

## Killing and Caching of an Adult White-tailed Deer, *Odocoileus virginianus*, by a Single Gray Wolf, *Canis lupus*

MICHAEL E. NELSON

U.S. Geological Survey, Northern Prairie Wildlife Research Center, 8711-37th Street Southeast, Jamestown, North Dakota 58401 USA; mailing address: 7332 Tracy Road, Duluth, Minnesota 55803 USA; email: meklnelson2@gmail.com

Nelson, Michael E. 2011. Killing and caching of an adult White-tailed deer, *Odocoileus virginianus*, by a single Gray Wolf, *Canis lupus*. *Canadian Field-Naturalist* 125(2): 162–164.

A single Gray Wolf (*Canis lupus*) killed an adult male White-tailed Deer (*Odocoileus virginianus*) and cached the intact carcass in 76 cm of snow. The carcass was revisited and entirely consumed between four and seven days later. This is the first recorded observation of a Gray Wolf caching an entire adult deer.

Key Words: Gray Wolf, *Canis lupus*, White-tailed Deer, *Odocoileus virginianus*, caching, surplus killing.

When killing ungulates during winter, Gray Wolves (*Canis lupus*) typically remain near kill sites until the prey is entirely eaten (Mech 1970). The exception to this is “surplus killing,” when escape by prey is impeded by features of the landscape and Gray Wolves kill more than they can immediately consume (Mech et al. 1971; Carbyn 1983; Miller et al. 1985; Boyd et al. 1994; DelGiudice 1998). Throughout the year, meat and other prey parts that are not immediately consumed are cached underground or beneath snow (Mech 1970; Adams et al. 1995; Nelson and Mech 2011). Herein, I report the caching of an intact adult male White-tailed Deer (*Odocoileus virginianus*) killed by a single Gray Wolf during a winter of extreme snow depths.

### Study Area and Methods

The event occurred during a long-term study of White-tailed Deer in northwestern Lake County in the Superior National Forest in northeastern Minnesota (48°N, 91°W, Nelson and Mech 1981, 2006). Topography is flat, dominated by lakes and rivers (Heinselman, 1996). Forests are primarily deciduous-coniferous mixtures of Aspen (*Populus tremuloides*), Jack pine (*Pinus banksiana*), and Spruce (*Picea* spp.) (Heinselman, 1996). Temperatures and weekly snow depths during February when the observation occurred average -13°C (Heinselman, 1996) and 46 cm (Nelson unpublished 1975–2010) respectively. Gray wolf (*Canis lupus*) predation is the primary cause of winter deer mortality (Nelson and Mech 1986). The White-tailed Deer in this observation was captured in a Clover trap, radio-collared, and followed 2–3 times per week by aerial radio-tracking (Nelson and Mech, 1981, 2006).

### Results

An 8.5-year-old radio-collared male White-tailed Deer died between 2 and 5 February 1996. On 8 February I found the carcass completely buried intact, covered with ~10 cm of snow. The snow depth was 76 cm, requiring snowshoes for human travel. A deep, narrow trail led to the kill site, which became apparent only after my snowshoes contacted compacted snow cov-

ering the White-tailed Deer and the radio-collar’s signal confirmed that the collar must be underneath the snow. Snow mixed with a few broken dead twigs had been raked over the carcass from a radius of ~1 m. I cleared the compacted snow by hand to expose the White-tailed Deer, being careful not to disturb the hair or other evidence related to cause of death.

There was a single large carnivore track present, but the track details and other tracks were masked by the fluffy snow from the sides of the deep trail created by the chase. The chase must have taken place within the confines of the single deep trail because there was no other trail or track sign on either side of it. The carcass was cached in the trail next to two dead conifers ~8 cm in diameter, presumably at the site of death because there was no drag path away from the pursuit trail. The legs were angled down below the body, with the hooves buried deep in the snow, which covered the legs completely. I removed the snow from the head and neck first and found a few drops of blood on the throat and the snow beneath it. I removed the remaining snow from the carcass and found no further evidence of external trauma (i.e., tooth punctures, gashes, hair loss).

