

Observations of Barren-Ground Caribou Travelling on Thin Ice during Autumn Migration

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ABSTRACT. In October 1982 we observed the consequences of migrating barren-ground caribou (*Rangifer tarandus groenlandicus*) encountering lake ice too thin to bear their weight. The observations were made on a portion of taiga winter range of the Beverly caribou herd during autumn migration in the Northwest Territories. We observed caribou hesitating to cross ice that had no snow cover and also saw caribou breaking through ice. Bulls had greater difficulty extricating themselves from the icy water than did relatively light-bodied cows and young individuals. We necropsied one bull that we found dead after it had broken through the ice and remained in the water for more than 20 hours. The bull had died apparently from stress and hypothermia and had heavily traumatized areas on its forelegs and sternum from struggling to break the ice. We could not evaluate the overall extent of injuries and mortalities to caribou from their encounters with thin ice, although we observed signs that at least hundreds had broken through the ice on different lakes.

Key words: behaviour, injuries, barren-ground caribou, *Rangifer tarandus groenlandicus*, thin ice, autumn migration, Northwest Territories

RÉSUMÉ. En octobre 1982, nous avons observé les conséquences de la migration de caribous des landes (*Rangifer tarandus groenlandicus*) sur des lacs où la glace était trop mince pour supporter leur poids. Ces observations furent faites dans une région du domaine hivernal de taïga du troupeau de caribous Beverly durant sa migration automnale dans les Territoires du Nord-Ouest. Nous avons observé les caribous hésitant à traverser la glace sans couvert de neige et nous avons aussi vu des caribous tomber à travers la glace. Les mâles adultes éprouvaient plus de difficulté à s'en sortir que les femelles et les jeunes animaux. Nous avons examiné un mâle adulte que nous avons trouvé mort après qu'il ait eu tombé à travers la glace et ait eu demeuré dans l'eau pendant plus de 20 heures. Le mâle avait apparemment péri de stress et d'hypothermie et était gravement traumatisé sur les jambes antérieures et le sternum en résultat de ses tentatives de briser la glace. Nous n'avons pu évaluer la portée générale des blessures et des mortalités des caribous entraînées par leurs rencontres avec des lacs à glace mince bien que nous avons observé des signes qu'au moins quelques centaines de caribous étaient tombés à travers la glace dans des lacs divers.

Mots clés: comportement, blessures, caribou des landes, *Rangifer tarandus groenlandicus*, glace mince, migration automnale, Territoires du Nord-Ouest

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INTRODUCTION

The tundra and taiga ranges of migratory barren-ground caribou (*Rangifer tarandus groenlandicus*) in Canada are characterized by numerous water bodies. The caribou's migratory movements frequently take them across such water bodies by swimming or wading during summer and by travel across ice during the winter. During October 1982 we observed the consequences of migrating caribou trying to travel on ice too thin to bear their weight.

STUDY AREA

The study area was roughly centered on our base camp at 60°56'N, 105°30'W in the Northwest Territories (N.W.T.). The area lies within the Northwestern Transition Forest Section of the Boreal Forest Region (Rowe, 1972:55, 62). The area is heavily treed with black spruce (*Picea mariana*); other softwoods and some hardwoods occur locally at varying but low frequencies. Much of the surface is covered by lakes, ponds, muskegs, rivers, and streams.

During the last week of October 1981, when we initiated composition counts, all lakes were frozen. The ice was 10 cm or more thick and with 5-10 cm of snow cover on it. Caribou could travel freely on the lakes, and we could land on the ice of any lake and move about freely on foot.

By contrast the autumn of 1982 was mild. Throughout the last week of October the ground was essentially snow free; ice had

formed on only the smallest lakes and in some shallow bays or narrows of some larger lakes. The ice was only 2-4 cm thick, snow free, and not safe for helicopter landings or foot travel until the first week of November 1982, when temperatures plummeted and ice rapidly covered all lakes. A snow cover comparable to that of late October 1981 was not obtained until mid-November 1982.

Three weather stations were located similar distances from the study area: Ennadai Lake, N.W.T., on the tundra about 240 km to the east; Stoney Rapids, Saskatchewan, in the taiga about 200 km to the south; and Uranium City, Saskatchewan, also in the taiga about 250 km to the southwest (Table 1). The 30-year temperature statistics from those stations for October and November of each year (Table 1) seemingly indicate that most lakes on the study area should usually be at least partially frozen by late October. Temperature information from the one station left operating in 1981 and 1982 (Table 1) further indicates that October 1981 was relatively cold (-2.2°C deviation from the 30-yr mean) and October 1982 warmer than on the average (+1.5°C deviation from the 30-yr mean). This is in agreement with the observed extensive ice formation by late October 1981 and the generally open water condition in October 1982.

