A POSSIBLE CLEANING SYMBIOSIS BETWEEN *PICA PICA* AND *ODOCOILEUS HEMIONUS*

During a field study of mother-fawn interactions in Rocky Mountain mule deer (*Odocoileus hemionus*), black-billed magpies (*Pica pica*) were observed to perch on deer and to apparently remove ectoparasites. References to similar behavior in the literature are scarce. Cattle egrets (*Bubulcus ibis*) commonly associate with large ungulates, and have been observed perching on white-tailed deer (*O. virginianus*) and feeding on flies around open wounds (Halley and Lord, 1978). Linsdale and Tomich (1953) reported that several species of Corvidae, including *P. pica*, perch on deer and eat ectoparasites. Bailey (1960) observed magpies sitting on mule deer and concluded that they were feeding on ectoparasites. He stated that removal of ectoparasites might be beneficial to the deer.

Mule deer inhabit several canyons and mesas in the foothills west of Boulder, Colorado. Recent estimates of the population place the number of deer at approximately 800 animals (R. Green, Western Resource Development Corporation, pers. comm.). The habitat (elevation = 1700-1850 m) is characterized by open meadows, with scattered stands of ponderosa pine (*Pinus ponderosa*), and a variety of shrubs and succulents, including skunkbrush (*Rhus trilobata*), juniper (*Juniperus scopulorum*), *Opuntia phaeacantha*, and *Yucca glauca*.

From October 1983 through December 1984, magpies were seen perching on deer on 29 different days; 91 distinct bouts were recorded. A bout was defined as any period during which a magpie was perched upon a deer, whether or not it was actively picking at the animal's body. A magpie typically landed on the back or neck of a standing or resting deer, and concentrated its movements around the ears, neck, and anal region of the deer. The birds apparently were "cleaning" the deer by removing ticks and other ectoparasites from the animals' bodies.

Twice, magpies were seen walking on the ground around a resting deer, picking at the ground or at the body of the animal. Once a deer performed a behavior that I interpreted as cleaning solicitation. A buck approached a group of does, one of which had a magpie on its back. The approaching animal lowered its head, and the magpie moved onto the back of this animal from the deer upon which it had previously been foraging. There were no obvious interactions among any of the deer during this observation.

The mean length of a cleaning bout, based on 91 observed bouts, was 85 sec, ± a standard error of 12 sec, and the maximum bout length recorded was 792 sec. The mean bout length for females was 63±10 sec (n=56); for males, $\bar{x}$=171±38 sec (n=22); for fawns, $\bar{x}$=35±8 sec (n=13). In the observed groups of deer, 14.6% of the animals were bucks, 52.5% were does, and 32.9% were fawns.

Do deer that are cleaned by magpies accrue some benefit from the relationship? In a study of marine cleaning symbioses, Losey (1979) suggested that such relationships may be mutualistic when the negative effects of the parasite on the host are large; the relationship may be commensalistic or parasitic when the costs of a heavy ectoparasite load are minimal. The lack of information on ectoparasite load in the Boulder deer herd makes it impossible to determine whether the magpie-mule deer relationship is in fact, mutualistic. Although mule deer are susceptible to numerous parasites, the effects are generally minor unless deer are stressed.

Malnutrition and other environmentally-induced stressed commonly are suffered by Rocky Mountain mule deer in the winter. No magpie-cleaning was observed during the summer months (May through mid-August); all cleaning bouts were observed during the months of comparatively harsh environmental conditions. Thus, this relationship may be mutualistic. However, if the magpies are consuming ectoparasites or insects that swarm around the deer, as also seems likely, then the realtionship is certainly commensal. Environmental conditions, as well as the physical condition of the participants, may influence the nature of this symbiotic relationship.

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A WOODLAND MUSK OX, *SYMBOS CAVIFRONS* (ARTIODACTYLA: BOVIDAE), FROM BAYOU SARA, LOUISIANA

The woodland musk ox, *Symbos cavifrons*, was distributed throughout much of North America during the late Quaternary. Most records for this species are from Alaska, the middle Mississippi Valley-southern Great Lakes area, and the northern Great Basin (Kurten and Anderson, 1980; McDonald, 1985; J. N. McDonald, unpubl. data; C. E. Ray, unpubl. data). Records of *Symbos* crania from the lower Mississippi Valley are rare. DeKay (1828) provided the first published record of a *Symbos* cranium from this region when he described the New Madrid, Missouri, specimen. Lowery (1974) reported a second *Symbos* record—this from Bayou Sara, Louisiana. The only other musk ox crania known to us from along or near the Mississippi River south of New Madrid are specimens from Friars Point, Coahoma Co. Mississippi (identified as *Symbos* by C. E. Ray) and Rosedale Sandbar, Bolivar Co., Mississippi (J. Connaway, in litt.). Leidy reported an unerupted ovibovine m3 found at or near Natchez, Mississippi, but the generic identity of this specimen was not established (Hay 1923, 1930). Other ovibovine specimens are probably to be found in private and institutional collections from the lower Mississippi Valley.

In this paper we describe a partial skull from Bayou Sara, West Feliciana Parish. This specimen is significant becaue: 1) it is the most southerly record for *Symbos cavifrons* (and for all low-horned North American musk ox taxa); 2) it helps to define the southern extent of the range of *Symbos cavifrons*; 3) as a result of a peculiar damage pattern, it displays details about the structure of the dorsal cranium in *Symbos*; 4) it appears to have been slightly deformed in life and thus provides information about paleopathology in the genus; and 5) it shows evidence of having been subjected to at least two episodes of fluvial abrasion, and thus provides information about sequential damage patterns of interest to taphonomists. This is also the first specimen of a generically or specifically identifiable musk ox to be described from Louisiana.

The specimen was collected by one of us (KCC) on 16 April 1972, when it was found almost completely exposed in the sandy bedload of a shallow, narrow section of Gales Creek along the east side of the Bayou Sara floodplain. The spot of discovery is about 300 m downstream from the 143′ benchmark (U.S.G.S.,) along Bayou Sara. The geographic coordinates of this site are approximately 30° 57′ 20″ N, 91° 24′ 00″ W (UTM coordinates are approximately 652820 E, 3425340 N, 15, N); it is located on the Weyanoke Quadrangle, U.S.G.S. 7.5′ series (Fig. 1).

The cranium was donated to the Louisiana State University Museum of Zoology, where it was cataloged as LSUMZ 17814. Clayton E. Ray (National Museum of Natural History) identified the specimen in 1973 as *Symbos cavifrons*. Lowery (1974) reported, but did not describe, discuss, or figure this record in *The Mammals of Louisiana and Its Adjacent Waters.*

This specimen consists of much of the cranium caudal to the level of the orbits and ethmoid but the specimen is damaged and some of the features are broken or rounded. The entire dorsal surface of the skull is missing, as is all of both horn cores except the ventral edge of the base of the left core. The occipital, basioccipital, and the temporal surfaces are relatively complete, but the tympanic bullae and the jugular, zygomatic and pterygoid processes are missing or badly damaged. Other edges and prominences are chipped. Selected cranial measurements are given in Table 1.

The absence of the dorsal surface of the cranium has exposed the frontoparietal sinus region. This provdes an uncommon view of the sinus complex in the dorsal cranium of *Symbos*. In this specimen, the paired caudal sinuses appear to have been largest, with the lateral frontal sinuses that extend into the base of the horn core (and typically, in other specimens, terminate just distal to the base) being slightly smaller. Smaller, more convoluted sinus chambers occur rostral and