Natural History Museum of The University of Kansas
Scientific Papers, 2001, 22, pp. 1-10

A New Species of Marsupial Frog (Anura: Hylidae: *Gastrotheca*)

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ABSTRACT A new species of *Gastrotheca* from the southern end of the Cordillera Azul in Peru seems to be most closely related to *G. lateonota* known only from the Cordillera Huancabamba in northern Peru. Both of these species and *G. marsupiata, monticola* and *peruana* produce tadpoles, whereas the other species of *Gastrotheca* in Peruvian Andes have direct development.

KEY WORDS: Anura; Hylidae; *Gastrotheca*; new species; Peru; Andes.

RESUMEN Una nueva especies de *Gastrotheca* del extremo sur de la Cordillera Azul aparentemente está realcionada a *G. lateonota* que sólo está registrada para la Cordillera de Huancabamba al norte de Peru. Ambas especies junto con *G. marsupiata*, *monticola*, y *peruana* producen renacuajos, mientras que las otras especies de los Andes peruanos tienen desarrollo directo.

PALABRAS CLAVES: Anura, Hylidae, *Gastrotheca*; especie nueva; Peru; los Andes.

INTRODUCTION

Marsupial frogs of the genus *Gastrotheca* are highly diverse in the Andes, especially in Colombia, Ecuador, and Peru, where 31 species have been recorded; 14 of these species have been reported from Peru (Duellman, 1987; Duellman and Fritts, 1972; Duellman and Trueb, 1988; Duellman and Wild, 1993; Trueb and Duellman, 1978). Of these species, *G. longipes* occurs in the upper Amazon Basin, and *G. testudinea* and *G. weinlandii* have extensive distributions in cloud forests on the eastern slopes of the Andes from Colombia to Bolivia. The other species in Peru are restricted to the Andes, mostly at elevations above 2000 m.

Of these high Andean species, four have rather extensive distributions. *Gastrotheca marsupiata* ranges from central Peru into Bolivia and *G. griswoldi* occurs in central Peru; the range of *G. peruana* extends from central Peru northward in the Cordillera Occidental, whereas that of *G. monticola* includes the northern parts of the Cordillera Occidental and Cordillera Central, the Cordillera de Huancabamba, the Huancabamba Depression in Peru and Ecuador, and the southern part of the Cordillera Occidental in Ecuador. The nominal species *G. lojana* was placed in the synonymy of *G. monticola* by Duellman and Hillis (1987).

The other seven species have restricted distributions in the Andes. *Gastrotheca abdita* is known only from the isolated Cordillera Colán, and *G. galeata* and *G. lateonota* are known only from the Cordillera de Huancabamba in northern Peru. Four other species (*G. excubitor, ochoai, pacchamama,* and *rebeccae*) have restricted allopatric distributions at high elevations in the Cordillera Oriental in central and southern Peru.

Field work in 1998 by Lehr and Aguilar in the Cordillera Azul, a part of the Cordillera Oriental in central Peru, resulted in the discovery of several new species of anurans (Lehr, 2001; Lehr et al. 2001, 2002). Among these is a previously unknown species of *Gastrotheca*.

ACKNOWLEDGMENTS

The field work was supported by the Forschungsinstitut und Naturmuseum Senckenberg. Lehr is grateful to personnel at the Instituto Nacional de Recursos Naturales of the Ministerio de Agricultura in Lima, Peru, for providing collecting and export permits. Javier Icochea and Gunther Köhler made helpful suggestions. The manuscript benefited from critical reviews by Joseph R. Mendelson III and Erik R. Wild, and from careful editing by Linda Trueb. The accurate renderings of the frogs are from the talented hand of Christopher A. Sheil (Kansas).

MATERIALS AND METHODS

The 16 morphological measurements and 25 external descriptive characters are those used by Duellman and Pyles (1980), Duellman and Hillis (1987), and Duellman and Trueb (1988). All measurements are in mm; snout–vent length is abbreviated SVL. Museum codes are those of Leviton et al. (1985) with the addition of the Museo de Historia Natural Universidad San Marcos, Lima, Peru (MHNSM). The distribution map is based on the Mapa Físico Político (Instituto Geográfico Militar del Peru, 1973). Statistical analyses were performed with StatView 4.5 (Abacus Concepts, Inc., 1992–1995). Numbered colors refer to corresponding colors in the color guides of Smithe (1975, 1981).

DESCRIPTION OF NEW SPECIES

Gastrotheca ***stictopleura*** new species

Holotype.—MHNSM 20319, an adult female, from Tranca Grande at Chaglla (09°51'08" S, 75°54'37" W, elevation 3090 m), Provincia de Pachitea, Departamento de Huánuco, Peru, obtained on 23 August 1998 by Edgar Lehr.

Referred specimens.—SMF 80328–29, juveniles, from Cochacalla at Chaglla, Provincia de Pachitea, Departamento de Huánuco, Peru, obtained on 23 August 1998 by Edgar Lehr.

Diagnosis.—A moderate-sized species (females to 68.3 mm) having (1) tibia length 49.9% SVL, noticeably shorter than foot; (2) interorbital distance noticeably greater (160%) than width of upper eyelid; (3) skin on dorsum finely shagreen, not co-ossified with skull, lacking transverse ridges; (4) supraciliary processes absent; (5) heel lacking calcar or pronounced tubercles; (6) tympanic annulus smooth; (7) Finger I shorter than Finger II; width of disks greater than that of digits; (8) fingers unwebbed; (9) web-

Table 1. Measurements of adult females of three species of *Gastrotheca*. Means and 1 SD given below ranges

