

The distribution and movement patterns of four woodland caribou herds in Quebec and Labrador.

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Abstract: Recent studies of woodland caribou (*Rangifer tarandus caribou*) in northern Quebec and central Labrador have demonstrated similar patterns of seasonal movements and distribution among four herds. Aerial surveys and radio-telemetry indicated that animals occupied forest-wetland habitat at densities of 0.03 caribou km⁻², or lower, for most of the year. Although females were widely dispersed at calving individuals demonstrated fidelity toward specific calving locations, in successive years. Caribou did not form large post-calving aggregations. Movement was greatest in the spring, prior to calving, and in the fall, during or immediately after rutting. Caribou were generally sedentary during summer and winter, although some moved relatively long distances to late-winter range. Although the herds occupy continuous range across Quebec and Labrador, our data indicate that the herds are largely discrete and should be managed individually.

Keywords: woodland caribou, Quebec, Labrador, distribution, movements

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Introduction

Most current understanding of seasonal movements, aggregation behaviour and habitat use by caribou (*Rangifer tarandus*) in North America is based upon studies of primarily tundra-dwelling barren-ground caribou (*R. t. groenlandicus*) or woodland caribou (*R. t. caribou*) in open or mountainous habitats (Bergerud, 1974; Bloomfield, 1980; Edwards and Ritcey, 1959; Freddy, 1979; Kelsall, 1968; Oosenbrug and Theberge, 1980; Skoog, 1968). The only detailed studies of caribou that occupy boreal-forest habitat in northern Canada year-around are from Alberta (Edmonds and Bloomfield, 1984; Fuller and Keith, 1981) and Manitoba (Darby and Pruitt, 1984; Shoesmith and Storey, 1977; Stardom, 1975). In this paper, we summarize and compare the movements,

habitat use and herd discreteness of four forest-dwelling herds in northern Quebec and central Labrador (Fig. 1).

The four populations are: the Lac Bienville herd (LBH); the Caniapiscou herd (CH); the Lac Joseph herd (LJH) and the Red Wine Mountains herd (RWMH). All four ranges lie on or within the southern periphery of the winter range of the much larger George River herd, currently estimated at >500 000 caribou (S. Luttich, unpublished data). The results of our studies have important implications for the management of these herds.

Study areas

The ranges of the four herds extend >1000 km from near Hudson Bay in northwestern Quebec to Lake Melville, Labrador (Fig. 1). The entire

area is located on a series of adjacent, level to gently rolling, poorly drained plateaux. Uplands of low, rolling hills are interspersed throughout the region. Elevations on the plateaux range from 300 — 800 m and uplands extend to >1000 m.

The vegetation of the plateaux region is a mosaic of boreal forest and wetlands. Forests are primarily open lichen-woodlands, dominated by black spruce (*Picea mariana*), with tamarack (*Larix laricina*) common on wetter sites. Scattered stands of jack pine (*Pinus banksiana*) are found at the southern limit of the LBH range but do not extend further east or north. Deciduous forest, including trembling aspen (*Populus tremuloides*), and white birch (*Betula papyrifera*), occur uncommonly and only at lower elevations on some south-facing slopes and in major river valleys. The wetlands comprise a complex of fens, bogs and swamps interspersed with abundant lakes and rivers.

The uplands are dominated by tundra vegetation consisting of lichens, mosses, sedges and prostrate shrubs. Exposed bedrock and glacial erratics are common in upland areas.

Major predators of the caribou are wolves (*Canis lupus*) and black bears (*Ursus americanus*). Lynx (*Lynx canadensis*) are also present but are not numerous.

Human population centers in the region are sparse and located on the peripheries of the ranges (Fig. 1). The major industrial developments include iron-ore mines, near Labrador City and Schefferville, and the La Grande (in Quebec) and Churchill Falls hydroelectric projects. Transportation corridors include: a summer-use road across the southern portion of the range of the CH; a railway in western Labrador between the ranges of the LJH and CH; an «all-weather» road from the railway to Churchill Falls through the range of the LJH and a summer-use road through the range of the RWMH between Churchill Falls and Goose Bay.

