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## THE BIG FREE-TAILED BAT, *Nyctinomops macrotis* (GRAY, 1839), IN CENTRAL AMERICA

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**ABSTRACT.** The big free-tailed bat, *Nyctinomops macrotis*, is a large molossid with a discontinuous distribution in the southwestern United States and most of Mexico (northern range), and northern South America (southern range). In addition, the species has been documented in the Caribbean in Cuba (type locality), Hispaniola, and Jamaica. A large gap in the species distribution existed from the Isthmus of Tehuantepec (Mexico) southward to southeast of the Darién Gap, between Panama and Colombia, an overland distance of some 2500 km. Here, we report the first records of the species for Central America, based on two recently collected specimens from the southern highlands of Honduras.

**RESUMEN.** El murciélago grande de cola libre, *Nyctinomops macrotis* (Gray, 1839), en Centro América. *Nyctinomops macrotis* es una especie grande de molósido cuya amplia distribución en las Américas es notablemente discontinua. Por una parte, está distribuido en el suroeste de Estados Unidos y la mayor parte de México (área de distribución norte), por otra, se encuentra distribuida en Suramérica (área de distribución sur). Asimismo ha sido registrado en el Caribe en Cuba (localidad tipo), La Española y Jamaica. Sin embargo, existe un gran vacío en la distribución geográfica de la especie, pues hasta el momento no se ha encontrado entre el Istmo de Tehuantepec (México) y el sureste del Tapón de Darién, entre Panamá y Colombia: una distancia por tierra de cerca de 2500 km. En este trabajo, proporcionamos los primeros registros de la especie para Centroamérica, con base en dos especímenes colectados recientemente de la región montañosa del sur de Honduras.

**Key words:** Chiroptera. Distribution. Honduras. Molossidae.

**Palabras clave:** Chiroptera. Distribución. Honduras. Molossidae.

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The distributional patterns of the *Nyctinomops macrotis* are generally well known: discontinuously distributed in a northern and southern range from the southwestern United States to northern Argentina. However, in recent years, range expansions have been reported to the known distribution of the species, in the northern range (Frick et al., 2008, 2009; Muñoz-Martínez et al., 2003, Orozco-Lugo et al., 2014), but especially in the southern range (Fabián and Gregorin, 2007; Ojeda and Tabeni, 2009; Oprea et al., 2009; Cavallini Sanches et al., 2012; Talamoni et al., 2013; Hoppe et al., 2014; da Rocha et al., 2015), resulting in vastly expanded southern range since the relatively recent summary by Eger (2008).

Recent studies of bats in Central and South America, particularly insectivorous ones, similarly have resulted in novel records of occurrence, suggesting that much remains to be known regarding the presence, relative abundance, and other population aspects of several bat species (Kalko et al., 2008). Distributional data have been generated for several vespertilionid species and some molossids, the two most important families of insectivorous bats. For example, although *Lasiurus egregius* (see Ziegler et al., 2016) was known only from few individuals from Brazil, Guyana, and Panama, we now know that its distribution is wider and that it probably is not as rare as was assumed (Mora, 2012; López-Baucells et al., 2014). Notwithstanding, there remains still a vast gap in our knowledge of the distribution range of many bat species: numerous species have been reported from two or more distant geographical areas without any records between known points of occurrence. As a result, many species' ranges of distribution remain incompletely understood.

Central America remains a vast distributional chasm between the northern and southern ranges of the distribution of *N. macrotis* (Fig. 1). Although broadly distributed, the species remains comparatively rare and little known. The purpose of this paper is to document the presence of *N. macrotis* in Central America, based on two recent records from Honduras.

Surveys of bats were conducted at San Marcos de Colón and El Corpus, southern Honduras at ca. 13°23'06.1" N, 86°57'53.1" W, 1082 m a.s.l. for 11 months during 2013-2015. The two areas together contain five wind power generation plants, hence they are of interest in terms of their effects on the bat fauna. We mist-netted bats five nights per month and in conjunction conducted acoustical surveys during every visit to the area. In parallel, we undertook standardized daytime searches for bat refuges, roosting sites and dead or injured bats. Specimens collected dead on the ground that were not severely damaged were preserved as vouchers. The research described above followed American Society of Mammalogists' guidelines (Sikes et al., 2011).