Character	*G. stictopleura*	*G. lateonota*	*G. monticola*
N	1	13	73
Snout–vent length*, **	68.3	54.4–63.7	46.3–73.0
	—	59.2 ± 2.13	59.4 ± 4.42
Tibia length*, **	34.1	26.2–30.2	24.1–38.2
	—	27.6 ± 1.11	29.8 ± 2.21
Foot length	30.5	25.8–31.8	21.2–39.4
	—	29.2 ± 1.34	27.6 ± 2.48
Head length*	20.3	16.7–20.0	14.7–22.7
	—	18.5 ± 0.89	18.8 ± 1.18
Head width*	23.1	18.7–21.8	16.4–29.8
	—	20.8 ± 0.57	21.5 ± 1.77
Interorbital distance*	8.0	5.6–6.7	5.0–10.0
	—	6.2 ± 0.67	7.4 ± 1.03
Eyelid width**	5.0	3.9–5.1	3.0–5.1
	—	4.3 ± 0.32	4.2 ± 0.35
Internarial distance*	4.1	3.3–4.1	3.2–4.6
	—	3.8 ± 0.27	3.9 ± 0.31
Eye diameter*	5.8	5.0–5.8	3.9–6.8
	—	5.4 ± 0.29	5.5 ± 0.44
Eye–nostril distance	5.0	4.4–5.2	4.4–6.5
	—	4.8 ± 0.30	5.2 ± 0.51
Orbit–jaw distance*	3.0	2.4–2.9	2.1–3.7
	—	2.7 ± 0.19	2.8 ± 0.31
Nostril–jaw distance*, **	5.3	3.6–4.3	2.6–4.8
	—	4.0 ± 0.27	3.9 ± 0.41
Tympanum diameter	3.0	2.5–3.2	2.3–3.8
	—	2.8 ± 0.23	3.0 ± 0.36
Thumb length	12.0	9.5–12.7	8.5–13.3
	—	10.8 ± 0.71	10.8 ± 1.07
Third finger length*	21.8	17.5–21.8	15.3–24.4
	—	20.3 ± 0.84	19.3 ± 1.76
Disc width*	3.5	2.7–3.3	2.3–4.2
	—	3.0 ± 0.21	3.1 ± 0.40

* Differences between *G. stictopleura* and mean of *G. lateonota* significant (*t*-test, $P \leq 0.01$).
** Differences between *G. stictopleura* and mean of *G. monticola* significant (*t*-test, $P \leq 0.01$).

bing extending to penultimate subarticular tubercle on Toe IV, extending to distal subarticular tubercle on Toe V; (10) dorsum essentially uniform green; (11) head markings consisting of pale cream labial and canthal stripes, the latter bordered below by narrow brown stripe; (12) pale cream labial stripe present, bordered below by brown; (13) flanks green with small white spots posteriorly; (14) venter creamy tan.

Gastrotheca stictopleura most closely resembles *G. lateonota* and *G. monticola*; all three species are similar in size and proportions, although the single adult female of *G. stictopleura* is slightly larger than females of *G. lateonota*. Furthermore, there are significant morphometric differences between the two species; *G. stictopleura* has a significantly larger head (Table 1). Also, the snouts in profile are slightly different (Fig. 1), and the ventral color pattern is different in the three species; the belly is dull grayish

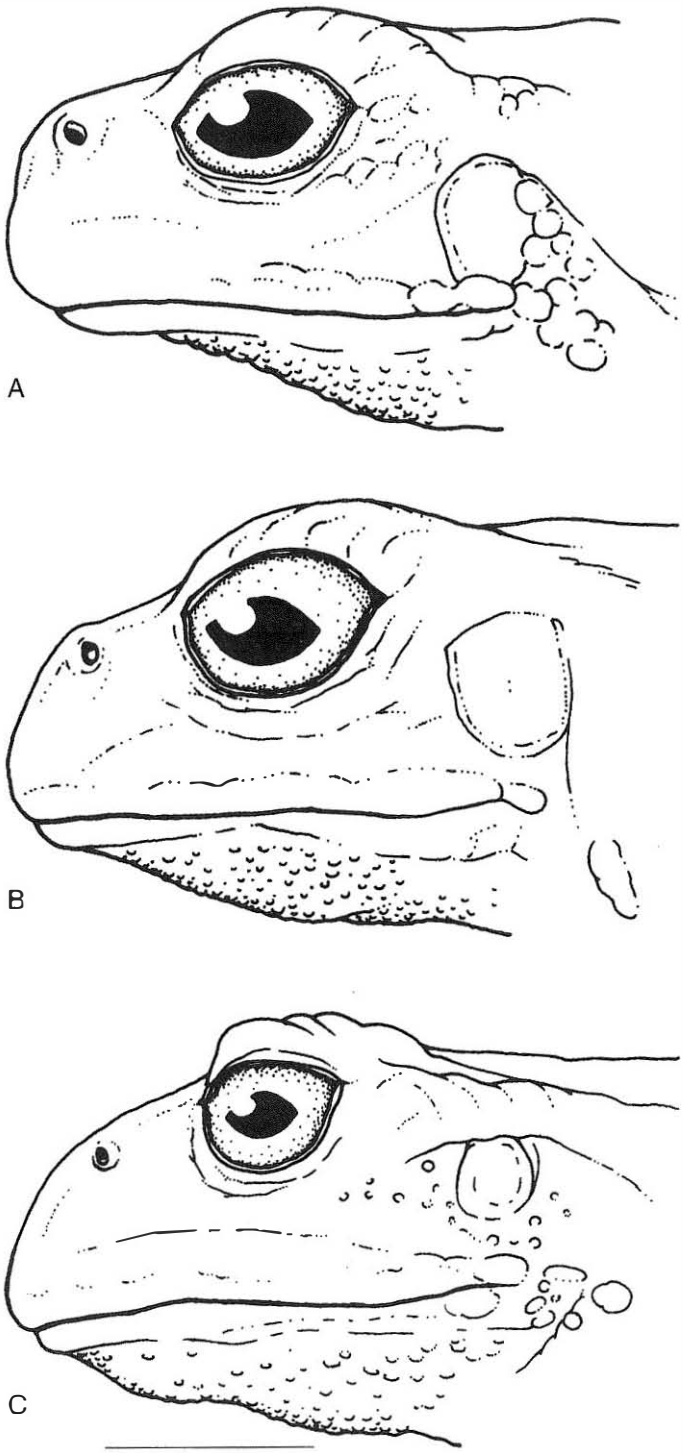


Fig. 1. Heads of three species of *Gastrotheca*. A. *G. lateonota*, KU 181733. B. *G. monticola*, KU 181743. C. *G. stictopleura*, MHNSM 20319. All are adult females. Scale bar = 5 mm.

brown in *G. lateonota*, cream with black spots in *G. monticola*, and creamy tan with a few brown flecks in *G. stictopleura* (Fig. 2). Other species in the high Andes of central and northern Peru are *G. griswoldi*, *marsupiata*, and *peruana*.

