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Amphibian & Reptile Conservation
9(1) [Special Section]: 15–25 (e105).

Two new species of frogs of the genus *Phrynopus* (Anura: Terrarana: Craugastoridae) from the Peruvian Andes

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***Abstract.*—We describe two new species of *Phrynopus* from the western and eastern Andes of northern and central Peru. One of them occurs in the Andean highlands of La Libertad region and is described from 20 specimens. This species can be differentiated from other *Phrynopus* species that lack a tympanum by the following combination of characters: skin of dorsum shagreen with scattered low tubercles; skin of venter smooth; no tubercles on upper eyelids; dentigerous process of vomers absent; vocal slits and nuptial pads absent; finger I slightly shorter than finger II; toe V slightly longer than toe III; and maximum SVL of females is 31.2 mm. The other species is described from three individuals found under moss-covered floors in the cloud forest of the Cordillera de Carpish, Huánuco region. It can be easily distinguished from other *Phrynopus* species by its vermilion red coloration on dorsum and venter.**

Key words. Central Peru, Cordillera de Carpish, La Libertad, Huánuco, taxonomy

***Resumen.*— Describimos dos nuevas especies de *Phrynopus* de los Andes occidentales y de los Andes orientales del centro de Perú. Una de ellases una especie de las zonas altoandinas de la región La Libertad, que puede ser diferenciada de las otras especies de *Phrynopus* que no tienen tímpano por una combinación única de caracteres que consiste en: piel del dorso granulada con presencia de tubérculos bajos desordenados; piel del vientre lisa; ausencia de tubérculos sobre los párpados; procesos vomerianos de los dientes ausentes; machos sin sacos vocales ni excrescencias nupciales; dedo I de la mano ligeramente más corto que el dedo II; dedo V del pie ligeramente más largo que el dedo III; longitud hocico-cloaca de hembras alcanza los 31.2 mm. La otra especie es descrita de tres individuos encontrados bajo el musgo del suelo en los bosques nublados de la Cordillera de Carpish, en la región de Huánuco que puede ser fácilmente diferenciada de las demás especies de *Phrynopus* por su coloración rojo bermellón, tanto en el dorso como en el vientre.**

Palabras clave. Centro de Perú, Cordillera de Carpish La Libertad, Huanuco, taxonomía

Citation: Chávez G, Santa-Cruz R, Rodriguez D, Lehr E. 2015. Two new species of frogs of the genus *Phrynopus* (Anura: Terrarana: Craugastoridae) from the Peruvian Andes. *Amphibian & Reptile Conservation* 9(1) [Special Section]: 15–25 (e105).

Received: 30 May 2015; **Accepted:** 09 October 2015; **Published:** 18 October 2015

Introduction

Systematics of the frog genus *Phrynopus* were until recently poorly known. Over the last seven years this taxa was recognized as members of the family Craugastoridae (Hedges et al. 2008; Pyron and Wiens 2011; Padial et al. 2014), and placed into the taxon Holoadeninae (genera *Bryophryne*, *Lynchius*, *Noblella*, *Psychophrynella*, and *Oreobates*; Padial et al. 2014).

The Andes of Peru hold a rich fauna of the genus *Phrynopus*. For instance, from a total of 26 species, 22 have been described from 2000 to 2015 (AmphibiaWeb 2015). Remarkably, central Peru has the highest diversity of this genus (Duellman and Lehr 2009; Lehr et al. 2000;

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Lehr 2002; Lehr et al. 2002; Lehr and Aguilar 2003; Lehr et al. 2005; Lehr and Oroz 2012; Mamani and Malqui 2014) with 25 species ocurring in the Huánuco, Pasco, and Junín regions. *Phrynopus thompsoni* from La Libertad region currently marks the northernmost distribution of the genus. All species of *Phrynopus* are restricted to cloud forests and puna regions from 2,200 to 4,400 meters (m) of elevation (Duellman and Lehr 2009). During 2013 and 2014, fieldwork in the Andean highlands of La Libertad region (northwestern Peru) and cloud forests of the Huanuco region (Cordillera de Carpish, central Peru) revealed two new species of *Phrynopus*, which are described herein.

Material and Methods

Format of description follow Lynch and Duellman (1997) and character definitions defined in Duellman and Lehr (2009). We used preserved specimens (Appendix) and original species descriptions for the comparative diagnoses. Specimens were preserved in 96% ethanol and permanently stored in 70%. The following variables were measured to the nearest 0.1 mm with digital calipers under a microscope: 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), interorbital distance (IOD), upper eyelid width (EW), internarial distance (IND), eye-nostril distance, and (E-N, straight line distance between anterior corner of orbit and posterior margin of external nares). Fingers and toes numbered preaxially to postaxially from I–IV and I–V respectively. We determined comparative lengths of toes III and V by adpressing both toes against toe IV; lengths of fingers I and II were determined by adpressing the fingers against each other. Specimens were sexed based on external sexual characteristics (e.g., presence of vocal sacs) or through dissections to evaluation of gonads. To reduce reflections, preserved holotypes were photographed submersed in ethanol. Photographs taken in the field by the authors were used for descriptions of color in life. Specimens were deposited in the herpetological collection of the Centro de Ornitología y Biodiversidad (CORBIDI), Lima, Museo de Historia Natural Universidad

