Fertility and twinning in Canadian reindeer

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Abstract: This study was carried out from 1976 to 1981 on the Mackenzie Delta reindeer herd with the co-operation of the owners, Canadian Reindeer Ltd., Tuktoyaktuk, Northwest Territories. The reproductive organs of 4050 female reindeer (*Rangifer tarandus*) were collected at slaughter. The pregnancy rates averaged 99.5% of the females examined. In the years 1978 and 1981, 24.7% (713) of the animals were carrying twins, as compared to a twinning rate of 0.4% observed for the intervening years. Nineteen animals were not pregnant. Of these, 14 were emaciated with no gross pathology of the reproductive tract. Five females had either a mummified fetus or uterine adhesions preventing a viable pregnancy. Estimated fawn survival rates from birth to June varied from 51.7 to 95.7%. Fawn survival from June to yearlings of June the next year varied from 51 to 86.4% as determined by count at roundup. Increment averaged 15.8% per year after a slaughter of 13.4% of the herd yearly.

Key words: reindeer, pregnancy rates, twinning, Canada, fawn survival, recruitment, Arctic.

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Introduction

Domestic reindeer, transplanted to Alaska in 1891, came from two Asian stocks, a large form presumably from forest reindeer stock and a small form presumably from a tundra subspecies (Banfield, 1961). A herd of some 3000 reindeer was purchased in Alaska in 1929 by the government of Canada and, after an epic journey of 63 months, was delivered to the Mackenzie Delta region in 1935 (Scotter, 1978). The larger form, which calved in April, was selected for introduction to Canada (Porsild, 1954).

The following is a report of my evaluation of reproductive rates, occurrence of twinning, and fawn survival in the Mackenzie Delta herd from 1976 to 1981, based on examination of female reproductive tracts obtained from reindeer slaughtered either in November or in February — March of each year and annual records of sex and age composition of the herd obtained during June roundups.

Study herd

The reindeer are managed on an open herding basis on the winter range; that is, the herd is kept in a certain region selected by the owner, but no attempt is made to keep the herd as one group. The summer range is the Tuktoyaktuk Peninsula where no herding is required except for periodic surveillance by aircraft. As the herd migrates southward down the peninsula in the fall, it is met by the herders and guided to the grazing area selected for that winter. The herd is kept under surveillance by aircraft and snowmobile to prevent straying and to check for wolves. During the winter the herders use snowmobiles to bring straying animals back to the vicinity of the main herd.

The major slaughter is conducted between 18 February and 5 March in order to utilize the ice road to ship the meat to southern markets. Occasionally there has been a small inspected slaughter in November, mostly for northern

markets. The slaughter site is moved each year to an area where there is enough forage to sustain 1500 to 2000 reindeer for two weeks. About 1500 reindeer are separated from the main herd and brought to the slaughter area. Selected animals are slaughtered, that herd is moved away and another group is brought in. Nutrition is at its lowest ebb and fawning time is near, so the slaughter period is also the most critical time of year for the reindeer. Therefore, an attempt is made to utilize a sub-unit of the herd for only 2 days to minimize the stress.

After slaughter the whole herd is guided towards the fawning area, so as to arrive by fawning time. Fawning takes place in an area protected by hills from the cold spring winds. The first fawn will be born 30 March to 2 April and fawning will be general 10 days later. Most of the fawns are born by the middle of May although an occasional fawn may arrive as late as the middle of August. Most of the fawns born late probably do not survive the following winter.

Immediately after fawning the herd begins to migrate towards the Tuktoyaktuk Peninsula for summer range. The migration is led by older females who fawned early or lost their fawns, with the majority of the bulls following 1 or 2 days later. The remainder of the herd is strung out for 100 km with the females with late born fawns and the yearlings bringing up the rear. The leaders reach the tip of the peninsula about 20 June, with the last ones arriving 2 weeks later. The reindeer have to summer on the Arctic coast for minerals and possibly also to avoid insect harassment, which they do by standing in the water or lying on sandy beaches.

Materials and methods

Examination of reproductive tracts

Between 1976 and 1981, 5700 reindeer were examined at slaughter under the auspices of the Food Production and Inspection Branch, Agriculture Canada. Most of the slaughter was done in the month of February each year, although some small slaughters were done in November.

