

Caribou calf deaths from intraspecific strife — a debatable diagnosis

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Abstract: In our review of the literature we found only one example of an instance when intraspecific strife supposedly led to the deaths of several newborn barren-ground caribou (*Rangifer tarandus groenlandicus*) calves within a short period of time and on a small area. This event took place during calving in June 1958 on the calving ground of the Beverly caribou herd in the Northwest Territories. The lack of other examples of multiple deaths of newborn caribou calves from intraspecific strife and our findings on the same calving ground during a study of calf mortality in June 1981, 1982, and 1983 and a study of cow-calf behaviour in June 1981 and 1982 cause us to question the published explanation. As we rarely saw aggressive behaviour among cows and newborn calves that involved actual physical contact and none that resulted in injury or death and because we found instances of multiple killings of calves by wolves (*Canis lupus*) we suggest that a probable alternative explanation of the 1958 findings is surplus killing by wolves. Most importantly, only direct observation of an event allows separation of a death caused by injuries due to intraspecific strife from a death caused by accidental injuries.

Key words: caribou, calf, mortality, intraspecific strife, Northwest Territories, Canada.

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Introduction

Field observations of behaviour of barren-ground caribou (*Rangifer tarandus groenlandicus* and *R.t. granti*) on calving grounds document few instances of aggressive behaviour involving actual contact (e.g., de Vos, 1960; Pruitt, 1960; Lent, 1966; Kelsall, 1968; Skoog, 1968). For the most part, those observations were unsystematic (excluding Lent, 1966) and none of those studies reported rates of occurrence of aggressive behaviour relative to «active time periods» of the cows or calves involved. The observations of aggressive behaviour emphasized, however, that the likelihood of injury to or death of calves due to intraspecific strife was slight as the aggressive behaviour rarely included physical contact (e.g., Lent, 1966; Kelsall, 1968).

Studies of the causes of mortality of newborn calves (e.g., Lent, 1966; Skoog, 1968; Bergerud, 1971; Miller and Broughton, 1974) have also found only few instances of calf deaths that apparently could have been caused by aggressive behaviour and those few instances were the finding of single carcasses. The exception is de Vos' (1960) report of finding seven dead calves in one locality on the calving ground of the Beverly herd and subsequently ascribing, at least, five of those deaths to injuries caused by intraspecific strife among cows and newborn calves.

Our studies of calf mortality and cow-calf behaviour were not carried out specifically to address the subject of intraspecific strife among caribou cows and calves but it was part of our

overall consideration. After completing our studies and reexamining the literature related to intraspecific strife among caribou we came to the conclusion that the single example of multiple deaths of calves supposedly resulting from intraspecific strife (de Vos, 1960) warrants reevaluation. Furthermore, our own findings and the limited diagnostic evidence previously presented by de Vos (1960) and Kelsall (1960) led us to speculate that a second alternative explanation is as likely as the original interpretation made by de Vos (1960) or the alternative explanation offered by Kelsall (1960). The following is our evaluation of the evidence for intraspecific strife among barren-ground caribou cows and newborn calves causing injury or death to calves. Our emphasis is on the unlikelihood of such agonistic behaviour leading to deaths of calves, especially multiple deaths at one time and in one place.

Methods

We used standardized all-occurrence sampling (Altman, 1974) to measure the rate of occurrence of head swings, kicks and rushes by caribou during calving and early postcalving. One observer of a pair would continually watch one to four cow-calf pairs for a 10-minute sampling period while the second observer recorded the behaviour on a prepared form (Jingfors *et al.*, 1982; Gunn *et al.*, 1983). The daily observation period was between 1000 and 1700 h: three 10-minute samples of behaviour were taken each hour provided a cow-calf pair was visible.

The causes of calf mortality were determined by field necropsies of calf carcasses found during

low-level helicopter searches. All calves were skinned, eviscerated and examined in detail by a veterinarian-pathologist (E. Broughton, CWS) and us for injuries, even when the cause of death (e.g., crushed skull) was immediately obvious.

