

# First record of the Pale-faced Bat *Phylloderma stenops* Peters, 1865 (Chiroptera: Phyllostomidae) in the province of Guayas, southwestern Ecuador

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**ABSTRACT:** We report the first record of *Phylloderma stenops* in the province of Guayas, Ecuador. The specimen was captured in a heavily disturbed area, surrounded by small remnants of semi-deciduous lowland forests. We also present a predictive distribution map, constructed with the new and existing information for *P. stenops* in Ecuador and other countries in South America, showing that this species may occur in other areas where it has not yet been observed.

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*Phylloderma stenops* Peters, 1865 is a large bat with robust body, white wingtips, large and narrow muzzle, broad and lance-shaped nose leaf, and reddish-brown dorsal hairs with pale base and an often slightly bright terminal band (Goodwin 1942; LaVal and Rodríguez-H. 2002; Tirira 2007; Medellín *et al.* 2008; Díaz *et al.* 2011). Currently, three subspecies are recognized (Simmons 2005; Gardner 2008): *P. s. septentrionalis* Goodwin, 1940, which occurs in Central America, from southern Mexico to Belize (Goodwin 1942, 1946; LaVal and Rodríguez-H. 2002; Cruz-Lara *et al.* 2004; Medellín *et al.* 2008; Reid 2009); *P. s. stenops* Peters, 1865, recorded in several countries of northern South America, such as Trinidad and Tobago, Venezuela, Colombia, Ecuador, and the northwest and southern regions of Peru (Goodwin and Greenhall 1964; Handley 1976; Sánchez and Rivas 1993; Ascorra *et al.* 1991, 1993; Tirira 2007; Williams and Genoways 2008), extending into the Amazon Basin and southeastern Brazil (Sampaio *et al.* 2003; Esbérard and Faria 2006; Williams and Genoways 2008); and *P. s. boliviensis* Barquez & Ojeda, 1979, endemic to Bolivia (Anderson 1997; Acosta and Aguanta 2006; Díaz *et al.* 2011). In Ecuador, *P. stenops* was reported in 1998, in a meeting abstract by I. Castro and L. Novilos, but the first published reference was provided by Albuja and Mena-V. (2004), and it has been reported in the coastal (lowland evergreen forests, inundated floodplain forests, deciduous forests) and Amazonian regions (mostly evergreen forests), but not in the inter-Andean region (Tirira 1999, 2007, 2008; Albuja and Mena-V. 2004; Trujillo and Albuja 2005; Carrera *et al.* 2010; Table 1).

On 7 October 2010, we conducted a survey of the fauna on the grounds of El Retiro Ranch, near the Pucón River (01°18'41.7" S, 79°56'33.4" W, 40 m above sea level), Chicompe sector, Balzar locality, Guayas province-Ecuador. This ranch is characterized by the presence of livestock and silvopasture systems, and it is surrounded

by small remnants of semi-deciduous lowland forests (Ministerio del Ambiente de Ecuador 2013). The predominant native plants observed in these remnants during the survey were *Spondias mombim*, *Phytelephas aequatorialis*, *Cochlospermum vitifolium*, *Cordia alliodora*, *Capparis* spp., *Albizia multiflora*, *Centrolobium ochroxylum*, *Pseudosamanea guachapele*, *Machaerium millei*, *Ficus obtusifolia*, *Muntingia calabura*, *Piper* spp., *Sapindus saponaria*, *Chrysophyllum argenteum*, *Guazuma ulmifolia*, *Trema micrantha*, and *Vitex gigantea*; the predominant species close to the river were *Albizia saman* and *Erythrina edulis*.

Trapping was conducted for one night, using two mist nets of 6 × 2.5 m each. These nets were placed above the river, from 18:00 h until approximately 06:00 h (following Kunz *et al.* 1996). Bats were identified according to the guidelines detailed in Albuja (1999) and Tirira (2007). In the case of *P. stenops*, in order to achieve identification to the subspecies level, we also analyzed specimens from eastern and western Ecuador deposited at the Mammalogy Division of the Museo de Zoología at the Pontificia Universidad Católica del Ecuador-QCAZ. Specimens from El Retiro Ranch were collected under Permit No. 001-10 IC-FAU-DNB/MA, issued by the Ministerio del Ambiente of Ecuador.