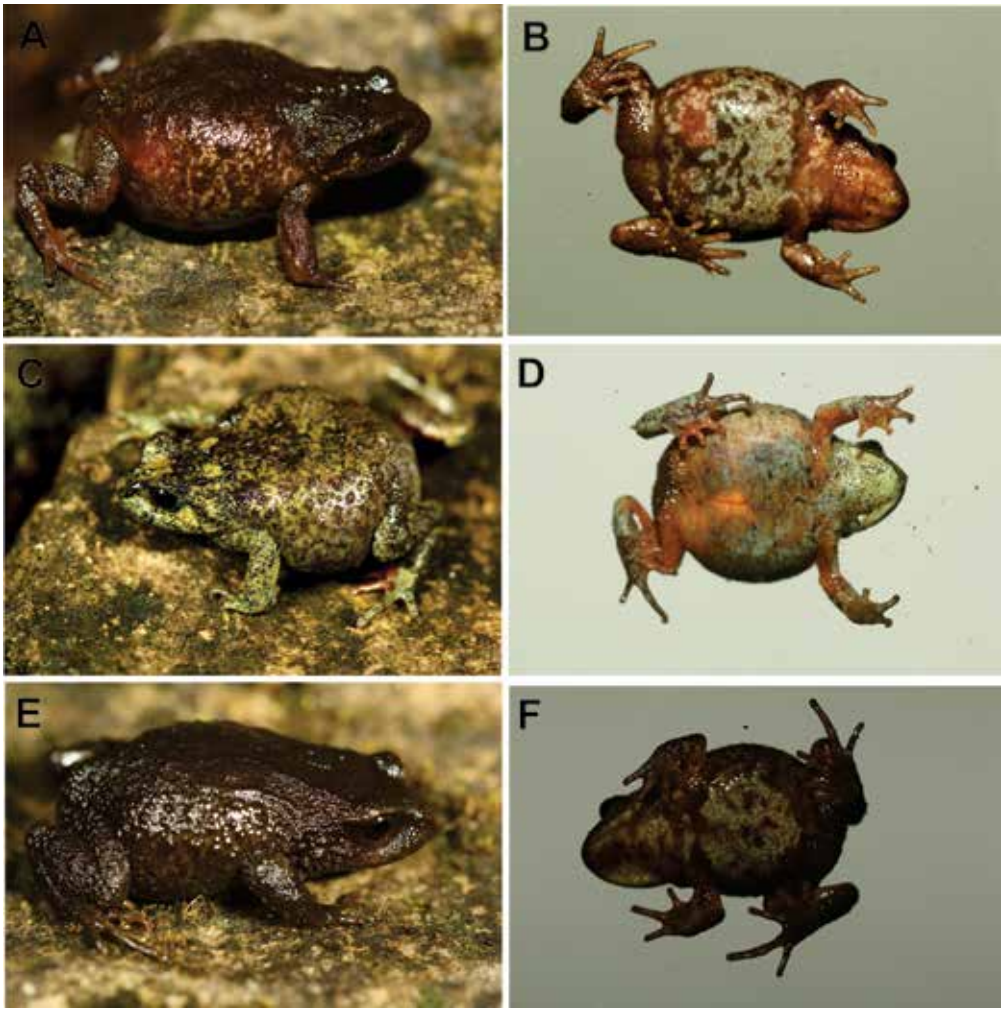

Fig. 1. Dorsal (left) and ventral (right) views of specimens of the type series of *Phrynopus valquii* sp. nov.: A–B) Holotype (CORBIDI 14005, adult female, SVL = 31.2 mm); C–D) Paratype (CORBIDI 14007, adult female, SVL = 28.07 mm); E–F (CORBIDI 13993, adult male, SVL = 25.2 mm). *Photographs by Germán Chávez.*

Nacional de San Marcos (MUSM), Lima, and Museo de Historia Natural de la Universidad Nacional San Agustín (MUSA), Arequipa, all in Peru. For specimens examined see Appendix I.

Results

Phrynopus valquii sp. nov.

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Holotype: CORBIDI 14005 (Figs. 1–2), an adult female from "Cerro Alto Chucaro" (8° 3'0.60"S, 77°24'9.24"W) 4,025 m.a.s.l., Distrito de Parcoy, Provincia de Pataz, La Libertad region, Peru, collected on 26 February 2014 by Germán Chávez.

Paratypes: CORBIDI 13998–14001, 14003–04, 14006, and 14008 adult males and CORBIDI 14007 adult female, same data as holotype; CORBIDI 13989–94, 13996–97, adult males and CORBIDI 13988 and, 13995, adult females, collected two km southern of "Cerro Mush Mush" (8°4'12.08"S, 77°25'33.94"W) 4,123 m.a.s.l., Distrito de Parcoy, Provincia de Pataz, La Libertad region, Peru, on 27 February 2014 by Germán Chávez.

Diagnosis: A species of *Phrynopus* having the following combination of characters: (1) skin on dorsum shagreen with low scattered tubercles, skin on flanks areolate, skin on throat, chest and belly smooth, ventral surface of thighs coarsely areolate; discoidal and thoracic fold absent; dorsolateral folds absent; (2) tympanic membrane and tympanic annulus absent, supratympanic fold absent; (3) snout rounded in dorsal and lateral views; (4) upper eyelid without conical tubercles; width of upper eyelid narrower than IOD; cranial crests absent; (5) dentigerous processes of vomers absent; (6) males lacking vocal slits and nuptial pads; (7) finger I slightly shorter than finger II; tips of digits rounded; (8) fingers without lateral fringes; (9) ulnar and tarsal tubercles absent; (10) heels lacking tubercles; inner tarsal fold absent; (11) inner metatarsal tubercle ovoid, about 1.5 times larger as rounded outer metatarsal tubercle; supernumerary plantar tubercles absent; (12) toes without lateral fringes; basal webbing present; toe V slightly longer than toe III; toe tips rounded, about as large as those on fingers; (13) in life, dorsum dark brown, reddish brown or olive green with irregular darker blotches, dark brown post orbital stripe present; throat cream, pearly white, pale salmon or creamy yellow, chest and belly creamy white or bluish white with or without brown irregular blotches; ventral surfaces of forearms and thighs brown or salmon, ventral surface of hands and feet cream or dark brown with irregular creamy white flecks or blotches; groin dark brown, or reddish brown with pearly white flecks; (14) SVL in females 26.4–31.2 mm (n = 4), in males 14.9–16.5 mm (n = 16).

The assignment of the new species to *Phrynopus* is based on the structure of the digital discs that lack circumferential groves as well as the overall morphological similarity with other members of the genus. *Phrynopus valquii* shares the absence of tympanic annulus and tympanic membrane with most species except *P. auriculatus*, *P. montium* (tympanic annulus visible beneath skin), and *P. peruanus*. The only other species of *Phrynopus* known from La Libertad region is *P. thompsoni*, which inhabits mountains of western Andes, approximately 123 km from known localities of *P. valquii*. The following characters

Table 1. Range of measured characters (mm) and proportions of the type series of *Phrynopus valquii* and *P. daemon*. Range of measured characters is followed by mean and standard deviation in parentheses.

