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Anurans from two high-elevation areas of Atlantic Forest in the state of Rio de Janeiro, Brazil

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ABSTRACT. The anurofauna inhabiting higher montane Atlantic forest areas in southeastern Brazil, which often attain heights of more than 2000 m, is still insufficiently known. In this study, we present data on anuran species composition and abundances in two high-altitude (i.e. > 1000 m) sites within the Parque Estadual dos Três Picos (PETP), in the state of Rio de Janeiro. Field surveys were done at altitudes between 1100 and 1900 m above sea level. We recorded 35 species during our study, adding 22 records to the set of anuran species previously known to occur within the PETP. The stability of the species accumulation curve, as well as the richness estimations, showed that the sampling methodology employed and the total sampling effort were appropriate to inventory the anuran assemblages of both sites. Direct-developing frogs such as *Ischnocnema parva* (Girard, 1853) (at the 1100-1400 m altitude site), and *Brachycephalus garbeanus* Miranda-Ribeiro, 1920 (at the 1600-1900 m altitude site) were the most locally abundant species. None of the species recorded during the study is listed as threatened, though nine of them are currently considered endemic to the state of Rio de Janeiro. Furthermore, eight of the species recorded are likely restricted to high-altitude habitats. The relatively high diversity of anurans (some of them endemic to the state), the presence of species restricted to high-altitude habitats, and the occurrence of rare and presently undescribed species attest to the biological relevance of the studied areas within the PETP.

KEY WORDS. Altitude; amphibian; community; Serra dos Órgãos mountains; species richness.

Brazil has almost 900 species of anurans currently recorded (SBH 2010), corresponding to ca. 14% of the world's anuran diversity (Araújo *et al.* 2009). One of the main Brazilian biomes, the Atlantic Rainforest, is one of the world's richest amphibian hotspots, housing ca. 400 species of anurans, with more than 80% of them considered endemic to this biome (Cruz & Feio 2007). The state of Rio de Janeiro, despite its relatively small area (ca. 43,700 km^2), contains a considerable proportion of Atlantic Rainforest anuran species, with relatively high rates of endemism (Rocha *et al.* 2004, Van Sluys *et al.* 2009). Rocha *et al.* (2004) listed 166 amphibian species for the state of Rio de Janeiro. Since then, several species have been added due to descriptions/revalidations of taxa (Carvalho-e-Silva & Carvalho-e-Silva 2005, Canedo & Pombal 2007, Pombal *et al.* 2008, Prado & Pombal 2008, Silva & Alves-Silva 2008, Carvalho-e-Silva *et al.* 2009, 2010, Targino *et al.* 2009, Pombal 2010, Weber *et al.* 2011) and to new occurrence records for the state (Marques *et al.* 2006, Vrcibradic *et al.* 2006, 2010, Pimenta *et al.* 2007, Carvalho-e-Silva *et al.* 2008, Silva-Soares *et al.* 2009, Silveira *et al.* 2009, Caramaschi 2010), raising the list of amphibians to presently 187 species. This number is likely to increase as further research on the state's anurofauna keeps advancing.

Preliminary lists of species of amphibians have been published for a number of areas in the state of Rio de Janeiro (Izecksohn & Carvalho-e-Silva 2001a, b, Van Sluys *et al.* 2004, Almeida-Gomes *et al.* 2008, 2010, Carvalho-e-Silva *et al.* 2008, Silva *et al.* 2008, Salles *et al.* 2009, Silva-Soares *et al.* 2010), but those refer basically to low to mid-elevation (up to ca. 1000 m) areas. Although the two main mountain ranges in eastern Brazil, the Serra do Mar and the Serra da Mantiqueira, occasionally attain heights of more than 2000 m in the state of Rio de Janeiro, knowledge of the anurofauna inhabiting higher montane areas in the state is still insufficient. The most comprehensive work to date is the revision of Cruz & Feio (2007), who listed the anuran species endemic to the higher portions of the aforementioned mountain ranges in southeastern Brazil.

