Anurans from the Serra da Bocaina National Park and surrounding buffer area, southeastern Brazil

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ABSTRACT: Here, we review the species of anuran amphibian from the Serra da Bocaina National Park and its buffer area, in the Atlantic Forest of southeastern Brazil, comparing the data from a recent survey with museum records. We surveyed adult and larval anurans in ponds, marshes, and streams discontinuously from May 2008 to January 2011. In total, 63 anuran species were previously known to occur at the Park and its surrounding buffer area. In our survey, we recorded 46 species, of which five represented new records, and 22 appeared only in the historical list. Seven topotypic populations were not found in the present study. We suggest that conservation strategies for anurans in the Serra da Bocaina should also consider the surrounding areas that are subjected to anthropogenic pressure, due to the high diversity recorded, high altitudinal variation in species distribution, and various vegetation formations.

INTRODUCTION

Brazil is the home of 968 amphibian species, of which 932 are anurans (AmphibiaWeb 2014). The highest amphibian richness in Brazil occurs along the coastal Atlantic Forest, to which many species are endemic (Rossa-Feres et al. 2011; Haddad et al. 2013). This high richness is in part due to the environmental heterogeneity created by the various vegetation types, the altitudinal, and longitudinal and latitudinal variation along this biome (Haddad and Prado 2005; Araújo et al. 2009; Ribeiro et al. 2009), which limit the dispersal and favor the occurrence of species with small range sizes (Villalobos et al. 2013). Furthermore, the climatic refugia of the Pleistocene and neotectonism (Thomé et al. 2010) seem to play a key role in dictating the contemporary species richness of several taxa (Carnaval and Moritz 2008).

The Atlantic Forest is composed of two main vegetation types: Atlantic Rain Forest and Atlantic Semi-deciduous Forest (Morellato and Haddad 2000). The Serra da Bocaina National Park is a protected area in the Atlantic Forest in the Serra do Mar, at the border between the states of São Paulo and Rio de Janeiro, in Southeastern Brazil. The Park currently comprehends an area of 140,000 ha, from the sea level up to 2,088 m a.s.l. and is covered by the Atlantic Rain Forest, with natural and anthropogenic grasslands in high altitudes. Although many collections of amphibians have been carried out in the past (1925 to 1970), mainly by Adolpho and Bertha Lutz, and Werner C.A. Bokermann, no long-term ecological study encompassing an entire reproductive season had been conducted. These past research efforts resulted in 17 anuran species being described from the Park and its surrounding buffer area, which includes the Fazenda Bonito (Lutz 1925; Bokermann 1967a,b,c; Frost 2013). Eight species are only known to occur in the Park and the buffer area: Brachycephalus vertebralis, Ischnocnema pusilla, Bokermannohyla ahenea, B. clepsydra, Scinax ariadne, Megaelosia bocainensis, Physalaemus barrioti, and Paratelsmatobius gaigei (Frost 2013).

Recently, two studies provided new information on the anuran fauna of the Serra da Bocaina highlands (Zaher et al. 2005; Serafim et al. 2008). Zaher et al. (2005) provided a list of anurans from the Bananal Biological Station, a protected area near the Serra da Bocaina National Park, and Serafim et al. (2008) provided a list of anurans from the surrounding buffer area of the Serra da Bocaina National Park. Despite this new information, data on anuran species composition in the area is yet fragmented and anecdotal at best. Here, we present the species list of anurans for the Serra da Bocaina National Park and its surrounding buffer area based on a recent field survey. We also gathered data about species occurrence from museum records available in online databases. Additionally, we also provide data on habitat use, which can subsidize both management plans and future research projects.

MATERIALS AND METHODS

Our survey was concentrated in the northern region of the Serra da Bocaina National Park, mainly in São José do Barreiro, São Paulo, Brazil (Figure 1). The climate in this region is of the type Cwb (humid subtropical highland; Peel et al. 2007), with moderated temperatures, dry winters (between April and September) and warm summers (from October to March). The annual rainfall varies between 400 and 2,100 mm, with mean annual temperature of 22° C. The buffer area is a ring of 10 Km wide surrounding the
Park, which includes areas of the cities of Arapeí, Areias, Bananal, Cunha, São José do Barreiro, Silveiras, Ubatuba in the state of São Paulo, and Angra dos Reis and Paraty in the state of Rio de Janeiro.

