HERPETOTROPICOS Vol. 8(1-2):23-38

ISSN 1690-7930 (Printed) ISSN 1856-9285 (Online)
Printed in Venezuela.

ANNOTATED CHECKLIST AND ECOLOGICAL NOTES OF ANURANS FROM THE SOUTHERN REGION OF YANACHAGA CHEMILLEN NATIONAL PARK, CENTRAL ANDES OF PERU

GERMÁN CHÁVEZ[1,3], CATERINA H. COSMÓPOLIS[2] and LESLY LUJÁN[1]

[1] Centro de Ornitología y Biodiversidad (CORBIDI), Calle Santa Rita 103, Los Huertos de San Antonio, Surco, Lima, Perú.

[2] Universidad Nacional Agraria La Molina (UNALM), Avenida La Molina, La Molina, Lima, Perú.

Abstract: Distribution data, ecological and taxonomical notes of twenty-one species of anurans are presented. This information was collected on a survey conducted on the southern border of Yanachaga Chemillen National Park, central Andes of Peru, during 2011. Furthermore, preliminary specific richness and additional field data on the species occurring in the area are presented in this article.

Keywords: Amphibia, distribution data, taxonomical notes, ecological notes, survey, specific richness, Llamaquizu-San Alberto river basin.

Resumen: G. Chávez, C.H. Cosmópolis y L. Luján. "Lista comentada y notas ecológicas de los anuros de la región sur del Parque Nacional Yanachaga Chemillen, Andes centrales de Péru." El registro de veintiún especies de anuros, datos de distribución, ecología y taxonomía son el resultado de una expedición realizada en la región sur del Parque Nacional Yanachaga Chemillen, en los Andes centrales de Perú durante el año 2011. Adicionalmente, datos preliminares acerca de la riqueza específica y otros datos tomados en campo acerca de las especies que ocurren aquí son presentados en este artículo.

Palabras clave: Amphibia, datos de distribución, notas taxonómicas, notas ecológicas, inventario, riqueza específica, Cuenca del río Llamaquizú-San Alberto.

INTRODUCTION

The eastern slopes of the Andes are characterized for its endemism and specific richness. Many expeditions have explored this area, but its great amphibian's biodiversity was only noticed in the early 1980's (Lynch 1979, Lynch and Duellman 1980) in Ecuador and the late 1990's in Peru (Duellman and Pramuk 1999).

Many other biological expeditions followed on the Peruvian montane forest, resulting on the discovery of several new frog species (Duellman and Chaparro 2008), especially on the vicinity of Yanachaga-Chemillen National Park (YCNP), in the province of Pasco. Some of these species include a harlequin frog of the genus *Atelopus* (Lehr *et al*. 2008); a *Hypsiboas* hylid frog (Lehr *et al*. 2010); four *Phrynopus* species (Chaparro *et al*. 2008, Duellman and Hedges 2008), thirteen *Pristimantis* species (Boano *et al*. 2008; Duellman and Hedges 2005, 2007; Lehr *et al*. 2004a, 2006), one species of *Hypodactylus* (Lehr 2005) and one species of *Noblella* (Lehr *et al*. 2004b). This list involves some critically endangered frogs (e.g. *Ameerega planipaleae*, Morales and Velazco 1998; *Atelopus oxapampae*, Lehr *et al*. 2008). These findings highlight the importance of the YCNP area that might be one of the last refugia for amphibian species on the eastern slopes of the Andes. Unfortunately, this area is constantly threatened by agricultural activities that seem to be invading the border of the national park. Consequently, a long term study was initiated in the southern border of the YCNP and this article presents the results obtained from the field trip performed from July to August 2011.

STUDY AREA AND METHODS

Study Area

The study area is located at the southern border of YCNP, on the central Peruvian Andes (Fig. 1), characterized by montane and cloud forest vegetation. Some arboreal and shrub species of the genera *Acacia*, *Chusquea, Clusia, Cecropia, Hedyiosmum, Heliconia, Podocarpus* and *Weinmannia,* and herbaceous species of the genera *Bomarea, Carex*, *Oreobolus*; as well as lichens and many species of orchids and bromeliads are present in the area (Foster 1985, 1986). Several waterfalls and dissected mountains shape the terrain and the soil structure consists of clay and rocks (mainly along riversides). Agricultural land and human settlements are found on the lower basin of the region.

Amphibians were surveyed on the two main basins within the

[3] Send correspondence to / *Enviar correspondencia a*:
vampflack@yahoo.com

Received / *Recibido:* 24 May 2012
Accepted / *Aceptado:* 17 Sep 2012
Published / *Publicado:* 15 Dec 2012

study area: San Alberto stream and Llamaquizu river. For practical reasons, these basins were classified in four sampling locations (Table 1): (i) Lower Llamaquizú (LLB), located at the YCNP buffer area and with agricultural areas, riparian forest and secondary forest; (ii) Upper Llamaquizú (ULB), at the southern border of YCNP, characterized by riverside forest, primary and secondary forest; (iii) Lower San Alberto (LSAB), on the buffer area with the presence of secondary forest and human settlements; and 4) Upper San Alberto (USAB), inside YCNP and only with primary forest.

METHODS

Diurnal and nocturnal transects were used to survey amphibians in the area. Seventeen transects of 200 m^2 were surveyed on each locality, with a minimum distance of 200 meters between transects (Heyer *et al*. 1994). Two researchers walked along each transect at low speed during the day (08:00 - 13:00h) and night (20:00 - 02:00h). All anurans heard calling were identified and registered.

Deep-water sampling was also performed by using a dip net and moving it slowly through the water. Caught animals were identified, measured, photographed and released at the site of capture, if no further identification was required. For further identification, some specimens were preserved in 10% buffered formalin, and kept in 70% ethanol. Detailed examination of collected material was conducted by GC and LL on preserved material. Acronym for voucher specimens is CORBIDI= Centro de Ornitologia y Biodiversidad (Lima, Peru).

Capture success and specific richness (S) was tested using rarefaction analysis (PAST statistical program, Hammer *et al*. 2001) in order to avoid potential bias due to differences on sampling size (Adrain *et al*. 2000). Hammer *et al*. (2001) based his algorithm on Krebs (1989) analysis, which used a log Gamma function for computing combinatorial terms. We used this method to obtain the expected S value on the study area.

RESULTS

A total of 21 species were recorded, corresponding to eight genera and five families: Bufonidae (3 spp.), Centrolenidae (1 sp.), Dendrobatidae (1 sp.), Hylidae (2 spp.) and Strabomantidae (14 spp.) (Table 2). A total of 305 individuals were recorded, showing a relative high abundance in the study area. However, rarefaction curve tends to be infinite (see Discussion), as an evidence that the total sampling is not enough to represent the real richness in the area. Our results also show a high specific richness in ULB and USAB; both localities are away from human settlements. Only two species were common in all localities: the strabomantid frogs *Pristimantis bromeliaceus* and *Pristimantis saggitulus*.

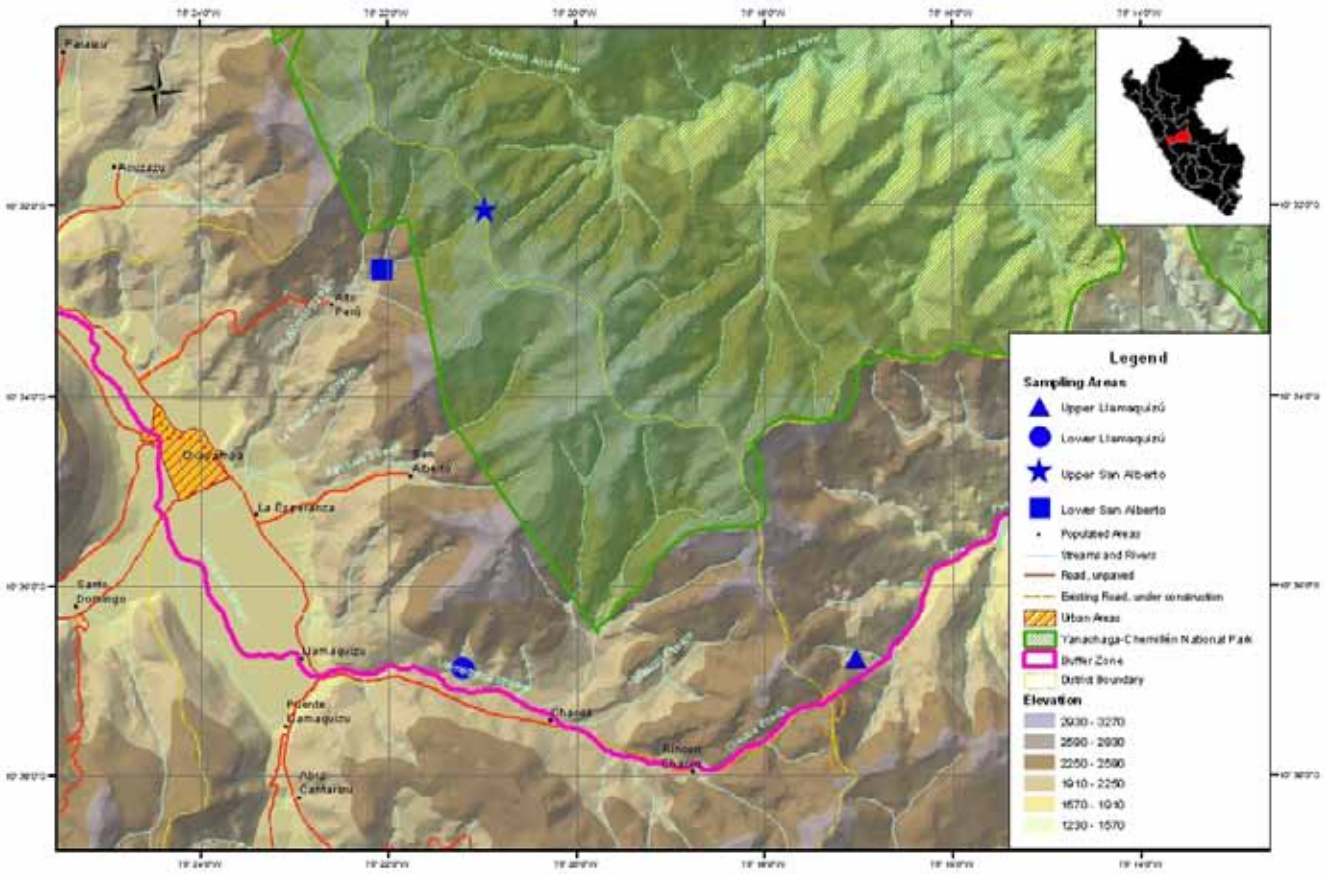

FIG. 1. Map showing the study area and the four localities sampled.
Mapa que muestra el área de estudio y las cuatro localidades evaluadas.

