AN AERIAL SURVEY OF MUSKOXEN NORTH OF GREAT BEAR LAKE, AUGUST, 1987

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ABSTRACT

An aerial strip transect survey of the area north of Great Bear Lake to the Arctic coast and between the Anderson and Hornaday rivers was conducted between 26 August and 3 September 1987. The survey documented numbers and distribution of muskoxen (Ovibos moschatus). The total number of muskoxen observed on transect was 316 non-calves plus 35 calves. The resulting estimate was 3040 ± 1296 (SE of estimate) non-calf muskoxen. An additional 176 non-calves plus 9 calves were observed off transect. The overall calf percentage of 9% is low. Mean group size, excluding calves was 20.7 ± 16.5 (SD) and 22.0 ± 16.0 (SD) including calves. The population estimate should be interpreted cautiously as it has a very large SE. The low densities and clumped distribution of muskoxen in this area make it a difficult population to survey. Future surveys should concentrate on smaller areas where hunting or other management concerns are a priority. Age and sex classification in the survey area would assist in the interpretation of population estimates. No changes are proposed to existing management zones.

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INTRODUCTION

Muskoxen (Ovibos moschatus) were extirpated at the beginning of this century from large areas of the mainland west of Dolphin and Union Strait (Hone 1934). Since 1917, when muskox hunting was prohibited, the number of muskoxen in this area has slowly recovered probably from a remnant population in the Coppermine - Dismal Lakes area (Hone 1934). Estimates of muskoxen increased from 525 animals in 1955, 625 in 1966, to an estimated 2022 animals in 1974 (Kelsall et al. 1971, Hawley et al. 1976) . Carruthers and Jakimchuk (1981), incorporating the results of Spencer (1980), estimated the population north of Great Bear Lake to be 6728 $\pm$ 2400 (95% C.I.) in March 1980. A survey in March 1983 from a large area north of Great Bear Lake to the coast and between Coppermine and approximately the Anderson River on the west estimated there to be 3315 $\pm$ 1262 (95% C.I.) muskoxen (Case and Poole 1985).

In 1987 funds were made available under the Northern Oil and Gas Action Program (NOGAP) of Indian and Northern Affairs Canada (INAC) to conduct a survey for muskoxen of the areas north of Great Bear Lake to the coast between the Anderson River and the Hornaday River on the east (Figure 1). The survey was designed to update our population and distribution information. These data are essential for assessing the status of the muskox population, and permit us to respond to requests for changes in quotas and to comment on potentially conflicting land uses. Results from a 1987 muskox survey of the Rae-Richardson area near Coppermine will be reported elsewhere (Gunn pers. comm.).

