DISTRIBUTION AND ABUNDANCE OF MUSKOXEN AND PEARY CARIBOU ON SOUTHERN ELLESMERE ISLAND, NWT, JULY 1989

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ABSTRACT

An aerial survey of southern Ellesmere Island conducted in July 1989 provided an estimate of 2020 ± 285 S.E. muskoxen (*Ovibos moschatus*) and 89 ± 31 Peary caribou (*Rangifer tarandus pearii*) . Muskox calf production was good with 17.3% calves in the population; however, first year survival appears to have been low with only 7.3% yearlings in the population. Caribou calves made up 22.2% (10/45) of the caribou observations; however, no yearlings were found. The muskox population is up 56% from that reported in 1973 while the caribou population is down about 33% from 1973. A muskox quota increase and restrictions on caribou harvesting are recommended for the study area.

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INTRODUCTION

In 1987 the Grise Fiord Hunters' and Trappers' Association (HTA) expressed concern over the status of Peary caribou (*Rangifer tarandus pearii*) and muskox (*Ovibos moschatus*) on southern Ellesmere Island. The caribou were becoming increasingly difficult to locate while the muskox population appeared to be increasing. In response to these concerns an aerial survey for muskoxen and caribou was conducted between 17 and 23 July 1989. The objective of the survey was to determine how low the Peary caribou population had become and whether or not the muskox population had increased enough to permit an increase in the quota for muskoxen in the area.

STUDY AREA

The study area was broken down into five areas or strata. These included Svendsen Peninsula, Bjorne Peninsula, the area between Vendom Fiord and Makinson Inlet, southwestern Ellesmere Island west of Sydkap Icecap and the area of Ellesmere Island south of Baumann Fiord (Figure 1). The icecaps were not included in the study area.

The division of the study area into five strata was made based on geographical features and not on expected muskoxen or caribou densities. The division was made to ensure that there was adequate coverage of the various parts of the Island. The division also allows for population calculations for the various hunting areas and comparisons between areas on the Island.

Stratum I, Southern Ellesmere Island, has steep sided fiords along the southern coast. There are several small icecaps as well as the large Sydkap Icecap in the central area. A number of well-vegetated slopes and valleys are located east of Grise Fiord and on Makinson Inlet. The major vegetated area is in the Sor and Stenkul fiord areas where a wide coastal plain and several rivers provide the low relief necessary for plant growth.

Stratum II, the Svendsen Peninsula, is characterized by north-south mountain ridges separated in the south by a wide valley. The eastern coast along Vendom Fiord is gently sloped with numerous small creeks draining into Vendom Fiord. The lower portion of the east slope is well vegetated. The central valley at the south end

