1994

Out-of-Season Births of Elk Calves in Wyoming

Bruce L. Smith
National Elk Refuge

Out-of-Season Births of Elk Calves in Wyoming

BRUCE L. SMITH

National Elk Refuge, Jackson, WY 83001

ABSTRACT—Five out-of-season births of Rocky Mountain elk were documented over a 24-month period at the National Elk Refuge, Wyoming. One of four November neonates was radio-instrumented and subsequently died seven days later due to hypothermia. An April-born calf was killed by a coyote. Supplemental winter feeding of elk at the Refuge may increase the frequency of asynchronous reproduction.

Key words: Elk, *Cervus elaphus*, birth, reproduction, mortality, supplemental feeding

Rocky Mountain elk (*Cervus elaphus nelsoni*) are polyestrus, seasonal breeders, and the reproductive cycle corresponds to forage phenology (Taber et al. 1982). Calves are normally produced at peak forage quality in spring when the energetic demands of lactation on dams are rapidly increasing (Moen 1973, Robbins et al. 1981). The majority of calves are produced in late May and June (Taber et al. 1982, Sadlier 1987), after a 246-250-day gestation (Morrison et al. 1959, Blunt 1962, Hepworth 1966). In studies of pastured elk at Wyoming's National Elk Refuge (NER), Oldemeyer et al. (1993) reported that 80% of calves were born by June 15, the same percent recorded for Roosevelt elk in Oregon (Hines and Lemos 1979).

Although estrus recurs at 21-day intervals in reproductive age females, more than four estrus periods (Morrison 1960) and births later than mid-July (Johnson 1951, Oldemeyer et al. 1993) have rarely been documented in free-ranging elk. I found only Wishart's (1981) account of a near-term fetus recovered from an Alberta elk on 21 September, Seton's (1909:34) record of a neonate on 15 October, and Murie's (1951:133) report of an April birth near the NER. Presumably, females remain anestrous if they fail to conceive after a third or fourth estrus. On those rare occasions when births occur later in the year, offspring are nonviable or neonatal mortality is high. Guinness, Gibson, and Clutton-Brock (1978) reported 12 of 236 births in wild red deer after July 15. Over-winter survival of calves was correlated negatively with birth date (Guinness, Clutton-Brock, and Albon 1978).

Approximately 7500 elk winter annually on the 10,000-ha National Elk Refuge in northwestern Wyoming. Although elk migrate from the refuge in April and May prior to the calving season (Smith and Robbins 1994), one or two spotted red calves are observed each winter. Spots usually fade in July and are lost with the first pelage molt in August, 8-10 weeks post-partum (Johnson 1951, Murie 1951:75), suggesting that spotted calves observed in December and January were likely born during October-November.

Elk were supplementally fed all but nine winters since the NER's establishment in 1912 to maintain larger numbers of elk than the available habitat could support and to reduce winter mortality (Boyce 1989:130-145, Robbins et al. 1982). Since 1975, elk have been fed an average of 3.1 (SE=0.22) kg/elk/day of pelleted alfalfa hay for 73 (SE=8) days each winter. Supplemental feeding likely contributes to the survival of late-born calves, as over-winter mortality rates of calves have averaged just 2.4% (0.47 SE) over the past 30 years. However, mortality may be significant among late-born calves peripartum, either due to insufficient milk production by dams or poor energetics of neonates.

Beginning in 1991, staff of the NER began documenting all observed neonatal elk on the Refuge. Here I report those observations and fates of those calves.

METHODS

Neonates were opportunistically located during the six months (November-April) that elk winter on the NER. Calves were captured by manual restraint, blindfolded, hobbled, sexed, and weighed to the nearest 0.25 kg. Measurements of hoof growth, eruption of incisor 1, and umbilicus diameter were recorded to determine age (Johnson 1951). One neonate was radio-instrumented with an expandable Telonics Inc. (Mesa, AZ) transmitter collar weighing 230 g. A mortality switch with a 5.5-hr time delay was integrated into the transmitter's circuitry. The calf was radio-monitored and observed at least twice daily thereafter.