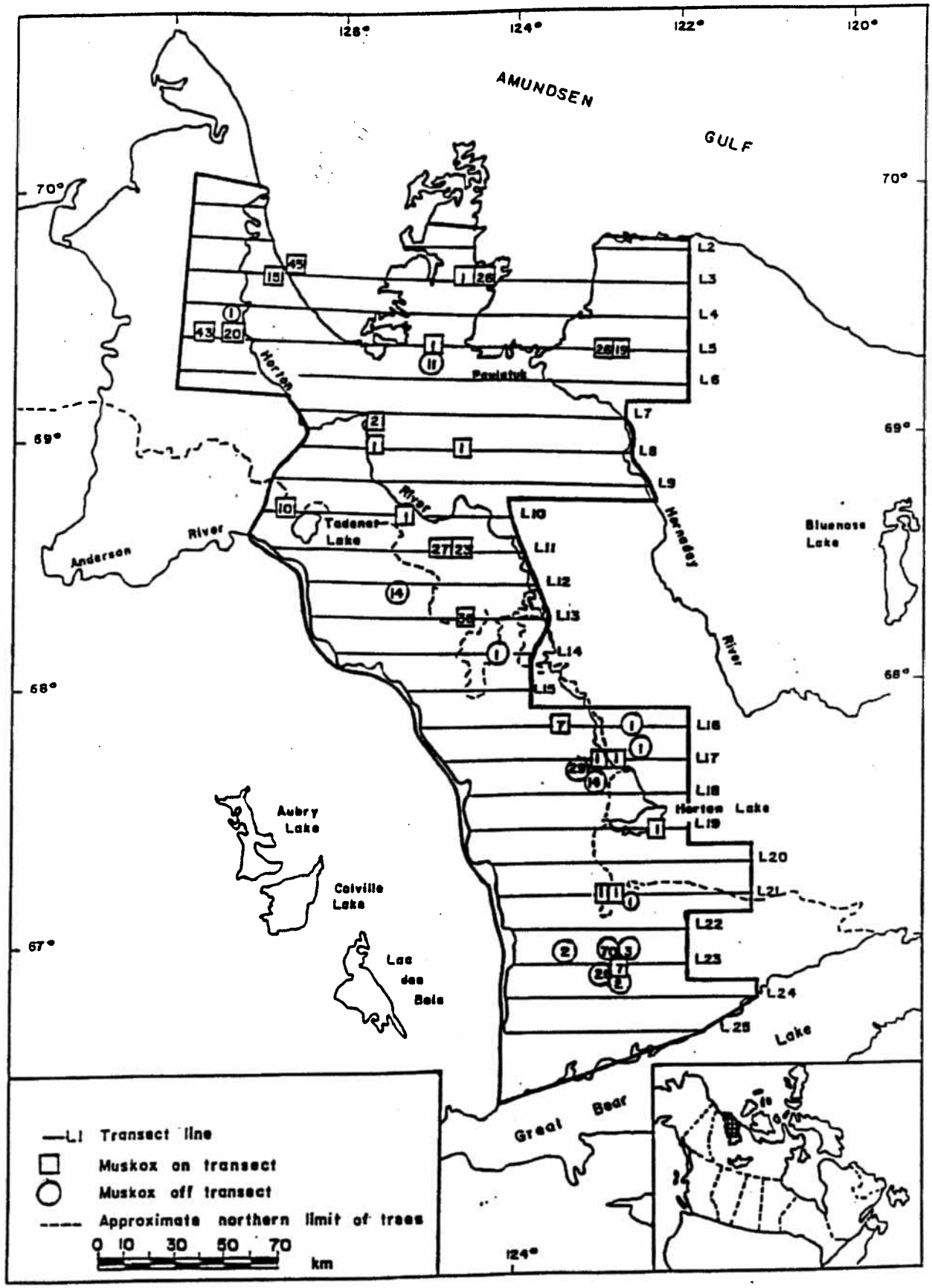

Figure 1. Transect lines and number of muskoxen observed during north Great Bear muskox survey August 1987.

STUDY AREA

The area covered by this survey encompasses 42,300 sq. km. and is bounded by Amundsen Gulf in the north, Anderson River in the west, and Great Bear Lake in the south. The eastern boundary incorporates portions of the Brock and Hornaday rivers in the north, and Horton River in the lower half of the study area (Figure 1).

Four broad wildlife zones or ecoregions in the area include Sparsely Vegetated Tundra, Lush Vegetation Tundra, Forest-Tundra Transition, and Open Forest (Jacobsen 1979). The region is characterized by rolling hills with numerous lakes and ponds (Jacobsen 1979). Prominent uplands include the Melville Hills in the northeast (elevation 900m asl) and Big Spruce Hills in the south (elevation 700m asl). Approximately 60% of the study area occurs north of the tree line and consists of tundra and barrenlands.

