DISTRIBUTION AND ABUNDANCE OF MUSKOXEN ON ADELAIDE PENINSULA, NWT, 1986 AND 1992

ANNE GUNN

KEN LAMBERT

AND

RON MORRISON

DEPARTMENT OF RENEWABLE RESOURCES

GOVERNMENT OF THE NORTHWEST TERRITORIES

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ABSTRACT

We conducted a systematic strip transect survey in June 1986 to determine the extent to which muskoxen (*Ovibos moschatus*) had spread east and north on Adelaide Peninsula. The estimate in June 1986 was 213 ± 146 (S.E.) based on 44 muskoxen (excluding calves) counted on transect. The survey was repeated in June 1992 and the estimated population was 1165 ± 380 (S.E.) based on 233 muskoxen (excluding calves) counted on transect. Both surveys were imprecise with Coefficients of Variation of 59% and 33% in 1986 and 1992, respectively. The significant increase documents the continued return of muskoxen to their historic ranges. This "colonizing edge" should continue to be lightly harvested to encourage expansion of the muskoxen east of Chantrey Inlet.

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INTRODUCTION

Muskox sightings (*Ovibos moschatus*) on Adelaide Peninsula have increased since the 1970s after a period of two to three decades in which muskoxen were virtually absent. In 1984, based on hunters' reports, the muskox population was assumed to be sufficient to support a quota of 10. The Gjoa Haven Hunters' and Trappers' Association (H.T.A.) had requested the quota to hunt muskoxen on Adelaide Peninsula in summer. This would allow travel by boat, with lower travel costs than to H/1-1 (Queen Maud Gulf) for winter muskox hunting.

In 1985, Gjoa Haven H.T.A. requested a survey and a quota increase mainly because they wanted to hunt muskoxen closer to their community. In response, we planned to survey Adelaide Peninsula in June 1986 to determine muskox numbers on Adelaide Peninsula and the west side of Chantrey Inlet. We had received a report of a muskox and caribou (*Rangifer tarandus*) on King William Island, so we also planned to survey the island.

We did not find sufficient muskoxen to warrant an increase in the quota at that time. Hunters continued to report more muskoxen on Adelaide Peninsula; so in June 1992, we repeated the survey to determine whether or not the numbers of muskoxen had significantly increased. This report describes the survey results and the subsequent recommendations for the quota.

METHODS

June 1986 survey:

We held an H.T.A. meeting in Gjoa Haven the evening before the survey began to determine areas that we should survey. Our survey area was King William Island, Adelaide Peninsula and the area south of it between the west coast of Chantrey Inlet and 99°W (Figure 1). The systematic aerial survey was not preceded by an aerial reconnaissance survey to use the available flying time to cover the largest area possible because we were combining the muskox survey with a caribou survey (Gunn in prep.).

We flew strip transects 9.6 km apart to have 20% coverage. The transects were oriented east-west to be perpendicular to the long axis of the coastline and the major rivers. We placed the first transect randomly along a line of latitude and evenly spaced the other lines.

The survey aircraft was a Helio-Courier on skis. The survey crew comprised 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 left observer recorded the sightings for both observers by location number.