We surveyed tadpoles and adult anurans in 14 breeding sites monthly (May 2008 to June 2009, and November 2009 to February 2010), including ten ponds, three marshes, and one stream. These water bodies were sampled once during one week each month. We also surveyed other ten breeding sites (six streams and four ponds) occasionally. Tadpoles were sampled with hand dipnets along the entire margins of water bodies, with effort proportional to surface area (Skelly and Richardson 2010). To survey adult anurans, we employed three different and complementary methodologies: visual encounter surveys, survey at breeding sites (Scott and Woodward 1994), and also searched for direct-developing species on the forest floor and bromeliads, near water bodies or along trails. In every breeding site, we recorded calling males as well as adults that were not vocalizing. Further environmental data on sampling sites are available in Provete (2011). Pictures from the sampling points, along with their geographical coordinates, are available online at CalPhotos (bitly.com/Bocaina). A Google Earth file with sampling points is available at diogoprovete.weebly.com/publications.

We also conducted two surveys of three days each in a tourist trail, known as Caminho do Ouro, which crosses the Park from São José do Barreiro (22°44'03.7" S; 44°36'58.6" W) to Vila de Mambucaba in Angra dos Reis, Rio de Janeiro (23°00'27.9" S; 44°32'05.8" W; Figure 1), in January 2010 and January 2011. During these surveys, we recorded anurans encountered visually (Crump and Scott 1994) and tadpoles in streams crossing the trail using a hand dipnet. Overall, our sampling effort comprised 141 survey days throughout 20 incursions in 18 months, with approximately 1,270 sampling hours/person, with two researchers conducting the samplings. IBAMA provided collecting permits (14474-1, 14861-1, and 16461-1).

Adult anurans collected were euthanized in 20% ethanol, fixed in 10% formalin, and stored in 70% ethanol. Voucher specimens are housed at the Célio F. B. Haddad collection (CFBH), Rio Claro, São Paulo, Brazil, and DZSJRP-Amphibia collection, São José do Rio Preto, São Paulo, Brazil. Tadpoles were killed and fixed in 10% formalin in the field and housed at the DZSJRP- Tadpoles collection, São José do Rio Preto, São Paulo, Brazil (Appendix 1).

To assemble the historical list of species, we searched for museum records and in the literature. Literature search took into account the locality (e.g., Parque Nacional da Serra da Bocaina, Campo de Fruticultura, município de Bananal). Museum search included Museu de Zoologia da Unicamp (ZUEC-AMP; Campinas, Brazil) and Coleção Célio F. B. Haddad (CFBH; Rio Claro, Brazil) available online at www.splink.cria.org.br (captured on 10 January 2014), besides the amphibian collection of the Smithsonian National Museum of Natural History (USNM; Washington D.C., United States). Since this study was not designed to be a taxonomic revision, we did not check the identity of each museum specimen, except for the specimens housed at the CFBH collection. We checked each record of the other museums to exclude any outlier or those species that are not known to occur in the Serra da Bocaina using the available geographic coordinates. Furthermore, uncertain identifications, such as "sp.", "affinis", or "group" were also excluded from our list. We looked for literature and catalogs mentioning material collected in the Serra da Bocaina and its buffer area (Lutz 1925; 1929; Lutz and Lutz, 1938; 1939; Lutz in Lutz 1950; Cochran 1955; Bokermann 1966; 1967a,b; Heyer 1985; Cruz and Peixoto 1984; 1985; Peixoto 1989; Giaretta, Bokermann and Haddad, 1993; Pombal and Hadad 1999; Pombal 2001; Napoli and Caramaschi 2004; Almeida and Angulo 2006; Prado and Pombal 2010; Martins and Zaher 2012; Frost 2013, Caramaschi and Cruz 2013; Appendix 2). In the case of the genus Fritziana, the historical list includes four species. However, those species in the genus occurring in southern Brazil seem to be a species complex, whose members are difficult to tease apart. Therefore, we took a conservative decision and list only one species, the nomenclature used here follows Frost (2013).

We run a Jackknife 2 to estimate the species richness based on the incidence of larvae and adults. We used this estimator because it can handle unequal sampling effort among habitats and is biased to species that occur in a few samples (Hortal et al., 2006). Data were analyzed using software EstimateS ver. 8.2 (Colwell, 2006).

