# Calving of the experimental reindeer herd in Kaamanen during 1970 - 85

**Eija Eloranta**[1] and **Mauri Nieminen**[1]

*Abstract:* Calving and calf production were studied in an experimental reindeer (*Rangifer tarandus* L.) herd in Inari, Kaamanen (69°10'N) in northern Finland. Most of the calving took place between May 10 and 29; 50% of the calves were born up to 22.5. and 90% up to 29.5. The percentage of calves (calves/hinds preceeding year) was on average 79.2%. The newborn sex ratio was 1:1. There was a large range (1.8 to 8.5 kg) in the birth-weight of newborn calves; male calves weighed about 0.3 kg more than female. The total loss of calves during summer and autumn was about 34.5% (range 6.3 to 100.0%). During the calving period 111 calves (12.2%) died. They were usually younger than one day, and on average weighed 1.3 kg less at birth than calves who lived until autumn. The hinds of calves dying very early were usually young and calving for the first time. The autumn-weight of hinds correlated significantly (r=0.49) with the birth-weight of their calves. Over-5-year-old and over 80 kg hinds bore the heaviest calves (mean weight 6.3 kg) and the survival of these calves was very good. The first hinds to calve in the spring (calving up to 22.5.) are 5-year-old and older, which are also the heaviest and produce the most vital calves.

**Key words:** reindeer, calving, birth-weight, age, mortality.

[1] Finnish Game and Fisheries Research Institute, Game Division, Reindeer Research, Koskikatu 33 A, SF-96100, Rovaniemi, Finland

**Rangifer,** Special Issue No. 1, 1986: 115 - 121

## Introduction

Seasonality and predation are the two main factors invoked to explain the birth synchrony in *Ungulates.* Births are timed to minimize environmental or energetic stress on mother or offspring and the optimal slot, in very seasonal climates, is narrow. Births are also synchronised to reduce predation on the vulnerable newborns either by satiating or confusing predators (Bergerud, 1974; Dauphiné and McClure, 1974).

As a result of high adaptation to seasonal variations reindeer and caribou (*Rangifer tarandus* spp.) undergo seasonal physiological changes with the highest metabolic demands in the spring and early summer. Calves are born, and must be nursed at the same time as the hinds are recovering from the rigors of winter. Although lactation begins before all the snow has melted and hinds are very lean, the milk of reindeer is outstandingly rich in protein and fat and the energy content is high (Arman, 1979).

The reproduction of reindeer and caribou has been extensively studied including the timing of reproduction (Bergerud, 1975; Holthe, 1975), reproduction data of reindeer and caribou (McEwan and Whitehead 1972), reproductive physiology (Dott and Utsi, 1973; Roine, 1974; Parker, 1981; Roine *et al.*, 1982), calving and related social behaviour (Lent, 1966; Espmark, 1980), maternal effects upon calving (Lenvik and Bø, 1983; Skogland, 1984) and mortality rates (Pruitt, 1961; Rognmo *et al.*, 1983). The objective of the present study was to obtain information on calving and calf production of Finnish reindeer.

## Material and methods

The study was carried out in the area of Kaamanen reindeer research station (pasture area about 70 km$^2$) in Inari (69°10'N). In this area the reindeer were freely grazing most of the year excluding the calving period when the females

were kept in the calving area (about 8 ha). In winter and during the calving period the animals were offered a supplement containing lichens, molasses and pelleted concentrates. In the study area the 6-month-long winter usually begins in Mid-October. The snow depth is as its greatest in early May (70 - 80 cm) and snow melts usually by the end of May. During the calving period in May-June minimal temperature varies daily between -6°C and +8°C and maximal temperature between +3°C and +18°C.