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

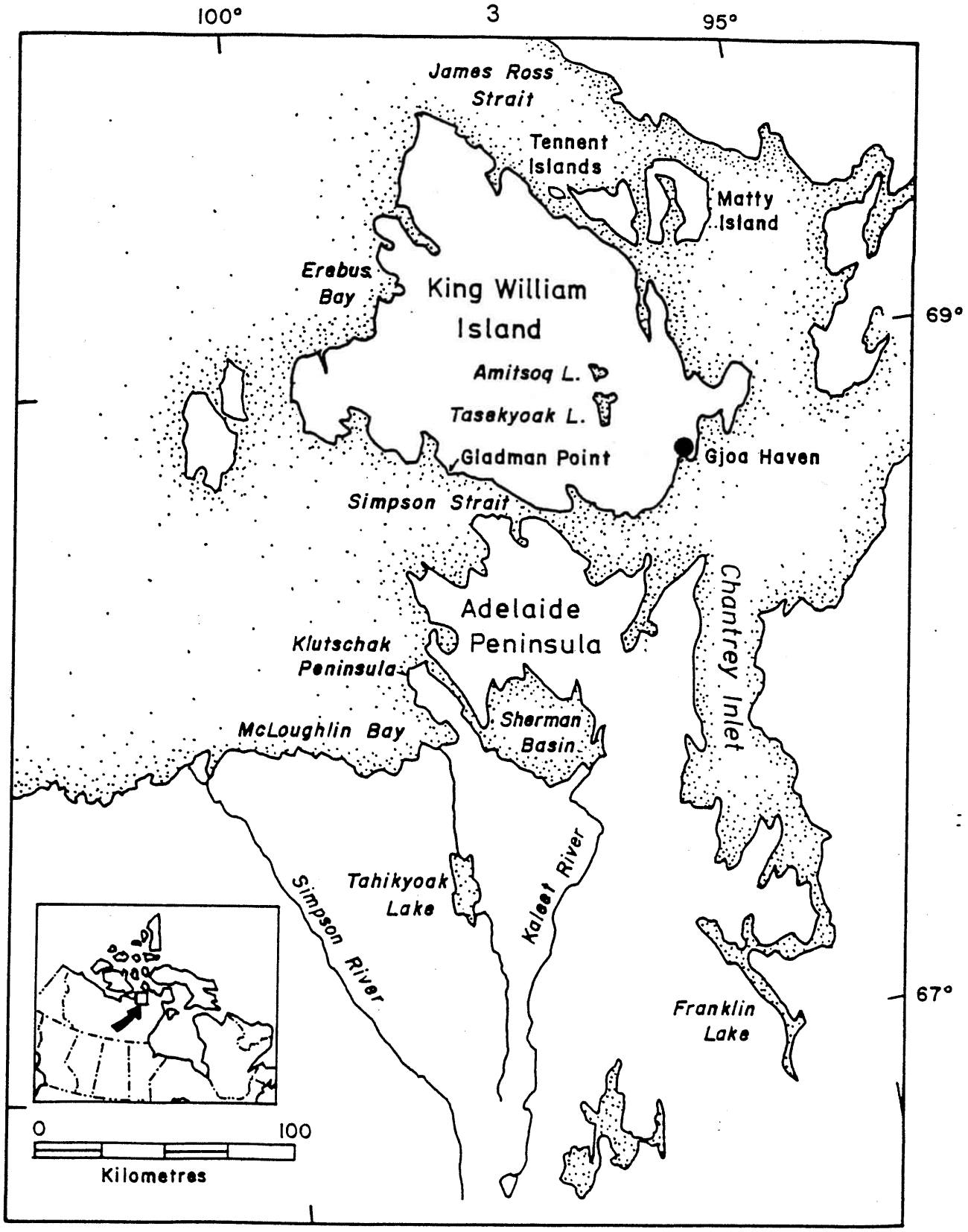

Figure 1. The King William Island and Adelaide Peninsula survey area, NWT.

and windows. The transect width was 1.0 km on both sides of the aircraft. We checked the markers by flying at survey altitude over the lights and runway end markers on the Cambridge Bay airstrip. When flying along the transects, the aircraft altitude was 150 m above ground level. The airspeed was 160 km/h. No sex and age classification counts were systematically attempted during the aerial survey, but we counted calves when they were conspicuous.

June 1992 survey:

We repeated the survey techniques used in 1986 (altitude 150 m agl; 2 km strip width; speed 160km/h) including the same aircraft flying along similar transects and with the same 20% coverage. We did not survey King William Island in June 1992.

