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Blastocerus dichotomus.

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Blastocerus Wagner, 1844

Blastocerus Wagner, 1844:366. Type species designated by Gray, 1850:68, as *Blastocerus paludosus* Desmarest (Hershkovitz, 1958, regards the first valid use of *Blastocerus* as Gray, 1850: 68).

Bezoarticus Marelli, 1931:57 (as subgenus of *Blastocerus* Wagner). Type species *Blastocerus paludosus* Desmarest by monotypy.

Edocerus de Avila-Pires, 1957:5. Type species *Edocerus dichotomus* Illiger by original designation.

CONTEXT AND CONTENT. Order Artiodactyla, Suborder Ruminantia, Infraorder Pecora, Superfamily Cervoidea, Family Cervidae, Subfamily Odocoileinae, Tribe Odocoileini. The genus *Blastocerus* contains one species. In addition to *Blastocerus*, this tribe includes the extant genera *Hippocamelus*, *Mazama*, *Odocoileus*, *Ozotoceros*, *Pudu*, and *Rangifer* (Groves and Grubb, 1987).

Blastocerus dichotomus (Illiger, 1815)

Marsh Deer

Cervus dichotomus Illiger, 1815:117. Type locality "Paragüay" (based upon "güazu-pucú" de Azara, 1801:70).

Cervus paludosus Desmarest, 1822:443. Type locality "Paraguay" (based upon "güazu-pucú" de Azara, 1801:70).

Cervus palustris Desmoulins, 1823:379. Type locality "Paraguay."

Mazama furcata Gray, 1843:176. No type locality (*nomen nudum*).

Blastocerus dichotomus Allen, 1916:565. Type locality "Parguay" (based upon *B. dichotomus* Illiger, 1815:117).

CONTEXT AND CONTENT. Context as noted in generic account above. *B. dichotomus* is monotypic.

DIAGNOSIS. *Blastocerus dichotomus* (Fig. 1) is the largest of the South American deer (Cabrera and Yepes, 1940). A straight basicranium and the antlers distinguish *Blastocerus* from the other Odocoileini. Antlers of adult marsh deer have four tines, which are never pointed inward as in *Odocoileus* (Fig. 2). The main beam bifurcates near the base, and each prong is again bifurcated, a condition rarely seen in *Ozotoceros* (Groves and Grubb, 1987; Jackson, 1987). The legs of adult *Blastocerus* are black up to the radius or tibia and pelage of the young is unspotted. The two toes of the hoof are bound by a strong membrane, and can be spread up to 10 cm apart. No other South American deer attains such interdigital amplitude (Hofman et al., 1976).

GENERAL CHARACTERS. The hair of the marsh deer is long and tangled. During the winter the coat is brownish red, and paler on the flanks, neck, and chest. The rather bushy tail is a yellowish, rusty red above and black below. In the summer, the coat color is bright rufous chestnut. There is a white ring around the eyes, and white hairs inside the ears and inside the legs (Fig. 1; de Azara, 1809; Miranda Ribeiro, 1919; Nowak and Paradiso, 1983). Albinos are known (de Azara, 1802).

There are few data regarding body measurements. Length of head and body is 153–191 cm (n = 6), length of tail is 12–16 cm (n = 6), shoulder height is 110–127 cm (n = 4), and weight is 80–125 kg (n = 7). Mean cranial dimensions for adults (in mm) are: total length, 319.2 (n = 18; range, 305–335); basilar length, 282.9 (n = 17; range, 262–305); zygomatic width, 119.6 (n = 8; range, 112–130 mm; Fig. 3; da Cunha Vieira, 1951; Hofmann et al., 1976; Miranda Ribeiro, 1919; Schaller, 1983). Cranial dimensions suggest that individuals from the Araguaia Basin are somewhat larger than their conspecifics from the Pantanal, Brazil (Miranda Ribeiro, 1919).

