KAMINURIAK CARIBOU HERD

CALVING GROUND SURVEY, 1976

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N.W.T. WILDLIFE SERVICE

1981

File Report No. 16

This report has been submitted for publication in the Arctic Island Pipeline Project (AIPP) report series. The AIPP report format has been used rather than that of the N.W.T. Wildlife Service.

ABSTRACT

The calving grounds of the Kaminuriak caribou herd were located and surveyed 30 May to 4 June 1976, using 20% coverage aerial transects. The 1976 calving area was nearly identical to that of other years, although the majority of the herd wintered on the tundra north of Baker Lake in 1976. Caribou density on the calving grounds averaged 2.0 adult caribou/km^2. The population was estimated at 43,800 animals ± 34.0% with 95% confidence. To increase precision of population estimates from caribou surveys in the future, the allocation of transects in study areas should be stratified according to density.

ACKNOWLEDGEMENTS

Financial support for this study was provided by the Environmental-Social Program (Arctic Islands Pipeline Project), Department of Indian Affairs and Northern Development, Ottawa.

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1. INTRODUCTION

The Kaminuriak herd of barren-ground caribou (Rangifer tarandus groenlandicus) ranges over more than 250,000 km^2 of country in southeastern Keewatin, Saskatchewan, and Manitoba, and returns each spring to a calving ground near Kaminuriak Lake (Fig. 1). These caribou provide meat and skins for hunters from the communities of Baker Lake, Chesterfield Inlet, Whale Cove, Eskimo Point and Lac Brochet, who kill approximately 4,000 animals each year (Appendix A). One of the proposed Polar Gas pipeline routes passes near to the calving grounds, and cuts through the traditional spring migration routes (Fig. 1).

Much is known about this herd and its ranges from the detailed studies carried out by the Canadian Wildlife Service from 1966 to 1968 (Parker 1972, Miller 1974, Dauphine 1976, Miller 1976). However, recent reports of new and unusual movements, as well as suspicions of overharvest, suggested that additional studies of the Kaminuriak herd were required to update our knowledge before any assessment could be made of potential impact by proposed pipelines. During late May and early June 1976, a survey was carried out to locate the calving ground of this herd and to restimate numbers of caribou present.

2. METHODS

From 30 May to 4 June, survey flights were flown to determine the boundaries of caribou distribution. A series of 39 east-west transect lines was then established over the area of caribou distribution (Fig. 2). These lines were flown at an altitude of 120 m agl. (above ground level) at approximately 190 km/hr in a Cessna 185 aircraft. Two observers in the back seats of the aircraft each observed a strip 0.4 km wide on either side of the aircraft. The transects were spaced at 4 km intervals, so 20% coverage of the area was achieved.

When either observer saw caribou, he counted or estimated the number, and classified them as bulls (by the presence of antlers), unknowns, or cows and calves. All unidentified adult animals in groups containing calves were classified as cows. This information was recorded on tape so that the observers did not have to look away from the transect strip. The location of each sighting was plotted on 1:250,000 scale maps by the navigator in the front seat, who ensured that the aircraft remained on transect.

The entire survey required 49 hours of flying including 26 hours on transect. Details of the flights are provided in Appendix B.

3. RESULTS

3.1 Distribution

The 1976 calving grounds of the Kaminuriak caribou herd lay roughly between 62°25' and 63°55' north latitude, and 93°30' and 95°00' west longitude, occupying approximately 9,600 km^2 (Fig. 1).

The density averaged 2.0 caribou/km^2 (excluding calves, Table 1). The animals were distributed quite evenly over the calving grounds with the exception of two areas. Between transects 5 and 10, density was much higher, averaging 7.2 caribou/km^2. Group size on the calving grounds averaged 4.9 (3,781/770). Only four mature bulls were identified on the calving grounds, and there was no evidence from flights that mature bulls were near the periphery of the calving grounds.

3.2 Population Estimate

A total of 3,781 caribou (excluding bulls and calves) was observed on the calving grounds (Table 1). The number of caribou estimated on the entire calving grounds (19,226) was derived by multiplying the average density (2.0) by the area of the calving grounds (9,613 km^2).

