

# An elusive new species of Marsupial Frog (Anura: Hemiphractidae: *Gastrotheca*) from the Andes of northern Peru

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## Abstract

**An elusive new species of Marsupial Frog (Anura: Hemiphractidae: *Gastrotheca*) from the Andes of northern Peru.** A new species of marsupial frog, genus *Gastrotheca*, is described from high-elevation grasslands in the Andes in Región Amazonas in northern Peru, where even calling males are well hidden in deep moss. The new species is distinguished from all congeners by its unique color pattern that includes a narrow, black-bordered, yellow middorsal stripe. The species apparently belongs to the *Gastrotheca plumbea* Group, which ranges in the Andes from northern Colombia to northern Peru.

**Keywords:** Andes, *Gastrotheca dysprosita*, new species, Peru.

## Resumen

**Una nueva especie de rana marsupial (Anura: Hemiphractidae: *Gastrotheca*) de los Andes del norte de Perú.** Se describe una nueva especie de rana marsupial del género *Gastrotheca*, de pajonales altoandinos en los Andes del Perú, donde incluso los machos vocalizando están bien escondidos en la capa espesa de musgo. La nueva especie se distingue de todos sus congéneres por un patrón de coloración único que incluye una banda estrecha medio dorsal amarilla con bordes negros; aparentemente pertenece al grupo de *Gastrotheca plumbea*, el cual se distribuye en los Andes desde el Norte de Colombia hasta el Norte de Perú.

**Palabras Clave:** Andes, *Gastrotheca dysprosita*, nova espécie, Perú.

## Resumo

**Uma nova espécie de perereca-marsupial (Anura: Hemiphractidae: *Gastrotheca*) dos Andes do norte do Perú.** Descrevo aqui uma nova espécie de perereca-marsupial, gênero *Gastrotheca*, dos campos de altitude dos Andes da Região Amazonas, norte do Perú, onde mesmo os machos vocalizantes permanecem bem escondidos nas camadas profundas de musgo. A nova espécie pode ser distinguida de todos os congêneres por seu padrão exclusivo de coloração, que inclui uma estreita faixa mediana dorsal amarela com margens pretas. Aparentemente a espécie pertence ao grupo de *Gastrotheca plumbea*, que se distribui nos Andes do norte da Colômbia ao norte do Perú.

**Palavras-chave:** Andes, *Gastrotheca dysprosita*, nova espécie, Perú.

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## Introduction

The hemiphractid genus *Gastrotheca* contains 62 species (Duellman *et al.* 2011, Frost 2011, Lehr and Catenazzi 2011, Teixeira *et al.* 2012). Most species of *Gastrotheca* occur in the Andes. The species occurring in Peru were reviewed by Duellman and Fritts (1972), and those in Ecuador were treated by Duellman (1974). Subsequently, six additional species were discovered in northern Peru, a region of complex topography and environments. *Gastrotheca galeata* was found in the semi-arid Huancabamba Depression (Trueb and Duellman 1978), whereas *G. lateonota* (Duellman and Trueb, 1988) and *G. abdita* (Duellman, 1987) were discovered in cloud forest in the Cordillera de Huancabamba and above treeline in the Cordillera Colán, respectively. More recently, three new species of *Gastrotheca* were discovered in the northern part of the Cordillera Central in the Región (Departamento) Amazonas (*G. ossilaginis* and *G. phalarosa* Duellman and Venegas, 2005) and in the Región San Martín (*G. phelloderma* Lehr and Catenazzi, 2011).

In April 1972, the intrepid malacologist Fred G. Thompson from the University of Florida collected snails and a single frog (*Gastrotheca* sp.) on Abra Barro Negro in the Región Amazonas in northern Peru. Field parties from the University of Kansas worked in northern Amazonas in 1979 and again in 1989; both times they worked in cold drizzling rain on the wind-swept Abra Barro Negro at elevations of 3230–3470 m (Figure 1A). On 6–7 March 1979, they found a few *Pristimantis* (then *Eleutherodactylus*) and *Telmatobius*, but they neither heard nor saw *Gastrotheca*. While passing over the Abra Barro Negro on 22 January 1989, *Gastrotheca* was heard, and finally one adult male was found. The following day, two hours were spent in the wind and rain at elevations of 3230–3470 m on the Abra; *Gastrotheca* was heard at the higher elevations but none could be found. In recent years, Pablo Venegas has collected extensively in Región San Martín and Región Amazonas,

including on Abra Barro Negro, but he found no additional individuals of this elusive species, which I finally describe herein.

