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Anuran species composition from Serra do Ouro Branco, southernmost Espinhaço Mountain Range, state of Minas Gerais, Brazil

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Abstract: This study provides for the first time a detailed list of anuran species from Serra do Ouro Branco, southernmost Espinhaço Mountain Range, state of Minas Gerais, southeastern Brazil. We present data from monthly field surveys made between 2006 and 2007 and data from sporadic surveys conducted between 2003 and 2006. We recorded 47 species, corresponding so far to one of the highest frog richness known for a single location in Minas Gerais. We recorded typical species from the Atlantic Forest (19) and Cerrado (6) morphoclimatic domains; species restricted to the Espinhaço Range (8); or opened areas in mountainous regions (4); and widely distributed species (10). The Serra do Ouro Branco corresponds to the southernmost record of six species, besides holding important populations of other species with restricted geographic distributions. The high richness of frog species and the actual threats to which species are subject make the adoption of conservation measures in the region an emergency action.

Introduction

The Espinhaço Moutain Range extends from the Serra do Ouro Branco (SOB), municipality of Ouro Branco, state of Minas Gerais, to the Serra de Jacobina, municipality of Juazeiro, state of Bahia (Derby 1906). It is a biologically important area, because it houses several types of vegetation within the morphoclimatic domains of Caatinga, Atlantic Forest, and Cerrado, the last two considered conservation hotspots due to their high biological diversity and degree of threat (Mittermeier *et al.* 2004). The dominant vegetation in the Espinhaço Range are the rocky fields ("campos rupestres"), one of the Brazilian's vegetation physiognomies with the highest rate of endemism, perhaps due to its relative geographic isolation and special conditions of weather, soil, and relief (Giulietti and Pirani 1988).

The knowledge of the anurofauna from the Espinhaço Range is still poor and much of its territory lacks any study (Leite *et al.* 2008). Information about species occurrence is mostly concentrated in the Serra do Cipó (*eg*. Bokermann and Sazima 1973a, b; Bokermann and Sazima 1978; Eterovick and Sazima 2004) and in the Iron Quadrangle region ("Quadrilátero Ferrífero"), in the Serra do Caraça (Afonso and Eterovick 2007; Canelas and Bertoluci 2007), municipalities of Ouro Preto and Mariana, (Pedralli *et al.* 2001) and in the Peti Environmental Reserve (Estação Ambiental de Peti), municipality of São Gonçalo do Rio Abaixo (Bertoluci *et al.* 2009), all in the state of Minas Gerais. Other areas in the Espinhaço Range have been studied, in north of Minas Gerais (Feio and Caramaschi 1995) and at the Chapada Diamantina, state of Bahia (Juncá 2005). Until now, the only studies with amphibians from Ouro Branco were partial lists of species (Nascimento *et al.* 2005; Leite *et al.* 2008; São-Pedro and Feio 2010). Even with these previous data on anurans of the southern Espinhaço, further and more detailed studies in this region are necessary, because there are many species with unknown conservation status, due to a lack of information about their geographic distribution, biology and ecology.

The mountainous regions of southeastern Brazil have high rates of amphibian endemism, and therefore are priority areas for conservation and understanding local biogeographic patterns (Cruz and Feio 2007). Due to a considerable part of its original landscape that remains preserved, the high endemic species richness and presence of areas from three morphoclimatic domains (Caatinga, Cerrado and Atlantic Forest) the Espinhaço Range is one of the most important regions for biodiversity conservation in Brazil (Leite *et al.* 2008).

The region of the Espinhaço Range in the state of Minas Gerais, where SOB is located, was declared a Biosphere Reserve (UNESCO 2005). Located in the Iron Quadrangle, SOB still presents significant stretches of natural vegetation, home to a potentially diverse and practically unknown wildlife. The region was classified as an Area of Special Importance for amphibian conservation in Minas Gerais, and the achievement of inventories and the creation of conservation units were recommended (Drummond *et al.* 2005). Recently, the SOB State Park (Parque Estadual da Serra do Ouro Branco) and the Private Natural Heritage Reserve Luiz Carlos Jurovsky Tamassia (Reserva Particular do Patrimônio Natural Luiz Carlos Jurovsky Tamassia) were created in the region.

This paper presents a list of anuran species from SOB and discusses aspects of taxonomy, geographic distribution and conservation status of some of them.

