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Hylid Frogs of the Genus *Scinax* Wagler, 1830, in Amazonian Ecuador and Peru

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ABSTRACT Eight species of the hylid frog genus *Scinax* are recognized in the Amazon Basin and on the eastern slopes of the Andes in Ecuador and Peru. Two new species, *S. icterica* and *S. oreites*, are described from Peru, and *Hyla epacrorhina* Duellman, 1972, is placed in the synonymy of *S. garbei* (Miranda-Ribeiro, 1926). *Scinax chiquitana* is reported for the first time from Peru. Diagnoses and distributions are presented for all species. A neotype is designated for *Hyla rubra*, Laurenti, 1768.

RESUMEN Ocho especies de hílidos del género *Scinax* se reconocen en la cuenca amazónica y en la vertiente oriental de los Andes en el Ecuador y Perú. Dos especies nuevas, *S. icterica* y *S. oreites*, se describen del Perú, e *Hyla epacrorhina* Duellman, 1972, se pone en la sinonimia de *Scinax garbei* (Miranda-Ribeiro, 1926). *Scinax chiquitana* se reporta por primera vez del Perú. Se presentan diagnosis y distribuciones para todas las especies. Se designa un neotipo para *Hyla rubra* Laurenti, 1768.

Key words: Hylidae, *Scinax: S. icterica* and *S. oreites*, new species; Peru; Ecuador; *Hyla rubra* neotype.

Among the most frequently encountered hylid frogs in the upper Amazon Basin are the small to medium-sized treefrogs of the genus *Scinax*. Formerly, many authors (e.g., Cochran and Goin, 1970; Duellman, 1978) referred to these frogs as members of the *Hyla rubra* group, which was recognized as generically distinct and placed in the genus *Ololygon* by

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Fouquette and Delahoussaye (1977). As pointed out by Duellman and Wiens (1992), the earliest generic name for this assemblage of species is *Scinax*, Wagler, 1830.

A field party from The University of Kansas discovered a new species of *Ololygon* (=*Scinax*) in the Andes of northern Peru in 1979. Another new species was discovered in the lowlands of the Departamento Madre de Dios, Peru, in 1986. In 1989 and 1990 we revisited these areas and gathered more material of the new species and related taxa. In preparing descriptions of the new species, we examined most available specimens of *Scinax* from Ecuador and Peru. The results of our endeavors are presented herein.

MATERIALS AND METHODS

We examined 2336 specimens of frogs, 16 lots of young, 90 lots of larvae, four batches of eggs, and 43 skeletal preparations (dried and cleared-and-stained) from Ecuador and Peru (Appendix I). Acronyms for museum collections follow Leviton et al. (1985), with the addition of EBD = Estación Biologica Doñana, Sevilla, Spain, and MHNSM = Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Perú. The distribution maps show only localities in Ecuador and Peru; in some cases not all localities are shown because of crowding of symbols.

Measurements were taken to the nearest 0.1 mm using needle-tipped calipers in the manner described by Duellman (1970a). Seven morphometric variables were recorded for some or all adult specimens of the eight species of *Scinax* (Table 1). These variables are abbreviated as follows: SVL (snout-vent length), TIBL (tibia length), FOOT (foot length), HLEN (head length), HWID (head width), and TYMP (tympanum diameter). In order to eliminate the effects of sexual dimorphism, multivariate analyses were based only on males and included the same seven variables plus four others: IOD (interorbital distance), IND (internarial distance), FING (maximum width of terminal disk of the third finger), and EYNO (eye-nostril distance). Descriptive statistics for these variables were computed using the NCSS statistical package. Multivariate analyses were performed using the SAS statistical package on a mainframe computer.

Formulae for toe webbing are based on Savage and Heyer (1967) as modified by Myers and Duellman (1982). Terminology of larval features follows Altig and Johnson (1989); format for tadpole descriptions follows McDiarmid and Altig (1990). In the diagnoses, comparable, numbered statements are given for each species; these are followed by direct comparisons with other species from Ecuador and Peru. In the descriptions of new taxa, the characters in the diagnoses generally are not repeated. Calls were recorded in the field using a variety of tape recorders and microphones;

calls were analyzed on a Sona-Graph Model 7029A spectrum analyzer and a Macintosh computer using the Macrecorder software.

SPECIES ACCOUNTS

We recognize eight species of *Scinax* in Amazonian Ecuador and Peru. In each of the following accounts, an abbreviated synonymy precedes a diagnosis, in which characters are listed numerically for easy comparison. For the new taxa, the diagnoses are followed by descriptions of adults, larvae, and advertisement calls. References to descriptions of larvae and advertisement calls of previously described species are given in the remarks in those accounts. Notes on life history and ecology, and geographic distributions are presented for all species.

Morphometric data are summarized in Table 1. Most of the characters used in the diagnoses are evident; but the terms regarding snout shape need to be clarified. Four terms are applied to snout shape in dorsal view: bluntly round (Fig. 1A), acutely round (Fig. 1B), acuminate (Fig. 1C), acuminate with fleshy proboscis (Fig. 1D). In profile, the shapes are: bluntly round (Fig. 1A), round (Fig. 1B), acuminate (Fig. 1C), acuminate with fleshy proboscis (Fig. 1D).

Scinax chiquitana (de la Riva)

Figure 2

Ololygon chiquitana de la Riva, 1990:83.—Holotype: EBD 28828 from Puerto Almacén, Río Negro, 70 km NW Concepción, Provincia Ñuflo de Chávez, Departmento de Santa Cruz, Bolivia (15°46'S, 62°15'W).

Scinax chiquitana—Duellman and Wiens, 1992:22.

Diagnosis.—(1) SVL in males to 33.3 mm, in females to 36.2 mm; (2) snout nonacuminate; (3) ulnar and tarsal tubercles absent; (4) enlarged heel tubercles absent; (5) tubercles absent on lower jaw; (6) skin on dorsum smooth to very finely shagreened; (7) dorsum tan with or without small dark brown flecks; in life (at night) males yellowish gold to orange, females beige or pale brown, both sexes dark brown by day (de la Riva, 1990); (8) flanks tan with or without small dark spots; (9) posterior surfaces of thighs uniform tan, with or without a broad, dark brown longitudinal stripe or lightly pigmented spots; (10) iris pale gold.

Scinax chiquitana can be distinguished from *S. pedromedinai* and *S. garbei* by having a rounded, nonacuminate snout and in lacking labial, heel, tarsal, and ulnar tubercles. *Scinax chiquitana* is distinct from the remaining species in having smooth skin and a mostly uniformly colored dorsum and posterior surface of thighs. *Scinax funerea* differs from *S. chiquitana* in having strongly tuberculate skin, contrasting dark bars and unpigmented areas on the posterior surface of the thigh, and a unique

Table 1. Morphometric data for the *Scinax* of Amazonian Ecuador and Peru. First line is mean and 1 SD; second line is range. All values are in millimeters; see text for abbreviations of characters.

	S. chiquitana		*S. cruentomma*		*S. funerea*		*S. garbei*	
	Males $n = 14$	Females $n = 4$	Males $n = 25$	Females $n = 15$	Males $n = 13$	Females $n = 15$	Males $n = 45$	Females $n = 21$
SVL	30.2 ± 1.42 27.9 –33.3	33.5 ± 1.94 31.6 –36.2	26.4 ± 0.87 24.8 –27.1	28.0 ± 1.29 25.8 –30.6	32.4 ± 2.17 29.8 –36.9	35.0 ± 2.22 30.5 –37.5	35.2 ± 3.07 29.5 –42.2	41.3 ± 2.38 38.4 –47.9
TIBL	15.0 ± 1.57 14.1 –16.0	17.2 ± 0.41 16.8 –17.7	12.2 ± 0.48 11.6 –13.5	13.4 ± 0.90 12.0 –15.0	16.6 ± 1.11 14.9 –18.8	17.9 ± 1.19 15.6 –20.0	19.9 ± 1.91 17.1 –24.6	23.9 ± 1.63 21.5 –27.1
FOOT	12.6 ± 0.58 11.2 –13.6	14.2 ± 0.45 13.8 –14.8	10.6 ± 0.41 9.9 –11.6	11.3 ± 0.50 10.6 –12.2	13.4 ± 0.86 12.5 –15.2	14.3 ± 0.99 12.3 –15.3	15.1 ± 1.67 11.2 –19.0	18.2 ± 1.42 15.3 –20.8
HLEN	10.2 ± 0.49 9.3 –10.9	11.2 ± 0.31 10.9–11.6	8.7 ± 0.32 8.1 – 9.1	9.4 ± 0.46 8.4 –10.0	12.0 ± 0.91 11.0 –13.7	12.8 ± 0.71 11.7 –14.0	12.9 ± 1.15 11.0 –16.2	14.8 ± 0.99 13.1 –16.7
HWID	9.0 ± 0.36 8.4 – 9.8	10.0 ± 0.24 9.9 –10.4	8.7 ± 0.34 8.1 – 9.2	8.9 ± 0.45 7.7 – 9.7	10.4 ± 0.65 9.4 –11.6	11.4 ± 0.83 10.0 –12.5	11.0 ± 1.17 9.0 –14.5	12.8 ± 1.16 11.4 –15.4
EYE	2.9 ± 0.18 2.5 – 3.2	3.1 ± 0.10 3.0 – 3.2	3.0 ± 0.19 2.7 – 3.3	2.9 ± 0.15 2.7 – 3.2	3.4 ± 0.22 3.0 – 3.7	3.4 ± 0.24 2.8 – 3.6	3.0 ± 0.28 2.5 – 3.6	3.6 ± 0.29 3.0 – 4.1
TYMP	1.58± 0.18 1.2 – 1.8	1.7 ± 0.13 1.5 – 1.8	1.3 ± 0.12 1.1 – 1.5	1.4 ± 0.26 1.1 – 2.1	1.8 ± 0.18 1.5 – 2.1	1.9 ± 0.20 1.6 – 2.3	2.0 ± 0.26 1.7 – 2.7	2.4 ± 0.26 2.1 – 3.2

Table 1. Continued.

	S. icterica		*S. oreites*		*S. pedromedinai*		*S. rubra*	
	Males $n = 49$	Females $n = 17$	Males $n = 51$	Females $n = 7$	Males $n = 11$	Females $n = 6$	Males $n = 27$	Females $n = 11$
SVL	29.9 ± 0.89 28.0 –31.6	32.0 ± 0.92 30.2 –33.5	31.4 ± 1.23 28.4 –33.5	36.5 ± 1.53 34.4 –39.3	26.4 ± 1.81 22.2 –28.9	29.4 ± 1.34 27.5 –31.5	33.1 ± 2.27 29.4 –41.2	40.3 ± 1.98 37.2 –43.8
TIBL	14.8 ± 0.62 13.9 –16.3	16.2 ± 0.65 15.3 –17.9	15.9 ± 0.78 14.4 –17.6	18.7 ± 0.83 18.0 –20.3	14.2 ± 0.73 12.8 –15.2	15.8 ± 0.78 14.8 –16.9	16.6 ± 1.06 15.3 –20.7	20.5 ± 0.81 19.5 –22.2
FOOT	12.7 ± 0.53 11.8 –14.4	14.0 ± 0.54 13.5 –15.5	13.3 ± 0.75 11.7 –14.8	15.4 ± 0.59 14.6 –16.2	11.0 ± 0.68 9.4 –11.7	12.1 ± 0.74 11.3 –13.4	14.4 ± 0.85 13.1 –17.7	17.5 ± 0.71 16.5 –18.9
HLEN	10.4 ± 0.29 9.7 –11.1	11.3 ± 0.27 11.0 –11.8	11.1 ± 0.56 10.0 –12.7	12.7 ± 0.33 12.2 –13.1	9.1 ± 0.40 8.3 – 9.6	10.5 ± 0.56 9.8 –11.3	11.9 ± 0.64 11.0 –14.3	14.1 ± 0.58 13.5 –15.3
HWID	9.5 ± 0.31 8.9 –10.5	10.3 ± 0.38 9.6 –11.1	9.9 ± 0.46 8.9 –11.0	11.4 ± 0.38 11.0 –12.2	8.2 ± 0.43 7.1 – 8.7	9.3 ± 0.37 8.8 – 9.8	10.5 ± 0.67 9.4 –13.0	12.7 ± 0.57 11.9 –13.8
EYE	3.3 ± 0.20 3.0 – 3.7	3.5 ± 0.20 3.2 – 3.9	3.1 ± 0.22 2.7 – 3.5	3.1 ± 0.20 2.9 – 3.5	2.4 ± 0.19 2.0 – 2.7	2.5 ± 0.21 2.2 – 2.8	3.2 ± 0.23 2.8 – 3.7	3.7 ± 0.42 3.1 – 4.5
TYMP	1.7 ± 0.12 1.4 – 2.0	1.9 ± 0.10 1.7 – 2.0	1.9 ± 0.15 1.6 – 2.2	2.2 ± 0.19 1.9 – 2.4	1.5 ± 0.10 1.2 – 1.6	1.5 ± 0.10 1.4 – 1.6	1.9 ± 0.26 1.5 – 2.5	2.4 ± 0.19 2.1 – 2.8

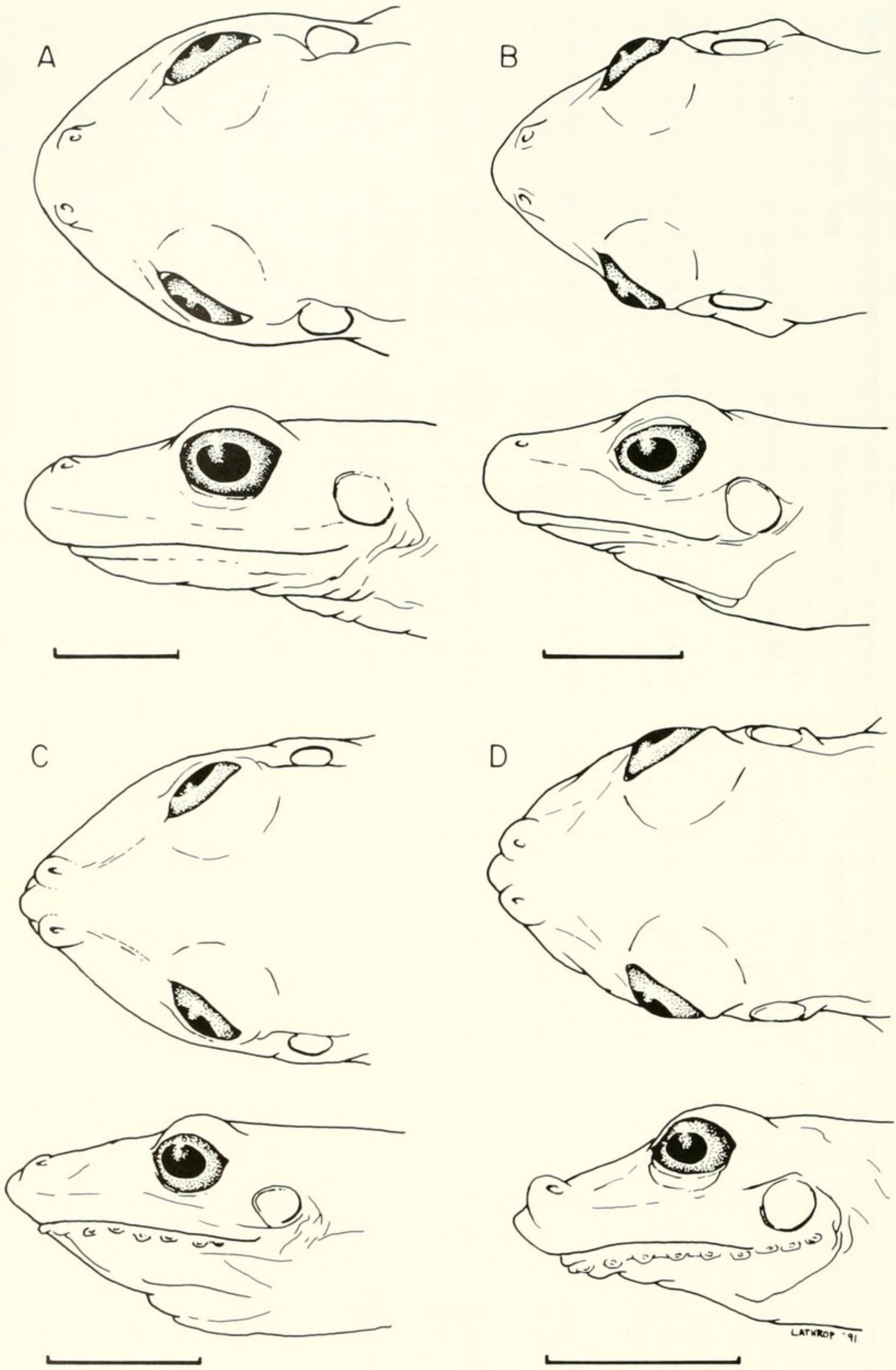

Fig. 1. Dorsal and lateral views of snouts of *Scinax*. **A**. *S. funerea* (KU 105160), bluntly rounded in dorsal view and in profile. **B**. *S. oreites* (KU 181803), acutely rounded in dorsal view and round in profile. **C**. *S. sugillata* (KU 146445), acuminate in dorsal view and in profile. **D**. *S. pedromedinai* (KU 205326), acuminate in dorsal view and in profile, with fleshy proboscis.

pattern of dark spots and elongate markings on the dorsum. *Scinax oreites* has a more robust body, narrow cream dorsolateral stripes, and unpigmented spots on the posterior surfaces of the thighs. *Scinax rubra* usually has wide, dark-bordered, pale dorsolateral stripes, reticulate pattern of yellow on a black ground color on the posterior surfaces of thighs, hidden surfaces of hind limbs, and in the flanks, and larger adult size. *Scinax chiquitana* also can be distinguished from *S. rubra* by usually having a smaller tympanum. *Scinax icterica* is more strongly tuberculate and usually has dark transverse markings on the dorsum, interorbital region, and limbs. *Scinax cruentomma* has a red streak through the eye, is smaller, and generally has a shorter, more bluntly rounded snout.

Comparison of *S. chiquitana* and *S. rubra*.—Multivariate analyses were performed to evaluate morphometric differences between topotypic *S. chiquitana* ($n = 6$) and populations of *S. chiquitana* and *S. rubra* from southeastern Peru ($n = 8$ and $n = 8$, respectively). Based on the stepwise discriminant analysis, four variables were found to contribute significantly to distinguishing among these populations (F for removal > 0.05). These four variables were used in a canonical discriminant analysis, and the raw canonical coefficients for these variables are as follow (pooled within-class standardized canonical coefficients in parentheses): CAN AXIS I = SVL:– 0.21 (–0.30), HWID:2.37 (0.93), IOD:–1.10 (–0.26), HLEN:0.75 (0.38); CAN AXIS II = SVL:1.16 (1.66), HWID:0.83 (0.33), IOD:4.65 (1.11), HLEN:–3.61 (–1.81).

The plot of individual scores shows complete separation of the three populations (Fig. 4). The populations *S. chiquitana* are separated primarily along Canonical Axis II, and male *Scinax chiquitana* and *S. rubra* (from Madre de Dios) are separated primarily along Canonical Axis I.

Several osteological differences were observed between a single cleared-and-stained specimen of *S. chiquitana* and several cleared-and-stained skeletons of *S. rubra*. In *S. chiquitana*, the postorbital process of the maxilla is narrow (about as wide as the quadratojugal at their articulation), and the zygomatic ramus of the squamosal is long and anteriorly oriented, whereas in *S. rubra* the postorbital process of the maxilla is wider (slightly wider than the quadratojugal at their articulation), and the zygomatic ramus of the squamosal is shorter and deflected more ventrally (Fig. 5). The anterior process of the hyale is longer in *S. chiquitana* than in *S. rubra* (Fig. 6); the cartilaginous "style" of the omosternum is elongate, and the cartilaginous sternal "style" is narrow, in contrast to the shorter and wider omosternal style and wider style of the sternum in *S. rubra* (Fig. 7).

In contrast to the call of *S. chiquitana*, the call of *S. rubra* consists of a series (usually no more than 10) short notes, "aah-aah-aah." The duration of the notes of *S. rubra* is 0.11–0.15 sec, and they have a much slower pulse rate and lower pitch than the notes of *S. chiquitana*.

Fig. 2. Photographs of *Scinax*. **Upper left**: *Scinax chiquitana*, USNM 222194, male, 30.8 mm SVL. **Upper right**: *S. rubra*, KU 205344, female, 41.0 mm SVL. **Lower left**: *S. oreites*, KU 212143, male, 29.9 mm SVL. **Lower right**: *S. funerea*, KU 146298, male, 35.2 mm SVL.

Distribution and ecology.—*Scinax chiquitana* occurs in seasonal tropical or subtropical rainforest in the upper Amazon Basin of southeastern Peru and eastern Bolivia (Fig. 8). According to de la Riva (1990), *S. chiquitana* at the type locality in Bolivia is reproductively active during the rainy season (December–March), and males call from emergent vegetation in ponds in primary forest or at the border of primary forest. In Peru, *S. chiquitana* is ecologically separated from *S. rubra; S. chiquitana* occurs in forest whereas *S. rubra* generally is restricted to clearings.

Remarks.—The call of *S. chiquitana* is a short rattling buzz. The call consists of a series of notes having durations of 0.08–0.10 sec repeated at a rate of 20–45 notes per min. The pulse rate is about 290 pulses per second; the fundamental frequency is at 125–130 Hz, and the dominant frequency is at about 2000 Hz (Fig. 9). Comparison of two recordings made at 23.2 and 24.0°C at Tambopata, Peru, with one made at an unknown temperature at Puerto Almacén, Bolivia (type locality of *S. chiquitana*) only showed differences in note repetition rate—20 and 36 notes per min at Tambopata and 45 note per min at Puerto Almacén.

The tadpoles are unknown. The sperm of *S. chiquitana* are like those of *S. rubra* (M. J. Fouquette, Jr., pers. comm.). Thus, on the basis of sperm morphology, S. *chiquitana* is a member of the *S. rubra* group as defined by Fouquette and Delahoussaye (1977).

Fig. 3. Photographs of *Scinax*. **Upper left**: *Scinax cruentomma*, KU 183631, female, 25.7 mm SVL. **Upper right**: *S. icterica*, KU 215350, female, 32.8 mm SVL. **Lower left**: *S. garbei*, KU 215325, female, 42.9 mm SVL. **Lower right**: *S. pedromedinai*, KU 209953, female, 28.6 mm SVL.

Scinax cruentomma (Duellman)

Figure 3

Hyla cruentomma Duellman, 1972a:266.—Holotype: KU 126587 from Santa Cecilia, Río Aguarico, (0°02'N, 76°58'W, 340 m), Provincia de Sucumbios, Ecuador.

Ololygon cruentomma—Fouquette and Delahoussaye, 1977:393.

Scinax cruentomma—Duellman and Wiens, 1992:22.

