

Rediscovery of *Vampyressa thyone* (Chiroptera, Phyllostomidae) in Honduras: updated distribution and notes on its conservation

Diego I. Ordoñez-Mazier¹, Hefer D. Ávila-Palma¹, José A. Soler-Orellana^{1,2},
Eduardo J. Ordoñez-Trejo¹, Marcio Martínez³, Manfredo A. Turcios-Casco^{4,5}

- 1 Escuela de Biología, Facultad de Ciencias, Universidad Nacional Autónoma de Honduras, Francisco Morazán, Honduras
- 2 Colección Privada y Centro de Rescate de Fauna Silvestre “El Ocotal”, Francisco Morazán, Honduras
- 3 Región Biosfera del Río Plátano, Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre, Olancho, Honduras
- 4 Departamento de Vida Silvestre, Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre, Francisco Morazán, Honduras
- 5 Biological Institute, Tomsk State University, Tomsk, Russia

Corresponding author: Manfredo Alejandro Turcios-Casco (manturcios21@gmail.com)

Academic editor: A. M. Leal-Zanchet | Received 29 April 2020 | Accepted 16 August 2020 | Published 3 September 2020

Citation: Ordoñez-Mazier DI, Ávila-Palma HD, Soler-Orellana JA, Ordoñez-Trejo EJ, Martínez M, Turcios-Casco MA (2020) Rediscovery of *Vampyressa thyone* (Chiroptera, Phyllostomidae) in Honduras: updated distribution and notes on its conservation. Neotropical Biology and Conservation 15(3): 379–390. <https://doi.org/10.3897/neotropical.15.e53766>

Abstract

In Central America, *Vampyressa* is represented by two species, *Vampyressa elisabethae* and *V. thyone*. The latter is the only representative of the genus in Honduras and the most recent record was in 2007. Six surveys were carried out in the Departments of Cortés, Atlántida and Gracias a Dios. Only seven individuals of *V. thyone* were recorded between March 2016 and September 2017. The low abundance of *V. thyone* supports the fact that it is an uncommon species in the country; however, these records update the distribution in northern Honduras. We recommend systematic bat assessments on the three protected areas in which we recorded *V. thyone* for a better comprehension of the local populations on this species in the country.

Keywords

Central America, conservation, distribution, Northern Little Yellow-eared Bat, Stenodermatinae

Introduction

Vampyressa Thomas, 1900 is a genus of phyllostomid bats of the subfamily Stenodermatinae and currently comprises five species: *Vampyressa elisabethae* Tavares, Gardner, Ramirez-Chavez & Velazco, 2014, *Vampyressa melissa* Thomas, 1926, *Vampyressa pusilla* (Wagner, 1843), *Vampyressa sinchi* Tavares, Gardner, Ramirez-Chavez & Velazco, 2014 and *Vampyressa thyone* Thomas, 1909 (Simmons and Cirranello 2020). The latter and *V. elisabethae* are the only representatives of the genus in Central America and *V. thyone* is the only species of the genus occurring in Honduras (Tavares et al. 2014; Turcios-Casco et al. 2020a). The Northern Little Yellow-eared Bat, *V. thyone*, has its northernmost limits in Veracruz and Guerrero, Mexico, excluding the Yucatan peninsula (Reid 2009; Hernández-Canchola et al. 2019; Simmons and Cirranello 2020). *V. thyone* occurs in the Caribbean slope of Guatemala and Honduras, while in Nicaragua, Costa Rica and Panama, it occurs in the Caribbean and Pacific slopes; in South America, it has been recorded in Bolivia, Brazil, Peru, Ecuador, Colombia, Venezuela, Guyana and French Guiana (Medina-Fitoria 2014; Hernández-Canchola et al. 2019; Simmons and Cirranello 2020).

The ecology of *V. thyone* has been poorly studied in Honduras. Accordingly, Gardner (1977) stated that its diet is strictly frugivorous, with a predominance of figs (Bonaccorso 1979). In addition, it is usually caught on mist-nets in elevations between sea level and 1000 m a.s.l. (Tavares et al. 2015), mainly in evergreen and gallery forests, streams and other moist areas (Handley 1966). However, Medina-Fitoria (2014) mentioned that the species may occur up to 1500 m a.s.l. in cloud forests. Despite being widespread, its roosting habits are based on few observations. *V. thyone* modifies leaves to turn them into roosting tents; this phenomenon was firstly documented by Timm (1984). Plant species modified by *V. thyone* are *Philodendron macrophylla* and *Rhodospatha wendlandii* (Araceae) and it has been stated that the roosts in *Pentagonia donnell-smithii* (Rubiaceae) were built by a larger bat species and left abandoned (Kunz et al. 1994; Rodríguez-Herrera et al. 2001, 2007).