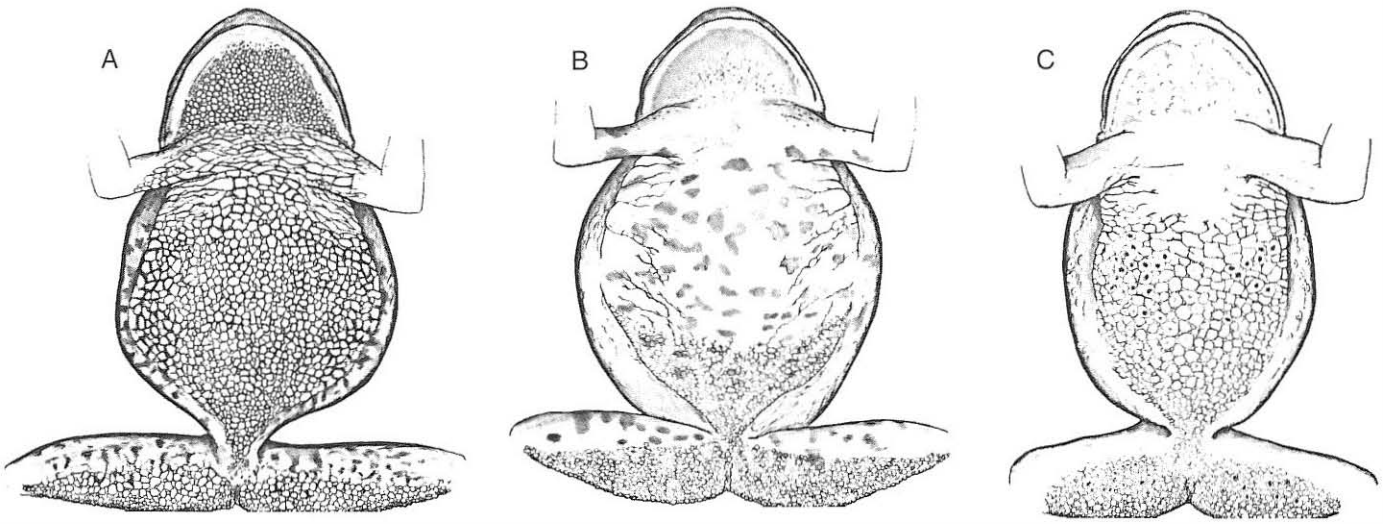


Fig. 2. Ventral coloration in adult females of three species of *Gastrotheca*. A. *G. lateonota*, KU 181736, 63.3 mm SVL. B. *G. monticola*, KU 181743, 64.1 mm SVL. C. *G. stictopleura*, MHNSM 20319, 68.3 mm SVL.

These are smaller species (SVL < 57 mm) that have smaller discs on the fingers and less webbing, which extends only to the penultimate subarticular tubercle on Toe V. *Gastrotheca peruana* differs further by having Fingers I and II equal in length, a granular tympanic annulus, and pustular skin on the dorsum. Furthermore, these three species differ from *G. stictopleura* in dorsal coloration. *Gastrotheca griswoldi* and *G. marsupiata* have a dark interorbital bar; in *G. griswoldi*, the bar usually is connected to diagonal or paravertebral marks on the body, whereas in *G. marsupiata* the bar is separate from the dark flecks or spots on the body. *Gastrotheca peruana* lacks a dark interorbital bar and has elongate paravertebral marks on the body.

Other species of *Gastrotheca* inhabiting the Cordillera Oriental in Peru (*G. excubitor, ochoai, pacchamama*, and *rebeccae*) are smaller than *G. stictopleura* (maximum SVL < 46 mm) and have direct development. Two species inhabiting cloud forests on the Andean slopes of the cordillera (*G. testudinea* and *G. weinlandii*) differ from *G. stictopleura* in several characters. Both are much larger, with females attaining a SVL in excess of 80 mm, and have Finger I longer than Finger II, discs on digits much wider than digit at base of the disc, granular tympanic annulus, and a tan dorsum with transverse bark brown bars (*G. testudinea*) or chevrons (*G. weinlandii*). The latter has the skin on the head co-ossified with the skull and has large calcars, whereas the skin is not co-ossified in *G. testudinea*, which has a small tubercle on the heel. On cursory examination, the skin on the dorsal surface of the skull appears to be co-ossified with the underlying cranial elements in some preserved specimens of *G. lateonota, monticola, stictopleura*, and *testudinea*; however, the texture of the skin reflects to sculpturing of the underlying bone, and the skin is moveable on the top of the head.

Description of holotype.— Brooding female having a SVL of 68.3 mm; head slightly wider than long, narrower than body; head length 29.7% SVL; head width 33.8% SVL; snout-moderately long, acutely rounded in dorsal view, inclined anteroventrally in profile; nostrils slightly protuberant, directed anteroventrally, situated at a point 54.2% distance from anterior level of orbit to tip of snout, at level well behind margin of lower jaw; eye–nostril distance 86.2% length of eye. Canthus rostralis straight, elevated, rounded in profile; loreal region noticeably concave; lips rounded; internarial region slightly concave; top of head depressed; interorbital distance 34.6% head width, 160% width of upper eyelid. Tympanum vertically ovoid, separated from eye by distance 1.4 × length of tympanum; tympanic annulus distinct anteriorly and ventrally, smooth; supratympanic fold moderately weak, barely overlapping upper edge of tympanum, extending from posterior corner of orbit to point above insertion of forearm.