To calculate the total number of caribou in the population, the age structure and sex ratio of the animals on the calving grounds must be known, so that the estimate of numbers can be corrected for missing age and sex classes. Unfortunately, we did not have a helicopter available to do segregation counts of the caribou on the calving grounds. Therefore, we must assume that age and sex ratios of caribou on the Kaminuriak calving grounds in 1976 would be similar to those in this herd during previous years. Parker (1972) found that 80% of the caribou 1 year of age and older on the calving grounds of the Kaminuriak herd were adult breeding females. Similar findings have been made for other herds. If this figure is applied to our estimate of total numbers on the calving ground, we arrive at an estimate of 15,380 (19,226 x 0.8) breeding cows on the calving grounds. According to Parker (1972), breeding females comprised 43% of the total spring population. If a similar proportion of breeding females occurred in the herd during 1976, then the total population would be calculated at 35,767 (15,380/0.43). If we assume that we failed to observe 20% of the animals in the survey area as did Parker (1972) and Thomas (1969), then the final estimate is 43,814 (35,051 x 1.25).

To place a confidence interval on this estimate we can estimate caribou density for each of the 39 transects (Table 2) and calculate the standard error of these estimates. Since the transects are of different lengths, the density restimates are weighted according to transect length. Two different approaches have been used for calculating standard errors from surveys involving transects of unequal lengths:

(1) $$S.E.\ (\hat{Y}) = \sqrt{(1 - f)} \times \sqrt{\frac{\sum(y_i^2/L_i) - (\sum y_i)^2/\sum L_i}{(N - 1) \sum L_i}}$$

Where:

y_i = number of caribou observed on transect i

L_i = area covered by transect i

N = number of transects

f = sampling frequency

(2) $$S.E.\ (\hat{Y}) = \sqrt{\frac{1 - f}{(n)(\bar{x})}} \times \sqrt{\frac{\sum y - 2\hat{R} \sum(yx) + \hat{R}^2 (\sum x)^2}{n - 1}}$$

Where:

f = sampling fraction

n = number of transects

$\bar{x}$ = average transect area

y_i = number of caribou observed on transect i

x_i = area of transect i

$$\hat{R} = \frac{\sum y_i}{\sum x_i}$$

Equation (1) assumes that variance is inversely proportional to transect length (M. Kingsley, pers. comm.). Equation (2) (Cochrane 1977) assumes that variance is constant for all transects. The 95% confidence interval for our population

estimate applying Equation (1) is ±34.04%. The 95% confidence interval applying Equation (2) is ±29.40%.

3.3 Productivity Estimate

It was not possible to count the calves present in most of the groups of caribou observed during the survey. Therefore, no estimate is available for initial productivity of the Kaminuriak herd in 1976. The observers in the aircraft agreed, however, that 75% - 90% of the cows appeared to be accompanied by calves.

4. DISCUSSION

The Kaminuriak caribou occupied calving grounds in 1976 which were in large part identical to the areas used from 1966 to 1968 and from 1971 to 1974. The 1976 calving area extended slightly further west than in most other years. The fidelity to traditional calving grounds, although expected of a caribou herd, is interesting in light of the unusual winter distribution of the Kaminuriak herd during the winters of 1974-75 and 1975-76. Normally the majority of the Kaminuriak caribou winter in the forests of Manitoba and Saskatchewan. However, during the last 2 years few have wintered there (R. Robertson, pers. comm. to B. Hubert). In 1975-76 the majority of the caribou wintered on the tundra north and northeast of Baker Lake and approached the calving grounds from the north rather than from the southwest as they have been observed to do in the past (B. Wooley, pers. comm.; Fig. 1).

The precision of the 1976 survey was greater than that of previous surveys (Table 2). The increase in precision is probably attributable to the use of transects in this survey rather than random blocks. As Cook and Jacobson (1976) state, "the high variance of a block sampling design appears to require prohibitive sampling intensities for a statistically reliable estimate."

Results of the 1976 survey were less variable than in previous surveys, possibly because the 1976 survey was conducted during the peak of the calving period, before the formation of large post-calving aggregations. Some of the previous surveys probably extended into the post-calving period, when variation in density among areas would increase.

In previous Kaminuriak surveys a potential source of error was the presence of many groups too large to count accurately. For example, in the 1971 survey, only 11% of the total survey count was based on exact counts; the remaining 89% was estimated. The problem of estimating large groups posed no problem during the 1976 survey, where only 8% (292/3,781) of the total animals were estimated and the largest group was estimated at only 50.

Despite improvements in the 1976 survey, the 95% confidence interval of 34% of the mean is still unacceptable for management purposes. Clearly, further improvements are required. Stratifying the allocation of transects according to density would undoubtedly improve the precision of the estimate. For example, if more intense sampling had been allocated to the areas between transects 5 and 10, and transects 34 and 38, the precision would have been increased.

