

**DIRECT OBSERVATIONS OF A WOLVERINE SCAVENGING AT AN ACTIVE GRAY WOLF
KILL SITE.**

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ABSTRACT—Scavenging carrion is an important source of nutrition for Wolverines (*Gulo gulo*) who are facultative scavengers. Other large carnivores, particularly Gray Wolves (*Canis lupus*), may compete with and exclude Wolverines from carrion or pose a risk of death or injury to Wolverines attempting to utilize these resources. We used a video-camera trap to document a Wolverine scavenging an Elk (*Cervus elaphus*) being actively consumed by a Gray Wolf in Idaho. The Wolverine investigated the kill, fed, scent marked, and removed pieces of the carcass to cache at other sites. Between the second and third visit by the Wolverine, a wolf returns to feed at the kill. These observations establish that Wolverines do not necessarily avoid kills when Gray Wolves are present and that species interactions are more complex than generally thought.

Keywords: Wolverine, Gray Wolf, *Gulo gulo*, *Canis lupus*, competition, scavenging, scent marking,

Wolverines (*Gulo gulo*) are a large, nomadic carnivore with a circumpolar distribution (Abramov 2016). Wolverines eat a variety of species from small rodents to large ungulates, but have historically been regarded primarily as facultative scavengers that feed on kills made by other larger carnivores (Landa and others 1997). For example, Wolverines with home ranges that do not overlap with Gray Wolves (*Canis lupus*) primarily consume Caribou (*Rangifer tarandus*) and rodents, but when home ranges do overlap their diet matches that of Gray Wolves (*Alces alces*; van Dijk and others 2008b). The recolonization of Gray Wolves in some areas has increased Wolverine populations (van Dijk and others 2008a), as the presence of this large carnivore increases the abundance of carrion biomass available to wolverines and other scavengers (Wilmers and others 2003).

Although the energy gained from carrion may be a benefit to Wolverines, potential interactions with Gray Wolves put them at risk of injury or death (Krebs and others 2004; Lofroth and others 2007). As solitary carnivores, Wolverines are likely at a disadvantage to a larger pack of Gray Wolves (e.g., Allen and others 2016a), increasing the likelihood of encounters being fatal for the Wolverine, and may explain why it is thought that Wolverines only scavenge from wolf kills after they have been abandoned (van Dijk and others 2008a; Abramov 2016). Despite the importance of interactions between Wolverines and Gray Wolves, the literature is lacking information on direct observations of Wolverine scavenging behavior at Gray Wolf kill sites. Here we provide a review of documented Gray Wolf-Wolverine interactions as well as insights and observations of Wolverine scavenging behavior at a Gray Wolf kill site in Idaho.

Our study was in Valley County, Idaho; a rural, mountainous area in central Idaho that is primarily federal land (88.1%). The mountains are composed of granite and are primarily forested with Ponderosa pine (*Pinus ponderosa*), Douglas fir (*Pseudotsuga menziesii*), and Grand fir (*Abies grandis*), along with intermixed high mountain meadows. The mean elevation is 1,525 m, with peaks as high as 2,750 m. The average annual precipitation is 67.84 cm and ranges from a high in December of 9.58 cm to a low in August of 2.57 cm (Western Regional Climate Center, wrcc.dri.edu). Mean monthly

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temperatures range from a high of 26.78°C in July to a low of -12.72°C in January (Western Regional Climate Center, wrcc.dri.edu).

We discovered a juvenile (calf of the year) Elk (*Cervus elaphus*) carcass on 15 September 2012 while conducting radio-monitoring of collared wolves as part of a separate long-term wolf monitoring project. The Elk was killed by wolves and partially consumed with > 15 kg of meat remaining, along with viscera and bones. We placed a video camera trap (Bushnell TrophyCam, Overland Park, Kansas) to monitor the carcass in the midafternoon of 15 September 2012. We set the camera to take 15-second videos each time motion was detected with no refractory period.

We first documented the Wolverine visiting the Elk carcass for 4 minutes on 15 September 2012 at 21:18. The Wolverine initially investigated the area and then sprayed urine on a nearby grass clump. The Wolverine then sniffed the carcass before spending the rest of the visit feeding while intermittently looking around the area. At the end of the visit, the Wolverine severed and carried off the front leg.

The Wolverine returned the following day (16 September 2012) at 09:25. It primarily fed for 22 minutes but also spent time adjusting the position of the Elk carcass (Video 1), intermittently looking around the area (Video 2) and spraying urine on vegetation around the carcass. The Wolverine fed mostly on the inner organs, consuming multiple mouthfuls of long grass stalks that had been mixed in with the carcass (Video 3). The visit concluded with the Wolverine severing the other front leg and carrying it off out of the view of the camera.

