

## Notes on amphibians recently collected in the Yungas de La Paz region, Bolivia

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**Abstract.** We report on amphibian species recently collected in lower montane forests of the Departamento La Paz, Bolivia. Several taxa are recorded for the first time from the Yungas de La Paz region, considerably extending the known ranges for the respective species. The collection also includes specimens of recently described new taxa and a possibly undescribed one. The advertisement calls of *Cochranella nola*, *Epipedobates bolivianus* and *Hypsiboas* cf. *callipleura* are described and figured.

Key words: Amphibia: Anura, Urodela; distribution; advertisement calls; Bolivia.

### Introduction

For a long period, Bolivia has been one of the least known countries of South America with respect to its biodiversity. This was particularly true for the amphibian fauna. Intensive herpetological investigations, starting in the early 1990s, led to a tremendous increase of knowledge and resulted in many new records and descriptions of new species (DE LA RIVA et al. 2000). This improved knowledge recently enabled for an extrapolation of distributions for many species and the identification of species-rich regions within the country (e.g. IBISCH et al. 2003a). However, a considerable number of identified hotspots for amphibian diversity is actually barely investigated and hardly accessible areas. One of these species-rich areas is the Yungas de La Paz region with its supposedly "mega-diverse" Madidi National Park.

During biological investigations, the junior author (AJ) collected amphibians and recorded their advertisement calls in the lower montane rain forests of the Departamento La Paz (Fig. 1). The purpose of this contribution is to describe the advertisement call of *Epipedobates bolivianus* for the first time, provide new distribution data for certain species and comment on their taxonomic allocations.

### Materials and methods

Field studies were conducted from 18 February to 20 May 2003. The study area is located along the road from Caranavi northward to Palos Blancos and comprises elevations between 900-1500 m a.s.l. (Fig. 1). At km 30 on the road from Caranavi, a small settlement, named Colonia Eduardo Avaroa (in the following referred to as CEA), was used as a base camp for night excursions (15°41' S, 67°27' W, 1300 m a.s.l.). This site is referable to the Yungas ecoregion sensu IBISCH et al. (2003b). At CEA the forest is partly cleared for small-scale crop and coffee plantations. Several small rivers are present within the forest. Another point of intensive investigations is located at approximately km 55 on the road from Caranavi (15°39' S, 67°16' W, 900 m a.s.l.) to the north, near the small town of Palos Blancos (in the following referred to as PB). This area is situated within Amazonian sub-Andean forests (IBISCH et al. 2003b).

Advertisement calls were recorded using a Sony WM-D6C tape recorder, a Sennheiser Me-66 directional microphone, and TDK metal cassettes. Recordings were analyzed with the sound analysis software Cool Edit 96 (Syntrillium Software Corp.) on a PC and were sampled with a rate of 22.05 kHz and 16-bit resolution. Frequency information

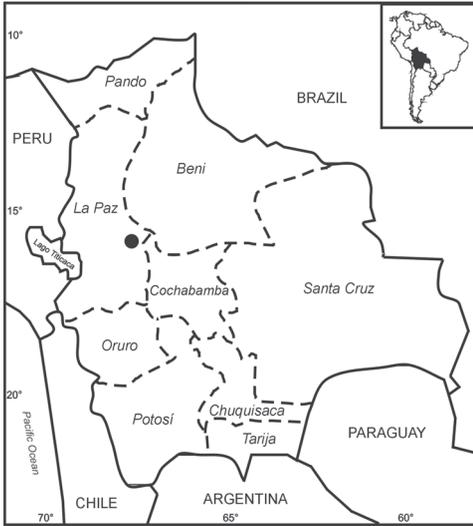


Fig. 1. Schematic map of Bolivia showing the political borders of the Departamentos. Study area indicated by black dot.

was obtained through Fast Fourier Transformation (FFT, width 1024 points); spectral settings in figures are Hanning window function with 256-bands resolution. Time scales of the figured spectrograms and waveforms were chosen to allow for an optimal display of call characteristics. Terminology in call descriptions follows HEYER et al. (1990) as extended by KÖHLER (2000).