Data analyses:

We 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 1986 (H_o: $T_1 \leq T_2$) was tested using a one-tailed Student's t-test. The probability of a Type I error was set at 0.05 and the consequential difference of interest was set at 25% of the 1986 estimate. The difference between the right and left observer's counts was not tested for significance as sample sizes were too small.

RESULTS

June 1986 survey

We flew 1,560 km of strip transects for a total flying time of 88.0 h. This included 19.5 h for the muskox survey, 40.6 h for the caribou survey, 14.9 h of ferry time from Norman Wells to Gjoa Haven and 13.0 h ferry time between Gjoa Haven (our operational base) and the transects. We flew the transects on Adelaide Peninsula between 6 and 7 June, 1986 (Figure 2), and those on King William Island on 10 and 11 June 1986 (Figure 3).

We saw no muskoxen on King William Island. On Adelaide Peninsula and south of it, we counted 44 muskoxen (excluding 6 calves) for an estimate of 213 ± 125 (S.E.) muskoxen (Table 1, Appendix A). The estimate is imprecise as the densities were low and the muskoxen were clumped in relatively large herds (Table 1). We counted 92 muskoxen (excluding 22 calves) off transect during the survey (Figure 2). The mean size of the 16 herds (excluding calves) was 15.7 ± 3.50 (S.E.) and the proportion of calves was 17.1% (28/164).

June 1992 survey:

We counted 233 muskoxen (excluding 18 calves) on 1,512 km of strip transects flown across Adelaide Peninsula and west of Chantrey Inlet. This resulted in an estimate of 1,165 ± 381 (S.E.) muskoxen (Table 1, Appendix B). The total flying time of

