Papéis Avulsos de Zoologia
Museu de Zoologia da Universidade de São Paulo

ARTICLE

On the occurrence of *Scinax kennedyi* (Pyburn, 1973) (Anura, Hylidae) in the state of Roraima, northern Brazil

André Gomes Lopes[1,2,3] & Ariovaldo Antonio Giaretta[1,4]

[1] Universidade Federal de Uberlândia (UFU), Instituto de Ciências Exatas e Naturais do Pontal (ICENP), Laboratório de Taxonomia e Sistemática de Anuros Neotropicais (LTSAN). Ituiutaba, MG, Brasil.
[2] Universidade de São Paulo (USP), Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto (FFCLRP), Departamento de Biologia (DB), Programa de Pós-Graduação em Biologia Comparada. Ribeirão Preto, SP, Brasil.
[3] ORCID: https://orcid.org/0000-0002-4130-0005. E-mail: gomesandrebio@gmail.com (corresponding author)
[4] ORCID: https://orcid.org/0000-0001-7054-129X. E-mail: aagiaretta@gmail.com

Abstract. *Scinax* comprises 129 species of treefrogs divided between the *S. ruber* and the *S. catharinae* clades. The *S. rostratus* group belongs to the *S. ruber* clade, and comprises ten species characterized by having a dark interorbital triangular mark, tubercle on the heel and by vocalizing in a head-down position. Within this group, *S. kennedyi* and *S. rostratus* are similar in that they are the only species that do not possess a row of tubercles on the lower jaw. In spite of their morphological similarity, they can be distinguished from each other by male size and advertisement call traits. *Scinax kennedyi* was described from eastern Colombia, and occurs from central Colombia to western Venezuela, whereas *S. rostratus* was described from northern Venezuela, and is thought to occur from Panama to eastern Venezuela, and in the Brazilian state of Pará. A recent study reported a population identified as *S. rostratus* from the state of Roraima, in northern Brazil. However, this population presented substantial differences in male size and advertisement call in comparison to the described for this species, and apparently it best fits the diagnosis of *S. kennedyi* instead. In view of this, the present study aimed to clarify the identity of this Brazilian population through a reassessment of its specimens and call recordings, together with the examination of data of *S. kennedyi* from its type locality, and of *S. rostratus* from northern Venezuela. Acoustic and morphological analyses revealed that specimens from northern Brazil were indeed misidentified as *S. rostratus,* and hence they were herein reassigned to *S. kennedyi*. The study therefore demonstrates the occurrence of *S. kennedyi* in Brazil, extending its distribution *ca.* 1,120 km east by south from its type locality, and *ca.* 844 km east-southeast from its easternmost previous record. With this reassessment, a clearer acoustic diagnosis between *S. kennedyi* and *S. rostratus* was provided, as well as further data on fine-scale temporal traits of their calls.

Keywords. Advertisement call; Amazon Basin; Bioacoustics; Geographic distribution; *Scinax rostratus* group.

INTRODUCTION

As presently defined, *Scinax* Wagler, 1830 comprises 129 species of treefrogs (Frost, 2022) allocated into the *S. catharinae* and *S. ruber* clades (*sensu* Faivovich *et al.,* 2005). The *S. ruber* clade contains 77 species, of which ten are assigned to the *S. rostratus* group and three to the *S. uruguayus* group (Faivovich *et al.,* 2005; Baldo *et al.,* 2019), while the remaining are not assigned to any group until the present moment. The *S. rostratus* group was first proposed by Duellman (1972) and supported as monophyletic by subsequent morphological and molecular studies (*e.g.,* Faivovich, 2002; Faivovich *et al.,* 2005). Its species are characterized mainly by having a dark triangular mark between the eyes and tubercle on the heel [this latter character may be absent in *S. kennedyi* (Pyburn, 1973) and *S. rostratus* (Peters, 1863) (Faivovich *et al.,* 2005; present study)], in addition to typically calling in a vertical head-down position (Duellman, 1972; Faivovich, 2002; Faivovich *et al.,* 2005).

Among the species of the *Scinax rostratus* group, *S. kennedyi* and *S. rostratus* are the only ones that do not possess a row of tubercles on the edge of the lower jaw (Duellman, 1972; Pyburn, 1973; Duellman & Wiens, 1992; Lescure & Marty, 2000; Lima *et al.,* 2004). Although they are similar regarding this aspect, they differ from each other mainly in male size, with *S. kennedyi* having smaller snout-vent length (SVL) (31.1-35.3 mm vs. 40-45.7 mm in *S. rostratus;* Duellman, 1970; Pyburn, 1973), and in advertisement call traits (León, 1969; Duellman, 1972; Pyburn, 1973). *Scinax kennedyi* was described from "*ca.* 110 mi ESE Puerto Gaitán, Departamento de Meta, Colombia",

Pap. Avulsos Zool., 2022; v.62: e202262036
http://doi.org/10.11606/1807-0205/2022.62.036
http://www.revistas.usp.br/paz
http://www.scielo.br/paz
Edited by: Pedro Murilo Sales Nunes
Received: 01/12/2021
Accepted: 12/04/2022
Published: 27/05/2022

ISSN On-Line: 1807-0205
ISSN Printed: 0031-1049
ISNI: 0000-0004-0384-1825

and occurs in central and eastern Colombia, and in westernmost Venezuela (Pyburn, 1973; Angarita-Sierra *et al.,* 2013; Pedroza-Banda *et al.,* 2014; Acosta-Galvis 2018a, b). *Scinax rostratus* was described from Caracas, northern Venezuela, with occurrences reported from Panama to eastern Venezuela, and also from two localities in the Brazilian state of Pará, geographically disjunct from the remaining of its distribution records (Peters, 1863; Rivero, 1968; Duellman, 1972; Gorzula & Señaris, 1998; Nieto-Castro, 1999; Barrio-Amorós *et al.,* 2004, 2019; Sturaro *et al.,* 2010).