Species Accounts

FAMILY BUFONIDAE

***Atelopus oxapampae* (Lehr, Lötters *et* Lundberg, 2008)**
(Fig. 2, A-B).

This relatively recent described frog is one of the rarest species in this study. Only one individual was recorded (CORBIDI 010270) in the Lower San Alberto basin, within the type locality. It is the only harlequin frog that occurs in this area. The individual was caught at night showing low activity at that time. The habitat where it was captured matches the data presented by Lehr *et al.* (2008) who recorded the six type specimens in a narrow creek. This creek is characterized by a dense cloud forest which vegetation covers the creek, and direct sunlight rarely reached the ground. The individual was found on leaves at 30 cm above the ground, very close to the creek (less than 20 cm of distance). The predominant vegetation on the area is secondary forest and crops. Based on our field data and habitat described by Lehr *et al.* (2008), the major threat for this species is the human impact in the area; thus, extensive agriculture is practiced for plantations of granadilla or coffee. In consequence of this practice, agrochemical substances for plantations are used here and the farmers usually throw the remnants to creeks or streams, places where *Atelopus oxapampae* could breed. Sympatric species are *Pristimantis saggitulus* and *Hyalinobatrachium carlesvilai*; both are nocturnal species and therefore their niches do not overlap with *A. oxapampae*. Remarkably, this harlequin frog is the only diurnal amphibian recorded in the entire San Alberto basin.

Rhinella* cf. *leptoscelis (Fig. 2, C-D).

The recognized species *Rhinella leptoscelis* Boulenger, 1912, was rediscovered and redescribed by Padial *et al*. (2009). Individuals were captured in LLB (CORBIDI 010166, 010175-76, 010192, 010194) and agree with Padial *et al.* (2009). They have tympanum distinct, large paratoids glands -separated from eyelid and tympanum by the supratympanic crests-, body surface covered by spiny tubercles and the basal webbings are serrated. Nevertheless, they are different because they have small tubercles on the dorsum (large in *R. leptoscelis*) and yellow iris (green in *R. leptoscelis*). Furthermore, Padial *et al*. (2009) defined its distribution from Cordillera de Vilcabamba, Cusco Region, southern Peru, to Chapare region, in Bolivia. If we can confirm the identity of these specimens considered as *Rhinella* cf. *leptoscelis* in this study, it would be the first record for the species at central Peru.

Cordillera de Vilcabamba is approximately 400 km from YCNP. Although it is a long distance, other records for species from Cordillera de Yanachaga or surrounding areas, even most northerly than the locality of this study, have been reported in the past years (*Chávez et al*. 2008). Therefore, it would not be strange to record species from Cordillera de Vilcabamba in Yanachaga; nevertheless, more studies need to be performed and more specimens should be captured to confirm this record. The habitat defined for this species is humid montane forest, same habitat where *Rhinella* cf. *leptoscelis* was recorded. In addition, we have records of juveniles in the riverside vegetation of LLB, surrounded by agriculture zones and open areas, which evidence that *R.* cf. *leptoscelis* tadpoles could develop in disturbed rivers and open territories. The only sympatric species with this toad was *Pristimantis bipunctatus*, a species highly recorded in open areas and agriculture zones. Despite the presence of *P. bipunctatus*, there is no evidence about the type of competition between both species. Apparently, the great differences in length (*Rhinella* cf. *leptoscelis* is much larger than *P. bipunctatus*) could be caused by a separation of niches.

TABLE 1. Coordinates of the sampled localities. LLB=Lower Llamaquizu Basin; ULB=Upper Llamaquizu Basin; LSAB=Lower San Alberto Basin; USAB=Upper San Alberto basin.
TABLA 1. *Coordenadas de las Localidades evaluadas. LLB=Cuenca baja de Llamaquizú; ULB= Cuenca alta de Llamaquizú; LSAB=Cuenca baja de San Alberto; USAB=Cuenca alta de San Alberto.*

	Coordinates		
Locality	Southern	Western	Elevation (m)
LLB	10°36'52.06"	75°21'12.52"	2080
ULB	10°36'46.62"	75°17'01.90"	2148
LSAB	10°32'40.62"	75°22'03.89"	2231
USAB	10°32'02.24"	75°20'58.31"	2765

Rhinella yanachaga
(Lehr, Pramuk, Hedges *et* Cordova, 2007)
(Fig. 2, E-F).

This arboreal toad belongs, according to morphological characters, to the *Rhinella veraguensis* group, having orbito-tympanic and postorbital crests weak and parotoid glands moderately large. However, it is distinguished from other similar species of the *veraguensis* group by having a small snout-to-vent lenght (maximum SVL 45.7 mm) and males with vocal slits. The specimens recorded in this research (CORBIDI 010236, 010279–010283) agree very well with all morphological characters recognized for *Rhinella yanachaga* and with the color pattern described for this species. Sites were sampled at the surroundings of the type locality for *R. yanachaga* and this species was recorded only on the primary forests of ULB and USAB, being abundant on the latest. Nevertheless, the species was not recorded in the secondary forest or other habitats present in the other sampling sites; this is apparently a remarkable habitat quality preference, not mentioned by Lehr *et al*. (2007). These authors defined the type locality inside YCNP as cloud forests, mainly primary, with low levels of human impact, which match our field data for the species. All individuals were recorded in bushes, between 0.5-2 m above the ground, although it is not possible to

confirm their habitat preferences. Individuals were captured at night, between 19:00–23:00h, resting on leaves. *Rhinella yanachaga* was found sympatric with *Phrynopus bracki, Prhynopus tribulosus, Pristimantis bromeliaceus, Pristimantis lucasi, Pristimantis* sp. 1 and *Pristimantis stictogaster*. With the exception of *P. stictogaster*, these *Pristimantis* species were recorded in the same place, used bushes as microhabitat, and were active at the same time than *R. yanachaga*. This overlap of niches could suggest a potential competition between the species and, in that case, probably the microhabitat use would be the determinant for the relationship.

FAMILY CENTROLENIDAE

***Hyalinobatrachium carlesvilai* (Castroviejo-Fisher, Padial, Chaparro, Aguayo *et* de la Riva, 2009)**

(Fig. 3, A-B).

This is the first record of this glassfrog for the Pasco region. The presence of this species involves a new locality but not an extension of its distribution. Specimens recorded (CORBIDI 010178-010183, 010272-010274) exhibit all diagnostic characters described by Castroviejo-Fisher *et al*. (2009) such as: iridophorous absent on the ventral parietal peritoneum, snout truncate in dorsal and lateral view, liver bulbous; humeral spine is absent in adult males, finger webbing absent between fingers I and II and basal between fingers II and III. *Hyalinobatrachium carlesvilai* is the most abundant species in habitats related to streams and it was found in bushes, bromeliads, *Heliconia* spp. and some high herbs. Most of the specimens recorded were males and captures were performed during the night, when many male adults were calling on leaves above water. This data correspond with the findings of Castroviejo-Fischer *et al.* (2009). Even though the vegetation in streams was dense, the places where this glassfrog was recorded are inside an area strongly impacted by agricultural and construction activities similar to the habitat for *H. carlesvilai* in Brazil (Cisneros-Heredia *et al*. 2009). The level of the impact in the type locality or localities for paratypes is not mentioned in the description. In the study area, *H. carlesvilai* is sympatric with *Pristimantis saggitulus, P. bromeliaceus* and *P. cruciocularis*. These species are mainly nocturnal, like *H. carlevilai*, but the strata of the

TABLE 2. Species recorded by each locality. LLB=Lower Llamaquizu Basin; ULB=Upper Llamaquizu Basin; LSAB=Lower San Alberto Basin; USAB=Upper San Alberto basin.

TABLA 2. *Especies registradas por cada localidad. LLB=Cuenca baja de Llamaquizú; ULB= Cuenca alta de Llamaquizú; LSAB=Cuenca baja de San Alberto; USAB=Cuenca alta de San Alberto.*

Clase	Orden	Family	Species	LLB	ULB	LSAB	USAB
		Bufonidae	*Atelopus oxapampae*			X	
		Bufonidae	*Rhinella leptoscelis*	X	X		
		Bufonidae	*Rhinella yanachaga*		X		X
		Centrolenidae	*Hyalinobatrachium carlesvilai*	X	X	X	
		Dendrobatidae	*Amerega planipaleae*	X			
		Hylidae	*Hypsiboas aguilari*		X		
		Hylidae	*Scinax oreites*			X	
		Strabomantidae	*Phrynopus tribulosus*				X
		Strabomantidae	*Phrynopus bracki*				X
Amphibia	Anura	Strabomantidae	*Phrynopus auriculatus*				X
		Strabomantidae	*Pristimantis adiastolus*		X		
		Strabomantidae	*Pristimimantis albertus*		X	X	X
		Strabomantidae	*Pristimantis bipunctatus*	X	X	X	
		Strabomantidae	*Pristimimantis bromeliaceus*	X	X	X	X
		Strabomantidae	*Pristimantis cruciocularis*	X	X		
		Strabomantidae	*Pristimantis leucorrhinus*		X		
		Strabomantidae	*Pristimantis lucasi*		X		X
		Strabomantidae	*Pristimantis rhabdocnemus*		X	X	X
		Strabomantidae	*Pristimantis sagittulus*	X	X	X	X
		Strabomantidae	*Pristimantis* sp.				X
		Strabomantidae	*Pristimantis stictogaster*		X		X

