ABUNDANCE AND DISTRIBUTION OF MUSKOXEN IN CENTRAL KEEWATIN, NWT, JULY 1986

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FORT SMITH, NWT

1990

Northwest Territories Renewable Resources

File Report No. 92

ABSTRACT

In July 1986 we conducted a stratified, random transect survey of the area southwest of Baker Lake which included almost all of Muskox Management Area J/1-1. This survey was to verify and expand upon the unstratified survey carried out in a portion of the same area in November 1985. After a reconnaissance flight along transects which covered 16% of the area, we established high, low and zero density strata. The zero density area was removed from further consideration, while the high density area was surveyed with transects 4 km apart (50% coverage) and the low density area was surveyed with transects just over 6 km apart (30% coverage).

We actually counted 362 adult muskoxen on transect, resulting in an estimate of 838 $\pm$ 176 (S.E.), with a Coefficient of Variation equal to 0.21. Calves represented 11.5% of the animals observed which is similar to results from other summer surveys in the NWT. Group size was considerably higher, however, than other summer surveys. Although the population estimate was 30% less than the November 1985 survey, we recommend no further management changes because the quota which was established in early 1986 was conservative, and because the estimate from this stratified survey is likely closer to the true muskox population than that provided by the previous unstratified effort.

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INTRODUCTION

The southern and eastern boundaries of muskox distribution in the central Keewatin were delineated by an aerial survey in November 1985 (Case and Graf 1986) (Figure 1). Sufficient funds were available to provide only 16.8% coverage of the area, which was considered inadequate. The resulting estimate of 1,262 $\pm$ 563 (S.E.) was subjectively considered to be high and that the best estimate was nearer 1,000. On this basis, the quota was raised from 3 to 23, representing 2.3% of the estimate. In July 1986, another survey was undertaken to obtain a more precise estimate of the population in muskox zone J/1-1.

We conducted a stratified, random transect survey which covered an area bounded on the north by Aberdeen and Schultz lakes, on the east by Pitz Lake, on the south by Tulemalu Lake and on the west by Wharton Lake (Figure 2). The survey overlapped the area of highest density found in November 1985 (Case and Graf 1986).

