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Research note

First records and abundance of margay *Leopardus wiedii* from semi-arid thorny scrub habitat of the Brazilian Caatinga

Primeros registros y abundancia de margay *Leopardus wiedii* en hábitat de matorral espinoso semiárido de la Caatinga brasileña

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Abstract

The margay (*Leopardus wiedii*) is a small to medium sized Neotropical felid classified as Vulnerable in Brazil. The species' northeastern range limits and use of open vegetation habitats has not been properly defined. The Caatinga biome is composed of a variable mosaic of semi-arid scrub/forest habitats and dominates the northeast region of Brazil. To date, it has not been confirmed that margays use the more open semi-arid thorny scrub habitat which is most characteristic of this region (the caatinga scrub). This study presents data from the first camera trap records for margays occurring in caatinga scrub, and documents new localities which constitute an extension of the species' range in northeastern Brazil.

Keywords: Caatinga domain; Camera trap; Distribution; Relative abundance; Northeast Brazil

Resumen

El margay (*Leopardus wiedii*) es un felino de tamaño pequeño a mediano clasificado como vulnerable en Brasil. Los rangos de distribución nororiental de la especie y el uso de hábitat en ambientes abiertos no han sido bien definidos. El bioma Caatinga está compuesto por un mosaico de ambientes semiáridos arbustivos y forestales, los cuales dominan la región nororiental de Brasil. A la fecha no se ha confirmado el uso del hábitat semiárido abierto arbustivo espinoso que es característico de esta región (la caatinga propiamente dicha). Este estudio presenta los primeros registros de margay en cámaras trampa en la caatinga y documenta nuevas localidades que constituyen la ampliación del rango de distribución de esta especie en el nororiente brasileño.

Palabras clave: Dominio Caatinga; Cámara trampa; Distribución; Abundancia relativa; Noreste de Brasil

There are currently 38 extant species of wild felids in the world, 11 of which occur in the Neotropical region of the Americas, 9 in Brazil alone (Hunter, 2015). The Caatinga biome, or “White forest” (translated from the original indigenous word), comprises a mosaic of semi-arid scrub/forest and is located in northeastern Brazil. Six felid species have been recorded in this vast area, including jaguar (*Panthera onca*), puma (*Puma concolor*), jaguarundi (*Puma yagouaroundi*), ocelot (*Leopardus pardalis*), northern-tiger cat (*Leopardus tigrinus*), and margay (*Leopardus wiedii*) (Oliveira et al., 2003). The latter only for the forest enclaves (Oliveira, 1994, 1998; Tortato et al., 2013).

The margay is a small to medium sized spotted cat (ca. 3.3 kg). Its conservation status is near threatened worldwide, and currently vulnerable in Brazil (Oliveira, 1998; Oliveira & Cassaro, 2005; Oliveira et al., 2015; Tortato et al., 2013). Although the species is listed as occurring in all of the biomes within the territory of Brazil, it is mainly associated with forested habitats ranging from dense and continuous forest to fragments and forest enclaves within the open vegetation biomes of the cerrado and pampas (Oliveira, 1994, 1998; Tortato et al., 2013).

However, it is debatable if margay actually range in the more semi-arid formations characteristic of the open Caatinga biome (Oliveira, 1994). To date, they have been described as restricted to forest enclaves within the biome, being Atlantic forest remnants at higher altitudes, or the forested areas located in valleys and canyons, such as those characteristic of Serra da Capivara National Park. As such, the extent of the species’ range in the Caatinga domain is marked as unknown on several distribution maps (Nowell & Jackson, 1996; Oliveira, 1994; Oliveira et al., 2015). Its worldwide distribution is also being updated by new records (e.g., Aranda & Valenzuela-Galván, 2015; Farias et al., 2015). The aim of this paper is to document the first confirmed observations of margays using open formations in the Caatinga domain and to estimate their relative abundance there. We also present reliable location records that will help improve the accuracy of distribution maps for the species.

The area in question is located in the municipalities of Caetitê, Igaporã and Urandi, in the state of Bahia, northeast Brazil, and is the path of a series of wind energy projects that were already either installed and operational or were under construction at the time of this study. Temperatures in this area are nearly constant at approximately 21°C, while precipitation varies from 800 mm to 1,000 mm, and is concentrated in a 4-month rainy season (500 mm from November to January). The area is within the Serra do Espinhaço mountain range and is dominated by a mosaic of vegetation types featuring Brazilian savanna

(cerrado), seasonal deciduous forests, semi-arid thorny scrub (caatinga), and carrasco, a transitional formation of cerrado-caatinga (Zappi, 2008). In general, the landscape is characterized by small rural properties, subsistence agriculture and small-scale cattle ranching. Although there are also a variety of agricultural projects, livestock tends to be grazed on the native scrub vegetation. The impact of anthropogenic activities such as road building, wind farms, pasture, crop plantations, subsistence agriculture, and deforestation resulting in forest fragments in different stages of regeneration, is thus considerable in this area (Barreto, 2014; Sampaio, 2010).