Diagnosis.—(1) Snout-vent length in males to 27.1 mm, in females to 30.6 mm; (2) snout nonacuminate; (3) ulnar and tarsal tubercles absent; (4) enlarged heel tubercle absent; (5) tubercles absent on lower jaw; (6) skin on dorsum smooth to finely shagreened; (7) dorsum creamy tan to uniform dark brown, usually with brown markings that typically consist of canthal stripe, supratympanic stripe, transverse bars on limbs (about 50% of specimens), and irregular (often longitudinal) marks on body; (8) flanks pale with or without small dark spots; (9) posterior surfaces of thighs tan, usually with a diffuse covering of dark brown pigment (pale green or yellowish green in life); (10) iris silvery bronze with median horizontal red streak.

Scinax cruentomma can be distinguished from *S. garbei* and *S. pedromedinai* by having a rounded, nonacuminate snout, and lacking la-

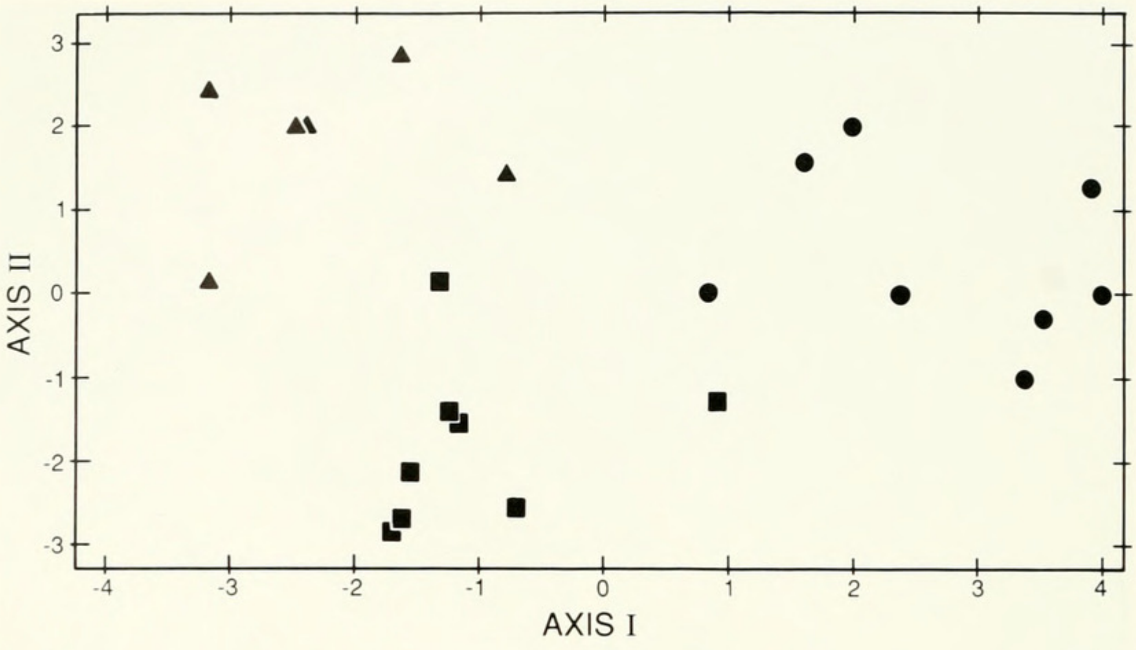

Fig. 4. Plots of individual scores from canonical discriminant analysis of morphometric data from three populations of *Scinax*. Solid dots = *S. rubra* from Departamento Madre de Dios, Peru; triangles = *S. chiquitana* from Puerto Almacén, Bolivia; squares = *S. chiquitana* from Tambopata, Peru.

bial, heel, tarsal, and ulnar tubercles. *Scinax cruentomma* can be distinguished from the remaining *Scinax* in the region by having a median horizontal red streak through the eye. *Scinax cruentomma* can be distinguished further from *S. oreites* and *S. rubra* by lacking pale dorsolateral stripes and pale spots on the posterior surface of the thighs, and in its smaller size. *Scinax chiquitana* is larger and generally has a longer snout. *Scinax funerea* is larger, has strongly tuberculate skin, a unique dorsal color pattern consisting of elongate dark markings and abundant dark spots (that

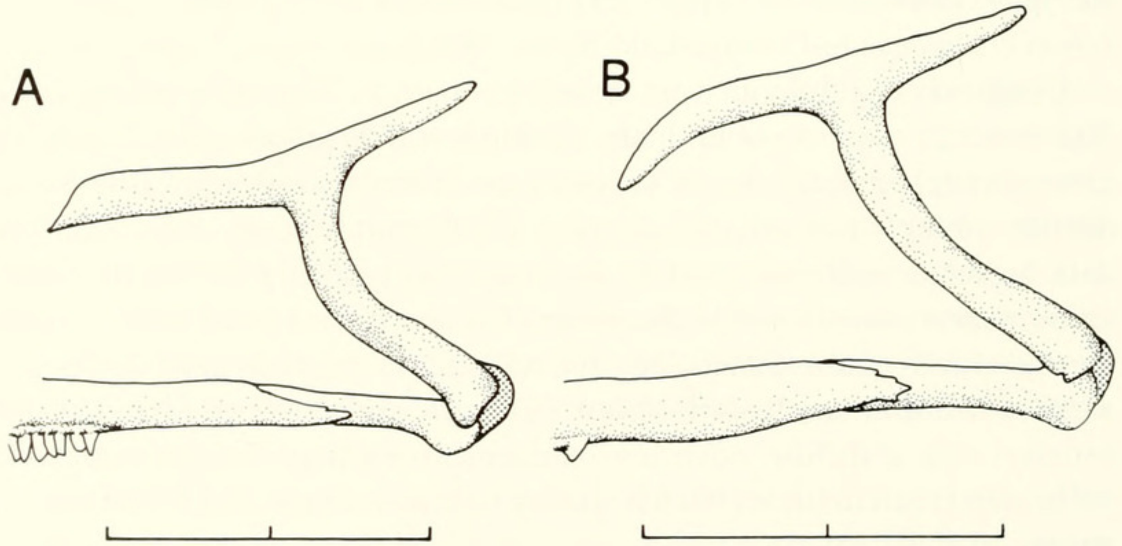

Fig. 5. Posterolateral corner of skulls of *Scinax*. **A**. *S. chiquitana*, USNM 312659. **B**. *S. rubra*, KU 123048. Lines = 2 mm.

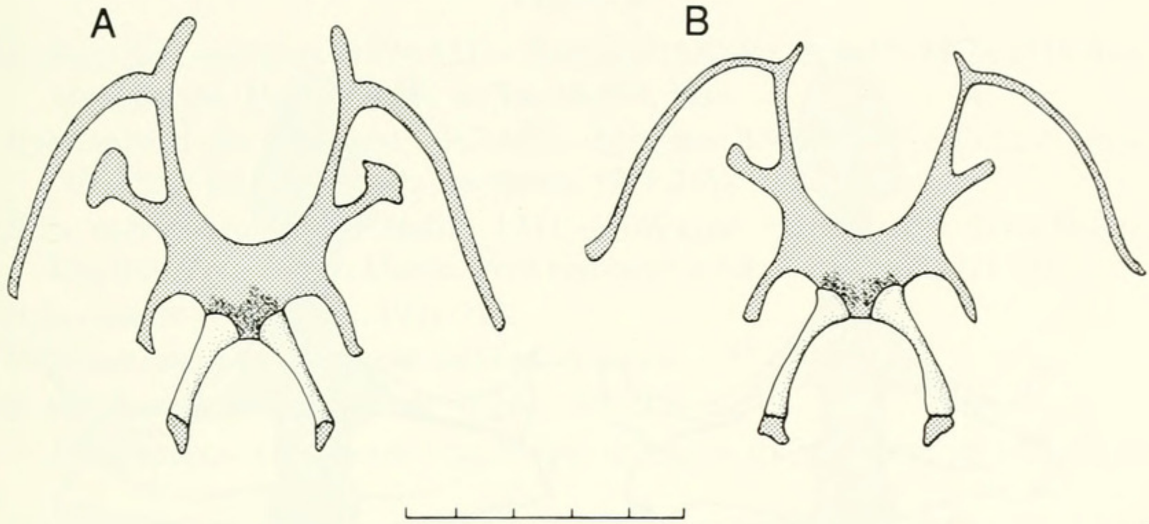

Fig. 6. Ventral view of hyoids of *Scinax*. **A**. *S. chiquitana*, USNM 312659. **B**. *S. rubra*, KU 123048. Line = 5 mm.

usually correspond to the outlines of tubercles) and usually has dark pigmentation on the posterior surface of the thighs concentrated into discrete dark blotches. *Scinax icterica* also differs from *S. cruentomma* in being larger (SVL to 31.6 and 33.5 in males and females, respectively) and more tuberculate. In *S. icterica*, low ulnar and tarsal tubercles are usually present (always absent in *S. cruentomma*), supernumerary plantar tubercles are usually present and distinct (absent or indistinct), the outer metatarsal tubercle is present and well developed (absent or indistinct), and the dorsum is usually shagreened or finely tuberculate (smooth or finely shagreened).

Distribution and ecology.—*Scinax cruentomma* is widely distributed in the Amazon Basin in Ecuador and northern Peru, where it occurs in the drainages of the Río Napo, Río Marañón, and Río Ucayali (Fig. 10). In major river valleys, such as that of the Río Pastaza, it ascends the slopes of the Andes to elevations of 1200 m. The eastern extent of the range is unknown; Zimmerman and Rodrigues (1990) reported *S. cruentomma* from a locality 70–90 km north of Manaus, Brazil.

At Limoncocha and Santa Cecilia, Ecuador, *S. cruentomma* occurs in rainforest more commonly than in disturbed areas. Breeding takes place in open or *Heliconia*-choked ponds in clearings and in the forest. The tadpoles usually are found just below the surface of the water; they take shelter amid aquatic vegetation.

Remarks.—Comparisons of the osteology, advertisement calls, and morphometrics of *S. cruentomma* and *S. icterica* are presented in the account of the latter species. The advertisement call and tadpole were described and illustrated by Duellman (1972a).

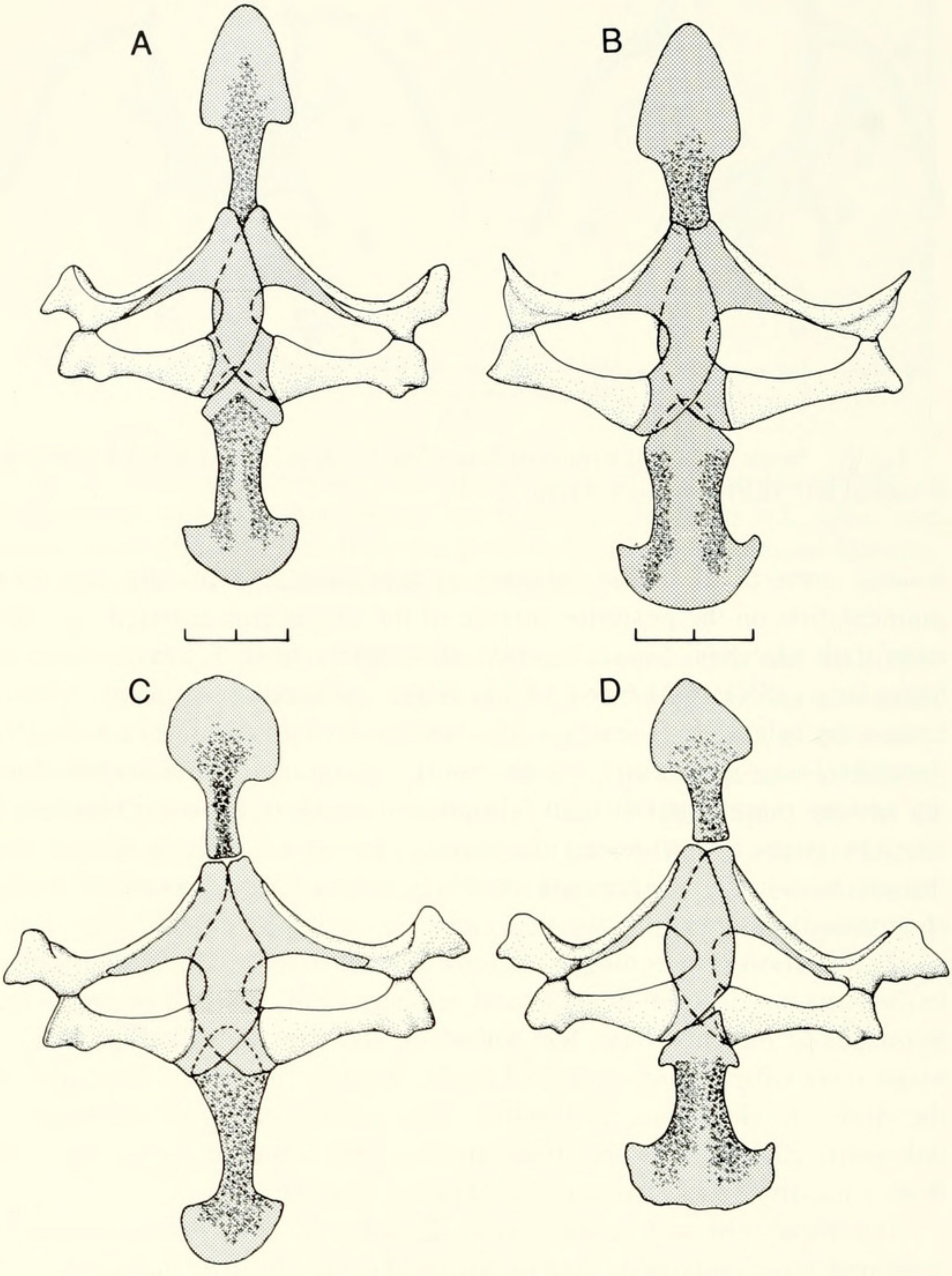

Fig. 7. Pectoral girdles of four species of *Scinax*. **A**. *S. chiquitana*, USNM 312659. **B**. *S. rubra*, KU 123048. **C**. *S. cruentomma*, KU 111928. **D**. *S. icterica*, KU 205375. Scales = 2 mm.

Scinax funerea (Cope)

Figure 2

Scytopis funereus Cope, 1874:123.—Syntypes: ANSP 11396–97, MCZ 4778 from Moyobamba, Departamento de San Martín, Peru.

Hyla depressiceps Boulenger, 1882:402.—Syntypes: BMNH 1947.5.13.52–53 from "Ecuador" (synonymy fide Duellman, 1971:218).

Hyla rubra inconspicua Melin, 1941.—Holotype: NHMG 480 from Roque, Departamento de San Martín, Peru (synonymy fide Duellman, 1971:218).

Hyla funerea—Duellman, 1971:218.

Ololygon funerea—Fouquette and Delahoussaye, 1977:392.

Scinax funerea—Duellman and Wiens, 1992:22.

Diagnosis.—(1) Snout-vent length in males to 36.9 mm, in females to

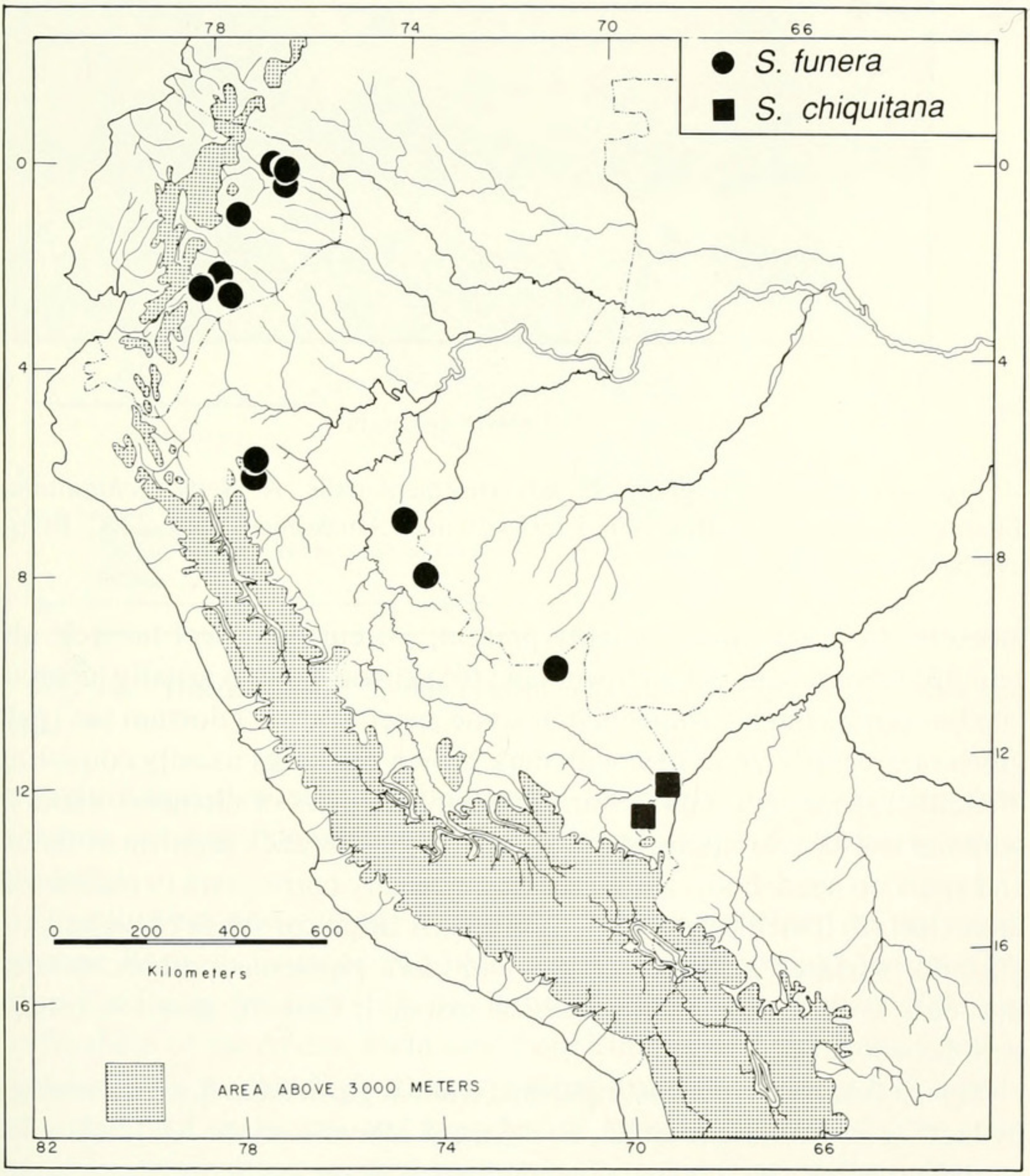

Fig. 8. Distribution of *Scinax chiquitana* and *S. funerea* in Ecuador and Peru.

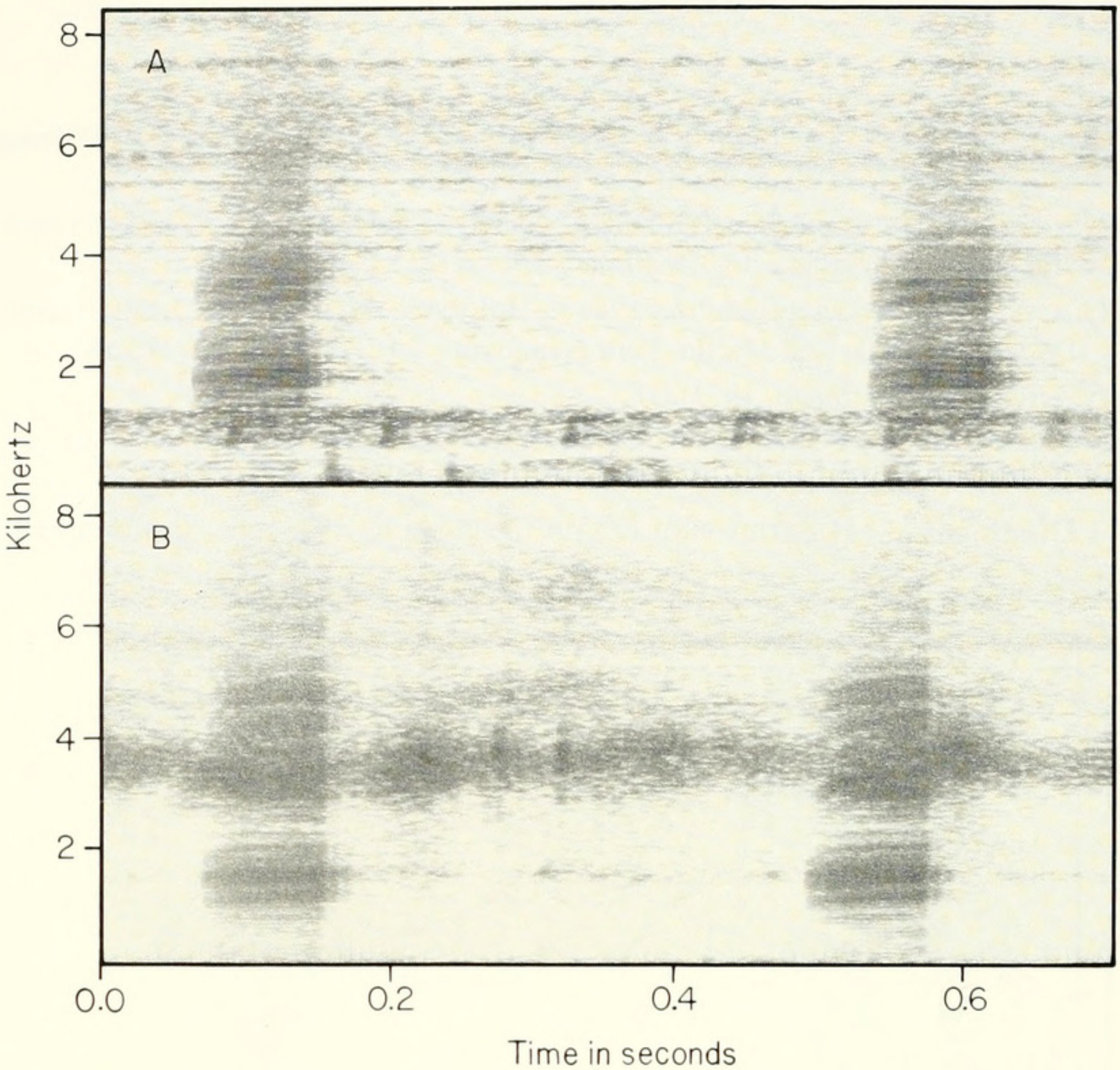

Fig. 9. Audiospectrograms of advertisement calls. **A**. *Scinax chiquitana*, Tambopata, Peru, 24°C. **B**. *Scinax icterica*, Cuzco Amazónico, Peru, 23°C. Effective band width 45 Hz.

tubercles low, indistinct, variably present; (4) enlarged heel tubercle absent; (5) tubercles absent on lower jaw; (6) skin on dorsum usually tuberculate but can be finely shagreened in some specimens; (7) dorsum tan (pale green or greenish tan in life) with dark brown markings usually consisting of canthal stripe, interorbital bar, spots on lips, pairs of elongate marks in scapular and sacral regions, three transverse bars on each segment of limbs, and spots on head, body, and limbs that typically correspond to outlines of tubercles; (8) flanks yellow with dark brown stripes or series of dashes; (9) posterior surfaces of thighs yellow with dark pigmentation concentrated into dark brown spots or longitudinal stripe(s); (10) iris greenish bronze with brown flecks.