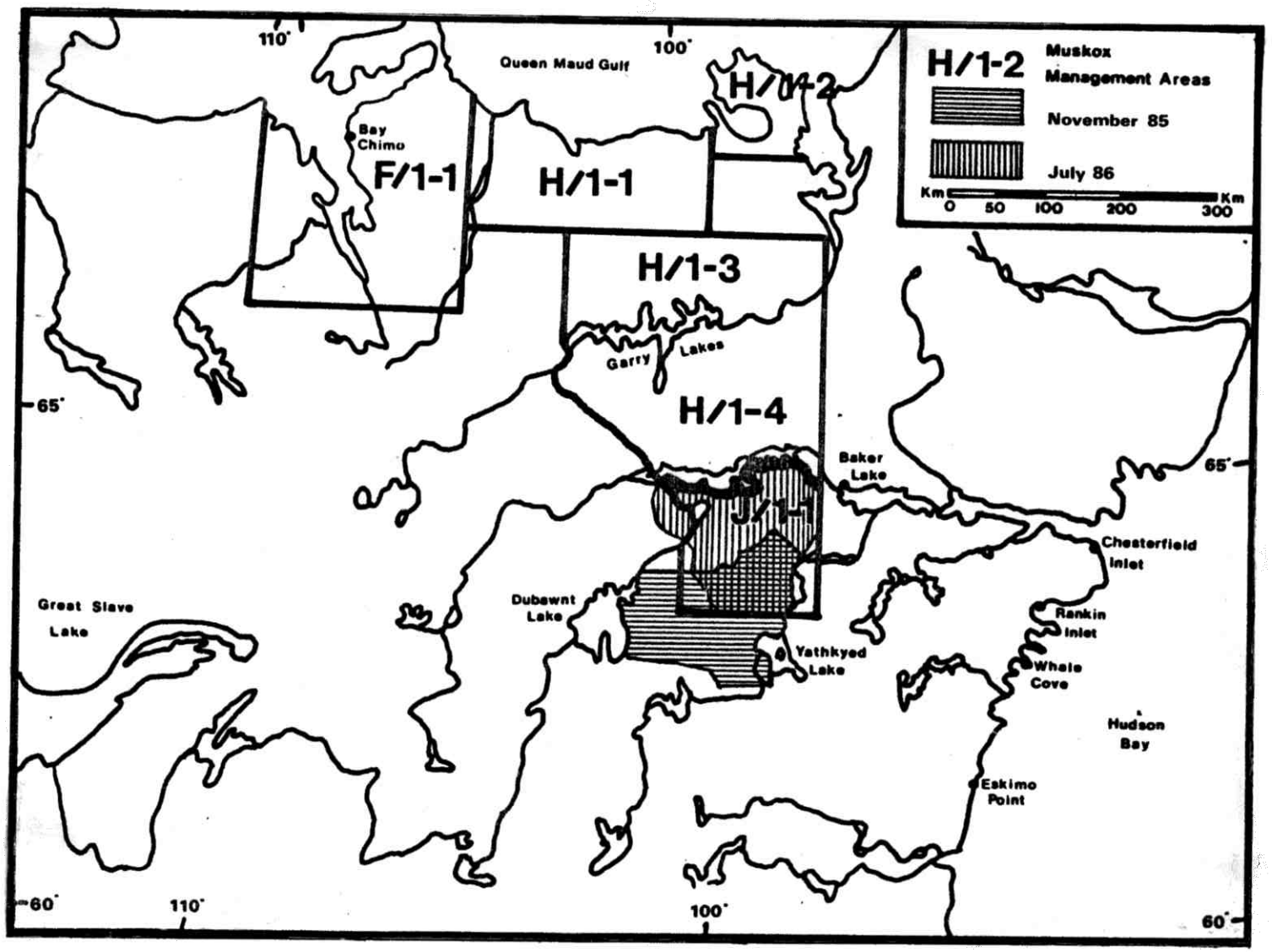

Figure 1. Map of Keewatin Region showing existing Muskox Management Areas and the areas surveyed in November 1985 and July 1986.