Antlers are present only in males, can be up to 600 mm in length along the beam, and have a spread of 590 mm (Fig. 2; Cabrera, 1945; Miller, 1930; Miranda Ribeiro, 1919). Each beam is rugose longitudinally. Adults usually have a fifth point in one or both of the antlers. However, the fifth point may be either on the base of the beam or on the top of a terminal bifurcation. Old individuals may develop up to 28 tines forming asymmetrical racks (Cabrera, 1945; de Almeida, 1976).

DISTRIBUTION. The marsh deer historically occurred throughout the marshy habitats south of the Amazon River into northern Argentina (Cabrera, 1961; de Azara, 1802; Miranda Ribeiro, 1919). Although the geographic range has changed only slightly, the loss of habitat has caused increasing isolation of the species into small and disconnected populations (Fig. 4; Schaller and Vasconcelos, 1978). There are only a few remaining individuals known from Peru, Argentina, Paraguay, and Uruguay (Hofmann et al., 1976; Jungius, 1976; Thornback and Jenkins, 1982). Marsh deer are still widely distributed in Bolivia, although populations seem to be low (Thornback and Jenkins, 1982). Only four to eight individuals survive in the Brazilian state of Rio Grande do Sul (Voss et al., 1981). The last populations in the Brazilian state of São Paulo are doomed to extinction due to plans, already in process, for building a series of dams. A sizable population exists in the northern Pantanal region between the Paraguay and São Lourenço rivers. Schaller and Vasconcelos (1978) estimated a population of 4,000 for the northern Pantanal, and a conservative total of 7,000 for the entire Pantanal region.

FIG. 1. Adult male marsh deer (*Blastocerus dichotomus*) in the Berlin Zoo. Courtesy of H. Fradrich, Berlin Zoo.

FIG. 2. Frontal view of the skull and antlers of *Blastocerus dichotomus* (adult male, United States National Museum of Natural History 261017). Courtesy of R. W. Thorington, Jr.

FOSSIL RECORD. Cervids are poorly represented in the fossil records of South America. Fossil marsh deer were first known from Pleistocene remains found in the caverns of Lagoa Santa, Brazil (de Paula-Couto, 1950, 1953; Winge, 1915). Subsequently remains of *Blastocerus* were found in the Pampeana formation of Buenos Aires Province, which were designated as *Cervus magnus* and later renamed as *Blastocerus dichotomus* (Ameghino, 1917). Ameghino (1917) also found many remains of the species in the Quaternary and Pampeana formations of Buenos Aires (Bianchini and DeLupi, 1978). Recently, de Souza Cunha and de Magalhaes (1981) identified remains of a Pleistocene skull of the marsh deer from Vitória do Palmar, Rio Grande do Sul, Brazil. *Blastocerus* probably evolved in South America, after the cervid invasion during the Pleistocene, and subsequent radiation (Eisenberg, 1987).

FORM AND FUNCTION. *Blastocerus* is well adapted to life in marshy habitats. The two toes on each foot are 70–80 mm in length (Grzimek, 1975) and are bound by a strong membrane that increases the surface contacting the muddy soil.

The dental formula is 0/3, 0/1, 3/3, 3/3, total 32 (Fig. 3). The crown widths of the incisors and canines are about the same. The premolars show less molarization than *Ozotoceros* and *Odocoileus*. The molars of adults, unlike *Ozotoceros*, have a protoconal fold (Groves and Grubb, 1987). The maxillar and mandibular tooth row length is 78–88 mm (n = 9) (Miranda Ribeiro, 1919).

Preorbital scent glands are present. Interdigital, long, and glandular pouches are located on the hind feet; metatarsal glands and tufts are absent. Tarsal glands are present, but rub-urinating behavior has not been observed (Groves and Grubb, 1987). Vestibular nasal glands are flattened oval sacs known only for *Blastocerus* and *Ozotocerus*. One sac lies in either side of the nose underneath the skin. Each sac is formed by several holocrine sebaceous and sudoriferous apocrine glands. Vestibular nasal glands may serve in individual recognition (Langguth and Jackson, 1980), but a role in territorial marking has been suggested (Jacob and von Lehmann, 1976*a*, 1976*b*).

