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Integrative taxonomy of *Cercomacroides serva* (Sclater, 1858) demonstrates the validity of *C. hypomelaena* (Sclater, 1890) comb. nov. (Aves: Thamnophilidae)

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Abstract

Cercomacroides serva is widely distributed in northern South America. However, this species has never been thoroughly evaluated taxonomically. We conducted a taxonomic study of three taxa currently classified under *Cercomacroides serva*, based on a study of 307 skins and 145 recordings of male loudsongs. Females from the northwest Amazonian population differ qualitatively from populations from the southwest Amazon in the coloration of the upperparts, primary, and tail. Male loudsongs are superficially similar between these two populations, but the shape of the notes differs significantly. There is no evidence of intergradation or clinal variation in female plumage or male loudsongs. Based on differences in plumage coloration, loudsongs, and lack of evidence of intergradation, we suggest that two species are best recognized. The name *Cercomacroides serva* is here restricted to populations north of the Marañon River in Peru, to the north in Ecuador, and in southwestern Colombia. The name *Cercomacroides hypomelaena* **comb. nov.** is revived. This species is found south of the Marañon River, and on both banks of the Ucayali River in Peru, to the eastern left bank of the Madeira River in Brazil, and in northern Bolivia.

Keywords

Bioacoustics, *Cercomacra serva*, morphology, species limits, taxonomy, vocalizations, western Amazonia

Introduction

Cercomacroides Tello & Raposo, 2014 was once classified within *Cercomacra* Sclater, 1858, which has traditionally comprised two clades: the *nigricans* and *tyrannina* groups (Silva 1992; Tello et al. 2014). A well-supported molecular phylogeny showed that *Cercomacra* (sensu Dickinson 2003) is a paraphyletic assemblage, and a new generic name for the *tyrannina* clade was warranted (Tello et al. 2014). As a result, *Cercomacroides* currently has six species (*C. laeta*, *C. parkeri*, *C. tyrannina*, *C. serva*, *C. nigrescens*, and *C. fuscicauda*; Gill et al. 2023). The latter was treated as a subspecies of *C. nigrescens* but was subsequently shown to be vocally distinct from other subspecies of *C. nigrescens* (Mayer et al. 2014).

Pyriglena serva (= *Cercomacroides serva*) was described by Sclater (1858) based on specimens collected near the Napo River, in Eastern Ecuador. *Cercomacra*

hypomelaena (= *Cercomacroides hypomelaena*), from southeastern Peru, was originally described as a full species a few decades later (Sclater 1890), but was later synonymized with *C. serva* due to the similarity of the plumage between these topotypical males and males of *C. hypomelaena* from Peru (Cory and Hellmayr 1924, Dickinson and Christidis 2014). This taxon was treated as a valid subspecies, *C. s. hypomelaena*, after an evaluation of a larger series of specimens (Zimmer 1931). This arrangement was followed by Peters (1951) and maintained by Zimmer and Isler (2003), who suggested that *hypomelaena* represents paler plumaged birds on a cline found in the southernmost portion of the distribution area of the species (Zimmer and Isler 2003). Dickinson and Christidis (2014) referred to Zimmer and Isler (2003) to justify synonymizing *hypomelaena* with *serva*, a recommendation in accordance with current authorities (Gill et al. 2023). None of these authors considered *C. tyranina* (sic) *atrogularis*, Lletget, 1918, a neglected synonym of *C. s. serva* (Lletget 1918). Because these taxonomic and nomenclatural histories have not been properly evaluated in modern times, and since there is only incipient genetic information that cannot properly address the taxonomy of multiple lineages (Tello et al. 2014), we conducted a taxonomic review of the *Cercomacroides serva* complex. We based our evaluations on morphological and vocal characteristics, considering all available names, and analyzing specimens from the entire range of its taxa.

Methods

Plumage coloration

We evaluated 307 specimens of both sexes from the entire range of *C. serva* spp., including all type specimens, as well as the holotype of *C. tyranina* (sic) *atrogularis* (Appendix 1). The coloration of (i) crown, (ii) forehead, (iii) lores, (iv) eyebrows, (v) auricular region, (vii) upperparts, (vii) throat, (viii) belly, (ix) flanks, (x) primaries, and (xi) tail were determined and compared between specimens, and were coded according to Munsell (1994).

Morphometrics

Morphometric characters were measured to the nearest 0.05 mm using a digital caliper and a 1 mm precision ruler, and included (i) culmen length (**BNdist**, from the distal edge of the nostril to the tip of the bill), (ii) bill height (**Bd**, at the distal edge of the nostril), (iii) bill width (**BWd**, at the distal edge of the nostril), (iv) tail length (**T1**, from between the innermost rectrices to the tip of the longest feather), (v) tail graduation (**Tgrad**, from the tip of the longest to the shortest feather), (vi) tarsus length (**Tar1**, from the joint between the tarsus and toes to the intertarsal joint), and (vii) wing chord (**Wchord**, distance from the carpal joint to the tip of the wing). All birds were measured by one person and on the left side of specimens in a standardized manner (Eck et al. 2011).

Vocalizations

A total of 145 recordings were analyzed (Appendix 2). Notes were considered as continuous lines separated by silence on a spectrogram, while phrases comprised one or a group of notes (Isler et al. 1998). Vocal characteristics included (i) highest frequency, (ii) lowest frequency, (iii) maximum frequency, (iv) bandwidth, (v) song duration, (vi) pace 1 (pace of the first half of a phrase), (vii) pace 2 (pace of the second half of a phrase), (viii) change in pace (pace 1/pace 2, indicating whether loudsongs accelerate or deaccelerate), (ix) peak time, and (x) number of notes. Highest frequency is the upper frequency bound of the selection, and the maximum frequency is defined as the frequency at which maximum power occurs within the selection. Loudsongs were analyzed with Raven 1.4 (Charif et al. 2010), and spectrograms were created with the warbleR package (Araya-Salas and Smith-Vidaurre 2017) with window length = 600 and overlap = 90.

We considered diagnostic morphological and vocal features as an indication of full species rank, following the Phylogenetic Species Concept (Cracraft 1983). Since vocal learning is absent from most Thamnophilidae, their vocalization is said to be innate and evidence for species recognition (Isler et al. 1998). Thus, differences in songs are likely evidence of reproductive isolation, the criterion for species' recognition under the Biological Species Concept (Mayr 2000).

Analyses

Morphometrics and vocal characteristics were compared between groups with Multivariate analysis of variance (MANOVA), and differences within groups were compared with Analysis of variance (ANOVA). Principal component analysis (PCA) was used to reduce the dimensionality of several characters into two axes, eliminating correlated variables. Potential discrimination between populations according to morphometrics and vocalizations was tested with a Linear discriminant analysis (LDA), which was performed by using the same criteria as for the PCA. All analyses were conducted within the R environment (R Core Team 2022).

New specimens (n = 16) from Rondônia, Brazil, were collected under license #25589-6, issued by Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), which was also approved by an Ethics Committee at the Museu de Zoologia da Universidade de São Paulo (MZUSP), and were deposited in the same institution. Localities were mapped following ornithological gazetteers (Stephens and Traylor 1983, Paynter and Traylor 1991, Paynter Jr. 1993, Paynter Jr. 1997). Lists of synonymies were prepared according to Dubois (2000).

Results

Plumage coloration

Two geographically cohesive, geographically adjacent populations were diagnosed based on female plumage color, one from northwestern Amazonia and the other from southern Amazonia. Male specimens of the northwestern Amazonian population were entirely black (black N 2.5/) with sickle-shaped white fimbriae on the outer wing coverts. These showed no white coloration on the inner wing coverts, and had white interscapular patches and shoulders. The females had an orange (7.5YR 5/8) belly, eyebrows and auriculars, while the forehead was concolorous with the crown (olive brown 2.5Y 4/3).