Recently, Bang & Giaretta (2017) reported a population identified as *Scinax rostratus* from the state of Roraima, northern Brazil, thus supposedly filling this gap in the species' distribution. However, these specimens have smaller size than the reported in literature for this species (León, 1969; Duellman, 1970, 1972; Sturaro *et al.,* 2010), and calls with substantially lower pulse rate and lower dominant frequency of both emphasized frequency bands in comparison to the previously reported (León, 1969; Duellman, 1972). Actually, the traits Bang & Giaretta (2017) described for this population best fit the diagnosis of *S. kennedyi.* In view of these discrepancies, the present study aims to clarify the identity of this Brazilian population based on the re-examination of the data presented in Bang & Giaretta (2017), together with the examination of data of *S. rostratus* from northern Venezuela, and of topotypic *S. kennedyi.*

MATERIAL AND METHODS

Data acquisition

Specimens and call recordings presented in Bang & Giaretta (2017), deposited in the Collection of Frogs of the Museu de Biodiversidade do Cerrado (Universidade Federal de Uberlândia; AAG-UFU), were reanalysed. These data were obtained on 27-28 July 2016, in the municipality of Cantá, state of Roraima, Brazil [02°45′59.0″N, 60°36′32.0″W; 70 m above sea level (asl); datum WGS84] (Fig. 1). Recordings were made with a Sennheiser® K6/ME67 directional microphone connected to a Marantz® PMD 671 digital recorder (sampling rate of 44.1 kHz; 24-bits resolution).

Recordings of *Scinax kennedyi* presented in Pyburn (1973), deposited in the Macaulay Library collection (Cornell Lab of Ornithology), were also reanalysed. These

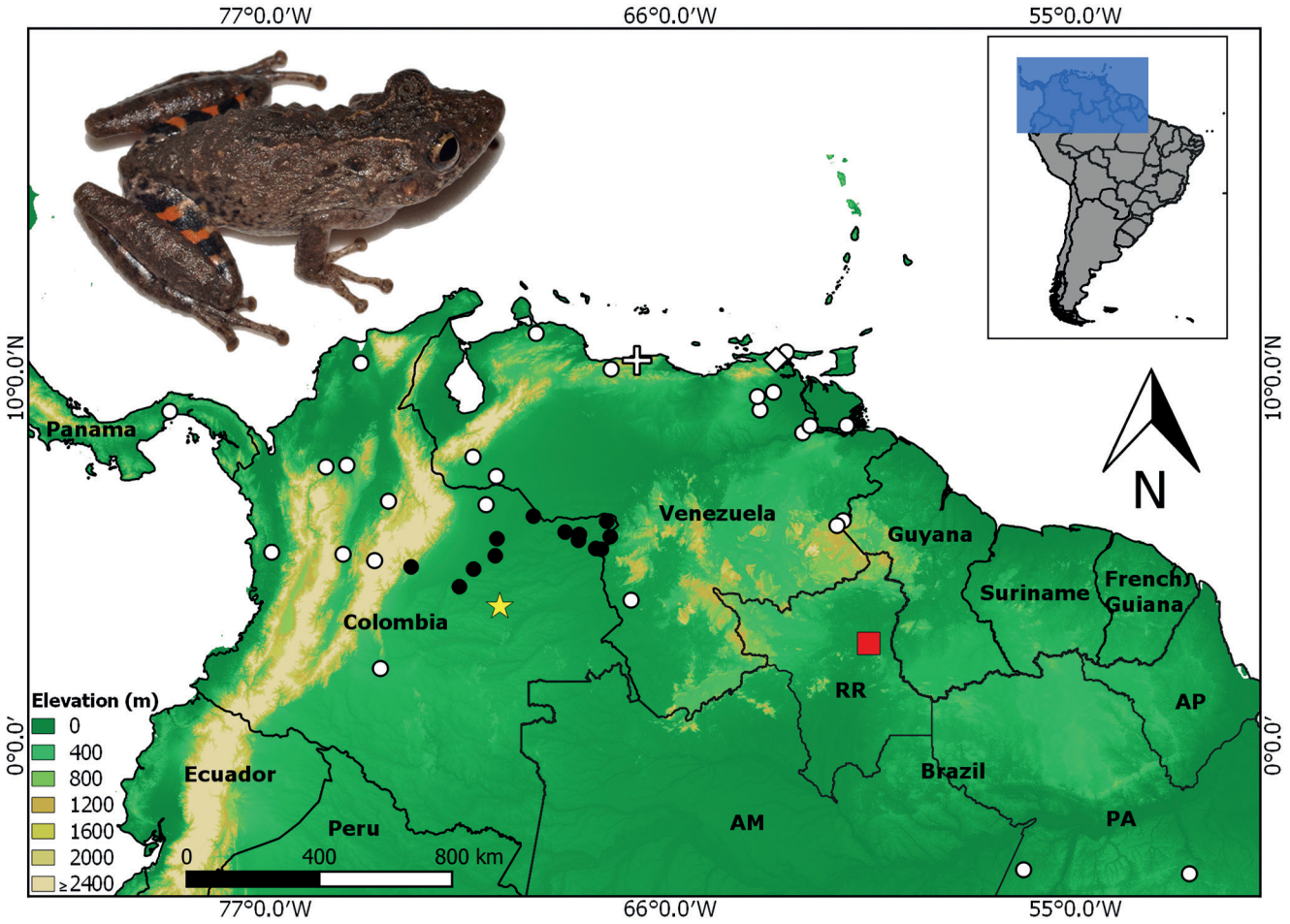

Figure 1. Distribution records of *Scinax kennedyi* [yellow star = type locality (approximation); black dots = literature records (Pyburn, 1973; Angarita-Sierra *et al.,* 2013; Pedroza-Banda *et al.,* 2014; Acosta-Galvis, 2018a, b); red square = new record] and *S. rostratus* [white cross = type locality; white dots = literature records (Rivero, 1968; Duellman, 1972; Gorzula & Señaris, 1998; Nieto-Castro, 1999; Barrio-Amorós *et al.,* 2004; Sturaro *et al.,* 2010); white diamond = Guaráunos, state of Sucre (data herein examined)]. Abbreviations of the Brazilian states: AM (Amazonas), AP (Amapá), PA (Pará), and RR (Roraima). Specimen in the upper left area: *Scinax kennedyi* (AAG-UFU 5573; SVL = 31.8 mm) from municipality of Cantá, state of Roraima, Brazil.