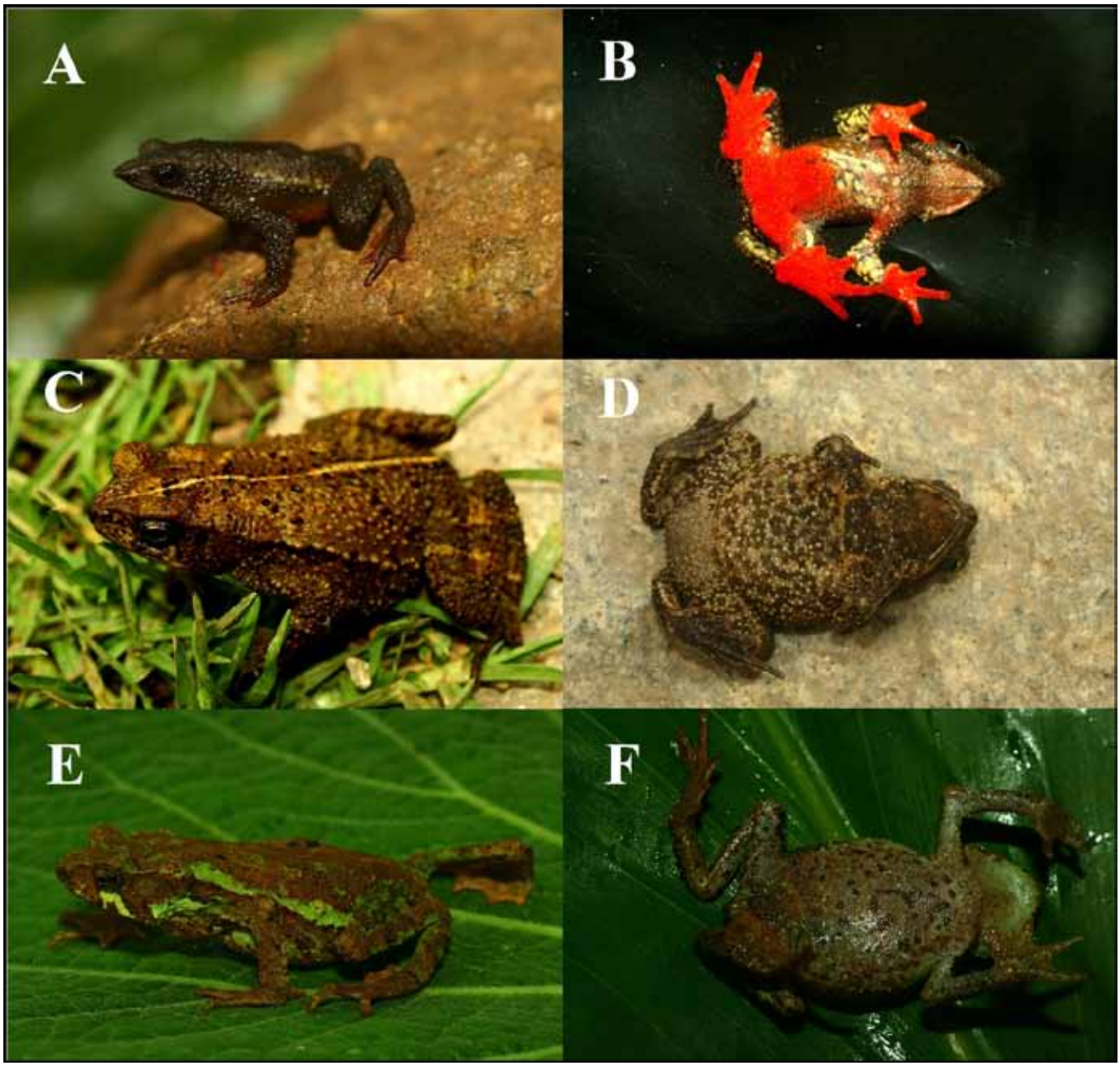

FIG. 2. Dorsal and ventral view of: A–B) *Atelopus oxapampae*; C–D) *Rhinella* cf. *leptoscelis*; E–F) *Rhinella yanachaga*. *Vista dorsal y ventral de: A–B)* Atelopus oxapampae*; C–D)* Rhinella *cf.* leptoscelis*; E–F)* Rhinella yanachaga.

forest that they use is lower than the one used by the mentioned species.

FAMILY DENDROBATIDAE
***Ameerega planipaleae* (Morales *et* Velazco, 1998)**
(Fig. 3, C-D).

Seven specimens were recorded and none of them were collected. They all presented the diagnostic characters for this species (Morales and Velazco 1998) such as: skin on dorsum granular, dorsal coloration yellow with two dorsolateral yellow stripes and ventral coloration pale blue or turquoise with black reticulations. Coloration on groins and anterior surfaces of thighs is black with red or orange spots. Some individuals presented red spots on ventral surfaces of shanks, a color variation previously described by Medina-Muller and Chávez (2009). This species is known only from the type locality, a location that, unfortunately, lacks precise geographic information. Data based on field observations performed by GC, define *A. planipaleae* distribution as very restricted, justifying its

inclusion under the Critically Endangered category of IUCN (2004). Ecological and natural history data are scarce for this frog. Our field observations evidenced that it is a typical diurnal species, being very active in the afternoon, between 17:00-18:30 h. Habitat recorded for this frog is secondary forests, where individuals use mainly leaf litter at day and night. Despite this species being sympatric with *Pristimantis cruciocularis, P. bipunctatus, P. bromeliaceus* and *Hyalinobatrachium carlesvilai*, there is not overlapping of microhabitats or activities. Consequently, the chances of ecological competition with other frogs are scarce, because it is the only diurnal species recorded in the LLB. Our field data reveals that this frog is threatened by habitat loss and degradation, since the surrounded area is completely covered by farms and human buildings.

FAMILY HYLIDAE

***Hypsiboas aguilari* (Lehr, Faivovich *et* Jüngfer, 2010)**
(Fig. 3, E-F).

Many individuals of this species were recorded but only three were collected (CORBIDI 010196-98). Specimens exhibit a head wider than the body, a snout rounded in dorsal view and slightly truncate in lateral view, prominent eyes with the upper half of palpebral membrane translucent and the lower half with brown reticulations, hypertrophied arms in males, and dorsolateral folds; all of these characters differ from other similar species (Lehr *et al*. 2010). This species was extremely abundant in impacted areas. In fact, tadpoles, juveniles an adult were recorded massively in creeks or streams along farms or towns, and were absent on streams inside primary forest or areas without evidence of human impact. This species does not climb trees or bushes, and is recorded frequently hidden between low vegetation. Although no adults of other species were recorded sympatrically with *H. aguilari*, tadpoles of *Scinax oreites* were recorded in the same creeks; these data is coincident with the data given in the description by Lehr *et al*. (2010) which mention the fact that *S. oreites* tadpoles occurs syntopically with *H. aguilari* tadpoles in the Llamaquizu basin. All males were recorded active at night, from 18:00 – 24:00 h and the male's density was considerably higher than that for females.

***Scinax oreites* (Duellman *et* Wiens, 1993)** (Fig. 4, A-B).

Although this species can be abundant in some areas at northern Peru (GC, unpublished data), in the study area only three individuals were recorded (CORBIDI 010264-65, 010269). Both juveniles corresponded with the species description (Duellman and Wiens, 1993) presenting yellow groins, the main diagnostical character for this species. The individuals were captured on riparian vegetation, where they used bushes and some trees as shelter and were usually found on leaves 1–2 meters above the ground. They were active during the nights (20:00 – 23:00 h). Lehr *et al.* (2010) mentioned this species occurs simpatrically with *Hypsiboas aguilari* in open areas and even agricultural zones; this data was corroborated in the present research.

FAMILY STRABOMANTIDAE

***Phrynopus auriculatus* (Duellman et Hedges, 2008)**
(Fig. 4, C-D).

This species was recorded only on primary forest, at the USAB, inside YCNP. The only individual captured (CORBIDI 010304) exhibits the most remarkable traits for the species: bearing a tympanic membrane and tympanic annulus, and toe V was slightly longer than toe III. The type locality is the same where *Phrynopus auriculatus* was recorded. The temperature in this habitat is the lowest for the whole study area and the elevation was the highest. *P. auriculatus* was recorded among lichens and sharing microhabitat with *Phrynopus bracki* and *Phrynopus tribulosus*, species that have a very similar length. Other frog recorded using the same microhabitat was *Pristimantis stictogaster*, but this species is longer than the others, and all these species are nocturnal. Based on these observations, it is possible to suppose that the niches are overlapping between *P. auriculatus, P. bracki* and *P. tribulosus* and, in consequence, a potential ecological competition occurs between these species.

***Phrynopus bracki* (Hedges, 1990)** (Fig. 4, E-F).

This species is (like *Phrynopus auriculatus*) one of the rarest in the study area and was only found at the type locality. Two individuals were captured (CORBIDI 010302-03). Both of them showed a small length (19.00 mm or less) a vestigial first toe with the width equal to the length, and a fourth toe long and broad. This frog was found in primary forest with cold temperatures. The species is sympatric and syntopic with *P. auriculatus* and *Phrynopus tribulosus*, probably establishing a relationship of competition because the overlapping of the niches. Males were calling inside the lichens or leaf-litter that they inhabit, and the species is active at night.

***Phrynopus tribulosus* (Duellman *et* Hedges, 2008)**
(Fig. 5, A-B).

This small frog was recorded sympatrically with *Phrynopus auriculatus* and *Phrynopus bracki* in a primary forest. Individuals captured (CORBIDI 010299-010301) exhibit diagnostic characteristics mentioned by Duellman and Hedges (2008) such as: tympanic membrane not differenced and tympanic annulus absent, upper eyelid bearing small tubercles, vocal slits and nuptial pads absent, subconical tubercle on the heel and outer edge of tarsus with row of subconical tubercles and a green dorsal coloration. This species was previously known just by a single individual found deep within a mossy bank by day (Duellman and Hedges, 2008). We found three specimens, all of them using lichens and leaf litter as microhabitat for shelter; two of them were calling inside leaf-litter at night, at 20:30 h.

