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OCCURRENCE OF *Lycalopex vetulus* (Carnivora, Canidae) IN THE CERRADO-AMAZON FOREST ECOTONE AND PANTANAL

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Short title: THE HOARY FOX Lycalopex vetulus IN ECOTONAL AREAS OF BRAZIL.

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ABSTRACT

The hoary fox is a small insectivorous-omnivorous canid that occurs mainly in open habitats of the south-central Brazilian Cerrado. However, its distribution limits in the neighboring biomes are not clear. In addition to present three new hoary fox records, two in ecotones Cerrado-Amazon, Mato Grosso and one in the Pantanal wetland, Mato Grosso do Sul, Brazil, this study suggest that hoary fox may be expanding its area of occurrence to previously forested environment. The increase of pastures for livestock and important trophic resources can to favor, at least in part, to expansion in these environments.

Key words: Brazil, Distribution, Transitional areas, Hoary fox

RESUMEN

El zorro de campo es un pequeño cánido insectívoro-omnívoro que se encuentra principalmente en hábitats abiertos del centro-sur del Cerrado brasileño. A pesar de la ocurrencia registrada en el bioma Cerrado, sus límites de distribución en los biomas vecinos no están claros. Este estudio presenta tres nuevos registros de zorro de campo, dos en ecotonos Cerrado-Amazon, Mato Grosso y uno en el Pantanal, Mato Grosso do Sul. Además de las nuevas ocurrencias, los datos obtenidos sugieren que el zorro de campo puede estar expandiendo su área de distribución a espacios previamente boscosos y que el incremento de pastizales para ganado y recursos tróficos importantes pueden conducir, al menos en parte, esta expansión en estos ambientes.

Palabras clave: Brasil, Distribución, Zonas de transición, Zorro de campo.

The hoary fox, *Lycalopex vetulus*, the smallest Brazilian canid (body mass between 3–4 kg; Dalponte & Courtenay 2004), is considered endemic to the Cerrado and the Caatinga biomes (Eisenberg & Redford 1999; Gutiérrez & Marinho-Filho 2017). The hoary fox is an insectivore-omnivore forager (Dalponte 1997; Courtenay et al. 2006) exhibiting specialized feeding behaviour during predation on leaf-feeding termites (Dalponte 2003). The species occurs mostly in the central part of Brazil, mainly in the savannah-like Cerrado biome (Dalponte 2009), but the exact limits of its distribution in the transitional zones between the Cerrado and adjacent Brazilian biomes are unclear.

The geographic range of the hoary fox extends to the west of the São Paulo state to north to Piauí, south of Ceará, including the states of Mato Grosso do Sul, Mato Grosso, Goiás, Distrito Federal, Minas Gerais, Tocantins, south-west Bahia, open areas of south central Maranhão and south Rondônia (Costa & Courtenay 2003; Dalponte

2003, 2009; Cáceres et al. 2007; Dalponte & Courtenay 2004; Carmignotto & Aires 2011; Olifiers & Delciellos 2013; Fernandes & Costa 2013; Lemos et al. 2013. In this study, three new hoary fox records are presented. Furthermore, comments are made on the occurrence of hoary fox in other locations where the Cerrado meets neighbouring biomes.

The first new record of hoary fox was a road killed individual (voucher specimen UNEMAT field number EL 269) obtained in the municipality of Ribeirão Cascalheira, northeast Mato Grosso (13º 4 '22 "S, 51º 49' 57" W; elevation 380m; Fig. 1), in a locality where the forest was converted into exotic pastures. This location is in the abrupt transition from the Cerrado to a peripheral form of the Amazon rainforest, the Evergreen Seasonal Forest (IBGE 2012).

The second record was obtained in Juína, northwest Mato Grosso (12°09'45.9" S, 59°42'50.77" W, elevation 480m; Fig. 1). This record was made on November 12, 2013 at 04:30, when an adult male hoary fox (Figs. 2a and 2b) was sighted in open woodland savanna (cerrado sensu stricto; Fig.2c), a transitional extension form of Cerrado over the Amazonian forest domain (Miranda et al. 2006).