Materials and Methods

Study area

The study was carried out in SOB (20°31' S, 43°41' W), located in municipality of Ouro Branco, Minas Gerais (Figure 1). With altitudinal range from 900 to 1600 m above sea level, the region is in the south end of the Espinhaço Range, within a transitional area between the Cerrado and Atlantic Forest morphoclimatic domains, presenting rocky fields ("campos rupestres") at higher elevations. Despite the advance of mineral extraction and agricultural activities in the region, some fragments of native vegetation in good condition can still be found. The climate is mesothermal (Köppen's Cwb) with mean annual rainfall of 1188.2 mm and average annual temperature of 20.7°C. The springs that flow eastward supply the Doce River, while those that flow westward feed the Paraopeba River – a tributary of the São Francisco River – which makes the region an important water recharge area for those basins (Paula *et al.* 2005).

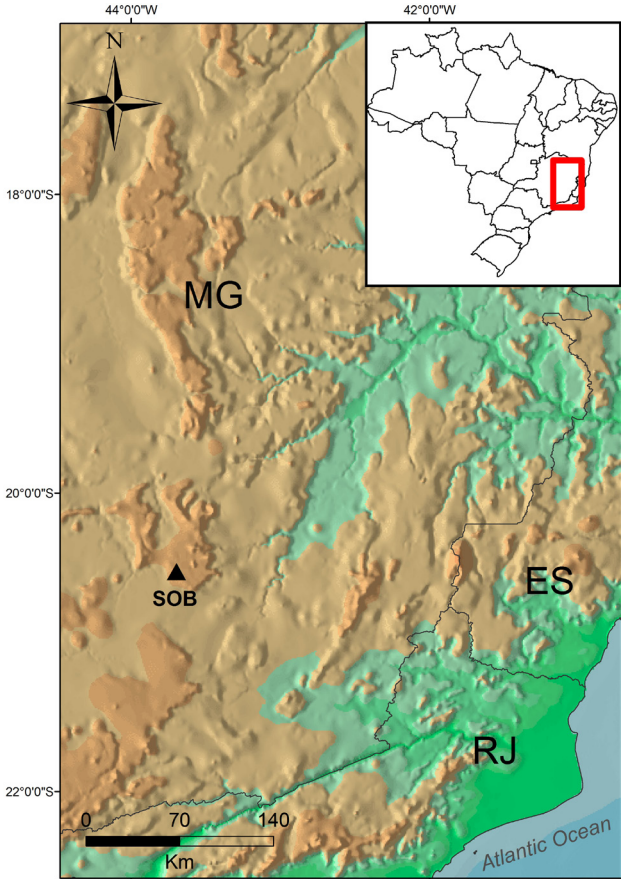

Figure 1. Geographic position of Serra do Ouro Branco (triangle), located in the south end of Espinhaço Range, southeastern Brazil. States: ES – Espírito Santo; MG – Minas Gerais and RJ – Rio de Janeiro. Map by Diego. J. Santana.

Data collection

Field work was conducted monthly, with three nights of observation and collection of specimens (collection permit #231/06, process 02015.003338/06-83, provided by IBAMA) between July 2006 and June 2007, resulting in a total of about 150 hours of work, on the dry and rainy seasons. Specimens were registered by direct visual search and acoustic identification. Records from the amphibian collections of Laboratório de Zoologia dos Vertebrados, Universidade Federal de Ouro Preto (LZV/UFOP) (which has specimens collected in the study area by the senior author since 2003), and Museu de Ciências Naturais, Pontifícia Universidade Católica de Minas Gerais (MCN-AM) were used as well.

The species listed here are from different environments such as lakes, streams, forests, fields and temporary aquatic environments, located in SOB, Serra do Itatiaia and surroundings, all in the municipality of Ouro Branco and part of the municipality of Ouro Preto. Within the 17 sample sites, we tried to cover the greatest variety of environments in areas presenting the different vegetation types and river basins in the region (Figure 2; Table 1).

Voucher specimens collected during the field work from July 2006 to June 2007 are deposited in the herpetological collections of LZV/UFOP and the Museu de Zoologia João Moojen, Universidade Federal de Viçosa (MZUFV). Species identification were based on the literature, on the aid provided by experts, and the comparison with material already housed in MCP-AM, MZUFV and Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ).