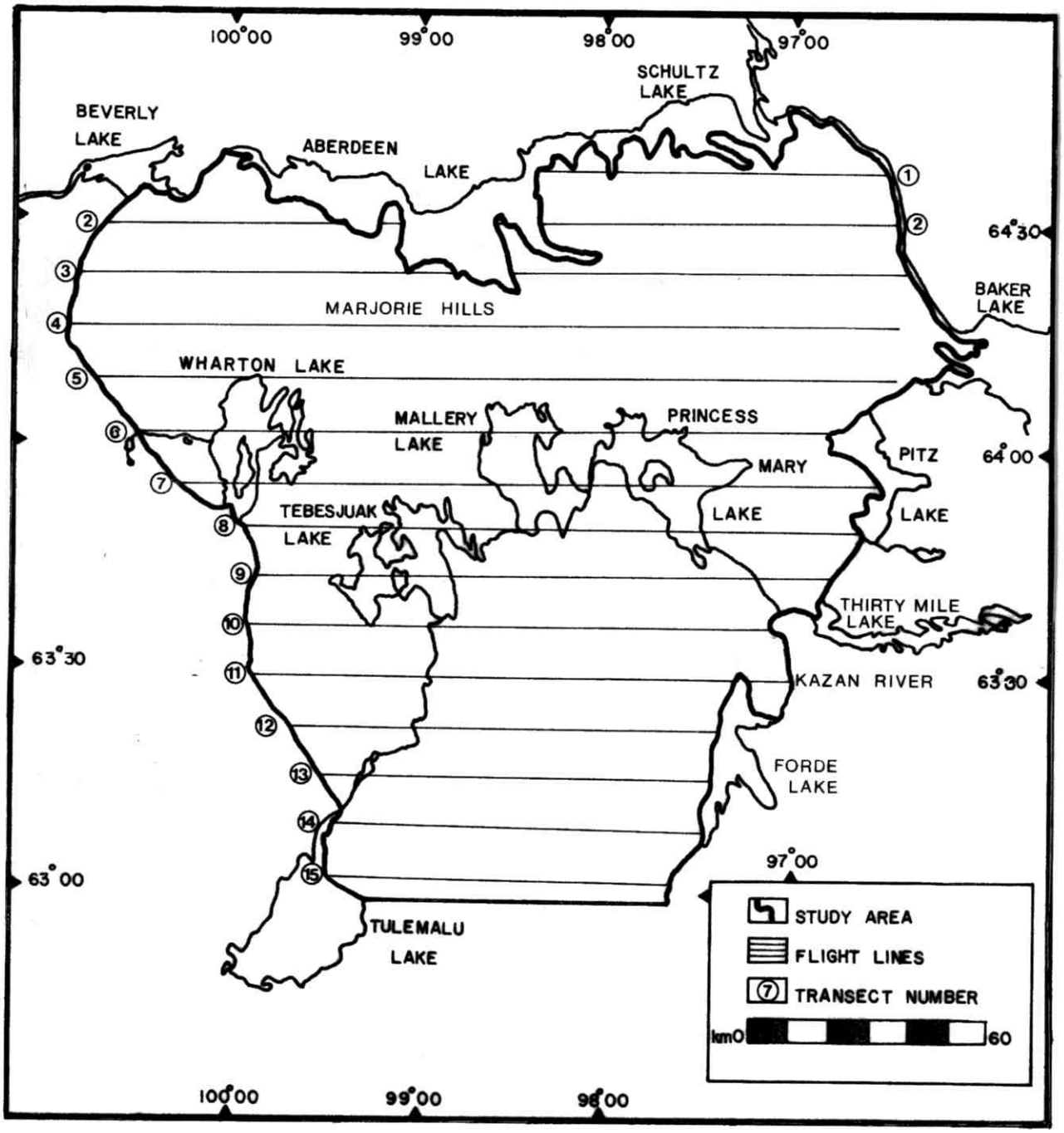

Figure 2. Transect lines for reconnaissance phase of survey, central Keewatin study area, July 1986.

METHODS

The survey was conducted using a Cessna 337 from Landa Aviation of Hay River. The strip widths were established by using taped dowlings which were attached to the wing struts. The actual strip width was tested by flying perpendicular to the Baker Lake runway across one of the airport windsocks and using the location of the other windsock as the outer boundary. The windsocks were 975m apart according to the survey maps used by the Transport Canada engineers who were working on runway improvements that summer. We re-checked the strip width several times during the survey, plus each time a new observer joined us. We therefore obtained a total strip width of 1.95 km along each transect. On transect the aircraft was flown at an altitude of 185m and at an airspeed of 225 kph.

We initially conducted a reconnaissance flight using transect lines 12.5 km apart (16% of the area) to determine the relative densities of muskoxen in the survey area (Figure 2). Based on these reconnaissance flights we defined high, low and zero density areas (Figure 3). In the high density stratum our transects were four km apart and in the low density stratum the transects were six km apart. This provided coverages of 50% and 33%, respectively. We did no further sampling of those areas we defined as zero density areas. Areas covered by large bodies of water were subtracted from the total area calculations. The survey data were analyzed on a microcomputer using Jolly's method