Table 1. Numbers of caribou observed per transect on the Kaminuriak calving grounds, June 1976.

Transect number	Transect area (km^2)	Cows & unidentified adults	Cows & unidentified adults/km^2
1	9.0	20	2.2
2	29.4	27	0.9
3	28.2	30	1.1
4	30.7	60	1.9
5	30.7	137	4.5
6	30.7	320	10.4
7	32.0	286	8.9
8	32.0	434	13.6
9	41.0	188	4.6
10	46.0	160	3.5
11	51.2	51	1.0
12	51.2	32	0.6
13	58.9	49	0.8
14	62.7	29	0.5
15	51.2	47	0.9
16	60.2	79	1.3
17	57.6	54	0.9
18	66.6	47	0.7
19	67.8	21	0.3
20	66.6	31	0.5
21	64.0	71	1.1
22	44.8	49	1.1
23	47.4	48	1.0
24	44.8	48	1.1
25	43.5	50	1.2
26	43.5	156	3.6
27	66.6	107	1.6
28	56.3	81	1.4
29	61.4	55	0.9
30	62.7	33	0.5
31	61.4	49	0.8
32	62.7	82	1.3
33	48.6	38	0.8
34	57.6	159	2.8
35	55.0	108	2.0
36	49.9	194	3.9
37	53.8	167	3.1
38	60.2	133	2.2
39	34.6	51	1.5
	1,922.5	3,781	2.0

Table 2. Summary of Kaminuriak calving ground population estimates for the period 1968 - 1976[1].

	1968	1971	1972	1973	1974	1976
Number of 16-square mile blocks on calving ground	168	49	124	72	147	Transects used
Sample size	28	7	18	20	30	20% coverage
Average caribou/block[2]	185.1	392.1	108.3	137.7	190.9	81.9[3]
Standard deviation	175	817	169	118	313	6.10
Estimated calving ground population size (Y)	31,098	19,215	13,495	9,915	28,072	23,610[4]
Half width of a 95 percent confidence interval on Y as a percent of Y	33%	178%	71%	66%	53%	34%[5]

[1]Calculations for years 1976-1974 from Cook & Jacobson (1976)

[2]Calculated by multiplying caribou density by 16 (the area of previously used sampling blocks)

[3]Calculation: $\frac{2.0 \text{ caribou}}{\text{km}^2}$ (1976 survey) x 2.56 $\frac{\text{km}^2}{\text{mi}^2}$ x 16 $\frac{\text{mi}^2}{\text{block}}$

[4]Population estimate for 1976 includes 20% correction factor used in previous surveys.

[5]Calculated according to Equation 1 (Pg. 4)