Results

We watched caribou for 220 h between 2 - 23 June 1981 and obtained 578 10-minute samples which totalled to 6464 active cow-minutes and 4329 active calf-minutes (Jingfors *et al.*, 1982). We observed 264 aggressive acts with the observed cow and calf as the recipient or aggressor: 67.8% (179) were head swings; 25.4% (67) were rushes and 6.8% (18) were kicks. Usually the aggressive act was a single event but 42 head swings (23.5%) were followed by rushes and two head swings (1.1%) were followed by kicks. During calving (2 - 9 June), observed cows initiated aggressive acts toward their calf or other calves in similar proportions, 35.5% and 37.1% (Table 1). The maternal cow's aggression toward her calf decreased during postcalving (11 - 23 June) as only 2.6% of the maternal cow's aggressive acts were toward her calf compared to 72.7% toward other calves. The level of aggression toward the observed calf by other cows was similar during calving and postcalving (Table 1).

In 1982, we observed caribou for 166.7 h between 3 and 29 June and we obtained 498 continual 10-minute samples which totalled 4754 active cow-minutes and 3201 active calf-minutes (Gunn *et al.*, 1983). The proportion of rushes and head swings of the 201 aggressive acts were similar (45.7% and 44.3%, respectively) and

Table 1. Seasonal variation in the initiator and recipient of aggressive acts among barren-ground caribou, Beverly calving ground, Northwest Territories, 1981 - 82.

Year	Season	Initiator	% Recipients			
			Focal pair		Other pairs	
			cow	calf	cow	calf
1981	calving	focal cow	—	22	17	23
		other cows	12	40	—	—*
	postcalving	focal cow	—	2	19	56
		other cows	12	49	—	—
1982	calving	focal cow	—	4	27	26
		other cows	11	74	—	—
	postcalving	focal cow	—	0	3	22
		other cows	1	17	—	—

* Only aggressive acts involving one or both members of a focal pair are given in this consideration.

only 10.8% were kicks. Most aggressive events were a single act but 17 events were two acts and three were three-act events.

Little aggression by the maternal cow towards her calf was seen during calving (3 - 13 June) as only 7.0% of the maternal cow's aggressive acts were toward her calf compared to 45.6% against other calves (Table 1). The maternal cow was not aggressive towards her calf during postcalving (4 - 29 June) but directed 88.0% of her aggressive acts towards other calves compared to 45.6% during calving (Table 1).

The mean rate of aggressive acts was not significantly different ($P > 0.05$) between 1981 and 1982 when the mean rates were 2.0/100 cow-minutes and 1.72/100 cow-minutes, respectively. In both years, aggressive acts occurred more frequently than expected when group size changed (Table 2).

We observed no apparent injuries to calves during 204 aggressive acts toward calves in 1981 and 146 acts toward calves in 1982. Physical contact was rare and the calves were nimble in avoiding the aggressive behaviour.

Only three (1.0%) of the 287 dead calves found on the Beverly calving ground in June 1981 - 83 exhibited trauma most likely caused by adult caribou. All were found as singles and no absolute distinction could be made as to whether or not the fatal injuries occurred accidentally or were the results of deliberate acts of aggression. In 1981, a 1 - 3 day old female calf apparently was kicked in the right rib cage, causing compression of the thoracic cavity and hemorrhaging in the lungs. Hemorrhages in the mouth were traced from blood clots accumulated throughout the trachea. The second calf in 1981, less than 1-day-old of indiscernible sex, appeared

Table 2. Distribution of aggressive acts by caribou cows by changes in group size or composition, Beverly calving ground, Northwest Territories, 1981 - 82.

Year	Rate of aggressive acts	Change in group size or composition	
		Change	No change
1981 above median		62*	20
below median		262	227*
1982 above median		46*	10
below median		125	149*

* Significantly greater than expected, $P < 0.005$.

Table 3. Percentage occurrence of utilized carcasses of wolf-killed barren-ground caribou calves found in clumped associations, Beverly calving ground, Northwest Territories, June 1981 - 83.

