

Illinois Wesleyan University

From the Selected Works of Edgar Lehr

2011

A New Species of Marsupial Frog (Anura: Hemiphractidae: Gastrotheca) from the Río Abiseo National Park in Peru

Edgar Lehr, *Illinois Wesleyan University*
Alessandro Catenazzi



Available at: https://works.bepress.com/edgar_lehr/71/

A New Species of Marsupial Frog (Anura: Hemiphractidae: Gastrotheca) from the Río Abiseo National Park in Peru

Edgar Lehr and Alessandro Catenazzi

Abstract

We describe a new species of *Gastrotheca* from the Río Abiseo National Park of the San Martín Region in the Andes of northern Peru. The description is based on a series of 29 specimens that were collected between 1989 and 1999 at two localities (Pampa del Cuy, Alpamachay) in the wet puna of the national park between 3380 and 3470 m elevation. The new species has a snout–vent length of 46.9–57.7 mm (53.5 ± 3.0) in females ($n = 21$), and 35.3–43.8 mm (41.6 ± 3.2) in males ($n = 6$). In life, the dorsum is pale grayish brown with reddish-brown paravertebral markings or blotches, and the venter is cream. Females have a single median, dorsal brood pouch and release tadpoles in water as indicated by two specimens found at Gosner Stages 45 and 46. The new species is distinguished from all of its congeners by having the dorsum with two reddish-brown paravertebral markings bearing prominent longitudinal ridges and warts. The new species differs from the two other species of *Gastrotheca* (*G. ossilaginis*, *G. phalarosa*) known from the Region San Martín by lacking integumentary-cranial co-ossification (present in *G. ossilaginis*), by having the skin on dorsum with prominent longitudinal ridges and warts (dorsal skin shagreen in *G. ossilaginis*), and in producing tadpoles (direct development in *G. ossilaginis*). The new species most closely resembles *G. phalarosa*. Both species produce tadpoles, have fingers and toes with lateral fringes, and Finger I larger than Finger II. *Gastrotheca phelloderma* differs from *G. phalarosa* by having the skin on dorsum with prominent longitudinal ridges (absent in *G. phalarosa*), the venter granular (smooth except granular on posterior part of belly and proximal posteroventral surfaces of thighs in *G. phalarosa*), a palmar tubercle (absent in *G. phalarosa*), a long and distinct inner tarsal fold (barely evident on distal fifth of tarsus in *G. phalarosa*), and the throat and belly grayish tan (black with white spots in *G. phalarosa*).

Resumen

Describimos una nueva especie de *Gastrotheca* del Parque Nacional del Río Abiseo, Región San Martín, en los Andes del norte de Perú. Basamos la descripción sobre una serie de 29 especímenes colectados entre 1989 y 1999 en dos localidades (Pampa del Cuy y Alpamachay) en la puna húmeda del parque nacional entre 3380 y 3470 m de altitud. La nueva especie mide 46.9–57.7 mm (53.5 ± 3.0) de longitud hocico-cloaca para las hembras ($n = 21$) y 35.3–43.8 mm (41.6 ± 3.2) para los machos ($n = 6$). Las hembras tienen una bolsa incubatriz única y depositan renacuajos en cuerpos de agua, como indicado por el hallazgo de dos especímenes en estadios de Gosner 45 y 46. La coloración *in vivo* es marrón claro a gris con bandas o manchas paravertebrales marrones-rojizas en el dorso, y crema en el vientre. La nueva especie se distingue

de las demás especies de *Gastrotheca* por tener un dorso con dos bandas paravertebrales marrones-rojizas y tubérculos y pliegues longitudinales prominentes. La nueva especie difiere de las dos otras especies de *Gastrotheca* (*G. ossilaginis*, *G. phalarosa*) conocidas de la Región San Martín por carecer de co-osificación craneal integumentaria (presente en *G. ossilaginis*), por tener la piel del dorso con tubérculos y pliegues longitudinales prominentes (ausentes en *G. ossilaginis*), y por producir renacuajos (desarrollo directo en *G. ossilaginis*). La nueva especie se asemeja más a *G. phalarosa*. Ambas especies producen renacuajos, tienen dedos con pliegues laterales, y dedo manual I más largo que el II. *Gastrotheca phelloderma* se diferencia de *G. phalarosa* por tener piel dorsal con pliegues longitudinales prominentes (ausentes en *G. phalarosa*), vientre granular (liso en *G. phalarosa* excepto por piel granular en la parte posterior del vientre y las superficies posteroventrales proximales de los muslos), tubérculo palmar (ausente en *G. phalarosa*), por tener un pliegue tarsal interno largo y conspicuo (poco visible en el quinto distal del tarso en *G. phalarosa*), y garganta y vientre gris oscuro (negros con manchas blancas en *G. phalarosa*).

Keywords: Amphibia, Andes, *Gastrotheca* new species, Peru, Río Abiseo National Park

Marsupial frogs of the genus *Gastrotheca* currently comprise 59 described species which are known from Costa Rica and Panama, from northern and western South America southward to northern Argentina, and from eastern and southeastern Brazil (Frost, 2011). Twenty-two species of *Gastrotheca* are known from Peru (Frost, 2011), and 16 (76%) of them are endemic to this country. Six species of *Gastrotheca* were described within the last 10 yr from Peru, four from the Andes of central Peru (*G. stictopleura*: Duellman et al., 2001; *G. atympana*, *G. zeugocystis*: Duellman et al., 2004; *G. carinaceps*: Duellman et al., 2006), two from the Andes of northern Peru (*G. ossilaginis*, *G. phalarosa*: Duellman and Venegas, 2005), and two from the Andes of southern Peru ("*Hyla*" *antoniochoai*: De la Riva and Chaparro, 2005, which was transferred to *Gastrotheca* by Catenazzi and Lehr [2009]; *G. pachachacae*: Catenazzi and von May, 2011).