were obtained on 13 April 1971, in the species' type locality (*ca.* 110 mi ESE Puerto Gaitán, Departamento de Meta, Colombia; *ca.* 03°46′35.2″N, 70°37′48.4″W; 179 m asl) (Fig. 1). Recordings were made with a Uher® 4000 Report-L recorder (digitized at a sampling rate of 44.1 kHz and 16-bits resolution). Although none of the recorded specimens were collected, they were recorded at the same site and date the holotype was collected (Pyburn, 1973).

Specimens and recordings of *Scinax rostratus,* respectively deposited in the KU Herpetology collections (University of Kansas; KUH) and in the Macaulay Library collection (Cornell Lab of Ornithology), were analysed. These data were obtained on 28 July 1974, nearby Guaráunos, Río Sabacual, state of Sucre, northern Venezuela (*ca.* 10°30′16.3″N, 63°07′54.5″W; 23 m asl), located *ca.* 413 km east from the species' type locality (Fig. 1). Recordings were made with a Uher® microphone connected to a Uher® 4000S recorder (digitized at a sampling rate of 96.0 kHz; 24-bits resolution). See Appendices 1 and 2 for further details on specimens and recordings herein examined, respectively.

Acoustic analyses

Calls were analysed in Raven Pro v.1.5 software (K. Lisa Yang Center for Conservation Bioacoustics, 2014) with the following settings: window size = 256 samples; 3 dB filter bandwidth = 248 or 539 Hz; window type = Hann; overlap (locked) = 89.8%; hop size = 0.271 or 0.590 ms; DFT size = 1,024 samples; grid spacing = 43.1 or 93.8 Hz. High-pass filters up to 500 Hz and low-pass filters up to 5,000 Hz were applied to the recordings to reduce background noise. Dominant, maximum, and minimum frequencies were respectively obtained with the "Peak Frequency", "Frequency 95%", and "Frequency 5%" functions of the software. Pulse rate was measured from a 100 ms section in the middle of the call, as follows: (number of pulses – 1)/time between the onset of first and last pulse. It was adopted the call-centered approach *sensu* Köhler *et al.* (2017). Acoustic terminology and definitions followed Köhler *et al.* (2017). Sound figures were produced in R platform v.3.6.2 (R Core Team, 2019) with seewave v.2.1.6 (Sueur *et al.,* 2008) and tuneR v.1.3.3 (Ligges *et al.,* 2018) packages, under the following settings: window = Hanning; overlap = 85%; FFT = 256.

RESULTS

Specimen identification

Specimens from Cantá (Roraima, Brazil) (n = four males; two being call vouchers) match the diagnosis provided in the original description of *Scinax kennedyi* by Pyburn (1973), being diagnosed by the following combination of traits: (1) snout-vent length (SVL) of 31.8-34.3 mm in males; (2) absence of a row of tubercles in the lower jaw; (3) extremely reduced, rounded heel tubercle (absent in AAG-UFU 5575); (4) dark interorbital triangular mark (apex directed posteriorly) edged with a pale cream line; (5) dark dorsum, with some individuals having a nearly smooth skin texture bearing very few, small, rounded tubercles (AAG-UFU 5575-76), whereas other individuals have a more (albeit still moderately) tuberculate skin texture (AAG-UFU 5573-74); (6) broad orange and black (in life; colours respectively become creamy white and black in preservative) vertical bars on anterior and posterior surfaces of thigh, and inner surface of tarsus; (7) dark transverse bars on upper surfaces of tibia and forearm; (8) snout slightly acuminate, projecting beyond the margin of lower jaw, and lacking a fleshy proboscis.

Specimens from Guaráunos (Sucre, Venezuela) (n = two; both being call vouchers) match the diagnoses of *Scinax rostratus* provided by Duellman (1970, 1972), being diagnosed by the following combination of traits: (1) SVL of 41.59-43.27 mm in males; (2) absence of a row of tubercles in the lower jaw; (3) extremely reduced, rounded heel tubercle; (4) dark interorbital triangular mark (apex directed posteriorly); (5) pale brown (in preservative) dorsum, with nearly smooth skin texture; (6) broad creamy white and dark brown (in preservative) vertical bars on anterior and posterior surfaces of thigh, and inner surface of tarsus; (7) dark transverse bars on upper surfaces of tibia and forearm; (8) snout broad, acutely rounded, projecting beyond the margin of lower jaw, and lacking a fleshy proboscis.

As depicted above, *Scinax kennedyi* and *S. rostratus* turned out to be quite similar to each other, so that morphological and chromatic traits traditionally used in their respective diagnoses, although useful to distinguish them from the remaining species of the *S. rostratus* group, were not enough to unambiguously separate one from the other. The only character that proved to be reliable to establish a clear differential diagnosis between the two species was the male SVL, since examined males of *S. kennedyi* have smaller SVL than those of *S. rostratus* (no overlap of values).

