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Parinacota: Quebrada de Zapahuira, 3270 m, DBCG 630, 639.

Telmatobius philippii—CHILE: Provincia El Loa: Quebrada de Amincha, 3700 m, IZUA 3093, 3087; Provincia El Loa: Quebrada del Inca, 3700 m, IZUA 3088–92, 3193–95 (three cleared-and stained speci-

mens, chromosomes), 3094 (seven tadpoles), 3196–97 (chromosomes).

Telmatobius fronteriensis.—CHILE: Provincia El Loa: Puquios, 4150 m, MZUC 25094, 25095–103, 25261–78, 25095, and 25103 (cleared-and stained adults).

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A NEW SPECIES OF *BUFO* (ANURA: BUFONIDAE) FROM SOUTHERN ECUADOR

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ABSTRACT: We describe a new species of *Bufo* from the Andes of southern Ecuador. This species is assigned to the phenetic *Bufo spinulosus* group based on its narrow frontoparietals, poorly developed cranial crests, and weak sculpturing of the dermal roofing bones. This species most closely resembles *B. spinulosus*, but they differ from one another in several aspects of their external and cranial morphology. A key is provided for the species of the *Bufo* from the Andes of Ecuador and Peru.

Key words: Anura; *Bufo*; *Bufo amabilis*; *Bufo spinulosus*; Bufonidae; Ecuador; New species

THE GENUS *Bufo* Laurenti 1768 contains approximately 205 species and is nearly ubiquitous, occurring everywhere except in arctic regions, the Australo-Papuan Realm, and Madagascar (Duellman and Sweet, 1999). At least eight phenetic species groups have been proposed for South American *Bufo* (Duellman and Schulte, 1992). Despite much work by researchers on the phylogeny of *Bufo* (e.g., Blair, 1963, 1966, 1972; Grandison, 1981; Graybeal, 1997; Inger, 1972; Martin, 1972; Maxson, 1981a,b, 1984; McDiarmid, 1971; Tihen, 1960, 1962), the systematic relationships and alpha taxonomy of species in this genus are poorly understood.

The neotropical *Bufo spinulosus* group occurs at elevations above 1000 m from the province of Loja in Ecuador to southern Chile and Argentina, as well as at lower elevations along the arid Pacific coastal plains of Peru and Chile and in the temperate regions of Argentina and Chile. Species assigned to the *B. spinulosus*

group are characterized by a combination of osteological and external morphological characters, including narrow frontoparietals, no cranial crests, and weak sculpturing of the dermal roofing bones (Duellman and Schulte, 1992). Some taxa assigned to this group (*B. cophotis*, *B. corynetes*, and *B. variegatus*) have obscured tympana or lack them entirely.

Duellman and Schulte (1992) recognized 13 species in the *B. spinulosus* group: *B. achalensis* Cei, *B. arequipensis* Vellard, *B. arunco* (Molina), *B. atacamensis* Cei, *B. cophotis* Boulenger, *B. corynetes* Duellman and Ochoa, *B. flavolineatus* Vellard, *B. limensis* Werner, *B. rubropunctatus* Guichenot, *B. spinulosus* (Wiegmann), *B. trifolium* Tschudi, *B. variegatus* (Günther), and *B. vellardi* Leviton and Duellman.

The taxonomic status of some species in the *B. spinulosus* group is uncertain. Vellard (1959) revised the *B. spinulosus* group in Peru and described three new subspecies of *B. spinulosus*: (1) *B. s. arequipensis* from the vicinity of Arequipa and the sur-

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rounding Andes, (2) *B. s. flavolineatus* from the altiplano area around Lago Junín, and (3) *B. s. orientalis* from the high valleys of the Río Marañón. Subsequently, Cei (1972) elevated geographic subspecies including *B. s. trifolium* and *B. s. flavolineatus* to full species status but did so without a diagnosis or description. Morrison (1992) reassessed the systematics of the group and found no morphological evidence to distinguish *B. spinulosus*, *B. flavolineatus*, and *B. trifolium* as separate species. As a result, he proposed placement of *B. flavolineatus* and *B. trifolium* as junior synonyms of *B. spinulosus*. Upon examination of specimens previously assigned to *B. flavolineatus* and *B. trifolium*, we found no external morphological or osteological characters to distinguish these taxa from *B. spinulosus* and agree with the taxonomic changes proposed by Morrison (1992).

Gallardo (1965) commented that *B. variegatus* was erroneously placed in the *B. spinulosus* complex. Subsequently, Frost (1985) excluded *B. variegatus* from the group. Duellman and Ochoa (1991) considered the similarity of the cranial characters of *B. variegatus* and *B. corynetes* to other members of the *B. spinulosus* group (e.g., narrow frontoparietals with cranial crests absent) and tentatively placed these species into the group.

Taking into consideration the work of Morrison (1992) and the taxonomy of Duellman and Schulte (1992), we consider the following six species to be included in the *B. spinulosus* group from Ecuador and Peru: *B. arequipensis*, *B. cophotis*, *B. corynetes*, *B. limensis*, *B. spinulosus*, and *B. vellardi*. Herein, we describe a new species that tentatively is assigned to this group and provide a key to the species of *Bufo* that inhabit the Andes of Ecuador and Peru.

MATERIALS AND METHODS

This investigation is based upon 297 fluid-preserved specimens and 13 skeletal and/or cleared-and-stained preparations (Appendix I). For ease of comparison, we generally follow the format of Duellman and Ochoa (1991) for the diagnosis and

descriptions. Measurements were made (nearest 0.1 mm) using digital calipers from specimens fixed in 10% formalin and preserved in 70% ethanol. Abbreviations for museums follow standardized acronyms (Leviton et al., 1985). Webbing formulae follow that of Savage and Heyer (1967) as modified by Myers and Duellman (1982). Ecological distributions of the new species are given in the Ecuadorian life zones defined by Valencia et al. (1999); climatological data for the life zones also are from Valencia et al. Osteological terminology is that of Trueb (1993). The following 12 morphological measurements were made to the nearest 0.1 mm: snout-vent length (SVL), head width (at the level of the rictus), head length (from the rictus to the tip of the snout), tympanum diameter, naris-eye distance (from anterior margin of eye to naris), eye length, upper eyelid width, interorbital distance, anteriormost parotoid width, anteriormost parotoid length, foot length (measured from the tip of Toe IV to the tarso-metatarsal articulation), and tibia length (measured from the convex surface of the knee to the convex surface of the heel). Sex was determined by observation of presence of the gonads or by observation of secondary sexual characteristics of males (i.e., nuptial excrescences and vocal slits). We compared specimens of the species described in this paper with all species of *Bufo* in South America; however, we present diagnoses that consider only those species with which it is likely to be confused based on overall appearance and geographic distribution—viz., species of the *B. spinulosus* group from Ecuador and Peru (*sensu* Duellman and Schulte, 1992; Morrison, 1992).