The jar containing the holotype of this new species has been gathering dust in a cabinet in my office for nearly a quarter century. Periodically I have examined the frog again and again trying to make it fit into a named species to no avail. Recently, I borrowed again the specimen collected by Fred Thompson in 1972. Again, there was no question that they were the same species. I have been trying to clean up loose ends during the preparation of a monograph on marsupial frogs. Thus, herein I eliminate a loose end by describing the new species.

## Materials and Methods

The 16 morphological measurements, external descriptive characters, and diagnostic characters are those used by Duellman and Pyles (1980), Duellman and Hillis (1987), Duellman and Trueb (1988), and Duellman *et al.* (2001, 2004, 2006). All measurements are in millimeters; snout–vent length is abbreviated SVL. Specimens examined other than of the new species are listed in Appendix I. Codes for museum collections are those listed by Sabaj Pérez (2010).

## Results

### *Gastrotheca dysprosita* sp. nov.

*Holotype*.—KU 212078, an adult male, from the west slope of Abra Barro Negro (6°47'30" S, 77°52'00" W, 3440 m), 27 km (by road) WSW of Leimebamba, Provincia Chachapoyas, Región Amazonas, Peru, obtained on 22 January 1989 by J. J. Wiens.

*Paratype*.—UF 30080, an adult male, from 24 km (by road) WSW of Leimebamba, 3370 m, Provincia Chachapoyas, Región Amazonas, Peru, obtained on 24 April 1972 by F. G. Thompson.

*Diagnosis*.—A moderately large (males to 60.5 mm SVL) species of *Gastrotheca* with the





**Figure 1.** (A) Fog enshrouded northern slope and crest of Abra Barro Negro, 3500 m, 7 March 1979. (B) Habitat of *Gastrotheca dysprosita* on Abra Barro Negro. The extensive layer of moss is partially covered by white lichens and interrupted by bunch grass (*Stipa* sp.). 22 January 1989. Photographs by W. E. Duellman.

tibia length less than 50% of SVL, longer than foot; interorbital distance less than width of upper eyelid; skin on dorsum coarsely granular, not co-ossified with skull. Supraciliary process and calcar absent; Fingers I and II equal in length; discs on fingers slightly wider than adjacent digits; fingers not webbed; webbing on foot extending to antepenultimate subarticular tubercle on Toe IV and to penultimate tubercle of Toe V. In life, dorsum bright green (in preservative, dark brown) with narrow middorsal and dorsolateral stripes; markings on head absent; flanks green (brown in preservative) with yellow flecks; venter cream with small brown spots.

*Comparison with other species.*—*Gastrotheca dysprosita* differs from the other 10 species of *Gastrotheca* known from the Andes of northern Peru and southern Ecuador in coloration (green with middorsal yellow stripe in *G. dysprosita*) and texture of the skin on the dorsum (coarsely granular in *G. dysprosita*). *Gastrotheca galeata* differs from *G. dysprosita* (and all other species in the region) by having a casqued head with a somewhat spatulate snout and co-ossification of the skin with the dermal roofing bones of the skull. Similar co-ossification exists in *G. ossilaginis*, which differs further from *G. dysprosita* by having an anteroventrally inclined snout in profile, basal webbing between the toes, and shagreen skin on the dorsum. *Gastrotheca dysprosita* is like *G. peruana* and two related species, *G. phalarosa* and *G. phelloderma*, in having a narrow interorbital distance (equal to, or less than, width of upper eyelid), but differs in dorsal coloration (green with narrow yellow middorsal stripe in *G. dysprosita* versus dark brown paravertebral markings in the others) and texture of the skin on the dorsum (coarsely granular in *G. dysprosita* versus pustular in the others). *Gastrotheca dysprosita* differs from the smaller *G. abdita* (females to 46.2 mm in SVL), which has eggs that undergo direct development, by lacking basal webbing between the outer fingers and a tubercle on the heel, and by having webbing extending to the distal subarticular tubercle on Toe V.