A total of 23 historical records (see Table 1) of *V. thyone* can be accounted for Honduras and only nine were published. Herein, we present the first records of *V. thyone* in Honduras since 2007. Additionally, notes on its conservation and potential threats within the study areas are discussed.

Materials and methods

Study area

Six surveys were carried out from March 2016 to September 2017 in west-central, northern and north-eastern Honduras in the following localities: Cerro Azul Meámbar National Park (PANACAM), Cortés Department (14°52'8.6"N, 87°54'17.9"W; 870 m a.s.l.), Lancetilla Botanical Garden (LBG), Atlántida Department (15°44'5.6"N,

Table 1. Localities and chronology of the occurrence of *Vampyressa thyone* in Honduras. The new records of this study are marked with an asterisk (*). See Harvard University M and Morris (2020) for a discussion of the specimen MCZ 29706 (individual of the first row in the table) that was previously identified as *Artibeus nanus* and corroborated as *V. thyone*. All the coordinates were based on the references of the GBIF.org (2020) database.

No	Department	Locality	Latitude and Longitude	Individuals	Year
1	Yoro	Subirana	15°11'60.0"N, 87°27'00.0"W	1	1933
2	Atlántida	4 mi SW Tela	No coordinates	1	1964
3	Copán	Copán	No coordinates	1	1967
4	Olancho	40 km E Catacamas	No coordinates	3	1967
5	Atlántida	Lancetilla	No coordinates	2	1969
6	Olancho	10.3 mi by RD SSW Dulce Nombre de Culmí	15°01'09.6"N, 85°35'31.2"W	3	1971
7	Gracias a Dios	Quebrada Tiro, Río Plátano	15°48'00.0"N, 84°52'00.0"W	2	1981
8	Atlántida	Lancetilla	No coordinates	1	1983
9	Atlántida	Lancetilla	No coordinates	1	1991
10	Cortés	Cusuco National Park	No coordinates	6	2007
11	Cortés*	Cerro Azul Meámbar National Park	14°52'8.6"N, 87°54'17.9"W	2	2016
12	Atlántida*	Lancetilla Botanical Garden	15°44'5.6"N, 87°27'32.3"W	1	2016
13	Gracias a Dios*	Ciudad Blanca	15°14'33.6"N, 84°57'39.1"W	3	2017
14	Gracias a Dios*	Pico Dama	15°41'40.5"N, 84°54'54.3"W	1	2017

87°27'32.3"W; 60 m a.s.l.); and Pico Dama (15°41'40.5"N, 84°54'54.3"W; 373 m a.s.l.), Ciudad Blanca (15°14'33.6"N, 84°57'39.1"W; 245 m a.s.l.) in the Río Plátano Biosphere Reserve (RPBR), Gracias a Dios Department (Fig. 1). According to Holdridge (1987) Life Zones, the sampling sites in LBG and RPBR were located in tropical moist forests and the ones in PANACAM in subtropical wet forests.

Bat sampling and ethical guidelines

To capture bats, we used two mist-nets (9 × 2.5 m and 14 × 2.5 m; with a mesh of 35 mm) that remained opened from 16:30 h until 02:30 h and checked every 20 minutes. We selected their position and location based on Kunz and Kurta (1988), using the vegetation, topography and bodies of water as reference. In the field, we determined the sex of the bats following Kunz et al. (1996) and the biological age following Brunet-Rossinni and Wilkinson (2009). We took measurements using a caliper with a spire Mitutoyo (505–675) to the closest 0.01 mm, in accordance with Srinivasulu et al. (2010) as follows: forearm length (FA), tibia length (Tib), ear length (E), ear width (EW), thumb length (Th), noseleaf length (LN), tragus length (Tr), calcaneus length (Ca), body height (BH), hind foot length (HF), wingspan (WS), metacarpal of third finger (3mt), first phalange of third finger (1ph), second phalange of third finger (2ph) and third phalange of third finger (3ph). Body mass (BM) was measured with a scale of 10 (Table 2). We followed Timm et al. (1999), Medellín et al. (2008) and Mora (2016) for the taxonomic identification of the bats and Porter and Baker (2004) and Tavares et al. (2014) for the systematics of *Vampyressa*. Finally, we calculated the sampling effort following Straube and Bianconi (2002).

