POPULATION ESTIMATES FOR PEARY CARIBOU AND MUSKOX ON BANKS ISLAND, NT, AUGUST 1992

John A. Nagy[1], Anne Gunn[2], and Wendy H. Wright[1]

[1] Department of Environment and Natural Resources
Government of the Northwest Territories
Inuvik, NT X0E 0T0
Canada

[2]Department of Environment and Natural Resources
Government of the Northwest Territories
Yellowknife, NT X1A 2L9
Canada

2009

Manuscript Report No. 198

ABSTRACT

A stratified strip transect aerial survey was conducted on Banks Island, NT during 21 to 30 August 1992 to documented the numbers and distribution of Peary caribou (*Rangifer tarandus pearyi*) and muskox (*Ovibos moschatus*).

We observed a total of 279 non-calf and 113 calf caribou on transect giving estimates of 1,018 ± 270 (95% CI) non-calf and 451 ± 135 (95% CI) calf caribou. Approximately 28.8% of the caribou observed were calves. Overall there were 0.014 non-calf caribou per km^2 on the island. The results of this survey indicate that the Peary caribou population on Banks Island continued to decline between 1989 and 1992.

We observed a total of 11,829 non-calf and 2,455 calf muskoxen on transect giving estimates of 53,526 ± 4,032 (95% CI) non-calf and 11,123 ± 891 (95% CI) calf muskoxen. Approximately 17.2% of the muskoxen observed were calves. Overall, there were 0.758 non-calf muskoxen per km^2 on the island, with densities reaching 1.627 and 1.931 muskoxen per km^2 in the Egg and Massik River drainages, respectively. The results of this study indicate that the muskox population on Banks Island continued to increase between 1989 and 1992.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The history of the Peary caribou and muskox population on Banks Island has been well documented (Nagy *et al.*, 1996; Nagy *et al.*, 1998). Between 1972 and 1989, five whole island surveys had been conducted to document the number of caribou and muskoxen on the island (Urquhart, 1983; Latour, 1985; Nagy *et al.*, 2007a; McLean *et al.*, 1986; McLean, 1992; McLean and Fraser, 1992). Between 1972 and 1992, the Peary caribou population declined from about 12,000 to 2,600 non-calf animals, respectively, while the muskox population increased from about 3,800 to about 34,300 non-calf animals (Urquhart, 1983; Latour, 1985; Nagy *et al.*, 2007a; McLean *et al.*, 1986; McLean, 1992; McLean and Fraser, 1992). Because of the “endangered” status of Peary caribou and the importance of Peary caribou and muskox to the community of Sachs Harbour (subsistence and commercial harvest), the Department of Environment and Natural Resources established a plan in the early 1990s to continue to survey these population every two to four years to monitor their status (McLean, 1992; McLean and Fraser, 1992; Nagy *et al.*, 2007b; Nagy *et al.*, 2007c; Nagy *et al.*, 2007d; Nagy *et al.*, 2007e; Nagy *et al.*, 2007e).

A stratified strip transect aerial survey designed to obtain population estimates for and Peary caribou and muskox on Banks Island was conducted in August 1992 with the following objectives:

- to obtain estimates of the number of non-calf and calf caribou and muskoxen,
- to determine the status of the Peary caribou and muskox population,

- to document observations of wolves and den sites,
- to document the distribution of caribou and muskoxen,
- to recommend whether the current quotas for caribou and muskoxen are sustainable, and
- if necessary, recommend management options to facilitate recovery of the Peary caribou populations.

This report summarizes the results of the survey completed on Banks Island during August 1992.

METHODS

In order to conduct a strip transect survey, we partitioned Banks Island into survey blocks (Figure 1). Transects were oriented to intersect major river systems and drainages at approximately a 90^{o} angle (Figure 2). Survey blocks A, B, C, D, P, and T were flown at 20% coverage (transects spaced at 5-km intervals). Survey blocks E and M were flown at 40% coverage (transects spaced at 2.5 km intervals).

The survey crews were comprised of a pilot, an observer in the left back seat and an observer/recorder in the front right seat of the aircraft (Helio Courier and Cessna 185). Transect lines were marked on 1:250,000 scale NTS maps for each survey block. These maps were used by the pilot to navigated along transects. The aircraft flew at an altitude of 100 m above ground level and airspeed of 160 km per hour.

Caribou were counted inside and outside of the boundaries of a 500 m wide strip on each side of the aircraft. Muskoxen were counted within the boundaries of the strip. Strip width was marked using wooden dowels taped to the wing struts (Cessna 185) or tape marker on a wire stretched between the tie-down rings and the fuselage (Helio Courier) using the formula:

$$w = W \times h \div H$$

where w is the calculated strip width on the ground, W is the chosen survey strip width, h is the height of the observer on the ground, and H is the chosen survey altitude (Norton-Griffiths, 1987). All sightings of wolves were recorded.

Caribou were classified as adults (cows and yearlings), bulls, calves, or unknown. Muskoxen were classified as adults (age ≥ 1 year) and calves (age < 1 year). Observers were equipped with binoculars to help ensure that caribou and muskoxen were counted and classified accurately. If an observer had difficulty, the pilot flew the aircraft off transect and flew in a tight circle around the caribou or muskoxen, so that an accurate count and classification could be done. The pilot then flew the aircraft back to the transect and the survey resumed. The pilot recorded the sighting numbers on the 1:250,000 NTS maps.

We downloaded rasterized versions of the 1:250,000 NTS mapsheets covering Banks Island from Toporama (http://toporama.cits.rncan.gc.ca/toporama_en.html). These were appended using PCI Geomatica software (Geomatica software Geomatica) to create a single raster covering the entire study area. The resulting digital map was imported into OziExplorer GPS software (OziExplorer GPS Mapping Software).

We used OziExplorer to create waypoints at the start and end of each transect and to digitize the location of each observation made during the survey. The resulting OziExplorer waypoint files were parsed using Microsoft Excel and the data for each observation was then entered from the field data sheets. At the end of this process the survey data were geo-referenced. This allowed us to map the distribution of Peary caribou and muskoxen observed during the survey.

Shape files were created for each survey block so that total area of each could be measured using ArcView 3.2 GIS software (Environmental Systems Research Institute). The specifications of the projection used are as follows: Lambert Conformal Conic, NAD83, Central Meridian: 123.0 W, Latitude of Origin: 73.0 N, SP1: 72.0 N, SP2: 74.0 N.

The numbers of non-calf and calf caribou and muskoxen observed on and off transect for each transect was summarized using Microsoft Excel. The length of each transect was derived using the start and end point coordinates of each transect and the route function in OziExplorer.

The population estimates and associated statistics were calculated using the Aerial2 version 3.0 method 2 (Krebs, 1999). Estimates for non-calf, calf, and all caribou and muskoxen, respectively, were derived for each survey block. Population and variance estimates from each stratum were combined to derive an overall population and population variance estimate for non-calf, calf, and all caribou and muskoxen, respectively, in all survey blocks.

The estimation of population number and variance from stratified surveys is given in (Compton *et al.*, 1995) cited by (Johnson *et al.*, 2004). The total population number is the summation of individual strata estimates or:

$$\hat{N}_{total} = \sum_{h=1}^{L} \hat{N}_h$$

where there are L strata units. Assuming that the selection of sample units within each strata is independent of other strata units, the variance is estimated as the sum of individual variance estimates for each strata, or:

$$\mathrm{var}_{total} = \sum_{h=1}^{L} \mathrm{var}_h$$

Confidence intervals for the population estimate can be approximated by:

$$\hat{N}_{total} \pm t\sqrt{\mathrm{var}_{total}}$$

The degrees of freedom (*d*) for the t-statistic can be approximated by the following formula:

$$d = \frac{\left(\sum_{h=1}^{L} a_h s_h^2\right)^2}{\left[\sum_{h=1}^{L}\left((a_h s_h^2)^2 / (n_h - 1)\right)\right]}$$

where $a_h = N_h(N_h - n_h)/n_h$ where N_h is the possible number of transects in an individual block and n_h is the actual number of transects flown. The sample variance from each block is denoted as s^2 in the above formula, and L is the total number of strata (Compton *et al.*, 1995 cited by Johnson *et al.*, 2004). This assumes that the population estimates and variance estimates from each stratum are unbiased and independent.

Maps showing the distribution of caribou observed on and off transect, muskoxen observed on transect, and wolves on Banks Islands were created using ArcView (Environmental Systems Research Institute).

RESULTS

The survey was completed during 21 to 30 August 1992. Weather conditions were variable with periods of snow, fog, and rain. As a result, conditions were generally moderate to good during the survey. All transect lines were flown as planned except for portions of 7 lines in survey block B (Figure 3). Persistent fog prevented us from surveying the coastal portions of these transects.

Peary caribou

The distribution of non-calf and calf Peary caribou observed during the survey is shown in Figures 4 and 5, respectively. We observed a total of 279 non-calf and 113 calf caribou on transect giving estimates of 1,018 ± 270 (95% CI) non-calf and 451 ± 135 (95% CI) calf caribou on the island (Table 1). Overall there were 0.014 non-calf caribou per km^2.

We were not able to compare the results of this survey with that completed in 1989 because relevant statistics associated with the estimate were not reported (McLean and Fraser, 1992). However, the 95% CIs of the estimates for non-calf caribou do not overlap indicating that the differences were significant (Figure 6). A comparison of the mean population estimates for 1989 (McLean

and Fraser, 1992) and 1992 indicate that the caribou population declined at an annual finite rate of 13% per year during this period (Caughley, 1980).