While reviewing specimens at the Natural History Museum of the University of San Marcos in Lima (Peru), the senior author found an unidentified series of *Gastrotheca* from the Río Abiseo National Park, Region San Martín, northern Peru. Comparison of these specimens with examined material from herpetological collections as well as with literature, confirmed the existence of a new species of *Gastrotheca*, which we describe here.

Materials and Methods

Specimens were preserved in 10% formalin and stored in 70% ethanol. Sex was determined by the presence of brood pouches or by examination of gonads. Definitions for dermal protuberances follow Duellman and Lehr (2009). Measurements of 16 morphological characters, numbered diagnostic characters, and format of description follow Duellman et al. (2004).

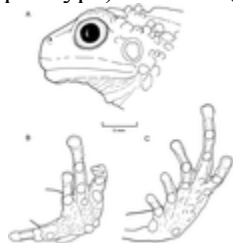
Measurements were taken with digital calipers under a microscope and rounded to the nearest 0.1 mm; these are: snout–vent length (SVL), tibia length (TL), foot length (FL, distance from proximal margin of inner metatarsal tubercle to tip of Toe IV), head length (HL, from angle of jaw to tip of snout), head width (HW, at level of angle of jaw), eye diameter (ED), tympanum diameter (TY), interorbital distance (IOD), upper eyelid width (EW), internarial distance (IND), eye–nostril distance (E–N, straight line distance between anterior corner of orbit and posterior

margin of external nares), nostril–jaw distance (N–J, horizontal distance between the ventral margin of the external naris and the upper lip), orbit–jaw distance (O–J, horizontal distance between the ventral margin of the orbit and the margin of the upper lip), Thumb length (F1L, distance from the proximal edge of the prepollical tubercle to the tip of the finger), Finger-III length (F3L, distance from the proximal edge of the palmar tubercle to the tip of the finger), and width of disc on Finger III (DF3, at middle of disc). Comparative lengths of Fingers I and II were determined by adpressing the fingers against each other. Webbing formula was determined by the method proposed by Savage and Heyer (1967), as modified by Myers and Duellman (1982). For comparisons of SVLs among species, data for adult females were used if not otherwise stated. Tadpole stages follow Limbaugh and Volpe (1957) as modified by Gosner (1960). Drawings were made by E. Lehr using a stereomicroscope with drawing tube attachment. Photographs taken by A. Catenazzi were used for descriptions of coloration in life and are available for all new specimens at the Calphoto online database (<http://calphotos.berkeley.edu>). Specimens collected were deposited in the herpetological collections of the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos (MUSM) in Lima, Peru. Other museum acronyms follow Sabaj Pérez (2010). For specimens examined, see Appendix I. All geographic coordinates were based on the WGS84 datum.

FIG. 1. Dorsal (A) and ventral (B) views of preserved holotype of *Gastrotheca phelloderma* (MUSM 27739, SVL 48.3 mm). Photos by E. Lehr.

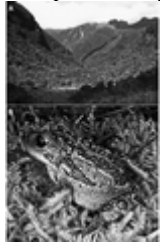


FIG. 2. Lateral (A) view of head (MUSM 27739, holotype) and ventral views of hand (B, MUSM 27741, paratype) and foot (C, MUSM 27752, paratype) of *Gastrotheca phelloderma*. Drawings by E. Lehr.



Holotype.—MUSM 27739 (Fig. 1), an adult female from Parque Nacional del Río Abiseo at Pampa del Cuy (07°34.8'S, 77°27.0'W; Fig. 3A) ca. 24 km NE Pataz at 3400 m elevation, Distrito de Huicungo, Provincia de Mariscal Cacerés, Región de San Martín, Peru, collected by M. Leo on 3 August 1990.

FIG. 3. Type locality Pampa del Cuy, Río Abiseo National Park (A). Live male *Gastrotheca phelloderma* (B, MUSM 15965, SVL 37.9 mm) from Alpamachay (7°58'41"S, 77°21'13"W, 3470 m) ca. 38 km SE of Pampa de Cuy, Río Abiseo National Park. Photos by A. Catenazzi.

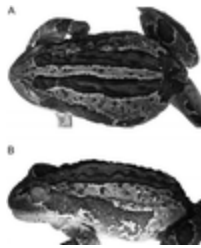


Paratypes.—A total of 28 specimens: 6 adult males (MUSM 15966–67, 3760–61, 27751, 27753), 20 adult females (MUSM 3756–3759, 27735–38, 27740–50, 27752), 2 juveniles (MUSM 27606: Gosner Stage 46, 27754: Gosner Stage 45). Twenty specimens (MUSM 27735–38, 27740–54, 27606) were collected along with the holotype at Pampa del Cuy, ca. 24 km NE Patata at 3380 m elevation by M. Leo in 1990; two specimens (MUSM 15966–67) from Parque Nacional del Río Abiseo collected by L. Rodríguez in 1989; six specimens (MUSM 3756–3761) from Parque Nacional del Río Abiseo collected by L. Rodríguez in 1987.

