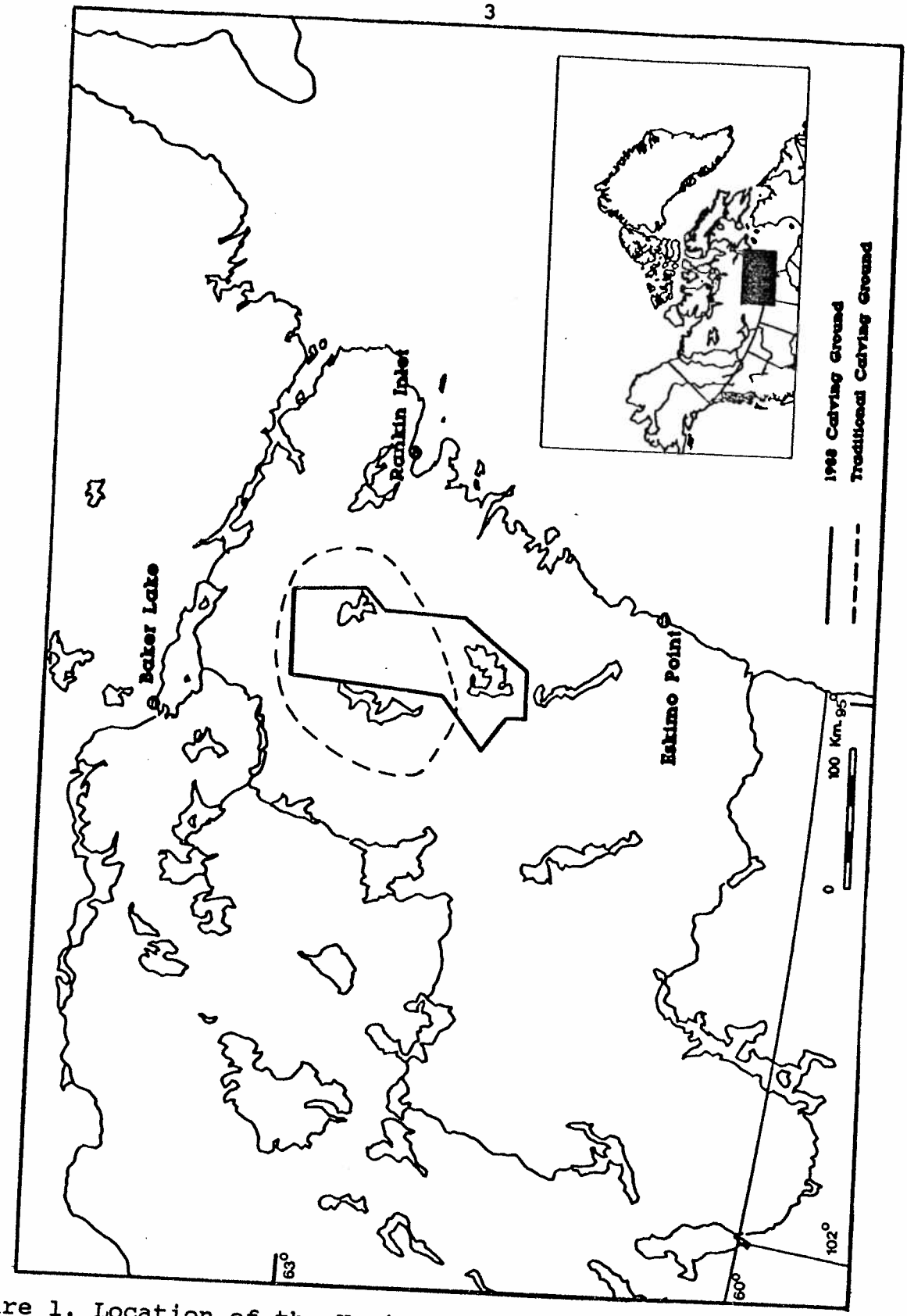

Figure 1. Location of the Kaminuriak calving ground in June 1988.