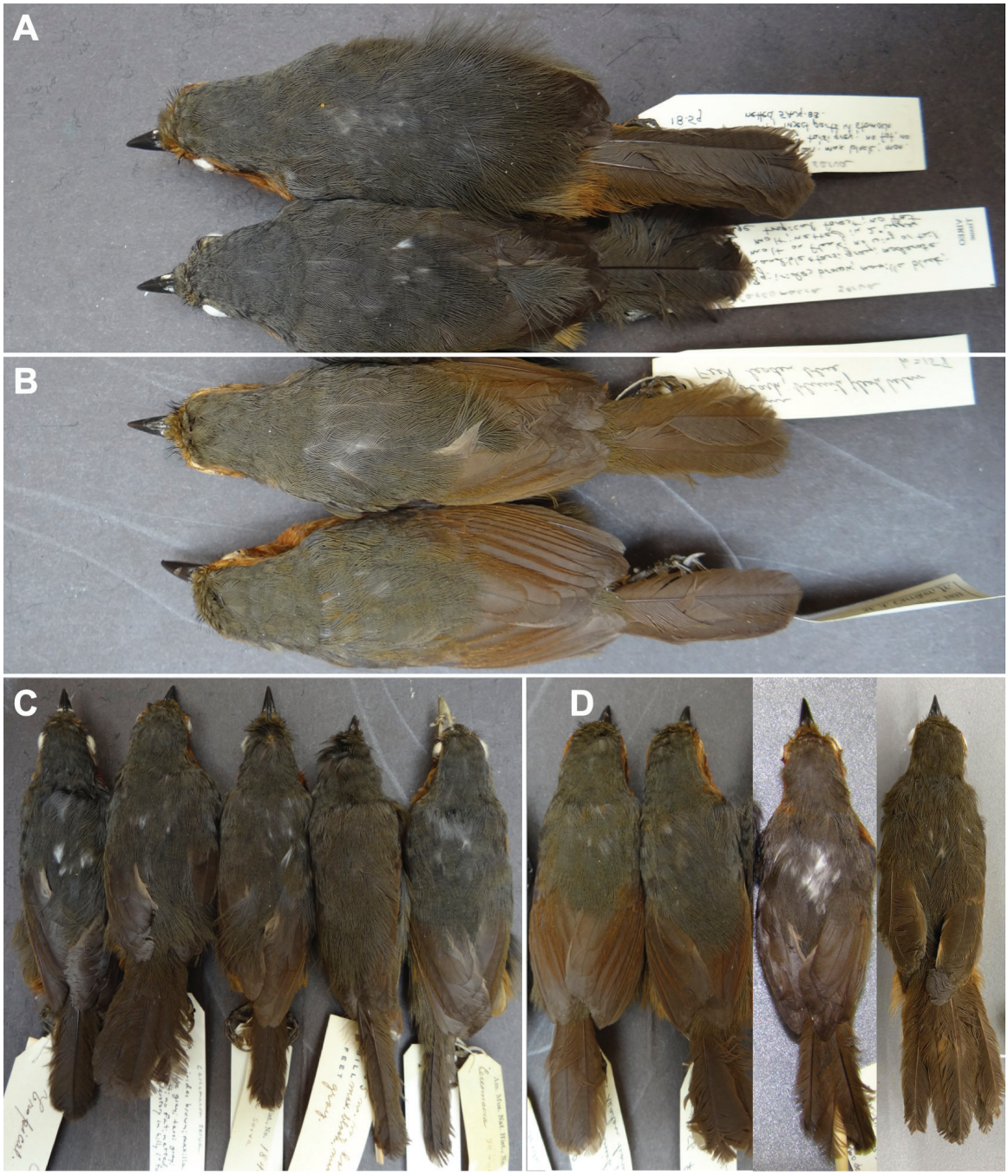

Figure 1. Dorsal view of (**A**) *Cercomacroides serva* (ANSP 189169 – N Lumbagui, Sucumbíos, Ecuador; ANSP 176140 – Rio Maniti, Santa Cecilia, Loreto, Peru), and (**B**) *Cercomacroides hypomelaena* **comb. nov.** (ANSP 103221 – La Pampa, Sandia, Peru; ANSP 120221 – Teoponte, Rio Kaka, La Paz, Bolivia). The lack of intergradation of plumage coloration along their range is demonstrated for (**C**) *C. serva* (ANSP 83291 – R. Suno Abajo, Orellana, Ecuador; ANSP 159994 – Umbria, Putumayo, Colombia; ANSP 83292 – Abajo San José, Coca, Ecuador; ANSP 168085 – Montallo, Oriente, Ecuador; ANSP 176140 – Rio Maniti, Santa Cecilia, Loreto, Peru), and (**D**) *C. hypomelaena* **comb. nov.** (ANSP 92202 – Puerto Yessup, Junín, Peru; ANSP 120226 – Huanay, Rio Mapiri, La Paz, Bolivia; INPA 1962 – km 260, BR 319, módulo 5 do PPBio (Igapó-açu), Amazonas, Brazil; MZUSP 109099 – Left bank of Madeira River, Abunã, Rondônia, Brazil).

Table 1. Descriptive statistics (mean, standard deviation [SD], sample size [N], and minimum and maximum range) of the morphometrics of the *Cercomacroides serva* complex. * $p \leq 0.010$ (MANOVA) for males.

	Males				Females			
	Northern		Southern		Northern		Southern	
Measurements	mean±SD (N)	range	mean±SD (N)	range	mean±SD (N)	range	mean±SD (N)	range
Culmen length	10.5±0.4 (74)	9.3–11.9	10.6±0.5 (127)	9.2–12.1	10.0±0.3 (42)	8.7–10.8	10.1±0.0 (72)	9.1–11.4
Bill height	4.5±0.2 (56)	4.1–4.9	4.5±0.2 (101)	3.8–5.3	4.4±0.1 (34)	4.1–4.8	4.4±0.2 (54)	3.9–5.7
Bill width	6.9±0.7 (73)	5.3–7.9	7.0±1.1 (128)	4.9–10.2	6.8±0.8 (44)	5.1–8.1	6.9±0.8 (72)	5.1–9.4
Tail*	59.0±2.6 (69)	51.0–67.0	60.4±3.0 (125)	50.0–67.0	56.6±2.6 (38)	52.0–64.0	57.2±3.2 (68)	50.0–65.0
Tail graduation	21.6±3.0 (65)	7.9–26.4	20.8±3.1 (107)	9.0–27.4	21.3±3.6 (36)	10.8–27.7	19.7±3.4 (63)	11.3–25.4
Tarsus length*	23.1±0.6 (72)	21.6–24.9	22.7±0.8 (130)	19.3–24.6	22.1±0.7 (42)	20.7–24.2	22.1±0.7 (75)	20.8–24.2
Wing chord	62.9±2.5 (75)	57.0–70.0	63.1±2.9 (131)	54.0–72.0	58.4±2.9 (44)	52.0–67.7	59.4±2.4 (76)	55.0–65.0

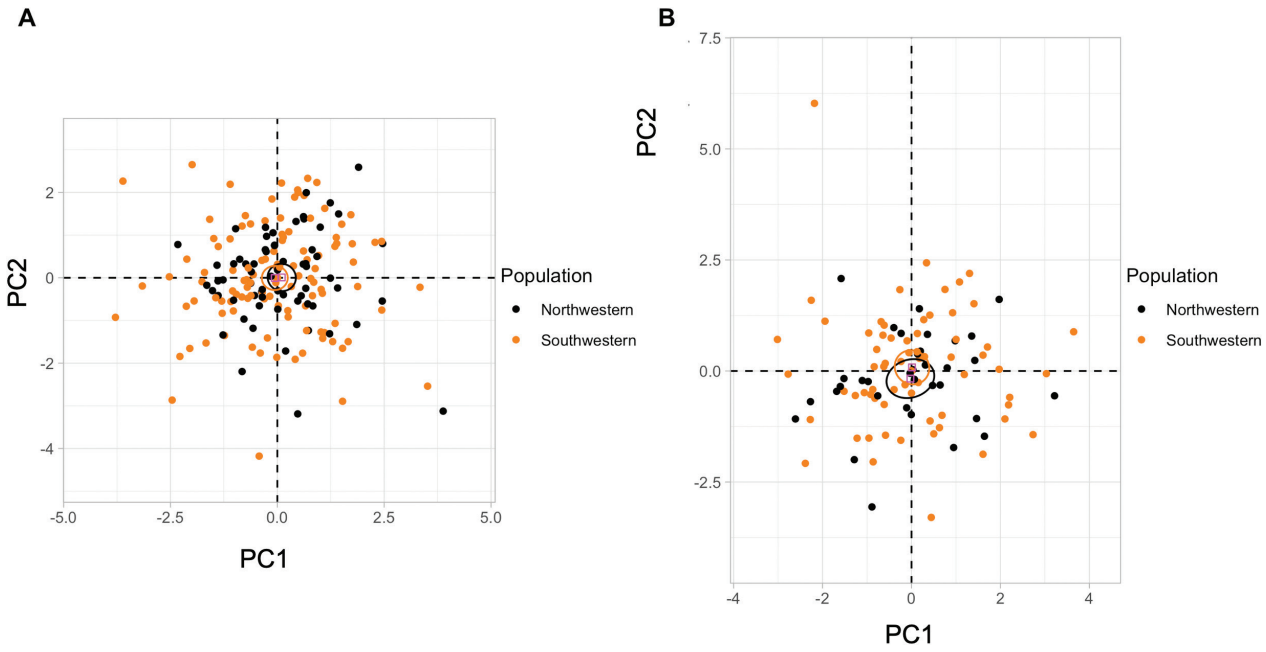

Figure 2. Principal component analysis of six morphometric variables of males (**A**) and females (**B**) of the *Cercomacroides serva* complex, depicting the northwestern (black) and southwestern Amazonian (orange) populations. Cumulative proportion of the total variance explained by function 1 (culmen length, bill height and tarsus length) and function 2 (bill width, tail length and graduation and wing chord) are in Table S2. Pink squares represent centroids, and the 95% confidence intervals are shown by the ellipses.