DESCRIPTION OF NEW SPECIES

Bufo amabilis sp. nov.

Holotype.—University of Kansas Museum of Natural History (KU) 120361 (collector's tag: JDL 3486), an adult female from Loja (04° 00' S, 79° 13' W, 2150 m), Provincia Loja, Ecuador, one of a series of nine specimens collected on 10 June 1968 by John D. Lynch.

Paratypes.—All from Provincia Loja, Ecuador (11 males, 7 females, 3 juveniles): KU 120362–64, 120366–70, 120372–74, 124587 from Loja, 2150 m, collected by J. D. Lynch; KU 141523 from 4.6 km N Loja, 2065 m, collected by R. R. Montanucci; KU 142650 from 7.6 km S Loja, 2210 m, collected by W. E. Duellman; CAS 93914–17 collected G. P. Frymire and C. H. Dodson and CAS 119033–35 collected on 4 December 1957 by G. P. Frymire, C. H. Dodson, and J. S. Strobel on the property of Don Luis Figueroa, 2 km S of Loja.

Diagnosis.—Largest species of *Bufo* in the *B. spinulosus* group from Ecuador and Peru (average SVL of adults = 82.6; $n = 18$) characterized by: (1) head wider than long; (2) snout long, triangular; (3) nares protruding laterally; (4) cranial crests absent; (5) tympanum large, defined, with pectral apparatus present; (6) parotoid glands moderately large, ovoid, broader posteriorly than anteriorly; (7) structure of dorsal glandular formations sexually dimorphic (males: glandular and warty with single keratinous spine per glandular formation, except multiple points on limbs and on flanks; females: less glandular, rarely with keratinous spines); (8) ventral granules enlarged or elevated; (9) length of Digit I of manus equal to length of Digit IV; (10) hind limbs long; (11) tibial gland absent; (12) basal webbing on feet; (13) fingers not webbed, toes approximately $\frac{1}{2}$ webbed.

The absence of cranial crests distinguishes *B. amabilis* from *B. marinus*, and *B. poeppigii* (both assigned to the *B. marinus* group), and *B. nesiotes*, and *B. veraguensis* (assigned to the *B. veraguensis* group), as well as from *B. margaritifer*, and *B. caeruleostictus*. The great snout–vent length and structure of the dorsal glandular formations distinguish this species from all other taxa in the *B. spinulosus* group in Peru and Ecuador, except for *B. limensis*, *B. spinulosus*, and *B. vellardi*. *Bufo amabilis* differs from *B. limensis* by having bilateral vocal slits in males (absent in *B. limensis*). *Bufo spinulosus* differs from *B. amabilis* by having round parotoid glands and absent vocal slits in males (triangular parotoid glands and bilateral vocal

slits in *B. amabilis*). *Bufo amabilis* can be distinguished from *B. vellardi* by having a round snout in dorsal view and bilateral vocal slits in males (acuminate snout in dorsal view and vocal slits absent in *B. vellardi*). *Bufo amabilis* can be distinguished from *B. caeruleostictus* by having an externally visible tympanum (not visible in *B. caeruleostictus*).

Description of the holotype.—Adult female (Fig. 1); SVL 77.6 mm; tibia length 31.6 mm; foot length 34.4 mm; head length 24.1 mm; head width 26.4 mm; interorbital distance 8.43 mm; upper eyelid width 7.38 mm; naso-eye distance 6.91 mm; eye length 10.2 mm; anteriormost parotoid length 9.35 mm; anteriormost parotoid width 6.44 mm; head wider than long, 34.0% SVL; snout moderately long, about same length as diameter of eye, only slightly protruding beyond margin of lower jaw; snout rounded in dorsal view, truncate in profile; top of head flat; cranial crests and canthal absent, except for weak supratympanic crests; skin on head co-ossified with underlying cranial bones; upper eyelid 86.6% interorbital distance; internarial area flush with dorsal surface of head; nostril slightly protuberant, directed laterally; loreal region slightly concave; lip rounded; eye–nostril distance 67.7% length of eye; tympanum distinct, ovoid, width 85.2% height, width 44.5% width of orbit; tympanic annulus raised, upper margin contacting dorsal margin of supratympanic crest, posterior margin of annulus obscured by overlying flesh. Forelimb moderately long and slender; hand broad with relatively long fingers; relative lengths of adpressed fingers II < IV < I < III (Fig. 2A); webbing absent; lateral fringe on fingers weakly developed, tips of fingers not enlarged, smooth dorsally; palmar tubercle low, diffuse, nearly round; thenar tubercle moderately developed, elevated, two-thirds size of palmar tubercle, ovoid; subarticular tubercles moderately developed, ovoid, except proximal tubercles on Finger II weakly bifid; supernumerary tubercles absent, metacarpal tubercles distinct; Finger I broad, fleshy; nuptial excrescences absent. Hind limbs moderately short; tibia length 40.7% SVL; foot length 44.3% SVL;



FIG. 1.—Holotype of *Bufo amabilis* (KU 120361); an adult female from Provincia Loja, Ecuador (SVL = 77.6 mm). Photograph by J. D. Lynch.

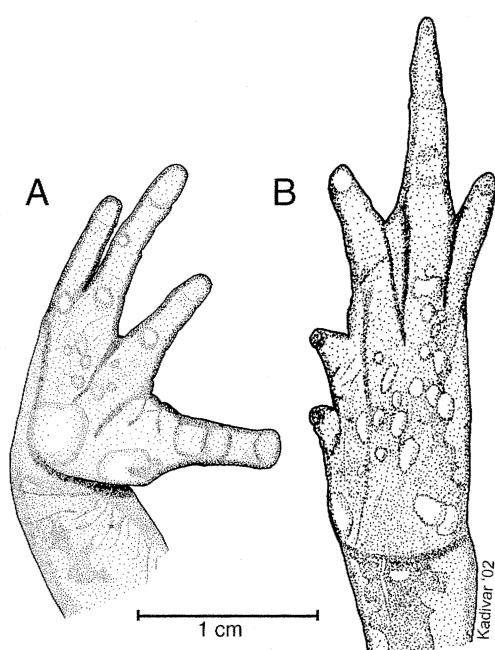


FIG. 2.—*Bufo amabilis* (KU 120361). Ventral aspect of (A) hand and (B) foot.

tarsal fold present, moderately developed, extending length of shank; outer metatarsal tubercle one-half size of inner metatarsal tubercle (Fig. 2B), low, round; inner metatarsal tubercle moderately large, ovoid, slightly spade shaped; toes moderately long, narrow; relative length of adpressed toes I < II < V < III < IV; fleshy webbing basally continuing as fleshy lateral fringes; webbing formula I 2–2½ II 2–2¾ III 2–3 IV 3–1½ V; tips of digits not enlarged, smooth dorsally; subarticular tubercles poorly developed; supernumerary and metatarsal tubercles weak.