Size of clumped association	Number of clumped associations	% individuals not fed on by wolves
8	1	100.0
34	1	50.0
5	2	30.0
3	5	26.7
6	1	16.7
2	8	6.0
11	1	0.0
4	1	0.0

to have been kicked at the base of the skull but the carcass had been extensively scavenged. In 1983, a 1-3-day-old female calf had a ruptured liver, there was extensive hemorrhaging throughout the abdominal cavity in association with the injury. Most likely the calf's death resulted from it being trodden on by an adult caribou. The calf was lying at the edge of a small island just above the snow on the lake where many caribou had left the lake. None of the three calves had other injuries or pathological conditions.

We found 154 carcasses of caribou calves that we determined were killed by wolves (*Canis lupus*) in June 1981 - 83. Most of the calves (72.1%) were estimated to have been less than 4 days old at death; 26.6% were estimated to have been between 4 and 7 days old; and 1.3% greater than 7 days old (but less than 2 weeks old). Most (44.1%) of the wolf-killed calves were males; 35.1% were females; and the sex of 20.8% was indiscernible, due to carcass utilization.

One hundred and four (67.5%) of the 154 wolf-killed calves were found in 20 «clumped associations» (within 500 m of each other) of 2 to 34 carcasses each (mean 5.2 ± 7.18 S.D.). In 1981, 1982, and 1983 the locations of the wolf-killed calves that we found (assuming that we did not miss adjacent kills around single finds) suggested that 43.5% (10), 75.4% (52), and 67.7% (42) were in clumped associations. In 1981, 3 calves in one clump were within about 6 to 45 m of each other and the 3 calves in the other clump were within about 60 to 170 m of each other. The two individuals in each of the

two clumped pairs in 1981 were about 10 and 30 m apart, respectively. On 17 June 1982, we found 34 carcasses from wolf-killed calves within a 3 km² area (Miller *et al.*, 1985). All of the calves had been killed by wolves, all within a short period of time of each other, and all within about the previous 24 hours. In 1982 we found 11 wolf-killed calves together (all within 300 m of each other) on a small island only several hundred metres in size in a large frozen lake. In 1982 the 3 wolf-killed calves in one clump were within about 50 to 200 m of each other. The two individual calves in each of the two clumped pairs in 1982 were within about 100 m of each other. In 1983 within clump distances for the individuals in the clump of eight were about 50 to 500 m; in the clump of six, about 5 to 500 m; and one clump of five, about 100 to 500 m. The individuals in the second clump of five in 1983 were within about 200 to 500 m of each other; those in the clump of four, about 20 to 300 m; those in the two clumps of three, about 50 m and 300 m; and those in the four clumped pairs, about 5, 50, 200, and 200 m.

The number of calf carcasses in each of these 20 clumped associations that were fed on by wolves varied from none to all (Table 3). The most extreme examples of no or little utilization being the killing of eight calves in one area with absolutely no feeding on them by wolves; and the killing of 34 calves with absolutely no use made of 17 by wolves and only minimal feeding on the remaining 17.

Discussion

Our observations of caribou cow-calf behaviour documented a low incidence of aggressive behaviour between cows and calves. Our postmortem findings also suggested that intraspecific aggression rarely, if ever, caused fatal injuries. We could not isolate (if it occurred) accidental injury inflicted by trampling in stampedes from deliberate aggression. The knocking over and trampling of calves during panicky behaviour of caribou groups cannot be termed intraspecific strife as it is accidentally caused by other caribou.

Most all of the limited literature related to aggressive acts by barren-ground caribou cows towards strange caribou calves or less frequently towards their own offspring is descriptive and lacks any objective measure of severity.

Observers tend to vary in their subjective evaluations of the severity of aggression by caribou cows toward newborn calves but there is one common thread that prevails - the lack of evidence for such intraspecific strife commonly leading to the deaths of newborn calves.