**RESULTS**

Sixty-three anuran species were previously known from the Serra da Bocaina National Park and its surrounding buffer zone (Table 1; Figures 2-3). In this study, we recorded 46 species (Jackknife 2 = 53 species), of which 41...
also appear in museum records and five species represent new records from the Serra da Bocaina National Park. These records increased the list of the area to 68 species.

We recorded 26 (57%) out of 46 species as larvae, of which four (9%) were recorded exclusively using this sampling method. We recorded 42 species (91%) as adults, in which 20 (44%) were only recorded by adult sampling, and 22 species (48%) were found as both larvae and adults (Table 1). The majority of species were recorded in forested environments (41 species, 60%), 26% (18 species) in grasslands, and 9% (six species) in both. We recorded 34 species (49%) in lentic water bodies, 16 (24%) in lotic water bodies, 14 (21%) in leaf litter, two (3%) in bromeliads, and other two (3%) occurred in both lentic and lotic water bodies.

According to the IUCN Red list of threatened species (IUCN, 2008), 13 species (19%) are classified as Data Deficient (DD), whereas the remaining species were either Not Evaluated (NE) or not under any threatened status (LC). The São Paulo state red list (Garcia et al. 2009), includes 4 species as threatened: Crossodactylus dispar is endangered (EN), Paratelmatobius gaigeae is vulnerable (VU), and Bokermannohyla ahenea and Physalaemus barrioi are near threatened (NT).

**Discussion**

The anuran fauna currently known in the Serra da Bocaina National Park and surrounding buffer areas represents approximately 13% of the species known to Atlantic Forest biome (Rossa-Feres et al. 2011; Haddad et al. 2013). Considering only the species richness along the Serra do Mar, the anuran diversity in the Park is similar to other localities with high altitudinal variation, such as the Boracéia Biological Station (65 species; Heyer et al. 1990) and Carlos Botelho State Park (65 species; Forlani et al. 2010). The high diversity along this mountain range is probably due to its high altitudinal variation, which favors the high species turnover along altitudinal gradients. Species turnover along altitudinal gradients in the Atlantic Forest has already been found in several groups (e.g., Almeida-Neto et al. 2006), including anurans (Giaretta et al. 1999).

The greatest sampling efforts, both in the past and in the present study, was concentrated on the northern areas, above 1,000 m a.s.l. In this area, we record the highest species richness. These data reinforce the need to increase sampling efforts in the southern region of the Park and areas of lower altitude, which certainly will prove fruitful.

Some topotypic populations and species known from museum records were not found in the current surveys. The majority of these species occur in the highlands, such as Bokermannohyla clepsydra, Megaelosia bocainensis, Crossodactylus dispar, Cycloramphus granulosus, Paratelmatobius gaigeae, Vitreorana eurygnatha, and Ischnocnema pusilla. Some species present direct development on the forest floor (Brachycephalus vertebralis and Holoaden suarezi, Haddad and Prado 2005), or are stream breeders (C. dispers and V. uranoscopa, Haddad and Prado 2005), which were habitats poorly sampled in our study. Since our sampling effort was concentrated in high altitude areas, widely distributed species, such as Hypsiboas faber, Leptodactylus labyrinthicus, and Leptodactylus mystacinus and also those known to occur in lower altitude areas (Serafim et al. 2008) were not recorded. The specific locality in which Bokermann (1972) found B. clepsydra, and Giaretta et al. (1993) found M. bocainensis, called Campo de Friticultura (also known as Fazenda Ponte Alta) was surveyed for 14 consecutive months. However, we find neither adults nor tadpoles of these species. Probably, the lack of current records of B. clepsydra might be due to environmental changes, occurred since this area passed to the Park administration in the late 1970s. After that, the forest expanded and the landscape changed dramatically, which might have contributed to the local decline of this population. The same seems to be the case for other endemic species, which were known to inhabit the Campo de Friticultura, such as Physalaemus barrioi that now is found only in open areas in the buffer area of the Park (Provete et al. 2012).

The two survey techniques employed in this study demonstrated to be complementary. We recorded four species only by sampling tadpoles (Phasmahyla cochranae, Scinax ariadne, Scinax crospedospilus, and Thoropa taephora). While 20 species were only recorded by adult sampling, and 22 species were found as both larvae and adults. Both methods contribute to a more accurate sampling of the anuran richness if applied together, as already pointed out by a recent study (Silva 2010).

