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# Scientific Papers

Natural History Museum  
The University of Kansas

17 June 2004

Number 32:1-10

## Two New Species of Marsupial Frogs (Anura: Hylidae: *Gastrotheca*) from the Cordillera Oriental in Central Peru

By

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**ABSTRACT** A distinctive new species of *Gastrotheca* from the Río Chanchamayo Valley in the Cordillera Oriental in Peru is the only known member of the genus that lacks a tympanum. Another new species from the Cordillera de Carpish is distinctive in having a pair of lateral brood pouches and only basal webbing on the foot.

**Key words:** Systematics; Anura; Hylidae; *Gastrotheca atympana*, new species; *Gastrotheca zeugocystis*; Peru.



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**Key words:** Systematics; Anura; Hylidae; *Gastrotheca atympana*, new species; *Gastrotheca zeugocystis*; Peru.

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**RESUMEN** Se describe una especie nueva de *Gastrotheca* del valle del Río Chanchamayo en la Cordillera Oriental del Perú; esta especie se distingue de todos los otros taxa del género en no poseer tímpano. Otra especie nueva de la Cordillera de Carpish se caracteriza por tener bolsas de incubación pareadas y membranas basales entre los dedos del pie.

Palabras claves: Sistemática; Anura; Hylidae; *Gastrotheca atympana*, especie nueva; *Gastrotheca zeugocystis*, especie nueva; Perú.

## INTRODUCTION

Herpetological exploration of the Cordillera Oriental in central Peru through a cooperative agreement between the Museo de Historia Natural Universidad Mayor de San Marcos and the Museum für Tierkunde Dresden has revealed the existence of a rich montane herpetofauna containing many previously unknown species. For more than three decades, one of us (WED) has studied the genus *Gastrotheca*, a genus now containing 47 species. Among the new species of anurans from the eastern front of the Andes in central Peru was a large species of *Gastrotheca* described by Duellman et al. (2001). In more recent collections made

by Lehr and his Peruvian colleagues, there are additional undescribed species in the genus; two of these are described herein.

## ACKNOWLEDGMENTS

Lehr thanks R. Acero for collecting and export permits issued by the Ministerio de Agricultura (INRENA), Peru. We thank Juan Manuel Guayasamin for the resumen; Joseph R. Mendelson, Linda Trueb, and Eric R. Wild for their critical comments on the manuscript; and Linda Trueb for aid with the illustrations.

## MATERIALS AND METHODS

The 16 morphological measurements, 25 external descriptive characters, and numbered diagnostic characters are those used by Duellman and Pyles (1980), Duellman and Hillis (1987), Duellman and Trueb (1988), and Duellman et al. (2001); the latter also incorporated the 15 numbered diagnostic traits. All measurements are in millimeters; snout-vent length is abbreviated SVL. Sex was determined by examination of gonads. Webbing formulae

were determined by the method proposed by Savage and Heyer (1967), as modified by Myers and Duellman (1982). The Museo de Historia Natural Universidad Mayor de San Marcos, Lima, Peru, is noted as MHNSM, the Museum für Tierkunde Dresden, as MTD, and the University of Michigan Museum of Zoology, as UMMZ. Most comparisons were made with specimens of *Gastrotheca* in the Museum of Natural History, The University of Kansas (KU).

## DESCRIPTIONS OF NEW SPECIES

### *Gastrotheca atympana* new species

**Holotype.**—MHNSM 18692, an adult male, from Pampa Hermosa, (10°59'33.3" S, 75°25'58.0" W), 1540 m, Provincia de Tarma, Departamento de Junín, Peru, obtained 28 August 2003 by Rudolf von May.

**Diagnosis.**—A moderate-sized species (to 46.7 mm) having: (1) tibia length 51.6% SVL, much longer than foot; (2) interorbital distance more than twice eyelid width; (3) skin on dorsum shagreen, not co-ossified with skull, lacking transverse ridges; (4) supraciliary processes absent; (5) heel with transverse row of small tubercles; (6) tympanic annulus absent; (7) Finger I slightly shorter than Finger II, with discs much wider than digits; (8) fingers unwebbed; (9) webbing extending to antepenultimate subarticular tubercle on Toe IV, to penultimate subarticular tubercle on Toe V; (10) dorsum tan with irregular transverse brown markings; (11) head markings consisting of broad, dark brown interocular bar and pale labial and canthal-postorbital stripes; (12) pale dorsolateral stripe absent; (13) flanks cream with irregular, vertical black marks; (14) venter pale tan; (15) position of brood pouch unknown.

*Gastrotheca atympana* differs from the other 46 members of the genus by lacking an external tympanum. Seven other species of *Gastrotheca* have a tibia length 50–55% of SVL and Finger I shorter than Finger II. Of these, *G. antonia* differs by having supraciliary processes, two tubercles on the heel, and a venter that is orange or red anteriorly and black posteriorly. *Gastrotheca orophylax* differs by being uniformly green dorsally and ventrally, except for a cream labial stripe. *Gastrotheca argenteovirens* and *G. dunni* differ by having pale dorsolateral stripes, and *G. psychrophila* differs by having a uniform brown to dull green or nearly black dorsum and basal webbing between the fingers. *Gastrotheca ochoai* and *G. rebecca* differ by having a narrower interorbital regions (IOD about 1.5x eyelid width); the former is smaller (to 38 mm SVL) and lacks an interocular bar, whereas the latter is about the same size as *G. tympana*, but the markings on the head consist of a dark canthal stripe in addition to the dark interocular bar and pale labial stripe. Two other larger species have vertical black bars on the flanks. Of these, *G. ovifera* differs by having the skin co-ossified with the skull and a prominent

transverse occipital ridge; it also differs by having the webbing extending to the distal subarticular tubercle on Toe V, as opposed extending only to the penultimate tubercle in *G. atympana*. In *Gastrotheca testudinea*, Finger I is longer than Finger II, and the webbing extends to the distal subarticular tubercle on Toe V.

