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## FIRST RECORD OF BUSH DOG, *Speothos venaticus*, FOR THE CERRADO OF SÃO PAULO, BRAZIL

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**ABSTRACT.** We provide an updated geographical distribution map of *Speothos venaticus* (Lund, 1842) for Brazil and report the first record of this species for the Cerrado of São Paulo, which was known only from the Atlantic Rain Forest within the state. We built the distribution map based on occurrence sites for the species in Brazil available in the literature and our new record: a deceased male cub, found near a forest fragment in a matrix of sugarcane plantations. We performed ecological niche modeling with GIS analysis to obtain a predictive map of the areas potentially suitable for *S. venaticus*. This species distribution and ecology are still poorly known, and additional studies are needed to evaluate its current state of conservation.

**RESUMO.** Primeiro registro de Cachorro-vinagre, *Speothos venaticus*, para o cerrado de São Paulo, Brasil. Nós apresentamos um mapa de distribuição atualizado de *Speothos venaticus* para o Brasil e reportamos o primeiro registro desta espécie para o Cerrado de São Paulo, que era conhecida apenas para a Mata Atlântica desse estado. Construímos o mapa, baseado nas ocorrências relatadas na literatura para o Brasil e no nosso novo registro: um filhote macho morto, encontrado próximo a um fragmento florestal cercado por uma área de plantação de cana-de-açúcar. Nós realizamos uma análise GIS para obtermos um mapa preditivo de modelagem das áreas provavelmente mais adequadas para *S. venaticus*. A distribuição e ecologia dessa espécie ainda são pouco conhecidos, e estudos adicionais são necessários para avaliar seu real estado de conservação.

**Key words:** Canidae. Carnivora. Conservation of mammals. Points of occurrence. Tropical savanna.

**Palavras chave:** Canidae. Carnivora. Conservação de mamíferos. Pontos de ocorrência. Savana tropical.

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*Speothos venaticus* (Lund, 1842), popularly known as bush dog, is the smallest of Brazilian canids; it occurs in South America from Panama to Argentina, with records also in French Guiana, Venezuela, Ecuador, Peru and Paraguay (Langguth 1969; Beisiegel & Zuercher 2005; Reis et al. 2014). In Brazil, this species

already had been recorded in the Amazon, Cerrado, Atlantic Rain Forest, Pantanal and Caatinga biomes (Fernandes-Ferreira et al. 2011; Jorge et al. 2013; Rocha et al. 2015; Oliveira et al. 2016; Tiepolo et al. 2016). DeMatteo & Loiselle (2008) and Jorge et al. (2013) indicate that the entire State of São Paulo has potential

for the occurrence for this species, but currently *S. venaticus* records in this state are restricted to the Atlantic Rain Forest (Beisiegel & Ades 2004; Beisiegel 2009). The species is classified as “near threatened” by IUCN (DeMatteo et al. 2011), “vulnerable” by the Brazilian National List of Endangered Species (ICMBIO 2014), “endangered” for the Cerrado (Jorge et al. 2013) and “threatened of extinction” for the State of São Paulo by Decree N° 60.133 of 2014.

We provide an updated geographical distribution map with all known occurrence points of the species within Brazil, based on literature data (**Table S1**) and a new and first record of *S. venaticus* for the Cerrado areas of the State of São Paulo, located in the central Paranapanema region. Previous records in this region were limited to Serra de Paranapiacaba, an Atlantic Rain Forest area in the southeastern State of São Paulo (Beisiegel & Ades 2004; Beisiegel 2009). We highlight an historical document which reports a skin sample record, deposited at the Museum of Zoology of the University of São Paulo (MZUSP 4026), from São João da Boa Vista, São Paulo, examined by Vieira (1946) and considered to represent *S. wingei* (currently considered to be a subspecies of *S. venaticus* [Wilson & Reeder 2005]).