Referred specimens.—Two desiccated specimens (MUSM 15973–74) from Parque Nacional del Río Abiseo collected by L. Rodríguez in 1989; one specimen (MUSM 15965, male, SVL 37.9 mm; Fig. 3B) was not available as loan but served as a photo voucher, collected at Alpamachay (7°58'41"S, 77°21'13"W, 3470 m) ca. 38 km SE of Pampa de Cuy, Parque Nacional del Río Abiseo by L. Rodríguez and A. Catenazzi on 15 July 1999.

Diagnosis.—A medium-sized species of *Gastrotheca* (to 57.7 mm in females, to 43.8 mm in males) with: (1) tibia length \leq 52% SVL, slightly shorter than foot; (2) interorbital distance slightly larger than width of upper eyelid; (3) skin on dorsum with prominent longitudinal ridges and scattered warts (Fig. 4), not co-ossified with skull, lacking transverse ridges; (4) supraciliary processes absent; (5) heel lacking calcar or tubercle; (6) tympanic annulus smooth; (7) Finger I slightly larger than Finger II, width of discs about equal to digits; (8) fingers unwebbed; (9) webbing extending to penultimate subarticular tubercle on Toe IV, to distal subarticular tubercle on Toe V; (10) in life, dorsum pale grayish brown with reddish-brown paravertebral markings or blotches; (11) head markings consisting of pale margin of upper lip; (12) pale dorsolateral stripe absent; (13) in life, flanks tan with a reddish-brown diagonal stripe extending from behind jaw to middle of flank; (14) in life, venter cream; (15) single brood pouch.

FIG. 4. Dorsal (A) and lateral (B) views of female *Gastrotheca phelloderma* (MUSM 27750, SVL 54.7 mm) showing skin texture composed of dorsal and dorsolateral ridges and scattered warts. Photos by E. Lehr.



Gastrotheca phelloderma is readily distinguished from the other species of *Gastrotheca* by having the dorsum with two dark brown paravertebral markings bearing prominent longitudinal ridges and warts (Figs. 3 and 4). *Gastrotheca phelloderma* differs from the two other species of *Gastrotheca* (*G. ossilaginis*, *G. phalarosa*) known from the Region San Martín in the Andes of northern Peru (Fig. 5) by lacking integumentary-cranial co-ossification (present in *G. ossilaginis*), by having the skin on dorsum with prominent longitudinal ridges and warts (dorsal skin shagreen in *G. ossilaginis*), and in producing tadpoles (direct development in *G. ossilaginis*; Table 1). *Gastrotheca phelloderma* most closely resembles *G. phalarosa*. Both species produce tadpoles, have fingers and toes with lateral fringes, and Finger I larger than Finger II with discs barely wider than digits (in *G. phalarosa*) or equal to digits (in *G. phelloderma*). *Gastrotheca phelloderma* differs from *G. phalarosa* by having the skin on dorsum with prominent longitudinal ridges (absent in *G. phalarosa*), the venter granular (smooth except granular on posterior part of belly and proximal posteroventral surfaces of thighs in *G. phalarosa*), a palmar tubercle (absent in *G. phalarosa*), a long and distinct inner tarsal fold (barely evident on distal fifth of tarsus in *G. phalarosa*), and the throat and belly grayish tan (black with white spots in *G. phalarosa*). *Gastrotheca phelloderma* differs from *Gastrotheca monticola*, which is known from the northern Peruvian Regions of Amazonas, Cajamarca, and Piura and from southern Ecuador by being smaller (SVL to 57.7 mm vs. 73 mm in *G. monticola*; Duellman et al., 2001), and having the belly uniform pale grayish tan (cream with black spots in *G. monticola*). Both *Gastrotheca phelloderma* and *Gastrotheca pseustes* from southern Ecuador have narrow discs on fingers and produce tadpoles, but *G. phelloderma* is smaller (to 57.7 mm SVL vs. 62 mm in *G. pseustes*; Duellman and Hillis, 1987) and has the skin on dorsum with prominent ridges and warts (skin on dorsum granular, pustular or areolate), Finger I > II (Finger I = II in *G. pseustes*). Other species of *Gastrotheca* from southern Ecuador include *G. litonedis* (male SVL to 53 mm; Duellman and Hillis, 1987) and *G. psychrophila* (male SVL to 50 mm; Duellman and Hillis, 1987), both of which have larger males than *G. phelloderma* (male SVL to 43.8 mm). Furthermore, *G. phelloderma* differs from *G. psychrophila* in having Finger I > II (Finger I < II in *G. psychrophila*), and from *G. litonedis* in having the skin on dorsum with prominent ridges and warts (usually areolate in *G. litonedis*) and finger and toe discs about equal to the width of digit (twice the width of digit in *G. litonedis*). *Gastrotheca longipes* from the Upper Amazon Basin in Ecuador and northern Peru usually has a uniform green dorsal coloration (grayish tan with reddish-brown paravertebral markings in *G. phelloderma*) and the fingers webbed (unwebbed in *G. phelloderma*). From other Peruvian species of *Gastrotheca*, *G. phelloderma* (SVL to 57.7 mm in adult females) can be distinguished by its smaller size compared to *G. lateonota* (to 63.7 mm; Duellman and Trueb, 1988), *G. stictopleura* (to 68.3 mm; Duellman et al., 2001), *G. cariniceps* (to 79.7 mm; Duellman et al., 2006), or *G. testudinea* and *G. weinlandii*, in both of which females attain SVLs of >80 mm (Duellman et al., 2001).

