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A new species of *Phrynopus* from Departamento Cusco, southern Peru (Anura: Brachycephalidae)

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Abstract

We describe a new species of *Phrynopus* (Anura: Brachycephalidae) from two close localities at the upper limits of cloud forest in the southern Peruvian Departamento Cusco, between 3555–3950 m a.s.l. The new species is characterized by having medium size (maximum snout-vent length 23.4 mm), dentigerous processes of vomers absent, tympanic membrane inconspicuous, dorsal skin coarsely shagreen in life, dorsolateral folds, ventral skin areolate, dorsum tan, venter bold black with conspicuous bluish-gray spots, and a bluish-white iris.

Key words: Andes, Peru, *Phrynopus*, Anura

Introduction

Frogs of the genus *Phrynopus* Peters, 1874 occur along the Andes of Colombia, Ecuador, Peru, and Bolivia, between 1000 and 4400 m a.s.l. (De la Riva 1992; Lehr *et al.* 2005a; Lynch 1975; Lehr 2006). The genus comprises 29 species, with more than half of them described during the last 15 years (see Frost 2007). Nineteen species are known from Peru, many of them described recently (e. g., Duellman 2000; Lehr 2001, 2006; Lehr & Aguilar 2002, 2003; Lehr *et al.* 2000, 2002*a*, 2002*b*, 2005*b*). Nevertheless, many new species remain to be described in Peru and Bolivia. Intensive fieldwork during the last two years along the southern Andes of Peru revealed high species level endemism associated to glacial valleys. Several new species of *Phrynopus* were discovered and one of them is herein described.

Material and methods

Specimens were fixed in 10% formalin and preserved in 70% ethanol. The format for the description follows that of Lynch (1975). Specimens examined are listed in the Appendix. Measurements were taken with a digital caliper to the nearest 0.1 mm. Abbreviations are as follows: SVL (snout-vent length), TL (tibia length), FL (foot length, distance from posterior margin of inner metatarsal tubercle to tip of fourth toe), HL (head length, from posterior margin of jaw to tip of snout), HW (head width, maximum width of head), ED (horizontal eye

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diameter), IOD (interorbital distance), EW (eyelid width), IND (internarial distance), END (eye-nostril distance, straight line distance between anterior corner of orbital opening and posterior margin of external nares). Description of coloration in life is based on the field notes by J.C.C. Drawings were made by K. Siu-Ting using a stereomicroscope with a camera lucida. Museum abbreviation refers to Museo de Historia Natural, Universidad Nacional de San Antonio Abad, Cusco, Peru (MHNC).

Systematics

Phrynopus bustamantei sp. nov.

(Figs. 1–4)

Holotype. MHNC 6018, an adult female (Fig. 1), from Canchayoc (13°07'16.2" S, 72°19'53.0" W, 3663 m a.s.l.), near Abra de Málaga, Distrito de Huayopata, Provincia de la Convención, Departamento Cusco, Peru, collected on 15 April 2007 by J. C. Chaparro and J. A. Ochoa.

Paratypes. MHNC 6019, adult male (Fig. 2) from near Canchayoc (13°06'56.4" S, 72°20'29.0" W, 3621 m a.s.l.), collected on 6 August 2006 by J. A. Ochoa; MHNC 6017, subadult male from near Canchayoc (13°07'20.9"S, 72°19'28.0" W, 3741 m a.s.l.), collected on 6 August 2006 by J. A. Ochoa; MHNC 6015, a subadult female from near Canchayoc (13°06'49.7" S, 72°21'17.8" W, 3555 m a.s.l.), collected on 15 April 2007 by J. A. Ochoa; MHNC 6016, a juvenile, from near Canchayoc (13°06'49.7" S, 72°21'17.8" W, 3555 m a.s.l.), collected on 6 August 2006 by J. C. Chaparro and J. A. Ochoa.

