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First record of *Cyttarops alecto* in Ecuador

Primer registro de *Cyttarops alecto* en Ecuador

Isabela Vivas-Toro[1,2*], María A. Camacho[3], and Santiago F. Burneo[3]

[1]Museo de Zoología "Alfonso L. Herrera", Facultad de Ciencias, Universidad Nacional Autónoma de México. Circuito Exterior s/n, C. P. 04510, Ciudad Universitaria. Ciudad de México, México. E-mail: isavivas94@gmail.com (IV-T).

[2]Posgrado en Ciencias Biológicas, Unidad de Posgrado. Edificio D, 1° Piso, Circuito de Posgrados, C. P. 04510, Ciudad Universitaria. Ciudad de México, México.

[3]Museo de Zoología, Pontificia Universidad Católica del Ecuador. Avenida 12 de Octubre 1076 y Roca. Quito, Ecuador. E-mail: macamachom@puce.edu.ec (MAC); sburneo@puce.edu.ec (SFB).

*Corresponding author

Cyttarops alecto Thomas, 1913 is one of the rarest Neotropical bat species found in biological collections. Here we report the first record of *C. alecto* for Ecuador, which represents a new genus and species of Emballonuridae for the country. This record is based on an adult male specimen from Yasuní National Park, Orellana, Northeastern Ecuador, which was held in a national mammal collection previously misidentified as *Peropteryx macrotis*. We provide a detailed description of the specimen and an updated distribution map for the species. We show the importance of reviewing and verifying identifications of voucher specimens in biological collections as they contribute to historical knowledge of distributions and biodiversity.

Key words: Distribution update; northeastern Ecuador; Orellana; preserved specimen; short-eared bat.

Cyttarops alecto Thomas, 1913 es una de las especies neotropicales más raras de encontrar en las colecciones biológicas. En el presente estudio reportamos el primer registro de *C. alecto* para Ecuador, que representa un nuevo género y especie de Emballonuridae para el país. Este registro se realizó a partir de un espécimen de macho adulto proveniente del Parque Nacional Yasuní, Orellana, al noreste de Ecuador, preservado en una colección nacional de mamíferos y que estaba previamente mal identificado como *Peropteryx macrotis*. Presentamos una descripción detallada del espécimen y un mapa de distribución actualizado de la especie. Nuestro trabajo demuestra la importancia de revisar y verificar las identificaciones de los ejemplares en colecciones biológicas pues estos contribuyen al conocimiento histórico de las distribuciones y a la biodiversidad.

Palabras clave: Actualización de distribución; espécimen preservado; murciélago de orejas cortas; noreste de Ecuador; Orellana.

Cyttarops alecto Thomas, 1913, also known as the short-eared bat, is an Emballonurid bat belonging to the Neotropical subtribe Diclidurini and the monotypic genus *Cyttarops* (Simmons and Cirranello 2023). Although it is considered widespread ranging from Nicaragua to Brazil, Perú and north of Bolivia (Baker and Jones 1975; Aguirre *et al.* 2010; Bonaccorso 2019), it appears to be patchily distributed with records in South America from only a few individuals or single locations (*e. g.*, Velazco *et al.* 2011; Rivas and Ferrer 2012; Ludeña and Medina 2017). The distributional gaps suggest that the range may be underestimated and may be more widespread than thought (Ochoa *et al.* 1994).

The species inhabits humid lowland forests and riparian gallery forests below 500 m where it roosts in relatively open areas in groups of 1 to 10 individuals (Bonaccorso 2019). It is insectivorous and forages near creeks, small rivers and forests (Jung *et al.* 2007). There is scarce information about its biology, ecology and natural history (Nunes *et al.* 2006; Hood and Gardner 2008). It is considered a least concern species by the International Union for Conservation of Nature and Natural Resources (IUCN; Lim *et al.* 2016). The species generally detects and avoids traditional capture methods, such as ground mist nets, resulting in low representation within biological collections (Francis 1989; Bonaccorso 2019). Currently, there are less than 40 specimens in collections, from Brazil, Colombia, Costa Rica, Guyana, Nicaragua and Suriname (Global Biodiversity Information Facility (GBIF; https://www.gbif.org/es/species/2433138). The presence of *C. alecto* in Colombia (Ochoa *et al.* 1994; Calderón-Capote *et al.* 2016), Perú (Velazco *et al.* 2011) and other countries within the Amazon basin (Masson and Cosson 1992; Lim 2007; Aguirre *et al.* 2010; Rivas and Ferrer 2012; Tavares *et al.* 2012) suggests it could also occur in Ecuador. However, to date there are no voucher specimens available for verification. Herein, we present the first documented record of *C. alecto* for Ecuador, which was identified from a specimen preserved in a national biological collection.