Altogether 2210 semi-domestic reindeer (*R. t. tarandus* L.) (1132 females, 165 males and 913 calves) were studied. During the calving period newborn calves were caught by hand after the calf had been licked dry by the mother. The calf was weighed with a steelyard to the nearest 0.1 kg. Then the calf was ear-marked with numbered ear-tags and sexed. Also the color of newborns, date of their birth and information on their mother were recorded. Mortality among the calves during the calving period was also recorded. The calving area was examined daily and carcasses found were collected and examined. The calving percentage was estimated according to the number of calves born and the number of hinds the preceeding autumn. All the reindeer including calves were weighed annually (1970 - 84) during the slaughtering period at the turn of November - December and 1985 in addition to this just prior to calving in April using a spring balance to the nearest 0.5 kg. The mortality of calves during summer and autumn was estimated according to the number of calves present during the weighing. The statistical analyses were performed using BMDP-program packets. The significances of the differences between the group mean values were calculated by t-test.

## Results

During 1970 - 84 there were altogether 1297 adult reindeer in the Kaamanen reindeer herd. The sex-ratio (female:male) was on an average 11:1. There were annually about 75 females (range 22-132) and 11 males (range 2-25). The average age of 3-year-old and older females was 5.3 years (range 3.0 - 14.0 years, n= 929) and the mean weight of these animals was 70.8 ± 0.3 kg ($\bar{x}$ ± S.E.) (range 50.0 - 106.0 kg, n= 712). Three-year-old and older males were younger, the mean age being 4.1 years (range 3.0 - 8.0 years, n= 88). The mean weight of these males was 95.0±1.7 kg (range 60.0 - 133.0 kg, n= 75). The mean weight of pregnant adult hinds was 71.7±0.3 kg (n= 583), which was significantly greater ($P < 0.001$) than that of barren animals (67.0±0.6 kg, n= 133). The young pregnant hinds weighed on an average 59.6±0.8 kg (n= 96), significantly more ($P < 0.001$) than barren animals of the same age (51.7±0.3 kg, n= 87).

The calving percentage of hinds in this study was on average 79.2% (range 64.3 - 93.4%). Only 44.5% of those hinds weighing under 60 kg had a calf. Of heavier hinds (weighing 60 - 80 kg) 82.2% had a calf and almost every hind weighing over 80 kg produced a calf (94.7%) (Table 1). A highly significant linear regression was obtained between the birth-weight of calves and the weight of pregnant females just prior to calving ($r= 0.58$, $P < 0.001$, n= 70) and also between the birth-weight of calves and the weight of pregnant females in preceeding autumn ($r= 0.49$, $P < 0.001$, n= 619) (Fig. 1).

The body weight of hinds increased clearly up to the age of 5 years. After that it kept quite constant increasing slightly until it started falling after the hinds reached the age of 12 - 13 years. The hinds got pregnant for the first time usually

Table 1. Percentage calving, calf weights at birth, and calf autumn weights in relation to maternal weight in the preceeding autumn in the Kaamanen reindeer herd during 1975-84 (numbers in parentheses)

| Weight of hinds (kg) | Calving percent | Birth-weight of calves (kg) | Autumn-weight of calves (kg) |
|---|---|---|---|
| ≤50 | 12.2 | 4.2 ± 0.58 ( 4) | 37.0 ± 0.0 ( 2) |
| 51-60 | 53.9 | 4.5 ± 0.10 ( 63) | 37.0 ± 0.92 ( 41) |
| 61-70 | 80.5 | 5.0 ± 0.05 (263) | 38.7 ± 0.51 (151) |
| 71-80 | 84.4 | 5.5 ± 0.06 (218) | 42.1 ± 0.52 (143) |
| 81-90 | 93.4 | 6.1 ± 0.11 ( 56) | 45.1 ± 1.01 ( 42) |
| ≥90 | 100.0 | 6.6 ± 0.23 ( 15) | 52.3 ± 1.91 ( 13) |

