Short Communication

Bush Dogs in Central America: Recent Range Expansion, Cryptic Distribution, or Both?

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Abstract

Bush dogs (*Speothos venaticus*) are a small, wide-ranging neotropical pack-hunting canid whose ecology is relatively poorly known. Here, we document new, repeated observations of bush dog groups in east-central (Barbilla National Park) and south-eastern (La Amistad International Park) Costa Rica that suggest either that their recent or historic range has been underestimated, or that their potential range in Central America may have recently expanded and could now include not only borderlands with Panama but perhaps a substantial portion of the Talamanca Mountains up to 120 km to the north-northwest and at elevations up to 2,119 m. In light of their inherently low density, documenting the current and future distribution of bush dogs in Central America will be challenging.

Keywords

Canidae, Costa Rica, distribution, geographic range, *Speothos venaticus*

Introduction

Historically, bush dogs (*Speothos venaticus*) were identified as occurring from northern South America, south to Paraguay, and north-eastern Argentina (Scott, 1913). They were not known outside of South America (cf. Alston, 1879–1882) until a presumed sister species was documented/collected by Goldman (1912) in far eastern Panama near the border with Colombia. Apparently, nothing else was documented on bush dog distribution in Panama (cf. Mendez, 1970) until DeMatteo and Loiselle (2008) reported from a survey response two exact locations where *Speothos* was recorded, one in Darién (eastern Panama), and one in Chiriqui (western Panama). Reid (2009) identified three additional reports across Panama (including Fortuna in the west) and mapped the entire northern half of the country as bush dog range. More recently, Meyer et al. (2015) reported additional photos at four study sites and from sightings (the 1970s to 2014) at seven locations, corroborating the species' broad and continuous distribution along the Panamanian Isthmus, thus confirming an increase of their known distributional range.

In adjacent Costa Rica, bush dogs were never identified as a resident species, although apparent sightings during the 1990s from the northern Osa Peninsula (Marenco Field Station) in southwestern Costa Rica and from the central border region with Panama (Las Cruces Biological Station) were reported (de la Rosa & Nocke, 2000; Hull, 2018). Hull (2018) also reported seeing a pair of bush dogs in November 2015 at Finca Cántaros, only 3 km north of the Las Cruces Biological Station. Then, in March 2016, González-Maya, Gómez-Hoyos, and Schipper (2017) obtained photos of bush

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dogs in the Las Tablas Protected Zone in the southern part of the Talamanca Mountain Range in Costa Rica, 25 km northeast of Las Cruces Biological Station, 9 km from the Panamanian border, and 73 km west of the western-most reported observations (Fortuna; Meyer et al., 2015; Reid, 2009). This apparent range extension was also at what was considered to be a record high elevation (1,511 m) for the species. González-Maya et al. (2017) noted that, despite their work with camera traps in the area for 10 years previously, this was the first record they obtained of bush dogs, confirming the species' natural rareness. They also surmised that, given the extensive deforestation of the Talamanca range (especially on the Pacific slopes where their records were obtained) and that most of the habitat in the range is located above 1,500 m, there were likely not many areas within Costa Rica where the bush dogs could occur (González-Maya et al., 2017).

Here, we report new locations of bush dogs in Costa Rica that suggest that their potential range in Central America may have recently expanded and could now include not only borderlands with Panama, but perhaps a substantial portion of the Talamanca Mountains up to 120 km to the north-northwest. We speculate on the current and future distribution of the species in Central America and the efforts needed to better document their occurrence and population establishment.