Methods

In North America, caribou herds have been defined most often on the basis of the location of their calving grounds. The populations we report on calved over broad areas and did not use relatively confined calving grounds. However, they used these broad areas faithfully and displayed regular seasonal patterns of range use. As well, portions of each population aggregated

during other critical life-history periods such as winter or rut. Thus we consider the populations to be relatively discrete and refer to them as «herds». All caribou of the Quebec — Labrador peninsula were classified by Banfield (1961) as the woodland subspecies (*R. t. caribou*).

In each study, radio-telemetry was used to monitor caribou movements and distribution, with emphasis on adult (>1-year old) females. Caribou were monitored at approximately monthly intervals from either fixed-wing aircraft or helicopters. Caribou habitat use was determined by observations made during aerial and ground-based surveys.

The herds and study periods are described below:

Lac Bienville herd (LBH)

Data from the LBH were collected between 1975 and 1980 by P. Lamothe. Seventeen female caribou were radio-collared in March 1977 and monitored through May 1979. During the study, the herd was estimated at approximately 1500 caribou. The range of the herd was >35 000 km² and winter densities were <0.03 caribou km⁻².

Caniapiscou herd (CH)

In 1981 and 1983, 42 female caribou of the CH were radio-collared (N=25 and 17, respectively). Data were collected from March 1981 through December 1984 by M. Paré and J. Huot. In 1977, prior to the study, the herd was estimated at approximately 600 animals. Because of winter ingress of caribou from the George River herd, the total herd size and density could not be estimated during the study. The entire range of the herd was not determined. The study area was approximately 41 000 km².

Lac Joseph herd (LJH)

Detailed study of the LJH, by G. St. Martin, S. Luttich and J. B. Theberge, began in April 1984 when 18 female caribou were radio-collared. Monitoring of the herd will continue through April 1986. In 1985, the herd was estimated at a minimum of 240 caribou. The herd's total range was >35 000 km² and caribou densities were estimated to be <0.03 caribou km⁻².

Red Wine Mountains herd (RWMH)

Data were collected for the RWMH from March 1982 through June 1985 by W. K. Brown,

S. Luttich and J. B. Theberge. In March 1982, 27 female caribou were radio-collared. Sixteen adult caribou (nine females and seven males) were radio-collared in March 1983. Herd size was estimated at approximately 800 in 1983 and the range of the herd, based upon the relocation of radio-collared caribou, was >25 000 km². Densities were <0.03 caribou km⁻².

Data were not collected in a standardized fashion among all studies and, therefore, some data are not available for all herds. Study of the LJH is ongoing and the information presented is based upon 13 months of monitoring, including two calving periods only.

Caribou distribution is described for the following seasons: spring (May — June; summer (July — August); fall (September — November); winter (December — February) and late-winter (March — April). The movements of radio-collared caribou in Fig. 2 are expressed as «mean kilometres moved per day» to standardize observations over variable survey intervals.

These values are not intended to describe the actual daily movements of the caribou but represent indices to compare seasonal and herd variability in mobility.

Results

Spring

In spring, prior to calving, caribou in all herds dispersed widely from areas of late-winter aggregation. The greatest movements of radio-collared caribou between successive relocations occurred during this period (Fig. 2). Although individuals moved relatively long distances during this dispersal, the general area and extent of the ranges used remained the same as during winter and late winter.

