

A new tapaculo related to *Scytalopus rodriguezi* from Serranía de los Yariguíes, Colombia

by Thomas M. Donegan, Jorge E. Avendaño & Frank Lambert

Received 15 February 2013

SUMMARY.—Upper Magdalena Tapaculo *Scytalopus rodriguezi* was described (in 2005) as restricted to the headwaters of the Magdalena Valley in dpto. Huila, Colombia. Here we describe a new but related taxon from the Serranía de los Yariguíes, dpto. Santander, Colombia, c.580 km to the north, which differs in its darker dorsal coloration, shorter tail, smaller body, lower mass and lower pitched song with reduced frequency bandwidth in its notes.

Scytalopus tapaculos are small, primarily montane suboscines that inhabit the understorey of Neotropical forests. Species limits within the genus are problematic because of the morphological homogeneity of different populations, which masks a rich diversity, only detected in recent decades via vocal and genetic studies. Since vocalisations are believed to be innate and distinctive among genetically divergent *Scytalopus* species, and vocal differentiation tracks molecular differentiation more so than morphology (Arcander & Fjeldså 1994), the number of recognised species of *Scytalopus* has increased dramatically from ten in the mid 1990s to more than 40 today (Krabbe & Schulenberg 1997; see also, e.g., Krabbe & Schulenberg 2003, Krabbe & Cadena 2010, Hosner *et al.* 2013). Four new *Scytalopus* taxa have been described from Colombia since the late 1990s: Chocó Tapaculo *S. chocoensis* (Krabbe & Schulenberg 1997), Upper Magdalena Tapaculo *S. rodriguezi* (Krabbe *et al.* 2005), Stiles' Tapaculo *S. stilesi* (Cuervo *et al.* 2005) and a subspecies of Pale-bellied Tapaculo *S. griseicollis gilesi* (Donegan & Avendaño 2008). Various other undescribed populations were discussed and illustrated (but not named) by Donegan & Avendaño (2008) and McMullan *et al.* (2010, 2011).

In January 2003, TMD observed tapaculos on the west slope of Serranía de los Yariguíes, a western spur of the East Andes of Colombia. Their song comprised a series of simple, frog-like notes, repeated relatively slowly, while their plumage was typical of the '*S. femoralis*' group (*sensu* Hilty & Brown 1986), being generally dark grey with a brown-barred vent. The species involved was reported as '*Scytalopus* sp.' (Donegan *et al.* 2003) or *S. viciniior* (Donegan & Huertas 2005) in expedition reports. Subsequently, *S. rodriguezi* was described from pre-montane forests of the upper Magdalena Valley, dpto. Huila (Krabbe *et al.* 2005). During 2006, JEA obtained specimens from both slopes of the Yariguíes massif and FL made sound-recordings in 2006–07. Donegan *et al.* (2007) then considered the Yariguíes population to represent an undescribed taxon that is vocally distinct from *S. viciniior*, *S. rodriguezi* and other species. A detailed study of Colombian and Venezuelan *Scytalopus* (Donegan & Avendaño 2008), using sound-recordings and specimens, clarified the application of several names and discussed the existence of four undescribed populations in the northern Andes. Among these were 'a presumably undescribed taxon related to *S. rodriguezi*' from Serranía de los Yariguíes.

Methods

Methods undertaken in connection with this research and details of localities appear in Donegan *et al.* (2003), Donegan & Huertas (2005) and Huertas & Donegan (2006). The new

taxon was initially recorded at 1,700–2,100 m at: (i) Alto Siberia (a property subsequently purchased by Fundación ProAves and now the main part of Reserva Natural de Aves (RNA) Reinita Cielo Azul); and (ii) El Talismán, an adjacent property at higher elevation than RNA Reinita Cielo Azul owned by the municipality of San Vicente de Chucurí (effectively a nature reserve, but now also part of Parque Nacional Natural [PNN] Serranía de los Yariguíes). JEA collected two males and a female at El Talisman in 2006, and J. C. Luna *et al.* mist-netted five individuals in RNA Reinita Cielo Azul, which were measured (wing and mass), photographed and released. FL visited RNA Reinita Cielo Azul for ten days in 2007 and made recordings of the tapaculo's vocalisations on 4–5 May 2007 using a Sennheiser ME66 microphone and Sony TCM5000. In total, at least 19 sound-recordings were obtained by FL & D. Willis in 2006–07 and others subsequently (see Appendix). The Yariguíes population was subjected to *ad hoc* playback of songs of *rodriguezi* from Huila (in Álvarez *et al.* 2007).

We compared specimens from Serranía de los Yariguíes with the type series of nominate *rodriguezi* and an apparent *rodriguezi* at the Natural History Museum, Tring. Measurements were taken with callipers to the nearest 0.1 mm for bill length (skull to tip of maxilla) and tarsus length, and with a metal ruler to the nearest 0.5 mm for tail length and wing chord. Body mass (g) was taken from specimen labels and in the field using a 30 g pesola. We also include measurements from the ProAves database of five *S. rodriguezi* mist-netted by J. C. Luna *et al.* (e.g. Fig. 7), following the same protocols. These data were treated both separately and combined with specimen data to produce two sets of analyses, one excluding potentially incomparable data and the other based on higher degrees of freedom (Table 1). Specimens examined by the authors personally or via photographs are listed in Donegan & Avendaño (2008) and include the type series of *S. rodriguezi*, the specimens detailed below and types of all names described from East Andes localities.

Vocal analyses evaluated level of diagnosability in songs and calls between the new subspecies and the nominate. We analysed seven acoustic variables for songs (examples appear in Figs. 3–4) as follows: (i) total number of notes; (ii) total song duration; (iii) song speed or pace (mean number of notes per second, by dividing number of notes in song

TABLE 1

Biometric differences between *S. r. rodriguezi* and *S. r. yariguiorum*. Raw data are presented in the form: mean \pm standard deviation (lowest value–highest value) (n = no. of specimens). Differences are based on statistical tests set out in Methods. Data combined for males and females owing to small sample sizes when treating sexes separately.