The third record was a sighting obtained in the Pantanal of Nhecolândia, Corumbá, Mato Grosso do Sul state (18°59'27.0" S, 56°39'14" W, elevation 104m; Fig. 1). This record was made on July 9, 1990; about 3.7 km west of the headquarters of the Nhumirim Ranch (EMBRAPA Pantanal) in a mosaic of habitats that include forests patches and scrub forests, seasonally flooded grasslands, and permanent or temporary ponds (Alho et al. 1987).

The preference of the hoary fox for more open habitats of the Cerrado may be related to occurrence and availability of important food resources. The hoary fox may be considered an as specialists in relation to both diet and habitat use (Juarez & Marinho-Filho 2002), feeding mainly on leaf-feeding termites of the genera Syntermes and Cornitermes (Dalponte 1997).

The core range of the hoary fox is the Cerrado biome (Dalponte, 2009), where termites are probably the dominant form of animal life, both in number of species and biomass (Coles de Negret & Redford 1982). The occurrence of the hoary fox in areas of the Atlantic Forest is in a matrix of anthropogenic pastures, regionally interspersed with semi-deciduous forest remnants and small patches of Cerrado (Cáceres et al. 2007 Fernandes & Costa 2013). These areas, although within the Atlantic Forest biome boundaries, should be classified as a transitional zone record, on the periphery of the southernmost known distribution of the species (Dalponte & Courtenay 2004; Lemos et al. 2013).

Although previous studies did not list the hoary fox in the Caatinga biome (Mares et al. 1981; Willig & Mares 1989; Feijó & Langguth 2013), recent records have confirmed the

occurrence of the species in (Costa & Courtenay 2003), and near (Olifiers & Delciellos 2013) Cerrado habitat enclave within the Caatinga biome, in the western ecotone to the Cerrado.

The typical Caatinga of the crystalline peneplains is the most widespread environment type of the Caatinga Phytogeographic Domain (Moro et al. 2016). There are a rarity and even absence of leaf-feeding termites in different semiarid habitats (Constantino 1995; Vasconcellos et al. 2010; Alves et al. 2011). A significantly low termite abundance and species richness in these Caatinga sites is relating to the low mean annual rainfall and extreme drought (Collins 1991; Bandeira & Vasconcellos 1999; Couto et al. 2015).

In the Pantanal, some areas can remain flooded for more than six months annually, which may limit leaf-feeding termite activity and diversity above ground (Plaza et al. 2014; Cunha et al. 2015). The specialized diet and feeding behaviour of hoary fox seems to preclude its occurrence in most Caatinga and Pantanal habitats.

The recent deforestation of tropical forest areas, such as the Amazonian and Atlantic rainforests, may be the key factor inducing a possible expansion of hoary fox populations across previously forested areas. Although exotic pastures are associated with a general decrease of the termite richness (Brandão & Souza 1998; Carrijo et al. 2008, Cunha & Orlando 2011), some species of leaf-feeding termites can increase their populations in this environment (Ackerman et al. 2007; Cunha & Morais 2010). In this aspect, these exotic grasslands are similar to open and semi-open ancient habitats where hoary foxes may have evolved in South America (Tchaicka et al. 2016) and to which they are well adapted as an open savanna canid. Conversion of forests into pastures and main prey availability may be driving the establishment of hoary fox populations.in these areas.

Advances and retractions of forest habitats, as observed in the last 40 years in the Cerrado-Amazonian ecotone of the headwaters of the Xingu basin in Mato Grosso (Marimon et al. 2006), may be influencing the population dynamics of hoary fox. It may be that the species responds to these changes on a large scale in ecotonal areas and, even on a small scale, at localities in the core area of its distribution, expanding and retracting its populations in time and space. However, these trends requiring a large-scale cross-boundary regional analysis to improve understanding the status and conservation of hoary fox.