We observed a total of 279 non-calf and 113 calf caribou on and off transect giving a ratio of 40.5 calves per 100 cows. Approximately 28.8% of the caribou observed during the survey were calves. The majority of these caribou (116 non-calf) and (55 calves) were found on the southeastern portion of the island in survey block D (Table 1 and Figures 4 and 5).

We found 2 caribou mortality sites (Figure 7). These were found in survey blocks T and P on the northern portion of the island.

Muskox

The distribution of non-calf and calf muskoxen observed during the survey is shown in Figures 8 and 9, respectively. We observed a total of 11,829 non-calf and 2455 calf muskoxen on transect giving estimates of 53,526 ± 4,032 (95% CI) non-calf and 11,123 ± 891 (95% CI) calf muskoxen on the island (Table3). Overall there were 0.758 non-calf muskoxen per km^2 on the island (Table 3). Densities exceeded one non-calf muskox per km^2 in the Egg, Massik, and Thomsen river drainages (Table 3).

We were not able to compare the results of this survey with that completed in 1989 (McLean and Fraser, 1992) because relevant statistics associated with the estimate were not reported. However, the 95% CIs of the estimates for non-calf caribou do not overlap indicating that the differences were significant (Figure 10). A comparison of the mean population estimates for 1989

and 1992 indicate that the muskox population increased at an annual finite rate of 52 percent per year during this period (Caughley, 1980) (Figure 10).

Approximately 17.2% of the muskoxen observed on transect were calves. There were 20.8 calves per 100 non-calf muskoxen.

We observed 35 dead muskoxen during the survey. The majority of these were found on the northern portion of island in survey block T (Figure 11). These are areas of high muskoxen densities (Figure 6).

Wolves

We observed a total of 2 wolves. These were found in survey block P west of Parker Point (Figure 12).

DISCUSSION

The results of our survey indicate that there were approximately 1,018 ± 270 non-calf and 451 ± 135 non-calf caribou on Banks Island (70,583 km^2). We were not able to compare the results of the 1989 and 1992 surveys because relevant statistics associated with the 1989 estimate were not reported (McLean and Fraser, 1992). However, the 95% CIs of the estimates for non-calf caribou do not overlap indicating that the two estimates are significantly different; the 1992 estimate is significantly lower than that for 1989. This indicates that the Peary caribou population on Banks Island continued to decline between 1989 and 1992.

The majority of the Peary caribou are typically found on post-calving ranges on the extreme northwestern portion of Banks Island. The majority of the caribou during this survey were found on late-summer ranges in the central and southeastern portions of Banks Island.

The results of our survey indicate that there were 53,526 ± 4,032 non-calf and 11,123 ± 891 calf muskoxen on Banks Island. We were not able to compare the results of the 1989 and 1992 surveys because relevant statistics associated with the 1989 estimate were not reported (McLean and Fraser, 1992). However, the 95% CIs of the estimates for non-calf muskox do not overlap indicating that the two estimates are significantly different; the 1992 estimate is significantly higher than that for 1989. This indicates that the muskox population on Banks Island continued to increase between 1989 and 1992.

The majority of muskoxen were found in the Egg, Massik, and Thomsen river drainages. This is consistent with observations made in the past.

We observed 2 wolves during the survey; these were found west of Parker Point near an area with large numbers of muskoxen.

ACKNOWLEDGEMENTS

This project was funded through the Wildlife Studies Fund allocated to the Department of Environment and Natural Resources under the Inuvialuit Final Agreement.

REFERENCE LIST

Caughley, G. 1980. Analysis of vertebrate populations. A Wiley-Interscience Publication. 234 pp.

Compton, B.B., Zager, P., and Servheen, G. 1995. Survival and mortality of translocated woodland caribou. *Wildlife Society Bulletin* 23: 490-496.

Environmental Systems Research Institute. ArcView GIS:Release 3.2 [software]. Redlands, California: Environmental Systems Research Institute, 1992-1999.

Geomatica software Geomatica. Version 9. Richmond Hill, Ontario: PCI Geomatics, 2005.

Johnson, C.J., Parker, K.L., Heard, D.C., and Seip, D.R. 2004. Movements, foraging habits, and habitat use strategies of northern woodland caribou during winter: Implications for forest practices in British Columbia. *BC Journal of Ecosystems and Management* 5: 22-35.

Krebs, C.J. 1999. Ecological Methods, 2nd edition. Benjamin/Cummings, California.

Latour, P. 1985. Population estimates for Peary caribou and muskoxen on Banks Island in 1982. NWT Wildlife Service File Report No. 49. 21 pp.

McLean, B., Jingfors, K., and Case, R. 1986. Abundance and distribution of muskoxen and caribou on Banks Island, July 1985. Department of Renewable Resources, Government of the Northwest Territories, Inuvik, NWT File Report No. 64. 45 pp.

McLean, B.D. 1992. Abundance and distribution of caribou and muskoxen on Banks Island, NWT July 1987. Department of Renewable Resources, Government of the Northwest Territories, Inuvik, NWT File Report No. 95. 28 pp.

McLean, B.D. and Fraser, P. 1992. Abundance and distribution of Peary caribou and muskoxen on Banks Island, NWT June 1989. Department of Renewable Resources, Government of the Northwest Territories, Inuvik, NWT File Report No. 106. 28 pp.

Nagy, J.A., Gunn A., and Wright, W.H. 2007b. Population estimates for Peary caribou and muskox on Banks Island, NT, August 1992. Department of Environment and Natural Resources, Government of the Northwest Territories, Inuvik, NT, Canada. In prep.

Nagy, J.A., Larter, N., Branigan, M., McLean, E., and Hines, J. 1998. Co-management plan for caribou, muskoxen, Arctic wolves, snow geese, and small herbivores on Banks Island, Inuvialuit Settlement Region, Northwest Territories (draft). prepared by the Department of Resources, Wildlife, and Economic Development, Inuvik Region, Inuvik for the Wildlife Management Advisory Council (Northwest Territories). 80 pp.

Nagy, J.A., Larter, N., and Wright, W.H. 2007c. Population estimates for Peary caribou and muskox on Banks Island, NT, July 1994. Department of Environment and Natural Resources, Government of the Northwest Territories, Inuvik, NT, Canada. In prep.

Nagy, J.A., Larter, N., and Wright, W.H. 2007e. Population estimates for Peary caribou and muskox on Banks Island, NT, July 2001. Department of Environment and Natural Resources, Government of the Northwest Territories, Inuvik, NT, Canada.

Nagy, J.A., Larter, N.C., and Fraser, V.P. 1996. Population demography of Peary caribou and muskox on Banks Island, N.W.T., 1982-1992. *Rangifer* Special Issue No. 9: 213-222.

Nagy, J.A., Larter, N.C., and Wright, W.H. 2007d. Population Estimates for Peary caribou and muxkox on Banks Island, NT, July 1998. Department of Environment and Natural Resources, Government of the Northwest Territories, Inuvik, NT, Canada. In prep.

Nagy, J.A., Latour, P., and Wright, W.H. 2007a. Population estimates for Peary caribou and muskox on Banks Island, NT, July 1982: a retrospective analysis. Department of Environment and Natural Resources, Government of the Northwest Territories, Inuvik, NT, Canada. In prep.

Norton-Griffiths, M. 1987. Counting animals: Serengetti Ecological Monitoring Program Handbook No. 1. African Wildlife Leadership Foundation, Nairobi, Kenya. 110 pp.

OziExplorer GPS Mapping Software D&L Software Pty Ltd. Version 3.95.4m.

Urquhart, D.R. 1983. The status and life history of the Porcupine caribou herd (1983). Prepared for the Department of Renewable Resources, Government of the Yukon Territory. 78 pp.

Figure 1. Location of survey blocks for the August 1992 Banks Island Peary caribou and muskox survey.