Maternal cows maintain social stability through the bond with their own calf and by reinforcing the bonds of other cow-calf pairs by the maternal cow reacting agonistically toward strange calves (Lent, 1966). Lent (1966) described that cows threatened calves more frequently than any other aggressive act compared to yearlings which cows were more likely to hook at with their antlers. Pruitt (1960:33) has stated that the «threat pose» is «a true instinctive action» and serves as a «flight releaser» even in newborn calves. Thus, it seems unlikely that fatal encounters between newborn calves and strange cows would be a frequent event, as the calves would perceive the warning that most always precede any aggressive acts. Lent (1966: 744) noted that the frequency of actual striking of calves by cows during agonistic interactions was low, 6%. He observed cows only actually contact calves during foreleg strikes and he doubted that any of the kicks were hard enough to cause serious injury and also the calves are adept at avoiding agonistic acts. Lent (1966: 745) concluded that, «Although under certain conditions calf mortality may result from agonistic interactions, it must be considered relatively rare. Most agonistic activity clearly results in no contact between individuals. Not only is there little contact, there are no long sequences of agonistic behaviour, at least outside of the rutting period.»

Breeding females usually cast their antlers at about the time of calving: some parturient females, within a few days before; and some maternal females, within a few days after (e.g., Lent, 1965; Kelsall, 1968; Skoog, 1968; Espmark, 1971; Bergerud, 1976). Thus, if the social function of antlers in intraspecific roles during calving or early postcalving was a significant one in terms of inflicting injury on calves, one would not expect the timing of antler drop that one sees. Also, that both antlered and antlerless cows make «threat» and «attack» postures (e.g., Pruitt, 1960; Lent, 1966) against calves (and actual contact is seldom made), strongly suggests that the function of such acts is simply to displace the calf rather than to do it

any real harm. Thus, these conditions, seemingly, all would greatly reduce the likelihood of antler attacks by cows on calves during, at least, late calving and early postcalving.

Bergerud (1971) found only two calves dead with punctures (supposedly from antlers) and one calf trampled in a sample of 121 dead caribou (*R. t. terraenovae*; *R. t. caribou* Banfield, 1961) calves in Newfoundland though he did not describe the actual injuries. Skoog (1968: 575) noted that 3 of 16 calves found dead on the Nelchina herd's calving grounds in 1956 apparently had antler punctures and he believed that young calves especially those <5 days old received a great deal of abuse during the calving period, particularly when bands stampeded and calves were stepped on (not intraspecific strife). Skoog (1968: 575) agreed with Lent (1966) that such mortality from intraspecific strife is usually low but suggested that under some situations (not expounded on) could be significant. However, he only mentions six single calves that appeared to have died from antler punctures (apparently not verified by postmortem examination) and four that had been trampled or kicked to death.

Studies of calf mortality using radio-collars to detect and locate dead calves have not documented calf deaths due to intraspecific strife. Sixty-two calf carcasses were examined from a sample of 169 radio-collared newborn calves of the Porcupine herd between 1982 and 1984 (Mauer *et al.*, 1983; Whitten *et al.*, 1984, 1985) and none of the 62 calves had died from injuries following intraspecific strife. Maternal cows had subsequently abandoned 23 of the 169 radio-collared calves but the rejection of the handled calves was observed on only one occasion. That calf was abandoned by the cow after the cow struck it with her forefeet; however, the calf did not have any signs of traumatic injury but died from starvation (Mauer *et al.*, 1982).

Although the views on intraspecific strife among cows and calves at or about the time of calving vary qualitatively, the consensus is that mortality due to aggression under normal conditions will be low at worst and most likely only negligible. Possibly intraspecific strife is most likely to occur during and after some stampedes when temporarily separated calves are approaching strange cows while searching for their maternal cows. Furthermore, the reported observations of intraspecific strife suggest that

foreleg kicks are more likely to result in injury rather than punctures from antlers during head threats or swings.