	Phrynopus valquii		***Phrynopus daemon***	
	Males (n = 16)	Females (n = 4)	Male (n = 1)	Females (n = 2)
SVL	21.02–26.45 ($\bar{x}$ = 23.59 ± 1.34)	26.48–31.21 ($\bar{x}$ = 28.89 ± 2.05)	21.7	21.42–24.35
HL	6.35–7.64 ($\bar{x}$ = 7.03 ± 0.39)	7.31–8.22 ($\bar{x}$ = 7.85 ± 0.40)	7.8	6.98–7.89
HW	7.56–8.72 ($\bar{x}$ = 8.15 ± 0.39)	8.89–9.84 ($\bar{x}$ = 9.43 ± 0.41)	7.6	8.02–8.08
TL	7.63–8.93 ($\bar{x}$ = 8.33 ± 0.42)	8.91–9.36 ($\bar{x}$ = 9.17 ± 0.19)	8.5	7.84–8.17
FL	8.53–10.44 ($\bar{x}$ = 9.48 ± 0.63)	10.13–10.86 ($\bar{x}$ = 10.43 ± 0.30)	9	7.98–9.61
ED	2.02–2.81 ($\bar{x}$ = 2.22 ± 0.21)	2.17–3.27 ($\bar{x}$ = 2.74 ± 0.51)	2.3	1.64–1.81
E-N	1.74–2.19 ($\bar{x}$ = 1.93 ± 0.12)	1.74–2.37 ($\bar{x}$ = 2.08 ± 0.26)	1.8	1.63–1.82
IOD	2.14–2.93 ($\bar{x}$ = 2.44 ± 0.24)	2.68–2.91 ($\bar{x}$ = 2.78 ± 0.10)	2.6	2.59–2.64
EW	1.56–2.27 ($\bar{x}$ = 2.01 ± 0.16)	2.05–2.56 ($\bar{x}$ = 2.23 ± 0.23)	1.7	1.96–1.98
IND	1.72–2.35 ($\bar{x}$ = 2.02 ± 0.18)	2.05–2.61 ($\bar{x}$ = 2.36 ± 0.23)	1.9	1.94–2.06
HL/SVL	0.27–0.32 ($\bar{x}$ = 0.29 ± 0.01)	0.26–0.27 ($\bar{x}$ = 0.27 ± 0.00)	0.35	0.32–0.32
HW/SVL	0.33–0.38 ($\bar{x}$ = 0.34 ± 0.01)	0.31–0.33 ($\bar{x}$ = 0.32 ± 0.00)	0.35	0.33–0.37
TL/SVL	0.32–0.38 ($\bar{x}$ = 0.35 ± 0.01)	0.29–0.34 ($\bar{x}$ = 0.31 ± 0.01)	0.39	0.33–0.36
E-N/ED	0.61–1.08 ($\bar{x}$ = 0.87 ± 0.10)	0.55–1.00 ($\bar{x}$ = 0.78 ± 0.22)	0.78	0.99–1.00
EW/IOD	0.66–1.00 ($\bar{x}$ = 0.83 ± 0.09)	0.76–0.90 ($\bar{x}$ = 0.80 ± 0.07)	0.65	0.75–0.75

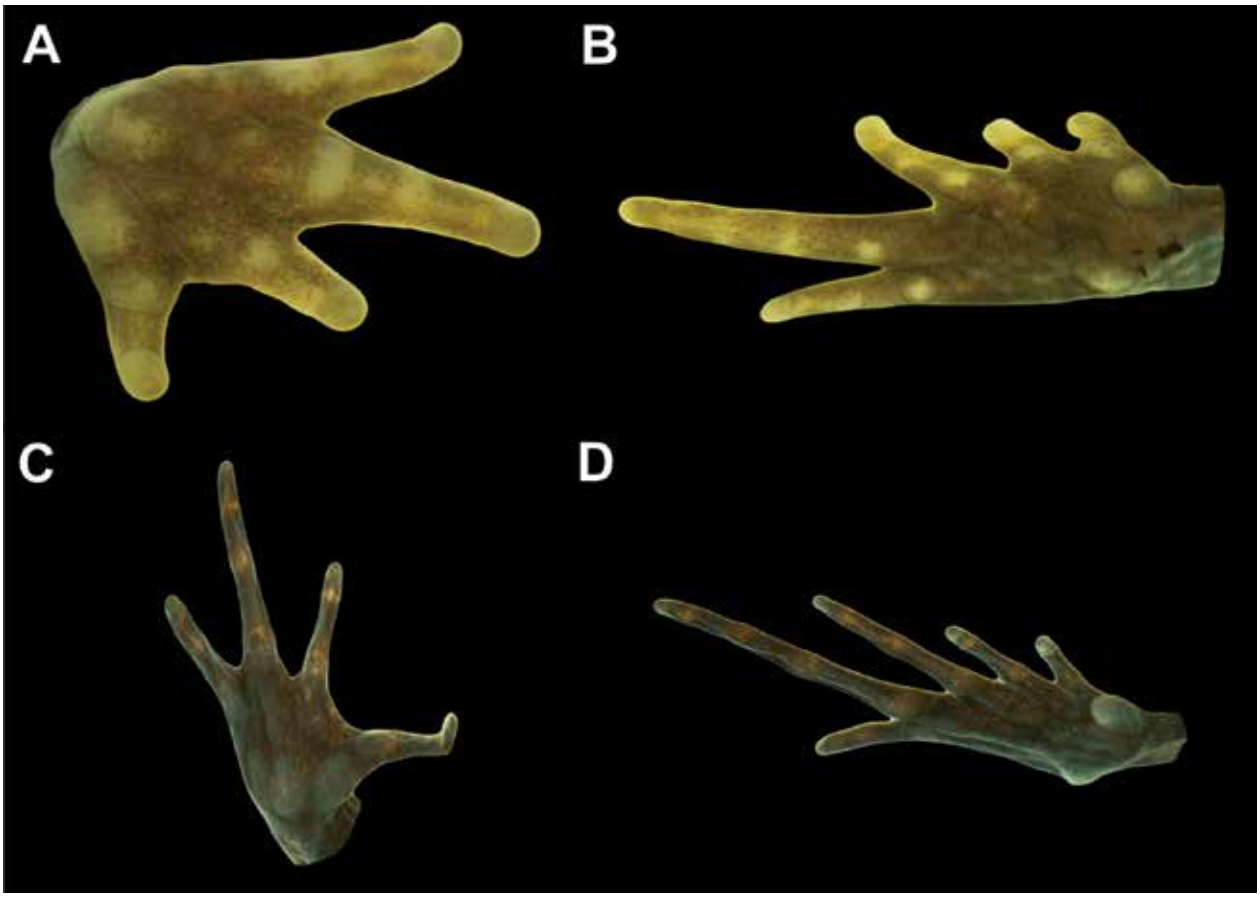

Fig. 2. Ventral view of: A) right hand of the holotype of *Phrynopus valquii*; B) right foot of the holotype of *Phrynopus valquii*; C) right hand of the holotype of *Phrynopus daemon*; D) right foot of the holotype of *Phrynopus daemon*. *Photographs by Germán Chávez.*