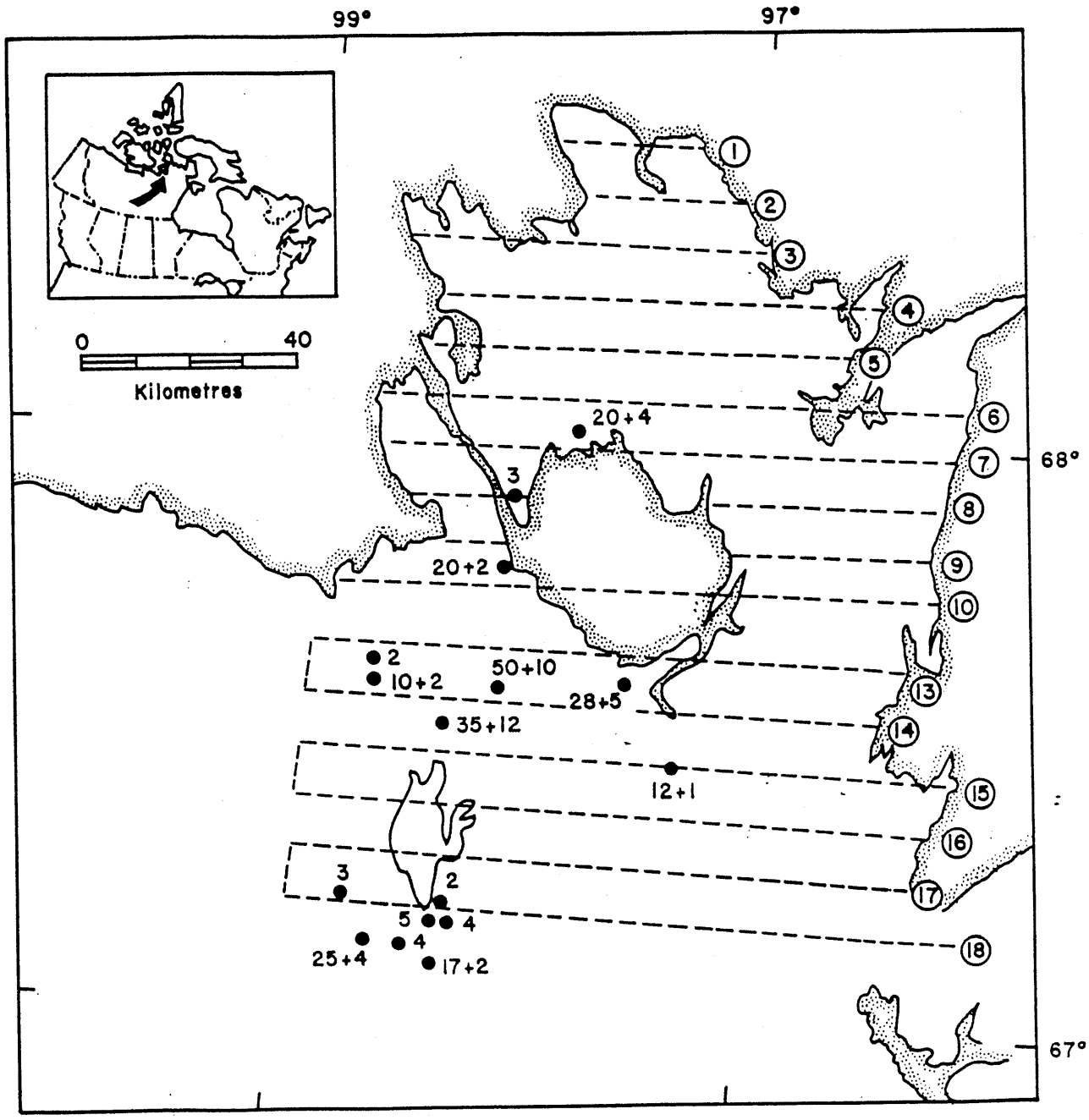

Figure 2. Muskox observations recorded during a survey of Adelaide Peninsula, NWT, June 1986.