**Description of holotype.**—An adult male; body moderately slender; head wider than long, about as wide as body; snout narrowly truncate in dorsal view, barely rounded above and slightly inclined anteroventrally in profile; canthus rostralis angular, curved; loreal region barely concave; lips not flared; top of head flat; IOD 240% EW; nostrils slightly protuberant, directed laterally just below anterior terminus of canthus rostralis, at level just posterior to anterior margin of lower jaw; diameter of eye slightly greater than distance from anterior corner of orbit to nostril; tympanum not differentiated; tympanic annu-

lus and columella absent; supratympanic fold elevated, angular, deflected laterally, continuous with distinct, nearly vertical fold extending ventrally to point just above insertion of forelimb (Fig. 1).

Arm moderately robust; ulnar tubercles small, barely evident; hand large; fingers long, bearing large round discs; width of disc on Finger III nearly twice width of penultimate segment of finger; relative lengths of fingers  $1 < 2 < 4 < 3$ ; fingers unwebbed, with narrow lateral fringes on Fingers II–IV; subarticular tubercles moderately large, round, none bifid; supernumerary tubercles subconical, nearly as large as subarticular tubercles; palmar tubercle indistinct; prepollical tubercle elongate, elliptical; nuptial excrescences not evident (Fig. 2). Hind limb slender; tibia length 51.6% of SVL; foot length 40.7% of SVL; heel bearing transverse row of five or six small tubercles; tarsal tubercles absent; inner tarsal fold low, weak on distal three-fourths of tarsus; low, crenulated outer tarsal fold extending from heel nearly to disc on Toe V (evident in living individual [Fig. 3] but not visible proximally and barely visible distally in preserved specimen); outer metatarsal tubercle absent; inner metatarsal tubercle small, elliptical, visible from above; toes long, bearing round terminal discs about same size as those on fingers; relative length of toes

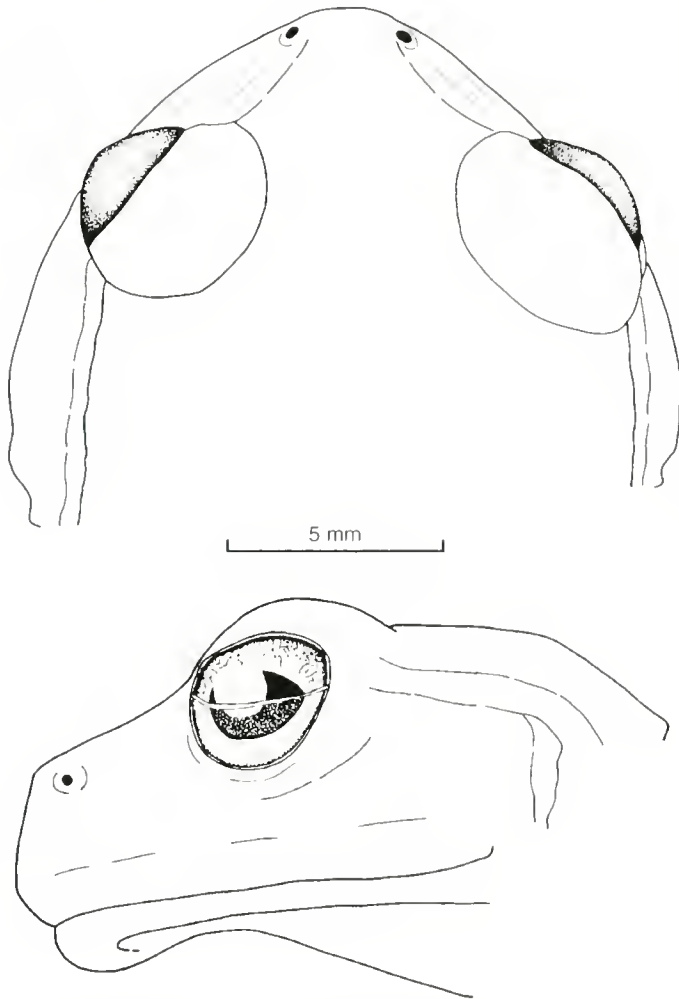


Fig. 1. Dorsal and lateral views of the head of the holotype of *Gastrotheca atympana*, MHNSM 18692.

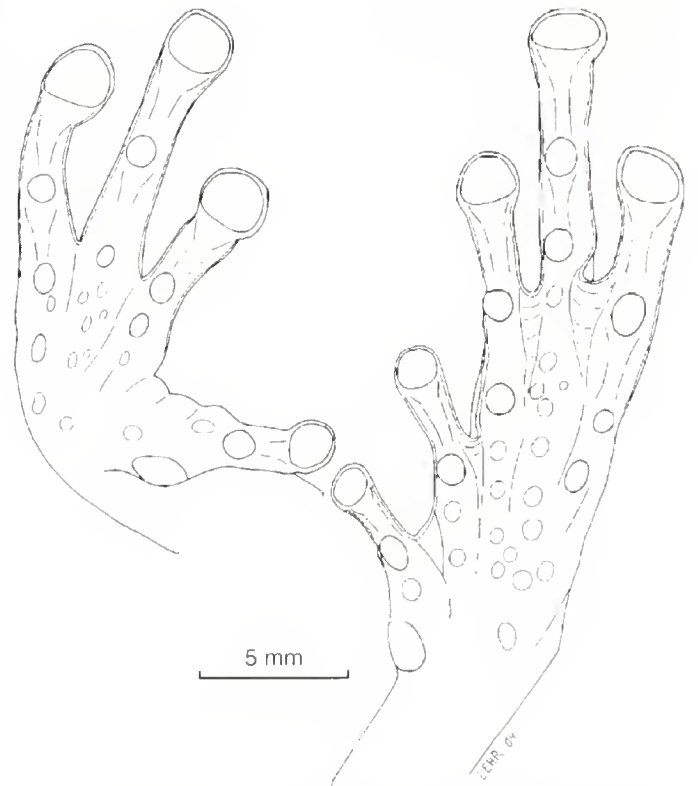


Fig. 2. Palmar surface of right hand and plantar surface of left foot of holotype of *Gastrotheca atympana*, MHNSM 18692.