Scinax funerea can be distinguished from *S. garbei* and *S. pedromedinai* by lacking an acuminate snout, an enlarged tubercle on the heel, tubercles on the lower jaw, and conical ulnar and tarsal tubercles. *Scinax funerea* can be distinguished from the remaining species in the region in usually having

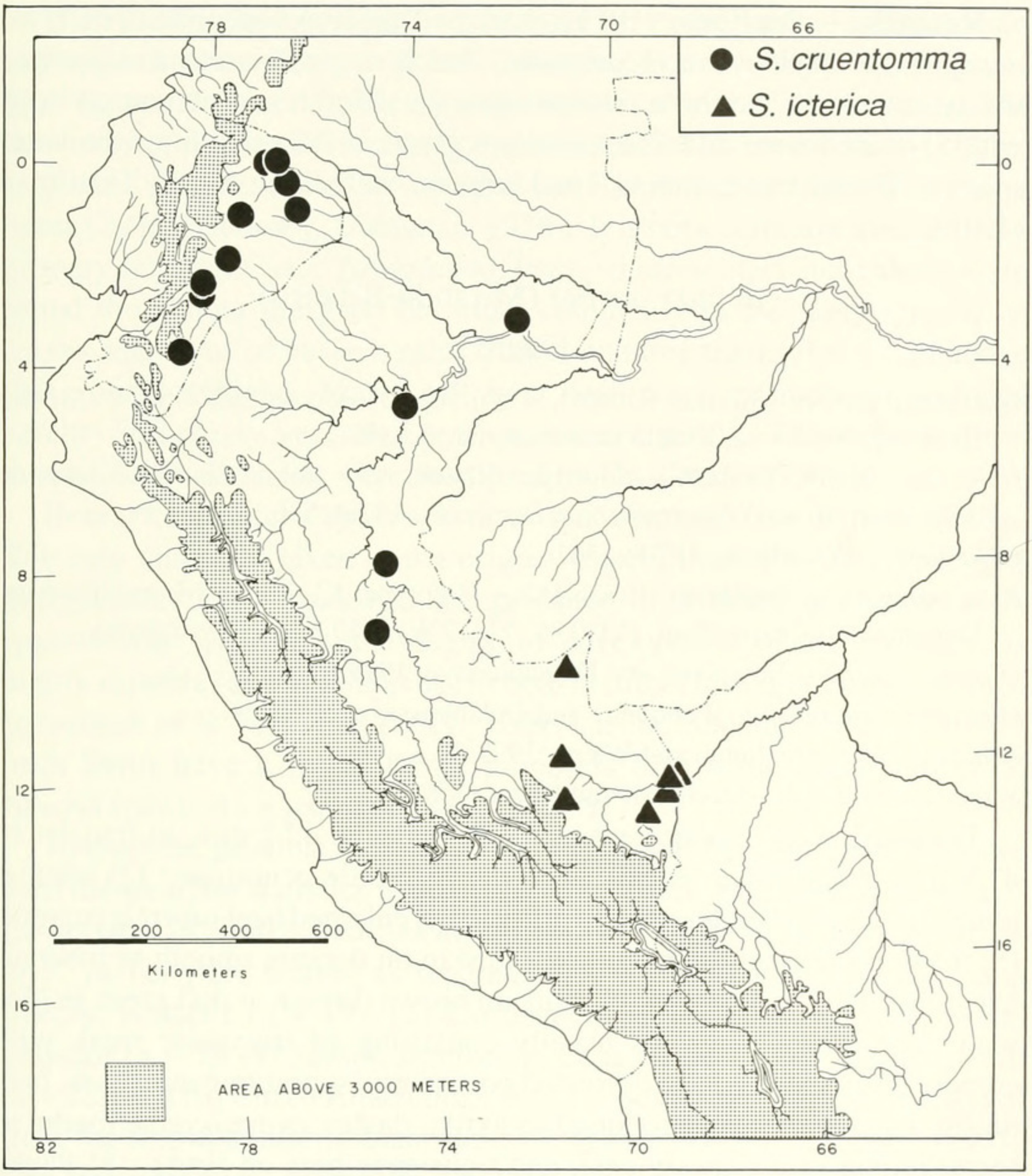

Fig. 10. Distribution of *Scinax cruentomma* and *S. icterica* in Ecuador and Peru.

strongly tuberculate skin on the dorsum, pale thighs with discrete dark blotches, and a tan dorsum with a characteristic pattern of dark brown spots and stripes.

Distribution and ecology.—*Scinax funerea* is restricted to the upper Amazon Basin in Ecuador and Peru, where it ranges southward into the upper Río Purús drainage (Fig. 8). It reaches elevations of about 500 m in the foothills of the Andes. Field data from Limoncocha and Santa Cecilia, Ecuador, indicate that *S. funerea* is a forest inhabitant. Most individuals were observed on bushes and branches of trees at night. Tadpoles were found in semipermanent and temporary ponds in, or at the edge of, rainforest.

Remarks.—Duellman (1971) examined the type specimens of *Hyla depressiceps*, *Hyla rubra inconspicua*, and *Scytopis funereus* and justified the synonymy of the three nominal species. Morphometric comparisons with *S. cruentomma* and *S. icterica* are given in the account of the latter species. The advertisement call and tadpoles were described by Duellman (1978).

Scinax garbei (Miranda-Ribeiro)

Figure 3

Garbeana garbei Miranda-Ribeiro, 1926:96.—Holotype: MZUSP 277 from Eirunepé, Río Juruá, Estado do Amazonas, Brasil.

Hyla lutzi Melin, 1941:36.—Holotype: NHMG 481 from Manaus, Estado do Amazonas, Brazil (synonymy fide Duellman, 1970b:536.

Hyla garbei—Duellman, 1970b:536.

Hyla epacrorhina Duellman, 1972b:182.—Holotype: KU 139247 from Pilcopata, Departmento Cuzco, Peru, (13°05'S, 71°12'W), 750 m. New synonymy.

Ololygon garbei—Fouquette and Delahoussaye, 1977:393.

Ololygon epacrorhina—Fouquette and Delahoussaye, 1977:393.

Scinax garbei—Duellman and Wiens, 1992:22.

Scinax epacrorhina—Duellman and Wiens, 1992:22.

Diagnosis.—(1) Snout-vent length in males to 42.2 mm, in females to 47.9 mm; (2) snout in dorsal view and in profile acuminate; (3) conical ulnar and tarsal tubercles usually present; (4) enlarged heel tubercle present; (5) tubercles present on lower jaw; (6) skin on dorsum smooth to tuberculate, tubercles often conical; (7) dorsum brown (brown or dull green in life) with dark brown markings usually consisting of triangular mark with corners on eyelids and apex directed posteriorly, supratympanic mark, bars on lip, large marks posterodorsal to axilla, dashes or transverse marks in sacral region (most specimens), and transverse bars on limbs; (8) flanks cream with brown flecks; (9) posterior surfaces of thighs cream (yellow or orange in life) with broad, vertical black bars or reticulations; (10) iris pale creamy bronze with median horizontal reddish brown streak.

Scinax garbei can be distinguished from all other species in the region (except *S. pedromedinai*) by having a depressed, acuminate snout, an enlarged tubercle on the heel, tubercles on the lower jaw, and conical tarsal and ulnar tubercles. *Scinax garbei* can be distinguished from *S. pedromedinai* by being larger (SVL to 42.2 and 47.9 in males and females vs. SVL to 28.9 and 31.5 in males and females of *S. pedromedinai*) and in having yellow to orange coloration on the posterior surfaces of the thighs with black vertical bars or reticulations (uniform brown in *S. pedromedinai*).[1]

[1]In six specimens (KU 220342–45, 220432–33) collected recently at the junction of the Río Yanamono and the Río Amazonas, Departamento Loreto, Peru, the black bars on the hidden surfaces of the thighs were separated by dark red in life.

Distribution and ecology.—*Scinax garbei* is widespread in the middle and upper Amazon Basin in Brazil, Colombia, Ecuador, and Peru (Figs. 11, 12). It ascends several valleys on the eastern slopes of the Andes, and in the valley of the Río Pastaza in Ecuador, it reaches an elevation of 1260 m.

Scinax garbei seemed to become more common as forest was cut at Santa Cecilia, Ecuador (Duellman, 1978). It is not a common species in the primary forest at Cuzco Amazónico, Peru, where solitary individuals were found throughout the year, but more commonly in the rainy season, on leaves and stems of bushes, palm fronds, and tree trunks 0.4–1.5 m above the ground at night. Males call in a head-down position on secluded perches in densely vegetated semi-permanent ponds. The tadpoles from Santa Cecilia, Ecuador, were described by Duellman (1978).

Remarks.—*Scinax epacrorhina* is synonymized here with *S. garbei*. The only character given in the original description of *S. epacrorhina* to differentiate these species is the presence of a fleshy proboscis in *S. epacrorhina*. However, the degree of development of the proboscis is highly variable (and overlapping) in both nominal taxa. For example, some specimens of *S. garbei* (e.g., KU 120991 from Ecuador and KU 207617 from Peru) have a larger fleshy proboscis than some specimens of *S. epacrorhina* (e.g., a paratype, KU 139243).

To examine possible morphometric differences between these taxa, we used multivariate statistics to compare topotypic *S. epacrorhina* (n = 3), *S. garbei* (n = 59), and *S. pedromedinai* (n = 19). Males from six populations of *S. garbei* were treated as separate classes in the analyses—(1) Santa Cecilia, Ecuador (n = 19); (2) Limoncocha, Ecuador (n = 4); (3) Mera, Ecuador (n = 5); (4) Misión Bomboiza, Ecuador (n = 5), (5) Estirón, Peru (n = 22); and (6) Cuzco Amazónico, (n = 5). Seven variables were selected from the stepwise discriminant function analysis (F for removal < 0.05). The raw canonical coefficents for these variables are as follow (pooled within-class standardized canonical coefficients in parentheses): CAN AXIS I = TIBL:0.75 (0.85), EYNO:1.34 (0.38), TYMP:0.83 (0.17), IND:–3.61 (–0.79), HWID:–0.41 (–0.31), HLEN:1.07 (0.80), FING:–2.06 (0.40); CAN AXIS II = TIBL:–0.34 (–0.39), EYNO:1.86 (0.53), TYMP:–6.29 (–1.31), IND:4.60 (1.01), HWID:0.51 (0.39), HLEN:0.12 (0.09), FING:–1.67 (–0.32).

A plot of individual scores for these coefficients (Fig. 13) shows that *S. pedromedinai* is well separated from *S. epacrorhina* and the populations of *S. garbei* along Canonical Axis I. This separation seems to reflect the much smaller size of individuals of *S. pedromedinai*. *Scinax epacrorhina* shows some separation from populations of *S. garbei* along Canonical Axis II. The results of the morphometric analyses do not provide convincing evidence for or against the recognition of *S. epacrorhina* as a species distinct from *S. garbei*.

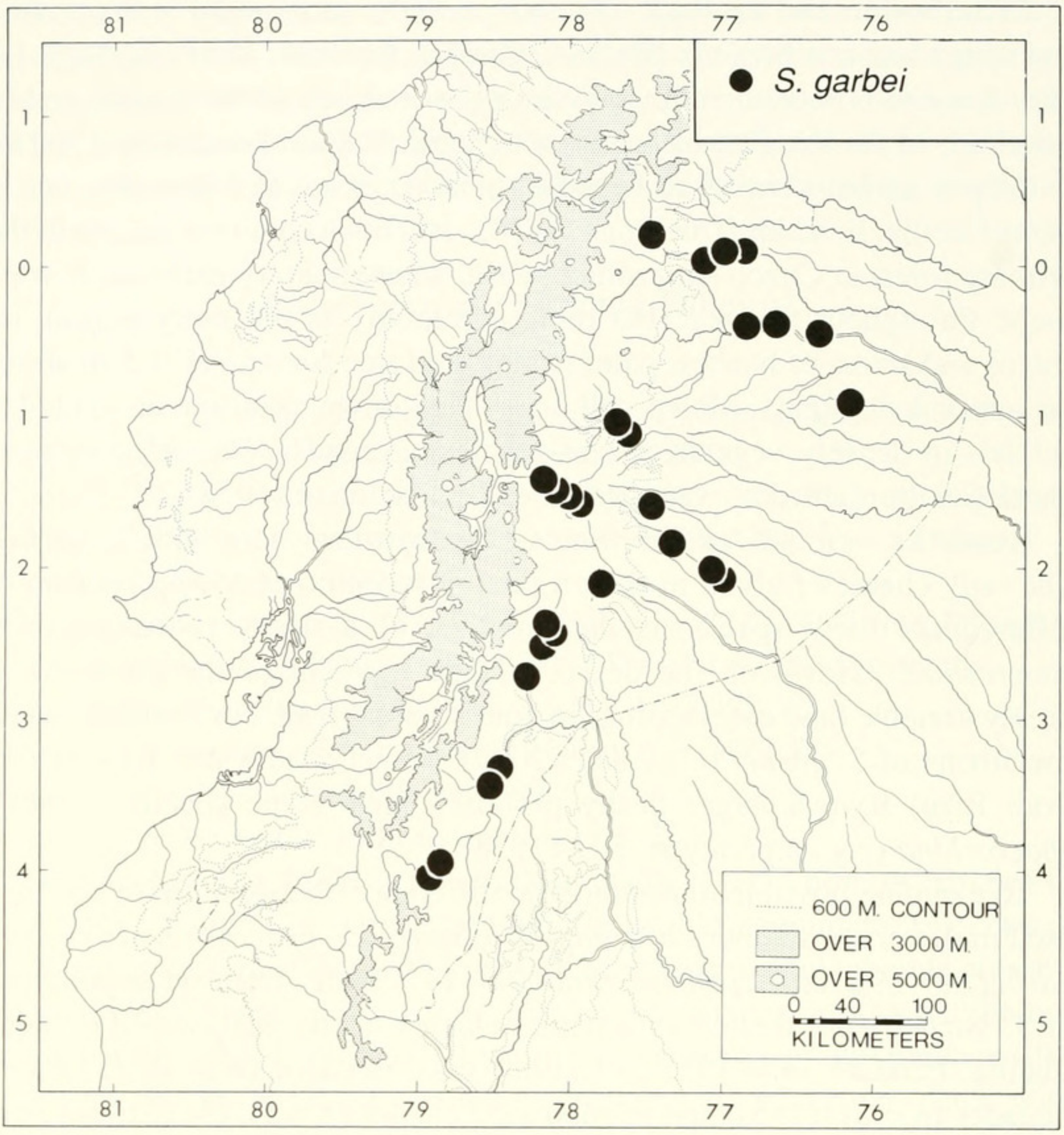

Fig. 11. Distribution of *Scinax garbei* in Ecuador.

Duellman (1972b) presented data on the calls of these taxa that supported the status of these taxa as different species. However, additional data on the calls of *S. garbei* in southern Peru suggest that these differences represent geographic variation within a single species. The calls of *S. garbei* from Ecuador differ from those from southern Peru in three parameters. Recordings of eight individuals at temperatures of 23–26°C at Santa Cecilia, Ecuador, have notes 0.16–0.26 ($\bar{x}$ = 0.21) sec produced at a rate of 14 notes per min with 195–240 pulses per sec. In contrast, two individuals recorded at 23°C at Pilcopata, Peru (type locality of *S. epacrorhina*), produced only 9.8 notes per min with durations of 0.65 and 0.80 sec and 65 and 70 pulses per sec. An individual recorded at 23.8°C at Tambopata, Peru, produced 24 notes per min with durations of 0.50–0.70 sec and 110 pulses per sec. The dominant frequencies in all of these recordings ranges from 3240 to 3760 Hz.

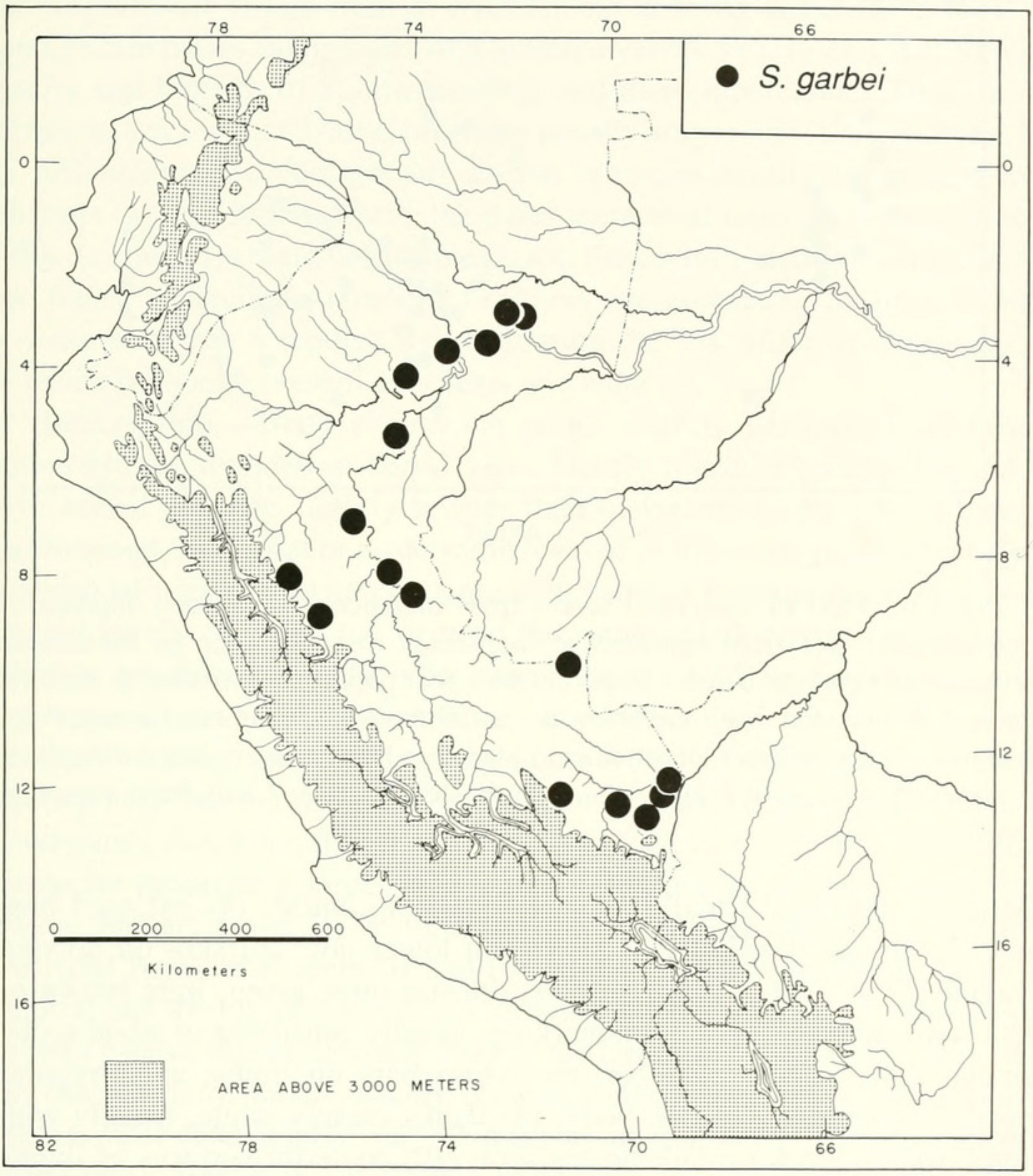

Fig. 12. Distribution of *Scinax garbei* in Peru.

Scinax icterica new species

Figure 3

Holotype.—KU 205349, an adult male, from Cuzco Amazónico (12°35'S, 69°05'W, 200 m), 15 km east-northeast of Puerto Maldonado, Provincia Tambopata, Departamento Madre de Dios, Peru, one of a series collected on 19 January 1986 by William E. Duellman and Linda Trueb.

Paratopotypes.—KU 205347–48, 205350–69, 205374–402, 207624–40, 209954, 215337–57, MHNSM 3510–54.

Referred specimens.—See Appendix I.

Diagnosis.—(1) Snout-vent length in males to 31.6 mm, in females to 33.5 mm; (2) snout in dorsal view and profile bluntly round, nonacuminate;

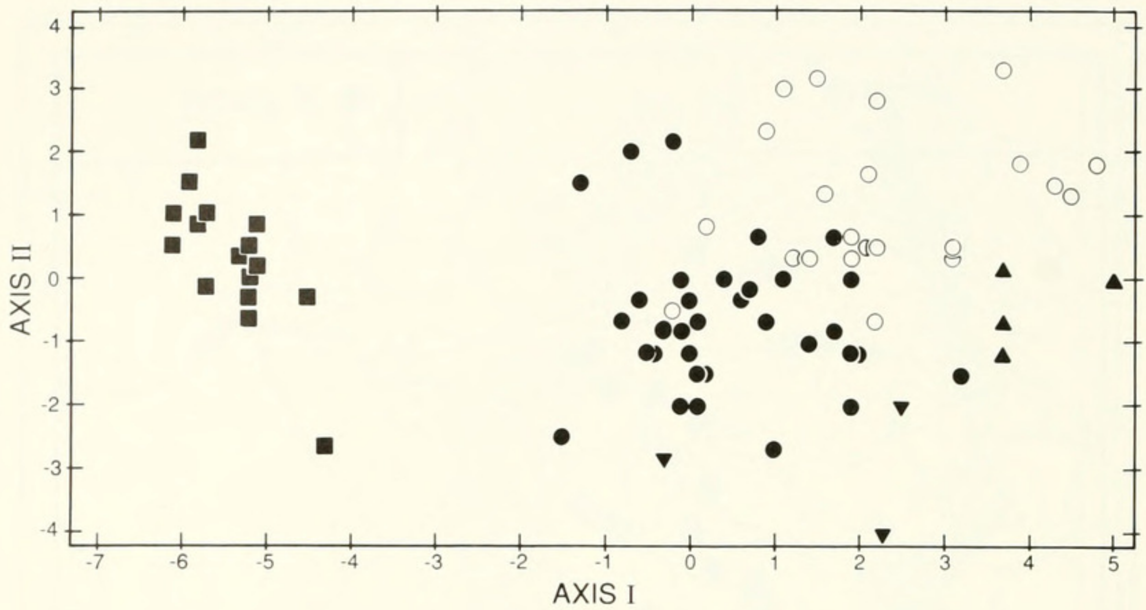

Fig. 13. Plots of individual scores from canonical discriminant analysis of morphometric data from members of the *Scinax rostrata* group in Amazonian Ecuador and Peru. Solid dots = *S. garbei* from four populations (treated as separate classes) in Ecuador; open circles = *S. garbei* from Departament Loreto, Peru; triangles = *S. garbei* from Departamento Madre de Dios, Peru; inverted triangles = *S. garbei* (type series of *S. epacrorhina*) from Departamento Cuzo, Peru; squares = *S. pedromedinai*.