We captured one female *P. stenops* (QCAZ 12651; Figure 1, Table 1), presenting the following external measurements (in mm): total length, 95.8; tail length, 12.4; hind foot length, 28.1; ear length, 21.1; forearm length, 64.1; tragus, 9. Cranial measurements (following Barquez and Ojeda 1979) are close to those described for the subspecies *P. s. stenops* (Barquez and Ojeda 1979; Table 2), which is in agreement with Williams and Genoways (2008), who assigned this subspecies to Ecuador. The analysis of a larger sample, however, is necessary to validate this identification at the subspecies level. Other

bat species captured during fieldwork by mist netting were *Carollia brevicauda* (Schinz, 1821), *Artibeus fraterculus* Anthony, 1924, and *Phyllostomus discolor* (Wagner, 1843); *Molossus molossus* (Pallas, 1766) and *Eptesicus innoxius* (Gervais, 1841) were found in shelters under the bark of an *A. saman* tree.

Previous records of *P. stenops* in Ecuador were obtained from protected natural areas (e.g., Limoncocha Biological Reserve, Yasuní National Park, and Cuyabeno Wildlife Reserve, in the Amazonian region; and La Chiquita Wildlife Refuge, Río Palenque Protected Forest, and Puyango Petrified Forest, in western Ecuador) or in disturbed areas such as banana plantations (Table 1). The previous locations in protected areas contrast with our record, which was located in a place heavily disrupted by livestock, with small remnants of riparian vegetation. Emmons and Feer (1997), however, reported that this species is found around streams and swamps or marshes, which coincides with our findings. *Phylloderma stenops* roosts in caves (Trajano 1982; Bredt et al. 1999; Esbérard et al. 2005) and feeds on fruit pulp, insects, and even small vertebrates (e.g., a large rat, apparently a *Proechimys*) (Jeanne 1970; LaVal 1977; Esbérard and Faria 2006; York 2008; Sampaio et al. 2008), resources that might be available at the forest remnants around El Retiro Ranch.

*Phylloderma stenops* is a rare species in Ecuador (Reid et al. 2000; Albuja and Mena-V. 2004; Trujillo and Albuja 2005; Carrera et al. 2010; Brito and Arguero 2012) and other South American countries (Ascorra et al. 1991, 1993; Sánchez and Rivas 1993; Bredt et al. 1999; Sampaio et al. 2003; Acosta and Aguanta 2006), with no previous record from Guayas Province or in semi-deciduous forests (Parker and Carr 1992; Rodríguez et al. 1995; Albuja 1982, 1999; Albuja and Mena-V. 2004; Trujillo and Albuja 2005; Tirira 2007, 2008; Salas 2008). Recent records that have been published for this species are from other locations in southwestern Ecuador, specifically in Puyango, in the El Oro Province (Carrera et al. 2010), and in the Amazonian Region, specifically from the Morona Santiago and Zamora Chinchipe provinces (Brilo and Arguero 2012).

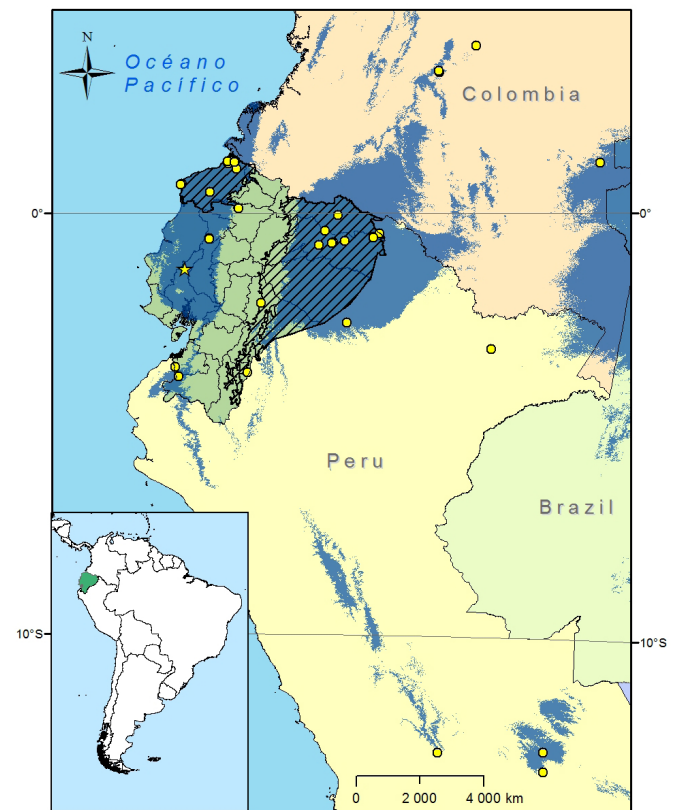
In recent years, there have been new records and extensions in the distribution of various species of bats in Southwestern Ecuador (Salas 2008; Carrera et al. 2010; Narváez et al. 2012; Tirira et al. 2012a, b; Salas et al. 2013), despite the rapid deterioration of its vegetation cover and expected loss of biodiversity (Dobson and Gentry 1991; Ministerio de Ambiente de Ecuador 2013). This region should be considered a priority for bat research and conservation programs, both in protected and unprotected forest areas. Although the occurrence of *P. stenops* in Guayas Province was predicted by Williams and Genoways (2008), the predictive distribution map presented for this species by Tirira (2007) restricted its occurrence to the northwestern rainforests and Amazonia.