Gastrotheca phelloderma is much larger than *Gastrotheca griswoldi* (to 44.0 mm; Duellman and Fritts, 1972), *Gastrotheca ochoai* (to 37.9 mm; Duellman and Fritts, 1972), *Gastrotheca pachachacae* (to 35.3 mm; Catenazzi and von May, 2011), *Gastrotheca pacchamama* (to 38.0 mm; Duellman, 1987), *Gastrotheca marsupiata* (to 46.5 mm; Duellman and Fritts, 1972), *Gastrotheca peruana* (to 52.8 mm; Duellman and Fritts, 1972), *Gastrotheca rebecca* (to 45.7 mm; Duellman and Trueb, 1988), and *Gastrotheca excubitor* (to 47.3 mm; A. Catenazzi, personal observation), and produces tadpoles, whereas all others mentioned herein (except *G. peruana* and *G. marsupiata*) have direct development. *Gastrotheca phelloderma* differs from *Gastrotheca galeata* in being slightly smaller (to 57.7 mm SVL vs. to 59.4 mm in *G. galeata*; Trueb and Duellman, 1978), and by lacking a casqued, co-ossified head (present in *G. galeata*). *Gastrotheca phelloderma* has a rounded snout in dorsal view, whereas *Gastrotheca abdita*, *G. ochoai*, and *Gastrotheca zeugocystis* have the snouts acuminate in dorsal view. *Gastrotheca atympanais* is unique in lacking a tympanum (present in *G. phelloderma*).

FIG. 5. Type localities of *Gastrotheca phelloderma*, *G. ossilaginis*, and *G. phalarosa*. Arrows indicate the Río Abiseo, a tributary of the Río Huallaga.

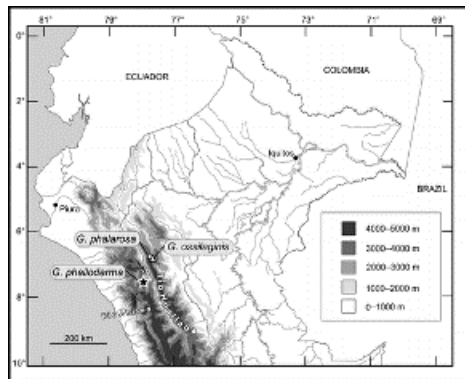


TABLE 1. Comparisons of *Gastrotheca phelloderma* with the two other species of *Gastrotheca* (*G. ossilaginis*, *G. phalarosa*) known from the Region San Martín in the Andes of northern Peru.

Characters	<i>G. phelloderma</i> (this paper)	<i>G. ossilaginis</i> (Duellman and Venegas, 2005)	<i>G. phalarosa</i> , (Duellman and Venegas, 2005)
Female SVL	46.9–57.7 (53.5 ± 3.0) <i>n</i> = 21	44.3–53.3 <i>n</i> = 2	43.3 <i>n</i> = 1
Male SVL	35.3–43.8 (41.6 ± 3.2) <i>n</i> = 6	36.7–38.5 <i>n</i> = 2	45.2 <i>n</i> = 1
Skin on dorsum	With prominent longitudinal ridges and scattered warts	Finely shagreen	With scattered prominent pustules
Skin on head	Not co-ossified	Co-ossified with skull	Not co-ossified
Skin on belly	Granular	Coarsely areolate	Smooth anteriorly, granular posteriorly
Coloration of belly in preservative	Cream	Creamy gray to grayish tan	Black with white spots
Comparative lengths of Fingers I and II	I > II	I < II	I > II
Reproduction	Tadpoles	Direct	Tadpoles
Elevational distribution (m)	3380–3470	3000–3100	3435

Notes: Comparisons of *Gastrotheca phelloderma* with the two other species of *Gastrotheca* (*G. ossilaginis*, *G. phalarosa*) known from the Region San Martín in the Andes of northern Peru.

Description of holotype.—An adult female (Fig. 1); body moderately robust; head wider than long, as wide as body; snout rounded in dorsal view, bluntly rounded in lateral profile (Fig. 2A); canthus rostralis elevated, straight, angular in section; loreal region concave; lips flared; top of head flat; interorbital distance 124% of eyelid width; internarial area slightly concave; nostrils slightly protuberant anteriorly, directed anterolaterally, well behind level of anterior margin of lower jaw; diameter of eye greater than its distance from nostril; tympanum oval, higher than wide, separated from eye by distance about equal to diameter of tympanum; tympanic annulus distinct, smooth; tympanic membrane smooth; supratympanic fold moderately weak, extending from posterior corner of upper eyelid, curving behind tympanum, slightly covering its posterior margin and ending at insertion of arm.

Fore limb robust, long; ulnar tubercles absent; hand large; fingers long with distinct, narrow lateral fringes, bearing narrow, round discs of about equal width compared to digits proximal to them (Fig. 2B); width of disc on Finger III half the diameter of tympanum; relative lengths of fingers: $I > II < IV < III$; fingers unwebbed; subarticular tubercles large, round, conical in lateral profile, none bifid; supernumerary tubercles numerous, subconical, about one-half to one-third the size of subarticular tubercles, nearly covering surfaces of hand, most prominent along segments of fingers than in between; palmar tubercles low, bifid; prepollical tubercle elliptical. Hind limb robust; tibia length 47% SVL; foot length 49% SVL; calcar and tarsal tubercles absent; inner tarsal fold distinct, extending from posterior corner of inner metatarsal tubercle along three-fourths of tarsus, sharply projecting and slightly undulated (Figs. 1B and 2C); outer metatarsal tubercle absent; inner metatarsal tubercle conical, ovoid; toes long with distinct, narrow lateral fringes, bearing narrow, round discs of about equal width compared to digits proximal to them; relative lengths of toes: $I < II < V < III < IV$; toes about one-third webbed; webbing formula $I2-3II2-3III2-2IV2-2V$; subarticular tubercles moderately large, ovoid, conical in lateral profile, none bifid except for slightly bifid penultimate subarticular tubercle on Toe IV; supernumerary tubercles small, numerous, subconical, more prominent along segments of toes than in between (Fig. 2C).