Arm moderately robust; hand moderately large; fingers unwebbed; distinct lateral fringes on Fingers II–IV; discs moderately large with median longitudinal groove in anterior part of each pad; width of disc on third finger noticeably greater than length of tympanum; relative length of fingers 1 < 2 < 4 < 3; subarticular tubercles large, rounded, none bifid; supernumerary tubercles absent; palmar tubercle low, elliptical; prepollical tubercle elongately elliptical (Fig. 3A). Hind limb moderately robust; tibia length 49.9% SVL; foot length 44.7% SVL; heels of adpressed limbs overlapping by about one-fourth length of shank; calcar, heel tubercle, and outer tarsal fold absent;

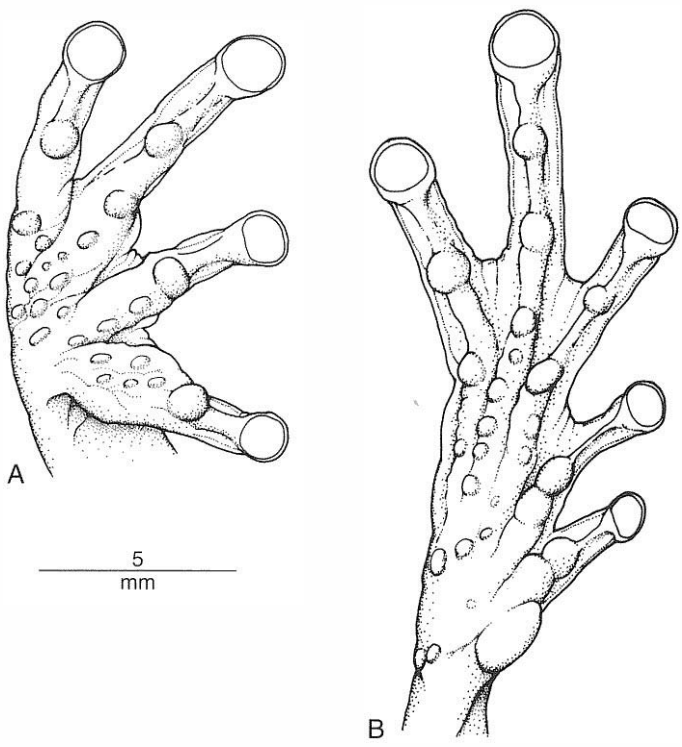


Fig. 3. Hand (A) and foot (B) of holotype of *Gastrotheca stictopleura*, MHNSM 20319.

inner tarsal fold distinct, extending full length of tarsus; outer metatarsal tubercle absent; inner metatarsal tubercle ovoid, barely visible from above. Toes long, slender, bearing distinct lateral fringes; relative length of toes a < 2 < 3 < 5 < 4; toes less than one-half webbed; webbing formula **I** 2—**2 II** 1—3 **III** 2—3 **IV** 3—2 **V**; discs slightly smaller than those on fingers; subarticular tubercles prominent, round; supernumerary tubercles prominent, present on proximal segments of all toes (Fig. 3B).

Skin on dorsum shagreen; skin on ventral surfaces of forearms and shanks smooth; skin on other ventral surfaces granular; vertical cloacal folds present; transverse row of four rounded tubercles on posterior surface of each thigh lateral to cloaca, decreasing in size distally; opening of brood pouch V-shaped, with the apex just posterior to sacrum. Vomerine odontophores slightly oblique posteromedially, narrowly separated medially, at posterior margins of choanae, bearing 5 and 6 teeth; choanae moderately large, nearly round; tongue bluntly ovoid, shallowly notched posteriorly, free posteriorly for about one third of its length.

Color in preservative: Dorsum of head, body, and limbs bluish gray with narrow cream stripe originating as vertical line on snout, passing along canthus rostralis, margin of upper eyelid, and supratympanic fold, terminating on upper flank at about midlength of body; narrow cream stripe on margin of upper lip, followed posteriorly by two white spots above insertion of forelimb. Axilla and median and posterodorsal surfaces of flanks bluish gray with small white spots; groin pale grayish tan without markings. Narrow, transverse white stripe above vent; crests of vertical folds and tubercles lateral to vent white; narrow white stripe on ventrolateral edge of forearm; narrow white bar on heel. Dorsal surfaces of fingers and Toes I–III tan; other toes and all discs bluish gray. Throat pale bluish gray with creamy white granules; other ventral surfaces and anterior and posterior surfaces of thighs dull creamy tan; some granules on the belly with a small amount of brown pigmentation (Fig. 3C).

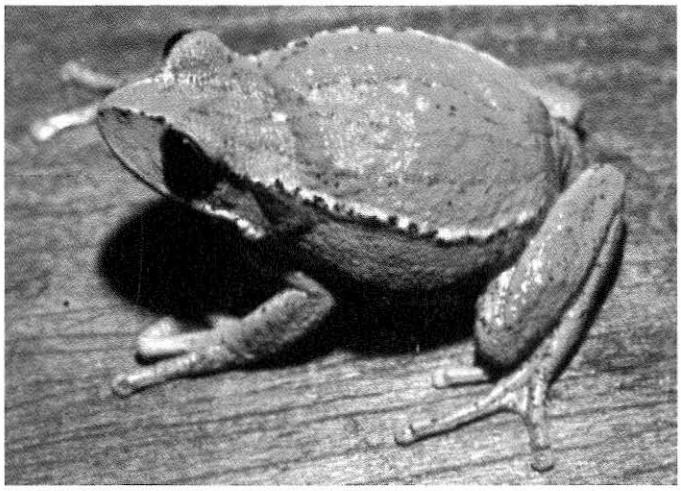
Color in life: From color photographs and field notes by Lehr. Dorsal surfaces of head, body, and limbs, and loreal and tympanic regions bright dark green (162B) with diffuse salmon (6) on body and limbs; labial and dorsolateral stripes cream (54); dorsolateral stripe bordered ventrally by brown (38) stripe; spots on flanks, above insertion of forearm, and lateral to vent white. Throat, chest, and ventral surfaces of arms cream (54) to yellow (56) with diffuse green (162B) and salmon (6) spots; belly pale brown (223D); ventral surfaces of thighs dark brown (119A); shanks green (162B); hands and feet dark gray (79). Iris metallic orange (17) with fine black reticulations (Fig. 4E).

Measurements of holotype: See Table 1.

