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A preliminary checklist of amphibians and reptiles from the vicinity of La Nube Biological Station, Bahuaja-Sonene National Park, Peru

Irbin B. Llanqui[1, 2, 3], Cinthya Y. Salas[1], Melissa P. Oblitas[1]

1 Universidad Nacional de San Agustín de Arequipa, Museo de Historia Natural (MUSA). Av. Alcides Carrión s/n, Cercado, Arequipa, Peru. **2** Centro de Ecología y Biodiversidad. PJ El Sol 103, Barranco, Lima, Peru. **3** Escuela de Ciencias Biológicas, Universidad Nacional Mayor de San Marcos. Av. Venezuela s/n, Lima, Peru.

Corresponding author: Irbin B. Llanqui, ibllanquia@gmail.com

Abstract

We present a preliminary list of the herpetofauna in the vicinity of La Nube Biological Station, Bahuaja-Sonene National Park, Peru. We recorded 18 amphibian species and 15 reptile species. We add 14 species to the final list, which were not confirmed by previous studies for this area. For 2 amphibian species, *Pristimantis* cf. *ockendeni* Boulenger, 1912 and *Bolitoglossa* cf. *altamazonica* Cope, 1874, we provide a brief description for our tentative identifications. Similarly, we comment on 2 rare reptile species, *Apostolepis nigroterminata* Boulenger, 1896 and *Epictia diaplocia* Orejas-Miranda, 1969.

Keywords

Andean foothills, herpetofauna, new records, *Pristimantis*, rare species, salamander.

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Introduction

The oriental slopes of the Andes represent one of the most diverse habitats of the world (Myers et al. 2000). In Peru, several protected areas have been created for the conservation of their biodiversity. A recent example is Bahuaja-Sonene National Park (BSNP), which is located between the Puno and Madre de Dios Regions, southeastern Peru, and created in 1996 to protect representative ecosystems of the Subtropical Amazonia and Yungas Biogeographic Provinces (INRENA 2003). To meet these aims, and to study the biological diversity in a key sector of the park, La Nube Biological Station (LNBS) was built in 2001 on the lower Távara River, where the transition between lowland and montane forest occurs. Unfortunately, this station was abandoned in 2009 (Fig. 2), and very few biological inventories have been conducted near this location (Foster et al. 1994).

The few assessments of the herpetological diversity in the montane forest of BSNP are all restricted to the vicinity of LNBS. Icochea (1994) and Rodríguez and Emmons (1994) assessed the diversity of amphibians and reptiles from the Lower and Upper Távara River Basin respectively, obtaining remarkable records and even new species (Myers et al. 1998). Another assessment was performed by Venegas and Crnobrna (2015) at "Cerro Cuchilla" (Fig. 1). Including all the records from these studies, LNBS and surroundings have a total of 43 amphibian and 25 reptile species. The list is likely incomplete, especially when compared with inventories

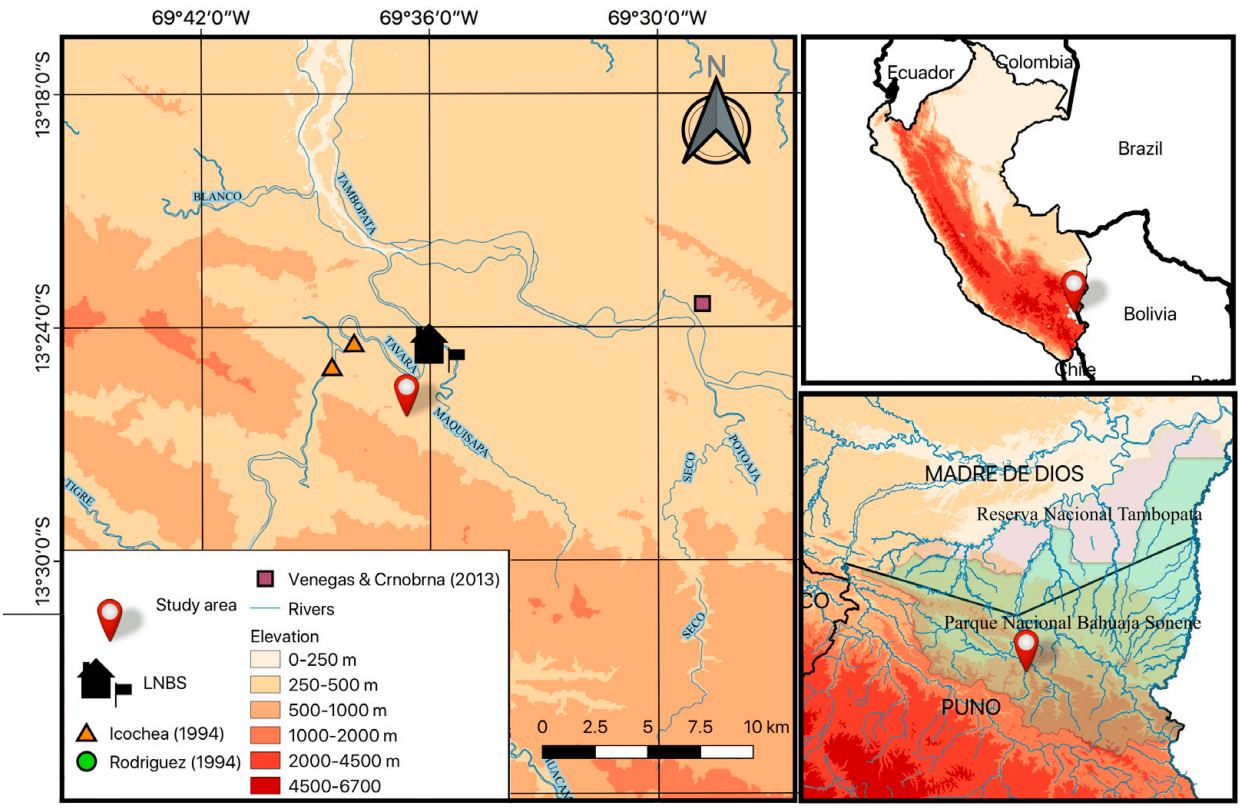

Figure 1. Location of the study area in La Nube Biological Station, Bahuaja Sonene National Park, Peru.

from nearby localities, such as those in Duellman and Salas (1991), Doan and Arizábal (2002), Duellman (2005) and von May et al. (2010).

In September of 2013, we surveyed amphibians and reptiles near LNBS as part of a multidisciplinary biological diversity inventory. Herein we present the results of our assessment and we combine our species records with those from Icochea (1994), Rodríguez and Emmons (1994) and Venegas and Crnobrna (2015) in order to obtain a general species list of amphibians and reptiles for the vicinity of LNBS. Additionally, we comment on 2 amphibian species: *Pristimantis* cf. *ockendeni* Boulenger, 1912 and, *Bolitoglossa* cf. *altamazonica* Cope, 1874 because their identification is uncertain, and 2 reptiles: *Apostolepis nigroterminata* Boulenger, 1896 and *Epictia diaplocia* Orejas-Miranda, 1969 because they are rarely recorded.

Methods

Study site. The survey was conducted in the foothills surrounding La Nube Biological Station, BSNP, Puno Region, Peru (13°25′20″ S, 069°36′37″ W). This sector is close to the junction between the lower basin of the Távara River and the upper basin of the Tambopata River near the boundary of Madre de Dios Region (Fig. 1).

The climate in the lower basin of the Tavara River is typical of Subtropical Forest: damp to very damp, with an average annual temperature of 26 °C, varying between 10 and 38 °C. The topography is mountainous with the highest peaks at 800 m above sea level (a.s.l.). Vegetation consists of a transition between the Amazon lowlands and montane forest (INRENA 2003) (Fig. 2).

The assessment period was September 22–28, 2013 at the end of the dry season according to SENAMHI Peru (Datos Hidrometeorologicos, Estación Malinowski and Estación San Gabán).

Data collection. We sampled the herpetofauna using transects and Visual Encounter Survey (VES) (W.R. Heyer et al. 1994, McDiarmid et al. 2012). We established thirty 50 m transects, separated by 50 m (Table A1). The transects were located in a range of elevations from the river level to the ridgetop of a mountain (298–484 m a. s. l) in order to cover the variety of microhabitats between the riverbank and upland forest. The transects were assessed once by 2 observers for a duration of 30 ± 5 min, between 19:00 and 00:00 h. We invested a total effort of 31.3 and 21.97 person-hours for transects and VES, respectively. Also, we installed 2 lines of pitfall traps, each with 6 buckets 5 m apart, with a fence 1 m in height (W.R. Heyer et al. 1994, McDiarmid et al. 2012). The pitfall traps were left open for 6 nights and were visited twice per day. The area surveyed by the transects and pitfall traps was approximately 16 ha. Coordinates of transects and pitfall traps are in Table A1. Opportunistic observations were added to our final list, but they were not considered for the data analyses. We collected some specimens with authorization from Resolución Jefatural No. 008-2013-SERNANP-JEF, obtained from the Servicio Nacional de Áreas Naturales Protegidas por el Estado (SERNANP), Peru. Specimens were euthanized using lidocaine, following approved protocols, then fixed in 10% formalin and stored in 70% ethanol. Tissue

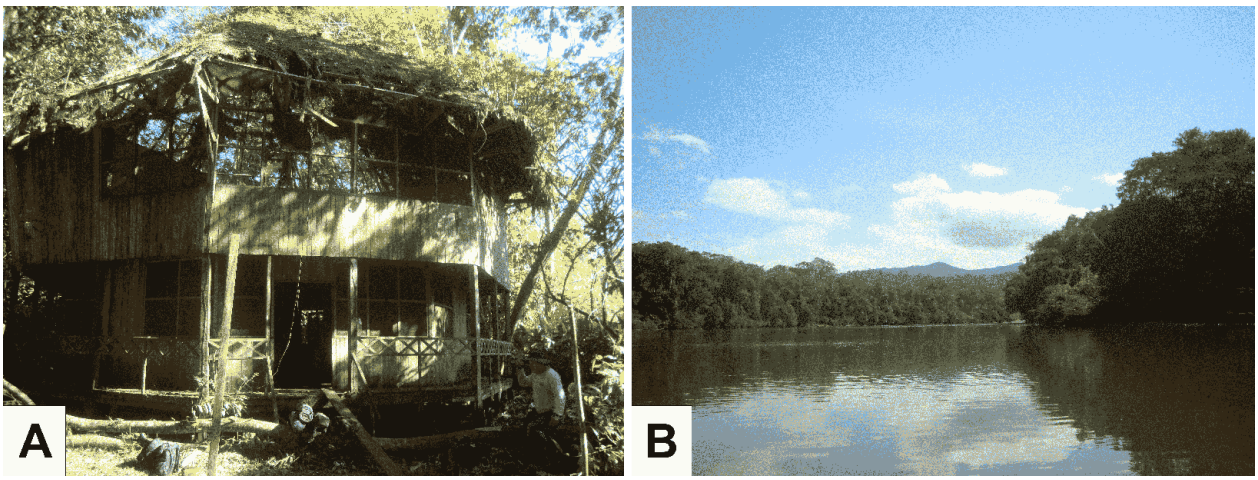

Figure 2. A. La Nube Biological Station. **B.** Landscape in the vicinity of the study area.

samples were removed from some specimens and preserved in 96% ethanol. The snout-vent length (SVL) was measured for all collected specimens. IBL collected all the specimens and tissue samples which were deposited in the scientific collection of the Museo de Historia Natural de la Universidad Nacional de San Agustín de Arequipa (MUSA), Peru. Some specimens that were not collected were photographed; photos are available from MUSA or from IBL.

Data analysis. Using the data obtained, we constructed species accumulation curves and applied the Chao 2 estimator to assess the completeness of our inventory (Colwell and Coddington 1994). For this, we used the "vegan" package (Oksanen et al. 2015) in the R platform (R Core Team 2018).

We followed the taxonomic classifications suggested by Frost (2019) for amphibians, and Uetz and Hošek (2019) for reptiles.