Using data from museum specimens collected in Ecuador, Colombia, and Peru (Table 3), a predictive distribution model was generated using a Maximum Entropy approach (MaxEnt; Phillips et al. 2006). Eight replications of the model were run separating 15% of the occurrences in a test set for evaluation purposes by measuring the area under the ROC curve (AUC) in each evaluation set. The mean AUC for the model replications

was 0.789 (SD = 0.156). The model predicts the distribution for *P. stenops* in protected areas where this bat has not yet been observed, as the Protected Forests as Chillanes-Bucay, Molleturo-Mollepongo, Cerro Blanco, or Isla Santay Recreation National Area in Guayas Province (Figure 2).



**FIGURE 1.** Pale-Faced Bat *Phylloderma stenops* (QCAZ 12651, ♀) captured in the Pucón River area (Guayas Province-Ecuador). Photo by Jaime Salas.



**FIGURE 2.** Distribution of *Phylloderma stenops* in Ecuador. Black lines represent the current distribution as reported by Tirira (2007). The blue-shaded area represents the predictive distribution model proposed for Ecuador. Yellow dots represent known records with registered geographic coordinates. The yellow star represents our record near the town of Balzar.

The climatic envelope that the model predicted for this species included an annual mean temperature of 25.2°C ( $\pm 0.91$ ) and a mean annual rainfall of 2,846 mm ( $\pm 617$ ). The temperature at the new location reported here (25.6°C) is consistent with the predictions of the model. However, the model's prediction for precipitation is higher than the annual average of the new location (1,306 mm), although

this value is within the range of the model's precipitation (328–5,016 mm), which suggests that this location is likely near the edge of the climatic envelope. Also, four bioclimatic variables explained 55% of the variation seen in the model: the precipitation of the warmest quarter (15.2%, model average: 686.2 mm  $\pm$  217; new locality 879 mm), maximum temperature of warmest month (13.6 %, model