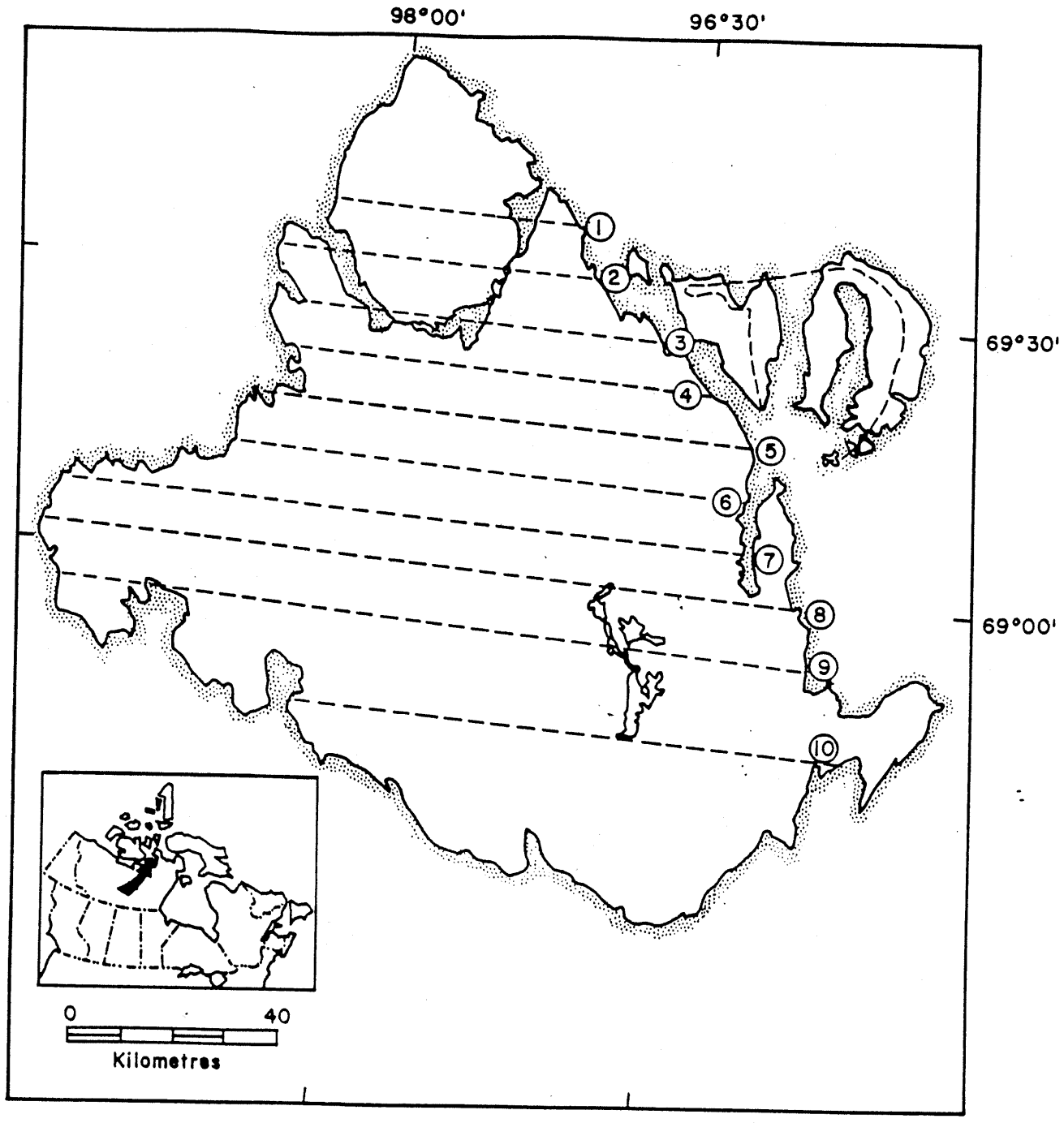

Figure 3. Transect lines flown during a survey of King William Island, NWT, June 1986.

20.3 h included 18.9 h for the muskox survey and 2.1 h of ferry time from Pelly Bay to Gjoa Haven then to Spence Bay. We flew the transects on Adelaide Peninsula between 20 and 21 June, 1992 (Figure 4).

The number of muskoxen estimated was imprecise as the densities were low and the muskoxen were clumped in relatively large herds (Table 1). We counted 118 muskoxen off transect (excluding 7 calves) during the survey (Figure 4). The mean size of the 31 herds (excluding calves and two single muskoxen) was 11.3 ± 2.00 (S.E.) and the proportion of calves was 6.6% (25/376).

Table 1. Analysis of data from transect surveys, Adelaide Peninsula and the area south, NWT, June 1986 and 1992

	1986	1992
Maximum number of transects (N)	82	82
Number of transects surveyed (n)	17	17
Stratum area, km^2 (Z)	15,115	15,115
Transect area, km^2 (z)	3,120	3,023
Number of muskoxen counted (y)	44	233
Muskoxen density, Muskoxen/km^2 (R)	0.014	0.78
Population estimate (Y)	213	1,165
Population variance (Var,Y)	15663	145304
Standard error (SE,Y)	125	381
Coefficient of variation (CV)	0.59	0.33