Despite intense deforestation, the state of Rio de Janeiro still has proportionately large forested areas, most of them along the Serra do Mar mountain range (Rocha *et al.* 2003). The central portion of the Serra do Mar in Rio de Janeiro receives the

regional denomination of Serra dos Órgãos, and is renowned by its remarkable biodiversity and rates of endemism, particularly regarding the fauna (Rocha *et al.* 2003, Cruz & Feio 2007). The Parque Estadual dos Três Picos (hereafter PETP), with a total area of more than 46,000 ha, represents one of the state's most extensive continuous areas of Atlantic Rainforest contained within a Conservation Unit (Rocha *et al.* 2003). It contains some of the highest peaks of the Serra dos Órgãos mountain range, often exceeding 2000 m in altitude. Two recent studies have been carried out on anuran assemblages within this Park, both dealing specifically with the leaf-litter anuran guild: one was carried out at altitudes up to 400 m (Rocha *et al.* 2007) and the other at altitudes between 500 and 800 m (Siqueira *et al.* 2009). Here, we present data on anuran species composition and abundance in two high-altitude areas (above 1000 m high) within the Parque Estadual dos Três Picos and discuss the species richness recorded at each site, as well as the species showing restricted endemism. The list of anurans presented herein represents the continuation of our efforts to investigate the anuran assemblages on the Atlantic Forests of the state of Rio de Janeiro, aiming to contribute toward their conservation.

MATERIAL AND METHODS

The Parque Estadual dos Três Picos (hereafter PETP) is a conservation unit that is co-extensive with most of the Serra dos Órgãos mountain range, and encompasses portions of five municipalities in the state of Rio de Janeiro, southeastern Brazil. The study was carried out in two adjacent mountains located inside the PETP, in the municipality of Nova Friburgo: one in Theodoro de Oliveira district (22°21'59"-22°22'23"S, 42°33'16"-42°33'31"W) and the other in an area locally known as Baixo Caledônia (22°21'34"S, 42°34'04"-42°34'25"W), on the Caledônia mountain (one of the highest in the Serra dos Órgãos, reaching over 2200 m at its peak). Vegetation at Theodoro de Oliveira consists of Dense Ombrophilous Montane Forest, whereas at Baixo Caledônia it ranges from High Montane Forest at the lower portion to Montane Fields ("campos de altitude"; see Eiten 1992) at the higher portion (IBGE 1992). At the Theodoro de Oliveira site there is a greater availability of water bodies (mainly rocky streams) when compared to Baixo Caledônia. In this latter locality, the terrain is quite steep over much of the forested portions, whose vegetation is more dense and with a lower canopy compared to the Theodoro de Oliveira site. Annual rainfall in the general area is about 1,700-2,300 mm and the mean annual temperature is ca. 18° C. The climate in the region is seasonal, with a dry/cool season from May to September and a wet/warm season from November to March (INEA 2009).

Surveys were carried out in March, July and August 2008, in February, March, August and September 2009, and in January and March 2010, at altitudes between 1100 and 1400 m at Theodoro de Oliveira, and between 1600 and 1900 m at Baixo Caledônia. We sampled during months of both the wet/warm (January-March) and dry/cool (July-September) seasons to account for possible seasonal variations in activity of different frog species. Samplings of anurans were always done at night, using an adaptation of the time-constrained visual encounter survey method (Crump & Scott 1994). The number of observers at each survey episode (i.e. month) was usually five. Sampling effort totaled 180 hours of active search in wet season months and 120 hours in dry season months at Theodoro de Oliveira, and 60 hours in wet season months and 40 hours in dry season months at Baixo Caledônia. Thus, we performed a total of 300 hours of searches at Theodoro de Oliveira, and of 100 hours at Baixo Caledônia. We worked fewer hours at Baixo Caledônia because it was harder to move around in this area due to the structure of the vegetation and the steep terrain, and because the total area available for searching was smaller.