We also performed a GIS analysis, using occurrence information within the Brazilian boundaries to generate an ecological niche modeling (ENM) and predict the distribution of *S. venaticus* based on eight bioclimatic variables (annual mean temperature, mean seasonal temperature, isothermality, seasonality, annual precipitation, driest month of the year, precipitation seasonality and warmest quarter precipitation) downloaded from the WorldClim database (<http://www.worldclim.org/>) interpolated to 30 arc-sec resolution (Hijmans et al. 2005) with WGS84 projection. We calibrated and designed the model for the entire country of Brazil. These variables were considered to be the most important variables defining the distribution of the bush dog by DeMatteo & Loiselle (2008). The area under the curve (AUC) for the model was 0.83; in general, values above 0.7 are indicative of a

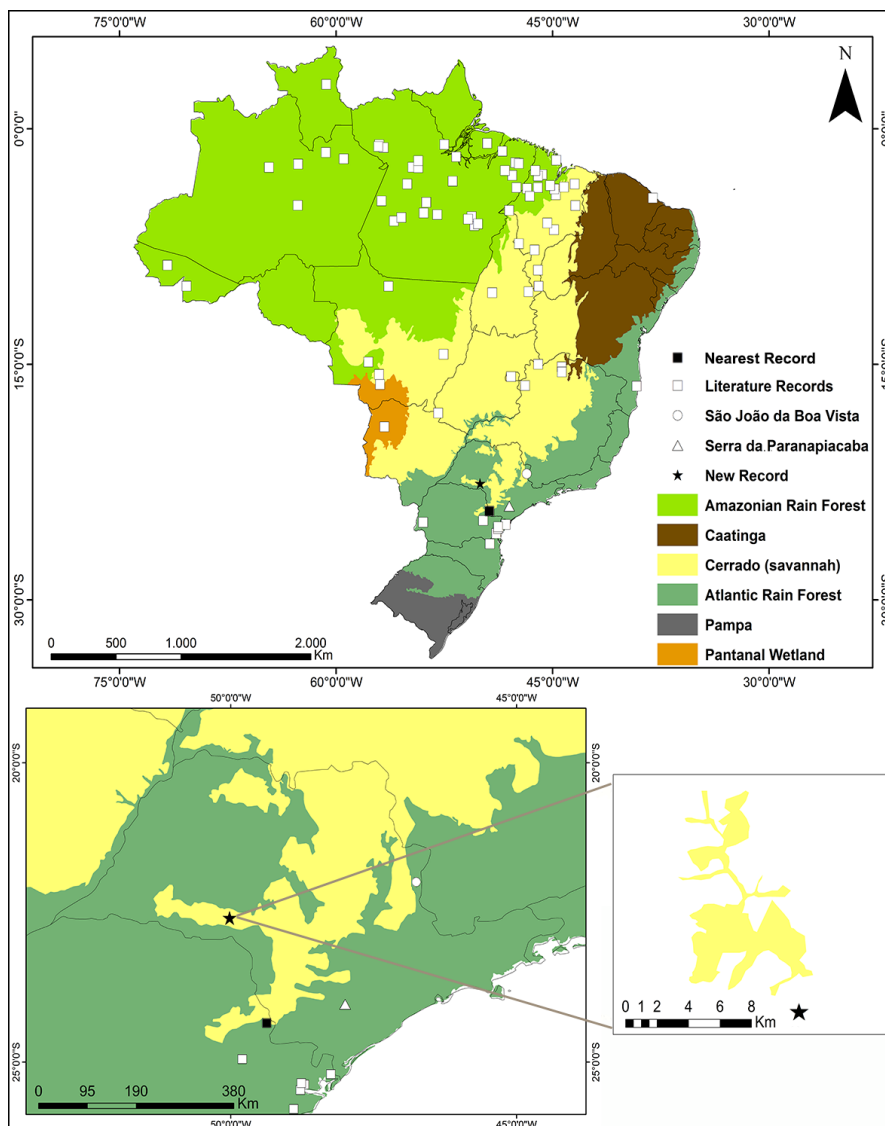
good fit (Kleibbaum 1996). Niche modeling was carried out using the MaxEnt software v. 3.4.1 (Phillips et al. 2006).