Results

In a total effort of 53.27 person-hours, we recorded 18 amphibian species in 7 families: Aromobatidae (2 species), Bufonidae (2 species), Craugastoridae (6 species), Dendrobatidae (1 species), Hylidae (3 species), Leptodactylidae (3 species), Plethodontidae (1 species). Fifteen reptile species were recorded in 10 families: Dactyloidae (1 species), Gymnophthalmidae (2 species), Scincidae (1 species), Teiidae (1 species), Tropiduridae (1 species), Colubridae (4 species), Viperidae (2 species), Leptotyphlopidae (1 species), Alligatoridae (1 species), Podocnemidae (1 species) (Tables 1, 2).

We recorded 5 amphibian species and 9 reptile species which were not reported previously in the vicinity of LNBS (Icochea 1994, Rodríguez and Emmons 1994, Venegas and Crnobrna 2015). The updated list for this area now includes 48 amphibian species and 34 reptile species.

Table 1. Amphibians recorded in the vicinity of La Nube Biological Station, Bahuaja-Sonene National Park, Peru. We only consider confirmed records.

	Taxa	Icochea (1994)	Rodríguez (1994)	Venegas and Crnobrna (2015)	This study
	Order Anura				
	Family Aromobatidae				
1	*Allobates femoralis*	X			X
2	*Allobates trilineatus*				X
	Family Bufonidae				
3	*Rhaebo guttatus*			X	
4	*Rhinella margaritifera*	X	X	X	X
5	*Rhinella marina*	X	X	X	X
6	*Rhinella poepiggi*		X		
	Family Centrollenidae				
7	*Cochranella* sp.		X		
	Family Craugastoridae				
8	*Nobella myrmecoides*		X		
9	*Oreobates cruralis*			X	
10	*Oreobates quixensis*		X		
11	*Pristimantis* cf. *croceoinguinus*		X		
12	*Pristimantis buccinator*		X		
13	*Pristimantis fenestratus*	X	X	X	X
14	*Pristimantis* cf. *ockendeni*	X	X		X

Table 1. *Continued.*

	Taxa	Icochea (1994)	Rodríguez (1994)	Venegas and Crnobrna (2015)	This study
15	*Pristimantis ockendeni*				X
16	*Pristimantis reichlei*			X	X
17	*Pristimantis skydmainos*		X		
18	*Pristimantis* sp. 1				X
19	*Pristimantis* sp. 2		X		
20	*Pristimantis toftae*	X	X		
21	*Pristimantis ventrimarmoratus*			X	X
	Family Dendrobatidae				
22	*Ameerega hahneli*			X	
23	*Ameerega simulans*		X		X
	Family Hemiphractidae				
24	*Hemiphractus helioi*		X		
	Family Hylidae				
25	*Boana boans*				X
26	*Boana balzani*		X		
27	*Boana calcarata*			X	
28	*Boana cinerascens*			X	
29	*Boana fasciata*			X	
30	*Boana geographica*			X	
31	*Boana lanciformis*			X	X
32	*Dendropsophus minutus*			X	
33	*Dryaderces* cf. *pearsoni*		X	X	
34	*Osteocephalus castaenicola*			X	
35	*Osteocephalus helenae*			X	
36	*Osteocephalus* cf. *leoniae*			X	
37	*Osteocephalus leprieuri*		X		
38	*Osteocephalus taurinus*	X			X
	Family Leptodactylidae				
39	*Adenomera andreae*			X	X
40	*Engystomops petersi*			X	
41	*Leptodactylus leptodactylioides*		X		
42	*Lithodytes lineatus*			X	
43	*Leptodactylus pentadactylus*				X
44	*Leptodactylus rhodonotus*	X	X		X
	Family Phyllomedusidae				
45	*Phyllomedusa bicolor*		X	X	
46	*Phyllomedusa vaillantii*		X	X	
	Order Caudata				
	Family Plethodontidae				
47	*Bolitoglossa* cf. *altamazonica*		X	X	X
	Order Gymnophiona				
	Family Caeciliidae				
48	*Caecilia* sp.			X	
	Total	**8**	**23**	**25**	**18**

For both amphibians and reptiles, the accumulation curves represent straight lines which do not reach an asymptote. The Chao 2 estimator predicts 16 ± 5 amphibian species and 12 ± 7 reptile species in the transects. However, it does not show stability (Fig. 3); indicating that the predictions are not reliable and the inventory is, as expected, incomplete. The data obtained for creating the species accumulation curve are available in the Appendices A2 and A3. The amphibian and reptile species recorded during our assessment are treated below, with voucher specimens, localities, date of record, and a brief description and identification characters for distinguishing them from similar species. Coordinates are provided only for opportunistic records. See Table A1 for coordinates of the specimens recorded in transect or pitfall traps.

Class Amphibia

Order Anura

Family Aromobatide

***Allobates femoralis* Zimmermann & Zimmerman, 1988**

Material examined. MUSA 4925–6; (13°25′20″S, 069° 36′36″W), 22.IX.2013.

Identification. A small frog, SVL 20–33.5 mm in males and 20.5–33.5 mm in females. It can be identified by

Table 2. Reptiles recorded in the vicinity of La Nube Biological Station, Bahuaja-Sonene National Park, Peru. We only consider confirmed records.

	Taxa	Icochea (1994)	Rodríguez (1994b)	Venegas and Crnobrna (2015)	This study
	Lacertilia				
	Family Alopoglossidae				
1	*Ptychoglossus brevifrontalis*			X	
	Family Dactyloidae				
2	*Anolis fuscoauratus*			X	X
	Family Gymnophthalmidae				
3	*Bachia dorbignyi*			X	
4	*Cercosaura ocellata*				X
5	*Potamites ecpleopus*	X			X
6	*Ptychoglossus brevifrontalis*			X	
	Family Scincidae				
7	*Varzea altamazonica*				X
	Family Teiidae				
8	*Ameiva ameiva*			X	
9	*Kentropyx pelviceps*	X		X	X
	Family Tropiduridae				
10	*Plica plica*				X
11	*Stenocercus rosieventris*			X	
	Ophidia				
	Family Boidae				
12	*Corallus hortulanus*			X	
13	*Epicrates cenchria*		X		
	Family Colubridae				
14	*Apostolepis nigroterminata*				X
15	*Clelia clelia*		X		
16	*Dendrophidion* sp.		X		
17	*Erythrolamprus typhlus*			X	
18	*Helicops polylepis*			X	
19	*Imantodes cenchoa*			X	X
20	*Leptodeira annulata*			X	X
21	*Oxyrhopus formosus*			X	
22	*Pseustes poecilonotus*			X	
23	*Siphlophis compressus*			X	
24	*Xenodon severus*			X	X
	Family Elapidae				
25	*Micrurus obscurus*			X	
	Family Viperidae				
26	**Bothrops atrox**			X	
27	*Bothrocophias* cf. *microphtalmus*				X
28	*Bothrops billineata*				X
	Family Leptotyphlopidae				
29	*Epictia diaplocia*				X
	Order Crocodylia				
	Family Alligatoridae				
30	*Paleosuchus palpebrosus*				X
	Order Testudines				
	Family Chelidae				
31	*Phrynops geoffranus*	X			
32	*Platemys platycephala*			X	
	Family Podocnemididae				
33	*Podocnemis unifilis*				X
	Family Testudinidae				
34	*Chelonoidis denticulatus*			X	
	Total	**3**	**3**	**20**	**15**

dark brown dorsum with conspicuous dorsolateral and ventrolateral white stripes; throat and chest black; venter bluish white with black blotches. A yellow or orange spot extends from the inguinal region to the dorsal thigh region, and another on the proximal dorsal surface of the arms. Dorsal surfaces of digital discs bear a pair of scutes. Similar species in adjacent localities, *Ameerega hahneli* and *Lythodytes lineatus*, differ by lacking a

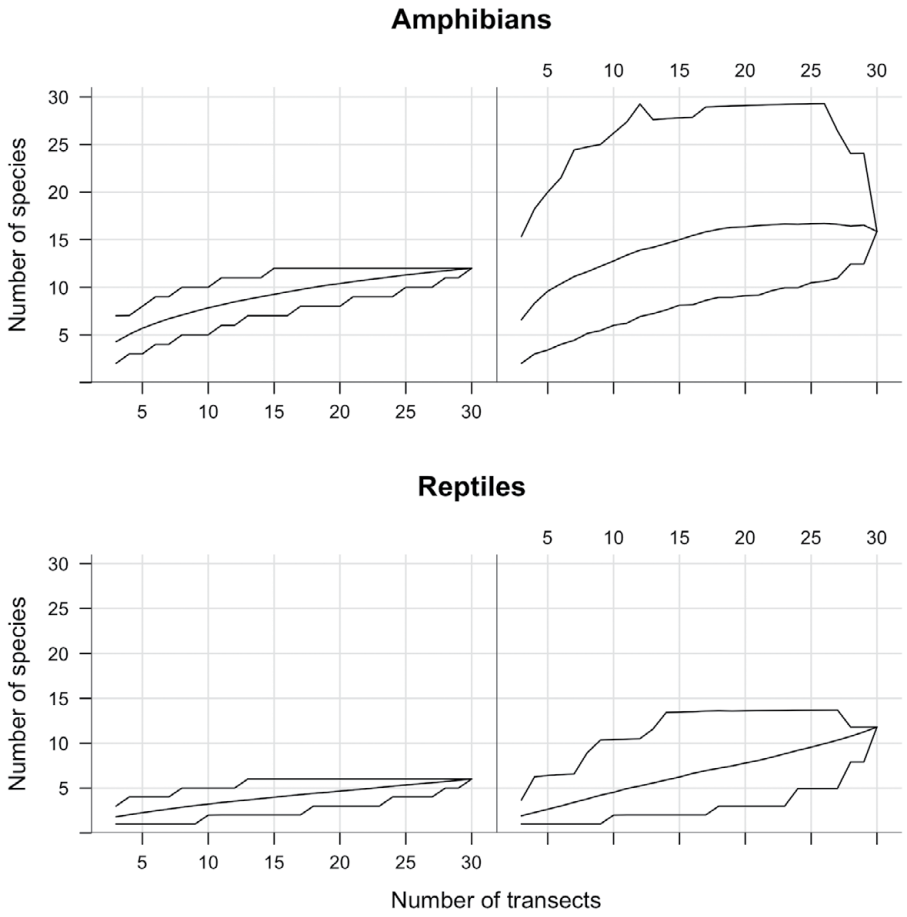

Figure 3. Accumulation curve (left) and Chao 2 estimator (right) for amphibians and reptiles recorded in the vicinity of LNBS, BSNP, Peru.

ventrolateral white stripe, venter is blue with black reticulation and uniformly gray respectively. Furthermore, *L. lineatus* lacks scutes on the dorsal surfaces of discs (Duellman 1978, 2005, Rodriguez and Duellman 1994).

Distribution. *Allobates femoralis* is a pan-Amazonian frog widely distributed throughout primary, non-flooded forest areas in the Amazonian forest in Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname and Venezuela (de la Riva et al. 2000, Barrio-Amorós and Santos 2010, Simões et al. 2010, Frost 2019).

***Allobates trilineatus* (Boulenger, 1884)**

Material examined. MUSA 4933; Transect TN18, 25. IX.2013. MUSA 4934–5 (13°25′20″S, 069°36′36″W), 22. IX.2013.

Identification. A small frog, SVL 11.4–17.7 mm in males and 14.2–19.3 mm in females. It can be identified by having dorsum tan to dark brown with dorsolateral and ventrolateral cream stripes bordering a broad blackish brown lateral band extending from the snout to the groin. Venter creamy white, usually with the throat gray in males. Finger I > II. The digital discs are expanded and have 2 dorsal scutes. Similar *Allobates "Colostethus"* species in near localities are: *A. alessandroi*, which has a ventrolateral stripe extending onto the venter; *A. conspicuus*, which has an immaculate throat and finger III not swollen in males (Morales 2000, Grant and Rodríguez 2001, Duellman 2005).

Distribution. *Allobates trilineatus* is distributed in Amazonia of Bolivia, Brazil, and Peru, at low elevation forests up to 900 m a.s.l. (Grant and Rodríguez 2001, Frost 2019).

Remarks. *Allobates trilineatus* is also similar to *A. marchesianus*, but the presence of the latter in Peru is unproven (Grant and Rodríguez 2001, Caldwell et al. 2002).