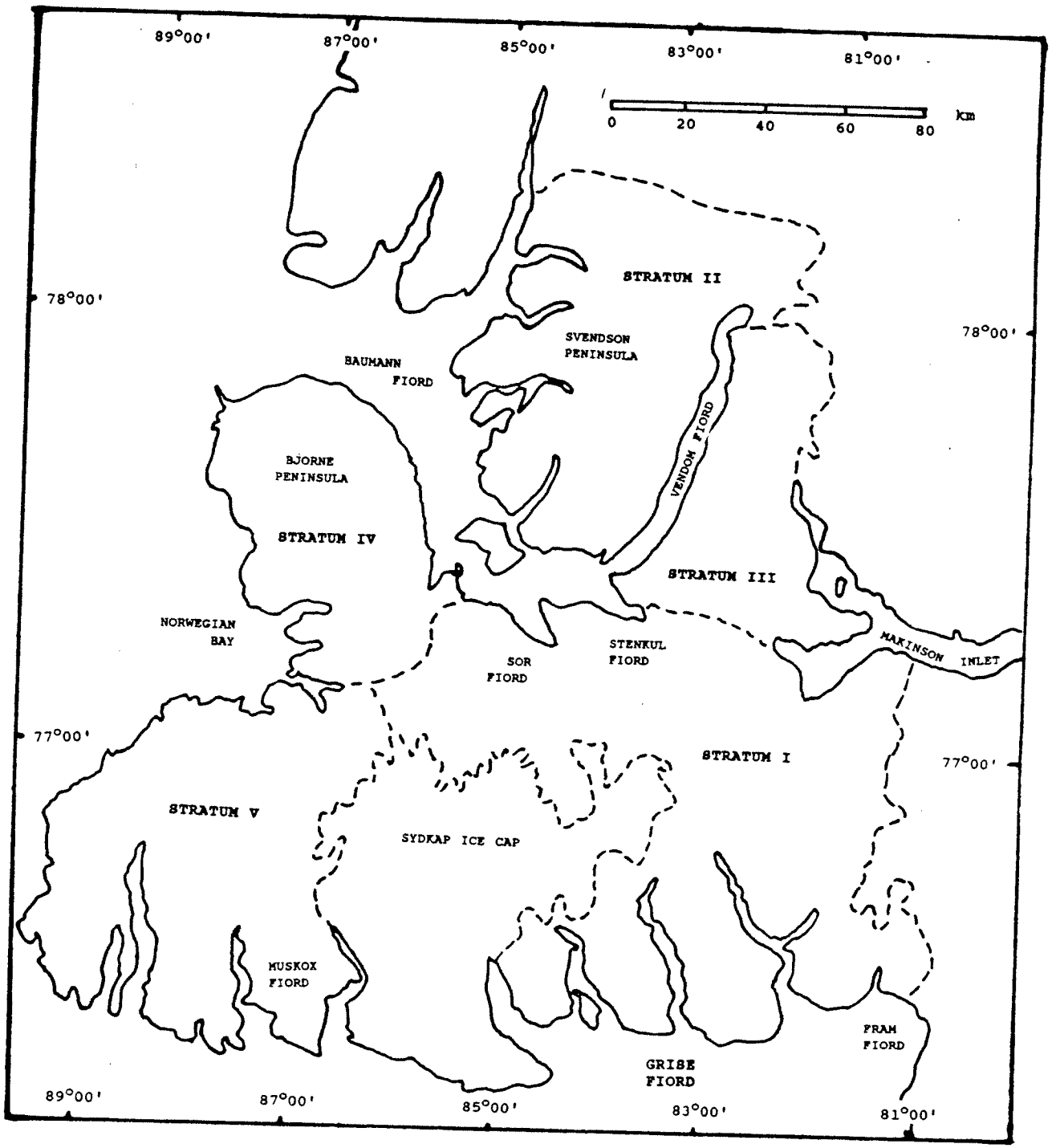

Figure 1. Southern Ellesmere Island study area and strata, July 1989.

is also well-vegetated. The remainder of Svendsen Peninsula is mostly mountainous with steep unvegetated slopes.

Stratum III, the area between Vendom Fiord and Makinson Inlet, is also very mountainous; however, there is a wide, well-vegetated coastal plain along Vendom Fiord. There are also several well-vegetated river valleys and deltas along the Makinson Inlet coast.

Stratum IV, Bjorne Peninsula, is much flatter than the remainder of the study area. A wide coastal plain extends almost all around the Peninsula. Low rolling hills are found in the central area. The extreme south of the peninsula is more mountainous with elevations up to 1800 ft. above sea level. There is also a high ridge at the extreme north end with elevations up to 2200 ft. asl (Ammonite Mountain).

Stratum V, Southwestern Ellesmere Island, has steep-sided fiords along the southern coast with a few steep-sided river valleys. The north coast, however, is a wide, well-vegetated coastal plain with numerous creeks flowing northward into Norwegian Bay.

METHODS

The survey was conducted using a Bell 206B helicopter based out of Grise Fiord. The crew consisted of the pilot, an observer/navigator in the front left seat and an observer in the right rear seat.

Two survey techniques were used in this survey. On Bjorne Peninsula an unstratified transect survey was conducted. The methodology for this portion of the survey was adapted from Miller (1987). Transect lines were laid out perpendicular to the longest axis of the peninsula. The first transect was selected at random with the remaining transects placed 6.4 km apart.

