Unusual Documentation of Elk Behaviors Using Automated Cameras

W. David Walter
Oklahoma Cooperative Fish and Wildlife Research Unit, 404 Life Sciences West, Oklahoma State University, Stillwater, OK 74078

Ralph L. Bryant
Wichita Mountains Wildlife Refuge, Route 1, Box 448, Indiahoma, OK 73552

David M. Leslie, Jr.
U.S. Geological Survey, Oklahoma Cooperative Fish and Wildlife Research Unit, 404 Life Sciences West, Oklahoma State University, Stillwater, OK 74078

Automated cameras have been used to monitor wildlife movement and activity, raptor nests, captive animals, and ground nest predators (Kucera and Barrett 1993, Kristan et al 1996, Hernandez et al 1997, Bauman et al 1999). In a review of 107 remote-photography publications, nest predation, feeding ecology, nesting behavior, and evaluation of equipment accounted for 21, 18, 18, and 18% of studies, respectively (Cutler and Swann 1999). Activity of Rocky Mountain elk (*Cervus elaphus*) was monitored in Wind Cave National Park, South Dakota, with still and video cameras to document use of and damage to fence lines, but no additional data on activity of elk at fences were reported (Bauman et al 1999). We used automated cameras to document elk that were using fence-breaks to enter and leave the Wichita Mountains Wildlife Refuge (WMWR) in southwestern Oklahoma. We noted various behaviors that were previously unrecorded for free-ranging elk in this region.

Our study was conducted on private lands surrounding the 23,879-ha WMWR (34°47′ to 34°57′N, 98°25′ to 98°50′W). Elk, bison (*Bos bison*), white-tailed deer (*Odocoileus virginianus*), and longhorn cattle (*Bos taurus*) are common in WMWR. Private land borders WMWR to the north with igneous mountain peaks and slopes >25% extending northward from WMWR (Buck 1964). Lowlands comprised of grasslands used for cattle grazing form a mosaic with upland and riparian forests and wheat fields.

Automated still cameras (e.g., DeerCam®, Non Typical Inc., Park Falls, Wisconsin) were placed on the private-land side of fence-breaks with the motion sensor aimed toward the fence to photograph an elk at the fence. Video cameras (Guardian 2000®, First Witness Video, Mt. Sydney, Virginia) were equipped with a seismic detector placed on the ground and were placed at ramps construced to permit elk to enter but not leave WMWR.

Elsewhere in the study area we monitored with automated cameras a natural spring confined by a concrete-constructed basin that was 5 m from a secondary road. The camera system documented nocturnal use of the spring by a female elk.

Mature bulls (>2 years) were photographed alone prior to 8 July 2002 and then photographed alone or in mixed groups with females and offspring after 8 July. Yearling males (1.5 years of age) were photographed, but none occurred with groups of females. Based on unique antler characteristics, a mature male elk in velvet was photographed without females prior to 8 July; after 8 July, the male was photographed with 3-4 female elk (one was radiocollared). The male also was photographed without the females from 10-19 July on 11 occasions near the fence-break. During that 9-day span, the radiocol-

lared female was located within WMWR by radiotelemetry triangulations (W. D. Walter, unpublished data). Similar to Tule elk (*C. e. nannodes*) in California, the spread of the calving period over a greater time period could cause rutting activities to start before velvet is shed (McCullough 1969).

Placement of a salt lick near cameras increased number of elk photographed two-fold. Radiocollared female elk were photographed with calves, in social groups, individually, and nursing at salt licks. Because increased sodium is required during lactation (Dalke et al 1965, Robbins 1993), salt licks may have caused female elk with young calves to frequent the area.

Video-camera footage can document more detailed elk behavior for an extended period of time compared with still-cameras (Bauman et al 1999). On 21 July 2000, an adult male elk with 5x5 antlers, in velvet, was observed jumping from WMWR to private land at a ramp with a bar place on the ramp to prevent elk from leaving WMWR. The front legs of the elk did not clear the bar causing it to collapse on the private land side of the ramp. The fall was about 1 m and did not appear to harm the elk because it raised within seconds to a full stance.

On 27 September 2001, an adult female was observed entering WMWR leaving a calf on the private-land side of the ramp. An adult male elk was present in WMWR and attempted to mount the female several times for 5-10 s within view of the video camera within WMWR. The calf eventually used the ramp to enter WMWR and joined its dam. An extended calving period in WMWR was documented by video of a cow elk and a relatively small calf on 28 October 2003. Based on sizes of calves born during the typical May-June calving period for the area, this calf appeared to be <1 month old.

On 19 April 2002, a female elk was video-taped chewing the end of sun-bleached shed elk antler. She chewed on two distal ends of antler points with her front teeth apparently consuming some of the degraded antler. Osteophagia has been documented for cervids and has been linked to deficiencies of calcium and phosphorus (Krausmand and Bissonette 1977, Wilka 1982, Bowyer 1983), but has not been reported for elk in Oklahoma.

On 27 October 2003, a female elk (1.5 years old) was observed on video entering the field of view with a coyote (*Canis latrans*) attacking her around the neck. The video captured the elk thrashing about with the coyote holding on using its jaws around the elk's throat. After the elk was brought to the ground, legs thrashing was intermittent in the video's view. After the coyote had successfully killed the elk, later footage documented hogs dragging the carcass under the fence and scavenging of the carcass. To our knowledge, this was the first observation of successful predation of elk by an adult coyote. Coyote scat from WMWR contained only 0.8% elk, but it could not be determined if that was from predation or scavenging (Litvaitis 1978).

Automated cameras documented calving success of radiocollared elk, osteophagia, breeding attempts, use of a man-made water basin, and a mortality source previously undocumented for elk in Oklahoma. Automated cameras documented behavioral interactions of elk that typically require intense field work and direct observation, and could be useful as a reconnaissance tool to refine research protocols.

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