On the first day of October 2016 a male cub was found dead by residents in Campos Novos Paulista, municipality of São Paulo (22° 35.505' S and 50° 1.227' W), in a sugarcane plantation area. The causes of death are unknown, but the cub was found a day after the harvest and it is possible that he was run over by a vehicle.

The animal was located 2.5 km south of a forest fragment of approximately 2000 ha, composed predominantly of Cerradão and Cerrado sensu strictu (Bitencourt et al. 2007) crossed by São José stream (**Fig. 1**). The local climate, according to Köppen's classification is Cfa type, with rainy summer and dry winter, and the annual average precipitation is 1217 mm (Climate-Data.org 2016). The specimen was deposited at the Museu de Zoologia da Universidade Estadual de Londrina (Voucher - MZUEL375) in Londrina, Parana. The diagnosis characteristics to confirm the identification follows Pocock (1927) and Langguth (1969) (**Fig. 2**).

The niche suitability value of the pixel in which our record was obtained was 0.24 in the ENM, i.e., the local environment is 24% likely to be suitable for the species distribution. This record expands the distribution of *S. venaticus* about 210 km northward and 256 km westward of the nearest records: respectively in the Sangés municipality, Paraná State (Tiepolo et al. 2016) and in the Serra da Paranapiacaba (Beisiegel 2009; Beisiegel & Ades 2004). These regions have suitability values of 0.41 and 0.60, respectively, in our model (**Fig. 3**).

Ferreira et al. (2015) suggested that the low detection probability of the bush dog may be due to large home ranges (approximately 4.5 km<sup>2</sup>) and displacements over long distances, as well as habit of using burrows as refuge and living in small groups, ranging from 2 to 12 members (Boada 1901; Sheldon 1992). However, Oliveira et al. (2016) carried out a study with high sampling effort (using camera traps) and demonstrated that even in unaltered areas, the bush dog is naturally rare, and not only poorly detected.



**Fig. 1.** Map of Brazil with all occurrence sites of *Speothos venaticus* (white squares) (Table S1). The expanded map of the State of São Paulo shows our record (black star); the earlier record (white triangle) for the state (Beisiegel & Ades 2004; Beisiegel 2009), the historical record in the municipality of São João da Boa Vista (white circle) (Vieira 1964); and the nearest occurrence relative to our new record, in the Sangés municipality, Paraná state (black square) (Tiepolo et al. 2016).

Oliveira (2009) found that 43% of the records for *S. venaticus* are in human-impacted areas, such as fragmented forests, *Eucalyptus* plantations and pastures. However, these are not ideal habitats for this species because bush dogs avoid areas of agricultural matrix even in fragmented landscapes and choose natural

habitats to live (Lima et al. 2012). Furthermore, Oliveira et al. (2016) found a tendency for the relative abundance of this species to increase in unaltered or slightly disturbed areas in comparison to disturbed or fragmented areas.

Because the species is strictly carnivorous, its occurrence is expected to be related to