Referred specimens. Twenty-three specimens: MHNC 796–798, from Cochayoc, Distrito de Huayopata, Provincia de la Convención, Departamento Cusco, Peru, collected on 25 August 1995 by W. Arizábal and J. A.Ochoa; MHNC 800, 811– 814, from Carrizales, Distrito de Huayopata, Provincia de la Convención, Departamento Cusco, Peru, collected on 26 and 27 August 1995 by W. Arizábal and J. A. Ochoa; MHNC 861, from Cochayoc, Distrito de Huayopata, Provincia de la Convención, Departamento Cusco, Peru, collected on 24 November 1995 by A. W. Salas; MHNC 921–926, from Cochayoc, Distrito de Huayopata, Provincia de la Convención, Departamento Cusco, Peru, collected on 27 April 1996 by J. A. Ochoa; MHNC 931–936, 837, 938, from Canchayoc, Distrito de Huayopata, Provincia de la Convención, Departamento Cusco, Peru, collected on 28–30 April 1996 by J. A. Ochoa.

Diagnosis. (1) Medium-sized (maximum SVL 23.4 mm), body robust, legs short (TL+FL between 30–40% SVL); (2) tympanic membrane not apparent; (3) first finger slightly shorter than second; (4) tips of digits slightly swollen, not expanded laterally; (5) webbing of toes and lateral fringes absent; (6) two metatarsal tubercles, tarsal fold absent; (7) dorsal skin coarsely shagreen, dorsolateral folds present, ventral skin areolate; (8) snout rounded in dorsal view and in profile; (9) dorsum tan in life; (10) venter black with large, irregular, bluish-gray blotches.

Phrynopus bustamantei is distinguished from other species of *Phrynopus* by the combination of the following characters: vocal slits and vocal sac present, nuptial pads absent, tarsal fold absent, bold black venter with or without large bluish-gray to metallic white spots, orange plantar surfaces, metallic blue iris, and dorsolateral folds. *Phrynopus* species are highly endemic, most of them are allopatric, and often occupy extremely reduced ranges. To the north, the closest species to *P. bustamantei* are *P. montium* and *P. peruanus*, from Departamento Junín in central Peru, and they are separated from *P. bustamantei* by a gap of more than 400 km (airline) in which no *Phrynopus* species is known. Only four species of *Phrynopus* are known from southern Peru: *P. bagrecito, P. boettgeri, P. cophites*, and *P. peruvianus* (the last two species are sympatric and they are separated by an airline distance of 100 km from the type locality of *P. bustamantei;* the two other species occur further to the south). *Phrynopus bustamantei*, *P. bagrecito* and *P. peruvianus* are of similar size, and they have males with vocal slits and vocal sac present, but nuptial pads absent. However, *P. bustamantei* dif-

fers from these species in lacking a tarsal fold. *Phrynopus cophites* has nuptial pads on first and second finger, which are absent in *P. bustamantei*. *Phrynopus boettgeri* is smaller than *P. bustamantei* (SVL to 18.4 mm in females; Lehr 2006) and males lack vocal slits and vocal sac (both present in *P. bustamantei*). In addition to morphological and color pattern differences, due to the high degree of endemism (De la Riva, 2007) it is extremely unlikely that these populations of *Phrynopus* are conspecific or closely related.