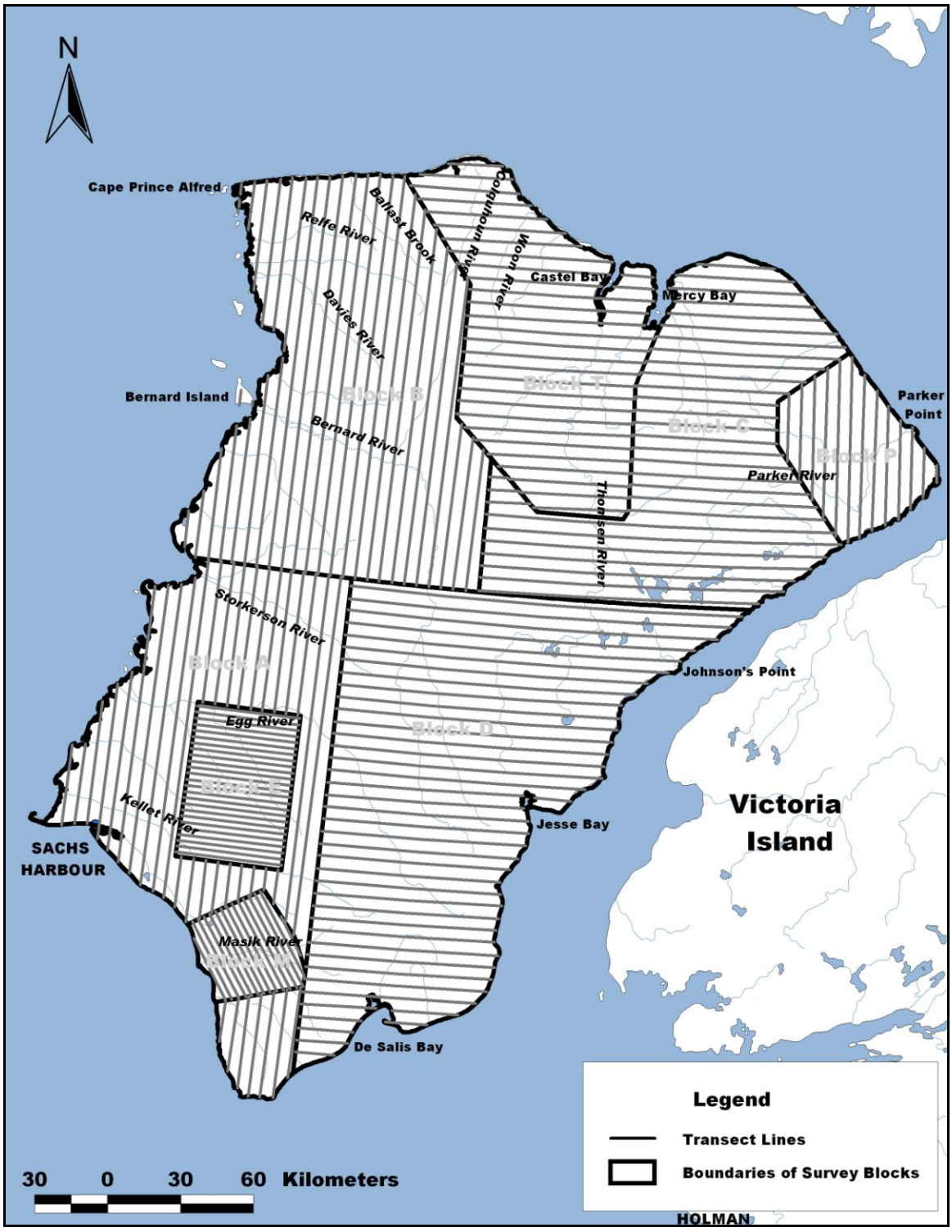

Figure 2. Distribution of survey blocks and transect lines for the August 1992 Banks Island Peary caribou and muskox survey as planned.

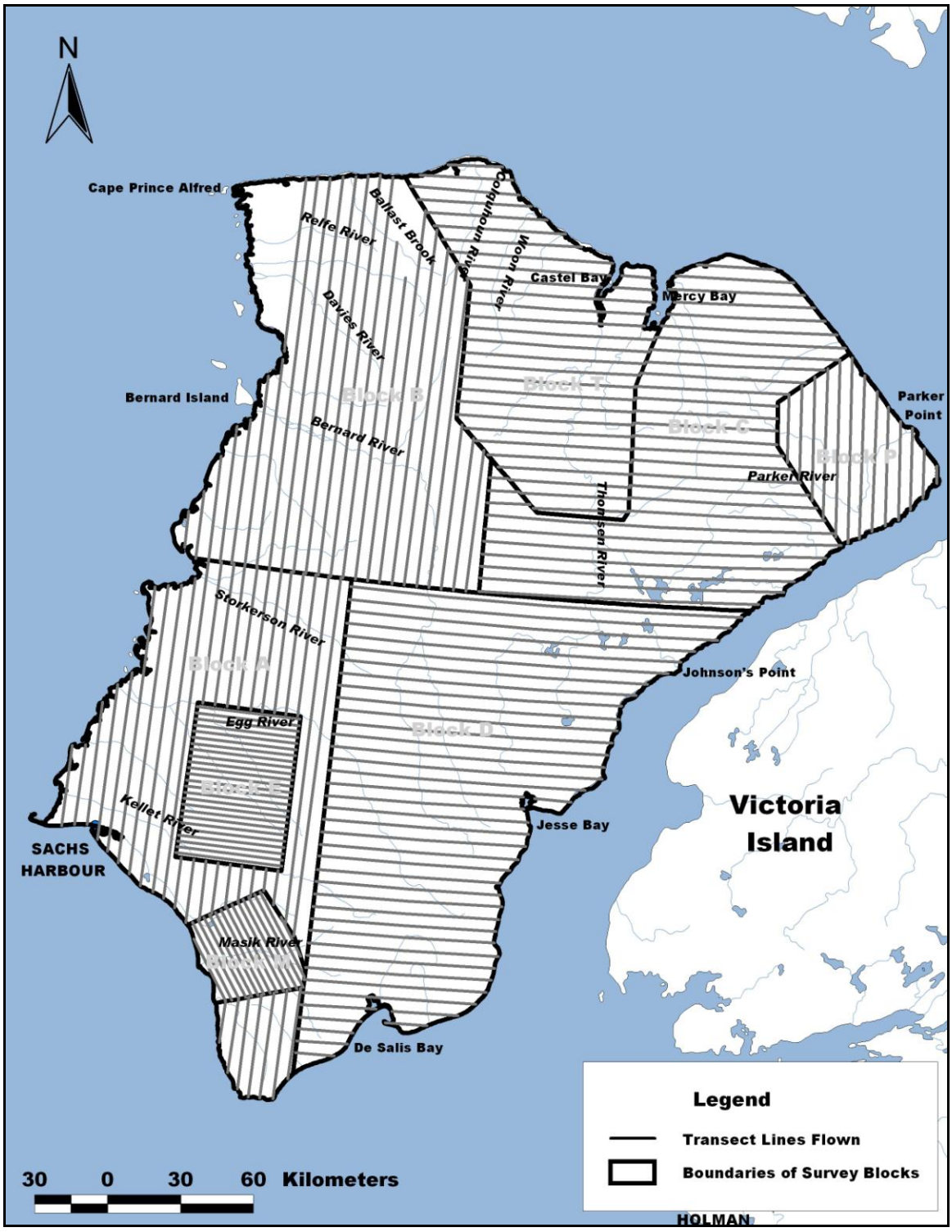

Figure 3. Distribution of survey blocks and transect lines for the August 1992 Banks Island Peary caribou and muskox survey as flown.

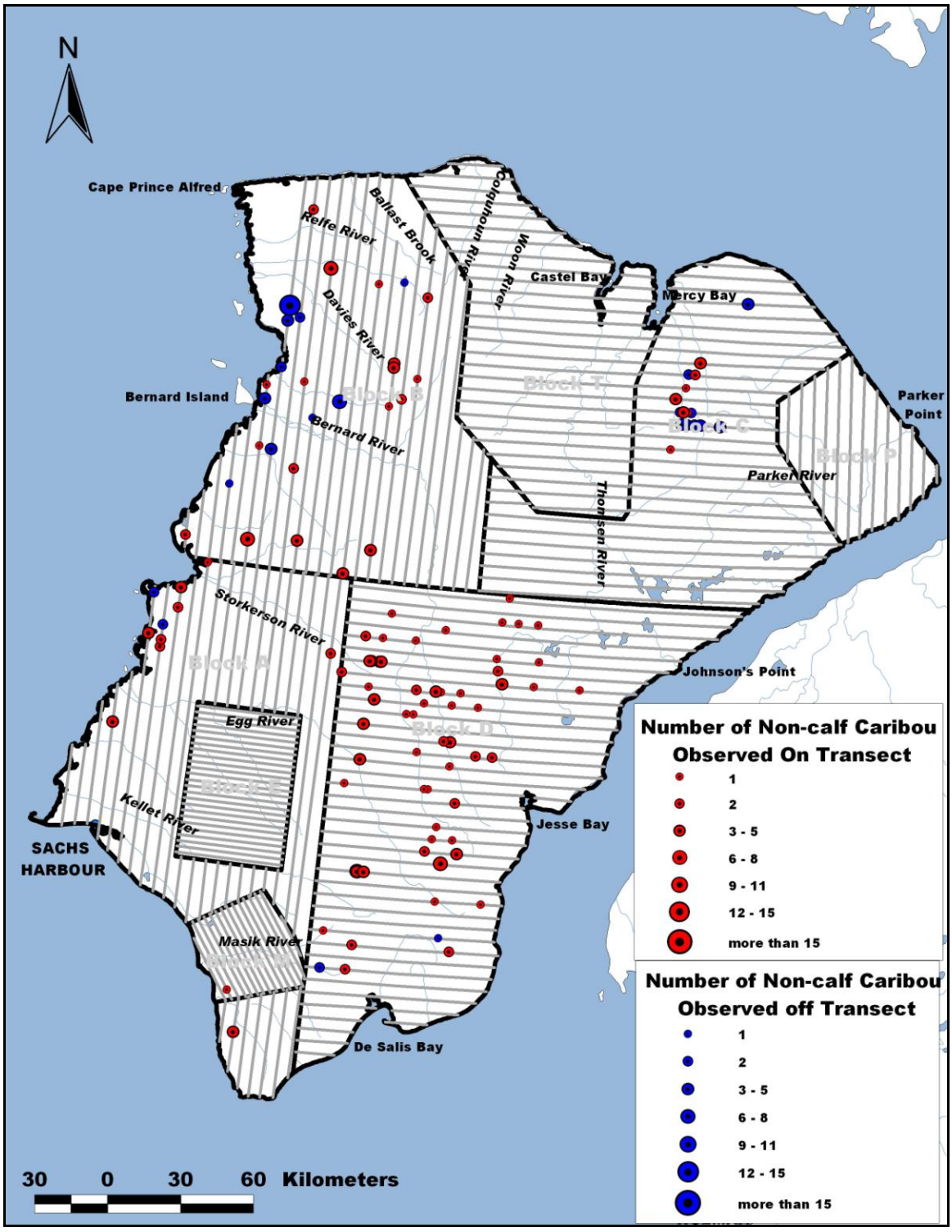

Figure 4. Distribution of non-calf caribou on Banks Island during the August 1992 Banks Island Peary caribou and muskox survey.