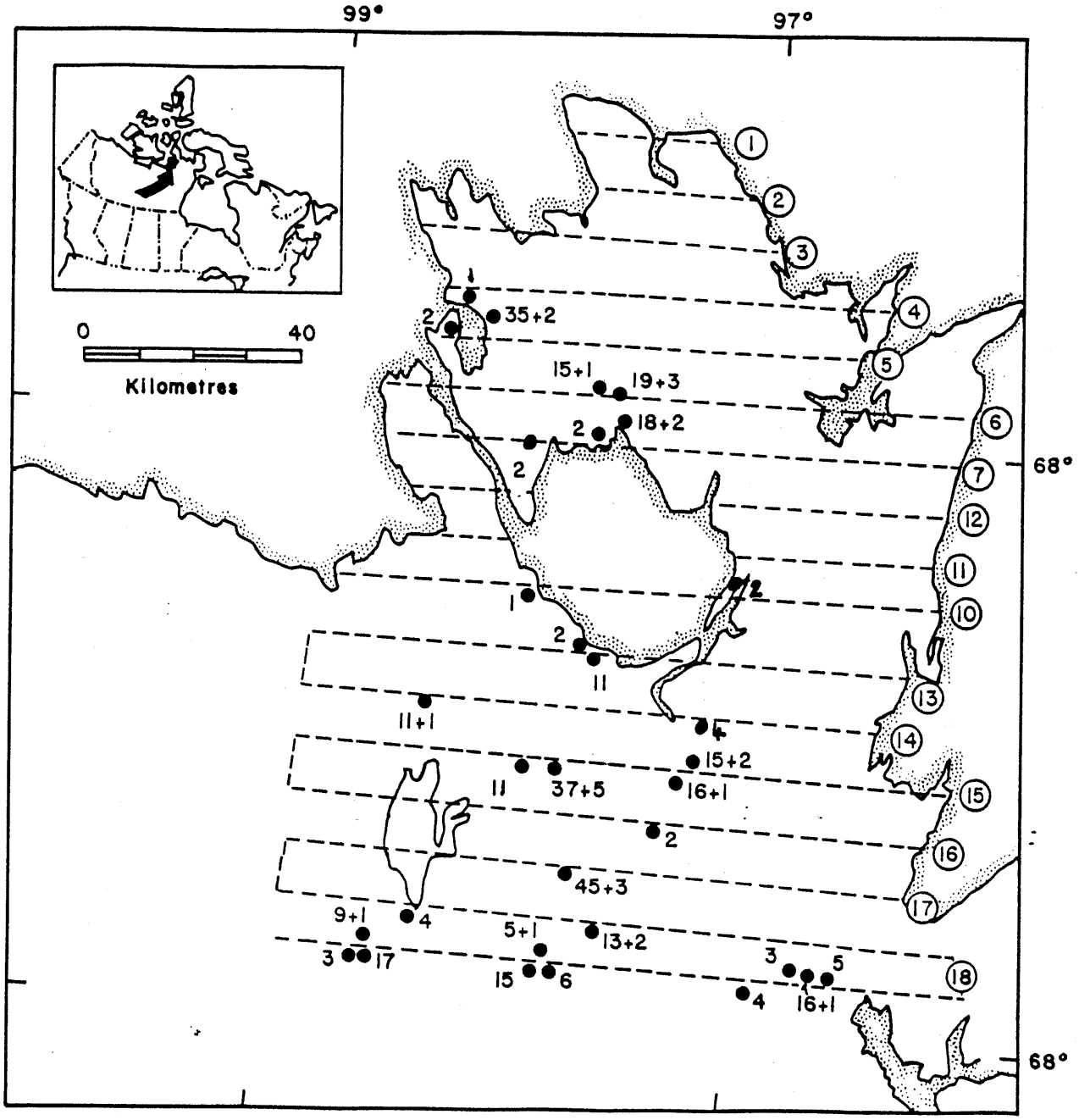

Figure 4. Muskox observations recorded during a survey of Adelaide Peninsula, NWT, June 1992.

Table 2. Weather and light conditions during an aerial survey, King William Island and Adelaide Peninsula, NWT, June 1986 and 1992.

Date	Transects	Weather and light conditions
1986		
6 June	1 - 10	Overcast; caribou inconspicuous
7 June	13 - 17	Overcast becoming broken cloud
10 June	King William	Overcast becoming broken
11 June	King William	Overcast
1992		
20 June	1 - 13	Clear, 12-15 km/h winds
21 June	14 - 17	Clear

DISCUSSION

The muskox population on Adelaide Peninsula had significantly increased between 1986 and 1992 ($P<0.05$, $t' = 2.29$; $t_{.05,45} = 1.73$). We ensured that the survey methodology in June 1992 (aircraft type, speed and altitude; strip width and stratification) were identical to those used in June 1986. This standardization of methods reduces bias which improves accuracy in determining the trend in population size. The low density of muskoxen and their clumping into herds on only a few transect lines contributed to the large variances.