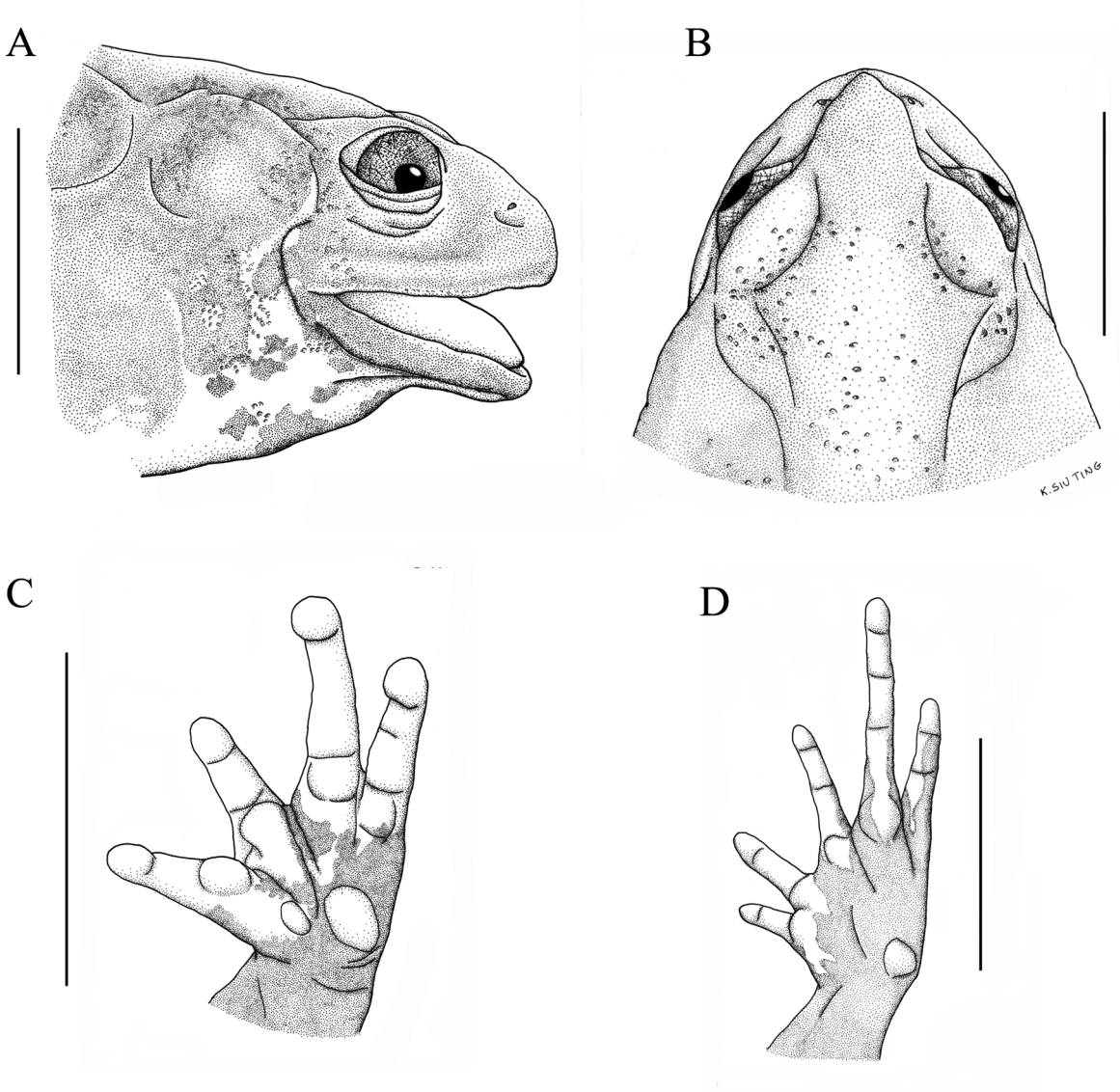

FIGURE 1. Lateral (A), and dorsal (B) views of head, and ventral views of hand (C), and foot (D) of the female holotype of *Phrynopus bustamantei* **sp. nov.** (MHNC 6018). Scale bar = 5 mm. Drawings by K. Siu-Ting.