RESULTS

Calf 1: On 27 November 1991, an adult cow elk was observed at 1400 hr leading a wobbly neonatal elk calf across an irrigated field on the NER. I captured and radio-collared it at 1600 hr on 28 November as its dam looked on from 175 m away. This male calf was 1 day old and weighed 17.5 kg, slightly heavier than mean birth weights for male calves reported in Montana (approximately 16.7 kg, Johnson 1951), Idaho ($\bar{x}$=17.1, Schlegel 1976), and calving areas north of the NER ($\bar{x}$=16.2±0.03 SE, B. Smith unpubl. data). Total handling time was 7 minutes.

The dam moved the calf 1.2, 1.2, and 0.5 km/day on 28, 29, and 30 November, respectively. Mother and calf remained at the 30 November location isolated from the herds of elk on the NER, until 3 December. The calf was observed nursing on two days.

The morning of 3 December, the dam crossed an interior gravel road of the refuge toward a heavily forested slope. The calf followed until it fell into a badger burrow where both hind legs became tightly lodged. At 1330 hr I approached the listless calf and carried it to a patch of sagebrush near its dam.

At 0810 hr on 4 December, I detected a mortality signal from the radio transmitter and found the calf dead at the location where I had placed it the previous day. The dam was nearby. I froze and transported the carcass to the Wyoming State

Veterinary Lab in Laramie, WY, where a necropsy and diagnostic tests were conducted. Major organs were essentially normal and no evidence of infectious disease was discovered. The abomasum was filled with milk curd. Cause of death was considered to be hypothermia (exposure). The calf weighed 18.0 kg at death. Normal daily rate of gain for neonatal elk is 0.8-0.9 kg (Johnson 1951, Robbins et al. 1981).

Clearly, the dam had nursed her offspring and protected it from potential predators that inhabit the NER, including coyotes (*Canis latrans*), ravens (*Corvus corax*), and bald and golden eagles (*Haliaeetus leucocephalus* and *Aquila chrysaetos*). However, overnight low temperatures had ranged from -9 to -27° C during the week the calf was alive, and there was 5 cm of snow cover.

Calves 2 and 3: During November 1992, two more newborn calves were observed on the NER. One was captured on 7 November. It had apparently been separated from its dam by elk hunting activity, which occurs on a limited portion of the refuge each fall. This female weighed 13.8 kg compared to spring birth weights for female calves reported by Johnson (1951, approximately 13.7 kg), Schlegel (1976, $\bar{x}$=15.6 kg), and north of the NER (B. Smith unpubl. data, $\bar{x}$=15.4 kg $\pm$0.03 SE). The calf was less than 1 day old. It was transported to the Wyoming Game and Fish Department's Sybille Research Station and then to the Riverside Zoological Park in Scottsbluff, NE, where it was successfully reared.

I observed the other calf with its dam 13 days later on 20 November in a herd of several hundred elk. Given its wobbly stature, the calf was likely less than 4 days old (Johnson 1951). This calf was not seen again on the NER.

Calf 4: Another newborn was seen on the NER on 21 April 1991, approximately one month before the normal parturition period. A wildlife photographer observed and photographed it for several hours from a distance of approximately 1 km. The dam was fending off attempts by a coyote to reach the calf. The author and photographer attempted to locate the calf 1 hr later. A lone coyote was found feeding on remains where the calf had last been observed.

Calf 5: On 17 November 1993, a calf judged to be less than two weeks old, based on its size and stature, was observed in a herd of 200 elk. I saw the calf twice more in early December 1993 in the same area. Both times it was nursing.

DISCUSSION

These opportunistic observations of five newborn elk calves over a period of 24 months suggest that out-of-season births occur with some regularity on the NER. The four fall births occurred approximately five months after the normal peak of parturition in free-ranging elk. Given a 250-day gestation, calves born in mid-November would have been conceived in mid-March. I offer the following as possible explanations.

Out-of-season births may be more common than reported or believed. However, observing neonates on most elk ranges is simply more improbable than on grassland habitats of the NER, which are relatively visible from roads and harbor

large concentrations of elk. Parturient females often remain isolated from other elk for several days postpartum and the hider strategy of calves reduces their chances of detection (Geist 1982).