Skin on dorsum of head, body, and limbs with prominent longitudinal ridges and many scattered warts and pustules giving a tree bark-like appearance, not co-ossified with skull, lacking transverse ridges; large warts on inner margin of upper eyelid narrowing interorbital distance; small, strongly elevated pustules (higher than broad) on dorsal surface of head; paravertebral ridges from shoulder to level of sacrum consisting of elongate coalesced warts; two ridges from opening of brood pouch to level of thighs; narrowly separated ovoid warts in longitudinal row extending from level of arm insertion to groin forming an irregular dorsolateral fold; skin on flanks tubercular; skin on throat, belly, and anterior half of ventral surfaces of thighs granular, posterior half of ventral surface of thighs and posterior surface of thighs strongly granular consisting of small conical tubercles; remaining skin surfaces smooth; three large tubercles on each side below cloacal opening; opening of pouch V-shaped with anterior border at level of posterior edge of sacrum. Dentigerous processes of vomers narrowly separated medially between small ovoid choanae, each bearing four teeth. Tongue broadly cordiform, shallowly notched posteriorly, free behind for about one-fourth of its length.

Measurements of holotype (in mm).—SVL 48.3, TL 22.7, FL 23.8, HL 19.4, HW 19.7, ED 5.7, TY 3.0, IOD 5.7, EW 4.6, IND 3.5, E–N 4.6, N–J 3.7, O–J 2.5, F1L 5.8, F3L 15.3, DF3 1.5.

Coloration of holotype in preservative.—Dorsal and lateral ground color dark gray (Fig. 1). Each upper eyelid with a dark grayish-brown blotch, interorbital bar absent; one dark grayish-brown, irregularly shaped paravertebral stripe on each side extending from mid level of tympanum to cloacal opening; left paravertebral stripe continuous until brood pouch, then followed by dark grayish-brown blotch at left side of brood pouch opening, and by a stripe extending from inside the brood pouch opening diagonally to left corner of cloacal opening; right paravertebral stripe as described for left, but with a separation at level behind arm insertion; each upper arm anteriorly with a small dark grayish-brown blotch, dorsal surface of each upper arm below elbow with a dark grayish-brown bar, and a second one above ankle of hand, small blotch dorsolaterally on Finger IV; dorsal surface of each thigh with a dark grayish-brown bar; posterior surface of thighs dark gray with minute black spots; one dark grayish-brown bar on knee, one ovoid dark grayish-brown blotch dorsally on middle of shank, outer surface of foot with two dark grayish-brown blotches; head laterally dark gray, canthal stripe absent; upper lip pale at level below eye and tympanum pale gray otherwise dark gray; irregularly shaped dark grayish-brown blotch from posterior corner of eye across tympanum to upper half of middle of flank; flanks dark gray with minute black spots; throat pale gray to white, with few black spots on its margin; chest, belly, and extremities ventrally cream, except for pale gray tarsus.

Coloration of holotype in life.—Unknown.

Variation.—Coloration in life is based on photos taken by A. Catenazzi from a male and female specimen. Male specimen (MUSM 15965; Fig. 3B): Venter cream with pattern of brown spots. Paravertebral brown rows join posterior to midbody on dorsum. Ventral surfaces of hands and feet and pericloacal region yellow (A. Catenazzi, field notes). Female specimen: Dorsum grayish tan. A reddish-brown paravertebral stripe on each side from upper eyelid to cloacal opening surrounded by pale gray; canthal and interorbital stripes absent, upper lip at level of tympanum and eye pale gray to white otherwise grayish tan. Reddish-brown flecks laterally on head posterior to eye, followed by reddish-brown stripe extending from posterior corner of tympanum to middle of flank, surrounded by black; flanks grayish tan with few minute dark brown spots; few pale green flecks scattered dorsally on head and laterally below eye; extremities dorsally with reddish-brown ovoid blotches surrounded by dark brown followed by a surrounding of pale gray; venter pale gray; iris reddish brown with fine black reticulations, pupil with a bronze ringlet.

Coloration and skin texture are highly variable. Large warts and ridges are associated with dark brown paravertebral markings, which are usually continuously extending from upper eyelid to cloacal opening. The longest dorsal ridges are found in a female (MUSM 27750; Fig. 3). Males are smaller than females, have vocal slits, a median subgular vocal sac, which is cream with dark gray or brown flecks, and pale cream nuptial pads on dorsal surface of thumb and dorsolateral surface of prepollical tubercle. Juveniles (MUSM 27606: Gosner Stage 46, SVL 25.0 mm; MUSM 27754: Gosner Stage 45, SVL 23 mm) have the typical coloration pattern consisting of brown paravertebral markings extending from upper eyelid to sacrum, but dorsal skin texture

(longitudinal ridges, warts) is weakly developed (MUSM 27606) or absent (MUSM 27754). For ranges and proportions of the type series of *G. phelloderma* see Table 2.