Four other species of *Gastrotheca* in the region (*G. lateonota*, *G. monticola*, *G. pseustes*, *G. psychrophila*) have eggs that hatch as feeding tadpoles, which are highly variable in coloration. In addition to the dorsal coloration and texture of the dorsal skin emphasized above, there are other less obvious differences that distinguish these species from *G. dysprosita*, such as having an interorbital distance that is noticeably wider than the width of the upper eyelid. The tympanic annulus is smooth in all four species, which, in contrast, is granular in *G. dysprosita*. A temporal arcade (see Duellman and Trueb 1988: fig. 4) is absent in *G. lateonota*, *G. pseustes*, and *G. psychrophila* but present in *G. dysprosita* and *G. monticola*. In addition to those features mentioned previously, *G. dysprosita* differs from *G. monticola* by having a round, instead of vertically oval, tympanum and a shorter inner tarsal fold (distal fifth of tarsus versus distal two-thirds of tarsus).

*Description of holotype.*—Adult male; body robust; SVL 60.5 mm; head slightly wider than long, as wide as body; snout bluntly rounded in dorsal view and in profile; canthus rostralis slightly curved, rounded in profile; loreal region barely concave; lips rounded. Top of head flat; interorbital distance 92% of upper eyelid width; supraciliary process absent. Internarial area narrowly depressed; nostrils not protuberant, directed laterally at a point slightly posterior to anterior margin of lower jaw. Diameter of eye much greater than its distance from nostril, much greater than distance between orbit and upper margin of jaw. Tympanum round, separated from eye by a distance about two-thirds the length of the a tympanum; tympanic annulus barely distinct, granular; supratympanic fold moderately weak, extending from posterior corner of orbit to point above the angle of the jaw, barely obscuring the upper edge of the tympanum.

Arm moderately slender; ulnar tubercles absent; fingers long, not webbed; terminal discs on fingers small; digit adjacent to disc 60% of width of disc on Finger III, diameter of which is



66% of diameter of tympanum; relative lengths of fingers  $I = II < IV < III$ . Subarticular tubercles low, round; supernumerary tubercles small, subconical; palmar tubercle low bifid; prepollical tubercle low, elliptical; nuptial excrescences absent (Figure 2). Hind limb short, slender; tibia length 46.4% of SVL; foot length 40.2% of SVL; heel lacking tubercles and calcar; inner tarsal fold on distal fifth of tarsus; inner metatarsal tubercle absent; outer metatarsal tubercle small, elliptical, not visible from above, Toes moderately long, slender; relative lengths of toes  $I < II < III < V < IV$ ; outer toes about one-fourth webbed; webbing formula for outer toes  $III1\frac{1}{2}-3-IV3-2V$ ; subarticular tubercles low, round; supernumerary tubercles small, round, numerous on proximal segments.

Skin on all surfaces coarsely granular; cloacal folds and tubercles absent. Dentigerous processes of vomers inclined posteromedially, widely separated medially between large, round choanae, each process bearing seven teeth. Tongue cordiform, shallowly notched posteriorly, free behind for about one third of its length. Vocal slits short, diagonal between base of tongue and angle of jaw.

In preservative, dorsum, flanks, and head dark brown; digits colored like dorsum except Fingers I and II cream with small brown spots; narrow, irregularly margined cream middorsal stripe from posterior margin of head to point slightly posterior to sacrum; similar cream dorsolateral stripe extending from point above tympanum to groin; flanks and anterior and posterior surfaces of thighs brown with small irregularly shaped cream spots. Interorbital bar, canthal and labial stripes or bars absent; venter cream with small brown spots on chest and laterally on belly; vocal sac brown.

In life, dorsum bright green with middorsal and dorsolateral irregular bronzy cream stripes; flanks green with cream and black spots (Figure 3). Anterior and posterior surfaces of thighs mottled cream and black; throat dark green; vocal sac dull brown medially; belly cream with black flecks. Iris color reddish copper.