Family Bufonidae

***Rhinella margaritifera* (Laurenti, 1768)**

Material examined. MUSA 4923; (13°25′20″S, 069°36′ 36″W), 24.IX.2013.

Identification. A moderate sized toad, SVL 40–67 mm in males and 46–87 mm in females. It can be identified by having typical cranial crests which are expanded dorsolaterally. Head is typically triangular in dorsal view. Dorsal skin tubercular; venter coarsely areolate. Dorsum highly variable: brown, grayish brown, reddish brown or tan, commonly exhibiting dark brown to black blotches, a light cream vertebral line present in some individuals. Venter cream, or gray in some cases with brown mottling. Similar species in nearby localities is:

Amazophrynella javierbustamantei, which can be confused with juveniles of *R. margaritifera*, but its posterior venter is pale yellowish-orange with small rounded black or dark brown spots (Duellman 1978, 2005, Rodriguez and Duellman 1994, Lavilla et al. 2013, S. P. dos Santos et al. 2015, Rojas et al. 2016).

Distribution. *Rhinella margaritifera* is widely distributed in the Amazonian forest in Bolivia, Brazil, Colombia, French Guiana, Guyana, Panama, Peru, Suriname, and Venezuela up to 2400 m a.s.l. (Lavilla et al. 2013, Frost 2019).

***Rhinella marina* (Linnaeus, 1758)**

Material examined. Field observations; (13°25′20″S, 069°36′36″W), 22–28.IX.2013.

Identification. The largest toad in the Peruvian Amazon, SVL 90–187 mm in males and 95–287 mm in females. It can be identified by its large size, highly tuberculate dorsum, granular venter, large and prominent parotoid glands. Dorsum and flanks vary from grayish tan, olive-brown or even reddish brown, usually with dark brown or black spots, especially in females. Venter dull cream or white, commonly with black mottling. Similar species in nearby localities are: *Rhaebo guttatus*, which differs by having a smooth dorsum orange-tan to olive-tan, the sides of the head and flanks are brown; *Rhinella poeppigii*, which has flattened parotoids with borders poorly defined and never hypertrophied (Duellman 1978, 2005, Rodriguez and Duellman 1994, de la Riva 2002, Cole et al. 2013).

Distribution. *Rhinella marina* is distributed along the east of the Andes throughout Amazonia in Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru and Venezuela (Acevedo et al. 2016, Frost 2019).

Remarks. The characters listed above can be insufficient to distinguish between *R. marina* and *R. poeppigii*, especially in juvenile individuals; see discussion in de la Riva (2002).

Family Craugastoridae

***Pristimantis fenestratus* (Steindachner, 1864)**

Material examined. MUSA 4924; (13°25′20″ S, 069°36′ 36″ W), 28.IX.2013.

Identification. A member of the *Pristimantis conspicillatus* species group (Lynch and Duellman 1997, Hedges et al. 2008, Padial et al. 2014). A moderate-sized *Pristimantis,* SVL 23.4–39.3 mm in males and 31.9–57.2 mm in females. It can be identified by dorsum shagreen with scattered tubercles; smooth skin on venter; discoidal fold prominent and dorsolateral folds absent. Upper eyelids lack tubercles. Finger I > II, discs on digits are considerably expanded. Toe V slightly longer than III. Dorsum varies from yellowish tan, pale grayish tan or pale reddish tan, usually with darker markings of the same color. Venter pale cream with mottling on the throat. Faint labial bars. Posterior surfaces of thighs same as the dorsal ground color. Similar species in adjacent localities are: *P. peruvianus* and *P. buccinator*, but they differ by having the posterior surfaces of thighs brown with cream spots, and brown with minute white flecks respectively (Duellman 2005, Duellman and Lehr 2009).

Distribution. *Pristimantis fenestratus* is widespread throughout the Amazon Basin in Bolivia, Brazil, Ecuador, Colombia and Peru in an elevation range from 100 to 1800 m a.s.l. (Lynch 1980, de la Riva et al. 2000, Duellman and Lehr 2009, Padial and de la Riva 2009, Frost 2019).

Pristimantis* cf. *ockendeni
Figure 4A–C

Material examined. MUSA 4954; (13°25′24″S, 069°36′ 35″W), 22.IX.2013. MUSA 4955; (13°25′21″S, 069°36′ 35″W), 22.IX.2013. MUSA 4957, 4959, 4965–6, 5797, 5801, 5805; (13°25′20″S, 069°36′36″W), 22–24,28. IX.2013. MUSA 4960; Transect TN12, 26.IX.2013. MUSA 4963; Transect TN11, 26.IX.2013. MUSA 4964, 5792; Transect TN6, 27.IX.2013. MUSA 4967; Transect TN17, 25.IX.2013. MUSA 5796; Transect TN4, 22.IX.2013. MUSA 5811; Transect TN1 28.IX.2013.

Identification. This species does not resemble any other *Pristimantis* recorded in the vicinity of LNBS, but it can be recognized by a dorsal tan coloration with faint longitudinal stripes and venter pale cream to pale gray. Posterior surfaces of thighs bright orange in some individuals. Typical measurements and characteristics, together with a comparison with the most similar species, *P. ockendeni*, are in Table 3.

Distribution. This *Pristimantis* has not been reported outside PNBS.

Remarks. Several *Pristimantis* species were observed during our sampling but *P.* cf. *ockendeni* was the only one with orange thighs and dorsal pattern with longitudinal stripes (Fig. 4A and 4C). *Pristimantis ockendeni* is morphologically similar, and its type locality is ~12 km from our study area (Duellman and Lehr 2009). Nevertheless, our comparison revealed some differences, especially the length of toes (Table 3), which suggest our specimens may be an undescribed species.

***Pristimantis ockendeni* Boulenger, 1912**
Figure 4D

Material examined. MUSA 4956, 4958, 5794; (13°25′ 20″S, 069°36′36″W), 22,23.IX.2013. MUSA 4961, 5799; Transect TN21, 25.IX.2013. MUSA 4962; Transect TN20, 25.IX.2013. MUSA 5793; Transect TN16, 26.IX.2013. MUSA 5795, 5800; (13°25′41″S, 069°36′45″W), 23.IX.2013. MUSA 5798; TN13, 26.IX.2013. MUSA 5802; Transect TN11, 26.IX.2013. MUSA 5803, 5807, 5810; (13°25′25″S, 069°36′36″W), 22.IX.2013. MUSA

5804, 5806; Transect TN21, 21,25.IX.2013. MUSA 5808; (13°25′26″S, 069°36′36″W), 22.IX.2013. MUSA 5809; Transect TN20, 25.IX.2013. MUSA 5812; (13°25′24″S, 069°36′35″W), 22.IX.2013.

Identification. According to Hedges et al. (2008), a member of the *Pristimantis frater* species group, but unassigned to any species group by Padial et al. (2014). A small frog, SVL 12.5–21.3 mm in males and 22.2–31.5

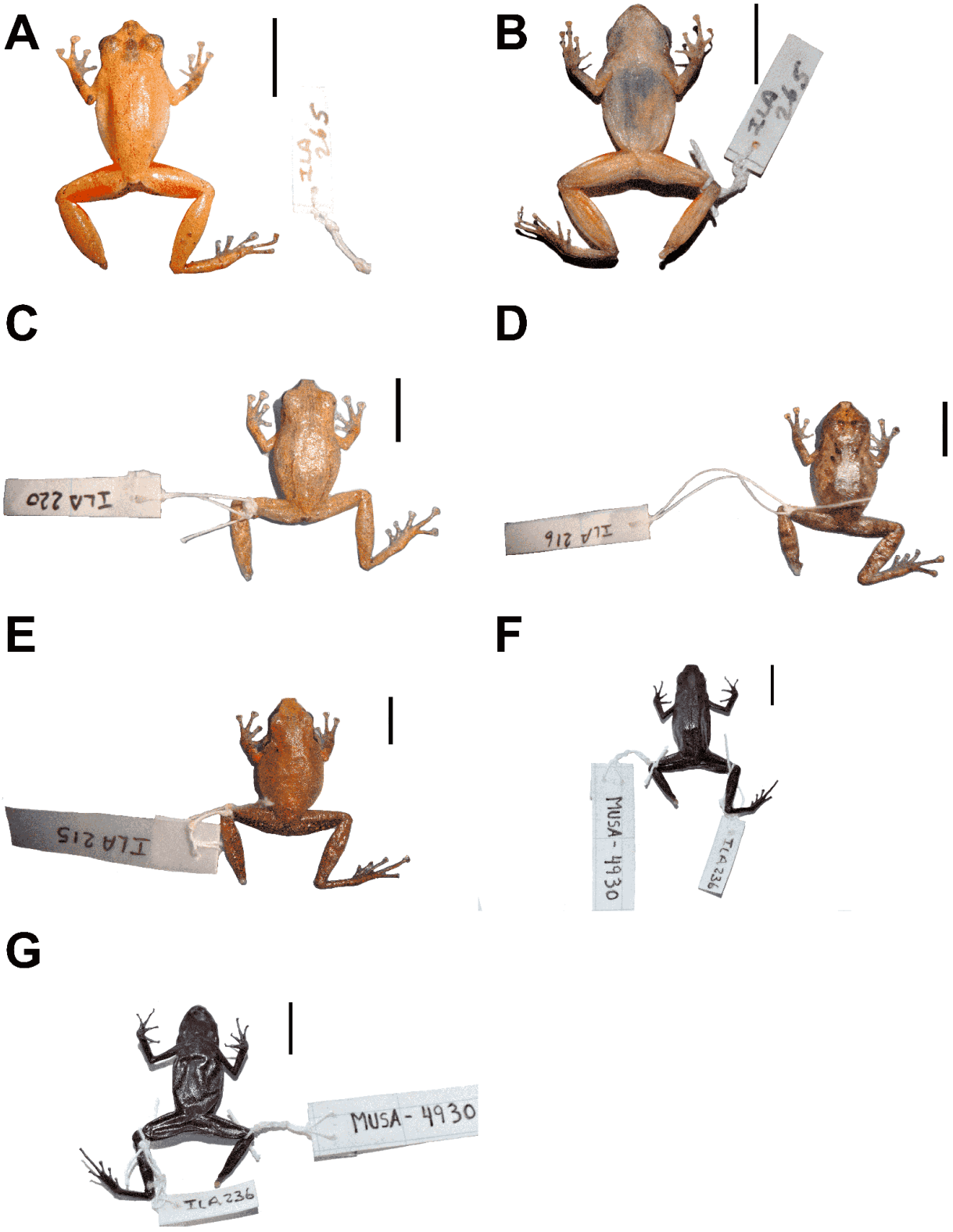

Figure 4. A. *Pristimantis* cf. *ockendeni* (MUSA 4963, SVL: 21.8 mm), dorsal view. **B.** MUSA 4963, ventral view. **C.** *Pristimantis* cf. *ockendeni* (MUSA 4965, SVL: 22.7), dorsal view. **D.** *Pristimantis ockendeni* (MUSA 5808, SVL: 24.2 mm), dorsal view. **E.** *Pristimantis reichlei* (MUSA 4950, SVL: 29.1 mm), dorsal view. **F.** *Ameerega simulans* (MUSA 4930, SVL: 25.53 mm), dorsal view. **G.** MUSA 4930, ventral view. Scale bars = 10 mm.

Table 3. Comparison of characters of *Pristimantis* cf. *ockendeni* with those given by Duellman and Lehr (2009) and Ocampo et al. (2017).