Description of advertisement calls

The advertisement calls from Cantá (Fig. 2A) and of the topotypes of *Scinax kennedyi* (Fig. 2B) have the same structural pattern and very similar trait values. These calls consist of a single multi-pulsed note with variable durations and intervals. The first pulse has a remarkably smaller amplitude, whereas all other pulses share with each other nearly the same amplitude level. Pulses are well-spaced from each other (Figs. 3A, B), usually have slight internal amplitude modulations, and in general the first pulse is longer than the others. Calls have two emphasized frequency bands, hereinafter referred to as the lower (LFB) and the higher (HFB) frequency bands, with the dominant frequency being able to alternate between both along call emissions [as it is common in calls of several *Scinax* species; *e.g.,* Magrini *et al.* (2011); Novaes & Zina (2016)]. Regarding the Brazilian population, the dominant frequency corresponded only to the

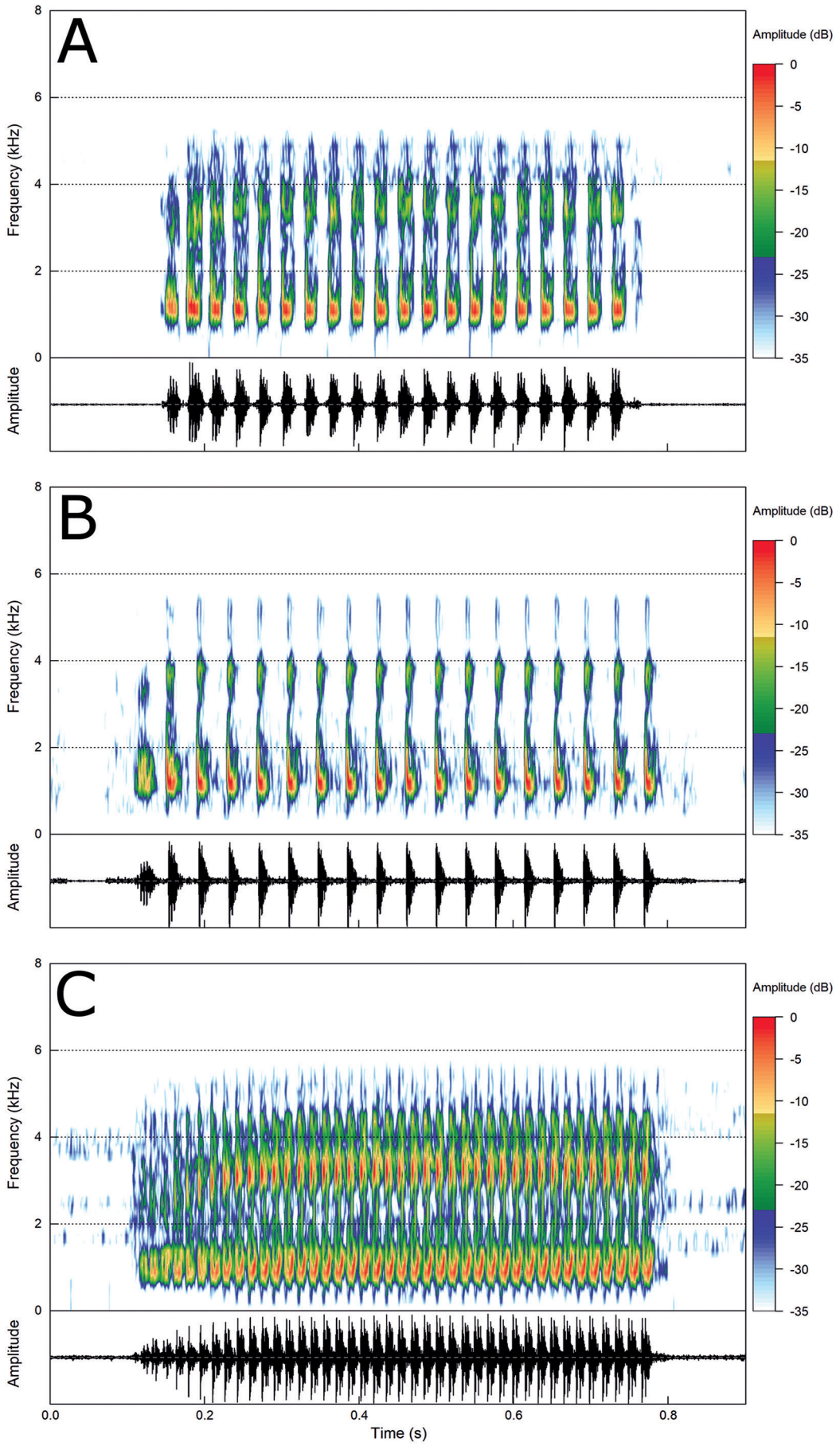

Figure 2. Audiospectrograms (above) and respective oscillograms (below) of the advertisement calls of: (A) *Scinax kennedyi* from municipality of Cantá, state of Roraima, Brazil (sound file: Scinax_kennedyiCantaRR3aAAGm671); (B) *S. kennedyi* from its type locality (*ca.* 110 mi ESE Puerto Gaitán, Departamento de Meta, Colombia) (sound file: ML218364); (C) *S. rostratus* from Guaráunos, state of Sucre, Venezuela (sound file: ML194689).