We recorded the majority of species in forested environments, including most of the endemic species in the study area (Table 1). However, the high species richness in grasslands, with some of the species restricted to this environment (e.g., P. barrioi), highlight the need for conserving this type of environment, which currently is under high anthropogenic pressure in the surrounding buffer area.

The conservation status of most species was not evaluated yet, mainly due to lack of detailed information about natural history (IUCN 2008; Garcia et al. 2009). Bokermannohyla ahenea and P. barrioi are both classified as Near Threatened and are also endemic to the Serra da Bocaina highlands. Two species listed as threatened in the state redlist (Garcia et al. 2009) are found in the Park: C. dispar (EN) and P. gaigeae (VU). Crossodactylus dispar is widely distributed, occurring in the states of Rio de Janeiro, São Paulo, and Minas Gerais. Paratelmatobius gaigeae is also endemic to the study area, occurring at the Fazenda do Bonito and Bananal Ecological Station (Zaher et al. 2005; Frost 2013). None of the former species were recorded by us, and more field work aiming specifically to collect those species seems to be necessary to evaluate their conservation status properly and extent of occurrence. In this study, we provided a list of anuran species, mainly for the northern portion of the Serra da Bocaina considering the current survey and museum data. Information about species richness and composition and current population trends are relevant to subsidize management plans and conservation strategies (Colombo et al. 2008). Furthermore, data about species distribution can have an additional practical application in providing data to studies on species distribution modeling under future climatic scenarios (Bini et al. 2006), as well as helping on-the-ground conservation measures by the protected area network in the Atlantic Forest of southeastern Brazil.
Figure 2. Some species of amphibians from the Serra da Bocaina National Park: (A) Aplastodiscus albosignatus; (B) A. callipygius; (C) A. perviridis; (D) A. arildae; (E) Bokermannohyla ahenea; (F) B. circumdata; (G) Dendropsophus elegans; (H) D. microps; (I) D. minutus; (J) Hypsiboas bandeirantes; (K) Scinax sp. (aff. duartei); (L) Scinax hayii; (M) Scinax sp. (aff. obtriangulatus); (N) S. atratus; (O) S. eurydice; (P) S. flavoguttatus; (Q) S. squalirostris; (R) Trachycephalus imitatrix.
Figure 3. Some species of amphibians from the Serra da Bocaina National Park: (A) Fritziana sp.; (B) Fritziana sp.; (C) Vitreorana uranoscopa; (D) Hylodes sp.; (E) Hylodes phylloides; (F) Ischnocnema sp. (aff. guentheri); (G) L. parva; (H) L. vizottoi; (I) Ischnocnema sp. (aff. melanopygia); (J) Leptodactylus latrans; (K) L. furnarius; (L) Physalaemus barrioi; (M) P. cuvieri; (N) P. ofersii; (O) Rhinella icterica; (P) Proceratophrys melanopogon; (Q) Chiasmocleis mantiqueira; (R) Myersiella microps.
| FAMILY/SPECIES                  | REFERENCE/MUSEUM RECORD | SURVEY DATA | ENVIRONMENT | HABITAT | ALTITUDINAL RANGE (M) | METHOD | IUCN STATUS | SÃO PAULO STATE RED LIST |
|--------------------------------|-------------------------|-------------|-------------|---------|-----------------------|--------|--------------|-------------------------|
| Brachycephalidae               |                         |             |             |         |                       |        |              |                         |
| *Brachycephalus ephippium*     | Zaher et al. 2005; CFBH | M           | Forest      | FF      | ?                     | -      | LC           | LC                      |
| *Brachycephalus vertebralis*  | Pombal 2001; CFBH; MNRJ | M           | Forest      | FF      | ?                     | -      | DD           | DD                      |
| *Ischnocnema parva* (Girard 1853) | Zaher et al. 2005; Serafim et al. 2008; USNM | B           | Forest      | FF      | 1,200-1,600           | A      | LC           | LC                      |
| *Ischnocnema pusilla* (Bokermann, 1967)** | Martins and Haddad 2010 | B           | Both        | FF      | 1,400-1,600           | A      | NE           | NE                      |
| *Ischnocnema sp.* (aff. *melanopygia*) | -                          | B           | Forest      | FF      | 1,400-1,600           | A      | NE           | NE                      |
| *Ischnocnema sp.* (gr. *lactea*) | Serafim et al. 2008 | B           | Forest      | FF      | 1,500                | A      | NE           | NE                      |
| Bufonidae                      |                         |             |             |         |                       |        |              |                         |
| *Bhinhella icterica* (Spix, 1824) | Zaher et al. 2005; Serafim et al. 2008; USNM | B           | Open areas  | LE      | 1,400-1,600           | B      | LC           | LC                      |