Character	MUSA 4957, 4963, 4964, 4965, 4967	Duellman and Lehr (2009), and Ocampo et al. (2017)
Dorsal view of head	Subacuminate	Subacuminate
Lateral view of head	Rounded	Rounded
Snout	Short	Short
Skin dorsum	Shagreen	Shagreen
Discoidal fold	Present	Present
W–shaped occipital ridges	yes/not	yes/not
Skin venter	Weakly areolate	Areolate
Cranial crests	Absent	Absent
Tympanic annulus	Evident	Usually evident
Tympanic membrane	Evident	Usually evident
Tympanum length	0.16–0.32 of the eye length	0.25–0.4 of the eye length
Eye length	> eye nostril distance	> eye nostril distance
Prevomerine odontophores	Oblique	Oblique
Canthal stripe from nostril to eye	Absent	Absent
Upper eyelid tubercles	Yes/not	Present
Supratympanic stripe	Present	Present
Finger	I < II	I < II
All fingers bearing pads and discs	Yes	Yes
Largest pad on finger III or IV	Slightly larger/yes	Yes
Toes	III ≈ V	III << V
Ulnar tubercles	Conspicuous	Minute
SVL males (mm)	18.75–23.45	15.3–21.3
SVL females (mm)	No available	22.2–31.5
Lumbar bar	Absent/Present	Present
Dorsal design	Some with longitudinal lines	Dark brown markings
Tights coloration	Brown to orange-red	Brown to rose-red

mm in females. It can be identified by dorsum shagreen; venter coarsely areolate. Discoidal fold evident. Dorsolateral folds present or absent. Upper eyelids usually with small tubercles. Finger I < II. Toe V >> III. Dorsum varies from pale tan to reddish brown with dark brown marking, sometimes with an H- or W-shaped mark on the scapular region; venter pale gray. Labial bars present. Ventral and dorsal surfaces of thighs are brown to rose-red (Duellman 1978, 2005, Rodriguez and Duellman 1994, Duellman and Lehr 2009). There are no other similar *Pristimantis* species in the area with small tubercles on the upper eyelids.

Distribution. *Pristimantis ockendeni* has a controversial distribution (see Elmer and Cannatella 2008, Duellman and Lehr 2009), but currently is restricted to Amazonia of Bolivia, Brazil, Colombia, Ecuador, and Peru, from 300 to 1800 m a.s.l. (Ocampo et al. 2017, Frost 2019).

Remarks. In respect to coloration and dorsal pattern, *P. ockendeni* can be highly variable, and this character is insufficient to identify this species.

Pristimantis reichlei Padial & de la Riva, 2009

Figure 4E

Material examined. MUSA 4937; Transect TN28. 24. IX.2013. MUSA 4940–1, 4944, 4952; (13°25′20″S, 069° 36′36″W), 23,24.IX.2013. MUSA 4942; Transect TN27, 24.IX.2013. MUSA 4945; Transect TN29, 24.IX.2013. MUSA 4949; (13°25′28″S, 069°36′37″W), 22.IX.2013. MUSA 4950; (13°25′26″S, 069°36′36″W), 22.IX.2013. MUSA 4951; (13°25′25″S, 069°36′36″W), 22.IX.2013. MUSA 4953; Transect T29, 24.IX.2013.

Identification. A member of the *Pristimantis danae* species group (Padial et al. 2014). A small frog, SVL 23.9–37.1 mm in males. It can be identified by skin of dorsum shagreen; venter coarsely granular; discoidal fold and dorsolateral folds absent. Upper eyelids lack prominent tubercles. Finger I < II, discs on the digits moderately expanded. Dorsal coloration variable, typically tan with dark brown flecks and chevrons; venter white with fine mottling. Posterior surface of thighs brown with orange spots. Similar species in adjacent localities are: *P. peruvianus*, which differs by Finger I > II, and dorsolateral folds present; *P. skydmainos*, which has a dark brown facemask and dorsolateral folds (Duellman and Lehr 2009, Padial and de la Riva 2009).

Distribution. *Pristimantis reichlei* is distributed in the Amazon Basin and lower Andean foothills from southern Peru, southwestern Brazil and central Bolivia up to 1500 m a.s.l. (Padial and de la Riva 2009, Melo-Sampaio and de Souza 2010, Frost 2019).

Prinstimantis ventrimarmoratus (Boulenger, 1912)

Material examined. MUSA 4838; Transect TN2, 28. IX.2013. MUSA 4839; Transect TN5, 27.IX.2013.

Identification. A member of *Pristimantis unistrigatus* species group according to Lynch and Duellman (1997), Hedges et al. (2008) and, Duellman and Lehr (2009), but unassigned to any species group by Padial et al. (2014). A

moderate-sized *Pristimantis* species, SVL 17.8–26 mm in males and 33–44 mm in females. It can be identified by having the skin on dorsum shagreen; venter coarsely areolate; discoidal fold prominent; dorsolateral folds absent. Upper eyelids lack tubercles. Finger I < II, discs on fingers expanded. Dorsum tan with irregular brown mottling and distinct diagonal bars on the limbs. Venter white with bold black mottling. Conspicuous brown labial bars are present. Surface of the thighs cream with dark brown diagonal bars. Similar species in neighboring localities are: *P. altamazonicus*, which has a cream venter, and posterior surface of thighs black with red mottling; *P. imitatrix* which has tubercles on the upper eyelids (Duellman and Lehr 2009).

Distribution. *Pristimantis ventrimarmoratus* is distributed in the Amazon Basin and cloud forest of Bolivia, Ecuador, and Peru below 1800 m a.s.l. (Duellman and Lehr 2009, Frost 2019).

Family Dendrobatidae

***Ameerega simulans* Myers, Rodríguez, & Icochea, 1998**
Figure 4F, G

Material examined. MUSA 4929, 4931; (13°25′24″S, 069°36′35″W), 22,24.IX.2013. MUSA 4930; (13°25′49″S, 069°36′36″W), 24.IX.2013. MUSA 4932; (13°25′41″S, 069° 36′45″W), 23.IX.2013.

Identification. A small dendrobatid species, SVL 18.9–22.4 mm in males and 23.6–27 mm in females. It can be identified by granular dorsal skin; head and dorsum black; flanks black with a bright yellow stripe extending from groin to tip of the snout. Venter blue with black reticulum. Similar species in adjacent localities are: *A. trivittata*, which is larger, SVL males = 37–40 mm, females = 42–46 mm, and venter black with blue spots; *A. petersi* and *A. macero*, which have a brown and red dorsal coloration respectively (Myers et al. 1998).

Distribution. According to Myers et al. (1998), *A. simulans* inhabits in the lower montane Andean forest in the upper Rio Madre de Dios watershed, Cusco, Madre de Dios and Puno Regions, Peru.

Family Hylidae

***Boana boans* (Linnaeus, 1758)**
Figure 5A, B

Material examined. MUSA 4922; (13°25′25″S, 069°36′ 36″W), 22.IX.2013.

Identification. A large tree-frog species, SVL 84–118 mm in males and 88–110 mm in females. It can be identified by its large size, small calcars and extensive webbing on hands and feet. Males present a typical spine on the thumb. Dorsum smooth, tan to brown with faint darker marks, flanks grayish tan with thin dark brown vertical bars. A similar species in neighboring localities is *B. geographica*, but it differs by having hands and feet <50% webbed, and orange dorsal coloration (Duellman 1978, 2005, Rodriguez and Duellman 1994).

Distribution. *Boana boans* is widely distributed in the Amazonian forests in Bolivia, Colombia, Ecuador, Peru, French Guiana, Guyana, eastern Panama and Trinidad (Hoogmoed 1990, de la Riva et al. 2000, Duellman et al. 2016, Frost 2019).

***Boana lanciformis* (Cope, 1871)**

Material examined. Field observations; (13°25′20″S, 069°36′36″W), 27–28.IX.2013.

Identification. A large tree-frog, SVL 61.5–80 mm in males and 83–94 mm in females. It can be identified by a pointed snout with a white labial line. Dorsal skin smooth and light brown; venter light cream with distinctive large darker cream blotches. There are no similar tree frog species in the neighboring localities (Duellman 1978, Rodriguez and Duellman 1994).

Distribution. *Boana lanciformis* is widely distributed in the Amazonian forests in Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, and Venezuela (Duellman 1978, de la Riva et al. 2000, Frost 2019).

***Osteocephalus taurinus* Steindachner, 1862**
Figure 6C, D

Material examined. MUSA 4921; (13°25′20″S, 069°36′ 36″W), 28.IX.2013.

Identification. A large spiny-backed treefrog, SVL 66–91.1 mm in males and 56.4–109.8 mm in females. It can be identified by spinous dorsal tubercles in males. Dorsum reddish brown with darker irregular marks; venter cream with mottling on throat and chest. Flanks with small dark brown spots. Fingers and toes less than half webbed. Iris golden with bold black radiating lines, distinguishing *Osteocephalus taurinus* from other similar species such as *O. castaenicola*, *Trachycephalus coriaceus*, *T. cunauaru* and *T. typhonius* (Rodriguez and Duellman 1994, Jungfer et al. 2000, 2013, Duellman 2005, Moravec et al. 2009).

Distribution. *Osteocephalus taurinus* is widely distributed across the Amazon and upper Orinoco Basin in Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana and Venezuela (de la Riva et al. 2000, Cole et al. 2013, Jungfer et al. 2013, Frost 2019).

Family Leptodactylidae

***Adenomera andreae* (Müller, 1923)**

Material examined. MUSA 4927–8; (13°25′20″S, 069° 36′36″W), 23,28.IX.2013. MUSA 4936; Transect TN23, 25.IX.2013.

Identification. A small leptodactylid species, SVL18–25 mm in males and 22.1–28 mm in females. It can be

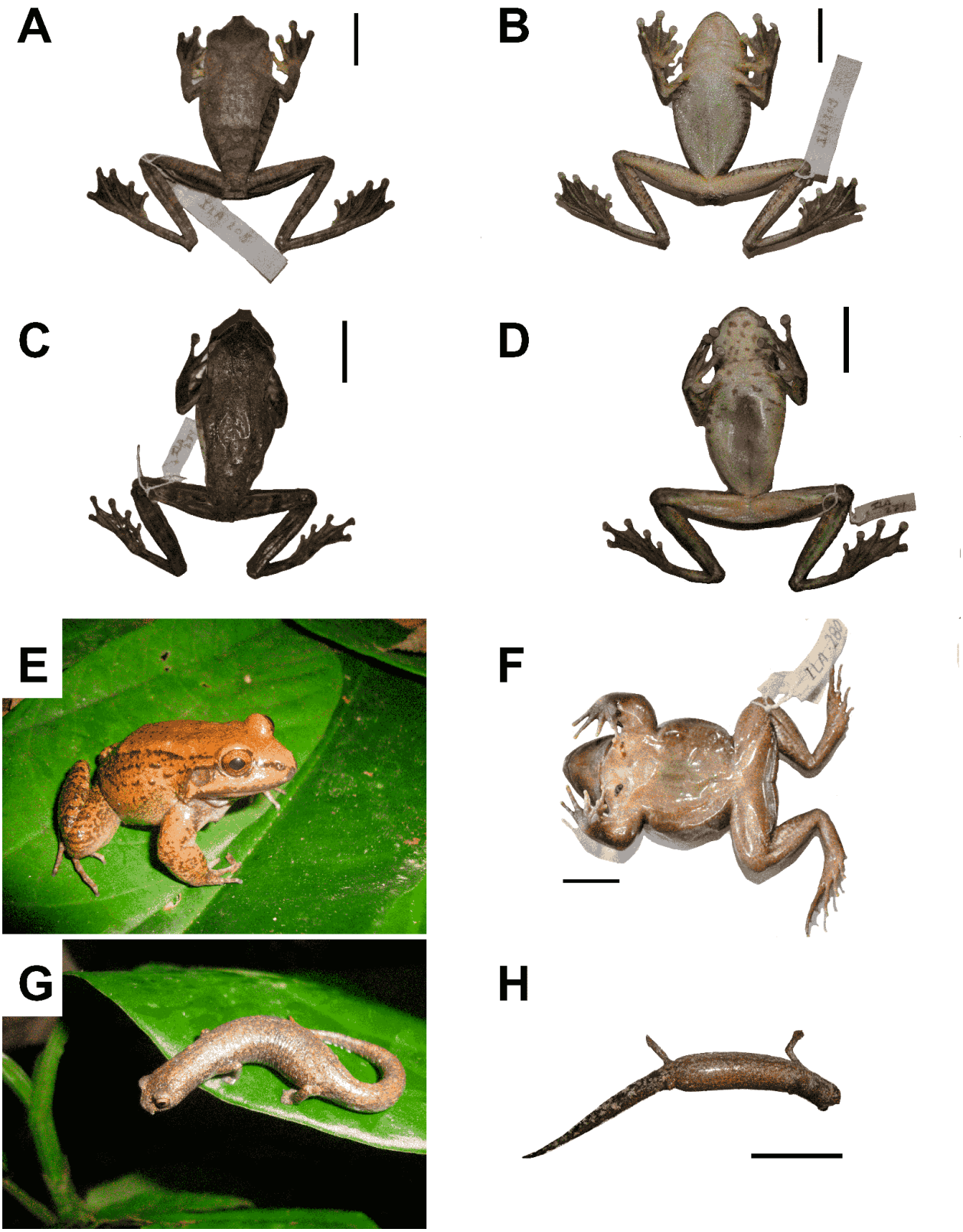

Figure 5. A. *Boana boans* (MUSA 4922, SVL: 72.1 mm), dorsal view. **B.** MUSA 4922, ventral view. **C.** *Osteocephalus taurinus* (MUSA 4921, SVL: 66.1 mm), dorsal view. **D.** MUSA 4921, ventral view. **E.** *Leptodactylus rhodonotus* (MUSA 4918, SVL: 76.27 mm), lateral view. **F.** MUSA 4918, dorsolateral view. *Leptodactylus rhodonotus* (MUSA 4918, SVL: 76.27 mm), ventral view. **G.** *Bolitoglossa* cf. *altamazonica* (MUSA 4970, SVL: 42.4 mm), dorsolateral view. **H.** MUSA 4970, ventral view. Scale bars = 20 mm.

