ABUNDANCE AND DISTRIBUTION OF CARIBOU ON BANKS ISLAND, NWT JULY 1987

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ABSTRACT

A stratified strip transect survey of Banks Island, NWT was flown between 27 and 30 June, 1987. The survey documented distribution and numbers of Peary caribou (Rangifer tarandus pearyi). The total number of non-calf caribou observed on transect was 432, resulting in an estimate of 4500 ± 660 (SE of estimate). Densities varied from 0.02 caribou/km^2 in the low-density stratum to 0.4 caribou/km^2 in the high-density stratum on northwestern Banks Island. Mean group size, including calves, was 4.1 ± 3.04 (S.D.) overall and was significantly greater in the high-density area. The proportion of calves to total caribou classified was 22.6% (126/557). The population estimate suggests that numbers have declined from the 1970s. Observations of muskoxen (Ovibos moschatus) were also recorded. That data will be used to map distribution and plan for a population survey of muskoxen in 1989.

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INTRODUCTION

Banks Island (70,000 km^2) is inhabited by both Peary caribou (Rangifer tarandus pearyi) and muskoxen (Ovibos moschatus). Previous survey work suggested that the caribou population declined from an estimated 11,000 animals (including over 2,000 calves) in 1972 (Urquhart 1973) and 8,000-9,000 in 1979-1980 (Vincent and Gunn 1981) to an estimated 5,000 ± 910 (SE of estimate) non-calves in 1985 (McLean et al. 1986).

About 400 caribou/yr are shot by the people of Sachs Harbour for personal consumption. Guided non-resident hunters take about 20 more (M. Fabijan pers. comm.). Caribou are preferred over muskoxen for food. Local people have expressed concerns over the increased numbers of muskoxen and the apparent decrease in the caribou population which they have observed. They feel that the decrease may be due to competition between muskoxen and caribou for food. Numbers of muskoxen have increased from approximately 3,800 in 1973 (Urquhart 1973) to an estimated 25,700 ± 2050 (SE of estimate) in 1985 (McLean et al. 1986). Renewable Resources has monitored the populations of both species through periodic aerial surveys. An aerial survey was conducted in 1987 to confirm the apparent decline in numbers of caribou and to document their distribution.

METHODS

The aerial survey was conducted similarly to the 1985 survey (McLean et al. 1986). For the survey, the island was divided into four relatively equal areas. Transect lines were drawn perpendicular to the major river drainages and were spaced 18 km apart to provide 5-6% coverage (Fig. 1). Strip width was 0.5 km on either side. Areas of caribou concentrations were delineated and an additional eight transects were surveyed in Stratum B-2 to provide higher coverage (15%).

Two Cessna 185 STOL (short takeoff and landing) equipped aircraft on tundra tires were used for the survey. The survey was conducted at an altitude of 150 m agl at an air speed of about 160 kph. Strip width was 0.5 km on each side of the aircraft for a total transect width of 1.0 km. The strip width was marked using wooden dowels taped to the wing struts according to the formula provided by Norton-Griffiths (1978). It was then checked against a known distance on the runway at Sachs Harbour and adjusted accordingly during several passes of each aircraft at survey altitude.

In each aircraft, the pilot navigated and marked the location of animals on 1:250,000 scale topographical maps. Two observers in the rear continuously searched for and counted caribou older than calves observed on transect. Calves were counted whenever possible. The number of muskoxen observed was also recorded. The information was transmitted on a Sigtronics 4-way intercom system