50 m above ground level and 100 km/hr although speed and height were variable.

Caribou were classified as neonates, yearlings, bulls (two year old and older males), and parturient and barren cows. Parturient cows were pregnant and post-partum females were identified by the presence of an udder or a calf at heel. Barren cows were two year old and older females with no calf or visible udder. The mean and variance of the proportion of parturient females on the calving ground was determined by the Jackknife method. The finite population correction factor used in that procedure was equal to the number of caribou classified divided by the stratum population estimate.

The proportion of parturient females was multiplied by the population estimate to obtain an estimate of the number of parturient females in each stratum. Total herd size was calculated by dividing the estimate of the number of parturient females by the sex ratio characteristic of most caribou herds (62% females) and by the proportion of females in a caribou herd that are usually pregnant (72%).

RESULTS

Most cows calved in the traditional calving ground location east of Kaminuriak Lake but the distribution extended further south than usual (Figure 1).

The number of one year old and older caribou on the calving ground was estimated at 56,000 ± 6,400 (SE) and 160,000 ± 20,800 based on the visual and photographic counts, respectively (Tables 1 and 2). The standard error of the estimate based on visual counts was probably underestimated because it was based on post-census stratification. Composition counts indicated that parturient females made up 64% of the caribou in the high density stratum and 41% of the animals in the low density stratum (Table 3). The number of parturient females on the calving ground was estimated to be 99,000 ± 29,200 (based on the photographic counts, Table 4) which extrapolates to a total herd size of 220,000 ± 72,000 (Appendix 4).

The estimate of the proportion of parturient females in the high density stratum was independent of sample size. The coefficient of variation of the Jackknife mean declined with each subsequent sample, but after 10 samples was still well above the target of 0.1 (Figure 2). In the low density stratum the mean varied with sample size and the coefficient of variation increased with sample size. More samples would have been desirable in both strata. The proportion of yearlings was much lower in the high density stratum than in the low density stratum at 28% and 42%, respectively (Table 3).

Table 1. The estimated number of caribou on the Kaminuriak herd's calving ground in June 1988 based on the visual transect strip survey.

Stratum	Number of caribou	Density (caribou/km^2)	Variance	SE	CV
High	47,017	9.18	38617622		.1322
Low	9,092	2.02	2263072		.1654
Total	56,109		40880694	6394	.1140

Table 2. The number of caribou estimated on the Kaminuriak caribou herd's calving ground in June 1988 based on an aerial photographic transect strip survey.

Stratum	Estimate	Density (caribou/km^2)	Variance	SE	CV
High	142,003	35.43	409970982		.1426
Low	18,182	4.74	24362509		.2715
Total	160,185		434333491	20,841	.1301

Table 3. Composition of one year old and older caribou classified on the Kaminuriak herd's calving ground in June 1988.

Classification	Number of caribou		
	High stratum	Low stratum	Total
Parturient cows	2925	489	3414
0 antlers	1225	174	1399
1 antler	273	64	337
2 antlers	1427	251	1678
Barren cows	291	169	460
0 antlers	234	167	401
1 antler	9	1	10
2 antlers	48	1	49
Yearlings	1266	501	1767
Bulls	38	21	59
Totals	4520	1180	5700
Proportion of parturient cows*	.6422	.4103	
SE	.1828	.1214	
CV	.2846	.2959	

* Jackknife technique (see Methods)

Table 4. The estimated number of parturient female caribou on the Kaminuriak herd's calving ground in June 1988 based on composition counts and the photographic transect strip estimates.