In all herds, calving took place primarily during the first two weeks of June. Caribou were widely dispersed with estimated distributions of calving females of >12 000 km² for the LBH, >15 000 km² for the CH, >29 000 km² for the LJH and >12 000 km² for the RWMH. The

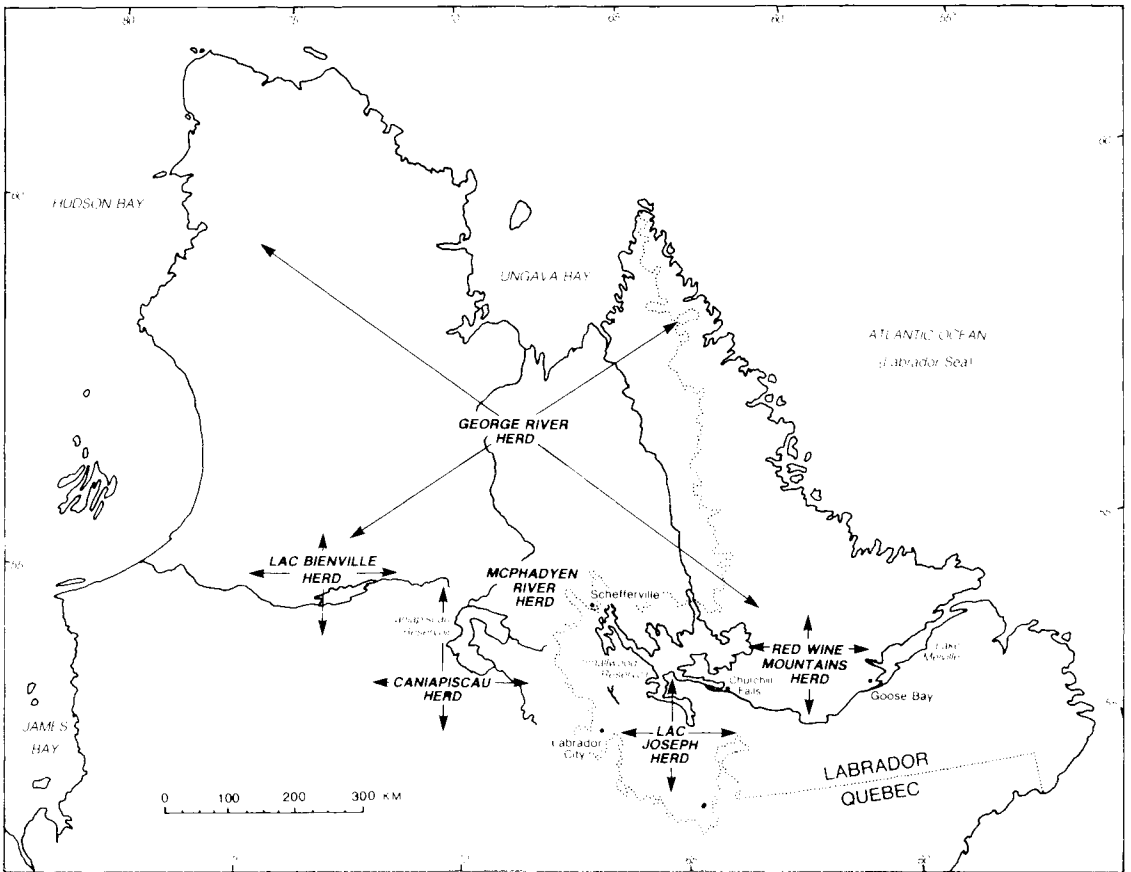


Fig. 1. Study areas in Quebec and Labrador.

estimated densities of calving females were <0.04 females km^{-2} in the LBH, LJH and RWMH. The mean group size, excluding newborn calves, in the RWMH in mid-June was 1.2 (SD=0.46, range=1 - 3, n=70).

Individual females displayed marked fidelity toward specific calving locations. During the calving period, $>95\%$ (n=70), 82% (n=9) and a minimum of 64% (n=23) of radio-collared females from the CH, LJH and RWMH, respectively, were located <10 km from their calving-period locations of the previous year. Of females in the LJH and RWMH, 33% (n=3) and 64% (n=16), respectively, were located <3 km from their former calving-period location. Several females were observed on the same island, peninsula or bog they had occupied the previous year. From their locations in March, some females of the CH travelled from 200 to >500 km (mean=75.3, SD=72.0, range=10 - 520, n=85) to return to the calving location they had used the previous year.