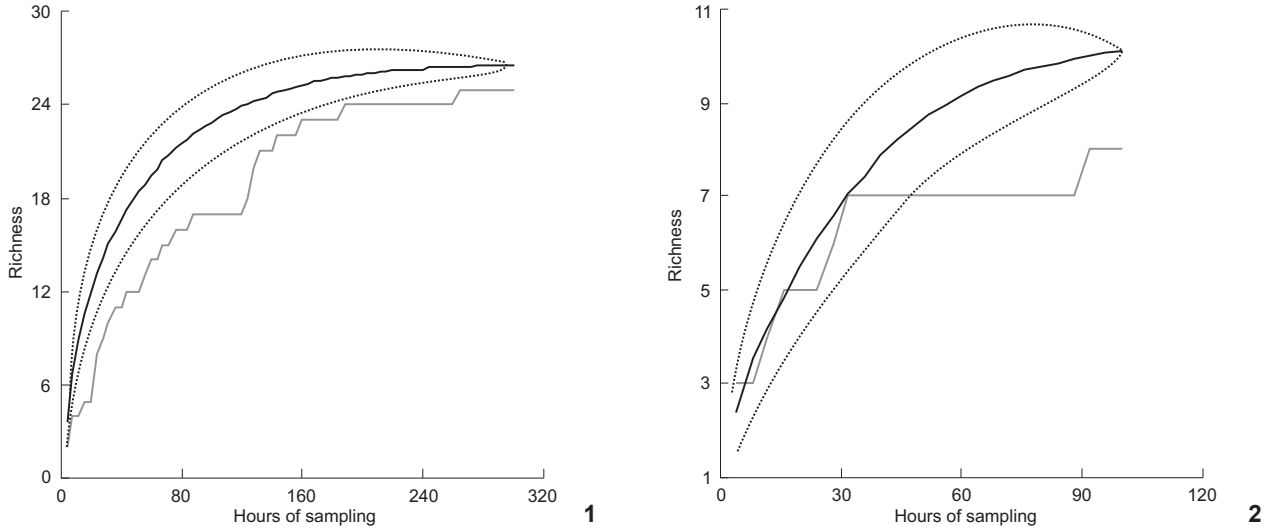
All frogs found were captured, identified and most were released after fieldwork. Besides, all individuals found during casual encounters (i.e. outside the sampling period) were also recorded, though not included in the estimates of relative abundances. Voucher specimens of all frog species recorded during the study, with the exception of *Hypsiboas faber* (Wied-Neuwied, 1821) and *Rhinella icterica* (Spix, 1824), were deposited at the Museu Nacional, Rio de Janeiro (see Appendix).

The evaluation of collection effectiveness (from VES method) was undertaken by a species accumulation curve (collector curve) and a rarefaction curve. The latter was done using an estimator (Bootstrap) performing 1,000 randomizations without replacement, using the program EstimateS 8.2.0 (Colwell 2005).

RESULTS

We recorded a total of 35 species of anurans in the present study, with 31 species recorded at Theodoro de Oliveira and nine species at Baixo Caledônia (Tab. I). The species accumulation curves and the rarefaction curves showed a clear asymptotic shape, with a tendency to reaching stability (Figs 1 and 2). Also, our estimates of frog richness for both sites (26.5 ± 0.2 species at Theodoro de Oliveira and 10.1 ± 0.4 species at Baixo Caledônia) were close to the richness values (25 and eight species, respectively) obtained by us with visual encounter surveys.

The most abundant species were *Ischnocnema parva* (Girard, 1853) at Theodoro de Oliveira (comprising 62% of all individuals recorded there), and *Brachycephalus garbeanus* Miranda-Ribeiro, 1920 (93%) at Baixo Caledônia (Tab. I). The most specious anuran families at the studied areas were Hylidae (11 species) and Brachycephalidae (8 species) at Theodoro de Oliveira, and Brachycephalidae (4 species) at Baixo Caledônia (Tab. I). Among the species recorded during the study, ten (excluding the undescribed ones) are currently considered endemic to the state of Rio de Janeiro and 22 represent new records for the PETP (Tab. I).