METHODS

A Helio Courier aircraft was used with a survey crew consisting of the pilot, front seat recorder, and two observers in the rear. In the southern half of the survey the right rear observer recorded as we were short one person for the front seat. Survey altitude was 200 m above ground level (agl) and flying speed was maintained at 160 kph. The survey transect width was 0.75 km on each side of the aircraft, for a total of 1.5 km. Markers for the outside boundary of the transect were set up on the aircraft as outlined in Norton-Griffiths (1978) and checked against a known distance marked out on the Paulatuk runway. Twenty-five transects, space 15 km apart (10% coverage) and running in an east to west direction were drawn on 1:250,000 scale map sheets of the area. The direction of the survey lines was chosen to minimize ferry time. I had originally planned to stratify and resurvey areas which the initial transects suggested were of higher density. The pilot navigated and plotted locations of muskoxen on the map sheets. Photographs were taken of groups of muskoxen for comparison with visual counts. Other wildlife species observed during the survey were also recorded.

Transect data were tabulated and the population estimate, variance, and coefficient of variance (C.V.) calculated using a modification of Jolly's (1969) program. Survey areas were calculated using a polar planimeter.

RESULTS

Bad weather caused numerous delays. The survey was completed over a 10 day period (5 actual days of flying). A total of approximately 40 hours was spent surveying (Appendix A). Twenty-three groups and 15 single animals were counted for a total of 492 non-calf muskoxen: 316 on transect and 176 off transect. This gave an estimate for the survey area of 3040 ± 1296 (S.E. of estimate) non-calf muskoxen (Table 1). In other words if the survey were repeated 95% of the estimates would fall between 500 and 5580. The size of the groups ranged from 2-70 animals with a mean group size of 20.7 ± 16.5 (S.E.) (Table 2). The sum of visual counts was 8 animals greater than the photographic counts, a difference of 2.2% (Appendix B).

The percentage of calves observed was low with 10% of the population observed on transect being calves and 8.2% being calves when including the off-transect observations. Classification of the age and sex of the herds was not possible so calf:cow ratios can not be calculated. This information can help interpret the status of a population.

The patchiness of the muskox distribution and the delays with weather made it impossible to stratify and resurvey. The resulting estimate should be interpreted cautiously because of the large S.E. of the estimate 3040 ± 1296, a C.V. of 0.42.

Table 1. Analysis of data from the strip transect survey of muskoxen north of Great Bear Lake, August 1987

Area	Density (muskox/km^2)	Population estimate (± S.E.)	Coefficient of variation	Coverage[a] (%)
Total	.07	3040 ± 1296[b]	.42	10 %

[a] Proportion of survey area sampled.

[b] DF = 23 (after Cochran 1977:96)

Table 2. Muskox herd size data for north of Great Bear Lake, 1953 - 1987.

Year	Month	Mean Group Size+	S.E.[a]	Range	No. of Singles	N[a]	Source
1953	Feb.	28.7	14.7	2-63	0	3	Kelsall
1955	Mar.	10.5	3.2	1-25	1	6	et al. (1971)
1958	Mar.	17.0	5.0	4-32	0	5	"
1967	Mar.	21.0	11.7	6-73	0	5	"
1967	Apr.	14.0	4.6	2-50	0	9	"
1966	Mar.	19.8	4.3	1-35	1	5	Carruthers and
1974	Mar.	20.4	3.4	2-90	0	51	Jakimchuk (1981)
1980	Mar.	16.3	1.5	1-75	9	91	"
1983	Mar.	21.06	16.99	1-100	4	143	Case and Poole (1985)
1987	Aug.	20.7	16.5	2-70	15	23	This study

[a] Excluding Singles

DISCUSSION

Survey Conditions and Design

This survey was planned for July or August on the assumption that muskoxen would be in smaller groups versus the winter and consequently would have a less clumped distribution. Case and Poole (1985) reported difficulty delineating high density areas because of the highly clumped, irregular distribution they found in March 1983. Unfortunately the 1987 survey suffered from the same problem. It was not feasible because of the cost and the weather delays to delineate higher density areas and resurvey them. Stratification has the effect of reducing the variance of the estimate. Without any stratification the resulting standard error (S.E.) and coefficient of variation (C.V.) are very large. In other aerial surveys in the NWT a C.V. of .10 is considered desirable, whereas a C.V. greater than .20 would be considered poor (Heard 1985). The C.V. in this survey was .42, clearly in the undesirable range.