**TABLE 1.** Annotated list of records of the Pale-faced Bat *Phylloderma stenops* in Ecuador.

PROVINCE	LOCALITIES	CITATION OR NUMBER OF VOUCHER*	VEGETATION TYPE**
Esmeraldas	El Porvenir 01°12' N, 78°55' W - Cayapas Mataje Reserve	DMMECN 1222	Lowland evergreen forest of Equatorial Chocó
	Valle de Sade 00°31'04" N, 79°20'29" W	Albuja and Mena-V. (2004); MEPN-3954	Lowland evergreen forest of Equatorial Chocó
	Río San Francisco, Muisne 00°42'05.01"N, 80°01'46.64"W	Database from Mammalogy Division of the Museo Ecuatoriano de Ciencias Naturales; DMMECN 2037	Inundated floodplain forest of Equatorial Chocó
	Río San Francisco, Muisne 00°41'11.48" N, 80°00'35.20" W	Database from Mammalogy Division of the Museo Ecuatoriano de Ciencias Naturales; -DMMECN 3060	Lowland evergreen forest of Equatorial Chocó
	San Francisco de Bogotá 01°05' N, 78°42' W	Tirira (2008); TTU 103072	Lowland evergreen forest of Equatorial Chocó
	Banana plantation near San Lorenzo 01°15'31" N, 78°46'51" W	Carrera et al. (2010); QCAZ 9641	Lowland evergreen forest of Equatorial Chocó
	La Chiquita Wildlife Refuge 01°14' N, 78°45' W	Carrera et al. (2010); TTU 085300 -QCAZ 9189	Lowland evergreen forest of Equatorial Chocó
	Pichincha	Nanegal 00°07' N, 78°46' W	Trujillo and Albuja (2005); MEPN-9179
Francisco de Orellana		Yasuní National Park 00°42'01" S, 76°28'05" W	Trujillo and Albuja (2005); MEPN-9178
	Pompeya Sur 00°40' S, 76°22' W	Reid et al. (2000); ROM 105186	Lowland Evergreen forest of Napo-Curaray, in Amazonian Region
	Onkone Gare 00°45' S, 76°46' W	Reid et al. (2000); ROM 105749	Lowland Evergreen forest of Napo-Curaray, in Amazonian Region
Sucumbios	Limoncocha Biological Reserve 00°24' S, 76°38' W	Reid et al. (2000); DMMECN 902	Lowland Evergreen forest of Napo-Curaray, in Amazonian Region
		Trujillo and Albuja (2005); MEPN-9177	Lowland Evergreen forest of Aguarico-Putumayo, in Amazonian Region
	Cuyabeno Wildlife Reserve 00°7'00.12" S, 75°09'59.88" W	Tirira (2007); QCAZ 6881	Lowland Evergreen forest of Aguarico-Putumayo, in Amazonian Region
	Recinto Sansahuari, Putumayo 00°12'02.8" N, 76°16'55.30"	Database from Mammalogy Division of the Museo Ecuatoriano de Ciencias Naturales; DMMECN 3237	Lowland Evergreen forest of Aguarico-Putumayo, in Amazonian Region
Morona Santiago	Destacamento Patria, hito 63 00°27'54.11" S, 75°20'42.43" W	Database from Mammalogy Division of the Museo de Zoología at the Pontificia Universidad Católica del Ecuador; QCAZ 7168	Lowland Evergreen forest of Aguarico-Putumayo, in Amazonian Region
	Domono Alto 02°07'02.3" S, 78°08'36.6" W	Brito and Arguero (2012); MEPN-11154	Evergreen foothill forest in mountains of Cóndor-Kutukú, in Amazonian region
Zamora Chinchipe	Tigre River 03°46'16.6" S, 78°27'23.6" W	Brito and Arguero (2012), MEPN-11180	Evergreen forest over sandstone plateaus of Cóndor mountain, in Amazonian region
Los Ríos	Río Palenque Scientific Center 00°35' S, 79°22' W	Tirira (2008); USNM 528488	Lowland evergreen forest of Equatorial Chocó
El Oro	Puyango Petrified Forest 03°53'3.4" S, 80°4'41.1" W	Carrera et al. (2010); QCAZ 9190	Deciduous lowland forests from Jama Zapotillo on Southern Coast
Guayas	Pucón River 01°18'41.7" S, 79°56'33.4" W	This publication; QCAZ 12651	Semi-deciduous lowland forests from Jama Zapotillo on Southern Coast

\* Full collection names with acronyms are presented in Table 3.

\*\* Ministerio del Ambiente del Ecuador. 2013. *Sistema de Clasificación de los Ecosistemas del Ecuador Continental*. Quito: Subsecretaría de Patrimonio Natural. 232 pp.

**TABLE 2.** Cranial measurements (mm) taken from specimens of *Phylloderma stenops* in eastern and western Ecuador.

CHARACTER	EASTERN ECUADOR		NORTHWESTERN ECUADOR		SOUTHWESTERN ECUADOR	
	QCAZ 6881, ♀	QCAZ 7168, ♂	QCAZ 9641, ♀	QCAZ 9189, ♀	QCAZ 9190, ♀	QCAZ 12651, ♀
Condylbasal length	27.3	26.6	27.2	26.5	26.3	27.2
Skull's total length	36.2	32.1	31.1	31.0	31.5	32.4
Palate length	14.0	13.0	14.4	13.4	13.0	14.0
Zygomatic breadth	11.6	16.0	15.5	16.6	16.0	15.4
Braincase breadth	13.4	13.0	11.5	12.0	12.2	12.7