| *Bhinhella ornata* (Spix, 1824) | Serafim et al. 2008 | B           | Forest      | LE      | 100-200               | A      | LC           | LC                      |
| Centrolenidae                  |                         |             |             |         |                       |        |              |                         |
| *Vitreorana eurygnatha* (Lutz, 1925) | Lutz 1925; Serafim et al. 2008; Heyer 1985; CFBH; USNM; ZUEC; MZUSP | M           | Forest      | LO      | 1,200-1,700           | -      | LC           | LC                      |
| *Vitreorana uranoscopa* (Müller, 1924) | Heyer 1985; CFBH; USNM | B           | Forest      | LO      | 1,400-1,600           | A      | LC           | LC                      |
| Ceratophryidae                 |                         |             |             |         |                       |        |              |                         |
| *Ceratophrys aurita* (Raddi, 1823) | USNM | M           | ?           | LE      | ?                     | -      | LC           | LC                      |
| Craugastoridae                 |                         |             |             |         |                       |        |              |                         |
| *Haddalus binotatus* (Spix, 1824) | Zaher et al. 2005; Serafim et al. 2008; CFBH | M           | Forest      | FF      | Up to 1,100           | -      | LC           | LC                      |
| *Hobaden suarezi* (Martins and Zaher, 2013) | Zaher et al. 2005; Martins and Zaher 2013; MZUSP | M           | Forest      | FF      | 900 – 1,300           | -      | NE           | NE                      |
| Cycloramphidae                 |                         |             |             |         |                       |        |              |                         |
| *Cycloramphus eleutherodactylus* (Miranda-Ribeiro, 1920) | Zaher et al. 2005 | M           | Forest      | FF      | ?                     | -      | -            | -                       |
| *Cycloramphus granulosus* (Lutz, 1929) | Lutz 1929; USNM; ZUEC | M           | ?           | FF      | 1,200-1,700           | -      | DD           | LC                      |
| *Thompa taophora* (Miranda-a-Ribeiro, 1923) | - | P           | Forest      | LO      | 200-500               | T      | NE           | NE                      |
| Hemiphractidae                 |                         |             |             |         |                       |        |              |                         |
| *Fritziana* sp.*                  | Serafim et al. 2008; USNM; ZUEC | B           | Open areas  | BR      | 1,500-1,600           | A      | NE           | NE                      |
| Hylidae                        |                         |             |             |         |                       |        |              |                         |
| *Aplastodiscus albosignatus* (Lutz & Lutz, 1938) | USNM | B           | Forest      | LO      | 1,300-1,600           | B      | LC           | LC                      |
| *Aplastodiscus arildae* (Cruz & Peixoto, 1987) | Zaher et al. 2005; CFBH; USNM; ZUEC | B           | Forest      | LE      | 1,300-1,400           | A      | LC           | LC                      |
| *Aplastodiscus callipygius* (Cruz & Peixoto, 1985)** | Cruz and Peixoto 1984; CFBH; MZUSP; MNRJ | M           | Forest      | LO      | 1,300-1,500           | B      | LC           | LC                      |
| *Aplastodiscus leucopygius* (Cruz & Peixoto, 1985) | Zaher et al. 2005; Serafim et al. 2008; CFBH | M           | Forest      | LE      | 1,100-1,500           | -      | LC           | LC                      |
| *Bokermannohyla aheana* (Napoli & Caramaschi, 2004)** | Napoli and Caramaschi 2004; CFBH; MZUSP; MNRJ | B           | Forest      | LO      | 1,500-1,600           | B      | DD           | NT                      |
| *Bokermannohyla circundata* (Cope, 1871) | Zaher et al. 2005; Serafim et al. 2008; CFBH; ZUEC | B           | Open areas  | LE      | 1,500-1,600           | B      | LC           | LC                      |
| *Bokermannohyla clepsydra* (Lutz, 1925)* | Lutz 1925; Bokermann 1972; MNRJ; MZUSP | M           | Forest      | LO      | ?                     | -      | -            | -                       |
| *Dendropsophus elegans* (Wied-Neuwied, 1824) | Zaher et al. 2005; Serafim et al. 2008 | B           | Open areas  | LE      | 1,400-1,600           | A      | LC           | LC                      |
| *Dendropsophus microps* (Peters, 1872) | Zaher et al. 2005; Serafim et al. 2008; CFBH; ZUEC | B           | Both        | LE      | 1,000-1,600           | B      | LC           | LC                      |
| *Dendropsophus minutus* (Peters, 1872) | Zaher et al. 2005; Serafim et al. 2008; CFBH; ZUEC | B           | Both        | LE      | 1,000-1,600           | B      | LC           | LC                      |