Description of the holotype. Body robust; dorsal skin coarsely shagreen, with granules grouping; flanks warty, some warts bearing granules; ventral skin areolate; dorsolateral folds conspicuous, from posterior margin of eye to the level of sacral region; pectoral fold present; head wider than long, HW 40% of SVL; HL 30% of SVL; snout rounded in dorsal view and in profile; nostrils not protuberant, closer to snout than to eyes; canthus rostralis straight to slightly concave in dorsal view, rounded in frontal profile; END 70% of ED; loreal region slightly concave; cranial crests absent; tympanic membrane and tympanic annulus not apparent; supratympanic fold weak; tongue large, oval; choanae round, small, widely spaced; dentigerous processes of vomers absent; limbs moderately short; tips of digits barely swollen, not expanded laterally; ulnar tubercle and fold absent; inner palmar tubercle single, oval, flattened, sligthly smaller than oval outer; fingers moder-

ately short, not fringed; subarticular tubercles round, those at the basis of proximal phalanges swollen; first finger slightly shorter than second, relative length of fingers 1<2<4<3; TL 30% of SVL; tarsus lacking tubercles and folds; two metatarsal tubercles, the oval inner (not visible in holotype due to preservation, Fig. 1) slightly larger than the round outer (Fig. 4); supernumerary tubercles small, poorly defined; subarticular tubercles of the toes round, medium-size; toes not webbed, lateral fringes absent; relative length of toes 1<2<5=3<4; FL 40% of SVL.

FIGURE 2. Living male paratype of *Phrynopus bustamantei* **sp. nov.** (MHNC 6019, SVL 22.9 mm) in dorsolateral (A) and ventral (B) views. Photos by J. C. C.

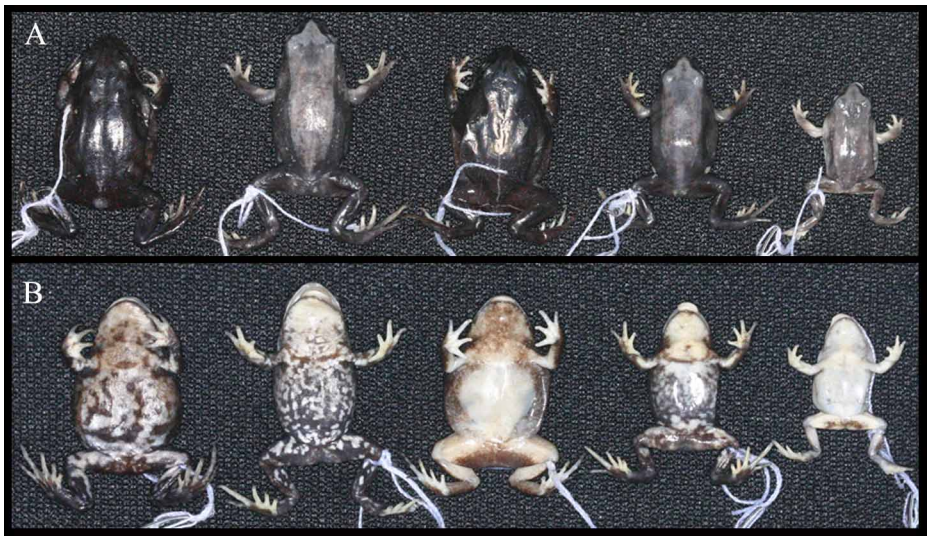

FIGURE 3. Dorsal (A) and ventral (B) views of adults and subadults of *Phrynopus bustamantei* **sp. nov.** From left to right: MHNC 6018 (holotype, adult female), MHNC 6019 (adult male), MHNC 6017 (subadult male), MHNC 6015 (subadult female), MHNC 6016 (juvenile). Photos by J. C. C.

In preservative, the holotype has dorsal surfaces, head and extremities, uniformly dark gray and a grayish-white supratympanic stripe; most parts of the belly are grayish-white and dark brown marmorated; the throat is grayish-white with dark brown blotches at the border of the chin; palmar surfaces are grayish–white with some dark gray tonalities at the distal end; plantar surfaces are dark gray with cream toes; the groin is grayish-white with dark gray blotches.