Figures 1-2. Cumulative curves of species (gray solid line), and richness estimators (black solid line), with the respective standard deviation (dashed lines), of anurans recorded in the Atlantic Rainforest areas of Theodoro de Oliveira (1) and Baixo Caledônia (2), within the Parque Estadual dos Três Picos, in Rio de Janeiro State, Brazil.

Seven species (six at Theodoro de Oliveira and one at Baixo Caledônia) were found only during occasional encounters). Among them, five hylids – *H. faber*, *Hypsiboas polytaenius* (Cope, 1870), *Dendropsophus minutus* (Peters, 1872), *Scinax fuscovarius* (Lutz, 1925) and *S.* cf. *perereca* – were found only in open/anthropically disturbed habitats, whereas *Gastrotheca albolineata* (Lutz & Lutz, 1939) was found at a forested area, and *Rhinella* gr. *crucifer* was found both within the forest and in open areas. *Rhinella icterica*, though also found during "visual encounter surveys" within the forest, was found much more frequently during casual encounters in open, disturbed habitats.

DISCUSSION

Based on the comparatively few studies reporting anuran species from areas within the PEPT (Rocha *et al*. 2007, Weber *et al*. 2007, 2009, Pombal *et al*. 2008, Siqueira *et al*. 2009, Pombal 2010), 26 anuran species are presently reported for areas within that State Park, all at low to mid-elevations. The present study, carried out at high-elevation areas, raise the current anuran list for the PETP to 48 species, by adding 22 records. Considering the vast area of the PETP (over 46,000 ha), its considerable altitudinal range and habitat heterogeneity, and the fact that most of it remains poorly studied regarding its anurofauna, we believe that 48 species is still a gross underestimate of the anuran diversity contained within the Park's limits. Moreover, at least ten of the 35 species recorded by us at the study sites (ca. 29% of the total) are currently considered endemic to the state of Rio de Janeiro.

The tendency for stability of the species accumulation and rarefaction curves, as well as the richness estimations, showed that the sampling methodology employed and the total sampling effort were appropriate to inventory the local anuran assemblages (even considering the large difference in number of sampling hours between the two sites). Species richness values (both estimated and observed) for Theodoro de Oliveira were about three times higher than for Baixo Caledônia. This may be a consequence of distinct environmental conditions between the two sites, as a result of their altitudinal differences. Some previous studies on anuran assemblages in tropical forests have shown a tendency for species richness to be lower at higher elevations (e.g., Brown & Alcala 1961, Scott 1976, Fauth *et al*. 1989), as observed in our study. The Baixo Caledônia site presents harsher conditions (e.g., lower mean and minimum temperatures, wider daily thermal variations, more reduced availability of free water, greater exposure to wind; INEA 2009, pers. obs.) compared to the Theodoro de Oliveira site. Such conditions could be limiting to a number of species, preventing their occurrence at the higher site (see Navas 2003), though this has not been tested in the present study. Additionally, the lower species richness at Baixo Caledônia may also reflect the smaller area available for sampling at that locality.

The brachycephalids *I. parva* (at Theodoro de Oliveira; 1100-1400 m altitude), and *B. garbeanus* (at Baixo Caledônia; 1600-1900 m altitude) were the most locally abundant species found during our study. In previous studies carried out in other areas within the PETP, the most abundant species were also direct developers: *Euparkerella brasiliensis* (Parker, 1926) (Strabomantidae) at a mid-elevation (500-800 m) area (Siqueira *et al*.

Table I. List of anuran species occurring in the Atlantic Rainforest areas of Theodoro de Oliveira (TO) and Baixo Caledônia (BC), within the Parque Estadual dos Três Picos (PETP), in Rio de Janeiro State, Brazil. Abundance is given for each species in each area as absolute values and percentages (in parentheses). The species endemic to the state (RJ) are indicated with an "X". Species that have been recorded only during occasional encounters are indicated by "OE" and were not quantified. Species that have not been previously reported for the PETP are marked with asterisks (*).