identified by snout rounded, toe discs flattened and no lateral fringes on toes. Finger I = II. Dorsum tuberculate, tubercles white-tipped in males, dorsum brown or tan with small black spots arranged in longitudinal rows. Ventral skin smooth, light cream or white. A broad cream dorsolateral stripe is present in some individuals. Similar species in adjacent localities are: *Adenomera hylaedactyla*, which is very similar to *A. andreae*, but

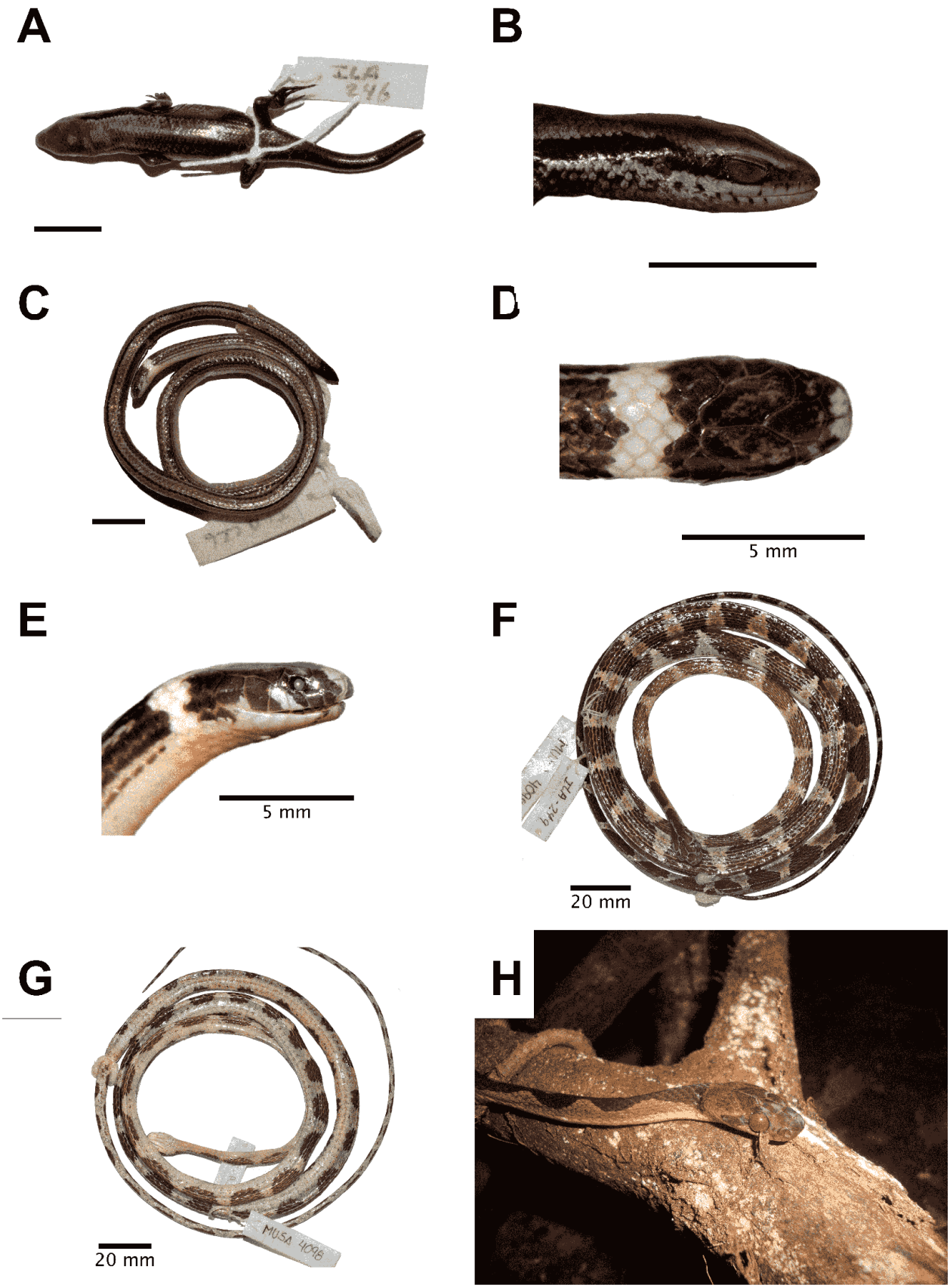

Figure 6. A. *Varzea altamazonica* (MUSA 4102, SVL: 34.88 mm), dorsal view. **B.** MUSA 4102, head lateral view. **C.** *Apostolepis nigroterminata* (MUSA 4106, SVL: 245.5 mm), dorsal view. **D.** MUSA 4106, head dorsal view. **E.** *Apostolepis nigroterminata* (MUSA 4106, SVL: 245.5 mm), head lateral view. **F.** *Imantodes cenchoa* (MUSA 4098, SVL: 774.5 mm), dorsal view. **G.** MUSA 4098, ventral view. **H.** *Leptodeira annulata* (not collected), dorsolateral view. Scale bars = 10 mm, except where otherwise indicated.

without flattened discs on toe tips; *Leptodactylus leptodactyloides* and *L. petersii*, have Finger I > II (W.R. Heyer 1973, Angulo et al. 2003, Duellman 2005, Angulo and Icochea 2010).

Distribution. *Adenomera andreae* is widely distributed in the lowlands of north, central and western South America east of Andes up to 1200 m a.s.l. (W.R. Heyer 1973, de la Riva et al. 2000, Frost 2019).

Remarks. *Adenomera* species of southern Peru require a taxonomic review because several cryptic species probably exist under the name *A. andreae* (Angulo et al. 2003, Angulo and Icochea 2010).

***Leptodactylus pentadactylus* (Laurenti, 1768)**

Material examined. Field observations; (13°25′20″S, 069°36′36″W), 27–28.IX.2013.

Identification. A large leptodactylid species, SVL 100–195 mm in males and 115–181 mm in females. It can be identified by smooth dorsum with continuous dorsolateral folds from eyes to groin; dorsum uniform grayish brown with 1 or 2 narrow transversal bands. Venter dark gray with small light gray reticulations or mottling. Lips with dark brown triangular marks. A distinctive supratympanic fold from above the tympanum to the shoulder, usually dark brown outlined. Posterior thighs dark gray with light cream small vermiculation or spots. Similar species in neighboring localities are: *L. knudseni*, which differs by having dorsolateral folds extending to the sacrum, venter uniform gray, males with spines on chest and thumbs; *L. stenodema*, which is smaller, SVL <100 mm and its dorsolateral folds originate posterior to tympanum (Duellman 1978, 2005, W.R. Heyer 1979, 2005, Rodriguez and Duellman 1994, M. Heyer et al. 2012, de Sá et al. 2014).

Distribution. *Leptodactylus pentadactylus* is widely distributed in the Amazonian forests in Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname and Venezuela (de la Riva et al. 2000, M. Heyer et al. 2012, Cole et al. 2013, Frost 2019).

***Leptodactylus rhodonotus* (Günther, 1869)**
Figure 5E, F

Material examined. MUSA 4918, 4920; (13°25′20″S, 069°36′36″W), 28.IX.2013. MUSA 4919; Transect TN2, 28.IX.2013.

Identification. A moderate sized leptodactylid species, SVL 54–79.4 mm in males and 55.8–90 mm in females. It can be identified by dorsum smooth with scattered tubercles, and prominent tubercular dorsolateral folds extending at least to the sacrum. Breeding males have 2 nuptial spines on each thumb and a pair of spines on the chest. Dorsum brown with dark brown spots; venter grayish cream with light cream marks. Upper lip cream with irregular dark brown blotches. Posterior thighs cream with black mottling. Similar species in adjacent localities are: *L. rhodomystax*, which lacks dorsal tubercles and upper lip is uniformly cream; *L. bolivianus*, which has smooth and continuous dorsolateral folds (W.R. Heyer 1979, Rodriguez and Duellman 1994, Duellman 2005, de Sá et al. 2014).

Distribution. *Leptodactylus rhodonotus* is distributed on the Andean slopes and the lowlands of the upper Amazon Basin of Bolivia and Peru, from 200 to 2050 m a.s.l. (W.R. Heyer 1979, de la Riva et al. 2000, de Sá et al. 2014, Frost 2019).

Order Caudata

Family Plethodontidae

Bolitoglossa* cf. *altamazonica
Figure 5G, H

Material examined. MUSA 4969; (13°25′42″S, 069°36′46″W), 23.IX.2013. MUSA 4970; Transect TN1, 28.IX.2013.

Identification. There are three salamander species in Peru: *Bolitoglossa altamazonica*, *B. peruviana* and *B. digitigrada* (Frost 2019) but they have minimal morphological differences. *Bolitoglossa* cf. *altamazonica* can be distinguished by its unique ventral coloration, light brown with irregular cream specks. This coloration has not been reported in any other salamander species recorded in Peru. Typical measurements and characteristics, together with a comparison with the most similar species, *B. altamazonica*, are presented in Table 4.

Distribution. This species has been recorded only in the vicinity of LNBS, but likely occurs elsewhere because

Table 4. Comparison of characters of *Bolitoglossa* cf. *altamazonica* with those given by Brcko et al. (2013). Measurements are in millimeters.

Character	MUSA 4970	MUSA 4969	Brcko et al. (2013)	Brame and Wake (1969)
Coastal grooves	10	Not distinguishable	13	
Snout Vent Length (SVL)	42.5	41.1	30–57	40.3
Head width (HW)	6.1	5.6		5.9
SVL/HW	7	7.3	6.3–8.1	6.8
Foot width (FW)	3.1	2.5		
Length hind limb (HLL)	9.8	7.7		8.8
FW/HLL	0.32	0.32	>0.4	
Tail length (TL)	37.00	33.20		36.9
TL/SVL	1.15	1.24	0.7–1.2	0.92

similar specimens have been observed in the buffer zone of Manu National Park (Villacampa et al. 2017).

Remarks. The only salamander species recorded for the southern Peruvian Amazon are *B. altamazonica* and *B. digitigrada*, but the latter is only known from its type locality, Rio Santa Rosa, Ayacucho Region (Wake et al. 1982, Frost 2019). Salamanders found in the vicinity of LNBS have a white mottled venter that does not match the description of *B. altamazonica*. Because coloration is not a reliable character, we have reservations about the identity of these salamanders, mainly because they are very distant from the type locality of *B. altamazonica*. Tissue samples were taken and we encourage a genetic analysis to determine its identity; until then, we leave the identification as *B.* cf. *altamazonica*. A comparison of morphometrics can be found in Table 4.

Class Reptilia

Family Dactyloidae

***Anolis fuscoauratus* d'Orbigny 1837**

Material examined. MUSA 4103; Transect TN13, 26. IX.2013. MUSA 4104; Transect TN17, 25.IX.2013.