Skin on dorsum of head, body, and limbs bearing small, round, smooth tubercles that become more concentrated anteriorly. Parotoid glands moderately large, ovoid, width 68.9% of length, extending from posterior margin of supratympanic crest to anterior margin of insertion of arm; flanks smooth; enlarged glands on limbs absent; skin on throat smooth; skin on chest, belly, and ventral surfaces of limbs smooth; cloacal opening not protu-

TABLE 1.—Means, standard error, and ranges (in parentheses) of *Bufo amabilis*. Note that a few of the specimens of this species appear to be subadults. The extent to which the morphometry of this species changes through ontogeny is not known.

Variable	Males (n = 11)	Females (n = 7)
Snout-vent length	82.45 ± 14.92 (49.1–96.8)	72.84 ± 12.09 (85.3–50.1)
Head width	32.65 ± 4.65 (22.4–39.9)	27.46 ± 4.64 (18.2–32.9)
Head length	27.41 ± 2.72 (22.8–32.2)	24.03 ± 4.14 (15.1–27.2)
Tympanum diameter	4.35 ± 0.68 (2.93–5.21)	3.71 ± 1.00 (2.03–4.95)
Eye–narix distance	6.84 ± 0.85 (5.50–7.93)	6.39 ± 0.93 (4.5–7.17)
Eye length	11.01 ± 1.45 (8.25–12.4)	10.44 ± 1.68 (7.22–12.6)
Upper eyelid width	7.51 ± 0.74 (5.83–8.13)	6.89 ± 1.12 (4.89–8.21)
Interorbital distance	9.63 ± 1.15 (7.19–11.0)	8.75 ± 1.44 (6.33–10.28)
Anteriormost parotoid width	8.12 ± 0.95 (6.5–9.48)	7.33 ± 0.94 (6.44–9.02)
Anteriormost parotoid length	12.09 ± 1.17 (9.14–13.61)	10.63 ± 1.54 (8.21–11.37)
Foot length	35.79 ± 4.15 (25.61–40.4)	31.72 ± 5.38 (20.66–36.69)
Tibia length	33.69 ± 4.92 (23.77–39.55)	29.51 ± 5.72 (17.23–33.66)

berant, directed posteriorly at upper level of thighs.

Choanae moderately large, ovoid, widely spaced; vomerine odontophores, maxillary, premaxillary, and vomerine teeth absent; tongue large, ovoid, widest posteriorly, free behind for about one-half its length, about two times as long as wide.

Color of holotype in preservative.—Background of dorsum dark grayish brown with lighter, grayish tan mottling; dorsal surface of forearms with gray background and dark grayish brown spots; upper lip pale grayish brown, loreal and supralabial areas lighter grayish brown, upper loreal region dark grayish brown; parotoid glands medium tan; tympanum and surrounding area dark grayish brown; venter uniformly creamy tan with faint dark brown mottling posteriorly; ventral surfaces of hands and feet medium grayish tan with faint medium gray mottling on chest; largest tubercles on hands and feet cream.

Color of holotype in life.—Dorsum dark brown to yellowish brown with large brown spots; dorsal surfaces of limbs paler tan with black bars and spots; lips cream; venter white to cream; iris greenish gold (J. D. Lynch, field notes 10 June 1968).

Variation.—Morphometric variation is summarized in Table 1. Two females (KU 120367, KU 120372) have similar dorsal coloration and pattern, as does the holotype. One male (KU 120369) has a dorsum that is more uniform gray than the holotype. One female (KU 120372) has a dor-

sal pattern of dark brown reticulations, extending onto the lateral region of the belly. Males have uniformly medium brown dorsal coloration that is more uniform than in females. Variation exists among males in amount of dark grayish brown patterning on the dorsum; some specimens (KU 120362, 120366, 120368) have almost uniform medium grayish brown dorsal coloration, whereas others (KU 120370, 120374, 142650) have more pattern on the dorsum and extending onto the dorsal surface of the legs. All males have bilateral vocal slits.

Nuptial excrescences are present on the first finger only (KU 120363), on Fingers I and II only (KU 120366, 120370), or on Fingers I–III (KU 120373–74).

Distribution and ecology.—This species has been collected only from elevations of 2050–2200 m in the Loja Basin, an inter-Andean valley in Loja Province, Ecuador (Duellman, 1979) (Fig. 3). At the time of collection, most specimens were active at night in small pools and irrigation canals (J. D. Lynch, field notes, 10 June 1968). The distribution of *B. amabilis* occurs within the Matorral Seco Montano Sierra life zone, where the mean annual precipitation is 250–500 mm and the mean annual temperature is 7–12 C. *Bufo amabilis* is the only species of the *B. spinulosus* group occurring north of the Huancabamba Depression.