Species	Abundance (%)		Endemic
	TO	BC	
Bufonidae			
Dendrophriniscus cf. *brevipollicatus**		4 (1.5)	
Rhinella icterica (Spix, 1824)	4 (0.4)		
Rhinella gr. *crucifer*	OE		
Brachycephalidae			
Brachycephalus didactylus (Izecksohn, 1971)	3 (0.3)		X
Brachycephalus garbeanus Miranda-Ribeiro, 1920	2 (0.2)	247 (92.9)	X
Brachycephalus sp.*	17 (1.8)		X
Ischnocnema erythromera (Heyer, 1984)*	103 (11.0)		X
Ischnocnema guentheri (Steindachner, 1864)	6 (0.6)	4 (1.5)	
Ischnocnema cf. *holti**	6 (0.6)	3 (1.1)	X
Ischnocnema parva (Girard, 1853)	577 (61.6)	3 (1.1)	
Ischnocnema sp. (gr. *lactea*)*	4 (0.4)		?
Craugastoridae			
Haddadus binotatus (Spix, 1824)	6 (0.6)		
Cycloramphidae			
Proceratophrys boiei (Wied-Neuwied, 1824)	2 (0.2)		
Proceratophrys melanopogon (Miranda-Ribeiro, 1926)*	39 (4.2)	1 (0.4)	
Zachaenus parvulus (Girard, 1853)	32 (3.4)		
Hemiphractidae			
*Flectonotus fissilis**	2 (0.2)		
Flectonotus sp.*		3 (1.1)	?
Gastrotheca albolineata (Lutz & Lutz, 1939)*	OE		
Gastrotheca ernestoi Miranda-Ribeiro, 1920*		1 (0.4)	X
Hylidae			
Aplastodiscus arildae (Cruz & Peixoto, 1987)*	3 (0.3)		
Aplastodiscus leucopygius (Cruz & Peixoto, 1985)*	6 (0.6)		
Bokermannohyla carvalhoi (Peixoto, 1981)*	10 (1.1)		X
Bokermannohyla circumdata (Cope, 1871)*	11 (1.2)		
Dendropsophus minutus (Peters, 1872) *	OE		
Hypsiboas faber (Wied-Neuwied, 1821)*	OE		
Hypsiboas polytaenius (Cope, 1870)*	OE		
Scinax albicans (Bokermann, 1967)	8 (0.9)		X
Scinax flavoguttatus (Lutz & Lutz, 1939)*	12 (1.3)		
Scinax fuscovarius (Lutz, 1925)*		OE	
Scinax cf. *obtriangulatus**	1 (0.1)		
Scinax cf. *perereca*	OE		?
Scinax v-signatus (Lutz, 1968)*	13 (1.4)		
Hylodidae			
Hylodes charadranaetes Heyer & Cocroft, 1986	60 (6.4)		X
Microhylidae			
Myersiella microps (Duméril & Bibron, 1841)	5 (0.5)		
Strabomantidae			
Holoaden pholeter Pombal, Siqueira, Dorigo, Vrcibradic & Rocha, 2008	4 (0.4)		X
Total	936 (100.0)	266 (100.0)	

2009), and *Ischnocnema guentheri* (Steindachner, 1864) at low altitudes (up to 400 m) (Rocha *et al.* 2007). Individuals of species with direct development and terrestrial eggs (Terrarana sensu Hedges *et al.* 2008) thus appear to numerically dominate the anuran assemblages at the PETP (irrespective of altitude), as has been observed in most studied Neotropical litter frog assemblages (e.g., Scott 1976, Lieberman 1986, Fauth *et al.* 1989, Giaretta *et al.* 1997, 1999, Rocha *et al.* 2001).