Methods

Barbilla National Park

Independent surveys of wildlife using camera traps were conducted in two areas of Costa Rica. From 2012 to 2018, we surveyed medium and large size terrestrial mammals (with a focus on jaguars) in the 120-km^2 Barbilla National Park (9.97096°N, −83.46172°W), which is within the La Amistad Caribe Conservation Area (ACLA-C) of the National System of Conservation Areas (SINAC), on the eastern slopes of the Cordillera de Talamanca in east-central Costa Rica (Figure 1). Park lands are roadless and mainly covered with virgin tropical rainforest which consists of a variety of forest types that occur at elevations of 200 to 1,600 m over terrain that is highly variable. Rainfall averages >3,000 mm per year and is typically distributed evenly throughout the year. We deployed cameras (Bushnell Trophy Cam®) at sites within the Park representing the variety of forests and terrain, both on trails commonly used by humans and on trails likely only used by wildlife; sites were at elevations of 295 to 1,281 m. At each

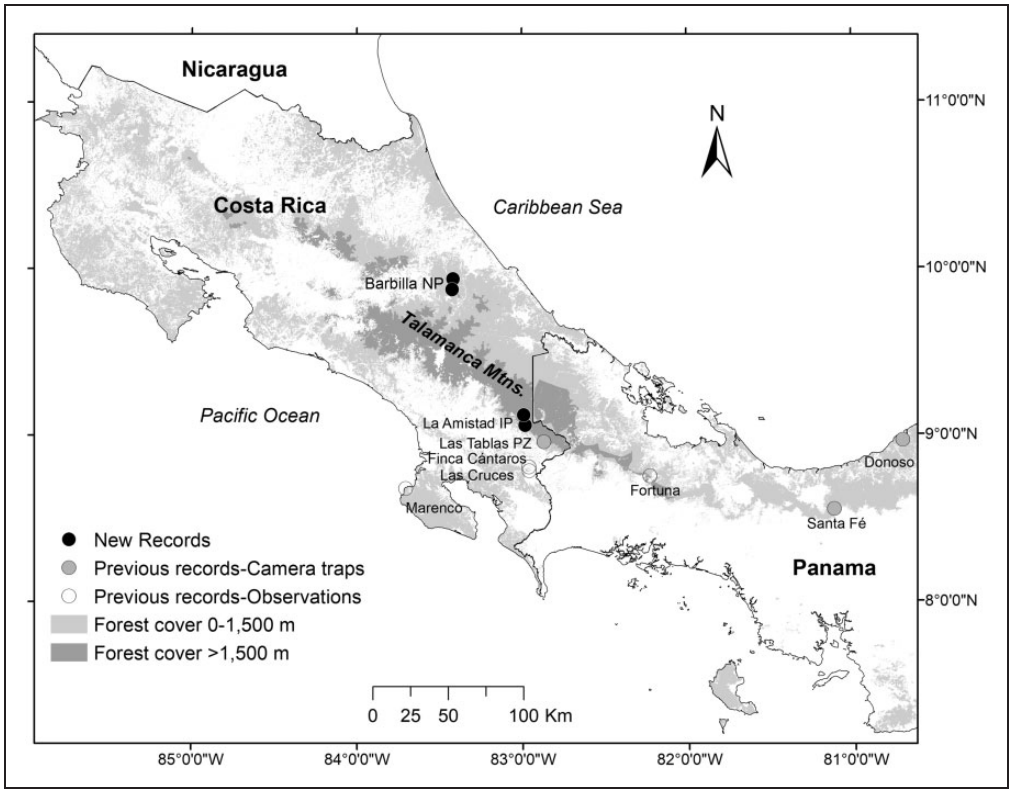

Figure 1. Location of new and recent records of bush dogs in Costa Rica (see text) and Panama (Meyer et al. 2015; Reid, 2009).

deployment location, an unbaited camera was placed 0.5 m above the ground, 2 to 4 m from the center of the trail, and with an unobstructed view of the trail. Cameras were active 24 hr per day during January–April 2012 and from April 2013 through June 2018; when activated, they recorded a 30-s video with a minimum of 1 min between consecutive videos (2014–2017) or a series of three still photos taken either 2 s apart (2012) or 1 s apart (2018).