(3) ulnar and tarsal usually present, low, not conical; (4) enlarged heel tubercle absent; (5) tubercles absent on lower jaw; (6) skin on dorsum shagreened to finely tuberculate; (7) dorsum olive green, light brown or yellowish tan with dark brown markings usually consisting of labial spots, canthal stripe, interorbital bar, transverse bars on limbs, and irregular mostly transverse marks on body; (8) flanks creamy white, usually with small, round, black or dark brown spots; (9) posterior surfaces of thighs evenly covered with brown pigment, often very dark; (10) iris pale coppery bronze.

Scinax icterica can be distinguished from *S. garbei* and *S. pedromedinai* by having a nonacuminate snout, and in lacking an enlarged heel tubercle, tubercles on the lower jaw, and conical ulnar and tarsal tubercles. *Scinax icterica* can be distinguished from *S. oreites* and *S. rubra* by lacking pale dorsolateral stripes and pale spots on the posterior surface of the thighs. *Scinax chiquitana* is not as strongly tuberculate and lacks dark transverse markings on the dorsum, interorbital region, and on the limbs. *Scinax funerea* is larger (SVL to 36.9 and 37.5 in males and females, respectively), has strongly tuberculate skin, a distinct dorsal color pattern consisting of elongate dark markings and numerous dark spots (that usually correspond to the outlines of tubercles) and usually has the dark pigmentation on the posterior surface of the thighs concentrated into discrete dark blotches.

Scinax icterica differs from *S. cruentomma* in being larger (SVL to 31.6 and 33.5 in males and females of *S. icterica* versus SVL to 27.1 and 30.6 in males and females of *S. cruentomma*) and more tuberculate. Thus, in *S. icterica*, low ulnar and tarsal tubercles usually are present (always absent in *S. cruentomma*), supernumerary plantar tubercles usually are present and distinct (absent or indistinct), the outer metatarsal tubercle is present and well developed (absent or indistinct), and the dorsum usually is shagreened or finely tuberculate (smooth or finely shagreened). In life, *Scinax cruentomma* has a reddish streak through the iris which is absent in *S. icterica* (although present in at least one tadpole).

Description.—Body slender, in males slightly narrower than head; snout bluntly rounded in dorsal view, bluntly round in profile (Fig. 1A); eye-nostril distance slightly greater than diameter of eye; nostril barely portuberant, usually at or posterior to level of anterior margin of lower jaw; internarial region moderately depressed; canthus rostralis rounded; loreal region barely concave; top of head flat; interorbital distance equal to or slightly less than width of eyelid; supratympanic fold weak, barely obscuring upper edge of tympanic annulus; tympanum round. Forelimbs moderately short; ulnar tubercles largest and most distinct distally; fingers moderately long bearing transversely rounded terminal discs, palmar tubercle moderately low, bifid; thenar tubercle slightly elevated, ovoid; subarticular tubercles moderately large, round, as wide as digits; webbing absent between Fingers I and II, vestigial or absent between Fingers II and III, vestigial between Fingers III and IV; narrow lateral keels on all fingers; nuptial pad weakly developed, not keratinized (Fig. 14). Hind limbs moderately robust; toes moderately long; inner tarsal fold absent; low tubercles on outer edge of tarsus usually present; outer metatarsal tubercle small, round; inner metatarsal ovoid; subarticular tubercles distinct, round; supernumerary tubercles small, distinct on proximal segments; toes about two-thirds webbed, webbing formula I 2—(2–2½) II (1^+–1½)—(2–2½) III 1^+—(2–2^+) IV (2–2^+)—(1–1^+) V; narrow dermal keel on inner edge of Toe I and outer edge of Toe V (Fig. 13). Skin on dorsum shagreened with small tubercles in supratympanic region and on dorsal surfaces of shanks; skin on throat weakly granular, on chest, belly, and ventral surfaces of thighs coarsely granular, on other ventral surfaces smooth; anal sheath moderately long; anal opening directed posteroventrally at upper level of thighs; many small subanal tubercles; vocal sac single, median subgular; vocal slits extending from lateral base of tongue to angles of jaws; tongue cordiform, shallowly notched posteriorly, free posteriorly for about one-eighth of its length; vomerine odontophores transverse between subcircular to ovoid choanae, moderately separated to abutting medially, each bearing 3–8 ($\bar{x}$ = 5.0, n = 49) teeth in males and 4–9 ($\bar{x}$ = 6.6, n = 17) in females.

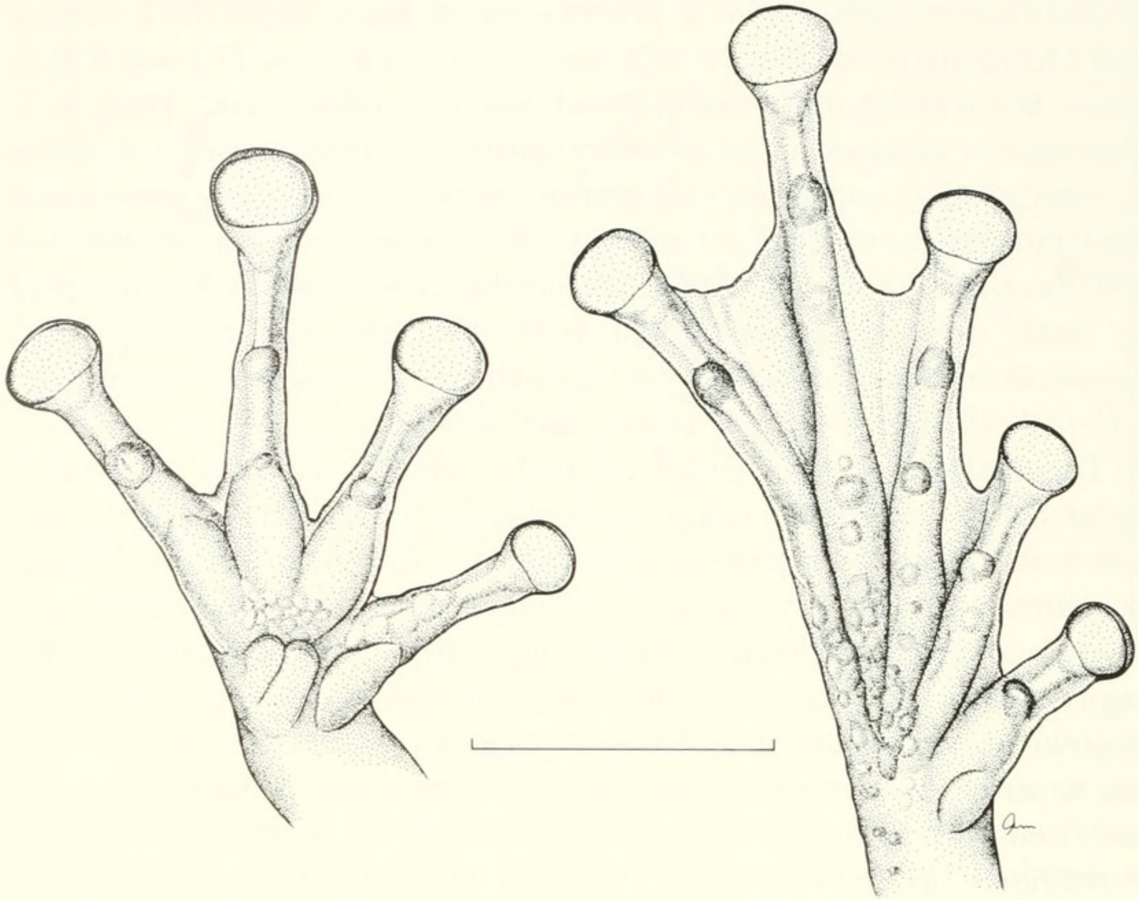

Fig. 14. Hand and foot of *Scinax icterica*, KU 205353. Line = 5 mm.

Coloration in preservative (112 topotypes): Dorsum yellowish or grayish tan to pale brown; dorsum in 86.6% of specimens with dark brown markings consisting of an interorbital bar, scapular marks (narrow inverted V, chevron, paired elongate blotches, paired angular bars, or transverse), sacral mark (chevron or tansverse), irregular postsacral spots, and scattered flecks (Fig. 15). Dark brown canthal stripe present in 72.3%; two or three small, irregular labial spots present in 64.3%; transverse dark marks on limbs in 84.8% consisting of three marks each on forelimbs, thighs, and shanks, and four or five marks on tarsus. Flanks in 83.0% marked with numerous small, round black or dark brown spots; anal region cream; posterior surfaces of thighs dark brown; venter cream white; plantar surfaces grayish brown.

Coloration in life: At night, dorsum pale yellowish tan with no distinct darker markings; venter bright yellow. By day, dorsum brown with darker brown markings; flanks cream with brown spots; posterior surfaces of thighs dark brown; throat yellow; belly white; ventral surfaces of limbs bluish green; iris pale copper (WED Field notes on topotypes, KU 205347–52; 19 January 1986). At night, dorsum pale yellowish tan or pale greenish tan with brown markings. By day, pale brown with darker reddish brown markings; flanks cream with dark brown spots; anterior and posterior

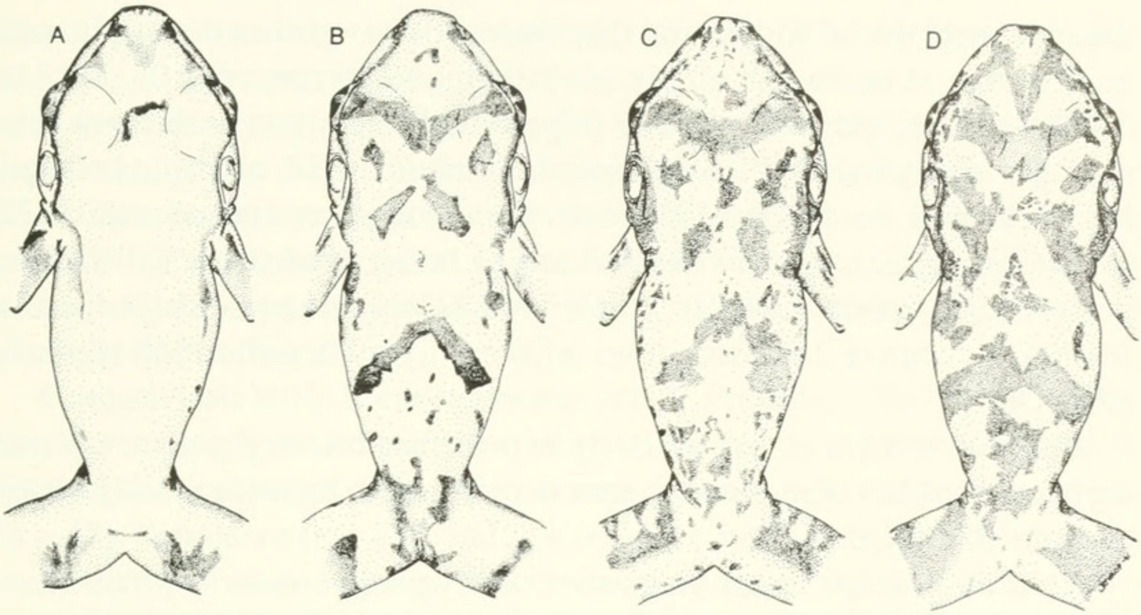

Fig. 15. Variation in dorsal color pattern in topotypic *Scinax icterica*. **A**. KU 205360. **B**. KU 205349. **C**. KU 205353. **D**. KU 205357.

surfaces of thighs black; belly dull white; vocal sac yellow; iris pale coppery bronze (WED Field notes on topotypes, KU 205380–401; 19 February 1986). At night, dorsum dull olive green with slightly darker markings. By day, dorsum cinnamon brown with darker olive brown markings; flanks cream with black spots; posterior surfaces of thighs black; iris olive tan with orange cast around pupil (WED Field notes on topotype, MHNSM 14427; 16 November 1989).

Measurements of holotype (in mm): SVL 30.0, tibia length 15.5, foot length 12.5, head length 10.0, head width 9.3, diameter of eye 3.2, diameter of tympanum 1.8.

Tadpoles.—An individual in Stage 40 (KU 205860) has the following measurements (in mm): total length 31.0, body length 9.6, basal tail muscle height 3.6, basal tail muscle width 2.5, maximum dorsal fin height 2.4, located 8.9 from body terminus, maximum ventral fin height 2.7, located 8.9 from body terminus, body width 8.6, body height 5.3, eye diameter 1.5, pupil diameter 0.5, interorbital distance 2.8, narial diameter 0.7, internarial distance 2.4, snout-naris 1.9, snout-eye 3.7, naris-eye 1.0, transverse oral disc diameter 3.0. Other major characteristics: oral disc anteroventral with wide dorsal gap in marginal papillae; labial tooth row formula 2/3; eyes dorsolateral; spiracle sinistral; vent median; dorsal fin extending onto body; neuromasts not visible.

Body ovoid in dorsal and lateral view; snout bluntly rounded; nares round, large, having darkly pigmented rim, situated dorsally; eyes large, directed dorsolaterally, visible from above but not from below; lateral spiracular tube short, sinistral, indistinct, unpigmented; vent median, unpigmented; dorsal and ventral fins slightly narrower than depth of caudal musculature at midlength of tail; tail tapering to narrow point.

Oral disc roughly triangular or trapezoidal, sometimes with sharp anterior apex; marginal papillae arranged in irregular series usually two papillae thick, may be darkly pigmented; jaw sheaths keratinized with finely serrated margins; upper jaw sheath forming broad, gradual arc with distinct posterior projection medially; lower jaw sheath narrow, V-shaped; labial tooth row formula 2/3; tooth rows adjacent to jaw sheaths cleft medially (Fig. 16).

Coloration in preservative: Body with diffuse brown pigment; tail with scattered blotches of pigment; venter unpigmented; intestine readily visible through skin (Fig. 16).

Coloration in life: Body gray brown; belly golden white; tail translucent with gray brown; iris cream with horizontal red streak (WED Field notes, KU 205860; 11 January 1986). Body and caudal musculature pale yellow; fins transluscent; dark brown stripe from snout through eye and continuing as narrow stripe on proximal half of tail; another brown stripe from point below eye connecting to first stripe on posterior part of body; venter

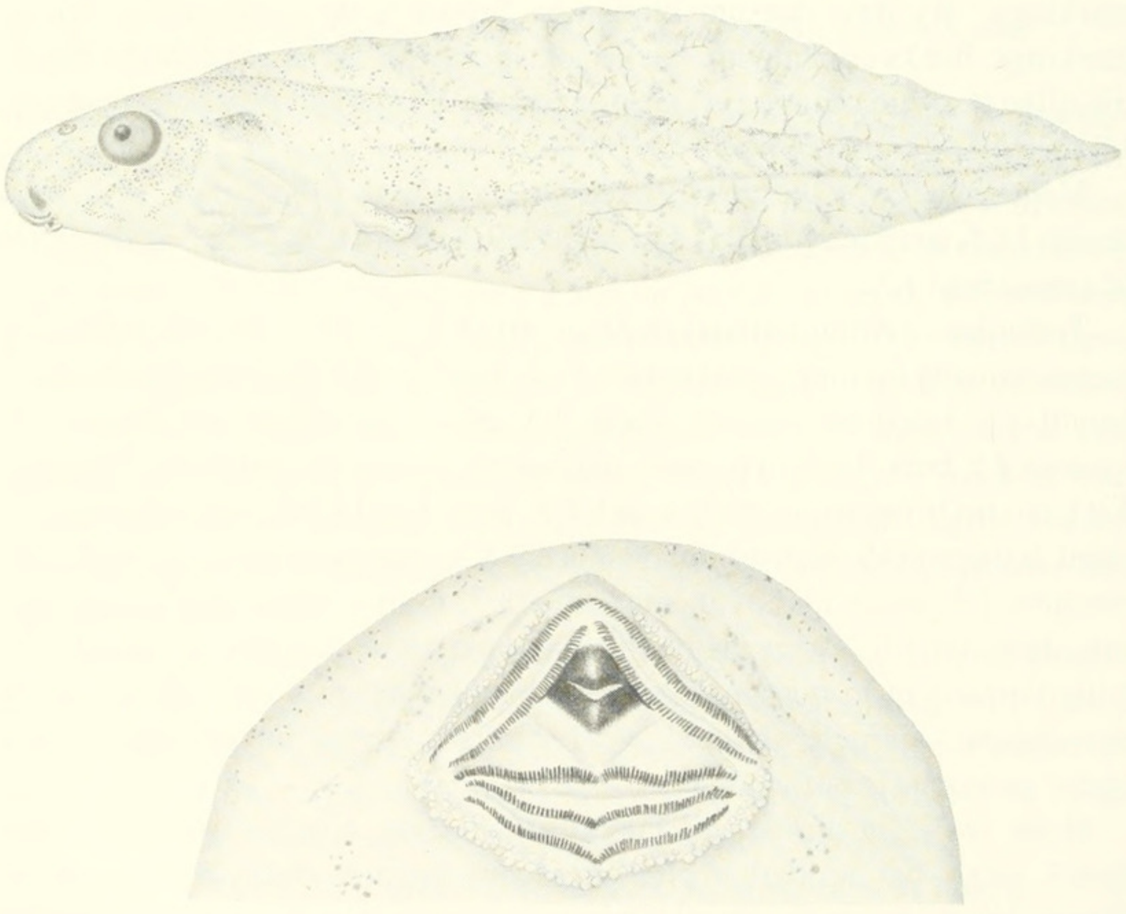

Fig. 16. Tadpole of *Scinax icterica*, KU 215834.

transparent anteriorly, white posteriorly (E. R. Wild Field notes, KU 215833; 20 February 1990).

Advertisement call.—The call of *S. icterica* is a short "wraack" that is repeated quickly. Seven individuals recorded at temperatures of 22.4–25.0°C produced notes with durations of 0.07–0.09 ($\bar{x}$ = 0.79 sec, at a rate of 38–90 ($\bar{x}$ = 59) notes per min. The notes have about 160 pulses per sec, a fundamental frequency of about 500 Hz, and a dominant frequency of about 1500 Hz (Fig. 9).

Comparison with *S. cruentomma* and *S. funerea*.—To test the differentiation of *S. icterica* from the similar species *S. cruentomma* and *S. funerea*, we performed multivariate comparisons of males of *S. cruentomma* (n = 45), *S. funerea* (n = 13), and *S. icterica* (n = 53). Initially, all variables were included in a stepwise discriminant function analysis. From this analysis, five variables were found to discriminate significantly (F for removal < 0.01) among these three species. These five variables were then used in a canonical discriminant analysis. The raw canonical coefficients for these five variables are as follow (pooled within-class standardized canonical coefficients in parentheses): CAN AXIS I = TIBL:0.80 (0.64), HLEN:0.38 (0.22), IOD:0.15 (0.04), FOOT: 0.15 (0.11), IND:0.73 (0.12); CAN AXIS II = TIBL:0.28 (0.22), HLEN:–1.81 (–1.05), IOD:2.97 (0.71), FOOT:1.16 (0.83), IND:–3.01 (–0.51)

A scattergram of the individual scores for the specimens shows these species to be incompletely separated morphometrically (Fig. 17). Nonetheless, there is relatively little overlap among the plots of specimens of the three species. Only one individual of *S. icterica* would be within a polygon inscribed around the individuals of *S. cruentomma*, and only one individual

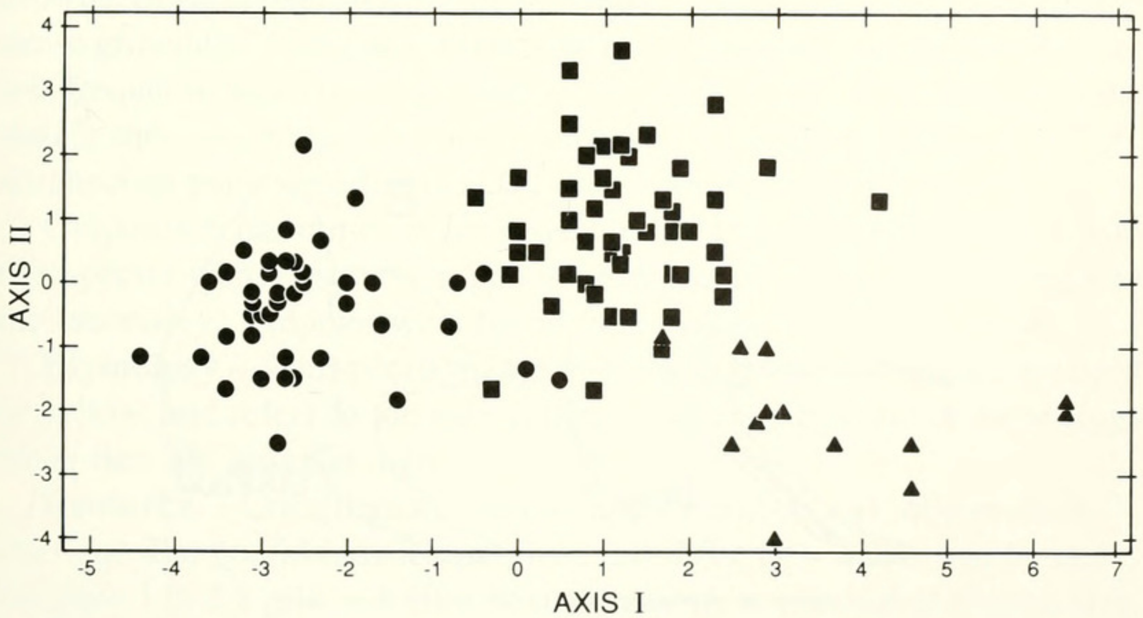

Fig. 17. Plots of individual scores from canonical discriminant analysis of morphometric data from three species of *Scinax*. Solid dots = *S. icterica;* open circles = *S. cruentomma;* triangles = *S. funerea*.

of *S. funerea* would be within a polygon enclosing the scores of individual *S. icterica*. The latter can be distinguished from *S. cruentomma* primarily along Canonical Axis I; *S. icterica* can be differentiated from *S. funerea* primarily along Canonical Axis II.

The advertisement call of *S. icterica* differs in duration, repetition rate, and pitch from the call of *S. cruentomma*, which is longer (0.35–0.37 sec) with a note repetition rate of four notes per sec and a dominant frequency of 3200–3400 Hz (Duellman, 1972a). The call of *S. funerea* consists of a single, moderately long, rather high-pitched note (Duellman, 1978); no recordings are available.