Reproductive biology.—The eggs and larvae of *B. amabilis* are unknown. Both of

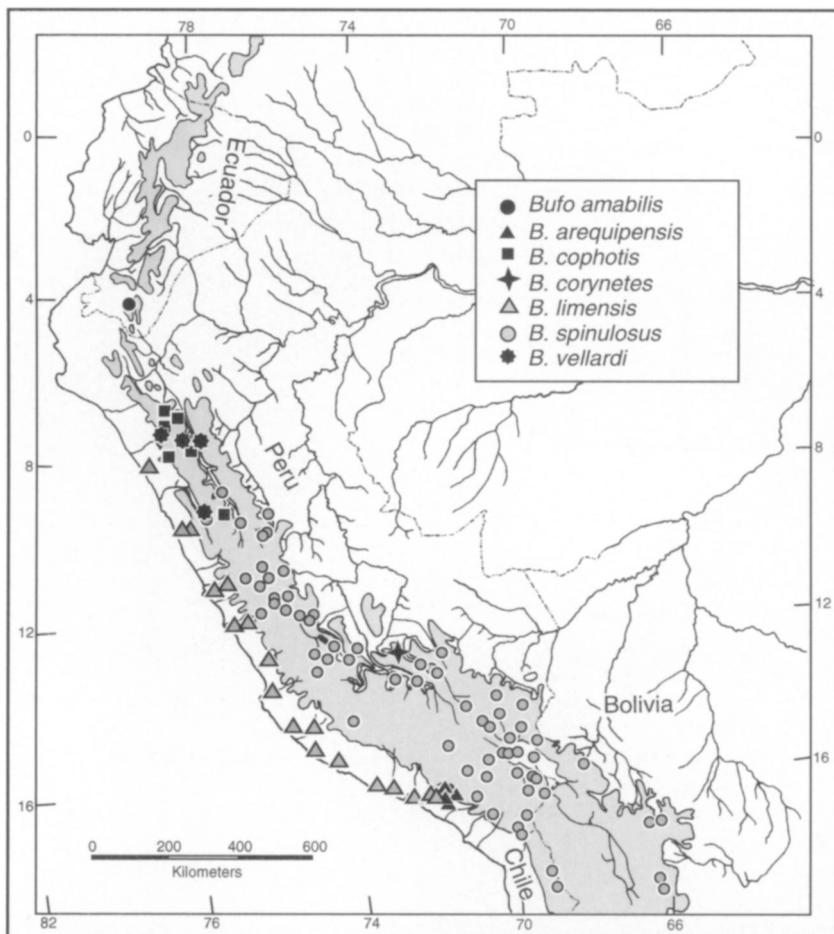


FIG. 3.—Geographical distribution of the *Bufo spinulosus* group in Ecuador, Peru, and northern Bolivia and Chile. The shaded areas represent elevations above 3000 m. To prevent crowding of symbols, some represent more than one specific locality.

the two adult females examined (both collected in June) had large pigmented and small unpigmented oviductal eggs; KU 120372 contained 1436 eggs with an average diameter of 30 randomly chosen eggs = 0.47 mm (0.36–0.52).

Etymology.—The specific epithet is the Latin *amabilis* and refers to the particularly lovely demeanor of this and all toads of the genus *Bufo*. With this name, we hope to change (at least in part) the often maligned public image of these beautiful and ecologically beneficial animals.

Osteological comparisons.—The skull of *B. amabilis* is broadly rounded anteriorly and is wider than long, with the greatest

width being at the level of the quadratojugals (Fig. 4A,B). Overall, the skull is most similar in structure to the crania of *B. limensis* (Fig. 5A–C), *B. spinulosus* (Fig. 5D–F), and *B. vellardi* (Fig. 5G–I); all three of these species have moderately ossified skulls with very slight dermal ornamentation on the dorsal surface of the nasals and frontoparietals. In dorsal view, *B. amabilis* (Fig. 4A) lacks a temporal arcade (articulation between the squamosal and frontoparietal over the crista parotica; sensu Lynch, 1971). In contrast, in *B. limensis* (Fig. 5A), *B. spinulosus* (Fig. 5D), and *B. vellardi* (Fig. 5G), the lateral edge of the frontoparietal is in contact with the

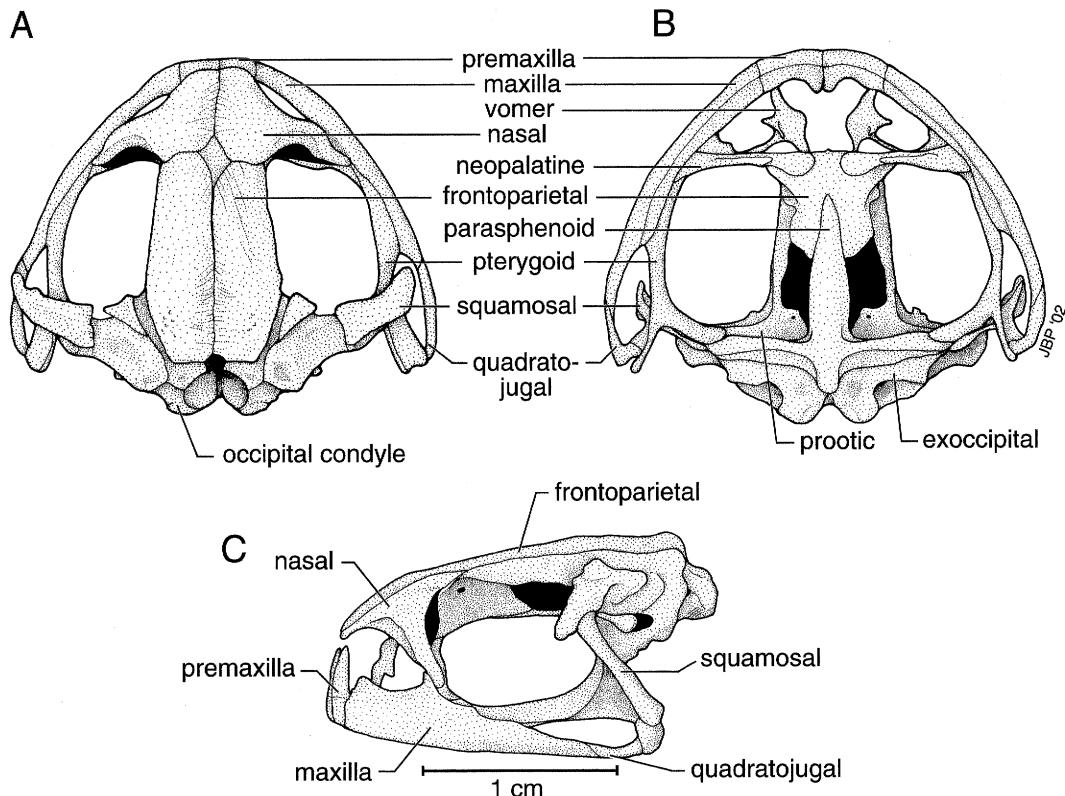


FIG. 4.—Skull of *Bufo amabilis* (KU 120361, adult female, SVL = 77.6 mm) in dorsal, ventral, and lateral aspects.

medial edge of the squamosal. In ventral view, the amount of anterior ossification of the sphenethmoid in *B. amabilis* (Fig. 4B) does not reach beyond the anterior limit of the neopalatines, whereas it does so in *B. limensis*, *B. spinulosus*, and *B. vellardi* (Fig. 5B,E,H, respectively). In ventral view, the neopalatine becomes broader medially in *B. amabilis* (Fig. 4B), whereas it tapers medially in *B. limensis* (Fig. 5B) and is approximately of equal length in all other taxa. Overall, the skulls of *B. amabilis* and *B. spinulosus* are relatively narrower than that of *B. limensis* (length of skull 80.1% and 79.2% of width in *B. amabilis* and *B. spinulosus*, respectively, as compared with 70.7% of width in *B. limensis*), whereas the width of the skull of *B. vellardi* is the narrowest among compared taxa (length of skull 84.0% of width). In anterior view, the alary process of the premaxilla of *B. amabilis* is approximately

three times higher than wide, whereas in all other members of the *B. spinulosus* group, it is approximately two times higher than wide. The quadratojugal of *B. amabilis* is small and overlaps slightly the posterior margin of the maxilla. In lateral view, the preorbital process of the pars facialis of the maxilla of *B. vellardi* (Fig. 5I) is well developed and is in broad contact with the nasal ventrally, whereas in all other taxa it is poorly developed.