The systematic nomenclature used follows Faivovich *et al.* (2005), Frost *et al.* (2006), Chaparro *et al.* (2007), Hedges *et al.* (2008) and Guayasamin *et al.* (2009).

Results and Discussion

Fourty seven anuran species from 18 genera were found, belonging to 10 families: Brachycephalidae (3), Bufonidae (2), Centrolenidae (2), Craugastoridae (1), Cycloramphidae (2), Hylodidae (1), Hylidae (24), Leiuperidae (5), Leptodactylidae (6) and Microhylidae (1) (Table 2; Figures 3-5). Only *Leptodactylus furnarius* Sazima and Bokermann, 1978 was not observed by the authors during field work. Its inclusion is based on a specimen housed in MCN-AM (see Appendix 1).

The present work reports 13 species for the first time for the SOB region compared with the other three previous papers that mention the area (Nascimento *et al.* 2005, Leite *et al.* 2008, São-Pedro and Feio 2010) which together recorded a total of 34 anuran species. These new records put SOB as one of the areas with the highest amphibian richness of the Espinhaço Range and in the state of Minas Gerais. Two other mountain regions of the state, Serra do Cipó and Serra do Caraça, both in the Espinhaço Range, are close SOB in anuran richness, each one with about 50 species. For Serra do Cipó, Eterovick and Sazima (2004) found 43 species of frogs; Leite *et al.* (2008) compiled the records of 44 species for the municipality of Santana do Riacho, at the same region; Nascimento *et al.* (2005) recorded 49 species in a survey covering three municipalities in this region (Jaboticatubas [Santana do Riacho]), Itambé do Mato Dentro and Morro do Pilar). With regard to Serra do Caraça, Canelas and Bertoluci (2007) reported 43 species in the Private Natural Heritage Reserve Santuário do Caraça (Reserva Particular do Patrimônio Natural Santuário do Caraça); another work presents 41 species at the municipality of Catas Altas (Leite *et al*. 2008), and a last one registered 49 species at Catas Altas and Santa Barbara together (Nascimento *et al.* 2005).

The amphibian richness in SOB corresponds to 23.5% of the 200 species estimated to occur in Minas Gerais (Drummond *et al*. 2005) and about 44.7% of the 105 species known for all the Espinhaço Range (Leite

et al. 2008). However, data gathered for Espinhaço are likely underestimated due to the lack of information about the anuran occurrence in different localities of this mountain range and because unidentified species were not considered by Leite *et al*. (2008). The list by Leite *et al*. (2008) does not include, for example, five species (*Ischnocnema surda* Canedo, Pimenta, Leite and Caramaschi, 2010, *Physalaemus crombiei* Heyer and Wolf, 1989, *Dendropsophus giesleri* (Mertens, 1950), *Scinax* cf. *tripui* and *Scinax rogerioi* Pugliese, Baêta and Pombal-Jr, 2009) recorded in the present study. Data collected during 12 months of sampling at three locations in the SOB revealed the occurrence of only 28 species (São-Pedro and Feio 2010), highlighting the importance of long-term surveys, covering a wide range of environments, to provide a more complete and reliable sampling of the local faunal composition.

The high anuran species richness found in SOB is due, at least in part, to the fact that the region is inserted in a transitional area between two major morphoclimatic domains and still presents significant remnants of native vegetation. According the available data in the literature, 19 (40.5%) species found in SOB are typical from the Atlantic Forest, as *Phyllomedusa burmeisteri* Boulenger, 1882, *Rhinella pombali* (Baldissera-Jr, Caramaschi, and Haddad, 2004), *Proceratophrys boiei* (Wied-Neuwied, 1825) and species of the genera *Aplastodiscus* Lutz, 1950 and *Vitreorana* Guayasamin, Castroviejo-Fisher, Trueb, Ayarzagüena, Rada, and Vilà, 2009; six (13%) other species are typical from the Cerrado domain, as *Rhinella rubescens* (A. Lutz, 1925) and *Hypsiboas albopunctatus* (Spix, 1824). There are also eight (17%) species restricted to the Espinhaço Range, as *Bokermannohyla alvarengai* (Bokermann, 1956), *Phasmahyla jandaia* (Bokermann and Sazima, 1978) and *Scinax curicica* Pugliese, Pombal and Sazima, 2004 and four (8.5%) species from opened areas in mountainous regions of southeast and mid-west Brazil, as *Scinax rogerioi*. Finnaly, 10 (21%) species are considered widely distributed, because they are not limited to a single biome or mountain range, as *Hypsiboas faber* (Wied-Neuwied, 1821), *Physalaemus cuvieri* Fitzinger, 1826 and *Elachistocleis cesarii* (Miranda-Ribeiro, 1920) (Table 2).