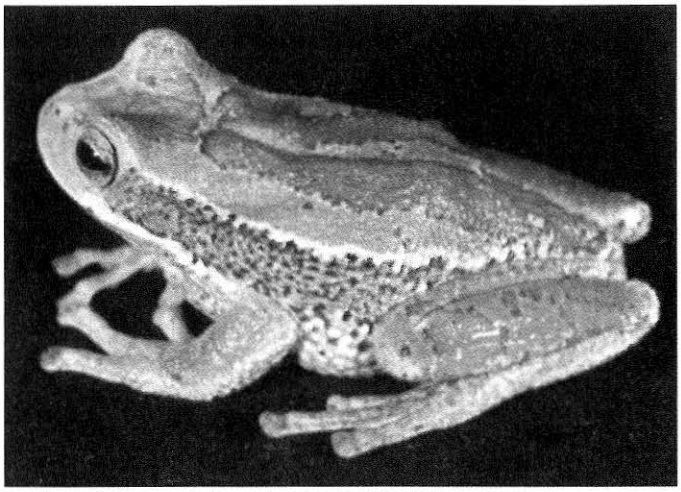
Cranial osteology: By lifting the skin covering the right posterolateral part of the skull, it was possible to determine the association of the frontoparietal and squamosal. The squamosal lacks a medial flange and is not in contact with the otic flange of the frontoparietal. This condition is like that described for *Gastrotheca lateonota* by Duellman and Trueb (1988) and differs from that in *G. monticola*, in which a median flange of the squamosal is in broad contact with the otic flange of the frontoparietal (Fig. 5).

Variation.—Two juveniles have SVLs of 28.5 and 32.7 mm. The coloration of the larger of these (SMF 80328) is like that of the holotype, except that there are faint tan markings—elongate, X-shaped mark on the dorsum beginning on the upper eyelids and terminating postsacrally with the intersection in the scapular region; a short, longitudinal, middorsal mark posterior to the sacrum; irregular marks on dorsal surfaces of limbs. The posterior part of the flanks is white with three vertical brown marks. The dorsal coloration of the smaller specimen (SMF 80329) is like that of the holotype, but the venter has more granules with brown pigmentation; the flanks posterior to the axillary region are white with brown spots.

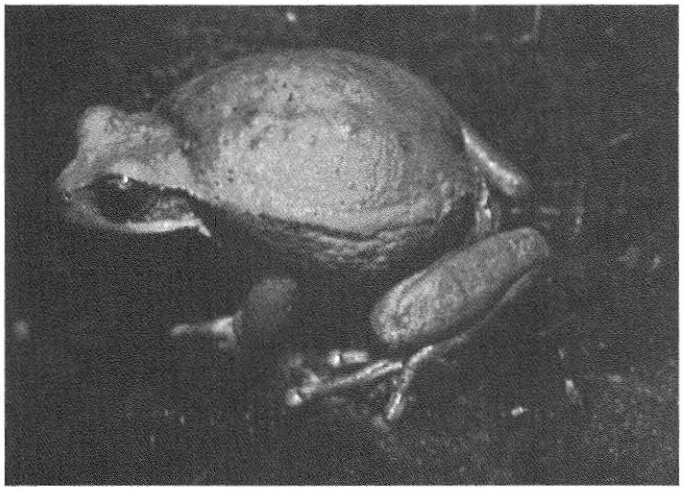
Field notes on coloration in life of these two juveniles are: SMF 80328: Dorsum green (159) with metallic salmon (6) spots on head, body, and extremities. SMF 80329: Dorsum green (6), hands and feet cream (54); cloacal region



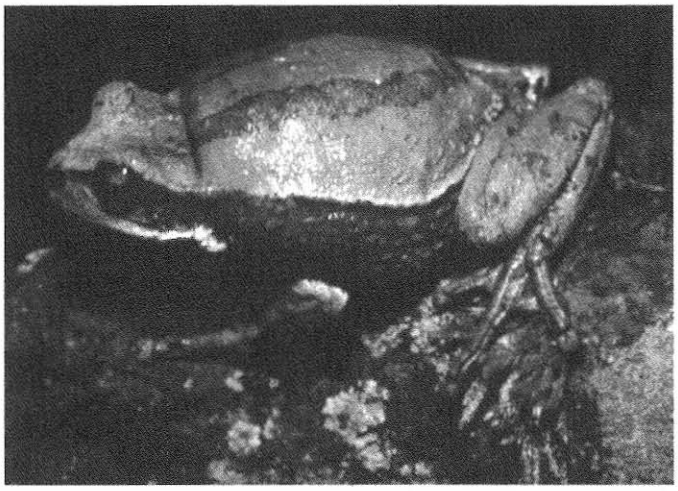
A. *Gastrotheca monticola*, female, KU 212022, 51.5 mm SVL.



B. *Gastrotheca monticola*, male, KU 148568, 62.9 mm SVL.



C. *Gastrotheca lateonota*, female, KU 181732, 54.6 mm SVL.



D. *Gastrotheca lateonota*, female, KU 181730, 61.2 mm SVL.



E. *Gastrotheca stictopleura*, female, MHNSM 20319, 68.3 mm SVL.



F. *Gastrotheca stictopleura*, juvenile, SMF 80329, 28.5 mm SVL.

Fig. 4. Three species of *Gastrotheca* from Peru and southern Ecuador.

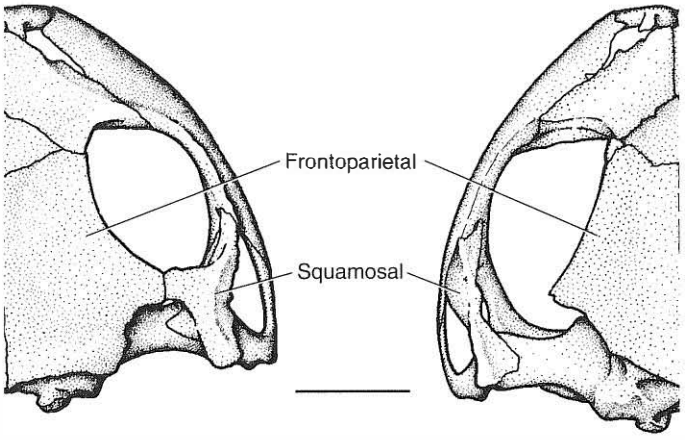


Fig. 5. Skulls of *Gastrotheca monticola* (left) and *G. lateonota* (right) showing relationship of frontoparietal and squamosal. The condition in *G. stictopleura* is like that in *G. lateonota*. Scale bar = 5 mm. Adapted from Duellman and Trueb (1988).