Stratum	Number of caribou		Parturient Females Proportion		Number	Variance*	SE
High	142,003	x	0.6422	=	91,194	842711270	
Low	18,182	x	0.4103	=	7,460	8974881	
Total					98,654	851686151	29,183

* Variance in each stratum is equal to the number of parturient females (the product) squared, times the sum of the squares, of the CV's, of the estimates that were multiplied together to get that product (Heard 1987) e.g., $91194^2 \times [(0.1426)^2 + (.2846)^2]$

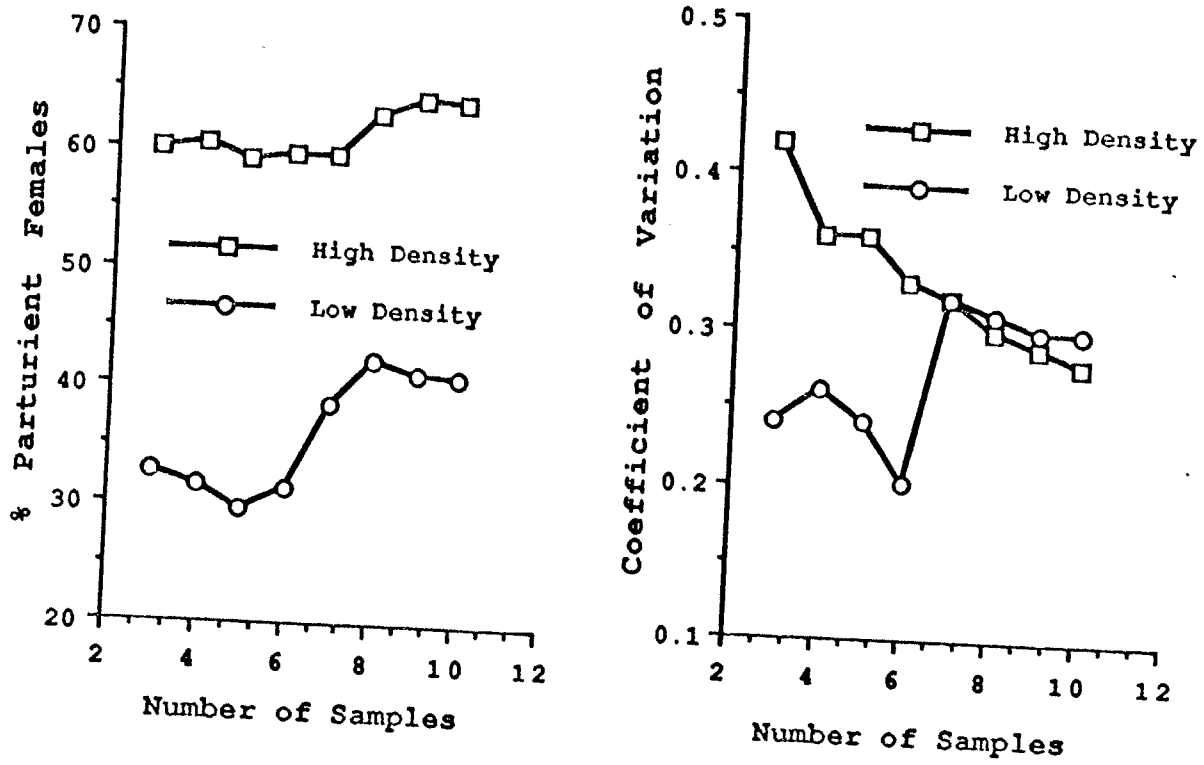

Figure 2. The effect of sample size on the estimate of the proportion of parturient females and its coefficient of variation on the Kaminuriak calving ground in 1988.

DISCUSSION

The number of parturient females on the Kaminuriak caribou herd's calving ground has been relatively stable since 1983 (Figures 3 and 4). In addition, the 1987 post-calving survey which estimated a minimum of 260,000 caribou (Russell pers comm.), provided independent support for our estimate of total population size (Figure 3).

Estimates from past photographic counts ranged between 1.6 and 2.5 times higher than those from visual counts (Heard 1985). The 1988 estimate based on aerial photography was 2.95 times higher than the 1988 estimate based on visual counts of the same area. This result further emphasizes the variability in caribou sightability on calving grounds. Calculations based on visual estimates have been presented to allow comparison with past reports but in future, we recommend only estimates from photographic data be used.