Voucher specimens are deposited in the Museo de Historia Natural “Noel Kempff Mercado”, Santa Cruz de la Sierra (NKA), and Zoologisches Forschungsmuseum Alexander Koenig, Bonn (ZFMK). The taxonomic account follows the alphabetical order of families and species. Nomenclature of hylid species follows the recent revision by FAIVOVICH et al. (2005).

## Results and discussion

*Bufo stanlaili* LÖTTERS & KÖHLER, 2000 – Two specimens (NKA 6528, ZFMK 80580) were collected during the study in the beginning

of March 2003. One individual was found in a road side ditch at approximately 900 m a.s.l. (PB), whereas the other specimen was in a coffee plantation at 1400 m a.s.l. (CEA). *Bufo stanlaili* has been reported to occur in montane forests of the Departamentos Cochabamba and Santa Cruz at 1600–2000 m a.s.l. (LÖTTERS & KÖHLER 2000a). The present record provides the first for the Departamento La Paz, extending the known distribution for approximately 230 km to the north-west. Furthermore, the altitudinal distribution of *B. stanlaili* is extended to 900–2000 m a.s.l. Because of the new records, *B. stanlaili* is likely to occur in montane forests of adjacent Peru.

*Cochranella nola* HARVEY, 1996 – An adult male (NKA 6540) was collected on 28 March 2003 in a tree at approximately 2.0 m height (CEA) near a small stream. Advertisement calls were heard from the end of March until mid of April 2003. A freshly metamorphosed froglet was found on 12 Mai 2003. At the time of its description, *C. nola* was known only from the type locality, a semi-deciduous forest remnant (1600 m a.s.l.) in the Río Piray valley near Samaipata, Departamento Santa Cruz (HARVEY 1996). Later, LÖTTERS & KÖHLER (2000b) provided an additional record from pre-Andean Amazonian rain forest at Mataracú (500 m a.s.l.) and KÖHLER (2000) reported the species from humid montane forest at La Hoyada (1750 m a.s.l.; both localities within Departamento Santa Cruz). Based on a record of *C. nola* in another, more humid ecoregion, LÖTTERS & KÖHLER (2000b) argued that the population from the type locality represents a relict one, the species possibly being more widespread in humid forests of the Andean slopes. Thus, DE LA RIVA et al. (2000) predicted the species to occur also in the Departamentos Cochabamba and Chuquisaca. The recent record of *C. nola* in the Departamento La Paz is somewhat surprising, since it provides a north-westward range extension along the Andean slopes of approximately 450 km from its nearest known locality.

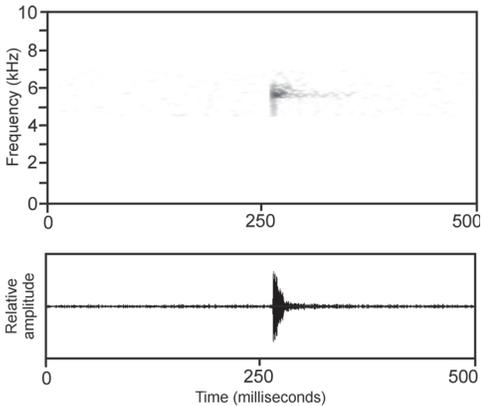


Fig. 2. Spectrogram and waveform of the advertisement call of *Cochranella nola* from CEA, recorded on 28 March 2003. Air temperature 18.7 °C.

In preservative, centrolenid frogs are sometimes difficult to identify due to a lack of distant morphological characters in congeneric taxa. Therefore, we analysed the recently recorded advertisement calls and compared them to calls from the type locality of *C. nola*. The numerical parameters of calls from CEA (Fig. 2) are as follows (range followed by mean  $\pm$  standard deviation): notes/call, 1 ( $1.0 \pm 0.0$ ); note duration, 68-106 ms ( $87.0 \pm 15.7$ ); calls were repeated at irregular intervals with a rate of approximately 2.5 calls/minute; dominant frequency range, 4500-6800 Hz; maximum call energy, 5635-5715 Hz ( $5677 \pm 29$ ). Seven calls of one individual analyzed. Air temperature during recording was 18.7 °C. Thus, the calls from CEA are nearly identical to those recorded at the type locality of *C. nola* (LÖTTERS & KÖHLER 2000b), supporting the specific assignment of the CEA population. Therefore, *C. nola* is expected to occur also in the Departamento Cochabamba.