KEY TO THE SPECIES OF THE ANDEAN BUFO OF ECUADOR AND PERU

1. Tympanic membrane and annulus not visible externally 2
- Tympanic membrane and annulus visible 5
2. SVL of adults <50 mm 2
- SVL of adults >70 mm; parotoid glands elongate (Fig. 6), distinct, extending posteriorly to insertion of

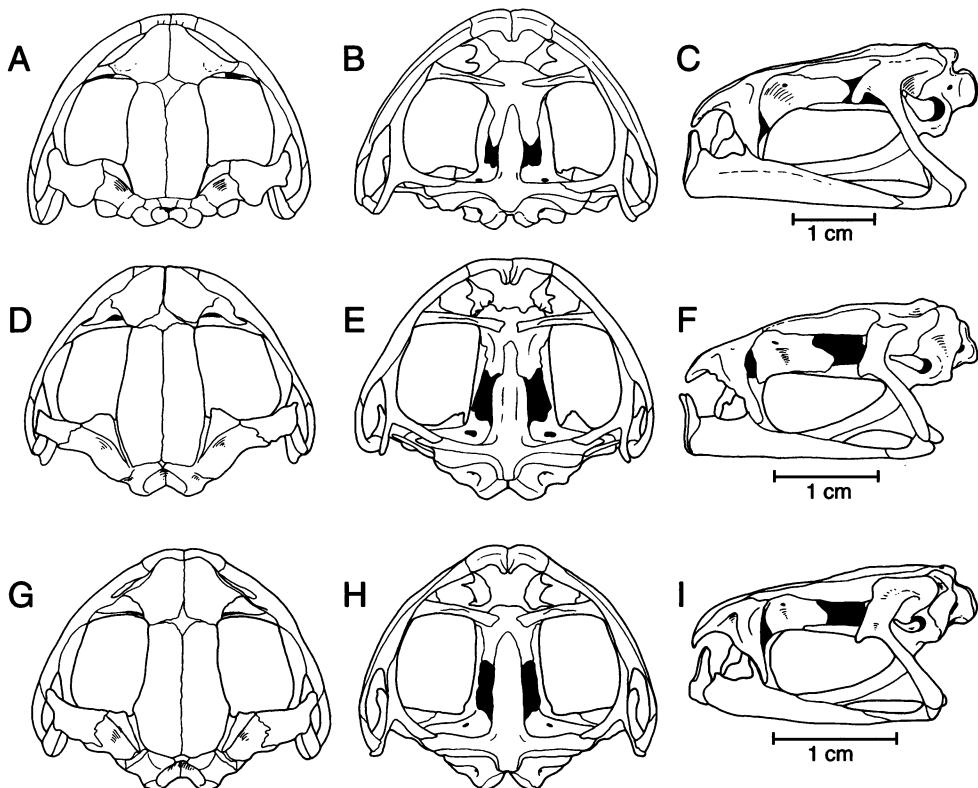


FIG. 5.—Skulls of *Bufo limensis* (A; KU 209226), *B. spinulosus* (B; KU 160271), and *B. vellardi* (C; KU 136053). Of all *Bufo* in Ecuador and Peru, the cranial osteology of these species most closely resembles that of *B. amabilis*. Differences distinguishing the cranial osteology of *B. amabilis* from that of *B. limensis*, *B. spinulosus*, and *B. vellardi* are presented in the text.

- arm; venter with distinctive reticulated pattern *B. caeruleostictus*
 3. Longitudinal series of enlarged glands present on the dorsum 4
 Longitudinal series of enlarged

glands on the dorsum absent, supraorbital crest present, tarsal fold consisting of single row of granules, parotoid glands subtriangular
 *B. veraguensis*

4. First parotoid gland conspicuous, larger than other dorsal glandular formations *B. corynetes*
 First parotoid gland equal in size or smaller than other dorsal glandular formations *B. cophotis*
 5. Parotoid glands round or ovoid (Fig. 7A,B) 6
 Parotoid glands triangular or subtriangular (Fig. 7C,D) 8
 6. SVL of adults >50 mm 7
 SVL of adults <35 mm, cranial crests absent, tympanum distinct, parotoid glands low, ovoid *B. nesiotes*
 7. Tympanum small, approximately 20% diameter of eye, tympanic membrane depressed; tympanic annulus



FIG. 6.—Lateral view of the head of *Bufo caeruleostictus* (KU 152059), depicting the absence of a visible tympanum, elongate parotoid gland, and reticulated pattern on the venter of this species.

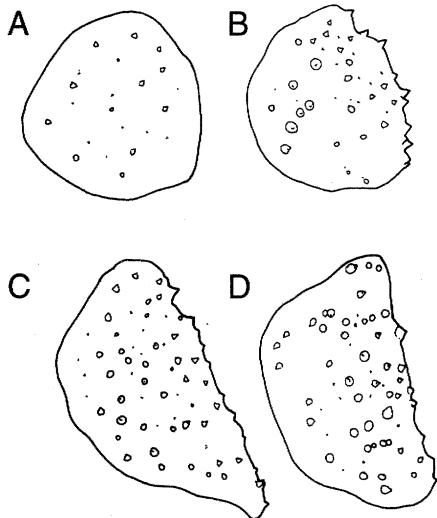


FIG. 7.—Round parotid glands of (A) *Bufo spinulosus* (KU 161611) and (B) *B. arequipensis* (KU 214795). Triangular and rectangular parotid glands of (C) *B. amabilis* (KU 120366) and (D) *B. vellardi* (KU 221702).

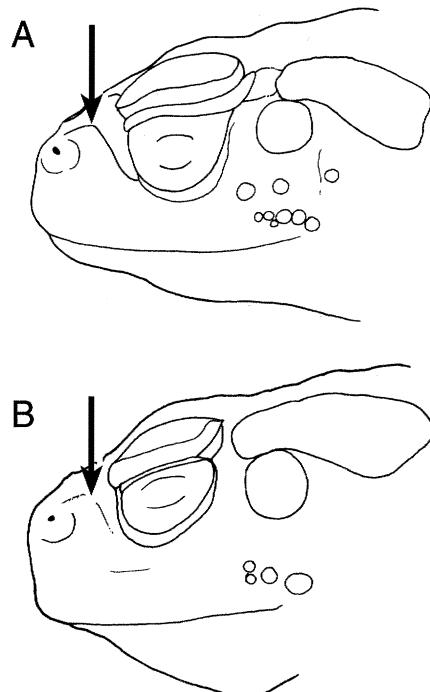


FIG. 9.—Lateral aspect of the heads of (A) *Bufo vellardi* (KU 221702) and (B) *B. amabilis* (KU 120366), illustrating well developed and weak canthal and preorbital crests, respectively.