***Pristimantis adiastolus* (Duellman *et* Hedges, 2008)**
(Fig. 5, C-D).

This frog, a member of the *Pristimantis peruvianus* group, was recorded by only one individual (CORBIDI 010221). This species is

cryptic with *Pristimantis bipunctatus* and in the original description of *P. bipunctatus* (Duellman and Hedges, 2005) several individuals of *Pristimantis adiastolus* were included but were later separated through morphological and phylogenetic analyses. Diagnostic characters for *P. adiastolus* are present in the specimen captured in this study, such as skin on dorsum shagreened and weakly areolate on venter, dorsolateral folds present, tympanic membrane differentiated and posterior surfaces of thighs brown. The specimen was found in a primary forest in the ULB, on a leaf 1.5 meters above the ground, in simpatry with *Pristimantis bromeliaceus, P. saggitulus* and *P. rhabdocnemus*. It is difficult to establish a relationship between *P. adiastolus* and the rest of species co-inhabiting this area, but this species is probably closer to *P. rhabdocnemus* which uses the same microhabitats. The species is different from *P. saggitulus,*

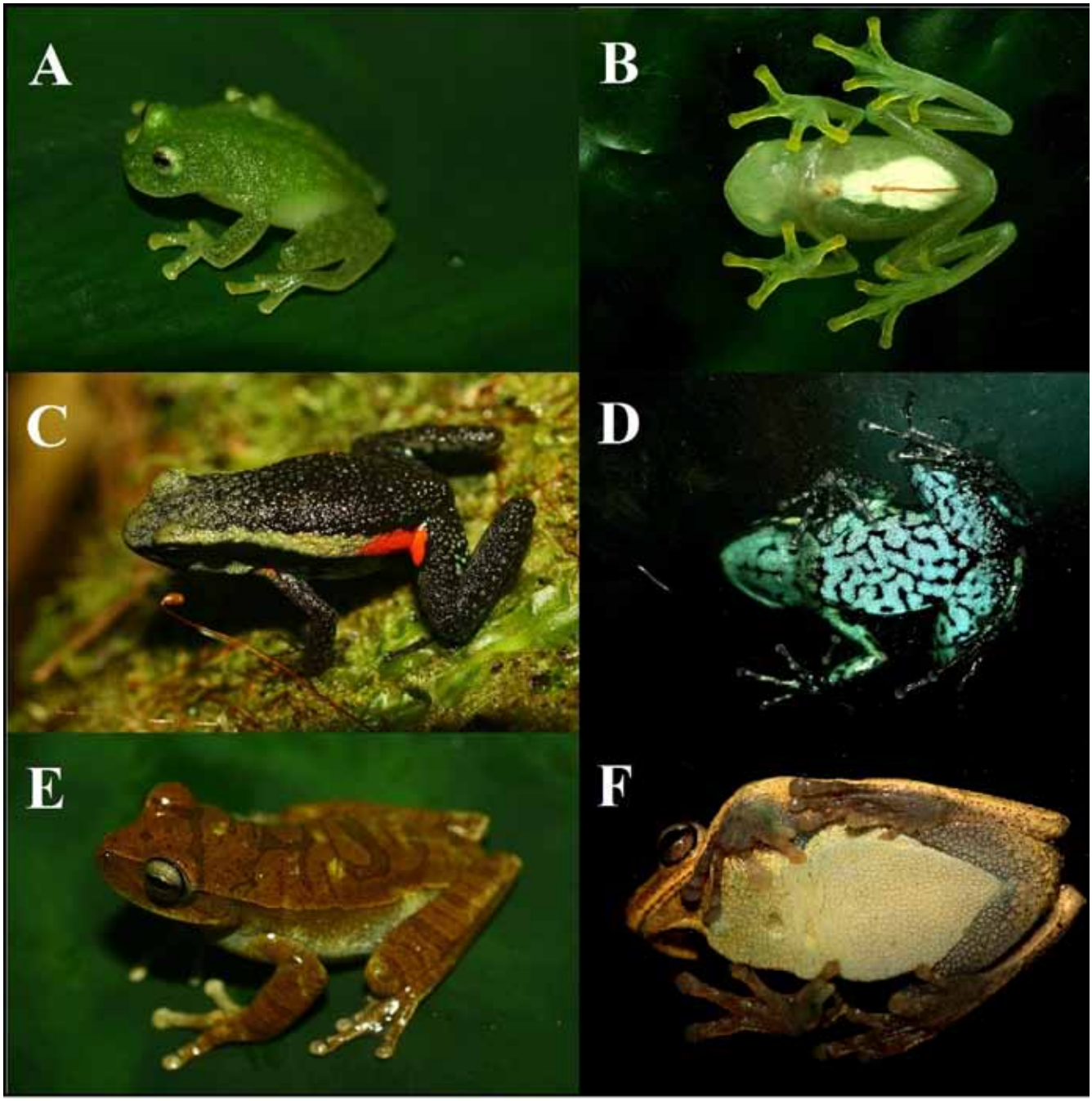

FIG. 3. Dorsal and ventral view of: A–B) *Hyalinobatrachium carlesvilai***;** C–D) *Ameerega planipaleae***;** E–F) *Hypsiboas aguilari. Vista dorsal y ventral de: A–B)* Hyalinobatrachium carlesvilai*; C–D)* Ameerega planipaleae*; E–F)* Hypsiboas aguilari.

because it uses vegetation (trees, bushes or herbs) very close to body waters; and *P. bromeliaceus* uses a higher stratum in the forest than *P. adiastolus*. According to the description (Duellman and Hedges 2008) this species inhabits humid montane forest at 1200 meters of elevation; however, this study presents a new altitudinal record: 2140 m, a difference almost one thousand meters higher than previous known records.

***Pristimantis albertus* (Duellman *et* Hedges, 2007)**
(Fig. 5, E-F).

This species was intensively recorded in three out of four sampled areas, increasing the known number of individuals, because it was described only with two specimens. The voucher frogs (CORBIDI 010202-010203, 010219, 010255, 010261, 010263, 010285, 010291) show characters such as shagreened skin on dorsum with scattered small tubercles, low dorsolateral folds roughened and discontinuous, tympanic membrane differentiated, tympanic annulus distinct, upper eyelid lacking tubercles and the color on the posterior surfaces of thighs is brown, all of them coincident with the diagnosis of *Pristimantis albertus*. Furthermore, this species was recorded not only in the type locality (USAB) but also in the Lower and Upper Llamaquizú basins. The habitat where this species was found includes primary and secondary forests. All the individuals were

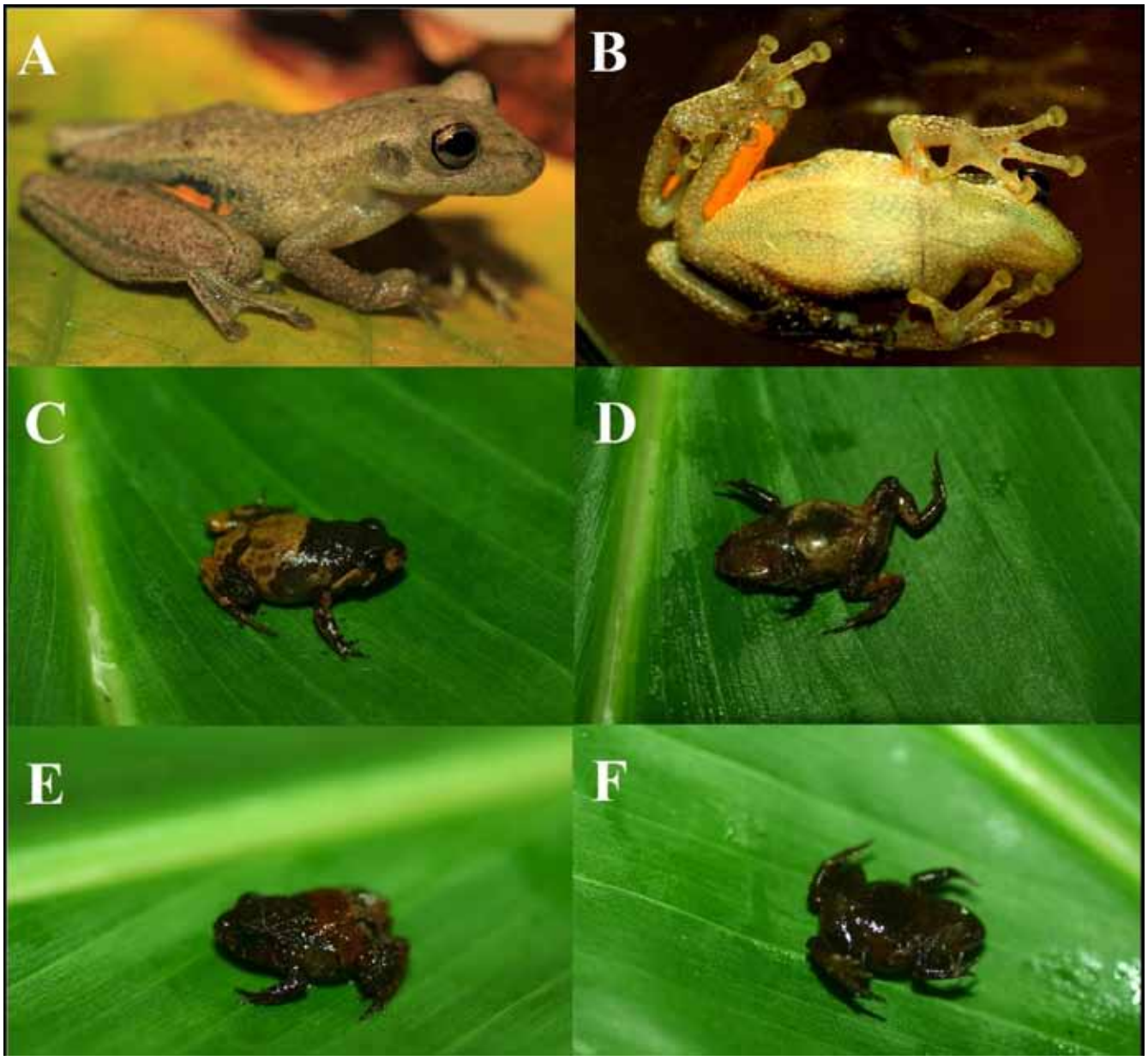

FIG. 4. Dorsal and ventral view of: A–B) *Scinax oreites*; C–D) *Phrynopus auriculatus*; E–F) *Phrynopus bracki.*
Vista dorsal y ventral de: A–B) Scinax oreites*; C–D)* Phrynopus auriculatus*; E–F)* Phrynopus bracki.

captured on leaves, far from any body of water, between 0.3 to 1.5 m above the ground, and were active at night. The species is sympatric with *Pristimantis lucasi*, *P. bromeliaceus, P. rhabdocnemus, P. bipunctatus* and *P. saggitulus*, but presents an overlapping of niches with *P. lucasi, P. rhabdocnemus* and *P. bipunctatus*, which probably causes competition between the species.