Fig. 3. A and B. Dorsal and lateral views of holotype of *Gastrotheca atympana*, MHNSM 18692, adult male, 46.7 mm SVL. C and D. Dorsal and lateral views of holotype of *Gastrotheca zeugocystis*, MHNSM 18675, adult female, 37.5 mm SVL. Photographs by Edgar Lehr.

$1 < 2 < 3 - 5 < 4$ ; toes less than one-half webbed, with narrow lateral fringes distally; webbing formula I2-2II2-3 III2-3IV2-1 V; subarticular tubercles large, round; supernumerary tubercles small, diffuse (Fig. 2).

Skin on dorsum finely shagreen, that on head not ossified with underlying cranial elements; transverse dermal ridges absent; supraciliary processes absent; many small, subconical tubercles in temporal region; skin on flanks areolate; skin on throat, chest, belly, and posteroventral surfaces of thighs coarsely granular; other ventral surfaces smooth; transverse row of five subconical tubercles below cloacal opening. Shape of opening of brood pouch unknown; vocal slits and vocal sac absent. Vomerine odontophores elevated, posteromedially inclined, narrowly separated medially, between posterior margins of ovoid choanae, each bearing six teeth.

*Color in preservative:* Dorsum of head and body grayish tan with dull brown markings consisting of broad in-

terorbital bar connected to a triangular mark in scapular region and irregular marks posteriorly on body; dorsal surfaces of limbs pale gray with narrow transverse bars, three on each forearm, thigh, and foot, six or seven on shanks; those on thighs continuous onto anterior surfaces; flanks pale brown anteriorly, pale grayish white posteriorly; interstices in areolate skin on flank black; flanks with four (right side) or five (left side) irregular vertical black marks. Side of head pale grayish tan; narrow, creamy white stripe from point just behind nostril, along canthal crest, edge of upper eyelid, and edge of supratympanic fold, bordered below by narrower brown stripe in loreal and temporal regions; margin of upper lip creamy white. Posterior surfaces of thighs dark brown with triangular extensions dorsally meeting transverse bars on dorsal surfaces; tubercles on ventrolateral edges of forearms, heel, below cloacal opening, and fold on outer edge of foot white. Throat cream; chest, belly, and palmar surfaces pale brown;

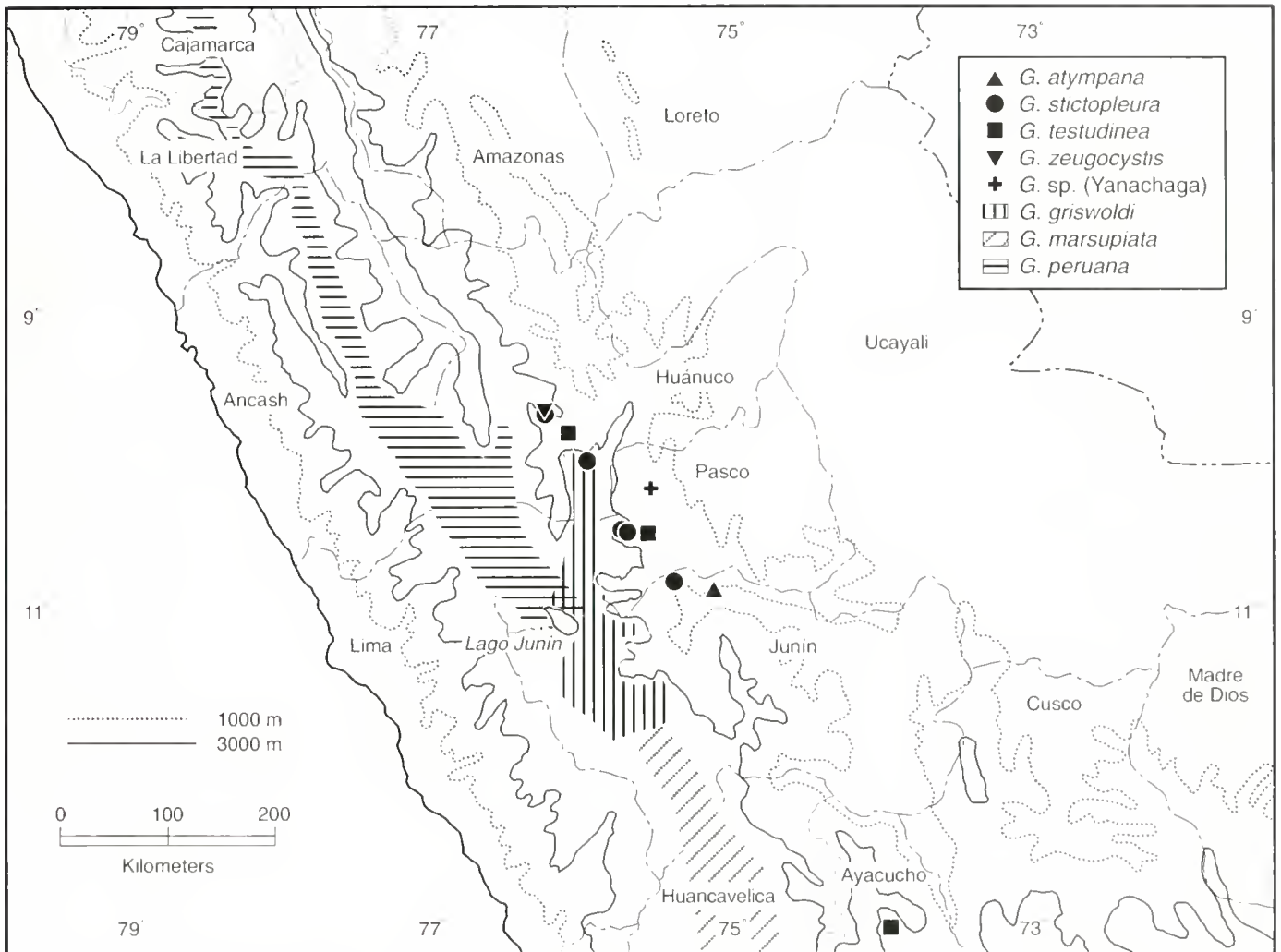


Fig. 4. Map of central Peru showing localities of occurrence of five species of *Gastrotheca* on the Andean slopes (symbols) and generalized distribution patterns of three species of *Gastrotheca* that occur at high elevations in the Andes (hash marks).