In the RWMH, there was no significant difference (G-test, $P>0.99$) between the fidelity of those females known to have had calves in

successive years (n=15) and those whose reproductive status in successive years was unknown (n=8) (Brown and Theberge, 1985).

Not all females returned to their former calving locations. Two females of the LBH gave birth in successive years at sites separated by 120 and 139 km respectively. As well, two radio-collared CH females were located >250 km northeast of the study area, within the range of the George River herd, during calving in 1984; whether those individuals calved that year is unknown. Sixteen percent (n=6) of RWMH caribou were located during the 1983 and 1984 calving periods >30 km from their previous calving-season location (range=35 - 69 km). However, all remained within the recognized range of the RWMH. During the 1985 calving period, one RWMH female of unknown reproductive status moved >100 km east into the centre of the LJH range. That animal had been located on the western edge of the RWMH range during the previous 2 calving periods.

All observed calving sites of the LBH (n=29) and 82% (n=71) of the CH were located in small ($<1 \text{ km}^2$), open wetlands, and usually only one

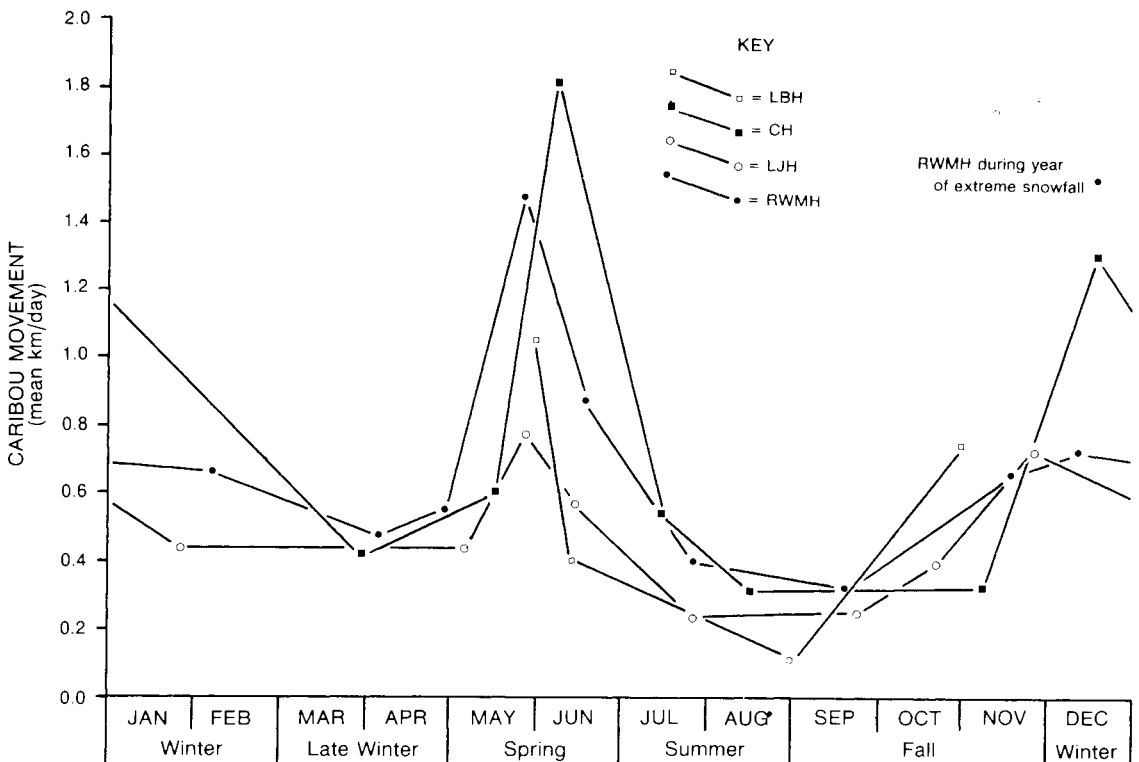


Fig. 2. Seasonal movements of caribou in the Lac Bienville, Caniapiscou, Lac Joseph and Red Wine Mountains herds.

female was observed per wetland. Caribou of the LJH and RWMH occupied similar forest-wetland habitats during the calving period but the specific habitat types used for calving were not determined. No radio-collared females of any herd were known to have calved in upland tundra, although this habitat type was available within each range.