In the wild, males have been seen with mature antlers throughout the year (Cabrera and Yepes, 1940; Miller, 1930). Antlers can be shed during any month, but there seems to be a peak during the winter. The duration of mature antlers seems to vary among individuals in the same population, and with age in the same animal. Mature antlers of males in São Paulo Zoo were kept for longer periods at each new replacement (I. Deutsch, pers. comm.). Differences between individuals were also noticed in the Berlin Zoo, with a male keeping the same pair of antlers for 21 months (Frädrich, 1987). Reproduction may occur with males still in velvet (Frädrich, 1987).

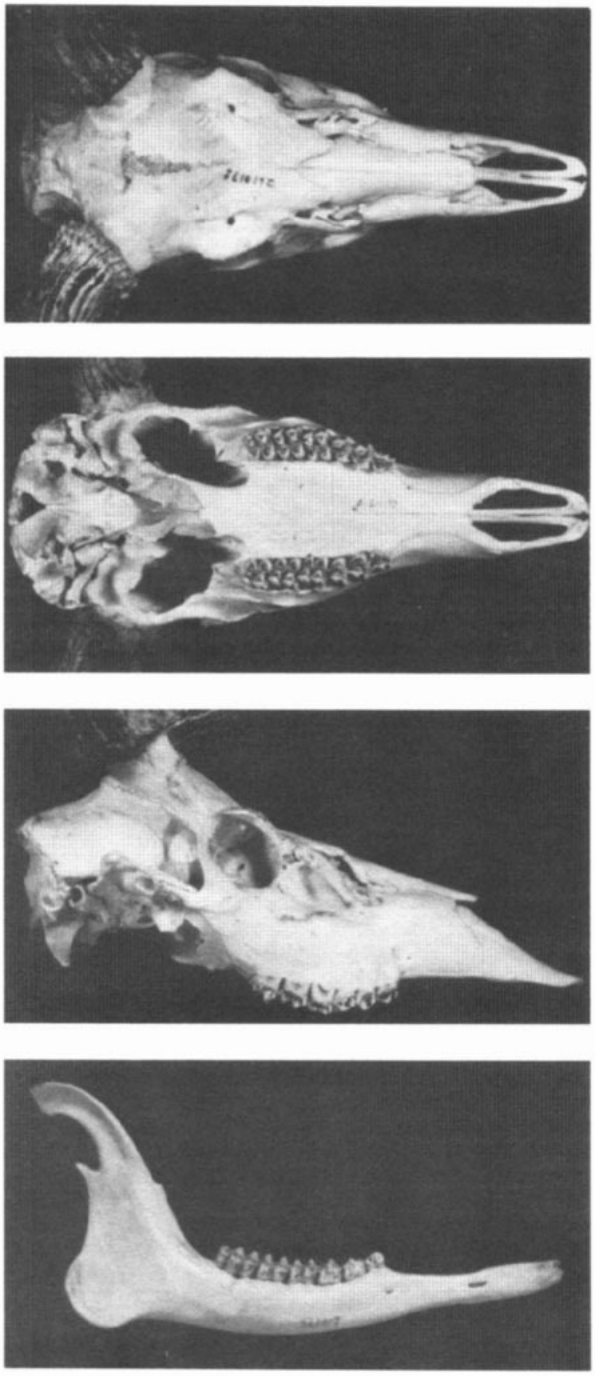

FIG. 3. Dorsal, ventral, and lateral views of the skull and lateral view of the mandible of *Blastocerus dichotomus* (adult male, USNM 261017). Greatest length of skull is 328 mm.

ONTOGENY AND REPRODUCTION. Usually, marsh deer live alone, except for females with their young, but may seasonally form groups of up to five individuals (Miller, 1930; Nogueira-Neto, 1973). Of the observations by Schaller and Vasconcelos (1978), 74% were of individual marsh deer; the remainder consisted of mixed or single sex groups. Harem formation has not been observed.