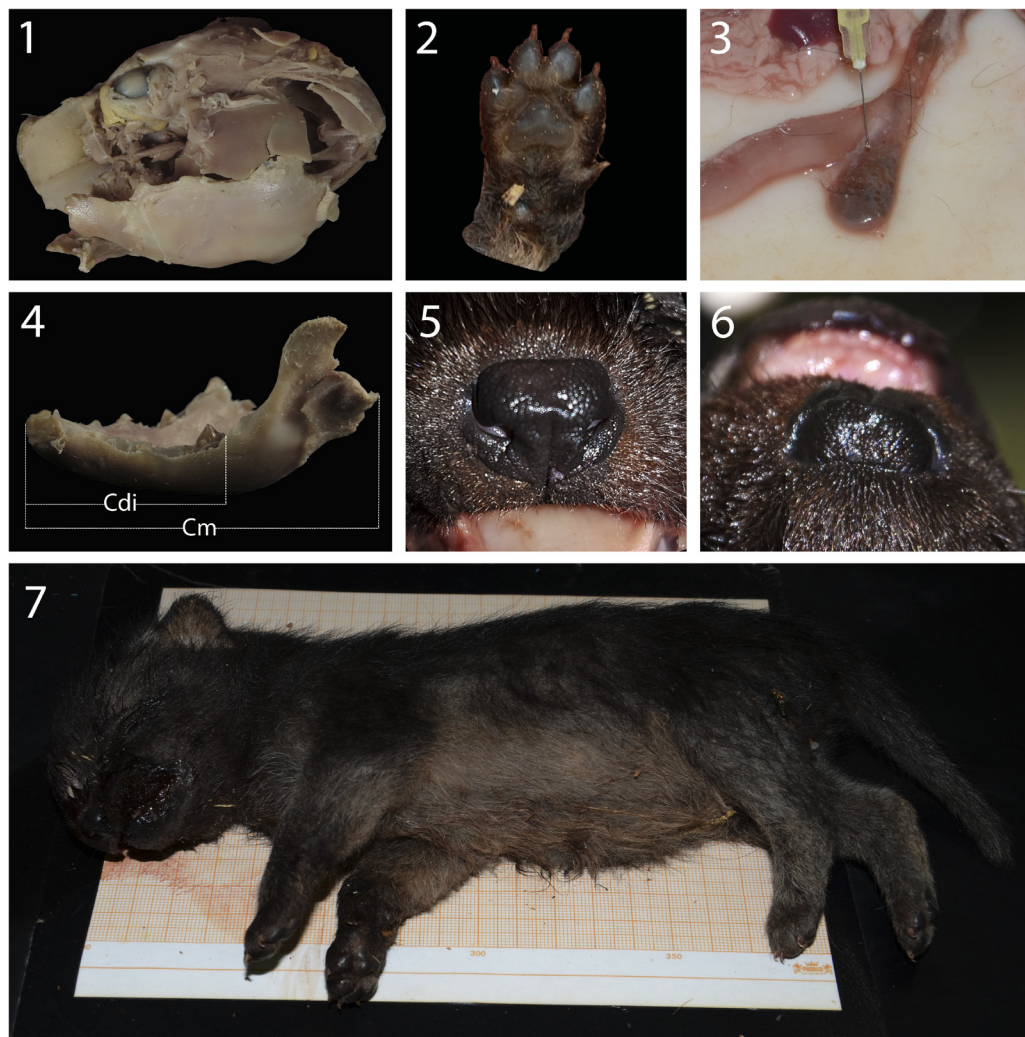
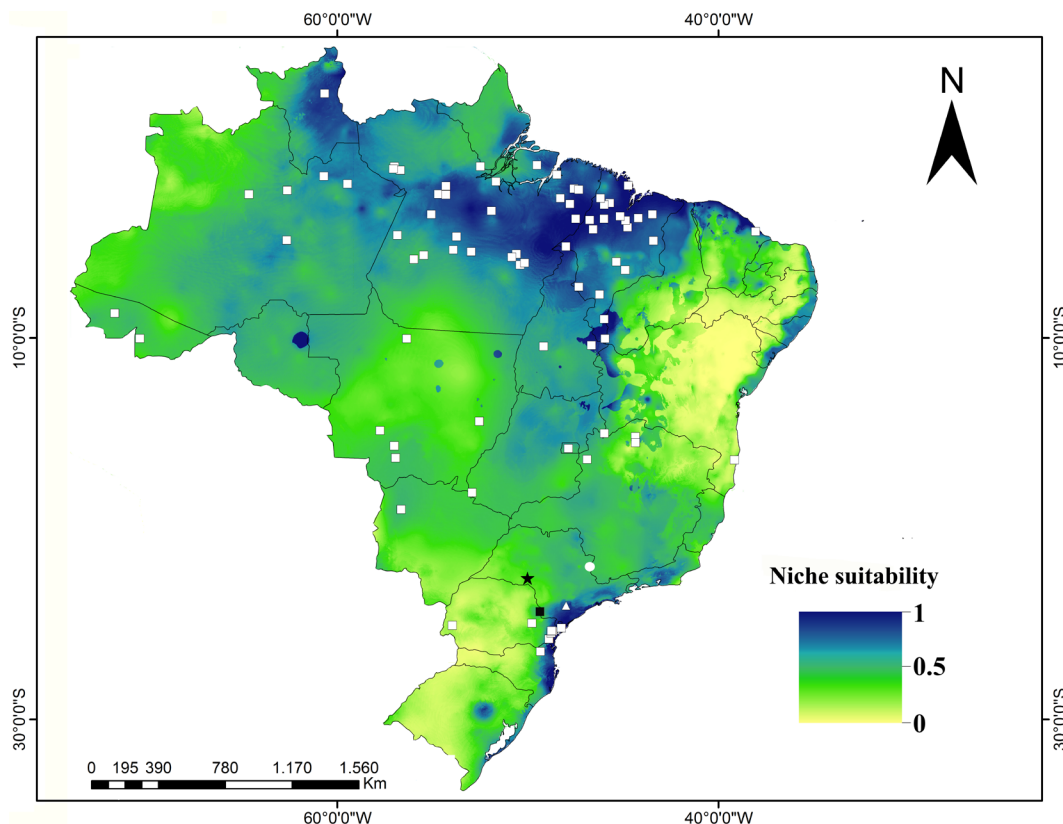