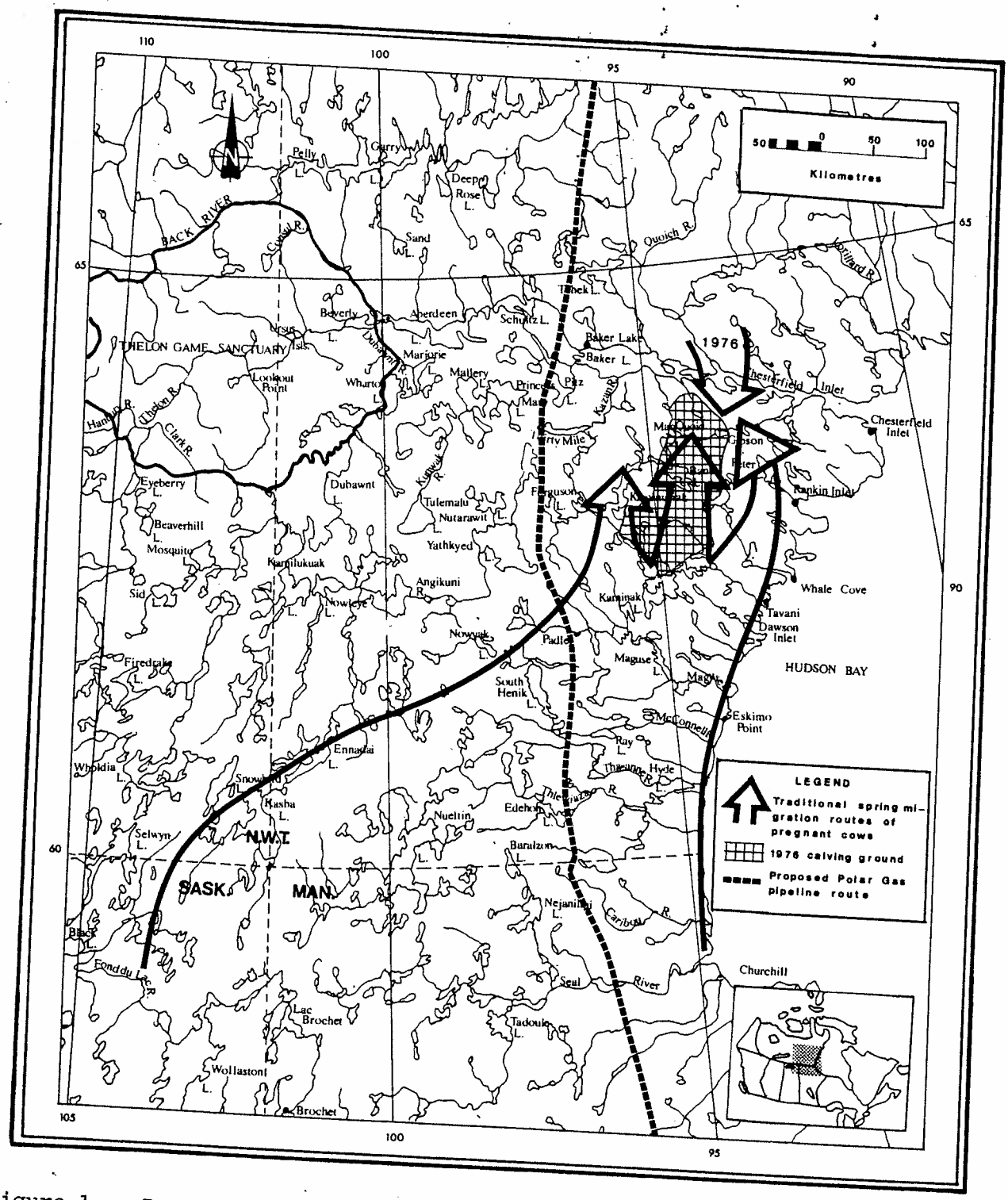

Figure 1. Range of the Kaminuriak caribou herd, showing 1976 calving grounds.