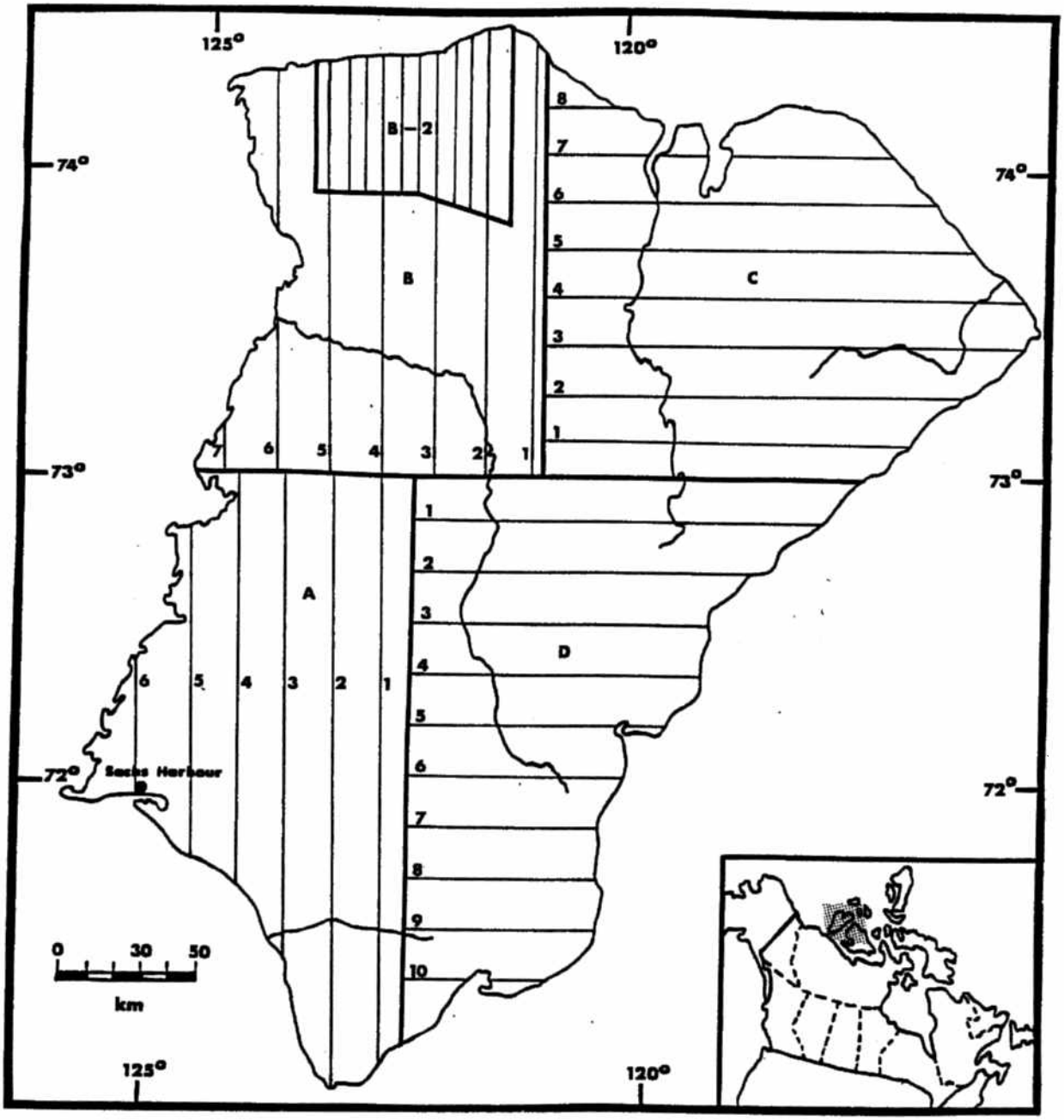

Figure 1. **Transect lines and strata boundaries used during the caribou survey on Banks Island, NWT, June 1987.**

and recorded on data sheets by the front-seat passenger who also assisted by spotting animals for the right rear observer.

Transect data were transcribed daily onto summary sheets. Descriptive statistics were calculated on an Apple IIc computer using a census data program based on Jolly (1969), method 2 for unequal sample sizes. Survey areas were calculated using a polar planimeter.

RESULTS

The survey aircraft were based in Sachs Harbour during the survey, 26-30 June 1987. The survey was initially delayed because of the late snow melt (we wanted no snow to maximize sightability) and poor weather. The survey was completed in 5 days. The weather was good on 3 days, but fog reduced visibility on the first and the last days. Five of the initial 25 transects were shortened because of poor visibility (1D-5D). All were completed later that day or the next day where possible, reducing the likelihood that animal movements biased the results. We flew for approximately 35 hrs for the initial reconnaissance of the whole island from 27-29 June. On 30 June one high density area was resurveyed (15 hrs) for a cumulative total of approximately 60 hrs of survey effort (including ferry time, Appendix A). An attempt to survey additional transects in the Jesse Bay area (Stratum D) on 1 July was cancelled due to persistent fog.