distinguish the two species: *P. valquii* lack pustules on skin of dorsum (*P. thompsoni* has skin on dorsum bearing pustules arranged in longitudinal rows), has smooth skin on venter (*P. thompsoni* has skin on venter coarsely areolate), finger I slightly shorter than finger II (*P. thompsoni* has fingers I and II of equal lenght), body size with a maximum SVL in females of 31.2 mm (*P. thompsoni* has a maximum SVL in females of 27.6 mm). Furthermore, *P. valquii* can be distinguished from its congeners which lack tympanic annulus and tympanic membrane by having skin on dorsum shagreen with scattered low tubercles (vs coarsely tuberculate in *P. barthlenae*, *P. chaparroi*, and *P. miroslawae*; smooth in *P. kauneorum*, *P. nicolae*, *P. oblivius*, and *P. tautzorum*; bearing conical or elongated tubercles, wart or ridges in *P. badius*, *P. bracki*, *P. bufoides*, *P. curator*, *P. nicolae*, *P. paucari*, *P. vestigiatus*, and *P. daemon* sp. nov.); skin on throat, chest, and belly smooth (vs weakly areolate in *P. badius*, *P. curator*, *P. interstinctus*, *P. lechriorynchus*, and *P. oblivius*; areolate in *P. barthlenae*, *P. bufoides*, *P. chaparroi*, *P. dagmarae*, *P. heimorum*, *P. horstpauli*, *P. kotosh*, *P. miroslawae*, *P. nicolae*, *P. paucari*, *P. pesantesi*, *P. tautzorum*, and *P. vestigiatus*; coarsely areolate in *P. daemon* sp. nov.); dorsolateral folds absent (vs present in *P. daemon* sp. nov., *P. dagmarae*, *P. horstpauli*, *P. interstinctus*, *P. kotosh*, *P. miroslawae*, and *P. vestigiatus*); supratympanic fold absent (vs present in *P. kauneorum*); snout rounded in dorsal view (vs elongated in *P. lechriorynchus*; truncate in *P. vestigiatus*); tubercles on upper eyelid absent (vs present in *P. barthlenae* and *P. curator*); dentigerous processes of vomers absent (vs present in *P. bracki*, *P. dagamarae*, *P. kauneorum*, *P. kotosh*, *P. lechriorynchus*, and *P. nicolae*; and minute in *P. interstinctus* and *P. vestigiatus*); nuptial pads absent (vs present in *P. barthlenae* and *P. chaparroi*); finger I slightly shorter than finger II (vs finger I much shorter than finger II in *P. dagmarae* and *P. horstpauli*; equal length in *P. juninensis*; finger I longer than finger II in *P. daemon* sp. nov.); lateral fringes on fingers and toes absent (vs present in *P. dagmarae*, *P. barthlenae*, and *P. vestigiatus*; and narrow lateral fringes present on fingers in *P. bracki*); ulnar tubercles absent (vs present in *P. kotosh*); tarsal fold absent (vs present in *P. lechriorynchus*); tubercles on heels absent (vs present in *P. badius*, *P. bracki*, *P. curator*, *P. dagmarae*, *P. horstpauli*, and *P. tribulosus*) and toe V slightly longer than toe III (vs toe V elongated, much longer than toe III in *P. bracki*, and *P. horstpauli*; equal length in *P. miroslawae*, *P. kotosh*, *P. tribulosus*, and *P. vestigiatus*; toe V slightly shorter tan toe III in *P. heimorum*, *P. juninensis*, and *P. daemon* sp. nov.).

Description of Holotype (Fig. 1): Head narrower than body, wider than long, HW 119.7% of HL; HW 31.5% of SVL; HL 26.3% of SVL; snout short, rounded in dorsal and lateral views, (Fig. 1A), ED about as large as E-N distance; nostrils slightly protuberant, directed dorsolaterally; canthus rostralis short, straight in dorsal view, rounded in profile; loreal region slightly concave; lips rounded; upper eyelid without enlarged tubercles; EW narrower than IOD (EW 77.31% of IOD); tympanic region bearing rounded tubercles distinguishable in preservation; tympanic membrane and tympanic annulus absent; postrictal tubercles present. Choanae small, ovoid, not concealed by palatal shelf of maxilla; dentigerous processes of vomers absent; tongue broad, slightly longer than wide, not notched posteriorly, posterior one half free. Skin on dorsum shagreen with small scattered tubercles, without dorsolateral folds; skin on flanks areolate; skin on throat, chest, and belly smooth; discoidal and thoracic folds present; cloacal sheath not discernible; large tubercles absent in cloacal region. Outer surface of forearm without minute tubercles; outer and inner palmar tubercles low, outer rounded, the same size of inner, rounded palmar tubercle; supernumerary tubercles absent, rounded, about half the size of subarticular tubercles; subarticular tubercles prominent, ovoid in dorsal view, rounded in lateral view, most prominent on base of fingers; fingers without lateral fringes; finger I slightly shorter than finger II; tips of digits rounded lacking marginal grooves (Fig. 2A). Hind limbs slender, short, TL 29.9% of SVL; FL 34.8% of SVL; upper surface of hind limbs shagreen with small, scattered tubercles; posterior and ventral surfaces of thighs coarsely areolate; heel without conical tubercles; outer surface of tarsus without tubercles; inner metatarsal tubercle ovoid, about one and a third times larger as rounded outer metatarsal tubercle; supernumerary plantar tubercles absent; subarticular tubercles low, ovoid in dorsal view; toes without lateral fringes; basal webbing present; toe tips rounded, lacking marginal grooves, about as large as those on fingers; relative lengths of toes: 1 < 2 < 3 < 5 < 4; toe V slightly longer than toe III (Fig. 2B). Measurements (mm) of holotype: SVL 31.2; TL 9.3; FL 10.8; HL 8.2; HW 9.8; ED 2.4; IOD 2.9; EW 2.2; IND 2.4; E-N 2.3.

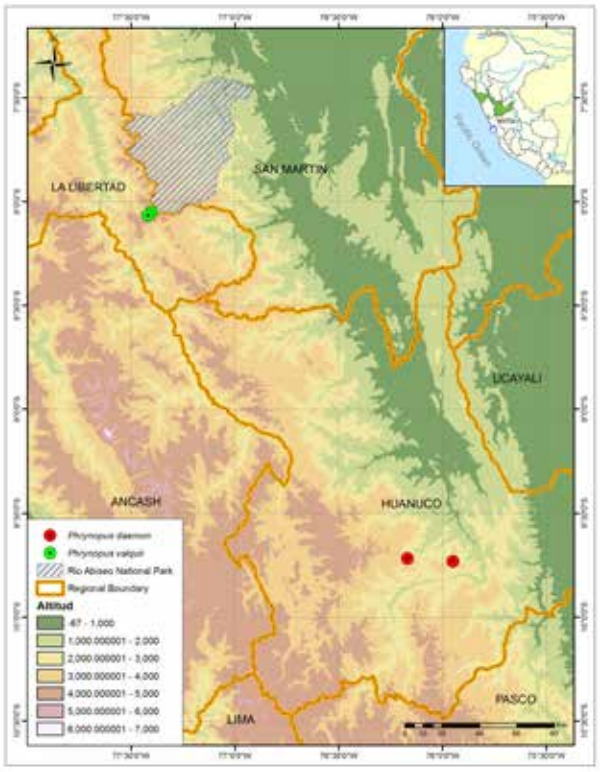

Fig. 3. Distribution of *Phrynopus valquii* sp. nov. (green circles) and *Phrynopus daemon* sp. nov. (red circles). *Map by Caterina H. Cosmopolis.*

Coloration of holotype in life (Fig. 1): Dorsum reddish brown with small creamy white irregular flecks; postrictal tubercles creamy white; dorsal surface of forearms reddish brown; canthal and supratympanic regions dark brown; flanks colored as dorsum, reddish brown with small creamy white irregular flecks; axilla and groin reddish brown (Fig. 1B); posterior surfaces of thighs and concealed surfaces of shanks reddish brown with pearly white blotches; throat pale salmon; chest, belly, and extremities (except ventral surfaces of hands and feet) bluish white with pale salmon irregular blotches; fingers and toes reddish brown, palmar and plantar surfaces and subarticular tubercles pale salmon; iris dark brown with creamy white reticulations.