***Pristimantis bipunctatus* (Duellman** et **Hedges, 2005)**
(Fig. 6, A-B).

This species is a member of the *Pristimantis conspicillatus* group and was recorded remarkably along the Llamaquizu basin (lower and upper) and in Lower San Alberto basin, where it was one of the most abundant species. Collected specimens (CORBIDI 010170-010174, 010201, 010204, 010251, 010289) show the diagnostic characters described by Duellman and Hedges (2005), such as: skin on dorsum finely shagreened with a couple of black warts on the scapular region, dorsolateral folds absent and color on the posterior surface of thighs is brown with cream flecks. *Pristimantis bipunctatus* was recorded on riverside low vegetation, being the predominant species in this

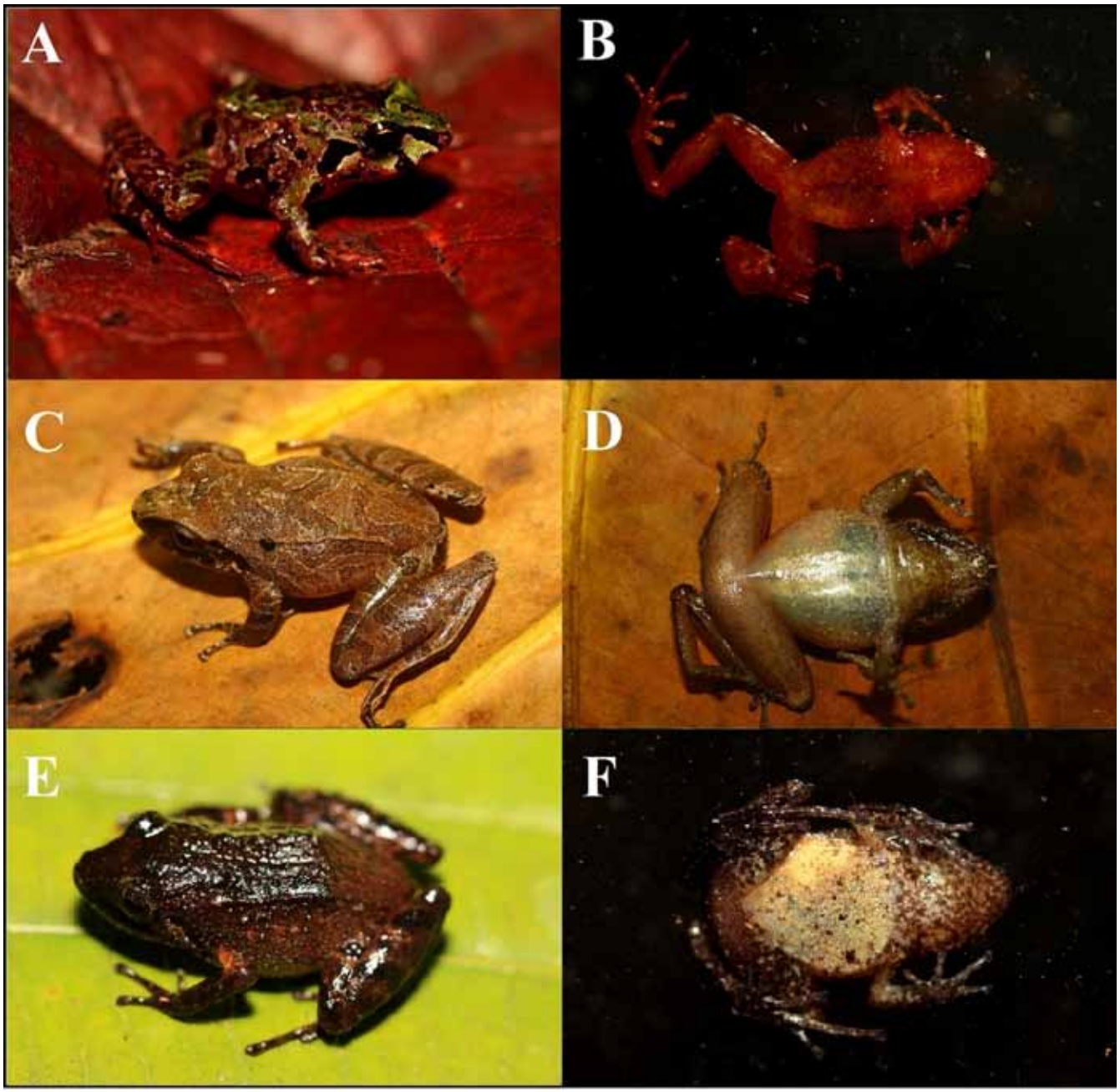

FIG. 5. Dorsal and ventral view of: A–B) *Phrynopus tribulosus*; C–D) *Pristimantis adiastolus*; E–F) *Pristimantis albertus.*
Vista dorsal y ventral de: A–B) Phrynopus tribulosus*; C–D)* Pristimantis adiastolus*; E–F)* Pristimantis albertus.

habitat and, in fact, the most abundant anuran inhabiting near body waters in LLB. In lower and upper San Alberto this frog was recorded simpatrically with *Pristimantis saggitulus*; however, their microhabitats do not overlap. *Pristimantis bipunctatus* use the lower strata in the vegetation next to a stream or river, while *P. saggitulus* use the medium strata (bushes or young trees).

***Pristimantis bromeliaceus* (Lynch, 1979)** (Fig. 6, C-D).

This frog, a member of the *Pristimantis lacrimosus* group, was the most abundant species in the entire study area. The specimens (CORBIDI 010184-010185, 010200, 010217, 010222–010230, 010248-010249, 010253, 010294-010295) correspond very well with the description: bearing a sub-acuminate snout, small tubercles on the upper eyelid, dentigerous processes of vomers oblique, prominent and small tubercles on heels and outer side of tarsi. The coloration exhibited by these specimens was yellowish, pale reddish or green and some individuals have an interorbital bar that corresponds with the description and with the colors mentioned by Duellman and Lehr (2009). This arboreal species uses the higher strata of primary forest, secondary forest, and riparian vegetation. It is usually recorded active at night, with males calling actively from 19:00 to midnight or beyond. The distance between males in some cases was only 0.1 m, and only some females were found. Several *Pristimantis* species were recorded simpatrically with *Pristimantis bromeliaceus*, but only a few were using the same microhabitat. Only *Hyalinobatrachium carlesvilai* could overlap in microhabitat and time of activity. But according to our field observations, when males of *P. bromeliaceus* and *H. carlesvilai* are using the same site (leaves of bush or trees), males of *H.carlesviali* call underneath leaves and *P. bromeliaceus* on top of the leaves. Although bromeliads are reported as a usual shelter, we caught *P. bromeliaceus* by day on leaves and inside some young leaves of *Heliconia* spp. This species is considered under the Vulnerable category by IUCN (2008) having as justification its occurrence area, which is probably less than 20.000 Km^2 in a very fragmented region of the Andes in Peru. Despite this, *P. bromeliaceus* shows healthy populations in most of the habitats present here, even in areas strongly impacted by human activity or buildings. However, more studies are needed to increase the knowledge about the real conservation status of this species.

***Pristimantis cruciocularis* (Lehr, Lundberg, Aguilar *et* von May, 2006)** (Fig. 6, E-F).

This frog was recorded only in the Llamaquizu basin. Although it was not an abundant species, it had a moderate abundance in upper Llamaquizu basin. The specimens (CORBIDI 010186-010191, 010238) exhibit diagnostic characters for the species: two tubercles on the upper eyelid, skin on dorsum shagreened with scattered small spicules, males lack vocal sacs, red or orange and white spots on groins and anterior surfaces of thighs. Only one captured individual (CORBIDI 010238) exhibits a different color on dorsum and groins (Fig. 7), presenting a uniform red color on groins and anterior surfaces of thighs, and a longitudinal brown and pale brown pattern on dorsum. *Pristimantis cruciocularis* was recorded at medium strata on primary and secondary forests, on leaves and 1.5 m above the ground. The species was always recorded during night and was found on leaf-litter, in vegetation close to streams or creeks. These data correspond with the species description information (Lehr *et al*. 2006). Sympatric species were *Hyalinobatrachium carlesvilai, Pristimantis bipunctatus, P. saggitulus and P. bromeliaceus*. Of these, only *P. saggitulus* is overlapping the microhabitat with *P. cruciocularis* and both are nocturnal, which indicates a potential source of competition between these frogs.

***Pristimantis leucorrhinus* (Boano, Mazzotti *et* Sindaco, 2008)** (Fig. 8, A-B).

This species, a member of the *Pristimantis unistrigatus* group, was recorded in the study area by only two individuals (CORBIDI 010237, 010277). These specimens agree with the species description (Boano *et al*. 2008) by having skin tuberculate on dorsum with prominent pointed tubercles on limbs and areolate with scattered rounded tubercles on venter, several tubercles on the upper eyelid, one of them is large and conical and groins and anterior surfaces of thighs coloration black with white spots. According to the characters mentioned by Boano *et al*. (2008) the specific name *leucorrhinus* is derived from the latin "*leucos"* meaning white and the Greek noun "*rhinos"* meaning snout because the holotype (the only previously known specimen for this species) has a white spot in the pit of the nose, like the specimens collected in this research. However, this character is present or absent in several individuals of many species of the *Pristimantis unistrigatus* group. Although the records are scarce to define any ecological data, both individuals of *Pristimantis leucorrhinus* were recorded at primary forest, on leaves at 1.5 m above the ground and during the night. The species is sympatric with *Pristimantis bromeliaceus* and *P. rhabdocnemus*, and probably has a niche overlap with *P. rhabdocnemus*, recorded in the same microhabitat and having the same activity periods. Therefore, it is probable that both taxa have a potential competition relationship.