The use of two aircraft was essential to complete the survey in a short time. Division of the island into four parts helped to shorten the transect lines and minimized observer fatigue. The STOL-equipped aircraft also permitted landings for breaks during the survey.

Most of the snow had melted by the start of the survey except for drifts and some patches in high elevations. The majority of caribou were still in light winter pelage and contrasted with the darker ground. Caribou were observed in small groups sparsely

distributed on most of the island. The one area of relatively high caribou density was delineated from the initial transects in the northwest section of the island (Fig. 1).

We observed 431 caribou (non-calves) on transect, 301 in the high-density area (Appendix B). An estimate of 4500 ± 660 (SE of estimate) non-calf caribou was calculated for the entire island (Table 1). The high-density stratum (B-2) covered only 7% of the island, but had over 40% of the estimated caribou (Fig. 2). Densities were low over the rest of the island (0.02 - 0.05 caribou/km^2).

The mean size of caribou groups, excluding single animals but including calves, was significantly larger in the high-density area (4.48 ± 3.39 SD) on northwestern Banks Island than on the rest of the island (3.36 ± 1.91 SD; $t = 1.99$, $0.1>p>0.05$), (Table 2).

The proportion of calves to total caribou was 22.6% (126/557), including individual caribou and all groups for which calf and total counts were determined, and was highest in the high-density area (24.2% vs. 18.8% in the low-density area).

Table 1. Estimated numbers of caribou (non-calves), by stratum, on Banks Island, NWT, June 1987.

Stratum	Density (caribou/Km^2)	Pop. Est. (+S.E.)	Coefficient of Variation	Coverage (%)[a]
LOW DENSITY:				
A	0.02	390 ± 100	0.27	5.7
B	0.03	350 ± 140	0.40	6.0
C	0.04	870 ± 450	0.52	5.2
D	0.05	880 ± 240	0.27	4.8
HIGH DENSITY:				
B-2	0.4	1980 ± 380	0.19	15.0
TOTAL		4500 ± 660	0.15	

[a] based on n/N, proportion of possible transects.

