Acta Theriologica 39 (3): 325–328, 1994.
PL ISSN 0001–7051

FRAGMENTA THERIOLOGICA
BISONIANA 111

Supernumerary teeth in a captive population of American bison *Bison bison*

Kevin R. CROOKS* and Dirk VAN VUREN

Crooks K. R. and Van Vuren D. 1994. Supernumerary teeth in a captive population of American bison *Bison bison*. Acta theriol. 39: 325–328.

A link between dental abnormalities and loss of genetic variation has been reported for unconfined populations of American bison *Bison bison* (Linnaeus, 1758) but not for captive populations. From a zoo herd with a small founder population and likely history of inbreeding, we report the first recorded occurrence of dental abnormalities in captive bison and the first case of supernumerary second premolars in bison.

Department of Wildlife and Fisheries Biology, University of California, Davis, California 95616, USA

Key words: *Bison bison*, supernumerary teeth, inbreeding

European bison *Bison bonasus* (Linnaeus, 1758), and American bison *B. bison* (Linnaeus, 1758) both have suffered severe population bottlenecks or founder events because of human activities, thus there has been considerable interest in the effects of inbreeding on genetic (McClenaghan *et al.* 1990), demographic (Slatis 1960), and morphological (Van Vuren 1984, Kobryńczuk 1985) traits of extant bison. Dental abnormalities, particularly supernumerary teeth, are morphological traits that have been linked to inbreeding in American bison (Wilson 1974, Frison *et al.* 1976, McDonald 1981, Van Vuren 1984), but only in unconfined populations. We know of no reports of abnormal dentition from captive bison, yet it is captive ungulates that are particularly vulnerable to inbreeding (Ralls *et al.* 1979). Herein we report the first instance of abnormal dentition in captive bison and the first case of a supernumerary second premolar in bison.

Four adult male and two adult female American bison from a herd maintained by the San Francisco Zoo were sacrificed after testing positive for bovine tuberculosis. Subsequent examination revealed that the two females had supernumerary teeth; teeth of the four males were normal. One female (Female 1) had a supernumerary lower premolar located in the tooth row on the left dentary between the P_2 and P_3 (Fig. 1). The other female (Female 2) had bilateral supernumerary

* Present address: Department of Biology, University of California, Santa Cruz, CA, 95064 USA

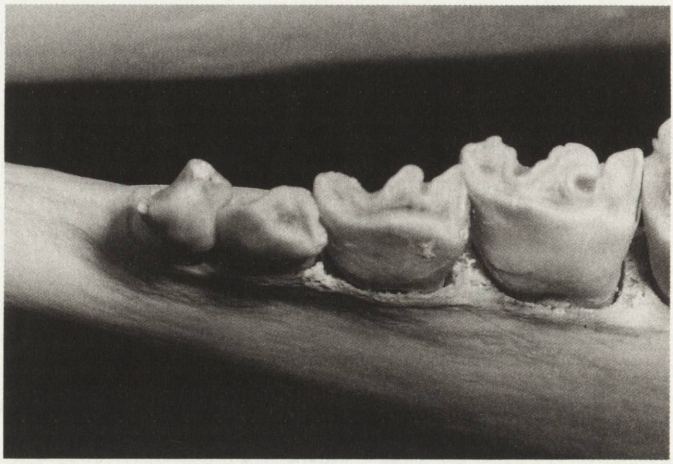

Fig. 1. Lower left dentary (from the left: P_2, supernumerary premolar, P_3, P_4) of Female 1, a mature female American bison. Supernumerary premolar is in the tooth row between the P_2 and P_3.

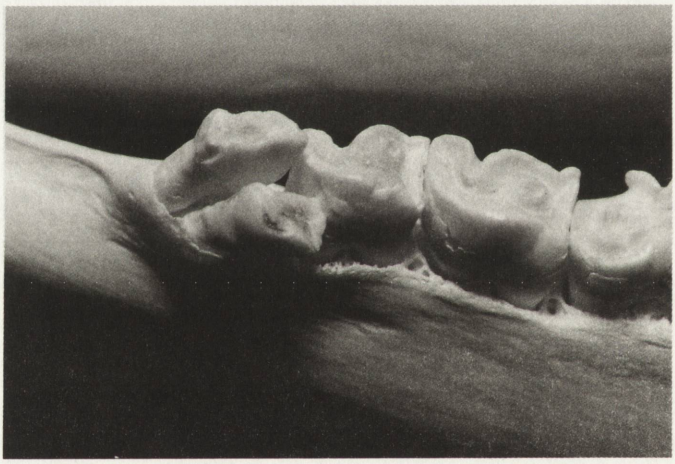

Fig. 2. Lower left dentary (P_2, supernumerary premolar, P_3, P_4) of Female 2, a mature female American bison. Supernumerary premolar is outside the tooth tow on the labial side, between the P_2 and P_3.

premolars, one on each dentary. The supernumerary premolar on the left dentary was outside the tooth row on the labial side, between the P_2 and P_3 (Fig. 2). The supernumerary premolar on the right dentary was located in the tooth row between the P_2 and P_3 (Fig. 3). The skull of Female 2 was deposited in the Museum of Wildlife and Fisheries Biology at the University of California, Davis (specimen # WFB 2637). All permanent teeth in the two females were fully erupted and in regular wear, including the third cusp of the M^3, so these bison were mature individuals at least five years of age (Frison and Reher 1970).