Their upperparts were grayish brown (very dark gray 10YR 3/1), tails were dark brown (very dark brown 10YR 2/2), and primaries are yellowish-brown (dark yellowish brown 10YR 3/6).

Male specimens of the southern Amazonian population were virtually identical to those of the northwestern population. For this reason, the holotype of *C. tyranina* (sic) *atrogularis*, a male, could only be morphologically evaluated based on its geographic range (see Discussion). Females of the southern Amazonian population, however, had brown backs (dark yellowish brown 10YR 3/6), brown tails (dark brown 7.5Y3/4) and reddish-brown primaries (dark reddish brown 5YR 3/4). The orange (7.5YR 5/8) of the eyebrows, auriculars and bellies was quite similar to that of females of the northwestern population (Fig. 1). The plumage coloration of the specimens from a significant part of the species' ranges do not show intergradation (Fig. 1C, D).

Morphometrics

Morphometrically, females did not differ significantly between populations (MANOVA, F = 1.1, p = 0.388, d.f. = 1), but northwestern males had a slightly, but significantly (MANOVA, F = 4.0, p = 0.001, d.f. = 1), longer tails and tarsus than southern males (Table 1). Seven principal components accumulated 100% of the total variance of quantitative traits (Table S1). Eigenvalues and PC loadings are given in Table S2. The PCA demonstrated a wide overlap in the distribution of morphometric measurements of males and females from northwestern and southwestern populations, including 95% confidence interval ellipses, meaning that differences between those populations are not significant (Fig. 2). The linear combination of predictor variables that were used to form the decision rule of the LDA model (accuracy = 0.77) for males was 0.56*culmen – 0.17*height + 0.01*width

– 0.21*width + 0.91*tail – 0.73*tarsus – 0.11*tail graduation. For females, the model presented the accuracy of 0.58, and was detailed as 0.87*culmen – 0.79*height + 0.26* width + 0.63*wing + 0.32*tail −0.59*tarsus – 0.58*tail graduation.

Vocalizations

Visual and metric evaluations allowed us to distinguish between two types of male loudsongs (Fig. 3), distinct from the females given their higher frequencies. Of the

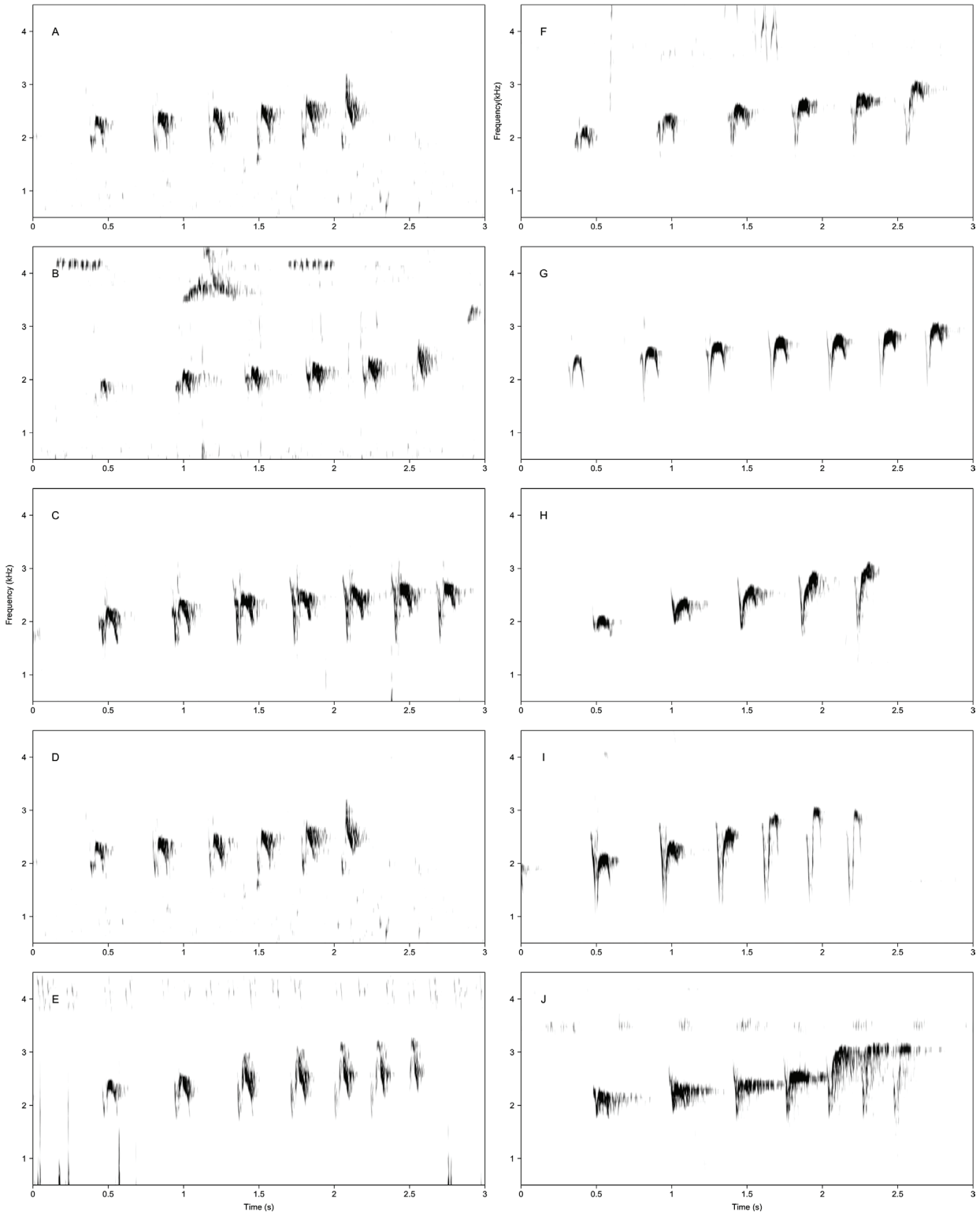

Figure 3. Spectrograms representing male loudsongs of the *Cercomacroides serva* complex. Loudsong 1: **A** XC 332752 from Putumayo, Colombia; **B** XC 249951 from Morona-Santiago, Ecuador; **C** XC 39346 from Amazonas, Peru; **D** ML 29257 from Napo, Peru; **E** XC 335223 from Amazonas, Colombia. Loudsong 2: **F** XC 47602 from San martin, Peru; **G** ML 38868 from Pando, Bolivia; **H** XC 435874 from Reserva Natural Palmarí, Amazonas, Brazil; **I** XC 118906 from Tapauá, Amazonas, Brazil, **J** XC 583021, from Tupana Lodge, Amazonas, Brazil.

Table 2. Descriptive statistics (mean, standard deviation [SD], sample size [N], and minimum and maximum range) of vocal characters of the *Cercomacroides serva* complex. Frequency is expressed in kHz, and duration is expressed in seconds). *** p = 0.000; ** p ≤ 0.007; * p = 0.039 (MANOVA).