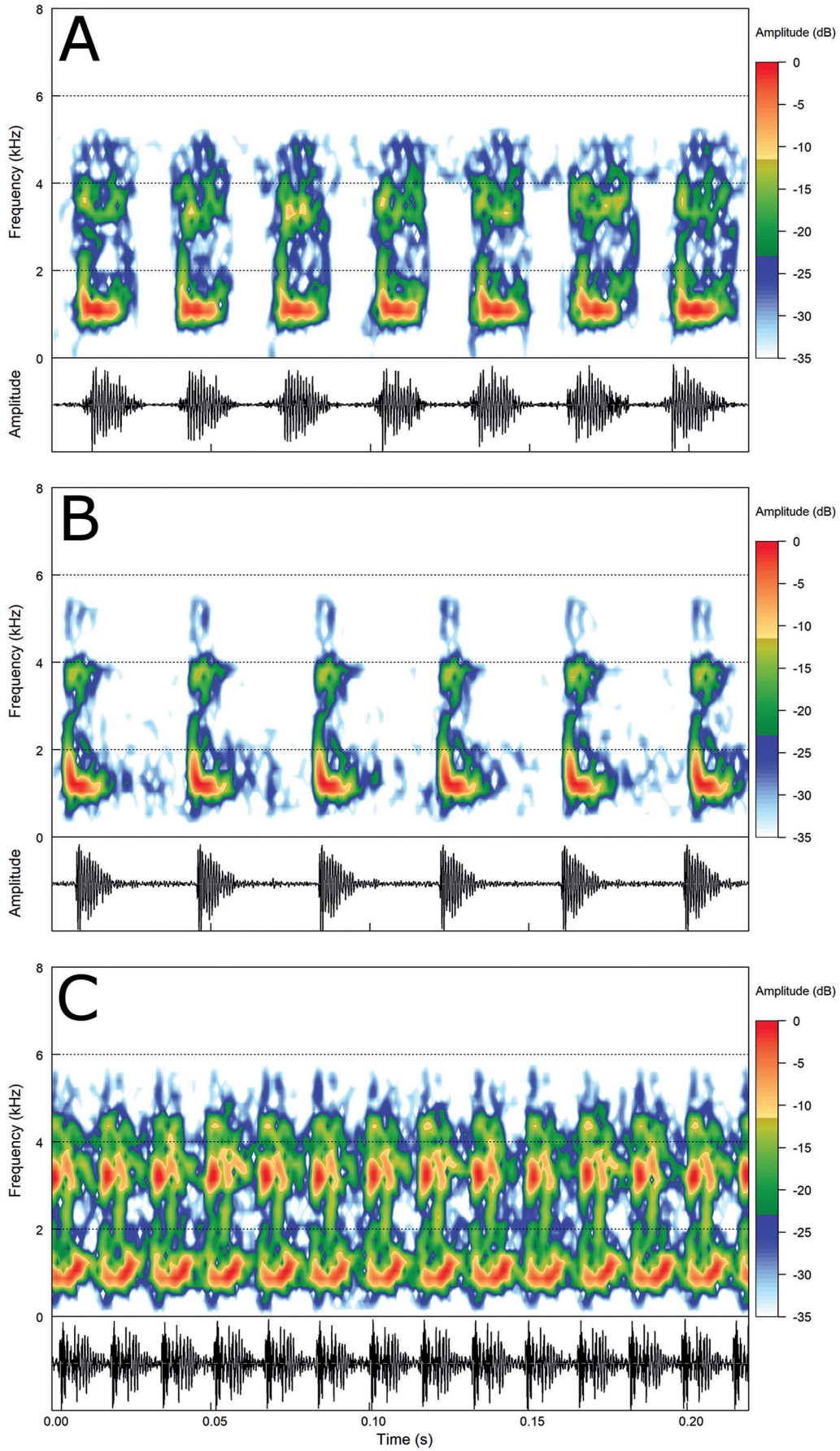

Figure 3. Audiospectrograms (above) and respective oscillograms (below) of sections of *ca.* 0.22 s extracted from the middle portion of each call depicted in Fig. 2, detailing the pulse emission pattern: (A) *Scinax kennedyi* from municipality of Cantá, state of Roraima, Brazil; (B) *S. kennedyi* from its type locality (*ca.* 110 mi ESE Puerto Gaitán, Departamento de Meta, Colombia); (C) *S. rostratus* from Guaráunos, state of Sucre, Venezuela. Notice the substantially shorter pulse intervals (= higher pulse rate) of the call of *S. rostratus*.

Table 1. Advertisement call trait values of the populations of *Scinax kennedyi* and *S. rostratus* studied here. N = recorded individuals/calls analysed. Values are given as mean ± SD (minimum-maximum).

Call traits	*S. kennedyi* (N = 7/121)	*S. kennedyi* (N = 3/12)	*S. rostratus* (N = 2/28)
Locality	Cantá (Roraima, Brazil)	Type locality (Colombia)	Guaráunos (Sucre, Venezuela)
Notes per call	1	1	1
Call duration (s)	0.85 ± 0.16 (0.16-3.11)	2.22 ± 0.92 (0.42-3.01)	0.80 ± 0.26 (0.42-1.29)
Call interval (s)	0.89 ± 0.49 (0.21-5.02)	23.20 ± 8.59 (15.58-39.59)	0.97 ± 0.33 (0.35-1.93)
1st pulse duration (ms)	18 ± 1 (11-25)	17 ± 5 (10-27)	8 ± 2 (5-13)
Mid-portion pulse duration (ms)	12 ± 2 (7-17)	14 ± 2 (10-16)	11 ± 1 (9-13)
Final pulse duration (ms)	13 ± 2 (8-21)	13 ± 2 (11-18)	13 ± 3 (7-17)
1st pulse interval (ms)	13 ± 3 (6-23)	21 ± 5 (14-28)	7 ± 2 (4-12)
Mid-portion pulse interval (ms)	17 ± 2 (12-22)	24 ± 1 (22-26)	5 ± 1 (4-6)
Final pulse interval (ms)	19 ± 2 (12-27)	24 ± 1 (22-28)	7 ± 2 (4-11)
Pulse rate (pulses/s)	34 ± 1 (32-36)	27 ± 2 (25-29)	60 ± 1 (57-63)
Minimum frequency (Hz)	1066 ± 91 (904-1335)	955 ± 12 (904-991)	750 ± 72 (656-844)
Maximum frequency (Hz)	3840 ± 224 (3402-4436)	3989 ± 215 (3790-4522)	3931 ± 102 (3750-4125)
Dominant frequency of LFB (Hz)	1207 ± 42 (1077-1852)	1279 ± 130 (1120-1421)	1048 ± 89 (938-1313)
Dominant frequency of HFB (Hz)	3375 ± 134 (3144-3747)	3612 ± 87 (3359-3833)	3144 ± 74 (3000-3375)
Temperature (°C)	28-29	25	24

HFB in five individuals, only to the LFB in one individual, and alternated between both bands along call emissions of one individual; regarding the topotypic population, the dominant frequency corresponded only to the LFB in all individuals.