Table 2. Data obtained from each individual recorded between 2016 and 2017. Abbreviations for morphometric data are described in the Materials and Methods section. External measurements are given in mm and Body mass (BM) is presented in grams.

Record	Locality	Date	Capture hour	Sex	Biological age	BM	FA	Tib	LN	Th	Tr	E	EW	Ca	BH	HF	WS	3mt	1ph	2ph	3ph
1	Cerro Azul Meámbar National Park	18/03/2016	19:35 hs	Male	Adult	8.6	30.1	12.85	7.81	6.51	3.41	10.51	6.49	3.19	35.11	3.58	26.21	26.68	12.81	14.95	NA
2	Cerro Azul Meámbar National Park	19/03/2016	21:05 hs	Male	Adult	NA	31.27	NA	6.40	5.19	3.21	8.49	7.79	3.24	38.30	NA	24.71	28.12	13.25	14.91	11.51
3	Lancetilla Botanical Garden	28/10/2016	21:00 hs	Female	Juvenile	7.8	30.93	12.86	9.65	5.28	3.36	10.3	6.65	3.32	36.48	2.94	NA	29.48	13.24	15.13	11.57
4	Ciudad Blanca	16/02/2017	18:00 hs	Female	Adult	8	31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Ciudad Blanca	16/02/2017	19:00 hs	Female	Adult	9	31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	Ciudad Blanca	17/02/2017	20:30 hs	Male	Adult	7	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Pico Dama	08/09/2017	00:00 hs	Male	Juvenile	7.5	29.70	11.30	7.25	4.20	2.90	10.75	6.75	3.35	34.45	N.A	NA	22.65	12.85	16.95	11.30

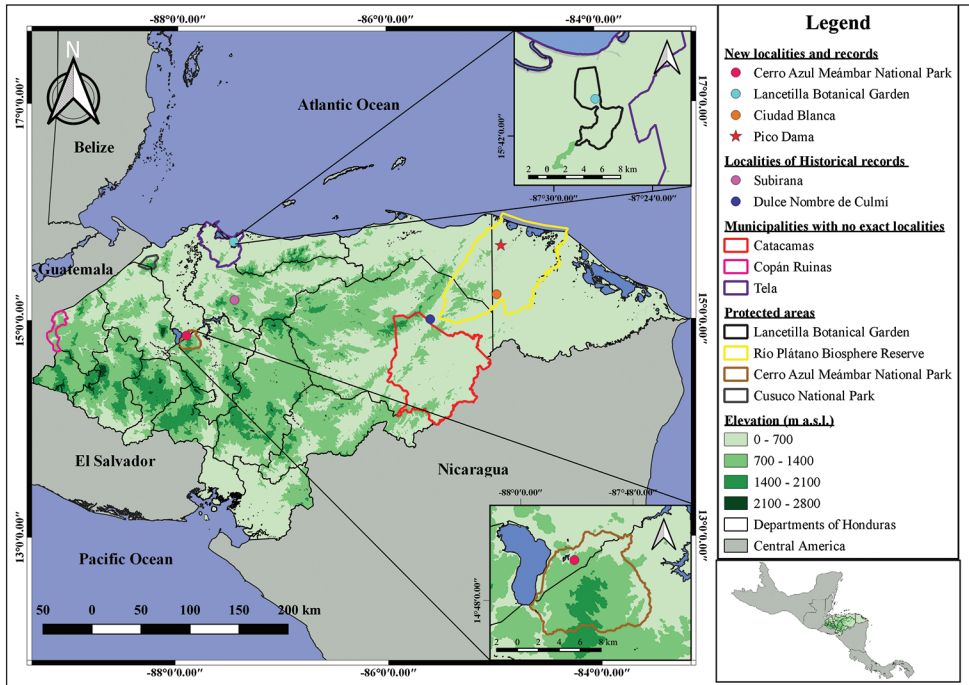


Figure 1. Records of *V. thyone* from Honduras. Georeferenced records are represented by symbols in the map. The red star represents the site at which the voucher specimen was collected. Records lacking coordinates are represented by the municipalities referenced in each record. Considering that the records of Lancetilla from 1969–1991 lack coordinates, the locality of Lancetilla Botanical Garden in 2016 is provided as a reference in the map.

