

Mammalia, Chiroptera, Thyropteridae, *Thyroptera tricolor* Spix, 1823: Distribution extension in Ecuador

Carlos E. Boada^{1,2}, Diego G. Tirira², M. Alejandra Camacho¹ and Santiago F. Burneo^{1*}

1 Museo de Zoología de la Pontificia Universidad Católica del Ecuador (QCAZ), Av. 12 de Octubre 1076 y Roca, Quito, Ecuador

2 Fundación Mamíferos y Conservación, Víctor Balseca No. 100, Conocoto, Quito, Ecuador

* Corresponding author E-mail: sburneo@puce.edu.ec

ABSTRACT: In Ecuador, *Thyroptera tricolor* is distributed on the northern coastal region, in Amazonia, and in the foothills of the Andes between 50 to 1,800 m of altitude. We reported a capture of a non-breeding female at El Descanso, Los Ríos Province, in the central coastal region of Ecuador. With this record, we have extended the geographical distribution of *T. tricolor* in Ecuador 55 km further south. Using the available data for Ecuador, a predictive distribution model was generated using a Maximum Entropy approach.

Bats of the family Thyropteridae are characterized by the presence of circular or oval sucking disks on the bases of the thumbs and soles of the feet. Members of this family are therefore known as New World Sucker-footed Bats. The discs are used to support the bats while hanging, head up, mostly inside the tubular young leaves of *Heliconia* (Nowak 1999). The family is endemic to the Neotropics with a wide distribution in rainforests from southern Mexico, Central America, and into South America to southern Brazil. The family is represented by a single genus *Thyroptera* that is composed of four insectivorous species (Wilson 2008).

Three species of *Thyroptera* are found in Ecuador: *Thyroptera discifera* Lichtenstein and Peters 1854, *Thyroptera lavalii* Pine 1993 and *Thyroptera tricolor* Spix 1823. *Thyroptera lavalii* is known only from three records in the Yasuní National Park (Reid *et al.* 2000), while *T. discifera* is found only in the tropical rainforests of the northern coastal region between 50 – 700 m of altitude (Tirira 2007). Of these three species, *T. tricolor* is most commonly observed, and is the most widely distributed. This species is distributed in tropical forests from southern Mexico to Bolivia, Peru, south Brazil, and Trinidad (Nowak 1999; Simmons 2005). The northernmost recorded observation is near Sontecomapán, Veracruz, México, while the most southern recorded observation is the type locality of the subspecies *T. t. juquiaensis*, in southern Brazil (Wilson and Findley 1977).

In Ecuador, *T. tricolor* has been found on the northern coast, in Amazonia, and in the foothills of the Andes between 50 to 1,800 m of altitude, being more common below 600 m (Tirira 2007). Although *T. tricolor* is a widely distributed species, it is nevertheless considered a rare species by Albuja (1999), and uncommon by Tirira (2007) in Ecuador.

During May 2007, a survey of mammals was performed at El Descanso (Cantón Buena Fé), Los Ríos Province, in the central coast of Ecuador. The area is quite disturbed primarily by the conversion of natural forests in large

monoculture crops, especially bananas and pineapples. There are small remnants of primary forest along the Baba River within the study area. Specimens were captured in a disturbed area that has practically no forest remains. The habitat consisted of rubber tress surrounded by grassland. The study area has an annual mean temperature of 24.6 °C (min 20.2 – max 29.0) and a yearly rainfall of 2570 mm.

In this study we captured 104 individuals, with representatives from 13 species. In addition to *T. tricolor*, we captured *Anoura geoffroyi* Gray, 1838, *Artibeus lituratus* (Olfers, 1818), *Artibeus jamaicensis* Leach, 1821, *Dermanura rava* Miller, 1902, *Carollia brevicauda* (Schinz, 1821), *Carollia perspicillata* (Linnaeus, 1758), *Glossophaga soricina* (Pallas, 1766), *Phyllostomus discolor* (Wagner, 1843), *Platyrrhinus matapalensis* Velazco, 2005, *Sturnira lilium* (Geoffroy, 1810), *Sturnira ludovici* Anthony, 1924, and *Sturnira luisi* Davis, 1980. These species are usually associated with disturbed ecosystems.

One individual *T. tricolor* (QCAZ 8898) was captured in a mist net located at 0°39'41.5" S, 79°25'26.7" W at an altitude of 150 m. The habitat consisted of rubber trees surrounded by grassland.

The individual is a non-breeding female and has a long dorsal pelage with dark brown streaks; the ventral pelage is whitish and contrasts clearly with the fur on its back. The alcohol preserved specimen had the following measurements (in millimeters): total length 38.62, cranial length 15.54, tail length 26.50, foot length 5.22, ear length 11.41, forearm 37.82, calcar 8.34, hand disc diameter 3.52, and foot disc diameter 2.08.