The advertisement call of *Scinax rostratus* from northern Venezuela (Fig. 2C) consists of a single multi-pulsed note with variable durations and intervals. It has an ascending amplitude modulation at its onset, and quickly reaches a level that is sustained over its duration with minimal variations. Pulses are spaced from each other by very short intervals (Fig. 3C) and have internal amplitude modulations. Calls have two emphasized frequency bands, the LFB and the HFB, with the dominant frequency being able to alternate between both along call emissions. The dominant frequency corresponded only to the HFB in one individual, whereas it alternated between both bands along call emissions of the other individual. Descriptive statistics of the call of each species are provided in Table 1.

DISCUSSION

The call trait values resulting from the present reanalysis are congruent with those reported by Bang & Giaretta (2017) and those of topotypic *Scinax kennedyi* reported by Pyburn (1973). However, Pyburn (1973) reported a third emphasized frequency band at about 1,700 Hz in some calls, which was not detected here. The analysis of the call recordings of *S. rostratus* from Guaráunos (northern Venezuela) retrieved trait values similar to those previously reported for this species (*see* León, 1969; Duellman, 1970, 1972). However, León (1969) and Duellman (1970) reported a fundamental frequency around 56 Hz, which is an unrealistic value for the call of this species. Such minor differences between our results and literature data are most likely due to the limited technology for call analysis available at that time.

The reassessment of the call recordings presented in Bang & Giaretta (2017) demonstrated that the call of the Brazilian population does not match neither in structure nor in trait values with the call of *Scinax rostratus,* thus contradicting their species identification. Contrariwise, the call of this population matched in structure and trait values to the topotypic call of *S. kennedyi.* A minor difference was observed in pulse intervals, with calls from Brazil having slightly shorter pulse intervals (which reflected in its slightly higher pulse rate) in comparison to the topotypic calls. Nevertheless, such small variation in temporal trait values may be explained by the considerable difference in temperature (*ca.* 3°C) between both localities (Appendix 2; Table 1), since it is known that temperature may exert considerable influence on such fine-scale temporal traits of advertisement calls of frogs (Gerhardt, 1994; Valetti & Martino, 2012; Köhler *et al.,* 2017). In addition to this, males from Brazil matched the morphological diagnosis provided for *S. kennedyi* in Pyburn (1973), thus corroborating the acoustic identification.

Therefore, it is demonstrated here that *Scinax kennedyi* and *S. rostratus* can be clearly acoustically distinguished from each other. The advertisement call of *S. kennedyi* has longer pulse intervals, substantially lower pulse rate, first pulse with considerably longer duration, higher minimum frequency, and higher dominant frequencies of both LFB and HFB (Table 1). Moreover, there is also difference in the structure of the calls of these species (*see* Fig. 2; *see* Results section). In addition to the acoustic diagnosis, it is important to note that although these species are morphologically similar to each other, there is an expressive difference in the SVL of males that allows for a straightforward differentiation between them, with males of *S. kennedyi* being smaller than those of *S. rostratus.*

Concluding, the population from Cantá was misidentified as *Scinax rostratus* by Bang & Giaretta (2017), and hence it is herein reassigned to *S. kennedyi.* Therefore, this is the first study to recognize the occurrence of *S. kenne-*

dyi in Brazil, thus extending its distribution *ca.* 1,120 km east by south from its type locality, and *ca.* 844 km east-southeast from its previously known easternmost locality (Puerto Ayacucho, state of Amazonas, Venezuela; Fig. 1). This is now the southernmost and easternmost occurrence of this species. It is possible that new populations of *S. kennedyi* in eastern/southeastern Venezuela will be revealed by future research. That said, the previously existing gap in the southeastern portion of the distribution of *S. rostratus* still remains (Fig. 1). Besides extending the distribution of *S. kennedyi,* the present study provided a clearer acoustic diagnosis between *S. kennedyi* and *S. rostratus,* and presented new data on fine-scale temporal traits of their calls. Such contribution is relevant as it may help future studies to more accurately identify new populations of the species studied here.

AUTHORS' CONTRIBUTIONS: AGL: Formal analysis, Software, **AAG:** Data curation, Funding acquisition, Resources, **AGL, AAG:** Conceptualization, Investigation, Supervision, Verification, Visualization, Writing – original draft, Writing – review & editing. All authors actively participated in the discussion of the results; they reviewed and approved the final version of the paper.

CONFLICTS OF INTEREST: Authors declare there are no conflicts of interest.

FUNDING INFORMATION: The CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) provides a research grant to AAG (#300903/2015-4; #305169/2019-0), and provided a M.Sc fellowship to AGL (#130380/2020-2).