Measurements of the holotype in mm are: SVL 60.5, tibia length 28.1, foot length 24.3, head length 20.0, head width 21.7, interorbital distance 6.0, width of upper eyelid 5.6, internarial distance 3.8, eye–nostril distance 3.8, diameter of eye 6.2, diameter of tympanum 3.8, orbit–jaw distance 3.3, nostril–jaw distance 4.5, length of thumb 11.2, length of third finger 18.8, width of disc on third finger 2.5.

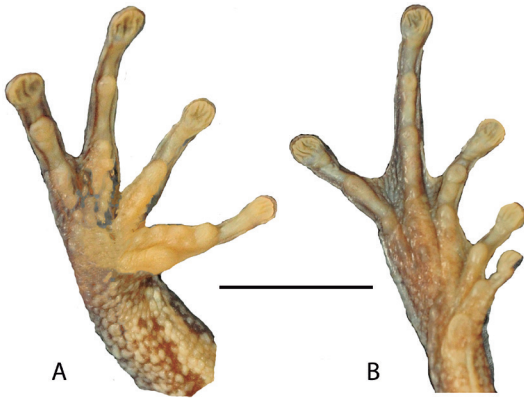
*Description of paratype.*—The paratype is smaller (45.9 mm SVL) than the holotype but similar to the holotype in all structural features. In preservative the dorsum is brown with faint markings of a middorsal stripe bordered by black and a similar dorsolateral stripe.

*Measurements of paratype in mm.*—SVL 45.9, tibia length 23.4, foot length 22.5, head length 18.5, head width 17.7, interorbital distance 4.9, width of upper eyelid 5.2, internarial distance 4.1, eye–nostril distance 3.5, diameter of eye 5.6, diameter of tympanum 3.6, orbit–jaw distance 2.6, nostril–jaw distance 4.0, length of thumb 10.2, length of Finger III 16.2, width of disc on Finger III 2.3.

*Distribution and ecology.*—*Gastrotheca dysprosita* is known only from elevations of 3370 and 3440 m on the north slope of Cerro Barro Negro (Figure 4). The holotype was sitting on a mossy cliff during rain by day. On Abra Barro Negro, there is a mixture of elfin forest with epiphytic moss, lichens, and some bromeliads up to about 3350 m, above which is puna—ground moss, lichens, and bunch grass (*Stipa*) (Figure 1B). Using the criteria of the IUCN, this species must be categorized as Data Deficient.

*Etymology.*—The specific name is derived from the Greek adjective, *dysprositos*, meaning hard to get. The name reflects the difficulty in finding this elusive frog.

*Remarks.*—What apparently is the call of *Gastrotheca dysprosita* was heard from mossy cliffs; the call is a series of three or four short notes. This call was first heard on the night of 6 March 1979 and on the following day. At both times, a cold rain hampered collecting activities, and no *Gastrotheca* was found.



**Figure 2.** Right hand and foot of the holotype of *Gastrotheca dysprosita*, KU 212078. Line equals 10 mm. Photographs by Andrew Campbell.

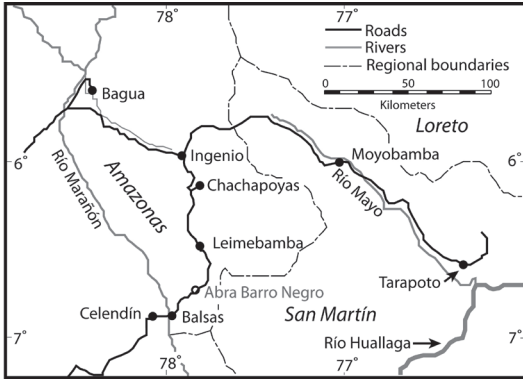
No other anurans were found at the type locality, but at a site at 3740 m (28 km SSW, by road, from Leimebamba), three new species of anurans were found—*Pristimantis melanogaster* and *P. pataikos* reported by Duellman and Pramuk (1999), and *Telmatobius truebae* reported by Wiens (1993).