Some authors have stated that *T. tricolor* use shelters that are near water and in shadows away from direct sunlight (Villa 1966; dos Reis *et al.* 2007; Aguirre 2007). Esbérard *et al.* (2007) recorded the first occurrence of *T. tricolor* in Brazilian caves. The occurrence of this species in disturbed areas has already been reported: Findley and Wilson (1974) found individuals in clearings and along the edges of roads and trails.

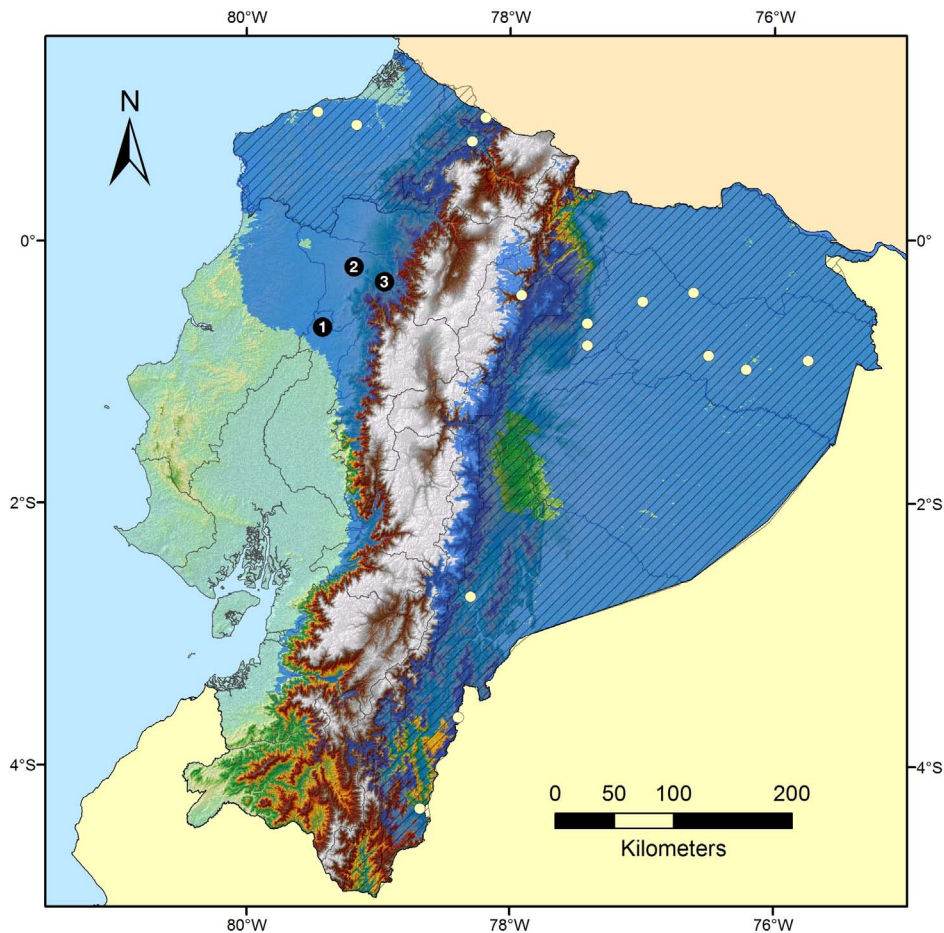


FIGURE 1. Distribution of *Thyroptera tricolor*. Black lines represent the current distribution as reported by Tirira (2007). Blue shading represents the predictive distribution model in Ecuador. Yellow dots and numbered locality points represent known observations: 1. El Descanso (Buena Fe), Los Ríos Province, western southernmost known occurrence; 2. Finca La Esperanza, Santo Domingo de los Tsáchilas Province (Wilson 2008); 3. La Unión del Toachi, Pichincha Province (Tirira 2008).

Before this work, the southernmost records of *T. tricolor* in Ecuador, and west of the Andes in South America, were an individual collected in 1979 by J. Ayala, at Finca La Esperanza, Santo Domingo de los Tsáchilas Province (MEPN 3019), at 0°15' S, 79°09' W at 600 m (Wilson 2008), and another collected near La Unión del Toachi, Pichincha Province (QCAZ 5617), at 0°19' S, 78°57' W at 950 m (Tirira 2008).

With this new observation, we have extended the geographical distribution of *T. tricolor* in Ecuador (and for South America west of the Andes) 55 km further south (Figure 1).