There are some osteological differences between *S. cruentomma* and *S. icterica*. In *S. icterica*, the cartilaginous sternum is uniform in width throughout its length (except at the posterior dilation), but the sternum is distinctly narrowed anterior to the posterior dilation in *S. cruentomma* (Fig. 8). *Scinax icterica* also has more extensive ossification of the vomer (Fig. 18); specifically the prechoanal process is ossified farther anteriorly in *S. cruentomma*, and there is more extensive ossification between the pre- and postchoanal processes. Also, the dentigerous processes of the vomer are oriented medially in *S. icterica* but tend to be slanted posteromedially in *S. cruentomma*.

The tadpoles of *S. cruentomma* and *S. icterica* seem to be unique among *Scinax* in Peru and Ecuador by having a red streak through the eye. The tadpole of *S. icterica* is distinct from that of *S. cruentomma* in having larger nares and a gray-brown, rather than olive-green dorsum (in life). The tadpole of *S. funerea* has a single row of mental papillae laterally (double in *S. icterica*), a pale green body, and pale orange tail. The tadpoles of *S.*

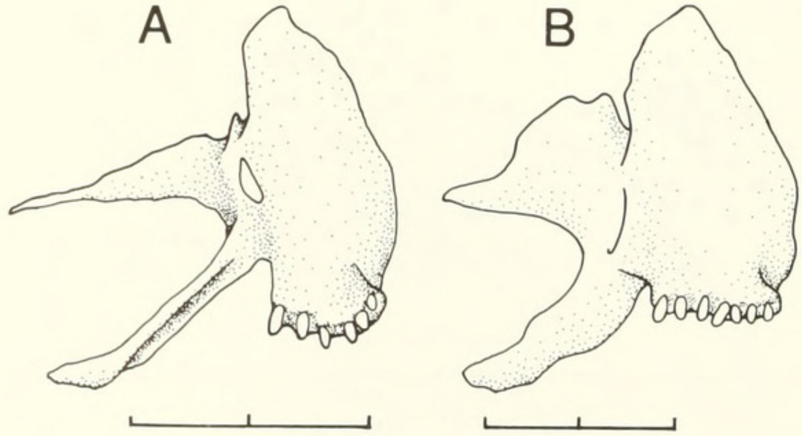

Fig. 18. Ventral views of right vomers. **A**. *S. cruentomma*, KU 152980. **B**. *S. icterica*, KU 205371. Lines = 2 mm.

garbei and *S. pedromedinai* have a labial arm to support the lower row of labial teeth (absent in *S. icterica*). The tadpoles of *S. oreites* and *S. rubra* have smaller, subcircular nares.

Distribution and ecology.—*Scinax icterica* is known from several localities at elevations of less than 300 m in the drainages of the Rio Purús and Río Madre de Dios in southern Peru (Fig. 10).

The type locality is a private reserve on the north bank of the Río Madre de Dios and is reached by launch from Puerto Maldonado, 15 km upstream from the reserve. The area is covered with lowland tropical rainforest (*bosque húmedo tropical;* Tosi, 1960), which is subjected to a dry season from May until November. The area was described in detail by Duellman and Koechlin (1991).

Adult *Scinax icterica* were found in the dry season, but individuals were far more common in the rainy season, especially after heavy rains. During the dry season, adults were perched on leaves or stems of bushes and on palm fronds 0.5–2.5 m above the ground at night. Two juveniles were found on leaves 1.5 and 2.0 m above the ground at night; one was on a tree trunk 1.5 m above the ground at night, and another was in leaf litter on the ground by day. At the type locality, water accumulates in depressions after heavy rainfall. Some of these depressions are deep and retain water throughout the rainy season and well into the dry season. *Scinax icterica* does not breed frequently in such semipermanent ponds, where *Hyla granosa*, *H. leucophyllata*, *S. pedromedinai*, *S. garbei*, and *Sphaeorhynchus lacteus* breed. Instead, *S. icterica* congregates at more ephemeral ponds that also are inhabited by *Hyla koechlini*, *H. leali*, and *H. parviceps*. *Scinax icterica* is most commonly observed and heard at ponds lacking dense growths of *Heliconia*, whereas it is relatively uncommon at ponds having dense growths of *Heliconia*. Males call from leaves and stems of bushes (or less frequently from leaves of *Heliconia*) at heights of 0.3–1.5 m above the water; they are most commonly observed at heights of about 0.5 m. Amplectant pairs were found at 0.2–0.6 m above the water.

Oviposition has not been observed, and no egg masses associated with this species were observed in ponds. Amplectant pairs deposited eggs in the laboratory. Tadpoles were found in midwater in ponds in forest.

Etymology.—The specific name is Greek, *ikterikos*, meaning jaundiced or yellow, and refers to the pale yellow color characteristic of these frogs when they are active at night.

Remarks.—Considerable variation in weights was observed in *S. icterica*. Ten gravid females weighted 2.0–2.8 g ($\bar{x}$ = 2.39), and 67 males weighed 1.0–2.2 g ($\bar{x}$ = 1.60). Sexual maturity is reached at a small size, for the smallest of these males (1.0–1.3 g) were calling. The smallest juvenile weighed 0.4 g.

The absence of series of well-preserved specimens with documentation of color in life, osteological preparations, larvae, and recordings of advertisement calls from northern and central Peru precludes determination if *S. cruentomma* and *S. icterica* represent the extremes of geographic variation in a single species. However, the differences in structure, coloration, and advertisement calls, as well as the large hiatus between their known ranges, suggest that they represent distinct species.

Scinax oreites new species

Figure 2

Holotype.—KU 181776, an adult male, from 8 km NNE Balzapata (05°46'S, 77°48'W; 1850 m), Provincia Bonagará, Departamento Amazonas, Peru, one of a series collected on 3 March 1979 by Thomas J. Berger, David C. Cannatella, and William E. Duellman.

Paratypes.—All from Provincia Bongará, Departamento Amazonas, Peru: KU 181777–95 (topotypes); KU 212167–69 from 2 km NNE Balzapata, 2200 m; MHNSM 6285 from 12 km NNE Balzapata, 1940 m; KU 181796–805, MHNSM 14801–04 from Pomacochas (= Florida), 2180 m; KU 196948–49 from 28 km SE Ingenio (= Pedro Ruíz Gallo), 2070 m.

Referred specimens.—See Appendix I.

Diagnosis.—(1) Snout-vent length in males to 33.5 mm, in females to 39.3 mm; (2) snout rounded and nonacuminate in dorsal view and profile; (3) ulnar and tarsal tubercles absent; (4) enlarged heel tubercle absent; (5) tubercles absent on lower jaw; (6) skin on dorsum smooth; (7) dorsum creamy tan to brown (yellowish tan or brown in life) with creamy white dorsolateral stripe extending from eye to groin; (8) flanks tan or brown (brown in life); (9) posterior surfaces of thighs evenly covered with brown pigment, with unpigmented spot(s) distally (brown with yellow blotch distally in life); (10) iris bronze with median horizontal brown streak.

Scinax oreites is easily distinguished from all other species in Ecuador and Peru in having a pair of narrow, white dorsolateral stripes on the dorsum. *Scinax oreites* can be distinguished further from *S. pedromedinai* and *S. garbei* in having a rounded, nonacuminate snout and in lacking heel, labial, ulnar, and tarsal tubercles. *Scinax oreites* can be distinguished from most other species in the region (except *S. rubra*) in usually lacking dark spots or stripes on the dorsum and in having the posterior surfaces of the thighs brown with a pale spot or spots distally. *Scinax oreites* is most similar to *S. rubra,* but can be distinguished in having: (1) dorsolateral stripes which are narrow, creamy white, and lack darker borders (wider, tan, and having darker borders in *S. rubra*); (2) small pale spots on the posterior surfaces of the thighs which are not bordered by black (extensive black and yellow mottling on the posterior surfaces of the thighs in *S. rubra*); (3) smooth skin on the dorsum (smooth to finely tuberculate in *S. rubra*); (4) diameter of tympanum about 30% greater than its distance from the eye (diameter of tympanum about equal to its distance from the eye in *S. rubra*).

Description.—Body moderately slender, in males about as wide as head; snout narrowing anterior to nostrils, acutely rounded in dorsal view, depressed and round in profile (Fig. 1B); eye-nostril distance greater than diameter of eye; internarial region slightly depressed; canthus rostralis barely evident; loreal region nearly flat; top of head flat; supratympanic fold weak, barely obscuring dorsal rim of tympanic annulus; tympanum round. Forelimbs short; ulnar fold absent; ulnar tubercles low and indistinct if present; fingers moderately short bearing transversely rounded terminal discs, supernumerary palmar tubercles small, low often in two rows on proximal segments; palmar tubercle large, flat, bifid; thenar tubercle flat, ovoid; subarticular tubercles moderately large, round, as wide as digits; webbing vestigial between Fingers III and IV, reduced further between Fingers II and III, more reduced or absent absent between Fingers I and II; narrow lateral keels on all fingers but reduced on inner edge of Finger I and outer edge of Finger IV; nuptial excresence present in males, not keratinized (Fig. 19). Hind limbs robust; toes moderately short; inner tarsal fold indistinct or absent; outer metatarsal tubercle round, approximately one half size of inner tubercle; inner metatarsal tubercle broadly ovoid; subarticular tubercles distinct, round; supernumerary tubercles small, most distinct on proximal segments; toes about two thirds webbed; webbing formula I 2^{+}—2½ II (1–1½)—(2–2^{+}) III (1–1½)—(2—2½) IV (2–2½)—(1–1½) V; narrow dermal keel on outer edge of Toe V (Fig. 19). Skin on throat, belly, proximal ventral surfaces of thighs, and forelimbs coarsely granular; skin on other surfaces smooth; anal sheath short; anal opening directed posteroventrally at upper level of thighs; many small subanal granules; vocal sac subgular, bilobate; vocal slits extending from midlateral base of tongue to angles of jaws; tongue cordiform, shallowly notched and free posteriorly for approximately one-eighth of its length; vomerine odontophores robust, transverse between round choanae, narrowly separated medially, each odontophore bearing 2–8 ($\bar{x}$ = 5.2, n = 51) teeth in males and 3–7 ($\bar{x}$ = 5.6, n = 7) in females.

Coloration in preservative: Dorsum and flanks tan to grayish brown or dark brown with or without small brown flecks; narrow cream dorsolateral stripe from posterior corner of eyelid to groin (narrowly bordered by dark brown in some pale specimens, indistinct in 1 male and 2 females, absent in 2 females); narrow brown canthal stripes present in most specimens; brown supratympanic stripes present in a few specimens; dorsal surfaces of thighs colored like body, lacking dark transverse markings; posterior surfaces of thighs pale brown with longitudinal, irregular cream markings distally, not bordered by concentration of darker pigment; venter creamy white with small brown flecks usually present on chin and present less commonly on

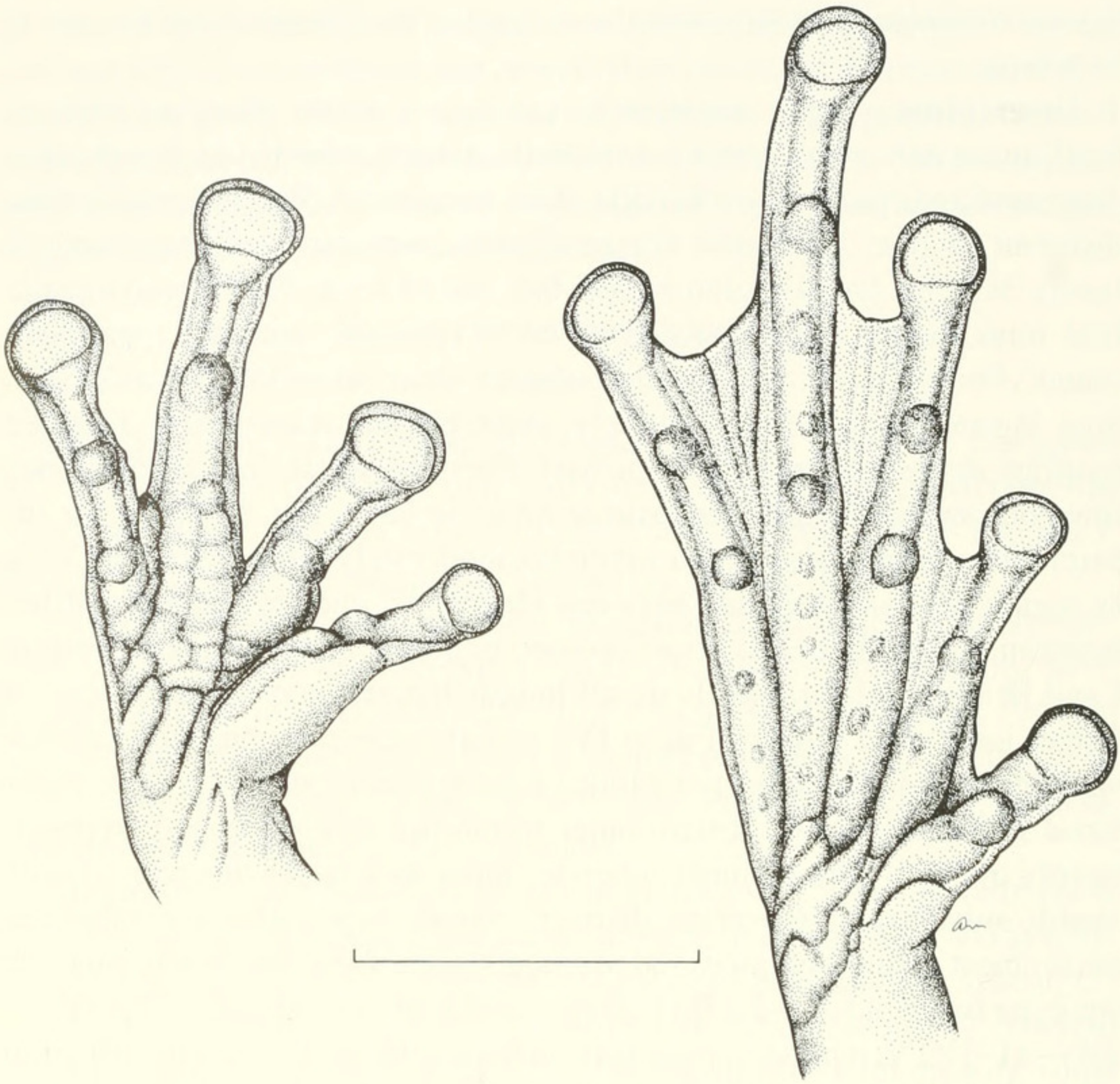

Fig. 19. Hand and foot of *Scinax oreites*, KU 181776. Line = 5 mm.

chest, belly, and underside of limbs.

Coloration in life: Dorsum yellowish tan to dark brown; dorsolateral stripe pale creamy yellow with bronze tint; posterior surfaces of thighs dark brown with bright yellow mark distally; flanks brown; groin deep yellow; suborbital area creamy tan with bronze tint. Ventral surfaces of thighs creamy tan; belly creamy yellow with grayish brown flecks on throat and chest. Iris dull bronze with black flecks (WED Field notes on topotypes; 3 March 1979).

Measurements of holotype (in mm): SVL 30.8, tibia length 15.3, foot length 13.1, head length 10.7, head width 9.7, diameter of eye 2.8, diameter of tympanum 1.9.

Tadpoles.—An individual in Stage 38 (KU 212499) has the following measurements (in mm): total length 39.4, body length 15.7, basal tail muscle height 4.0, basal tail muscle width 2.5, maximum dorsal fin height 3.7, located 9.4 from body terminus, maximum ventral fin height 3.7, located 6.3 from body terminus, body width 8.5, body height 9.4, eye diameter 1.7, pupil diameter 0.5, interorbital distance 4.8, narial diameter 0.4, internarial distance 4.8, snout-naris 3.1, snout-eye 4.4, naris-eye 2.0, transverse oral disc diameter 3.5. Other major characteristics are: oral disc anteroventral, marginal papillae uniserial dorsally and biserial (but irregularly arranged) laterally and ventrally with wide dorsal gap; labial tooth row formula 2/3; eyes lateral; spiracle sinistral; vent sinistral; dorsal fin extending onto body for short distance; neuromasts not visible.

Body globular, almost spherical in dorsal and lateral view; snout short, sharply rounded; anteroventral mouth almost at terminus of snout; nares opening dorsally, ovoid, surrounded by darker pigment; eyes lateral; spiracular tube clear, situated laterally on body; vent sinistral, unpigmented; caudal musculature thicker than dorsal and ventral fins at midlength of tail; tail bluntly tapering to narrow point.

Oral disc roughly trapezoidal, sometimes with narrow anterior apex; marginal papillae monoserial dorsally and irregularly arranged laterally and ventrally; jaw sheaths keratinized, finely serrated; upper jaw forming broad, gentle arc with wide, indistinct, medial projection; lower jaw narrow, V-shaped; labial tooth row formula 2/3; tooth rows adjacent to jaw sheaths cleft medially; dorsalmost tooth row markedly indented anteriorly (Fig. 20).

Coloration in preservative: Dorsum, flanks, fins, and caudal musculature finely and evenly pigmented, with darker blotches on fins in some specimens; venter not strongly pigmented; viscera concealed by dark iridescent peritoneum extending dorsally almost to level above level of caudal musculature (Fig. 20).

Coloration in life: Dorsum yellowish green; musculature similarly colored but paler; fins golden yellow; belly silvery white; iris pale gold (WED Field notes, KU 181879; 3 March 1979). Body olive tan; venter clear with bronze peritoneum; tail greenish yellow with pale gray fins; iris bronze (WED Field notes, KU 212499; 26 January 1989).

Advertisement call.—The call of *S. oreites* is a series of short notes, "hah-hah-hah." Two individuals recorded at a temperature of 18°C at the type locality produced notes 0.08 and 0.11 sec in duration at rates of 30 and 34 notes per min, respectively. These notes had pulse rates of 70 and 80 pulses per sec; the fundamental frequency at 1050 and 1000 Hz is dominant (Fig. 21).

Comparison with *S. rubra*.—In addition to the external morphological features and coloration, two osteological differences were noted between *S. oreites* and *S. rubra*. *Scinax oreites* is unique among the species in Ecuador and Peru in having an exposed frontoparietal fontanelle (Fig. 22). *Scinax oreites* also differs from *S. rubra* in having ilial shafts which are more narrowly separated medially (Fig. 23).

The tadpole of *Scinax oreites* is similar to that of *S. rubra*, but there are

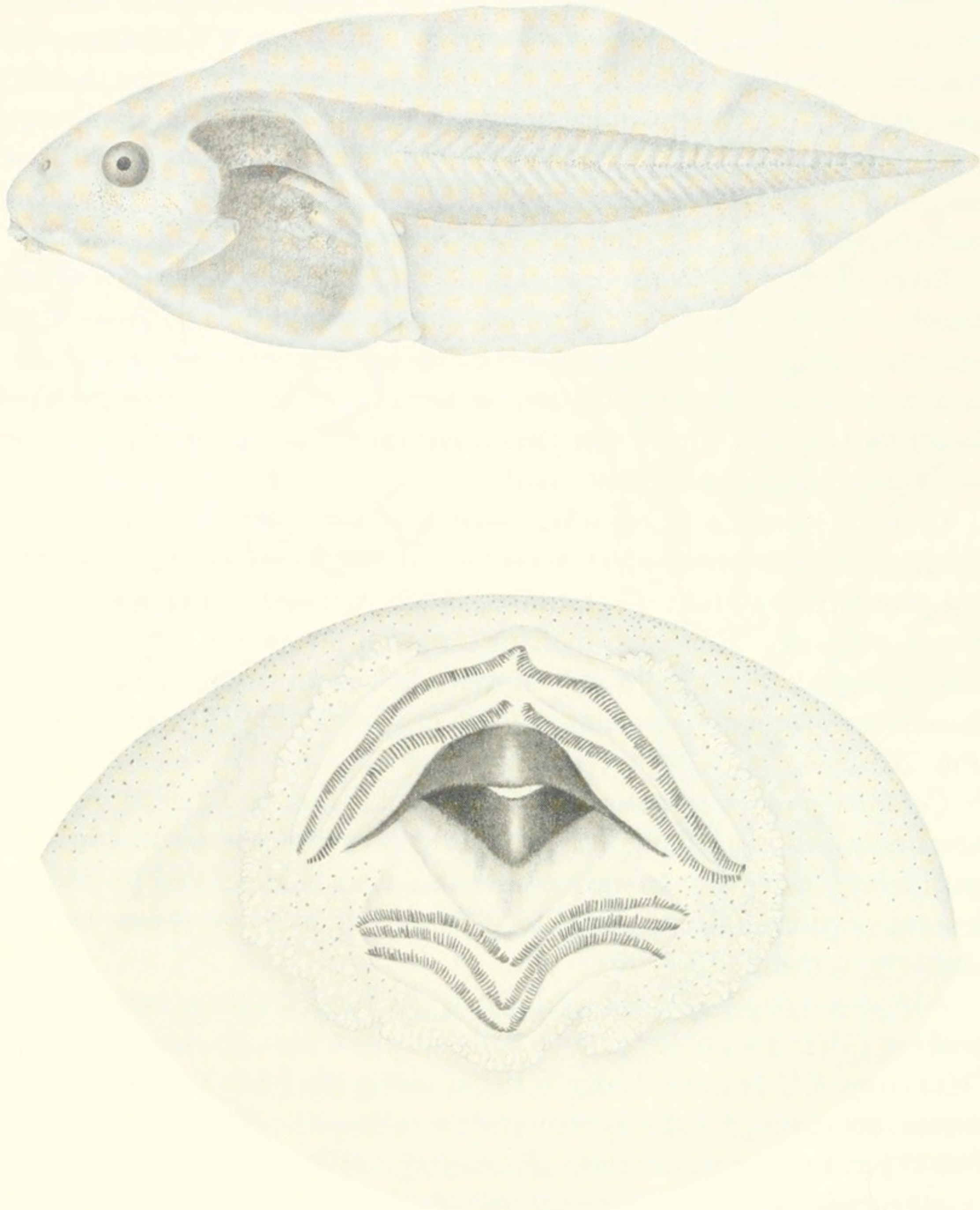

Fig. 20. Tadpole of *Scinax oreites*, KU 181879.

several differences. In *S. rubra*, the pigmentation on the tail is restricted to numerous small blotches, whereas in *S. oreites* the entire tail is evenly covered with fine pigmentation (with or without the addition of darker blotches). The visceral peritoneum of *S. oreites* is more darkly pigmented than that of *S. rubra*. The labial teeth of *S. oreites* generally are smaller than those of *S. rubra*. The posterior terminus of the tail is longer and narrower in *S. rubra*. The large size and bluntly rounded and evenly pigmented tail of *S. oreites* easily distinguish it from the other *Scinax* tadpoles of the region; other distinguishing characters include: eye lacking

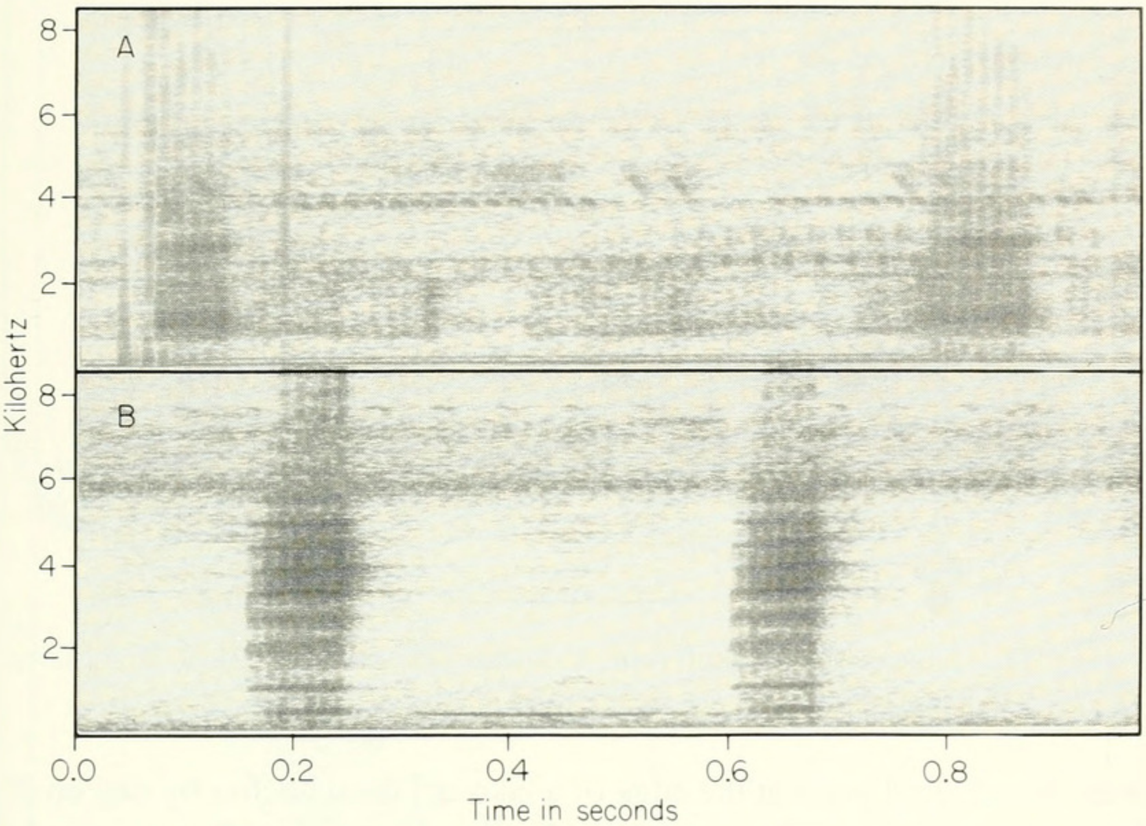

Fig. 21. Audiospectrograms of advertisement calls. **A**. *Scinax oreites*, 8 km NNE Balzapata, Peru, 18°C. **B**. *Scinax pedromedinai*, Tambopata, Peru, 25.4°C. Effective band width 45 Hz.

red streak (present in *S. cruentomma* and *S. icterica*), nares small, subcircular (large, circular in *S. icterica*), marginal papillae biserial ventrally and laterally (monoserial in *S. funerea*), and labial arm absent (present in *S. pedromedinai* and *garbei*).