The transects were surveyed at an elevation of 90m above ground level at approximately 90km/hr. Muskoxen or caribou observed within 860m of the helicopter were classified as being on transect. The transect boundaries were determined using an inclinometer. The 860m boundary corresponded to 6 degrees from the horizontal.

The remaining four areas were surveyed using an unstratified block survey technique adapted from that developed for moose by Gasaway et al. (1986). The four areas were broken down into quadrates approximately 100 km^2 based on UTM lines on a 1:250,000 scale topographic map sheet. These quadrates were numbered sequentially. Random numbers were then obtained from a random number table to select the quadrates to be surveyed. As the UTM lines did not permit accurate navigation, geographic features along

the edge of the quadrate were used to draw the blocks. This resulted in some variation in the shape and size of the blocks.

The blocks were intensively searched to ensure that 100% of the muskoxen and caribou in the blocks were counted. Some areas within the blocks were not searched. These included cliff-sided river gorges, small icecaps, nearly vertical mountain slopes and coastlines and snow covered mountain tops. It was assumed that these areas harboured no muskoxen or caribou. Ferry flights which crossed some of these areas supported this assumption.

All muskoxen and caribou observed in or out of blocks or on or off transect were classified into one of four categories: Male 2+, Female 2+, Yearling, and Calf. Yearlings were identified by their short horns projecting straight out from the side of the head (Olesen and Thing 1989). It was not possible to classify muskox yearlings as to sex from the helicopter. Two year old bulls could not be reliably differentiated from cows, so some two year old bulls, especially those in mixed groups, may have been included in the cow 2+ classification. Groups were small and scattered which excluded a large ground-based sample.

RESULTS

The survey was completed in seven consecutive days from 17 to 23 July 1989. The weather during this period was excellent with the exception of 18 July when afternoon fog prevented flying. There was also occasional low cloud over the higher elevation blocks, but the survey design allowed us to search the blocks under the cloud base.

A total of 839 muskoxen and 45 Peary caribou was observed during the survey. Of the animals seen, 567 muskoxen and 25 Peary caribou were within the survey units (Appendix A). These observations resulted in estimates of 2020 $\pm$ 285 S.E. muskoxen and 89 $\pm$ 31 S.E. Peary caribou in the study area (Tables 1 and 2). The overall density of muskoxen in the study area was .081 muskox/km^2, while the overall density for caribou was only .0036 caribou/km^2.

Muskoxen were concentrated along the wide coastal plains along Baumann and Vendom fiords (Figure 2). There were also concentrations along the coastal plain of Norwegian Bay, around Fram Fiord and at the north end of Makinson Fiord. Muskoxen were also found on nearly every vegetated river valley and delta and on Hoved Island. Caribou were scattered across the study area with no apparent concentrations.

The sex ratio of muskoxen varied among strata with the lowest sex ratio (37 Males 2+:100 Females 2+) being found in the southwest Ellesmere and Bjorne Peninsula strata. The highest sex ratio was found on Svendsen Peninsula (83 Males 2+: 100 Females 2+). Over

Table 1. Muskox population estimate by stratum, southern Ellesmere Island, NWT, July 1989.

Stratum	Estimate	Density	Variance	S.E.	C.V.
I S.Ellesmere	550	.063	18814	137	.249
II Svendsen P.	350	.066	8104	90	.257
III E. Vendom	280	.108	16612	129	.458
IV Bjorne P.	410	.121	9655	98	.241
V S.W.Ellesmere	430	.087	27966	167	.384
Totals	2020		81151	285	.140

Degrees of freedom = 62
90% Confidence Interval: 1546 to 2494

Table 2. Caribou population estimate by stratum, southern Ellesmere Island, NWT, July 1989.