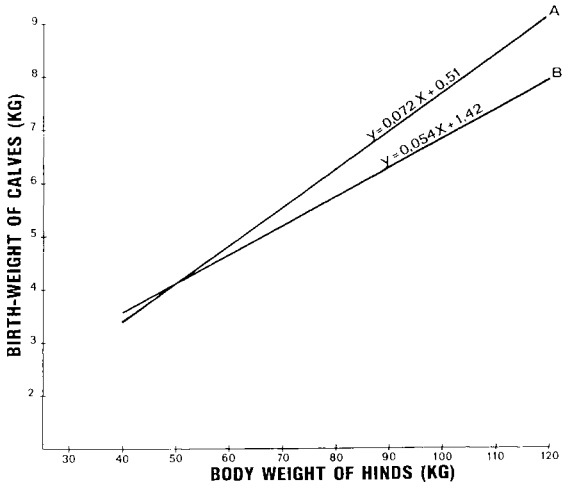


Fig. 1. Mean calf birth-weights in relation to maternal weights just prior to calving (A) and in preceeding autumn (B). The lines were obtained by polynomial regression analyses and are described respectively by the following equations: $y = 0.072x + 0.51$, $r = 0.58$, $n = 70$ and $y = 0.054x + 1.42$, $r = 0.49$, $n = 619$, where y is the weight of calves and x is the weight of hinds.

at the age of 2.5 years. The calving percentage among under 3-year-old hinds was only 38.0%. The 3-4-year-old hinds calved most successfully (calving percentage 87.9%). Although the heaviest hinds which are expected to be also the oldest ones gave birth to the heaviest calves (Table 1), the calf percentage started to decrease with age among middle-aged and older hinds being only 65.7% among over 10-years-old hinds and 41.7 after the hinds reached the age of 12 years. Hinds produced vital calves up to the 9th pregnancy during which the mean age of these hinds was 10.5 ± 0.2 years (n= 15) (Fig. 2).

During 1970 - 84 the calving period began usually on the 10th of May. The first half of calves were born up to May 22nd and 90% up to May the 29th. The beginning and the end of calving period varied greatly annually (27.4. - 15.5. and 22.5. - 5.6., respectively). The peak of calving varied yearly between May the 15th and 25th. The duration of calving time from the first birth until the main calving was on an average 19 days (range 9 - 32 days).

During 1970-84 together 913 calves were born (including stillbirths). The mean birth-weight of calves was 5.1 ± 0.04 kg (range 1.8 - 8.5 kg, n= 823). There was no annual variation in the birth-weight of newborn calves except the year 1973 which was a bad year and the 2 recent years (1983-84) when the birth weights have been significantly ($P < 0.001$) greater compared to the earlier years. Of the 913 calves born 49.2% (n= 448) were males and 46.9% (n= 427) were females. In addition to this 4.2% (n= 38) of calves could not be sexed. The sex-ratio (female:male) at birth was 1:1. The birth-weight of male calves was on an average 5.3 ± 0.1 kg (n= 423) and it was significantly greater ($P < 0.001$) than the birth-weight of female calves (5.0 ± 0.1 kg, n= 397). Calves of 3-year-old and older hinds weighed (5.2 ± 0.04 kg, n= 729) significantly more ($P < 0.001$) than the calves of young hinds (4.3 ± 0.1 kg, n= 90).

The mean age of hinds calving before the peak of calving was 5.6 ± 0.1 years (n= 344), being significantly higher than that of hinds calving

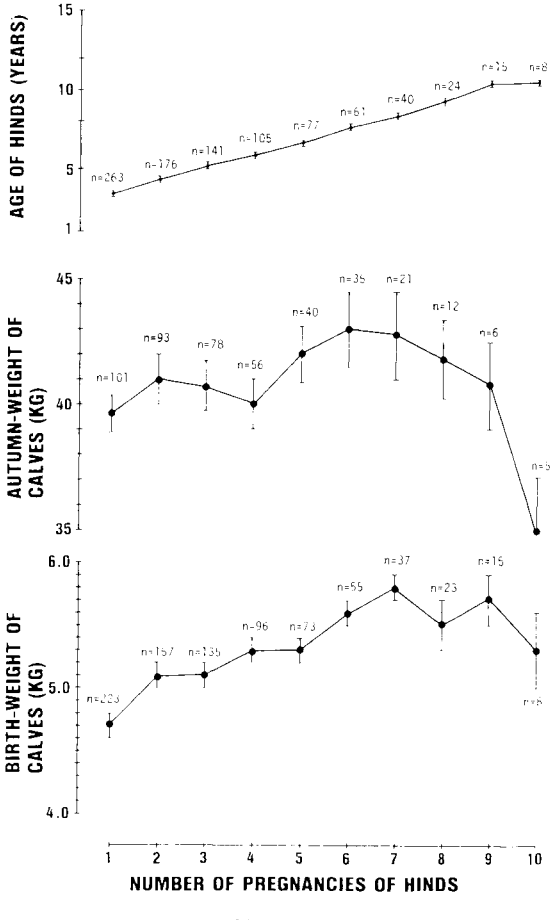


Fig. 2. Changes in calf birth- and autumn-weights as well as maternal age ($\bar{x}$ ± S.E.) with respect to the number of pregnancies of the mothers.