*Epipedobates bolivianus* (BOULENGER, 1902) – On 21 February 2003 (13:30 h), one male was observed and heard calling near CEA within a crop field at the edge of secondary forest (1400 m a.s.l.). Advertisement calls

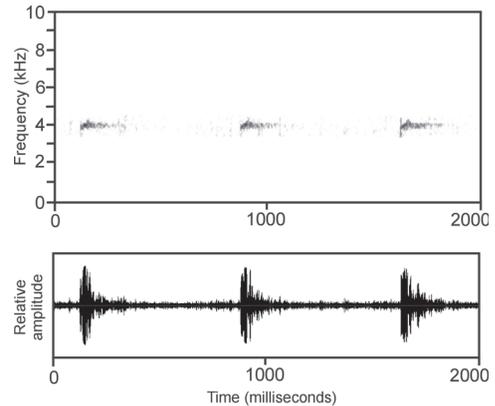


Fig. 3. Spectrogram and waveform of the advertisement call of *Epipedobates bolivianus* from CEA, recorded on 21 February 2003. Air temperature 19.6 °C.

were recorded, but no voucher specimen was collected. After almost one century this species was recently rediscovered in the Yungas de La Paz region by GONZALES et al. (1999). Colour pictures were published by the same authors and subsequently by DE LA RIVA et al. (2000). As far as known, it is the only species of *Epipedobates* occurring in Bolivia exhibiting a reddish-brown dorsum and thus is easily distinguishable from other *Epipedobates* which may occur in sympatry. A call recording from Correo, Departamento La Paz, was provided by MÁRQUEZ et al. (2002), but no numerical call parameters were provided (LÖTTERS et al. 2003). The analysis of the call recording from CEA (Fig. 3) reveals the following advertisement call characters: notes/call, 1.0 ( $1.0 \pm 0.0$ ); note duration, 57-83 ms ( $70.2 \pm 7.1$ ); notes/minute, 67.5-79.9 ( $74.1 \pm 5.1$ ); dominant frequency range, 3800-4400 Hz; maximum call energy, 4030-4145 Hz ( $4092 \pm 24$ ). Calls consist of single notes, repeated at regular intervals. Notes exhibit an indistinct pulsatile structure. Thirty-seven calls of one individual were analyzed. Air temperature during recording was 19.6 °C. The calls agree with those from Correo provided by MÁRQUEZ et al. (2002).

*Epipedobates* species – A species of *Epipedobates* related to *E. pictus*, but distinguished by the lack of orange flecks in the groin and on the upper thighs. Furthermore the advertisement call of *Epipedobates* sp. is composed of shorter notes repeated at a faster rate. Compared to calls of *E. hahneli* and *E. pictus* (see KÖHLER & LÖTTERS 1999, KÖHLER 2000), calls of *Epipedobates* sp. appear intermediate in temporal characteristics. A formal species description including bioacoustic data will be provided by LÖTTERS et al. (in press). It was commonly observed at forest edges along the Caranavi-Palos Blancos road between 1000-1450 m a.s.l. (voucher specimens NKA unnumbered).

*Dendropsophus coffea* (KÖHLER, JUNGFER & REICHEL, 2005) – A recently described small species of *Dendropsophus* (originally described as *Hyla coffea*) probably related to the *D. microcephalus* species group (KÖHLER et al. 2005). An amplexant pair (NKA 6538, ZFMK 80590) was collected on 2 March 2003 near PB at the edge of a permanent pond. The species is known only from the general area described above.