The herd sizes were smaller in 1992, but the difference was insignificant ($t' = 0.26$; $t_{.05,11} = 1.80$). In 1992, calves were scarce. The 1992 snowmelt was 2 weeks late which may have decreased calf survival by imposing nutritional stress on the nursing females.

Muskox history on Adelaide Peninsula and King William Island:

Muskox history on Adelaide Peninsula and King William is fragmentary. What is plain is that the areas are within the historic range of muskoxen and that their numbers had dwindled to virtually none by the late 1960s for reasons that can only be surmised. The archaeological evidence is sparse, but muskox bones (1650 ± 60 A.D.) were found at a Thule site near Gladman Point, on the south coast of King William Island (Savelle 1987). Historic references are also few, but the search for Franklin did bring several expeditions to the area (see Macpherson and Manning 1959 for a summary). Barr

(1991) noted that Simpson (1843 in Barr 1991) is the only historic reference to muskoxen on King William Island. Elder hunters remember isolated muskox occurrences on King William Island; for example, Simon Kernek remembers only two muskoxen being shot on the island about 1919 (S. Kernek pers. comm.). Muskoxen have apparently returned to King William Island. In the 1980s, hunters reported sightings of muskoxen on the northeast and south coasts (B. Konana pers. comm.).

On the nearby mainland, in 1834, Back records killing a muskox near Barrow Inlet and on Montreal Island (in Macpherson and Manning 1959). Klutschak (1987) did not mention muskoxen on King William Island or Adelaide Peninsula, although he travelled extensively in the area in 1880. Brice-Bennet (in Freeman 1976) interviewed hunters in Gjoa Haven and established that muskoxen were hunted south of the Sherman Basin, the mouth of the Kaleet River and Tahikyoak Lake during the period 1927 to 1974. Barr (1991) noted from the RCMP records that 3 muskoxen were killed near Sherman Basin in 1934-35. Macpherson and Manning (1959) spent the 1957 summer describing the bird and mammal life on Adelaide Peninsula. Macpherson and Manning (1959) commented that muskoxen no longer occurred on Adelaide Peninsula, although they used to be common along the Chantrey Inlet coast. They found weathered muskox bones at old camp sites on Adelaide Peninsula.

Distribution and dispersal:

In this report, we use changes in the numbers of herds and individuals to demonstrate that the muskoxen have continued their recolonization since 1983. Both

the numbers of individuals and herds have increased between 1986 and 1992 on Adelaide Peninsula and east of the Kaleet River (Figures 1, 2, and 4; Table 3). Growth of the population is insufficient to explain the increases. This suggests that muskoxen have moved into the areas. Hunters have reported muskoxen throughout the year, which hints that it is colonisation and not seasonal movements that explain the increase.

Table 3. Comparison of muskox distribution on Adelaide Peninsula and east of the Kaleet River, June 1986 and 1992.

Area and Date	No. of herds	No. of individuals (non-calves)
Adelaide Peninsula (north of Transect 10)		
June 1986	2	23
June 1992	10	97
East of the Kaleet River (to the west coast of Chantrey Inlet)		
June 1986	1	12
June 1992	10	84

The recolonization preceding the survey in 1986 is more tenuous as there are few data on the distribution. Gunn and Case (1984) surveyed muskoxen in Queen Maud Gulf in July 1983 as far east as the Kaleet River, but they did not survey

Adelaide Peninsula. Gunn and Case (1984) counted 448 muskoxen along the Simpson River and 24 muskoxen east of the Simpson River to the unnamed river draining north from Tahikyoak Lake. Only two bulls were seen at the mouth of the Kaleet River during a flight along the Kaleet River which was the only flight east of Tschek Lake. Gunn et al. (1984) traced the muskox recolonization of the Queen Maud Gulf and estimated that the average annual rate of spread to the east was 13 km/year.