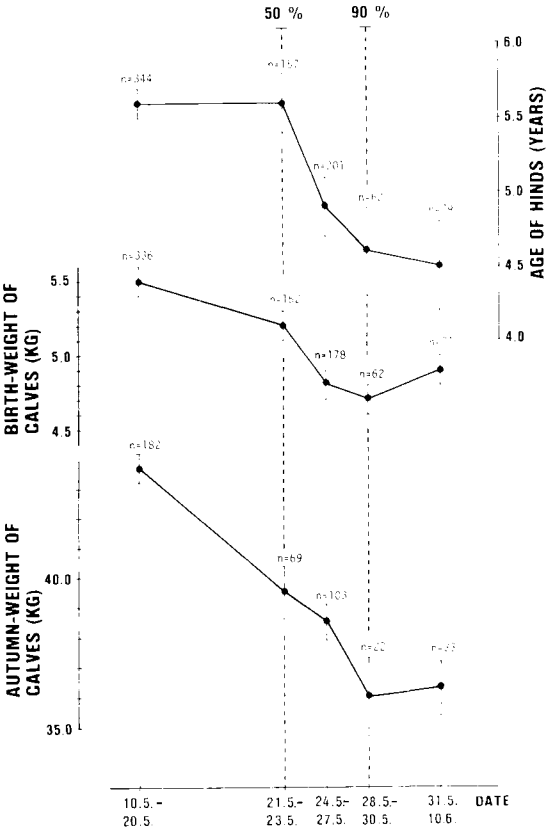


Fig. 3. Birth-weight, autumn-weight and age ($\bar{x} \pm$ S.E.) of calved females in relation to timing of births. Peak calving (50% calves born) was 22 May and mean calving (90% calves born) 29 May. The lines are described according to groups; calves born before peak calving, during peak calving, after peak calving but before the main calving, during the main calving and calves born after the main calving.

after the peak (4.9 ± 0.2 years, n= 201) (Fig. 3). The mean age and weight of hinds which calved before the peak of calving time (5.6 ± 0.1 years, n= 344 and 72.7 ± 0.6 kg, n= 256, respectively) were higher than those of hinds which calved after the peak. Those hinds that calved during the main calving time were significantly ($P < 0.001$) younger (4.6 ± 0.3 years, n= 62) and lighter (67.4 ± 1.1 kg, n= 47) than the first mentioned.

The birth-weight of calves was related to the timing of births. The first calves that were born before the peak of calving were significantly heavier ($P < 0.001$) weighing 5.5 ± 0.1 kg (n= 336) than those who were born later. These calves were also the heaviest ones in autumn (Figs 3 and 4). The calves that were born in the beginning of the calving period were about 7.5 kg heavier in autumn than those born at the end. The difference of 0.6 kg (10.9%) increased during the summer and autumn months to 7.5 kg (16.9%).

Of those 913 calves born, 34.5% died before the slaughtering period. Male calves were slightly more likely to succumb (47.5%) than female calves (41.4%). 35.4% of dead calves died during the calving period in May - June, the rest (64.6%)of the calves died until the slaughtering period in November - December. During the calving period the mortality of male calves was on an average 11.6%, being almost double compared to that of female calves (6.8%). After the calving period the mortality ratio was on the contrary 23.7% for females and 21.7% for males.

The birth-weight of calves that died during the first 6 months was significantly lower ($P < 0.001$) compared to those that survived (4.6 ± 0.1 kg, n= 276 and 5.4 ± 0.04 kg, n= 487, respectively). The greatest number of calves that died during the calving period (67.2%) died during their first day of life. These calves were also the smallest ones (birth-weight 3.6 ± 0.2 kg, n= 45) and their birth-weight was almost 2 kg lower than that of surviving ones. Calves that died after the calving period were heavier at birth (4.9 ± 0.1 kg, n= 195) than those dying during the calving period (4.1 ± 0.1 kg, n= 81) but, however, lighter than the surviving ones. The smallest calf that survived during 1970-84 weighed 2.7 kg at birth.