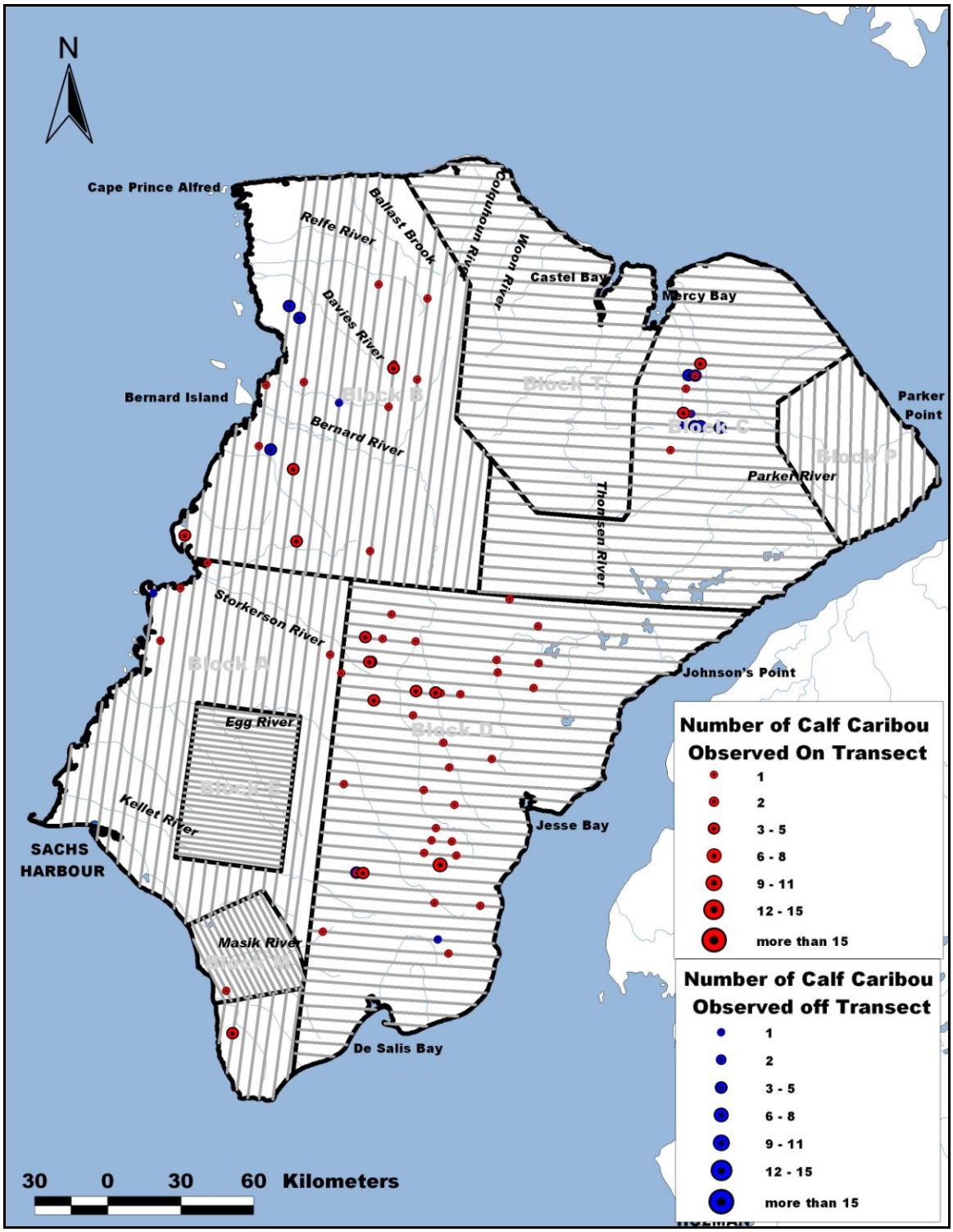

Figure 5. Distribution of calf caribou on Banks Island during the August 1992 Banks Island Peary caribou and muskox survey.

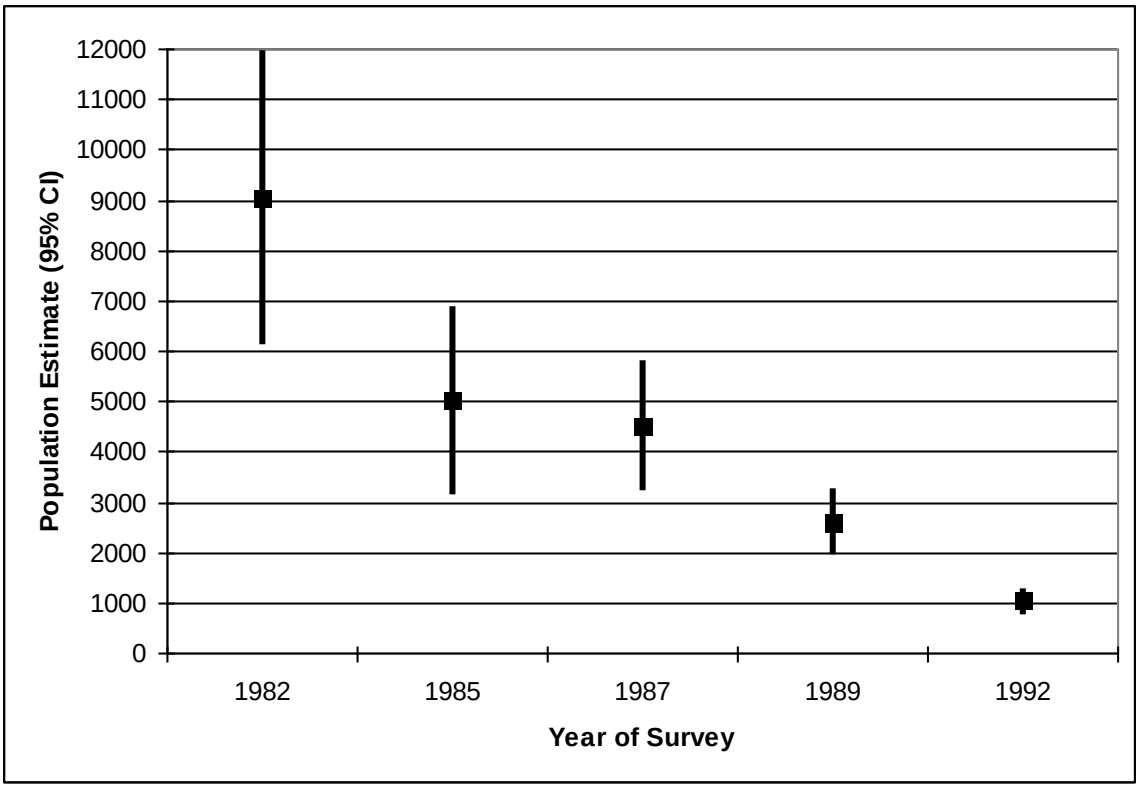

Figure 6. Population estimates with 95% CI for Peary caribou on Banks Island, NT, 1982 to 1992[A].

[A] Population estimates obtained from:

- 1982 (Nagy *et al.*, 2007a)

- 1985 (McLean *et al.*, 1986)

- 1987 (McLean, 1992) Information required to calculate 95% CI was not provided. We estimated the 95% CI as SE*1.96.

- 1989 (McLean and Fraser, 1992) Information required to calculate 95% CI was not provided. We estimated the 95% CI as SE*1.96.

- 1992 (this report)

