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BOBCAT PREDATION ON BIGHORN LAMB IN THE WESTERN BLACK HILLS OF SOUTH DAKOTA—

Bighorn sheep (*Ovis canadensis*) are found throughout western North America (Krausman et al. 1993, Goodson 1994, Krausman et al. 1996, Besser et al. 2012). In their current range, commonly documented large predators of bighorn sheep include cougars (*Puma concolor*), gray foxes (*Urocyon cinereoargenteus*), wolves (*Canis lupus*), and coyotes (*C. latrans*; Ross et al. 1997, Neale et al. 1998, Corti and Shackleton 2002, Dekker 2009, Karsch et al. 2013). Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) also have been documented as predators to both wild and domestic sheep (Kennedy 1948, Cunningham 1970, Nette et al. 1984, Watte and Phillips 1994, Warren et al. 2001). Eagles often take lambs and occasionally a yearling bighorn sheep (Kennedy 1948, Russo 1956, Jantzen 1961). Additionally, several biologists have reported watching eagles harass lambs, ewes, and young rams (Jantzen 1961, Cunningham 1970).

Studies have reported bobcat (*Lynx rufus*) predation on animals of similar size and weight to bighorn lambs (Jones and Smith 1979, Koehler and Hornocker 1991, Jacques and Jenks 2008) but few articles document bobcat predation on bighorn sheep (Groves 1957, Russo 1957, Johnson 1958, Elliot 1961). Bobcats have been observed stalking bighorn sheep with the subsequent escape of these potential prey (Hornocker 1969, Kelly 1980). Some early sources report bobcats killing young rams or ewes (Groves 1957, Russo 1957, Johnson 1958, Elliot 1961); in each of these reports, the authors provide compelling evidence on the cause of death to the sheep. More recent studies report bighorn lamb deaths attributed to bobcats (Deforge et al. 2000, Deforge 2002); no information, however, was provided to support their findings. Here we report, with evidence, a rare instance of a bobcat preying on a bighorn lamb.

Adult bighorn sheep inhabiting the Elk Mountain region of South Dakota and Wyoming were captured on 21 January 2013 via drop net (Jessup et al. 1984, Kock et al. 1987) and on 6 February 2013 via helicopter net gun (Jacques et al. 2009). We tested ewes for pregnancy using a Bantam XLS portable ultrasound (E.I. Medical Imaging, Loveland, CO, USA), and if pregnant, fitted them with vaginal implant transmitters (VITs; model M3930, Advanced Telemetry Systems, Isanti, MN, USA). Beginning 15 April 2013, we monitored ewes daily to determine if VITs had been expelled through parturition. When expelled, a team of one or two technicians tracked the VIT and ewe using hand-held directional antennas (model RA-2AK, Telonics, Inc., Mesa, AZ, USA) and attempted to locate the lamb (Smith et al. 2014b). We captured lambs by hand, collared them with expandable very high frequency collars (VHF; model M4210, Advanced Telemetry Systems), sexed, weighed, and released them. We then monitored ewes and lambs daily for mortality signals.

On 29 April 2013, ewe 041 expelled her VIT. Technicians

successfully captured and collared the female lamb (4.74 kg) the same day and we monitored the lamb and ewe daily thereafter. All capture and handling procedures were approved by the South Dakota State University Animal Care and Use Committee (Approval Number 12-090A) and followed recommendations of the American Society of Mammalogists (Sikes et al. 2011).

On 4 May 2013, the lamb collar emitted a mortality signal. While locating the lamb carcass via radio telemetry, the collar signal changed from mortality to emitting a live signal. The carcass was found to be partially consumed and had been recently moved from under a rock overhang. The ground under the overhang had indications of a predator having pulled the carcass out. However, the predator's tracks were not uniquely identifiable to the species level.

Examination of the lamb carcass revealed a single canine puncture (3 mm in diameter) on the side of the head. A tooth indentation and associated bruising was found subcutaneously approximately 2.0 cm from the tooth mark, but there was no puncture. The dorsal and lateral side of the lamb's neck was severely damaged, indicating it was likely the location of initial capture by the predator and subsequent cause of death to the lamb. The viscera had been consumed, but the majority of the muscles remained on the carcass.

Virchow and Hogeland (1994) reported that bobcats typically kill prey by biting the throat, neck, or skull. The distance between canines of bobcats ranges from 1.9–2.5 cm (Wade and Bowns 1982, Virchow and Hogeland 1994). Additionally, bobcats begin feeding on larger prey by opening up the carcass behind the ribcage to feed on the viscera and will often make return visits to the carcass until fully consumed (Wade and Bowns 1982, Virchow and Hogeland 1994).

The area surrounding the carcass was searched for additional evidence of the predator. Tracks of a bobcat and the lamb were found within 20 m of the carcass. The bobcat's plantar pad tracks measured roughly 3.8 cm in diameter, which is consistent with the size of documented bobcat tracks (Wade and Bowns 1982, Virchow and Hogeland 1994). We followed this set of tracks away from the carcass where feces consistent with those of felids were located along a rocky ridge, which also was consistent with typical bobcat behavior (Wade and Bowns 1982, Acorn and Dorrance 1990, Virchow and Hogeland 1994).

Cougars also inhabit the study area (Thompson and Jenks 2010). They are a known predator of bighorn sheep (Smith et al. 2014a) and have killed several adult and lamb bighorn sheep on Elk Mountain during this study (B.L. Parr, South Dakota State University, unpublished data). Cougar canines are 3.9 to 5.7 cm apart, and the diameter of cougar tracks ranges between 9.0 and 10.2 cm (Wade and Bowns 1982, Acorn and Dorrance 1990). Cougars typically leave feces covered with debris near kill sites (Wade and Bowns 1982, Acorn and Dorrance 1990). Additionally, cougars often consume entire lamb carcasses in a single feeding event (J.

Smith, South Dakota State University, personal communication).

The size of tooth marks and tracks, along with the pattern in which the carcass had been consumed, and the location of feces all supported bobcat rather than cougar predation of the lamb. Therefore, we concluded that the likely cause of death for this lamb was predation by a bobcat.

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