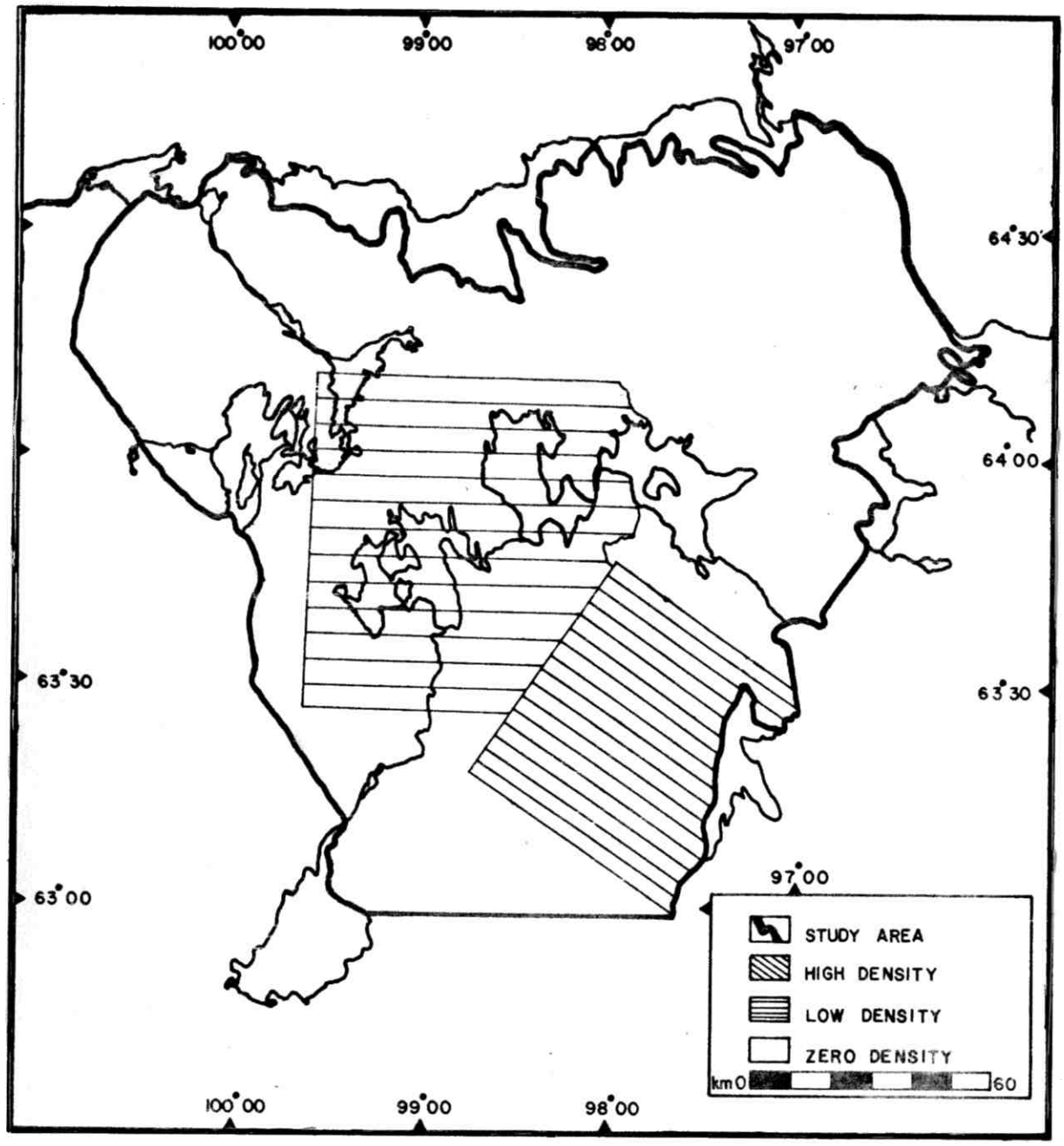

Figure 3. Transect lines for high and low density strata during estimation phase of survey.

2 for unequal sample sizes (Jolly 1969).

Some logistical and human health problems arose which forced us to change observers more often then we would have liked. During the reconnaissance, transects 1-9 were surveyed with only one observer in the rear left seat with the navigator in the front right seat also acting as a full-time observer. During the remainder of the reconnaissance (transects 9-15) and the survey of the high density area we were at full strength (i.e., two observers in the rear with the navigator in the front right seat). The low density area, which required about five hours of flying time, was done with only two people in the aircraft. The pilot was acting as a full-time observer on the left. The navigator was acting as a full-time observer for the right side from the rear seats. The navigator also attempted to check the outer boundary of the pilot's strip whenever possible. Upon completing the survey of the low density area, we flew once, in a straight line, through the high density area to try to establish for ourselves whether or not we had seen most of the animals. On that one line we observed muskoxen at a density approximately equal to that found in the high density stratum by our full complement of observers the previous day. The density was about four times that which we had just found in the low density stratum.

RESULTS

A total of 20.3 hours of flying time was used on transect with a further 8.2 hours used as ferry time. In addition, the ferry trip to Baker Lake from Hay River (the aircraft's base) via Yellowknife and return, required 9.1 hours. The actual survey required three and a half days of flying from July 22 to 25, 1986. We had no down time because of weather or mechanical problems. It was generally cloudy in the area, from 10-70%, with scattered showers on several days. The temperature was stable at approximately 10 degrees Celsius.

We counted 362 non-calf muskoxen on transect (Appendix A). This resulted in an estimate of 224 in the low density areas and 614 in the high density area for a total of 838 $\pm$ 176 S.E. (Table 1). The Coefficient of Variation was 0.21. Calves represented 11.5% (47/409) of the muskoxen counted on transect. The mean herd size, excluding 28 single animals but including calves, was 19.1 $\pm$ 13.2 S.D. with a range of 5-52, based on 20 groups (Appendix B). For the first time, a large group of muskoxen, 44 animals including 9 calves, was found east of the Kazan River (Figure 2).