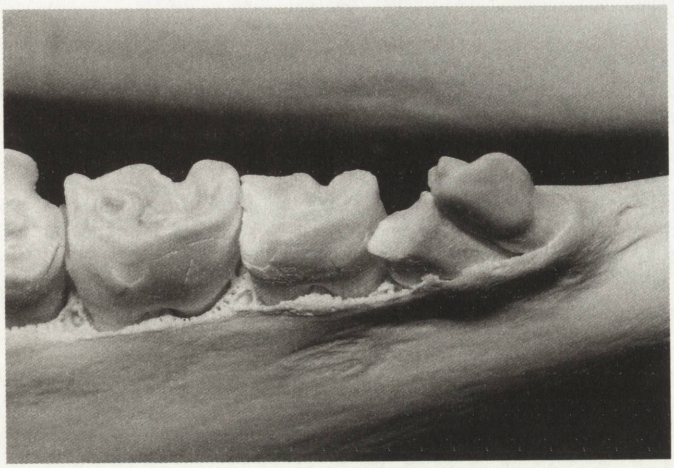

Fig. 3. Lower right dentary (P_4, P_3, supernumerary premolar, P_2) of Female 2, a mature female American bison. Supernumerary premolar is in the tooth row between the P_2 and P_3.

Although ancestral forms of bison contained four premolars, the cases reported here likely do not represent recovery to this ancestral state. Vestigial first premolars do occasionally appear in bison, but they occur in the middle of the diastema, not adjacent to the other cheek teeth (Fuller 1954). Further, the supernumerary premolars were very similar in size and appearance to the normal P_2 but very dissimilar to the normal P_3. As is characteristic of normal P_2 teeth in bison (Węgrzyn *et al.* 1990), each supernumerary tooth had a short and wide crown, a sharp peak of enamel in the cranial (anterior) lobe, and small depressions in the caudal (posterior) lobe. Thus, we conclude that the supernumerary premolars are P_2 teeth, resulting from a splitting of the P_2 tooth germ (Wolsan 1984).

Increased frequency of supernumerary teeth in the San Francisco Zoo bison may have resulted from a small founder population and subsequent inbreeding. The herd directly descends from the first herd of bison acquired by the zoo ca. one hundred years ago. In 1946 the bison were quarantined when some individuals were diagnosed with bovine tuberculosis. Information from available records indicate this herd has remained as a closed population until the present; the herd currently numbers only eight individuals (F. Dunker, pers. comm.). Substantial inbreeding is therefore likely to have occurred following the initial founder events. Interestingly, in addition to the supernumerary teeth, both female bison showed grossly deformed occipital condyles.

Recent studies suggest that inbreeding in small captive populations may have harmful effects due to loss of genetic variation (Senner 1980, Ralls and Ballou 1983, Ralls *et al.* 1988). The occurrence of dental and cranial abnormalities in the small, closed herd of bison at the San Francisco Zoo may serve to further emphasize the importance of genetic management in captive populations.

References

Frison G. C. and Reher C. A. 1970. Age determination of buffalo by teeth eruption and wear. Plains Anthropol. 15: 46–50.

Frison G. C., Wilson M. and Wilson D. J. 1976. Fossil bison and artifacts from an early alti-thermal period arroyo trap in Wyoming. American Antiquity 41: 28–57.

Fuller W. A. 1954. The first premolar and the canine tooth in bison. J. Mammal. 35: 454–456.

Kobryńczuk F. 1985. The influence of inbreeding on the shape and size of the skeleton of the European bison. Acta theriol. 30: 379–422.

McClenaghan L. R. Jr, Berger J. and Truesdale H. D. 1990. Founding lineages and genetic variability in plains bison (*Bison bison*) from Badlands National Park, South Dakota. Conserv. Biol. 4: 285–289.

McDonald J. N. 1981. North American bison: their classification and evolution. University of California Press, Berkeley: 1–316.

Ralls K. and Ballou J. 1983. Extinction: lessons from zoos. [In: Genetics and conservation: A reference for managing wild animal and plant populations. C. M. Schonewald-Cox, S. M. Chambers, B. MacBryde and W. Lawrence Thomas, eds]. The Benjamin/Cummings Publishing Company Inc., Menlo Park, California: 164–184.

Ralls K., Ballou J. D. and Templeton A. 1988. Estimation of lethal equivalents and costs of inbreeding in mammals. Conserv. Biol. 2: 185–193.

Ralls K., Brugger K. and Ballou J. 1979. Inbreeding and juvenile mortality in small populations of ungulates. Science 206: 1101–1103.

Senner J. W. 1980. Inbreeding depression and the survival of zoo populations. [In: Conservation biology: an evolutionary-ecological perspective. M. E. Soulé and B. A. Wilcox, eds]. Sinauer Associates Inc., Sunderland, Massachusetts: 225–242.

Slatis H. M. 1960. An analysis of inbreeding in the European bison. Genetics 45: 275–287.

Van Vuren D. 1984. Abnormal dentition in the American bison, *Bison bison*. Can. Field Nat. 98: 366–367.

Węgrzyn M., Roskosz T. and Serwatka S. 1990. Some comments on the cheek teeth of the representatives of *Ruminantia* suborder. Ann. Warsaw Agricult. Univ. SGGW-AR, Vet. Med. 16: 3–12.

Wilson M. 1974. The Casper local fauna and its fossil origin. [In: The Casper site: A Hell Gap bison kill on the high plains. G. C. Frison, ed]. Academic Press, New York: 125–171.

Wolsan M. 1984. The origin of extra teeth in mammals. Acta theriol. 29: 128–133.

Received 27 April 1993, accepted 17 June 1994.