Coloration of holotype in preservative: As described above with reddish brown coloration being dark brown and salmon coloration being creamy white; flanks dark brown; iris gray.

Variation: The males are smaller than the females and lack vocal slits and nuptial pads. The post-orbital stripe is absent in female CORBIDI 13988 and males CORBIDI 13997 and CORBIDI 14001, which have dorsal cream coloration with irregular weak brown blotches, and yellow blotches between the upper eyelids. Female CORBIDI 13988 bears tubercles on the upper eyelids and on the dorsum, where they are higher in the occipital region. Brown blotches on belly are present in most of individuals except in males CORBIDI 13998 and CORBIDI 13993 that have dark brown venter; CORBIDI 13998 has little white spots on the belly. Two males (CORBIDI 13989, 14008) have belly creamy white with weak brown irregular blotches. The color pattern of the ventral surfaces of thighs and forearms in female CORBIDI 13988 and male CORBIDI 14008 is salmon.

Etymology: The name is a patronym as tribute to Thomas Valqui, Ph.D. (Peru), ornithologist and founder of CORBIDI, in recognition of his valuable contributions and efforts for the conservation, research, and knowledge of Peruvian birds.

Fig. 4. Dorsal (left) and ventral (right) views of the type series of *Phrynopus daemon* sp. nov.: A–B) Holotype (CORBIDI 15364, adult female, SVL = 24.3 mm); C–D) Female paratype (MUSA 4916, adult female, SVL = 21.4 mm); E–F) Male paratype (MUSM 32747, SVL = 21.7). *Photographs: A–D by Roy Santa-Cruz and E–F by Daniel Rodriguez.*

Distribution and Ecology: *Phrynopus valquii* is known from eastern Andes of La Libertad Region, two km far from southwestern limit of Rio Abiseo National Park (Fig. 3). All individuals were collected during the dry season, at daytime between 9:00 a.m. and 14:00 p.m in a flat and very humid grassland area sorrounded by rocks clusters and mountains, under stones which form the dry bed of an old creek. The vegetation includes grasses of the families Poaceae and Valerianaceae, lichens and fungi growing on stone surfaces. The only sympatric anuran species recorded is *Gastrotheca phelloderma*.

Phrynopus daemon sp. nov.

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Holotype: CORBIDI 15364, (Figs. 2, 4A–B), an adult female, from Achupampa, Cordillera de Carpish (8°45’15.55”S, 76°34’39.03”W), 3,138 m.a.s.l., Distrito de Chinchao, Provincia de Huánuco, Huánuco region, Peru, collected on 20 October 2014 by Roy Santa Cruz, Heidy Cardenas, Nelin Ramos, and Eduardo Crispin.

Paratypes: MUSA 4916 (Fig. 4 C–D), adult female, same data as holotype; MUSM 32747 (Fig. 4 E–F), an adult male from Unchog elfin forest, Cordillera de Carpish (09°43’1.93”S, 76°10’3.71”W), 3,341 m.a.s.l., Distrito de Churubamba, Provincia Huánuco, Huánuco region, Peru, collected on 20 July 2013 by Daniel Rodríguez.

Diagnosis: A species of *Phrynopus* having the following combination of characters: (1) skin on dorsum shagreen with small scattered tubercles, skin on flanks areolate, skin on throat, chest, belly and ventral surface of thighs areolate; thoracic fold evident; discoidal fold absent; fragmented dorsolateral folds present; (2) tym-

panic membrane and tympanic annulus absent, short supratympanic fold present; (3) snout rounded in dorsal view, subacuminate in lateral view; (4) upper eyelid without enlarged tubercles; width of upper eyelid narrower than IOD; cranial crests absent; (5) dentigerous processes of vomers absent; (6) vocal slits and nuptial pads absent, subgular vocal sac present; (7) finger I and II of equal length or finger I shorter than finger II; tips of digits rounded; (8) fingers with weak lateral fringes; (9) ulnar tubercles absent, low tarsal tubercles present; (10) heels lacking tubercles; inner tarsal fold absent; (11) inner metatarsal tubercle ovoid, about 1.5 times larger than rounded outer metatarsal tubercle; supernumerary plantar tubercles absent; (12) toes with lateral fringes; basal webbing absent; toe V slightly shorter than toe III; toe tips rounded, about as large as those of fingers; (13) in life, dorsum and flanks vermilion red or blackish brown; throat orange-red, chest, and belly vermilion red or blackish brown, ventral surface of hands and feet dark grey, iris green with fine black reticulations; (14) SVL in females 21.42–24.35 mm (n = 2), in single male 21.7 mm.

The assignment of the new species to *Phrynopus* is based on the structure of the digital discs lacking circumferential groves, as well as the overall morphological similarity with the other members of the genus. *Phrynopus daemon* is readily distinguished from its congeners by its uniform red or blackish-brown coloration with an orange-red throat, and by its distinct fragmented dorsolateral folds. *Phrynopus daemon* shares with nine other species of *Phrynopus* (*P. badius*, *P. bracki*, *P. dagmarae*, *P. heimorum*, *P. interstinctus*, *P. nicoleae*, *P. paucari*, *P. peruanus*, *P. vestigiatus*) coloration consisting of red in the groin. However, none of these species has a color combination consisting in the entire dorsum vermilion red or blackish brown and throat orange-red. Likewise, this species shares the absence of tympanic annulus and tympanic membrane with most species except *P. auriculatus*, *P. montium* (tympanic annulus visible beneath skin), and *P. peruanus*. Furthermore, *P. daemon* can be distinguished from the rest of its congeners by having skin on dorsum shagreen with scattered small tubercles (vs coarsely tuberculate in *P. barthlenae*, *P. chaparroi*, and *P. miroslawae*; smooth in *P. kauneorum*, *P. nicolae*, *P. oblivius*, and *P. tautzorum*; bearing conical, elongated, or low tubercles, warts or ridges in *P. badius*, *P. bracki*, *P. bufoides*, *P. curator*, *P. nicolae*, *P. paucari*, *P. thompsoni*, *P. vestigiatus*, and *P. valquii* sp.nov.); skin on throat, chest and belly areolate (vs weakly areolate in *P. badius*, *P. curator*, *P. interstinctus*, *P. lechriorynchus*, and *P. oblivius* and smooth in *P. bracki*, *P. juninensis*, *P. kauneorum*, *P. tribulosus*, and *P. valquii* sp. nov.); fragmented dorsolat-

