DISTRIBUTION AND ABUNDANCE OF MUSKOXEN
WEST OF COPPERMINE
NWT, 1987-88

ANNE GUNN

DEPARTMENT OF RENEWABLE RESOURCES

GOVERNMENT OF THE NORTHWEST TERRITORIES

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ABSTRACT

The muskoxen (*Ovibos moschatus*) that recolonized the Rae-Richardson river valley, Northwest Territories in the 1970s were previously surveyed in March 1983. We conducted a systematic strip transect survey in August 1987 to determine if the population had continued to increase. The estimate in August was low and imprecise: only 163 muskoxen were observed on transect. A repeat of the survey in March 1988 when the muskoxen were still concentrated in the valley gave an estimate of 1,800 ± 290 (S.E.) from the 547 muskoxen counted on transect. The estimate suggests that the increase in the population during the 1970s and early 1980s has not continued. A sex and age composition survey in August 1987 documented poor calf survival - grizzly bear (*Ursus arctos*) predation is a likely factor.

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INTRODUCTION

Muskoxen in the Rae-Richardson valley, west of Coppermine (Figure 1) have increased since the 1960s (Case and Poole 1985). Case and Poole (1985) compared the results of their March 1983 systematic survey to observations of muskoxen recorded during a previous systematic aerial survey for caribou in March 1980 (Carruthers and Jakimchuk 1981). Their comparison suggested an increase of 49% in population size between 1980 and 1983 and a continued eastward expansion (Case and Poole 1985). The 1983 estimate of 1295 ± 279 (S.E.) led to a quota increase from 12 to 35 and an eastern expansion of the Management Unit C1-2.

In 1986, the Kugluktuk Hunters' and Trappers' Association requested an increase in the quota and the Northwest Territories Department of Renewable Resources planned a resurvey of the area in early August 1987. The timing of the survey followed Case and Poole's (1985) recommendation to take advantage of the seasonal low in herd sizes to reduce the problem of inaccurate counting of individuals in the large herds typical of winter. The distribution of the muskoxen in August was also expected to be along the major river valleys. The August 1987 survey was, however, unsuccessful as the muskoxen were scattered away from the river valleys. The resulting estimate was so low that the survey was repeated in March 1988. This report describes the aerial surveys in August 1987 and March 1988 and a sex-age composition survey in August 1987.

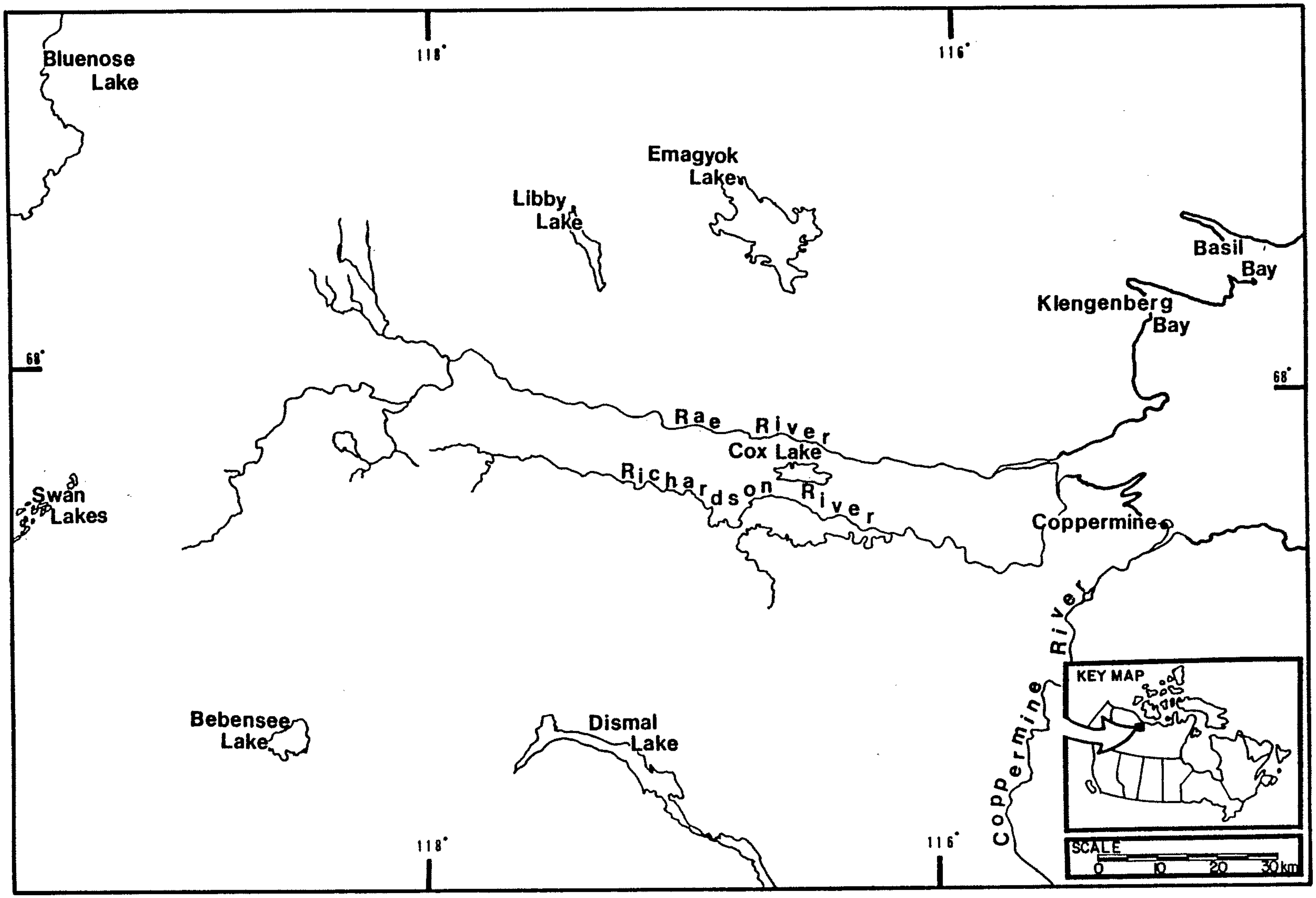

Figure 1. Rae and Richardson river valleys, NWT.