The specimen of *C. alecto* was discovered in the Colección de Mastozoología del Museo de Zoología de la Pontificia Universidad Católica del Ecuador (QCAZ). It was previously misidentified as *Peropteryx macrotis.* The speci-

men was captured on July 31, 1999 by P. Jarrín at the Yasuní scientific station, Yasuní National Park, Orellana, Ecuador (0° 40' 41.484'' S, 76° 23' 47.76'' W, 200 m; Figure 1).

Yasuní National Park is the largest protected area in continental Ecuador (Ministerio del Ambiente 2015). It is located in the Amazon basin, in the Napo Moist Forest ecoregion (Olson *et al.* 2001) and is part of the Napo-Curaray lowland evergreen forest, according to the Ecuadorian Ministry of Environment's Ecosystem Classification System (Ministerio del Ambiente 2012). It is characterized by low hills, heavily dissected hills with steep slopes, flat terraces, and small valleys, from marine, lacustrine, and fluvial sediments, between 250 and 400 m of elevation (Guevara *et al.* 2013).

External and cranial measurements were taken using a digital caliper with 0.01 mm precision following Simmons and Voss (1998) and Van Cakenberghe *et al.* (2002). We were unable to obtain accurate measurements of the ears and tragus because they were partially folded. In the same way, the total body length could have been altered due to the taxidermic work and consequently was not measured. Since there were no records of these measurements on the specimen label either, we did not consider them.