Biometric variable	Wing chord (mm)	Tail length (mm)	Tarsus length (mm)	Bill length (mm)	Mass (g)
<i>S. r. rodriguezi</i> specimens	54.8 \pm 1.9 (52.0–56.0) (n = 4)	45.8 \pm 2.1 (44.0–48.0) (n = 4)	22.3 \pm 0.9 (21.5–23.5) (n = 4)	14.8 \pm 0.3 (14.5–15.0) (n = 3)	21.6 \pm 0.3 (21.4–21.9) (n = 3)
<i>S. r. yariguiorum</i> all	55.0 \pm 2.1 (52.0–57.0) (n = 9)	39.2 \pm 1.8 (36.0–40.2) (n = 5)	20.8 \pm 0.5 (20.0–21.5) (n = 5)	14.1 \pm 0.8 (13.5–15.0) (n = 3)	17.1 \pm 1.1 (15.2–19.0) (n = 9)
<i>S. r. yariguiorum</i> specimens	56.3 \pm 0.6 (56.0–57.0) (n = 3)	38.6 \pm 2.27 (36.0–40.2) (n = 3)	21.1 \pm 0.4 (20.8–21.5) (n = 3)	13.5 (n = 1)	17.4 \pm 0.6 (16.8–18.0) (n = 3)
Differences based on 'all' data	N/A	Levels 1, 2 and 4.	N/A (note: level 1 p = 0.04)	N/A	Levels 1–5
Differences based solely on specimen data	N/A	Levels 2 and 4 (note: level 1 p = 0.011).	N/A (note: level 1 p = 0.07)	Level 4	Levels 2–5 (note: level 1 p = 0.003)

by song duration); (iv) max. acoustic frequency of the lowest harmonic (undertone) of the lowest note (kHz); (v) max. frequency of the lowest harmonic of the highest note (kHz); (vi) variation in frequency (difference between the latter two measurements) (kHz); and (vii) frequency bandwidth of the lowest harmonic of the third note (kHz) (the difference between the max. and min. frequency of the lowest harmonic; third note chosen because some but not all recordings, especially after playback, attain higher frequencies towards the song's terminus and the first 1–2 notes are sometimes atypical). In songs, several overtones are present. Measures of max. frequency are of the max. peak point of the lowest undertone (shown as a continuous form on a sonogram) and not of any overlapping or other harmonics. We also considered note shape (viii). For calls, only recordings that increased in acoustic frequency over time were considered (examples in Fig. 5: 'call'). In some recordings of calls for both groups, a fast, scolding rasp followed the initial note, which was ignored for purposes of analysis. For calls, we measured only the following, for the rising note or initial rising note only: (i) length (seconds); (ii) max. frequency of the second-lowest harmonic (kHz); (iii) min. frequency of the second-lowest harmonic (kHz); and (iv) frequency variation (difference between the latter two measurements) (kHz). Note shape (v) was also considered. The second-lowest harmonic was stronger in calls (in contrast to songs), so this and not the lowest harmonic was measured. A max. 3 vocalisations per assumed individual were included in analyses. Recordings both with and without playback were included for both taxa, to ensure that a full range of variables was analysed. Sonograms were produced in Raven Lite 1.0 (sometimes adjusted for brightness, expanded to show up to c.5 kHz and 2–5 seconds). For a list of sound-recordings analysed, see the Appendix. We assessed level of diagnosability in biometrics and vocalisations between the Yarigués and Huila populations using various tests presented in Donegan & Avendaño (2008, 2010) and Donegan (2008, 2012), as follows.

LEVEL 1: statistically significant differences at $p < 0.05$. A Bonferroni correction was applied for both vocal data and biometrics with the number of variables treated separately for each different call type (songs: eight variables, $p < 0.0002$; calls and biometrics: five variables, $p < 0.01$). An unequal variance (Welch's) t -test was used to compare datasets; for song speeds, a two-sample Kolmogorov-Smirnov test was applied as an additional test that must be satisfied for Level 1, to account for the possibility of a non-normal distribution. These calculations assess the statistical significance of differences between the means of populations, but do not address diagnosability, as they tolerate considerable overlap.

Further calculations, described below, were undertaken to measure inter-population differences in the context of various species and subspecies concepts. In the formulae used below, \bar{x}_1 and s_1 are the sample mean and sample standard deviation of Population 1; \bar{x}_2 and s_2 refer to the same parameters in Population 2; and the t value uses a one-sided confidence interval at the percentage specified for the relevant population and variable, with t_1 referring to Population 1 and t_2 referring to Population 2.

LEVEL 2: a '50% / 97.5%' test, following one of Hubbs & Perlmutter's (1942) subspecies concepts, which is passed if sample means are two average standard deviations or more apart controlling for sample size, i.e. the sample mean of each population falls outside the range of 97.5% of the other population: $|\bar{x}_1 - \bar{x}_2| > (s_1(t_{1@97.5\%}) + s_2(t_{2@97.5\%}))/2$.

LEVEL 3: The traditional '75% / 99%' test for subspecies (Amadon 1949, Patten & Unitt 2002), modified to control for sample size, which requires both the following tests to be passed: $|\bar{x}_1 - \bar{x}_2| > s_1(t_{1@99\%}) + s_2(t_{2@75\%})$ and $|\bar{x}_2 - \bar{x}_1| > s_2(t_{2@99\%}) + s_1(t_{1@75\%})$.

LEVEL 4: diagnosability based on recorded values or, for plumage and note shape, subjective diagnosability (the first part of Isler *et al.*'s 1998 diagnosability test).

LEVEL 5: 'Full' statistical diagnosability (where sample means are four average standard deviations apart at the 97.5% level, controlling for sample size). This is the second part of Isler *et al.*'s (1998) diagnosability test: $|\bar{x}_1 - \bar{x}_2| > s_1(t_{1@97.5\%}) + s_2(t_{2@97.5\%})$.

The method for ranking species based on scores using a range of characters developed by Tobias *et al.* (2010) was also applied, subject to the modifications for more rigorous statistical tests applied here, as set out in Donegan (2012). The authors do not necessarily endorse any species concept or statistical approach applied here for assessing species rank.

Results

Morphological and vocal comparisons suggest that the Yariguíes population is related to *S. rodriguezi* but differs sufficiently to be recognised as a new taxon, which we name:

Scytalopus rodriguezi yariguiorum, subsp. nov.

Holotype.—Adult male (Instituto de Ciencias Naturales, Universidad Nacional, Bogotá, Colombia, no. ICN 36178), collected by Jorge E. Avendaño on 18 November 2006 (field no. JEA 391) on the 'Camino del Lenguerke' above Finca El Talimán, Vereda El Centro, San Vicente de Chucurí municipality, west slope of the Yariguíes massif, dpto. Santander, Colombia (06°50'N, 73°21'W; 2,100 m). Tissue sample (heart, Andes-BT 513) and skeleton deposited at the Banco de Tejidos, Universidad de los Andes, Bogotá.

