

Predation on Caribou (*Rangifer tarandus*) by Wolverines (*Gulo gulo*) after long pursuits

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Abstract

Ungulates are an important source of food for Wolverines (*Gulo gulo*), especially in winter when scavenging on carcasses is a primary means of obtaining food. However, Wolverines are also known to prey on ungulates. We followed fresh tracks of Wolverines pursuing Caribou (*Rangifer tarandus*) on six occasions on the tundra of northern Alaska in 2011, 2015, 2017, and 2018; all ended in a predation event after pursuits of 4–62 km. Exhaustion of the Caribou after long pursuits appeared to contribute to the success of predation attempts. Snow conditions appeared to be a factor in only one of the six cases.

Key words: Alaska; Caribou; *Gulo gulo*; predation; *Rangifer tarandus*; Wolverine

Introduction

Ungulates are an important source of food for Wolverines (*Gulo gulo*), especially in winter when scavenging on carcasses is a primary means of obtaining food (Banci 1994; Copeland and Whitman 2003). However, Wolverines are capable of killing ungulates, including Moose (*Alces americanus*; Haglund 1974), Caribou/Reindeer (*Rangifer tarandus*; Burkholder 1962; Lofroth *et al.* 2007; Mattisson *et al.* 2017), Mountain Goats (*Oreamnos americanus*; Lofroth *et al.* 2007), Dall's Sheep (*Ovis dalli*; Gill 1978), and Elk (*Cervus canadensis*; Inman and Packila 2015). In Scandinavia, Wolverines are one of the main predators of unattended, free-ranging, semi-domestic Reindeer. While tracking Wolverines in snow and locating Reindeer carcasses fed on by Wolverines, both Haglund (1966) and Bjärvall (1982) stated that Wolverines were responsible for killing at least 30% of the Reindeer at the carcass sites they found. Mattisson *et al.* (2017) reported average individual kill rates for Wolverines ranging from less than one to five Reindeer per month depending on season and area, with as many as 15 during a single month.

Predation on ungulates by Wolverines is thought to occur opportunistically, with vulnerability of prey being a key factor determining the success of predation attempts (Haglund 1966; Banci 1994; Mattisson *et al.* 2017). Factors affecting vulnerability of prey include deep or crusted snow (Haglund 1966; Bjärvall 1982), poor body condition (Lofroth *et al.* 2007; Mattisson *et al.* 2017), and age of prey (Gustine *et al.* 2006; Inman and Packila 2015; Mattisson *et al.* 2017).

We are not aware of published reports of Wolverines pursuing Caribou over long distances in predation attempts. Haglund (1966) stated that no pursuits of Reindeer by Wolverines were more than 1 km. However, Reindeer herders and field personnel of the Norwegian Environment Agency in Scandinavia have reported long chases by Wolverines (J. Mattisson pers. comm. 9 January 2018). Here we report six occurrences of Wolverines killing Caribou after pursuits of 4–62 km on snow-covered tundra in northern Alaska.

Methods

We documented Wolverines killing Caribou by following Wolverine and Caribou tracks from a PA-18 Super Cub aircraft (Piper Aircraft, Vero Beach, Florida, USA). We made opportunistic observations on the Alaska North Slope between 68°N and 70°N and between 147°W and 155°W, while primarily engaged in Wolverine surveys and, in one case, during a Caribou telemetry flight. Poley *et al.* (2018) have presented details of the Wolverine survey methods.

Habitat in the study area consisted of snow-covered tundra with gentle relief, small drainages with shrubs protruding above the snow, and occasional ridges blown free of snow. Except for observation 4 below, snow conditions were similar throughout the track sequences and consisted of relatively firm, windblown snow, in which Wolverine tracks penetrated 0.5–10.0 cm and Caribou tracks perhaps slightly more, depending on conditions.

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Observations

(arranged chronologically within year from most recent year)

Kill 1

On 8 April 2018, while conducting a survey for Wolverine tracks in the Arctic National Wildlife Refuge in northern Alaska, P.V. and A.J.M. came across the tracks of a Wolverine and a Caribou that led to a Caribou carcass, near which a Wolverine was seen running at the approach of the aircraft. The Caribou kill was very fresh with the head only partly removed by the Wolverine. The Caribou had hard antlers, indicating it was a pregnant cow. The tracking team back-tracked the pair of footprints for 18 km before returning to the carcass where the Wolverine had just finishing removing the head.