To assess the likelihood of finding *N. macrotis* elsewhere in Central America, we also analyzed the two capture sites' data using ecological niche modeling. The capture sites' latitude and longitude were georeferenced in ArcMap 10.2 (ESRI, 2013). We then retrieved 19 environmental variables available in WorldClim (Hijmans et al., 2005) and a total of 35 (including WorldClim's original 19) available in CliMond (Kriticos et al., 2012), together with elevation and vegetation, the latter derived from Data Basin (2014). The bioclimatic layers used represent a range of climate conditions including temperature, isothermy, seasonality, precipitation, solar radiation and moisture index. We used ArcMap 10.2 to mask the environmental layers to our spatially proscribed study area. We then used MaxEnt v. 3.3.3k (Phillips et al., 2006) to run the ecological niche models to estimate potential range, with probability of occurrence, based on the capture sites.

We collected two individuals of *N. macrotis* on 15 December 2014; one was captured at 13°24'35.0" N, 86°55'30.2" W (elevation: 1208 m); the other at 13°26'08.8" N, 86°55'08.5" W (1321 m; Fig. 1). Both individuals were males and are deposited in the Portland State University Museum of Vertebrate Biology (MVB). MVB 4962 and MVB 4963 were collected dead on the ground; each had a forearm broken that must be a result of bat accidents with aero generators. Measurements of both specimens agree



**Fig. 1.** Approximate known distribution of *Nyctinomops macrotis* (darker gray) in North and South America and the Caribbean, modified from the IUCN Red List database; northern range is updated by inclusion of data from Frick et al. (2008, 2009). Inset map: Honduras, showing sites (star) where the two new specimens were collected, in southern Honduras: 13°24'35.0" N, 86°55'30.2" W (elevation: 1208 m), and 13°26'08.8" N, 86°55'08.5" W (1321 m). The two sites are separated by 3 km airline distance; at the scale of the map, a single point describes both sites.

with those previously reported for the species (Table 1). Both specimens similarly agree with the diagnostic morphological features generally ascribed to *N. macrotis* by Kumirai and Jones, 1990; Medellín et al., 1997; Eger, 2008; Hoppe et al., 2014; Da Rocha et al., 2015.

A comprehensive analysis of the area's bat fauna is forthcoming. In the interim, we report that the *Nyctinomops* were sampled in a bat fauna that included species (higher level classification for Phyllostomidae of Baker et al., 2016): *Glossophaga leachii*, *G. commissarisi* (Phyllostomidae: Glossophaginae), *Micronycteris microtis* (Phyllostomidae: Micronycterinae),

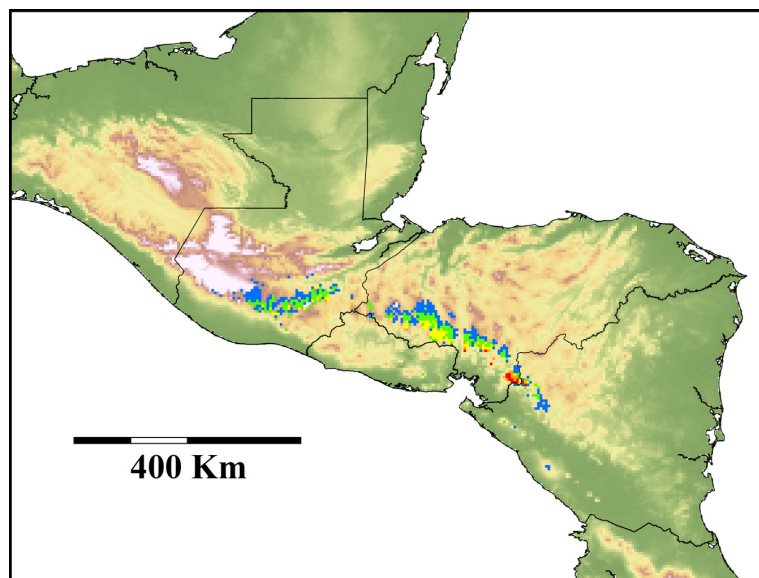
*Sturnira parvidens* (Phyllostomidae: Stenodermatinae: Sturnirini), *Artibeus lituratus*, *A. jamaicensis*, *A. tolteca*, *A. watsoni* (Phyllostomidae: Stenodermatinae: Mesostenodermatini), and *Chiroderma salvini* (Phyllostomidae: Stenodermatinae: Stenodermatini). In addition, the presence of *Desmodus rotundus* (Phyllostomidae: Desmodontinae), and *Cynomops mexicanus*, *Molossus molossus*, and *M. rufus* (Molossidae) were confirmed by acoustical recordings.