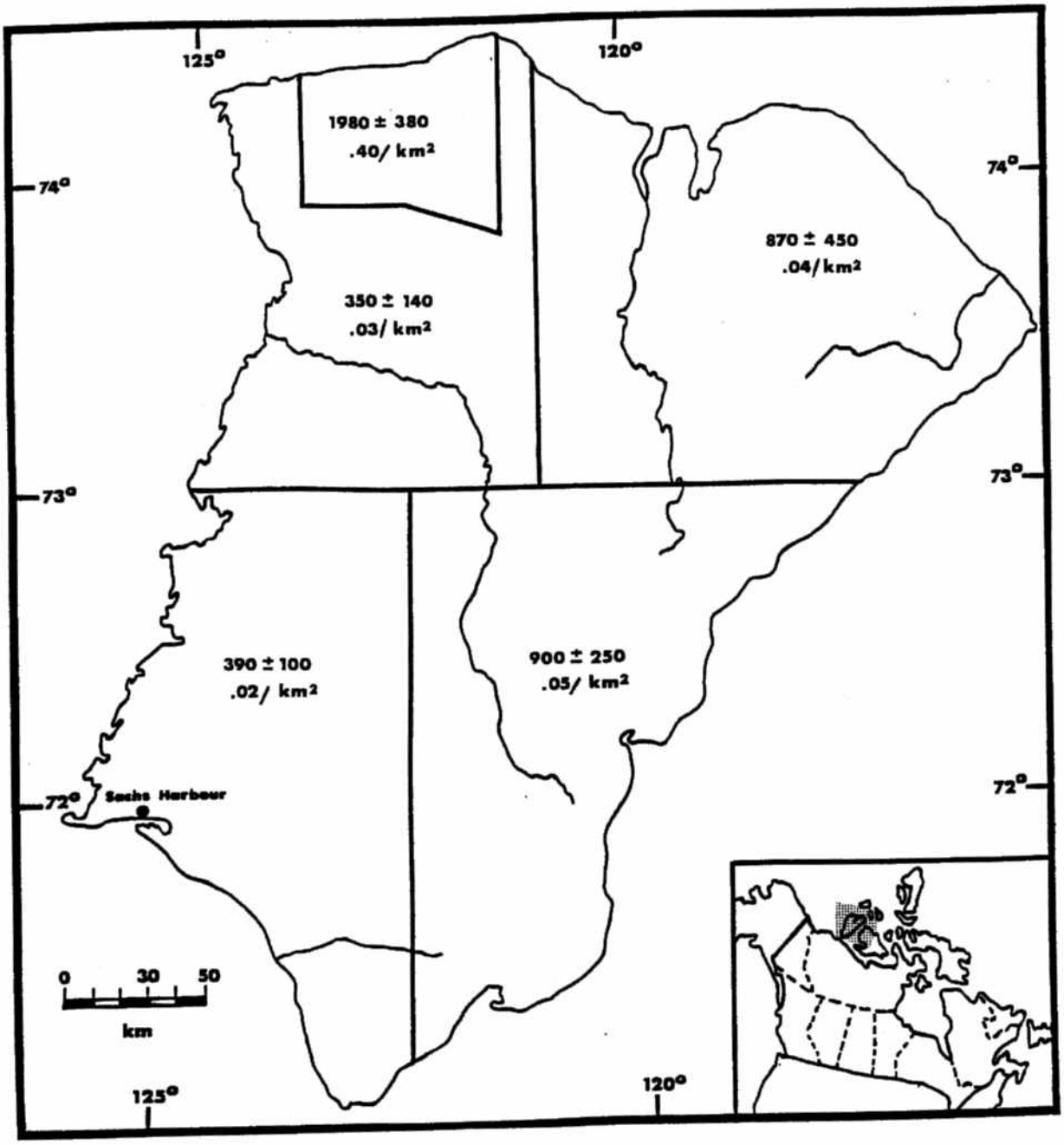

Figure 2. **Population estimates and densities, by stratum, for caribou on Banks Island, NWT, June 1987.**

Table 2. Caribou group characteristics (including calves), by stratum, on Banks Island, NWT, June 1987.

Stratum	Group Size			% Calf/	
	Mean ± S.D.	(N)	Range	Total	(N)
South & East Banks	3.4 ± 1.9	28	2-9	18.8	(160)
Northwest Banks (high density)	4.5 ± 3.4	62	2-18	24.2	(397)
All areas combined	4.1 ± 3.0	90	2-24	22.6	(557)

DISCUSSION

Survey Conditions and Design

Stratification of the high-density area and surveying of additional transects there reduced the variance of the final estimate. Caribou that did not move were difficult to see against some backgrounds. We have no correction factor to quantify this possible bias from missed animals.

Survey altitude and strip width were chosen to maximize visibility of caribou. We flew lower and used a narrower strip than during the 1985 survey (150 m vs 185 m; 1 km vs 2 km).

The coefficient of variation of the estimated number of caribou was 0.15; this is higher than the level of precision (0.10) recommended for the NWT (Heard 1985). The percent coverage of the initial flight lines was quite low (5-6%) and may have contributed to a less precise estimate. A random distribution would have resulted in a lower variance for the same coverage. The caribou had a clumped distribution, although the high-density area was not as discrete as in 1985. The late spring may have contributed to the relatively scattered distribution.

Population Estimates and Trends

The 1987 population estimate of 4500 ± 660 (SE of estimate) is slightly lower than, but not statistically different from, the July 1985 estimate of 5000 ± 910 (SE of estimate, McLean et al. 1986) ($t = 0.4$, $p = 0.10$). The 1985 population estimate was also lower than the estimate in July 1982 of 7200 ± 1000 (SE of the estimate) (Latour 1985). Although the 1985 and 1982 estimates were not statistically significantly different ($t = 1.63$, $p = 0.10$), the 1987 estimate is significantly smaller than the 1982 estimate ($t = 2.25$, $p = 0.05$). The trend in the estimates indicates a decline in numbers of caribou (Fig. 3).

Urquhart (1973) estimated there to be approximately 11,000 caribou in July 1972, including over 2,000 calves. Vincent's 1980 estimate of 8,000-9,000 caribou was calculated by combining the estimates from the north and south of the island surveyed in March 1979 and 1980, respectively.

Latour (1985) believed that sightability of caribou in July 1982 was excellent. In the July 1985 survey, the observers felt that animals were probably missed, as some caribou were not detected until the aircraft was almost past them. In 1987, caribou were more visible with the reduced strip width and lower altitude, although caribou that did not move were difficult to see against some backgrounds. No measure of observer bias is available for the 1985 and 1987 surveys.