Thirty-five percent ($n=10$), 41% ($n=38$) and <10% ($n=5$) of the calving sites of LBH, CH and RWMH females, respectively, were located on islands or peninsulas. The relatively greater proportion of LBH and CH caribou calving on these isolated topographic features compared with the RWMH may be due to a greater abundance of open water (approximately 20% in the LBH area and 21% in the Caniapiscu area after reservoir flooding, versus 13% in the Red Wine area).

Summer

Following calving, caribou did not form large post-calving aggregations. Females of the LBH, CH and RWMH remained alone with their calves or formed groups of two to three adult-calf pairs.

The caribou in all herds were relatively sedentary throughout the summer. Mean distances moved between calving and mid-summer were 10 - 20 km (Fig. 2). The animals remained in forest-wetland habitat; however, the relative use of forests versus wetlands was not determined.

Fall

Movements increased during the fall, probably due to breeding activity as the animals moved to form rutting groups, and caribou remained distributed over much of the total range of each herd. Rutting of the RWMH was estimated, based upon the timing of calving, to have peaked in mid- to late October (Brown and Theberge, 1985). Rutting appeared to take place in open wetlands, although quantitative data are lacking.

During the fall, group sizes increased but were variable among herds, ranging from 2.5 in the LJH ($SD=1.46$, range =1 - 5, $n=17$; late October) and 5.7 in the CH ($SD=4.4$, range=1 - 23, $n=77$; early November) to 15.5 ($SD=13.9$, range=2 - 60, $n=22$; early November) in the RWMH.

Winter and late-winter

Caribou movements varied among herds during winter and late-winter. Between Novem-

ber and early December, the distances moved by CH caribou increased substantially (Fig. 2). Other herds did not demonstrate a similar increase in movement at this time except for a distinct range shift by RWMH caribou between fall and early winter of 1983. That range shift was characterized by a synchronous northward movement of widely scattered animals, apparently made in response to extreme November snowfall (446.4 cm or 214% of normal snowfall at Churchill Falls). The direction of the winter movements of the CH caribou was not coordinated as was that of the RWMH, and the movement was not associated with greater than average snowfall.

Some caribou of the CH left the study area with caribou of the George River herd each winter, moving as far away as 520 km before returning during the calving period. In February and March 1984, >2000 George River caribou moved onto the range of the McPhadyen River herd (Fig. 2). Three of four resident caribou, which had been radio-collared in conjunction with the LJH study, associated with the George River animals at that time. However, they did not leave the McPhadyen area when the George River caribou migrated north in April.

Caribou of the LJH appeared to be the most sedentary of the four herds during winter and late winter. LJH caribou remained in localized areas of forest-wetland habitat, moving only short distances between surveys (mean=<26 km).

More than half of the RWMH made distinct range-shifts during the winter and late-winter from forest-wetland habitat to the upland-tundra regions of the Red Wine Mountains. Many of these movements were relatively long (range=16 - 86 km), and the caribou making them were generally sedentary both before and after. Caribou of the other herds remained primarily in forest-wetland habitat throughout the entire winter. LBH caribou used upland-tundra areas for loafing in late winter but returned to lichen woodlands to feed.

The mean group size in the LJH in February was 11.4 ($SD=8.2$, range=2 - 28, $n=21$). The mean group size in the RWMH in April was 11.1 ($SD=8.8$, range=1 - 43, $n=53$).

Discussion

Distribution and movements

The four study herds demonstrated similar patterns of seasonal dispersion and movements.

Caribou were widely dispersed at calving, demonstrated calving-site fidelity and did not form large post-calving aggregations. Throughout the summer, they remained dispersed in small groups and were relatively sedentary. They increased their movements and group sizes during the rut, and then generally remained sedentary throughout the winter and late-winter. With the exception of the RWMH, the caribou did not extensively utilize available upland-tundra habitat.