At about the same time, M.A.K. and C.R.L. were tracking a Wolverine and Caribou ~50 km away (straight-line), where a Wolverine had encountered a small herd of Caribou and began pursuing one of them. They tracked the animals for 20 km to where the tracks disappeared in a windblown area. At that point, they returned to their survey route but, later that day, picked up the back-tracking effort from where the first team had stopped and followed the Wolverine and Caribou for an additional 22 km to within 2 km of where their forward-tracking session had ended earlier in the day, and the tracks again disappeared in the wind-blown area.

Piecing together the tracking sessions, the teams calculated that the total distance of the Wolverine's pursuit of the Caribou was 62 km. For most of the track sequence, the Wolverine tracks were a typical three by three pattern with spacing that indicated a fast and steady lope but not a full run, closely following the route of the Caribou. There were shorter sections of tracks where patterns indicated increases or decreases in speed, perhaps associated with changes in slope, snow conditions, or distance between the animals. There were occasional divergences between the two sets of tracks where the Wolverine took a more direct line to try to intersect the Caribou. The Caribou tracks indicated a similar strategy of an overall fast pace but not a full run, except near the end of the pursuit when both the Wolverine and Caribou appeared to run full speed. Along the chase route and at the kill site, there were no tracks of Wolves (*Canis lupus*), the only other Caribou predator in the study area in winter.

Kill 2

On 3 April 2017, M.A.K. and C.R.L. came across Wolverine tracks following the trail of a single Caribou and tracked the animals for 31 km to a freshly killed Caribou with the Wolverine resting next to the carcass. We estimated that the Caribou had been killed within an hour before our arrival based on the freshness of blood in the snow and the lack of feeding or caching activity by the Wolverine. We also returned to the point where

we first found the tracks and traced them 4 km back to the point where the Wolverine started following the Caribou. The entire distance travelled by the Caribou and Wolverine was ~35 km, and the tracks roughly formed a large loop.

There was no indication that the Caribou floundered in snow while the Wolverine travelled on the snow surface. Throughout the track sequence, we did not observe anything to indicate that the Caribou or Wolverine tried to take advantage of any particular snow type or topographic feature (e.g., staying on the crest of a ridge where snow was hardest or following tracks from other groups of Caribou). Based on the tracks, covering distance seemed to be the strategy of the Caribou. With the exception of the last 100 m, there appeared to be no direct interactions between the Caribou and Wolverine (i.e., the Wolverine did not try to jump on or attack the Caribou during the pursuit). We suspect that the Wolverine simply followed closely behind the Caribou, eventually exhausting it. In the last 100 m, tracks showed that the Wolverine attempted to jump on the Caribou several times. Tracks at the kill site indicated relatively little struggle. No other predator tracks were observed during the tracking session.

Kill 3

On 5 April 2017, M.A.K. and C.R.L. found Wolverine tracks along with the tracks of two Caribou and tracked the animals for 31 km to the kill location. The Wolverine was not in sight when we arrived. Pursuit behaviour was similar to that in kill 2. We estimated that the Caribou had been killed approximately two days earlier based on the age of snow, the freshness and amount of blood in the snow, the nearly complete caching of the carcass in the vicinity of the kill site, and the amount of tracking at the kill site. We did not return to where we initially intersected the tracks to back-track to the beginning of the pursuit, so the entire length of the pursuit is unknown.

In this track sequence, the Caribou and Wolverine generally stayed on the crest of a ridge, where perhaps snow conditions were firmer than in the valley bottoms. As with kills 1 and 2, the Caribou did not flounder in snow or break through crust into deep snow. Except in the last 400 m, there appeared to be no direct interactions between the two Caribou and the Wolverine. Starting ~400 m from the kill site, both the Caribou and the Wolverine made a loop of about 100 m, at which time the two Caribou separated. The Caribou that was still being pursued by the Wolverine then travelled a short distance before making several rough figure eights ~100 m long before the Wolverine caught and killed it. The site of the kill did not indicate a long struggle between the Caribou and Wolverine once the Wolverine had overtaken the Caribou. The second Caribou was not pursued by the Wolverine once it separated from the other. We observed no Wolf tracks at the kill site or along the chase route.