METHODS

Aerial Surveys

I initially based our August 1987 survey area (Figure 2, Stratum II) on previous reports of the muskox distribution in March 1983 (Case and Poole 1985). But as we found relatively few muskoxen, we added two strata (III and IV) south of Stratum II (Figure 2). We then designated the high muskox density part of Stratum II as Stratum I (Figure 3) and resurveyed it with increased survey coverage to improve the precision of the estimate. The transects were spaced 6.4 km apart in strata II and III; 12.4 km apart in Stratum IV and 3 km in Stratum I.

I repeated the aerial survey in March 1988 and based the survey area (Figure 4, Stratum I) on the distribution in March 1983. I added Stratum II based on hunters' reports of muskox sightings (Figure 4). The transects were 10 km apart in both strata.

The strip transects were perpendicular to the major rivers to avoid a sampling bias if the muskoxen were concentrated along drainages and in the lowlands. In Stratum I in August, however, the transects were perpendicular to the first set of transects.

The survey aircraft was a Helio-Courier on wheels in August and skis in March. The survey crew was a right and left observer both seated in the rear and the pilot who navigated and plotted observation numbers on 1:250,000 scale topographic maps. The

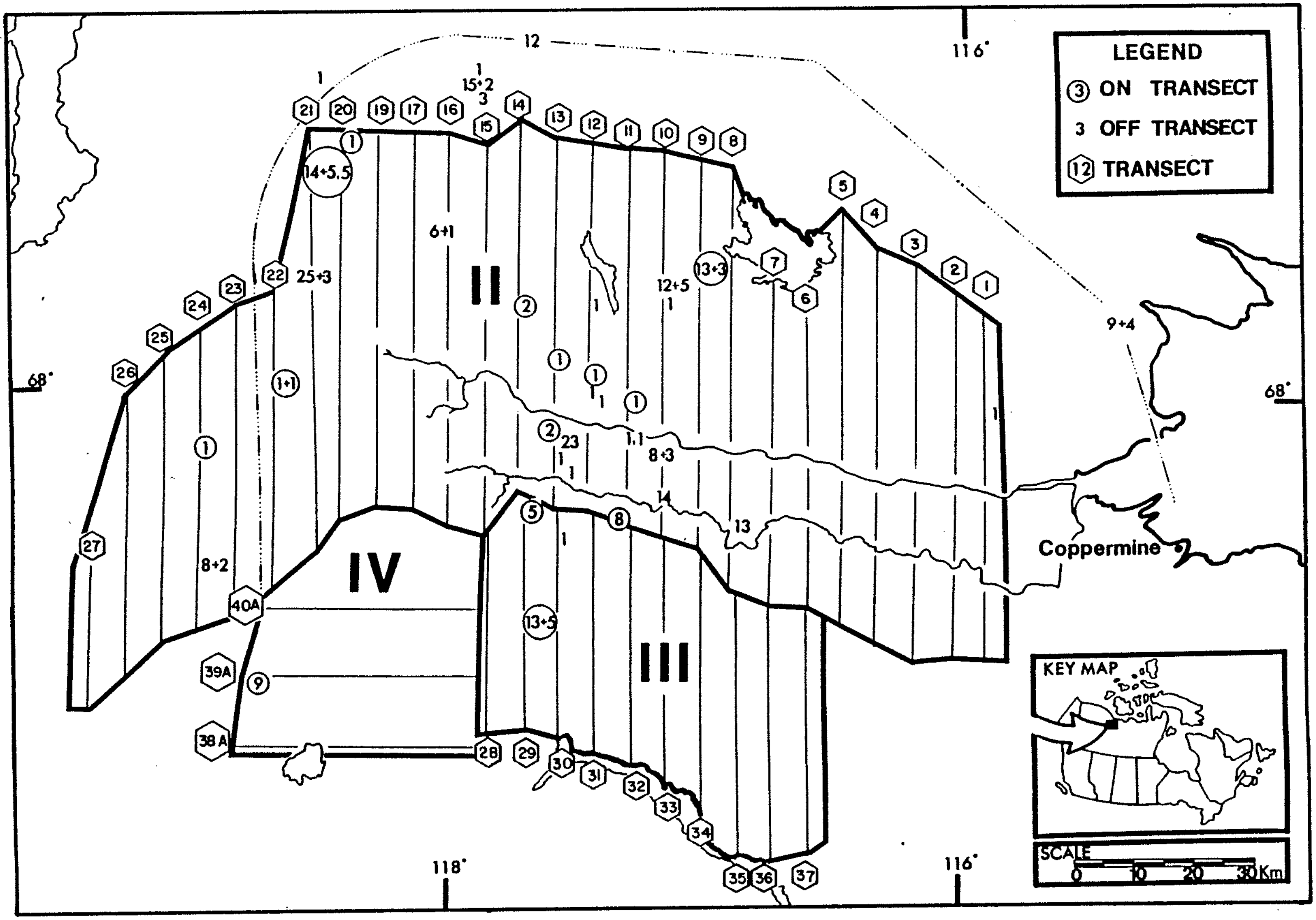

Figure 2. Strata, transects, reconnaissance flight and muskox observations for a muskox survey of Rae-Richardson river valleys, August 1987, NWT.