Stratum	Estimate	Density	Variance	S.E.	C.V.
I S.Ellesmere	20	.002	151	12	.609
II Svendsen P.	31	.006	534	23	.735
III E. Vendom	6	.002	26	5	.813
IV Bjorne P.	8	.002	50	7	.880
V S.W.Ellesmere	24	.005	194	14	.568
Totals	89		955	31	.342

Degrees of freedom = 34
90% Confidence Interval: 37 to 141

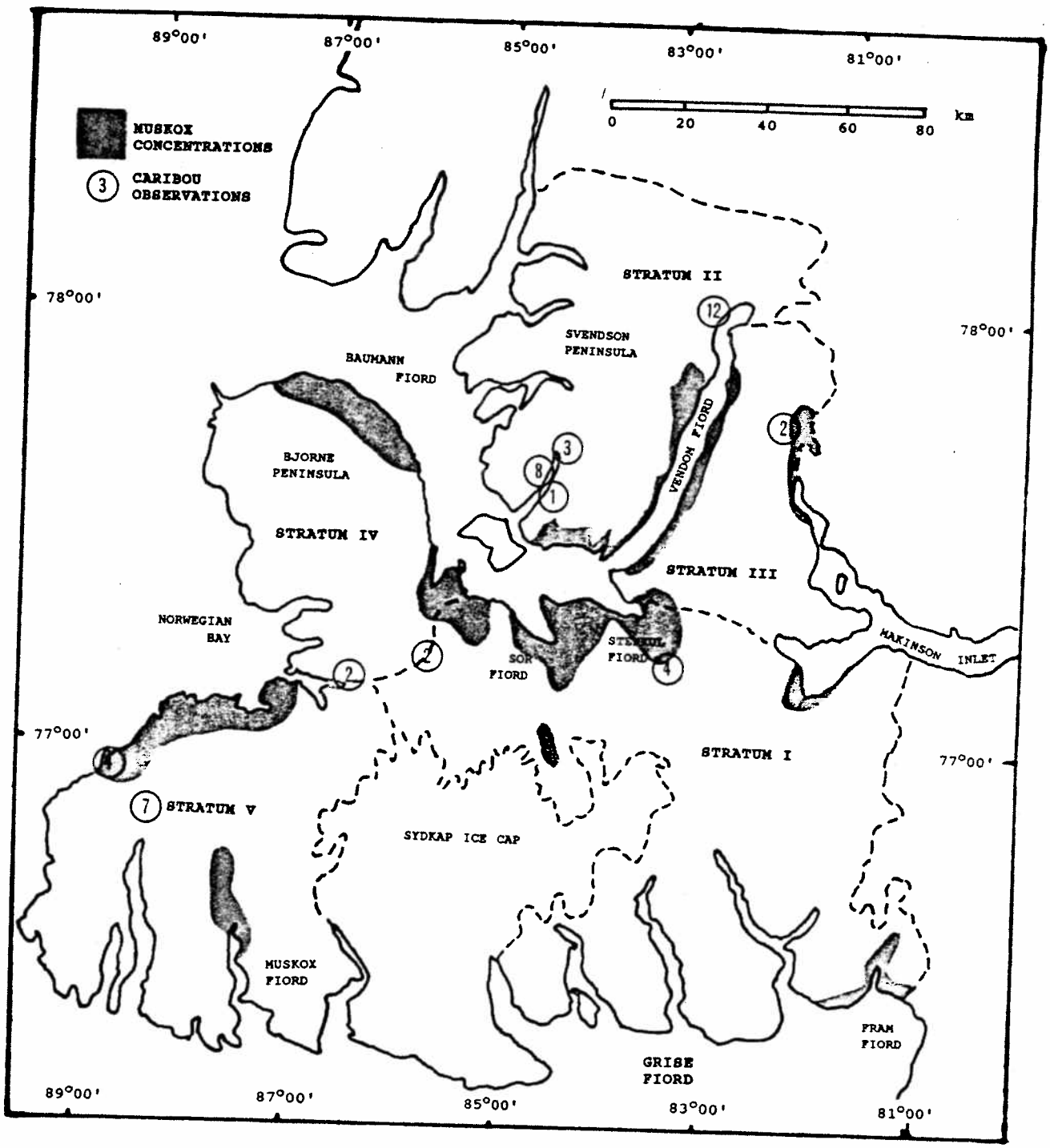

Figure 2. Distribution of muskoxen and Peary caribou on southern Ellesmere Island, NWT, July 1989.

the entire study area the sex ratio was (53 Males 2+: 100 Females 2+) (Table 3).

