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EVIDENCE FOR FATAL INJURY INFLICTED ON A FEMALE BLACK BEAR BY A MOOSE

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Abstract: Predators may risk injury or death when attacking large prey. Black bears (*Ursus americanus*) are known predators of young moose (*Alces alces*), which may be defended from predators by their mothers. We report evidence that a radio-collared adult female black bear was killed by a cow moose during a presumed predatory attack. This observation suggests that moose are dangerous prey for black bears.

Key Words: *Alces alces,* black bear, boreal forest, moose, natural mortality, Ontario, predation, predation risk, *Ursus americanus*

Predators which attack prey larger than themselves may be regularly exposed to risk of serious injury. For example, timber wolves (*Canis lupus*) have sustained various types of skeletal injuries (Pasitschniak-Arts et al. 1988, Mallory et al. 1994), or been killed (Nelson and Mech 1985, Mech and Nelson 1989, Weaver et al. 1992) during observed or presumed encounters with prey. These traumas are generally attributed to blows from the front hooves of ungulates such as moose. Solitary predators such as cougars (*Puma concolor*) have also suffered fatal injuries (Gashwiler and Robinette1957, Hornocker 1970, Brown et al. 1988, Ross et al. 1995) during predation attempts on ungulates such as elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*).

The black bear is reported to commonly prey on neonate and young cervids such as elk (Schlegel 1976), white-tailed deer (*Odocoileus virginianus*) (Ozoga and Verme 1982), caribou (*Rangifer tarandus*) (Mahoney et al. 1990), and moose (Ballard et al. 1979, Ballard et al. 1990, Ballard 1992). Though black bears are generally not considered to be successful predators of adult ungulates (Ballard 1992), a radio-collared adult male black bear killed an adult female moose in our study area in northern Ontario (Austin et al. 1994), and black bears were implicated in the deaths of adult caribou in Labrador (Veitch and Krizan 1996). Nevertheless, most

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predatory encounters between black bears and ungulates probably involve bears attacking neonate ungulates. In such encounters, bears are unlikely to suffer injury from the much smaller young ungulates. However, adult female moose are large, powerful animals that will aggressively defend their offspring against attack by wolves (Stephenson and Van Ballenberghe 1995). It seems likely that black bears, especially the smaller body-sized adult females, may expose themselves to the risk of being injured by cow moose when attempting to prey on moose calves.

In areas of open habitat, encounters between bears or other predators and ungulate prey may be readily seen from aircraft (Ballard et al. 1990, Stephenson and Van Ballenberghe 1995). However, in the dense boreal forest of northern Ontario it is extremely unlikely that such interactions could be observed. Documentation of such interactions between predator and prey in dense forest habitat must rely on interpretation of available evidence. Here we report indirect evidence of a fatal injury incurred by a radio-collared adult female black bear during a presumed predatory attack on a cow moose and or her offspring in the Chapleau Crown Game Preserve, Ontario (48ºN, 83ºW).

RESULTS

On 18 May 1995, the radio-collar of adult female black bear #017 (13 years old) emitted a signal in mortality mode suggesting either the collar had dropped off the bear or the bear was dead. Radio-collars (Lotek Engineering Inc., Newmarket, Ontario, Canada) used in our study contained a motion sensor with a 2-h delay resulting in a change in signal pulse rate if the collar had not moved in that previous 2-h period. The site was investigated on 19 May 1995 and bear #017 was found dead. The carcass lay in lateral recumbency on its right side, with all limbs extended in a normal walking gait. It appeared that bear #017 stepped over a log on the ground, then within 2 m had fallen over on her right side and was unable to rise. There were no visible signs of a struggle within 100 m of the carcass. The site was in a dense (>75% canopy closure) mixed stand of trembling aspen (*Populus tremuloides*), white birch (*Betula papyrifera*), and white spruce (*Picea glauca*) and was 1.5 km from the nearest road. The carcass was examined thoroughly in the field but no signs of external wounds or injuries were found. The carcass of bear #017 was recovered from the field on 19 May and the entire carcass was frozen at –20 °C. The carcass was kept frozen at –20 °C until it was transported to the Ontario Veterinary College, University of Guelph, Guelph, Ontario where a necropsy was performed on 5 June 1995.

At necropsy, body mass of bear #017 was 49 kg; there was 1 cm or less of subcutaneous fat and only small amounts of perivisceral and omental fat. There was diffuse subcutaneous emphysema in the anterior portion of the body. No movement of air occurred when the diaphragm was incised, and both lungs were collapsed and compressed. There were two areas of haemorrhage in the subcutaneous tissue of the right side of the thorax, lying approximately 20 cm apart and corresponding with two areas of damage to the thoracic wall. The more rostral area measured approximately 10–15 cm in width and overlay an oblique

fracture of the seventh rib at a point approximately 1.5 cm from its insertion on the spine. The intercostal muscles between the seventh and eighth ribs were torn throughout their length and there was haemorrhage within and adjacent to the muscle. The more caudal area of subcutaneous haemorrhage was approximately 5–10 cm in width. Beneath it, the tenth and eleventh ribs were fractured transversely approximately 4–6 cm dorsal to the sternum. There were extensive haemorrhages on the pleural surface and within the parenchyma of the right lung. No other skeletal injuries were detected. No significant findings indicative of pre-existing or concurrent disease conditions were detected at necropsy. Death was attributed to respiratory failure secondary to pneumothorax. The presence of subcutaneous emphysema indicates that there was an episode of respiratory distress prior to death. The fresh state of the haemorrhages, without significant inflammation, indicates that death occurred acutely following the injury.