After the ecological niche modeling (Fig. 2), using the two new sites of captures, the probability of occurrence of *Nyctinomops macrotis* throughout Central America only ranges from 0.0–0.6, with the sites of capture displaying the highest probability of occurrence, but only at 0.5–0.6. In addition, we hasten to point out that these analyses typically model the funda-

**Table 1**

Standard external measurements for the two specimens of big free-tailed bat (*Nyctinomops macrotis*) collected in southern Honduras. Forearm (FA), body length (BL), ear (E), foot (F), tail (T) and total length (TL) are given in mm; weight (W) is in grams. MVB refers to the Portland State University Museum of Vertebrate Biology.

Specimen no.	FA	BL	E	F	T	TL	W
MVB 4962	63.25	84.33	23.01	8.57	47.47	129.55	32.8
MVB 4963	60.43	73.47	25.69	8.61	56.89	132.54	31.5



**Fig. 2.** Ecological niche model for *Nyctinomops macrotis* based on the ecological characteristics of the two sites of capture in southern Honduras. Probability of occurrence is relatively rare throughout the area, ranging from 0.1 (blue) to 0.6 (red; at sites of capture).

for sampling bats, is a technique that normally undersamples aerial insectivores (Sampaio et al., 2003), particularly high, fast fliers such as *N. macrotis*. Furthermore, *N. macrotis* is hypothesized to be a

seasonal migrant throughout much of its range (Milner et al., 1990; Bárquez et al., 1999). Distributional information for other species of *Nyctinomops* in Central America also is limited: *N. laticaudatus* is common in some areas, such as Cerro de Hula, Honduras, where several individuals were found in our surveys. *Nyctinomops aurispinosus* is known from northwestern Mexico, and South America (Bianconi et al., 2009) but only recently was reported for Central America (Espinal et al., 2016).

Individuals of *N. macrotis* apparently inhabit towns and cities, presumably as they have a wide availability of structures offering suitable roosting conditions and year-round food supplies: urban street lights function as light-traps for numerous species of insects and are used by *N. macrotis* as feeding stations (Silva et al., 1996). *Nyctinomops macrotis* was the third most abundant insectivorous species in a survey conducted at the city of São Paulo, Brazil (Silva et al., 1996). Despite the potential for aerial insect control by *N. macrotis*, its presence was considered an important health issue, as two cases of rabies were detected in *N. macrotis* in the greater São Paulo, Brazil (Silva et al., 1996).

As in the instance of the recent record of *N. aurispinosus* for Honduras (Espinal et al., 2016), the present novel record for *N. macrotis* confirms the existence of the species in a pre-

mental niche, whereas in nature, species will typically occupy a more geographically and ecologically restricted realized niche. Further, our analysis is based on presence only data, rather than including information on absence and abundance, which may bias the results with respect to the “real” distribution of a species (Anderson, 2012, 2015). We did not undertake a niche modelling assessment of the species throughout its full range, but we hypothesize based on our current results that: either the collected individuals were migrants or, that if they are resident, suitable habitat is extremely scant throughout the region, as determined by our analysis and the suggestion of a realized niche smaller than a fundamental niche, and the species therefore quite rare in Central America.

*Nyctinomops macrotis* has been detected in urban areas, dry forests, pine forests, and tropical evergreen forests depending on the geographic area. The species also has been reported from sea level up to 2600 m a.s.l. (Arita, 2005). Notwithstanding this broad distribution, the species is not commonly detected in the course of bat surveys (Hoppe et al., 2014) although some authors hypothesize that this is nevertheless a common species (Bárquez et al., 2015).

Low detection rates follow from the suggestion that mist-netting, habitually employed

viously undocumented region that constituted a vast gap of its distribution between Mexico and South America. The record of occurrence also increases the chiropteran and mammalian fauna of Honduras, highlighting not only the variety of habitats and potential for additional species in that country (e.g. Mora et al., 2014), but also the need for continued sampling of all biota: we clearly do not know what we think we know.

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