

Distribution and habitat use of the Bluenose caribou herd in mid-winter

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Abstract: The mid-winter distribution and densities of the Bluenose caribou herd were compared with previous surveys over six years and were similar in all years except 1981 when exceptionally mild weather prevailed. Differences in group size, distribution and habitat use between sexes were noted in 1983. Caribou were distributed disproportionately to availability of vegetation types and used lakes significantly more than expected based on their occurrence. Male groups used conifer cover more than did female-calf groups which used open areas (lakes, fens, bogs) more than males. Cow-calf groups chose areas with a higher small lake density compared to lake density generally available. Generally caribou preferred habitat between 200 and 300 m in elevation with high densities of lakes less than 1 km² in size. Snow depths and hardness were greater in most unoccupied habitats than in occupied habitats. Wolves were associated with high densities of cow/calf groups.

Keywords: Barren-ground caribou, caribou winter habitat, distribution, Bluenose caribou herd.

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Introduction

Nine aerial surveys of the winter range of the Bluenose caribou herd were conducted by Renewable Resources Consulting Services Ltd. between 1976 and 1983. Surveys conducted prior to 1982 were designed to describe the density and distribution of caribou on winter range. Surveys in 1982 and 1983 were designed to characterize habitats within winter range in order to predict caribou distribution in relation to petroleum exploration activity. This report presents the results of surveys conducted in January and February 1983, the objectives being:

- 1) to describe the distribution and density of caribou on winter range and compare these data with past surveys;
- 2) to describe caribou distribution in relation to vegetation types, elevation, the presence of lakes, snow conditions and wolf numbers.

Study area

The study area covers 63 000 km² within the region bounded by the Mackenzie river to the

west, the Hare Indian River and Great Bear Lake to the south, and the Anderson river to the north and east (Fig. 1).

The area has a polar continental climate with long, cold winters and short, cool summers. The mean daily temperature for the coldest month (February) is -30°C and mean daily temperature for the warmest month (July) is 11°C (ALUR, 1977). The mean annual precipitation is 27 cm with an annual snowfall of 174 cm measured at Inuvik. Most snowfall occurs during September to December; June, July and August are the wettest months.

Much of the study area consists of rolling or undulating till plain, with numerous lakes and ponds. The major drainage systems in the region include the Anderson and Mackenzie rivers which drain northward into the Arctic Ocean. The area borders on the western extremity of the Precambrian Shield, referred to as the Mackenzie Uplands (Bird and Bird, 1961). Glacial features present in the study area include meltwater channels, eskers, drumlins, hummocky moraine

