

Characteristics of Wolf Attacks on Moose in Mount McKinley National Park, Alaska

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Wildlife managers often need to determine if wild animals, particularly ungulates, were killed by predators or if they died of other causes. Research has been conducted with livestock to help distinguish between losses to predators and losses from other causes (Browns *et al.*, 1973; Connolly *et al.*, 1976; Murie, 1948; Wade, 1973; Wiley and Bolen, 1971). Characteristic wounds and field signs resulting from predator attacks on deer and other wild ungulates have also been described (Crisler, 1958; Gray 1970; Mech, 1970; Murie, 1944; Nielson, 1975; Ozoga and Harger, 1966). The present paper describes attack patterns and wounds inflicted on moose (*Alces alces*) by wolves (*Canus lupus*) and comments on attacks by grizzly bears (*Ursus arctos*) on ungulates in Mount McKinley National Park, Alaska.

Visible wounds associated with attacks were examined to determine if the predator could be identified by type and location of wounds. The area surrounding carcasses was searched for blood, tracks, broken vegetation, and other signs that might aid in identifying the predator involved.

From May 1974 to September 1977 the senior author examined 11 moose that had been injured or killed by wolves. All had cuts on the posterior surface of one or both rear legs. The posterior leg wounds occurred from the hock dorsally midway up the rump and varied from small superficial cuts concealed by hair to gaping skin perforations over 4 cm in diameter. Subcutaneous hemorrhage and muscle contusion was evident beneath the more severe skin lacerations.

Injuries on the rear legs were apparently made by canine teeth of wolves as they gripped the legs of moose from the rear. Such attacks have often been considered attempts to hamstring prey (Young, 1944). Generally, hamstringing refers to severing the Achilles tendon but no severed tendons were noted among the moose killed by wolves in this study, even when posterior leg tendons were exposed and muscles damaged. Mech (1970) was critical of early reports of prey hamstringing by wolves (Young, 1944), and he pointed out that no recent studies of the killing tactics of wolves indicated that hamstringing is common.

Another sign of wolf attack on moose which we observed on two occasions was tooth punctures of the fleshy nose. These punctures caused bleeding and blood was sprayed on vegetation and snow. Blood was apparently atomized

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as it was blown forcefully from the nostrils of the frightened moose. The fleshy nose is highly palatable and often the first portion of the carcass to be eaten. Thus, lacking other signs, the presence of atomized blood on snow or vegetation may be the only indicator of nose injury before death. Mech (1970) described three attacks on adult moose by packs of wolves and in each instance wolves grabbed the moose by the nose. Mech mentioned blood on the snow from the injured moose, but did not describe sprayed areas where blood was blown from the nose. Nielson (1975) described a deer killed by coyotes that apparently had been held by the nose.

Signs of wolf attack of less diagnostic value were lacerations or amputation of one or both ears and lacerations of the perineum or lateral and dorsal neck.

Simultaneous attacks on a calf and a cow moose by three wolves were observed by several park visitors in September 1977 and reported to Buskirk. A group of five moose (one bull, three cows, and a calf) were observed feeding near the park road. Following a general commotion among the moose, the calf moved away from the others and was attacked by two wolves. One wolf held the calf by the nose while the second wolf attacked from the rear. A cow, presumably the mother of the calf, approached and was attacked from the rear by the third wolf. The two wolves quickly killed the calf and moved away from the carcass. The cow approached and looked closely at the carcass of the calf, then left the area. She was limping noticeably in the hind legs.

One attack was observed of a moose calf accompanied by a cow and a second calf. The calf (approximately 3 months old) was abandoned by the cow moose and the second calf following repeated harassment by wolves. It fled into a small pond when approached by two wolves which alternately swam to the calf and bit it along the dorsal neck until it ceased to struggle. The wolves waited for three hours until the carcass floated to shore and began feeding.

One incident of wolf predation on Dall sheep (*Ovis dalli*) and attacks by grizzly bears on moose and one caribou (*Rangifer rangifer*) were also investigated. An adult ewe sheep was killed by wolves in low country while the ewe was crossing from one mountain to another. Lacerations were present on one side of the neck and the posterior surface of one hind leg. No injuries were found on the nose, throat, or dorsal back.

Two adult moose killed by grizzly bears were examined. Both carcasses showed multiple puncture wounds along the mid-dorsal line from the occiput to the lumbar region. These punctures had apparently been made by the canine teeth of adult grizzlies. The underlying fascia was torn and hemorrhaged. Dorsal vertebral processes had been fractured, and muscle macerated. The head and neck of one moose was severely injured. The left orbit was compound fractured ventrally and the left ear amputated. Both grizzly-killed adult moose showed claw scratches on the skin of the lateral thorax which could be observed only by clearing the thorax of hair. Murie (1948) described results of post-mortem examinations of grizzly-killed cattle in Wyoming. He consistently noted bite marks on the dorsal back or back similar to injuries on the moose that we examined in Mount McKinley

National Park. The bite wounds that Murie noted were occasionally accompanied by soft tissue trauma to the neck and face.

Three juvenile (< 4 weeks old) moose were killed by grizzlies, but no useful information was obtained since consumption of the carcasses was nearly complete before they were found.

Observations were made and motion pictures taken by Mr. Earl Senn and others of an adult female grizzly accompanied by yearling cubs killing an adult male caribou along the East Fork River on 15 August 1973 (Reardon, 1974). According to witnesses, the caribou had been attacked and injured by wolves prior to the grizzly attack. In the movie, the caribou stood facing the grizzly and intermittently charged. The grizzly grasped the caribou with one forepaw between the antlers and over the neck and the other forepaw under the neck. The bear then seized the struggling caribou near the occiput with its teeth. Several times the bear adjusted its bite, taking in more of the dorsal neck. The caribou lost its footing and fell to the ground. The bear continued to bite and the caribou quickly succumbed. The cubs did not participate in killing the caribou.

Signs that generally indicate death due to predation are skin lacerations or punctures accompanied by subcutaneous hemorrhaging and blood on vegetation or the ground (Connolly *et al.*, 1976; Wade, 1973; Mech, 1970; Nielson, 1975). Vegetation is usually broken and trampled and tracks of the predator are often apparent. In subzero temperatures, the abdominal viscera of predator-killed ungulates are usually found frozen outside the body cavity, having been removed before the prey carcass froze. The prey animal often shows signs of a violent chase such as broken antlers or hooves cut by sharp rocks. Moose that die of non-predatory causes are often found in a resting posture (Stephenson and Johnson, 1973). The skeletons of carcasses that were solidly frozen before scavenging tended to remain articulated longer than skeletons of ungulates fed upon promptly. All of these criteria should be considered in the context of weather, snow conditions, and other attending circumstances.

In this investigation, wolves attacked the hind legs, nose, and dorsal and lateral neck of moose, one calf caribou, and one adult sheep. Grizzlies bit the dorsal neck and back of adult moose and adult caribou.

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