DISCUSSION

The fact that both lungs were collapsed is evidence that bear #017 died of respiratory failure due to pneumothorax, caused by the entry of air into the thoracic cavity through the lacerations in the intercostal muscles. This condition would have caused death within a few hours or even minutes (Blood and Radostits 1989). Injuries of this sort are undoubtedly due to trauma, the sources of which under the circumstances are limited. Possibilities include vehicular trauma, misadventure such as a fall from a height, attack by another bear, or attack by a member of another species.

It is unlikely that bear #017 was struck by a vehicle. Vehicular traffic on the road at the time of the incident was limited to occasional fishing parties (1 or 2 vehicles per day), and because of the rough condition of the road vehicle speed was limited to a maximum of 10–15 km/h. In addition, bear #017 did not incur the kinds of injuries such as multiple fractures to the limbs, widespread haemorrhage, and multiple cuts and scrapes that are typical of those seen with the blunt trauma of vehicular collisions. The fact that bear #017 was found approximately 1.5 km from a lightly travelled, tertiary gravel road in a remote part of northern Ontario, and the nature of the injuries makes it highly unlikely that bear #017 was struck by a vehicle.

We also reject the possibility that bear #017 suffered the observed injuries in a fall. There was no evidence at the site where the bear was found to indicate a possible fall. If bear #017 had fallen from a cliff or tree and died as a result, it seems likely that there would have been evidence of superficial cuts, extensive subcutaneous haemorrhaging, and probably broken limbs. However, the only injuries incurred by #017 were the two areas of subcutaneous haemorrhage and fractured ribs described above. The dominant surficial features in our study area are glacial deposition features such as ground moraines, terminal moraines, and eskers (Thurston et al. 1977). Bedrock outcroppings are rare, and although there are a few small cliff faces, none are found in bear #017's home range. It seems equally unlikely that bear #017 fell from a tree. Black bears in the Game Preserve do climb high in aspen trees to feed on newly emergent leaves, but aspen leaves are

generally not available until later in May (Romain 1996). The stomach of bear #017 contained green vegetation, but not aspen leaves. Further, we are not aware of any reports of adult black bears sustaining serious injury by falling out of trees.

It also seems unlikely that bear #017's injuries were suffered during an attack by another bear. The observed wounds were not typical of those inflicted in intra-specific conflicts in bears. In such cases, there often are puncture wounds on the hind legs and forelegs, and there typically are bites in the cervical region with concomitant damage to the underlying vertebrae. The fact that there were no superficial cuts, scratches or bites on the carcass strongly suggests that #017 did not sustain the fatal injuries during an intra-specific encounter.

We suggest that the size and distribution of the areas of haemorrhage (linear subcutaneous haemorrhage), and the severity of damage to underlying muscular and skeletal tissue (traumatic laceration of the thoracic wall, multiple rib fractures) are consistent with trauma involving both a direct blow and a raking action such as might be delivered by striking blows from the hooves of a moose. The distribution of areas of injury further suggests that the blows may have been delivered separately. The more rostral injury site was high on the bear's right side (rib 7 was fractured 1.5 cm from its insertion on the vertebral column) suggesting that this blow was delivered from above, possibly by the front hoof of a moose. The more caudal injury site was low on the bear's right side (ribs 10 and 11 were fractured about 4-6 cm dorsal to the sternum) and may have been delivered from low on the side by a rear hoof in an upward-swinging arc. Alternatively, if the more rostral injury was received first, this blow may have knocked the bear onto its side or back and the injury low on the right side may have been caused subsequently by a front hoof.

Additional observations of bear #017 suggest that she had attempted to prey on moose in previous years. Bear #017 was observed by one of us (MEO) apparently stalking a cow moose and calf on 25 June 1989. In this encounter, bear #017 was first seen standing 3 m out on the trunk of an eastern white cedar (*Thuja occidentalis*) that leaned out over the water of a small lake. A cow moose stood in a shallow marshy area about 150 m downwind from bear #017. The moose was agitated and frequently snorted and spun around in the water. Bear #017 stared in the direction of the moose for about 3 min, then quickly turned and ran off the log into the forest. Telemetry signals indicated that the bear moved rapidly along the shore in the direction of the moose. Shortly after the bear ran into the forest, the cow moved quickly towards the shore of the lake, called, and ran off followed by a calf which appeared from the vegetation at the shore of the lake. The bear subsequently appeared to follow in the general direction of the fleeing moose, but close contact was lost with the bear and the outcome of this encounter is unknown. In a second encounter, bear #017 successfully killed a young moose calf in late May 1992. In this incident, radio-tracking data suggested that bear #017 spent 2 days at the same location. When the site was investigated the remains of a moose calf were found along with signs of a struggle, bear and adult moose tracks, and several bear scats that contained moose sign such as dewclaws.

In Ontario, the start of the calving period for moose is consistent among years (10-16 May; Addison et al. 1985) so there is a strong possibility that cow moose in the Chapleau Crown Game Preserve would be accompanied by neonate calves on 18 May.

Therefore, we suggest that the balance of evidence—the nature of the injuries sustained by bear #017, the timing of this event during the moose calving period, the anecdotal evidence of previous predatory encounters between bear #017 and moose, and the unlikely possibility that #017 was struck by a vehicle, suffered a fall, or received the injuries in an intra-specific conflict—indicates that bear #017 was fatally injured during a predatory attack on a cow moose and or her calf. This observation suggests that adult moose are dangerous prey for black bears.

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