Bokermannohyla alvarengai is restricted to high-altitude rocky fields ("campos rupestres") in Espinhaço Range. Its occurrence in SOB represents the southernmost record for this species, instead of the Serra do Caraça, which was previously considered the southern limit to the species distribution (Eterovick and Sazima 2004). Several populations of this species were recorded in reproductive activity in the study area, with calling males, eggs and tadpoles. They are always associated with temporary

Figure 2. Some kinds of aquatic environments that occur in Serra do Ouro Branco. A: marsh in a rocky field; B: anthropic pond; C: stream inside a forest fragment and D: temporary pond inside a forest fragment. Photos by V. A. São-Pedro.

streams formed by drainage of rainwater through the "rails" on rocky outcrops. São-Pedro *et al.* (2008) observed tadpoles of *B. alvarengai* feeding upon cospecific eggs in a temporary stream at SOB.

Physalaemus crombiei was previously known from the center of Espírito Santo state to the southern portion of Bahia state, where it occurs in forests up to 750 m above sea level (Peixoto and Pimenta 2004). Our data represents the most inland record of this species and expands its known distribution about 350 km to west. This new record also represents the highest elevation reported for *P. crombiei*, since the site where we found the species is 950 m above sea level (Table 1).

Scinax tripui Lourenço, Nascimento and Pires, 2010 was recently described based on specimens from the municipality of Ouro Preto, Minas Gerais (Lourenço *et al*. 2009). Individuals collected in Ouro Branco were compared to those from Ouro Preto, and despite being isolated by just a few kilometers the two populations differ markedly, particularly regarding to color of spots on inner thighs and flanks. These spots, described as light green in the type series, are yellow in all specimens from SOB. Until a more detailed taxonomic analysis is conducted to clarify whether this is just an intraspecific variation or a difference between two species, it is prudent to consider specimens from Ouro Branco as *Scinax* cf. *tripui*.

Phasmahyla jandaia and *Crossodactylus bokermanni* Caramaschi and Sazima, 1985 had been considered vulnerable species in the red list of threatened fauna in the state of Minas Gerais (Machado *et al.* 1998). However, in the latest revision of this list (Fundação Biodiversitas 2007; COPAM 2010) both were considered as non-threatened, because their geographic distribution was discovered to be wider than previously thought. *Crossodactylus bokermanni* was first recognized as restricted to its type locality (Eterovick and Sazima 2004). Subsequently, other populations were found elsewhere along the Espinhaço Range (Nascimento *et al.* 2005). Pimenta *et al.* (2008) confirmed that the species is restricted to the south Espinhaço Range, between the municipality of Serranópolis de Minas on the north, and the boundary between the municipalities of Ouro Preto and Ouro Branco on the south, in the state of Minas Gerais. Besides *C. bokermanni* and *Bokermannohyla alvarengai*, SOB is also the southernmost locality recorded for four other species: *Bokermannohyla martinsi* (Bokermann, 1964), *Phasmahyla jandaia*, *Physalaemus evangelistai* Bokermann, 1967 and *Scinax curicica*.

Table 1. Main sampled sites for anuran species in the region of Serra do Ouro Branco, south end of Espinhaço Range, Minas Gerais, southeastern Brazil.