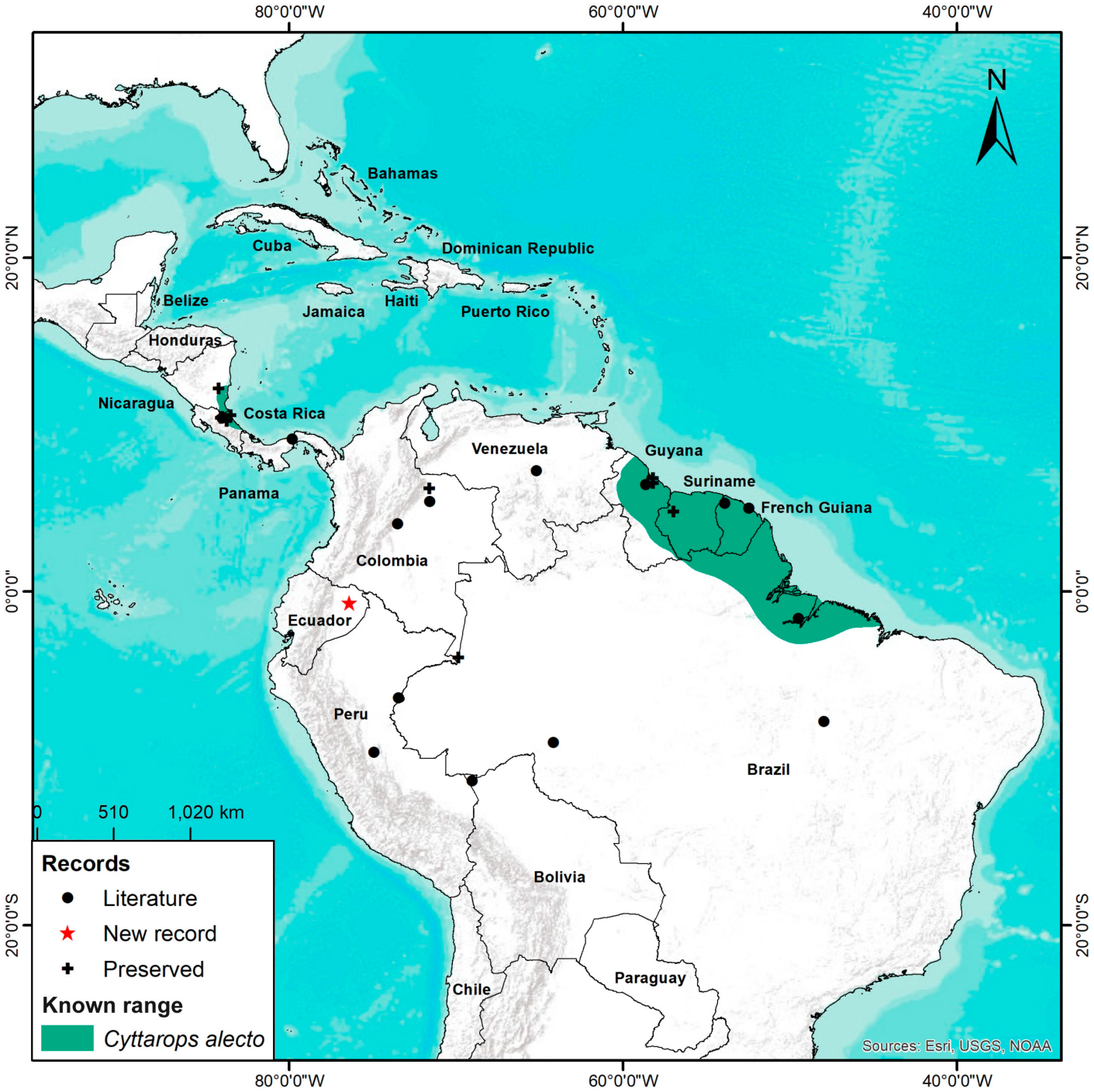

Figure 1. Location of new record of *Cyttarops allecto* (star); circles and crosses are occurrences from GBIF (GBIF, https://www.gbif.org/es/species/2433138), Masson and Cosson 1992, and Ludeña and Medina 2017; green polygon represents the known range excluding locations with only one record (edited from Marsh *et al.* 2022).

We verified the identification, based on published descriptions (Starrett and de la Torre 1964; Hood and Gardner 2008; Díaz *et al.* 2021) and comparing morphological measurements to those in current publications (Starrett and de la Torre 1964; Tavares *et al.* 2012; Calderón-Capote *et al.* 2016; Ludeña and Medina 2017; see Table 1). Some measurements were not comparable due to the lack of historical data (mandible length, toothrow length, skull height from bullae, tibia). The skull was photographed in its original state of preservation to avoid deterioration because of its delicate condition. Finally, we present an updated distribution map for *C. alecto*, which incorporates published and verified records, including our recent discovery in Ecuador.

The specimen QCAZM 3298 correspond to an adult male. It was assigned as *C. alecto* based on the following diagnostic characters: low rounded ears, broad antebrachial membrane which extends to the base of the distal phalanx of the thumb, absence of antebrachial sac, long strong calcar (±16 mm, 16.21 mm in this study), silky fur (Starrett and de la Torre 1964) and a patch of bare skin on the forehead (Velazco *et al.* 2011). The skull has a deep cuplike depression in the rostrum and long postorbital processes that are not fused to the supraorbital ridge (Hood and Gardner 2008; Díaz *et al.* 2021; Figure 2).

Measurements are within the range reported for the species across its distribution (Table 1). Other measures taken but not compared are: skull height from bullae = 7.5 mm; tibia = 19 mm; mandible toothrow = 6.04 mm. The Ecuadorian specimen has almost uniform grayish-brown fur and is ventrally slightly lighter, which is somewhat different to the smoky gray fur that has been recently reported for the species in Colombia or Nicaragua (Calderón-Capote *et al.* 2016; Medina-Fitoria *et al.* 2016). The specimen also presents a diastema between the upper premolars, similar to that reported in specimens from Brazil (Tavares *et al.* 2012), Colombia (Calderón-Capote *et al.* 2016), Perú (Velazco *et al.* 2011; Ludeña and Medina 2017) and Venezuela (Rivas and Ferrer 2012), as well as a well-developed posterior ventral process in the mandible.

This voucher specimen QCAZ 3898 was misidentified as *P. macrotis*. However, despite their similar size, distinguishing *C. alecto* from *P. macrotis* is straightforward, as *P. macrotis* has a small glandular sac near the anterior edge of the antebrachial membrane, larger ears (Hood and Gardner 2008), and free thumbs. Another significant difference between these two species is that *C. alecto* has a skull with a cup-shaped depression, a feature lacking in *P. macrotis* (Díaz *et al.* 2021).

Table 1. Selected external and cranial measurements of *Cyttarps alecto*. Comparison of measurements between the Ecuadorian specimen (QCAZ 3898) and other recorded specimens along its distribution. TBL = Total body length, TL = Tail length, HF = Hind foot length, EAR = Ear length, FA = Forearm length, GLS = Greatest length of the skull, CBL = Condylobasal length, ZB = Zygomatic breadth, MB = Mastoid breadth, BBC = Braincase breadth, TR = Maxillary toothrow length, C-M3 = Canine-molar length, M3-M3 = Breadth across molars, Mand = Mandible length. Values between parentheses represent range values of that measurement. The numbers before each sex mean the number of specimens from which the average values were obtained for each case. Global average does not include this study specimen. *Measures from a single specimen.