At elevations above 1,000 m in the Espinhaço Range, savanna (cerrado) formations that transition from grasslands to sparse and woody formations dominate the sandy soil plateaus. The physiognomy of the remaining caatinga vegetation is that of shrubs averaging 2-4 m in height, and some sparsely occurring small trees from 5-8 m tall. This particular type of physiognomy, the caatinga proper or caatinga scrub, is mostly found at the marginal levels of the Espinhaço Range (700-900 m), and has suffered severe impacts from anthropogenic activities (Pirani et al., 2003; Zappi, 2008). Deciduous forest is more restricted in range and is associated with the more fertile soils that occur discontinuously in the mountain valleys, where there is also a greater accumulation of water and nutrients (Almeida-Abreu & Renger, 2002; Azevedo et al., 2009).

Since these forested areas are often located in places where access is relatively difficult, the vegetation tends to be better preserved, sometimes harboring 10-20 m tall trees with a closed canopy formation and significant understory vegetation including lianas and epiphytes. Such places are of particular importance because they are essentially forest enclaves, usually located in steep valleys and gullies that facilitate rainwater drainage and protect the source of many rivers in the area. They are remnants of the once more widespread Brazilian tropical Atlantic Forest biome. There are also carrasco formations in the area, a type of mixed transitional vegetation of woodland savanna and caatinga scrub. Although there is some disagreement about its definition, some botanists consider carrasco to be a proper type of vegetation, composed of a plant species community that combines elements of Caatinga, cerrado and forest formations (Rizzini, 1997).

We generated data regarding margay occurrence through use of camera traps while conducting faunal monitoring at wind parks in the state of Bahia. We installed 15 to 17 Bushnell Trophy Cam XLT cameras on trees or posts at a height of about 50 cm, from 1 to 50 km apart. To improve the incidence of wildlife detections, we baited the camera trap sites with sausage, chicken pieces, fruits and roots (Srbek-Araújo & Chiarello, 2007; Tomas

& Miranda, 2003). We undertook 3 sampling periods, one each in 2012, 2014 and 2015 at the same sites in the area of the Espinhaço Range. Cameras were located within all the vegetative formations found (savanna, seasonal deciduous forests, semi-arid thorny scrub [caatinga], and carrasco).

We recorded 5 different margay individuals on 6 occasions, in 4 different areas after a total effort of 4,260 trap-days. One was recorded in a habitat characterized by the semi-arid thorny scrub (caatinga) in Caetité (14°00'20.78" S, 42°38'39.62" W), on 30/07/2015 (Fig. 1A). The remaining 5 were in areas of dry deciduous forest habitat. Four were in Igaporã at 2 different camera stations (13°51'18.59" S, 42°40'19.51" W and 13°52'52.98" S, 42°40'29.02" W) on 15/10/2012, 08/10/2012, 19/10/2012,

and 12/01/2014 and the other was in Urandi (14°32'08.78" S, 42°35'04.08" W) on 19/07/2015 (Fig. 1 B-F). These new records extend the known range of the margay considerably, by at least 325 km north, 234 km east and 162 km west of the known range, an area extension larger than Portugal or French Guiana ($> 90,000 \text{ km}^2$) (Fig. 2). They redefine the species' distribution in northeastern Brazil, the limits of which remain uncertain (Nowell & Jackson, 1996; Oliveira, 1994; Oliveira et al., 2015), and go some way towards bridging this gap in knowledge and helping to define the potential distributional models of margays in northeast Brazil. Additionally, these data represent the first confirmed records of the species using the open vegetation formations that are characteristic of semi-arid caatinga thorny scrub habitats.