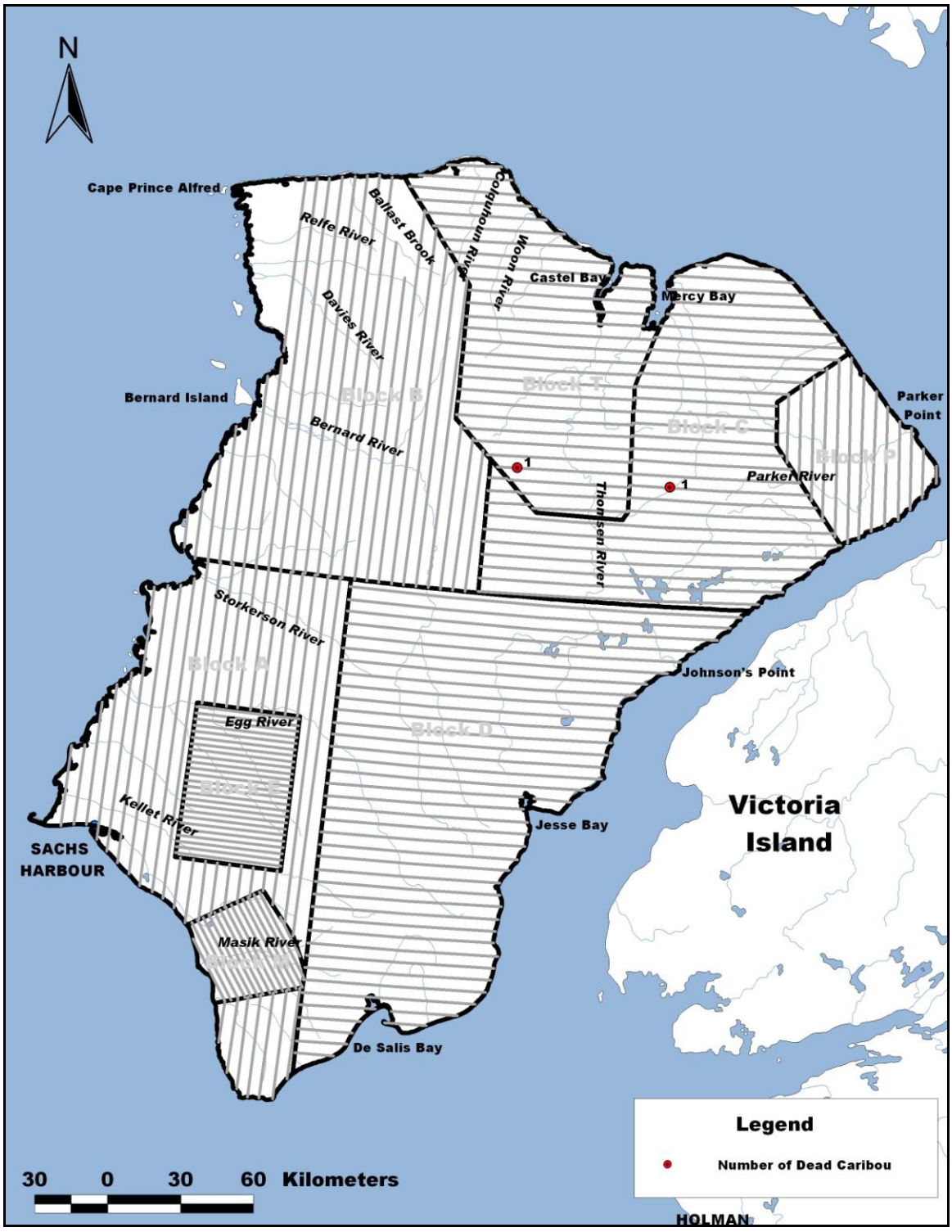

Figure 7. Distribution of dead caribou observed during the 1992 Banks Island Peary caribou and muskox survey.

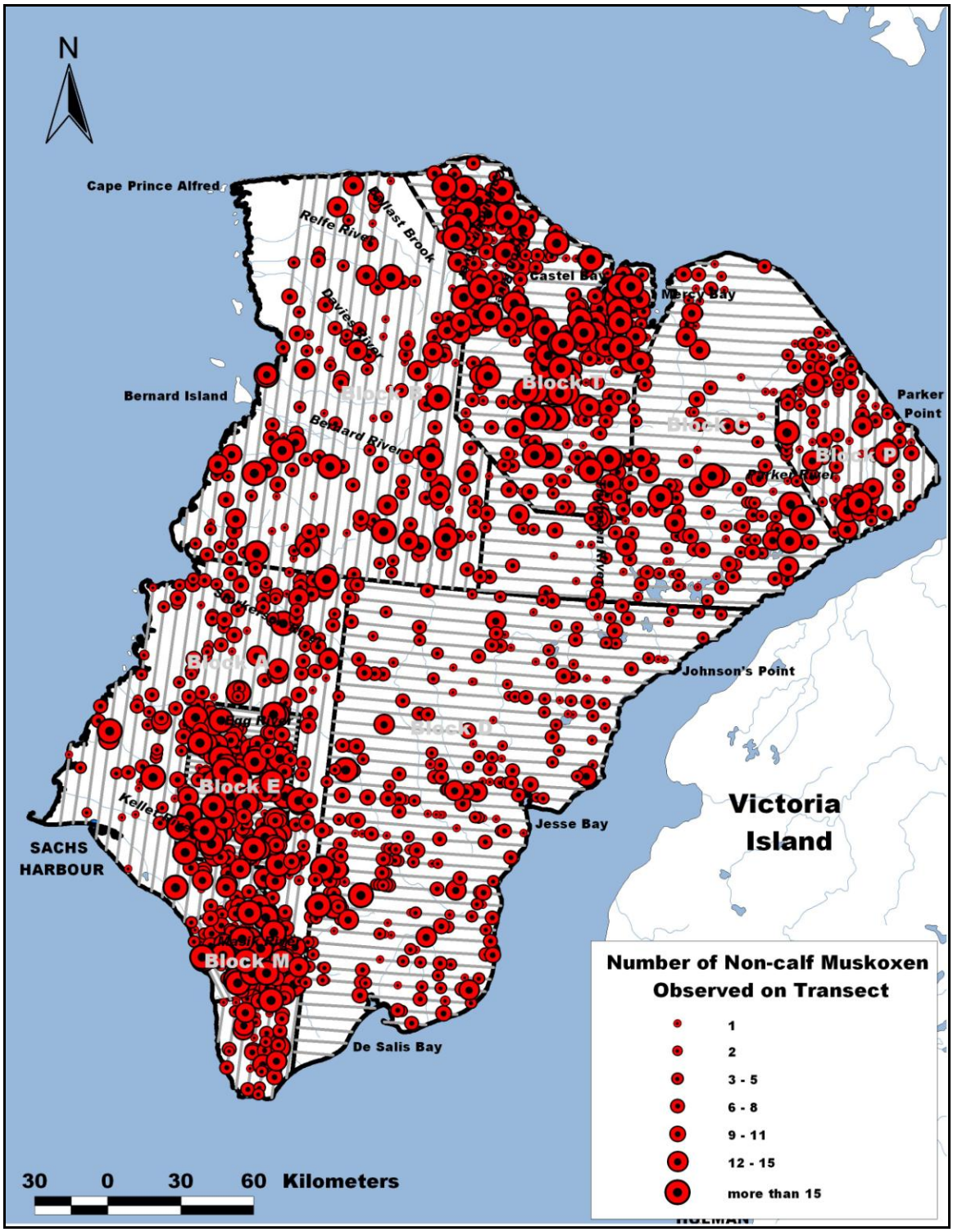

Figure 8. Distribution of non-calf muskoxen on Banks Island during the August 1992 Banks Island Peary caribou and muskox survey.

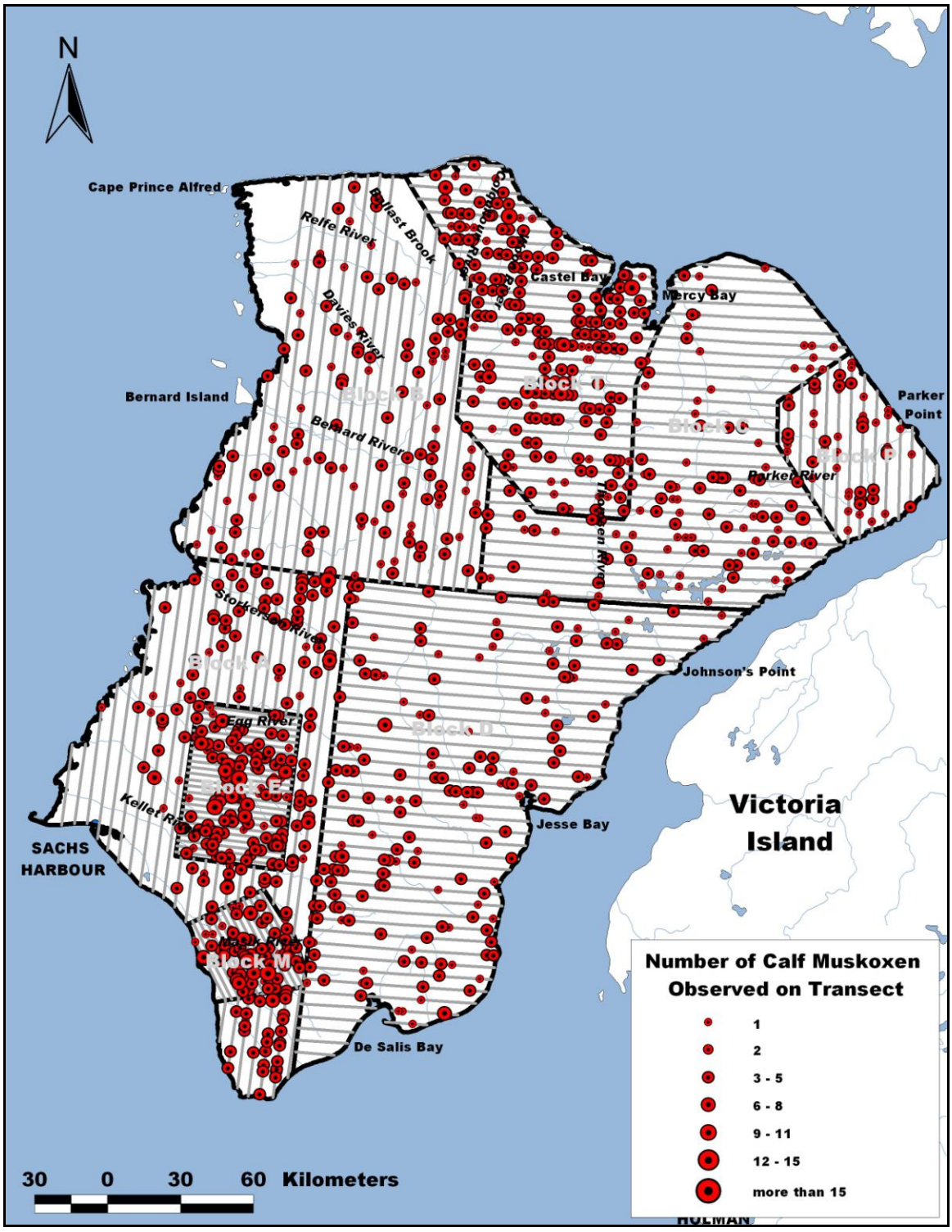

Figure 9. Distribution of calf caribou on Banks Island during the August 1992 Banks Island Peary caribou and muskox survey.