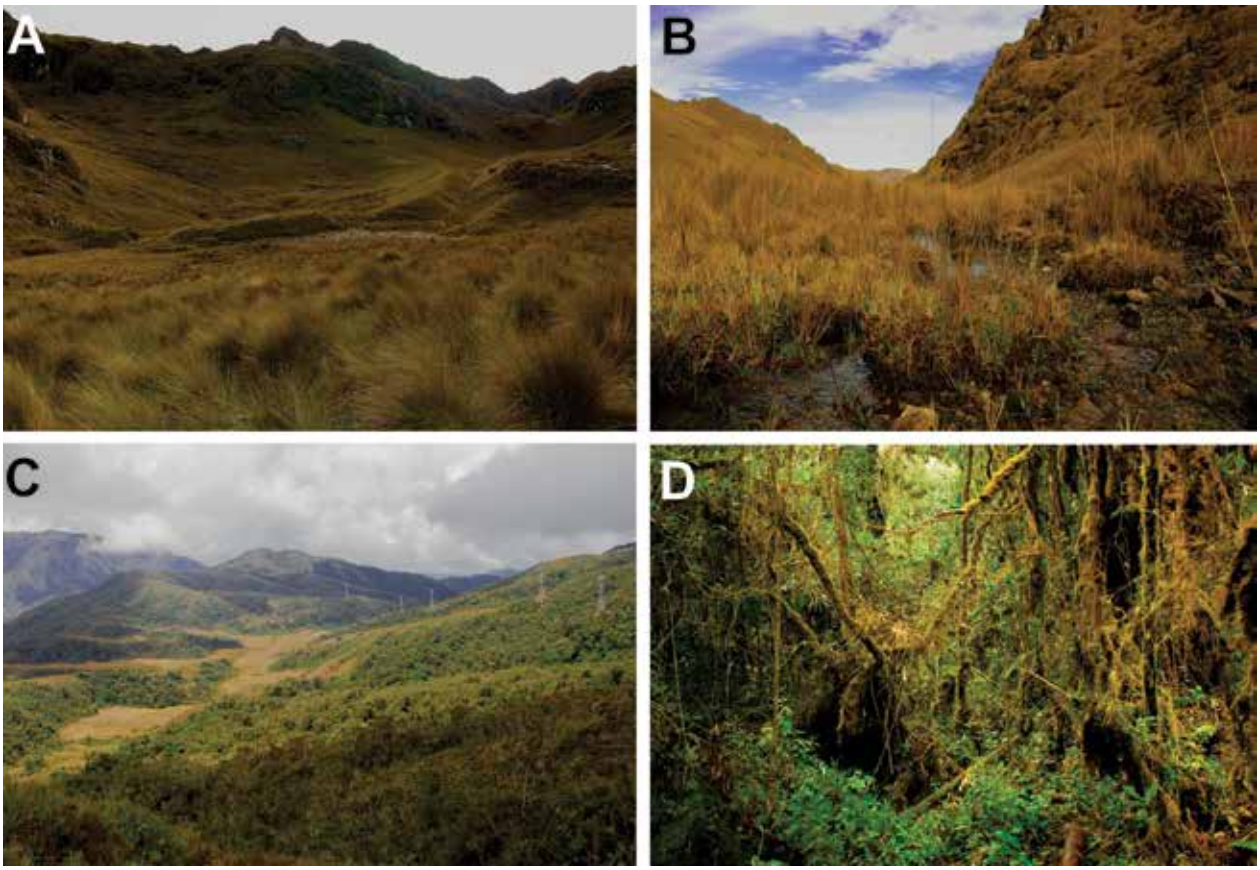

Fig. 5. A) Habitat of the type locality of *Phrynopus valquii* sp. nov.; B) Microhabitat of *Phrynopus valquii* sp. nov.; C) Habitat of the type locality of *Phrynopus daemon* sp. nov.; D) Microhabitat of *Phrynopus daemon* sp. nov. *Photographs: A–B by Germán Chávez and C–D by Roy Santa-Cruz.*

eral folds preent (vs continous dorsolateral folds present in *P. dagmarae*, *P. horstpauli*, *P. interstinctus*, *P. kotosh*, *P. miroslawae*, and *P. vestigiatus*); snout rounded from dorsal view (vs elongated in *P. lechriorynchus*; truncate from dorsal view in *P. vestigiatus*); tubercles on upper eyelid absent (vs present in *P. barthlenae* and *P. curator*); dentigerous processes of vomers absent (vs present in *P. bracki*, *P. dagmarae*, *P. horstpauli*, *P. kauneorum*, *P. kotosh*, *P. lechriorynchus*, and *P. nicolae*; minute in *P. interstinctus* and *P. vestigiatus*); lateral fringes on fingers absent (vs present in *P. dagmarae*, *P. barthlenae*, *P. thompsoni*, and *P. vestigiatus*; narrow lateral fringes present on fingers in *P. bracki*); ulnar tubercles absent (vs present in *P. kotosh*); tarsal fold absent (vs present in *P. lechriorynchus*); tubercles on heels absent (vs present in *P. badius*, *P. bracki*, *P. curator*, *P. dagmarae*, *P. horstpauli*, and *P. tribulosus*) and toe V slightly shorter than toe III (vs toe V elongated, much longer than toe III in *P. bracki* and *P. horstpauli*; of equal length in *P. kotosh*, *P. miroslawae*, *P. thompsoni*, *P. tribulosus*, and *P. vestigiatus*; toe V slightly longer than toe III in *P. bufoides*, *P. chaparroi*, *P. interstinctus*, *P. kauneorum*, *P. oblivius*, *P. paucari*, *P. pesantesi*, and *P. valquii* sp. nov.). Four other species of *Phrynopus* have been recorded from Cordillera de Carpish. Those are *P. dagmarae* (Lehr et al. 2002), *P. interstinctus* (Lehr and Oróz 2012, at San Marcos, 3,100–3,160 m), *P. kauneorum* (Lehr et al. 2002), and *P. vestigiatus* (Lehr and Oróz 2012, at San Pedro de Carpish, 3,100 m), but all of them can be differentiated from *P. daemon* sp. nov. by their different color pattern on dorsum, throat, and belly.