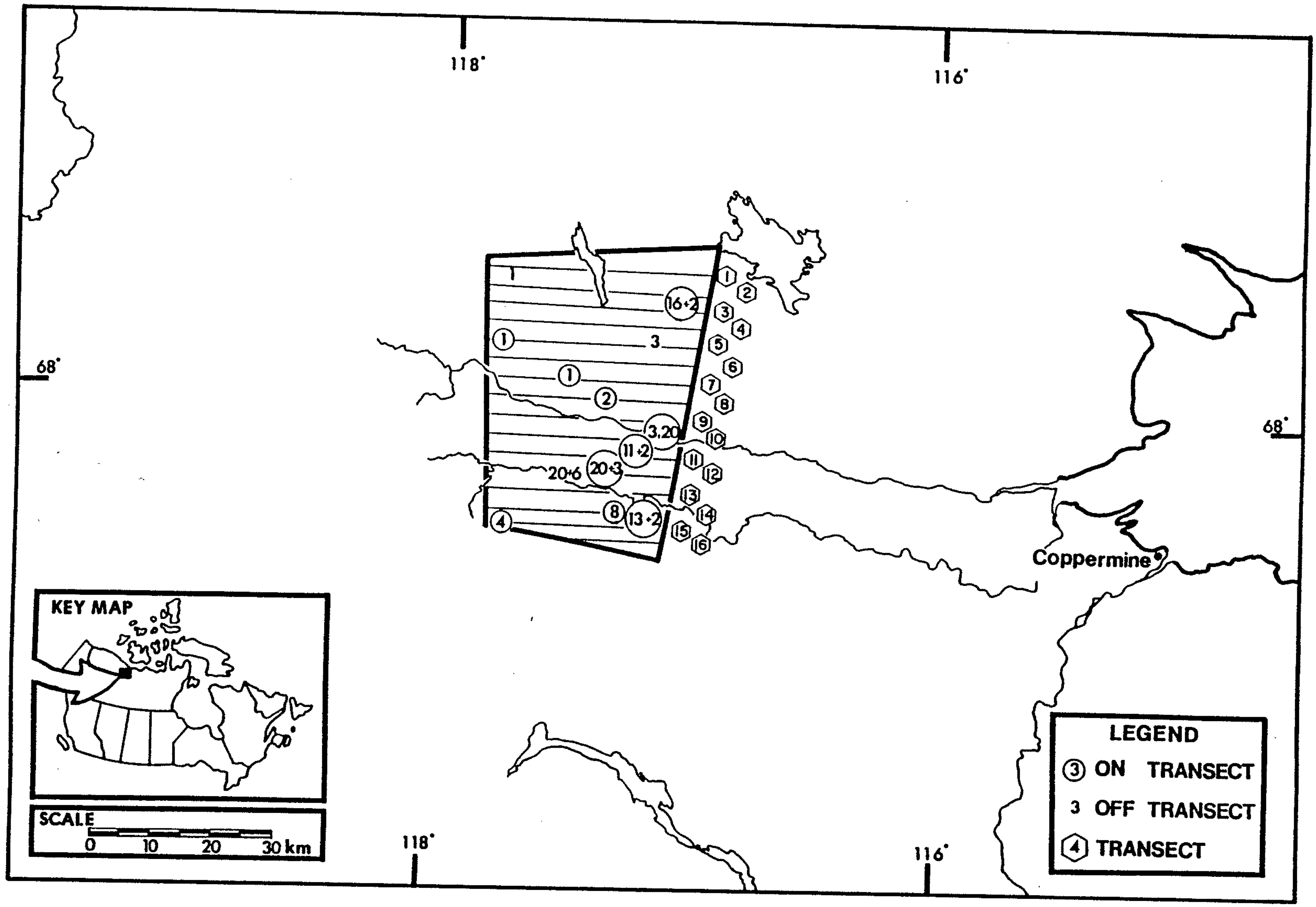

Figure 3. Stratum I, transects and muskox observations for a muskox survey of Rae-Richardson river valleys, August 1987, NWT.