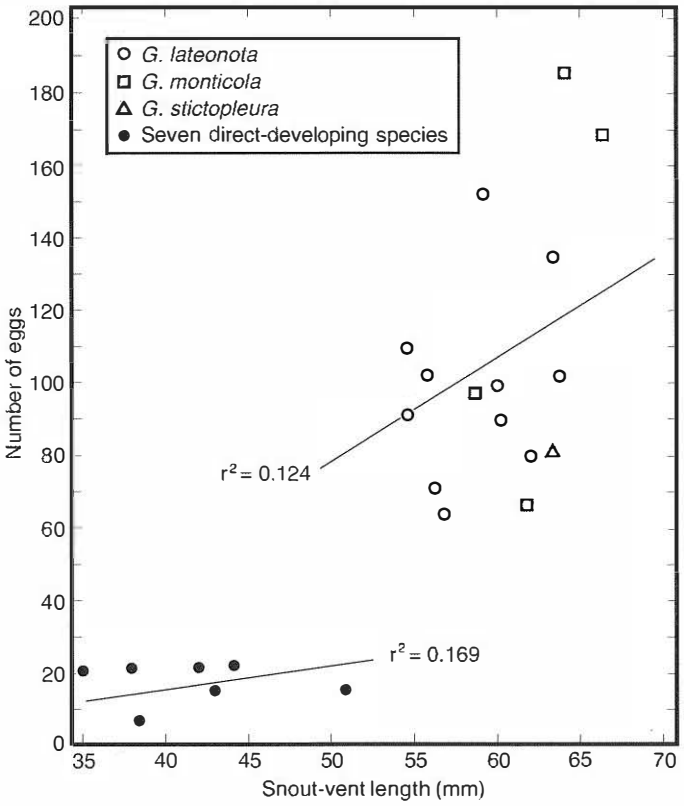


Fig. 6. Regression plots of number of eggs in brood pouches and corresponding female snout-vent length. Open symbols are for species producing eggs that hatch as tadpoles; solid symbols are means of seven Peruvian species producing eggs that hatch as froglets. The latter group includes *Gastrotheca abdivita* (n = 8), *G. excubitor* (n = 7), *G. galeata* (n = 4), *G. griswoldi* (n = 6), *G. ochoai* (n = 12), *G. pacchamama* (n = 4), and *G. rebeccae* (n = 1).

dark brown (119B) bordered by white; canthal and dorsolateral stripes cream (54) bordered below by dark brown (223B) stripe; lips cream (54); flanks white with dark brown (119) spots; throat pale brown (92); chest and belly dark brown (119B) with pale brown (92) spots; ventral surfaces of extremities dark brown (119B) with horn-colored (92) and salmon (106) spots; iris salmon (132D) (Fig. 4F).

Life history and development.—The holotype is a brooding female. Opening the brood pouch revealed ova about 5.3 mm in diameter. Eggs were not removed from the pouch, but an estimated 82 eggs are present. At least some of these eggs appear to be in developmental Stages 17–20 (Gosner, 1960); these stages are equivalent to Stages 16–18 described for *Gastrotheca riobambae* by del Pino and Escobar (1981). The number and size of eggs indicate that the eggs of *Gastrotheca stictopleura* hatch into tadpoles that complete their development in ponds (Fig. 6). *Gastrotheca lateonota* and *G. monticola* also produce eggs that hatch as tadpoles. Eleven brooding females of *G. lateonota* contained 66–152 ($\bar{x}$ = 103.1 ± 27.6) eggs in developmental Stages 31–35 (Gosner, 1960) having diameters of 5.3–7.3 ($\bar{x}$ = 6.4 ± 0.66) mm. Four brooding females of *G. monticola* contained 66–186 ($\bar{x}$ = 129.5 ± 57.3) eggs having diameters of 3.6–4.9 ($\bar{x}$ = 4.4 ± 0.57) mm. The number of eggs brooded by females of species having direct development is much smaller (Fig. 6).

Distribution and ecology.—*Gastrotheca stictopleura* is known only from the immediate vicinity of Chaglla, Departamento Huánuco, Peru (Fig. 7). This site is in the southern end of the Cordillera Azul; this name is applied to that part of the Cordillera Oriental lying to the east of the Río Huallaga Valley. Chaglla is in the transition zone between "matorral húmedo" and "bosque húmedo de montañas" (INRENA, 1995, 1996). The former exists at elevations of 2600–3400 m and is characterized by evergreen bushes. The village of Chaglla is in a region of extensive cultivation, principally potatoes.

Cochacalla and Tranca Grande are local names for areas within Chaglla. Cochacalla is a narrow valley with bushes and small trees along a small stream; Tranca Grande is a marshy, grassy plain with scattered trees and bushes. The specimens of *Gastrotheca stictopleura* were obtained by local residents who claimed that the frogs were found in trees.

Gastrotheca stictopleura is sympatric with the smaller, terrestrial *G. griswoldi* at Chaglla. Other species of anurans collected in the immediate vicinity of Chaglla include *Bufo spinulosus*, a new species in the *Bufo veraguensis* group, and four species of *Phrynopus*.