La Amistad International Park

From May 31, 2017 through September 24, 2018, we conducted a general camera-trap survey in the 1,940-km^2 Parque Internacional La Amistad (PILA) along the Valle de Silencio trail (midpoint location: 9.09537°N, −82.97634°W), at elevations ranging from 2,086 m to 2,474 m. This section of the park is located on the western slope of the Talamanca Cordillera within both the La Amistad Pacifico (ACLA-P) and ACLA-C of SINAC. The habitat along the Valle de Silencio trail consists of montane mixed oak forests and receives an average of 3,500 mm of rain annually. Due to its rugged terrain, PILA has no interior roads and few trails, and the park is relatively unexplored due to its size, despite its biodiversity importance. On May 31, 2017, we deployed five camera trap stations (Bushnell Trophy Cam®) and accompanying scent stations along a 10-km stretch of the Valle de Silencio trail between Altamira station and Cerro Hoffmann (within ACLA-P) at elevations ranging from 2,086 to 2,486 m. An additional five cameras were added July 9–10, 2018 on the 5 km portion of the trail within ACLA-C going to the Valle de Silencio hostel and descending to 2,474 m. Cameras were set approximately every 1 km at a height of 1.0 m above the ground and positioned with a view down the trail in order to maximize the time the subject was visible. Cameras were programmed to be active 24 hr per day and to take a series of three still photos when activated with a 1-s interval until activated again. An attractant (Calvin Klein's Obsession) was applied to a small sponge within a plastic tube and attached to a 65 cm post placed in front of each camera in order to cause passing animals to slow down for clearer photos (Braczkowski et al., 2016).

Results

Barbilla National Park

During 2012 to 2018, 4 to 12 cameras (mean = 9.2) were set for 841 to 3,520 (mean = 1,681) each year (Table 1). The first record of bush dogs was a video obtained at 10:04 on May 30, 2017 by a camera set on a rarely used human trail at 950 m elevation in continuous primary forest (9.94129°N, −83.4173°W) that showed two adult bush dogs, one of which (a male) marked a tree with urine. (https://www.youtube.com/watch?v=ogwrwS6JwNM). A second set of three still photos of a pack of three bush dogs was taken on 10 April 2018 at 06:53 on an animal trail at 1,238 m elevation (Figure 1) and ∼4.5 km south (9.90088°N, −83.4189°W) of where the video was recorded approximately 10 months earlier.

La Amistad International Park

During 2017 to 2018, cameras were functional for a total of 2,376 camera nights. On November 6, 2017 between 10:57:16 and 10:59:30, the PILA2 camera (9.06226°N, −82.98378°W; 2,086 m elevation) took five photographs of a pack of three bush dogs crossing the trail (Figure 1);

Table 1. Annual Camera-Trapping Effort (Number of Cameras and Trapnights), and Photo Rates (Number of Independent[a] Photos/100 Trapnights) of Bush Dogs in Barbilla National Park in the Northern Talamanca Mountains of Costa Rica, and in La Amistad International Park in the Southern Talamanca Mountains Near the Panama Border.

Location	Year	No. of camera sites	No. of trapnights	No. of independent photos	Photo rate
Barbilla	2012	12	887	0	0.000
	2013	4	841	0	0.000
	2014	7	1,101	0	0.000
	2015	11	2,054	0	0.000
	2016	12	3,520	0	0.000
	2017	11	2,091	1	0.048
	2018	7	625	1	0.160
La Amistad	2017–2018	10	2,376	2	0.084

[a]Photos or videos were considered an independent record of a species if they were (a) taken at least 30 min apart (e.g., a series of three photos of the same species taken in consecutive seconds = one photo event), (b) consecutive photos of the same species could be identified as different individuals (spots, scars, horns/antlers, sex) and not part of the same group (e.g., 15 min apart, going in opposite directions = two photo events), or (c) photos of the same species separated by photos of a different species (e.g., Species 1, followed 2 min later by a Species 2, followed 5 min later by Species 1 = one species with two photo events and another species with one photo event).

Table 2. Photo Rates (Number of Independent Photos/100 Trapnights) of Bush Dogs, and Potential Competitors and Prey in Barbilla National Park in the Northern Talamanca Mountains of Costa Rica, La Amistad International Park in the Southern Talamanca Mountains Near the Panama border, and in Areas Known to be Occupied by Bush Dogs at Four Sites Throughout the Brazilian Amazon (de Oliveira et al., 2016).