*Dendropsophus delarivai* (KÖHLER & LÖTTERS, 2001) – Three individuals (NKA 6539, ZFMK 80587-588) were collected at an ephemeral pond (app. 5 m in diameter) within open habitat at the edge of the CEA (at 1300 m a.s.l.). Males were calling from the end of February to mid of March 2003. A freshly metamorphosed froglet was collected on 10 March from a leaf of an aquatic plant, strongly suggesting that development took place within the pond. *Dendropsophus delarivai* was formerly known only from the Chapare region of the Departamento Cochabamba (KÖHLER & LÖTTERS 2001). The morphology of specimens from the Departamento La Paz agrees perfectly with those from the type locality. The specific identification was furthermore confirmed by comparison of advertisement calls. In their species description, KÖHLER & LÖTTERS (2001) stated that *D. delarivai* is possibly related to *D. minutus*. Both

species may occur in sympatry, since *D. minutus* was found at a nearby locality (PB).

*Hypsiboas* cf. *callipleura* (BOULENGER, 1902) – The species was abundant in the study area. Males called in small choruses from vegetation at the edge of small streams and road side ditches with slow-running water. Four specimens were collected (NKA 6532-33, ZFMK 80582-583). In a revision of the *Hylascirtus armatus* and *Hypsiboas pulchellus* species groups, DUELLMAN et al. (1997) placed *H. callipleura* in the synonymy of *H. balzani* (BOULENGER, 1898) based on morphological comparisons. The authors restricted the type locality of *H. callipleura* to Charuplaya, Departamento Cochabamba, by lectotype designation. The type locality of *H. balzani* is near Coroico in the Yungas de La Paz region at 1600 m a.s.l. KÖHLER (2000) referred to populations in the Chapare region of the Departamento Cochabamba tentatively as *H. cf. callipleura*, because advertisement calls differ considerably from those of *H. balzani* occurring in the vicinity of Coroico. Thus, there is bioacoustic evidence that more than one species is involved under the name *H. balzani* sensu DUELLMAN et al. (1997). As discussed by KÖHLER (2000), correct assignment of a specific name for the Chapare population is difficult, since the type locality of *H. callipleura* is hardly accessible nowadays, preventing call recordings of topotypes. However, the advertisement calls recently recorded at CEA (Fig. 4) exhibit the same characteristics as those reported by KÖHLER (2000) for the Chapare populations, thus confirming the occurrence of *H. cf. callipleura* sensu KÖHLER (2000) in the Departamento La Paz. It seems therefore probable that *H. balzani* and *H. cf. callipleura* occur in sympatry at least in the Yungas de La Paz region. Numerical call parameters of *H. cf. callipleura* from CEA (Fig. 4) are as follows (range followed by mean  $\pm$  standard deviation): notes/call, 1-5 ( $3.1 \pm 1.2$ ); call duration, 15-205 ms ( $115.3 \pm 54.2$ ); note duration, 15-29 ms ( $20.2 \pm 4.6$ ); note repetition rate, 14-19 notes/second ( $15.9 \pm 1.3$ ); calls

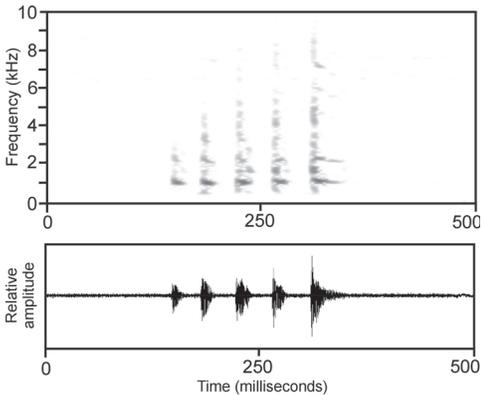


Fig. 4. Spectrogram and waveform of the advertisement call of *Hypsiboas* cf. *callipleura* from CEA, recorded on 10 March 2003. Air temperature 20.0 °C.

were repeated in regular intervals with an approximate rate of 8-12 calls/minute (depending on motivation); dominant frequency range, 1000-9000 Hz; maximum call energy, 1140-1320 Hz ( $1260 \pm 99$ ); additional frequency bands at approximately 2700, 4000, 6500, and 7400 Hz. Eight calls of two individuals analysed. Air temperature during recording was 20.0 °C.