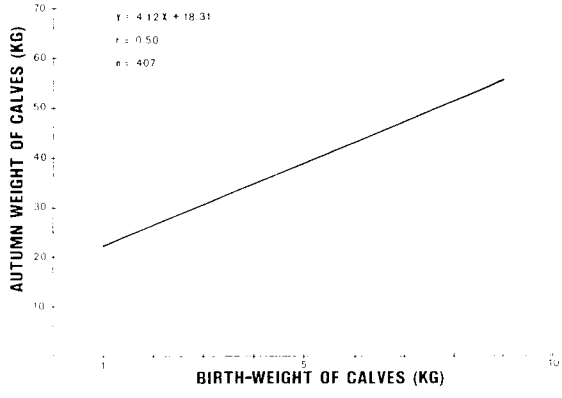


Fig. 4. The relationship between birth-weight and autumn-weight of calves. The line was obtained by linear regression analyses and is described by the following equation: $y = 4.2x + 18.31$, $r = 0.50$, $n = 407$, where y is the birth-weight and x is the autumn-weight of calves.

The principal causes of calf mortality during 1970-84 were stillbirths (17.1%), poor condition (20.7%), abandonment followed by starvation (11.7%), predation (10.8%) (red fox, *Vulpes vulpes* and golden eagle, *Aquila chrysaetos*), due to disease (8.0%) and accident (7.2%). Young hinds had more stillbirths (18.8%) than the 3-year-old and older hinds (3.8%). The mortality rate among the calves from young hinds was almost 10% higher than that of older ones. The largest number of calves of young hinds died just after parturition (45.8%) while the mortality of calves of full-grown hinds occurred mainly after the calving period (68.8%).

## Discussion

By the turn of Mid-October over 90% of the hinds have ovulated and the conception rate in Finland is over 60% (Roine, 1974). Gestation takes 208 - 227 days depending on ambient conditions (McEwan and Whitehead, 1972; Dott and Utsi, 1973). Calving in reindeer and caribou usually commences in late April and reaches its peak in Mid-May (Espmark, 1971). In caribou populations calves are born during an effective 2-week period (Lent, 1966). Reindeer calves have been indicated to be born in even briefer periods (Holthe, 1975). In the present study calving from the first birth up to the date when 90% of calves were born took on an average 19 days. The timing of births is due to genetics as well as nutrition. The study by Espmark (1980) supports the theory of parturition delay in undernourished hinds. In reindeer populations the location of the herd home range area also has its effect upon the timing of the calving period. In Norway the peak of calving varied in different populations between May the 6th and the 29th (Holthe, 1975). On the other hand it has been found that when the level of nutrition was lower than usual before the normal time of estrus, the time for the onset of estrus was slightly delayed in white-tailed deer (*Odocoileus virginianus*) (Verme, 1965).

The pregnancy rate of reindeer and caribou in good conditions is known to be very high, in places over 90% (Parker, 1981; Mossing and Rydberg, 1982). The conception rate of Finnish reindeer is on an average 64.5% but the corresponding calving percent is 60%. The present findings about the calving percentage of hinds (on an average 79.4%) differ slightly from earlier Finnish observations. Less than half of those hinds weighing under 60 kg produced a calf but almost every hind weighing over 90 kg was pregnant also gave birth. Because age and weight correlate, it is expected that the heaviest hinds are also the oldest ones (Hamilton and Blaxter, 1980). However, the most successful in calving were the 3-8 years old hinds while the productivity of younger and older hinds was clearly decreased. The present observations about the reproductive ability of hinds and the influence of age and weight to it agree with earlier studies (Clutton-Brock *et al.*, 1982; Skogland, 1984).