Females reproduce once a year and a post-partum estrus occurs if the fawn dies. Usually one fawn, rarely two, is born after a gestation period of 271 days (Frädrich, 1987; Nogueira-Neto, 1973). A peak of mating behavior occurs in October–November, but fawns can be seen at anytime during the year (Miranda Ribeiro, 1919). Most of the fawning in the Pantanal seems to occur from May to September, when the water level is declining (Miller, 1930; Nogueira-Neto, 1973; Schaller and Vasconcelos, 1978). Newborns have no white

spots, but may show vestiges of the maculation (de Azara, 1802; Miranda Ribeiro, 1919). Fawns that are 5 days of age are able to follow their mothers (Nogueira-Neto, 1973).

The legs of juveniles are black only on the dorsal side of the metacarpals and metatarsals (Hofman et al., 1976). Old individuals may lose hair around the neck, which then appears darker (Miranda Ribeiro, 1914). In their first set of antlers, young males have only one longitudinally rugose spike, which is flattened and truncated on the top. These antlers take 150 days to be stripped of the velvet (Autuori, 1972; Miranda Ribeiro, 1919). They develop a fork in their second set of antlers (Burmeister, 1854).

ECOLOGY. The marsh deer occur in marshy habitats and seasonally flooded riverine areas. They avoid forest, selecting areas with standing water 30–60 cm in depth. This characteristic allows them to be censused from the air (Schaller and Vasconcelos, 1978). Optimal habitat in marsh lands seems to be characterized by the presence of Cyperaceae, such as *Rynchospora schraderiana* and *Cyperus giganteous*, and Gramineae of the genera *Paspalum* and *Sorgastrum* (Miller, 1930; G. Schuerholz and G. Mann, pers. comm.; Voss et al., 1981). If not hunted, *Blastocerus* may adapt to disturbed habitats. Marsh deer use rice and maize fields in a drained marshy area in Rio Grande do Sul (Voss et al., 1981).

Marsh deer are mainly grazer-browsers of semi-aquatic species, but may rely on the leaves of adjacent shrubs (*Aeschynomene sensitiva* and *Discolobium pulchellum*) and vines (*Rhabdadenia pohli*) in marginal habitats during flooding (Schaller, 1983). Large quantities of "arosillo" and "kortcho de curichi" were found in the stomachs of two young marsh deer (G. Schuerholz and G. Mann, pers. comm.). A number of them die of starvation during long-lasting floods, when many are trapped on small fragments of high terrain (Schaller and Vasconcelos, 1978).

Until a few decades ago, thousands of marsh deer skins were shipped annually from Mato Grosso to markets in Montevideo, and many others were shot from the decks of the launches that regularly transported people between Corumbá and São Luis on the Paraguay River (Miller, 1930). Although hunting of this species is currently forbidden, law enforcement is ineffective and reported cases of slaughtering are common (Schaller, 1983; Schaller and Vasconcelos, 1978). Predation on adult marsh deer by *Panthera onca* and domestic dogs has been reported (Schaller, 1983), and wild canids, cats, and boas may prey on the fawns.

Cattle diseases, such as brucellosis, are the current primary threat to the population of marsh deer in the Pantanal. Schaller and Vasconcelos (1978) noticed a continuous decline in numbers of *Blastocerus* since 1974, and low recruitment of fawns during 3 consecutive years of surveys. Foot-and-mouth disease has caused mortalities among marsh deer in Bolivia. Unidentified endoparasites have been reported from the stomachs of marsh deer, but no other organ was affected (G. Schuerholz and G. Mann, pers. comm.).

Domestication as well as maintenance in captivity are prone to failure. Only fawns survive the stress of capture, the adults struggle until death. Although tame as juveniles, the males become aggressive as adults. Female often do not reproduce in captivity and frequently they die of anemia (Nogueira-Neto, 1973). The Berlin Zoo is the only organization currently breeding this species.

BEHAVIOR. Little is known about the behavior of this species in the wild. Marsh deer have not been seen active during the night, and tend not to live in groups (de Almeida, 1976; Hofmann et al., 1976; Nogueira-Neto, 1973).