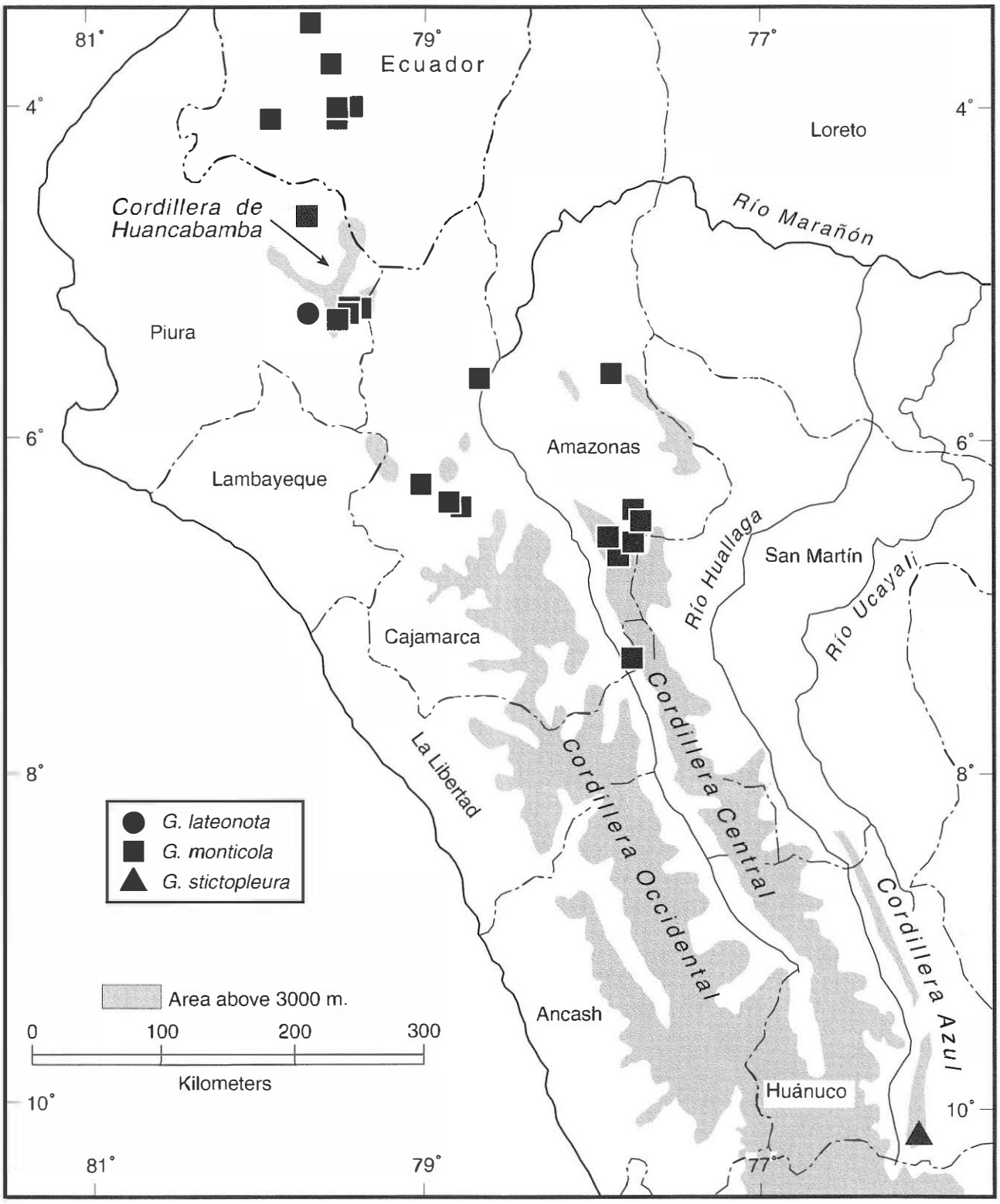


Fig. 7. Distributions of three species of *Gastrotheca* in southern Ecuador and northern Peru.

Etymology.—The specific name is a Latinized feminine adjective derived from the Greek *stiktos*, meaning dappled or spotted, and the Greek *pleura*, meaning side. The name refers to the spotted pattern on the flanks.

DISCUSSION

In size, external morphology, nature of the frontoparietals and squamosals, and mode of life history, *Gastrotheca stictopleura* is most like *G. lateonota*, known only from the Cordillera de Huancabamba in northern Peru (Fig. 6). With the exception of the nature of the frontoparietals and squamosals, these two species are more like *G. monticola* than any other members of the genus. *Gastrotheca monticola* ranges from southern Ecuador throughout northern Peru (Fig. 7).

Like many other species of *Gastrotheca* in the high Andes, *G. lateonota*, *monticola*, and *stictopleura* exhibit considerable variation in dorsal coloration. In *G. lateonota*, the dorsum is green or brown with or without darker paravertebral marks, and in *G. monticola*, the dorsum is green or brown, usually with a darker middorsal blotch or paravertebral marks (Fig. 4A–D). The three known specimens of *G., stictopleura* are green dorsally, but one specimen (SNM 80328) also has tan markings on the dorsum.

The co-occurrence of *Gastrotheca griswoldi*, in which eggs hatch as froglets in the brood pouch, and *G. stictopleura*, in which eggs hatch as tadpoles that complete their development in ponds, reflects a consistent pattern in *Gastrotheca* in the high Andes. All cases of sympatry include one species that produces tadpoles and another in which the eggs undergo directed development. Thus, the direct-developing *G. griswoldi* occurs sympatrically in different parts of its range with *G. peruana* and *G. stictopleura*, both of which produce tadpoles. Likewise, the widespread *G. marsupiata*, which produces tadpoles, occurs sympatrically with slightly smaller species that exhibit direct development (*G. excubitor*, *ochoai*, and *pacchamama*) throughout their separate ranges in the Cordillera Oriental. On the other hand, no two species that produce tadpoles are known to occur sympatrically. The same situation prevails in the high Andes of Bolivia, Ecuador, and Colombia.

LITERATURE CITED

Del Pino, E. M., and B. Escobar. 1981. Embryonic stages of *Gastrotheca riobambae* (Fowler) during maternal incubation and comparison of development with that of other egg-brooding hylid frogs. Journal of Morphology 167:277–295.

Duellman, W. E. 1987. Two new species of marsupial frogs (Anura: Hylidae) from Peru. Copeia 1987:903–909.

Duellman, W. E., and T. H. Fritts. 1972. A taxonomic review of the southern Andean marsupial frogs (Hylidae: *Gastrotheca*). Occasional Papers Museum Natural History University of Kansas 9:1–37.

Duellman, W. E., and D. M. Hillis. 1987. Marsupial frogs (Anura: Hylidae: *Gastrotheca*) of the Ecuadorian Andes: resolution of taxonomic problems and phylogenetic relationships. Herpetologica 43:141–173.