- not distinct; vocal slits absent in males *B. spinulosus*
Tympanum large, approximately 30% diameter of eye, tympanic membrane flush with side of head, tympanic annulus distinct; vocal slits present in males *B. arequipensis*
8. Some (or all) cranial crests poorly developed (Fig. 8A) 9
Full complement of well developed cranial crests (Fig. 8B) 11
9. In lateral view, canthal and preorbital

crests well developed (Fig. 9A); in dorsal view, upper lip slightly flared; vocal slits absent in males 10
In lateral view, canthal and preorbital crests weak or absent (Fig. 9B); in dorsal view, upper lip not flared; in

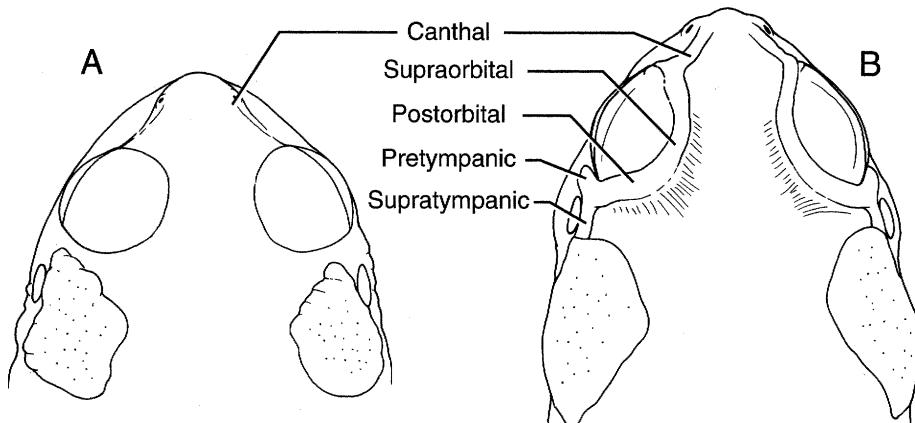


FIG. 8.—Dorsal view of the heads of (A) *Bufo amabilis* (KU) and (B) *B. poeppigii* (USNM) illustrating the difference between poorly and well developed cranial crests, respectively.

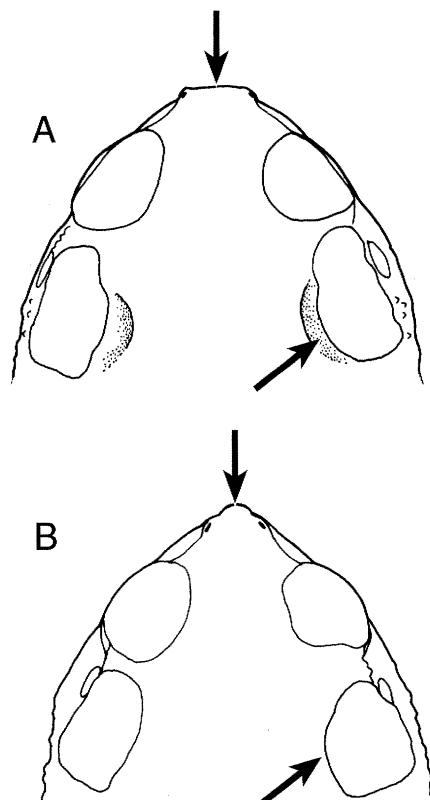


FIG. 10.—Dorsal aspect of the heads of (A) *Bufo limensis* (KU 219737) and (B) *B. vellardi* (KU 221702), illustrating the medially depressed parotoid glands and acuminate snout of the former and latter species, respectively.

- male, vocal slits present in males *B. amabilis*
- 10. Medial edge of parotoid gland depressed (Fig. 10A); snout rounded in dorsal view *B. limensis*
Medial edge of parotoid gland flush with surrounding skin of dorsum (Fig. 10B); apex of snout acuminate in dorsal view *B. vellardi*
- 11. Supraorbital, parietal, postorbital, and canthal crests prominent, supra tympanic crest not expanded dorsolaterally, SVL of adults often >100 mm 12
Supraorbital, parietal, postorbital, and canthal crests prominent, supra tympanic crest often expanded dorsolaterally, snout pointed in dorsal view, acuminate and protruding an-

- teriorly in profile *B. margaritifer* group*
- 12. Parotoid glands robust, triangular; venter with reticulated pattern on cream background *B. marinus*
Parotoid glands subtriangular, venter immaculate cream to white *B. poeppigii*

CLAVE PARA LAS ESPECIES ANDINAS DE *BUFO* DE ECUADOR Y PERÚ

- 1. Membrana y anillo timpánicos no visibles 2
Membrana y anillo timpánicos visibles 5
- 2. Longitud rostro-cloacal (SVL) en adultos menor a 50 mm 3
Longitud rostro-cloacal (SVL) en adultos mayor a 70 mm; glándulas parótidas alargadas y definidas (Fig. 6), extendiéndose posteriormente hasta la inserción del brazo; vientre con patrón reticulado definido *B. caeruleostictus*
- 3. Series longitudinales de glándulas agrandadas presentes en el dorso 4
Series longitudinales de glándulas agrandadas ausentes en el dorso, cresta supraorbital presente, pliegue tarsal compuesto por una sola línea de gránulos, glándulas parótidas subtriangulares *B. veraguensis*
- 4. Primera glándula parótida conspicua, más grande que las demás formaciones glandulares dorsales *B. corynetes*
Primera glándula parótida del mismo tamaño o más pequeña que las demás formaciones dorsales *B. cophotis*
- 5. Glándulas parótidas redondeadas u ovoides (Fig. 7A,B) 6
Glándulas parótidas alargadas y rectangulares o triangulares (Fig. 7C,D) 8
- 6. SVL en adultos mayor a 50 mm 7
SVL en adultos menor a 35 mm, crestas craneales ausentes, anillo tim-

* The *B. margaritifer* group is a complex of approximately 10 described species and subspecies and contains many undescribed taxa. Investigators (e.g., C. Vélez, personal communication) currently are delineating the alpha taxonomy of the group. Until the diversity of these toads is described in better detail, we are refraining from providing a key to the species of this assemblage and instead refer to species of this Andean taxa from Ecuador and Peru as the “*B. margaritifer*” group.