Results

Two families (Phyllostomidae and Mormoopidae), 15 species and 96 individuals were recorded in a sampling effort of 16,854 m²·h. Phyllostomidae was represented by 95.83% of the individuals, 14 species and three subfamilies: three species of Glosophaginae (4.17% of individuals), three species of Carrollinae (23.96%) and eight species of Stenodermatinae (67.70%). *Pteronotus mesoamericanus* (4.17%) was the only species that we captured of Mormoopidae in all the surveys (Table 3). Seven individuals of *V. thyone* were captured, four males (three adults and one juvenile) and three females (two adults and one juvenile). None of the individuals was reproductively active. *V. thyone* individuals were captured between 18:00–21:05 h and only one individual was recorded at 00:00 h. The specimens of *V. thyone* caught at PANACAM represent the first records of this species in this protected area. All individuals were released except for one adult male captured in Pico Dama (Gracias a Dios Department). This specimen was euthanised according to the guidelines for the use of mammals in wildlife research (Sikes et al. 2016). It was deposited in the Zoological Collection of the Museum Biodiversidad y Ciencia of the Universidad Nacional Autónoma de Honduras (UNAH) in the Sula Valley with catalogue number UVS-V-02071 (Fig. 2).

Table 3. Species and individuals captured during the surveyed nights. *Vampyressa thyone* was recorded throughout the four localities surveyed in 2016 and 2017.

Department	Municipality	Locality	Species	Individuals
Cortés	Santa Cruz de Yojoa	Cerro Azul Meámbar National Park	<i>Artibeus jamaicensis</i>	1
			<i>Artibeus lituratus</i>	2
			<i>Dermanura tolteca</i>	2
			<i>Glossophaga soricina</i>	1
			<i>Vampyressa thyone</i>	2
			Total	8
Atlántida	Tela	Lancetilla Botanical Garden	<i>Artibeus jamaicensis</i>	14
			<i>Platyrrhinus helleri</i>	1
			<i>Sturnira parvidens</i>	3
			<i>Uroderma convexum</i>	3
			<i>Vampyressa thyone</i>	1
			Total	22
Gracias a Dios	Brus Laguna	Ciudad Blanca	<i>Artibeus jamaicensis</i>	15
			<i>Artibeus lituratus</i>	4
			<i>Carollia castanea</i>	4
			<i>Carollia perspicillata</i>	9
			<i>Carollia sowelli</i>	3
			<i>Glossophaga commissarisi</i>	2
			<i>Hylonycteris underwoodi</i>	1
			<i>Pteronotus mesoamericanus</i>	3
	Juan Francisco Bulnes	Pico Dama	<i>Uroderma convexum</i>	1
			<i>Vampyressa thyone</i>	3
			Total	45
			<i>Artibeus jamaicensis</i>	7
			<i>Artibeus lituratus</i>	1
			<i>Carollia castanea</i>	2
			<i>Carollia perspicillata</i>	1
			<i>Carollia sowelli</i>	4
			<i>Dermanura phaeotis</i>	4
			<i>Pteronotus mesoamericanus</i>	1
			<i>Vampyressa thyone</i>	1
			Total	21

Valdez and LaVal (1971) reported in Lancetilla, Atlántida Department (northern Honduras) the first records of *V. thyone* in Honduras, referred to as *V. pusilla*. Additionally, a male specimen deposited at the Museum of Comparative Zoology, Harvard University (MCZ) under catalogue number MCZ 29706, is identified as *Artibeus nanus* which was collected in Subirana, Yoro Department in 1933. It has the following note on the label: “*Vampyressa minuta* prob. same as *thyone* according DCH Handley *V. pusilla*, TJ McCarthy. Labelled on tag as *Vampyressa minuta*. Found with *Vampyressa* genus. Kaitlin Marie Sheridan. 17 November 2011” (Harvard University M and Morris 2020). Even though we have not revised this museum specimen, it may represent the oldest known record of *V. thyone* in Honduras.

V. thyone is similar to *Mesophylla macconnelli* and *Vampyriscus nymphaea*; however, our specimens identified as *V. thyone* had no dorsal line, which is present in *V. nymphaea*. All *V. thyone* specimens presented a hairy interfemoral membrane which is hairless in *V. nymphaea* and *M. macconnelli* (Medina-Fitoria 2014;



Figure 2. Photograph taken *in vivo* of the adult male *Vampyressa thyone* (UVS-V-02071) collected in Pico Dama, Río Plátano Biosphere Reserve. Photograph by Hefer Ávila.