Measurement	Ecuador	Colombia	Perú	Brazil	Global Average	
	Orellana	Meta and Casanare	Panguana	Belem (holotype)		
Sex	Male	4 Male	Male	Male	12 Male	11 Female
TBL	-	70.5 (63-78)	-	-	69.25 (63-78)	74 (71-75)
TL	16.2	22 (15-26)	-	20	21 (15-26)	21 (18-25)
HF	6.58	8 (7-9)	10	8	7.8 (5-10)	8.62 (7-9.90)
EAR	-	14 (13-15)	11	10	11.83 (10-15)	12.35 (10-13.40)
FA	41.16	42.87 (41.60-44.15)	45	46	44.46 (40-46)	46.76 (44-57)
GLS	13.35	13.22 (13.12-13.33)	13.52	12.6	13.33 (13.12-13.60)	13.68 (13.48-13.90)
CBL	12.57	12.02 (11.80-12.33)	12.8	-	12.64 (11.8-12.8)	12.75 (12.30-13.20)
ZB	8.38	8.27 (8.15-8.44)	8.28	8	8.36 (8-8.80)	8.50 (8-8.88)
MB	7.20	7.23 (7.10-7.45)	7.36	-	7.43 (7.10-7.70)	7.52 (7.4-7.60)
BBC	6.66	6.62 (6.46-6.89)	6.79	7	6.86 (6.46-7.10)	6.99 (6.70-7.10)
TR	5.60	-	5.21	-	5.21 (5.21)*	5.26 (5.10-5.37)
C-M3	5.20	5.24 (5.13-5.36)	-	5.5	5.38 (5.24-5.50)	5.50 (5.40-5.60)
M3-M3	5.91	5.77 (5.69-5.93)	-	6	6.02 (5.77-6.30)	5.90 (5.90)*
Mand	9.42	-	-	-	9.90 (9.90)*	9.96 (9.90-10)
tr	5.90	-	-	-	-	5.80 (5.80)*
Weigh	-	5.5 (5-6)	8	-	6.56 (5.50-8)	6.72 (5.6-9)
Source	This study	Calderón-Capote *et al.* 2016	Ludeña and Medina 2017	Thomas 1913	Thomas 1913; Starrett and Casebeer 1968; Masson and Cosson 1992; Reid and Langtimm 1993; Ochoa *et al.* 1994; Velazco *et al.* 2011; Calderón-Capote *et al.* 2016	Starrett and de la Torre 1964; Baker and Jones 1975; Reid and Langtimm 1993; Rivas and Ferrer 2012; Tavares *et al.* 2012; Calderón-Capote *et al.* 2016; Luñeda and Medina 2017