Hylodes charadranaetes Heyer & Cocroft, 1986, which was quite abundant at Theodoro de Oliveira, was the only strictly reophilic (stream-adapted) species found in our study. At night those frogs were always found inactive, mainly perched on vegetation at the margins of rocky streams, whereas during the day we heard (and occasionally sighted) calling males on rocks along the streams. Thus, the conservation of this type of environment is crucial for the permanence of the local population of this species. Hylodids, in general, can be considered as good indicators of habitat quality in forest environments, as they are dependent of lotic streams with clean water (Van Sluys *et al.* 2009).

Cruz & Feio (2007) listed 11 species they considered as endemic to highland areas in the Serra dos Órgãos region. However, two of them (*G. albolineata* and *H. charadranaetes*) have since been shown to range down to low altitudes and to occur outside the Serra dos Órgãos region (Carvalho-e-Silva *et al.* 2008, Gressler *et al.* 2008, Vrcibradic *et al.* 2008). In the present study, besides the two aforementioned species, we recorded two other – *Ischnocnema erythromera* (Heyer, 1984) and *Bokermannohyla carvalhoi* (Peixoto, 1981) – that are also in the list of Cruz & Feio (2007). *Holoaden pholeter* Pombal, Siqueira, Dorigo, Vrcibradic & Rocha, 2008, a species recently described based on specimens collected during the present study, can also be added to that list. Also, *B. garbeanus*, which has recently been removed from the synonymy of *Brachycephalus ephippium* (Spix, 1824) by Pombal (2010), is apparently another endemic of the Serra dos Órgãos mountains. Another species recorded in our study – *Gastrotheca ernestoi* Miranda-Ribeiro, 1920, a taxon recently revalidated by Caramaschi & Rodrigues (2007) –, though not endemic to the Serra dos Órgãos, is also probably restricted to high elevation areas in the mountains of southeastern Brazil. This is apparently the case for some of the other species found, such as *Aplastodiscus leucopygius* (Cruz & Peixoto, 1985), *Proceratophrys melanopogon* (Miranda-Ribeiro, 1926), and *Scinax* cf. *obtriangulatus* (Cruz & Feio 2007). Nevertheless, most of the species recorded in this study have wide altitudinal ranges, also occurring at mid- and low elevations – e.g., *Bokermannohyla circumdata* (Cope, 1871), *D. minutus*, *H. faber*, *G. albolineata*, *Haddadus binotatus* (Spix, 1824), *H. charadranaetes*, *I. parva*, *Proceratophrys boiei* (Wied-Neuwied, 1824), *R. icterica*, *R.* gr. *crucifer*, *Scinax albicans* (Bokermann, 1967), *Scinax flavoguttatus* (Lutz & Lutz, 1939), *S. fuscovarius*.

None of the species recorded by us in the present study (not counting the currently undescribed and the taxonomically problematic ones; see below) is considered as threatened with extinction at either a state-wide (Caramaschi *et al.* 2000), a country-wide (Machado *et al.* 2008), or a global scale (IUCN 2010). *Holoaden pholeter*, known only from the type locality in Theodoro de Oliveira (Pombal *et al.* 2008), is presently considered as "Data Deficient" by the IUCN (2010). At present, even after many hours of searches for frogs at that locality, only four individuals of this species (including the three that comprise the type series) have been found so far, which suggests us that this is a locally rare species. Because of its restricted geographic distribution and probably low population density, we believe that *H. pholeter* may be a candidate for inclusion in the "vulnerable" category of the IUCN red list of threatened species.

Though taxonomic issues are outside the scope of the present study, it is worth mentioning that some of the specimens collected by us represent new or presumably new taxa. *Brachycephalus* sp., found by us at Theodoro de Oliveira, is a previously unknown member of the genus and is currently in the process of being formally described. The specimens referred as *Flectonotus* sp. may also represent a currently undescribed taxon, and what we treat here as *Ischnocnema* cf. *holti* is possibly a taxon distinct from *I. holti* (Cochran, 1948) (M. Targino and C. Canedo, pers. comm.). Four small specimens of an indeterminate species of *Ischnocnema* of the *lactea* group collected at Theodoro de Oliveira may also possibly represent a new taxon (C. Canedo, pers. comm.). Additionally, *Dendrophriniscus brevipollicatus* Jiménez de la Espada, 1870 and *Scinax perereca* Pombal, Haddad & Kasahara, 1995 may represent species complexes, and the actual taxonomic status of the specimens collected during the present study may only be defined after a careful systematic revision (C.A.G. Cruz and J.P. Pombal Jr, pers. comm.). This considerable number of potentially new taxa found during our study is in turn suggestive of a high gamma-diversity at the PEPT. In fact, the few other studies providing information on the anurofauna of the Park (Rocha *et al.* 2007, Weber *et al.* 2007, 2009, Pombal *et al.* 2008, Siqueira *et al.* 2009) were performed in other sites, and the two areas we surveyed in the present study had not been previously searched for frogs.