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FIGURES

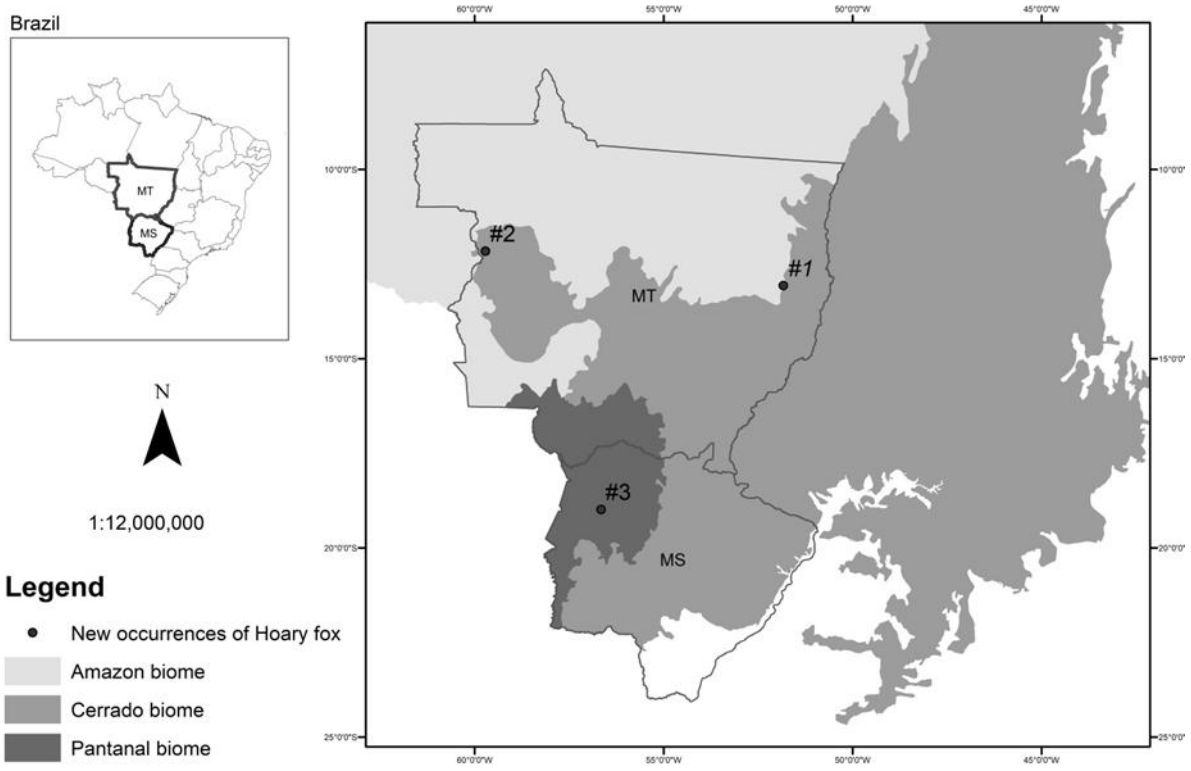

Figure 1. New occurrences of the hoary fox in transitional habitats between Cerrado - Amazon, Mato Grosso (MT) and in the Pantanal, Mato Grosso do Sul (MS), Brazil. Locality #1: Ribeirão Cascalheira; locality #2: state road MT 174, between Juína and Vilhena; locality #3: Nhumirim Ranch, Pantanal of Nhecolândia.

Figure 2. a) An adult male hoary fox photographed in Juína, northwest Mato Grosso, Brazil, b) The same fox in a sideview, c) Typical open savanna woodland hoary fox habitat on the roadside of the state road MT 174, between Juína and Vilhena (locality #2), Mato Grosso, d) An adult hoary fox photographed in the Nhumirim Ranch, Pantanal of Nhecolândia, Corumbá, Mato Grosso do Sul state.