TABLE 2. Measurements (in mm) and proportions of *Gastrotheca phelloderma*; ranges followed by means and one standard deviation in parentheses.

Characters*	<i>G. phelloderma</i>	
	Females (n = 21)	Males (n = 6)
SVL	46.9–57.7 (53.5 ± 3.0)	35.3–43.8 (41.6 ± 3.2)
TL	21.8–27.0 (23.6 ± 1.4)	18.4–20.4 (19.4 ± 0.9)
FL	21.2–26.6 (24.1 ± 1.3)	18.7–21.1 (19.8 ± 0.9)
HL	18.0–21.4 (19.5 ± 1.0)	16.1–18.1 (16.7 ± 0.7)
HW	19.1–23.3 (21.4 ± 0.9)	16.2–19.5 (18.1 ± 1.2)
ED	4.6–6.2 (5.4 ± 0.4)	4.3–4.8 (4.6 ± 0.2)
TY	2.1–4.4 (2.7 ± 0.5)	2.0–2.7 (2.3 ± 0.3)
IOD	3.4–6.6 (5.4 ± 1.0)	3.3–5.3 (4.4 ± 0.6)
EW	3.9–6.2 (5.0 ± 0.6)	3.7–4.9 (4.3 ± 0.4)
IND	3.1–4.1 (3.6 ± 0.3)	2.9–3.3 (3.1 ± 0.2)
E–N	4.5–5.7 (5.0 ± 0.3)	3.7–5.2 (4.6 ± 0.5)
N–J	3.7–5.1 (4.1 ± 0.3)	3.2–3.6 (3.4 ± 0.2)
O–J	2.5–3.6 (3.0 ± 0.3)	2.2–2.5 (2.4 ± 0.1)
F1L	8.1–10.9 (9.9 ± 0.7)	6.8–8.7 (7.9 ± 0.9)
F3L	13.4–16.3 (14.6 ± 0.7)	10.7–13.1 (11.9 ± 0.9)
DF3	1.5–2.3 (2.0 ± 0.2)	1.3–1.6 (1.5 ± 0.1)
TL/SVL	0.39–0.51	0.42–0.52
FL/SVL	0.38–0.52	0.45–0.53
HL/SVL	0.33–0.41	0.38–0.46
HW/SVL	0.38–0.44	0.41–0.46
HW/HL	1.02–1.17	1.01–1.10
E–N/IOD	0.77–1.16	0.84–1.08
EW/IOD	0.71–1.32	0.87–1.14
TY/IOD	0.39–0.81	0.45–0.56

* Abbreviations: snout–vent length (SVL), tibia length (TL), foot length (FL, distance from proximal margin of inner metatarsal tubercle to tip of Toe IV), head length (HL, from angle of jaw to tip of snout), head width (HW, at level of angle of jaw), eye diameter (ED), tympanum diameter (TY), interorbital distance (IOD), upper eyelid width (EW), internarial distance (IND), eye–nostril distance (E–N, straight line distance between anterior corner of orbit and posterior margin of external nares), nostril–jaw distance (N–J, horizontal distance between the ventral margin of the external nares and the upper lip), orbit–jaw distance (O–J, horizontal distance between the ventral margin of the orbit and the margin of the upper lip), Thumb length (F1L, distance from the proximal edge of the prepollical tubercle to the tip of the finger), Finger–III length (F3L, distance from the proximal edge of the pulnar tubercle to the tip of the finger), and width of disc on Finger III (DF3, at middle of disc).

Notes: Measurements (in mm) and proportions of *Gastrotheca phelloderma*; ranges followed by means and one standard deviation in parentheses.

Etymology.—The specific name *phelloderma* is derived from the Greek noun *phellos* meaning cork, bark, and the Greek noun *derma* meaning skin. The specific epithet is a noun and refers to the skin texture of the new species, which reminds us of the bark of a tree such as an oak.

Distribution and ecology.—The species is known from two sites (Pampa del Cuy and Alpamachay) in the Río Abiseo National Park (Fig. 5). One adult female (MUSM 27742) contained in the brood pouch 49 embryos at Gosner Stage 31. Two collected specimens at Gosner Stages 45 and 46 indicate development by tadpoles. The conservation status of populations within the Río Abiseo National Park is unknown. The fungus *Batrachochytrium dendrobatidis*, which causes chytridiomycosis in amphibians and has been linked to population declines of anuran species in the Peruvian Andes (Catenazzi et al., 2011; Seimon et al., 2007), has been detected in populations of *Atelopus patazensis* near Río Abiseo National Park (Venegas et al., 2008). The presence of this fungus could pose a threat to the conservation of *G. phelloderma* within the park.

Remarks

The Río Abiseo National Park was established in 1983 and is located in the eastern Andes at 7°45'S and 77°30'W in the San Martín Region of Peru between the Marañón and Huallaga rivers (Fig. 5). The park covers an area of approximately 2745 km² including 70% of the Abiseo River

basin. Elevations inside the park extend from 350–4200 m. Pampa del Cuy is located in the northwest sector of the park at 07°34.8'S, 77°27.0'W between 3400–3600 m. The type locality consists of wet puna and subpáramo grasslands, sympatric anurans include *Telmatobius atahualpai* and undescribed species of *Phrynopus* and *Pristimantis*. Leo (1995) assessed the endemism of three vertebrate groups (frogs, birds, and mammals) of the Río Abiseo National Park. She reported seven endemic and undescribed species of anurans for the park, including two species of *Phrynopus*, two *Eleutherodactylus* (= *Pristimantis*), one “*Hyla*,” and two species of *Gastrotheca*, including *Gastrotheca* sp. nov. 1 described here. Instituto Nacional de Recursos Naturales (2003) mentions 30 species of amphibians for the national park.