| *Hypsilosed bandeirantes* Caramaschi & Cruz, 2013 | Zaher et al. 2005; Serafim et al. 2008; Caramaschi and Cruz 2013; CFBH; USNM; MNRJ; ZUEC | B           | Both        | LE      | 1,000-1,600           | B      | NE           | NE                      |
| FAMILY/SPECIES                  | REFERENCE/MUSEIUM RECORD | SURVEY DATA | ENVIRONMENT | HABITAT | ALTITUDDINAL RANGE (M) | METHOD | IUCN STATUS | SÃO PAULO STATE RED LIST |
|--------------------------------|--------------------------|-------------|-------------|---------|------------------------|--------|-------------|--------------------------|
| Hypsiboas pardalis (Spix, 1824) | Zaher et al. 2005; Serafim et al. 2008; USNM | B | Open areas | LE | 900-1,000 | A | LC | LC |
| Hypsiboas fischeri (Wied-Neuwied, 1821) | Zaher et al. 2005; Serafim et al. 2008; ZUEC | M | Open areas | LE | ? | - | LC | LC |
| Phasmodyina cochranae (Bokermann, 1966)** | Bokermann 1966; MZUSP; USNM; ZUEC | B | Forest | LO | 1,300-1,400 | T | LC | LC |
| Sciens atrata (Bokermann, 1967)** | Bokermann 1967c; CFBH; MZUSP; ZUEC | B | Forest | LO | 1,300-1,400 | T | DD | DD |
| Sciens atroto (Peixoto, 1989)** | Peixoto 1989; MZUSP | B | Forest | BR | 1,200-1,300 | A | DD | DD |
| Sciens cromedopelus (Lutz, 1925) | - | B | Forest | LE | 1,400-1,500 | T | LC | LC |
| Sciens euprisec (Bokermann, 1968) | - | B | Open areas | LE | 1,500-1,600 | A | LC | LC |
| Sciens flavoguttatus (Lutz & Lutz, 1939)** | Lutz and Lutz 1939; USNM | B | Forest | LE | 1,200-1,300 | B | LC | LC |
| Sciens fuscomarginatus (Lutz, 1925) | Serafim et al. 2008 | M | Open areas | LE | 1,300-1,500 | - | LC | LC |
| Sciens fuscorvariatus (Lutz, 1925) | Zaher et al. 2008 | B | Forest | LE | 1,400-1,500 | A | LC | LC |
| Sciens guyi (Barbour 1909) | Zaher et al. 2005; Serafim et al. 2008; USNM | B | Open areas | LE | 1,300-1,600 | B | NE | NE |
| Sanaax squalirriss (Lutz, 1925)** | Lutz 1925; Serafim et al. 2008; USNM; ZUEC | B | Open areas | LE | 1,500-1,600 | B | LC | LC |
| Scinax sp. (aff. duartei) | MZUSP; USNM; ZUEC | B | Both | LE | 1,200-1,600 | B | NE | NE |
| Scinax sp. (aff. ohiangulatus) | ZUEC | B | Forest | LE | 1,200-1,600 | B | NE | NE |
| Sphaenorhynchus orophilus (Lutz & Lutz, 1938) | Lutz and Lutz 1938; USNM; | M | ? | LE | ? | - | LC | LC |
| Trachycephalus similis (Miranda-Ribeiro, 1926) | CFBH; USNM; ZUEC | B | Forest | LE | 1300-1400 | B | LC | DD |
| Hylidae |  |  |  |  |  |  |  |  |
| Crostodactylus dispar (Lutz, 1925) | Lutz 1925; USNM | B | Forest | LO | - | - | DD | EN |
| Hylodes asper (Müller, 1924) | USNM | B | Forest | LO | 200-600 | A | LC | LC |
| Hylodes phyllodes Heyer & Cocroft, 1986 | - | B | Forest | LO | 200-600 | A | LC | LC |
| Hylodes sp. | Serafim et al. 2008 | B | Forest | LO | 1300-1500 | B | NE | NE |
| Megaelosia boicanensis Giaretta, Bokermann & Haddad, 1993** | Giaretta et al. 1993, MNRJ | M | Forest | LO | - | - | DD | DD |
| Megaelosia goddi (Baumann, 1912) | USNM; MNRJ | M | Forest | LO | - | - | LC | LC |
| Leptodactylidae |  |  |  |  |  |  |  |  |
| Adenomera bokermanni (Heyer, 1973) | Almeida and Angulo 2006; USNM | M | Both | FF | - | - | LC | LC |
| Leptodactylus fernandicus (Spix, 1824) | Zaher et al. 2005; USNM; ZUEC | M | Open areas | LE | 1,500-1,600 | B | LC | LC |
| Leptodactylus hyalinobius (Spix, 1824) | Zaher et al. 2008; Serafim et al. 2008; MZUSP | M | Open areas | LE | 1,500-1,600 | A | LC | LC |
| Leptodactylus mystacinus (Burmeister, 1861) | Zuea et al. 2005; Serafim et al. 2008; MZUSP; USNM | M | Open areas | LE | - | - | LC | LC |
| Paratryphoncodes geiogae (Coelho, 1938)**,** | Coelho 1938; Zaher et al. 2005; MZUSP; USNM | M | Forest | LO | 1160-1230 | - | DD | VU |
| Physalaemus bartoi Bokermann, 1967**,** | Bokermann 1967b; Provete et al. 2012; CFH; MZUSP; USNM; ZUEC | B | Open areas | LE | 1500-1600 | B | DD | NT |
| Physalaemus caviheri Fitzinger, 1826 | Serafim et al. 2008; MZUSP | B | Open areas | LE | 1500-1600 | B | LC | LC |
| Physalaemus maculiventris (Lutz, 1925) | Zaher et al. 2005; Serafim et al. 2008; ZUEC; USNM | M | Forest | LE | Up to 1100 | - | LC | LC |
| Physalaemus olferi (Lichtenstein & Martens, 1856) | Zaher et al. 2005; Provete et al. 2013; MZUSP; ZUEC | B | Forest | LE | 1400-1500 | B | LC | LC |
| Microhylidae |  |  |  |  |  |  |  |  |
| Chiasmocleis mantiqueira Cruz, Feio & Cassini, 2007† | Zaher et al. 2005 | B | Forest | LE | 1400-1500 | B | DD | DD |
| Myersiella micropia (Duméril & Bibron, 1841) | Zaher et al. 2005; CFH | B | Forest | FF | 1400-1500 | A | LC | LC |
| Odontophrynidae |  |  |  |  |  |  |  |  |
| Proceratophrys appendiculada (Günther, 1873) | MZUSP | B | Forest | LO | 300-900 | A | LC | LC |
| Proceratophrys boiei (Wied-Neuwied, 1824) | Serafim et al. 2008; Zaher et al. 2005 | B | Forest | LE | Up to 1100 | A | LC | LC |
| Proceratophrys melanopogon (Miranda-Ribeiro, 1926) | Zaher et al. 2005; Provete et al. 2013; MZUSP; ZUEC | B | Forest | LL | 1300-1500 | B | LC | LC |