***Pristimantis lucasi* (Duellman *et* Chaparro, 2008)** (Fig. 8, C-D).

This frog, a member of the *Pristimantis unistrigatus* group, was recorded in a few localities, all of them in the upper basins (Llamaquizu and San Alberto). Four individuals were recorded (CORBIDI 010206-010207, 010297-010298), everyone showed diagnostic characters given by Duellman and Chaparro (2008) such as: skin on dorsum smooth with scattered subconical tubercles, tympanic membrane not differentiated, tympanic annulus absent, upper eyelid bearing two large and conical tubercles, heel bearing a single and conical tubercle, males with vocal slits, coloration on groins, posterior surfaces of thighs and ventral surfaces of shanks pale greenish tan. This species was only known from the montane forest, below the crest of Abra Esperanza, therefore we add a new place for this species occurrence: in the ULB, approximately 20 Km from the type locality. The habitat where this species was found is

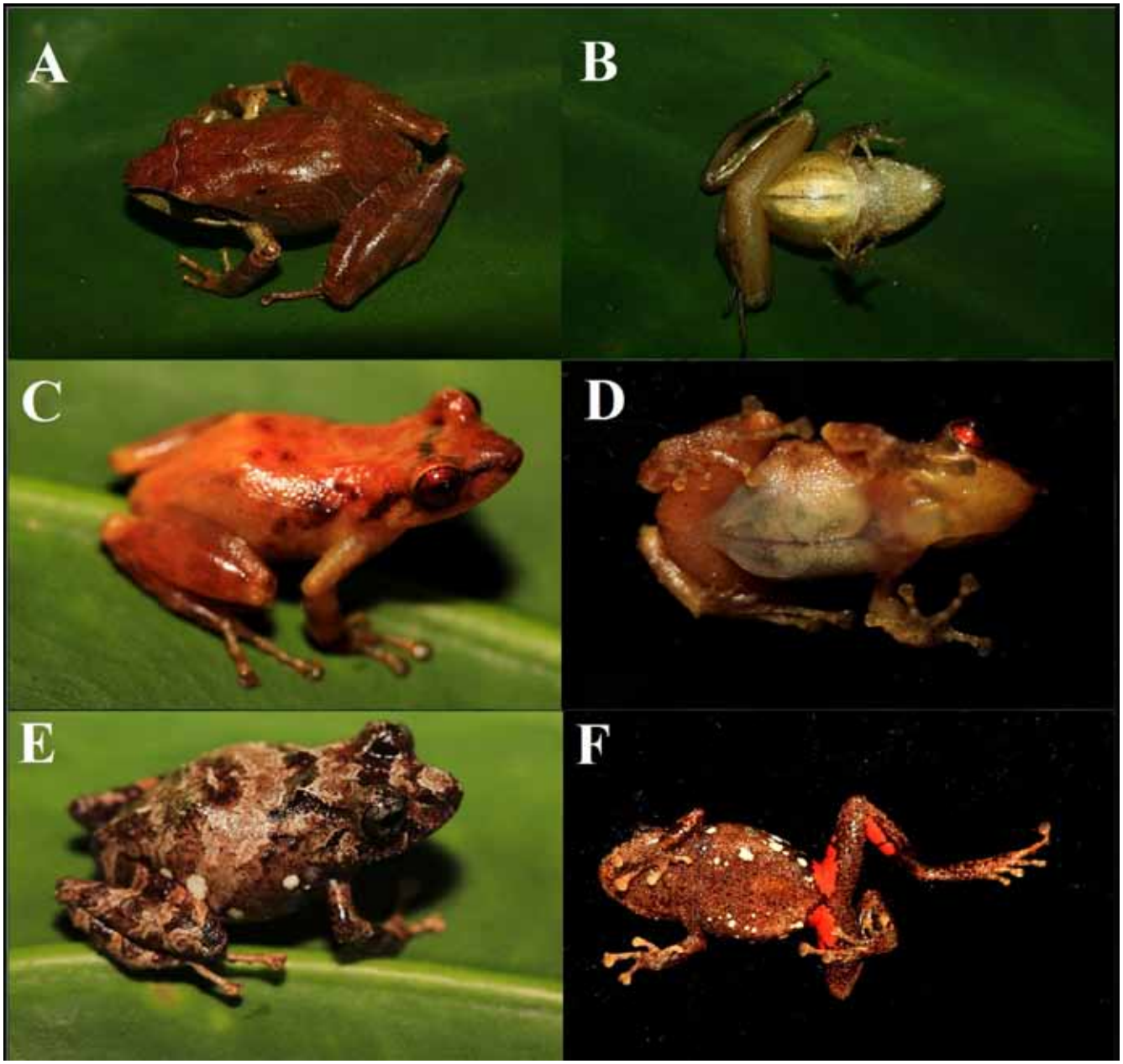

FIG. 6. Dorsal and ventral view of: A–B) *Pristimantis bipunctatus***;** C–D) *Pristimantis bromeliaceus***;** E–F) *Pristimantis cruciocularis*
Vista dorsal y ventral de: A–B) Pristimantis bipunctatus*; C–D)* Pristimantis bromeliaceus*; E–F)* Pristimantis cruciocularis.

mainly primary forest and only one individual was recorded in a trail inside secondary forest, although very close to a primary forest. *Pristimantis lucasi* uses microhabitats in the medium strata of the vegetation, was captured on leaves, 1–1.5 m above the ground and during the night. Sympatric species were *Phrynopus auriculatus. P. tribulosus, P. bracki, Pristimantis albertus, P. bipunctatus, P. bromeliaceus, P. cruciocularis, P. leucorrhinus, P. stictogaster, P. rhabdocnemus* and *Pristimantis* sp. From these species, *P. lucasi* microhabitat overlaps with *P. albertus, P. cruciocularis, P. leucorrhinus* and *P. rhabdocnemus*. These species use the same strata of the vegetation and have similar length; accordingly, a probable trophic competition could exist among these frogs.

***Pristimantis rhabdocnemus* (Duellman** et **Hedges, 2005)**
(Fig. 8, E-F).

This species was one of the three most abundant species in the study area. It was recorded in three out of four sampling sites. Seventeen individuals were captured (CORBIDI 010205, 010220, 010239-010240, 010242-010247, 010252, 010254, 010262, 010275, 010292-010293) and they correspond very well with the species description (Duellman and Hedges, 2005): by having shagreened

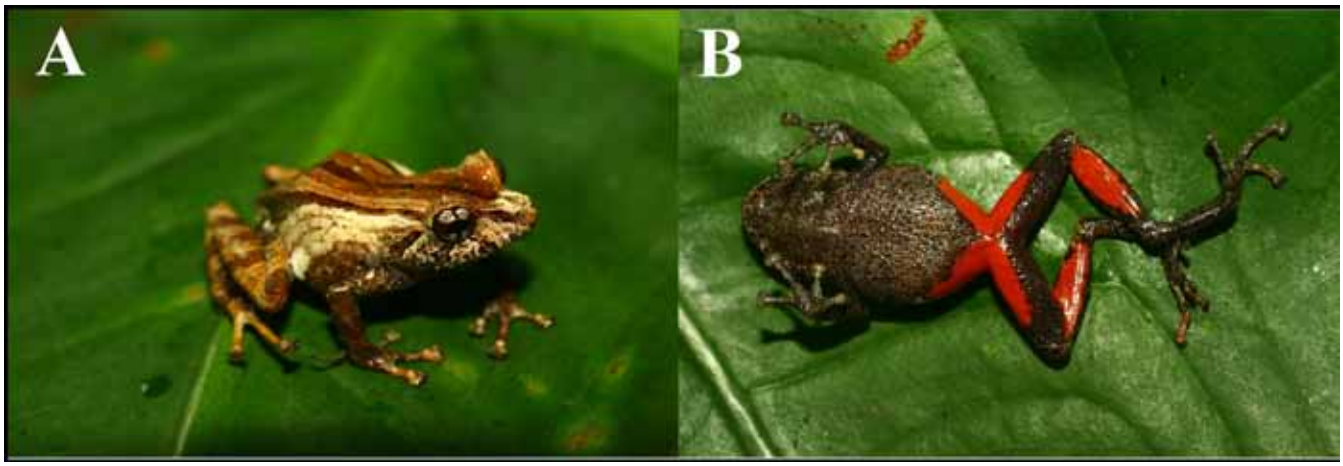

FIG. 7. *Pristimantis cruciocularis* (CORBIDI 010238): A) Dorsal view; B) Ventral view.
Pristimantis cruciocularis *(CORBIDI 010238): A) Vista dorsal; B) Vista ventral.*

skin on dorsum, generally, with scattered small tubercles, snout moderately long, round from dorsal and lateral view, upper eyelid without tubercles, heel with a single conical tubercle and lacking a differentiated tympanum. Except for *Pristimantis bromeliaceus*, this is the most abundant species of terrestrial breeding frogs in the study area. It was found in different habitats, always using medium strata in the vegetation of the forest, not really close to body waters. The species was sympatric with almost all strabomantid frogs occurring here, except with *Pristimantis* sp. Competition relationships are probably given with most of the *Pristimantis* species, which share microhabitat and time of activity.

***Pristimantis saggitulus* (Lehr, Aguilar** et **Duellman, 2004)**
(Fig. 9, A-B).

This is another of the most abundant species in the study area, forty two individuals were recorded and only eleven were collected (CORBIDI 010167-010169, 010214-010216, 010218, 010234, 010250, 010267-010268). All these specimens exhibit a shagreened skin on dorsum with low tubercles dorsolaterally and posteriorly, tympanic membrane smooth, upper eyelid without tubercles, vocal slits in males, heel bearing a prominent triangular tubercle, and posterior surfaces of thighs with a red longitudinal stripe. *Pristimantis saggitulus* was one of the most active species during night. It was found in secondary forests and riparian vegetation or around streams on leaves and ferns about 1.5 m above the ground. Males were calling from 19:00-23:00 h and active males were found always in low vegetation very close to streams or rivers. Sympatric species include *Atelopus oxapampae, Hyalinobatrachium carlesvilai, Rhinella* cf. *leptoscelis, Pristimantis albertus, P. bipunctatus, P. bromeliaceus* and *P. rhabdocnemus*. From these species, only *H. carlesvilai* and *P. bromeliaceus* show a strong activity at night, although males of both species use higher strata than *P.saggitulus* in the vegetation; in that case, microhabitats are not overlapping.