Using the available data for Ecuador, a predictive distribution model was generated using a Maximum Entropy approach (MaxEnt, Phillips *et al.* 2006). Five replications of the model were run separating 20 % of the occurrences in a test set for evaluation purposes by measuring the area under the ROC curve (AUC) in each evaluation set, following a methodology that has been proven useful for small numbers of occurrences (Burneo *et al.* 2009). The mean AUC for the model replications were 0.910 (SD = 0.019). The model predicts the distribution for *T. tricolor* in areas where they have not yet been observed (Figure 1).

The climatic envelope that the model predicted for this species included an annual mean temperature of 22.9 °C (± 2.57), and a mean annual rainfall of 2926 mm

(± 651), which are consistent with the new locality for this observation. Also, two bioclimatic variables explained 57 % of the variation seen in the model: the mean temperature of the warmest quarter (model average: 23.5 °C ± 2.6), and precipitation of the driest month (model average: 140.7 mm ± 70.8). The temperature (25.6 °C) at the new location is consistent with the predictions of the model, but the model prediction for precipitation is higher than the annual average of the new location (29 m), which suggests that this location is likely near the edge of the climatic envelope.

ACKNOWLEDGMENTS: To Felipe Moscoso for logistic support of the field work. To Museo de Zoología at the Pontificia Universidad Católica del Ecuador (QCAZ) for allowing us to take measures of the specimen and letting us use the data collection of *Thyroptera tricolor*. To Pablo Moreno and Luis Albuja for providing the data collection from MECN and MEPN, respectively. To Ashley Anderson and Eric Fortune, for reviewing previous drafts of this paper.

LITERATURE CITED

- Aguirre, L. 2007. *Historia natural, distribución y conservación de los murciélagos de Bolivia*. Santa Cruz de la Sierra: Centro de Ecología y Difusión Simón I. Patiño. 416 p.
- Albuja, L. 1999. *Murciélagos del Ecuador*, 2nd edition. Quito: Cicetrónica Cía. Ltda. Offset. 288 p.
- Burneo, S.F., J.F. González-Maya and D.G. Tirira. 2009. Distribution and habitat modeling for Colombian Weasel *Mustela felipei* in the Northern Andes. *Small Carnivore Conservation* 41: 41-45.

- dos Reis, N.R., A.L. Peracchi, W.A. Pedro and I.P. de Lima. 2007. *Morcegos do Brasil*. Londrina: Universidade Estadual de Londrina. 254 p.
- Esbérard, C.E.L., B.S. Santos and D. Faria. 2007. New *Thyroptera tricolor* Spix records in the Atlantic Forest, Brazil (Chiroptera; Thyropteridae). *Brazilian Journal of Biology* 67(2): 379-380.
- Findley, J.S. and D.E. Wilson. 1974. Observations on the Neotropical Disk-winged Bat, *Thyroptera tricolor* Spix. *Journal of Mammalogy* 55: 562-571.
- Nowak, R. 1999. *Walker's mammals of the world*. 6th edition. Volume 1. Baltimore: The Johns Hopkins University Press. 836 p.
- Phillips, S.J., R.P. Anderson and R.E. Schapire. 2006. Maximum entropy modeling of species geographic distributions. *Ecological Modelling* 190: 231-259.
- Reid, F.A., M.D. Engstrom and B.K. Lim. 2000. Noteworthy records of bats from Ecuador. *Acta Chiropterologica* 2: 37-51.
- Simmons N.B. 2005. Order Chiroptera; p. 312-529 In D.E. Wilson and D.M. Reeder (ed.) *Mammal species of the world: a taxonomic and geographic reference*, 3rd ed. Baltimore: Johns. Hopkins University Press.
- Tirira, D.G. 2007. *Guía de campo de los mamíferos del Ecuador*. Ediciones Murciélago Blanco. Quito: Publicación especial sobre los mamíferos del Ecuador 6. 576 p.
- Tirira, D.G. 2008. *Mamíferos de los bosques húmedos del noroccidente del Ecuador*. Ediciones Murciélago Blanco. Quito: Publicación especial sobre los mamíferos del Ecuador 7. 352 p.
- Villa, B. 1966. *Los murciélagos de México*. Instituto de Biología. México DF: Universidad Nacional Autónoma de México. 491 p.
- Wilson, D. 2008. Family Thyropteridae; p. 392-396 In A. L. Gardner (ed.). *Mammals of South America. Volume I. Marsupials, Xenarthrans, Shrews and Bats*. Chicago: The University of Chicago Press.
- Wilson, D.E. and J.S. Findley. 1977. *Thyroptera tricolor*. *Mammalian Species* 71: 1-3.

RECEIVED: November 2009

REVISED: April 2010

ACCEPTED: April 2010

PUBLISHED ONLINE: April 2010

EDITORIAL RESPONSIBILITY: Marcelo R. Nogueira