† The name Chiasmocles mantiqueira seems to be more adequate to designate the population of this species occurring in the study area, instead of Chiasmocles leucosticta, from which it was separated (M. Forlani, pers. comm.).
APPENDIX 1. Specimens collected in the study area during the course of this study.

| Family                  | Genus                           | Species                  | Catalog Numbers                          |
|------------------------|---------------------------------|--------------------------|------------------------------------------|
| Brachycephalidae       | Ischnocnema parva                | (DZSRP 13963-4)          | Ischnocnema vizottoi (CFBH 29433-34, DZSRP 13988-90); Ischnocnema sp. (aff. guntheri (DZSRP 13937, 12069-71; CFBH 28818-19); Ischnocnema sp. (aff. melanopogon) (DZSRP 14003-12); Buitonidae: Rhinella icteric (DZSRP 11717-21, 12103, 12157-8); Centrolenidae: Vitreorana uranoscapa (DZSRP 11705); Hemicriptidae: Fritiziana sp. (DZSRP 11733, 12156, 12159; CFBH 28886c); Hylidae: Aplastodiscus albosignatus (DZSRP 13980-1); Aplastodiscus arildae (DZSRP 12087-91, 13924; CFBH 28079-9); Aplastodiscus circularis (DZSRP 13982); Aplastodiscus perviridis (DZSRP 12087-91, 13924; CFBH 28079-9); Aplastodiscus microps (DZSRP 12087-91, 13924; CFBH 28079-9); Aplastodiscus fuscovarius (DZSRP 13983-60, 96361-67, 96368-9, 96460-1, 96462-9, 81153); Hylidae: Aplastodiscus leucopygius (CFBH 18109); Physalaemus goeldii (USNM 24374-5, 96316-9, 96460-1); Aplastodiscus melanopogon (DZSRP 12085-6, 13925-6, CFBH 2801-12).