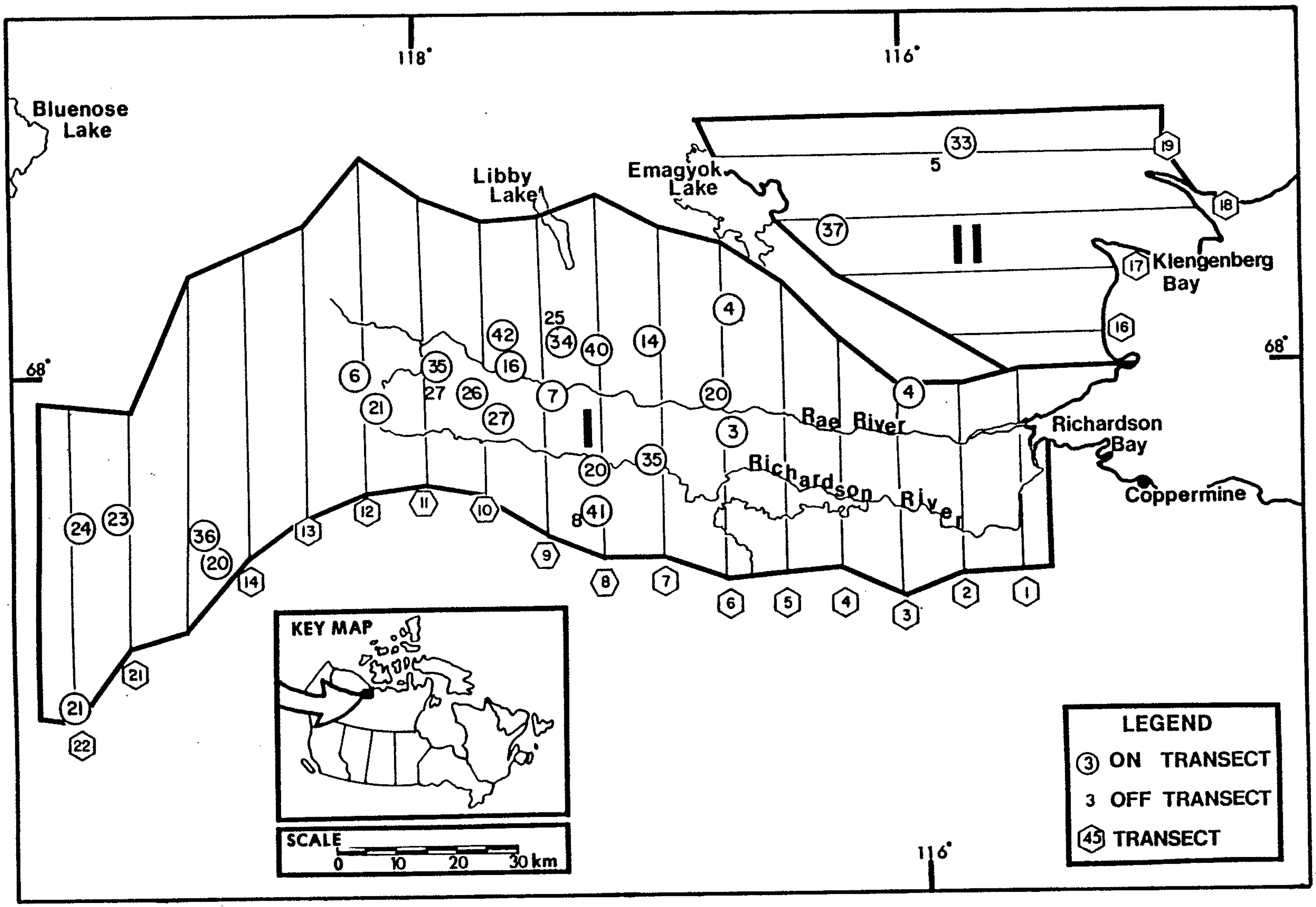

Figure 4. Strata, transects and muskox observations for a muskox survey of Rae-Richardson river valley, March 1988, NWT.

left observer recorded the sightings for both observers by location number in a field notebook.

A wire was stretched from an eye bolt on the wing to the fuselage. (The Helio-Courier does not have wing struts.) Boundaries for the inside and outside of the transect were calculated (Norton-Griffiths 1978) and marked by red tape on the wires and windows. The transect width was 0.75 km on both sides of the aircraft in August and 1.5 km in March. We checked the markers by flying at survey altitude over a truck parked 0.75 km or 1.5 km from the runway end markers on the Coppermine airstrip. When flying along the transects, the aircraft altitude was 200 m above ground level in August and 300 m agl in March. The airspeed was 160 km/h.

The first transect was randomly placed along a line of latitude and then the other lines were evenly spaced. No sex and age classification counts were systematically attempted during the aerial survey, but we counted calves when they were conspicuous.

I used Jolly's (1969) Method 2 estimate to calculate a population estimate from the numbers of muskoxen (excluding calves) counted on transect. The probability that the muskox population had significantly increased since 1983 (H_0: $T_1 > T_2$) was tested using a one-tailed Student's t-test. The probabilities of Type I and Type II errors were set at 0.01 and 0.2 , respectively, and the consequential difference of interest was set at 25% of the 1983 estimate. The difference between the right and left observers' counts was tested for significance with a Wilcoxon matched-pairs signed ranks test.

Sex and age composition survey

I flew in a Bell 206B helicopter to search for muskoxen at variable altitudes depending on the terrain, but usually at less than 100 m above ground level. If the herd contained fewer than 10 muskoxen, the helicopter flew slowly past them and it was possible to classify them as they grouped together and faced the helicopter. The helicopter would land 500 - 1000 m away from larger herds using the terrain as cover to remain out of sight whenever possible. I would approach on foot to within 300 m and observe the muskoxen through a 20x spotting scope.

I classified the muskoxen into sex-age classes on the basis of body size, guard hair length and horn development (Gray 1987, Henrichsen and Grue 1980). The classes are calves, yearlings, 2-year-old bulls and cows, 3-year-old bulls and 3+-year-old bulls. I was not confident of always separating 3-year-cows from cows >3 years so they were classified together as ≥ 3-year-old cows. Calves and yearlings were not sexed because their smaller horns were not always readily visible at a distance. Additionally, calves and yearlings were more likely to be partially concealed by other herd members when responding to the observer or the helicopter.

RESULTS

Aerial survey, August 1987

The overall estimate (including calves) for the survey area was 560 ± 187 (S.E.) muskoxen and the coefficient of variation was high (0.33). The coverage was 48.0% for Stratum I, 26.0% for Stratum III, 14.8% for Stratum II and 11.1% for Stratum IV. We counted 143 muskoxen and 20 calves on 1,775 km^2 of strip transects across the survey area (Table 1, Figures 2 and 3, Appendix A) in August 1987. We counted 64 muskoxen and 12 calves off transect and a further 28 muskoxen and 10 calves during ferry flights. The sightings in the part of Stratum II resurveyed as Stratum I numbered 31 (including 3 calves) on transect and 51 (including 3 calves) off transect and were excluded from the population estimate.