Tavares et al. 2014). Finally, the forearm length of the seven specimens was smaller in comparison to *V. nymphaea*, which is larger (FA = 35–39 mm) (Medina-Fitoria 2014; Tavares et al. 2014). Despite the overlap between the forearm of *V. thyone* and *M. macconnelli* (FA = 29–33 mm), the latter has not been recorded in Honduras (Turcios-Casco et al. 2020a).

Considering the historical occurrence of *V. thyone* in Honduras, 14 of these records, dating from 1964 to 1991, are available in the GBIF (2020) database. The specimens of these records are deposited in the mammal collections of the Museum of Texas Tech University (TTU), the Museum of South-western Biology (MSB) and the Texas A&M University Biodiversity Research and Teaching Collections (TCWC). These are distributed as follows: Olancho Department: three specimens collected in Dulce Nombre de Culmí (Garner 2016a, b, c) and three specimens from Catacamas (Prestridge 2019c, d, e); Atlántida Department: one specimen from Tela (Prestridge 2019a) and four specimens from Lancetilla (Valdez and LaVal 1971; Lee and Bradley 1992; Garner 2016d; Prestridge 2019f); Copán Department: one specimen from Copán Ruinas (Prestridge 2019b); Gracias a Dios Department: two specimens from Río Plátano (Cook 2020a, b). Furthermore, the most recent records for the country were reported by Estrada-Villegas et al. (2007) in Cusuco National Park, Cortés Department (Table 1).

Discussion

For Honduras, many records and distributions of bat species are separated by decades, which dulls the conservation and education actions, and for *V. thyone*, this is no exception. Our study, despite the few records of *V. thyone*, provides important updates in the distribution of the species in Honduras. From the seven specimens captured, only one female and one male were juveniles and none of the adults was in any reproductive condition. In general, Lewis and Wilson (1987) mentioned pregnant females in January, February, March, April, June, July, August and November; and lactating females in March, April, May, June and July, suggesting a binomial polyestrous pattern. However, for Honduras, there is only a record of Valdez and LaVal (1971) of a female captured in August in 1969 with an embryo of 18 mm.

According to our records, *V. thyone* was frequently active during the first hours after sunset and these results agree with the activity patterns reported by other authors. For example, Davis and Dixon (1976) captured 78.84% of individuals of *V. thyone* between 18:30 h–21:00 h in Peru and Bonaccorso (1979) stated that the activity of this species is higher during the first two hours after sunset in Panama. Furthermore, Bonaccorso (1979) obtained more captures of *V. thyone* (referred as *V. pusilla*) at subcanopy levels compared to ground levels. In this study, all mist-nets were set at ground levels and near or over streams, which may partially explain why *V. thyone* remained as one of the species with less capture frequency.

According to the IUCN (International Union for the Conservation of Nature), *V. thyone* is categorised as Least Concern (LC) (Tavares et al. 2015). However, populations of this species may be locally threatened throughout its distribution in Honduras. *V. thyone* highly depends on mature and well-preserved forests, forages in evergreen forests and has a relatively low abundance in Mexico and Central America being considered an uncommon species (Handley 1966; Jones et al. 1971; Lewis and Wilson 1987; Medina-Fitoria 2014; Zamora Mejías and Rodríguez Herrera 2017; Mora et al. 2018; Hernández-Canchola et al. 2019). In addition to Valdez and LaVal (1971), the sites in Lancetilla may no longer be undisturbed, because we found plantations of rambutans (*Nephelium lappaceum*) near the studied areas. On the other hand, the areas where *V. thyone* was captured in Gracias a Dios Department included preserved forests. While Tavares et al. (2015) and Davis and Dixon (1976) mentioned that *V. thyone* may be locally common within its distribution range in South America, the capture frequency in our study was of 0.0004 individuals per m²·h. The low abundance obtained supports the fact that *V. thyone* is an uncommon species in Honduras.

The records provided in this study were reported in protected areas within the Caribbean slope of Honduras. The rarity of *V. thyone*, combined with the constant and degenerative changes of the Honduran forests, could turn *V. thyone* into a vulnerable species. According to ICF (2017), the wood extracted from forests in Honduras was estimated to be 122,061,763.3 board feet per year. In addition, forest coverage is significantly affected yearly by bushfires; since 2007 to 2014, a total of 81,506.3 ha of forest have been lost. One of the most affected Departments was Gracias a Dios (CONADEH 2015), which harbours the most important extension of tropical moist forest (including

a part of the RPBR) in the country. This negative pressure turns into a gradual and constant perturbation to the different types of habitats throughout the RPBR.