Paratypes.—ICN no. 36179 / Andes BT-514 (male, collected by Jorge E. Avendaño at the type locality on 19 November 2006); ICN 35821 / Andes BT-512 (female, collected by Jorge E. Avendaño at Cerro La Luchata, Finca El Cerro, Vereda El Alto, Galán municipality, east slope of the Yariguíes massif, dpto. Santander, Colombia [06°34'N, 73°18'W; 2,100 m], on 18 April 2006).

Diagnosis.—Exhibits all characteristics of the genus *Scytalopus* (Ridgway 1911, Krabbe & Schulenberg 1997, Donegan & Avendaño 2008) and resembles *S. r. rodriguezi* in the general structure, note shape and sound of its song and calls. Distinguished from *S. r. rodriguezi* by its shorter tail (Table 1, Figs. 1–2A), reduced mass (Table 1, Fig. 2A), smaller body (Fig. 1), darker mantle (Fig. 1), lower pitched song with reduced frequency bandwidth within individual notes (Table 2, Figs. 2B–4) and more 'squashed' note shape (with flattish area of sound towards end of individual notes in the most similar songs) (Figs. 3–4). However, perhaps influenced by the sample size, despite a lack of recorded overlap in vocal variables (Fig. 2) and statistically significant differentiation, the two taxa fall marginally short of the level 5 statistical test of vocal or biometric diagnosis. Differs from *S. vicinior* by its shorter tail and tarsi, and by different note shapes to its songs and calls. Vocally very different from Stiles' Tapaculo *S. stilesi* and Ecuadorian Tapaculo *S. robbinsi* (which Cuervo *et al.* 2005 considered to be related to *S. rodriguezi*) in the note shape of its songs and calls (as for *S. rodriguezi*: see Krabbe *et al.* 2005).

Description of the holotype.—See Fig. 1. Colour nomenclature follows Munsell (1977), except for soft parts. Bill black; irides dark brown; tarsus dark brown, yellowish on front of toes and brown on soles. Crown, upperparts, tail and wings dark grey brown (10YR 2/1) becoming browner (10YR 3/4) on barred rump, with brownish tinge to greater wing-coverts. Tertiaries narrowly tipped brownish (10YR 3/3). Underparts grey (Gley 1, 3.5/N), vent and flanks brown (10YR 3/6) barred black (10YR 2/1). No moult noted. Left testis 2.7 × 1.7 mm. Stomach contents not determined. Measurements (mm): wing chord (skin) 56.0, tail 40.2, tarsus 20.9, total culmen 13.7, mass 18.0 g.

The holotype was not sound-recorded but was heard giving the vocalisation type shown in Fig. 4. Except for the vocally and morphologically distinctive Blackish Tapaculo *S. latrans*,



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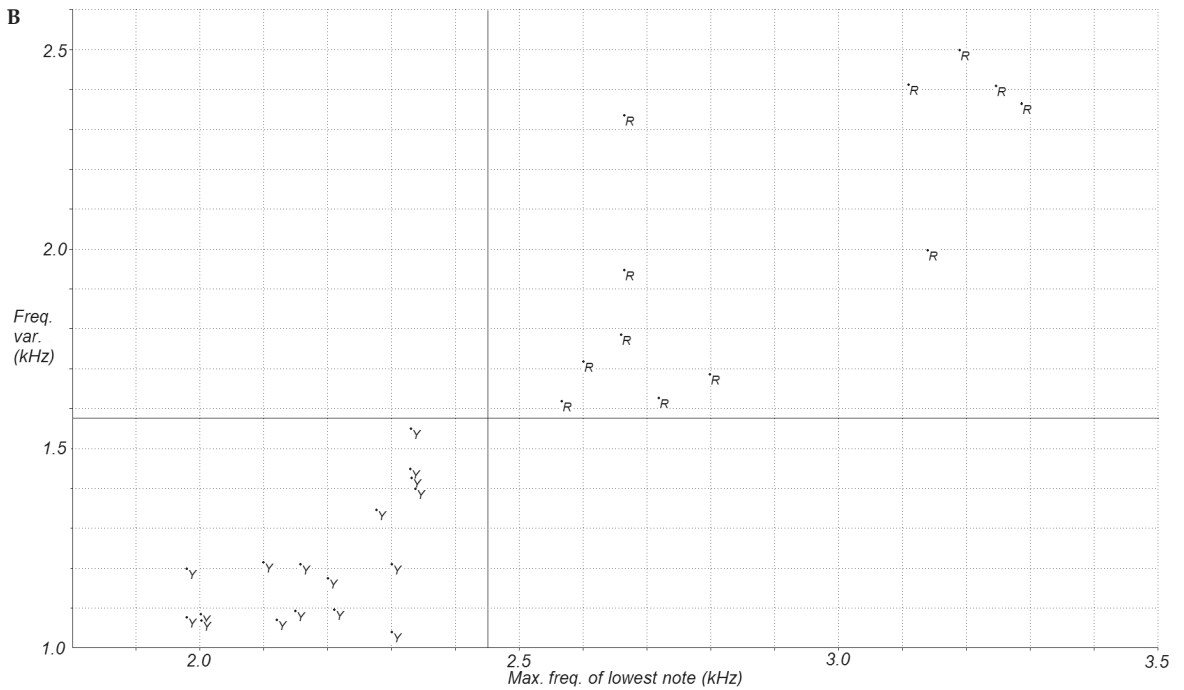
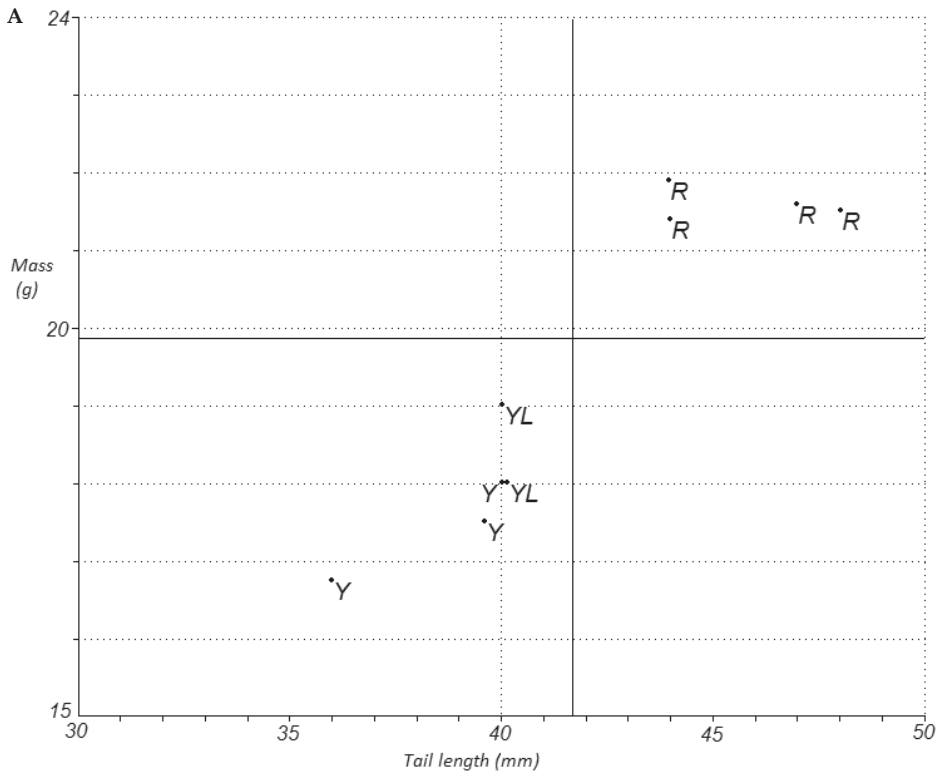