Species	Scientific name	Barbilla	La Amistad	Brazilian Amazon
Bush dog	*Speothos venaticus*	0.07[a]	0.08	0.06–0.19
Coyote	*Canis latrans*	0.05	0.75	(Not present)
Domestic dog		0.99	(Not detected)	(Not detected)
Jaguar	*Panthera onca*	1.55	1.05	0.08–1.60
Puma	*Puma concolor*	1.37	0.80	0.21–1.70
Ocelot	*Leopardus pardalis*	4.09	1.14	1.00–1.22
Nine-banded armadillo	*Dasypus novemcinctus*	1.47	0.08	1.10–7.01
Agouti	*Dasyprocta punctata*	26.10	0.04	4.61–16.13
Paca	*Cuniculus paca*	4.16	6.99	2.00–10.42

[a]Pooled value for 2017 and 2018 only.

this location is ∼17 km north-northwest of the Las Tablas Protected Zone photos (González-Maya et al., 2017) taken 8 months earlier (November 2016). The photos showed an adult and two smaller juveniles of unknown sex, possibly a female with two juvenile offspring. Then, on August 26, 2018 between 8:48:17 and 8:48:19, 1.0 km from the 2017 record, PILA1 camera (9.05387°N, −82.98760°W) recorded three photographs of a pack of two bush dogs walking down the trail at an elevation of 2,119 m; it was not possible to identify their age or sex.

Discussion

Our locations confirm the predictions of DeMatteo and Loiselle (2008). Reports of a species' occurrence outside of their documented range could indicate (a) the identification of an individual who has dispersed outside of its distributional range (e.g., Hawley et al., 2016), (b) the colonization of a species in new range (e.g., Hody & Kays, 2018), or (c) the documentation of a species in a location within its true historical range where scientific documentation was previously poor or never attempted (e.g., Ramírez-Chaves et al., 2013; Silva-Rodríguez et al., 2018). For bush dogs in Costa Rica, it is not clear when or if one or all of these scenarios have occurred.

Apparent bush dog prey abundances at Barbilla and La Amistad (armadillos, agoutis, and pacas) are, from comparison of photo rates, similar to those in areas occupied by bush dogs in the Brazilian Amazon (Table 2). Although no coyotes or domestic dogs were documented in the Amazonian sites, abundances of potential felid competitors also are similar to sites in Costa Rica. Also, much of the Talamanca Mountains are covered with relatively intact forest, and though bush dogs are certainly found in such areas in the rest of their range, they also are found in a wide variety of vegetation types (DeMatteo & Loiselle, 2008; Eisenberg, 1989; Lima, Jorge, Jorge, & Morato, 2015), at a variety of elevations (including our new altitudinal record of 2,119 m), and commonly occur outside of protected areas.

For species as naturally rare as bush dogs, monitoring them will be challenging. Documentation of range occurrence with camera traps is essential, and though consideration of sampling scale (Steenweg, Hebblewhite, Whittington, Lukacs, & McKelvey, 2018) and design (Shannon, Lewis, & Gerber, 2014) are important, for bush dogs, sampling effort is paramount. Thus, having as many cameras out for as long as possible in areas of suspected bush dog presence, for example, is key (Shannon et al., 2014). Many such places are remote and logistically difficult to access, so it makes some sense to leave cameras out a long time, rather than typical 30-day intervals (e.g., Rovero & Ahumada, 2017). Coordinated efforts among research teams to plan and document efforts and to share observations and results will help, as will alternative documentation of bush dog presence. Efforts to record road kills (e.g., Miranda et al., 2017), and use of other noninvasive techniques such as detection dogs and genetic analyses of scats (DeMatteo et al., 2014) could help initiate efforts in new places as well as confirm other observations. In addition, the use of interviews to gather knowledge from local people (e.g., Benchimol, von Mühlen, & Venticinque, 2017) might be especially helpful in the Talamanca Mountains where indigenous reserves comprise nearly half of the forested habitat there but also in rural areas that are on the surrounding of protected areas and indigenous territories.

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