***Pristimantis* sp.** (Fig. 9, C-D).
This unidentified species was recorded in the USAB, inside YCNP. Two individuals were captured (CORBIDI 010284, 010286) and both exhibit shagreened skin on dorsum, tympanic annulus and tympanic membrane distinct, skin on venter weakly areolate, dorsolateral folds absent, small tubercles on the upper eyelid, coloration on dorsum red or reddish yellow, transversal black chevrons on dorsum, black labial bars and supratympanic stripe from the end of the eye to behind the tympanum and ventral coloration reddish. This species is nocturnal, shows a preference for primary forest and use the higher strata of vegetation. This species is sympatric with *Phrynopus tribulosus, Phrynopus auriculatus, Phrynopus bracki, Pristimantis bromeliaceus, Pristimantis stictogaster* and *Pristimantis lucasi*. Microhabitat is overlapping with *P. bromeliaceus*, even the density of the latest is clearly higher than this unidentified species; thus, a competition relationship between them is possible, but more data is needed to confirm this. Call is unknown.

***Pristimantis stictogaster* (Duellman *et* Hedges, 2005)**
(Fig. 9, E-F).

This species, a member of the *Pristimantis unistrigatus* group, was recorded only in the upper San Alberto basin. Specimens (CORBIDI 010287-010288, 010290, 010296) show tuberculate skin on dorsum, areolate venter, tympanic membrane smooth, snout long, truncate in dorsal and lateral view, continuous dorsolateral folds, heels and tarsi without tubercles, and color of the venter with remarkable black or dark brown irregular-shaped spots on a creamy-white or white background. Only recorded in primary forest, this species is active at night, and use lower strata in the vegetation. The species could be sympatric with *Phrynopus auriculatus, P. tribulosus* and *P. bracki*, *Pristimantis bromeliaceus, P. rhabdocnemus, P. lucasi* and *Rhinella yanachaga*. Only *Phrynopus* species use the lower strata of the vegetation but the different length, as well as the courtship behavior of the males observed (*Phrynopus* called inside leaf litter or lichens while *Pristimantis stictogaster*, on the ground) indicate that niches might not be overlapping between these species.

DISCUSSION

The collection of 22 species presented in this study provides a preliminary view of the amphibian fauna from the southern region of YCNP. This collection also contains records of great importance for their biogeographical and taxonomical significance within the context of the current knowledge of Andean herpetofauna. Several specimens represent records of species that used to be considered endemic for a single or few localities inside YCNP (*e.g.* new localities are given here for *Pristimantis lucasi* and *P. leucorrhinus)*. Additionally, other species have been found outside their type localities *(e.g. Ameerega planipaleae, Phrynopus bracki, Phrynopus tribulosus and Phrynopus auriculatus)*.

Specific richness was tested with a rarefaction analyses on the total study area. According to Fig. 10, the lack of asymptote on the species' accumulation curve suggests that more species might be present in the study area. This result is supported on the remarkable increment of specific richness for Strabomantid frogs at the end of the fieldwork. Species described from Cordillera de Yanachaga, absent in this study belong, mainly, to the family Strabomantidae (Duellman

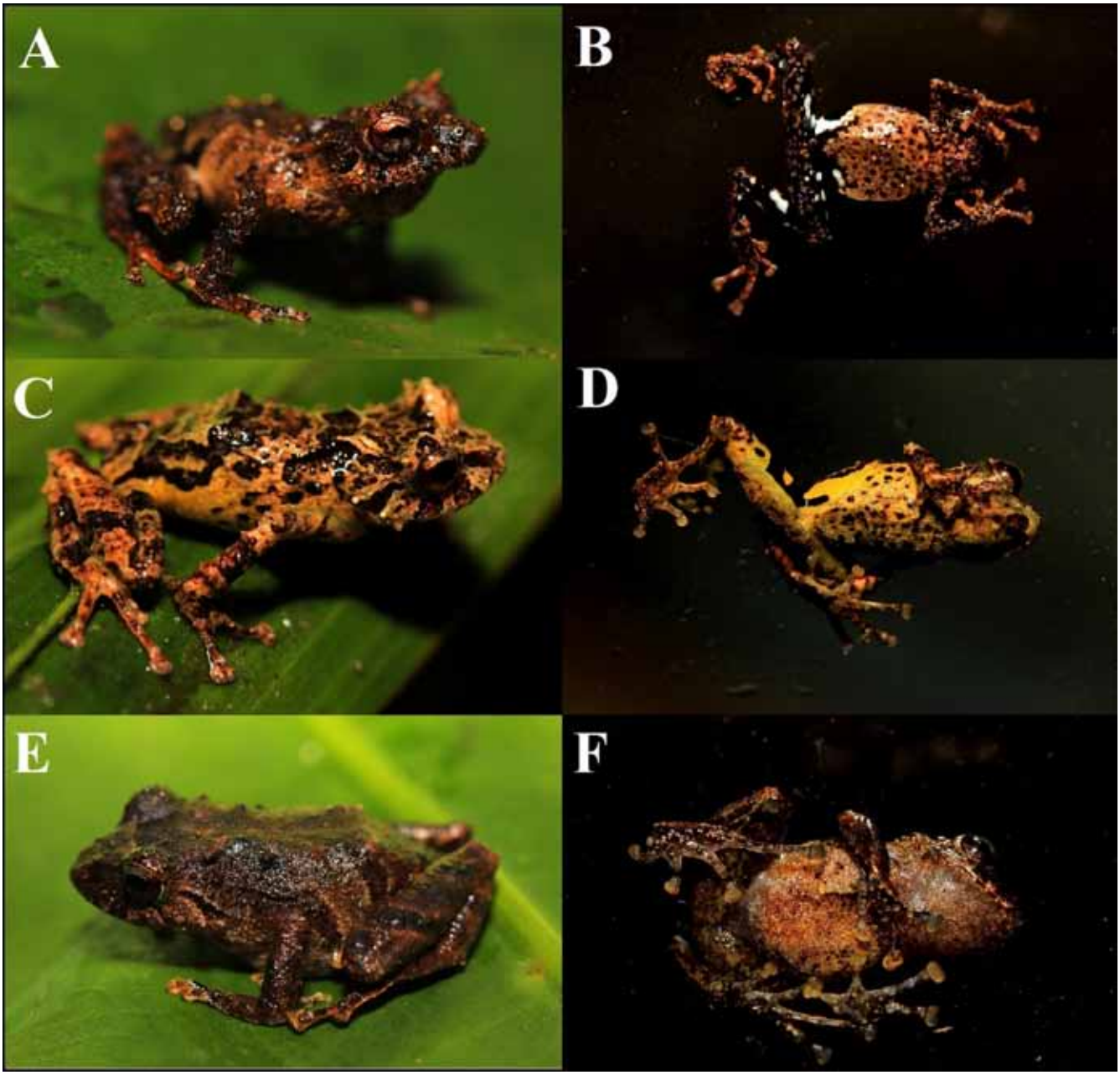

FIG. 8. Dorsal and ventral view of: A–B) *Pristimantis leucorrhinus*; C–D) *Pristimantis lucasi*; E–F) *Pristimantis rhabdocnemus. Vista dorsal y ventral de: A–B)* Pristimantis leucorrhinus*; C–D)* Pristimantis lucasi*; E–F)* Pristimantis rhabdocnemus.

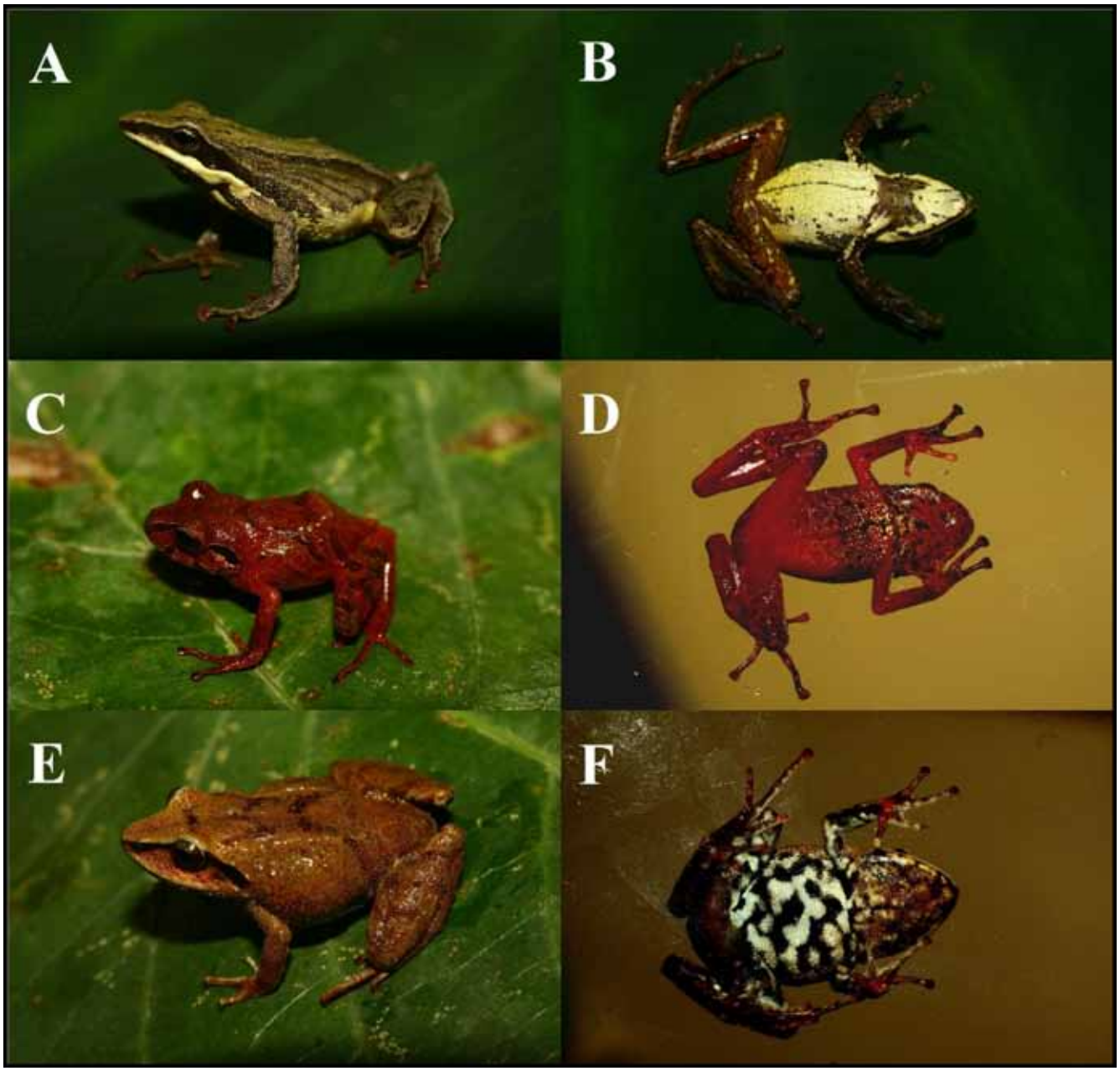

FIG. 9. Dorsal and ventral view of: A–B) *Pristimantis saggitulus*; C–D) *Pristimantis sp*; E–F) *Pristimantis stictogaster.*
Vista dorsal y ventral de: A–B) Pristimantis saggitulus*; C–D)* Pristimantis *sp; E–F)* Pristimantis stictogaster.

and Hedges 2005; Duellman and Chaparro 2008), being just a few exceptions. The possibility to find new taxa is open, and evidenced on the record of *Pristimantis* sp., thus, additional survey efforts are likely to reveal species missed in this survey. Furthermore, some frequently encountered species (e.g., *Hypsiboas aguilari*, *Hyalinobatrachium carlesvilai*, *Pristimantis bromeliaceus* and *P. saggitulus*) are as well considered moderately common by other herpetologists (pers. comm. with J.C. Chaparro and J. Icochea). Although our data is too limited to provide an analysis of abundance, temporal or elevational variation in herpetofaunal communities; ecological data presented here is a preliminary result that precedes future contributions based on the same study area.