ventral surfaces of limbs and plantar surfaces pale grayish brown.

*Color in life:* Dorsum and flanks pale grayish tan; dorsal markings orange-brown with narrow dark brown edges; labial and canthal-postorbital stripes pale beige, narrowly bordered below by brown; fringe on foot, ulnar and subcloacal tubercles white; dorsal surfaces of discs and distal parts of digits orange-brown; posterior flanks pale gray to white with black markings; throat pale beige with chocolate brown blotches; belly chocolate brown; palmar and plantar surfaces dark gray; iris pale yellowish tan above, pale gray below, with fine black reticulations (Fig. 3).

*Measurements (in mm) of holotype:* SVL 46.7, tibia length 24.1, foot length 19.0, head width 17.2, head length 15.1,

internarial distance, 2.6, interorbital distance 7.2, eyelid width 3.0, eye-nostril distance 3.9, eye length 4.5, nostril-jaw distance 2.6, orbit-jaw distance 2.4, third finger length 13.5, thumb length 6.5, width of disc on third finger 1.9.

**Etymology.**—The specific name is derived from the Greek *a-* meaning without and the Greek *tympanion* meaning ear drum; the name is used as an adjective describing the absence of a tympanum.

**Distribution and ecology.**—The species is known only from the type locality at an elevation of 1540 m in the valley of the Rio Chanchamayo, a broad intrusion into the Cordillera Oriental in central Peru (Fig. 4). The type locality is a locally protected dense humid montane forest. The holotype was on a branch of a tree 1.2 above the ground at 2100 h.

*Gastrotheca zeugocystis* new species

**Holotype.**—MHNSM 18675, an adult female, from the Cordillera de Carpish (09°43'58.2" S, 76°06'41.9" W), 2920 m, Provincia de Huánuco, Departamento de Huánuco, Peru, obtained on 24 July 2003 by Daniel Rodríguez.

**Referred specimen.**—MTD 45984, cleared-and-stained male, 28.2 mm SVL, collected with the holotype.

**Diagnosis.**—A small species (to 37.5 mm in females) having (1) tibia length 46.9% SVL, as long as foot; (2) interorbital distance less than twice eyelid width; (3) skin on dorsum smooth, not co-ossified with skull, lacking transverse ridges; (4) supraciliary processes absent; (5) heel lacking tubercles or calcar; (6) tympanic annulus smooth; (7) Finger I equal in length to Finger II, with discs barely wider than digits; (8) fingers unwebbed; (9) webbing absent on foot except for basal webbing between Toes III and IV; (10) dorsum brown with small, irregular black marks; (11) head markings absent; (12) pale dorsolateral stripe absent; (13) flanks grayish brown; (14) venter brown; (15) brood pouch paired, lateral.

In most species of *Gastrotheca*, the brood pouch is single, median, and dorsal. A paired of lateral pouches, one on each side of the abdomen, is known in only three species—*G. walkeri*, *williamsoni*, and *zeugocystis*. *Gastrotheca walkeri* and *G. williamsoni*, species living in northern Venezuela, differ from *G. zeugocystis* in many features—larger size (70 and 54 mm SVL, respectively), tibia length more than 50% SVL, presence of a triangular calcar on the heel and granular interocular ridge, and fingers one-fourth (*G. walkeri*) or one-half webbed (*G. williamsoni*). Three other species (*G. abdita*, *litonedis*, and *peruana*) are like *G. zeugocystis* in having the first and second fingers equal in length and in having a tibia length less than 50% of SVL. All three species have single dorsal brood pouches and much more webbing on the foot, reaching the penultimate subarticular tubercle of Toe V. The tympanic annulus is granular in *G. abdita* and *G. peruana*, whereas the snout is rounded in dorsal view in *G. litonedis* and *G. peruana*. Furthermore, *G. abdita* differs by having a small tubercle of the heel; *G. litonedis* differs by having pale labial and dorsolateral stripes, and *G. peruana* differs by having a pustular dorsum, dark canthal stripe, and pale labial stripe. Superficially, *G. zeugocystis* and *G. ochoai* are similar; they resemble one another in SVL, absence of head markings, and general body pattern, but the ground color in *G. ochoai* is tan instead of brown, Finger I is shorter than Finger II, and the webbing on the foot is more extensive (to penultimate subarticular tubercle on Toe V); furthermore, *G. ochoai* has a single, median, dorsal brood pouch.