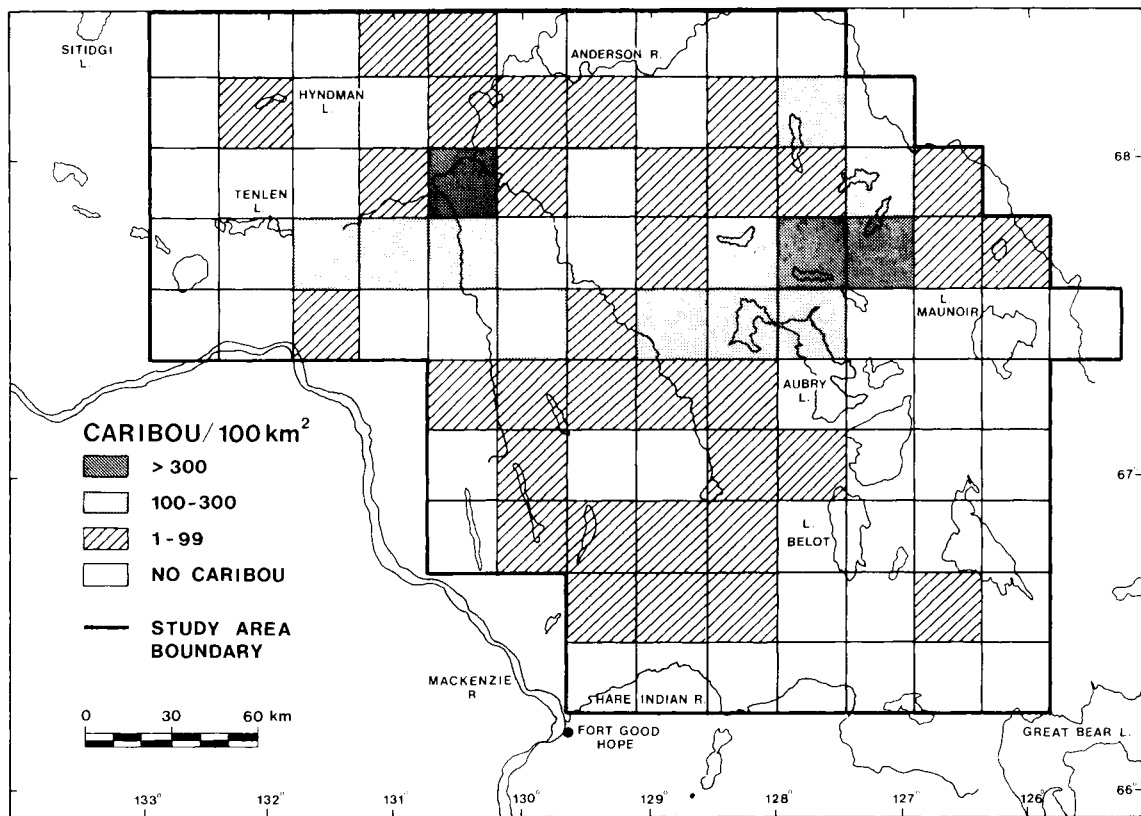


Fig. 1. Locations where caribou occurred in 4 years of 6 years during the mid-winter period (January through March) at different densities, 1976 - 1983.

and alluvial fans and deltas (ALUR, 1977). The most prominent uplands are the hills northeast of Lac Maunoir (maximum elevation = 550 m) and the Colville Hills (maximum elevation = 675 m) in the vicinity of Colville and Aubry lakes.

Three major forest types occur in the study area: upland spruce/feather moss, black spruce/sphagnum and black spruce/lichen (Forest Management Institute, 1974). Forest consisting of white (*Picea glauca*) and black (*Picea mariana*) spruce with abundant mosses and lichens, is the most common forest type (>80%) in the study area. Burns are also common in this type. Bog and forest consisting of black spruce, sedge meadows, willow sedge parklands and numerous shallow lakes and bogs, occurs in a limited area (<20% of study area) immediately north of the Hare Indian River and adjacent to the Mackenzie River (Jacobson, 1979).

Methods

Strip transects (1.0 km wide) spaced at 25 km intervals (4% survey coverage) were flown with

a Cessna 185 fixed-wing aircraft during 21 to 28 January, and 22 February to 2 March 1983.

Caribou were classified as to the number of calves (young-of-year) and adults (includes all non-calf animals) whenever possible. Groups not classified as above were designated as predominantly male or female and calves where greater than two-thirds of either sex was classified. During aerial survey of the study area, vegetation type was recorded at 5 km intervals along transects based on military grid lines. During February and March, snow depth and hardness measurements (Ramsonde Penetrometer) were taken at 22 stations in the study area in cooperation with the Northwest Territories Wildlife Service.

The study area was divided into 101 cells, each 25 km square (625 km²) to accommodate transect spacing and to facilitate analysis of caribou distribution and density.

Lake density and area were measured from 1:250 000 scale topographic maps with a circular sample plot of 5 km radius (78.5 km²) centered

on the vegetation sample points. The size of lakes within and partially within each plot was estimated based on diameter according to several classes.

Vegetation associations were evaluated using Ivlev's (1961) Electivity Coefficient:

$$E = (r_i - p_i) / (r_i + p_i)$$

Where: E=coefficient of electivity (preference index)

r_i =proportion of the variable used (use)

p_i =proportion of the variable occurring in the study area (availability)

Preference values indicate only the relative value (i.e., ranking) of a habitat component in comparison to others (Johnson, 1980).