Description of the Holotype (Fig. 4 A–B): Head narrower than body, wider than long, HW 102.4% of HL; HW 33.2% of SVL; HL 32.4% of SVL; snout moderately short, rounded in dorsal view, sub acuminate in lateral view, (Fig. 4A), ED about as large as E-N distance; nostrils slightly protuberant, directed dorsolaterally; canthus rostralis short, straight in dorsal view, sub acuminate in profile; loreal region slightly concave; lips rounded; upper eyelid without enlarged tubercles; EW narrower than IOD (EW 68.9% of IOD); tympanic region lacking tubercles; tympanic membrane and tympanic annulus absent; postrictal tubercles absent. Choanae small, ovoid, not concealed by palatal shelf of maxilla; dentigerous processes of vomers absent; tongue broad, slightly longer than wide, not notched posteriorly, posterior one half free. Skin on dorsum shagreen with a few conical scattered tubercles, with ridges forming fragmented dorsolateral folds; skin on flanks coarsely areolate; skin on throat, chest, belly, and ventral surfaces of thighs coarsely areolate; thoracic fold present, discoidal fold absent; cloacal sheath not discernible; large tubercles absent in cloacal region. Outer surface of forearms with low tubercles; outer and inner palmar tubercles low, outer bilobate, the same size as inner, rounded palmar tubercle; supernumerary tubercles indistinct in preservative; subarticular tubercles low, ovoid in dorsal view, most prominent on base of fingers; fingers without lateral fringes; finger I longer than finger II; tips of digits rounded lacking marginal grooves (Fig. 2C). Hind limbs slender, short, TL 33.5% of SVL; FL 39.4% of SVL; upper surface of hind limbs shagreen with scattered rounded tubercles; posterior and ventral surfaces of thighs coarsely areolate; heel without conical tubercles; outer surface of tarsus with low rounded tubercles; inner metatarsal tubercle ovoid, about one and a half times larger than rounded outer metatarsal tubercle; supernumerary plantar tubercles absent; subarticular tubercles low, ovoid in dorsal view; toes with lateral fringes; basal webbing absent; toe tips rounded, lacking marginal grooves, about as large as those of fingers; relative lengths of toes: $1 < 2 < 5 < 3 < 4$; toe V slightly shorter than toe III (Fig. 2D). Measurements (mm) of holotype: SVL 24.35; TL 8.17; FL 9.61; HL 7.89; HW 8.08; ED 1.81; IOD 2.64; EW 1.98; IND 2.06; E-N 1.82.

Coloration of holotype in life (Fig. 4 A–B): Dorsum, dorsal surface of forearms, canthal and supratympanic regions, flanks, axilla, and groin dark red (Fig. 4A); posterior surfaces of thighs and concealed surfaces of shanks of the same color as dorsum; throat, chest, belly, and ventral surfaces of forelimbs and hindlimbs red (Fig. 4B); fingers, toes, palmar, and plantar surfaces grayish black; iris bronze with fine black reticulations.

Coloration of holotype in preservative: As described above with dark red coloration being dark brown on dorsum and creamy white on venter and grayish black coloration being brown; iris gray.

Variation: Male MUSM 32747 has dorsal surfaces of head and body blackish brown, with vermilion red spots and black reticulations on dorsal surfaces of hind limbs, forelimbs and lateral surfaces of head and body; throat vermilion red, rest of ventral region is blackish brown. Dorsolateral ridges in this individual form fragmented dorsolateral folds (Fig. 3, E–F). Female paratype MUSA 4916 is smaller (SVL = 21.4) than the holotype, bearing higher tubercles on the dorsum; its dorsal color pattern is darker than the holotype, being the coloration of the belly and similar in all specimens.

Etymology: The specific name *daemon* is a latin word meaning "demon" in reference to the color pattern of the new species (red) which reminds the authors of the coloration attributed to the devil's servants, ancestrally called demons.

Distribution and Ecology: *Phrynopus daemon* sp. nov. is known from two localities, in the Huanuco region (Fig. 3), central Peru. Both localities (Achupampa and Unchog forest) are located in the cloud forests of the Cordillera de Carpish, near the treeline on the eastern

side of the Andes. These cloud forests may be among the ecosystems most affeced by new regimes of humidity and temperature caused by climate change, and by anthropogenic destruction (Gonzalez 2013). Individuals were collected during the dry season, at daytime, in very humid microhabitats. Females CORBIDI 15364 and MUSA 4916 were found on the ground underneath mosses and roots, at the transition between primary cloud forest and grassland, whereas male MUSM 32747 was found under a stone near a dry stream bed surrounded by a few bushes and trees. Sympatric amphibians recorded with the females are *Phrynopus dagmarae*, *P. horstpauli*, *Gastrotheca griswoldi*, and *G. stictopleura*, all of them more commonly observed than *P. daemon* sp. nov. Male MUSM 32747 was sympatric with two undescribed species of *Phrynopus*.

Discussion

The conservation status we propose for the two new species is based on IUCN´s Red List criteria (cite IUCN Red List) and known distribution and threats. We consider plausible the occurrence of *Phrynopus valquii* inside Rio Abiseo National Park (RANP) because its type locality is aproximately two km from the southwestern limit of this protected area, which covers more than 274,000 km^2; part of this area contains grassland habitats and there are no geographical barriers between this limit and the type locality of *P. valquii*. Nevertheless, there are no confirmed records of the species inside the RANP, so we suggest to evaluate this species as Data Deficient based on the limited information about its distribution range and population status.

Phrynopus daemon inhabits cloud forests of the Cordillera de Carpish, which is located in the Cordillera Oriental (Atlantic drainage), Huánuco region. In this Cordillera recent herpetological surveys (over the last five years) have resulted in the discovery of five endemic species of *Phrynopus*: *P. dagmarae* Lehr, Aguilar, and Koehler 2001; *P. interstinctus* Lehr and Oroz 2012; *P. kauneorum* Lehr, Aguilar, and Koehler 2001, *P. vestigiatus* Lehr and Oroz 2012, and *P. daemon* sp. nov. Known distribution ranges include, for most of them, only a few localities. In fact, the Cordillera de Carpish is a chain of mountains located between the Chinchao and Derrepente rivers (both small tributaries of the Huallaga river, Huánuco region), that might promote endemism because of its varied topography and sharp altitudinal gradient passing from 600 m (at the bank of the Chinchao river) to 3,200 m of altitude over an airline distance of 28 km. Remarkably, this important Cordillera is not protected under Peruvian law, making it susceptible to deforestation by agriculture and timber extraction. Reduction in cloud forest cover is the main threath for *Phrynopus daemon* sp. nov. Furthermore, an interstate road which crosses Cordillera de Carpish (at both sides of Chinchao river) and the developing of mining concessions in the area, add more threats to the conservation of the forests and their fauna. On the basis of a known distribution range smaller than 5,000 km^2, fragmentation of habitats near the type locality, and known threats from agriculture and mining, we suggest categorizing this species as Endangered (B1ab[ii,iii]) in the IUCN Red List.