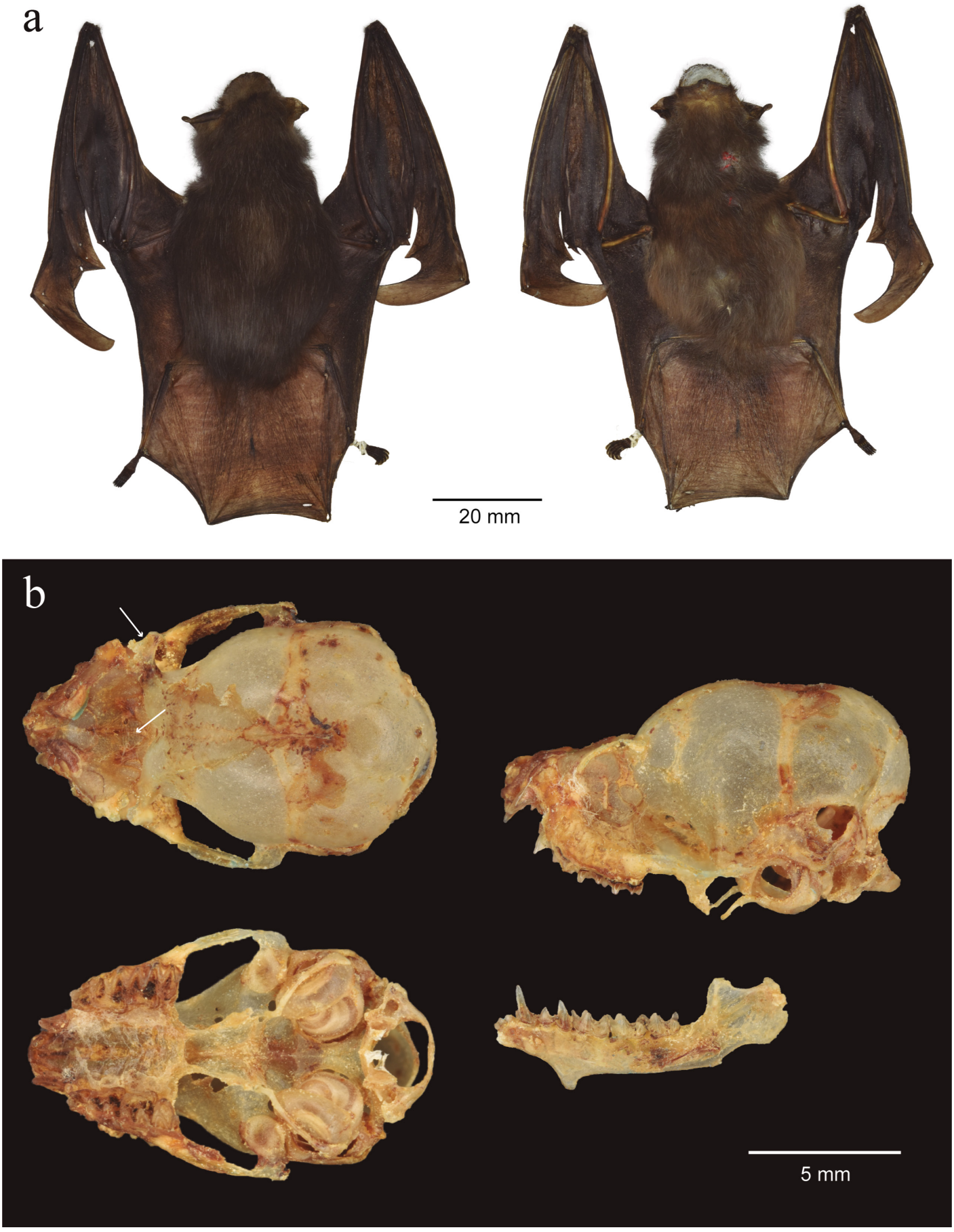

Figure 2. Skin and skull of an adult male of *Cyttarops alecto* (QCAZM 3298). a) Preserved skin, dorsal and ventral view. b) Skull, dorsal, ventral and lateral view, and lateral view of the mandible. White arrows show two diagnostic characters: cuplike depression in the rostrum; long postorbital processes.

This new record of *C. alecto* confirms the presence of the bat in Ecuador, increasing the known genera and species of the Emballonuridae family for the country, for a total of 8 genera and 13 species (Tirira *et al.* 2023). It also expands the distribution of the *C. alecto* in northwestern South America by 920 km to the south of the Colombian locations and, 810 km to the west and 950 km to the north of the Peruvian reported locations, confirming the prediction of occurrence in other areas within the Amazon basin (Bonaccorso 2019). Yasuní National Park is one of the most biodiverse ecosystems in the world, and is considered a site of global conservation significance (Bass *et al.* 2010). The presence of *C. alecto* in the region reveals that much remains to be explored and discovered in this vast protected area. Our work demonstrates the relevance of biological collections as a research source and the importance of reviewing preserved specimens for the identification and knowledge of biodiversity.

We detected some differences in the fur color of *C. alecto* from Ecuador in relation with recently recorded specimens, although it seems to be within the color range reported for the species according to Hood and Gardner (2008) and older descriptions (Starrett and de la Torre 1964). The general morphological measurements of the specimen QCAZM 3298 are also within the historical ranges reported for the species, although it should be noted that several of these measures have wide range values (*e. g.*, forearm and tail length; Table 1). Similar to what was reported for Colombia (Calderón-Capote *et al.* 2016), we also observed a diastema between the upper premolars in the Ecuadorian specimen. This trait, along with the level of development of the posterior ventral process of the mandible, seem to be variable within the species and do not follow an apparent geographic pattern. It is evident that gaps still exist in the current distribution of *C. alecto* and additional surveys are required for a better understanding of its range and morphological variation.

Mist nets have proven less effective for emballonurids and other insectivorous bats since high rates of net avoidance and/or above-canopy foraging preferences are common among these groups (Berry *et al.* 2004; Kalko *et al.* 2008). Mist netting near roosts or foraging areas seems to improve capture rate (Díaz and Linares García 2012), although it has the drawback that finding roosts can be challenging. Although *C. alecto* is adept at avoiding mist nets, its vocal signatures are readily identified (Jung *et al.* 2007; Barataud *et al.* 2013), implementing combined strategies such as acoustic sampling, harp traps and mist netting at different heights could improve detection of these elusive bats.

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