APPENDIX 2. Specimens from museum records.

| Family                  | Genus                           | Species                  | Catalog Numbers                          |
|------------------------|---------------------------------|--------------------------|------------------------------------------|
| Brachycephalidae       | Brachycephalus ephippium        | (CFBH 22562-7)           | Brachycephalus vertebralis (CFBH 3415-8; MNR 11098-9, 11130; 2063, 10559, 11094-6, 11100-2, 11105-7, 11112, 11114, 11116-8, 11120, 11122, 11123, 11225-129, 11311, 11312); Ischnocnema pusilla (WCAB-MZUSP 31461); Ischnocnema sp. (aff. guntheri) (USNM 96724-7, 96752); Ischnocnema parva (USNM 96753-5); Buitonidae: Rhinella icteric (USNM 96640-1, 207957-9); Centrolenidae: Vitreorana eurygnatha (CFBH 19254-55, 19278; USNM 96558, 96560-61, 96562, 96563, 96561-661, 217661-69; MZUSP 53052-59; ZUE 944-46); Vitreorana uranoscapa (CFBH 22587-89; USNM 96557, 96559, 96722-3); Ceratophryidae: Ceratophrya aurita (USNM 241298-9, 208078-83); Craugastoridae: Haddadus binotatus (CFBH 22590); Holoedon suarezii (MIZUSP 131872, 94415); Cycloramphidae: Cycloramphus granulosus (USNM 96742-51, 217903-5; ZUE 2166); Hemicriptidae: Fritiziana fisticus (USNM 56026-30); Centrolenidae: Vitreorana uranoscapa (DZSRP 13963-4); Hemicriptidae: Fritiziana sp. (aff. melanopogon) (DZSRP 14003-12); Buitonidae: Rhinella icteric (DZSRP 11717-21, 12103, 12157-8); Centrolenidae: Vitreorana uranoscapa (DZSRP 11705); Hemicriptidae: Fritiziana sp. (DZSRP 11733, 12156, 12159; CFBH 28886c); Hylidae: Aplastodiscus albosignatus (DZSRP 13980-1); Aplastodiscus arildae (DZSRP 12087-91, 13924; CFBH 28079-9); Aplastodiscus circularis (DZSRP 13982); Aplastodiscus perviridis (DZSRP 12087-91, 13924; CFBH 28079-9); Aplastodiscus microps (DZSRP 12087-91, 13924; CFBH 28079-9); Aplastodiscus fuscovarius (DZSRP 13983-60, 96361-67, 96368-9, 96460-1, 96462-9, 81153); Hylidae: Aplastodiscus leucopygius (CFBH 18109); Physalaemus goeldii (USNM 24374-5, 96316-9, 96460-1); Aplastodiscus melanopogon (DZSRP 12085-6, 13925-6, CFBH 2801-12).