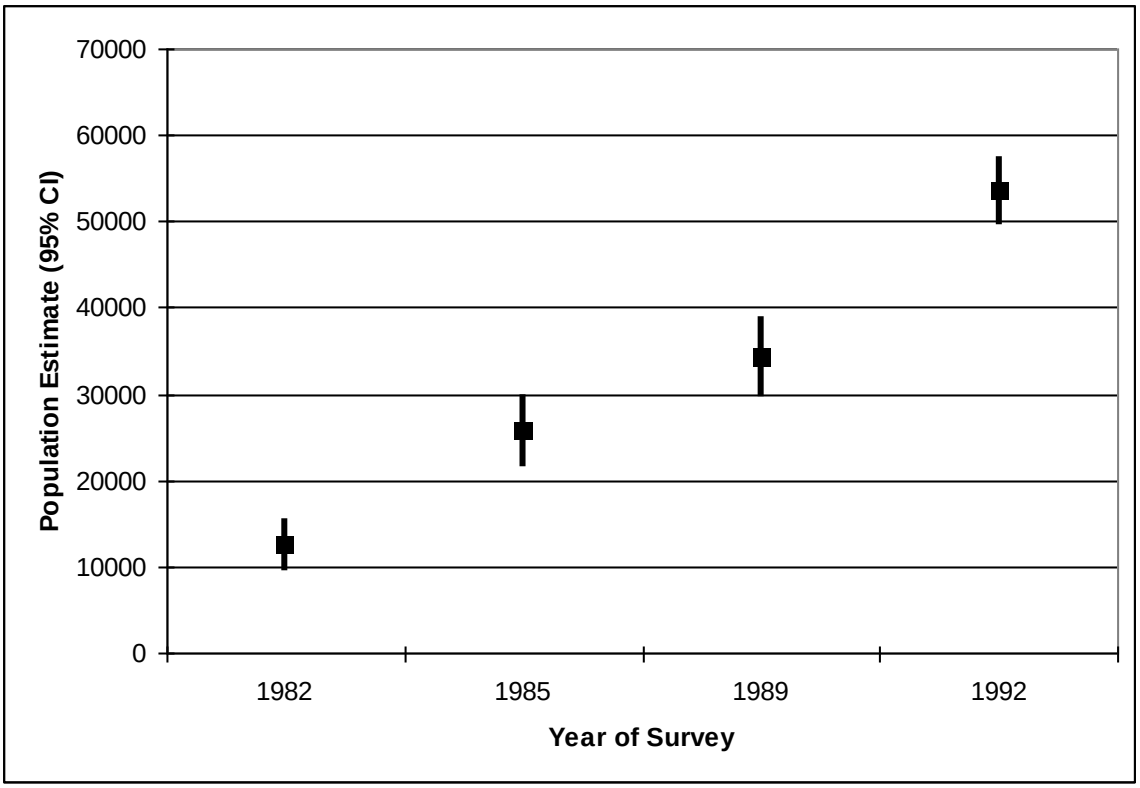

Figure 10. Population estimates with 95% CI for muskox on Banks Island, NT, 1982 to 1992[A].

[A] Population estimates obtained from:

- 1982 (Nagy *et al.*, 2007a)

- 1985 (McLean *et al.*, 1986)

- 1987 (McLean, 1992) Information required to calculate 95% CI was not provided. We estimated the 95% CI as SE*1.96.

- 1989 (McLean and Fraser, 1992) Information required to calculate 95% CI was not provided. We estimated the 95% CI as SE*1.96.

- 1992 (this report).

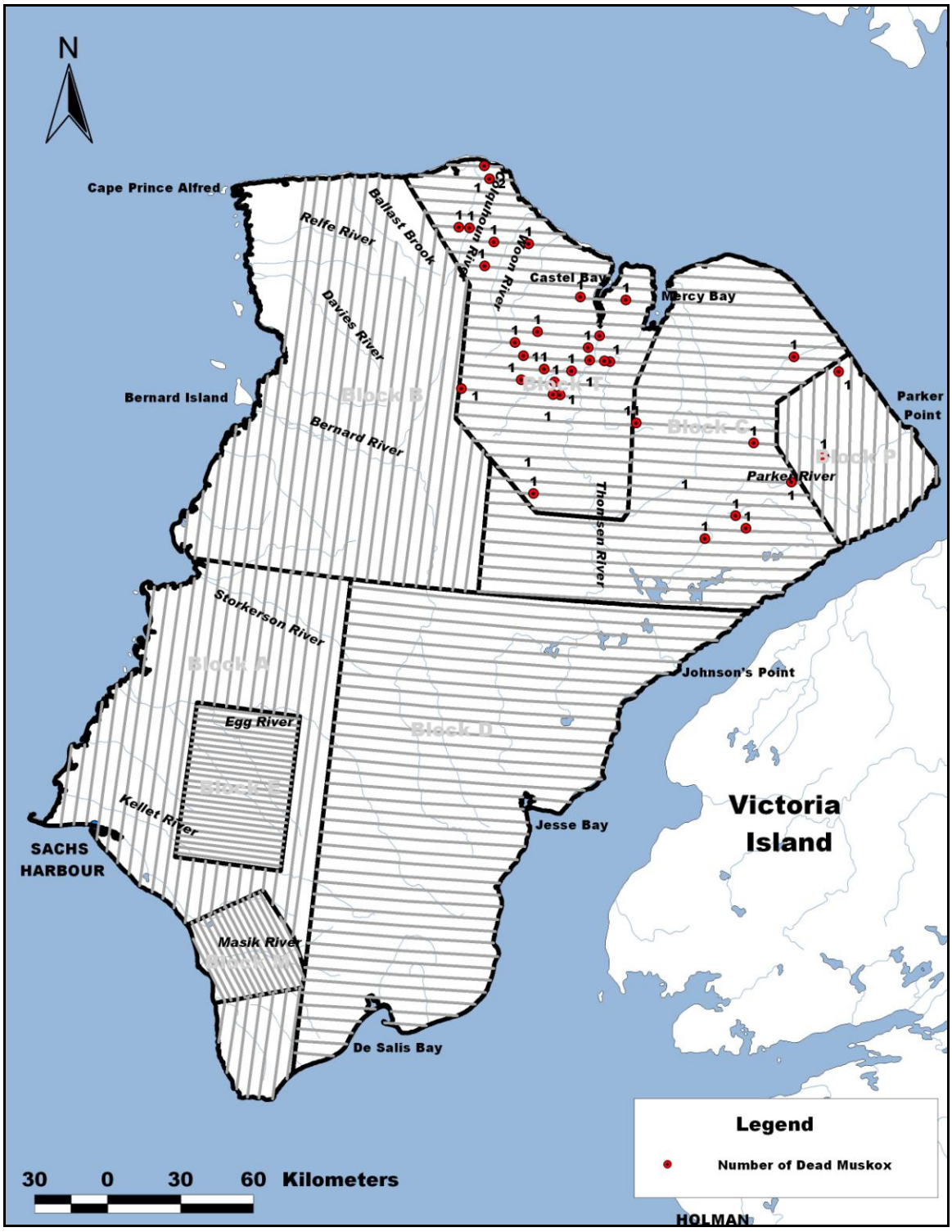

Figure 11. Distribution of dead muskoxen observed during the August 1992 Banks Island Peary caribou and muskox survey.