Kill 4

On 9 April 2017, while searching for fresh Wolverine tracks, P.V. and A.J.M. saw a Wolverine sitting beside a Caribou carcass with fresh blood in the snow. We back-tracked the Wolverine and Caribou tracks to determine how the kill was made. The Wolverine had apparently spotted a group of about eight Caribou feeding on the bank of a large lake and ran toward them. The Caribou ran down onto the wind-hardened, snow-covered lake, where both the Wolverine and Caribou were able to stay on top of the snow. The Caribou ran across the lake and started up the bank on the far side, at which point they broke through the snow crust covering shrubs bordering the lake. Before the Caribou reached the hard-packed snow at the top of the bank, a 10-month-old calf veered from the group and was quickly subdued by the Wolverine. The entire chase sequence covered 4 km. We landed the ski plane on the frozen lake and walked to the kill site. The Wolverine had eaten off the nose of the calf and had chewed into the throat and back of the head. No other wounds were evident and the calf was not yet fully frozen. We observed no wolf tracks in the area.

Kill 5

On 25 March 2015, M.A.K. and C.R.L. found the tracks of a Wolverine and a Caribou, which appeared to be less than 24 h old, and followed them for 9 km to where the Wolverine had killed the Caribou and apparently cached parts of it nearby. We saw the Wolverine as it ran from the kill site on our approach. We did not back-track to determine the total length of the pursuit. Track patterns of the pursuit were similar to those of kills 2 and 3. The only other tracks in the area were of Red Fox (*Vulpes vulpes*).

Kill 6

On 7 April 2011, L.S.P. encountered the tracks of a Wolverine following the trail of a Caribou and followed the tracks for ~26 km, mostly along a creek bottom. We did not back-track to determine the total length of the pursuit. There was no evidence of interaction along the route. We could not tell whether the Caribou knew the Wolverine was following it. Eventually, the Caribou climbed a hill overlooking the creek and bedded down on a slope. The tracks indicated that the Wolverine approached the hill outside the view of the Caribou, came over the crest, bounded a short distance to the Caribou, and then both animals apparently rolled together to the bottom of the hill. The Wolverine had just begun dismembering the carcass when we arrived at the site.

Discussion

In these accounts, the vulnerability of the Caribou to predation was only evident in kill 4 (i.e., crusted snow that broke under the weight of the Caribou). In the other five cases, lack of evidence of extended struggles at the kill sites suggests that exhaustion of the Caribou ended the pursuit. Both Wolverines (Haglund 1966; Björvall

1982) and Caribou (Pritchard *et al.* 2014) are capable of sustained, long-distance movements, but physical endurance will determine the outcome of long pursuits when movement rates are rapid. During 1-h continuous observations of Wolverines travelling (but not pursuing prey at maximum speed), Magoun (1985) documented speeds of up to 8.0 km/h for female Wolverines and up to 10.6 km/h for males in summer on tundra. If we consider 8–10 km/h to be the maximum sustained speed for Wolverines on firm snow in winter, the long pursuit in kill 1 could have lasted ≥ 6 h.

Pritchard *et al.* (2014) documented a maximum movement rate for a Caribou in our study area of 13.8 km/h (straight line winter movement of a female wearing a GPS collar with a 2-h fix interval), but this rate of movement was rare in their study. If sustained for 62 km, a pursuit at this speed would have lasted 4.5 h. Although the speeds of Wolverines and Caribou seem well-matched, the persistence of the Wolverines was likely key to predation success in the long pursuits we documented.

We did not determine the frequency of successful predation attempts. We only followed very fresh tracks when we were reasonably confident that we could find the Wolverine, and long pursuits had a better chance of being detected by us during our survey flights. Also, we cannot conclude that longer pursuits result in more successful predation attempts or that all pursuits under similar winter conditions are as successful as those we observed.

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