We also observed one grizzly bear (Ursus arctos), three wolves (Canis lupus), one wolf den and 23 sandhill cranes (Grus canadensis). Large groups of Canada geese (Branta canadensis) were swimming on numerous small lakes. We observed barren-ground caribou (Rangifer tarandus groenlandicus) sparsely distributed

Table 1. Analysis of data from the stratified transect survey of muskoxen in central Keewatin (J/1-1), July 1986.

Study area (km^2)	26,086
Zero areas and water bodies (km^2)	17,825
Stratum areas I and II (km^2)	8,261
Area surveyed (km^2)	4,833
Population estimate	838
Population variance	31,134
Population Standard Error	176
Coefficient of Variation	0.21
95% Confidence Interval	$\pm$362
Muskox densities (muskox per km^2)	
- total study area	0.03
- Stratum areas combined	0.10
- Stratum I (high density)	0.18
- Stratum II (low density)	0.05

throughout the study area, but also found 15-20,000 animals just on the east side of the Kazan River and Forde Lake from Yathkyed Lake north almost to Pitz Lake (Figure 2).

DISCUSSION

The impact on the population estimate of switching observers and then operating with fewer than necessary observers could not be measured. It would likely result in a bias which lowered the number of muskoxen observed and, therefore, the estimate. The actual coverage of 50% for the high density and 30% for the low density strata should have been sufficient, but the Coefficient of Variation (CV) of 0.21 is still quite high as a result of the CV of 0.447 for the low density stratum. The animals were too clumped and in too low a density to arrive at a precise estimate without increasing the coverage to 50% or more in the low density stratum.

The distribution of animals was quite disjunctive. The zero density areas in the northern portions of J/1-1 (Figure 3) separate the muskoxen in the Thelon Game Sanctuary and the Queen Maud area from the high and low density strata of this survey. There appeared to be a drastic change in the colour of the vegetation from brown in the north to green in the south, with the boundary line following approximately east-west along the southern boundary of the Marjorie Hills (Figure 2). All of the muskoxen were found in the green areas in the south. Given the opportunity, Regional staff may want to examine this relationship and/or discuss it with local hunters.

The location of the herd of muskoxen east of the Kazan River suggests that the eastern expansion of the central Keewatin

population towards Hudson Bay is still continuing and thus should be considered in our management decisions.

The group sizes found in this survey in the middle of summer of 19.1 (Table 2) are remarkably similar to the 19.8 found in November by Case and Graf (1986), although 28 single animals were found this time compared to two in the earlier survey. This summer group size is high compared to other populations in the NWT (Table 2) and perhaps may be accounted for by the small sample size of 20 when compared to other data on the same table. Another more likely possibility, however, is that the muskoxen may have aggregated into larger herds to avoid wolves or other predators, as suggested by Miller et al. (1977). Most of the muskoxen were located adjacent to some large groups of caribou which had formed into their summer aggregations. Although we did not see any wolves amongst the caribou, we did find three wolves in the study area along with one grizzly bear and assume there was probably an even higher density of wolves associated with the caribou herds. Grizzly bears are also known to prey upon muskoxen (Gunn and Miller 1982; R. Case unpubl. data).

We found 11.5% of the animals observed in the study area were calves. This is similar to that found in other summer populations of muskoxen in the NWT (Table 2) and would seem to indicate a population which is reproducing at a good rate.

The overall density of muskoxen in the study area, including the zero density areas, was 0.032 muskoxen per km^2, with the high density stratum and the low density stratum having 0.18 and 0.05

Table 2. Herd characteristics of some muskox populations during the summer in the Northwest Territories. (Group size includes adults and calves.)