ACKNOWLEDGEMENTS
We would thank the Instituto del Bien Común (IBC), Oxapampa office, Peru, for trust in GC work; and the Birdlife International and RARE Conservation, by their support on the fieldwork. For the permits, we

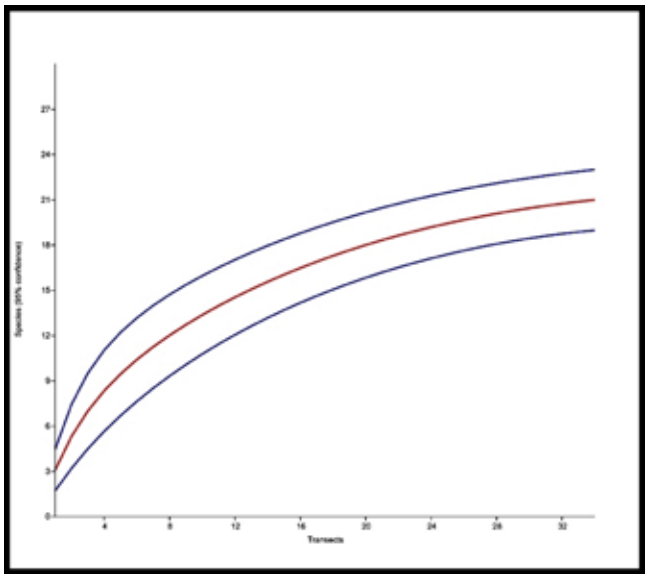

FIG. 10. Rarefaction curve of the study area.
Curva de rarefaction del área de estudio.

are indebted to the Servicio Nacional de Areas Naturales Protegidas, Oxapampa Office and Dirección General de Flora y Fauna Silvestre, Peru. And in particular, we are indebted with gratitude to Aimy Caceres for her valuable help, recommendations and contributions to the manuscript; Cesar Laura, Federico Rizopatrón, Alex Samar and Guido Casimiro, staff of IBC, for their valuable and unbelievable help and logistic assistance; with Florencia Trama by her hospitality in San Alberto; with "Mecho" by her friendship and hospitality in Llamaquizu, and with Daniel, Alex and Nildo Ermitaño by their enthusiastic field assistance.

REFERENCES

Adrain, J.M., S.R. Westrop and D.E. Chatterton. 2000. Silurian trilobite alpha diversity and the end-Ordovician mass extinction. Paleobiology 26:625–646.

Boano, G., S. Mazzotti and R. Sindaco. 2008. A new peculiar frog species of the genus *Pristimantis* from Yanachaga-Chemillén National Park, Peru. Zootaxa 1674:51–57.

Castroviejo-Fisher, S., J.M. Padial, J.C. Chaparro, R. Aguayo and I. de la Riva. 2009. A new species of *Hyalinobatrachium* (Anura: Centrolenidae) from the Amazonian slopes of the central Andes, with comments on the diversity of the genus in the area. Zootaxa 2143:24-44.

Chaparro, J.C., J.M. Padial and I. de la Riva. 2008. Two sympatric new species of *Phrynopus* (Anura: Strabomantidae) from Yanachaga Chemillén National Park (central Peruvian Andes). Zootaxa 1761:49–58.

Chávez, G., M. Medina-Müller and A. Pereyra. 2008. Amphibia, Anura, Hylidae, *Osteocephalus leoniae*: Distribution extension. Check List 4:401–403.

Cisneros-Heredia, D.F., C. Strüsmann, R.B. Ávila and R.A. Kawashita-Ribeyro. 2009. Amphibia, Anura, Centrolenidae, *Hyalinobatrachium carlesvilai* Castroviejo-Fisher, Padial, Chaparro, Aguayo and de la Riva 2009: First country record, Brazil. Checklist 6(2):225-226.

Duellman, W.E. and J.J. Wiens. 1993. Hylid frogs of the genus *Scinax* Wagler, 1830, in Amazonian Ecuador and Peru. Occasional Papers of the Museum of Natural History of the University of Kansas 153:1-57.

Duellman, W.E. and J.B. Pramuk. 1999. Frogs of the genus *Eleutherodactylus* (Anura: Leptodactylidae) in the Andes of northern Peru. Scientific Papers of the Natural History Museum. The University of Kansas 13:1–78.

Duellman, W.E and S.B. Hedges. 2005. Eleutherodactyline frogs (Anura: Leptodactylidae) from the CordilleraYanachaga in central Peru. Copeia 2005:526–538.

Duellman, W.E and S.B. Hedges. 2007. Three new species of *Pristimantis* (Lissamphibia: Anura) from montane forests of the Cordillera Yanachaga in central Peru. Phyllomedusa 6:119–135.

Duellman, W.E. and J.C. Chaparro. 2008. Two distinctive new species of *Pristimantis* (Anura: Strabomantidae) from the Cordillera Oriental with a distributional synopsis of strabomantids in Central Peru. Zootaxa 1918:13–25.

Duellman, W.E and Hedges, S.B. 2008. Two new minute species of *Phrynopus* (Anura: Strabomantidae) from the Cordillera Oriental of Peru. Zootaxa 1675:59–66.

Duellman, W.E. and E. Lehr. 2009. Terrestrial-breeding frogs (Strabomantidae) in Peru. Munster, Germany: Nature und Tier Verlag, 382 pp.

Foster, R. 1985. Principales especies de flora del Parque Nacional Yanachaga Chemillén. Pp. 148-176. *In*: 1987. A.J. Brack (ed.). Plan Maestro del Parque Nacional Yanachaga Chemillén. Pro Naturaleza, Lima, Perú.

Foster, R. 1986. Preliminary checklist. Plants of Parque Yanachaga (including the Palcazu Valley and Cordillera San Matías) Selva central, Perú. Field Museum of Natural History, Chicago. 49 pp.

Hammer, O., D.A.T. Harper and P.D. Ryan. 2001. Past: Paleontological Statistics Software Package for Education and Data Analysis. Palaeontologia Electronica 4(1):9 Pp.

Hedges, S.B. 1990. A new species of *Phrynopus* (Anura: Leptodactylidae) from Perú. Copeia 1990:108–112.

Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L.C. Hayek and M.S. Foster. 1994. Methods for Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians. Smithsonian Institution Press. Washington, D.C.

Krebs, C.J. 1989. Ecological Methodology. Harper and Row, New York. 425 pp.

Lehr, E., C. Aguilar and W.E. Duellman. 2004a. A striking new species of *Eleutherodactylus* from Andean Peru (Anura: Leptodactylidae). Herpetologica 60:275–280.

Lehr, E., C. Aguilar and M. Lundberg. 2004b. A new species of *Phyllonastes* from Peru (Amphibia, Anura, Leptodactylidae). Journal of Herpetology 38:214–218.

Lehr, E. 2005. A new species of the *Eleutherodactylus nigrovittatus* group (Anura: Leptodactylidae) from Andean Peru. Herpetologica 61:199–208.

Lehr, E., Lundberg, M., Aguilar, C. and von May, R. 2006. New species of *Eleutherodactylus* (Anura: Leptodactylidae) from the eastern Andes of Central Peru with comments on central Peruvian *Eleutherodactylus.* Herpetological Monographs 20:105–128.

Lehr, E., J.B. Pramuk, S.B. Hedges and J.H. Córdova. 2007. A new species of arboreal *Rhinella* (Anura: Bufonidae) from Yanachaga-Chemillén National Park in central Peru. Zootaxa 1662:1–14.

Lehr, E., S. Lötters and M. Lundberg. 2008. A new species of *Atelopus* (Anura: Bufonidae) from the Cordillera Oriental of Central Peru. Herpetologica 64(3):368–378.

Lehr, E., J. Faivovich and K-H. Jungfer, 2010. A new Andean species of the *Hypsiboas pulchellus* group, adults, calls and phylogenetic relationships. Herpetologica 66(3):296–307.

Lynch, J.D. 1979. Leptodactylid frogs of the Genus *Eleutherodactylus* from the Andes of southern Ecuador. Miscellaneous Publications of the Natural History Museum, The University of Kansas 66:1–62.

Lynch, J.D., and Duellman, W.E. 1980. The *Eleutherodactylus* of the Amazonian slopes of the Ecuadorian Andes (Anura: Leptodactylidae). Miscellaneous Publication of the Natural History Museum, The University of Kansas 69:1–86.

Medina-Muller, M and G. Chávez. 2009. *Ameerega planipaleae*: Color pattern variation and its relevance to *Ameerega* taxonomy (Amphibia: Dendrobatidae). Herpetotropicos 4(2):54.

Morales, V. and P. Velazco. 1998. Una nueva especie de *Epipedobates* (Amphibia, Anura, Dendrobatidae) de Perú. Amphibia - Reptilia 19:369–376.

Padial, J.M., J.C. Chaparro, J. Köhler and I. de la Riva. 2009. Rediscovery, resurrection and redescription of *Rhinella leptoscelis* (Boulenger, 1912) (Anura: Bufonidae). Zootaxa 2115:56–64.