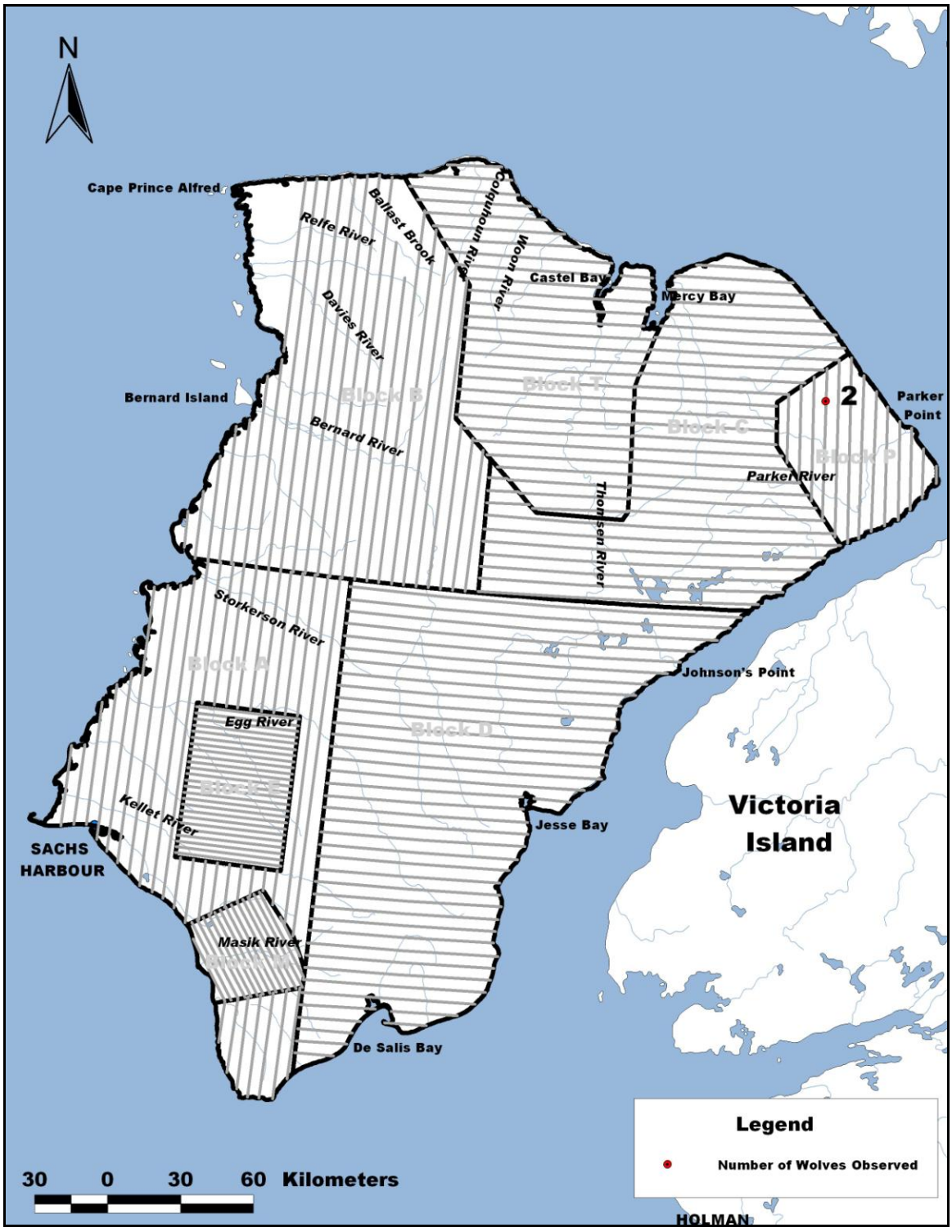

Figure 12. Distribution of wolves observed during the August 1992 Banks Island Peary caribou and muskox survey.

Table 1. Population estimates for Peary caribou on Banks Island, August 1992.

Stratum	Census Area (km^2)	Number of Transects Flown	Number of Possible Transects	Density (per km^2)	Population Total	Variance of Totals	S.E. of Y	95% Confidence Interval (±)	% of Total Area Sampled	Number On Transect	Number Off Transect	Coefficient Of Variation	df
Caribou: Non-calf													
A	10851	36	112.3	0.013	137	548.3	23.4	48	18.9	26	4	0.171	
B	14828	24	126.1	0.018	264	6795.5	82.4	171	18.2	48	37	0.313	
C	11477	28	142.8	0.006	70	809.4	28.4	58	20.0	14	33	0.406	
D	17832	36	202.4	0.031	545	9409.5	97.0	197	19.5	106	10	0.178	
E	2698	25	63.3	0.000	0				20.1	0	0		
M	1427	15	45.7	0.002	3	6.3	2.5	5	39.2	1	0	0.984	
P	2983	13	66.0	0.000	0				19.9	0	0		
T	8487	28	140.7	0.000	0				19.0	0	0		
sum of blocks	70583	205	899.3	0.014	1018	17569.0	132.5	270	20.4	195	84	0.130	33
Caribou: Calf													
A	10851	36	112.3	0.004	48	179.6	13.4	27	18.9	9	1	0.282	
B	14828	24	126.1	0.007	99	1145.7	33.8	70	18.2	18	8	0.343	
C	11477	28	142.8	0.004	40	327.0	18.1	37	20.0	8	13	0.452	
D	17832	36	202.4	0.015	262	2727.6	52.2	106	19.5	51	4	0.199	
E	2698	25	63.3	0.000	0				20.1	0	0		
M	1427	15	45.7	0.002	3	6.3	2.5	5	39.2	1	0	0.984	
P	2983	13	66.0	0.000	0				19.9	0	0		
T	8487	28	140.7	0.000	0				19.0	0	0		
sum of blocks	70583	205	899.3	0.006	451	4386.1	66.2	135	20.4	87	26	0.147	34
Caribou: Total													
A	10851	36	112.3	0.017	185	1124.2	33.5	68	18.9	35	5	0.181	
B	14828	24	126.1	0.024	362	12848.7	113.4	235	18.2	66	5	0.313	
C	11477	28	142.8	0.010	110	2022.5	45.0	92	20.0	22	46	0.409	
D	17832	36	202.4	0.045	807	19926.9	141.2	287	19.5	157	14	0.175	
E	2698	25	63.3	0.000	0				20.1	0	0		
M	1427	15	45.7	0.004	5	25.2	5.0	11	39.2	2	0	0.984	
P	2983	13	66.0	0.000	0				19.9	0	0		
T	8487	28	140.7	0.000	0				19.0	0	0		
sum of blocks	70583	205	899.3	0.021	1469	35947.5	189.6	386	20.4	282	70	0.129	33

Table 2. Population estimates for muskox on Banks Island, August 1992.

Stratum	Census Area (km^2)	Number of Transects Flown	Number of Possible Transects	Density (per km^2)	Population Total	Variance of Totals	S.E. of Y	95% Confidence Interval (±)	% of Total Area Sampled	Number On Transect	Number Off Transect	Coefficient Of Variation	
Muskox: Non-calf													
A	10851	36	112.3	0.733	7957	281583.7	530.6	1077	18.9	1507	not recorded	0.067	
B	14828	24	126.1	0.476	7055	338797.3	582.1	1204	18.2	1285	not recorded	0.083	
C	11477	28	142.8	0.473	5423	492931.7	702.1	1441	20.0	1084	not recorded	0.129	
D	17832	36	202.4	0.419	7478	569390.3	754.6	1532	19.5	1455	not recorded	0.101	
E	2698	25	63.3	1.627	4391	114654.8	338.6	699	39.6	1738	not recorded	0.077	
M	1427	15	45.7	1.931	2756	91249.3	302.1	648	39.2	1080	not recorded	0.110	
P	2983	13	66.0	0.979	2919	178689.4	422.7	921	19.9	581	not recorded	0.145	
T	8487	28	140.7	1.832	15548	1806956.7	1344.2	2758	19.9	3099	not recorded	0.086	
sum of blocks	70583	205	899.3	0.758	53526	3874253.2	1968.3	4032	20.4	11829		0.037	28
Muskox: Calf													
A	10851	36	112.3	0.182	1975	31044.1	176.2	358	18.9	374	not recorded	0.089	
B	14828	24	126.1	0.094	1400	14279.7	119.5	247	18.2	255	not recorded	0.085	
C	11477	28	142.8	0.089	1026	22237.8	149.1	306	20.0	205	not recorded	0.145	
D	17832	36	202.4	0.108	1927	43443.3	208.4	423	19.5	375	not recorded	0.108	
E	2698	25	63.3	0.327	882	5236.1	72.4	149	39.6	349	not recorded	0.082	
M	1427	15	45.7	0.426	607	7486.7	86.5	186	39.2	238	not recorded	0.142	
P	2983	13	66.0	0.138	412	5982.5	77.3	169	19.9	82	not recorded	0.188	
T	8487	28	140.7	0.341	2895	60583.1	246.1	505	19.9	577	not recorded	0.085	
sum of blocks	70583	205	899.3	0.158	11123	190293.2	436.2	891	20.4	2455		0.039	31
Muskox: Total													
A	10851	36	112.3	0.915	9931	480197.2	693.0	1407	18.9	1881	not recorded	0.070	
B	14828	24	126.1	0.570	8455	487354.5	698.1	1444	18.2	1540	not recorded	0.083	
C	11477	28	142.8	0.562	6448	719525.3	848.2	1741	20.0	1289	not recorded	0.132	
D	17832	36	202.4	0.527	9405	895290.4	946.2	1921	19.5	1830	not recorded	0.101	
E	2698	25	63.3	1.954	5272	159597.6	399.5	825	39.6	2087	not recorded	0.076	
M	1427	15	45.7	2.357	3363	145266.6	381.1	818	39.2	1318	not recorded	0.113	
P	2983	13	66.0	1.117	3331	247299.7	497.3	1084	19.9	663	not recorded	0.149	
T	8487	28	140.7	2.173	18443	2471915.8	1572.2	3226	19.9	3676	not recorded	0.085	
sum of blocks	70583	205	899.3	0.916	64650	5606447.2	2367.8	4850	20.4	14284		0.037	28

APPENDIX A.

Transect data for the August 1992 Banks Island Peary caribou and muskox survey.