These observations differ in some respects from the general patterns described for barren-ground caribou and tundra-dwelling woodland caribou (Bergerud, 1974; Kelsall, 1968; Skoog, 1968). None of the herds we report on migrated in large groups or followed «traditional» migration routes; the respective seasonal ranges of each herd largely overlapped; females did not aggregate on discrete calving grounds but still demonstrated marked calving-site fidelity; females did not utilize tundra habitat for calving although that habitat type was available; and caribou did not form large post-calving aggregations.

Movements similar to those of the herds we studied have been reported for other caribou and reindeer in forest habitats (Darby and Pruitt, 1984; Edmonds and Bloomfield, 1984; Fuller and Keith, 1981; Helle, 1979, 1980; Pulliainen *et al.*, 1983; Shoosmith and Storey, 1977; Stardom, 1975). Thus, the patterns we observed may be typical of most forest-dwelling *Rangifer* populations.

Herd discreteness and management implications

Our findings regarding caribou movements in northern Quebec and central Labrador have important management implications. The range fidelity displayed by caribou of the southern herds indicates that even with periodic, large influxes of George River caribou, the southern herds will persist and, therefore should be managed as discrete populations. More conclusive data concerning herd discreteness may be obtainable through comparisons of body morphology and the electrophoretic analysis of globulin transferrins (*e.g.* Nadler *et al.*, 1967; Roed, 1985).

Some interchange of caribou between adjacent southern herds during our studies was expected because of the continuous distribution of caribou

across the region. Our data indicate changes in the home ranges of some caribou in all herds, even during the calving period when range fidelity was greatest. However, interchange among the southern herds appeared to be a minor factor in the dynamics of the populations during our studies, based upon movement data from radio-collared caribou and empirical evidence collected during aerial surveys.

A more important factor was the periodic ingress by caribou of the George River herd. Since approximately 1980, large numbers of George River caribou have migrated through the ranges of the LBH and CH. In the winter of 1984 — 85, George River caribou were found at the northern and northwestern peripheries of the LJH and RWMH ranges.

The hypothesis regarding the persistence of southern herds will be testable if the range of the George River herd continues to expand. If the George River herd moves further south during future winters, and into the range of the LJH or the RWMH, our prediction is that such ingress will not substantially affect the distribution of those herds. The magnitude of the effect that such ingress may have on the population size of the southern herds cannot be predicted from our data. However, because of calving-location fidelity, a substantial shift in range affiliation by females of the southern herds should not occur.