Results

Caribou distribution and density

January — February 1983

Caribou occurred throughout most (57%) of the study area during the mid-winter period (January — February) in 1983. High (>300 caribou/100 km²) density cells were present over 8% of the area in the northwest and northeast. Densities greater than 100 caribou/km² occurred over less than 22% of the area in January and less than 20% in February. Caribou were absent over 43% of the study area. The distribution in 1983 was similar to that reported over a 6 year period.

In January, high densities of caribou were found in the Aubry-Tedji lakes area and northeast of Tenlen Lake. In February, high densities were found from Aubry/Niwelin lakes northeast to the Anderson River, and near Tenlen Lake. Generally, the distribution was similar during January and February except that more caribou occupied the northeastern portion of the study area in February.

Males and females were segregated on the range with most male groups occupying the southwestern half and females the northeastern half of the area. Female groups were three times larger ($\bar{x}=20.6$, $n=224$) than male groups ($\bar{x}=7.2$, $n=207$, $Z=5.1$, $P<0.05$) and contributed most to high caribou density areas. Males were much more dispersed than females and rarely occurred at densities exceeding 100 caribou/100 km².

Between late January and early March female caribou groups moved eastward while male groups exhibited no discernible direction of movement. Females were concentrated in an area surrounding Tedji Lake in February, whereas males were dispersed over the area between Travaillant Lake and Lac Belot. Subsequent movement by females in mid-March was north to the area between Simpson Lake and the Anderson River (Williams, pers. comm.).

Table 1. Caribou numbers and density for mid-winter aerial surveys within the study area, 1976 — 1983.

Observation	Survey date								
	1983		1982		1981		1980	1977	1976
	Feb.	Jan.	Feb. ¹	Jan. ¹	Feb. ²	Jan. ³	Mar. ²	Feb./ Mar. ⁴	Feb. ⁵
Total caribou	4047	5269	3179	2989	2060	3107	6945	4079	845
Caribou on transect	1745	2191	2235	2708	1966	1361	3759	2875	
Caribou/100 km ²	94.55	118.6	94	120	86	85	90	90	88
Survey area (km ²)	46 175	46 175	60 000	56 500	57 000	40 000	67 000	80 000	64 000
Percent sample	4	4	4	4	4	4	6.25	4	4

¹ Carruthers and Sopuck (1982)

² Carruthers and Jakimchuk (1981).

³ Carruthers (1981).

⁴ Wooley and Mair (1977).

⁵ Data for survey by Hawley, in Decker (1976); all caribou assumed to be on transect.

Data from nine aerial surveys in six winters (January — March) were used to analyze caribou distribution in the study area (Table 1). High densities (>300 caribou/100 km²) of caribou consistently used the northern half of the study area (Fig. 1). Between January and March there was a decrease in the dispersion of different density classes and a shift to the north and east.

Caribou distribution in relation to winter range physiography

Vegetation type

The distribution of caribou in relation to the availability of six vegetation types appears in Table 2. Caribou used lakes and rivers four times more frequently than their occurrence. Open conifer was used in proportion to its occurrence and all other types were used less than their occurrence.

No significant relationship was found between group size and vegetation type ($F=0.503$, $df=678$, $P>0.05$). Group size on lakes ($\bar{x}=15.6$, $n=368$) was the same as off lakes ($\bar{x}=12.0$, $n=310$, $t=-1.36$, $P>0.05$). However, group composition (age and sex) varied significantly with vegetation type ($\chi^2=15.2$, $P<0.05$). Male groups used open conifer forest more than female-calf groups which used open areas (lakes, fens, bogs) more than did males.

Table 2. The availability of six vegetation types and their use by caribou ranked by a preference index (+1.0=most preferred; -1.0=least preferred).