- pánico evidente, glándulas parótidas ovoides y aplanasadas *B. nesiotes*
7. Tímpano pequeño, aproximadamente 20% del diámetro del ojo, membrana timpánica hundida; anillo timpánico no definido; hendiduras vocales ausentes en machos *B. spinulosus*
Tímpano grande, aproximadamente 30% del diámetro del ojo, membrana timpánica no hundida, anillo timpánico definido; hendiduras vocales presentes en machos *B. arequipensis*
8. Algunas o todas las crestas craneales poco desarrolladas (Fig. 8A) 9
Todas las crestas craneales bien desarrolladas (Fig. 8B) 11
9. Crestas cantal y preorbital bien desarrolladas en vista lateral (Fig. 9A); labio superior ligeramente ensanchado en vista dorsal; hendiduras vocales ausentes en machos 10
Crestas cantal y preorbital poco desarrolladas o ausentes en vista lateral (Fig. 9B); labio superior no ensanchado en vista dorsal; hendiduras vocales presentes en machos
..... *B. amabilis*
10. Eje medio de glándula parótida hundido (Fig. 10A); hocico redondeado en vista dorsal *B. limensis*
Eje medio de glándula parótida al mismo nivel que la piel circundante del dorso (Fig. 10B); extremo del hocico acuminado en vista dorsal
..... *B. vellardi*
11. Crestas supraorbital, parietal, postorbital, y cantal prominentes; cresta supratimpánica no se expande dorso-lateralmente; SVL a menudo >100 mm en adultos 12
Crestas supraorbital, parietal, postorbital, y cantal prominentes; cresta supratimpánica a menudo se expande dorso-lateralmente; hocico puntiagudo en vista dorsal, acuminado y extendido anteriormente en vista lateral grupo *B. margaritifer**
12. Glándulas parótidas robustas, triangulares; vientre con patrón reticulado sobre fondo crema *B. marinus*
Glándulas parótidas subtriangulares, vientre crema o blanco uniforme ..
..... *B. poeppigii*

DISCUSSION

Attempts to collect more material of *B. amabilis* in Provincia Loja by L. A. Coloma (1989–1990) and by J. B. Pramuk (September–October 2001) have not been successful. Much of the area surrounding Loja has been modified for agriculture or to accommodate the increasing human population. The populations of these toads in the area surrounding Provincia Loja appear to have been severely affected by human activities. More exhaustive collections at the type localities are necessary to determine the status of the populations of this likely rare species.

The study of the systematics of South American *Bufo* has been limited by a lack of knowledge of phylogenetic relationships at and above the species level. Other than the study of Duellman and Schulte (1992) based on phenetic characters, few authors have examined the monophyly of species groups within South American *Bufo*. Currently, many of the species groups are based solely on shared geographic distributions or on similar overall external morphology. The *B. spinulosus* group is one such problematic taxon. Historically, species were assigned to this group because they had an Andean distribution or because they superficially resembled *B. spinulosus* (Duellman and Schulte, 1992).

Based on the absence of most cranial crests, assignment of *B. amabilis* to the *B. spinulosus* group is based on the absence of diagnostic features that otherwise could associate it with *B. margaritifer* group (e.g., well developed, laterally directed supraorbital crests merging with postorbital crests) or *B. guttatus* and *B. marinus* groups (e.g., heavily ossified, broad skulls with well developed cranial crests). *Bufo amabilis* differs from members of the *B. veraguensis* group in lacking canthal, parietal, postorbital pretympanic, and supraorbital crests (canthal, parietal, postorbital

* El grupo *B. margaritifer* es un complejo de aproximadamente 10 especies y subespecies descritas y muchas otras por describir. En el momento, algunos científicos están trabajando en la Alpha taxonomía del grupo (e.g., C. Vélez, comunicación personal). Mientras la diversidad del grupo no se encuentre resuelta, no es posible proveer una clave para sus especies. En este trabajo, nos limitamos a referirnos a este grupo de especies andinas del Ecuador y Perú como el grupo "*B. margaritifer*".

pretemporal, and supraorbital crests present).

An unpublished phylogenetic analysis of morphological data found no support for the monophyly of the *B. spinulosus* group (Morrison, 1994). As such, the monophyly of the *B. spinulosus* group is highly suspect; thus, placement of the newly described species in the *B. spinulosus* complex is tentative at this time and awaits validation by phylogenetic analysis.

Demonstration of monophyly of the *B. spinulosus* group is beyond the scope of this study; however, our study revealed characteristics that may be useful in defining and identifying the species occurring in Ecuador and Peru. Additional analyses will be necessary to determine the monophyly of the *B. spinulosus* group and to elucidate the evolutionary relationships of *B. amabilis* to other New World *Bufo*.

RESUMEN

Describimos una nueva especie del género *Bufo* de los Andes del sur del Ecuador. Asignamos a la nueva especie al grupo *B. spinulosus* por poseer frontoparietales angostos, crestas céfálicas poco desarrolladas y huesos craneales lisos dorsalmente. Esta especie se diferencia de *B. spinulosus* en varios aspectos de su morfología externa y craneal. Incluimos una clave para las especies de *Bufo* de los Andes del Ecuador y Perú.

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- Bufo caeruleostictus*: ECUADOR: LOS RÍOS: 8.7 km W La Esperanza, 900 m (KU 152057 [skel.], 152058–59). EL ORO: 10.7 km WNW Piñas (FLMNH 112465–66).
- Bufo cophotis*: PERU: CAJAMARCA: Cajamarca: S slope Abra Quilsh, 26 km NNW Cajamarca, 3500 m (KU 211685–726, 218555–56 [skel.], 218517–18 [C&S]); Abra Quilsh, 28 km NNW Cajamarca, 3520 m (KU 211727–29); 55 km N Cajamarca, 3600 m (KU 211730–39), S slope Abra Comulica, 20 km NE Encanada, 3520 m (KU 211740–42).
- Bufo corynetes*: PERU: CUZCO: 50 km NW Ollantaytambo, W slope Abra Malaga, 3780 m (KU 173229); San Luis, 3200 m (KU 212554, 212555 [C&S]).
- Bufo limensis*: PERU: ANCASH: 13 km N Huari, 4000 m (KU 214802); 2.8 km S Casma, Río Sechin (KU 219733–41). ICA: 3 km NE El Ingenio (USNM 120109). LIMA: ANCÓN: Rimac Valley (USNM 13981); Río Pativilca, 2 km SSE Pativilca, 2 m (KU 211743). CAJAMARCA: 2 km NW San Juan, 229 m (KU 211744); Lima, 20 m (KU 209226 [skel.], 209227–32). MOQUEGUA: Ilo, 5 m (KU 136182).
- Bufo marinus*: ECUADOR: TUNGURAHUA: Baños (KU 98971–74); 8.4 km E Baños (KU 178425); IMBABURA: Apuela, 1550 m (KU 117797); 1650 m (KU 132127–28); GUAYAS: 15 km NNW Guayaquil, 25 m (KU 120342–44); ESMERALDAS: 3 km E Atacames, 20 m (KU 142322).
- Bufo margaritifer*: ECUADOR: NAPO: 10.9 km NE Santa Rosa on Lago Agrio road, 1900 m (KU 189949); 9.5 km NE Santa Rosa on Lago Agrio road 1900 m (KU 189952); 11.1 km NE Santa Rosa on Lago Agrio road, 1900 m (KU 189953–54).
- Bufo nesiotes*: PERU: HUÁNUCO: Cuzeo, 4 km WSW Santa Isabel, 1700m (13115–31).
- Bufo poeppigii*: PERU: MADRE DE DIOS: 30 km (airline) SSW of Puerto Maldonado, Tambopata Reserve, Explorers' Inn, 280 m (USNM 268824).
- Bufo spinulosus*: ARGENTINA: JUJUY: La Quiaca (KU 74321, 93128–30, 93132 [skel.]); 5 km S Abra Pampa, 3550 m (KU 160309–11); 21 km ESE Tres Cruces, Río Grande (KU 160313); 10 km N Tilcara, Río Grande, 2670 m (KU 160314–21); Serranía de Calilegua, 1550 m (KU 189242). MENDOZA: Potrerillos, 1500 m; Bardas Blancas, Malargüe 1600 m; 29 km S Malargüe, 1620 m (KU 80851, 84758–59, 160334). NEUGUÉN: 17 km NNW Villa del Agrio; S shore Laguna Blanca, 1275 m (KU 160322–27, 160328–33). BOLIVIA: COCHABAMBA: 7.5 km S Epizana, 2960 m (KU 183281). LA PAZ: 50 km NW La Paz (KU 154598–602); 13 km E Tambillo, Río Pallina (KU 160018–19); 1.6 km S Cajamarca, 3910 m (KU 183265); Chua, 20.2 km NW Huarina, 3760 m (KU 183282); S shore Lago Titicaca, 3812 m (KU 126068–69). POTOSÍ: 45 km E Potosí, 3300 m (KU 160196–97, 160244–69, 183276–77); Río Tupiza, 12.5 km SSE Tupiza, 2920 m (KU 160271–72 [skel.]).