*Ischnocnema sanderi* PADIAL, REICHLÉ & DE LA RIVA, 2005 – Three specimens (NKA 6563, ZFMK 80600-01) of this species were collected at CEA between 1300-1500 m a.s.l. within disturbed forest. The species was recently described by PADIAL et al. (2005).

*Physalaemus albonotatus* (STEINDACHNER, 1864) – Two males were collected; one near PB (ZFMK 80613), the other one at a higher elevation near CEA (NKA 6543). These records are fairly remarkable, since *P. albonotatus* was thought to be associated with relatively dry environments and formerly known only from the Bolivian Departamentos Chuquisaca and Santa Cruz (DE LA RIVA et al. 2000). Thus far, records are lacking for the Departamentos Beni and Cochabamba, arguing for a significant collection gap or a dis-

junct distribution pattern. A similar pattern was reported for *Scinax squalirostris*, known from the Departamento La Paz and elsewhere in Cerrado formations of Brazil (DE LA RIVA et al. 2000).

*Bolitoglossa* cf. *altamazonica* (COPE, 1874) – A single specimen (NKA 6536) was collected on 9 March 2003 (22:30 h) at the edge of the settlement CEA (1300 m a.s.l.) within a coffee plantation. The specimen was sitting on a twig of a coffee plant approximately 1.5 m above the ground. This record represents the sixth *Bolitoglossa* specimen collected in Bolivia (see REICHLÉ et al. 2000), providing a north-westward range extension of approximately 300 km from the nearest Bolivian locality. Former Bolivian records refer to the Departamentos Cochabamba and Santa Cruz (WAKE et al. 1982, REICHLÉ et al. 2000), but the occurrence of *B. cf. altamazonica* in the Departamento La Paz was already predicted by DE LA RIVA et al. (2000). Thus, the present record closes a collection gap between Bolivian and Peruvian localities formerly known for this species. The nearest Peruvian locality for *B. altamazonica* is the Manu National Park (WAKE et al. 1982). The taxonomic status of Bolivian salamanders has not been studied in detail and it was suggested that Bolivian populations may represent one or more taxa different from *B. altamazonica* (REICHLÉ et al. 2000). The specimen from CEA differs somewhat from other Bolivian specimens by its tan dorsum which is mottled with irregular brown spots and longitudinal streaking extending to the tail. Generally, the dorsal coloration appears lighter than reported for other Bolivian specimens (REICHLÉ et al. 2000, DE LA RIVA et al. 2000). Thus, the colour pattern of NKA 6536 seems to be fairly similar to that of *B. digitigrada* described from the Departamento Ayacucho, southern Peru (WAKE et al. 1982). However, due to the variation present in salamanders referred to the *B. altamazonica* complex and the lack of additional specimens, we here refrain from assigning the specimen to any of the known species.

Additional species recorded – Other amphibians recorded during this study include the following species: At CEA: *Atelopus tricolor* BOULENGER, 1902; *Bufo veraguensis* SCHMIDT, 1857; *Hyloscirtus armatus* (BOULENGER, 1902); *Scinax ruber* (LAURENTI, 1768); *Eleutherodactylus cruralis* (BOULENGER, 1902); *Eleutherodactylus danae* DUELLMAN, 1978; *Eleutherodactylus platydactylus* (BOULENGER, 1903); *Leptodactylus rhodonotus* (GÜNTHER, 1869). At PB: *Bufo poeppigii* TSCHUDI, 1845; *Dendropsophus* cf. *bifurcus* (ANDERSSON, 1945); *Dendropsophus minutus* (PETERS, 1872); *Dendropsophus parviceps* (BOULENGER, 1882); *Hypsiboas lanciformis* COPE, 1871; *Leptodactylus griseigularis* (HENLE, 1981).

The recent records of species formerly unknown from the Departamento La Paz, including two formerly unnamed species of the genera *Dendropsophus* and *Ischnocnema*, as well as one species of *Epipedobates* new to science emphasize the need for further surveys with respect to a proper identification of species-rich areas and the setting of conservation priorities.

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