**TABLE 3.** Number of specimens used in the predictive niche modeling retrieved and verified using Red Noctilio\* and Global Biodiversity Information Facility (GBIF, www.gbif.org)

ACRONYM	MUSEUM	SPECIMENS
EPN	Museo Gustavo Orcés, Escuela Politécnica Nacional, Quito	4
FMNH	Field Museum of Natural History, Chicago, IL	3
ICN	Instituto de Ciencias Naturales, Museo de Historia Natural, Bogotá	5
KU	University of Kansas Natural History Museum, Lawrence, KS	2
LSUMZ	Louisiana State University, Museum of Zoology, Baton Rouge, LA	2
DMMECN	División de Mastozoología - Museo Ecuatoriano de Ciencias Naturales, Quito	4
QCAZ	Museo de Zoología, Pontificia Universidad Católica del Ecuador, Quito	6
ROM	Royal Ontario Museum, Toronto, ON	3
TTU	The Museum, Texas Tech University, Lubbock, TX	4
USNM	United States National Museum, Smithsonian Institution, Washington, DC	1
TOTAL		34

\*1995–2013 unpublished database on the mammals from Ecuador compiled by D. Tirira.

average: 30.9°C ± 0.8; new locality 31.6°C), temperature annual range (13.5%, model average: 11.1°C ± 1.3; new locality 12.3°C), and mean monthly temperature range (12.5%, model average: 9.4°C ± 1.0; new locality 10.1°C). These values also support the occurrence of *P. stenops* in transitional areas between deciduous and humid tropical, depicting a different scenario from those predicted for other phyllostomines based on a similar methodology (Narváez et al. 2012; Tirira et al. 2012a).