Duellman, W. E., and R. A. Pyles. 1980. A new marsupial frog (Hylidae: *Gastrotheca*) from the Andes of Ecuador. Occasional Papers Museum Natural History University of Kansas 84:1–13.

Duellman, W. E., and L. Trueb. 1988. Cryptic species of hylid marsupial frogs in Peru. Journal of Herpetology 22:159–179.

Duellman, W. E., and E. R. Wild. 1993. Anuran amphibians from the Cordillera de Huancabamba, northern Peru: systematics, ecology, and biogeography. Occasional Papers Museum Natural History University of Kansas 157:1–53.

Gosner, K. L. 1960. A simplified table for staging anuran embryos and larvae with notes on identification. Herpetologica 16:183–190.

INRENA (Instituto Nacional de Recursos Naturales). 1995. *Mapa Forestal del Peru*. Lima: Dirección General Forestal.

INRENA (Instituto Nacional de Recursos Naturales). 1996. *Guía Explicativa del Mapa Forestal*. Lima: Dirección General Forestal.

Lehr, E. 2001. A new species of *Phrynopus* (Anura: Leptodactylidae) from the eastern Andean slopes of central Peru. Salamandra 37:11–20.

Lehr, E. G. Köhler, and E. Ponce. 2001. A new species of *Phrynopus* (Anura: Leptodactylidae) from Peru. Senckenbergiana Biologie 80:205–212.

Lehr, E., C. Aguilar, and G. Köhler. 2002. Two sympatric new species of *Phrynopus* (Anura: Leptodactylidae) from a cloud forest in the Peruvian Andes. Journal of Herpetology (in press).

Leviton, A. E., R. H. Gibbs, Jr., E. Heal, and C. E. Dawson. 1985. Standards in herpetology and ichthyology: Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. Copeia 1985:802–832.

Smithe, F. B. 1975. *Naturalist's Color Guide*. Part I. Color Guide. New York: American Museum of Natural History.

Smithe, F. B. 1981. *Naturalist's Color Guide*. Part II. Color Guide Supplement. Color Swatches. New York: American Museum of Natural History.

Trueb, L., and W. E. Duellman. 1978. An extraordinary new casque-headed marsupial frog (Hylidae: *Gastrotheca*). Copeia 1978:498–503.

APPENDIX

Specimens Examined

Gastrotheca lateonota: PERU: *Piura*: El Tambo, 31.5 km E Canchaque, 2180 m, KU 181729, 181730 (holotype), 181731–39, 181836–37 (skeleton), MHNSM 1635.

Gastrotheca monticola: ECUADOR: *Azuay*: Girón, 2240–2500 m, KU 138401–03. *Loja*: Celica, 2130 m, BMNH 1931.11.3.3–4; Loja, 2150m, BMNH 1931.2.12.10–13, 1933.6.3.18–44, 1935.11.3.26–32, 1947.2.31.6–12, 1931.2.31.13 (holotype of *G. lojana*), 1931.2.31.14–18, KU 120673–74, USNM 258851–58; 2 km N Loja, 2100 m, KU 142846 (tadpoles); 5 km N Loja, 2150 m, KU 138235–36, 138237 (skeleton); 2 km E Loja, 2200 m, KU 120675, USNM 258849–50; 6.8 km E Loja, 2640 m, KU 217511–12; 9 km E Loja, 2660 m, KU 121387 (tadpoles); 10 km E Loja, 2600 m, KU 142855 (tads), 178470–76; 2 km S Loja, CAS 93898; 3 km W Loja, 2150 m, KU 138233; 5.2 km W Loja, 2310 m, KU 202688, 203547 (tadpoles); 5.5 km W Loja, 2330, KU 142603–08, 148549–51; 7.9 km W Loja, 2440 m, KU 203548 (tadpoles); 10 km W Loja, 2500 m, KU 138234; Saraguro, 2500 m, KU 138404–09, 138410 (skeleton), 148568. *Zamora-Chinchipe*: Zamora (?), BMNH 1933.6.24.45.

PERU: *Amazonas*: N slope Abra Barro Negro, 27 km WSW Leimebamba, 3440 m, KU 212078; Chachapoyas, 2340 m, KU 138238–41, 215627 (tadpoles), MCZ 88897–901, MHNSM 6277 (tadpoles); 20.5 km WSW Leimebamba, 3130 m, KU 181741; 22 KM WSW Leimebamba, 3220 m, KU 212495 (tadpoles), MHNSM 6294 (tadpoles); 24 km WSW Leimebamba, 3370 m, FSM 30080; 5 km N Levanto, 2850 m, KU 212021; 6 km NW Mendoza, 2200 m, KU 209421; Molinopampa, 2400 m, KU 212022–31, 212493 (young), 212494 (tadpoles), MHNSM 6116–21, 6287 (tadpoles), 6292 (young); Pomacochas (Florida), 2180 m, KU 181742–70, 181838–39 (skeleton), 212032–36, MHNSM 1040 (5), 6122–31. *Cajamarca*: No specific locality, MHNSM 204; Bellavista, 1947.2.22.47–48, 1947.2.25.77–78; Cutervo, 2620 m, KU 212055–66, NMW 6483; 8 km NW Cutervo, 2560 m, KU 212067, 212492 (tads); Querocotillo, MCZ 5328–30. *Piura*: Ayabaca,

2700 m, MHNSM 702 (2); W slope Cerro Chinguela on Huancabamba–San Ignacio trail, 2620 m, KU 196819; Huancabamba, 1960 m, AMNH 7551, KU 219771, MCZ 5290 (holotype), 5291–93, 5296–97, 5299–300, 5302, 5304–07, 5309, 5312–15, 5317, 5319, 5328–30; 1.8 km N Huancabamba, 1980 m, KU 219767–68, MHNSM 15418–19; 4 km N Huancabamba, 1900 m, KU 209769–70, MHNSM 15420–21; 18.5 km WSW Huancabamba, 2740 m, KU 181874 (tadpoles).

Gastrotheca stictopleura: PERU: *Huánuco:* Chaglla, MHNSM 20319 (holotype), SMF 80328–29.