In life, the holotype exhibited a tan dorsum with dark brown diffuse marks in the interocular, occipital and middorsal regions; the dorsolateral folds were dark brown to black, and the upper lip was brownish-orange,

with a diffuse dark brown vertical bar in front of the eyes; there was a supratympanic dark brown stripe; the flanks were dark brown posteriorly, and yellow anteriorly with dark brown spots associated to prominent warts; the throat was yellowish-orange; the belly, ventral surfaces of arms and legs were bold black, with dense bluish metallic-white spots, some of them anastomosed; the fingers and toes and distal regions of plantar surfaces were orange, while the proximal regions were bold black; the iris was metallic bluish-white with black reticulations.

Measurements (in mm): SVL, 23.4; HL, 6.9; HW, 8.4; IND, 2.1; END, 1.9; ED, 2.8; TL, 8.0; FL, 9.2.

Variation. The single adult male has vocal slits and a moderately developed vocal sac, but lacks nuptial pads. Males have more prominent dorsolateral folds (Figs. 2, 3A) compared to females. Males and juveniles differ in coloration by exhibiting lighter gray color on dorsum and darker gray on flanks when compared to females. Specimens MHNC 6017 and MHNC 6019 present smaller marmorated blotches on the venter than the female holotype. The venter is light gray without dark spots in MHNC 6015 and MHNC 6016. The throat is brownish–white in the subadult female MHNC 6015 and white in the juvenile MHNC 6016. One specimen (MHNC 6015) shows a distinctive white paravertebral stripe from middorsum to vent, and it extends perpendicularly along posterior surfaces of thighs (Fig. 3). Skin texture changes in preservative. Preserved specimens have smoother dorsal skin, with granules almost imperceptible in some of them. See Table 1 for measurements of the type series.

TABLE 1. Measurements (in mm) and proportions of the type specimens of *Phrynopus bustamantei* **sp. nov.** For abbreviations see text.

	MHNC 6018	MHNC 6019	MHNC 6015	MHNC 6017	MHNC 6016
	Adult female	Adult male	Subadult female	Subadult male	Juvenile
SVL	23.4	22.9	21.6	19.0	14.3
TL	8.0	8.0	7.9	6.5	5.1
FL	9.2	9.3	9.1	7.5	5.4
HL	6.9	7.0	6.9	6.0	5.0
HW	8.4	8.0	8.3	6.4	5.7
ED	2.8	2.4	2.4	2.1	1.8
IOD	3.3	3.3	3.2	3.0	2.7
EW	1.4	1.6	1.4	1.4	1.3
IND	2.1	2.1	2.1	1.9	1.8
END	1.9	1.8	1.9	1.6	1.2
HL/SVL	0.3	0.3	0.3	0.3	0.3
HW/SVL	0.4	0.3	0.4	0.3	0.4
END/ED	0.7	0.8	0.8	0.7	0.6
TL/SVL	0.3	0.3	0.4	0.3	0.4
FL/SVL	0.4	0.4	0.4	0.4	0.4

Etymology. The name is a patronym for Javier Bustamante in recognition of his support of taxonomic research and nature conservation in Peru.

Distribution. *Phrynopus bustamantei* is known only from the Umasbamba Valley, near to Abra de Málaga, and Canchayoc, Distrito de Huayopata, Provincia de La Convención, Departamento Cusco, between 3555–3950 m a.s.l. (Fig. 5).

Ecology and natural history. This species inhabits the transitional zone from cloud forest to puna known

as “ceja de montaña” (Fig. 6). Specimens were collected during the rainy and dry seasons, under stones along roads and within bushes and grass. Males were calling from bushes during the day in April. The call consisted of a short whistle. The female holotype, collected in April, contained convoluted oviducts. Other amphibians found in sympatry were *Nannophryne corynetes, Gastrotheca excubitor, Pleurodema marmoratum, and Pristimantis rhabdolaemus.* Individuals were found in two kinds of habitats: humid, grassy puna (between 3700–3950 m) and the adjacent humid forest (between 3555–3700 m). More patterned specimens were in puna and the transitional zone between the two kinds of habitats, while less patterned individuals were found in the forest. Most individuals were under stones or moss.