The female reproductive organs were placed to one side by the butcher during eviseration so they could be counted and examined at the end of the day's kill. Data recorded included (1) the number of pregnancies, (2) the number of fetuses per pregnancy (3) stage of gestation, and (4) gross reproductive pathology.

Since 1976 the herd has been rounded up beginning about 18 June each year by helicopter and corralled under supervision of Agriculture Canada. In 1976 and 1977 the roundups were incomplete, but from 1978 to 1981 for all practical purposes the complete reindeer herd was corralled.

The spring roundup is conducted to cut the velvet antlers from the bulls and females for export. All the animals were run through a chute, the fawns are tagged with color coded tags for the year of birth, females to be slaughtered the following winter are marked with ear ribbons and bulls which are surplus or inferior for breeding purposes are castrated.

The yearling females with fawns at the spring roundup were counted in with the mature females for the years under review. The percentage of yearling females producing fawns each year (bred as fawns) was not determined.

The numbers of major segments of the herd were recorded so the number of yearling bulls and yearling females without fawns allowed an estimate of survival to 1 year of life of previous year's fawns.

Results

Between 1976 and 1981, 5700 reindeer were examined at slaughter, mostly in February of each year. All but 19 of the 4050 2-year-old and over female reindeer examined at slaughter from 1976 to 1981 were pregnant with viable fetuses (99.5%). Five of the 19 females exhibited gross reproductive pathology: three had uterine adhesions and two each a mummified fetus. The

Table 1. Annual reproductive rates of female reindeer obtained at slaughter (Feb.-Mar.), Mackenzie Delta herd, NWT, Canada.

	2+-yr-old females sampled			
Year	N	% pregnant	% single fetus	% twin fetuses
1977	357	99.2	99.2	0.8
1978	932	99.6	73.8	26.2
1979	481	99.4	99.6	0.4
1980	231	98.7	99.6	0.4
1981	2042	99.7	76.9	23.1

Table 2. Proportions of females and fawns in the annual June roundup of Mackenzie Delta herd reindeer, NWT, Canada.

Year	Herd sample[a]	females[b] 1+yr	females[b] 2+yr	% Fawns	Fawns/100 females 1+yr	Fawns/100 females 2+yr
1977	5205	45.0	36.9	35.3	78.5	95.7
1978	8245	47.7	37.2	35.0	73.4	94.1
1979	9855	43.2	32.4	24.2	56.2	72.0
1980	12745	46.5	38.5	24.3	52.4	63.2
1981	10879	41.9	34.8	21.5	51.3	61.8

[a] All reindeer corralled.

[b] The category 1+-yr females includes all females 1-yr or older; and the category 2+-yr females includes all females 2-yr and older, plus yearling females with calves (excludes only yearling females without calves).

remaining 14 were not pregnant but showed no gross reproductive pathology (emaciation, either from old age or injury, probably had led to an anestrous condition during the rut). The annual rate of pregnancy (with a viable fetus or fetuses) averaged 99.5% (±0.4% S.D.).

Only seven 2+-year-old females were examined at slaughter in 1976: all were pregnant, each with a single fetus. Relatively large samples of 2+-year-old females were slaughtered from 1977 to 1981. Over the whole study period 17.8% of the mature females slaughtered were pregnant with twins. In 1978 26.2% and in 1981, 23.1% of the females at slaughter were carrying twins (Table 1). In the other 3 years under review the average twinning rate was 0.56% per year.

From 1977 to 1981 the fawns aged about 2 months made up 21.5 to 35.4% of the herd with an average of 26.7% (Table 2). The number of fawns per 100 females ranged from 51.3 to 78.5% averaging 64.9%. Since the yearling females with fawns are counted as adults, all the female yearlings have been included in the female counts (Table 2), for comparative purposes. Females comprised from 41.9 to 57.7% of the herd sample, averaging 44.7%. The yearling females without fawns comprised from 16.9 to 23.4% of the female population with an average of 19.3% (Table 3). Fawn survival to 1-year of age averaged 64.7% (Table 4). There has been an average slaughter of 13.4% of the herd yearly from 1977 to 1981 and increment has still averaged 15.8% per year. The size predicted for the total herd in 1980, calculated from these

Table 3. Reindeer production and survival to the 2nd month of life, Mackenzie Delta herd, NWT, Canada.