I necropsied the White-tailed Deer on site. The White-tailed Deer weighed 89 kg, the same weight as when it was radio-collared two years earlier. He had no remaining back, heart, kidney, or omental fat, but I collected a section of femur marrow fat for dry weight measurement of fat content (Neiland 1970), later measured at 50%. Bone marrow is the last site of depletion of stored fat, and it was at a level indicating poor nutritional condition as a result of nearly complete catabolism of all body fat (Verme and Ullrey 1984; DelGiudice 1998). Dissection of the neck showed subcutaneous haemorrhaging and contusions at the puncture sites. Two holes 40 mm apart on one side of the throat matched an open cut 35 mm long on the opposite side of the throat, measurements that match the distance between the canines from a cleaned Gray Wolf skull from within the study area. Death appeared to have resulted from the throat-hold.

I left the carcass uncovered at the site on 8 February. An unknown number of days later multiple Gray Wolves returned and consumed the carcass. Depending on when the White-tailed Deer was killed, it was not consumed until 4–7 days later. It is unknown if the same Gray Wolf that killed the White-tailed Deer returned to feed on it.

Strangulation by Gray Wolves with no obvious evidence of trauma was also the cause of death of an intact adult male American Elk (*Cervus elaphus*) I examined in Yellowstone National Park, Wyoming, in March 1997. The Elk was in poor condition at the end of a severe winter, as evidenced by lack of internal fat deposits and visibly low levels of fat in the femur marrow.

## Discussion

All the evidence indicates that a single Gray Wolf grabbed the White-tailed Deer's throat and strangled it. In snow depths < 50 cm, White-tailed deer can plant their legs on firm ground and they are able to run, bound, jump over objects, and turn acutely, and, when cornered, can strike attacking predators with their hooves and antlers (Mech 1970; Nelson and Mech 1985, 1993). I have even observed a White-tailed Deer standing and facing off against three Gray Wolves that surrounded it but were hesitant to approach it and finally left it alone (Nelson and Mech 1994). It follows that, when impeded by deeper snow, as in this case, a White-tailed Deer most likely loses all the aforementioned defenses, enabling a single Gray Wolf to kill it. However, direct observation of a kill under these conditions has not been reported.

Later in the winter of 1996, three more radio-collared White-tailed Deer were killed by Gray Wolves and not immediately or completely consumed. The first, which was killed in March, when snow depths reached 90 cm, also had bite marks on its throat. In April, when snow depths had receded to 70 cm, Gray Wolves killed two more radio-collared White-tailed Deer; one was 10% eaten and the other was uneaten when examined. The uneaten White-tailed Deer was killed 1 km from the cached White-tailed Deer in this account.

Concurrently, southwest of my study area, Gray wolves also underutilized their kills (DelGiudice 1998), just as Gray Wolves did in my study area in 1969 when snow depths exceeded 80 cm (Mech et al. 1971). However, neither study reported evidence of caching, although DelGiudice (1998) reported deer killed by Bobcats (*Lynx rufus*) which are present in my study area along with similar-sized Canada Lynxes (*Lynx canadensis*). Both species kill ungulates by bites to the throat and both cache parts of their prey (Bergerud 1971, Labisky and Boulay 1998). Although rare in my study area, a Canada Lynx previously killed a radio-collared White-tailed Deer by gripping the throat (unpublished). The distance between the canines in the Canada Lynx is ~ 25 mm, roughly 60% that of the dis-

tance in the Gray Wolf which excludes a Canada Lynx and a Bobcat as the predator that killed the White-tailed Deer in this observation.

Similar to my observation, one of my pilots recounted an aerial observation he made years earlier of a lone wolf bedded on top of a deer the wolf had killed approximately an hour prior to the observation. He first observed the wolf feeding on a deer it had just killed on a frozen snow-covered lake. The pilot made a return flight over the kill hours later, and the wolf was bedded on top of a mostly snow-covered deer. Although the observation was not made from the ground, it suggests that the bedded wolf had covered much of the deer with snow.

Nelson and Mech (2011) reported a wolf burying a White-tailed Deer's head and neck with the radio-collar still attached under the snow and then bedding on top of it. Adams et al. (1995) reported the caching of an intact Caribou (*Rangifer tarandus*) calf in snow, and Schultz (2010) observed an intact fresh White-tailed Deer foetus cached in snow and scent-marked with urine by wolves.

This observation is the first record of a Gray Wolf caching an entire adult deer. However, it is unknown if such caching is unique to the deep snow which already surrounded the deer's legs and which may have enabled the Gray Wolf to cover the rest of the body more easily.