*Death of calves in 1958 - as reported
by de Vos (1960)*

de Vos (1960:256) reported that he had «... surveyed a drumlin on which a calving band estimated at 600 cows had spent about 24 hours during the 2 previous days. On an area of about 25 acres, 7 dead calves were located. All of these, except one had died during the previous 24 hours. When five of these calves were skinned and examined more closely, it was found that all had bruises, two had body punctures, one a broken skull, and another one a broken vertebral column. From all appearances, the punctures were made by antlers, and it seems clear that all these calves died as a result of violence by adult caribou. Their ages varied from 1 day to 1 week. It was possible that these calves became lost in the band, tried to attach themselves to strange females, and were violently attacked. It seemed likely that this cause of mortality was restricted to calves not more than 1 week of age as older calves are able to elude attacking cows.»

*Kelsall's (1960) evaluation of de Vos'
1958 findings*

Kelsall (1960: 47 - 48) reported the following with regard to the skepticism about de Vos' (1960) interpretation of his findings in 1958, «de Vos's assessment of mortality observed differs from the conclusions of the other field men and for that reason it is worth mentioning... These observations (the ones reported in de Vos (1960:256)) were discussed, shortly after they were made, with de Vos and other of the field men. It seemed that something unusual was involved. While all field men had occasionally noted females striking or butting at strange calves, such instances seemed to be uncommon among calving bands under reasonably normal conditions. In fact, serious intra-band strife seemed to be relatively uncommon at any time. It was supposed that some of the dead calves had died somewhat earlier than de Vos estimated, during periods of adverse weather. With as many as 600 adult caribou on a 25-acre hill, dead or dying calves might easily receive bruises and injuries through trampling. Also, if predators

had seriously disturbed so large a herd, the resulting confusion might easily have resulted in injury to young calves, even in fine weather.»

Summary comparative discussion

de Vos' (1960) description of the injuries sustained by the five calves that he skinned and examined more closely in 1958 are comparable to the descriptions of wolf-inflicted injuries that we observed between 1981 and 1983. We found wolf-killed calves with various combinations of injuries some of which could have been simply described as broken skulls, broken vertebral columns, or bruises. Those injuries were not invariably associated with discernible tooth punctures. The injuries briefly described by de Vos (1960) are not diagnostic of the cause of death in themselves especially as antler punctures would not be readily distinguishable from single canine punctures. Also, the absence of tooth punctures does not reliably preclude predation as a cause of death. de Vos' (1960) description of the calves' injuries are as consistent with wolf predation or, as Kelsall (1960) suggested, accidental trampling as with intraspecific strife. The description of the five calves (de Vos, 1960) is indistinguishable from an example of surplus killing by wolves. de Vos' (1960) interpretation cannot be discounted but the reported incidences of injuries caused by aggressive behaviour and observed rates of aggressive behaviour among caribou cows and calves suggests that to find five (or more) calves dying at the same time and place from an unusual cause of death is extremely unlikely. Our identification of an alternative explanation to de Vos' (1960) interpretation and Kelsall's (1960) alternative explanation does highlight the importance of detailed postmortem examinations and their complete reporting. In the absence of diagnostic injuries, only direct observation of an event allows separation of a death caused by injuries due to intraspecific strife from a death caused by accidental injuries.

We think that it is important that a clear distinction be maintained between mortality of newborn calves due to intraspecific strife versus mortality caused by accidental injury. Death from intraspecific strife requires a deliberate lethal act of aggression against the calf while death from accidental injury results from an unpremeditated chance event. Most importantly, if significant mortality to calves routinely occurs due to intraspecific strife among maternal

cows and calves, it would indicate a, seemingly, serious flaw or weakness in the evolutionary development of the socialization of caribou. Such a significant fault would warrant detailed documentation before it is accepted as a truism.

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References

- Altmann, J.** 1974. Observational study of behaviour sampling methods. — *Behaviour* 49: 227 - 265.
- Bergerud, A. T.** 1971. The population dynamics of Newfoundland caribou. — *Wildlife Monograph* No. 25. 55 p.
- Bergerud, A. T.** 1976. The annual antler cycle in Newfoundland caribou. — *Canadian Field-Naturalist* 90: 449 - 463.
- de Vos, A.** 1960. Behaviour of barren-ground caribou on their calving grounds. — *Journal of Wildlife Management* 24: 250 - 258.
- Espmark, I.** 1971. Antler shedding in relation to parturition in female reindeer. — *Journal Wildlife Management* 35: 175 - 177.
- Gunn, A., Glaholt, R., Miller, F. L. and Jingfors, K.** 1983. Calving behaviour, range use patterns and short term responses to helicopter landings on the Beverly calving ground, NW.T., 1982. — *Northwest Territories Wildlife Service unpublished file report no. 30, Yellowknife*. 126 p. (Available from the Wildlife Management Division, Department of Renewable Resources, Government of the Northwest Territories, Yellowknife, N.W.T., Canada, X1A 21.9).