ACKNOWLEDGMENTS: The associate editor Dr. Pedro M.S. Nunes and two anonymous reviewers made valuable suggestions that helped to improve the quality of this work. The Cornell Lab of Ornithology (Bioacoustics Research Program) provided a free license of Raven Pro software to AGL. The staff of the KU Herpetology collections of the University of Kansas (namely: Dr. Rafe Brown, Camila Meneses, and Melissa Mayhew) kindly provided measurements, specific observational notes, and detailed, high-resolution photographs of the *S. rostratus* specimens from Venezuela. The Macaulay Library at the Cornell Lab of Ornithology allowed access to the recordings of topotypic *Scinax kennedyi* and of *S. rostratus* from Venezuela. Dr. William F. Pyburn made the recordings of topotypic *S. kennedyi.* Dr. William E. Duellman collected and recorded the *S. rostratus* specimens from Venezuela. This paper is dedicated to the memory of Dr. William E. Duellman in recognition of his outstanding scientific contributions over many decades.

REFERENCES

Acosta-Galvis, A.R. 2018a. Anfibios del Escudo Guayanés de Colombia: una aproximación preliminar. *In:* Lasso, C.A. & Señaris, J.C. (Eds.). *Volumen VI. Fauna Silvestre del Escudo Guayanés (Colombia-Venezuela).* Bogotá, D.C., Instituto de Investigación de Recursos Biológicos Alexander von Humboldt. p. 61-99. (Serie Editorial Fauna Silvestre Neotropical).

Acosta-Galvis, A.R. 2018b. Una nueva rana de huesos verdes del género *Scinax* (Anura: Hylidae) asociada a los bosques subandinos de la cuenca del río Magdalena, Colombia. *Biota Colombiana,* 19: 131-159. https://doi.org/10.21068/c2018.v19s1a11.

Angarita-Sierra, T.; Ospina-Sarria, J.J.; Anganoy-Criollo, M.; Pedroza-Banda, R. & Lynch, J.D. (Eds.). 2013. *Guía de campo de los anfibios y reptiles del departamento de Casanare-Colombia.* Bogotá-Arauca, Universidad Nacional de Colombia, Fundación de Investigación en Biodiversidad y Conservación.

Baldo, D.; Araujo-Vieira, K.; Cardozo, D.; Borteiro, C.; Leal, F.; Pereyra, M.O.; Kolenc, F.; Lyra, M.L.; Garcia, P.C.A.; Haddad, C.F.B. & Faivovich, J. 2019. A review of the elusive bicolored iris Snouted Treefrogs (Anura: Hylidae: *Scinax uruguayus* group). *PLoS ONE,* 14: e0222131. https://doi.org/10.1371/journal.pone.0222131.

Bang, D.L. & Giaretta, A.A. 2017. Filling a gap in the distribution of *Scinax rostratus* (Peters, 1863) (Anura, Hylidae) in northern Brazil, with further data on its advertisement call. *Check List,* 13: 2150. https://doi.org/10.15560/13.3.2150.

Barrio-Amorós, C.L.; Orellana, A. & Chacón, A. 2004. A new species of *Scinax* (Anura: Hylidae) from the Andes of Venezuela. *Journal of Herpetology,* 38(1): 105-112. https://doi.org/10.1670/82-01N.

Barrio-Amorós, C.L.; Rojas-Runjaic, F.J.M. & Señaris, J.C. 2019. Catalogue of the amphibians of Venezuela: illustrated and annotated species list, distribution, and conservation. *Amphibian and Reptile Conservation,* 13: 1-198.

Duellman, W.E. 1970. The Hylid Frogs of Middle America. *Monograph of the Museum of Natural History, the University of Kansas,* v. 1: 1-753. https://doi.org/10.5962/bhl.title.2835.

Duellman, W.E. 1972. South American frogs of the *Hyla rostrata* group (Amphibia, Anura, Hylidae). *Zoologische Mededelingen,* 47: 177-192.

Duellman, W.E. & Wiens, J.J. 1992. The status of the hylid frog genus *Ololygon* and the recognition of *Scinax* Wagler, 1830. *Occasional Papers of the Museum of Natural History University of Kansas,* 151: 1-23.

Faivovich, J. 2002. A cladistic analysis of *Scinax* (Anura: Hylidae). *Cladistics,* 18(4): 367-393. https://doi.org/10.1111/j.1096-0031.2002.tb00157.x.

Faivovich, J.; Haddad, C.F.B.; Garcia, P.C.; Frost, D.R.; Campbell, J.A. & Wheeler, W.C. 2005. Systematic review of the frog family Hylidae, with special reference to Hylinae: phylogenetic analysis and taxonomic revision. *Bulletin of the American Museum of natural History,* 294: 1-240. https://doi.org/10.1206/0003-0090(2005)294[0001:SROTFF]2.0.CO;2.

Frost, D.R. 2022. *Amphibian Species of the World: an Online Reference. Version 6.1.* New York, American Museum of Natural History. Available: https://amphibiansoftheworld.amnh.org. Access: 18/03/2022.

Gerhardt, H.C. 1994. The evolution of vocalization in frogs and toads. *Annual Review of Ecology and Systematics,* 25: 293-324. https://doi.org/10.1146/annurev.es.25.110194.001453.

Gorzula, S. & Senãris, J.C. 1998. Contribution to the herpetofauna of the Venezuelan Guayana I. A data base. *Scientia Guaianae,* 8: 1-269.

K. Lisa Yang Center for Conservation Bioacoustics. 2014. *Raven Pro: Interactive Sound Analysis Software (Version 1.5) [Computer software]. Ithaca, The Cornell Lab of Ornithology.* Available: http://ravensoundsoftware.com. Access: 18/10/2021.

Köhler, J.; Jansen, M.; Rodríguez, A.; Kok, P.J.R.; Toledo, L.F.; Emmrich, M.; Glaw, F.; Haddad, C.F.B.; Rödel, M-O. & Vences, M. 2017. The use of bioacoustics in anuran taxonomy: theory, terminology, methods and recommendations for best practice. *Zootaxa,* 4251: 1-124. https://doi.org/10.11646/zootaxa.4251.1.1.