### Discussion

The first molecular phylogeny of marsupial frogs (Wiens *et al.* 2007) showed two well-supported clades in the Andes; these clades also are evident in the analysis in Schmid *et al.* (2013), and in a taxonomically expanded analysis by Blackburn and Duellman (2013). As of



**Figure 3.** Holotype of *Gastrotheca dysprosita*, KU 212078, in life, an adult male, 60.5 mm SVL. Photo by W. E. Duellman.



**Figure 4.** Political map of the Andean region of northern Peru showing major roads, major rivers, towns, and the type locality of *Gastrotheca dysprosita* (open circle). Based on the Mapa Físico Político 1:1,000,000 (1973) produced by the Instituto Geográfico Militar del Perú.

September 2012, 23 additional tissues of *Gastrotheca* were available from the Andes in northern Peru; these included many samples of *G. monticola* and one sample from the holotype of *G. dysprosita*; regrettably, the later was degenerated and no DNA could be extracted.

The Central Andean clade recognized by Blackburn and Duellman (2013) contains 24 species; samples of DNA are not available for nine other species assigned to this clade. Species in this clade range from southern Ecuador to north-central Argentina. Although species in the southern part of the range of the genus occur as low as 600 m (*G. chrysosticta*), most species in the clade live at elevations above 2500 m. Four species (*G. griswoldi*, *G. marsupiata*, *G. peruana*, and *G. pseustes*) are known from elevations above 4000 m. *Gastrotheca peruana* extends upward to 4600 m, an elevation in the Andes exceeded by *Pleurodema marmoratum* and *Telmatobius marmoratus*, both of which exceed 5000 m (Seimon *et al.* 2007).

The smaller Northern Andean clade contains 16 species; samples of DNA are not available for

four other species assigned to this clade, plus *Gastrotheca dysprosita*, which presumably belongs to this clade. Species in this clade range from northern Colombia to northern Peru. Most species occur at elevations of 2300–3000 m; few species extend below 2000 m. *Gastrotheca riobambae* occurs as high as 3220 m and *G. monticola* reaches 3350 m. *Gastrotheca dysprosita* occurs at a slightly higher elevation (3440 m).

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Appendix I. Comparative material examined.