Identification. A small lizard, SVL 37.7–49 mm in males and 38–50.5 mm in females. It can be identified by weakly keeled dorsal scales, even on the head, and granular ventral scales. Dorsum varies from pinkish tan to grayish brown; venter white, commonly with gray flecks. Dewlap pale pink with some white scales. Tail with dark brown transversal bands. Similar species that occur in adjacent localities are: *A. ortonii*, which has smooth dorsal scales, even on the head, flat ventral scales, and dewlap yellow with white scales; *A. scypheus*, which has ventral scales keeled and imbricate, and dewlap rose with blue center (Duellman 1978, 2005, Ávila-Pires 1995, Cole et al. 2013).

Distribution. *Anolis fuscoauratus* is widely distributed in South America in Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Panama, Peru, Suriname, and Venezuela up to 1800 m a.s.l. (Ávila-Pires 1995, Poe and Yañez-Miranda 2008, Ribeiro-Júnior 2015, Koch et al. 2018, Uetz and Hošek 2019).

Family Gymnophthalmidae

***Cercosaura bassleri* Ruibal, 1952**

Material examined. MUSA 4108; PT1, 27.IX.2013.

Identification. A small lizard, SVL 48–65 mm in males and 49–64 mm in females. It can be identified by dorsal scales quadrangular, keeled, not imbricate; ventral scales quadrangular, smooth, imbricate. Flank scales granular. Frontonasal scale single; loreal double. Dorsum brown with black blotches; dorsolateral pale cream stripe and discontinuous ventrolateral line present. Venter light cream, flanks with a variable number of ocelli, black with white center. Tail pale orange. Similar species in adjacent localities are: *C. ocellata*, which has a single loreal; *C. argulus*, which has paired frontonasal scales and a continuous white dorsolateral stripe; *C. eigenmanni*, which lacks ocelli on flanks (Dixon and Soini 1986, Ávila-Pires 1995, Doan 2003, Duellman 2005, Sturaro et al. 2018).

Distribution. *Cercosaura bassleri* is distributed in western Amazonia in Bolivia, Brazil and Peru (Ávila-Pires 1995, Sturaro et al. 2018, Uetz and Hošek 2019).

Remarks. MUSA 4108 is a juvenile individual.

***Potamites ecpleopus* (Cope, 1876)**

Material examined. MUSA 4101; PT2, 28.IX.2013.

Identification. A small lizard, SVL 50–84 mm in males and 50–71 mm in females. It can be identified by having 6 longitudinal rows of dorsal keeled and tuberculate scales; 36–45 transverse dorsal scale rows. Ventral scales rectangular, slightly imbricate and arranged in transverse rows; flanks with medium to small trihedral tubercles. Tail laterally compressed with 4 middorsal rows of keeled scales. Frontonasal divided. Dorsum dark brown; venter cream, usually with brown spots. Flanks with 1–5 ocelli, black with white or yellow center. A similar species in adjacent localities is: *P. erythrocuaris*, but it has 30–33 transverse dorsal scale rows and frontonasal undivided (Duellman 1978, Dixon and Soini 1986, Ávila-Pires 1995, Doan and Castoe 2005, Chávez and Catenazzi 2014).

Distribution. *Potamites ecpleopus* is widely distributed in the Amazonian lowlands and foothills of cloud forests of Bolivia, Brazil, Colombia, Ecuador, and Peru up to 1500 m a.s.l. (Ávila-Pires 1995, Chávez and Catenazzi 2014, Ribeiro-Júnior and Amaral 2017, Uetz and Hošek 2019).

Family Scincidae

***Varzea altamazonica* Miralles, Barrio-Amoros, Rivas & Chaparro-Auza, 2006**
Figure 6A, B

Material examined. MUSA 4102; (13°25′42″S, 069°36′ 46″W), 25.IX.2013.

Identification. A relatively large skink, SVL 72.3–97.2 mm. It can be identified by paired prefrontals and frontoparietals, 7 supralabials, the fifth largest and placed directly below eye. Dorsum variable, typically bronze or light chocolate with many dark brown spots and black lateral stripes. Venter cream, palms and soles are dark brown-black. Similar species in adjacent localities are: *Copeoglossum nigropuctatum*, which has 8 supralabials, the sixth largest and below eyes; *Exila nigropalmata*, which has the frontoparietals fused. Morphometrics and pholidosis are presented in Table 5.

Table 5. Comparison of characters of *Varzea altamazonica* MUSA 4102 with those given by Miralles et al. (2006).

Character	MUSA 4102	Miralles et al. (2006)
Frontoparietals	2	2
Prefrontals	2	2
Nuchal pairs	1	1
Supraoculars	4	4
Supreciliars subequal	5	5
Vertebral thin stripe	Absent	Absent
Supralabials	7	7
5th supralabial in broad contact with the eye	Yes	Yes
Parietals in broad contact behind the interparietal	Yes	Yes
Palms and soles dark brown-black	Yes	Yes

Distribution. *Varzea altamazonica* is widely distributed in western Amazonia in Bolivia, Brazil, Peru, and probably in Ecuador, from 100 to 1239 m a.s.l. (Miralles et al. 2006, Miralles and Carranza 2010, Koch et al. 2018, Uetz and Hošek 2019).

Remarks. Our individual is a juvenile. Its morphology conforms with the characters provided by Miralles et al. (2006) (Table 5). This species is distributed throughout almost all of the Peruvian Amazon, especially in its western part including the Tavara basin. Few published studies have recorded this species. Recently, Venegas and Crnobrna (2015) recorded this species at Chocollatillo River, in the western part of BSNP, the first record in Puno Region. Our record is also in Puno Region but represents the southernmost record of this species in Peru. These records suggest that *V. altamazonica* is relatively common in transition areas between lowland and cloud forest. We agree with Catenazzi et al. (2013), who says *V. altamazonica* probably also occurs in Manu National Park.

Family Teiidae

***Kentropyx pelviceps* (Cope, 1868)**

Material examined. Field observations; (13°25′20″S, 069°36′36″W), 22–28.IX.2013.

Identification. A moderate sized lizard, SVL 80–130 mm in males and 80–122 mm in females. It can be identified by granular dorsal scales and ventral scales large, quadrangular, imbricate and arranged in 14–16 longitudinal rows. Dorsum dark brown with a broad lime-green vertebral stripe from the rostral scale to base of tail; borders of this stripe are wavy and extend onto the flanks. Venter grayish white. Similar species in the area and nearby localities are: *K. altamazonica*, which has a narrow vertebral stripe with straight borders; *Ameiva ameiva*, which lacks a vertebral stripe and has 8 longitudinal scale rows on the venter (Duellman 1978, 2005, Ávila-Pires 1995).

Distribution. *Kentropyx pelviceps* is widely distributed in western Amazonia in Bolivia, Brazil, Colombia, Ecuador and Perú (Ávila-Pires 1995, Dirksen and de la Riva 1999, Langstroth 2005, Ribeiro Júnior and Amaral 2016, Uetz and Hošek 2019).

Remarks. Several individuals were observed foraging close to our camping site, but we were unable to collect them.

Family Tropiduridae

***Plica plica* (Linnaeus, 1758)**

Material examined. Field observations; (13°24′31″S, 069°35′50″W), 22.IX.2013.

Identification. A moderate sized lizard, SVL 90–165 mm in males and 88–145 mm in females. It can be identified by having a vertebral crest, and distinctive tufts of spiny scales on the sides of the neck, and large head. Dorsal scales rhomboid, imbricate, keeled and mucronate, 121–162 scales around midbody. Dorsum pale green with black marks usually forming spotted, slightly V-shaped transverse bands. Venter pale gray to cream, throat black in males. Black marks on the tail. Similar species in adjacent localities are: *P. umbra*, which has fewer than 75 scales around mid-body, a standard head size, dorsum olive-brown with irregular black spots; *Stenocercus fimbriatus* and *S. roseiventris*, which have a distinctive brown dorsum; *Enyalioides laticeps*, which has granular dorsal scales (Etheridge 1970, Ávila-Pires 1995, Duellman 2005, Cole et al. 2013).

Distribution. *Plica plica* is widely distributed in Amazonia in Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, Trinidad and Tobago, and Venezuela (Ávila-Pires 1995, Ribeiro-Júnior 2015), but see Murphy and Jowers (2013) and Uetz and Hošek (2019).

Remarks. Several individuals were observed high in trees around LNBS, but we were unable to collect them.

Family Colubridae

***Apostolepis nigroterminata* Boulenger, 1896**
Figure 6C–E

Material examined. MUSA 4106; PT2, 24.IX.2013.

Identification. A small snake, SVL 199–301 mm. It can be identified by having snout blunt, typically with 6 supralabials; nasal contacting preoculars; temporals absent; ventrals 200–231, subcaudals 23–33. Dorsum pale red with a dark brown vertebral line and lateral streaks. Head dark brown with a cream spot on snout and fourth supralabial. A white nuchal collar 1–3 dorsals long; terminal scales on tail black with a cream tip. Venter yellow. There are no similar species in adjacent localities (Boulenger 1896, Harvey 1999, de Lema and Renner 2016). Morphometrics and pholidosis of our collected specimen are in Table 6.

Table 6. Comparison of characters of *Apostolepis nigroterminata* MUSA 4106 with those given by Harvey (1999). Measurements are in millimeters.

Character	MUSA 4106	Harvey (1999)
Total Length	267	(223)
Snout Vent Length	245.5	Up to 370 (206)
Tail Length	21.5	(17)
Prefrontal	2	(2)
Frontal	1	(1)
Occipitals	2	(3)
Pre-ocular	1/1	1/1
Supralabials	6/6	6/6
Infralabials	7/7	7/7
Preocular	1	1
Supralabials in contact with parietals	6th	5th & 6th
Ventrals	227	200–231 (207)
Scales around midbody	15-15-14	15-15-15
Anal scale	2	2
Subcaudals	28	23–33 (26)
Tip of tail white	yes	Yes

Distribution. *Apostolepis nigroterminata* is distributed in Amazonia in Bolivia, Brazil, and Peru from 150 to 760 m a.s.l. (Harvey 1999, de Lema 2001, Wallach et al. 2014, de Lema and Renner 2016, F. M. dos Santos et al. 2018, Uetz and Hošek 2019).

Remarks. We collected one individual of *A. nigroterminata*, in a pitfall trap. The specimen conforms to the description in Harvey (1999) (Table 6). It is a new record for this sector of the Távara River, Puno Region and is the most southern record in Peru, ~87 km south of the previous record (Harvey 1999). Duellman (2005) and Doan and Arizabal (2002) did not report *A. nigroterminata* from the Madre de Dios Region, although it could occur there.

***Imantodes cenchoa* (Linnaeus, 1758)**
Figure 6F, G

Material examined. MUSA 4098; Transect TN22, 25.IX.2013.

Identification. A mid-sized snake, SVL 656–1079 mm in males and 827 mm in females. It can be identified by a slender laterally compressed body; 17 scales around mid-body. Dorsum tan to pale brown with large dark brown blotches. Venter pale cream to yellow, usually dotted with dark brown. Similar snakes in nearby localities are: *I. lentiferus* and *Leptodeira annulata*, which have 15 and 19 scales around mid-body respectively (Roze 1966, Duellman 1978, 2005, Pérez-Santos and Moreno 1988).

Distribution. *Imantodes cenchoa* is widespread in America, including México, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Trinidad and Tobago, and Venezuela (Wallach et al. 2014, Uetz and Hošek 2019).

***Leptodeira annulata* (Linnaeus, 1758)**
Figure 6H

Material examined. Field observation; Transect TN7 27. IX.2013.

Identification. A mid-sized snake with SVL 250–660 mm. It can be identified by 19 scale rows around mid-body. Dorsum pale brown with dark brown blotches usually connected in a zig-zag mid-dorsal line. Venter cream, immaculate. Similar species in adjacent localities are: *Imantodes cenchoa* and *I. lentiferus*, which have 17 and 15 scale rows around mid-body respectively (Duellman 1958, 1978, 2005, Roze 1966, Dixon and Soini 1986, Pérez-Santos and Moreno 1988).