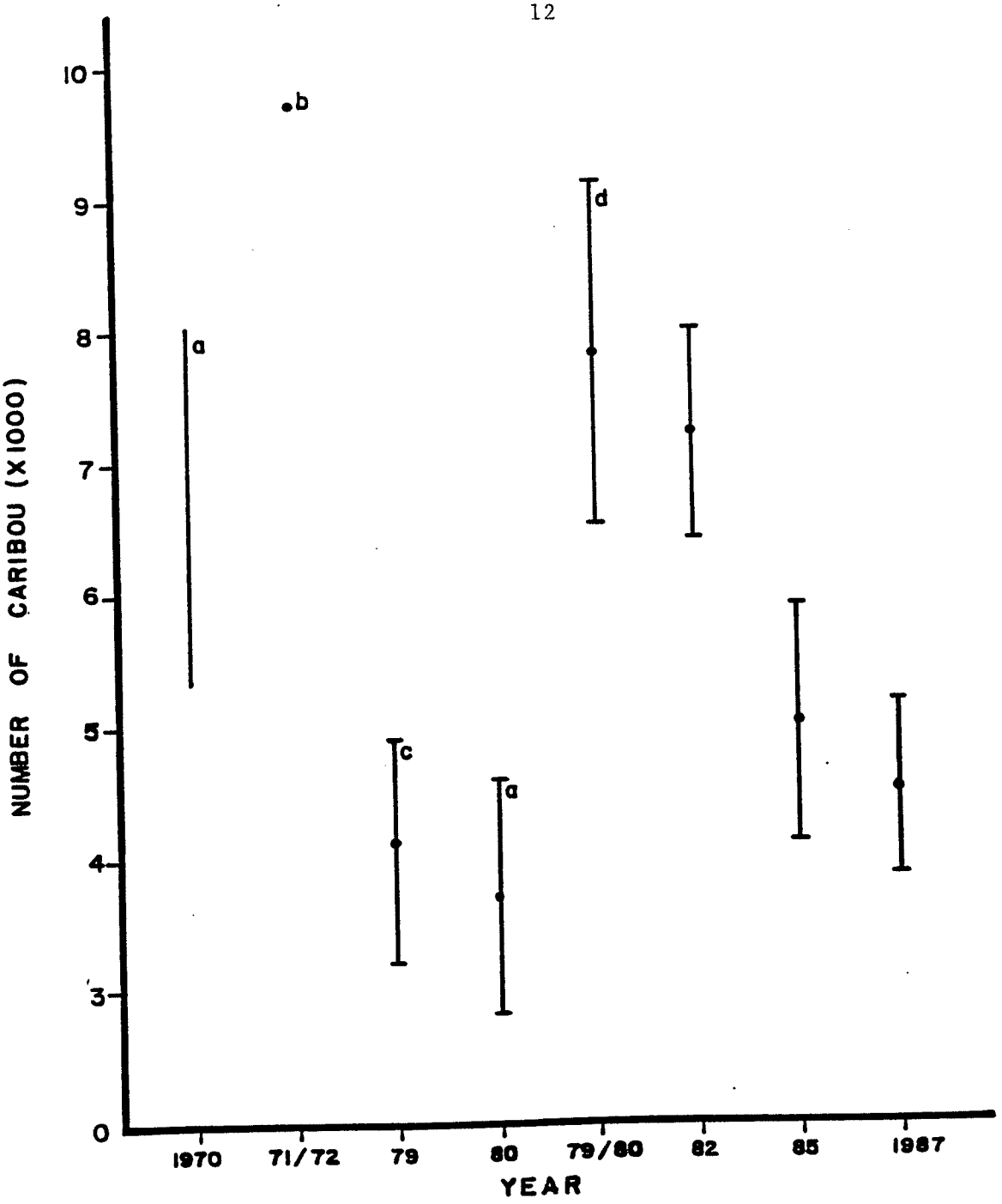

Figure 3. Population estimates for caribou on Banks Island, NWT, 1970-1987.

a North half of Banks Island only.
b Urquhart's estimate adjusted to include non-calves only.
c South half of Banks Island only.
d Combined estimates 1979-1980 (Vincent 1980).