Figure 1 (facing page and above). Left to right, three *S. r. yariguiorum* (ICN 36179 paratype, 35821 paratype and 36178 holotype, see text) and two *S. r. rodriguezii* (ICN 35234, 34845, both paratypes, see Donegan & Avendaño 2008) (Thomas Donegan)

TABLE 2

Vocal differences in songs between *S. r. rodriguezii* and *S. r. yariguiorum*. Data presented in form: mean \pm standard deviation (lowest value–highest value) (n = no. of recordings). N/A = no statistical differentiation. n_{ai} = no. of assumed individuals, whilst n refers to nos. of different actual vocalisations included in the sample.

Vocal variable / No. of notes Taxon		Song length	Song speed (notes / second)	Max. acoustic frequency of highest frequency note's lowest harmonic (kHz)	Max. acoustic frequency of lowest frequency note's lowest harmonic (kHz)	Variation in acoustic frequency of song, between frequencies of lowest harmonics of highest and lowest notes (kHz)	Acoustic frequency bandwidth of lower harmonic in third note (kHz)
<i>S. r. rodriguezii</i> (n_{ai} = 6)	96.17 \pm 70.81 (10.00–252.00) (n = 12)	20.98 \pm 14.80 (2.11–53.74) (n = 12)	4.54 \pm 0.24 (4.14–4.87) (n = 13)	3.35 \pm 0.38 (2.88–3.92) (n = 13)	2.96 \pm 0.37 (2.57–3.79) (n = 13)	0.39 \pm 0.23 (0.13–0.89) (n = 13)	2.10 \pm 0.42 (1.62–2.95) (n = 13)
<i>S. r. yariguiorum</i> (n_{ai} = 6)	77.59 \pm 68.15 (5.00–285.00) (n = 17)	16.07 \pm 13.19 (1.01–54.69) (n = 17)	4.89 \pm 0.53 (4.10–5.75) (n = 17)	2.44 \pm 0.18 (2.15–2.78) (n = 17)	2.18 \pm 0.13 (1.98–2.34) (n = 17)	0.26 \pm 0.14 (0.04–0.50) (n = 17)	1.22 \pm 0.16 (1.04–1.55) (n = 17)
Differences	N/A	N/A	N/A	Levels 1, 2 and 4	Levels 1, 2 and 4	N/A.	Levels 1,2 and 4



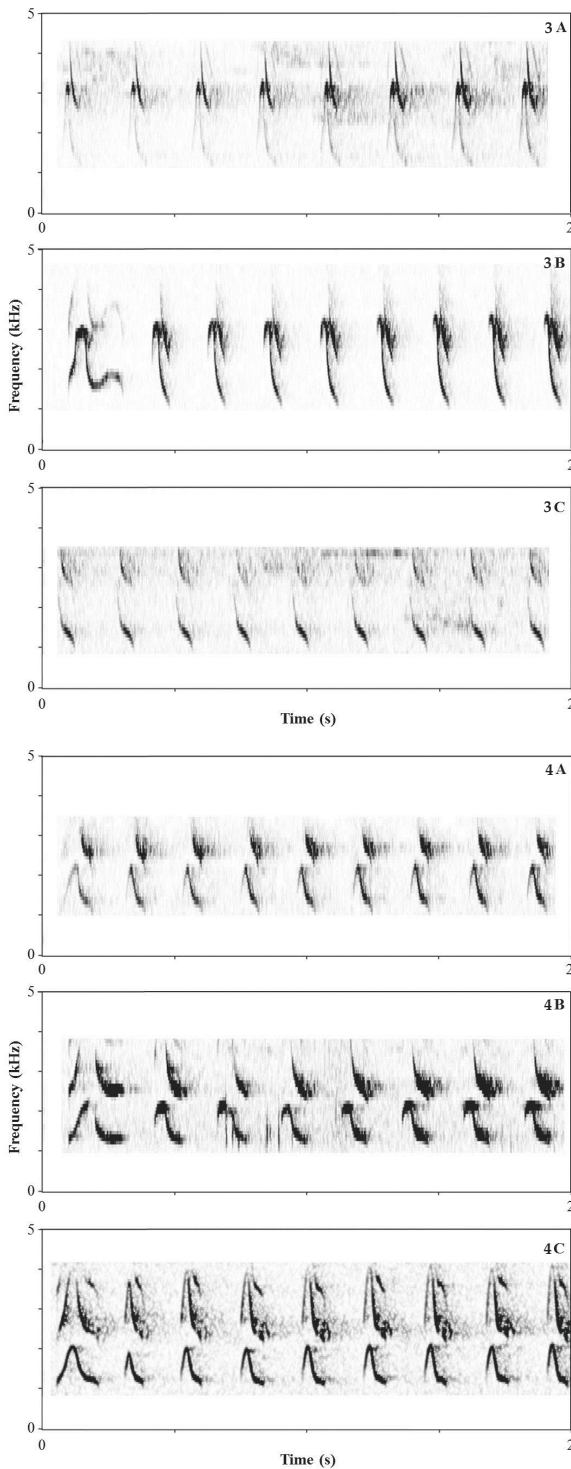


Figure 2 (facing page). Scatter graphs created using PAST showing differentiation: (A) tail length (x -axis) and mass (y) of *S. rodriguezi* populations. Y = Yariguíes specimens, YL = Yariguíes live capture data and R = nominate *S. rodriguezi* specimen data; (B) max. acoustic frequency of lowest note (x) and individual note frequency variation in acoustic frequency (y). Y = Yariguíes recordings, R = nominate *S. rodriguezi* recordings. Note diagnosability based on actual data for all four biometric and vocal variables plotted, denoted by horizontal or vertical lines on the graphs.