NUMBER	SAMPLE SITE NAME	COORDINATES	ALTITUDE (M)	DESCRIPTION
1	Mr. Mariano Farm	20°29'59" S 43°37'24" W	1115	Small stream dammed between preserved forest fragment and pasture area.
2	Garcia river	20°29'42" S 43°36'12" W	1029	Torrential stream, with sandy and rocky bed, inside preserved forest area.
3	Drainage lines	20°30'31" S 43°36'47" W	1213	Drainage of rain water in the rocky outcrops.
4	Dirty pond	20°28'47" S 43°35'35" W	1037	Anthropic pond between secondary forest fragment and pasture area.
5	Bico de Pedra marsh	20°26'51" S 43°36'26" W	1333	Marsh in a well preserved rocky field.
6	Lavrinha river	20°28'25" S 43°39'10" W	1337	Stream inside preserved forest.
7	Alegria Farm	20°26'16" S 43°35'21" W	1259	Stream inside secondary forest.
8	Falcão's stream	20°26'18" S 43°35'20" W	1356	Stream in a transitional area between Cerrado and rocky field.
9	Bico de Pedra river	20°26'24" S 43°35'34" W	1365	Stream inside secondary forest.
10	Water mine	20°29'26" S 43°35'47" W	1026	Small water mine inside secondary forest.
11	Soledade lake	20°30'36" S 43°43'11" W	920	Large artificial lake at the foot of Serra do Ouro Branco, inside Atlantic Forest, Cerrado and eucalyptus area.
12	Plateau I marsh	20°29'23" S 43°41'23" W	1,490	Wetland area in anthropic rocky field and streams with gallery forest.
13	Plateau II marsh	20°29'23" S 43°42'36" W	1,520	Wetland area in anthropic rocky field.
14	Itatiaia Mountain	20°28'48" S 43°34'12" W	1,440	Temporary streams in rocky field.
15	Serra river	20°28'11" S 43°35'24" W	1,310	Stream in a transitional area between Cerrado and rocky field.
16	Gorilla's pond	20°28'11" S 43°36'0" W	1,230	Temporary pond in rocky field.
17	Mr. Matias forest	20°30'36" S 43°36'35" W	980	Temporary pond and stream inside secondary forest at the foot of Serra do Ouro Branco.

Table 2. List of anuran species reported for the region of Serra do Ouro Branco, Espinhaço Range, Minas Gerais, southeastern Brazil, between 2003 and 2007, with data about their geographic distribution and sites of occurrence. **Distribution classes:** AF – restricted to Atlantic Forest; Ce – restricted to Cerrado; Es – restricted to Espinhaço Range; OM – restricted to opened areas in mountainous regions; Wd – Widely distributed (it is not restricted to one morphoclimatic domain or mountain range). **Sample sites:** 1 – Mr. Mariano Farm; 2 – Garcia river; 3 – Drainage lines; 4 – Dirty pond; 5 – Bico de Pedra marsh; 6 – Lavrinha river; 7 – Alegria Farm; 8 – Falcão's stream; 9 – Bico de Pedra river; 10 – Water mine; 11 – Soledade lake; 12 – Plateau I marsh I; 13 – Plateau II marsh; 14 – Itatiaia Mountain; 15 – Serra river; 16 – Gorilla's pond; 17 – Mr. Matias forest.