Distribution. *Leptodeira annulata* is widespread in America, including Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Panama, Paraguay, Peru, Suriname, Trinidad and Tobago, and Venezuela (Duellman 1958, Roze 1966, Daza et al. 2009, Cole et al. 2013, Wallach et al. 2014, Uetz and Hošek 2019).

***Xenodon severus* (Linnaeus, 1758)**
Figure 7A, B

Material examined. MUSA 4100; (13°24′31″S, 069°35′ 50″W), 22.IX.2013.

Identification. A mid-sized robust snake, SVL: 807–946 mm in males and 1000–1060 mm in females. It has 21 rows of smooth scales around mid-body; undivided anal plate; fewer than 42 divided subcaudals. Dorsum varies from brown, green to black with a highly variable pattern; commonly with black transversal bands in juveniles and uniform coloration in adults. Venter tan orange. Head and body are distinctively depressed, especially in the neck region as a defense behavior. Similar species in adjacent localities are: *X. rabdocephalus*, which has 19 scales around mid-body, *Helicops angulatus*, which has keeled dorsal scales (Roze 1966, Duellman 1978, 2005, Pérez-Santos and Moreno 1988).

Distribution. *Xenodon severus* is widely distributed in Amazonia in Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, and Venezuela up to 2000 m a.s.l. (Wallach et al. 2014, Uetz and Hošek 2019).

Remarks. The collected sample is a juvenile individual.

Family Viperidae

Bothrocophias* cf. *microphthalmus
Figure 7C, D

Material examined. MUSA 4099; Transect TN23, 25. IX.2013.

Identification. A small pitviper, SVL 397–724 mm. It can be identified by loreal scales elongate; 23 scale rows around mid-body; dorsal scales keeled and tuberculate on posterior part of body; 144–165 ventrals; anal plate single. Snout distinctly elevated. Dorsum brown

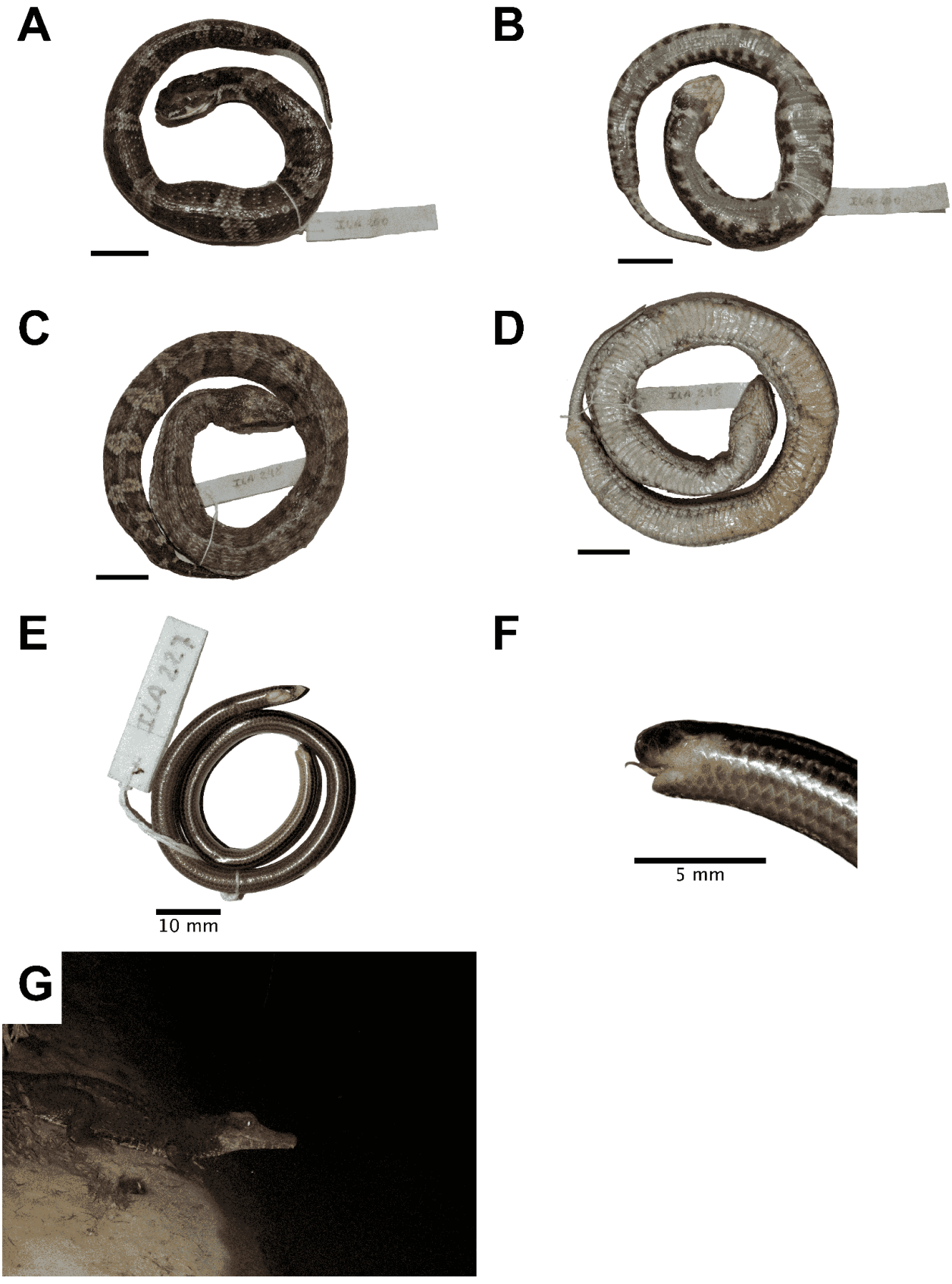

Figure 7. A. *Xenodon severus* (MUSA 4100, SVL: 245 mm), dorsal view. **B.** MUSA 4100, ventral view. **C.** *Bothrocophias* cf. *microphthalmus* (MUSA 4099; SVL: 395 mm), dorsal view. **-D.** MUSA 4099, ventral view. **E.** *Epictia diaplocia* (MUSA 4107, SVL 137.5 mm), ventrolateral view. **F.** MUSA 4107, head lateral view. **G.** *Paleosuchus palpebrosus,* (not collected), lateral view. Scale bars = 20 mm except where otherwise indicated.

to pale olive with a pattern of alternating triangular blotches, with dark brown borders, the apices meeting or approaching the midvertebral line. Venter pale gray, darkly mottled laterally, which intensifies in maturity. Similar species in adjacent localities are: *Bothrops atrox*, which has 180–200 ventral scales, and dorsal scales not tuberculate. *Bothrocophias andianus*, although not recorded nearby (Doan and Arizábal 2002, Duellman 2005), may occur near LNBS, and can be distinguished from *B. microphthalmus* by having 166–179 ventral scales (Peters and Orejas-Miranda 1970, Pérez-Santos and Moreno 1988, Harvey et al. 2005).

Distribution. *Bothrocophias microphthalmus* is distributed in the Andes Amazon foothills in Bolivia, Colombia, Ecuador, Perú, and Brazil from 900 to 2350 m a.s.l. (Gutberlet Jr. and Campbell 2001, Harvey et al. 2005, Cisneros-Heredia et al. 2006, Wallach et al. 2014, Uetz and Hošek 2019). *B.* cf. *microphthalmus* has been only observed in the vicinity of LNBS.

Remarks. The collected specimen is a pre-adult individual. Ventral coloration is unusually pale gray, but the pholidosis corresponds to *Bothrocophias microphthalmus*. We prefer to be cautious and leave the identification as *B.* cf. *microphthalmus* until more specimens become available.

***Bothrops bilineatus* (Wied-Neuwied, 1821)**

Material examined. Field observation; (13°25′38″S, 069° 36′42″W), 22.IX.2013.

Identification. A small pitviper, SVL maximum 365–840 mm in males and 555 mm in females. It can be identified by dorsal scales uniformly keeled but not tuberculated; 27–35 scale rows at mid-body; single anal plate. Dorsum pale green, with scattered black spots. Venter cream to white with a broken pale yellow paraventral stripe. This snake is arboreal with a prehensile tail. There are no similar pitviper species nearby. Some green colubrids such as *Philodryas viridissimus*, *Liophis typhlus* and the boid *Corallus batessi* could be confused, but they differ by lacking loreal pits and having labial pits respectively (Roze 1966, Duellman 1978, 2005, Dixon and Soini 1986, Pérez-Santos and Moreno 1988, Harvey et al. 2005).

Distribution. *Bothrops bilineatus* is widely distributed in Amazonia in Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname and Venezuela (Harvey et al. 2005, Uetz and Hošek 2019).

Remarks. The individual was found dead in an advanced stage of decomposition, so it was not collected.

Family Leptotyphlopidae

***Epictica diaplocia* Orejas-Miranda, 1969**
Figure 7E, 7F

Material examined. MUSA 4107; PT2, 24.IX.2013.

Identification. A small blind snake, total length 92–196 mm. It can be identified by a cylindrical body; eyes covered by a large scale; supraocular close to the top of the first supralabial but not in contact; 205–233 dorsal scales. Dorsum reddish brown with dark brown longitudinal lines. Venter dull tan. Tip of tail cream. There are no similar species in adjacent localities (Orejas-Miranda 1969, Duellman 2005). Additional morphometrics and pholidosis of this specimen are in Table 7.

Distribution. *Epictia diaplocia* is distributed in eastern Peru and northwestern Brazil from 45 to 1500 m a.s.l. (Wallach et al. 2014, Uetz and Hošek 2019).

Remarks. This specimen compares favorably with the description of Orejas-Miranda (1969) (Table 7), extending the species' range south >120 km from Cusco Amazónico, Peru, and is the first record for the Puno Region.

Order Crocodylia

Family Alligatoridae

***Paleosuchus palpebrosus* (Cuvier, 1807)**
Figure 7G

Material examined. Field observations; (13°25′20″S, 069° 36′36″W), 22–28.IX.2013.

Identification. A relatively small alligator, total length <1.75 m in males and <1.2 m in females. Adults can be identified by dorsum and tail black, lower jaws with 4 or 5 dark brown marks with poorly defined borders. Two rows of occipital scutes; 3–4 rows of dorsal scutes between the hind legs. Similar species in nearby localities are: *P. trigonatus*, which has a single row of occipital scutes; *Caiman crocodilus*, which has a bony ridge connecting the orbits, absent in *P. palpebrosus*, dorsum tan to pale olive-gray and no black marks on the jaws; *Melanosuchus niger*, which is larger (total length ~4–5 m),

Table 7. Comparison of characters of *Epictia diaplocia* MUSA 4107 with those given by Orejas-Miranda (1969). Measurements are in millimeters.

Character	MUSA 4107	Orejas-Miranda (1969)
Total Length	148.5	92–196
Tail Length	11	5.5–12
White mark on the tip of head and tail	Yes	Yes
Maxilar bigger than jaw	Yes	Yes
Frontal	1	1
Nasal	Divided	Divided
Supralabials	2/2	2/2
Infralabials	5/5	
Cephalic scale with conspicuous pits	Yes	yes
Dorsals	225	205–233
Subcaudals	18	15–20
Scales around mid-body	14	14
Scales around mid-tail	10	10

black dorsal coloration, and marks on lower jaws well defined.

Distribution. *Paleosuchus palpebrosus* is widely distributed in Amazonia in Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Trinidad, and Venezuela up to 1300 m a.s.l. (Magnusson 1992, Rueda-Almonacid et al. 2007, Cole et al. 2013, Uetz and Hošek 2019).

Order Testudines

***Podocnemis unifilis* Troschel, 1848**

Material examined. Field observation; (13°24′18″S, 069° 37′04″W), 22.IX.2013.

Identification. A large freshwater turtle, up to 50 cm in carapace length. It can be readily identified by the dull grayish brown carapace. Juveniles show distinctive cream or orange spots on the head which gradually vanish in maturity, especially in females. *Podocnemis unifilis* is commonly observed in groups along borders of rivers and lakes. There are no similar turtle species in adjacent localities (Duellman 2005, Rueda-Almonacid et al. 2007, Schneider et al. 2012).