Figure 3. Extracts of songs of *S. r. rodriguezi* at the dpto. Huila type locality. A: natural song of the type specimen, XC27395, N. Krabbe, 24 February 2003. B: male song after playback, XC27399, N. Krabbe, 22 February 2003. C: male song after playback, XC27398, N. Krabbe, 22 February 2003. Sonograms here and in Figs. 4–5 produced using 512 frequency bands in Syrinx V2.6h (Burt 2006).

Figure 4. Extracts of songs of *S. r. yariguiorum* all recorded at RNA Reinita Cielo Azul, municipality of San Vicente de Chucurí, Serranía de los Yariguíes, Santander. A: natural song, XC16701 by F. Lambert, 4 May 2007. B: song by P. Boesman (Boesman 2012, track 1695-1), 31 January 2011. C: natural song by D. Willis, unarchived, April 2007.

no other *Scytalopus* was recorded at the type locality. The holotype was collected within 200 m straight-line distance of birds whose sound-recordings are used here, which together with preliminary results of mitochondrial DNA analysis (which will be published elsewhere) leave no doubt that it is representative of birds that give the vocalisations shown in Fig. 4.

Variation in the type series.—See Fig. 1. Both paratypes are apparently subadults. Compared to the holotype, ICN 36179 has a browner back (averaging 10YR 2/2) due to more brownish tips to its mantle feathers. All wing-coverts have brown (10YR 3/4) subterminal marks, forming two wingbars. Flight feathers have a brown (10YR 3/3) tinge to the outer remex. The tertials and secondaries

each have a buffy (10YR 4/3) tip on the outer feather. The barring on the underparts and rump is paler brown (10YR 3/6). ICN 35821 has similar back and underparts colour to the holotype, but also has two brown wingbars, as did an individual trapped by J. C. Luna at

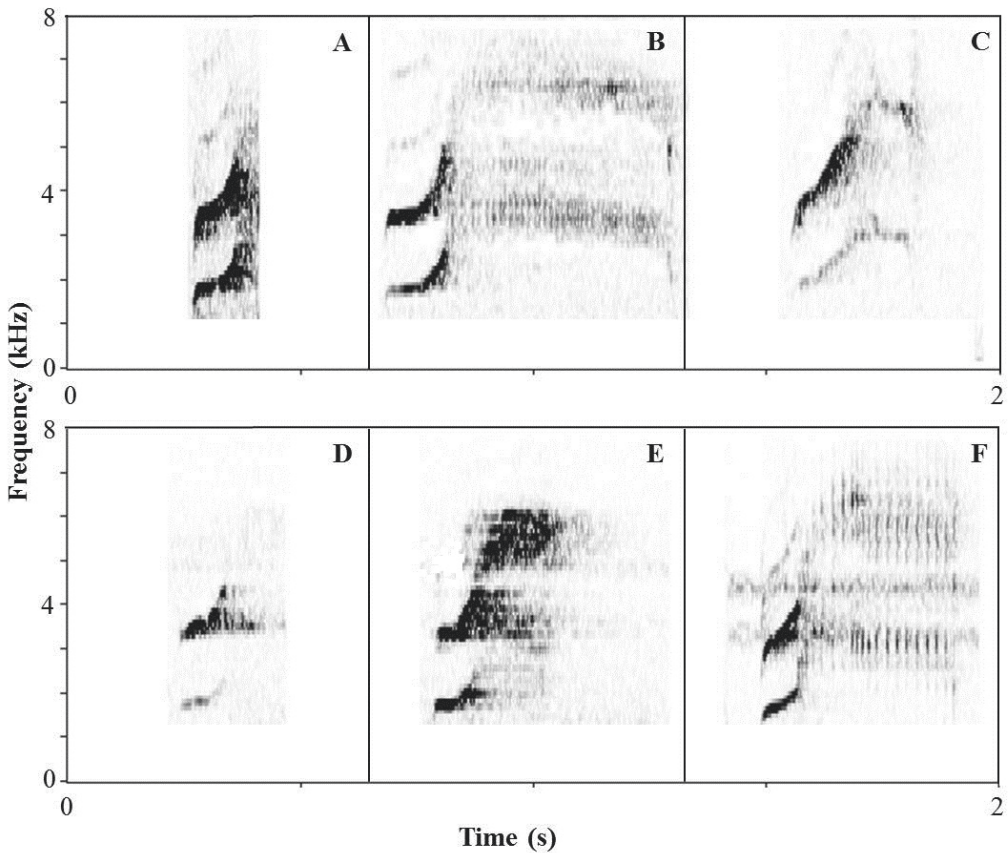


Figure 5. Calls of *S. r. rodriguezii* (A–C) and *S. r. yariguiorum* (D–F). A: call after playback, XC27396, at dpto. Huila type locality by N. Krabbe, 24 February 2003. B: call after playback, XC102442, same locality by J. King, 23 February 2011. C: apparently natural call, XC54842, at Vereda La Argentina, Quebrada Negra, Huila, 2,300 m, by P. Flórez, 18 March 2010. D–F all at RNA Reinita Cielo Azul, San Vicente de Chucurí, dpto. Santander, Colombia: D–E calls of the same individual by Boesman (2012, track 1695-3), 31 January 2011. F: natural call, XC95396 by F. Lambert, 5 May 2007.

TABLE 3

Differences in calls between *S. r. rodriguezii* and *S. r. yariguiorum*. For further information, see Table 2.

