

## American black bear predation of an adult white-tailed deer

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**Abstract:** American black bears (*Ursus americanus*) are opportunistic omnivores and can be proficient predators of neonate ungulates, but predation of adult ungulates is rare. In November 2009 we investigated a probable black bear predation of a radiocollared, adult (7.5 years old) female white-tailed deer (*Odocoileus virginianus*) in a densely vegetated, lowland conifer forest in the Upper Peninsula of Michigan, USA. The deer carcass was 80% buried with puncture wounds and lacerations on the back and hindquarters. The hide was everted, the intestines and stomach partially eaten, the mammary glands were punctured, and the skeleton remained articulated. All woody vegetation <5.0 cm diameter within 5 m of the carcass was trampled and contained bear and deer hair. We found no evidence of other carnivores. Based on the condition of the carcass, physical evidence at the site, and the similarity of this predation to reported black bear predations, we suggest this deer was attacked and killed by a black bear.

**Key words:** American black bear, Michigan, *Odocoileus virginianus*, predation, ungulate, *Ursus americanus*, white-tailed deer

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American black bears (*Ursus americanus*) are opportunistic omnivores (Pelton 2003, Zager and Beecham 2006), with most of their diet consisting of vegetation in the form of grasses, forbs, and soft and

hard mast (Bull et al. 2001, Pelton 2003). However, black bears will often switch their diet in response to seasonally and regionally abundant food sources (Raine and Kansas 1990, Holcroft and Herrero 1991, Pelton 2003), including animals such as insects, small mammals, fish, and ungulates (Bull et al. 2001, Belant et al. 2006). Although researchers have reported animal remains in black bear diets (Holcroft and Herrero 1991, Debruyne 1997, Bull et al. 2001), many believe consumption of larger mammals is by scavenging (Zager and Beecham 2006). Although scavenging is common (Raine and Kansas 1990, Debruyne 1997, Pelton 2003), black bears can be proficient predators of neonate ungulates including elk (*Cervus elaphus*; Smith 1994, Singer et al. 1997), moose (*Alces alces*; Franzmann et al. 1980, Schwartz and Franzmann 1991, Ballard 1992, Ballard and Van Ballenberghe 1997), deer (*Odocoileus* spp.; Ozoga 1982, Wilton 1983, Ozoga and Clute 1988, Kunkel and Mech 1994), and caribou (*Rangifer tarandus*; Rettie and Messier 1998). However, reports of black bear predation on adult ungulates are rare (Behrend and Sage 1974, Austin et al. 1994). Adult ungulates can be dangerous prey for adult black bears (Obbard et al. 2000), which may partially explain why observations of adult ungulate predation by black bears are uncommon. To our knowledge, there are no documented reports of black bear predation of free-ranging adult white-tailed deer (*O. virginianus*).

We describe a probable American black bear predation of an adult female white-tailed deer in Menominee County, Upper Peninsula of Michigan, USA (45°34'14"N, 87°20'47"W). This observation was part of a larger study examining multi-scale resource selection by carnivores and white-tailed deer. Deer were captured from 16 February to 22 March 2009. Major land-cover types within the study area include upland hardwoods, lowland hardwoods, lowland conifer swamps, upland conifers, aspen (*Populus* spp.) stands, agriculture, wetlands, and occasional patches of berry-producing shrubs (e.g., raspberries [*Rubus* spp.], and blueberries [*Vaccinium* spp.]).

On 10 March 2009, we captured an adult female white-tailed deer using a Clover trap (Clover 1956). This deer was 1 of 36 adult or yearling females captured and radiocollared during winter 2009. The deer was manually restrained in the trap and hand-

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injected intramuscularly with a 4:1 ketamine–xylazine mixture of 100mg/kg ketamine hydrochloride (Fort Dodge Laboratories, Inc., Fort Dodge, Iowa, USA) and 100 mg/kg xylazine hydrochloride (Butler Schein Animal Health™, Dublin, Ohio, USA). After immobilization, we removed a canine (Nelson 2001) for age estimation (Michigan Department of Natural Resources Diagnostics Laboratory, Lansing, Michigan, USA; Gilbert 1966), estimated weight to the nearest 1 kg using a spring scale, and attached a very high frequency (VHF) radiocollar equipped with an 8-hour motion-sensitive mortality signal (Advanced Telemetry Systems, Isanti, Minnesota, USA). We estimated body condition (scale: 1 [moribund]–5 [obese]; Gerhart et al. 1996), and determined pregnancy using ultrasonography (Del-Giudice et al. 2007). We released the deer at the capture site following recovery and subsequently located the animal using standard telemetry techniques (White and Garrott 1990) 2–4 times weekly until late-May, almost daily through mid-August, then about weekly thereafter. Animal handling protocols were approved by the Mississippi State University Institutional Animal Care and Use Committee (IACUC #09-004).