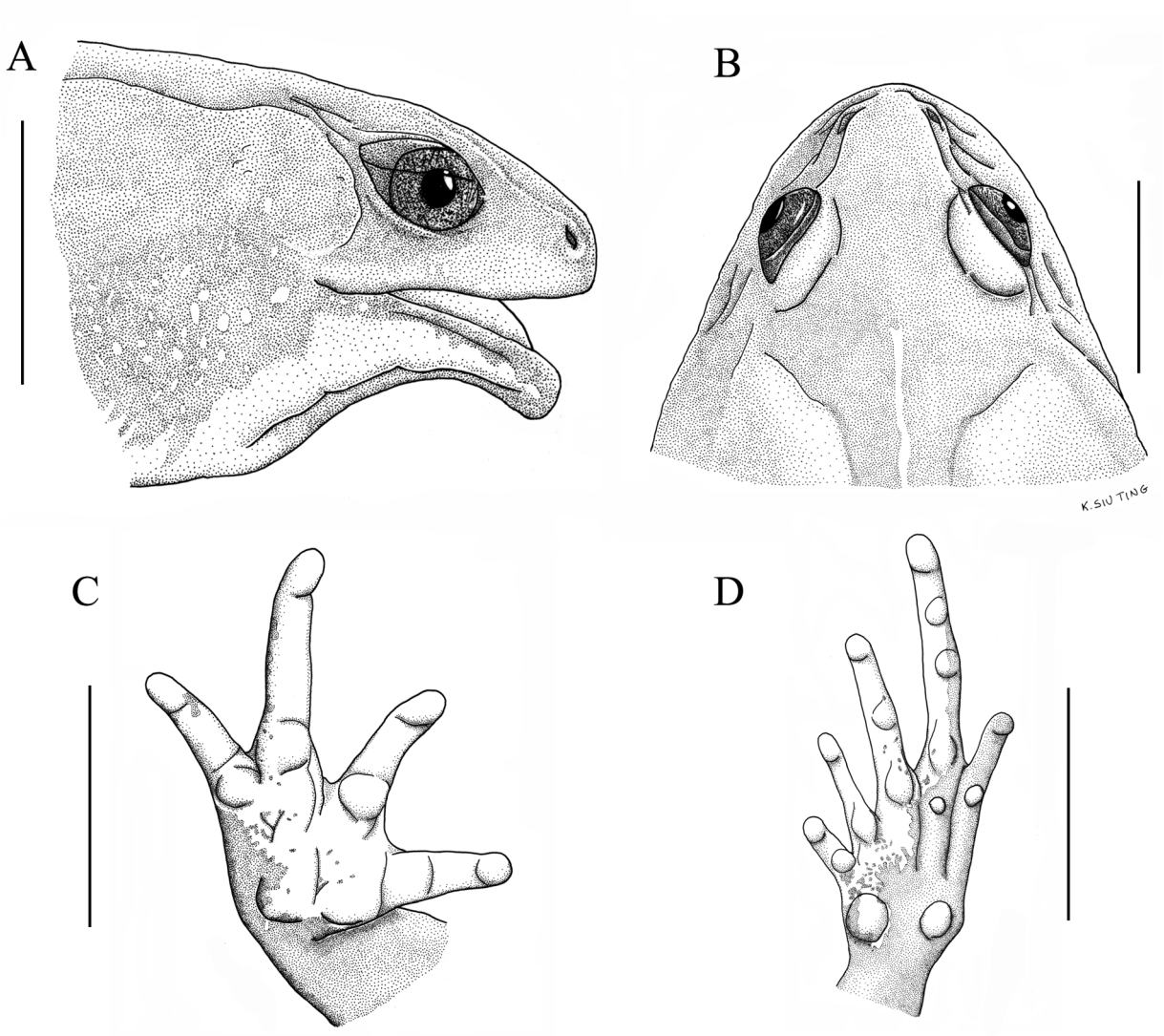

FIGURE 4. Lateral (A), and dorsal (B) views of head, and ventral views of hand (C), and foot (D) of subadult female *Phrynopus bustamantei* **sp. nov.** (MHNC 6015, paratype). Scale bar = 5 mm. Drawings by K. Siu-Ting.

Phrynopus bustamantei seems to be rare. Four surveys carried out in April, August and December 2006 and February 2007, totalizing 10 transects of 100 m each, rendered only six specimens in April and four in August. Data from 1995–1996 show similar results, which indicate a higher activity by the end of the rainy season.

Remarks. The type locality of *P. bustamantei* is being severely affected by the construction of the road Cusco-Quillabamba and the increasing human activity in the area. Given the restricted distribution of the spe-