## Acknowledgements

This research was supported by the U.S. Geological Survey, U.S. Forest Service, Northern Research Station, and the Special Projects Foundation. I also acknowledge volunteer wildlife technicians who assisted in live capture of White-tailed Deer and who helped retrieve radio-collars. I also thank the pilots of the U.S. Forest Service for skilful and safe flying and specifically pilot Douglas Bohman for his observation. I followed the American Society of Mammalogists Guidelines (Animal Care and Use Committee) for animal handling and care in conducting research.

## Literature Cited

- Adams, L. G., B. W. Dale, and L. D. Mech. 1995. Wolf predation on caribou calves in Denali National Park, Alaska. Pages 245-260 in *Ecology and Conservation of Wolves in a Changing World*. Edited by L. N. Carbyn, S. H. Fritts, and D. R. Seip. Canadian Circumpolar Institute, Edmonton, Alberta.
- Bergerud, A. T. 1971. The population dynamics of Newfoundland caribou. *Wildlife Monograph* No. 25. 55 pages.
- Boyd, D. K., R. R. Ream, D. H. Pletscher, and M. W. Fairchild. 1994. Prey taken by colonizing wolves and hunters in the Glacier National Park area. *Journal of Wildlife Management* 58: 289-295.
- Carbyn, L. N. 1983. Wolf predation on elk in Riding Mountain National Park, Manitoba. *Journal of Wildlife Management* 47: 963-976.
- DelGiudice, G. D. 1998. Surplus killing of white-tailed deer by wolves in northcentral Minnesota. *Journal of Mammalogy* 79: 227-235.

- Heinselman, M.** 1993. Boundary Waters wilderness ecosystem. University of Minnesota Press. Minneapolis, Minnesota.
- Labisky, R. F., and M. C. Boulay.** 1998. Behaviors of bobcats preying on white-tailed deer in the Everglades. *American Midland Naturalist* 139 (2): 275-281.
- Mech, L. D.** 1970. *The Wolf: The Ecology and Behavior of an Endangered Species*. Natural History Press, Garden City, New York.
- Mech, L. D., L. D. Frenzel, Jr., and P. D. Karns.** 1971. The effect of snow conditions on the ability of wolves to capture deer. Pages 51-59 in *Ecological Studies of the Timber Wolf in Northeastern Minnesota*. Edited by L. D. Mech and L. D. Frenzel, Jr. USDA Forest Service Research Paper NC-52. North Central Forest Experimental Station, St. Paul, Minnesota.
- Miller, F. L., A. Gunn, and E. Broughton.** 1985. Surplus killing as exemplified by wolf predation on newborn caribou. *Canadian Journal of Zoology* 63: 295-300.
- Neiland, K. A.** 1970. Weight of dried marrow as indicator of fat in caribou femurs. *Journal of Wildlife Management* 34: 904-907.
- Nelson, M. E., and L. D. Mech.** 1981. Deer social organization and wolf predation in northeastern Minnesota. *Wildlife Monographs* No. 77.
- Nelson, M. E., and L. D. Mech.** 1985. Observations of a wolf killed by a deer. *Journal of Mammalogy* 66: 187-188.
- Nelson, M. E., and L. D. Mech.** 1986. Mortality of white-tailed deer in northeastern Minnesota. *Journal of Wildlife Management* 50: 691-698.
- Nelson, M. E., and L. D. Mech.** 1993. Prey escaping wolves, *Canis lupus*, despite close proximity. *Canadian Field-Naturalist* 107: 245-246.
- Nelson, M. E., and L. D. Mech.** 1994. A single deer stands off three wolves. *American Midland Naturalist* 131(1): 207-208.
- Nelson, M. E., and L. D. Mech.** 2006. A 3-decade dearth of deer (*Odocoileus virginianus*) in a wolf (*Canis lupus*) – dominated ecosystem. *American Midland Naturalist* 155: 373-382.
- Nelson, M. E., and L. D. Mech.** 2011. Wolves, *Canis lupus*, carry and cache the collars of radio-collared deer they kill. *Canadian Field-Naturalist* 125 (1): 67-68.
- Schultz, R.** 2010. A case of mistaken identity? *International Wolf Magazine* 20: 16-17.
- Verme, L. J., and D. E. Ullrey.** 1984. Physiology and nutrition. Pages 91-118 in *White-tailed Deer: Ecology and Management*. Edited by L. K. Halls. Stackpole Books, Harrisburg, Pennsylvania.

Received 13 January 2011

Accepted 29 May 2011