Measurements	Loudsong 1 (N = 55)		Loudsong 2 (N = 90)	
	mean±SD	range	mean±SD	range
Highest frequency	3013.0±283.5	2248.9–3733.6	3064.2±309.3	2285.0–3711.8
Lowest frequency***	1563.8±181.5	1049.9–2007.1	1678.9±238.4	1048.0–2164.0
Maximum frequency	2412.5±226.7	1787.3–2907.0	2988.9±408.2	1765.7–4383.9
Bandwidth*	1449.2±293.6	676.8–2192.3	1385.3±310.7	679.3–2139.8
Song duration	2.0±0.5	0.6–3.7	2.1±0.5	0.1–4.3
Pace 1**	2.6±0.5	1.5–4.3	2.5±0.4	1.4–6.0
Pace 2**	3.5±0.5	2.4–5.0	3.3±0.6	1.9–8.1
Change in pace	0.77±0.18	0.5–1.0	0.76±0.16	0.5–1.0
Peak time	32.1±22.3	1.7–115.5	28.3±25.3	0.3–117.6
Number of notes	6.4±2.1	2.0–13.0	6.3±1.6	3.0–14.0

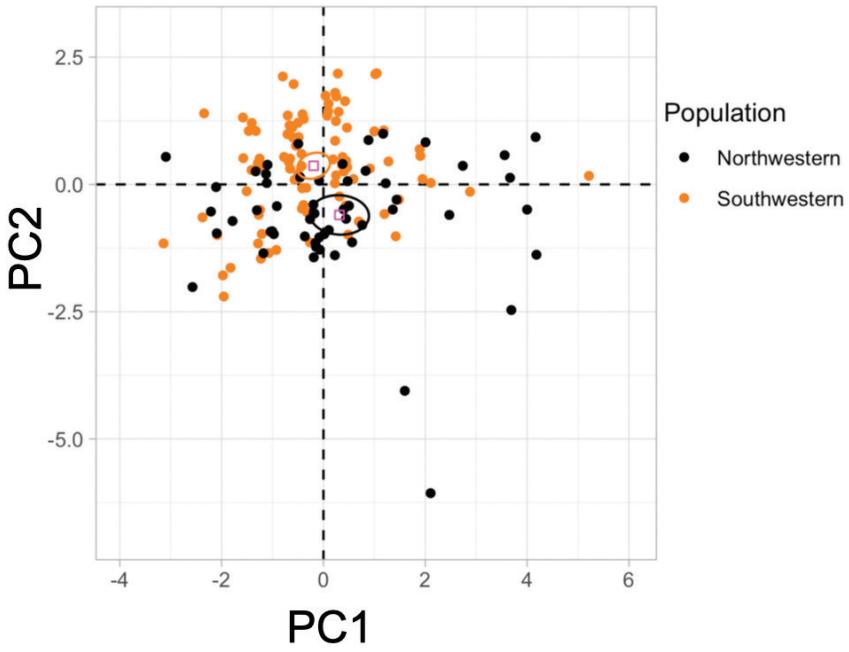

Figure 4. Principal Component Analysis of 10 variables of male loudsongs (type 1 – northwestern, type 2 – southwestern) of the *Cercomacroides serva* populations. The cumulative proportion of the total variance explained by function 1 (pace, note duration, number of notes) and function 2 (bandwidth, lowest and maximum frequencies, and peak time) are in Table S3. Pink squares represent centroids, and the 95% confidence intervals are shown by the ellipses.

145 recordings, there were five (8%) recordings in which female loudsongs could be analyzed without overlapping male loudsongs. Therefore, we only analyzed male loudsongs in our analyses.

Loudsong 1 (N = 55). Characterized by the presence of downslurred–upslurred notes. The number of notes was 6.5 ± 1.8, with a mean duration of 2.1 ± 0.5 s. The pace changed from the middle of the loudsong onwards, meaning that the loudsong accelerates. The respective females emit lower-pitched notes of similar shape, but with 7.4 ± 1.4 notes and a duration of 2.1 ± 0.3 s (Table 2).

Loudsong 2 (N = 90) did not display downslurred–upslurred notes, as they were less angled and had a concave lower boundary (corresponding to the minimum frequency). There were 6.3 ± 1.6 notes lasting for 2.1 ± 0.5 sec. The pace changed from the middle of the loudsong onwards, meaning that the loudsong accelerates. The song of the respective females was similar to that of loudsong 1, but consisted of 6.0 ± 0.4 notes, lasting for 1.6 ± 0.2 s (Table 2).

Loudsong 1 was restricted to the right (south) bank of the Putumayo River, on the border between Colombia and Ecuador, with a southern limit on the left (north) bank of the Marañon River, in northern Peru. Loudsong 2 was distributed on the right bank of the Marañon-Solimões-Amazonas River systems, with an eastern limit of distribution on the left bank of the Madeira River, in Brazil.

The values for the spectrogram measurements correspond to spontaneous vocalizations (Table 2). Comparisons between different loudsongs indicated significant differences between northwestern and southwestern male loudsongs (MANOVA, F = 13.9, p = 0.000, d.f. = 5). All measurements showed overlap between populations, except for the lower frequencies, which were significantly higher in loudsong 2 than in loudsong 1 (Fig. S1). Since highest frequency, pace 2 and change in pace were highly correlated with other vocal features, seven parameters were used for the PCA. Thus, seven functions accumulated 100% of the total variance (Table S1). Eigenvalues and PC loadings are included in Table S3. The PCA also distin-

Table 3. A combination of qualitative characters which diagnoses *Cercomacroides serva* and *C. hypomelaena* **comb. nov.** Plumage colors refer to female specimens.

Lineage	Upperparts	Primaries	Tail	Loudsong type
Northwestern Amazonia	very dark gray 10YR 3/1	dark yellowish brown 10YR 3/6	very dark brown 10YR 2/2	1
Southwestern Amazonia	dark yellowish brown 10YR 3/6	dark reddish brown 5YR 3/4	dark brown 7.5YR 3/4	2

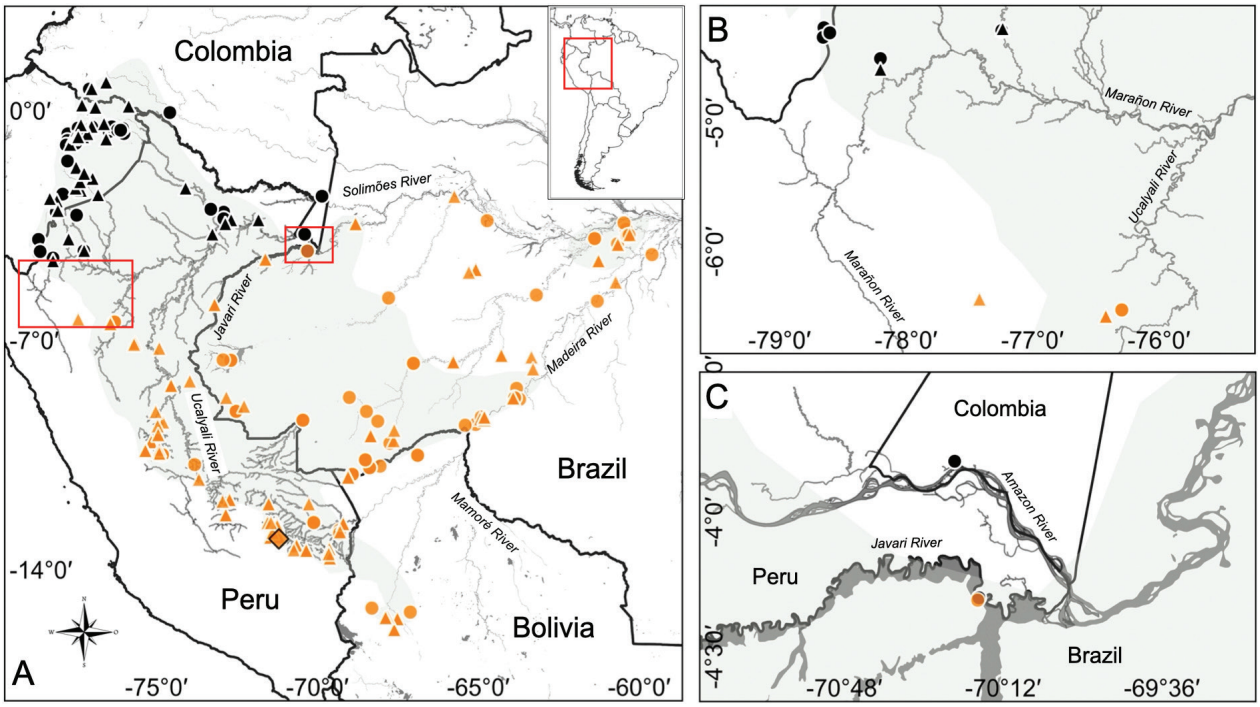

Figure 5. (**A**) Distribution of specimens (triangles), and recordings (circles) of *Cercomacroides serva* (black), and *Cercomacroides hypomelaena* **comb. nov.** (orange), examined in this study. A diamond in SE Peru represents the type-locality of *C. hypomelaena* **comb. nov.**; there is no precise type locality for *C. serva* (see text). Insets indicate potential contact areas in which species are separated by the Marañon (**B**) or the Amazon (**C**) River. Range map (light grey) from IUCN (2023).

guished differences in vocal measurements between populations, as seen from the 95% ellipses confidence intervals, indicating the categories of the supplementary variable are significantly different from each other (Fig. 4). The linear combination of predictor variables that were used to form the decision rule of the LDA model (accuracy = 0.67) for males was 0.18*maximum frequency + 0.59*lowest frequency – 0.09*peak time – 0.01*bandwidth −1.34*number of notes + 1.50*song duration + 0.07*pace.