Acknowledgments.—We are grateful to Ministerio del Ambiente and SERFOR for collecting and research permits. RSF fieldwork was possibe thanks to economical support of ODEBRECHT Peru, logistic support of Rafael Tamashiro from the environmental staff of ODEBRECHT, and Daniel Cossios from the staff of BIOSFERA Consultores. Specimens were loaned to EL by B. Milan and J. Córdova (MUSM). Likewise, we thank Ignacio de la Riva and Alessandro Catenazzi for reviewing the manuscript and providing critical suggestions and corrections to improve this paper.

Literature Cited

Duellman W, Lehr E. 2009. *Terrestrial-Breeding Frogs (Strabomantidae) in Perú.* Natur- und Tier-Verlag, Naturwissenschaft, Münster. 382 p.

Hedges SB, Duellman WE, Heinicke MP. 2008. New World direct-developing frogs (Anura, Terrarana), molecular phylogeny, classification, biogeography, and conservation. *Zootaxa* 1737: 1–182.

Lehr E. 2002. *Amphibien und Reptilien in Perú.* Die Herpetofauna entlang des 10. Breitengrades von Perú: Arterfassung, Taxonomie, ökologische Bemerkungen und biogeographische Beziehungen. Dissertation Natur-und Tier-verlag, Naturwissenschaft, Műnster. Germany. 208 p.

Lehr E, Aguilar C. 2003. A new species of *Phrynopus* (Amphibia, Anura, Leptodactylidae) from the puna of Maraypata (Departamento de Huánuco, Perú). *Zoologische Abhandlungen (Dresden)* 53: 87–92.

Lehr E, Aguilar C, Kőhler G. 2002. Two sympatric new species of *Phrynopus* (Anura: Leptodactylidae) from a cloud forest in the Peruvian Andes. *Journal of Herpetology* 36(2): 208–216.

Lehr E, Kőhler G, Ponce E. 2000. A new species of *Phrynopus* from Peru (Amphibia, Anura, Leptodactylidae). *Senckenbergiana biologica* 80(1/2): 205–212.

Lehr E, Lundberg M, Aguilar C. 2005. Three new species of *Phrynopus* from central Perú (Amphibia: Anura: Leptodactylidae). *Copeia* 2005: 479–491.

Lehr E, Oróz A. 2012. Two new species of *Phrynopus* (Anura: Strabomantidae) from the Cordillera de Carpish in central Perú (Departamento de Huánuco). *Zootaxa* 3512: 53–63.

Lynch J, Duellman W. 1997. Frogs of the genus *Eleutherodactylus* (Anura: Leptodactylidae) in western

Ecuador: Systematics, ecology, and biogeography. *Special Publication (University of Kansas. Museum of Natural History)* 23: 1–236.

Mamani L, Malqui S. 2014. A new species of *Phrynopus* (Anura: Craugastoridae) from the central Peruvian Andes. *Zootaxa* 3838(2): 207–214.

Padial JM, Grant T, Frost DR. 2014. Molecular systematic of Terraranas (Anura: Brachycephaloidea) with an assessment of the effects of alignment and optimality criteria. *Zootaxa* 3825(1): 1–132.

Pyron RA, Wiens JJ. 2011. A large-scale phylogeny of Amphibia including over 2,800 species, and a revised classification of extant frogs, salamander and caecilians. *Molecular Phylogenetics and Evolution* 61: 543–583.

Appendix 1

Specimens examined:

Phrynopus barthlenae.—PERU: Huánuco: Maraypata (10°11’11.29”S, 76°05’58.4”W), 3,749 m: CORBIDI 14496–98.

Phrynopus bracki.—PERU: Pasco: Abra Esperanza, Parque Nacional Yanachaga Chemillén (10°31’57.40”S, 75°20’58.20”W), 2,808 m: CORBIDI 10302–10304, 2750, 11616, 11621, 11628, 11631.

Phrynopus dagmarae.—PERU: Huánuco: Palma Pampa, 3,020 m: MUSM 20451 (holotype). Achupampa, (09°43’48.87”S, 75°57’04.29”W), 3,122 m: CORBIDI 14552–59, 3,160 m: CORBIDI 14564–72, 14580–90.

Phrynopus heimorum.—PERU: Huánuco: ca. 10 km E Conchamarca, 3,240 m: MUSM 20441 (holotype).

Phrynopus horstpauli.—PERU: Huánuco: Sacsahuanca (10°12’50.01”S, 76°07’10.18”W), 3,472 m: CORBIDI 14539.

Phrynopus interstinctus.—PERU: Huánuco: Cordillera de Carpish, San Marcos, 3,100 m: MUSM 29543 (holotype), 3,160 m: MUSM 29544–29545 (paratypes).

Phrynopus kauneorum.—PERU: Huánuco: Camino Pampa Alegre-Ruinas de Huanacaure (09°45’29.07”S, 75°53’21.37”W), 2,996 m: CORBIDI 14591, 14594–95, 14615, 14629; Cordillera de Carpish, 2,735 m: MUSM 18585.

Phrynopus peruanus.—PERU: Junin: Puna of Maraynioc (11°21’35.2”S, 75°28’52.6”W), 3,825 m: MUSM 19977–78.

Phrynopus tautzorum.—PERU: Huánuco: Maraypata (10°09’13.45”S, 76°04’39.56”W), 3,949 m: CORBIDI 14504–05, 14507.

Phrynopus tribulosus.—PERU: Pasco: Abra Esperanza, Parque Nacional Yanachaga Chemillén (10°31’57.40”S, 75°20’58.20”W), 2,808 m: CORBIDI 10299–10301, 10°31’57.40”S, 75°20’57.02”W, 2,748 m, CORBIDI 11626, 11627, 11638.

Phrynopus vestigiatus.—PERU: Huanuco: Cordillera de Carpish, San Pedro de Carpish, 3,100 m: MUSM 29542 (holotype); Camino Pampa Alegre, Ruinas de Huanacaure (09°45’29.07”S, 75°53’21.37”W), 2,996 m: CORBIDI 14598–99, 14600–02, 14617–18.

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In accordance with the International Code of Zoological Nomenclature new rules and regulations (ICZN 2012), we have deposited this paper in publicly accessible institutional libraries. The new species described herein has been registered in ZooBank (Polaszek 2005a, b), the official online registration system for the ICZN. The ZooBank publication LSID (Life Science Identifier) for the new species described here can be viewed through any standard web browser by appending the LSID to the prefix "http://zoobank.org/." The LSID for this publication is: urn:lsid:zoobank.org:pub:833E0DC3-AFD3-4BA4-83EF-B738F386D415.

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Citations

ICZN. 2012. Amendment of Articles 8,9,10,21 and 78 of the International Code of Zoological Nomenclature to expand and refine methods of publication. *Zootaxa* 3450: 1–7.

Polaszek A et al. 2005a. Commentary: A universal register for animal names. *Nature* 437: 477.

Polaszek A et al. 2005b. ZooBank: The open-access register for zoological taxonomy: Technical Discussion Paper. *Bulletin of Zoological Nomenclature* 62(4): 210–220.