Fig. 2. Some morphological diagnosis characters of *Speothos venaticus* according to Pocock (1927) and Langguth (1969). 1. Top view of the skull; 2. Front left leg showing the third and fourth digits joined at their inner proximal angles; 3. Intestinal cecum simple, not twisted; 4. Left lateral view of the jaw; 5. Front view of the nose; 6. superficial view of the nose; The nose extends to the upper lip, the nostrils are widely separated, the infranarinal portion on each side is exceptionally deep and the philtrum has a median groove that passes above the midline of the nose almost as high as the lower border of the nostrils; 7. The male cub collected.

prey availability, which may be considered an important, long term conservation factor, in conjunction with habitat integrity. Several potential mammalian preys for *S. venaticus*, such as *Dasyprocta azarae*, *Dasyopus novemcinctus*, *Mazama americana*, *Nasua nasua*, and *Tayassu tajacu* (see Martins 2009) have been reported for the Cerrado remnant near the locality of our new record.

Due to low population density and large living areas, carnivorous mammals are particularly vulnerable to local extinction in fragmented landscapes (Noss et al. 1996), with habitat loss and anthropogenic impacts, such as infectious diseases from domesticated dogs and illegal poaching, as some of the main threats to conservation (Oliveira 2009; Oliveira et al. 2016). It should also be emphasized that remnants of



**Fig. 3.** Ecological niche model for *Speothos venaticus*, performed in MaxEnt software. The occurrence points collected in the literature data and bioclimatic variables were used to predict the species distribution in Brazil. Our record (black star) it is inserted in a region with a suitability value of 0.24 within the model.

Cerrado have already been indicated as a top priority for conservation (Cerrado Workshop of 1995 and the Biota / FAPESP Workshop of 2008). The creation of a Conservation Unit of Integral Protection and Increase Connectivity was also suggested (Martins 2009). Given the relatively little information available about the species and the high degree of forest fragmentation of the Cerrado of São Paulo, greater efforts should be directed to studies on the conservation status of *S. venaticus*.

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## SUPPLEMENTARY ONLINE MATERIAL

### Supplement 1:

**Table S1.** Occurrence sites of *Speothos venaticus* with geographical coordinates, obtained from the literature of studies carried out in Brazil, including our record, used for building the distribution map of the species. The literature used as data source is listed under the table. The geographical coordinates were standardized in degrees, decimal minutes.

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