METHODS

We worked out of our base camp during the last week of October 1982. Our purpose was to do sex and age determinations (composition counts) of the barren-ground caribou of the

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TABLE 1. Statistics from the three closest weather stations for an estimate of temperatures on the study area in October and November

Weather station ^a	Mean daily temperatures °C (1951-82)					
	Mean ± s.d		Maximum		Minimum	
	Oct.	Nov.	Oct.	Nov.	Oct.	Nov.
1951-80 ^b						
ENT	-5.0 ± 2.8	-17.3 ± 3.0	-1.9	-13.4	-8.1	-21.2
SRS	0.1 ± 2.4	-13.1 ± 3.3	3.7	-9.1	-3.5	-16.9
UCS	0.6 ± 1.9	-11.3 ± 3.2	9.7	-2.3	-2.7	-15.2
1981 ^c						
UCS	-1.4	-5.8	2.0	-2.9	-4.7	-8.6
1982 ^c						
UCS	2.1	-16.4	5.8	-11.7	-1.7	-21.0

^a ENT = Ennadai Lake, N.W.T.; SRS = Stoney Rapids, Sask.; and UCS = Uranium City, Sask.

^b Data from Environment Canada, Canadian Climate Normals, Temperature, 1951-80, Atmospheric Environment Service, Canadian Climate Program, (1982), 2:1-306.

^c Data from Monthly Report (meteorological observations in western Canada) Atmospheric Environment Service, (1981) 66(10):1-104, 66(11):1-103 and (1982) 67(10):1-109, 67(11):1-103.

Beverly herd. Our methods required us to land a Bell-206B helicopter on lake ice or frozen muskegs and often to travel on foot to view the caribou. During the last week of October 1982, however, the lake ice was too thin to support the helicopter on floats or even to allow foot travel in most areas. Instead we began on 25 October to segregate the small groups of caribou around our camp. We concealed ourselves in the trees near trail leads at the edges of narrow ice crossings between points of land. Observations were made with the aid of 10 × 40 field glasses and a 15 × 60X zoom spotting scope. All data were recorded in field books; times were taken with a wristwatch with a second hand.

RESULTS

In late October 1982 caribou swam ice-free bays and narrows of lakes, seemingly without hesitation. They also attempted to cross the thin ice of the frozen bays and narrows. Some animals hesitated near the shore and sniffed the edge of the ice and then turned back into the forest. Most caribou, however, persisted in attempting to cross. The caribou usually appeared from the trees in single file at the narrows on lakes (Fig. 1). They often bunched up at the edge of the ice for several minutes before moving onto the ice. Although caribou mostly crossed the ice in single file (Fig. 1), they sometimes walked several abreast if a lead animal slowed or stopped briefly during the crossing. The rutting behaviour of the bulls tended to keep the groups moving.

On the afternoon of 25 October we saw 300 caribou cross a narrows about 50 m wide. Although 15 caribou broke through the ice, most of them got out of the water within 1-5 min. The exceptions were a cow that stayed in the water for 25 min, a cow and her calf for 35 min, and a bull for 3 h 23 min. At 1617 h on 25 October we also saw a bull break through the ice. He was last seen as darkness set in at 1752 h, still about 50 m from shore. We could hear ice being broken in the lake during the early hours of the night. At 0930 h on 26 October the bull was seen lying in the water about 20 m from shore with his head on the ice. A bald eagle (*Haliaeetus leucocephalus*) flew away from the bull's body when we approached in the helicopter and another eagle was circling nearby. We returned late on the 26th and with



FIG. 1. Characteristic movements of barren-ground caribou along lake shores in their forested winter range during autumn migration (background) and typical approach from cover to leads on frozen narrows of lakes (foreground), Beverly caribou herd winter range, Northwest Territories, October 1982. (Note an adult rutting bull taking the opportunity to sniff the vaginal area of a cow that hesitated at the lake edge.)

the helicopter removed the carcass from the water and moved it to our camp for necropsy.

From the wear pattern of its mandibular teeth the bull was estimated to be 8-10 years old. We found an area (14 × 7 cm) denuded of hair around a hole (2 cm diameter) in the lumbar area; a second hole (2 × 2.5 cm) on the left side of the spine, with a surrounding denuded area, was 25 cm posterior of the first hole. The left eye was missing and the lachrymal duct had been enlarged. Hemorrhaging associated with the eagle-made holes and the plucked eye allowed us to deduce that the bull had not been dead on the morning of the 26th but only comatose.

We deduced that the bull had not drowned, because he had no frothy appearance to his lung tissue and no water could be expressed from his lungs. We believe the bull died about midday on the 26th from shock and exposure, rather than from drowning, after having been in the water for more than 20 hours.

The bull had essentially no back or mesenteric fat reserves, apparently due to rutting activities. We found extensive hemorrhaging along the entire anterior surface of the left radius, along the proximal anterior surface of the right radius, along the anterior surface 9 cm from the proximal end of the left tibia, and along the proximal anterior surface 12 cm from the distal end of the right tibia. Extensive hemorrhaging and trauma causing a "jellied" appearance to the tissue were found over an area 24 × 12 cm centering on the sternum, with less severe hemorrhaging extending for 5-7 cm around the severely traumatized area. The locations of the hemorrhaged and traumatized areas were consistent with the parts of the body that would have contacted the ice while trying to climb out of the water.