Survey Block	Transect Number	Transect Area (km^2)	Caribou: Non-calf	Caribou: Calf	Caribou: Total	Muskox: Non-calf	Muskox: Calf	Muskox: Total
A	A01	32.914	0	0	0	1	0	1
	A02	32.723	0	0	0	3	0	3
	A03	50.044	0	0	0	16	1	17
	A04	63.618	4	0	4	32	0	32
	A05	73.247	0	0	0	5	0	5
	A06	113.048	3	0	3	22	2	24
	A07	118.288	6	1	7	33	7	40
	A08	123.243	5	1	6	79	19	98
	A09	128.522	0	0	0	38	6	44
	A10	138.433	1	1	2	66	15	81
	A11	78.392	0	0	0	51	13	64
	A12	83.727	0	0	0	44	13	57
	A13	81.542	0	0	0	69	13	82
	A14	78.617	0	0	0	68	14	82
	A15	75.364	0	0	0	83	28	111
	A16	89.381	0	0	0	49	9	58
	A17	99.837	5	5	10	82	15	97
	A18	104.383	0	0	0	146	43	189
	A19	113.873	0	0	0	131	18	149
	A20	185.394	0	0	0	287	94	381
	A21	191.175	2	1	3	202	64	266
	Total	2055.764	26	9	35	1507	374	1881
B	B01	57.543	0	0	0	24	6	30
	B02	61.941	0	0	0	37	9	46
	B03	66.955	0	0	0	47	5	52
	B04	125.082	0	0	0	96	19	115
	B05	131.543	0	0	0	136	28	164
	B06	137.219	0	0	0	75	15	90
	B07	144.208	3	2	5	43	11	54
	B08	151.351	2	0	2	74	14	88
	B09	123.543	14	6	20	39	8	47
	B10	137.258	0	0	0	49	9	58
	B11	163.387	5	1	6	31	6	37
	B12	163.596	0	0	0	87	18	105
	B13	162.633	0	0	0	65	14	79
	B14	161.790	0	0	0	84	18	102
	B15	160.904	9	2	11	36	7	43
	B16	159.600	3	3	6	74	14	88
	B17	159.015	2	0	2	43	7	50
	B18	155.016	0	0	0	76	16	92
	B19	77.179	8	2	10	57	10	67
	B20	58.706	0	0	0	35	6	41

Survey Block	Transect Number	Transect Area (km^2)	Caribou: Non-calf	Caribou: Calf	Caribou: Total	Muskox: Non-calf	Muskox: Calf	Muskox: Total
	B21	55.252	0	0	0	34	6	40
	B22	45.214	0	0	0	38	8	46
	B23	27.097	0	0	0	5	1	6
	B24	14.798	2	2	4	0	0	0
	Total	2700.827	48	18	66	1285	255	1540
C	C01	31.385	0	0	0	7	1	8
	C02	47.607	0	0	0	18	4	22
	C03	54.812	0	0	0	8	2	10
	C04	56.607	0	0	0	3	0	3
	C05	63.631	0	0	0	18	4	22
	C06	71.001	0	0	0	16	2	18
	C07	76.759	0	0	0	33	5	38
	C08	76.601	0	0	0	28	2	30
	C09	72.165	3	2	5	35	4	39
	C10	66.627	2	1	3	7	2	9
	C11	62.077	1	1	2	15	2	17
	C12	57.569	3	0	3	12	1	13
	C13	57.883	4	3	7	9	1	10
	C14	58.188	0	0	0	30	7	37
	C15	58.288	0	0	0	3	1	4
	C16	61.037	1	1	2	1	0	1
	C17	64.775	0	0	0	42	7	49
	C18	71.024	0	0	0	119	26	145
	C19	79.806	0	0	0	44	10	54
	C20	88.462	0	0	0	93	18	111
	C21	96.982	0	0	0	103	19	122
	C22	140.872	0	0	0	100	19	119
	C23	144.452	0	0	0	119	24	143
	C24	138.579	0	0	0	54	11	65
	C25	133.147	0	0	0	44	11	55
	C26	126.950	0	0	0	53	10	63
	C27	123.166	0	0	0	40	8	48
	C28	113.580	0	0	0	30	4	34
	Total	2294.030	14	8	22	1084	205	1289
D	D01	158.884	1	1	2	71	18	89
	D02	155.075	0	0	0	24	4	28
	D03	150.448	4	2	6	37	6	43
	D04	141.714	1	0	1	48	14	62
	D05	136.652	4	4	8	30	8	38
	D06	132.067	2	2	4	22	8	30
	D07	124.288	15	5	20	30	8	38
	D08	120.305	7	2	9	32	8	40
	D09	115.019	9	7	16	35	4	39
	D10	114.365	7	3	10	21	6	27
	D11	114.362	2	1	3	19	5	24
	D12	112.927	3	0	3	33	10	43

Survey Block	Transect Number	Transect Area (km^2)	Caribou: Non-calf	Caribou: Calf	Caribou: Total	Muskox: Non-calf	Muskox: Calf	Muskox: Total
	D13	111.745	5	1	6	7	2	9
	D14	110.930	5	1	6	41	15	56
	D15	110.729	4	1	5	55	14	69
	D16	104.407	0	0	0	98	24	122
	D17	94.721	3	2	5	79	23	102
	D18	80.654	2	1	3	55	16	71
	D19	82.980	0	0	0	19	5	24
	D20	83.753	1	1	2	32	10	42
	D21	83.163	2	2	4	42	6	48
	D22	80.744	7	2	9	38	7	45
	D23	77.901	6	6	12	41	16	57
	D24	74.668	7	3	10	61	19	80
	D25	75.361	0	0	0	90	17	107
	D26	76.571	2	2	4	36	6	42
	D27	75.832	0	0	0	76	18	94
	D28	75.265	0	0	0	49	12	61
	D29	75.207	1	1	2	35	9	44
	D30	77.543	4	1	5	31	9	40
	D31	76.579	0	0	0	28	15	43
	D32	75.819	2	0	2	38	8	46
	D33	74.225	0	0	0	45	9	54
	D34	70.639	0	0	0	22	3	25
	D35	26.999	0	0	0	27	12	39
	D36	17.024	0	0	0	8	1	9
	Total	3469.566	106	51	157	1455	375	1830
E	E01	42.099	0	0	0	58	8	66
	E02	42.149	0	0	0	6	1	7
	E03	42.202	0	0	0	51	11	62
	E04	42.254	0	0	0	59	14	73
	E05	42.306	0	0	0	44	8	52
	E06	42.357	0	0	0	42	8	50
	E07	42.411	0	0	0	99	25	124
	E08	42.460	0	0	0	74	14	88
	E09	42.514	0	0	0	68	14	82
	E10	42.566	0	0	0	53	21	74
	E11	42.617	0	0	0	39	9	48
	E12	42.668	0	0	0	114	26	140
	E13	42.722	0	0	0	56	2	58
	E14	42.774	0	0	0	84	11	95
	E15	42.826	0	0	0	104	19	123
	E16	42.877	0	0	0	75	13	88
	E17	42.929	0	0	0	37	13	50
	E18	42.982	0	0	0	60	20	80
	E19	43.032	0	0	0	71	16	87
	E20	43.085	0	0	0	27	5	32
	E21	43.138	0	0	0	178	29	207
	E22	43.194	0	0	0	107	23	130

Survey Block	Transect Number	Transect Area (km^2)	Caribou: Non-calf	Caribou: Calf	Caribou: Total	Muskox: Non-calf	Muskox: Calf	Muskox: Total
	E23	43.243	0	0	0	89	17	106
	E24	43.291	0	0	0	55	6	61
	E25	43.341	0	0	0	88	16	104
	Total	1068.035	0	0	0	1738	349	2087
M	M01	28.310	0	0	0	40	11	51
	M02	35.481	1	1	2	7	0	7
	M03	36.221	0	0	0	36	9	45
	M04	36.858	0	0	0	121	28	149
	M05	37.488	0	0	0	79	24	103
	M06	38.136	0	0	0	75	7	82
	M07	38.743	0	0	0	131	35	166
	M08	39.442	0	0	0	86	17	103
	M09	40.078	0	0	0	91	24	115
	M10	40.692	0	0	0	101	24	125
	M11	41.459	0	0	0	46	11	57
	M12	42.171	0	0	0	76	12	88
	M13	42.690	0	0	0	102	18	120
	M14	43.522	0	0	0	66	14	80
	M15	17.881	0	0	0	23	4	27
	Total	559.172	1	1	2	1080	238	1318
P	P01	27.508	0	0	0	73	12	85
	P02	38.578	0	0	0	9	0	9
	P03	50.031	0	0	0	81	12	93
	P04	60.351	0	0	0	32	3	35
	P05	71.634	0	0	0	55	8	63
	P06	74.930	0	0	0	71	8	79
	P07	65.948	0	0	0	80	15	95
	P08	56.694	0	0	0	57	7	64
	P09	48.034	0	0	0	88	13	101
	P10	40.036	0	0	0	21	1	22
	P11	32.972	0	0	0	14	3	17
	P12	20.021	0	0	0	0	0	0
	P13	7.069	0	0	0	0	0	0
	Total	593.806	0	0	0	581	82	663
T	T01	22.042	0	0	0	6	2	8
	T02	37.379	0	0	0	22	4	26
	T03	44.090	0	0	0	105	18	123
	T04	45.481	0	0	0	74	9	83
	T05	48.682	0	0	0	218	29	247
	T06	52.999	0	0	0	94	20	114
	T07	56.072	0	0	0	132	30	162
	T08	65.768	0	0	0	129	24	153
	T09	74.399	0	0	0	94	22	116
	T10	70.971	0	0	0	188	32	220
	T11	74.513	0	0	0	130	32	162

Survey Block	Transect Number	Transect Area (km^2)	Caribou: Non-calf	Caribou: Calf	Caribou: Total	Muskox: Non-calf	Muskox: Calf	Muskox: Total
	T12	72.672	0	0	0	159	30	189
	T13	71.780	0	0	0	201	39	240
	T14	76.255	0	0	0	257	41	298
	T15	74.795	0	0	0	214	47	261
	T16	73.352	0	0	0	96	10	106
	T17	71.886	0	0	0	88	16	104
	T18	70.604	0	0	0	146	23	169
	T19	70.862	0	0	0	194	40	234
	T20	71.136	0	0	0	88	18	106
	T21	71.358	0	0	0	115	21	136
	T22	67.922	0	0	0	35	8	43
	T23	63.214	0	0	0	18	4	22
	T24	58.125	0	0	0	120	25	145
	T25	53.636	0	0	0	64	11	75
	T26	48.905	0	0	0	45	6	51
	T27	44.025	0	0	0	35	7	42
	T28	38.536	0	0	0	32	9	41
	Total	1691.457	0	0	0	3099	577	3676