The total flying time of 36.1 h was composed of 11.1 h survey time, 7.0 h of return ferry time from Norman Wells to Coppermine and 18.0 h ferry time between the transects and Coppermine (our operational base). We surveyed the transects in Strata III and IV between 17 and 21 August and Stratum II on 22 August, 1987.

Weather that would influence the conspicuousness of the muskoxen against the background varied (Table 2). On overcast days, muskoxen were relatively inconspicuous among the tussock meadows and shrubs. The numbers of muskoxen counted by the left

Table 1. Analysis of data from the transect survey of muskoxen in the Rae-Richardson river valley, NWT, August 1987.

		Strata				
		I	II	III	IV	Total
Maximum number of transects	(N)	35	175	38	29	
Number of transects surveyed	(n)	16	26	10	3	
Stratum area, km	(Z)	1660	7680	2115	1595	
Transect area, km	(z)	797	1138	550	177	
Number of muskoxen counted	(y)	108	28	18	9	163
Muskoxen density, caribou/km	(R)	0.14	0.02	0.03	0.05	
Population estimate	(Y)	225	189	69	18	564
Population variance (Var Y)		3392	21492	3560	6397	34841
Standard error	(SE,Y)	58	147	80	18	187
Coefficient of variation	(CV)	0.259	0.776	0.862	0.982	0.331

Table 2. Weather and light conditions during transect aerial survey of Rae-Richardson River valley, NWT, August 1987.

Date	Transect	(stratum)	Weather and light conditions
17 Aug		II	Overcast, rain showers, flat light, break at line 21.
18 Aug			Low ceilings until mid- day becoming broken cloud.
19 Aug			Broken cloud becoming overcast and poor, flat light.
20 Aug			Overcast becoming broken with bright light conditions.
21 Aug			Broken and bright conditions becoming low overcast by afternoon.
22 Aug	1-16	I	Broken becoming overcast and flat light by lines 14-16.

and right observer did not significantly differ ($p<0.05$).

Group sizes ranged from 2 to 28 and small sample sizes prevented comparisons of group size among strata. Mean herd size (n = 25) was 12.0 +/- 2.29 (S.E.). The proportion of social units that were single bulls (n = 11) was 59% and the proportion of calves to total muskoxen counted was 11.0% (42/335).

Aerial survey, March 1988

The overall estimate for the survey area was 1,800 ± 290 (S.E.) muskoxen and the coefficient of variation was 0.16. We counted 547 muskoxen on 1,067 km^2 of strip transects across the survey area and 109 muskoxen off transect (Table 3, Figure 4, Appendix B) in March 1988. The total flying time of 21.9 h was composed of 6.7 h survey time, 7.0 h of return ferry time from Norman Wells to Coppermine and 8.2 h ferry time between the transects and Coppermine.

Weather conditions were favourable and the muskoxen were relatively conspicuous (Table 4). The numbers of muskoxen counted by the left and right observer did not significantly differ ($p<0.05$).

Group sizes ranged from 3 to 42 and the mean herd size of 29 herds was 22.6 +/- 2.29 (S.E.). No single bulls were observed.

Table 3. Analysis of data from the transect survey of muskoxen in the Rae-Richardson river valley, NWT, March 1988.

		Stratum I	Stratum II	Total
Maximum number of transects	(N)	46	9	55
Number of transects surveyed	(n)	17	4	21
Stratum area, km	(Z)	8,395	2,172	10,567
Transect area, km	(z)	2,544	658	3,202
Number of muskoxen counted	(y)	477	70	547
Muskoxen density, caribou/km	(R)	0.19	0.11	
Population estimate	(Y)	1,574	231	1,805
Population variance	(Var,Y)	83,467	2,200	85,667
Standard error	(SE,Y)	289	47	293
Coefficient of variation	(CV)	0.184	0.203	0.162

Table 4. Weather and light conditions during transect aerial survey of Rae-Richardson river valley, NWT, March 1988.

Date	Transect	(stratum)	Weather and light conditions
8 Mar	1 -11	I	Clear, light wind, light poor on lines 10 and 11.
9 Mar	12, 16-19	I	Ice fog ends line 12; overcast to broken conditions for lines 17-21.
10 Mar			Low cloud and snow.
11 Mar	12-15, 16-18	I II	Broken cloud but ground drift and turbulent winds.

Sex and age composition survey

I classified 235 muskoxen in 16 mixed sex age herds on 23 August, 1987 (Table 5, Figure 5). The adult sex ratio was low (bull:≤3-year cows = 0.59) but other adult bulls may have occurred as singles or in bachelor groups. The ratio of calves to ≤ 3-year cows was relatively low (0.25); the similar proportions of 2-year-olds (8.6%), yearlings (9.8%) and calves (11.1%) suggests that the survival of calves subsequent to a few months of age is relatively high (assuming relatively high calf production each year).

Table 5. Sex and age classification of muskox herds, Rae-Richardson river valley, NWT, August 1987.