The sex ratio of the Kaminuriak herd in 1981 was distorted relative to most caribou herds because of an increase in calf survival after 1979 (Heard and Calef 1986). Previous estimates accounted for that distortion when calculating total population size (Appendix 4). The structure of the herd in 1988 was probably more similar to the average found in other caribou herds than to its 1981 structure because numbers have been relatively stable over the last 5 years. We assumed that the sex ratio in 1985 would have been intermediate between 1983 and 1988 values.

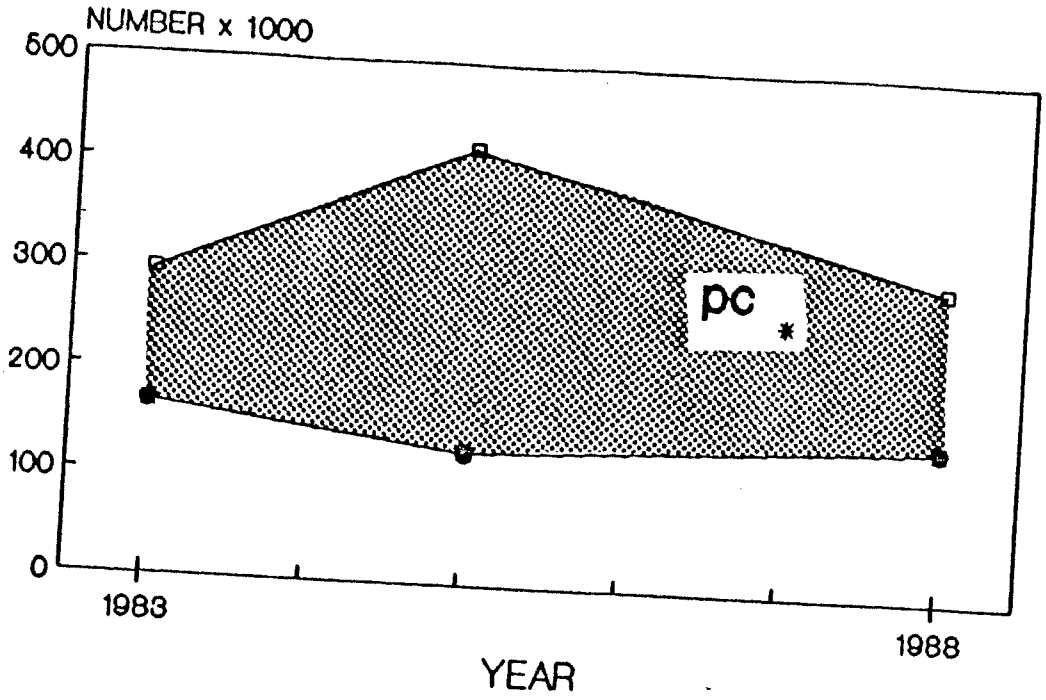

Figure 3. The trend in total population size of the Kaminuriak caribou herd between 1983 and 1988. (Band width represents the estimate based on aerial photographic counts plus and minus one standard error. PC indicates the 1987 estimate based on post-calving photography.)