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## LITERATURE CITED

- Acosta, L. and F. Aguanta. 2006. Preliminary List of Mammals from the Experimental Forest Elías Meneses, Santa Cruz, Bolivia. *Kempffiana* 2(1): 144–149 ([http://museoelkempff.org/sitio/Informacion/KEMPPFIANA/Kempffiana%202\(1\)/144-149.pdf](http://museoelkempff.org/sitio/Informacion/KEMPPFIANA/Kempffiana%202(1)/144-149.pdf)).
- Albuja, L. 1982. *Murciélagos del Ecuador*. (1<sup>st</sup> ed.). Quito: Escuela Politécnica Nacional. Departamento de Ciencias Biológicas. 285 pp.
- Albuja, L. 1999. *Murciélagos del Ecuador*. (2<sup>nd</sup> ed.). Quito: Escuela Politécnica Nacional. Departamento de Ciencias Biológicas. 288 pp.
- Albuja, L. and P. Mena-V. 2004. Quirópteros de los bosques húmedos del occidente del Ecuador. *Politécnica* 25(1): 19–96 (<http://bibdigital.epn.edu.ec/bitstream/15000/4744/3/QuiropterosOccidente2004Biologia5.pdf>).
- Anderson, S. 1997. Mammals of Bolivia, taxonomy and distribution. *Bulletin of the American Museum of Natural History* 231: 1–652 (<http://digitallibrary.amnh.org/dspace/handle/2246/1620>).
- Ascorra, C.F., D.E. Wilson and M. Romo. 1991. Lista anotada de los quirópteros del Parque Nacional Manu, Perú. *Publicaciones del Museo de Historia Natural. Universidad Nacional Mayor de San Marcos (A)* 42: 1–14 (<http://museohn.unmsm.edu.pe/publizoo/publizoo42.htm>).
- Ascorra, C.F., D.L. Gorchov and F. Cornejo. 1993. The bats from Jenaro Herrera, Loreto, Perú. *Mammalia* 57(4): 533–552 (doi: 10.1515/mamm.1993.57.4.533).
- Bárquez, R.M., and R.A. Ojeda. 1979. Nueva subespecie de *Phylloderma stenops* (Chiroptera Phyllostomidae). *Neotrópica* 25(73):83–89 ([https://www.researchgate.net/publication/259475671\\_Nueva\\_subespecie\\_de\\_Phylloderma\\_stenops\\_\(Chiroptera\\_-\\_Phyllostomidae\)?ev=srch\\_pub](https://www.researchgate.net/publication/259475671_Nueva_subespecie_de_Phylloderma_stenops_(Chiroptera_-_Phyllostomidae)?ev=srch_pub)).
- Bredt, A., W. Uieda and E.D. Magalhaes. 1999. Morcegos cavernícolas da região do Distrito Federal, centro-oeste do Brasil (Mammalia, Chiroptera). *Revista Brasileira de Zoologia* 16(3): 731–770 ([www.scielo.br/pdf/rbzool/v16n3/v16n3a12](http://www.scielo.br/pdf/rbzool/v16n3/v16n3a12)).
- Brito J. and A. Arguero. 2012. Nuevos datos sobre la distribución de *Scolomys ucayalensis* (Rodentia: Cricetidae) y *Phylloderma stenops* (Chiroptera: Phyllostomidae) en Ecuador. *Mastozoología Neotropical* 19(2): 293–298 ([http://www.sarem.org.ar/wp-content/uploads/2013/06/SAREM\\_MastNeotrop\\_19-2\\_08\\_Brito.pdf](http://www.sarem.org.ar/wp-content/uploads/2013/06/SAREM_MastNeotrop_19-2_08_Brito.pdf)).
- Carrera, J.P., S. Solari, P.A. Larsen, D.F. Alvarado-Serrano, A.D. Brown, C.B. Carrión and J.S. Tello. 2010. Bats of the tropical lowlands of Western Ecuador. *Special Publications, Museum of Texas Tech University* 57: 1–37 (<http://www.nsr.ttu.edu/publications/specpubs/sps/SP57.pdf>).
