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Shannon M. Barber-Meyer

*USGS Northern Prairie Wildlife Research Center, Jamestown, ND, sbarber-meyer@usgs.gov*

Lori J. Schmidt

*International Wolf Center, Ely, MN*

L. David Mech

*USGS Northern Prairie Wildlife Research Center, david\_mech@usgs.gov*

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### Gray Wolf (*Canis lupus*) Death by Stick Impalement

Shannon M. Barber-Meyer<sup>1,2,\*</sup>, Lori J. Schmidt<sup>3</sup>, and L. David Mech<sup>1,4</sup>

**Abstract** - Although *Canis lupus* L. (Gray Wolf) individuals are sometimes impaled by sticks, we could find no documentation of natural impalement by sticks as a cause of death for wild Wolves. Here we report on a wild Gray Wolf from northeastern Minnesota that died due to stick puncture of its thorax and abdomen.

*Canis lupus* L. (Gray Wolf or Wolf) impalement or puncture is often associated with *Erethizon dorsatum* (L.) (North American Porcupine) quills (Weiler et al. 1995, Wobeser 1992, Wydeven et al. 2003). Whereas humans have used sharpened sticks to kill Wolves (e.g., in pitfall traps, see Cluff and Murray [1995] for review), natural impalement by sticks has rarely been reported for wild Wolves (Wobeser 1992) and to our knowledge has not been found as a cause of death. Here we report on a wild Gray Wolf mortality caused by stick impalement that punctured the thorax and abdomen, resulting in massive hemorrhaging.

Male Wolf 7249 was captured with a rubber-padded-jaw, foot-hold trap on 1 September 2015 as part of long-term research in the Superior National Forest of northeastern Minnesota (48°N, 92°W; Mech 2009). He was fitted with a global positioning system (GPS), mortality-sensing radio collar equipped with an accelerometer that measured activity. The collar was programmed to email a mortality report after 12 hours of insufficient activity. The collar was scheduled to acquire a GPS location every 4 hr. The Wolf was estimated by tooth wear at capture to be 2 years old (Gipson et al. 2000). He weighed 27.7 kg (within the range of 2-yr-old males in northeastern Minnesota but below the mean [Mech 2006]) and appeared in generally good, but “thin” condition.

Following the release of Wolf 7429, the first author verified his VHF beacon approximately weekly via aerial radio-telemetry, and GPS locations were reported every few days. We never confirmed whether he was with another Wolf, but we suspect he was alone given he traveled widely (was not territorial), making extensive use of roads (S.M. Barber-Meyer and L.D. Mech, unpubl. data).

On 13 November 2016 at 08:12, we received a mortality report for 7249. Trained technicians conducted an in-field necropsy on 15 November at 14:00. The Wolf was found prone less than 10 m from a nearby walking path (Fig. 1). No disturbance to leaves, no sign of struggle, and no evidence of other mammal activity were found in the immediate area.

No external signs of Wolf aggression were found (e.g., no bite wounds) and no external trauma except an oval-shaped entry wound (~3½ cm x 1 cm) apparently made by a stick penetrating the left side of the ribcage (Fig. 2). The stick was embedded in the Wolf and did not exit the hide elsewhere. The Wolf’s coat was in good condition, and there was no evidence of mange. There were no signs of injury due to traps or other human influences (e.g., no bullet wounds). The Wolf’s eyes appeared normal and clear.

The stick was fairly flat (maximum height ~1 cm) and dagger-shaped (26½ cm long, 2½ cm wide at external end, 1¼ cm wide at internal end, 3¼ cm greatest width at 6½ cm

<sup>1</sup>US Geological Survey, Northern Prairie Wildlife Research Center, 8711–37th Street, SE, Jamestown, ND 58401-7317. <sup>2</sup>Current address - US Geological Survey, 1393 Hwy 169, Ely, MN 55731.

<sup>3</sup>International Wolf Center, 1396 Hwy 169, Ely, MN 55731. <sup>4</sup>Current address - US Geological Survey, The Raptor Center, University of Minnesota, 1920 Fitch Ave., St. Paul, MN 55108. \*Corresponding author - sbarber-meyer@usgs.gov.

from external end). The stick penetrated inter-costally and did not appear to break any ribs. It punctured the left lung, diaphragm, and stomach, as if having entered from the left side and driven posteriorly. There was significant hemorrhaging in the thoracic and abdominal cavities. Kidney and back fat were detected, and a sample from the left femur indicated the



Figure 1. Wolf 7249's position on the forest floor, found on 15 November 2016. Photograph © Blake Bornholdt, Vermilion Community College.



Figure 2. Penetration of the stick through the rib cage. The position of the stick has shifted from its original position in the body cavity because we opened the thorax and abdomen for examination. Ventral view of the Wolf with the penetrating end of the stick to the left. Photograph © Blake Bornholdt, Vermilion Community College.

marrow fat was not exhausted. Thorough examination of organs was hindered due to significant internal bleeding. There were no apparent broken bones, and no other abnormalities. Comparing tooth wear with that in Gipson et al. (2000), the first author later determined the age of the Wolf skull to be 5-yr old. Thus, Wolf 7249 was probably older than the 2-yr estimate at his capture in late summer 2015.

We suspect this Wolf became impaled while chasing *Odocoileus virginianus* (Zimmerman) (White-tailed deer), the primary prey in this part of our study area (Mech 2009). The last movement recorded by the collar's accelerometer was at 20:05 on 12 November 2016. The Wolf was located ~275 m southwest of his mortality site at 17:01 on 12 November on a winding 1-track dirt road where only slow travel by vehicle is possible. Vehicle traffic on the dirt road was blocked by boulders about 100 m southwest before the mortality site. His movements prior to the location cluster at the mortality site did not appear different from those of the previous 90 days, which included long movements along roads punctuated with periods of shorter movements in a more concentrated area. Given his movements and the extent of injury from the stick, the Wolf probably did not live long after impalement. It is also a possibility that he was impaled while potentially fleeing from an approaching vehicle on the 1-track dirt road where he was located ~3 hours before death. In this scenario, he would have had to travel a minimum of about 100 m after impalement due to the boulders blocking vehicle traffic on that section of road.

We could find no published record of Wolves killed by stick impalement. A *Puma concolor* (L.) (Cougar) skull was discovered with a stick penetrating its brain cavity, and it was suspected that the stick penetrated during a "violent action" such as attacking prey (Gashwiler and Robinette 1957:126), similar to how we suspect Wolf 7249 was penetrated by the stick. Wobeser (1992) necropsied 241 Gray Wolves and noted that two (<1%) had a stick embedded in them (one encapsulated by fibrous tissue, showing no active inflammation, in the frenulum of the tongue through to the pharynx, and the other in fibrous tissue ventral to the sternum). He stated, "Both these injuries likely resulted from running onto sticks but neither appeared to have caused serious debilitation" (Wobeser 1992:272). Thus, it appears that accidental death of Gray Wolves by stick impalement is rare, and ours may be the only reported case. Stick impalement is one of a number of potential natural habitat hazards that predators face when foraging (e.g., falling off a cliff, avalanche, drowning, etc.; Mech et al. 1998, Murphy and Ruth 2010).

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