3y bull	3y+ cow	2y bull	2y cow	yearl.	calf	Total
61(22.5)	104(44.3)	10(4.3)	10(4.3)	23(9.8)	26(11.1)	234

≥ 3-year bull: ≥3-year cow = 0.59 calf: ≥ 3-year cow = 0.25

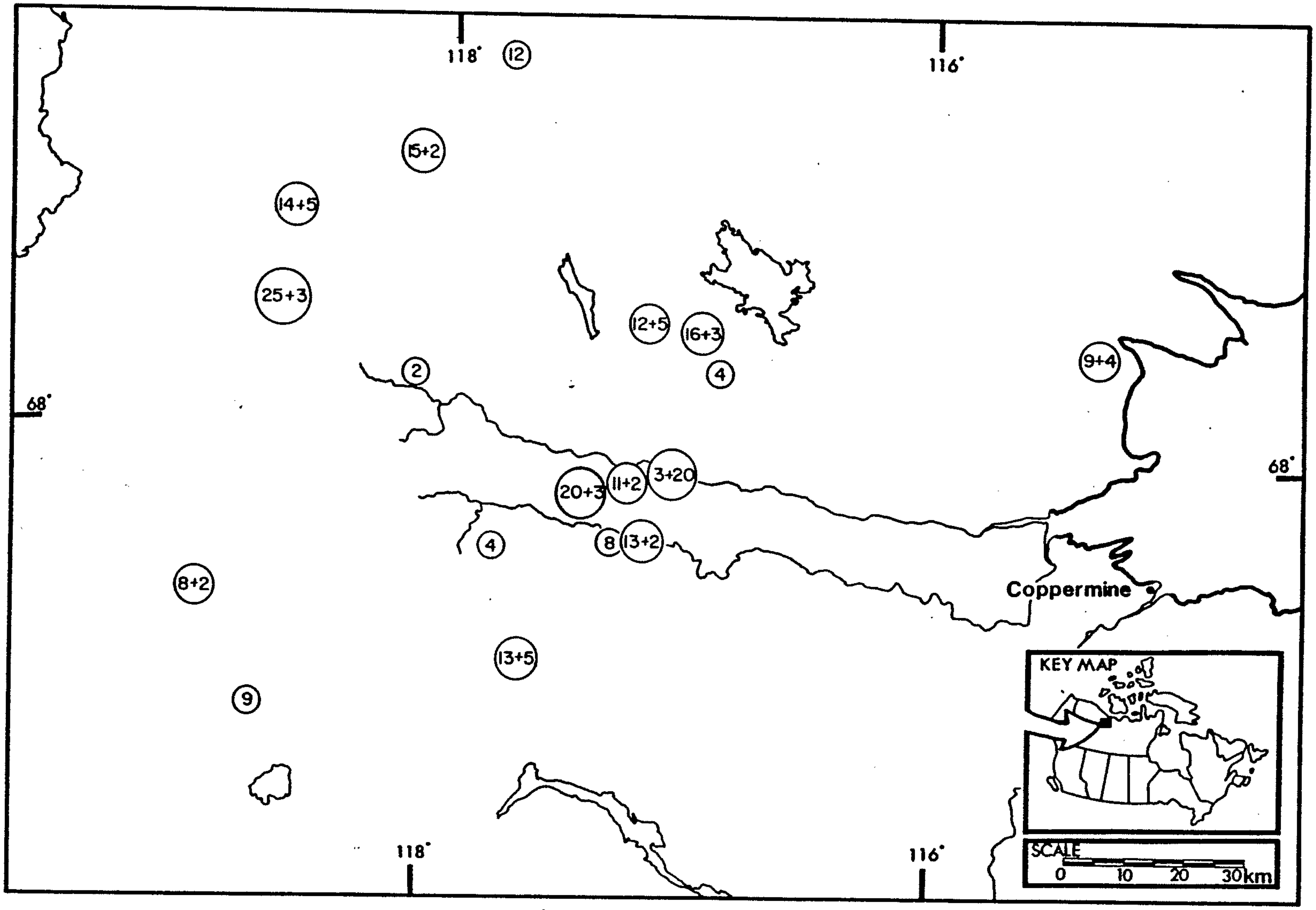

Figure 5. Location of muskox herds (≥ 1-year + calves) recorded during a sex and age composition survey of Rae-Richardson river valley, August 1987, N.W.T.

DISCUSSION

The null hypothesis that the estimated numbers of muskoxen in March 1983 was equal to or greater than in March 1988 was accepted ($t' = 1.26$; $t_{.01,6} = 1.44$) with a 0.20 probability of error. Any increase was less than 25% and statistically insignificant which suggests that the population has not maintained the rate of increase documented previously (Case and Poole 1985, Spencer 1976). The surveys in 1983 and 1988 used similar methods and covered similar areas. Two possible explanations for the apparent stability are either changes in productivity or survival and dispersal.

The cause of the low estimate in August 1987 was the unexpected seasonal movement away from the river valleys. This movement was confirmed during a subsequent study. Twenty cows were radio-collared between 1988 and 1989 (unpubl. data). The seasonal relocations showed an April migration away from the Rae-Richardson River valley to the north coast and return in the fall (unpubl. data).

The low proportion of calves evident during the August 1987 survey led to a follow-up sex and age classification of the herds which confirmed that the proportions of calves was low compared to Victoria Island (Table 6), Banks Island (Gunn et al. 1991) and the Alaskan North Slope (Reynolds 1989). But other NWT mainland muskox populations (Table 6) also have low proportions of calves by mid-summer. In the absence of unusually severe

Table 6. Comparison of proportions of calves to total muskoxen observed on Victoria Island and the NWT mainland (data obtained during ground-based sex and age composition surveys).

Location/ Date	No. muskoxen/ Herds	% calves	Calf: ≥ 3-year Cow
Queen Maud Gulf (unpubl. data):			
Jul 1989	376/24	15.16	0.31
Aug 1988	1305/68	11.65	0.23
Victoria Island (unpubl. data):			
Aug 1988	1412/138	15.08	0.40
Aug 1986	1830/242	20.55	0.61

weather conditions or other factors that could reduce the productivity of the cows, the low proportion of calves is attributable to poor calf survival during the summer.