Vegetation Type	Availability		Caribou groups ¹		Preference
	No.	%	No.	%	
Lake/River	59	14.5	368	54.4	+0.5791
Open conifer	226	55.5	254	37.4	-0.1948
Herbaceous	66	16.2	40	5.9	-0.4685
Closed conifer	15	3.7	11	1.6	-0.3962
Burned forest	38	9.4	4	0.6	-0.8800
Shrub	3	0.7	1	0.1	-0.7500
Total	407	100.0	678	100.0	

¹ Group chi-square = 895.0, $df = 5$, $p<0.001$

Elevation

Elevation was considered to be an important physiographic feature influencing caribou distribution. Caribou were found at a mean elevation of 250 m above sea level (asl) which was the average for the study area ($t=0.08$, $n=678$ 318; $P>0.05$) (Fig. 2). Differences related to sex of groups ($t=2.26$, $n=207$ 224; $P<0.05$) and survey data ($t=2.98$, $n=377$ 301; $P<0.05$), although statistically significant, were small (<12 m) and probably not biologically significant.

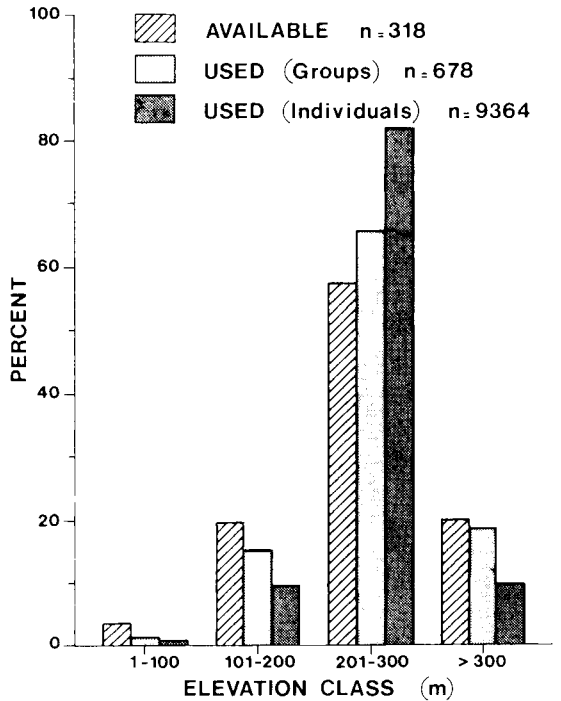


Fig. 2. The distribution of elevation classes and their use by caribou, January - February 1983.

Lakes

Open areas represented by lakes, rivers, fens and bogs were the most preferred of six vegetation types deemed available. To clarify this observation we examined the size and location of lakes in the study area.

Caribou preferred lakes less than 1.0 km² in area (Fig. 3). They selected locations with a large number of small lakes ($\bar{x}=0.53$ lakes/km², $n=678$) compared to lake density generally available ($\bar{x}=0.41$ lakes/km², $n=318$, $t=7.55$, $P<0.05$). Large lakes were not used by caribou as frequently as areas with high densities of small

lakes. Preferred locations contained many small lakes which comprised a total area of 2 - 30 percent of the landscape.

These patterns of selection were evident for all caribou groups but there were differences related to the sex of groups. Female-calf groups were observed on lakes more often (54.3%, n=204) than male groups (45.7%, n=172) ($\chi^2=4.07$, $df=1$, $P<0.05$) and female groups were observed in areas of higher lake density ($\bar{x}=0.57$ lakes/km², n=343) more than males ($\bar{x}=0.49$ lakes/km², n=329, $t=-4.94$, $P<0.05$).

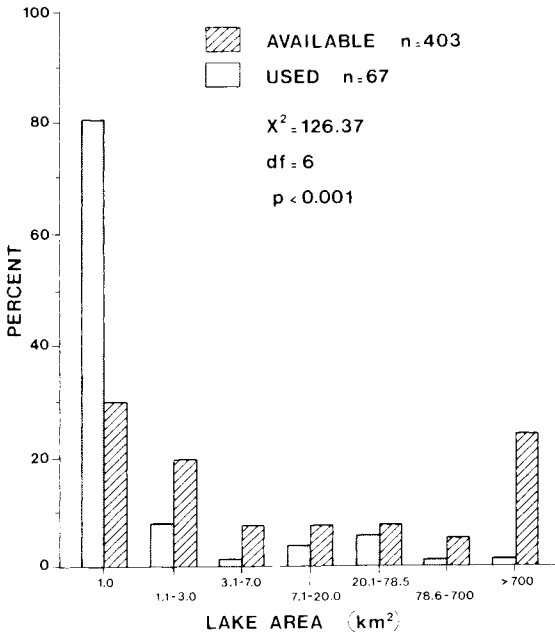


Fig. 3. Use of different sizes of lakes by caribou groups, January - February 1983.