Standard error given as closed bars; author's subjective estimate as open lines.

Distribution and Movements

Urquhart (1973) found that caribou were more common in the southwestern part of the island in winter and moved north or northeast to calving areas in spring. He found three major calving areas: the northwestern part of the island (north of Burnett Bay), around Jesse Bay on the east side of the island, and a third area on the northeast coast. Latour (1985) also found a concentration of caribou, mainly cows and calves, immediately west of Jesse Bay, as well as in the northwest. In 1987, as in other years, the highest densities were in the northwest. It was also our impression that there was a small concentration of caribou in the Jesse Bay area. We had planned additional flight lines in that area, but could not conduct the surveys because of fog.

Miller (1985) found a concentration mostly of breeding cows, newborn calves, juvenile females, and yearlings on eastern Banks Island in the Jesse Harbour area in May-June 1985. He also found a concentration, predominantly of bulls, juveniles, and yearlings, centred around Deans Dundas Bay on Victoria Island. Miller's speculation that the caribou observed on eastern Banks Island and western Victoria Island represent an inter-island population is less likely than his alternate speculation that he failed to find the other components of the respective island populations. A. Gunn (pers. comm.) observed concentrations of cows and calves east of Dundas Peninsula (Victoria Island) in 1987 and 1988. Miller was not able to find any direct evidence of inter-island movements

between Banks and Victoria islands during the calving period, although he did find winter pellets and tracks on Ramsey and Princess Royal islands.

Local people in Holman (Victoria Island) and Sachs Harbour (Banks Island) and observations from wildlife surveys (Kiliaan and Thomas 1983, Jingfors and Adjun 1984) suggest that caribou cross in small groups between Banks and Victoria islands in fall and winter. The extent of these movements is unknown and has not been studied quantitatively. Local people's observations and historical information indicate an increase in caribou on Victoria Island since the early 1970s. The island was partially surveyed in July 1980 (Jakimchuk and Carruthers 1980), but no comparable surveys have followed. If there has in fact been an increase, it is unlikely to be due to migration (A. Gunn pers. comm).

Peary caribou and similar races are believed to number 15,000-20,000 in total, over their entire range (Williams and Heard 1985). The Banks Island population, therefore, represents approximately one third of this subspecies. The people of Sachs Harbour have also commented that there seem to be fewer caribou. It is difficult to assess whether there are in fact fewer caribou in areas hunted in the fall-winter by residents of Sachs Harbour, or whether the distribution has changed.

Correction factors for animals missed in an aerial survey have been calculated for other ungulates (Caughley 1977, Gasaway et al. 1986, Samuel et al. 1987); however, this usually involves the use of radio-collars or some method of comparing the observed to an

actual known density. Not only would it be difficult to determine a correction factor for Banks Island caribou, but it would also vary depending on the observer.

Visual strip transect surveys are thought to underestimate numbers due to observers missing animals (Caughley 1974). Even trained observers may see only 30-70% of the animals actually present (Caughley 1974). As we relied on caribou moving in response to the plane in order to increase our ability to detect them (especially against mottled backgrounds), I feel that there could be a large but unquantified observer bias. Such a bias would result in an underestimate of caribou densities. Previous surveys undoubtedly were also affected by bias.

Limiting Factors

The annual caribou kill by hunters from Banks Island has been estimated at 400 animals in 1986-1987 and was approximately 390 in 1987-1988 (M. Fabijan pers. comm.). This would be a harvest rate of approximately 8-10% of the current population estimate. Mainland caribou are thought to have approximately 7-10% natural mortality in the presence of predators (Bergerud 1978).

Wolf numbers on Banks Island appear to be very low relative to mainland populations where summer wolf densities can be roughly calculated as 0.015 to 0.250 wolves seen per hour flown (Heard and Calef 1986). Three wolves were shot on southern Banks Island in the winter of 1987 by hunters from Sachs Harbour (M. Fabijan pers.

comm.). Residents of Sachs Harbour also feel that there are few wolves on the island. During other studies (McLean et al. 1986, Blake and McLean 1989, McLean unpub. data), very few wolves have been seen. Expressed as wolves observed per hour flown, 0.12 wolves/hr were observed during aerial surveys in 1985, 0.10 wolves/hr in 1986, and 0 wolves/hr (approximately 45 hrs) in 1987. During Bluenose caribou surveys wolves/hr have ranged much higher, from 0.16 to 3.02 (Williams and Elliott 1985, Heard and Calef 1986). On Banks Island one pack and pups were observed in 1985, 1986, and 1987 during ground studies.