**Description of holotype.**—Body moderately slender; head about as wide as long, about as wide as body; snout acuminate in dorsal view, rounded in profile; canthus

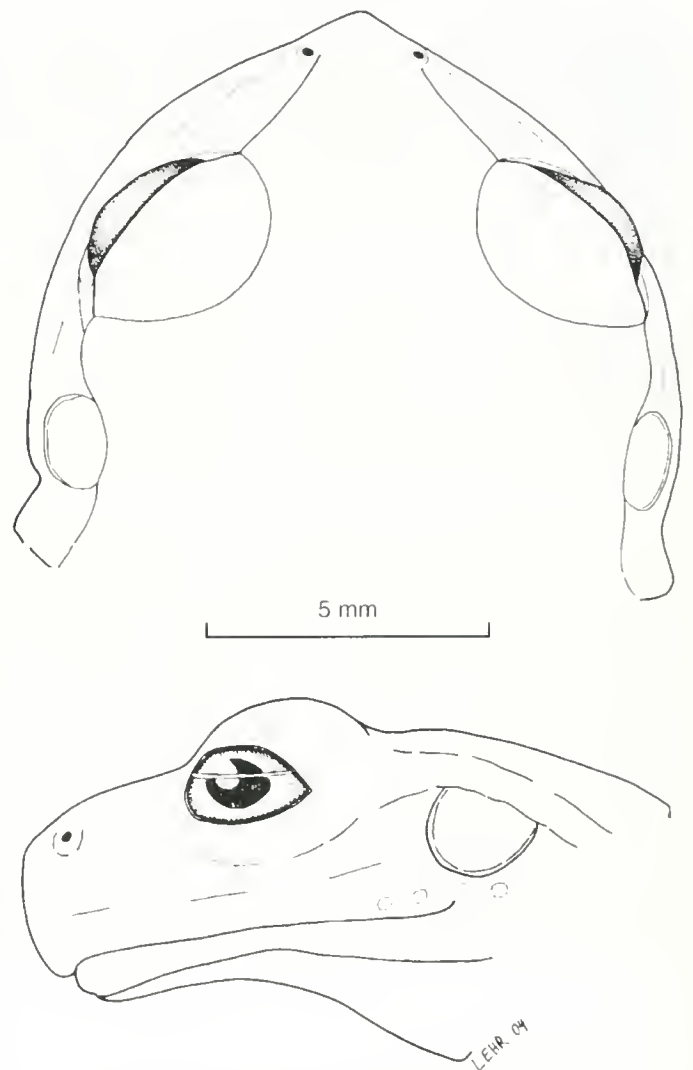


Fig. 5. Dorsal and lateral views of the head of the holotype of *Gastrotheca zeugocystis*, MHNSM 18675.

rostralis rounded, straight; loreal region shallowly concave; lips rounded; top of head flat; interorbital distance 168% of eyelid width; nostrils not protuberant, directed laterally just below anterior terminus of canthus rostralis, at level of anterior margin of lower jaw; diameter of eye much greater than distance from anterior corner of orbit to nostril; tympanum nearly round, well differentiated, separated from eye by distance about one-half diameter of eye; tympanic annulus smooth; supratympanic fold rounded, covering upper edge of tympanum, curved posteroventrally behind tympanum to point above insertion of forelimb (fig. 5).

Arm robust; ulnar tubercles absent; hand large; fingers moderately long, bearing round discs; width of disc on Finger III barely wider than penultimate segment of finger; relative lengths of fingers 1 = 2 < 4 = 3; fingers unwebbed, without lateral fringes; subarticular tubercles



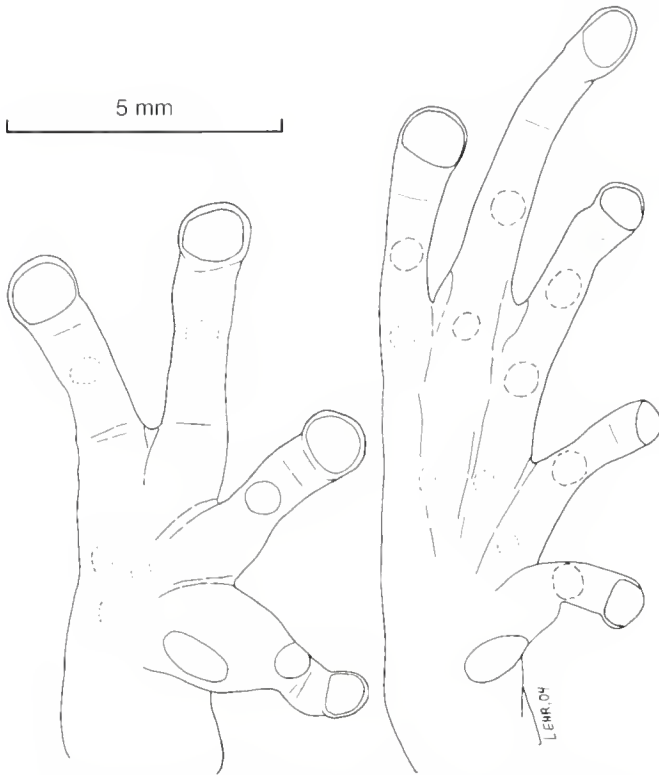


Fig. 6. Palmar surface of right hand and plantar surface of right foot of the holotype of *Gastrotheca zeugocystis*, MHNSM 18675.

moderately large, round, none bifid; supernumerary tubercle absent; palmar tubercle absent; prepollical tubercle massive, elliptical (Fig. 6). Hind limb moderately slender; tibia length 46.9% of SVL; foot length 46.1% of SVL; heels lacking calcar or tubercles; tarsal tubercles, inner and outer tarsal folds, outer metatarsal tubercle absent; inner metatarsal tubercle small, elliptical, not visible from above; toes moderately long, bearing round terminal discs smaller than those on fingers; relative lengths of toes  $1 < 2 < 3 < 5 < 4$ ; toes unwebbed except for basal webbing between Toes III and IV; toes lacking lateral fringes; subarticular tubercles diffuse, indistinct; supernumerary tubercles minute, few on proximal segments of digits (Fig. 6).

Skin on dorsum smooth, that on head not co-ossified with underlying cranial elements; transverse dermal ridge absent; supraclary processes absent; supratympanic fold tubercular; longitudinal row of tubercles below tympanum; skin on flanks smooth; skin of throat, chest, belly, and posteroventral surfaces of thighs coarsely granular; other surfaces smooth; pair of low, round tubercles below cloacal opening. Brood pouches paired; external margin elongately narrow, U-shaped; opening to pouches under lateral dermal folds, extending broadly ventrolaterally to pouch between body wall and skin. Tongue broadly cordi-

form, shallowly notched behind, free posteriorly for about one third of its length; vomerine odontophores low, transverse at level slightly behind posterior margins of small, round choanae, abutting medially, each bearing four teeth.