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References

- Banfield, A. W. F.** 1961. A revision of the reindeer and caribou, genus *Rangifer* — *National Museum of Canada Bulletin 177: Biological Series No. 66*. 137 p.
- Bergerud, A. T.** 1974. The role of the environment in the aggregation, movement and disturbance behavior of caribou. — In: V. Geist and F. Walther (eds.) *The Behaviour of Ungulates and its Relation to Management*. International Union for Conservation of Nature, Morges, Switzerland. 552 - 584.
- Bloomfield, M.** 1980. Patterns of seasonal habitat selection exhibited by mountain caribou in central British Columbia, Canada. — In: Reimers, E., Gaare, E. and Skjennneberg, S. (eds.) *Proceedings of the Second International Reindeer and Caribou Symposium*. Direktoratet for vilt og ferskvannsfisk, Trondheim. 10 - 18.
- Brown, W. K. and Theberge, J. B.** 1985. The calving distribution and calving-area fidelity of a woodland caribou herd in central Labrador. — In: Meredith, T. C. and Martell, A. M. (eds.) *Proceedings of the Second North American Caribou Workshop*, McGill Subarctic Research Paper. No. 40. McGill University, Montreal. 57 - 67.
- Darby, W. R. and Pruitt, W. O.** 1984. Habitat use, movements and grouping behaviour of woodland caribou, *Rangifer tarandus caribou*, in southeastern Manitoba. — *Canadian Field-Naturalist* 98: 184 - 190.
- Edmonds, E. J. and Bloomfield, M.** 1984. A study of woodland caribou (*Rangifer tarandus caribou*) in west central Alberta, 1979 to 1983. — *Alberta Fish and Wildlife Division, unpublished report*, 203 p. (Available from Alberta Energy and Natural Resources, Fish and Wildlife Division, Edmonton, Alberta, Canada).
- Edwards, R. Y. and Ritcey, R. W.** 1959. Migrations of caribou in a mountainous area in Wells Gray Park, British Columbia. — *Canadian Field-Naturalist* 73:21 - 25.
- Freddy, D. J.** 1979. Distribution and movements of Selkirk caribou, 1972 - 74. — *Canadian Field-Naturalist* 93: 71 - 74.
- Fuller, T. K. and Keith, L. B.** 1981. Woodland caribou population dynamics in northeastern Alberta. — *Journal of Wildlife Management* 45: 197 - 213.
- Helle, T.** 1979. Observations of group size and composition of wild forest reindeer, *Rangifer tarandus fennicus* Lönbn., during the calving and summer periods in eastern Finland — *Aquila Series Zoologica* 19:5 - 11.
- Helle, T.** 1980. Sex segregation during calving and summer period in wild forest reindeer in eastern Finland with special reference to habitat requirements and dietary preferences. — In: Reimers, E.; Gaare, E. and Skjennneberg, S. (eds.) *Proceedings of the Second International Reindeer and Caribou Symposium*. Direktoratet for vilt og ferskvannsfisk, Trondheim. 799 p. 508 - 518.
- Kelsall, J. P.** 1968. The migratory barren-ground caribou of Canada. — *Canadian Wildlife Service, Ottawa*. 340 p.
- Luttich, S.** 1978. Classification, distribution and movement of the George River caribou herd on the rutting range, October 1976 and 1977. — *Newfoundland-Labrador Wildlife Division, unpublished project report no. 4002*, 39 p. (Available from Newfoundland-Labrador Wildlife Division, Goose Bay, Labrador, Canada AOP 1C0).
- Nadler, C. F.; Hughes, C. E.; Harris, K. E. and Nadler, N. W.** 1967. Electrophoresis of the serum protein and transferrins of *Alces alces* (elk), *Rangifer tarandus* (reindeer), and *Ovis dalli* (Dall sheep) from North America. — *Comparative Biochemistry and Physiology* 23: 149 - 157.
- Oosenbrug, S. M. and Theberge, J. B.** 1980. Altitudinal movements and summer habitat preferences of woodland caribou in the Klune Ranges, Yukon Territory. — *Arctic* 33:59 - 72.
- Pulliainen, E.; Sulkava, S.; Erkinaro, E.; Heikura, K. and Lindgren, E.** 1983. Seasonal movements of the wild forest reindeer (*Rangifer tarandus fennicus*) in eastern Finland. — *Acta Zoologica Fennica* 175:15 - 16.
- Røed, K. H.** 1985. Genetic differences at the transferrin locus in Norwegian semi-domestic and wild reindeer (*Rangifer tarandus* L.) — *Hereditas* 102:199 - 206.
- Shoosmith, M. W. and Storey, D. R.** 1977. Movements and associated behavior of woodland caribou in central Manitoba. — *Proceedings of the International Congress of Game Biologists* 13:51 - 64.
- Skoog, R. O.** 1968. Ecology of the caribou (*Rangifer tarandus granti*) in Alaska. — *Unpublished Ph.D. Thesis, University of California, Berkely*. 699 p.
- Stardom, R. R. P.** 1975. Woodland caribou and snow conditions in southeast Manitoba. — In: Luick, J. R.; Lent, P. C.; Klein, D. R. and White, R. G. (eds.) *Proceedings of the First International Reindeer and Caribou Symposium*. Biological Papers of the University of Alaska. Special Report No. 1. 324 - 334.