Management recommendations

The recent management history (Table 4) has been to open up muskox harvesting opportunities to hunters from Gjoa Haven, Taloyoak and Pelly Bay. At the same time, the intent has been to harvest at a level low enough to allow the population to increase to encourage recolonization of historic ranges especially east across Chantry Inlet. The dispersal mechanisms for muskoxen are essentially unknown - which is also the case for most other large mammals as dispersal is difficult to measure (Caughley 1977). If environmental dispersal (sensu Caughley 1977) predominates, then the *ad hoc* strategy of lightly harvesting the low density peripheral areas to build up their density is appropriate. If, however, the dispersal is innate (density-independent) and occurs more as a reproductive strategy (bulls searching for breeding opportunities), then the sex-selective harvesting might be as important as rate. We recommend then that it is important to continue to collect harvest information on which sex and age classes are harvested and where they are taken.

There are two reasons not to recommend a substantial increase in the current

(1995) quota of 40. Firstly, the population is still relatively small and harvesting should remain conservative to encourage the population to continue to increase. Secondly, the muskoxen were unevenly distributed in the survey area and consequently the estimate was imprecise. As they were in only relatively few herds it was impractical to stratify to improve precision. Faced with a small population imprecisely estimated, we recommend a conservative quota. But to assist hunters by increasing access to the muskoxen, however, we recommend that the quota be increased to 55 (4.5% of the 1992 estimate).

Table 4. Chronology of legislative changes for Muskox Management Unit H/1-2.

March 1984	H/1-2 created with quota 10
June 1986	survey did not substantiate a quota increase
June 1992	survey - initial recommendation to increase quota to 30
June 1993	legislative change to increase quota to 30
March 1994	southern boundary of H/1-2 extended to northern boundary H/1-3
March 1994	H/1-2 quota further increased to 40.
June 1995	Eastern boundary H/1-2 extended to 93°W to reduce travelling distance for hunters from Pelly Bay.
October 1995	Hunters from Gjoa Haven request a quota increase for H/1-2

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PERSONAL COMMUNICATIONS

B. Konana, President, Hunters' & Trappers' Association, Gjoa Haven, NWT.

S. Kernek, Gjoa Haven, NWT.

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APPENDIX A: Numbers of muskoxen observed on the Adelaide Peninsula, NWT, June 1986.

Transect Number	Area (km^2)	Muskoxen On Transect	Muskoxen Off Transect
Stratum 1			
1	57.6	0	0
2	57.6	0	0
3	134.4	0	0
4	166.4	0	0
5	160.0	0	0
6	224.0	0	0
7	217.6	0	0
8	147.2	0	0
9	108.8	0	0
10	166.4	0	0
11	240.0	0	60
12	213.0	33	47
13	227.0	13	0
14	245.0	0	0
15	241.0	4	7
16	256.0	0	0
17	258.0	0	0
Total		50	114

APPENDIX B: Numbers of muskoxen observed on the Adelaide Peninsula, NWT, June 1992.

Transect Number	Area (km^2)	Muskoxen On Transect	Muskoxen Off Transect
Stratum 1			
1	54.5	0	0
2	60.6	0	0
3	136.4	0	0
4	165.4	0	0
5	158.6	0	40
6	145.4	38	0
7	217.2	2	22
8	151.5	0	0
9	95.9	0	0
10	163.6	1	2
11	232.3	13	0
12	213.1	12	4
13	227.3	87	0
14	245.3	2	0
15	241.4	48	0
16	256.5	0	19
17	257.6	48	38
Total		251	125