Genetic factors, maternal age and weight as well as nutrition are found to be of importance for calf birth-weight, growth and survival (Bergerud, 1975; Albon *et al.*, 1980; Rognmo *et al.*, 1983). The birth-weight of newborn reindeer calves in Finland is about 5-6 kg (Timisjärvi *et al.*, 1984). In Sweden and Canada the corresponding figures are 6.5 - 7.0 kg and male calves are usually about 0.5 kg heavier. The birth-weight of newborn calves was on an average 5.1 kg, which is somewhat lower than is reported in Sweden (Espmark, 1971) and in Canada (Nowosad, 1975) but is however in agreement with earlier Finnish observations.

The birth-weight of calves has been found to correlate with maternal weight just prior to calving (Espmark, 1980; Rognmo *et al.*, 1983). In the present study the birth-weight correlated with maternal weight just prior to calving but also almost as precisely with maternal weight in the previous autumn. The smallest hinds in autumn produced the smallest calves in the spring. The hinds calved for the first time at the age of 3 years and produced vital calves up to the age of 10.5 years. After 10.5 years was reached the birth-weight of calves started to decrease and survival rate dropped (see Fig. 2). This is in agreement with the observations in wild reindeer populations in South-Norway where the weight of fetuses correlated with maternal age as long as the body condition of hinds did not deteriorate with age (Skogland, 1984). Maternal age and calf weight are also found to correlate among Norwegian semi-domestic reindeer (Lenvik and Bø, 1983).

Although the pregnancy rate of reindeer and caribou is known to be high, the net production is highly reduced being 40 - 60% in reindeer (Nowosad, 1975; Rehbinder, 1975) and 30 - 50%

in caribou (Bergerud, 1971; Parker, 1972). Mortality during the first few days of life is assumed to be as high as 20% (Pruitt 1961). The total loss in the period from late pregnancy to the end of lactation can be 55% in wild reindeer (Skogland, 1984). The net productivity of the present study herd was on an average annually 65.5%. The calf percentage dropped until the end of the calving period 12.2% and 22.3% more during the remaining 5 months.

The calves that died were significantly smaller than those surviving and the smaller the calf was at birth the more probably it died. Also in wild ungulates a significantly higher mortality has been found among the smallest neonates (Verme, 1977). The birth-weight of the smallest calf to survive was 2.7 kg, which is somewhat lower than is reported to be the critical birth-weight of neonatal survival among wild reindeer in Norway (Skogland, 1984).

**Acknowledgements**

We would like to thank Dr Peter C. Lent, Bureau of Land Management (602), Department of Interior, Washington, D.C. 20240 USA and Dr M. Kingsley for useful comments on the draft of this paper.

## References

**Albon, S. D., Mitchell, B.** and **Staines, B. N.** 1983. Fertility and body weight in female red deer: a density-dependent relationship. — *Journal of Animal Ecology, 52: 969 - 980.*

**Arman, P.** 1977. Milk from semi-domesticated ruminants. — *World Rev. Nutr. Diet., 33: 198 - 277.*

**Bergerud, A. T.** 1971. The population dynamics of Newfoundland caribou. — *Wildlife Monographs, No. 25. 55 p.*

**Bergerud. A. T.** 1974. The role of the environment in the aggregation, movement, and disturbance behaviour of caribou. — *In: Geist, V. and Walther, F. (eds.) Behaviour of ungulates and its relationship to management IVCN, Morges, Switzerland. 552 - 584.*

**Bergerud, A. T.** 1975. The reproductive season of Newfoundland caribou. — *Canadian Journal of Zoology, 53: 1213 - 1221.*

**Clutton-Brock, T. H., Guinness, F. E.** and **Albon, S. D.** 1982. Red deer: behaviour and ecology of two sexes. — *University of Chicago Press, Chicago. 80 - 99.*

**Dauphiné, T. C. Jr.** and **McClure, R. L.** 1974. Synchronous mating in Canadian barren-ground caribou. — *Journal of Wildlife Management, 38: 54 - 66.*

**Dott, H. M.** and **Utsi, M. N. P.** 1973. Artificial insemination of reindeer *(Rangifer tarandus)* . — *Journal of Zoology, London, 170: 505 - 508.*