Acknowledgments

For loan of material we thank J. H. Córdova (MUSM). K. Siu-Ting kindly provided museum numbers for the specimens of *Gastrotheca* from the Río Abiseo National Park. We thank W. E. Duellman and I. Nunes for their constructive revision of our manuscript.

Literature Cited

- Catenazzi, A., and E. Lehr. 2009. The generic allocation of “*Hyla*” *antoniochoai* De la Riva & Chaparro, 2005 (Anura), with description of its advertisement call and ecology. *Zootaxa* 2304:61–68.
- Catenazzi, A., and R. von May. 2011. New species of marsupial frog (Hemiphractidae: *Gastrotheca*) from an isolated montane forest in southern Peru. *Journal of Herpetology* 45:161–166. BioOne
- Catenazzi, A., E. Lehr, L. O. Rodriguez, and V. T. Vredenburg. 2011. *Batrachochytrium dendrobatidis* and the collapse of anuran species richness and abundance in the upper Manu National Park, southeastern Peru. *Conservation Biology* 25:382–391. CrossRef, PubMed
- De la Riva, I., and J. C. Chaparro. 2005. A new species of treefrog from the Andes of southeastern Peru. *Amphibia-Reptilia* 26:515–521. CrossRef
- Duellman, W. E. 1987. Two new species of marsupial frogs (Anura: Hylidae) from Peru. *Copeia* 1987:903–909. CrossRef
- Duellman, W. E., and T. H. Fritts. 1972. A taxonomic review of the southern Andean marsupial frogs (Hylidae: *Gastrotheca*). *Occasional Papers of the Museum of Natural History, The 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 E. Lehr. 2009. *Terrestrial-Breeding Frogs (Strabomantidae) in Peru* Natur und Tier-Verlag, Münster, Germany.

- Duellman, W. E., and L. Trueb. 1988. Cryptic species of hylid marsupial frogs in Peru. *Journal of Herpetology* 22:159–179. CrossRef
- Duellman, W. E., and P. Venegas. 2005. Marsupial frogs (Anura: Hylidae: *Gastrotheca*) from the Andes of northern Peru with the descriptions of two new species. *Herpetologica* 61:295–307. BioOne
- 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, The University of Kansas Natural History Museum* 22:1–10.
- Duellman, W. E., E. Lehr, D. Rodríguez, and R. von May. 2004. Two new species of marsupial frogs (Anura: Hylidae: *Gastrotheca*) from the Cordillera Oriental in central Peru. *Scientific Papers, The University of Kansas Natural History Museum* 32:1–10.
- Duellman, W. E., L. Trueb, and E. Lehr. 2006. A new species of marsupial frog (Anura: Hylidae: *Gastrotheca*) from the Amazonian slopes of the Cordillera Oriental in Peru. *Copeia* 2006:595–603. BioOne
- Frost, D. R. 2011. Amphibian Species of the World: An Online Reference. Version 5.5 (January 31, 2011). American Museum of Natural History, New York, New York, USA. Available at: <http://research.amnh.org/vz/herpetology/amphibia/>.
- Gosner, K. L. 1960. A simplified table for staging anuran embryos and larvae with notes on identification. *Herpetologica* 16:183–190.
- Instituto Nacional de Recursos Naturales (INRENA). 2003. Parque Nacional del Río Abiseo. Plan Maestro 2003–2007 Imprenta CANAO s.r.l., Lima, Peru.
- Leo, M. 1995. The importance of tropical montane cloud forests for preserving vertebrate endemism in Peru: The Río Abiseo National Park as a case study. Pp. 198–211. *In* L. S. Hamilton, J. O. Juvik, and F. N. Scatena (Eds.), *Tropical Montane Cloud Forests, Ecological Studies* 110. Springer, New York, New York, USA.
- Limbaugh, B. A., and E. P. Volpe. 1957. Early development of the Gulf Coast Toad, *Bufo valliceps* Wiegmann. *American Museum Novitates* 1842:1–32.
- 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.
- Sabaj Pérez, M. H. (Ed.). 2010. Standard Symbolic Codes for Institutional Resource Collections in Herpetology and Ichthyology: An Online Reference. Version 2.0 (November 8, 2010). American Society of Ichthyologists and Herpetologists, Washington, DC, USA, Available at: <http://www.asih.org/>.
- Savage, J. M., and W. R. Heyer. 1967. Variation and distribution of the tree-frog genus *Phyllomedusa* in Costa Rica, Central America. *Beiträge zur Neotropischen Fauna* 5:111–131. CrossRef

Seimon, T., A. Seimon, P. Daszak, S. Halloy, L. Schloegel, C. Aguilar, P. Sowell, A. Handatt, B. Konecky, and J. Simmons. 2007. Upward range extension of Andean anurans and chytridiomycosis to extreme elevations in response to tropical deglaciation. *Global Change Biology* 13:288–299. CrossRef

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

Venegas, P. J., A. Catenazzi, K. Siu-Ting, and J. Carrillo. 2008. Two new species of harlequin frogs (Anura: Bufonidae: *Atelopus*) from the Andes of northern Peru. *Salamandra* 44:163–176.