The call of *S. oreites* differs from that of *S. rubra* by having slightly shorter and lower pitched notes.

Distribution and ecology.—*Scinax orietes* inhabits upper montane rainforest at elevations of 2000–2400 m on the front ranges of the Andes in northern and central Peru (Fig. 24). It descends to elevations of 1600 m in lower montane rainforest on the eastern slopes of the Andes. The natural vegetation in areas where most *S. oreites* have been found seems to be cloud forest (*bosque muy humedo montano* or *bosque pluvial montano;* Tosi, 1960), but at the lowest locality (Venceremos, 1600 m) the vegetation is lower montane cloud forest (*bosque húmedo montano bajo;* Tosi, 1960). Although remnants of cloud forest were present on steep slopes above Balzapata and Pomacochas, the valleys in which these villages are located, and the valley of the Río Sonche, in which Molinopampa is located, are nearly devoid of forest; the land has been cleared for agriculture and pasture.

At the type locality and at Pomacochas, males were calling from the water at edges of temporary ponds at night on 3 and 4 March 1979. Adults

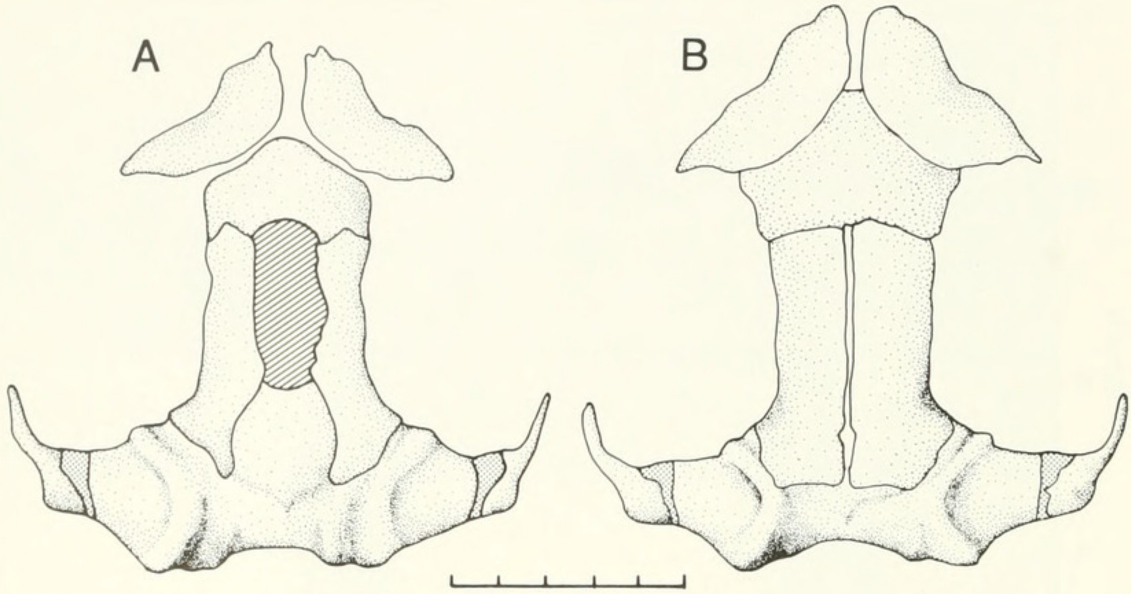

Fig. 22. Dorsal view of skull roof. **A**. *Scinax oreites*, KU 212172. **B**. *S. rubra*, KU 152975. Line = 5 mm.

were found amid grass at the edge of a lake at Pomachochas by day on 29 January 1989, on low bushes and amid grass along a slow-flowing marshy stream in a pasture by day on 26 January 1989 at Molinopampa, and in a grassy ditch by day on 19 February 1989 at a site 2 km E of Balzapata. One adult was on a low bush in cloud forest at night on 1 February 1989 at Venceremos.

Tadpoles were found in grassy road-side ditches and ponds near Balzapata and at Pomacochas in March 1979 and January 1989. In the vicinity of Molinopampa on 26 February 1989, tadpoles were found in a slowly flowing roadside ditch and in a sluggish marshy stream in a pasture; metamorphosing young (SVL 15.3–20.6 mm; $\bar{x}$ = 18.8 mm, n = 4) were found amid aquatic vegetation at the latter site. These limited data indicate that *S. oreites* breeds at least from January to March, but the presence of late larval stages and metamorphosing young in late January suggest that the breeding season may begin in November or December.

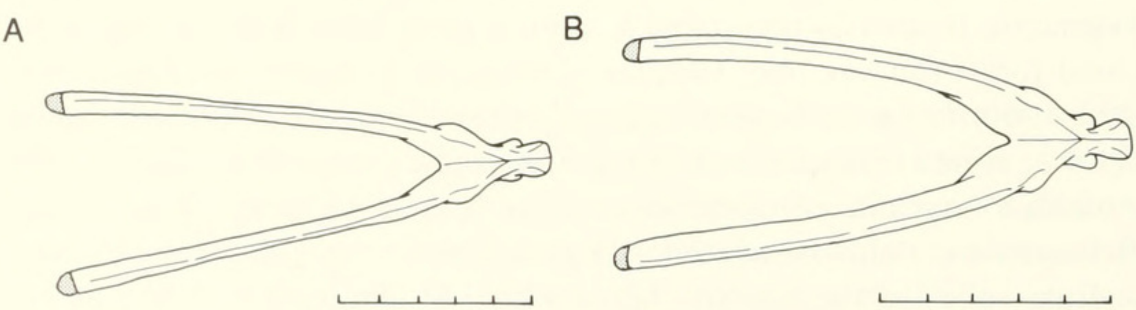

Fig. 23. Dorsal view of pelvic girdles. **A**. *Scinax oreites*, KU 212171. **B**. *S. rubra*, KU 152974.

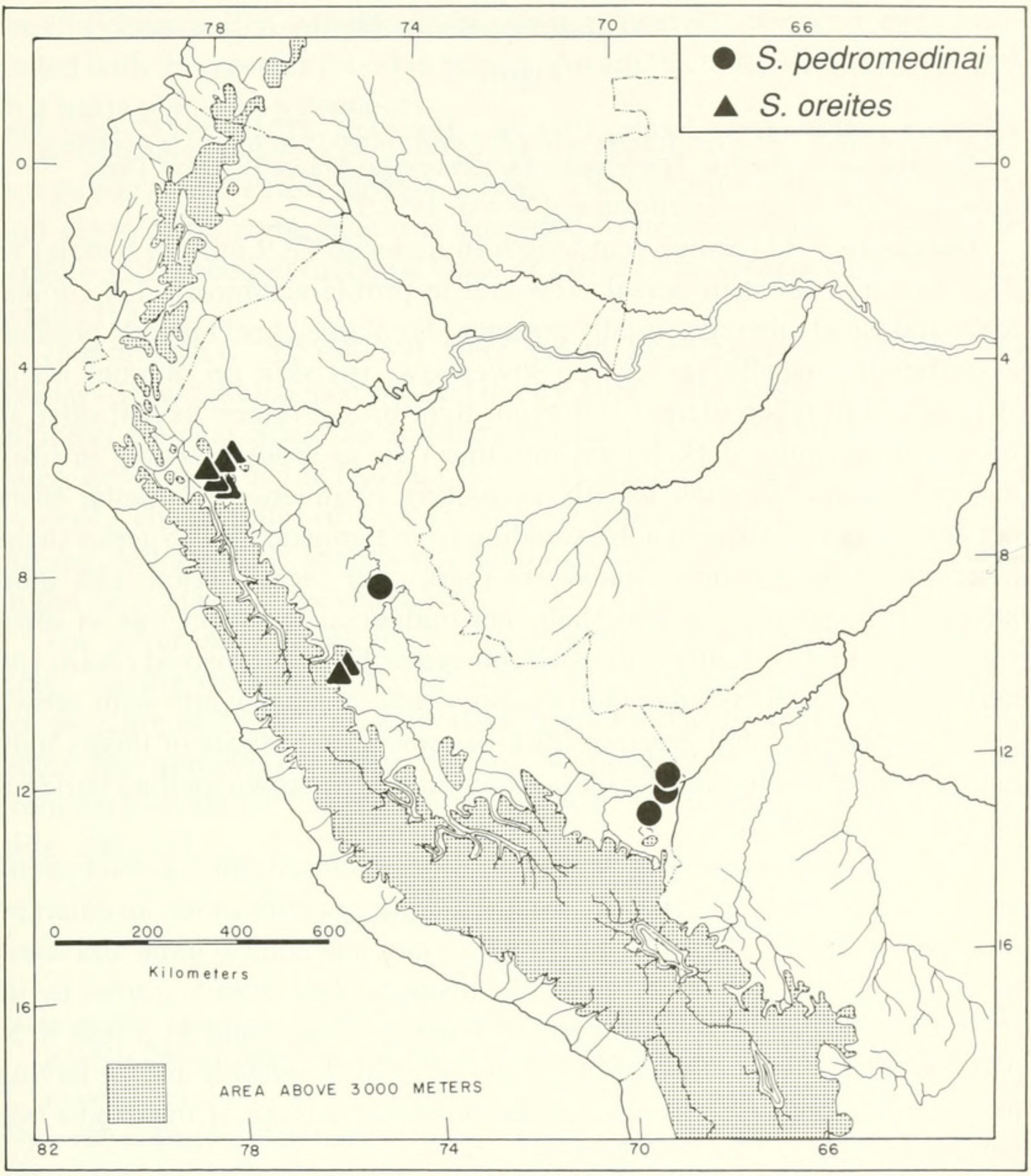

Fig. 24. Distribution of *Scinax oreites* and *S. pedromedinai* in Peru.

Etymology.—The specific name is Greek, meaning mountaineer, and refers to the high elevations inhabited by this species.

Remarks.—The type locality is on the road across the Cordillera Central from the valley of the Río Utucbamba to Moyobamba and Tarapoto. The small village of Balzapata is just south of this road; the entrance to Balzapata is 48 km from Pedro Ruíz Gallo, the junction with the road from Chachapoyas to Bagua. The sperm of *S. oreites* is like that of *S. rubra* (M. J. Fouquette, Jr., pers. comm.). Thus, based solely on sperm morphology, *S. oreites* is placed in the *S. rubra* group of Fouquette and Delahoussaye (1977).

Scinax pedromedinai Henle

Figure 3

Ololygon pedromedinae Henle, 1991:76.—Holotype: ZFMK 39737 from Tres Chimbadas on the Río Tambopata, Departamento Madre de Dios, Peru.

Scinax pedromedinae—Duellman and Wiens, 1992:23.

Diagnosis.—(1) Snout-vent length in males to 28.9 mm, in females to 31.5 mm; (2) snout in dorsal view and in profile acuminate; (3) conical ulnar and tarsal tubercles usually present; (4) enlarged heel tubercle present; (5) tubercles usually present on lower jaw; (6) skin on dorsum finely shagreened to tuberculate; (7) dorsum light brown (green to dull olive in life) with irregular dark brown mottling (tan to reddish brown in life); darker brown coloration usually consisting of inverted triangular mark between the eyes, large blotch extending from tympanum to posterior to the insertion of the forelimb, transverse mark over sacral region, and short lateral stripe paralleling ilial shaft; tan middorsal stripe present in some specimens; limbs usually with dark transverse bars; lips barred cream and dark brown; (8) flanks dark brown anteriorly, creamy white with brown flecks posteriorly (dull green in life); (9) posterior surfaces of thighs light brown (dull green in life); (10) iris silvery tan with brown median horizontal and vertical streaks.

Scinax pedromedinai can be distinguished from all other *Scinax* in the area (except *S. garbei*) in having a depressed, acuminate snout, an enlarged tubercle on the heel, tubercles on the lower jaw, and conical ulnar and tarsal tubercles. *Scinax pedromedinai* can be distinguished from *S. garbei* by its smaller size (SVL of adult males and females to 28.9 and 31.5 mm in *S. pedromedinai*, versus SVL to 42.2 and 47.9 in *S. garbei*) and in having uniform pale brown coloration on the posterior surface of the thighs (vs. yellow with black blotches or bars).

Distribution and ecology.—This species is confined to the upper Amazon Basin in exteme eastern Peru, where it occurs in the drainages of the Rio Purús and Río Madre de Dios (Fig. 24).

Observations were made on the ecology of this species at Cuzco Amazónico, Peru. Adults were found singly in primary rainforest throughout the year; most were observed on ferns and leaves or stems of bushes 0.2–1.0 m above the ground at night. Several individuals were found on low vegetation (< 0.1 m) by day, and two were in leaf litter on the forest floor by day. During the rainy season, recently metamorphosed young were found on a leaf 0.4 m above the ground and on a fern 0.2 m above water, both by day.

Breeding occurs in *Heliconia*-choked temporary ponds. An amplectant pair was found on the tip of a *Heliconia* leaf 1 m above the water on 17 February 1986, and another pair was found on a leaf 0.3 m above the water on 15 February 1990. Oviposition was not observed, nor were eggs associated with this species found in nature. An amplectant pair deposited eggs in a loose clump in a container.

Remarks.—Henle (1991) stated that the specific name *"pedromedinae"* is a patronym for Pedro Medina, a man. The feminine ending is incorrect, and the specific name herein is emended to *pedromedinai*, according to Article 32d of the International Code of Zoological Nomenclature (Anonymous, 1985).

Tadpoles (KU 205858–59) were raised from eggs deposited on 19 January 1986 and hatched on 21 January 1986. The largest tadpoles (KU 205859) are near Stage 26 and may not have fully developed oral structures; however, a distinct labial arm and elongate, recurved labial teeth are evident. The tadpoles of *S. pedromedinai* appear to be more elongate and streamlined and have shallower caudal fins than those of *S. garbei*, at least in the early stages of development.

The advertisement call of *S. pedromedinai* is a series of short rattling notes having durations of 0.09–0.10 sec. An individual recorded at a temperature of 25.4°C at Tambopata, Peru, produced notes at a rate of 32 notes per min with a pulse rate of 80 pulses per sec, a fundamental frequency of about 550 Hz, and a dominant frequency of about 3300 Hz (Fig. 21).

Scinax rubra (Laurenti)

Figure 2

Hyla rubra Laurenti, 1768:5.—Holotype: None designated; from "America." RMNH 25883 from Paramaribo Botanical Garden, Surinam, herein designated as neotype.

Hyla rubra Daudin, 1802:26.

Hyla lateristriga Spix, 1824:32.—Holotype: Formerly in ZSM (now lost) from "Brazil" (synonymy fide Peters, 1872:207).

Hyla conirostris Peters, 1863:464.—Holotype: ZMB 4917 from "Surinam" (synonymy fide Peters, 1872:207).

Hyla rubra—Peters, 1872:207, 214.

Scytopis cryptanthus Cope, 1874:123.—Holotype: Unknown, from Nauta, Departamento de Loreto, Peru (synonymy fide Boulenger, 1882:404).

Hyla rubra—Boulenger, 1882:403.

Hyla lineomaculata Werner, 1899:483.—Holotype: In ZIUG from "Trinidad" (synonymy fide Barbour, 1920:287).

Hyla rubra—Barbour, 1920:287.

Hyla rubra huebneri Melin, 1941:32.—Syntypes: NHMG 476 from Taracuá, 477 from São Gabriel, 478 from Manaus, all in Estado do Amazonas, Brazil (synonymy fide Cochran and Goin, 1970:240).

Hyla robersimoni Donoso-Barros, 1965:no page number.—Holotype: RD-B 645301 from Pajonales al sur de Macuro (Peninsula de Paria), Estado de Sucre, Venezuela (synonymy fide Duellman, 1977:97).

Hyla rubra orientalis Lutz, 1968:15.—Holotype: MNRJ 4030 from Crubixá, Santa Leopoldina, Espírito Santo, Brazil (non *Hyla orientalis* Bedriaga, 1889).

Hyla rubra—Cochran and Goin, 1970:239.

Hyla rubra altera Lutz, 1973:159 (substitute name for *Hyla rubra orientalis* Lutz, 1968; synonymy fide Duellman, 1977:97).

Hyla rubra—Duellman, 1977:97.

Ololygon rubra—Fouquette and Delahoussaye, 1977:392.

Scinax rubra—Duellman and Wiens, 1992:23.

Diagnosis.—(1) Snout-vent length in males to 41.2 mm, in females to 43.8 mm; (2) snout rounded and nonacuminate in dorsal and lateral view; (3) distinct ulnar and tarsal tubercles absent; (4) enlarged heel tubercle absent; (5) tubercles absent on lower jaw; (6) skin on dorsum smooth to finely tuberculate; (7) dorsum gray (tan to dull green in life) with wide tan (creamy tan to yellow in life) dorsolateral stripe with dark borders extending from eyelid to sacrum usually evident, a discontinuous tan middorsal stripe also usually present; (8) flanks cream with yellow spots usually edged with black in groin; (9) posterior surfaces of thighs brown with yellow to orange mottling enclosed in darker pigment; (10) iris bronze with black reticulations.

Scinax rubra can be distinguished from *S. pedromedinai* and *S. garbei* in lacking enlarged ulnar, tarsal, heel, and labial tubercles, and in having a rounded, nonacuminate snout. *Scinax rubra* can be easily distinguished from the remaining species in the region in having yellowish coloration on the anterior and posterior surfaces of the thighs and groin edged with darker, often black, pigmentation, and in usually having a pair of wide, tan, dark-bordered dorsolateral stripes on the dorsum. *Scinax rubra* is most similar to *S. oreites* but can be distinguished from that species in having: (1) dorsolateral stripes which are wide and tan with darker borders (narrow, creamy white, and usually lacking darker borders in *S. oreites*); (2) posterior surfaces of thighs with extensive dark-bordered yellowish reticulations (posterior surface of thighs with pale spots that are not bordered by concentrations of darker pigment in *S. oreites*); (3) skin on dorsum smooth to finely tuberculate (smooth in *S. oreites*); (4) diameter of tympanum about equal to its distance from the eye (diameter of tympanum about 30% greater than its distance from the eye in *S. oreites*).

Distribution and ecology.—As presently recognized, *Scinax rubra* is widely distributed from eastern Panama across northern South America to the Guianan region, including Trinidad, Tobago, and St. Lucia, eastern Brazil southward to Espírito Santo, and throughout the Amazon Basin. The species occurs throughout the Amazonian lowlands in Ecuador and Peru (Figs. 25–26) and ascends the slopes of the Andes to elevations of

1490 m along the Río Quijos and 1270 m in the valley of the Río Pastaza in Ecuador, and 1040 m in the valley of the Río Mayo in northern Peru.

In the upper Amazon Basin, *Scinax rubra* is a "weed" species primarily inhabiting cleared areas in the rainforest. Duellman (1978) noted that at Santa Cecilia, Ecuador, no individuals were found in primary forest and that only 42% of the specimens were found in cut-over forest; most were in clearings. At Cuzco Amazónico, Peru, one *S. rubra* was on a bush in forest at night; all others were observed in the camp clearing, where it occurs primarily on thatch-roofed buildings. The same is true at Tambopata, Peru (R. W. McDiarmid, pers. comm.). In cultivated areas, the species breeds in roadside ditches and shallow, temporary ponds. In the cities of Iquitos, Moyobamba, and Tarapoto, Peru, *S. rubra* occurs in gardens and parks.