On the days actually spent surveying, visibility was good and muskoxen were visible from farther away than the strip width. All visual surveys suffer from visibility bias (Caughley 1974). The observer bias can vary among observers and under different survey conditions or habitat. It is likely that muskoxen located within the treed areas were more difficult to detect although our strip width was only 750m on either side of the aircraft. We were not aware of a difference in animals detected. Observer bias generally

results in an underestimate of numbers (Caughley 1974). Muskoxen would be easier to see against a snowy background in the treed areas.

The delays because of weather increased the number of days required for the survey. It is unlikely that there was any movement of muskoxen among areas which would have resulted in animals being missed or counted twice. Muskoxen rarely move more than a few kilometers per day (Gunn 1982)

Aerial surveys for muskoxen using blocks as sample units have been attempted in the Queen Maud Gulf area (Gunn and Case 1984) and in the Rae-Richardson area in 1987 (Gunn pers. comm.). This method requires relatively uniform densities (usually high density), topographic features which allow the boundaries of the blocks to be precisely located, and relatively small survey areas. A block survey would be difficult to conduct in the north Great Bear Lake area.

Population Characteristics and Distribution

The population estimate is difficult to compare with the previous estimate of 3315 $\pm$ 1262 (S.E.) which included the Rae - Richardson rivers area (Case and Poole 1985). Both surveys have extremely large S.E.'s, and the 1983 survey covered a larger area. There did not appear to be any pattern which suggested a higher density area in the 1987 survey. Large groups, although few in number, were found on all parts of the survey area. I do not feel

that there is adequate data from this survey to speculate about changes in distribution since previous surveys. There have been reports of sightings of muskoxen farther west (near Colville Lake) in the last few years.

Aerial surveys generally underestimate the number of muskox calves as they can be difficult to see if the animals bunch up (McLean et al. 1986). The observed 8-10% calves suggests low calf survivorship or reduced pregnancy rates. The muskox population would be growing slowly at best with such low calf numbers. Detailed age and sex information is not available for this area, but numbers of calves in the Rae and Richardson rivers area were also low in 1987 (Gunn pers. comm.). The mainland muskox populations may not have increased at as high a rate as some of the Arctic Island populations like those on Banks Island or Victoria Island.

Management Considerations

Since 1985 the quotas assigned to C/1-1, C/1-2, and C/1-3 have been 50, 50, and 10 muskoxen respectively (Figure 2). In C/1-1 the quota is divided as 30 males and 20 females. The other two zones have no sex distinction made on the quota. Current harvest levels in C/1-1 are well below the quota and less than 5 muskoxen were shot in 1987 - 1988 (Green pers. comm.). The entire quota was not utilized in C/1-3 either. In both zones the majority of animals taken were shot by guided non-residents. Based on the present