Discussion

Mitochondrial DNA distances slightly vary (0–0.3%) among individuals within the same population in the Thamnophilidae (e.g., Fernandes et al. 2014), but preliminary genetic data only indicated the p-dist divergence value based on two individuals from Ecuador and Bolivia, which is insufficient evidence of divergence at species level between *Cercomacroides serva* taxa (Tello et al. 2014). Thus, further evidence from population genetic analyses is needed. However, morphological and vocal characteristics diagnose two lineages within the *Cercomacroides serva* species complex, one in northwestern (*C. serva*) and another in southwestern (*C. hypomelaena* **comb. nov.**) Amazonia. The latter, as suggested by loudsong recordings, may also occur on the left bank of the Mamoré River, in Bolivia. Plumage coloration was informative for females only, which was expected, due to the genus inherent heterogynism, when specific identification relies on female plumage characters (Hellmayr 1929). Male loudsongs, on the other hand, were informative in diagnosing species.

Based on differences in plumage coloration, loudsongs, and lack of evidence for intergradation, we suggest that two species are best treated independently. *Cercomacroides serva hypomelaena* (Sclater, 1890) is morphologically and vocally distinct from *C. serva serva* (Sclater, 1858), and the two species show no evidence of intergradation. We interpret this as evidence for full species rank. Although males are virtually identical, females can be distinguished by plumage coloration, and male loudsongs are distinguished based on the shape of their notes (Table 3). The combination of these characters is constant, and defines two lineages with cohesive geographical distribution (Fig. 5).

Cercomacroides serva (Sclater, 1858)

Northwestern black antbird (suggested English name)
Chororó-preto-do-noroeste (suggested Portuguese name)

Chresonymy.

Pyriglena serva Sclater, 1858, Proceedings of the Zoological Society of London 26: 66. Rio Napo, in Ecuador.

Cercomacra serva – Salvadori and Festa (1899), Bollettino dei musei di zoologia ed anatomia comparata della Università di Torino 14(362): 30.

Cercomacra tyranina (sic) *atrogularis* Lletget, 1918, Boletín de la Sociedad Española de Historia Natural 18: 341. Rio Napo.

Cercomacroides serva – Tello et al. (2014), Zoological Journal of the Linnean Society 170: 555.

Syntypes. BMNH 1889.9.20.449 (male) and 1889.9.20.450 (female). Napo, Eastern Ecuador.

Diagnosis. Males are entirely black, except for the white interscapular patch and fimbriae on the outer wing coverts. Females with grayish brown upperparts, which are concolorous with the eyebrows, a white interscapular patch, and a dark brown tail, and yellowish-brown primaries, an orange belly, concolorous with the auriculars and fimbriae on the outer wing coverts. The loudsong is Type 1.

Distribution. It is distributed north of the Marañon River in Peru, north to eastern Ecuador and southern Colombia, with the Andes serving as its westernmost range.

Cercomacroides hypomelaena (Sclater 1890) comb. nov.

Southwestern black antbird (suggested English name)
Chororó-preto-do-sudoeste (suggested Portuguese name)

Chresonymy.

Cercomacra hypomelaena Sclater, 1890, Catalogue of the Birds in the British Museum 15: 268. Cosnipata, S.W. Peru.

Pyriglena serva [non *Pyriglena serva* Sclater, 1858] – Allen (1889), Bulletin of the American Museum of Natural History 2: 96.

Cercomacra serva [non *Pyriglena serva* Sclater, 1858] – Berlepsch and Stolzmann (1906), Ornis, Internationale Zeitschrift für die gesamte Ornithologie 13: 117.

Cercomacroides serva – Tello et al. (2014), Zoological Journal of the Linnean Society 170: 555.

Holotype. BMNH 1889.7.10.574 (male). Cosnipata, Peru.

Diagnosis. Males indistinct from *C. serva*. Females with brown upperparts, which are concolorous with the eyebrows, a white interscapular patch, brown tail, reddish brown primaries, and an orange belly, concolorous with the auriculars and fimbriae on the outer wing coverts. The loudsong is Type 2.

Distribution. It can be found on the southern bank of the Marañon River and on both banks of the Ucayali River, in Peru. Its westernmost limit is the base of the Andes. It also ranges south of the Amazon River east to the Madeira River, in Brazil, and its southernmost range is in northwestern Bolivia.

Although the Ucayali is an important barrier to several taxa, the upper and middle sections of the Ucayali do not segregate the *C. serva* and *C. hypomelaena* **comb. nov**. This was already noted in a comprehensive biogeographic study, which documented only *hypomelaena* on both banks of that river (Harvey et al. 2014). *Cercomacroides hypomelaena* **comb**. **nov.** occurs on both banks of the Yavarí (Javari) River, being limited to the north by the Marañon-Amazonas River complex. We found no indication of clinal variations of female plumage coloration across the ranges of *C. serva* and *C. hypomelaena* **comb. nov.** (Fig. 1C, D) in contrast to what has been suggested (Zimmer and Isler 2003). The coloration of the upperparts was constant in females of each species, and from Colombia, south to Peru and Brazil, the female upperparts did not gradually fade into the lighter southwestern form (Zimmer and Isler 2003). This is especially valid when considering specimens that are separated by approximately 100 km in northwestern Peru. Female MUSM 10208 from Rio Cenepa is perfectly distinguished from female AMNH 240187 from Santa Rosa. These populations are probably not in contact, since the Marañon River apparently acts as a barrier, even in its narrower upper region (Fig. 5B). It has been shown that the width of a river near the headwater may not act as a barrier (Harvey et al. 2014), and the fact that those females are clearly distinguishable corroborates their specific status. Furthermore, the recordings from the northern (XC335224) and southern (XC89140) banks of the Amazon River on the borders of Colombia and Brazil, which are ~30 km apart (Fig. 5C), further corroborate the absence of intergradation. Via spectrogram analyses, both male loudsongs can be diagnosed as *C. serva* and *C. hypomelaena* **comb. nov.**, respectively, indicating that the river is a geographic barrier. From these few contact areas where we could assess the identify of *Cercomacroides* species, gene flow may be reduced or absent, reaffirming their specific status under the Biological Species Concept (Mayr 2000).

Our study indicates that *Cercomacra tyranina* (sic) *atrogularis* Lletget, 1918 is not a valid taxon. The holotype, a male from Archidona, Ecuador, was collected by Marcos Jiménez de la Espada during his visits from Guayaquil to Tabatinga between 1862–1866 (J. Barreiro in litt. 2013). We evaluated this specimen via photographs, but due to the similarity of male plumages of *C. serva* and *C. hypomelaena* **comb. nov.** we could not distinguish this specimen from *C. serva* on plumage alone. Lletget's type specimen originated from within the distribution of *C. serva*. Thus, we suggest that, pending molecular analysis, *atrogularis* is best synonymized with *C. serva* (Sclater, 1858).

The type locality of *C. serva*, Napo, is imprecise, but the banks of this river do not act as barriers to other species of Thamnophilidae (e.g., Cavarzere et al. 2012). Records from Ecuador merit a few comments. The presence of the species in the Ecuadorian *Chocó* is based on only

two specimens (MNHN 1936n117, 1936n118) collected by Carlos Olalla and sons, and this information is neglected without explanation in some references (Zimmer and Isler 2003). There is a great deal of discussion about some of the specimens collected by the Olalla family and kept in the American Museum of Natural History (AMNH), as well as in other museums (Wiley 2010). Few errors in locations can be attributed to the Olalla family, especially Alfonso, who contributed thousands of bird and mammal specimens, which are currently kept in dozens of institutions. His work significantly shaped the field of zoological studies of neotropical fauna (Wiley 2010). It is possible that these two specimens (as well as two other specimens of *C. cinerascens*, from the same locations and from similar dates) might be the result of a location error. This is partly because the species is restricted to the Amazon Basin, but also because among all the specimens examined in this study, only these two came from this location. For C. Vaurie, the former curator of ornithology at the AMNH, some specimens sold by Olalla exclusively to the Natural History Museum in Stockholm, then curated by N. Gyldenstolpe, were also traded with other buyers, which had incorrect information on their labels (Wiley 2010). Some of these specimens were found in the Muséum National d'Histoire Naturelle, Paris, and may include the examples cited here. P. E. Vanzolini, then curator of herpetology at the Museu de Zoologia da Universidade de São Paulo (MZUSP), was confident of the Olalla locations, and in a letter to Vaurie, dated 1965, explained that Olalla had more employees that collected on opposite riverbanks, at least for the Amazonian cases. This would explain why the collection includes taxa that inhabit different localities collected on the same day (Wiley 2010).