Remarks.—Tadpoles were described from Santa Cecilia, Ecuador, by Duellman (1978) and described and illustrated from Trinidad by Kenny (1969). The advertisement call of *Scinax rubra* from Santa Cecilia, Ecuador, was illustrated by Duellman (1972a). The call of *S. rubra* differs from the those of the allopatric *S. chiquitana* and the Andean *S. oreites*, as noted in the accounts of those species. However, the call of *S. rubra* in the upper Amazon Basin is highly variable. At Santa Cecilia, Ecuador, the note repetition rate of five individuals recorded at temperatures of 21.5–23.0°C was 16–86 ($\bar{x}$ = 48) notes per min with pulse rates of 61–65 ($\bar{x}$ = 63) pulses per sec. In these frogs, the fundamental frequencies at 1545–1640 Hz were dominant. Three individuals recorded at temperatures of 23.2–25.8°C at Tambopata, Peru, repeated notes at 14–36 ($\bar{x}$ = 27.3) notes per min with pulse rates of about 120 pulses per sec. In these calls, the fundamental frequency is 400–420 ($\bar{x}$ = 407) Hz, and the dominant frequency is 1200–1260 ($\bar{x}$ = 1220) Hz. One individual recorded at 21.0°C at 2 km S of San Luis de Shuaro, Departamento Junín, Peru, repeated notes at a rate of 38 notes per min.

Possibly *Scinax rubra,* as recognized herein, consists of more than one species. In addition to the differences in calls noted from various localities in Amazonian Ecuador and Peru, some morphological differences have been noted. For example, specimens from the vicinity of Méndez, Provincia Morona-Santiago, and some specimens from the lower Río Pastaza drainage, Ecuador, are smaller than "typical" *S. rubra* in the upper Amazon Basin. Also, some specimens from the western edge of the Amazon Basin in Departamento San Martín are larger, lack tan dorsolateral stripes, and have diffuse yellow spots on the posterior surfaces of the thighs.

The description of *Hyla rubra* by Laurenti (1768) was based on an illustration (Pl. 68:fig. 5), labelled *Ranula Americana rubra* in Seba (1735). Daudin (1802) also used the name *Hyla rubra,* referred to Seba's illustration, and noted the existence of the specimen upon which his description was based and which he figured in Seba's Cabinet in the Museum d'Histoire

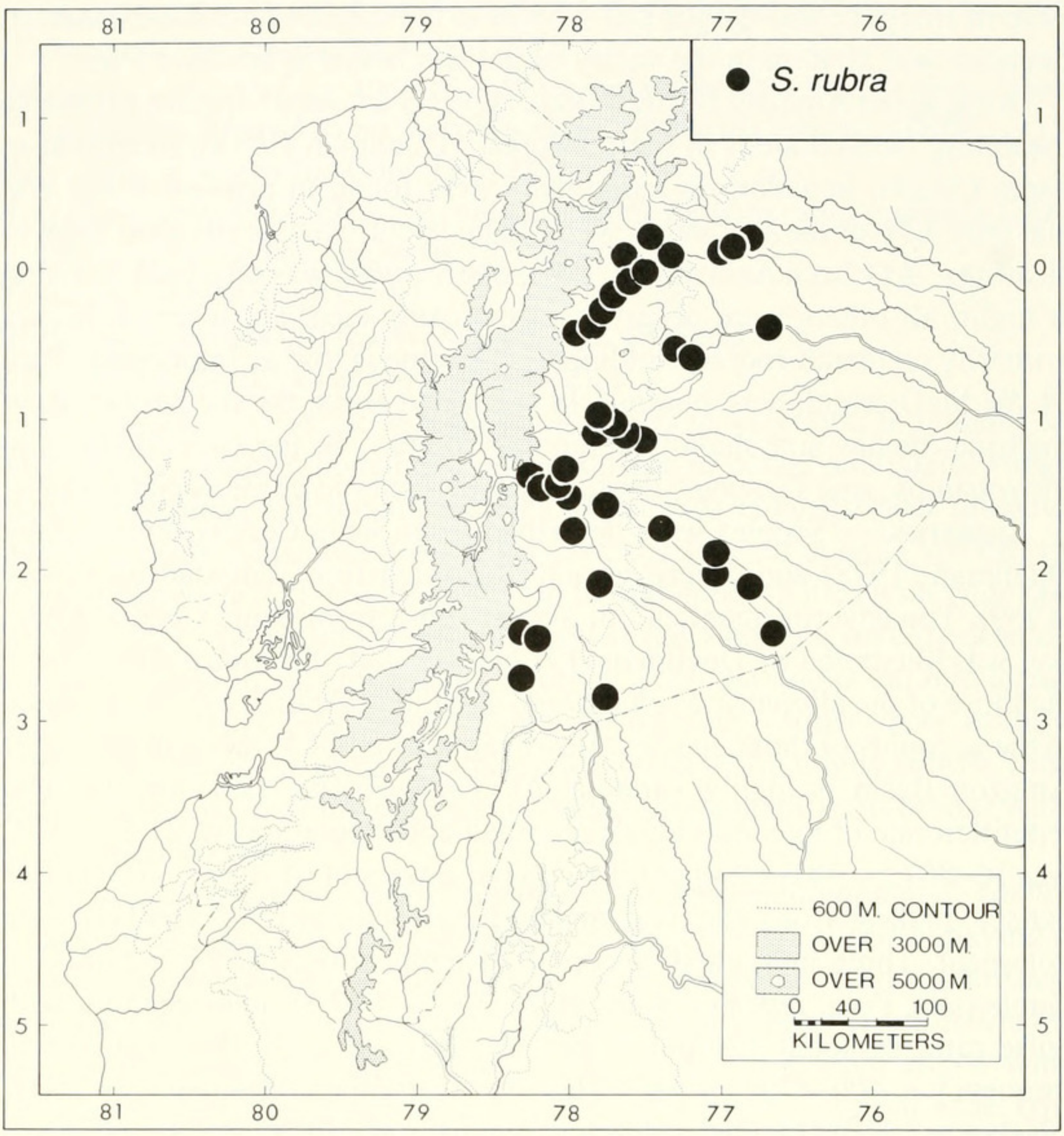

Fig. 25. Distribution of *Scinax rubra* in Ecuador.

Naturelle in Paris. Efforts to locate that specimen by Jean Guibé and the senior author in 1969 were unsuccessful. Daudin (1802; 1803) made no reference to Laurenti's use of the name *Hyla rubra,* so it must be assumed that Daudin considered his *Hyla rubra* to be a new name. Because of Daudin's reference to the illustration in Seba, it seems as though both descriptions of *Hyla rubra* were of the same animal; Laurenti's description was based solely on Seba's illustration, whereas Daudin's description was based on the specimen illustrated by Seba. Therefore, *Hyla rubra* Daudin, 1802, is a junior objective homonym of *Hyla rubra* Laurenti, 1768.

Hyla rubra (*auctorum*) is a highly variable and widespread species in Guianan and Amazonian South America. In the absence of a type specimen and in the interests of nomenclatural stability, it is necessary to designate a neotype of *Hyla rubra.* Among the rules for the designation of neotypes listed in Article 75d of the International Code of Zoological Nomenclature

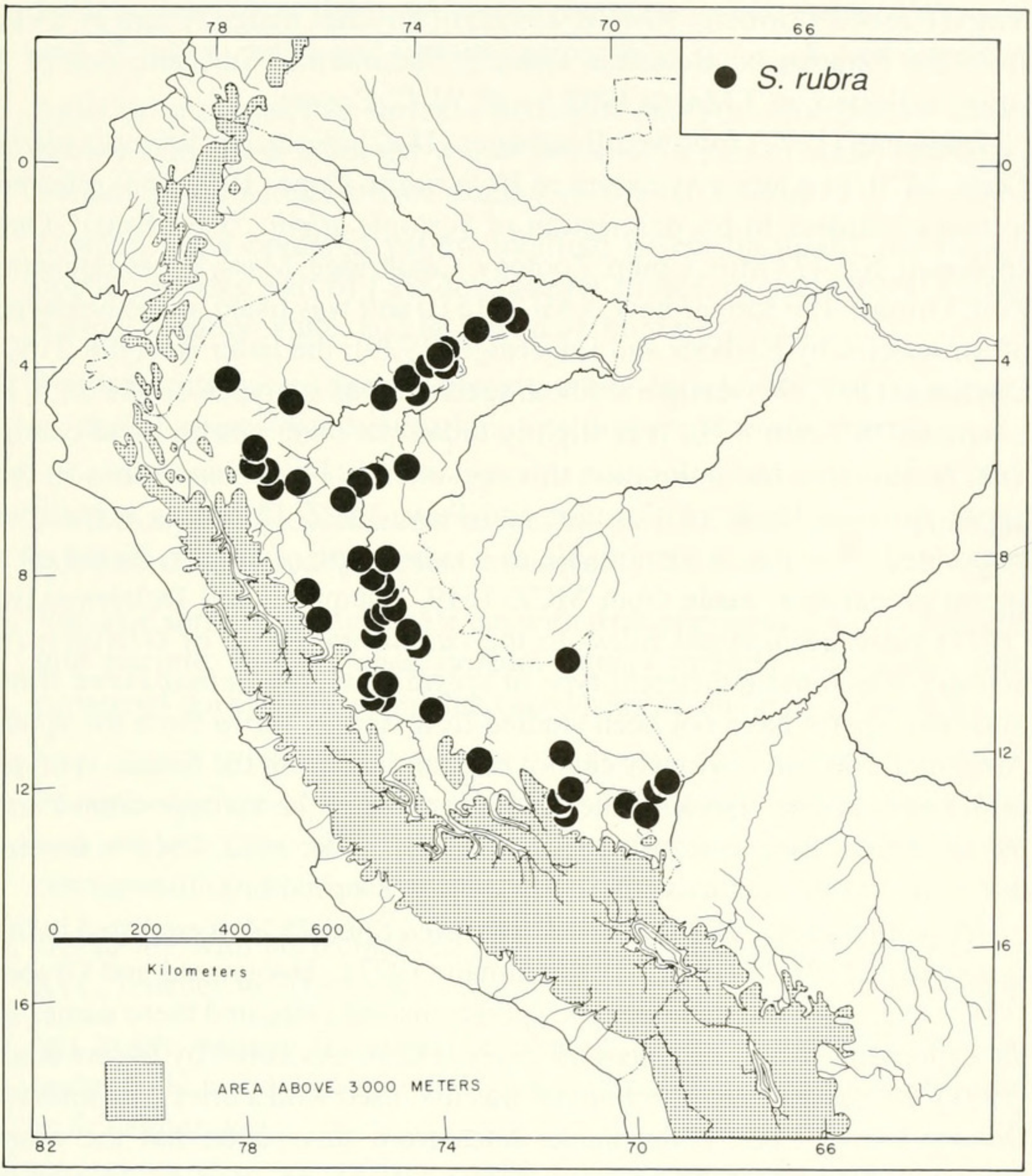

Fig. 26. Distribution of *Scinax rubra* in Peru.

(Anonymous, 1985) is the explicit requirement for evidence that the neotype came from as nearly as practical from the original type locality. The descriptions of both Laurenti and Daudin refer only to America. According to M. S. Hoogmoed (pers. comm.), Seba was an apothecary in Amsterdam. He visited incoming ships and bought specimens from sailors. In the early 1700s, most Dutch ships came from Indonesia, West Africa, the Dutch Antilles, and Surinam. Thus, it is most likely that Seba's specimen came from Paramaribo, the only port in Surinam.

In his account of *Hyla rubra,* Duellman (1977:96) stated: "Type: None designated (R.M.N.H. no. 15922B from Paramaribo, Surinam, being designated as neotype by Fouquette)." This designation never was made. Consequently, we hereby designate as the neotype of *Hyla rubra* Laurenti, 1768, RMNH 25883 (formerly RMNH 15922B), an adult male, 27 mm in SVL, from the Paramaribo Botanical Garden, Paramaribo, Surinam, one of a series collected on 7 March 1939 by H. W. C. Cossee.

Duellman (1977) followed Boulenger (1882) in placing *Scytopis alleni* Cope, 1870, as a junior synonym of *Hyla rubra*. Cope (1870:163) referred to two specimens in his description of *Scytopis alleni:* "Para Brazil. One specimen, No. 473 Mus. Comp. Zoology, Cambridge, Mass. Pebas Equador, Prof. Orton." The former now is MCZ 1519 and was listed as the holotype of the species by Barbour and Loveridge (1929); the latter is ANSP 2159. Duellman (1977:97) recognized both specimens as syntypes. ANSP 2159 is a female, 38.7 mm SVL; it is slightly faded but otherwise in good condition. In structure and coloration this specimen is like *Scinax rubra* in the upper Amazon Basin of Ecuador and Peru. MCZ 1519 is a somewhat desiccated male that is identifiable as a *rubra*-type of *Scinax*. Based on a sperm preparation made from MCZ 1519, Fouquette and Delahoussaye (1977) assigned *Scytopis alleni* to the *catharinae* group of *Ololygon* (= *Scinax*), which has a different type of sperm than does *Scinax rubra* from Surinam. Sperm have not been studied from *Scinax rubra* from the upper Amazon Basin and obviously cannot be examined from the female syntype of *Scytopis alleni.* Because the type of sperm in the syntype from Pará, Brazil, differs from that in topotypic *Scinax rubra*, MCZ 1519 is hereby designated as the lectotype of *Scytopis alleni* Cope, 1870.

Hyla affinis Spix, 1824, and *Hyla coerulea* Spix, 1824, were listed in the synonymy of *"Hyla rubra"* by Duellman (1977). Hoogmoed and Gruber (1983) examined the relevant type specimens and relegated these names to the synonymy of *Scinax x-signata* (Spix, 1824). As noted by Myers et al. (1991), the name *Hyla robersimonsi* was first used with a brief diagnosis by Donoso-Barros (1965); the name dates from this paper, not the more extensive description by Donoso-Barros (1966), as cited by Duellman (1977) in the synonymy of *"Hyla rubra."*

KEY TO THE ADULT *SCINAX* OF AMAZONIAN ECUADOR AND PERU

1. Snout acuminate, depressed; enlarged tubercle(s) present on heel; conical ulnar and tarsal tubercles present; row of tubercles usually present on lower jaw 2

   Snout rounded; enlarged tubercles absent on heel and lower jaw, ulnar and tarsal tubercles low or absent, not conica 2

2. Posterior surface of thighs with black vertical bars on a yellow background; adults large (SVL to 42 and 48 mm in males and females, respectively) .... *S. garbei*

Posterior surface of thighs uniform light brown; adults small (SVL to 28 and 32 mm in males and females, respectively) .... *S. pedromedinai*

3. Anterior and posterior surfaces of thighs and posterior part of flanks brown with black bordered yellow blotches; a pair of wide, tan, dark-bordered dorsolateral stripes usually visible on dorsum .... *S. rubra*

   Distinct black-bordered yellow mottling absent on thighs and flanks; dorsum lacking pair of pale dorsolateral stripes, or dorsolateral stripes narrow, creamy white, and lacking dark border 4

4. Dorsum with pair of narrow, creamy-white dorsolateral stripes; usually no darker stripes or other markings on dorsum; dorsum smooth .... *S. oreites*

   No creamy-white dorsolateral stripes on dorsum; dark spots, stripes, or other markings usually present on dorsum 5

5. Posterior surface of thighs pale tan with dark pigmentation concentrated into discrete, dark blotches; dorsum usually strongly tuberculate, with numerous dark brown spots that correspond to outlines of tubercles .... *S. funerea*

   Posterior surface of thighs with diffuse covering of dark pigment; dorsum smooth or weakly tuberculate; dark brown spots absent or not corresponding to outlines of tubercles 6

6. Iris in life with horizontal red streak; adults small (males to 27.1 mm SVL, females to 30.6 mm) .... *S. cruentomma*

   Iris in life without horizontal red streak; adults larger (males and females to 31.6 and 33.5 mm SVL in *S. icterica*, and to 33.3 and 36.2 mm in *S. chiquitana*) 7

7. Dosum smooth to very finely shagreened; ulnar and tarsal tubercles absent; dorsum and limbs lacking dark transverse markings .... *S. chiquitana*

   Dorsum shagreened to finely tuberculate; low ulnar and tarsal tubercles usually present; dorsum and limbs usually with dark transverse markings .... *S. icterica*

KEY TO KNOWN TADPOLES OF *SCINAX* IN AMAZONIAN ECUADOR AND PERU

1. Labial arm present; teeth elongate, recurved, fanglike .... *S. garbei*

   Labial arm absent; teeth normal 2

2. Single row of marginal papillae laterally; body pale green; tail pale

orange .... *S. funerea*

Double row of marginal papillae laterally; not so colored 3

3. Nares large, circular .... *S. icterica*

   Nares smaller, subcircular 4

4. Eye with horizontal red streak (in life) .... *S. cruentomma*

   Eye lacking red streak 5

5. Entire tail finely pigmented (with or without darker blotches); end of tail short, blunt; visceral peritoneum darkly pigmented; labial teeth relatively small .... *S. oreites*

   Pigment on tail in small, scattered blotches, terminus of tail long, narrow, and pointed; visceral peritoneum not as darkly pigmented, labial teeth relatively large .... *S. rubra*

DISCUSSION

This review of *Scinax* in Amazonian Ecuador and Peru is an initial effort in unraveling the complexities of the taxonomy and distribution of these frogs. Specific problems have been addressed in the remarks in the preceding accounts of the species. The scope of this review needs to be expanded to include western Brazil and Amazonian Colombia and Bolivia. Moreover, genetic comparisons need to be made among populations, especially of the widespread taxa, *S. garbei* and *S. rubra*.

As knowledge accumulates on the systematics and distribution of frogs in the upper Amazon Basin, it is becoming increasingly evident that many species have a broad latitudinal range. For example, three species in the *Hyla geographica* group (Duellman, 1973), two species of the *Hyla parviceps* group (Duellman and Crump, 1974), and three species of *Osteocephalus* (Trueb and Duellman, 1971) range throughout the upper Amazon Basin from Colombia to Bolivia, but another species, *O. subtilis*, is known only from the southern drainage system (Martins and Cardoso, 1987). One other species in the *Hyla parviceps* group is restricted to the northern Napo-Marañón drainage system, whereas four are restricted to the southern Purús-Madre de Dios drainage system (Duellman and Crump, 1974; Duellman and Trueb, 1989; Heyer, 1977; Martins and Cardoso, 1987). Likewise, five species of *Phyllomedusa* are widespread latitudinally in the upper Amazon Basin (Duellman, 1974), but two species (*P. atelopoides* [Duellman et al., 1988] and an undescribed species related to *P. tarsius* [D. C. Cannatella, pers. comm.]) are restricted to the southern drainage systems. A similar pattern of northern and southern species is apparent in *Eleutherodactylus* (Lynch, 1980). Moreover, geographic variants of one species of frog, *Edalorhina perezi*, have been identified in northern and southern drainage systems (Duellman and Morales, 1990).

The distribution of the species of *Scinax* in the upper Amazon Basin also reveals a pattern of some latitudinally widespread species and other species restricted to either northern or southern drainage systems. Of the seven lowland species of *Scinax* in the upper Amazon Basin, two (*S. garbei* and *S. rubra*) have broad latitudinal distributions, and *S. funerea* has a broader distribution than the remaining species. *Scinax cruentomma* is restricted to the northern Napo-Marañón drainage system, whereas *S. chiquitana, S. icterica,* and *S. pedromedinai* are restricted to the southern drainage systems.

Why do some species exhibit broad latitudinal distributions and other species have distributions restricted to the northern drainage systems or the southern drainage systems? It is generally agreed that the upper Amazon Basin has undergone perturbations in the Late Cenozoic and Quaternary, but disagreement exists if the isolation of populations was caused by climatic-ecological changes, fluvial perturbance, or flooding. The climatic-ecological model of alternating arid and humid phases corresponding to glacial and pluvial periods, respectively, was proposed by Haffer (1969) and was used to explain frog distributions by Duellman (1982) and Duellman and Crump (1974). Citing the absence of substantiating palynological data in Amazonian Ecuador, Liu and Colinvaux (1985) and Colinvaux (1989) discredited the theory, but Kronberg et al. (1991) provided geochemical evidence for aridity during the last glacial cycle in the upper Rio Purús and lower Rio Acre in southwestern Brazil.

Räsänen et al. (1987) presented geological evidence for dramatic modifications of river systems in the upper Amazon Basin; they identified four major geosynclinal basins with intervening anticlinal arches. The Fitzcarrald Arch separates the upper Río Ucayali drainage, which flows northward into the Río Marañón, from the southward-flowing drainages of the Rio Purús and Río Madre de Dios. Frailey et al. (1988) provided geological evidence for a large Pleistocene/Holocene lake in the Amazon Basin. This proposed lake extended from central Amazonia westward to include the lower Río Marañón in northern Peru and southward to include the Rio Purus and Rio Acre in southwestern Brazil but not the Río Madre de Dios in southeastern Peru and Bolivia.

It is tempting to speculate that the present patterns of distributions of some species of frogs were affected by Late Cenozoic tectonic events that changed river courses. Thus, species such as *Scinax cruentomma* were restricted to regions north of the Fitzcarrald Arch, whereas species such as *Scinax chiquitana, S. icterica,* and *S. pedromedinai* were to the south of the arch. However, this hypothesis does not explain the distributions of other species (e.g., *S. garbei* and *S. rubra*) that occur on both sides of the Fitzcarrald Arch.

Equally plausible are the effects of periods of glacial aridity in the Quaternary. Moderate descreases in rainfall from those at present would have had profound effects on the climate near the southern periphery of the Amazon Basin. For example, at two sites where *Scinax* have been studied extensively, the climatic patterns are dissimilar. Santa Cecilia, Ecuador (00°03'N, 76°59'W, elevation 340 m), has an aseasonal climate with 4390 mm of rain annually (Duellman, 1978), whereas Cuzco Amazónico, Peru (12°35'S, 69°05'W, elevation 200 m) has an average annual rainfall of 2387 mm, most of which falls from October through March (Duellman and Koechlin, 1991). A decrease of only 10% in annual rainfall with a lengthening of the dry season would result in a change from humid tropical forest to dry tropical forest (Holdridge classification; Tosi, 1960) at Cuzco Amazónico, whereas an equal decrease would have little effect at Santa Cecilia.

Perhaps we are witnessing only different ecological tolerances in the species of *Scinax* and other frogs. Thus, species that are restricted to the northern drainage systems where rainfall is higher and less seasonal are able to survive only under such humid conditions, whereas those species that are restricted to the southern drainages where rainfall is lower and seasonal are physiologically intolerant of continuous high humidity. In this scenario, species such as *Scinax garbei* and *S. rubra,* are tolerant of both extremes. However, until the ages and relationships of the species are known, it is possible only to speculate about their origins with respect to past climatic, pluvial, and tectonic events.

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APPENDIX I

Specimens examined and their localities for the species of *Scinax* in Amazonian Ecuador and Peru. Unless otherwise noted, specimens are preserved in fluid; cleared-and-stained skeletal preparations are designated "C&S."

Scinax chiquitana

PERU: *Madre de Dios:* Cuzco Amazónico, 15 km ENE Puerto Maldonado, 200 m, KU 207620; Reserva Tambopata, 30 km SSW (airline) Puerto Maldonado, MHNSM 14811-14, USNM 222194, 312657–58, 312659 (C&S), 312660.