Peary caribou, as well as muskoxen, are susceptible to periodic winter mortality caused by unavailability of forage after severe icing or deep snow (Parker et al. 1975). Winter mortality has been documented on Banks Island in 1969-1970 (Urquhart 1973) and in 1977-1978 (Morrison 1978) (Appendix C). Given the large size of the island and the relatively small area regularly travelled by people from Sachs Harbour, mortality could go unnoticed during some winters; therefore, die-offs may have gone undetected in other years over this period.

Little information on age and sex ratios and calf survival has been collected. Percentages of calves have ranged from 14-22.4% of animals classified during summer aerial surveys (Table 3). A low percentage of calves may be indicative of low pregnancy rates or very high calf mortality or both. The number of calves which survive their first winter, the age of first breeding, and pregnancy rates can vary annually in Peary caribou (Thomas 1982).

Table 3. Calf percentages recorded during aerial surveys on Banks Island, NWT, 1970-1987.

Date	%Calves	Sample Size	Reference
June 1970	19.0	1078[b]	Kevan 1970
June 1971	27.9	_[c]	Urquhart 1973
June 1972	14.3	_[c,d]	Urquhart 1973
July 1982	25.0[a]	1491	Latour 1985
July 1985	15.3	898	McLean et al. 1986
July 1987	22.4	557	This study

[a] estimated from report, not calculated by Latour.
[b] Northern Banks Island only.
[c] not given in the report.
[d] calving still in progress.

The cumulative effects of hunting and natural mortality due to winter conditions are probably causing the population to decline. Wolf predation may contribute only slightly to the decline.

The large increase in numbers of muskoxen at the same time as an apparent decline in numbers of caribou has led to concerns from Sachs Harbour that the muskoxen are competing with the caribou for food. While we have no evidence to suggest that this is happening, the need to monitor the status of Banks Island caribou closely is apparent. Data on recruitment, reproductive status, seasonal movements and distribution, and physical condition would help in understanding the population dynamics and making management decisions. Unfortunately high costs and logistics make collecting such information difficult.

RECOMMENDATIONS

A Banks Island caribou management plan should be prepared by Renewable Resources and include the following recommendations.

1) Conduct strip transect aerial surveys every 2-3 years. Conduct the survey at an altitute of 125 m (400 ft), with a strip width of no greater than 500 m on either side of the aircraft. The initial coverage should be increased to 10% to be certain of detecting all high-density areas.

2) Monitor body condition and age-specific reproductive status of females from hunter kill samples and/or a collection in late fall. This information would help assess pregnancy rates and their relationship to body condition. Representative skulls and liver samples could be taken for genetic analysis to determine the relationship of Banks Island caribou to other Peary caribou.

3) Conduct age and sex composition counts. This information is collected on all mainland caribou herds. Ground counts could be attempted in the late fall if suitable numbers of caribou are close to Sachs Harbour. It would be difficult and expensive to do classification counts by helicopter if animals were widely dispersed, but it may be the only way to get a good sample that is representative of the population.

4) Determine seasonal movements, use of calving areas, and annual variation of winter range used. This will assist in conducting and interpreting population censuses, collecting composition information, and interpreting reported movements by local hunters (inter-island or absence of caribou). Radio-telemetry is the only technique which would answer these questions satisfactorily. Results from the Victoria Island satellite collaring program on caribou should help assess the cost-effectiveness of using satellite collars and/or conventional telemetry.

5) Explore options for reducing the impact of the hunter kill (e.g., shooting more males than females), using the commercial quota only for sports hunting, or putting a ceiling on the number killed in any given year, especially if there were reports of any significant winter icing conditions or caribou mortality. Winter kill may affect males more, and if heavy winter mortality is suspected the sex ratio should be monitored.

N.B. A survey was conducted in June 1989 while this report was still in preparation (McLean and Fraser in prep.).
A draft management plan for Banks Island Caribou has been initiated.