It is important to mention that the sampling sites in Gracias a Dios took place near the limits of RPBR, the most important region for wildlife conservation in Honduras. Nonetheless, the RPBR is facing illegal cattle ranching, which is the main reason for forest loss in the reserve (Turcios-Casco et al. 2020b); therefore we recommend including *V. thylene* in the present RPBR management plan because it currently is mainly focusing on felines, primates and birds as fauna with priority for conservation. However, the RPBR is the only protected area in Honduras that includes a bat species (*Ectophylla alba*) in its conservation plan. We also recommend the inclusion of a systematic bat assessment in PANACAM and LBG, because it may provide a better comprehension of the local populations of *V. thylene* in Honduras. Finally, it is important to determine which species are used as tents by *V. thylene* in the study areas, not only to understand more about its ecology, but to know which plant species are also needed for conservation.

Acknowledgements

We are grateful to the ICF for the authorisation of research and collection permits (Resolución DE-MP-020-17 and Resolución-DE-MP-64-2017) of specimens in the study areas. To Marco Espinoza and Nereyda Estrada for their efforts and organisation in monitoring bats in the RPBR and PANACAM, respectively. We thank to Alex Vallejo of Museum Biodiversidad y Ciencia in the Universidad Nacional Autónoma de Honduras located in the Sula Valley for receiving the bat in the museum. We thank all the local people of the community of Las Marías and Shasling Pacheco for their efforts during the surveys in Pico Dama. To Josué Galdamez, Arnulfo Medina-Fitoria and Travis King for field assistance in Ciudad Blanca and to Allison Flores, Ana Reyes and Eduardo Carranza for assisting in PANACAM. To Ana Maria Leal-Zanchet, Mónica Díaz, Ricardo Moratelli, Mike Skinner and an anonymous reviewer for their comments to improve this manuscript.

References

- Bonaccorso FJ (1979) Foraging and reproductive ecology in a Panamanian bat community. *Bulletin of the Florida State Museum Biological Sciences* 24(4): 359–408.
- Brunet-Rossinni A, Wilkinson G (2009) Methods for age estimation and the study of senescence in bats. In: Kunz TH, Parsons S (Eds) *Ecological and Behavioral Methods for the Study of Bats*. The John Hopkins University Press, Baltimore, 315–325.
- CONADEH (2015) Informe Especial: Los Incendios Forestales en Honduras y su Impacto Sobre los Derechos Humanos de los Habitantes. Comisionado Nacional de los Derechos Humanos, Honduras, 44 pp.
- Cook J (2020a) MSB Mammal Collection (Arctos). Version 35.39. Museum of Southwestern Biology. <https://www.gbif.org/occurrence/1145333967> [accessed July 04, 2020]
- Cook J (2020b) MSB Mammal Collection (Arctos). Version 35.39. Museum of Southwestern Biology. <https://www.gbif.org/occurrence/1145333956> [accessed July 04, 2020]