The altitude of Carondelet, in the province of Esmeraldas, Ecuador, was questioned, since the amphibian species collected there normally occur at much higher elevations and further west than where this location was said to be, according to the gazetteers (Hoogmoed 1989, Paynter Jr. 1993). Hoogmoed (1989: 15) refrained from contradicting the locality itself, because Olalla specimens are generally reliable. These two specimens were collected by Manuel Olalla in February 1952, today held at MZUSP. For bats of the genus *Sturnira*, which inhabit western Ecuador and Colombia, nothing unusual has been reported for rio Cachabi, the location for *S. ludovici*, where a male of this species was collected by Carlos Olalla on 9 August 1935 (McCarthy et al. 2006). This date coincides with two specimens of *C. serva* (1 and 6 August 1935) and another two *C. cinerascens* (27 July and 5 August 1935).

There is a record of a young male *C. hypomelaena* **comb. nov.** from the right bank of the Madeira River (MZUSP 109098) collected on 8 November 2010. At the time of this collection in Porto Velho, Rondônia state, Brazil, all collected specimens were processed on the same day by a person accustomed to specimen tagging. This strongly suggests that there is no location error (E. Machado, pers. comm. 2015). There were no other records available for this species on the right bank of the Madeira River. Specimens and recordings from the left (southern) bank of the Marañon River near its headwater, and from the right (eastern) bank of the Ucayali River are warranted to further elucidate if those rivers impose barriers or whether the two taxa might form a hybridization zone.

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Appendix 1

Museum specimens of the *Cercomacroides serva* species complex.

Academy of Natural Sciences (ANSP), American Museum of Natural History (AMNH), Carnegie Museum of Natural History (CMNH), Centro de Ornitología y Biodiversidad (CORBIDI), Delaware Museum of Natural History (DMNH), Field Museum of Natural History (FMNH), Instituto Nacional de Pesquisas da Amazônia (INPA), Louisiana Museum of Natural History (LSUMZ), Moore Laboratory of Zoology (MLZ), Museo Nacional de Ciencias Naturales (MNCN), Museo de História Natural de la Universidad Nacional Mayor de San Marcos (MUSM), Museu de Zoologia da Universidade de São Paulo (MZUSP), Museu Nacional do Rio de Janeiro (MNRJ), Museu Paraense Emílio Goeldi (MPEG), Muséum National d'Histoire Naturelle (MNHN), Museum of Comparative Zoology (MCZ), Museum of Vertebrate Zoology (MVZ), Natural History Museum (BMNH), Naturalis Biodiversity Center (RMNH), Santa Barbara Museum of Natural History (SBMNH), Smithsonian National Museum of Natural History (USNM), Yale Peabody Museum (YPM).

Cercomacroides hypomelaena **comb. nov.** BOLIVIA • La Paz: Rio Beni, ca. 20 km by river N Puerto Linares: 1f# LSUMZ 102134, 2m# LSUMZ 102135, 102136; Huanay, Rio Mapiri: 2f# ANSP 120226, 120227, 3m# ANSP 120222, 120224, 120225; Sta. Ana, Rio Coroico: 1f# ANSP 120217, 2m# ANSP 120215, 120216; Teoponte, Rio Kaka: 1f# ANSP 120221, 2m# ANSP 120218, 120219. Pando: Nicolas Suarez, ca. 12 km by road S Cobija, Ca. 8 km W on road to Mucden: 9f# LSUMZ 132794, 132796, 132800, 132805, 132806, 132807, 132811, 132813, 132814, 12 m# LSUMZ 132792, 132793, 132795, 132797, 132799, 132801, 132802, 132804, 132808, 132809, 132810, 132812. BRAZIL • Acre: Marechal Thaumaturgo, margem direita Rio Tejo, ca 85 km da foz: 1m# MPEG 52147; Porto Acre, AC 010 linha 07, Reserva Humaitá: 1m# MPEG 63549; Rio Branco, Fazenda Experimental Catuaba: 1m# MPEG 59974; Rio Branco, Transacreana (AC-090) km 60, margem esquerda: 2f# MPEG 61426, 61429, 2m# MPEG 61427, 61428; Rio Juru·, margem direita, Cruzeiro do Sul, Porangaba: 1m# MPEG 48239. Amazonas: 8 km NE Careiro, Fazenda Toshiba: 1m# MPEG 55310; BR230, 4 km a oeste de Mucuim: 1f# MZUSP 86255, 1m# MZUSP 86218; BR319, 50 km ao sul de Humaitá: 1m# MZUSP 86219; Careiro, Br 319 km 158, Tupana Lodge: 2f# MPEG 68893, 68894; Coari, Rio Urucu, Estrada do NIT: 1f# MPEG 62318; Estirão

do Equador, rio Javari: 1f# MNRJ 29124; Humaitá, margem esquerda Rio Madeira, Ipixuna: 1m# MPEG 71092; Hyutanahan (Rio Purus; right bank): 1f# CMNH 86489, 2m# CMNH 86718, 86899; km 260, BR 319, módulo 5 do PPBio (Igapé-açu): 1f# INPA 1962, 1m# INPA 1976; margem esquerda do rio Madeira, comunidade Bela Vista, Lago Xadá, 40 km a 250km de Novo Aripuanã: 1m# INPA 850; Rio Javari, Estirão do Equador: 1m# MPEG 18475; São Paulo de Olivença, Rio Solimoes: 1f# YPM 28764, 2m# YPM 28765, 28766; São Paulo de Olivenca (Rio Solimoes; right bank): 5f# CMNH 95423, 95824, 96144, 96165, 96317, 8m# CMNH 95468, 95591, 95636, 95953, 96143, 96199, 96280, 96409; Tefé, Base Petrobras/Urucu, Papagaio: 2m# MPEG 57109, 57110. Rondônia: E.E. Antônio Mujica Nava: 1m# MZUSP 76612; M.D. Rio Madeira, Caiçara: 3f# MZUSP 1000, J17, J711, 10m# MZUSP J1025, J1060, J51, J611, J702, J710, J742, J743, J744, J999; Porto Velho, rio Madeira: 1f# MNRJ 8404, 2m# MNRJ 8434, 8936. PERU • Amazonas: Sta Rosa, alto Ucayali: 1f# AMNH 240187. Cuzco: 40 km E Quincemil on Pto. Maldonado rd. above Rio Marcapata: 1f# LSUMZ 78473, 2m# LSUMZ 78471,78470; Hda Cadena: 1m# FMNH 190082; Hda Villacarmen: 1f# FMNH 251899; Kiteni on Urubamba R. 66 km below Rosalina: 2f# LSUMZ 78472, 78468, 1m# LSUMZ 78469; La Convencion, Bajo Urubamba, Camisea, Lote 88: Casiquiari I 1f# CORBIDI Thomas Valqui 783, 2m# CORBIDI Thomas Valqui 782, Thomas Valqui 801; Prov. La Convencion, Proyecto Camisea, Sector SS2: 1m# MUSM 27651; prov. Paucartambo; near Chontachaca: 1f# CORBIDI NK161228, 3m# CORBIDI NK161200, NK161246, NK161247; Tono: 1f# MUSM 12562, 1m# MUSM 12603; Santa Isabel Village, Cuzco-Shintuya Highway: 1m# FMNH 364341; Tono: 2f# FMNH 322012, MUSM 12562, 2m# FMNH 322013, MUSM 12603. Huanuco: Biol. Station Panguana I. Rio Llullapichis: 1m# MUSM 3791; Cerros del Sira: 1f# AMNH 820898; Chuchurras: 1f# AMNH 491172, 1m# AMNH 491171. Junín: Payeni (Rio Tambo): 1m# MUSM 29694; Puerto Yessup: 2f# ANSP 92202, 92204, 5m# ANSP 92195, 92196, 92197, 92200, 92201. Loreto: 59 km. W. of Pucallpa: 1f# AMNH 822255, 1m# AMNH 822256; 79 km WNW Contamana: 1f# LSUMZ 161766; ca. 77 km WNW Contamana: 1m# LSUMZ 161765; x km Contamana: 1m# MUSM 17937; Rio Maniti, Santa Cecilia: 1m# ANSP 176139. Madre de Dios: 105 km by road SW P. Maldonado on road to Quincemil: 2m# LSUMZ 78474, 78477; 105–110 km SW P. Maldonado on rd. to Quincemil: 1f# LSUMZ 78475; Cerro de Pantiacolla, above Rio Palotoa: 2m# FMNH 322007, 322008; Cerro de Pantiacolla, E slope at base, 5 km ENE Shintuya: 1f# FMNH 310648, 1m# 310647; Hacienda Amazonia: 1m# FMNH 315703; Hacienda Amazonia, ridge above: 1f# FMNH 322010, 1m# FMNH 315707; km 106 W Puerto Maldonado on road. To Quincemil: 1m# LSUMZ 78476; left bank rio alto madre de dios, 13.4 km NNW Atalaya: 1m# MUSM 25772; ridge above Hda. Amazonia: 3f# MUSM 12422, 12519, MZUSP 70178; Moskoitania, 13.4 km NNW Atalaya, l bank Alto Madre de Dios: 1m# FMNH 433383; Mouth of Rio La Torre, south bank of Rio Tambopata: 1f# LSUMZ 92407; Pantiacolla, 15 km NE Rio Abajo de la localidad de Shintuia: 1f# MUSM 12584; Quebrada Aguas Calientes, 2.75 km E Shintuya, left bank alto madre de dios: 1m# MUSM 23202; Rio Manu, Parque Nacional del Manu, Puesto de Vigilancia Pakitza: 1f# MUSM 16127, 1m# MUSM 16131; Rio Palotoa, l. bank, 12 km from mouth: 2f# MUSM 12654, FMNH 322006, 1m# FMNH 322004. Oxapampa: Dsto Palcazo. Pque Nac. Yanachaga-Chemillen – camp lobo: 1m# MUSM 17010. Pasco: Camp Chontia (Shiringamazu): 1f# MUSM 16249; Hda Flor, Rio Pachitea: 1f# MUSM 1353, 1m# MUSM 1354; Hda. Roca-Luz. Rio MucÒis. LontaÒanza: 2f# MUSM 16306, 16327; Oxampampa. Dsto Palcazu. Pque Nacional Yanachaga-Chemillen. Paujil: 1m# MUSM 17011; Prov. Oxapampa, Distrito Puerto Bermudez, Comunidad San Juan, trail to Janiruani waterfall: 1m# LSUMZ B-74180; Prov. Oxapampa, Dsto Palcazo. Pque Nac. Yanachaga-Chemillen – camp lobo: 1f# MUSM 17007; Prov. Oxapampa, Dsto Palcazo. Pque Nac. Yanachaga-Chemillen – Panjil: 1f# MUSM 17013; Puerto Bermudez: 1f# FMNH 65810, 1m# FMNH 65809; Puerto Yessup: 1f# CMNH 117788, 2m# CMNH 117789, MCZ 179727. Puno: Astillero: 1m AMNH 146139; La Pampa: 4m# AMNH 146135, 146136, 146137, 146138; Orosa, R. Amazonas: 1m# AMNH 231798; Rio Santiago: 1f# AMNH 407117; Rio Tavara: 2f# AMNH 147694, 147695, 5m# AMNH 147690, 147691, 147692, 147693, 132709. San Martin: 10 km by road NE Tarapoto on road to Yurimaguas: 1m# LSUMZ 116914, 1f# LSUMZ 116915. Sandia: Huacamayo: 1f# MCZ 179728, 2m# ANSP 103214, 103215; La Pampa: 3f# ANSP 103221, 103222, 103223, 4m# ANSP 103217, 103218, 103219, 103220. Ucayali: W bank Rio Shesha, ca. 65 km ENE Pucallpa: 1f# LSUMZ 156541, 1m# MUSM 14774. Urubamba, Boca R. Urubamba, 3m# AMNH 240183, 240184, 240180bis.