Alternatively, asynchronous reproduction may be more likely among elk that winter on the NER. Sadlier (1987) speculated that some female cervids retain the ability to ovulate at times well away from normal, perhaps because their ovaries are not completely quiescent during anestrous. Fertility and conception rates of red deer are correlated with female condition (i.e. body weight, Mitchell 1973). Supplementally fed Scottish red deer continued to come into estrus until March when not allowed to breed (Guinness et al. 1971). Irrigated and subirrigated grasslands of the refuge provide abundant, high quality fall forage for the wintering herd, which arrives in late October and November (Smith and Wilbrecht 1990). As availability of standing forage declines, elk are fed a supplemental daily ration of pelleted alfalfa for an average of 73 days each winter. The feed averages 16.5% crude protein content and 60% digestibility (Smith and Wilbrecht 1990). Adult females fed a daily ration of 3.2-3.6 kg have maintained their January weights through early April (Smith and Robbins 1984). As a result, unbred females may be capable of conceiving during mid-late winter at the NER on this favorable plane of nutrition. Bull elk sporadically court and mount females during winter on the refuge.

Synchronous, seasonal breeding and poor survival of out-of-season offspring limit the prevalence of asynchronous reproduction in wild ungulate populations inhabiting northern latitudes. Strongly seasonal northern environments select for brief parturition periods in ungulates to maximize the dam's access to high quality forages and production of milk, and rapid growth of offspring (Berger 1979). Late-born offspring enter winter as small, energetically disadvantaged phenotypes and suffer high mortality (Guinness, Gibson, and Clutton-Brock 1978). Fertility rates of females are strongly related to body size and condition during the rut (Mitchell 1973, Blaxter and Hamilton 1980, Cameron et al. 1993), which is further correlated with nutritional plane of females (Verme 1969, Albon et al. 1983).

The studies cited above and many others suggest variation in fertility is of environmental origin. Reproductive plasticity is evidenced in translocated red deer that altered their breeding cycle by 10 days and matched that of the endemic population (Fletcher 1974). Northern-hemisphere red deer and elk that were translocated to New Zealand altered their reproductive cycles a full 6 months (Caughley 1971).

Although admittedly a small sample, these five observations indicate that out-of-season births of elk occur at the NER with some regularity. If out-of-season births are more common among elk receiving food supplementation, then occasional outlier births should also occur in herds of elk that are fed elsewhere in western Wyoming, Washington, Oregon, Idaho, and Utah. Given the secretive behavior of parturient females and their offspring and the high mortality rate of out-of-season births, it is not surprising that more have not been reported.

ACKNOWLEDGEMENTS

My thanks go to F. Camenzind, J. Creasy, M. Lanier, and A. Ridgway, who helped find and capture calves. E. Williams, Wyoming State Veterinary Laboratory, performed the necropsy and diagnostic testing.

LITERATURE CITED

Albon, S. D., B. Mitchell, and B. W. Staines. 1983. Fertility and body weight in female red deer: a density-dependent relationship. J. Anim. Ecol. 52:969-980.

Berger, J. 1979. Weaning conflict in desert and mountain bighorn sheep (*Ovis canadensis*): an ecological interpretation. Z. Tierpsychol. 50:188-200.

Blaxter, K. L., and W. J. Hamilton. 1980. Reproduction in farmed red deer. Calf growth and mortality. J. Agric. Sci. (Cambridge) 95:275-284.

Blunt, F. M. 1962. General study on breeding habits, gestation, lactation and young of big game animals. Pp. 20-23 *in* Job Completion Report, Federal Aid Project No. W-69-R-H. Wyoming Game and Fish Commission, Cheyenne.

Boyce, M. S. 1989. The Jackson elk herd. Cambridge University Press, Cambridge, U.K.

Cameron, R. D., W. T. Smith, S. G. Fancy, K. L. Gerhart, and R. G. White. 1993. Calving success of female caribou in relation to body weight. Can. J. Zool. 71:480-486.

Caughley, G. 1971. Season of births for northern-hemisphere ungulates in New Zealand. Mammalia 35:204-219.

Fletcher, T. J. 1974. The timing of reproduction in red deer. J. Zool. (Lond.) 172:363-367.

Geist, V. 1982. Adaptive behavioral strategies. Pp. 219-277 *in* The elk of North America: ecology and management (J. W. Thomas and D. E. Toweill, eds.). Stackpole Books, Harrisburg, PA.

Guinness, F. E., T. H. Clutton-Brock, and S. D. Albon. 1978. Factors affecting calf mortality in red deer. J. Animal Ecol. 47:817-832.