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APPENDIX A. Survey schedule and costs, June 1987

SURVEY SCHEDULE

Date	Location	Weather	Hrs. Flown
26 June	Sachs Harbour	Marginal, low cloud, fog	5 (ferry x 2)
27 June	Stratum D	Visibility good, periodic fog cloud layer at 185 m asl 2 - 5°C, wind light, N	
	5D - 10D		6 (approx.)
	1D - 4D	Fog in Jesse Bay area	4.4
28 June	1D,1A,2A,1C	Broken to overcast (1200agl) Temp. -3°C, wind N., light (TRD unservicable)	7.0 (approx.)
29 June	1B,2C,6C-8C	Visibility 15 km + cloud broken at 615 m	7.9
	3A,3C,4C,5C		7.0
30 June	5A,5B-7B,6A	CAVU, 12°C. Wind 050 at 10.	3.4
	4B,4B-2,5B		2.4
	2B-4B,1B-2,2B		10 (approx.)
	2B-2,3B,3B-2		
1 July	Stratum D	Fog prevented additional transects in this area.	5 (incl. ferry)
	Ferry to Inuvik	Good	

Total of approximately 45 hrs of survey and 10 hrs ferry time. Total cost of survey in 1987: $2,000 plus $5000 for fuel and barge to Sachs Harbour and another $7,000-10,000 for fuel cacheing

APPENDIX B. Caribou (non-calf) group size and numbers observed on Banks Island, NWT.

Caribou group size - calculated from ON TRANSECT observations only

Stratum	No. of Group	Group Size Range	Group size Mean	Std. dev.	Total # Animals
A	7	2-3	2.43	0.53	17
B (high density)	62	2-24	4.48	3.39	278
B (low density)	5	2-5	2.60	1.34	13
C	9	2-9	3.89	2.71	35
D	7	2-6	4.14	1.57	29
A, B(low) C, D	28	2-9	3.36	1.91	94
All areas combined	90	2-24	4.13	3.04	372

An additional 60 single caribou were observed on transect.

Caribou group size - calculated for ON TRANSECT & OFF TRANSECT observations

Stratum	No. of Group	Group size Range	Group size Mean	Std. dev.	Total # Animals
A	11	2-15	4.00	3.77	44
B (high density)	97	2-24	4.26	2.95	413
B (low density)	8	2-5	2.62	1.06	21
C	11	2-9	3.64	2.50	40
D	16	2-6	3.37	1.31	54
A,B(low),C,D	46	2-15	3.46	2.34	159
All areas combined	143	2-24	4.00	2.78	572

Percentage of Calves

	ON TRANSECT OBSERV. ONLY	ON & OFF TRANSECT
Low Density area (A,B(low),C,D)	18.8	15.9
High Density area (B(high)	24.2	21.0
All areas combined	22.6	19.5

Appendix C. Records of winter die-offs of caribou on Banks and Victoria islands, NWT.

Year	Comments	Source
1951-52	Many Banks Island caribou died from starvation during latter part of December and January. Trappers reported caribou did not breed during the rut. Very few calves seen in spring 1952.	McEwan 1952 Manning & MacPherson 1958
1952-53	Few caribou bred during the rut. Large numbers of dead found in January on Banks Island. Trappers reported no fetuses in caribou killed during winter and spring. No calves seen in spring 1953.	McEwan 1955 Manning & MacPherson 1958
1954-55	Banks Island trappers reported caribou dying over the winter. Dead, weak and emacipated animals found during January and February. A low calf crop was predicted based on low pregnancy rate of hunter-killed caribou.	McEwan 1955 Manning & MacPherson 1958
1969-70	Large number of carcasses on Banks Island in June 1970. Based on a carcass count, it was estimated that 1000 to 2000 caribou (9-18% of the population) died during the previous winter.	Urquhart 1973
1977-78	Freezing rain on Banks Island in November 1977 covered forage with up to 5 mm of ice. Trappers reported widespread mortality. Many carcasses seen on the Island in February and March. Caribou necropsied in spring 1978 showed signs of starvation.	Morrison 1978 Vincent 1979
1983-84	Localized icing conditions along the northwest coast of Victoria Island and parts of Banks Island. Caribou carcasses found in April 1984 along Victoria Island coast. Some Banks Island caribou in poor condition.	K. Jingfors pers. comm.