POP'N (date of survey)	DENSITY (# musk. per km^2)	GROUP SIZE -excl. singles n= # of groups	GROUP SIZE -incl. singles	# SINGLES /TOTAL # COUNTED ()= # of singles	PERCENT CALVES OF TOTAL COUNTED ()= total counted	AUTHORS
Queen Maud (7/82)	0.17	13.2 n=273	9.1 n=412	3.7 (139)	13.5 (3751)	Gunn & Case (1984)
Banks Island (7/82)	0.15	--	5.7 n=482	--	--	Latour (1985)
(7/85)	0.37	9.5 n=663	7.1 n=925	4.0 (262)	11.8 (5975)	McLean et al. (1986)
NW Vict. (8/83)	0.10	7.3 n=283	5.6 n=389	4.9 (106)	15.6 (1896)	Jingfors (1985)
Prince of Wales (7/80)	0.04	9.6 n=24	5.0 n=51	10.5 (27)	11.4 (439)	Gunn & Decker (1984)
Central Keewatin (7/86)	0.03	19.1 n=20	8.5 n=48	6.8 (28)	11.5 (409)	This study

muskoxen per km^2, respectively. The combined density for the high and low density strata only is 0.10 muskoxen per km^2. The overall density is quite low compared to other mainland populations and would seem to be more representative of high arctic island populations (Table 2).

The population estimate from this stratified transect survey of 838 animals is 424 less than that estimated by the unstratified survey of Case and Graf (1986). It would seem that Case and Graf's (1986) recommendation to use a conservative estimate of 1,000 animals to calculate the quota was reasonable. Even though this more precise 1986 estimate based on a stratified survey is somewhat less than 1,000, the possibility of a bias due to the observer problems resulting in a lower estimate suggests that 1,000 muskoxen remains a sensible estimate upon which to base a quota. Additionally, the large areas stratified as zero density areas probably have a few muskoxen hidden amongst the rocks. Therefore, we recommend that the quota remain at 23 animals, thus resulting in an allowable harvest rate of 2.7% of the estimate of 838 animals.

RECOMMENDATIONS

1. No immediate changes to quotas or zones.

2. Have our Regional staff in Keewatin discuss the implications of the total data base (Yathkyed Lake to Queen Maud Gulf) and the need for further studies with the appropriate community Hunters and Trappers Associations and the Keewatin Wildlife Federation.

ACKNOWLEDGMENTS

We would like to thank John Arnalujuak of Eskimo Point for accompanying us for most of the survey. Michael and Daniel Piryuaq from Baker Lake joined us for a short period and we appreciate their efforts. Chris Stokland, the pilot from Landa Aviation, once again did an admirable job of flying, navigating and spotting animals. Francis Jackson from Renewable Resources in Yellowknife did a fine job of assisting with the logistic preparations and his usual outstanding job of drafting the figures. Chris Shank (Renewable Resources, Yellowknife) reviewed earlier drafts of this report.

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APPENDIX A. Numbers of muskoxen observed in central Keewatin (J/1-1), July 1986.

TRANSECT NUMBER	AREA (km^2)	ADULTS & CALVES
High Density Stratum		
1	120.9	1 + 0
2	119.0	17 + 3
3	116.5	94 + 10
4	116.5	27 + 7
5	117.5	2 + 0
6	104.8	45 + 6
7	109.7	2 + 0
8	109.7	51 + 5
9	100.4	0 + 0
10	96.0	21 + 4
11	93.1	2 + 0
12	90.7	26 + 7
13	89.2	1 + 0
14	113.6	0 + 0
15	112.6	0 + 0
TOTAL	1,610.2	289 + 42
Low Density Stratum		
1	100.0	2 + 0
2	102.0	7 + 0
3	116.0	32 + 3
4	123.8	1 + 0
5	87.4	2 + 0
6	97.5	0 + 0
7	105.3	0 + 0
8	116.6	0 + 0
9	118.6	0 + 0
10	122.9	0 + 0
11	109.2	6 + 0
12	118.6	0 + 0
13	132.6	23 + 2
14	128.7	0 + 0
TOTAL	1,579.2	73 + 5
GRAND TOTAL	3,189.4	362 + 47

APPENDIX B. Herd characteristics of muskoxen observed in central Keewatin (J/1-1), July 1986.

HERD #	HERD SIZE (adults & calves)
High Density Stratum	
1	15 + 3
2	46 + 6
3	48 + 4
4	6 + 1
5	14 + 3
6	5 + 3
7	19 + 2
8	23 + 4
9	10 + 2
10	8 + 1
11	10 + 2
12	18 + 0
13	7 + 0
14	13 + 4
15	24 + 7
Singles	23
Subtotal	289 + 42
Low Density Stratum	
16	23 + 2
17	6 + 0
18	6 + 3
19	26 + 0
20	7 + 0
Singles	5
Subtotal	73 + 5
GRAND TOTAL	362 + 47

Mean group size is 19.1 $\pm$ 13.2 (S.D.)