Once caribou broke through the ice they seldom appeared to panic. Only on a few occasions did we see caribou briefly rise up and flail with their forefeet at the ice in front of them. Usually they simply swam forward to the leading edge of the ice. Then each animal would rock forward on its sternum on the edge of the ice, apparently at the same time kicking out with its hind legs in the water to help propel itself forward. As it rose out of the water and rocked forward on its sternum, it kept its forelegs tucked back against its body. Because the ice was essentially snow free, the wet pelage allowed the animal to slide far enough

forward to bring the forelegs onto the ice. With its front hooves firmly on the ice surface, the animal would push forward so that its hind feet would gain a grip on the ice. Frequently, however, the animal would either slide backwards, with its forelegs splayed on the ice, or the ice would break again and the attempt had to be repeated. Once the caribou had its hind feet on the ice, it scrambled to get its footing and quickly moved a few steps away from the hole before stopping and shaking the water from its pelage. Between attempts to get from the water onto the ice the caribou often rested their chins on the ice, apparently to hold them up. The greater body weight of bulls often caused them to repeatedly break through the ice and to be slower to extricate themselves. One cow was lame after climbing out of the water.

Most of the caribou that broke through the ice continued on with the ice crossings, once they had freed themselves. However, some bulls that broke through the ice turned around and retraced their route with no further attempts at that particular crossing.

The channels broken by caribou were clearly visible from the air; most were 10-75 m in length and some exceeded 100 m (Fig. 2). We observed only bulls in the channels, probably because



FIG. 2. Typical worm-like paths in lake ice made by barren-ground caribou breaking through thin ice while attempting to cross frozen lakes during autumn migration, Beverly winter range, Northwest Territories, October 1982.

they need the thicker ice near shore to bear their weight. The dead bull we found had broken a channel approximately 75 m in length through ice about 2 cm thick. Near his death site (Fig. 2) he had broken a considerable amount of ice laterally, probably as a result of disorientation brought on by fatigue and stress.

Our helicopter searches over about 5000 km² of taiga winter range suggested that this phenomenon was widespread in late October 1982 and involved at least hundreds of caribou. Virtually all of the frozen lakes in the area where caribou occurred had series of worm-like paths lined with the broken ice (Fig. 2).

DISCUSSION

Banfield (1954) recounts a second-hand observation of a young bull breaking through the ice in November 1948. The bull struggled for 15 min before clambering out and moved slowly across the ice before lying down. Banfield (1954) also reported Lawrie's observation of two caribou carcasses frozen into lake ice in November 1948. Kelsall (1960) reported four caribou frozen into the new ice of Lake Athabasca on 7 November 1957

and described caribou crossing the same lake when the ice was 2.5 cm thick. More than two dozen holes were evident in the ice where animals had gone through and 12 dead caribou were observed in the ice (Kelsall, 1960). Wilk (1958) recorded on 27 October 1958 a bull breaking through the ice, then having to break ice for 35 min to get to shore and bedding as soon as it had freed itself. In 1978 the large lakes in our study area were not frozen in the last week of October, and R. Decker (pers. comm. 1983) saw three bulls within 2.5 km of each other struggling to extract themselves from broken ice. Decker also saw paths through the ice where other caribou had successfully broken through to the lake shore.

Skoog (1968) described that in November 1962 two cows and a calf had broken through the ice of a small lake in Alaska; one of the cows escaped but a later flight revealed the other cow and calf had drowned or died of exposure. Bos (1973), also in Alaska, found a cow that apparently had drowned in October 1972 after breaking through thin ice, and he commented on numerous examples of broken ice. A local resident had reported several caribou that died after they broke through the ice (Bos, 1973).

Banfield (1954) suggested that the caribou, weakened by struggling in the water, would be more vulnerable to predation. The extent of traumatized and hemorrhaged tissue on the necropsied bull and our observation of a cow that was lame after freeing herself supports Banfield's suggestion. Evidence of injuries caused by breaking through ice was still apparent in caribou of the Beverly herd shot in late November 1982. About half of the 75 cows examined had resolving traumatized areas on the anterior foreleg surface (D. Thomas, pers. comm. 1983). Kelsall (pers. comm. 1983) also found extensive traumatized areas of the forelegs of a caribou shot in the early fall.

The calm behaviour of animals that broke through the ice and the tendency of those following to detour around them rather than retreat suggest that breaking through ice is not an uncommon or frightening experience to a caribou. The caribou seemed to be more apprehensive of crossing ice that was slippery with rain than they were of crossing thin ice, even when it cracked under their weight.

Our emphasis on composition counts prevented us from quantifying the extent to which caribou succumbed from breaking through ice. However, field workers were also in the general study area during late October 1979-80, and their observations plus ours indicate that migrating caribou were confronted with thin, often nonsupporting ice in 2 out of 4 years. Within 5 km of our camp we saw at least 100 trails in the ice where caribou had broken through but found only the one dead caribou. The critical time in the water is unknown but it appears to be a matter of hours, even for breeding bulls with low fat reserves. In some years, even the crossing of small lakes may result in mortality or in injuries that predispose individual caribou to predation by wolves. Such mortality could well be insidious over the years.

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