On average, marsh deer spend as much time feeding as they do laying down. They avoid foraging during the hottest hours of the day. When resting or ruminating, marsh deer lay down among tall grasses and patches of Cyperaceae in the marshes (Voss et al., 1981). Marsh deer allow people to approach up to 20 m before they escape with tails lifted high (Miller, 1930; Voss et al., 1981).

GENETICS. Marsh deer have a diploid number of 66 chromosomes. There are 6 metacentric and 58 acrocentric autosomes. The X chromosome is metacentric and the Y chromosome is acrocentric (Bogenberger et al., 1987).

REMARKS. *Blastocerus* was referred to as "güazu-pucú" by the meridional South American Guarany Indians (de Azara, 1802). The northern Indians used "suaçuetê" for the marsh deer, but as a general term the Indians used "suaçuapara" referring to *Odocoileus*, *Ozotoceros*, and *Blastocerus* (da Cunha Vieira, 1955; Nogueira-Neto, 1973). The Kayapó Indians refer to the marsh deer as "adioti" (de Carvalho, 1960). Other regional and current common names include veado galheiro, cervo, cervo-do-pantanal, ciervo, ciervo de los pantanos. In the English-language literature, *Blastocerus* formerly was called swamp deer, but more recently is being replaced by marsh deer.

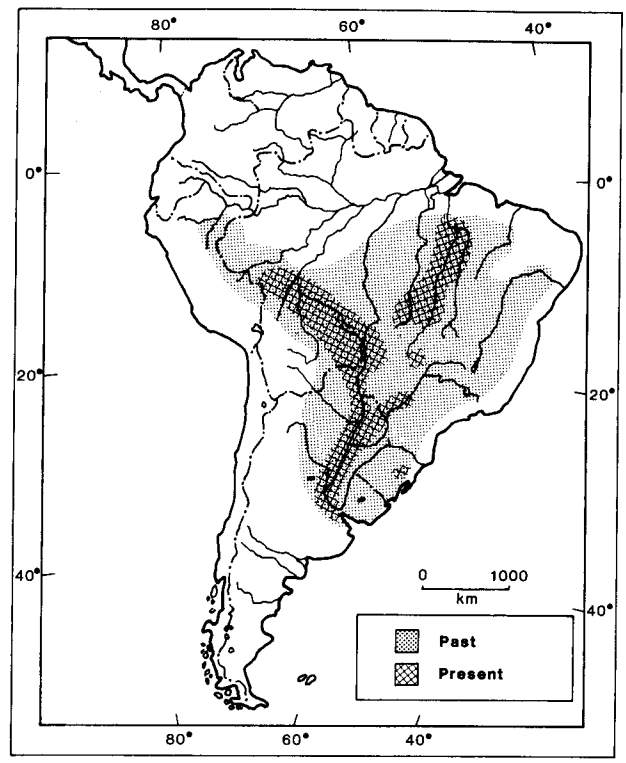

FIG. 4. Past and present distributions of *Blastocerus dichotomus* (based on Jungius, 1976; Schaller and Vasconcelos, 1978). Drawing by L. Pinder.

The marsh deer is considered vulnerable by the International Union for Conservation of Nature and Natural Resources (Thornback and Jenkins, 1982), endangered by the United States Department of the Interior (1980), and is listed in Appendix I of the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora. Protected areas where the species still occurs include: Araguaia and Emas national parks, Caracara, Guapore, Jarú, and Sema Island reserves, Brazil (Thornback and Jenkins, 1982); a provincial reserve in Formosa Province, Argentina; Isiboro Securé National Park, Bolivia (Jungius, 1976). None of these areas appears to have the necessary conditions or large enough populations to guarantee the long-term survival of the species. Amelioration of the parks system in Brazil, as well as the creation of protected areas in Argentina, Bolivia, Paraguay, and Peru have been proposed, but not seriously taken into consideration by the governments of these countries (Vershuren, 1980).

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