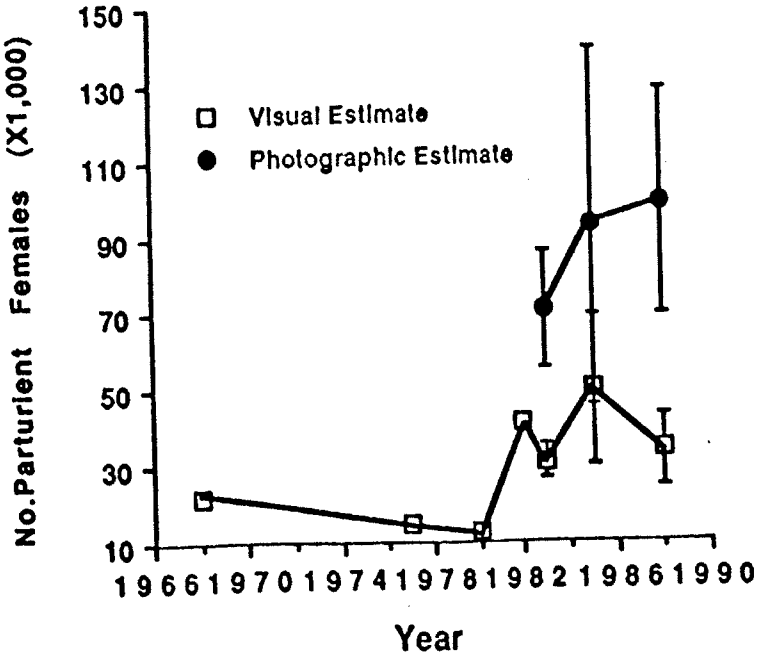

Figure 4. The trend in the number of parturient females on the Kaminuriak caribou herd's calving ground.

Assumptions about herd structure do not affect the interpretation of herd trend because trend is based on the number of parturient females, not on total population size.

ACKNOWLEDGEMENTS

Cam Elliott, Larry Gray and Robert Mulders carried out the field work, Mark Williams assisted with the analysis and Paul Roy counted the caribou on the aerial photographs. The Government of Manitoba provided the fixed wing aircraft and Polar Continental Shelf Project provided helicopter support.

LITERATURE CITED

Heard, D.C. 1985. Caribou census methods used in the Northwest Territories. McGill Subarctic Research Papers 40:229-238.

Heard, D.C. 1987. A simple formula for calculating the variance of products and dividends. NWT Department of Renewable Resources, Manuscript Report 6pp.

Heard, D.C., and G.W. Calef. 1986. Population dynamics of the Kaminuriak caribou herd, 1968 - 1985. Rangifer, Special Issue No. 1: 159 - 166.

Appendix 1. Personnel and itinerary as recorded by Cam Elliott.

Personnel

Cam Elliott, Larry Gray and Robert Mulders

Itinerary

June 4
Arrived in Rankin Inlet 1600h. Conducted a survey briefing that evening.

June 5
Departed Rankin Inlet 0900 and headed out for the calving ground delineation flights. During the day the aircraft developed mechanical problems. We were forced to land on the Kazan River 60 km southeast of Baker Lake around 1100h. We radioed in and a helicopter picked us up. We eventually got back to Baker Lake around 2400h.

June 6
Stayed in Baker Lake and waited for the part to arrive for the plane.

June 7
Delineated the western and southern boundaries of the calving grounds in the morning. The northern boundary was near Parker and MacQuoid lakes, southern at Kaminak Lake, and western at Kaminuriak Lake, the eastern boundary was about 60km from the west. Down at Rankin 1000h

June 8
Stratification of the northern half of the calving ground

June 9
The weather on the coast today was good. Departed Rankin Inlet in the morning for the southern half of the calving ground. About 1km from the eastern edge, fog obscured the area. There was less than 200 feet of airspace. We returned to Rankin Inlet. The pilot reports indicate fog bank remaining the area from Ferguson Lake to Happotiyik Lake which will cover most of the survey area. Another weather day.

June 10
The weather was out during the morning. By the afternoon there were blizzard conditions. No flights today, weather day.

June 11
Weather is good. Overcast and broken cloud conditions at approx.

3000ft. Completed stratification of the southern end. Flights through the northern end but no movement observed.

June 12
Allocation of effort for the photo transects was done. Completed the maps for the photo plane. Checked fuel caches for JP4 with Cessna.

June 13
Today we departed Rankin for Churchill.

Appendix 2. Caribou counted on each photographic transect of the Kaminuriak herd's calving ground in June 1988.

Transect No.	Area (km^2)	Caribou Counted
High stratum		
1	14.49	104
2	31.05	2207
3	53.36	2154
4	59.57	3400
5	75.67	2607
6	86.48	3730
7	77.74	2496
8	64.40	2808
9	53.13	205
10	41.86	50
Totals	557.75	19761
Low stratum		
1	46.69	453
2	48.30	215
3	48.30	164
4	49.91	168
5	47.38	140
Totals	240.58	1140

Appendix 3. Composition of one year old and older caribou by transect on the Kaminuriak herd's calving ground in June 1988.