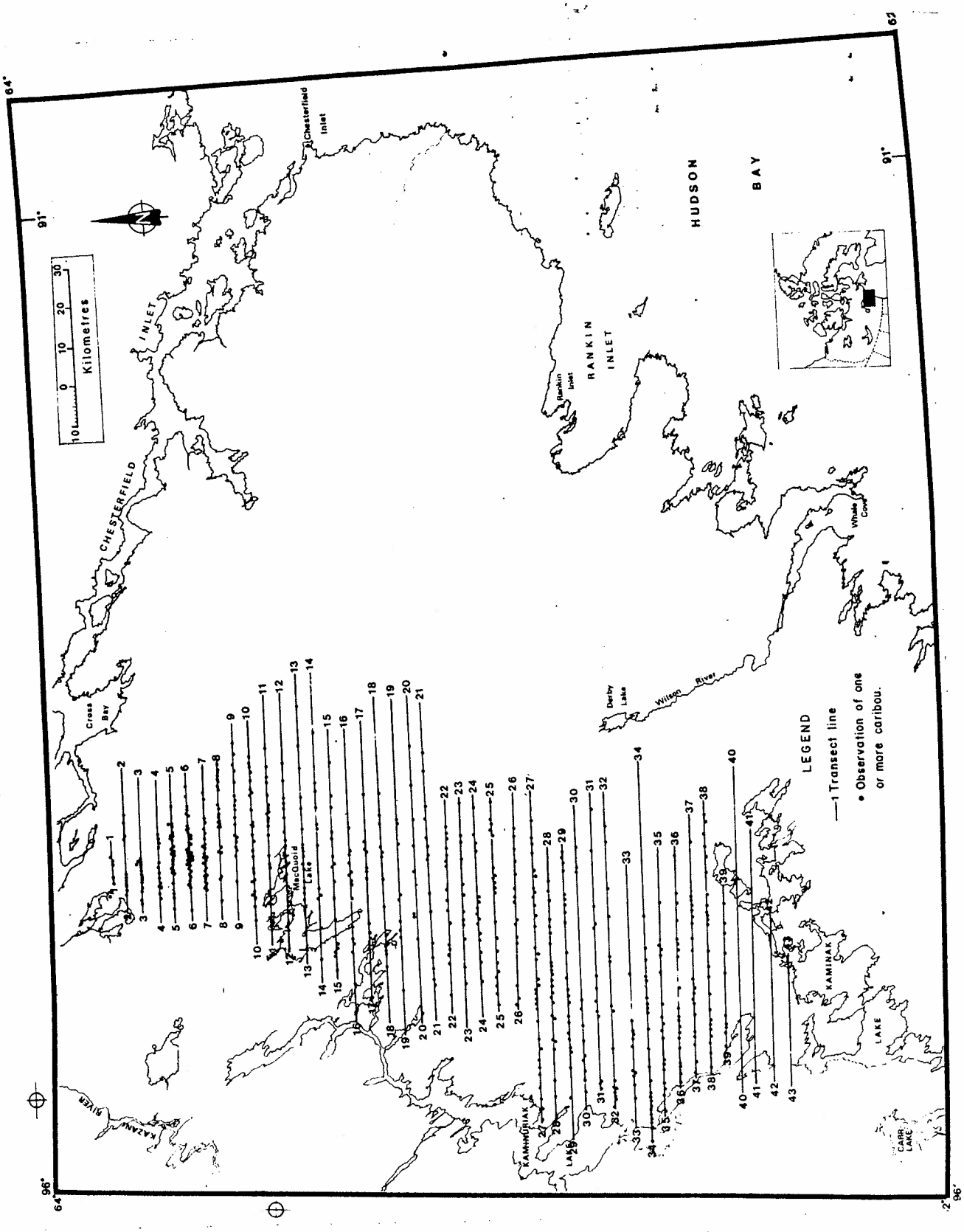

Figure 2. The study area of the 1976 calving ground survey, showing flight transects and caribou observations.

5. PERSONAL COMMUNICATIONS

Hubert, B. Norcor Engineering Ltd., Yellowknife. (Formerly, Supervisor of Wildlife Management, N.W.T. Wildlife Service, Yellowknife.)

Kingsley, M. Canadian Wildlife Service, Edmonton.

Robertson, R. Manitoba Department of Renewable Resources, Winnipeg.

Wooley, B. Wildlife Officer, N.W.T. Wildlife Service, Inuvik, N.W.T.

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APPENDIX A. Number of caribou reported killed by general hunting licence holders on five communities in southeastern Keewatin between 1963 and 1976.

Year	Community					
	Baker Lake	Chester-Field Inlet	Rankin Inlet	Whale Cove	Eskimo Point	Total
1963/64	2,351	100	1,123	-	1,385	4,959
1964/65	2,325	213	399	299	1,554	4,773
1965/66	1,452	301	450	333	1,367	3,903
1966/67	2,149	197	427	452	1,670	4,895
1967/68	826	107	118	161	1,203	2,415
1968/69	1,009	58	300	198	1,096	2,661
1969/70	2,030	216	474	459	982	4,161
1970/71	1,763	118	443	423	1,185	3,932
1971/72	1,586	84	539	248	1,265	3,722
1972/73	2,378	391	1,178	274	1,573	5,594
1973/74	2,000	251	804	228	1,649	4,932
1974/75	1,346	192	493	321	1,749	4,101
1975/76	483	340	188	178	2,297	3,486

Average Kill: 4,118 (53,538/13)

APPENDIX B. Summary of flight information for 1976 Kaminuriak calving ground survey.

Date	No. of hours flown (hr:min)	Speed of flight (km/hr)	Altitude (agl) (m)	Ground temp.	Ceiling (Cloud cover) (m)	Visibility (km)	Wind Direction (degrees)	Wind Speed (knots)	Snow Cover ground	Transects flown
May 30	3:20	220	180	-5°C	Cavu	-	120	9	8/10	Reconnaissance
31	4:25	220	180	0°	460	32	90	7	8/10	Reconnaissance
June 1	4:10	220	180	1°	250-2500 broken	2	130	6	-	Reconnaissance
2	5:35	220	180	-1°C	90-250 solid	32	120	12	-	Reconnaissance
3	No flying - rain, fog and wind									
4	6:00	220	120	-3°C	420 broken	32	310	13	1/10	Reconnaissance
5	5:45	180-220	120	+3°C	460 solid	16	330	8	-	1-7
6	5:20	180-220	120	-2°	900 broken	48	240	15	0/10-5/10	8-16
7	2:15	180-220	120	0°	750	12	340	13	-	17 only
8	6:10	180-220	120	0°	850 solid	32	330	15	1/10	18-29
9	6:05	180-220	120	-1°	1100 solid	32	010	06	0	30-39