Year	No. females producing[a] Singles	Twins	Fawns born	Fawns alive mid June	% early fawn survival
1977	1889	15	1919	1836	95.7
1978	2253	800	3853	2884	74.9
1979	3286	13	3312	2389	72.2
1980	4824	19	4862	3102	63.8
1981	2903	872	4647	2338	50.3

[a] Calculated from reproductive rates given in Table 1.

Table 4. Reindeer fawn survival from birth to the 2nd June of life, (13-14 months), Mackenzie Delta herd, NWT, Canada.

Year	Herd sample (less fawns)	Number of yearlings	% yearling recruitment	% fawns[a]	% fawns surviving to 1-yr[b]
1977				36.9	
1978	5361	1238	23.1	46.7	67.4
1979	7466	1721	23.1	33.6	59.67
1980	9643	2064	21.4	38.1	86.4
1981	8541	1582	18.5	42.7	51.0

[a] Percentage fawns equals estimated number of fawns born (Table 3) as proportion of herd sample (Table 2).

[b] Calculated by dividing the number of yearlings by the number of live fawns from the preceding year.

Table 5. Herd numbers calculated from increment 15.8% yearly.

Year	Calculated Herd	Actual Count
1974		5000
1975	5795	
1976	6716	
1977	7784	5205
1978	9022	8245
1979	10457	9855
1980	12120	12745
1981	14047[a]	10879
1982	12598	
1983	14588	

[a] Reduced by all large slaughter and a heavy neo-natal and fawn loss.

numbers, was at variance with the actual count at round up by —5% (Table 5). In 1981 the herd numbered 22.6% below the calculated number (Table 5) because of a large female slaughter. As well there was the lowest fawn survival in both the new born fawns and the coming yearlings of all the years under study (Table 3).

Discussion

The pregnancy rates observed in this reindeer herd (Table 1) seem to be higher than those reported in other *Rangifer tarandus* populations in the world (McEwan, 1963; Michurin, 1967; Kelsall, 1968; Dauphine, 1976). The rates reported here were based on counts of pregnancies at slaughter, mainly in females over 6 years old. These rates may have been slightly higher than the rates for the population as a whole, since the majority of does in the herd are under 4 years of age and are, therefore, least likely to be pregnant. However, the error appears to be slight, since in 1977 the birth of 1920 fawns was predicted on the basis of projected observed pregnancy rates at slaughter, and the actual count in June was 1863 (Table 3) for an error or a fawn loss from all causes of 4.3%. In Alaska fawn crops from 50 to 60% of the adult does are usual, but under ideal conditions fawns crops may reach 85 to 95% (Palmer, 1934). A fawn crop of 51.3% in the worst year (1981) (Table 2) is not below normal for other populations.

There was no way to determine how many of the females with fawns were just a year old. In Alaska, up to 5% of yearling females have been observed with fawns (Hadwen, 1942). Many of the yearlings with fawns appear to have fawned later than the main herd judging by the size and apparent age of the fawns in June. Yearling females have been observed fawning as late as 21 June.

The fawns of yearlings are weaker at birth and the young mothers do not have as much milk as the mature females, thus increasing the fawn loss from yearlings. However this loss is partly balanced by the more careful tending of a fawn by a yearling cow than by an old cow (Hadwen, 1942). When herding by helicopter the young females will drop behind with the fawn when it is exhausted, whereas the old females will leave the fawn to rejoin the herd.

Twinning has been reported in reindeer and caribou by Palmer (1934) and Nowosad (1973); for captive barren-ground caribou (*R. t. groenlandicus*) by McEwan (1971); and free-ranging woodland caribou (*R. t. caribou*) by Shoesmith (1976).

Twinning varied markedly from nearly no production of twins in 3-yr (mean = 0.5% ± 0.23% S.D.) to about 25% of the pregnancies in 2-yr (mean=24.7%±2.19% S.D.).