Grizzly bears are a likely cause of poor calf survival; the Rae-Richardson river valley is used by barren-ground grizzly bears (*Ursus arctos*). The bears may have learnt to stampede herds and take newborn calves which have difficulty keeping pace with a galloping herd.

Grizzly bear predation of muskoxen has not been previously considered in muskox population dynamics as descriptions of predation are infrequent and restricted to bulls (Gunn and Miller 1983, Case and Stevenson 1991). The role of grizzly bear predation in some moose (*Alces alces*) populations, however, has only been relatively recently appreciated after detailed radio-telemetry studies to investigate moose calf mortality.

The causes of the low calf survival is being determined in a follow-up study (unpubl. data). Grizzly bears killed four radio-collared cows during 1989 and 1991 and the remains of newborn muskox calves were visible in the stomachs of two male bears in May 1991 (A. Atatahak pers. comm.)

The relatively low calf survival and apparently stable size of the population suggests that the harvest should remain conservative until our understanding of the population dynamics is increased. The recommended quota increase from 35 to 50 which does not exceed 3% of the estimated population size was implemented in 1988.

The increase in muskoxen in the Rae-Richardson River valley is typical of current mainland muskox populations. The increases in numbers and recolonization of former ranges followed the protection after the unregulated commercial hunting of the turn of the century. The early history of muskoxen in the Rae-Richardson valley is, however, virtually unreported and any details of earlier numbers or distributions are lacking. Freeman (1976) does not describe muskox hunting for the pre-1916 period when describing the land use of the Coppermine region except for the Contwoyto Lake area. In the 1916-1955 period, mention is made of many muskoxen south of the Melville Hills and small numbers of muskoxen elsewhere. Specifically, muskoxen were hunted in the upper reaches of the Rae and Richardson rivers, and east of the Coppermine River in the vicinity of the Asiak and Tree rivers.

Muskoxen disappeared from the Rae-Richardson River valley by the 1950s (Jack Atatahak pers. comm. 1991), but the details of their disappearance are unrecorded. Historical records are either vague or refer specifically to sites along the Coppermine River and Great Bear Lake (Barr 1991). In the early 1960s, muskoxen were not seen along the Rae-Richardson River valley, although trappers travelled extensively in the area (C. Adjun pers. comm. 1991). Kelsall et al. (1971) cited a 1949 report of 10 muskoxen at Bluenose Lake and by 1961, Tener (1965) surmised that there were 100 muskoxen in the Bluenose Lake area. The sightings of muskoxen along the Rae-Richardson River valley began in the late 1960s (C. Adjun pers. comm. 1991), but there are relatively few details to describe the pattern of recolonisation.

Dispersal of the muskoxen is as potent a modifier of population dynamics as changes in productivity or mortality. The only data on muskox dispersal come from the long-term monitoring of introduced populations in Alaska (Reynolds 1989, Smith 1989). The movements of bulls searching for harems (Smith 1989) could be termed innate dispersal (Caughley 1977), as it was apparent when densities were still low. As densities increase, the dispersal of bulls may increase - environmental dispersal. Reynolds (1989) suggested that the movements of some muskox herds on the North Slope, Alaska was a response to the increasing densities. As Caughley (1977) pointed out, the behaviour of individuals needs to be known to determine the mechanisms of dispersal.

In the Coppermine area, evidence for dispersal is based on the reports of hunters both on the absence and on sightings of muskoxen. Consequently, the uneven coverage in time and space prevents any estimation of the rates of colonization. Furthermore, the peripheral areas to the Rae-Richardson River valleys, especially east of the Coppermine River and south of Dismal Lake, are rarely travelled. This compounds the problems of determining the extent of dispersal.

Reports of muskoxen east of the Coppermine River or in the Dismal Lake area are few, which suggests that dispersal is not the explanation for the apparent stability in the population size. The spread of muskoxen east of Cox Lake to the Coppermine River and south to the Dismal Lake area has apparently been slow, and there are only a few muskox sightings along the Coppermine River. In about 15 years of trapping and hunting from Dismal

Lake south to Great Bear Lake, Allen Niptanatiak (pers. comm. 1990) recalls only seeing a herd in the vicinity of the west end of Dismal lake in winter 1988 and 1991. The slowness to colonize east and south of the Rae-Richardson River valley may be a consequence of the apparent slow rate of increase of that population in the 1980s. The habitat may be less suitable either in terms of snowcover or the vegetation which is more dominated by coniferous trees and shrubs.

The low calf survival suggests that calf mortality is a factor in the reduced rate of increase in this muskox population, but the relative weight of its role compared to dispersal is unknown. Further monitoring will increase measures of the extent of calf and adult mortality, but only an experimentally designed monitoring of marked individuals will resolve the role of dispersal. Male and female muskoxen likely have different dispersal strategies related to their breeding. A study designed to test for sex-related differences would also have the management advantage of aiding the development of harvesting strategies for trophy bulls.

ACKNOWLEDGEMENTS

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PERSONAL COMMUNICATION

Adjun, C. Renewable Resource Officer, Department of Renewable Resources, Government of the NWT, Coppermine, NWT.

Atatahak, A. Coppermine, NWT.

Atatahak, J. Coppermine, NWT.

Niptanatiak, A. Coppermine, NWT.

LITERATURE CITED

Barr, W. 1991. Back from the brink: the road to muskox conservation in the Northwest Territories. Arctic Institute of North America Komatik Series 3, Calgary, Alberta, 127pp.