Snow Depth

In 1982, snow depth and hardness were measured at 64 stations throughout the study area. Mean snow depth was highest in forest >300 m asl (68.4 cm) and lowest in forest <300 m asl (62.2 cm). Snow depth in areas of high caribou density (>300 caribou/100 km²) averaged 62.2 cm. Snow was of similar hardness at low elevations but significantly harder at elevations >300 m asl.

Wolves

Wolves were found in areas with high densities of caribou. Caribou density in cells containing wolves ($\bar{x}=167$ caribou/100 km², n=23) was

significantly higher than in cells without wolves ($\bar{x}=73$, S.E.=12, n=188, $t=2.05$, $P<0.05$). This relationship was stronger for female-calf groups where their density in cells with wolves was much higher ($\bar{x}=19$ groups/100 km², n=23) than in cells without wolves ($\bar{x}=4$ groups/100 km², n=233, $t=2.49$, $P<0.05$). Wolves were observed only in the northern half of the study area.

Discussion

The distribution of caribou observed in January and February 1983 was consistent with the pattern recorded over the previous 5 years (Wooley and Mair, 1977; Carruthers and Jakimchuk, 1981; Carruthers and Sopuck, 1982). The consistent use and size of winter range and similar densities since 1976 corroborate census results that suggest the Bluenose herd has been relatively stable in numbers in recent times and suggests a strong affinity for particular habitat types.

Caribou were segregated on the winter range by sex which typifies most seasonal distributions and reflects differing adaptive strategies of males and females (Jakimchuk and Ferguson, unpublished data). Cows and calves were found in forested areas with high snow depths and high densities of small lakes whereas males occupied forested areas with often lower snow depths and fewer small lakes.

Burned forest was one of the least preferred vegetation types available to caribou. In 1983, 0.2% of caribou were found in burned forest, and a maximum of 3.3% (0.0 - 3.3%) was observed in the previous winters. Results from all winters showed that about 90% of all caribou were located in unburned areas below 300 m asl.

Snow depths and hardness were greater at high elevations than elsewhere and we believe that these conditions inhibit the use of such areas by caribou (Carruthers and Sopuck, 1982). Under normal or above-normal snow conditions in mid- and late-winter, caribou avoid high elevations. However, in the absence of a sufficient snow stimulus, such as in January 1981, and in the fall and early winter, caribou were dispersed through otherwise unfavourable mid-winter habitats. This pattern was reflected by the greater dispersion of caribou and wolves in January 1981 (Carruthers and Jakimchuk, 1981).

The selection of open habitat (lakes, fens and bogs) by caribou in mid-winter has been

previously noted by Miller (1974, 1975, 1976) and Pruitt (1959). The use of small lakes allows caribou to visually locate wolves and provides a sufficiently large, shallow, often wind-packed snow surface for escape by running (Nasimovich, 1955; Pulliainen, 1965).

Wolves can visually check large lakes for caribou rather quickly, whereas in areas of large densities of small lakes it takes longer for wolves to locate caribou since they have to check each lake individually. Also, individual caribou, fleeing across a large lake can be readily followed by wolves whereas caribou running from lake to nearby lake may make it more difficult for wolves to locate and follow individual animals.

The proximity of other lakes and open areas allows shorter movements in deep snow and efficient exploitation of the more extensive feeding sites on lake margins, adjacent forest and in bogs and fens (Riewe, 1979). These characteristics allow caribou to forage and escape predators even in the presence of deep snows. As snow depths increase through the winter, caribou, especially cows with calves, move into areas with these characteristics and away from areas which lack preferred habitats.

Bluenose caribou used their forested winter range in a consistent manner during winters of normal snow conditions. The pattern of use was consistent over 6 years and reflects the efficient response of caribou to snow conditions that gradually reduce forage and predator avoidance options through the winter. Caribou associate with habitat features that are most important to their survival.

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