*Color in preservative:* Dorsum of head and body brown with small, irregular black marks; dorsal surfaces of limbs brown with indistinct narrow, transverse dark brown bars—two on forearm, three on thigh, three on shank; irregular dark brown marks on foot; flanks grayish brown with few scattered dark brown marks. Side of head dark brown; tympanum tan; canthal, labial, and dorsolateral stripes absent. Anterior surfaces of thighs brown; posterior surfaces of thighs dull yellow; tubercles below cloacal opening cream. Throat, chest, and belly brown; ventral surfaces of limbs and palmar and plantar surfaces tan; axilla and adjacent venter yellowish orange.

*Color in life:* Dorsum reddish brown with dark brown markings; groin and anterior surfaces of thighs lavender; posterior surfaces of thighs orange; dorsal surfaces of digits bluish gray; dorsal surfaces of discs on digits orange (Fig. 3); venter brown; iris reddish bronze with black reticulations.

*Measurements (in mm) of holotype:* SVL 37.5, tibia length 17.6, foot length 17.3, head width 11.8, head length 11.7, internarial distance 2.3, interorbital distance 4.2, eyelid width 2.5, eye–nostril distance 2.8, eye length 3.7, tympanum length 2.4, nostril–jaw distance 20, orbit–jaw distance 1.3, third finger length 11.0, thumb length 6.1, width of disc on third finger 1.8.

**Etymology.**—The specific name is derived from the Greek *zeugos*, meaning pair, and the Greek *kystis*, meaning sac; the name refers to the paired brood pouches in this species.

**Distribution and ecology.**—*Gastrotheca zeugocystis* is known only from the type locality in the Cordillera de Carpish, a north-south outlier of the Cordillera Oriental between Huánuco and Tingo María in central Peru (Fig. 4). The type locality is reached by a narrow “road” that ascends the mountain immediately to the north of the Carpish Tunnel on the Huánuco–Tingo María road. The frogs were found during the day under leaves and under a piece of wood in cloud forest. The forest on the upper slopes of the Cordillera de Carpish is made up of low trees with moss-covered branches. The two adults were maintained for a short while in a terrarium, where they actively climbed about on the vegetation at night and remained quiet in bromeliads or under leaves and moss by day.

**Remarks.**—Although investigations on anurans in the Cordillera de Carpish are in their infancy, an interesting array of anurans has been discovered there, including new species of *Phrynomys* (Lehr et al., 2002) and of several taxa yet to be described. High degrees of species diversity have been reported for birds (Parker and O’Neill, 1976) and mammals (Pacheco, 2002) in the Cordillera de Carpish.

## DISCUSSION

One of us (WED) has examined more than 4000 specimens of *Gastrotheca*, of which the holotype of *G. atympana* is unique in having no external tympanum; thus, the naming of a new species based on a one specimen is warranted. Moreover, the color pattern and relatively large and prominent supernumerary tubercles on the fingers also are unique in the genus. The frog does not fit readily into the phenetic groups recognized by Duellman et al. (1988). However, tissues from the holotype will be used in a forthcoming analysis of mitochondrial and nuclear genes that will help to elucidate the phylogenetic relationships.

Three species (*Gastrotheca marsupiata*, *peruana*, and *stictopleura*) that occur at high elevations (> 2300 m) in the central and southern parts of the Cordillera Oriental of the Peruvian Andes produce many (63–112) relatively small eggs that hatch as tadpoles and complete their development in ponds, drainage ditches, and other lentic waters (Duellman and Fritts, 1972; Duellman et al., 2001). On the other hand, species of *Gastrotheca* that inhabit montane forests in central and southern Peru, usually at elevations of less than 3000 m produce far fewer (14–22) eggs that undergo direct development and hatch as froglets. Based