The high percentage of females observed with twin fetuses at slaughter in 1978 and 1981 has never been reported before in any *Rangifer tarandus* populations. Forty percent of barren-ground caribou in the wild produce two ova at one cycle, but no evidence of advanced development of a second embryo has ever been found (McEwan, 1963). If dual ovulation also occurs commonly in reindeer, then a trigger mechanism could be postulated which operates on occasion to allow the development of the second embryo.

Variable factors during the period of study included weather and antler removal. Climatological data for the Tuktoyaktuk area show that precipitation was slightly higher than normal in late June and early July, 1977 and again in 1980. This increased precipitation may have produced more forage earlier in the season by drawing the frost sooner and thus increased body condition to stimulate multiple ovulation and implantation. In caribou, full recovery of fat deposits during the summer is critical to reproduction, growth, and winter survival (Dauphine, 1976). The velvet antlers were removed from the reindeer herd for the first time in 1977. When a high rate of twin fetuses was found at slaughter in the following spring, the possibility of a casual relationship between antler removal and twinning was considered. However, twin pregnancies occurred at what appears to be the usual rate in the next 2 years, despite the annual antler harvest, and increased in frequency again in 1981. The only effect antler removal may have on twinning is the stimulation caused by roundup which promotes early shedding of the winter coat, which in turn may enhance early fattening.

Neo-natal mortality (between March 1 and June 30) estimated from pregnancy rates, (fawns dropped before April 1) due to abortion, lack of milk, abandonment, stillbirths, (fawns born after April 1 that are dead or so weak they are unable

to move) weak fawns, and inclement weather (Table 3) varied from 4.3% in 1977 to 49.7% in 1981. In 1981 the snow depth at the end of April was 66 cm as compared to 55 cm in 1980, when mortality was 36.8%. In the other years under study the snow depth was 15 to 33 cm, with fawn loss varying directly. In 1978 there were many females with twins at the roundup, and the snow depth at the end of April was 23 cm, whereas in 1981 only two females were seen with twins.

Predation is not a major factor in fawn mortality as the herd is under constant supervision after the first heavy snowfall in the fall until the end of May. The stress of herding, prolonged food deprivation, and hazing during the slaughter period is probably one of the major causes of fawn mortality, affecting both pregnant females and coming yearlings. In 1981 the slaughter was terminated early because of excessive fat vascularization from the rapid loss of body condition. After the harassment had been almost continous for 3 weeks, subsequent fawn losses were heavy from March until the middle of May. That year the herders reported many abortions and stillborn fawns. The fawns surviving at roundup were smaller than normal with very little antler growth. The females with the most fat reserves appeared to have the best rate of fawn survival. Whether the early fawns were aborted or the gestation time was prolonged could not be determined. A high plane of fat reserves and good nutrition decreases gestation time (Krog, 1980).

Since 1981 the slaughter procedure has been changed so that the animals to be slaughtered are corralled and the rest of the herd is not harassed all day. This reduces the stress on all the animals and helps prevent the loss of critical body fat reserves in the fawns and females.

Fawn mortality until the end of June seems to be directly related to the snow depth at the end of April and the amount of harassment at slaughter. Fawn losses from stress of handling start in March and continue, whereas losses from weather occur only at birth or shortly after. Twins most years are a disadvantage because of poor survival rates if conditions are not ideal, and thus they cause an increased net fawn loss.

The percentage of fawns surviving to one year of age (Table 4) is inaccurate to the extent that yearling females with fawns are counted as adults. Also small groups of just yearlings at roundup are not brought in for count because they have no antler of commercial value. The actual number of yearlings is, therefore, greater than the value given in Table 4.

The survival of fawns from June to yearlings would be greatly enhanced if coralling and slaughter procedures were modified. Too many fawns are separated from the females during the corralling and handling procedure for too long with some never getting back together. The fate of these fawns is unknown.

Fat reserves in February are excellent on the older females while the fat reserves on the fawns and young females are only moderate to poor, especially if they are badly infested with warbles. Therefore the fawns and young females will withstand very little food deprivation or harassment without serious consequences.

This initial investigation raises many questions:

(1) do range conditions govern rates of fertility in these reindeer;
2) is twinning related to the age of the breeding females (I suspect it is); and
(3) do they really have a different and usually greater genetic potential for growth than North American caribou.

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