- Davis WB, Dixon JR (1976) Activity of bats in a small village clearing near Iquitos, Peru. *Journal of Mammalogy* 57(4): 747–749. <https://doi.org/10.2307/1379444>
- Estrada-Villegas S, Allen L, García M, Hoffmann M, Munroe ML (2007) Bat Assemblage Composition and Diversity of the Cusuco National Park, Honduras. Operation Wallacea, Honduras, 5 pp.
- Gardner AL (1977) Feeding habits. In: Baker RJ, Jones Jr JK, Carter DC (Eds) *Biology of Bats of the New World Family Phyllostomatidae. Part II. Special Publications the Museum Texas Tech University, Lubbock*, 293–350.
- Garner H (2016a) TTU Mammals Collection. Version 9.1. Museum of Texas Tech University (TTU). <https://www.gbif.org/occurrence/911644042> [accessed July 04, 2020]
- Garner H (2016b) TTU Mammals Collection. Version 9.1. Museum of Texas Tech University (TTU). <https://www.gbif.org/occurrence/911644076> [accessed July 04, 2020]
- Garner H (2016c) TTU Mammals Collection. Version 9.1. Museum of Texas Tech University (TTU). <https://www.gbif.org/occurrence/911644110> [accessed July 04, 2020]
- Garner H (2016d) TTU Mammals Collection. Version 9.1. Museum of Texas Tech University (TTU). <https://www.gbif.org/occurrence/911692276> [accessed July 04, 2020]
- GBIF (2020) GBIF occurrence. <https://www.gbif.org/occurrence/search> [accessed July 04, 2020]
- Handley Jr CO (1966) Checklist of the mammals of Panama. In: Wenzel RL, Tipton VJ (Eds) *Ectoparasites of Panama. Field Museum of Natural History, Chicago*, 753–795.
- Harvard University M, Morris PJ (2020) Museum of Comparative Zoology, Harvard University. Version 162.216. <https://www.gbif.org/occurrence/476833797> [accessed July 04, 2020]
- Hernández-Canchola G, Gómez-Jiménez YA, Hernández-Chávez I, Lucero-Verdugo SC, León-Paniagua L (2019) Notes on *Vampyressa thuyone* (Chiroptera: Phyllostomidae): distribution, genetics and hypopigmentation. *Biota Neotropica* 19(2): e20180621. <https://doi.org/10.1590/1676-0611-bn-2018-0621>
- Holdridge L (1987) *Ecología Basada en Zonas de Vida* (Jiménez Saa H. Trad). Instituto Interamericano de Cooperación para la Agricultura (IICA), San José, 216 pp.
- ICF (2017) *Análisis Forestal de Honduras*. Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre, Comayagüela, 60 pp.
- Jones Jr JK, Smith JD, Turner RW (1971) Noteworthy records of bats from Nicaragua, with a checklist of the chiropteran fauna of the country. *Occasional Papers of the Museum of Natural History* 2: 1–35.
- Kunz TH, Fujita MS, Brooke AP, McCracken GF (1994) Convergence in tent architecture and tent-making behavior among neotropical and paleotropical bats. *Journal of Mammalian Evolution* 2(1): 57–78. <https://doi.org/10.1007/BF01464350>
- Kunz TH, Kurta A (1988) Capture methods and holding devices. In: Kunz TH (Ed.) *Ecological and Behavioral Methods for the Study of Bats*. Smithsonian Institution Press, Washington DC, 28 pp.
- Kunz TH, Wemmer C, Hayssen V (1996) Sex, age, and reproductive condition of mammals. In: Wilson DE, Cole RF, Nichols JD, Foster MS (Eds) *Measuring and Monitoring Biological Diversity Standard Methods for Mammals*. Smithsonian Institution Press, Washington DC, 279–290.
- Lee Jr TE, Bradley RD (1992) New distributional records of some mammals from Honduras. *The Texas Journal of Science* 44(1): 109–111.

- Lewis SE, Wilson DE (1987) *Vampyressa pusilla*. Mammalian Species 292(292): 1–5. <https://doi.org/10.2307/3503881>
- Medellín R, Arita H, Sánchez O (2008) Identificación de los Murciélagos de México, Clave de Campo. Segunda edición. Universidad Nacional Autónoma de México (UNAM), Distrito Federal, 83 pp.
- Medina-Fitoria A (2014) Murciélagos de Nicaragua, Guía de Campo. Programa para la Conservación de los Murciélagos de Nicaragua (PCMN) y Ministerio del Ambiente y los Recursos Naturales (MARENA), Managua, 279 pp.
- Mora JM (2016) Clave para la identificación de las especies de murciélagos de Honduras. Ceiba 54(2): 93–117. <https://doi.org/10.5377/ceiba.v54i2.3283>
- Mora JM, López LI, Espinal M, Marineros L, Ruedas L (2018) Diversidad y Conservación de los Murciélagos de Honduras. Master Print S. de R.L., Tegucigalpa, 284 pp.
- Porter CA, Baker RJ (2004) Systematics of *Vampyressa* and related genera of phyllostomid bats as determined by cytochrome-b sequences. Journal of Mammalogy 85(1): 126–132. <https://doi.org/10.1644/BWG-110>
- Prestridge H (2019a) Biodiversity Research and Teaching Collections – TCWC Vertebrates. Version 9.3. Texas A&M University Biodiversity Research and Teaching Collections. <https://www.gbif.org/occurrence/675792637> [accessed July 04, 2020]
- Prestridge H (2019b) Biodiversity Research and Teaching Collections – TCWC Vertebrates. Version 9.3. Texas A&M University Biodiversity Research and Teaching Collections. <https://www.gbif.org/occurrence/675808949> [accessed July 04, 2020]
- Prestridge H (2019c) Biodiversity Research and Teaching Collections – TCWC Vertebrates. Version 9.3. Texas A&M University Biodiversity Research and Teaching Collections. <https://www.gbif.org/occurrence/675808951> [accessed July 04, 2020]
- Prestridge H (2019d) Biodiversity Research and Teaching Collections – TCWC Vertebrates. Version 9.3. Texas A&M University Biodiversity Research and Teaching Collections. <https://www.gbif.org/occurrence/675808955> [accessed July 04, 2020]
- Prestridge H (2019e) Biodiversity Research and Teaching Collections – TCWC Vertebrates. Version 9.3. Texas A&M University Biodiversity Research and Teaching Collections. <https://www.gbif.org/occurrence/675808958> [accessed July 04, 2020]
- Prestridge H (2019f) Biodiversity Research and Teaching Collections – TCWC Vertebrates. Version 9.3. Texas A&M University Biodiversity Research and Teaching Collections. <https://www.gbif.org/occurrence/675911139> [accessed July 04, 2020]
- Reid FA (2009) A field Guide to the Mammals of Central America and Southeast Mexico (2nd edn.). Oxford University Press, New York, 384 pp.
- Rodríguez-Herrera B, Rodríguez-Brenes S, Sagot M (2001) Tent use in *Pentagonia donnell-smithii* (Rubiaceae) by *Vampyressa pusilla* (Chiroptera: Phyllostomidae) in Costa Rica. Bat Research News 42(2): 1–49.
- Rodríguez-Herrera B, Medellín RA, Timm RM (2007) Murciélagos Neotropicales que Acampan en Hojas. Instituto Nacional de Biodiversidad (INBio), Santo Domingo de Heredia, 184 pp.
- Sikes RS, The Animal Care and Use Committee of the American Society of Mammalogists (2016) Guidelines of the American Society of Mammalogists for the use of wild mammals in research and education. Journal of Mammalogy 97(3): 663–688. <https://doi.org/10.1093/jmammal/gyw078>