- Gastrotheca abdita*. PERU: Amazonas: Cordillera Colán, 2970–3330 m, E La Peca, KU 196833 (holotype), 196834–35.
- Gastrotheca galeata*. PERU: Piura: 15 km (by road) E Canchaque, 1740 m, KU 174361–63, 181700, LSUMZ 32050–51, 32058 (holotype), 32059; 15.8 km (by road) E Canchaque, 1890 m, KU 219765–66, MUSM 15416; 16 km (by road) E Canchaque, 1900 m, MUSM 15417; 33 km (by road) SW Huancabamba, 2130 m, LSUMZ 32052–53.
- Gastrotheca lateonota*. PERU: Piura: El Tambo, 31.5 km E Canchaque, 2180 m, KU 181729, 181730 (holotype), 181731–39, 181836–37 (skeletons), MUSM 1635.
- Gastrotheca monticola*. ECUADOR: Loja: Celica, 2130 m, BMNH 1931.11.3.3–4; Loja, 2150 m, 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, 101524–25, USNM 258851–58; 5 km N Loja, 2150 m, KU 138235–36, 138237 (skel); 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, 10 km E Loja, 2600 m, KU 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; 5.5 km W Loja, 2330, KU 142603–08, 148549–51; 10 km W Loja, 2500 m, KU 138234; Saraguro, 2500 m, KU 138404–09, 138410 (skel), 148568. PERU: Amazonas: Chachapoyas, 2340 m, KU 138238–41, MCZ 88897–901. Leimebamba (?), MUSM 24441; 20.5 km WSW Leimebamba, 3130 m, KU 181741; 22 km WSW Leimebamba, 3220 m, 5 km N Levanto, 2850 m, KU 212021; 6 km NW Mendoza, 2200 m, KU 209421; Molinopampa, 2400 m, KU 212022–28, 212030–31, MUSM 6116–21; Pomacochas (Florida), 2180 m, KU 181742–70, 181838–39 (skeleton), 212032–36, MUSM 1040 (5), 6122–31. Cajamarca: No specific locality, MUSM 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, Hacienda Taulis, 1500 m, SMF 81730–31; Quercotillo, MCZ 5328–30; Prov. Chota, MUSM 24443. Lambayeque: Penachi, 2000 m, MUSM 24443. Piura: Ayabaca, 2700 m, MUSM 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, MZUSP 101530–31; 1.8 km N Huancabamba, 1980 m, KU 219767–68, MUSM 15418–19; 4 km N Huancabamba, 1900 m, KU 209769–70, MUSM 15420–21.
- Gastrotheca ossilaginis*. PERU: San Martín: Lago Quindecocha, 3100 m, KU 227293–94, MUSM 19486 (holotype); Ullilen, 3000 m, MUSM 19488.
- Gastrotheca peruana*. PERU: Cajamarca: East slope Abra Gelic, 20 km E Celendín, 2740 m, KU 212071, MUSM 6115; South slope Abra Quilsh, 26 km NNW Cajamarca, 3500 m, KU 212068, MUSM 6114; South slope Abra Quilsh, 28 km NNW Cajamarca, 3520 m, KU 212069; Cajamarca, 2800 m, KU 138494, MNHN 57/863, MUSM 478 (4); 55 km N Cajamarca, 3600 m, KU 212072–75; 8 km S Cajamarca, 3050 m, KU 212070, MUSM 6182; 23 km SW Celendín, 3050 m, KU 181740; Cutervo, 2620 m, KU 212055–57, 212060–66, MUSM 269; 6188–92.
- Gastrotheca phalarosa*. PERU: San Martín: Esperanza, 3435 m, MUSM 19472, 19487 (holotype).
- Gastrotheca phelloderma*. PERU: San Martín: Pampa del Cuy, 24 km NE Pataz, 3400 m, Parque Nacional del Río Abiseo, KU 331039–40, MUSM 27735–42, 27744–52, 27606; Parque Nacional del Río Abiseo, MUSM 3756–61, 15966–67.
- Gastrotheca pseustes*. ECUADOR: Azuay: Bestión, AMNH 13967; Cajas, 3300 m, QCAZ 2374; Cuenca, 2540–2650 m, CAS 85172, KU 120676–708, 120711, 120713–17, 120723, 129797–98, 178565–67, 203465–68, 204032, USNM 258870–73, 258877; 6 km N Cuenca, AMNH 71588–600, 8 km N Cuenca, CAS-SU 21845–46; 9 km N Cuenca, CAS 95339–40, 93884–94, 94218–22, CAS-SU 21847–48; 18 km N Cuenca, CAS 93901, CAS-SU 21851; 1 km SE Cuenca, 2580 m, USNM 258874–76; 4 km E Cuenca, 2540 m, KU 138614–21; 8 km SW Cuenca, AMNH 71601–02; 8.8 km NW Cuenca, 2620 m, KU 141583–84; 42.8 km NW Cuenca, 3820 m, KU 203469; 0.8 km S Cutchil, 2535 m, KU 141582; 3.4 km S Cutchil, 2785 m, KU 141580–81; 8.5 km S Cutchil, 2905 m, KU 141577–78; 10 km NW Girón, 2750 m, KU 202691–92; 11.5 km SE Gualaceo, 2940 m, KU 203459–60; 17.6 km SE Gualaceo, 3150 m, KU 203552. Chimborazo: Escuela Río Colorado, 20 km SW Santa Rosa, 3700 m, KU 132348–49; Guamote, 2900 m, USNM 33863; 3 km S Guamote, 3200 m, KU 178553; 7 km SSW Guamote, 3050 m, KU 164239–41. Loja: 7.1 km N San Lucas, 2940 m, KU 203443 (holotype); Saraguro, 2500 m, KU 141565, 142609–13, 148563–67, 2.1 km N Saraguro, 2500 m, KU 178496–97, 2 km S Saraguro, 2560 m, KU 178477–95; 3.7 km S Saraguro, 2800 m, KU 203444–58.
- Gastrotheca psychrophila*. ECUADOR: Loja–Zamora–Chinchipec: 13–15 km E Loja, 2770–2850 m, KU 120760 (holotype), 120761–62, 141586, 142631–37, 148599, 164233–34.

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