Cercomacroides serva. COLOMBIA • Putumayo, Estacion de Bombeo Guamuez: 1f# FMNH 292916, 1m# FMNH 292915; Rio San Miguel: 1f# ANSP 165085, 4m# ANSP 165081, 165082, 165083, 165084; San Antonio Guamuez: 3f# FMNH 287086, 287087, 287090, 4m# FMNH 287085, 287089, 287091, MZUSP 70177; San Antonio, Rio Guamuez: 1f# FMNH 293232; Umbria: 1f# ANSP 159994, 1m# YPM 27031. ECUADOR • Napo, Eastern Ecuador: 1f# BMNH 1889.9.20.450, 1m# BMNH 1889.9.20.449. Rio Napo: 1m# MNCN 10309; Loreto: 1f# RMNH 6299, 1m# RMNH 6298. Morona-Santiago: ANSP 182494; 181643; Chupianza: 1m# SBMNH 8545; Macas region, Cutucuo: 1f# AMNH 156794; Mendez: 1f# MNHN 1935n195; Rio Pastaza, 1m# USNM 357206; San Jose Abajo: 1f# AMNH 184506, 4m# AMNH 184501, 184503, 184504, ANSP 83294. Santiago: 1f# ANSP 181644; 1m# ANSP 181643. Napo: [lower] Rio Suno, 1m# MCZ 138354; 20 mi. down Rio Napo from Missahuali: 1m# ANSP 175727; Concepcion, Oriente: 2m# MLZ 7358, 7685; km 17 Lago Angrio-Baeza Road: 1f# DMNH 59426, 2m# DMNH 59424, 59425; Limoncocha: 1f# LSUMZ 83160, 1m# LSUMZ 83161; Rio Suno: 1m# MNHN 1927n1408; Rio Suno Abajo: 4f# ANSP 83291, 83293, AMNH 184512, 184514, 3m# ANSP 83293, AMNH 184510, 184511; S. bank Rio Payamino, ca. 20 road km W of Coca: 1m# ANSP 184696. Orellana: San Jose Abajo: 1f# ANSP 83292, 4m# MLZ 7684, 7686, 7715, USNM 323078; San Jose de Sumaco, alto Napo: 1f# ANSP 169750; Rio Suno, above Avila: 1f# AMNH 179310, 4m# AMNH 179307, 179308, 179309, 179466. Oriente: between Concepcion and Sumaco: 2m# MCZ 299046, 299047; Cerro Galeras: 1m# ANSP 169657; Montallo: 1f# ANSP 168085' Rio Pucuno: 2f# MCZ 299042, 299044, 3m# MCZ 299040, 299043, 299045; upper Rio Pucuno: 1m# MCZ 299041. Pastaza: Andoas: 1m# BMHN 1940.12.5.1009; Rio Rotuno: 1m# SBMNH 8546. Sarayacu: 3f# BMHN 89.7.10.594, MNHN 2000n3610, 2000n3611, 2m# BMHN 89.7.10.592, 89.7.10.593. Sucumbios: N Lumbagui: 1f# ANSP 186169; Santa Cecilia, Rio Aguarico: 1m# MVZ 158014. PERU • Amazonas: Boca Rio Curaray: 1f# AMNH 255736, 4m# AMNH 255732, 255733, 255734, 255735; Caterpiza on Quebrada Caterpiza, E bank tributary of Rio Santiago: 1f# LSUMZ 99105; Pebas: 1f# BMHN 89.7.10.594; Rio Cenepa, Rio Comaina drainange: 1f# MUSM 10208, 1m# MUSM 5430. Loreto: 1 km N Rio Napo, 157 km by river NNE Iquitos: 1f# LSUMZ 109994, 4m# LSUMZ 109991, 109992, 109993, 109995; ca. 54 km NN boca del Morona en Ovilla Este: 1m# LSUMZ B-42793; ca. 54 km NNW mouth Rio Morona on west bank: 1f# LSUMZ 172957, 1m# LSUMZ B-42807; Lower Rio Napo region, E. bank Rio Yanayacu, ca. 90 km N Iquitos: 2f# LSUMZ 115343, 115344 Rio Maniti, Santa Cecilia: 1f# ANSP 176140.

Appendix 2

Recordings of the *Cercomacroides serva* species complex. Macaulay Library (ML), WikiAves (WA), and xeno-canto (XC). Personal archives: VC = Vagner Cavarzere.