Assuming a parturition date of 1 June (J.F. Duquette, unpublished data), the pregnant female at capture was 6.8 years old and weighed 47 kg with a body condition score of 3. We received a mortality signal on 2 November 2009; the last known location while the animal was alive was on 22 October, 12.9 km from the capture location and 0.8 km from the carcass location. The carcass was located on 3 November in a lowland conifer stand about 18 m from a deer trail, 138 m from the nearest seasonal road, and 300 m from an elevated hunting platform. The area surrounding the carcass included a dense understory of tamarack (*Larix laricina*), northern white cedar (*Thuja occidentalis*), hemlock (*Tsuga canadensis*), and tag alder (*Alnus serrulata*).

The carcass was about 80% covered with broken branches, soil, and leaf litter and did not exhibit signs of decomposition (e.g., no insect larvae). We noted puncture wounds on the outside of the right hindquarter near the femur and the inside of the left hind leg near the flexor digitorum. Apparent claw marks punctured and lacerated the hide near the thoracic vertebrae about 35 cm from the scapulae, resulting in subcutaneous hemorrhaging. The hide was everted from the lumbar vertebrae to the posterior end of the animal, and uncoagulated blood

covered most of the hind legs. The intestines and stomach were removed and partially consumed. Remaining stomach contents contained shelled corn and unidentified vegetation. The heart, lungs, and liver were intact and not removed from the ribcage; ribs were intact and not consumed. The head, neck, and legs were uneaten and the skeleton was articulated. Possible tooth marks or lacerations were visible on the hide near the teats but no measurements could be obtained. No evidence of hunting wounds (e.g., projectile hole) or collision with a vehicle (e.g., multiple fractures, extensive hemorrhaging, multiple cuts and bruises) was located on the hide or internal organs. Femur bone marrow was light pink in color with a firm, waxy consistency. Fresh bear scat was identified next to the carcass and had the color and consistency of meat consumption (dark in color and liquefied).

All tree branches and saplings <5.0 cm in diameter were broken at heights 38–216 cm above ground within 5 m of the carcass. Black bear and deer hair were located on numerous broken branches surrounding the carcass. Recent bear tracks were observed near the carcass (<3 m) as well as claw marks on surrounding woody debris. We found no evidence (hair, scat, tracks) of other carnivores (wolf, *Canis lupus*; bobcat, *Lynx rufus*; coyote, *Canis latrans*) within 30 m of the carcass.

The carcass was <3 m from a probable bear den that was partially constructed. The den was 2 m in diameter, located under the roots of a fallen tree, and was recently lined with grasses and other bedding material. Black bear hair was located inside the den, at the 2 den entrances, and on multiple tree branches surrounding the den, suggesting substantial activity (i.e., den construction). Recent bear claw marks were located on a cedar stump and 2 logs adjacent to the den.

Based on the condition of the deer carcass, physical evidence at the kill location, and the similarity of this predation to reported black bear predations (e.g., Wade and Bowns 1984), we suggest this adult female deer was attacked and killed by a black bear. Consistent with other bear predations of ungulates (Bertram and Vivion 2002, Barber et al. 2005), the hide was everted and mostly intact, the intestines and stomach were removed and partially eaten, the legs were untouched, and the skeleton remained articulated. Austin et al. (1994) reported a black bear predation of an adult moose in Canada and noted all organs were consumed, the hide was

everted, and most of the skeleton remained intact. In addition, Ozoga and Verme (1982) investigated 2 black bear predations of neonate white-tailed deer in an enclosure in Michigan's Upper Peninsula and found the carcasses partially consumed and uneaten portions of the legs remained. Consistent with our observation, black bears have been observed caching or partially covering their kills with vegetation and soil (Elgmork 1982, Bertram and Vivion 2002). The udders of the deer were bitten or lacerated, similar to other predation events in which bears have reportedly consumed the udders of female prey, possibly to obtain milk (Hygnstrom et al. 2005). Zager and Beechum (2006) reported that deer with decreased body condition are more vulnerable to bear predation; however, femur bone marrow indicated the deer was not severely malnourished (Stockle et al. 1978).

Because there was no indication the carcass was moved, we suggest the deer was killed at the location the carcass was found. The dense understory at the kill location may have facilitated this predation. Broken branches with bear and deer hair and knocked down trees in the area surrounding the kill suggested a considerable struggle occurred (Austin et al. 1994). Similar to Austin et al. (1994), a bear-rest site (i.e., den) and scat were located near the carcass. Evidence of a struggle further supports the assumption the deer was not compromised by a previous injury and was not scavenged. It is also unlikely this deer was struck by a vehicle because the carcass was located 138 meters from a rarely traveled, seasonal, gravel road in poor condition. Rough conditions of the road limit maximum vehicle speed to 15–25 km/hr, and the deer did not incur the types of injuries typically seen in vehicle collisions. Evidence at the kill site suggests the deer died from exsanguination from injuries received during the attack. However, it is possible the bear suffocated the deer by covering the muzzle or closing off the trachea (Austin et al. 1994).

Black bears can be effective predators of neonate ungulates (Zager and Beechum 2006), including moose, elk, and caribou, but are not considered predators of adult deer (Ballard 1992). The paucity of documented predation events on adult white-tailed deer undoubtedly reflects the increased speed and agility of mature white-tailed deer (Adams et al. 1995, Zager and Beechum 2006). Consequently, we consider this observation an opportunistic predation event and suggest the overall direct effects of black

bear predation on adult white-tailed deer are negligible.

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