Carruthers, D. and R. Jakimchuk. 1981. The distribution, numbers and movements of caribou and muskoxen north of great Bear Lake, Northwest territories. Renewable Resources Consulting Ltd. prepared for Polar Gas Project, 144pp.

Case, R.L. and K. Poole. 1985. Abundance, distribution and composition of muskoxen north of Great Bear Lake, March 1983. NWT Wildlife Service File Rep.51, 48pp.

Case, R. and J. Stevenson. 1991. Observation of barren-ground grizzly bear, Ursus arctos, predation on muskoxen, Ovibos moschatus, in the Northwest Territories. Can. Field-Nat. 105:105-106.

Caughley, G. 1977. Analysis of vertebrate populations. John Wiley & Sons, London, 234pp.

Freeman, M.M.R. 1976. Inuit Land Use and Occupancy Project. Indian & Northern Affairs Canada, Ottawa, Ontario, Vol. I, 262pp.

Gray, D.R. 1987. The muskoxen of Polar Bear Pass. Fitzhenry and Whiteside, Markham, Ontario, 191pp.

Gunn, A. and F.L. Miller. 1983. Muskox bull killed by a barren-ground grizzly bear, Thelon Game Sanctuary, N.W.T. Arctic 35:545-546.

Gunn, A., C.C. Shank and B. McLean. 1991. The history, status and management of muskoxen on Banks Island. Arctic 44: 188-195.

Henrichsen, P. and H. Grue. 1980. Age criteria in the muskox (Ovibos moschatus) from Greenland. Dan. Rev. Game Biol. 11:1-18.

Kelsall, J.P., V.D. Hawley and D.C. Thomas. 1971. Distribution and abundance of muskoxen north of Great Bear Lake. Arctic 24:157-161.

Jolly, G.M. 1969. Sampling method for aerial census of wildlife populations. E. Afr. Agric. For. J. 34:46-49.

Norton-Griffiths, M. 1978. Counting animals. Hand Book No. 1, African Wildlife Leadership Foundation, Kenya, 139pp.

Reynolds, P.E. 1989. Status of a translated muskox population in northeastern Alaska. In: Proceedings of the Second International Muskox Symposium, Saskatoon, Sask., Canada, 1 - 4 October 1987. Edited by P. F. Flood. National Research Council of Canada, Ottawa.

Smith, T. 1989. The role of bulls in pioneering new habitats in an expanding muskox populations on the Seward Peninsula, Alaska. In: Proceedings of the Second International Muskox Symposium, Saskatoon, Sask., Canada, 1 - 4 October 1987. Edited by P. F. Flood. National Research Council of Canada, Ottawa.

Spencer, W. 1976. Musk-oxen (Ovibos moschatus) survey, Cental Western Arctic, July 15 - July 24. 1976. N.W.T. Wildl. Serv. unpubl. report, 7pp.

Tener, J. S. 1965. Muskoxen in Canada. Canadian Wildlife Service Monogr. 2, 166pp.

Appendix A. Muskoxen observed on transect during an aerial survey of Rae-Richardson river valley, NWT, August 1987.

Transect No.	Transect Area (km)	muskoxen on transect	muskoxen off transect
Stratum I			
1	56.6	0	1
2	55.9	0	0
3	54.8	18	0
4	54.0	0	0
5	53.3	1	0
6	52.5	0	0
7	51.8	1	0
8	51.0	2	0
9	50.3	0	0
10	49.5	23	0
11	48.8	13	26
12	48.0	23	0
13	47.3	0	0
14	46.5	15	0
15	45.8	12	0
16	31.1	0	1
Total	**797.2**	**108**	**28**
Stratum 2			
1	50.4	0	1
2	53.9	0	0
3	57.9	0	0
4	58.3	0	0
5	61.4	0	0
6	42.4	0	0
7	46.9	0	0
8	62.8	0	0
9	31.0	0	0
10	16.4	0	0
11	15.9	0	0
12	17.2	0	0
13	18.1	0	0
14	21.2	0	0
15	57.0	0	0
16	57.5	0	7
17	55.7	0	0
19	55.7	0	0
20	56.1	1	0
21	60.1	24	28
22	43.3	2	0
23	45.5	0	0
24	45.5	1	10
25	42.4	0	0
26	42.9	0	0
27	22.5	0	0
Total	**1138.0**	**28**	**46**

Appendix A. (Cont.)

Transect No.	Transect Area (km)	muskoxen on transect	muskoxen off transect
Stratum III			
28	50.3	0	0
29	47.3	18	0
30	47.3	0	1
31	49.5	0	0
32	51.8	0	0
33	54.0	0	0
34	61.5	0	0
35	64.5	0	0
36	62.3	0	0
37	61.5	0	0
Total	**550.0**	**18**	**1**
Stratum IV			
38	60.8	0	0
39	62.3	9	0
40	53.3	0	1
Total	**176.4**	**9**	**1**

Appendix B. Muskoxen observed on transect during an aerial survey of the Rae-Richardson river valley, NWT, March 1988.

Transect No.	Transect Area (km)	muskoxen on transect	muskoxen off transect
Stratum I			
1	105.6	0	0
2	96.0	0	0
3	107.5	4	0
4	122.9	0	0
5	153.6	0	0
6	172.8	27	0
7	172.8	49	0
8	184.3	101	8
9	163.2	41	25
10	138.2	113	0
11	149.8	35	27
12	172.8	27	0
13	188.2	0	0
14	157.4	0	0
15	182.4	36	20
21	119.0	23	0
22	157.4	21	24
Total	**2,543.9**	**477**	**104**
Stratum II			
16	84.5	0	0
17	138.0	0	0
18	215.0	37	0
19	220.7	33	5
Totals	**658.2**	**70**	**5**