cies and its rarity, we propose to include it as "Endangered" in the Peruvian official list of threatened species managed by the INRENA. Likewise, we propose the same category within the IUCN Red List. This proposal is based on the following facts: the range of the species is smaller than 500 km^2, its population size is reduced, and its habitat is threatened.

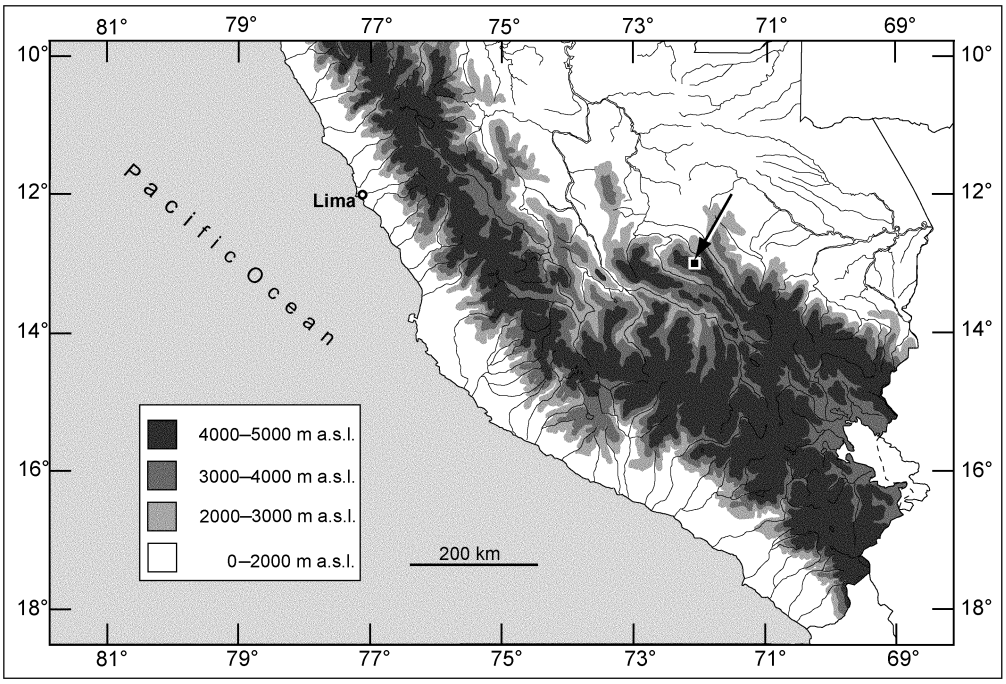

FIGURE 5. Map of southern Peru with an arrow pointing to a square indicating the type locality of *Phrynopus bustamantei* **sp. nov.**

FIGURE 6. Habitat at the type locality of *Phrynopus bustamantei* **sp. nov.** Photographed by J.C.C in August 2006.

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