- Cruz-Lara, L.E., C. Lorenzo, L. Soto, E. Naranjo and N. Ramírez-Marcial. 2004. Diversidad de mamíferos en cafetales y selva mediana de las cañadas de la selva Lacandona, Chiapas, México. *Acta Zoológica Mexicana* 20(1): 63–81 (<http://www.redalyc.org/pdf/575/57520106.pdf>).
- Díaz, M.M., L.F. Aguirre and R.M. Márquez. 2011. *Clave de identificación de los murciélagos del cono sur de Sudamérica*. Cochabamba, Bolivia: Centro de Estudios en Biología Teórica y Aplicada. 94 pp.
- Emmons, L.H. and F. Feer. 1997. *Neotropical rainforest mammals: a field guide*. (2<sup>nd</sup> ed.). Chicago: Chicago University Press. 307 pp.
- Esbérard, C.E.L., J.A. Mota and C. Perigro. 2005. Morcegos cavernícolas da APA Nascentes do Rio Vermelho, Goiás. *Revista brasileira de Zoociências* 7(2): 311–325 ([https://www.academia.edu/1212984/Morcegos\\_da\\_Area\\_de\\_Protecao\\_Ambiental\\_do\\_Rio\\_Vermelho\\_Goias](https://www.academia.edu/1212984/Morcegos_da_Area_de_Protecao_Ambiental_do_Rio_Vermelho_Goias)).
- Esbérard, C.E.L. and D. Faria. 2006. Novos registros de *Phylloderma stenops* Peters, na Mata Atlântica, Brasil (Chiroptera, Phyllostomidae). *Biota Neotropical* 6(2): 1–5 (<http://www.redalyc.org/pdf/1991/199114291025.pdf>).
- Gardner, A.L. (ed.) 2008 [2007]. *Mammals of South America: Volume I. Marsupials, Xenarthrans, Shrews, and Bats*. Chicago and London: University of Chicago Press. 690 pp.
- Goodwin, G.G. 1942. Mammals of Honduras. *Bulletin of the American Museum of Natural History* 79(2): 107–195 (<http://digitallibrary.amnh.org/dspace/handle/2246/986>).
- Goodwin, G.G. 1946. Mammals of Costa Rica. *Bulletin of the American Museum of Natural History* 87(5): 271–473 (<http://digitallibrary.amnh.org/dspace/handle/2246/316>).
- Goodwin, G.G. and A.M. Greenhall. 1964. New records of bats from Trinidad and comments on the status of *Molossus trinitatus* Goodwin. *American Museum Novitates* 2195: 1–23 (<http://digitallibrary.amnh.org/dspace/handle/2246/1270>).
- Handley, C.O. Jr. 1976. Mammals of the Smithsonian Venezuelan Project. *Brigham Young Brigham Young University Science Bulletin, Biological Series* 20(5): 1–89 (<https://ojs.lib.byu.edu/spc/index.php/BYUSciBullBioS/article/viewFile/30679/29161>).
- Kunz, T.H., C. Tidemann and G.C. Richards. 1996. Capturing small volant mammals; pp. 122–146, in: D.E. Wilson, F.R. Cole, J.D. Nichols, R. Rudran and M.S. Foster (ed.). *Measuring and Monitoring Biological Diversity. Standard Methods for Mammals*. Washington, D.C.: Smithsonian Institution Press.
- Jeanne, R.L. 1970. Note on a Bat (*Phylloderma stenops*) preying upon the brood of a social wasp. *Journal of Mammalogy* 51(3): 624–625 (doi: 10.2307/1378408).
- LaVal, R.K. 1977. Notes on some Costa Rican bats. *Brenesia* 10–11: 77–83 (<http://biblioteca.museocostarica.go.cr/articulo.aspx?id=2925&art=8698>).
- LaVal, R.K. and B. Rodríguez-H. 2002. *Murciélagos de Costa Rica*. Santo Domingo de Heredia: Instituto Nacional de Biodiversidad INBio. 320 pp.
- Ministerio del Ambiente del Ecuador. 2013. *Sistema de Clasificación de los Ecosistemas del Ecuador Continental*. Quito: Subsecretaría de Patrimonio Natural. 232 pp.