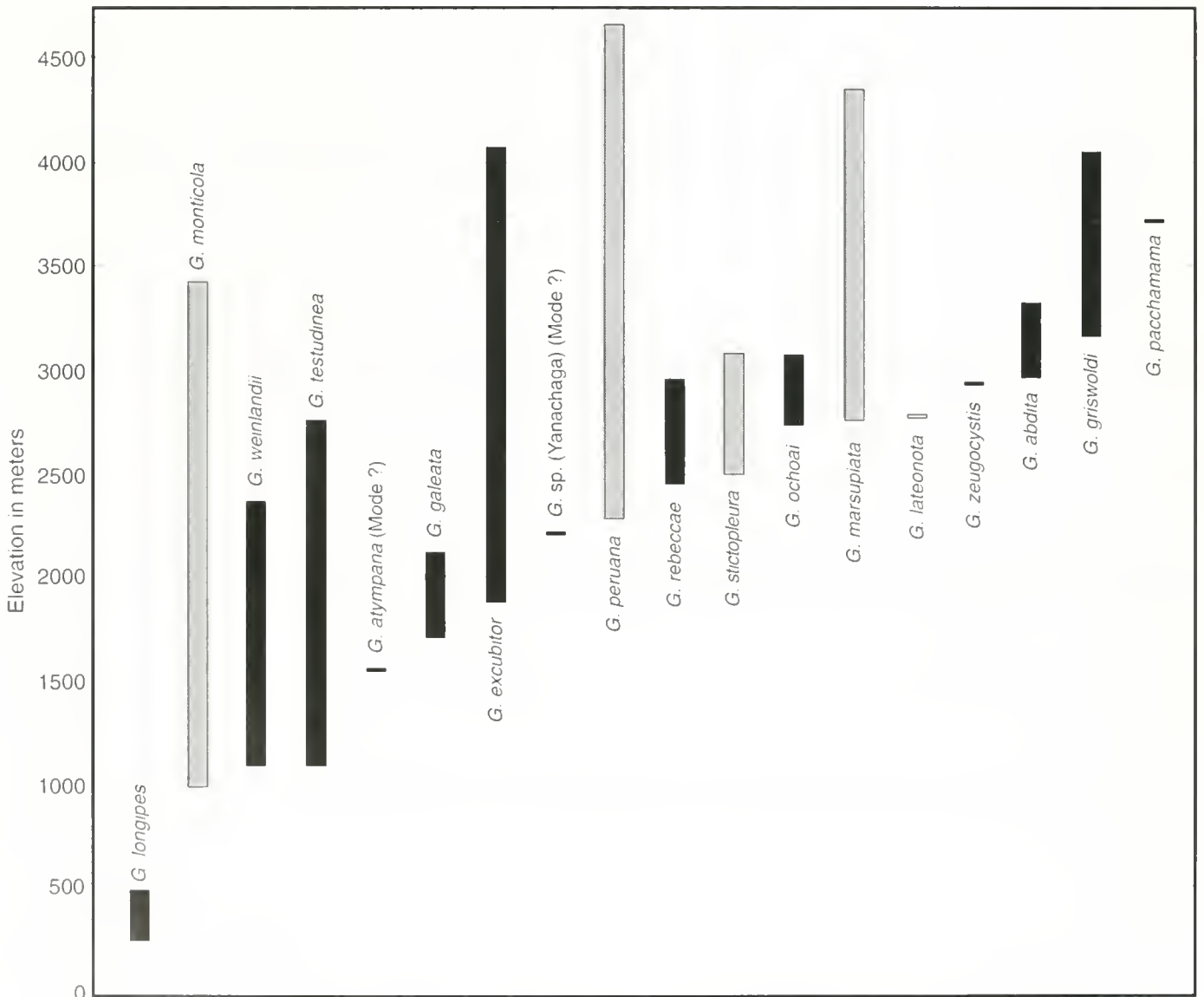


Fig. 7. Elevational distributions of species of *Gastrotheca* that occur in Peru. Black bars are species that produce eggs that undergo direct development; gray bars are species that produce eggs that hatch as tree-swimming tadpoles. The lower part of the range of *G. monticola* is in the Huancabamba Depression.

solely on elevation, we presume that *G. atypana* has direct development (Fig. 7). Three other species of *Gastrotheca* are known from montane forests in the central part of the Cordillera Oriental (departamentos of Ayacucho, Huánuco, and Junín). These include the larger *G. testudinca*, which occurs at elevations of 1560–2590 m and has direct development, and *G. zeugocystis*, which is known only from an elevation of 2920 m and presumably also has direct development. The low number (6) and large size (3.5 mm) of ovarian eggs in *G. zeugocystis* suggest that direct development occurs in this species.

The third species, *Gastrotheca stictopleura*, which has a large number of small eggs that presumably hatch as tadpoles (Duellman et al., 2001), has been found at an elevation of 2625 m on the Cordillera de Carpish. *Gastrotheca zeugocystis* is known from 2920 m in the same mountain range; thus, the two species may occur sympatrically. *Gastrotheca stictopleura* formerly was known only from the type locality in Departamento de Huánuco (Duellman et al., 2001), but we now report it from elevations of 2500–3090 m over a distance of about 200 km on the eastern face of the Cordillera Oriental and associated ranges (Fig. 4).

## LITERATURE CITED

- Duellman, W. E., and T. H. Fritts. 1972. A taxonomic review of the southern Andean marsupial frogs (Hylidae: *Gastrotheca*). Occasional Papers Museum of 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., E. Lehr, and C. Aguilar. 2001. A new species of marsupial frog (Anura: Hylidae: *Gastrotheca*) from the Cordillera Azul in Peru. *Scientific Papers Natural History Museum University of Kansas* 22:1–10.
- Duellman, W. E., L. R. Maxson, and C. A. Jesiolowski. 1988. Evolution of marsupial frogs (Hylidae: Hemiphraactinae): immunological evidence. *Copeia* 1988:527–543.
- Duellman, W. E., and R. A. Pyles. 1980. A new marsupial frog (Hylidae: *Gastrotheca*) from the Andes of Ecuador. Occasional Papers Museum of 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.
- Lehr, E., D. Rodríguez, and Jesús H. Córdova. 2002. A new species of *Phrynopterus* (Amphibia, Anura, Leptodactylidae) from the Cordillera de Carpish (Departamento de Huánuco, Peru). *Zoologische Abhandlungen Dresden* 52:65–70.
- Myers, C. W., and W. E. Duellman. 1982. A new species of *Hyla* from Cerro Colorado, and other tree frog records and geographical notes from western Panama. *American Museum Novitates* 2752:1–32.
- Pacheco, V. 2002. Protección de la biodiversidad en bosques montañosos fragmentados y propuesta para bosque de Carpish, Huánuco. Report I, II, CONCYTEC, Lima.
- Parker, T. A., and J. P. O'Neil. 1976. Introduction to bird-finding in Peru: Part II. The Carpish Pass region of the eastern Andes along the central highway. *Birding* 20 (3):205–216.
- Savage, J. M., and W. R. Heyer. 1967. Variation and distribution in the tree-frog genus *Phyllomedusa* in Costa Rica, Central America. *Beitrage zur Neotropische Fauna* 5:111–131.

## APPENDIX

## SPECIMENS EXAMINED

*Gastrotheca abdita*: PERU: Amazonas: Cordillera Colán, 2970–3330 m, E La Peca, KU 196833–35.

*Gastrotheca antonia*: COLOMBIA: Chocó: San José del Palmar, KU 289245. Valle: Paso de Galápagos, KU 289244.