TAXON	DISTRIBUTION	SAMPLE SITES
Brachycephalidae		
Ischnocnema izecksohni (Caramaschi and Kisteumacher, 1989)	Es	1, 2, 4, 6
Ischnocnema juipoca (Sazima and Cardoso, 1978)	Ce	1, 4
Ischnocnema surda Canedo, Pimenta, Leite and Caramaschi, 2010	AF	10
Bufonidae		
Rhinella pombali (Baldissera-Jr, Caramaschi, and Haddad, 2004)	AF	1, 4, 11
Rhinella rubescens (A. Lutz, 1925)	Ce	3, 5, 8, 13, 16
Centrolenidae		
Vitreorana eurygnatha (A. Lutz, 1925)	AF	7
Vitreorana uranoscopa (Müller, 1924)	AF	2, 6
Craugastoridae		
Haddadus binotatus (Spix, 1824)	AF	1, 4
Cycloramphidae		
Odontophrynus cultripes Reinhardt and Lütken, 1862 "1861"	Ce	1, 3, 4
Proceratophrys boiei (Wied-Neuwied, 1825)	AF	1, 2, 4, 7, 9
Hylidae		
Aplastodiscus arildae (Cruz and Peixoto, 1987 "1985")	AF	6
Aplastodiscus cavicola (Cruz and Peixoto, 1985 "1984")	AF	1, 4
Bokermannohyla alvarengai (Bokermann, 1956)	Es	3, 14, 15
Bokermannohyla circumdata (Cope, 1871)	AF	4, 7, 9, 12
Bokermannohyla martinsi (Bokermann, 1964)	Es	3, 7
Dendropsophus giesleri (Mertens, 1950)	AF	1, 4
Dendropsophus elegans (Wied-Neuwied, 1824)	AF	1, 4, 11
Dendropsophus minutus (Peters, 1872)	Wd	1, 4, 11
Hypsiboas albopunctatus (Spix, 1824)	Ce	1, 4, 11, 16
Hypsiboas faber (Wied-Neuwied, 1821)	Wd	1, 2, 4, 11, 16
Hypsiboas pardalis (Spix, 1824)	AF	1, 4
Hypsiboas polytaenius (Cope, 1870 "1869")	AF	4, 10, 13, 16
Phasmahyla jandaia (Bokermann and Sazima, 1978)	Es	6
Phyllomedusa ayeaye (B. Lutz, 1966)	OM	3, 14
Phyllomedusa burmeisteri Boulenger, 1882	AF	1, 4
Scinax curicica Pugliese, Pombal and Sazima, 2004	Es	5, 15
Scinax flavoguttatus (Lutz and Lutz, 1939)	AF	6, 12
Scinax fuscovarius (A. Lutz, 1925)	Wd	1, 5, 16
Scinax longilineus (B. Lutz, 1968)	AF	6, 12
Scinax luizotavioi (Caramaschi and Kisteumacher, 1989)	Wd	4, 10, 17
Scinax cf. *tripui*	Es	2
Scinax rogerioi Pugliese, Baêta and Pombal-Jr, 2009	OM	13, 16
Scinax squalirostris (A. Lutz, 1925)	Wd	5, 16
Scinax x-signatus Köhler and Böhme, 1996	AF	1, 4
Hylodidae		
Crossodactylus bokermanni Caramaschi and Sazima, 1985	Es	7, 9
Leiuperidae		
Physalaemus cuvieri Fitzinger, 1826	Wd	1, 4, 11, 16
Physalaemus evangelistai Bokermann, 1967	Es	5
Physalaemus maximus Feio, Pombal, and Caramaschi, 1999	AF	1, 4
Physalaemus crombiei Heyer and Wolf, 1989	AF	17
Pseudopaludicola serrana Todelo, 2010	OM	5, 8, 12, 14, 15, 16
Leptodactylidae		
Leptodactylus cunicularius Sazima and Bokermann, 1978	OM	3, 13
Leptodactylus furnarius Sazima and Bokermann, 1978	Ce	12
Leptodactylus fuscus (Schneider, 1799)	Wd	11
Leptodactylus jolyi Sazima and Bokermann, 1978	Ce	16
Leptodactylus labyrinthicus (Spix, 1824)	Wd	11, 16
Leptodactylus latrans (Steffen, 1815)	Wd	1, 4, 11, 13, 16
Microhylidae		
Elachistocleis cesarii (Miranda-Ribeiro, 1920)	Wd	3, 15, 16

Phyllomedusa ayeaye (B. Lutz, 1966) is the only species found in SOB that still appears on the lists of endangered species of Minas Gerais (COPAM 2010) and Brazil (IBAMA 2003). However, its permanence in these lists is questionable. It was believed that populations of *P. ayeaye* from south of the Espinhaço Mountain Range belonged to a distinct species, *P. itacolomi* (Caramaschi *et al.* 2006). But it was recently suggested that both names refer to the same species, and *P. itacolomi* is now recognized as a junior synonym of *P. ayeaye* (Baêta *et al.* 2009). *Phyllomedusa ayeaye* was previously considered endemic to the Poços de Caldas plateau, in southern Minas Gerais, and the loss of habitat by human activities together with its restricted distribution were the main reasons for including it among those species threatened of extinction (Machado *et al.* 1998). With *P. itacolimi* becoming its junior synonym, the distribution of *P. ayeaye* now includes several locations in the Espinhaço, Mantiqueira and Canastra Mountain Ranges, including protected areas, which led to the suggestion of its exclusion from the lists of threatened species (Baêta *et al.* 2009). The populations found in SOB seem to be well established and occur in locations with little or no human interference.

Figure 3. Some anuran species from Serra do Ouro Branco. A: *Haddadus binotatus*; B: *Vitreorana eurygnatha*; C: *Ischnocnema izecksohni*; D: *Rhinella pombali*; E: *Rhinella rubescens*; F: *Odontophrynus cultripes.* Photos by V. A. São-Pedro (A, C, D, F) and R. N. Feio (B, E).