	Transect no.	Number of parturient cows	Number of other caribou
High stratum	1	234	245
	2	1078	487
	3	217	355
	4	226	104
	5	86	142
	6	125	41
	7	76	64
	8	559	74
	9	316	55
	10	8	28
Total		2925	1595
Low stratum	11	79	143
	12	68	112
	13	9	78
	14	5	33
	15	31	102
	16	43	51
	17	132	57
	18	106	53
	19	12	48
	20	4	14
Total		489	691

Appendix 4. The extrapolation of the 1983-1988 calving ground survey data to total population size.

Survey data	Estimate	SE	CV
1983 visual survey			
Number of caribou on the calving ground	41,648	3,612	.0867
Number of parturient females on the calving ground	30,912	4,402	.1424
Sightability correction factor	1.25		.1[a]
Proportion of females in the entire herd	.54		.1[a]
Proportion of 1.5 year old and older females pregnant	.57		.1[a]
Total population[b]	125,536	28,149	.2242
1983 photographic survey			
Number of caribou on the calving ground	98,296	17,232	.1753
Number of parturient females on the calving ground	70,773	15,269	.2157
Proportion of females in the entire herd	.54		.1[a]
Proportion of 1.5 year old and older females pregnant	.57		.1[a]
Total population[b]	229,932	59,306	.2579

Appendix 4. (continued)

1985 visual survey			
Number of caribou on the calving ground	75,655	5,673	.0750
Number of parturient females on the calving ground	49,937	19,905	.3986
Sightability correction factor	1.25		.1[a]
Proportion of females in the entire herd	.56		.1[a]
Proportion of 1.5 year old and older females pregnant	.61		.1[a]
Total population[b]	182,732	79,416	.4346
1985 photographic survey			
Number of caribou on the calving ground	141,733	17,421	.1229
Number of parturient females on the calving ground	92,926	46,758	.5032
Proportion of females in the entire herd	.56		.1[a]
Proportion of 1.5 year old and older females pregnant	.61		.1[a]
Total population[b]	272,032[c]	142,199	.5227

Appendix 4. (continued)

1988 visual survey			
Number of caribou on the calving ground (Table 1)	56,109	6,394	.1140
Number of parturient females on the calving ground (Appendix 5)	33,924	9,559	.2818
Sightability correction factor	1.25		.1[a]
Proportion of females in the entire herd	.62		.1[a]
Proportion of 1.5 year old and older females pregnant	.72		.1[a]
Total population[b]	94,993	31,421	.3308
1988 photographic survey			
Number of caribou on the calving ground (Table 2)	160,185	20,841	.1301
Number of parturient females on the calving ground (Table 4)	98,654	29,184	.2958
Proportion of females in the entire herd	.62		.1[a]
Proportion of 1.5 year old and older females pregnant	.72		.1[a]
Total population[b]	220,999	72,459	.3279

[a] no data; value only a guess

[b] - total population = number of parturient females / proportion of females in the population / proportion of females pregnant x (for visual surveys only) a sightability correction factor of 1.25, eg., 30,912 / .54 / .57 x 1.25 = 125,536
- for SE calculations see Table 4 and Heard (1987)
- CV = SE / total population eg., 28,149 / 125,536 = .2242

[c] previously calculated as 320,000 assuming the same herd composition values as in 1983, see text for rationale for change

Appendix 5. The estimated number of parturient female caribou on the Kaminuriak herd's calving ground in June 1988 based on composition counts and the visual transect strip estimates.

Stratum	Number of caribou		Parturient Proportion		Females Number	Variance*	SE
High	47,017	x	0.6422	=	30,194	89776544	
Low	9,092	x	0.4103	=	3,730	1596778	
Total					33,924	91373322	9,559