*Gastrotheca argenteovirens*: COLOMBIA: Cauca: Coconuco, 2800 m, KU 145062, 145066–69; 2 km E Silvia, 2550, KU 181168–73; 6 km E. Silvia, 2690 m, KU 181174–84. Valle del Cauca: 7 km NE Tenerife, 2850 m, KU 169403–12.

*Gastrotheca atypana*: PERU: Junín: Pampa Hermosa, 2540 m, MHNSM 18692 (holotype).

*Gastrotheca dunni*: COLOMBIA: Antioquia: San Pedro, KU 204114–5.

*Gastrotheca litonedis*: ECUADOR: Azuay: Cuenca, 2600 m, KU 120709–10, 120712, 120718–22, 203442; 2.1 km S Cutchil, 2720 m, KU 141572; 3.5 km S Cutchil, 2785 m, KU 141579; 10 km NW Girón, 2750 m, KU 202690; Laguna de Zurucuchu, 16 km NW Cuenca, 3200 m, KU 203441; Río Matadero, 12 km E Cuenca, KU 129779–96; Río Mazan, near Casablanca, 3150 m, KU 207521. Cañar: Biblián, 2620 m, KU 141571, 141573, 142620–24, 147113.

*Gastrotheca ochoai*: PERU: Cusco: Chilca, 10 km N Ollantaytambo, 2760 m KU 138628–65, 139202–09, 148572, 173499–500 (C&S); Río Marcapata, below Marcapata, 2745 m, KU 196951–52. Puno: Ollachea, 53 km N Macusani, 2800 m, KU 138666–718.

*Gastrotheca orophylax*: ECUADOR: Carchi: El Carmelo, 2710 m, KU 178569; 5.7 km NW El Carmelo, 2910 m, KU 178570–84,

209578, 209579 (C&S), 209580; Santa Bárbara, 2650 m, KU 190022–29; 1 km E Santa Bárbara, 2650 m, KU 202693–94. Napo: 3 km E. Papallacta, 2900 m, KU 117981; 11 km ESE Papallacta, 2660 m, KU 164243–44, 178568; 12 km ESE Papallacta, 2630 m, KU 155469–70, 164242.

*Gastrotheca ovifera*: VENEZUELA: Aragua: Paso Portochuelo, 1170 m, KU 185733; Rancho Grande, 1100 m, KU 133388–89, 166760–64, 185732, 185785.

*Gastrotheca peruana*: PERU: Ancash: Chavín de Huántar, 3230 m, KU 138514–26; Chiquián, 3200–3400 m, KU 138495–512; Huaráz, 3250 m, KU 138513; 5 km N Recuay, 3450 m, KU 138527–44. Cajamarca: E slope Abra Gelic, 20 km E Celendin, 2740 m, KU 212071; S slope Abra Quilsh, 26 km NNW Cajamarca, 3500 m, KU 212068; S slope Abra Quilsh, 28 km NNW Cajamarca, 3520 m, KU 212069; Cajamarca, 2800 m, KU 138494; 55 km N Cajamarca, 3600 m, KU 212072–75; 8 km S Cajamarca, 3050 m, KU 212070; 23 km SW Celendin, 3050 m, KU 181740; Cutervo, 2620 m, KU 212055–57, 212060–66. Huánuco: 5 km NE La Unión, 3100 m, KU 138411–52. Junín: between Casa Pato and Anascancha, ca. 10 km S Carhuamayo, 4050 m, KU 139189–90; Odonores, 4115 m, KU 207815. La Libertad: Huamachuco, 3350 m, KU 138453–59; Laguna Sacsacoche, 12 km E Huamachuco, 3200 m, KU 138460–91; Otuzco, 2730 m, KU 138545–46.

*Gastrotheca psychrophila*: ECUADOR: Loja: Zamora-Chinchipec: 13–15 km E Loja, 2770–2850 m, KU 12076–62, 141586, 142631–37, 148599, 164233–34.

*Gastrotheca rebecca*: PERU: Ayacucho: 7.5 km SW Cano, 2970 m, KU 163302–03; Carpa, below Tambo on Valle de Apurimac Trail, 2470 m, KU 196806–11; Yuraccyacu on Tambo–Valle de Apurimac Trail, 2680 m, KU 196800–05.

*Gastrotheca stictopleura*: Peru: Huánuco: Chaglla, 3090 m, MHNSM 20319; Cordillera de Carpish, 2625 m, MTD 45615. Pasco: Auquimarca, 2650 m, MHNSM 19815, MTD 44755–56, 45691; above Auquimarca, MHNSM 17821, 17832, 17834, 17838, 17846, 17856, 18106; Paugmaray, Huachon, 2600 m, MHNSM 19166, 19168–79, 19172, 19186; MTD 45230; Uchuhuerta, 2500 m, MHNSM 19873, MTD 45909.

*Gastrotheca testudinea*: PERU: Ayacucho: Rio Piene, Tutumbaro, 1840 m, KU 163271–74, 163275 (skel), 163276–78. Huánuco: base of Bosque Zapata-Cocha, above Acamayo, 2545 m, KU 196815; Huaylaspampa, 2590 m, KU 196817, Rio Huaylaspampa, 2530 m, KU 196816. Pasco: Yaupi, MTD 45907.

*Gastrotheca walkeri*: VENEZUELA: Aragua: Km 26, Maracay–Ocumare de la Costa Road, 770 m, KU 166766; Km 29, Maracay–Ocumare de la Costa Road, 650 m, KU 166767–69, 185737–8; Rancho Grande, 1100 m, KU 133390–91, 166765, 185734–36.

*Gastrotheca williamsoni*: VENEZUELA: Carabobo: San Esteban, UMMZ 55559.

*Gastrotheca zeugocystis*: PERU: Huánuco: Cordillera de Carpish, 2920 m, MHNSM 18675 (holotype), MTD 45984 (C&S).

*Gastrotheca* sp.: PERU: Pasco: San Alberto, Parque Nacional Yanachaga, 2200, MHNSM 19901, MTD 45943.







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