- Medellín, R.A., H.T. Arita and O. Sánchez. 2008. *Identificación de los murciélagos de México. Clave de campo*. (2<sup>nd</sup> ed.). México D.F.: Instituto de Ecología, UNAM-CONABIO. 89 pp.
- Narváez C.A., M.V. Salazar, D.G. Tirira and S.F. Burneo. 2012. Extensión de la distribución de *Vampyrus spectrum* (Linnaeus, 1758) (Chiroptera, Phyllostomidae) para el Suroccidente de Ecuador; pp. 201–208, in: D.G. Tirira and S.F. Burneo (eds.). *Investigación y Conservación sobre Murciélagos en el Ecuador*. Publicación especial sobre los mamíferos del Ecuador 9. Quito: Pontificia Universidad Católica del Ecuador, Fundación Mamíferos y Conservación and Asociación Ecuatoriana de Mastozoología.
- Parker, T.A. III, and J.L. Carr (eds.). 1992. *Status of Forest Remnants in the Cordillera de la Costa and Adjacent of Southwestern Ecuador*. Washington: Conservation International. Rap Working Papers 2. 172 pp ([http://www.conservation.org/Documents/RAP\\_Reports/RAP02\\_Cordillera\\_Costa\\_Ecuador\\_Oct-1992.pdf](http://www.conservation.org/Documents/RAP_Reports/RAP02_Cordillera_Costa_Ecuador_Oct-1992.pdf)).
- Phillips, S.J., R.P. Anderson and R.E. Schapire. 2006. Maximum entropy modeling of species geographic distributions. *Ecological Modelling* 190: 231–259 (doi:10.1016/j.ecolmodel.2005.03.026).
- Reid, F. 2009. *A Field Guide to the Mammals of Central America and Southeast Mexico*. (2<sup>nd</sup> ed.) US: Oxford University Press. 346 pp.
- Reid, F.A., M.D. Engstrom and B.K. Lim. 2000. Noteworthy records of bats from Ecuador. *Acta Chiropterologica* 2(1): 37–51.
- Rodríguez, F., M. Larrea, A. Ruíz, V. Benítez, F. Nogales, P. Suárez, I. Jaramillo and P. Guerrero (eds). 1995. *Caracterización Ecológica y Socio-Económica de la Isla Santay, Guayas, Ecuador*. Quito: Ecociencia. 115 pp.
- Salas, J. 2008. Murciélagos del Bosque Protector Cerro Blanco. *Chiroptera Neotropical* 14(2): 397–402 (<https://chiroptera.unb.br/index.php/cn/article/view/97>).
- Salas, J.A., F. Viteri H., M. Zambrano M., V. Benavides H. and R. Carvajal M. 2013. Distribution extension of Proboscis Bat *Rhynchonycteris naso* (Wied-Neuwied, 1820) (Chiroptera: Emballonuridae): New record for southwestern Ecuador. *Check List* 9(5): 1054–1056 (<http://www.checklist.org.br/getpdf?NGD275-12>).
- Sampaio E.M., E.K.V. Kalko, E. Bernard, B. Rodríguez-Herrera and C.O. Handley-Jr. 2003. A biodiversity Assessment of Bats (Chiroptera) in a Tropical Lowland Rainforest of Central Amazonia, including methodological and conservation considerations. *Studies on Neotropical Fauna and Environment* 38(1): 17–31 (doi: 10.1076/snfe.38.1.17.14035).
- Sampaio, E., B. Lim, S. Peters and J. Arroyo-Cabrales. 2008. *Phylloderma stenops*; in: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. Accessible at <http://www.iucnredlist.org/>. Captured on 03 May 2013.
- Sánchez-Palomino, P. and P. Rivas-Pava. 1993. Composición, abundancia y riqueza de especies de la comunidad de murciélagos en bosques de galería en la Serranía de La Macarena (Meta-Colombia). *Caldasia* 17(2): 301–312 (doi: 10.15446/caldasia)
- Simmons, N.B. 2005. Order Chiroptera; pp. 312–529, in: D.E. Wilson and D.M. Reeder (eds.). 2005. *Mammal Species of the World. A Taxonomic and Geographic Reference*, 3<sup>rd</sup> edition. Baltimore: Johns Hopkins University Press.
- Tirira, D. 1999. *Mamíferos del Ecuador*. Quito: Museo de Zoología. Centro de Biodiversidad y Ambiente. Pontificia Universidad Católica del Ecuador/ Simbioe. Publicación Especial 2. 374 pp.
- Tirira, D. 2007. *Guía de Campo de los Mamíferos del Ecuador*. Ediciones Murciélago Blanco. Quito: Publicación especial sobre los mamíferos del Ecuador 6. 576 pp.
- Tirira, D. 2008. *Mamíferos de los Bosques Húmedos del Noroccidente del Ecuador*. Ediciones Murciélago Blanco. Quito: Publicación especial sobre los mamíferos del Ecuador 7. 352 pp.
- Tirira, D., S.F. Burneo and D. Valle. 2012a. Distribution extension of *Chrotopterus auritus* (Peters, 1856) (Chiroptera: Phyllostomidae) for southwestern Ecuador; pp. 195–200, in: D.G. Tirira and S.F. Burneo (eds.). *Investigación y Conservación sobre Murciélagos en el Ecuador*. Publicación especial sobre los mamíferos del Ecuador 9. Quito: Pontificia Universidad Católica del Ecuador, Fundación Mamíferos y Conservación and Asociación Ecuatoriana de Mastozoología.
- Tirira, D.G., S.F. Burneo, K. Swing, J. Guerra and D. Valle. 2012b. Comentarios sobre la distribución de *Amorphochilus schnabli* Peters, 1877 (Chiroptera, Furipteridae) en Ecuador; pp. 209–216, in: D.G. Tirira and S.F. Burneo (ed.). *Investigación y Conservación Sobre Murciélagos en el Ecuador*. Publicación especial sobre los mamíferos del Ecuador 9. Quito: Pontificia Universidad Católica del Ecuador, Fundación Mamíferos y Conservación and Asociación Ecuatoriana de Mastozoología.
- Trajano, E. 1982. New records of bats from southeastern Brazil. *Journal of Mammalogy* 63(3): 529 (doi: 10.2307/1380462).
- Trujillo, G.F. and L. Albuja. 2005. Nuevos registros de *Phylloderma stenops* (Chiroptera: Phyllostomidae) y *Lasiurus borealis* (Chiroptera: Vespertilionidae) para el Ecuador. *Politécnica* 26(1): 45–53. (<http://bibdigital.epn.edu.ec/bitstream/15000/4011/1/Phylloderma%20stenops.pdf>)
- Williams, S.L. and H.H. Genoways. 2008 [2007]. Subfamily Phyllostominae Gray, 1825; pp. 255–300, in: A.L. Gardner (ed.). *Mammals of South America. Volume I: Marsupials, Xenarthrans, Shrews, and Bats*. Chicago and London: Chicago University Press.
- York, H. 2008. Observations of frugivory in *Phylloderma stenops* (Chiroptera: Phyllostomidae). *Caribbean Journal of Science* 44(2): 257–260 ([http://caribjsci.org/July08/44\\_257-260.pdf](http://caribjsci.org/July08/44_257-260.pdf)).

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