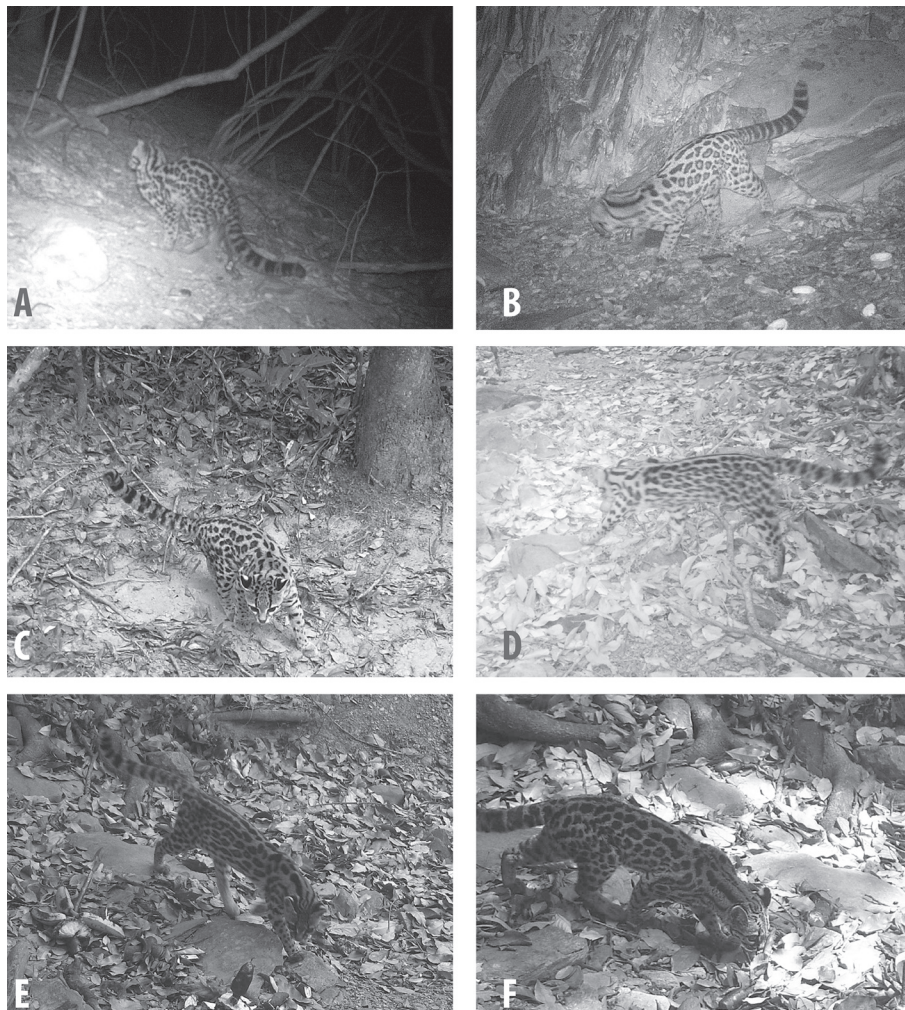


Figure 1. The first records of margay (*Leopardus wiedii*) in the open caatinga semi-arid thorny scrub (A) and in the dry deciduous forests (B, C, D, E, F) of the Caatinga domain in northeast Brazil.

Thus, it seems that although the species may have evolved a preference for more forested habitats, it also makes use of open formations, even if only secondarily. The use of dry forests by margays has also been reported in Mexico (Valenzuela-Galván et al., 2013). Additionally, Hodge (2014) recently showed that margays use areas with 51-75% canopy cover to a greater extent than the denser forest locations in the eastern Andean foothills of Ecuador. These observations suggest that the species

is far more flexible in its use of dense vegetation cover than previously thought, which our findings corroborate. Interestingly, 3 of our records were obtained during daylight hours, an unusual time for the species to be active: the vast majority of camera trap records to date have been nocturne-crepuscular ones (Oliveira et al., unpublished data; Vanderoff et al., 2011).

As expected, the abundance of margays observed here (0.141 records/100 trap-days) is relatively low, especially



Figure 2. Current margay (*Leopardus wiedii*) distribution map showing new records for the species in northeast Brazil according to the IUCN.

in comparison to other areas in the cerrado, Atlantic Forest and Amazon biomes in Brazil, where the species average is 0.7 records/100 trap-days (Oliveira, 2011). Abundance in the specific caatinga scrub habitat was even lower, at 0.081 records/100 trap-days. Thus, it is possible to conclude that, given the relatively low relative abundance, this felid is rare in both the biome and specific habitat of the Brazilian Caatinga (see Oliveira et al., 2018). In the tropical deciduous forest of southern Puebla, Mexico, margay abundance was found to be 0.112 records/100 trap-days (Fariás et al., 2015), similar to that found in this study. Conversely, in the Andean foothill forests of Ecuador, where the species is considered quite common, the relative abundance of margays was 2.64 records/100 trap-days (Vanderhoff et al., 2011). Therefore, although margays are present within the Caatinga biome, it seems that they have a marginal distribution and a very small population size. It is likely to represent a sink population from the nearby Atlantic Forest. Given their conservation status, and the species abundance found in the study area, this population should be regarded as highly threatened, particularly as it is currently under considerable pressure from anthropogenic activities. Since the margay is already classified as a Vulnerable species in Brazil (Tortato et al., 2013), we recommend that environmental authorities should give special attention to this recently discovered population.

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