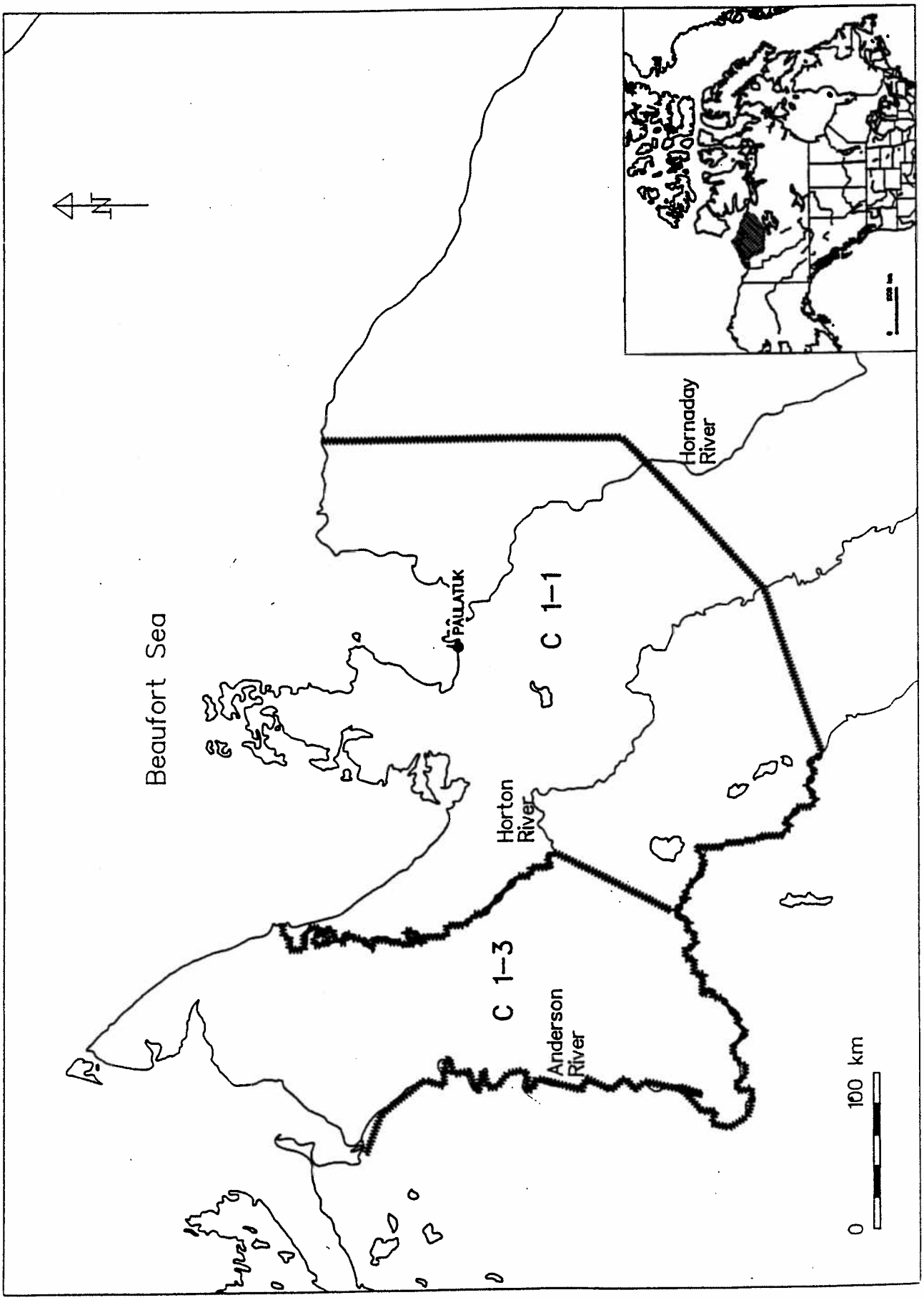

Figure 2. Muskox management zones north of Great Bear Lake, NWT.

survey no changes are recommended to the quotas or boundaries of C/1-1 or C/1-3.

Conclusions

The clumped but sparse distribution of muskoxen north of Great Bear Lake makes it a difficult population to survey. It is not possible to determine the trend of the muskox population from the results of this survey. Future efforts should concentrate on areas of greatest interest or potential for consumptive and non-consumptive use, areas with land use concerns or a representative area to monitor population trends. It is not feasible or worthwhile to survey the entire area north of Great Bear Lake in the future. Future surveys should be conducted in the winter to maximize observability of muskoxen.

RECOMMENDATIONS

1) Conduct an aerial strip transect survey of areas of management or land use interest in March 1990 or 1991. These areas would be used to monitor the trend of population growth in the future.

2) Conduct age and sex classification counts in the survey areas during the same time period as the population survey. It may be possible to do this from the ground by snow machine in certain areas, but could be done more effectively using a helicopter.