Calves:100 females 2+ ratios ranged from 30 calves:100 females 2+ on the Bjorne Peninsula to 54 calves:100 females 2+ on southwestern Ellesmere. The ratio for the entire study area was 35 calves:100 females 2+ (Table 4). The proportion of calves in the population was 17.3%.

Svendsen Peninsula had the lowest ratio of yearlings:100 females with 9 yearlings:100 females 2+. The highest ratio was in the east Vendom Fiord area with 32 yearlings:100 females 2+. The ratio for the entire study area was 15 yearlings:100 females 2+ (Table 5). The proportion of yearlings in the population was 7.3%.

Based on the limited sample of only 45 animals, the sex ratio for Peary caribou in the study area was calculated to be 75 males 2+:100 females 2+. No yearlings were observed. There were 50 calves: 100 females 2+ and 22% of the caribou seen were calves (10 of 45).

Groups of muskoxen were generally small and scattered. The largest group comprised only 18 animals including calves. A total of 49 single animals was found. Several (13) of these were lone cows and one was a lone yearling. The mean herd size was fairly consistent among strata and was not related to density. The mean group size, including single animals, for the study area was 3.95 $\pm$ 2.80 S.D. (Table 6).

Table 3. Muskox sex ratios by stratum, southern Ellesmere Island, NWT, July 1989. (Males 2+:100 Females 2+)

Stratum	Inside Block/Transect	Outside Block/Transect	Stratum Total
I S. Ellesmere	51:100	44:100	48:100
II Svendsen P.	83:100	81:100	83:100
III E. Vendom	89:100	56:100	76:100
IV Bjorne P.	39:100	30:100	37:100
V SW. Ellesmere	29:100	140:100	37:100
Total area	53:100	54:100	53:100

Table 4. Muskox calf to females ratios by stratum, southern Ellesmere Island, NWT, July 1989. (Calves:100 Females 2+)

Stratum	Inside Block/Transect	Outside Block/Transect	Stratum Total
I S. Ellesmere	31:100	33:100	32:100
II Svendsen P.	46:100	36:100	42:100
III E. Vendom	19:100	26:100	22:100
IV Bjorne P.	27:100	35:100	30:100
V SW. Ellesmere	55:100	40:100	54:100
Total area	36:100	33:100	35:100

Table 5. Muskox yearling to females ratios by stratum, southern Ellesmere Island, NWT, July 1989. (Yearlings:100 Females 2+)

Stratum	Inside Block/Transect	Outside Block/Transect	Stratum Total
I S. Ellesmere	17:100	8:100	13:100
II Svendsen P.	11:100	5:100	9:100
III E. Vendom	39:100	22:100	32:100
IV Bjorne P.	14:100	5:100	12:100
V SW. Ellesmere	13:100	n/a	12:100
Total area	18:100	9:100	15:100

Table 6. Muskox group size characteristics by stratum, southern Ellesmere Island, NWT, July 1989.

Stratum	Number of Herds	Single Animals	Mean Herd Size ± S.D.	Range
I S. Ellesmere	74	14	4.07 ± 2.60	1 - 13
II Svendsen P.	38	12	3.84 ± 2.93	1 - 14
III E. Vendom	35	3	4.17 ± 2.91	1 - 16
IV Bjorne P.	36	9	3.86 ± 2.62	1 - 10
V SW. Ellesmere	35	11	3.82 ± 3.26	1 - 18
Total area	218	49	3.95 ± 2.80	1 - 18

DISCUSSION

The combination of survey techniques used during this survey proved effective. By using blocks in the mountainous regions it was possible to search the areas even with cloud cover. It also allowed for a saving of flying time because areas such as steep talus slopes, cliffs and steep river gorges did not need to be searched. The technique also avoided the problem of determining which muskoxen and/or caribou were inside or outside the blocks; a significant problem with transects in mountainous terrain. All the navigator needed was to know the exact location on the 1:250,000 scale map sheet.