Guinness, F. E., R. M. Gibson, and T. H. Clutton-Brock. 1978. Calving times of red deer (*Cervus elaphus*) on Rhum. J. Zool., (Lond.) 185:105-114.

Guinnness, F., G. A. Lincoln, and R. V. Short. 1971. The reproductive cycle of the female red deer, *Cervus elaphus* L. J. Reprod. Fert. 27:427-438.

Hepworth, W. G. 1966. General study on breeding habits, gestation, lactation and young of big game animals. Pp. 1-4 *in* Job Completion Report, Federal Aid Project No. FW-3-R-13. Wyoming Game and Fish Commission, Cheyenne.

Hines, W. W., and J. C. Lemos. 1979. Reproductive performance by two age-classes of male Roosevelt elk in southwestern Oregon. Oreg. Dep. Fish Wildl., Wildl. Res. Rep. No. 8.

Johnson, D. E. 1951. Biology of the elk calf, *Cervus canadensis*. J. Wildl. Manage. 15:3967-410.

Mitchell, B. 1973. The reproductive performance of wild Scottish red deer. J. Reprod. Fertil. (Suppl.) 19:217-285.

Moen, A. N. 1973. Wildlife ecology. W.H. Freeman and Co., San Francisco.

Morrison, J. A. 1960. Ovarian characteristics in elk of known breeding history. J. Wildl. Manage. 24:297-307.

Morrison, J. A., C. E. Trainer, and P. L. Wright. 1959. Breeding season in elk as determined by known-age embryos. J. Wildl. Manage. 23:27-34.

Murie, O. J. 1951. The elk of North America. Stackpole Books, Harrisburg, PA.

Oldemeyer J. L., R. L. Robbins, and B. L. Smith. 1993. Effect of feeding level on elk weights and reproductive success at the National Elk Refuge. Pp. 64-68 *in* Proceedings western states and provinces elk workshop (R. L. Callas, D. C. Koch, and E. R. Loft, eds.). California Fish and Game Department, Eureka.

Robbins, C. T., R. S. Podbielancik-Norman, D. L. Wilson, and E. D. Mould. 1981. Growth and nutrient consumption of elk calves compared to other ungulate species. J. Wildl. Manage. 45:172-86.

Robbins, R. L., D. E. Redfearn, and C. P. Stone. 1982. Refuges and elk management. Pp. 479-507 *in* Elk of North America: ecology and management. (J. W. Thomas and D. E. Toweill, eds.). Stackpole Books, Harrisburg, PA.

Sadlier, R. M. F. S. 1987. Reproduction of female cervids. Pp. 123-44 *in* Biology and management of the Cervidae. (C. M. Wemmer, ed.). Smithsonian Institution Press, Washington, DC.

Schlegel, M. 1976. Factors affecting calf elk survival in Northcentral Idaho — a progress report. Proc. West. Assoc. State Game Fish Comm. 56:342-55.

Seton, E. T. 1909. Lives of game animals, Vol. III, Part 1. Doubleday, Doran and Co., New York.

Smith, B. L., and R. L. Robbins. 1984. Pelleted alfalfa hay as supplemental winter feed for elk at the National Elk Refuge. Unpublished Report, National Elk Refuge, Jackson, WY.

Smith, B. L., and R. L. Robbins. 1994. Migrations and management of the Jackson elk herd. U.S. Fish Wildl. Serv. Resour. Paper 199. In press.

Smith, B. L., and J. W. Wilbrecht. 1990. Supplemental winter feeding of elk on the National Elk Refuge, Wyoming. Pp. 30-41 *in* Proceedings western states and provinces elk workshop (M. Zahn, J. Pierce, and R. Johnson, eds.). Washington Department of Wildlife, Olympia.

Taber, R. D., K. Raedeke, and D. A. McCaughran. 1982. Population characteristics. Pp. 279-300 *in* The elk of North America: ecology and management (J.W. Thomas and D. E. Toweill, eds.). Stack pole Books, Harrisburg, PA.

Verme, L. J. 1969. Reproduction patterns in white-tailed deer related to nutritional plane. J. Wildl. Manage. 29:74-79.

Wishart, W. D. 1981. January conception in an elk in Alberta. J. Wildl. Manage. 45:544.

Received 10 August 1993. Accepted 4 April 1994.