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APPENDIX I

Specimens Examined

Skeletal and cleared-and-stained specimens are designated with Skel. and C & S, respectively

Bufo anabilis: ECUADOR: LOJA: Loja 2150 m; Loja, 2150 m (KU 120361; 120362–64; 120366–70; KU 120371 [skel.], 120372–74; 124587 [skel.]); 4.6 km N Loja, 2065 m; 7.6 km S Loja, 2210 m (KU 141523; 142650); 2 km S Loja (CAS 93914–17); 2 km

CHILE: BÍO-BÍO: Laguna La Laja, SW Shore, 1325 m; 6–7 km E El Chacay, 970 m (KU 161579–80; 161581–85). LLANQUIHUE: 6 km NE Ensenada, 70 m (KU 161578). SANTIAGO: Baños de Morales: 6 km E Los Valdes, 2250 m (KU 159967; 161594–98). TARAPACÁ: 3 km E Portezuela Chapiquina (KU 161625–32); Parinacota, 4310 m (KU 211747–48). PERU: ANCASH: Huaraz, 3250 m (KU 136050). APURIMAC: Curahuasi, 15 km W Abancay, 1800 m (KU 136059–70; 136071); Curahuasi, 2700 m (KU 136071). AREQUIPA: 1 km S Tambillo, 1180 m (KU 162989–90). AYACUCHO: 40 km SW Ayacucho, 3300 m (KU 136173–74). CAJAMARCA: 6 km NE Cajamarca, Baños del Inca (KU 136052, 136054–55). HUANCAYELICA: Huancavelica, 3780 m Huancavelica: 20 km W Lircay, 3700 m (KU 136141–43). HUÁNUCO: Huánuco, 1900 m; 5 km NE La Unión, 3100 m (KU 136179; 136180–81). JUNÍN: Mayu-

pampa, 2 km N La Oroya, 3400 m (KU 136112–13); 2 km NW San Lorenzo, 3200 m (KU 136126); Paccha, 9.5 km NW La Oroya, 3740 m (KU 139096–97); Carhuamayo, 4080 m (KU 139104–07); Comas, 3220 m (KU 136129). PASCO: 14 km SW Paucartambo, 3650 m (KU 139100). MOQUEGUA: 3.5 km S Piquina, Río Piquina (KU 163001). PUNO: 4 km W Santa Rosa 4010 m (KU 163032, 163041 [skel.]).

Bufo vellardi: PERU: CAJAMARCA: Baños del Inca, 6 km NE Cajamarca, 2750 m (KU 136053 [skel.]); 10 km SSE Cajabamba, 2900 m (KU 211764–67); Chota, Cochabamba (KU 221702).

Bufo veraguensis: PERU: CUZCO: 4 km WSW Santa Isabel, 1700 m (KU 139115–31); 2 km WSW Santa Isabel, 1580 m (KU 139132); 4 km SW Santa Isabel, Río Cosñipata (KU 163082–91). AYACUCHO: Tutumbaro, Río Piene, 1840 m (KU 163092).

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A NEW SPECIES OF *LIOLAEMUS* (SQUAMATA: LIOLAEMIDAE) FROM NORTHEASTERN ARGENTINA AND SOUTHERN PARAGUAY

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ABSTRACT: *Liolaemus azarai* is described as a new species of liolaemid lizard from northeastern Argentina and Yacyretá Island, Paraguay. It is a member of the *wiegmannii* species group and may be distinguished from other members of this group by its relatively small body size, fewer scales around the midbody, and dorsal color pattern. At the type locality, on Yacyretá Island, *L. azarai* is restricted to isolated sand dune formations and is known only from two others localities in the Province of Corrientes, northeastern Argentina. The new species is the smallest member of the *wiegmannii* group and, like other members of the group, except *L. wiegmannii*, *L. azarai* appears to be a sand dune obligate, insectivorous, and oviparous.

Key words: Argentina; Iguania; Liolaemidae; *Liolaemus*; *Liolaemus azarai* new species; Paraguay; Yacyretá Island

LIZARDS of the genus *Liolaemus* are the most species rich group of vertebrates in austral South America, and the number of described taxa is quickly approaching 180. The *Liolaemus* species are relatively small to moderately sized diurnal lizards, the majority of which are terrestrial, even though a few are semi-arboreal. Diets may

be insectivorous, herbivorous, or omnivorous; both oviparous and viviparous taxa are represented (Cei, 1986, 1993; Donoso-Barros, 1966). *Liolaemus* ranges from the high Andean mountains of Peru and Bolivia in the north to northern Tierra del Fuego Island in the south and from the Pacific beaches to the sandy Atlantic beaches of Argentina, Uruguay, and Brazil (Cei, 1986; Donoso-Barros, 1966).

Several different taxonomic groupings within *Liolaemus* have been proposed (e.g., Cei, 1979, 1986, 1993; Etheridge,

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