In July 1973 there were an estimated 1060 muskoxen in the area encompassed by our strata I, II, III and IV (Riewe 1973). This estimate was based on the number of muskoxen observed during reconnaissance flights. The population estimate of 1590 $\pm$ 230 S.E. in July 1989 is an increase of 56% over the past 16 years or an average of 3.5% per year. This is a relatively slow increase compared to the average of 16% per year observed on Banks Island between 1973 and 1985 (McLean et al. 1986), the 21% per year observed in the Queen Maud Gulf area between 1975 and 1985 (Gunn and Case 1984), and the 21% per year observed on Bathurst Island between 1974 and 1985 (Miller 1987).

The overall density figure of .081 muskox/km^2 on southern Ellesmere Island is also relatively low. However, comparison of the muskox density on Ellesmere Island is confounded by the

distribution of muskox habitat. If density figures could be calculated based on the amount of muskox habitat available, or even based on vegetated areas, the muskox density figure would be much more comparable to areas elsewhere in the Northwest Territories.

The proportion of calves on southern Ellesmere Island (17.3%) is comparable to other muskox populations in the Northwest Territories. McLean et al. (1986) found 16.8% calves on Banks Island in July 1985, while Miller (1987) found 18.1% calves on Bathurst Island in July 1985. On Nunivak Island, calf production averaged 19% over 20 years (Spencer and Lensink 1970).

Unfortunately, the proportions of yearlings have not been consistently recorded. The proportion for Ellesmere Island (7.3%) does, however, seem to be low when compared to Banks Island (12% in April 1985, McLean et al. 1986) and central Keewatin (17.9% in November 1985, Case and Graf 1986 and 11.7% in July 1986, Graf et al. 1989). High first year calf mortality would help explain the slow average annual rate of increase observed for this population.

Groups of muskoxen were generally small and widely scattered. Many of the groups consisted of only cows and calves. The small and consistent group size suggests that the level of wolf predation is low as larger groups would be necessary to provide effective defence from wolves.

Numbers of Peary caribou on southern Ellesmere Island are extremely low, even for the arctic islands. The density of Peary caribou on Bathurst Island was .031 caribou/km^2 in 1985 (Miller 1987), about ten times that observed on Ellesmere Island (.0036

caribou/km^2).

The reasons for the low numbers of Peary caribou are not immediately evident. In July 1973 Riewe (1973) estimated that there were only 150 caribou in the study area. During the winter of 1973-74 there was a drastic die-off of Peary caribou on the western Queen Elizabeth Islands (Miller et al. 1977). It is quite possible that this die-off extended to southern Ellesmere Island and the numbers of caribou were pushed to an even lower level.

The people of Grise Fiord have also been harvesting caribou in the area. Although no detailed records are available for the period 1972 to 1989, it is likely that the average annual harvest has been about 10 caribou.

It is also possible that the low density itself is hampering the productivity of the population. Two of the ten calves observed appeared to be very small and were likely born late in the spring. This may have resulted from the females not being bred on their first oestrus as there were no males in the area.

Although the sample size is limited, the proportion of caribou calves (22.0%) is encouraging. Riewe (1973) found only 5.5% calves in July 1973. The proportion of calves also compares favourably with Bathurst Island in 1985 where Miller (1987) found 22.1% calves.

RECOMMENDATIONS

1. A ten year moratorium on the harvest of Peary caribou on southern Ellesmere Island should seriously be considered.

2. Consideration should be given to increasing the muskox quotas on southern Ellesmere Island to replace Peary caribou as a protein source for local people.