Vocal variable / Taxon	Call length	Min. acoustic frequency of second-lowest harmonic (kHz)	Max. acoustic frequency of second-lowest harmonic (kHz)	Variation in acoustic frequency within second-lowest harmonic of call (kHz)
<i>S. r. rodriguezii</i> ($n_{\text{ind}}=3$)	0.12 ± 0.01 (0.10–0.14) ($n = 7$)	2.74 ± 0.21 (2.32–3.01) ($n = 7$)	5.01 ± 0.29 (4.70–5.47) ($n = 7$)	2.27 ± 0.31 (1.81–2.64) ($n = 7$)
<i>S. r. yariguiorum</i> ($n_{\text{ind}}=2$)	0.10 ± 0.01 (0.08–0.11) ($n = 6$)	2.38 ± 0.40 (1.99–2.77) ($n = 6$)	4.43 ± 0.15 (4.24–4.61) ($n = 6$)	2.05 ± 0.28 (1.74–2.37) ($n = 6$)
Differences	N/A (note: level 1 $p = 0.014$)	N/A	Levels 1, 2 and 4.	N/A

the type locality (Fig. 7). The brown barring on the rump extends up the central belly to the lower breast, with more extensive buffy spots on the ear-coverts, neck and face.

Etymology.—The name *yariguiorum* ('of the Yarigui people') is a plural possessive form based on the stem 'yarigui', which need not agree in gender with the generic name in combination under Art. 31.1.2 of the *International code of zoological nomenclature* (ICZN 1999). The name honours the extinct Yariguíes indigenous people and the massif that bears their name, the only region in which *S. r. yariguiorum* has been recorded. Further details of the Yariguíes as a region and people appear in Donegan & Huertas (2006) and Donegan & Avendaño (2010). In these descriptions, *yariguierum* was chosen as the epithet, based on the genitive plural of a fictitious Latin fifth declension noun 'yariguies'. Choice of *yariguiorum* here follows input from N. David & E. C. Dickinson (*in litt.* 2013) and is more consistent with other names such as those for the beetle *Epilachma incaorum* Gordon, 1975, and fungus *Psilocybe aztecorum* Heim, 1957. Neither of the names *yariguierum* Donegan & Huertas, 2006, nor *yariguierum* Donegan & Avendaño, 2010, are incorrect or require emendation.

Distribution.—*S. r. yariguiorum* has been recorded at three localities on both slopes of the Serranía de los Yariguíes at 1,700–2,200 m (Donegan *et al.* 2010; FL unpubl.). Its range and that of nominate *S. rodriguezi* are separated by c.580 km (Fig. 6). The number and concentration of localities (Appendix 1, Fig. 6) suggest that the two populations are presently isolated, but available distributional data preclude accurate niche modelling analysis (Pearson *et al.* 2007). White-crowned Tapaculo *S. atratus confusus* and Long-tailed Tapaculo *S. micropterus* replace *S. rodriguezi* below at least 1,650 m, whilst Spillmann's Tapaculo *S. spillmanni* replaces it at least above 2,400 m on the western slope. *S. latrans* is sympatric with both *S. spillmanni* and *S. r. yariguiorum* in the Yariguíes Mountains. *S. atratus* and *S. spillmanni* both range up to the treeline at 2,900 m in the region (Donegan & Avendaño 2008, Donegan *et al.* 2010).

There are no records of *S. rodriguezi* in dptos. Meta, Caquetá, Cundinamarca, Boyacá or Santander (Krabbe *et al.* 2005, McMullan *et al.* 2010, 2011; Fig. 6). Nominate *S. rodriguezi* has been recorded only in the southernmost part of the head of the Magdalena Valley in dpto. Huila, where it is known from several localities (Fig. 6, Appendix 1). We have searched forested localities at c.1,700–2,000 m on the west slope of the East Andes in dpto. Cundinamarca (e.g. Parque Nacional Chicaque and Pedro Palo: TMD) and dpto. Santander (14 localities at 1,000–2,100 m: Avendaño 2005, 2006, 2007), and higher elevations of Serranía de las Quinchas in dpto. Boyacá have also been worked (e.g. Laverde *et al.* 2005). However, *S. atratus*, *S. latrans*, *S. spillmanni* and *S. griseicollis* are the only *Scytalopus* recorded to date in the region, with *S. micropterus* recently sound-recorded in the lower part of RNA Reinita Cielo Azul below the range of *S. rodriguezi* (T. Ellery *in litt.* 2013; recordings on www.xeno-canto.org). Other observers (see Acknowledgments) who have studied birds in the central East Andes have similarly failed to record *S. rodriguezi*.

Several lines of evidence suggest that the two disjunct populations of *S. rodriguezi* are historical. First, collecting efforts over the past 200 years at several pre-montane sites in dptos. Cundinamarca, Boyacá and Santander, when forest cover was greater, resulted in tens of specimens of *S. griseicollis* and *S. latrans*, as well as a handful of *S. spillmanni* and *S. atratus* (Donegan & Avendaño 2008) but no *S. rodriguezi*, which is known from older skins also only from dpto. Huila. Second, despite extensive deforestation on the west slope of the East Andes, some remnant patches of pre-montane forest in dptos. Cundinamarca, Boyacá and Santander have been visited by many ornithologists but support only *S. atratus*, *S. spillmanni* and *S. latrans*. Among established geographic or environmental barriers that coincide with the range limits of several Andean birds are the Horta and Opón depressions (which isolate Serranía de los Yariguíes from the rest of the East Andes and south of which

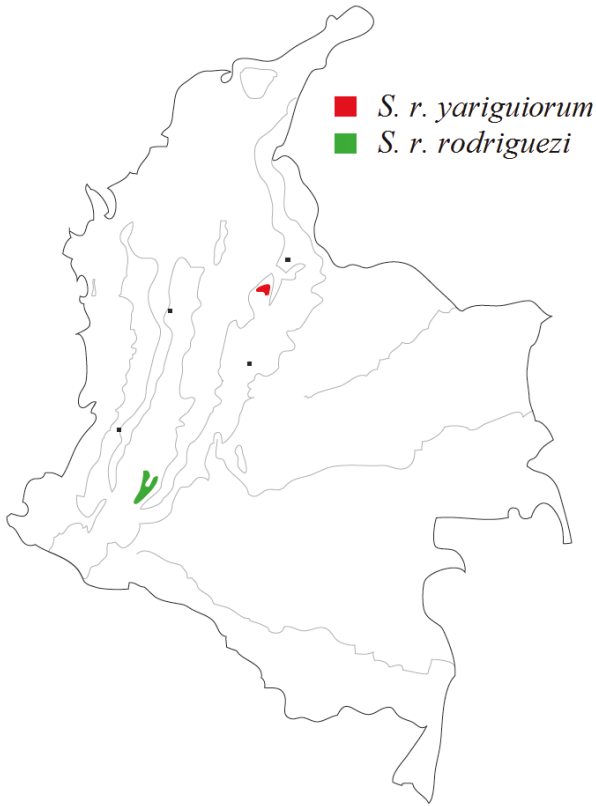


Figure 6 (left). Distributions of *S. rodriguezi yariguiorum* and *S. r. rodriguezi* in Colombia. Narrow lines show major eastern rivers and the 1,000 m contour. Small squares denote major Colombian cities.