The examples of *Crossodactylus bokermanni*, *Phasmahyla jandaia* and *Phyllomedusa ayeaye* cited above clearly illustrate the importance of taxonomic studies and wildlife inventories for compilation of reliable data about the real conservation status of species.

The review of the list of animal species threatened with extinction in Minas Gerais (Fundação Biodiversitas 2007) points *Physalaemus maximus* Feio, Pombal, and Caramaschi, 1999 as "data deficient", which means that the available information about its geographic distribution does not permit a precise inference about its conservation status. This species was described from Serra do Brigadeiro, Araponga, Minas Gerais (Feio *et al.* 1999), and later was found between Ouro Preto and Ouro Branco municipalities (Baêta *et al.* 2005). So far, these are the only regions with known occurrence of *P. maximus*. At SOB it was found in two small ponds close to patches of secondary forest, and more than 50 males in calling activity were observed at a single night. So it seems that *P. maximus* occurs in higher densities in SOB than in Serra do Brigadeiro (type locality) where such aggregations with so many specimens were never recorded (RNF pers. obs.).

Figure 4. Some anuran species from Serra do Ouro Branco. A: *Aplastodiscus arildae*; B: *Bokermannohyla alvarengai*; C: *Hypsiboas polytaenius*; D: *Hypsiboas pardalis*; E: *Phasmahyla jandaia*; F: *Phyllomedusa ayeaye*. Photos by V. A. São-Pedro (A, C, D, E), R. N. Feio (B, F) and H. C. Costa (C).

Some authors have suggested the existence of biogeographic homologies between the Espinhaço and Mantiqueira Mountain Ranges to explain why some anuran species like three *Physalaemus* species (Cruz and Feio 2007) and *Hylodes babax* Heyer, 1982 (Pirani *et al.* 2010) seem to be restricted to these mountain ranges. The occurrence of *P. maximus* in these same mountain ranges supports the existence of those homologies, extending them to the northeastern portion of Mantiqueira. There is an altitudinal continuous of at least 500 m linking the localities where all those species were recorded and this can be an important cue to explain the biogeographic relation between Espinhaço and Mantiqueira Mountain Ranges. Phylogeographic studies and possible future records of these species in other localities may elucidate this question.

During field work some threats to biodiversity were identified in SOB as possible causes of direct and indirect impacts over amphibians. These threats can be divided into two groups according to the type of activity they originate from: 1) touristic activities: presence of garbage on trails and water bodies; soil erosion in areas of rocky fields due to motorcycle trails or 2) exploratory activities: presence of cattle using the rocky fields as pastures; logging of native forest areas; deliberate burning of vegetation to renew the "pastures" and logging of native vegetation for setting of allotments and monocultures.

The region of SOB has an extreme importance for the conservation of Brazilian amphibians. Besides constituting one of the areas with the highest richness of anuran species in Minas Gerais, it harbors populations of species that are typical of two morphoclimatc domains (Atlantic Forest and Cerrado) and spread over two mountain ranges (Mantiqueira and Espinhaço). Adding to this, the presence of real threats to the existing diversity in SOB make conservation measures in the region urgently needed. We recommend the use of data from this and other zoological studies in the region as a basis for the development of management strategies for local conservation units, besides the continuity of the wildlife studies there.

Figure 5. Some anuran species from Serra do Ouro Branco. A: *Scinax luizotavioi*; B: *Crossodactylus bokermanni*; C: *Leptodactylus cunicularius*; D: *Physalaemus maximus*. Photos by V. A. São-Pedro (A, D), R. N. Feio (B) and E. T. Silva (C).

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Appendix 1. Voucher specimens.

Ischnocnema izecksohni – LZV/UFOP: 302; MZUFV: 7106, 7107, 7290, 7564, 7565, 7632. *Ischnocnema juipoca* – LZV/UFOP: 864, 866, 889, 890. *Ischnocnema surda* – MZUFV: 7231, 7232. *Rhinella pombali* – LZV/UFOP: 191, 453; MZUFV: 7249. *Rhinella rubescens* – LZV/UFOP: 454, 478, 506; MZUFV: 6575, 7518. *Vitreorana eurygnatha* – LZV/UFOP: 643-646. *Vitreorana uranoscopa* – MZUFV: 7287, 7563. *Haddadus binotatus* – LZV/UFOP: 854, 868, 869, 870, 871, 873, 892; MZUFV: 7553 -7555. *Crossodactylus bokermanni* – LZV/UFOP: 649 MZUFV: 6591 – 6595, 7104, 7105, 7233-7238, 7522. *Odontoprhynus cultripes* – LZV/UFOP: 821,