Distribution. *Podocnemis unifilis* is widely distributed in Amazonia in Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru and Venezuela (Rueda-Almonacid et al. 2007, van Dijk et al. 2012, Cole et al. 2013, Uetz and Hošek 2019).

Discussion

Given that our study area is in the transition between montane forest and Amazonian lowlands, we expected a high amphibian species diversity, but we only recorded 18 species, a relatively small number compared with the list of Doan and Arizábal (2002) for Tambopata Research Centre (78 species), Duellman (2005) for Cusco Amazónico (66 species), von May et al. (2010) for Los Amigos Research Center (65 species), Venegas and Crnobrna (2015) for Chocolatillo River (25 species), all in lowlands close to LNBS. Therefore, we believe our inventory is far from complete, as supported by the unstable behavior of the Chao 2 estimator (Fig. 3). The few amphibian species recorded could be a consequence of the short duration of our assessment. Icochea (1994), Rodriguez and Emmons (1994) and, Venegas and Crnobrna (2015) recorded 8, 23 and 25 amphibian species respectively, although only Venegas and Crnobrna (2015) present information on sampling effort; 62 person-hour, which is more than our 53.27 person-hour effort. The season may be another critical factor; our sampling took place in September when precipitation is reduced, limiting amphibian activity. Rainfall was only observed on one occasion, and the level of the Távara River was low during our sampling period, while the assessment of Rodríguez and Emmons (1994) was carried out at the end of the rainy season (May – June) when precipitation is frequent. For reptiles, we recorded 15 species, a higher number than provided by Icochea (1994) (3 species) and Rodriguez and Emmons (1994) (3 species). However, we believe our reptile inventory is also incomplete because of a greater number of reptiles reported in nearby locations such as Tambopata Research Center (Doan and Arizábal 2002) (61 species), Cusco Amazónico (Duellman 2005) (86 species) and the Chocolatillo River (Venegas and Crnobrna 2015) (33 species). On the other hand, we found unusual species that suggest that the reptile community on the lower basin of Távara river might be unique, including species that are rare in other sectors of the Peruvian Amazon.

We assessed the herpetofauna on only one slope of a mountain; due to the short sampling duration, travel to other sectors was not possible. The margins of the Távara River represent a more heterogeneous forest than lowland forests and differences in plant composition have been recorded even on slopes of the same mountain (Foster et al. 1994). These habitat changes plus the elevation gradient along the Távara River can cause changes in the composition of amphibian and reptile communities among mountains and even on a single mountain. According to Rodríguez and Emmons (1994), remarkable changes in amphibian and reptile communities occur above 500 m a.s.l. We anticipate that more amphibian and reptile species occur in the vicinity of LNBS, especially at higher elevations. We encourage additional inventories in the area, but we strongly suggest that future studies include the collecting effort involved, to facilitate comparison. We are aware that our data for building accumulation curves is limited, but it constitutes a basis for constructing a unique curve to which other authors can add their data, as long as they use a similar methodology.

Our list includes remarkable amphibian records such as *Pristimantis* cf. *ockendeni* which, although collected near the type locality of *P. ockendeni,* differs in several of the diagnostic characters provided by Duellman and Lehr (2009) and Ocampo et al. (2017); thus, it likely corresponds to a different population not recognized previously. The salamander *Bolitoglossa* cf. *altamazonica* exhibits a unique ventral coloration among the plethodontids recorded in southern Peru. The type locality of *B. altamazonica* is Nauta, Peru (Brame and Wake 1963) which is 900 km from LNBS. Because *B. altamazonica* is a species complex (de la Riva et al. 2000, Reichle et al. 2000), populations far from the type locality may belong to distinct species (Elmer et al. 2013). MUSA 4969–4970 could be an undescribed species, possibly related to *B. caldwellae* because they share a similar ventral coloration pattern (Brcko et al. 2013) and *B. caldwellae* occurs 676 km from LNBS. The snake *Apostolepis nigroterminata* had been recorded only in the type locality and the Ayacucho Region (Harvey 1999). Our record from LNBS is the first record in Puno Region and the most southern observation in Peru. Duellman (2005) and Doan and Arizabal (2002) did not report *A. nigroterminata* for the

Madre de Dios Region; however, the LNBS is less than 20 km from its border. Therefore, it is likely to occur in Madre de Dios Region. The blind snake *Epictia diaplocia* was recorded by Carrillo and Icochea (1995) in San Martín Region, and by Doan and Arizabal (2002) and Duellman (2005) in Cusco Amazónico. We found one individual that matches the description of *E. diaplocia* in Orejas-Miranda (1969) (Table), representing a new record for Puno Region as well as a southern extension of 120 km.

The recent surveys in BSNP carried out by Luján and Venegas (2014) and Medina et al. (2016) provided a range extension of the amphibian *Pristimantis divnae*, and new records of mammals for Peru. Likewise, Carrasco et al. (2019) described a new viperid species which has been recorded only in BSNP. Considering the above studies and our results, we are confident that other species distribution extensions and even new species will be recognized as the assessments continue in BSNP. Therefore, we believe that LNBS should re-open because it would facilitate the development of intensive and long-term studies in this poorly known sector of Peru.

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Authors' Contributions

IBL conceptualized the study design, collected the data, identified specimens, wrote text and made the analyses. CS identified specimens, wrote the text, and prepared the figures. MO identified specimens, wrote the text and prepared the figures.

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Appendices

Table A1. List of transects (TN) and pitfall traps (PT) installed in the vicinity of La Nube Biological Station, Bahuaja-Sonene National Park, Peru.

Code	Start	End	Code	Start	End
TN1	13°25′21″S, 069°36′35″W	13°25′20″S, 069°36′37″W	TN17	13°25′41″S, 069°36′45″W	13°25′40″S, 069°36′46″W
TN2	13°25′22″S, 069°36′36″W	13°25′23″S, 069°36′34″W	TN18	13°25′42″S, 069°36′46″W	13°25′43″S, 069°36′44″W
TN3	13°25′24″S, 069°36′35″W	13°25′23″S, 069°36′37″W	TN19	13°25′44″S, 069°36′46″W	13°25′45″S, 069°36′47″W
TN4	13°25′25″S, 069°36′36″W	13°25′26″S, 069°36′34″W	TN20	13°25′45″S, 069°36′46″W	13°25′44″S, 069°36′44″W
TN5	13°25′26″S, 069°36′36″W	13°25′23″S, 069°36′38″W	TN21	13°25′46″S, 069°36′45″W	13°25′45″S, 069°36′44″W
TN6	13°25′28″S, 069°36′37″W	13°25′29″S, 069°36′35″W	TN22	13°25′47″S, 069°36′44″W	13°25′46″S, 069°36′44″W
TN7	13°25′29″S, 069°36′37″W	13°25′28″S, 069°36′37″W	TN23	13°25′49″S, 069°36′44″W	13°25′47″S, 069°36′42″W
TN8	13°25′30″S, 069°36′39″W	13°25′30″S, 069°36′37″W	TN24	13°25′49″S, 069°36′42″W	13°25′47″S, 069°36′42″W
TN9	13°25′31″S, 069°36′40″W	13°25′32″S, 069°36′38″W	TN25	13°25′48″S, 069°36′41″W	13°25′50″S, 069°36′41″W
TN10	13°25′32″S, 069°36′41″W	13°25′31″S, 069°36′42″W	TN26	13°25′48″S, 069°36′39″W	13°25′47″S, 069°36′38″W
TN11	13°25′33″S, 069°36′42″W	13°25′34″S, 069°36′40″W	TN27	13°25′48″S, 069°36′37″W	13°25′46″S, 069°36′37″W
TN12	13°25′35″S, 069°36′43″W	13°25′36″S, 069°36′41″W	TN28	13°25′49″S, 069°36′36″W	13°25′47″S, 069°36′35″W
TN13	13°25′36″S, 069°36′43″W	13°25′35″S, 069°36′44″W	TN29	13°25′49″S, 069°36′35″W	13°25′50″S, 069°36′36″W
TN14	13°25′38″S, 069°36′42″W	13°25′38″S, 069°36′41″W	TN30	13°25′49″S, 069°36′33″W	13°25′47″S, 069°36′32″W
TN15	13°25′39″S, 069°36′43″W	13°25′39″S, 069°36′44″W	PT1	13°25′33″S, 069°36′42″W	13°25′33″S, 069°36′43″W
TN16	13°25′40″S, 069°36′43″W	13°25′41″S, 069°36′41″W	PT2	13°25′42″S, 069°36′46″W	13°45′43″S, 069°36′46″W

Table A2. Data used to create the species accumulation curve of amphibians in the vicinity of La Nube Biological Station, Bahuaja Sonene National Park, Peru

Transect	*A. femoralis*	*A. trilineatus*	*A. simulans*	*Pristimantis* sp.	*P. cf. ockendeni*	*P. ockendeni*	*P. reichlei*	*P. ventrimarmoratus*	*L. andreae*	*L. rhodonotus*	*B. cf. altamazonica*
TN1	0	0	0	0	1	0	0	0	0	0	1
TN2	0	0	0	0	1	0	0	1	0	1	0
TN3	0	0	1	0	0	0	0	0	0	0	0
TN4	0	0	1	0	0	0	0	0	0	0	0
TN5	0	0	0	0	0	0	2	1	0	0	0
TN6	0	0	0	1	1	0	0	0	0	0	0
TN7	0	0	0	0	0	0	0	0	0	0	0
TN8	0	0	0	0	0	0	0	0	0	0	0
TN9	0	0	0	0	0	0	0	0	0	0	0
TN10	0	0	0	0	2	0	0	0	0	0	0
TN11	0	0	0	1	1	1	0	0	0	0	0
TN12	0	0	0	0	1	0	2	0	0	0	0
TN13	0	0	0	0	1	0	0	0	0	0	0
TN14	0	0	0	0	0	0	0	0	0	0	0
TN15	0	0	0	0	0	0	0	0	0	0	0
TN16	0	0	0	0	0	1	0	0	0	0	0
TN17	0	0	0	1	1	0	1	0	0	0	1
TN18	0	1	0	0	0	1	0	0	0	0	0
TN19	0	0	0	0	0	0	1	0	0	0	0
TN20	0	0	0	0	2	2	0	0	0	0	0
TN21	0	0	0	0	0	0	1	4	0	0	0
TN22	0	0	0	0	0	0	0	0	0	0	0
TN23	0	0	0	0	0	0	1	0	1	0	0
TN24	0	0	0	0	0	0	2	0	0	0	0
TN25	0	0	0	0	0	1	0	0	0	0	0
TN26	0	0	0	0	0	0	1	0	0	0	0
TN27	0	0	0	0	0	0	1	0	0	0	0
TN28	0	0	0	0	0	0	1	0	0	0	0
TN29	0	0	0	0	0	1	3	0	0	0	0
TN30	1	0	0	0	0	0	0	0	0	0	0

Table A3. Data used to create the species accumulation curve of reptiles in the vicinity of La Nube Biological Station, Bahuaja Sonene National Park, Peru.

Transect	*A. fusco-auratus*	*I. cenchoa*	*L. annulata*	*B. cf. microph-talmus*	*B. billineata*
TN1	0	0	0	0	1
TN2	0	0	0	0	0
TN3	0	0	0	0	0
TN4	0	0	0	0	0
TN5	1	0	0	0	0
TN6	0	0	0	0	0
TN7	0	0	1	0	0
TN8	1	0	0	0	0
TN9	0	0	0	0	0
TN10	0	0	0	0	0
TN11	0	0	0	0	0
TN12	0	0	0	0	0
TN13	1	0	0	0	0
TN14	0	0	0	0	0
TN15	0	0	0	0	0
TN16	0	0	0	0	0
TN17	1	0	0	0	0
TN18	0	0	0	0	0
TN19	0	0	0	0	0
TN20	0	0	0	0	0
TN21	0	0	0	0	0
TN22	0	1	0	0	0
TN23	0	0	0	1	0
TN24	0	0	0	0	0
TN25	0	0	0	0	0
TN26	0	0	0	0	0
TN27	0	0	0	0	0
TN28	0	0	0	0	0
TN29	0	0	0	0	0
TN30	0	0	0	0	0