Figure 7 (below). Immature *S. rodriguezi yariguiorum*, RNA Reinita Cielo Azul, dpto. Santander, Colombia, 2005 (Juan Carlos Luna / ProAves)



the west slope is considerably less humid: Donegan & Avendaño 2010) and Las Cruces pass in PNN Serranía de los Picachos (at c.1,210 m) in the East Andes (Graham *et al.* 2010). Our explorations of Serranía de los Yariguíes in the mid 2000s led to the discovery of several new taxa endemic to the range among birds (Donegan 2008, Donegan & Avendaño 2008, 2010) and other groups (Huertas & Arias 2007), and which are represented by other subspecies in the adjacent East Andes, although these have tended to be higher elevation taxa than *S. r. yariguiorum*.

Conservation.—*S. rodriguezi* has an apparently restricted and fragmented range, and its only localities are in primary forest. It is therefore probably affected by habitat loss and is presently treated as Endangered. However, this assessment was made based on the upper Magdalena distribution, pending a review by BirdLife's taxonomic committee on whether to treat the Yariguíes population within *S. rodriguezi* or as a separate species (BirdLife International 2012). The east slope of the Yariguíes massif has been extensively deforested mainly between 400 m and 2,000–2,400 m. On this slope, only a single mist-net capture and no sound-recordings were made at La Luchata in two weeks of observations. La Luchata constitutes probably the largest remaining fragment of forest at c.2,000 m in the central to southern section of the east slope of the Yariguíes, but it is small and the habitat degraded. There is also some forest above Zapatoaca on the northernmost part of the east slope, mostly above 2,300 m, which may support *S. rodriguezi* in its lowest part. On the west slope, pre-montane forests have been cleared to 1,700–1,900 m in the north (in San Vicente de Chucurí municipality), to just below the lower altitudinal limit of *S. r. yariguiorum*. Forests of suitable elevation are largely intact in the more inaccessible central to southern regions on the west slope of the range, which were surveyed aerially (Donegan & Huertas 2005). Whilst deforestation has continued apace in the lowlands around the Yariguíes massif since 2004, Google Earth® maps suggests that higher elevations on the west slope remain relatively intact. As a result, conservation efforts should focus on the west slope of the Yariguíes where suitable elevations for the new taxon are largely protected within PNN Serranía de los Yariguíes and RNA Reinita Cielo Azul. *S. r. yariguiorum* is probably best treated as Endangered based on IUCN criteria B1ab(i,ii,iii) and A2c+3c+4c;B1ab(i,ii,iii).

Vernacular names.—'Yariguíes Tapaculo' would be an appropriate English name for *yariguiorum*. If it is lumped with *rodriguezi* then Magdalena Tapaculo, rather than Upper Magdalena Tapaculo, may be a more appropriate name for the combined species, given its broader distribution.

Ecology.—Typical of *Scytalopus*, the new taxon occurs in forest undergrowth, taller scrub at forest borders and in regenerating forest. It is skulking, virtually flightless and retiring like all congeners. Based on stomach contents it is insectivorous.

Taxonomic rank.—*S. r. yariguiorum* should be treated as meeting the requirements of subspecies concepts for allopatric populations (Remsens 2010) on account of its different biometrics, plumage and song from nominate *S. rodriguezi*. Isler *et al.* (1998) and Helbig *et al.* (2002) suggested treating distinctive allopatric populations as species or subspecies depending on the degree of differentiation compared to that between related species that are sympatric. Adopting such an approach, there is a reasonable case to rank *S. r. yariguiorum* as a species.

A benchmark comparison for *rodriguezi* vs. *yariguiorum* is fraught with difficulty because there are inconsistencies concerning the use of differences in songs and calls to rank allopatric species in *Scytalopus*. Andean forms differing principally in their calls (e.g. Páramo Tapaculo *S. opacus* and *S. (o.) androstictus*: Krabbe & Cadena 2010) or which show substantial but incomplete differentiation in songs (e.g. populations of *S. spillmanni*: Donegan & Avendaño 2008) are presently treated as subspecies (or, in the case of *spillmanni*,

monotypic) by most authorities (e.g. Remsen *et al.* 2013). In contrast, some Brazilian taxa have been ranked as species based on differences only in calls and juvenile plumages (e.g. Bornschein *et al.* 2007, Remsen *et al.* 2013). In the case of Brazilian taxa, although morphological differentiation is similar to or less impressive than that between some Andean subspecies, molecular distance is greater. No attempt at a phylogeny for Andean *Scytalopus* has been published since Arctander & Fjeldså (1994), whose taxon sampling, especially for northern Andean populations, was incomplete and based on a now much-revised taxonomy. This complicates the identification of related sympatric species pairs with which comparisons should be made.

Nevertheless, examples exist of Andean species with similar vocal differentiation to that between *rodriguezi* and *yariguiorum*. Donegan & Avendaño (2008) found *S. griseicollis* and the undescribed East Andes population of *S. spillmanni* to have more or less similar vocalisations and to replace one another by habitat and elevation in Serranía de los Yariguíes. They exhibit diagnostic differences in only a single variable in song, among those measured, although differences in the opening notes and in timbre were not studied in detail. In contrast, *S. rodriguezi* populations show two quantitative and one subjective differences in song (Table 2, Figs. 2B–4), although the former narrowly miss our statistical test of diagnosability.

The Tobias *et al.* (2010) test of species rank is another method for ranking allopatric populations. *S. r. yariguiorum* would attain 3 points vis-à-vis *rodriguezi* for biometrics (mass being strongest; but potentially could be scored 4 due to differences being in proportion, not just general size, on account of the similar wing but differing tail size: N. J. Collar *in litt.* 2013), 2 points for voice (2 for frequency, ‘note shape’ potentially scored 3 but subjective), 1–2 for plumage (darker mantle), giving a total of 6–9 points, with 7 being the recommended minimum for species rank, illustrating the borderline status of this case.