Scinax cruentomma

ECUADOR: *Morona-Santiago:* Sevilla Don Bosco, USNM 283719; 1.2 km N Gualaquiza, 850 m, KU 217699; Sucua, USNM 283721–35. *Napo:* Jatun Sacha, 420 m, KU 217701; La Cruz Blanca, S side Río Napo, 6.5 km ESE Puerto Misahualli, MCZ 109222–24, 111196–98; Río Yasuni, 150 km upstream from Río Napo, KU 175176–78. Pastaza: Mera, 1140 m, KU 120976. *Sucumbios:* Lago Agrio, 330 m, KU 126609–10; 2.5 km N Lago Agrio, KU 217700; Limoncocha, 243 m, KU 178635–42, 183623–34, 183674, UIMNH 88000, 88032, 90053–54, 90106, USNM 205014–15; Santa Cecilia, 340 m, AMNH 93189–92, KU 105157, 105163, 105167, 105180, 105182, 107022–24, 109491 (larvae), 109508, 109512–21, 111923–27, 111928 (C&S), 111930–53, 111955–60, 112349 (larvae), 123098–123113, 123129, 123924–26 (larvae), 123928 (eggs), 123929–30 (larvae), 123931 (young), 123932 (larvae), 126587 (holotype), 126588–608, 146296–97, 146788 (larvae), 150093–102, 152308–10 (larvae), 153911 (young), 152435–38, 152447, 152538 (larvae), 152980–85 (C&S), UMMZ 129321 (8). *Zamora-Chinchipe:* 10 km W Zamora, 1200 m, KU 135458.

PERU: *Loreto:* Colonia Calleria, Río Calleria, 15 km from Río Ucayali, CAS 93188; Estación Biológica Pithecia, Río Samiria, KU 192018–20; Pebas, CAS-SU 3161.

Scinax funerea

ECUADOR: No specific locality, BMNH 1947.2.13.52–53 (syntypes of Hyla depressiceps). *Morona-Santiago:* Cusuime, Río Cusuime, AMNH 94182; Sucua, MCZ 91363–64. *Napo:* Jatun Sacha, 420 m, KU 217702. *Pastaza:* Río Pastaza, CAS-SU 5063, 5087; Río Pastaza watershed, NHRM 1954 (5); Sarayacu, ZMB 10172. *Sucumbios:* Dureno, UIMNH 63139; Limoncocha, 243 m, KU 99221–22, 183635–43, MCZ 97672–78, UIMNH 53895, 54137, 63095, 80717, 88582, 90067, 90075, 90094, 90105, USNM 205019; Santa Cecilia, 340 m, KU 105156, 105148 (C&S), 105149–62, 105164–66, 105168–79, 105181, 105183–87, 109522–23, 111929, 111970, 123121–28, 124207 (young), 125949 (skeleton), 126393–301, 146814 (larvae), 150148–75, 152443–46, 152559–60 (larvae), 152978–79 (C&S), MCZ 57446, 57449, 57451–501, 57503–11, UMMZ 129320, USNM 283978.

PERU: *Huánuco:* Finca Panguana, Río Llullapichis, 4–5 km upstream from Río Pachitea, 200 m, MHNSM 10833–36. *Loreto:* Río Alto Tapiche at Río Contaya, AMNH 43252–53. *San Martín:* Moyobamba, ANSP 11396–97 (syntypes), MCZ 4778 (syntype); Roque, NHMG 480 (holotype of *Hyla rubra inconspicua*). *Ucayali:* Balta, Río Curanja, KU 196875; Río Utoquinia (Brazil-Peru border), AMNH 43382.

Scinax garbei

ECUADOR: Chamala, Normandia, AMNH 33879. *Morona-Santiago:* 3.0 km N Gualaquiza, 1140 m, KU 217704–05; 4.6 km N Gualaquiza, 1300 m, KU 217703; Macas, MCZ 96669, USNM 239508; Macuma, USNM 239509; Méndez, USNM 239504–07; Misión Bomboiza, 840 m, KU 147119–44, 147175–76 (young), 147177 (eggs); San José, MCZ 91365, 96678–79; Sevilla Don Bosco, USNM 283736–39, 96670–77; Sucua, USNM 239503. *Napo:* Hacienda Primavera, N bank Río Napo, 30 km downstream from Coca, MCZ 95381; Jatun Sacha, 420 m, KU 217714; La Cruz Blanca, S side Río Napo, 6.5 km ESE Puerto Misahualli, MCZ 111666–85; 18.2 km SW Loreto, 600 m, KU 217710–13; Río Yasuni, 150 km upstream from Río Napo, KU 175183–84, 175218 (larvae). *Pastaza:* Don Tomas, 5 km S Montalvo, USNM 239502; La Unión, 5.3 km SE Puyo, USNM 286494; Mera, 1140 m, KU 120981–1001, 121421–24 (larvae), 178723–26; Misahualli, 600 m, KU 202765; Montalvo, USNM 239500; Puyo, MCZ 91478–80, USNM 239499; 5.6 km N Puyo, 1150 m, KU 202764; 1 km SE Puyo, USNM 286475; 1 km W Puyo, MCZ 91161, 98003; Río Bobonaza (Cabeceras del), USNM 239496–98; Río Pastaza (between Canelos and Río Marañón, MCZ 19662; Río Villano, USNM 239501; Sarayacu, 400 m, KU 120977–80, 121425 (larvae); Shell Mera, CAS 94223, KU 99193. *Sucumbios:* 2.5 km N Lago Agrio, 350 m, KU 217706–08; 4.4 km N Lago Agrio, 350 m, KU 217709; Lago Garzacocha, 4 km N Añangu (Napo), MCZ 111811; Limoncocha, 243 m, AMNH 98089–90, KU 99194–96, 178646–50, MCZ 97753, UIMNH 64857, 90065, 90801; Puerto Ore, Río Aguarico, 420 m, KU 123120; Puerto Libre, Río Aguarico, 570 m, KU 123118–19; Santa Cecilia, 340 m, AMNH 93194–96, KU 104846–47, 109358–60, 111680–83, 112320 (eggs), 112321–26 (larvae), 112350 (larvae), 123114–17, 124201 (larvae), 125602–06, 125901 (larvae), 143134–37, 146302, 150176–228, 152293–95 (larvae), 152296 (young), 152539–40 (larvae), 152986–91 (C&S), 153275 (larvae), 153642 (skeleton), MCZ 56301, UMMZ 129319 (4). *Tungurahua:* Río Negro, 1260 m, KU 121440. *Zamora-Chinchipe:* 2 km SW Chumbaraza, 1000 m, 121002–07; Zamora, 1030 m, KU 121008–09, 121430 (larvae).

PERU: *Cuzco:* Pilcopata, 750 m, AMNH 85382, KU 139242–46, 139247 (holotype of *H. epacrorhina*), 139248–49. *Huánuco:* Río Huallaga, Puente Prado, 4 km S Tingo María, 670 m, USNM 193111; Tingo María, 670 m, AMNH 91916, CAS 85153, MHNSM 654, 10478, 10590–91, USNM 193106 (4), 193107 (2), 193108–10; Tocache, Río Huallaga, MHNSM 646. *Loreto:* Estirón, Río Ampi Yacu, AMNH 86787–827; Iquitos, AMNH 42087, KU 174899; Isla Lapuna, Iquitos, AMNH 43001; Isla Pasto, Río Amazonas opposite Aysana, ca 80 km NE Iquitos, LSUMZ 45206; Orellana, Quebrada Baños near Campo Santa Clara, USNM 127167; Pampa Hermosa, Río Cushabatay, AMNH 42465, 42467; Pebas, CAS-SU 3156, 6324, 12643; Río Tamaya, AMNH 43364, 43425; Río Tigre (mouth), AMNH 42318, 43438; Roaboya, AMNH 43533; Sabral, Río Tamaya, AMNH 42684; Transval, near Pebas, CAS-SU 3157. Yarinacocha, LSUMZ 31951. *Madre de Dios:* Cuzco Amazónico, 15 km ENE Puerto Maldonado, 200 m, KU 205339–42, 207617–18, 215323–28, MHNSM 14445, USNM 298780; 105–110 km SW Puerto Maldonado on road to Quince Mil, KU 196868, LSUMZ 32072–73; Reserva Tambopata, 30 km SSW (airline) Puerto Maldonado, MHNSM 10592–95, 10810, USNM 222191–92, 247216–20, 268906. Pasco: Villa América, MHNSM 10633–36. *San Martín:* Tocadue, MHNSM 10852. *Ucayali:* Balta, Río Curanja, 300 m, KU 196876.

Scinax icterica

PERU: *Huánuco:* Finca Panguana, Río Llullapichis, 4–5 km upstream from Río Pachitea, 200 m, KU 172143, MHNSM 10586–89, 10629–32. *Madre de Dios:* Aguas Calientes, 1 km downstream from Shintuya on Río Alto Madre de Dios, USNM 298731–32; Cocha Cachu, Río Manu, ca 80 km upstream from Río Madre de Dios, 400 m, KU 154680–81, 154728, USNM 298908; Cuzco Amazónico, 15 km ENE Puerto Maldonado, 200 m, KU 205347–69, 205370–73 (C&S), 205374–402, 205860 (larvae), 207624–40, 209954, 215337–57, 215736–37 (young), 215828–34 (larvae), MHNSM 3510–54, 10338, 14432, 14516–27, USNM 298751, 298779, 298781–82; Lago Sandoval, 12 km ENE Puerto Maldonado, 200 m, KU 216054 (larvae); Lago Valencia (W bank), USNM 298831; Puerto Maldonado, 210 m, USNM 269070; Reserva Tambopata, 30 km (airline) SSW Puerto Maldonado, MHNSM 10342–43, 10345–46, 10416, 10600, USNM 222187–89, 222196–201, 247201–13, 247224–45, 247602–06, 247609–12, 268891–96, 268908–12. *Ucayali:* Balta, Río Curanja, 300 m, KU 196859–67, LSUMZ 25663–69, 25672, 25674–75, 25973, 25976–77.

Scinax oreites

PERU: *Amazonas:* East slope Abra Pardo Miguel, Prov. Bongará, 2180 m, KU 212158–64, 215694–95 (larvae); 2 km E Balzapata, Prov. Bongará, 2200 m, KU 212167–69; 8 km NNE Balzapata, Prov. Bongará, 1850 m, KU 181776 (holotype), 181777–95, 181879 (larvae); 12 km NNE Balzapata, Prov. Bongará, 1940 m, KU 215693 (larvae), MHNSM 6285; Huamanpata, near Rodriguez de Mendoza, 1300 m, MCZ 89136–37; 28 km SE Ingenio, on road to Pomacochas, 2070 m, KU 196948–49; 5 km N Levanto, Prov. Chachapoyas, 2850 m, KU 215690 (larvae), 215691 (young); 6 km NW Mendoza, 2200 m, KU 209442–44; Molinopampa, Prov. Chachapoyas, 2400 m, KU 212143–52, 215692 (young), MHNSM 6132–39; 7 km W Molinopampa, Prov. Chachapoyas, 2370 m, KU 212142; 11 km W Molinopampa, Prov. Chachapoyas, 2200 m, KU 212499 (larvae), MHNSM 6293 (larvae); Pomacochas (Florida), Prov. Bongará, 2180 m, KU 181796–805, 181810–11 (C&S), 181880 (larvae), 181881 (young), 212153–57, 212170–74 (C&S), 212500–01 (larvae), MHNSM 14801–04. *Pasco:* Santa Cruz, ca 9 km SSE Oxapampa, 2050 m, KU 206151, LSUMZ 45055–56; Yaupi, 1620 m, KU 139250. *San Martín:* Venceremos, 89 km NW Rioja, Prov. Rioja, 1630 m, KU 212165–66.

Scinax pedromedinai

Peru: *Madre de Dios:* Cuzco Amazónico, 15 km ENE Puerto Maldonado, 200 m, KU 194924, 205304–336, 205337–38 (C&S), 205857 (eggs), 205858–59 (larvae), 207612–16, 209953, 215308–22, 215733–35 (young), MHNSM 10624, 10792–10808, 11027, 14420, 14481–83, 14457–63, 14465; Lago Sandoval, 12 km ENE Puerto Maldonado, 200 m, KU 215124; Reserva Tambopata, 30 km SSW (airline) Puerto Maldonado, USNM 222190, 247214–15, 247607–08, 268897–905.

Scinax rubra

Ecuador: Chamala, Normandia, AMNH 33878. *Morona-Santiago:* 32.4 km E Bella Unión (road to Méndez), 870 m, KU 218325 (larvae); 53.8 km E Bella Unión (road to Méndez), 1010 m, KU 217715; Limón, 1300 m, KU 217716–19, 218321 (larvae); Macuma, UIMNH 63135, 63141, USNM 239556; Méndez, USNM 239548–53, 283740–43; 2 km N Méndez, USNM 239554–55; San José, USNM 283744–51; Sucua, MCZ 91358–60, USNM 239547, 283752–79; 10 km W Sucua, USNM 283780–81. *Napo:* Borja, ZSM 51/1957; Cascada San Rafael, Río Quijos, Km 102 Quito-Lago Agrio road, MCZ 97661–68, USNM 286400–04; Coca, 320 m, KU 158729–34, 158759 (larvae), MCZ 104050, 104929–33, 105005, 105864, 106028–33, 106062, 106069; Concepción, USNM 239516–17; Cuyuja, MCZ 106971; Loreto, USNM 239518; 25.8 km W Loreto, 740 m, KU 218323 (larvae); Misahualli, 600 m, KU 202689; 6.5 km ESE Misahualli, south bank Río Napo, 420 m, MCZ 109220–21, 111225–308; Payamino, USNM 239514; 2 km E Puerto Napo, USNM 239511–13; 1 km W Puerto Napo, MCZ 108892–94; 17.1 km W Reventador, 1200 m, KU 217720–31, 218322 (larvae); Río Guataracu (mouth), USNM 239515; Río Napo, MNCN 143 (3); 2 km SSW Río Reventador, 1490 m, KU 164386–88; Río Salado, 1 km upstream from Río Coca, 1410 m, KU 164376–85, 166203 (young), 166204 (larvae), 178779–80, 190045; Tena, UIMNH 90107; 1.2 km NE Tena, USNM 239510. *Pastaza:* Canelos, 530 m, BMNH 80.12.5.173, 80.12.5.202, KU 120931; Chichirota, Río Bobonaza, USNM 239535; Conambo, UIMNH 63133; Don Tomas, 5 km S Montalvo, USNM 239539; Mera, 1140 m, KU 120921–22, 120927–28; 9.5 km NW Mera, 1270 m, KU 178778; Puyo, MCZ 91213, USNM 239519–22; 1 km W Puyo, MCZ 91214; 20 km NNE Puyo, USNM 239523; Río Alpayacu, 1 km E Mera, 1100 m, KU 120923–26, 120933–40; Río Bobonaza (Cabeceras del), USNM 239524–33; Río Conambo, near mouth of Río Romarizo, USNM 239537–38; Río Curaray (upper region), USNM 239541; Río Llushin, N of Arapicos, USNM 239540; Río Pastaza between Canelos and Marañón, MCZ 19698–700; Río Pindo, tributary of Río Tigre, USNM 239542–46; Río Puyo, ca. 9 km SE Veracruz, 840 m, MCZ 97705; Río Rutuno, tributary of Río Bobonaza, USNM 239536; San Francisco, Río Pastaza, NHRM 1953; Sarayacu, 400 m, BMNH 80.12.5.232, 80.12.5.247–48, KU 120932, 121415; Shell Mera, KU 99191–92, 99402–19; 3 km S Shell Mera, USNM 239534; Veracruz, 950 m, KU 120929–30; 9 km SE Veracruz, Río Puyo, USNM 286458–61. *Sucumbios*: El Reventador, 1420 m, KU 218324 (larvae), MCZ 104945; 2.5 km N Lago Agrio, 350 m, KU 217732–34; Limoncocha, 243 m, KU 99362–401, 107018–21, 178678–81, 183666–68, MCZ 56367–72, 56671–80, UIMNH 63090–94, 63096, 63099–100, 63117, 63304–05, 64826–56, 80726, 87739–45, 87802–05, 88453, 90003–36, USNM 205022; Lumbaqui, MCZ 106978; Puerto Libre, Río Aguarico, 570 m, KU 123035–47, 123048 (C&S), 124179 (larvae); Santa Cecilia, 340 m, AMNH 93204–05, KU 104411–12 (skeletons), 105136–51, 109469–90, 109492 (larvae), 111803–37, 112342–44 (larvae), 123011–34, 124180–85 (larvae), 125920 (eggs), 125921 (larvae), 125957–58 (skeletons), 125959–77, 136308, 143190–92, 146803–05 (larvae), 150409–33, 152550-51 (larvae), 152972–77 (C&S), 153258 (larvae), MCZ 56651–70. *Tungurahua:* Río Negro, 1260 m, KU 120941–44, 121416.

Peru: *Cuzco:* Atalaya, 650 m, KU 154729–38; Kiteni, Río Urubamba, 66 km below Rosalina, 460 m, LSUMZ 32080; Pilcopata, 750 m, KU 139240–41, USNM 222375. *Huánuco:* Aucayacu, Río Aucayacu at Río Huallaga, 600 m, USNM 196042 (2); Finca Panguana, Río Llullapichis, 4-5 km upstream from Río Pachitea, KU 172159–62, MHNSM 10253–54; Iparia, Río Pachitea, MHNSM 938 (2), 10251, 10267, 10274–75, 10280, 10288, 10306, 10819, TNHC 36603–04, 36606, 36749–60; Tingo María, 670 m, MHNSM 653 (2) 10287, USNM 196032–33, 196034 (3), 196035, 196036 (4), 196037 (3), 196038, 196039 (12), 196040 (17); Yurac, 67 mi E Tingo María, CAS 85164. *Junín:* 2 km SSW San Luis de Shuaro, 780 m, KU 181771–74; San Ramón, 825 m, KU 136309, 181775. *Loreto:* Achinamisa, Río Huallaga, AMNH 42504; Andoas, MHNSM 10255–63, 10305; Colonia Calleria, Río Calleria, 15 km from Río Ucayali, CAS 93124–25; Estirón, Río Ampiyacu, AMNH 115552–54, CAS 93290–05; Iquitos, AMNH 42082, 43046, 43328, 43334, 43465, 43467, 43620, 55174, MCZ 91257–59, 100078–79, MHNSM 10310–19, TCWC 26713–14, 38096, 38150, 39205, 39210–13; Lago de Mirano, mouth of Río Napo, AMNH 43187; Mishana, Río Nanay, KU 174912–14; Moropon, TCWC 36711, 38095, 39229; Orellana, Campo Santa Clara, 50 mi from Río Ucayali, USNM 127171–76; Pampa Hermosa, Río Cushabatay, AMNH 42359, 42378, 42459–64, 42723, 42725–28, 42897–98, 43210; Parinari, Río Marañón, AMNH 43434–35; Pebas, ANSP 2159 (syntype of *Scytopis alleni*), CAS-SU 3104, 3108–09, 3161, 3173–80, 6325, 6353–68, 12623–27, MHNSM 828, 832 (2), 10302–03, 10328, 10417–19; Puente Bermudez, AMNH 42054; Puerto Huaman, Río Yanayacu, KU 192014–17; Puerto Isango, Río Pebas, MHNSM 834, 10278; Punga, Río Tapiche, AMNH 42928; Río Atacuari at Quebrada Yaguas, AMNH 100005; Río Bajo Marañón, AMNH 42488–93, 42495–501; Río Itaya, AMNH 42891; Río Pastaza (above mouth), AMNH 42715; Río Pastaza (mouth), AMNH 42213–14, 42218–20, 42236–37; Río Pisque (lower Río Pisque Camp), AMNH 42610, 43538, 43541, 43549, 43554, 43557, 43559–60, 43562; Río Potro (mouth), AMNH 42618; Río Santiago (mouth), AMNH 43484, 43488; Río Tamayo, AMNH 42803–04, 42806, 42808, 43080, 43362; Río Tambo, AMNH 42089; Río Tigre (mouth), AMNH 32316–17, 42319, 43440; Sabral, Río Tamayo, AMNH 42682, 42911, 43244; San Pedro, Río Tapiche, MCZ 98923, 100066; San Regis, AMNH 42051, 42060, 42243, 42482–86; Transval, near Pebas, CAS-SU 3101, 3165–69; Yahuarmayo, BMNH 1913.2.25.8–9. *Madre de Dios:* Cocha Cachu, Río Manu, ca 80 km upstream from Río Madre de Dios, 400 m, USNM 299921–28 (larvae); Cuzco Amazónico, 15 km ENE Puerto Maldonado, 200 m, KU 205343–45, 207619, 207621–23, 209160, 215329–36, MHNSM 10334–36, 14454–56; Puerto Maldonado, 200 m, MHNSM 10292; 105–110 km SW Puerto Maldonado on road to Quince Mil, LSUMZ 32081–88; Reserva Tambopata, 30 km SSW (airline) Puerto Maldonado, MHNSM 10264–66, 10300–01, 10309; USNM 222193, 222195, 247221–23, 268907; Salvación (Hacienda Erika), Río Alto Madre de Dios, USNM 298865–87. *Pasco:* Oxapampa, Nevati, 275 m, KU 144365–70; Villa América, MHNSM 10271–73, 10820–21. *San Martín:* Grifo at KM 410, Prov. Rioja, USNM 299784; La Morda, 1.5 hrs down Río Huallaga from Aucayacu, 542 m, USNM 196041 (2); Moyobamba, Prov. Moyobamba, 860 m, KU 212175–76; Pongo de Shilcayo, ca 4 km NNW Tarapoto, Prov. San Martín, 470 m, KU 212178; 1 km NE San Juan de Pacaysapa, Prov. Lamas, 860 m, KU 212177, 215696 (larvae); 5 km NE San Juan de Pacaysapa, Prov. Lamas, 1040 m, KU

215697 (larvae); Tabolosos, KU 209446; Tarapoto, Prov. San Martín, 370 m, KU 212179; 5 km S Tarapoto, KU 209445; 14.5 km SW Zapatero, Prov. Lamas, 870 m, KU 215689 (larvae); 15.4 km SW Zapatero, Prov. Lamas, 990 m, KU 212688 (young). *Ucayali:* Alto Río Ucayali, AMNH 55171; Balta, Río Curanja, 300 m, LSUMZ 25648–53, 25670–71, 25673, 25676–80, 25975; Bosque von Humboldt, MHNSM 10299; Dos de Mayo, Río Ucayali, AMNH 42812–15, MHNSM 10269; Pucallpa, MHNSM 82, 85, 87 (2), 104 (4), 252, 603 (3), 897, 10268, 10276, 10279, 10290–91, 10298, 10320–26, 10329–33, 10337, TCWC 14033-37; Yarinacocha, 6 km NE Pucallpa, CAS 85316–17, 85321–22, 85330–31.