- Jingfors, K., Gunn, A. and Miller, F. L.** 1982. Behaviour and range use patterns of caribou on the Beverly calving ground, N.W.T. — *Northwest Territories Wildlife Service unpublished file report no. 22, Yellowknife. 118 p.* (Available from the Wildlife Management Division, Department of Renewable Resources, Government of the Northwest Territories, Yellowknife, N.W.T., Canada, X1A 2L9).
- Kelsall, J. P.** 1960. Cooperative studies of barren-ground caribou, 1957 - 1958. — *Canadian Wildlife Service Management Bulletin Series 1, No. 15. 145 p.*
- Kelsall, J. P.** 1968. The migratory barren-ground caribou in Canada. — *Canadian Wildlife Service Monograph No. 3. Queen's Printer, Ottawa. 339 p.*
- Lent, P. C.** 1965. Observations on antler shedding by female barren-ground caribou. — *Canadian Journal of Zoology 45: 553 - 558.*
- Lent, P. C.** 1966. Calving and related social behaviour in the barren-ground caribou. — *Zeitschrift für Tierpsychologie 23 (6): 701 - 756.*
- Mauer, F.J., Garner, G. W., Martin, L. D. and Weiler, G. J.** 1983. Evaluation of techniques for assessing neonatal caribou calf mortality in the Porcupine caribou herd. — *In: Garner, G. W. and Reynolds, P. E. (eds.) 1981 update report baseline study of the fish, wildlife and their habitats. United States Fish and Wildlife Service, Anchorage, Alaska. 201 - 226.* (Available from United States Department of the Interior, Fish and Wildlife Service, 1011 E. Tudor Road, Anchorage, Alaska U.S.A. 99701).
- Miller, F. L. and Broughton, E.** 1974. Calf mortality on the calving grounds of Kaminuriak caribou. — *Canadian Wildlife Service Report Series No. 26. 26 p.*
- Miller, F. L., Gunn, A. and Broughton, E.** 1985. Surplus killing as exemplified by wolf predation on newborn caribou. — *Canadian Journal of Zoology 63: 295 - 300.*
- Pruitt, W. O., Jr.** 1960. Behaviour of the barren-ground caribou. — *University of Alaska Biological Papers No. 3. 44 p.*
- Skoog, R. O.** 1968. Ecology of the caribou (*Rangifer tarandus granti*) in Alaska. — *Ph. D. Thesis. University of California, Berkeley. 699 p.*
- Whitten, K. R., Garner, G. W. and Mauer, F. J.** 1984. Calving distribution, initial productivity and neonatal mortality of the Porcupine caribou herd, 1983. — *In: Garner, G. W. and Reynolds, P. E. (eds.) 1983 update report baseline study of the fish, wildlife and their habitats. United States Fish and Wildlife Service, Anchorage, Alaska. 359 - 391.* (Available from United States Department of the Interior, Fish and Wildlife Service, 1011 E. Tudor Road, Anchorage, Alaska, U.S.A. 99701.)
- Whitten, K. R., Mauer, F.J. and Garner, G. W.** 1985. Calving distribution, initial productivity and neonatal mortality of the Porcupine caribou herd, 1984. — *In: Garner, G. W. and Reynolds, P. E., (eds.) 1984 update report baseline study of the fish, wildlife and their habitats. United States Fish and Wildlife Service, Anchorage, Alaska. 527 - 621.* (Available from United States Department of the Interior, Fish and Wildlife Service, 1011 E. Tudor Road Anchorage, Alaska, U.S.A. 99701.)