- Simmons NB, Cirranello AL (2020) Bat species of the World: A taxonomic and geographic database. <https://batnames.org>
- Srinivasulu C, Racey PA, Mistry S (2010) A key to the bats (Mammalia: Chiroptera) of South Asia. *Journal of Threatened Taxa* 2(7): 1001–1076. <https://doi.org/10.11609/JotT.o2352.1001-76>
- Straube FC, Bianconi GV (2002) Sobre a grandeza e a unidade para estimar força de captura com utilização de redes-de-neblina. *Chiroptera Neotropical* 8(1–2): 150–152.
- Tavares VDC, Gardner AL, Ramírez-Chaves HE, Velasco PM (2014) Systematics of *Vampyressa melissa* Thomas, 1926 (Chiroptera: Phyllostomidae), with descriptions of two new species of *Vampyressa*. *American Museum Novitates* 3813(3813): 1–27. <https://doi.org/10.1206/3813.1>
- Tavares V, Muñoz A, Arroyo-Cabral J (2015) *Vampyressa thylene*. The IUCN Red List of Threatened Species 2015: e.T136671A21989318.
- Timm RM (1984) Tent construction by *Vampyressa* in Costa Rica. *Journal of Mammalogy* 65(1): 166–167. <https://doi.org/10.2307/1381223>
- Timm RM, LaVal RK, Rodríguez-Herrera B (1999) Clave de campo para los murciélagos de Costa Rica. *Brenesia* 52: 1–32.
- Turcios-Casco MA, Ávila-Palma HD, LaVal RK, Stevens RD, Ordoñez-Trejo EJ, Soler-Orellana JA, Ordoñez-Mazier DI (2020a) A systematic revision of the bats (Chiroptera) of Honduras: An updated checklist with corroboration of historical specimens and new records. *Zoosystematics and Evolution* 96(2): 411–429. <https://doi.org/10.3897/zse.96.51059>
- Turcios-Casco MA, Manzanares T, Ávila-Palma HD, Martínez M, Mazier-Ordoñez DI (2020b) Reproductive, morphometric, and roosting description of the Honduran white bat, *Ectophylla alba* (Chiroptera: Phyllostomidae), in Honduras. *Mastozoología Neotropical* 27(1): 172–176. <https://doi.org/10.31687/saremMN.20.27.1.0.07>
- Valdez R, LaVal RK (1971) Records of bats from Honduras and Nicaragua. *Journal of Mammalogy* 52(1): 247–250. <https://doi.org/10.2307/1378465>
- Zamora Mejías D, Rodríguez Herrera B (2017) Murciélagos (Chiroptera) del bosque premontano de San Ramón, Costa Rica. *Revista Pensamiento Actual* 17: 105–113.