

Gray Wolves, *Canis lupus*, Killed by Cougars, *Puma concolor*, and a Grizzly Bear, *Ursus arctos*, in Montana, Alberta, and Wyoming

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Four cases where large predators caused Grey Wolf (*Canis lupus*) mortality are recorded. We describe two incidents of Cougars (*Puma concolor*) killing Wolves in Montana and one incident of a Cougar killing a Wolf in Alberta. We report the first recorded incident of a Grizzly Bear (*Ursus arctos*) killing a Wolf in the western United States.

Key Words: Gray Wolf, *Canis lupus*, Cougar, *Puma concolor*, Grizzly Bear, *Ursus arctos*, predation, interspecific interactions, Montana, Alberta, Wyoming.

Cougar (*Puma concolor*), Grizzly Bear (*Ursus arctos*), Black Bear (*Ursus americanus*), and Gray Wolf (*Canis lupus*) populations coexist in the Rocky Mountains of the United States and Canada. Reports of interactions between Wolves, Cougars, and bears are limited and most observations are anecdotal (Ballard et al. 2003). Wolves periodically usurp Cougar kills (U.S. Fish and Wildlife Service 1995; Ruth and Hornocker 1996; Ruth 2001) and occasionally kill adult Cougars (Schmidt and Gunson 1985; Boyd and Neal 1992; Jimenez, unpublished data) and Cougar kittens (White and Boyd 1989; Jimenez et al. 2006). Murphy et al. (1999) predicted that because Wolves travel in packs outnumbering Cougars, it is more likely for Wolves to kill Cougars than Cougars to kill Wolves. Cougars frequently kill domestic dogs; however, reports of Cougars killing Wolves are rare (Mexican Wolf Blue Ridge Adaptive Management Oversight Committee and Inter-agency Field Team 2005). We report two incidents of Cougars killing Wolves in Montana and one incident of a Cougar killing a Wolf in Alberta.

In 1995 and 1996, 35 Wolves were relocated from British Columbia and Alberta, Canada, to the Frank Church Wilderness Area in Central Idaho. Wolf #B-4, an adult female Wolf captured on 10 January 1995 at Petit Lake, Alberta, was released on 14 January 1995 in the Corn Creek drainage near Salmon, Idaho. By the end of February 1995, Wolf B-4 was located near the town of Drummond, Montana, approximately 185 km from the release site. Radio contact was lost on 17 November 1995, but we picked up a mortality signal in mid-January 1996 in that same vicinity. The dead Wolf was buried under approximately 60 cm of hard-packed snow in mountainous terrain covered by dense timber. We sent the frozen Wolf carcass to the U.S. Fish and Wildlife Service Forensics Lab in Ashland, Oregon. A necropsy revealed head trauma and a punc-

ture from a canine tooth through the top of the Wolf's skull. The Wolf had been killed, but not fed on, by a Cougar. From the time B-4 was released in 1995 until her death in 1996, we saw the Wolf one time and she was traveling alone.

On 29 January 2003, the radio-collar of female Wolf #297f from the Mill Creek Pack was located on mortality mode in the Paradise Valley, north of Gardiner, Montana. The pack consisted of three adults and four pups/yearlings. Investigation the following day found tracks of two Wolves traveling in 15-20 cm of snow along a two-track road in a mixed conifer forest. A barbed wire fence paralleled the road with briar bushes grown into it. Considerable amounts of Wolf hair and blood were found on the fence and on a bush. Tracks in the snow indicated that two Wolves were walking down the road but then both began to run. One set of Wolf tracks veered into the timber. The second set went through the barbed wire fence where the blood and hair were found. Drag marks in the snow led to a pile of 10 cm deep needles that covered the dead Wolf. Tracks indicated an adult Cougar with one or possibly two kittens had fed on the Wolf carcass. Punctures in the Wolf's hide and massive hemorrhaging were found on the neck and trachea. It was unknown if capture and handling twelve days earlier hindered the Wolf's flight, but we suspect that the Wolf running through the fence contributed to the Cougar catching and killing it.

A young, healthy, male Wolf #SR1 was fitted with an Argos satellite collar 18 November 2005 west of Turner Valley, Alberta, Canada. Wolf #SR1 appeared to be moving normally following capture until late February when daily locations localized in a 10 km² area. On 16 March 2006, Fish and Wildlife staff investigated the area and located the remains of #SR1 which included all four legs, head, tail, intestines, and stom-

ach cached under leaves and grass. Tracks in the snow indicated that a Cougar had been using an old farm shed at the site for shelter. It appeared that #SR1 traveled through the abandoned farm site and investigated the small shed where the Cougar was taking refuge. The Cougar attacked the Wolf and chased it through an open grassy area for approximately 50 m. Fresh blood was found where the Cougar made contact with the Wolf near trees at the edge of the grassy area. The Wolf was dragged by the Cougar approximately 130 m northwest and was cached in an area of thicker tree cover. Wolf hair was identified in Cougar scat found in the old farm shed. A necropsy of the Wolf remains revealed massive hemorrhaging in the muscle mass of the left jaw and a large fracture of the left dorso-ventral side of the skull.

Wolves and bears normally avoid each other; however, Wolves killed Black Bears in Alberta and Minnesota (Rogers and Mech 1981; Horejsi et al. 1984) and consumed denning Black Bears in Manitoba (Paquet and Carbyn 1986). Aggressive interactions between bears and Wolves are often associated with bears usurping ungulate carcasses from Wolves (Murie 1944; Ballard 1980; MacNulty et al. 2001; Ballard et al. 2003; Smith 2005) and defending young (Joslin 1966; Hayes et al. 1992; Ballard et al. 2003). A Brown [Grizzly] Bear killed a Wolf after usurping the carcass of a Moose (*Alces alces*) killed by Wolves in Alaska (Ballard 1980). We report the first recorded incident of a Grizzly Bear killing a Wolf in the western United States.

In summer 2005, we monitored a Wolf pack consisting of four adults and four pups, near Jackson, Wyoming. We placed an Argos satellite collar on a two-year-old Wolf and collected location data 4-24 times per day. Two clusters were less than a mile apart, indicating that Wolves had been there for 48 hours. We discovered the carcass of a yearling Moose at the first cluster. At the second cluster we found the fresh carcass of a 20-22 kg female Wolf pup that had been dead approximately one day. Along the back of the Wolf were large punctures through the hide, extensive muscle tissue damage, and massive hemorrhaging on the inside of the hide. The spine was broken in several places. Fresh Grizzly Bear tracks were found at the Moose carcass and the Wolf pup carcass. Based on the presence of Grizzly Bear tracks and the injuries to the Wolf pup, we concluded the Grizzly Bear killed the Wolf pup.

After extensive literature review, Ballard et al. (2003) summarized that Wolves, Cougars, and Grizzly Bears are occasionally adversaries due to interference competition; however, exploitation competition between wolves and other large predators did not result in significant resource partitioning. Wolf mortality from Cougar and Grizzly Bear predation is rare, and therefore it does not appear to be a significant factor impacting Wolves at the population level.

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