Appendix I

Comparative Specimens Examined

Gastrotheca abdita.—PERU: Amazonas: Cordillera Colán, E La Peca, 2970–3330 m: KU 196833 (holotype), 196834–35 (paratypes).

Gastrotheca antoniiiochoai.—PERU: Cusco: Paucartambo: Paucartambo–Shintuya road, Wayqecha Research Center, 13°11′07.8″S, 71°35′18.5″W, 2950 m: MUSM 27944–49.

Gastrotheca atympana.—PERU: Junín: Pampa Hermosa, 1540 m: MUSM 18692 (holotype).

Gastrotheca cariniceps.—PERU: Pasco: Parque Nacional Yanachaga, 2200 m: MUSM 19901 (holotype), MTD 45943 (paratype), Huánuco: Mayobamba, 1230 m, coll. October 1985: MUSM 7409.

Gastrotheca excubitor.—PERU: Cusco: Paucartambo: N slope Abra Acanacu, 31 km NNE Paucartambo, 3370 m: KU 139194 (holotype) and KU 139195–6 (paratypes), 33 km NNE Paucartambo: KU 139193 (paratype), 29 km NNE Paucartambo: KU 139198 (paratype), Abra Acjanaco: MUSM 27934–35, 27872–74, KU 139199–201 (paratypes).

Gastrotheca galeata.—PERU: Piura: 15 km (by road) E Canchaque, 1740 m: KU 174361–64, 181700, 15.8 km (by road) E Canchaque, 1890 m: KU 219765–66, MUSM 15416, 16 km (by road) E Canchaque, 1900 m: MUSM 15417.

Gastrotheca griswoldi.—PERU: Junín: Comas, 3220 m: KU 138222–31, 138813–21, Maraynioc, 72 km NE Tarma: KU 137583–137587 (paratypes), 6 km ENE Paccha, 3840 m: KU 181701–20, 3 km WSW Huaricolca, 3890 m: KU 181721–23, Huaropampa, Río Mantaro, 3540 m: KU 181724, 32 km SE La Oroya, 3600 m: KU 181725–26, 14 km SW La Oroya, 4020 m: KU 181727–28.

Gastrotheca lateonota.—PERU: Piura: El Tambo, 31.5 km E Canchaque, 2180 m: KU 181730 (holotype), 181729, 181731–39 (paratypes).

Gastrotheca longipes.—ECUADOR: Pastaza: Chichirota, Río Bobonaza: KU 182373.

Gastrotheca marsupiata.—PERU: Cusco: Paucartambo: Tres Cruces, 18 km north of Paucartambo, 3670 m: MVZ 57804, 14.5 km S Paucartambo, 3450 m: KU 139187–88, Cusco, San Jerónimo, 3150 m: KU 204007–11; Apurímac: 39 km NE Abancay, 3900 m: KU 163219–28, 70 km W Abancay, 3760 m:

KU 163229–31, 35 km W Andahuaylas, 3720 m: KU 163232–45, Abra Soraccocha, 4080 m: KU 163246–48; Ayacucho: 38 km S Ayacucho, 3710 m: KU 163249–50, 7 km N Mahuayura, 3710 m: KU 163251–52, 31 km SW Ayacucho, 3720 m: KU 163253, 18 km E Niñobamba, 3570 m: KU 163254–69.

Gastrotheca monticola.—PERU: Cajamarca: Cutervo, 2620 m: KU 212055–66.

Gastrotheca ochoai.—PERU: Cusco: Chilca, 10 km N Ollantaytambo, 2760 m: KU 138628–65, 139202–09, 148572.

Gastortheca ossilaginis.—PERU: San Martín: Lago Quindecocha, 3100 m: MUSM 19486 (holotype), 19488, KU 272293 (paratypes).

Gastrotheca pacchamama.—PERU: Ayacucho: N slope Abra Tapuna, 7 km N of Mahuayura, 3710 m: KU 163288 (holotype), KU 163279–87, KU 163289–301 (paratypes).

Gastrotheca pachachacae.—PERU: Apurímac: Chinchay, District of Pacobamba, 3050 m: MUSM 28489 (holotype), MUSM 28490–92 (paratypes).

Gastrotheca peruana.—PERU: Huánuco: 5 km NE La Unión, 3100 m: KU 138411–52.

Gastrotheca phalarosa.—PERU: San Martín: Esperanza, 3435 m: MUSM 19487 (holotype), 19472 (paratype).

Gastrotheca rebecca.—PERU: Ayacucho: 7.5 km SW Cano, 2970 m: KU 163302–03, Ccarpa, below Tambo on Valle de Apurimac Trail, 2470 m: KU 196806–11, Yuraccayacu on Tambo-Valle de Arpurimac Trail, 2680 m: KU 196800–05.

Gastrotheca stictopleura.—PERU: Huánuco: Chaglla, 3090 m: MUSM 20319 (holotype), Cordillera de Carpish, 2625 m: MTD 45615.

Gastrotheca testudinea.—PERU: Ayacucho: Río Piene, Tutumbaro, 1840 m: KU 163271–74; Cusco: Paucartambo: Paucartambo–Shintuya road: MUSM 27942–43, 4 km SW Santa Isabel, Río Cosñipata, 1700 m: KU 163270. Pasco: Yaupi: MTD 45907.

Gastrotheca weinlandii.—PERU: Amazonas: Cordillera Colán, ca. 20 km E La Peca, 2000 m: KU 196820.

Gastrotheca zeugocystis.—PERU: Huánuco: Cordillera de Carpish, 2920 m: MUSM 18675 (holotype).