León, J.R. 1969. The systematic of the frogs of the *Hyla rubra* group in Middle America. *University of Kansas Publications, Museum of Natural History,* 18(6): 505-545. https://doi.org/10.5962/bhl.part.19991.

Lescure, J. & Marty, C. (Eds.). 2000. *Atlas des Amphibiens de Guyane.* Paris, Publications Scientifiques du Museum National d'Histoire Naturelle.

Ligges, U.; Krey, S.; Mersmann, O. & Schnackenberg, S. 2018. *TuneR: Analysis of Music and Speech*. Available: https://CRAN.R-project.org/package=tuneR. Access: 18/10/2021.

Lima, L.P.; Bastos, R.P. & Giaretta, A.A. 2004. A new *Scinax* Wagler, 1830 of the *S. rostratus* group from central Brazil (Amphibia, Anura, Hylidae). *Arquivos do Museu Nacional,* 62: 505-512.

Magrini, L.; Carvalho-e-Silva, S.D.; Beda, A.F. & Giaretta, A.A. 2011. Calls of five species of the *Scinax ruber* (Anura: Hylidae) clade from Brazil with comments on their taxonomy. *Zootaxa,* 3066: 37-51. https://doi.org/10.11646/zootaxa.3066.1.3.

Nieto-Castro, M.J. 1999. Estudio preliminar de las especies del género *Scinax* (Amphibia: Anura: Hylidae) en Colombia. *Revista de La Academia Colombiana de Ciencias Exactas, Físicas y Naturales,* 23(Suppl. Especial): 339-346.

Novaes, G. & Zina, J. 2016. Advertisement call of *Scinax camposseabrai* (Bokermann, 1968) (Anura: Hylidae), with comments on the call of three species of the *Scinax ruber* clade. *Zootaxa,* 4084: 258-266. https://doi.org/10.11646/zootaxa.4084.2.5.

Pedroza-Banda, R.; Ospina-Sarria, J.J.; Angarita-Sierra, T.; Anganoy-Criollo, M. & Lynch J.D. 2014. Estado del conocimiento de la fauna de anfibios y reptiles del departamento de Casanare, Colombia. *Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales,* 38: 17-34. https://doi.org/10.18257/raccefyn.37.

Peters, W.C.H. 1863. Fernere Mittheilungen über neue Batrachier. *Monatsberichte der Königlichen Preussische Akademie des Wissenschaften zu Berlin,* 1863: 445-470.

Pyburn, W.F. 1973. A New Hylid Frog from the Llanos of Colombia. *Journal of Herpetology,* 7(3): 297-301. https://doi.org/10.2307/1563014.

R Core Team. 2019. *R: A Language and Environment for Statistical Computing (Version 3.6.2). R Foundation for Statistical Computing, Vienna, Austria.* Available: https://www.R-project.org. Access: 18/10/2021.

Rivero, J.A. 1968. Sobre la identidad de *Hyla rostrata* Peters (Amphibia, Salientia). *Acta Biologica Venezuelica,* 6: 133-138.

Sturaro, M.J.; Sarmento, J.M.; Lima, A.A.; Chalkidis, H.M. & Rocha, R.A.T. 2010. New records and distribution of the treefrog *Scinax rostratus* (Peters, 1863) (Amphibia: Anura: Hylidae). *Herpetology Notes,* 3: 161-166.

Sueur, J.; Aubin, T. & Simonis, C. 2008. Seewave, a free modular tool for sound analysis and synthesis. *Bioacoustics,* 18: 213-226. https://doi.org/10.1080/09524622.2008.9753600.

Valetti, J.A. & Martino, A.L. 2012. Temperature effect on the advertisement call of *Pleurodema tucumanum* (Anura: Leiuperidae). *Phyllomedusa: Journal of Herpetology,* 11: 125-134. https://doi.org/10.11606/issn.2316-9079.v11i2p125-134.

APPENDIX 1

List of examined specimens (call vouchers indicated in bold).

Scinax kennedyi: BRAZIL, state of Roraima, municipality of Cantá: AAG-UFU **5573-74,** 5575-76.

Scinax rostratus: VENEZUELA, state of Sucre, Guaráunos, Río Sabacual: KUH **167017-18** (high-resolution photographs).

APPENDIX 2

List of analysed sound files (.wav) for each species, with the associated metadata. * Species' type locality.

Label/catalogue number	Voucher	Time (h)	Date	Air (°C)
Scinax kennedyi (Cantá, Roraima, Brazil)				
Scinax_kennedyiCantaRR3aAAGm671	AAG-UFU 5573	19:31	27 Jul 2016	28
Scinax_kennedyiCantaRR4aAAGm671	—	19:34	27 Jul 2016	28
Scinax_kennedyiCantaRR4bAAGm671	—	19:35	27 Jul 2016	28
Scinax_kennedyiCantaRR5aAAGm671	AAG-UFU 5574	19:56	27 Jul 2016	28
Scinax_kennedyiCantaRR7aAAGm671	—	19:44	28 Jul 2016	29
Scinax_kennedyiCantaRR8aAAGm671	—	19:49	28 Jul 2016	29
Scinax_kennedyiCantaRR9aAAGm671	—	19:50	28 Jul 2016	29
Scinax_kennedyiCantaRR10aAAGm671	—	20:09	28 Jul 2016	29
Scinax kennedyi (*ca.* 110 mi ESE Puerto Gaitán, Departamento de Meta, Colombia)*				
ML218364	—	—	13 Apr 1971	25
ML218367	—	—	13 Apr 1971	25
ML218368	—	—	13 Apr 1971	—
Scinax rostratus (Guaráunos, Sucre, Venezuela)				
ML194688	KUH 167017	19:25	28 Jul 1974	24
ML194689	KUH 167018	19:30	28 Jul 1974	24

Published with the financial support of the "Programa de Apoio às Publicações Científicas Periódicas da USP"