We then documented a Gray wolf visiting the carcass on the evening of 16 September 2012 at 20:12. The wolf spent 8 minutes at the carcass, devoting the first minute to smelling the area. The wolf spent the remaining 7 minutes feeding on the Elk and intermittently looking around. The Wolverine returned approximately 3 hours after the wolf left at 23:21, for a visit that lasted 24 min. The Wolverine primarily fed, but also investigated around the carcass, intermittently looked around, and sprayed urine directly on the camera (Video 4). The Wolverine appeared to remove a piece of the carcass and carry it off. We did not document the Wolverine or wolf returning to the kill after this.

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In our review of interactions between Gray Wolves and Wolverines, 18 out of 25 interactions ended in mortality for the Wolverine (Table 1) and in every instance the Wolverine was chased. Gray Wolves do not usually actively seek out Wolverines, however, there was one instance where a pack of Gray Wolves dug up a Wolverine den and killed the juveniles. Most mortalities were of adult Wolverines (3 of 25 instances were of juveniles), and of those where the sex was known, four were female and three were male. With such a high mortality rate (18 out of 25 interactions, see Table 1), Gray Wolves clearly pose a risk to Wolverines.

We documented noteworthy behaviors in the videos, including scent-marking and caching. Spraying urine is a form of scent-marking that carnivores use for exhibiting dominance and attracting mates (Begg and others 2003; Allen and others 2016b). While interspecific communication via scent-marking is complex (Allen et al 2017), the Wolverine was making its presence known to Gray Wolves and other scavengers by spraying urine despite the potential risk from Gray Wolves. We also documented the Wolverine removing pieces of the carcass and caching them. Removing food from the immediate vicinity of the kill site may be an important component of Wolverines limiting risk in interactions with Gray Wolves. Finally, we documented the Wolverine inadvertently eating grass while feeding on the carcass, which is important to note as this may be one way vegetation shows up in studies of Wolverine diet using scat samples or gastro-intestinal tracts (e.g., Banci 1987).

Previous research has suggested that Wolverines avoid Gray Wolves by using primarily high elevations with short excursions into lower elevations and by using abandoned wolf kills (Abramov 2016; van Dijk and others 2008a). Our observation, however, shows a Wolverine and Gray Wolf intermittently feeding at a kill. Our observations support that scavenging on wolf kills is an important food source for Wolverines (van Dijk and others 2008b) but also suggests that Wolverines do not necessarily avoid kills where Gray Wolves are present. This suggests that Gray Wolf-Wolverine interactions are more complex than previously thought, but more research is needed to understand how Wolverines perceive the risk of encounters with wolves.

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1 Table 1. Documented interactions and outcomes between wolves and wolverines. We report interactions
 2 as either observed (direct observation), tracks (interpretation of tracks in snow), found carcass
 3 (opportunistically found carcass), or radio-marked (animals were tagged with VHF radio collars).

4

Date	Location	Observation	Description	Outcome	Reference
1960	Alaska, USA	Tracks	8 wolves killed one female wolverine	Mortality	Burkholder 1962
1963	Alaska, USA	Tracks	Wolf pursued wolverine	Not lethally harmed	Murie 1961
1963	Alaska, USA	Tracks	Wolf chased wolverine up tree	Not lethally harmed	Murie 1961
1963	Alaska, USA	Tracks	Wolf chased wolverine from moose carcass	Not lethally harmed	Murie 1961
1974	Northwest Territories, CA	Observation	Wolverine caught in trap was killed by wolf	Mortality	Boles 1977
1974	Northwest Territories, CA	Tracks	Approx. 4 wolves killed a male wolverine	Mortality	Boles 1977
1983	Alaska, USA	Aerial observation	5+ wolves dug up wolverine den and killed juveniles*	Mortality	White and others 2002
1987	Alaska, USA	Observation	7 wolves attacked a wolverine	Not lethally harmed	Mech and others 1998
1997	Alaska, USA	Found carcass	Unknown number of wolves killed a yearling female wolverine	Mortality	White and others 2002
2003	No information	No information	8 out of 14 interactions ended in mortality for wolverine**	8 mortalities; 6 not lethally harmed	Ballard and others 2003
2003	Norway	Radio-marked	Female wolverine and 1 cub were assumed killed by wolves	Mortality	Van Dijk and others 2008
1983	Alaska, USA	Observation	5 Gray wolves killed wolverine cubs*	Mortality	Magoun and Copeland 1998
1984	Yukon, CA	Radio-marked	Male wolverine was killed by wolves	Mortality	Banci 1987
1985	Yukon, CA	Found carcass	Adult male wolverine was found dead at a wolf kill	Mortality	Banci 1987
1984	Yukon, CA	Radio-marked	Adult female wolverine was attacked by wolves	Not lethally harmed	Banci 1987

5 *reported that wolves killed juveniles in den, so assumed ≥ 1 juvenile wolverines killed

6 **4 of the 14 interactions are included in the table (all interactions from 1963 & 1987)