However, there are some negative factors against treating *yariguiorum* specifically. First, while there is no measured overlap in voice and the differences are statistically significant and statistically differentiated, the level 5 test of diagnosis was not met for any quantitative vocal variable, perhaps due to sample size. Second, these differences in songs are for two measures of acoustic frequency, which was the most plastic of acoustic variables studied by Donegan & Avendaño (2008) for *Scytalopus* and capable of being influenced by environmental factors in suboscines (Kroodsma 2005, Saranathan *et al.* 2007). Finally, *S. r. yariguiorum* responds to playback of *rodriguezi* (Álvarez *et al.* 2007). This could be an aggressive territorial response, given that suboscine congeners will respond to playback of related species (e.g. Donegan 2012), or could mean that they would not be reproductively isolated in the unlikely event of contact.

S. r. yariguiorum, being a geographically isolated and morphologically diagnosable population, appears to be an ‘incipient species’ (Patten 2010) but whether it should be ranked as a subspecies or species is a question of species concept and approach. Some recently described new bird taxa from the Neotropics which could be considered similar cases have been described as species (e.g. Freitas *et al.* 2012, Lara *et al.* 2012, Seeholzer *et al.* 2012). However, we adopt a more conservative approach to bring the long-overdue naming of *yariguiorum* to conclusion. Its proposed rank here should not be taken as representing any of the authors’ views as to the more appropriate taxonomic treatment.

Acknowledgements

We thank the rest of the EBA Project team, particularly B. Huertas and E. Briceño and local guides J. Pinto and H. Figueroa. D. Willis kindly provided sound-recordings and other information and independently identified *S. rodriguezi* as occurring in the Yariguíes before we first published this finding. M. McMullan produced the distribution map, J. C. Luna provided photographs of live birds and he, F. Guerrero, Luz

Marina and Fundación ProAves made available biometric data. P. Salaman and J. C. Verhelst provided specimen data from the Biomap Project. D. Calderón-F., O. Cortés, O. Laverde and J. P. López commented on their observations in the East Andes. We acknowledge the recordists cited in the Appendix, especially N. Krabbe *et al.* in Huila, and P. Boesman for recordings in Yariguíes. C. D. Cadena facilitated genetic data. N. J. Collar, N. David, E. C. Dickinson, G. Kirwan, N. Krabbe, P. Salaman, R. Schodde and T. Schulenberg kindly commented on the manuscript. CAS (resolution no. 832 of 2004, with thanks to A. Prada, A. Rodríguez and H. Lamo), Corporación Autónoma Regional para la Defensa de la Meseta de Bucaramanga–CDMB (H. Guevara) and the mayors of San Vicente de Chucurí and Galán provided permissions for field work, the former including a collecting permit. We are grateful to Paul Sweet and Tom Trombone (American Museum of Natural History, New York), R. Prýs-Jones, M. Adams and D. Russell (Natural History Museum, Tring), F. Forero and S. Sierra (Instituto Alexander von Humboldt, Villa de Leyva), J. G. Moreno Patiño (Universidad Industrial de Santander, Bucaramanga), Hno. R. Casallas and D. Perico (Museo de Historia Natural, Universidad de la Salle, Bogotá), J.-F. & C. Voisin (Muséum National d’Histoire Natural, Paris), F. G. Stiles (Instituto de Ciencias Naturales, Bogotá), M. Lentino (Colección Ornitológica Phelps, Caracas), C. Milensky and H. James (National Museum of Natural History, Washington DC) for access to specimens. The EBA and YARÉ expeditions were supported by: the Royal Geographical Society, BP Conservation Programme (BirdLife International, Conservation International, Flora & Fauna International, Wildlife Conservation Society), Fondo para Acción Ambiental, Fundación Omacha, Conservation International Colombia (Becas Iniciativa de Especies Amenazadas—Jorge Ignacio ‘El Mono’ Hernández-Camacho), Rio Tinto plc, Duke of Edinburgh, the Percy Sladen Memorial Fund (Linnean Society), Fundación ProAves, Game Conservancy Trust, World Pheasant Association, Tropical Andean Butterfly Diversity Project, Carter Ecological, Universidad Industrial de Santander, Universidad de Caldas, Universidad de Tolima and Gobernación de Santander. IdeaWild and The Explorers Club provided equipment and financial support, respectively, to JEA.

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Addresses: Thomas M. Donegan, ProAves Foundation, Southmead, The Vale, London N14 6HN, UK, e-mail: tdonegan@proaves.org. Jorge Enrique Avendaño, Programa de Biología y Museo de Historia Natural, Universidad de los Llanos, sede Barcelona, km 12 vía Puerto López, Villavicencio, Colombia, e-mail: jorgeavec@gmail.com. Frank Lambert, e-mail: flambertemail@yahoo.co.uk

Appendix: list of sound-recordings used in vocal analyses.

S. r. rodriguezi.—COLOMBIA. Huila. Songs: Finca Merenberg (02°12'N, 76°06'W; 2,200 m) (XC27394–95 (type specimen of nominate *rodriguezi*, treated as same individual); as previous but two different individuals at 2,235 m (XC27398–99: N. Krabbe); as previous (Álvarez *et al.* 2007 track 34: P. Salaman, treated conservatively as same individual as one of Krabbe's recordings); as previous, 2,320 m (XC102441–12: J. King, treated as same individual). Cordillera de las Minas (02°05'N, 76°02'W; 2,000 m) (XC27397: N. Krabbe). La Argentina, Verena, Quebrada Negra (coordinates unknown; 2,350 m) (XC54841, 55220: P. Flórez). Calls: XC27393 (as XC27394). XC27396 (as 27398, but 2,300 m). XC54842 (as XC54841), XC102441 (as above).

S. r. yariguiorum.—COLOMBIA. Santander, Serranía de los Yariguíes, RNA Reinita Cielo Azul, San Vicente de Chucurí. Songs (XC16701 and two unarchived recordings, all treated as same individual): F. Lambert; XC143847–50, treated as same individual: D. Calderón; eight unarchived recordings, treated as three individuals: D. Willis; Boesman 2012, tracks 1695-1–2, treated as same individual). Calls (XC95396: F. Lambert; Boesman 2012, track 1695–3).