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APPENDIX A: Muskoxen observations by stratum and block.
STRATUM I - SOUTH ELLESMERE ISLAND

Stratum Area = 8770 km^2
Maximum number of blocks (N) = 77

Block #	Area (Km^2)	Males 2+	Females 2+	Ylgs	Calves	Total
91	149	1	3	0	1	5
80	84.8	0	1	0	1	2
63	108	0	0	0	0	0
54	117	0	0	0	0	0
67	101	0	0	0	0	0
73	122	0	0	0	0	0
5	133	4	7	2	2	15
13	124	9	4	0	2	15
4	111	8	13	2	4	27
1	101	0	10	1	4	24
10	101	1	2	2	0	5
19	111	2	10	1	2	15
40	83.3	0	0	0	0	0
41	92.3	0	0	0	0	0
28	112	0	0	0	0	0
17	112	0	0	0	0	0
16	125	4	13	2	7	26
37	101	2	18	4	3	27
24	117	1	1	0	0	2
32	161	1	0	0	0	1
45	135	0	0	0	0	0
52	99.2	0	0	0	0	0
23	109	0	0	0	0	0
TOTALS	2609.6	33	82	14	26	164

STRATUM II - SVENDSEN PENINSULA

Stratum Area = 5290 km^2
Maximum number of blocks (N) = 51

Block #	Area (Km^2)	Males 2+	Females 2+	Ylgs	Calves	Total
52	119	4	7	2	4	17
49	114	1	2	1	0	5
51	125	8	4	0	0	12
48	88.6	1	0	0	0	1
39	110	11	7	0	5	23
47	95.8	0	0	0	0	0
5	64.7	0	0	0	0	0
9	90.2	2	7	0	4	13
10	102	0	0	0	0	0
19	129	0	0	0	0	0
37	90.2	2	3	1	0	6
36	127	2	6	0	4	12
35	100	0	0	0	0	0
TOTALS	1355.5	31	36	4	17	89

STRATUM III - EAST VENDOM FIORD

Stratum Area = 2610 km^2
Maximum number of blocks (N) = 25

Block #	Area (Km^2)	Males 2+	Females 2+	Ylgs	Calves	Total
21	118	7	1	1	0	9
15	94.1	2	3	0	0	7
4	98.1	5	1	1	1	8
8	105	14	24	10	6	54
18	121	0	2	0	0	2
24	91	0	0	0	0	0
25	100	0	0	0	0	0
11	98	2	5	2	0	9
TOTALS	825.2	30	36	14	7	89

STRATUM IV - BJORNE PENINSULA

Stratum Area = 3360 km^2
Maximum number of transects (N) = 52

Transect#	Area (Km2)	Males 2+	Females 2+	Ylgs	Calves	Total
1	24.8	0	0	0	0	0
2	48	1	3	1	0	5
3	76.0	3	13	2	2	20
4	66.0	3	9	2	3	17
5	52.8	0	0	0	0	0
6	79.9	2	5	1	1	9
7	82.1	0	0	0	0	0
8	76.0	0	0	0	0	0
9	72	0	6	1	2	9
10	72.8	1	0	0	0	1
11	72.8	1	4	0	2	7
12	65.6	6	11	1	5	23
13	46.0	5	5	0	0	10
TOTALS	834.8	22	56	8	15	101

STRATUM V - SOUTHWEST ELLESMERE ISLAND

Stratum Area = 5020 km^2
Maximum number of blocks (N) = 49

Block #	Area (Km^2)	Males 2+	Females 2+	Ylgs	Calves	Total
45	89.4	1	0	0	0	1
30	89.2	0	0	0	0	0
43	108	1	12	2	6	21
42	92	4	5	0	2	11
21	90.5	0	0	0	0	0
14	96.2	0	0	0	0	0
5	122	7	31	3	16	57
10	124	4	8	1	5	18
19	104	0	3	1	1	5
24	135	0	0	0	0	0
32	90	1	5	1	4	11
39	76	0	0	0	0	0
56	115	0	0	0	0	0
57	98.6	0	0	0	0	0
TOTALS	1429.9	18	64	8	34	124