**Espmark, Y.** 1971. Mother-young relationship and ontogeny of behaviour in reindeer (*Rangifer tarandus tarandus* L.). — *Zeitschrift für Tierpsychologie, 29: 42 - 81.*

**Espmark, Y.** 1980. Effects of maternal pre-partum undernutrition on early, mother-calf relationship in reindeer. — *In: Reimers, E., Gaare, E. and Skjenneberg, S. (eds.), Proceedings 2nd International Reindeer/Caribou Symposium, Røros, Norway, 1979. Direktoratet for vilt og ferskvannsfisk, Trondheim. 485 - 496.*

**Hamilton, W. J.** and **Blaxter, K. L.** 1980. Reproduction in farmed red deer. — *Journal of Agricultural Science, 95: 261 - 273.*

**Holthe, V.** 1975. Calving season in different populations of wild reindeer in South-Norway. — *In: Luick, J. R., Lent, P. C., Klein, D. R. and White, G. R. (eds.), Proceedings First International Reindeer/Caribou Symposium, Fairbanks 1972. Biological Papers of the University of Alaska, Special Report No. 1, 194 - 198.*

**Lent, P. C.** 1966. Calving and related social behaviour in the barren ground caribou. — *Zeitschrift für Tierpsychologie, 6: 701 - 756.*

**Lenvik, D.** and **Bø, R.** 1983. Simlenes moregenskaper. — *Reindriftsnytt, 17: 13 - 16.*

**McEwan, E. H.** and **Whitehead, P. E.** 1972. Reproduction in female reindeer and caribou. — *Canadian Journal of Zoology, 50: 43 - 46.*

**Mossing, T.** and **Rydberg, A.** 1982. Reproduction data in Swedish domestic forest reindeer. — *Rangifer, 2 (2): 22 - 27.*

**Nowosad, R. F.** 1975. Reindeer survival in the Mackenzie Delta herd, birth to four months. — *In: Luick, J. R., Lent, P. C., Klein, D. R. and White, G. R. (eds.), Proceedings First International Reindeer/ Caribou Symposium, Fairbanks 1972. Biological Papers of the University of Alaska, Special Report No. 1, 199 - 208.*

**Parker, G. R.** 1972. Biology of the Kaminuriak population of barren-ground caribou. Part 1: Total numbers, mortality, recruitment, and seasonal distribution. — *Canadian Wildlife Service Report, Series No. 20, Ottawa, 95 p.*

**Parker, G. R.** 1981. Physical and reproductive characteristics of an expanding woodland caribou population (*Rangifer tarandus caribou*) in Northern Labrador. — *Canadian Journal of Zoology, 59: 1929 - 1940.*

**Pruitt, W. O.** 1961. On post-natal mortality in barren-ground caribou. — *Journal of Mammalogy, 42: 550 - 551.*

**Rehbinder, C.** 1975. Kalvdödligheten i Ängesä samebys renhjord. — *Nordisk Veterinärmedicin, 27: 241 - 252.*

**Rognmo, A., Markussen, K. A., Jacobsen, E.** and **Blix, A. S.** 1983. Effects of improved nutrition in pregnant reindeer on milk quality, calf birth-weight, growth and mortality. — *Rangifer, 3 (2): 10 - 18.*

**Roine, K.** 1974. Studies on reproduction in female reindeer. — *Helsinki, 58 p.*

**Roine, K., Nieminen, M.** and **Timisjärvi, J.** 1982: Foetal growth in reindeer. — *Acta Veterinaria Scandinavica, 23: 107 - 117.*

**Skogland, T.** 1984. The effects of food and maternal conditions on fetal growth and size in wild reindeer. — *Rangifer, 4 (2): 39 - 46.*

**Timisjärvi, J., Nieminen, M.** and **Sippola, A.-L.** 1984. The structure and insulation properties of the reindeer fur. — *Comparative Biochemistry and Physiology, 879 (4): 601 - 609.*

**Verme, L. J.** 1965. Reproduction studies on penned whitetailed deer. — *Journal of Wildlife Management, 29: 74 - 79.*

**Verme, L. J.** 1977. Assessment of natal mortality in Upper Michigan deer. — *Journal of Wildlife Management, 41: 700 - 709.*