823, 863; MZUFV: 7035, 7087, 7098, 7507. *Proceratophrys boiei* – LZV/UFOP: 853, 861; MZUFV: 7088 – 7093, 7289, 7550, 7551. *Aplastodiscus arildae* – MZUFV: 7285, 7286, 7562. *Aplastodiscus cavicola* – MZUFV: 7244, 7288. *Bokermannohyla alvarengai* – LZV/UFOP: 460, 461, 462, 632, 633, 634; MZUFV: 6579-6583, 7038, 7560. *Bokermannohyla circumdata* – LZV/UFOP: 455, 456, 631, 635, 636, 822; MZUFV: 6576-6578, 7513, 7519. *Bokermannohyla martinsi* – LZV/UFOP: 139, 229, 245, 246; MZUFV: 7099, 7295, 7631. *Dendropsophus giesleri* – LZV/UFOP: 298, 299, 498-500, 517, 518, 521, 522, 536, 537; MZUFV: 7030-7032, 7242, 7243. *Dendropsophus elegans* – LZV/UFOP: 112; MZUFV: 7511, 7512, 7548. *Dendropsophus minutus* – LZV/UFOP: 137; MZUFV: 7514. *Hypsiboas albopuncatus* – LZV/UFOP: 106, 107, 108, 133, 136; MZUFV: 7508. *Hypsiboas faber* – LZV/UFOP: 104, 222, 247. *Hypsiboas pardalis* – MZUFV: 7036, 7037, 7509, 7556. *Hypsiboas polytaenius* – LZV/UFOP: 423, 482, 483, 484; MZUFV: 6584, 6585, 7291, 7292, 7510, 7547. *Phasmahyla jandaia* – MZUFV: 7561. *Phyllomedusa burmeisteri* – MZUFV: 7230. *Phyllomedusa ayeaye* – LZV/UFOP: 463 - 465, 630 MZUFV: 6586-6588, 7100, 7101, 7228, 7229, 7293-7294, 7515. *Scinax curicica* – LZV/UFOP: 477, 481; MZUFV: 7516, 7517. *Scinax flavogutattus* – LZV/UFOP: 316, 317. *Scinax fuscovarius* – LZV/UFOP: 141, 288, 289, 331, 725 – 727; MZUFV: 7094-7096. *Scinax longilineus* – LZV/UFOP: 263, 648, 771, 784-787. *Scinax luizotavioi* – LZV/UFOP: 485-490, 788; MZUFV: 7246, 7247. *Scinax* cf. *tripui* – MZUFV: 7022-7029, 7039-7040, 7566-7571. *Scinax rogerioi* – LZV/UFOP: 123, 124, 480. *Scinax squalirostris* – LZV/UFOP: 138, 277, 293, 350, 351; MZUFV: 7103. *Scinax x-signatus* – LZV/UFOP: 647; MZUFV: 7033, 7239. *Physalaemus cuvieri* – LZV/UFOP: 142, 143, 281-285, 290-292, 418-422; MZUFV: 7240, 7241, 7649. *Physalaemus evangelistai* – MZUFV: 7520, 7521. *Physalaemus maximus* – MZUFV: 6597, 7091-7093, 7245, 7248, 7552. *Physalaemus crombiei* – LZV/UFOP: 491-496. *Pseudopaludicola serrana* – LZV/UFOP: 426- 430; MZUFV: 6596. *Leptodactylus cunicularius* – LZV/UFOP: 458, 459, 466, 467, 859, 860, 862; MZUFV: 6589, 6590, 7034, 7097, 7227. *Leptodactylus furnarius* – MCNAM: 6552. *Leptodactylus fuscus* – LZV/UFOP: 134. *Leptodactylus jolyi* – LZV/UFOP: 132, 228, 424, 425, 470, 471. *Leptodactylus labyrinthicus* – LZV/UFOP: 297. *Leptodactylus latrans* – LZV/UFOP: 105, 468, 469. *Elachistocleis cesarii* – LZV/UFOP: 135, 296; MZUFV: 7102.