Cercomacroides hypomelaena **comb. nov.** BOLIVIA • Beni: Pilon Lajas Biosphere Reserve; Serrania Chuchilla: ML101806. La Paz: Cerro Asunta Pata, La Paz: XC3295, XC4079; Madidi National Park: XC63257; Mapiri (near Achipiri), Larceja: XC692575. Pando: Bella Flor, Nicolas Suarez: XC497074; Orquidea del Manu, Abuná: XC685076, XC685166; SW of Cobija; Camino Mucden: ML38868, ML38884. BRAZIL • Acre: Área de Relevante Interesse Ecológico Japiim Pentecoste (Várzea do rio Moa), Cruzeiro do Sul: WA4871394; Fazenda próximo da Bonal, Senador Guiomard: WA741918; FE do Antimary, Bujari: WA2522533; Floresta Estadual do Antimary – Sena Madureira: XC372839; Mâncio Lima: WA3806801; Mata do Educandário, Cruzeiro do Sul: WA4901561 Parque Estadual Chandless, Santa Rosa do Purus: XC497978, XC555915, XC572294; Pedra Pintada, RESEX Alto Juruá, Marechal Thaumaturgo: WA2949604; Ramal Seringal Cachoeira, Xapuri: XC329060, XC329061; Reserva Extrativista Alto Juruá. Foz do Tejo: XC66587, XC89142; RESEX Alto Juruá, Marechal Thaumaturgo: WA248141, WA5153594; Xapuri: WA1025335, WA1063272, WA1063273. Amazonas: AM-354, Km 18, Careiro: XC504730; Beruri: WA1438748, WA1511713; BR 319 margem da rodovia, Beruri: WA1695165; ca. 8 km. ENE Careiro do Castanho, Fazenda Toshiba: ML127330; Carauari: XC284908; Careiro: WA5340004; Céu do Mapiá, Pauini: WA5263522; Manaquiri: WA3412586; Margem da BR 319 próximo à comunidade do Igapó Açu, Manicoré: WA2141619; Pauini: WA4387612; Purus River, Boca do Acre: XC537660; ramal da estrada pra Manaquiri, Careiro: WA2833136; Reserva Natural Palmarí, Rio Javarí: XC89140, XC435874, XC270643; Tefé: WA4359769; Tupana lodge: XC583021; Tapauá: XC118906; Tupana Lodge: XC38653, XC42894, XC73346; Turiaçu, Tapauá: WA733259. Rondônia: Candeias do Jamari: WA3339641; FE do Rio Madeira, Porto Velho: WA4994314; Linha C.01, Porto Velho: WA4788914, WA5076941, WA5079622, WA5151834; Mutum – Transecto 7 – ME, Porto Velho: XC427189; Porto Velho, ME Rio Madeira: VC101106_01; Porto Velho: WA2143857, WA2212387, WA288192, WA3204779, WA3517237, WA3553991, WA4128736, WA478508, XC342774. PERU • Cuzco: 2.0 km W of Pilcopata: ML30108; Manu Amazonia Lodge: XC220752, XC220758; Manu Road below San Pedro: XC11909; Quita Calzones, Manu Road: XC13348; Quitacalzones: XC75233; Quitacalzones, Manu road: XC102665; San Pedro (i.e. Cock of the Rock Lodge), Manu Road (1500–1700): XC63256; San Pedro, Manu Road: XC88568. Madre de Dios: 30.0 km SW of Puerto Maldonado; Tambopata Reserve: ML24333; Amazonia Lodge: WA499832; Amazonia Lodge, Alto Madre de Dios: XC97088; Centro de Investigación y Conservación de Río Los Amigos (CICRA): XC453511; CICRA: XC73350, XC73352; Manu Learning Center: XC122584, XC122752, XC123209, XC123310; near Santa Rosa: XC22909; Pantiacolla: ML103935; Posada Amazonas, Tambopata: XC446759; Quebrada Pacasmayo – Manu: XC21084; Sachavacayoc Lodge, Tambopata: XC79. Oxapampa: Distrito Puerto Bermudez; Comunidad San Juan; trail to Janiruani waterfall: ML163831, ML163862. San Martín: Cordillera Escalera: XC180930; 21 km E Tarapoto: XC47601, XC47602; Tunnel near Tarapoto: XC8365. Satipo: Distrito Atalaya; Comunidad Canuja; Central Hidroelectrica Ucayali: ML163823. Ucayali: Ridge about 40–50km from Atalaya by road: XC151780.

Cercomacroides serva. COLOMBIA • Amazonas: Puerto Nariño: XC335223, XC335224; Tarapacá: XC533378. Caquetá: Laguna el peregrino: XC372025. Putumayo: Nuevo mundo – Orito: XC305751; Nuevo Mundo, Resguardo Indígena Jardín de la Sierra, Orito: XC332752; Reserva Natural La Isla Escondida, Orito: XC449157, XC589016. ECUADOR • Morona-Santiago: E slope Cord. de Cutucú: Uuntsuants: XC249951; Santiago: ML49277, ML49286. Napo: 1 km S Puerto: XC249454; 3 km NW Guagua Sumaco: XC249351, XC249352; km 11.6 Narupa-Loreto road: XC249383, XC260799; Archidona área: XC220759; El Para, east of Archidona: XC11388; La Selva lodge: XC220753; Loreto road: XC12724; Ministerio road: XC220755; Tiputini Biodiversity Station: XC281850. Orellana: 30 km S of Coca; trail #8 past Mandi Cocha: ML60517; Maxus road km 37 (27 km SSE Pompeya): XC249101, XC275037; Parque Nacional Yasuní: XC478218; Rio Bigal Reserve: XC521259; Tiputini Research Station: XC260798, ML148555, ML148778; Yasuní Research Station, Parque Nacional Yasuní: XC17448, XC61358, XC70240, XC76999; Yuturi Lodge S bank Río Napo: XC258464. Pastaza: Churunalpi, 5 km N Canelos: XC249574. Sucumbios: Mirador de Lumbaqui: XC93165; La Selva Jungle Lodge, N bank Río Napo: XC248740. Zamora-Chinchipe: 3 km E Paquisha: XC250237; Maycu NR: XC512193; Nangaritza: XC237562; Near site of gold-mining in river, Río Nangaritza, south of Miasi, Via Nuevo Paraiso, Nangaritza: XC567221. PERU • Amazonas: XC8335; 1 km S of Libertad; south bank Rio Napo: ML29257, ML29266; Cordillera del Condor; Miazi: ML79743, ML79751, ML79763, ML80069; Huampami, on Rio Cenepa: ML17557, ML17567; Nuevo Salem: XC39346. Cuzco: 2 km W of Pilcopata: ML30108; Manu Amazonia Lodge: XC220752, XC220758; Manu Road below San Pedro: XC11909; Quita Calzones, Manu Road: XC13348; Quitacalzones: XC75233; Quitacalzones, Manu road: XC102665; San Pedro (i.e. Cock of the Rock Lodge), Manu Road (1500–1700): XC63256; San Pedro, Manu Road: XC88568. Junín: Atalaya hydroelectric plant: XC152490. Loreto: Morona, Datem del Marañón Province: XC621809; north bank Rio Napo, Quebrada, Sucusari: ML29103; Sucusari Camp, North Bank Of Rio Napo: ML34233; Tierra Blanca: XC195123. Madre de Dios: 30 km SW of Puerto Maldonado, Tambopata Reserve: ML24333; Amazonia Lodge: WA499832, XC97088; Centro de Investigación y Conservación de Río Los Amigos (CICRA): XC453511, XC73350, XC73352; Manu Learning Center: XC122584, XC122752, XC123209, XC123310; near Santa Rosa: XC22909; Pantiacolla: ML103935; Posada Amazonas, Tambopata: XC446759; Quebrada Pacasmayo – Manu: XC21084; Sachavacayoc Lodge, Tambopata: XC79. Oxapampa: Distrito Puerto Bermudez, Comunidad San Juan, trail to Janiruani waterfall: ML163831, ML163862. San Martín: 21 km E Tarapoto: XC47601, XC47602; Cordillera Escalera: XC180306, XC180930; Tarapoto Tunnel: XC83463; Tunnel near Tarapoto: XC8365. Satipo: Prov. Satipo; Distrito Atalaya, Comunidad Canuja, Central Hidroelectrica Ucayali: ML163823. Ucayali: Ridge about 40–50km from Atalaya by road: XC151780.

Supplementary Material 1

Figure S1

Authors: Cavarzere V, Silveira LF (2024)
Data type: .tiff
Explanation notes: Mean, minimum, and maximum values of vocalizations showing no overlap in measurements of low frequencies of male loudsongs of *Cercomacra serva* populations.

Link: https://doi.org/vz.74.e112446.suppl1

Supplementary Material 2

Tables S1–S3

Authors: Cavarzere V, Silveira LF (2024)
Data type: .pdf
Explanation notes: **Table S1.** Cumulative proportions of all principal components of morphological (according to sex) and male vocal parameters between *Cercomacroides serva* populations. — **Table S2.** Loadings and cumulative proportions of principal components of each morphological parameter between *Cercomacroides serva* populations according to sex. — **Table S3.** Loadings and cumulative proportions of principal components of each vocal parameter between *Cercomacroides serva* populations.

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