3) Monitor the reproductive and physical condition of muskoxen killed by hunters where opportunity allows.

4) Monitor seasonal movement patterns of muskoxen by maintaining a file of all sightings recorded during other work or by other individuals.

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PERSONAL COMMUNICATIONS

Green, P. Hunters and Trappers Committee, Paulatuk, NWT

Gunn, A. Regional Biologist, Renewable Resources, GNWT, Coppermine, NWT.

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Appendix A. North Great Bear Lake muskox survey schedule, August - September 1987.

Date	Location	Weather		Hours Flown
24 Aug	Paulatuk	Out	Ferry	3.5 hours
25 Aug	Paulatuk	Low ceiling/fog	In Paulatuk	
26 Aug	Paulatuk	800-1000 ft. vis. 15 miles (p.m.)		2.1 hours
27 Aug	Smoking Hills	Out - a.m. Clearing - p.m.		7.7 hours
28 Aug	Paulatuk	High winds, low ceiling rain and snow		0.0 hours
29 Aug	Paulatuk	vis. 1-3 miles in light rain; 300-500 ft ceiling		0.0 hours
30 Aug	Paulatuk	Snow squalls, vis. less than 1 mi. in squalls, strong winds, temp. 1-2 C		0.0 hours
31 Aug	Paulatuk	Strong winds WSW. gusting up to 35 knots, flew in p.m.		5.2 hours
1 Sept	Paulatuk Colville	low ceiling/rain/vis. 5-10 mi. better to the south		5.7 hours
2 Sept	Colville	Ceiling & visibility good		10.7 hours
3 Sept	Colville	Cloudy/low to the north	Ferry	1.1 hours
			Total	36.0 hours

Appendix B. Comparison of Muskox Group Counts (Survey Aug 27 - Sept/87)

Slide #	Grp.#	Visual (Adults & Calves)	Photocount
3	1	20 + 4 + 1 bull	20 + 1 bull
4	1	20 + 4 + 1 bull	20 + 3 + 1 bull
5	2	43 + 3	45 + 2
6	2	43 + 3	43 + 3
7	2	43 + 3	45 + 2
9	3 + 4	15 + 3, 45 + 5	15, 44
10	4	45 + 5	48 + 4 stragglers
13	3 + 4	15 + 3, 45 + 5	14, 42
26	5	10	10
27	6	27 + 3	30 + 2
28	6	27 + 3	30 + 3
29	6	27 + 3	29 + 3
30	7	23 + 0	23 + 0
32	8	14 + 3	17 + 3
34	9	36 + 2	35 + 3
35	9	36 + 2	36 + 2
36	9	36 + 2	36 + 2
Film Roll # 2			
8	11	29 + 0	28 + 0
14	11	70 + 3	55
15	11	70 + 3	53
16	11	70 + 3	55
18	11	70 + 3	54
20	12	26 + 3	28 + 2

Appendix C. Numbers of muskoxen observed on transect north of Great Bear Lake, August-September 1987.

Transect Number	Transect area (km^2)	Left		Right	
		Non-calves	Calves	Non-calves	Calves
1	49	0	0	0	0
2	158	0	0	0	0
3	207	87	15	0	0
4	238	0	0	0	0
5	300	66	9	43	3
6	335	0	0	0	0
7	211	2	0	0	0
8	214	1	0	1	0
9	244	0	0	0	0
10	166	0	0	11	3
11	158	23	0	27	3
12	149	0	0	0	0
13	152	0	0	36	2
14	122	0	0	0	0
15	75	0	0	0	0
16	174	7	0	0	0
17	158	1	0	1	0
18	146	0	0	0	0
19	144	1	0	0	0
20	182	0	0	0	0
21	194	1	0	1	0
22	170	0	0	0	0
23	131	7	0	0	0
24	177	0	0	0	0
25	144	0	0	0	0
Total	4398	196	24	120	11