As pointed out by Cruz & Feio (2007), the fauna of Atlantic Forest amphibians living at high altitudes is still insufficiently known. Our inventory is a contribution to the knowledge on the amphibian fauna of high-elevation forests in an area that is still poorly studied, with scattered information on the diversity and composition of frog assemblages. The fact that new species have been discovered at Theodoro de Oliveira during our fieldwork (including the recently described *H. pholeter*) reinforces this idea. We believe that the relatively high anuran richness (considering the relatively small area surveyed), the presence of species restricted to high-altitude habitats (including a few endemics of the Serra dos Órgãos region), and the occurrence of rare and of currently undescribed species makes Theodoro de Oliveira an area of great biodiversity relevance within the PETP.

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Appendix. Voucher specimens of the species recorded in the present study deposited at the Museu Nacional, Rio de Janeiro (MNRJ).

Aplastodiscus arildae: MNRJ 51867, MNRJ 53879, MNRJ 60199; *Aplastodiscus leucopygius*: MNRJ 60200, MNRJ 64589-91; *Bokermannohyla carvalhoi*: MNRJ 51489, MNRJ 66150-1, MNRJ 66154; *Bokermannohyla circumdata*: MNRJ 51490, MNRJ 56487-94; *Brachycephalus didactylus*: MNRJ 56514-15; *Brachycephalus garbeanus*: MNRJ 57124, MNRJ 57293; *Brachycephalus* sp.: MNRJ 51470-1, MNRJ 56504-13, MNRJ 56516, MNRJ 66543; *Dendrophriniscus* cf. *brevipollicatus*: MNRJ 58300-2, MNRJ 60700; *Dendropsophus minutus*: MNRJ 51875; *Flectonotus fissilis*: MNRJ 56942, MNRJ 67316; *Flectonotus* sp.: MNRJ 62845, MNRJ 64646; *Gastrotheca albolineata*: MNRJ 56528; *Gastrotheca ernestoi*: MNRJ 57129; *Haddadus binotatus*: MNRJ 51866, MNRJ 55479; *Holoaden pholeter*: MNRJ 51475 (holotype), MNRJ 53482-3 (paratypes), MNRJ 57242; *Hylodes charadranaetes*: MNRJ 59032-3, MNRJ 59061-2, MNRJ 59174-6, MNRJ 60159-61, MNRJ 68693-6; *Hypsiboas polytaenius*: MNRJ 51873-4; *Ischnocnema erythromera*: MNRJ 51868-72; *Ischnocnema guentheri*: MNRJ 57207, MNRJ 57288, MNRJ 60172, MNRJ 60178-9, MNRJ 66566; *Ischnocnema* cf. *holti*: MNRJ 51474, MNRJ 57251, MNRJ 57308-9, MNRJ 67511-3, MNRJ 68690, MNRJ 68940; *Ischnocnema parva*: MNRJ 55455, MNRJ 55480, MNRJ 66344-5; *Ischnocnema* sp. (gr. *lactea*): MNRJ 60164-6; *Myersiella microps*: MNRJ 66222-3; *Proceratophrys boiei*: MNRJ 64582; *Proceratophrys melanopogon*: MNRJ 51360-3, MNRJ 64229; *Rhinella* gr.*crucifer*: MNRJ 51857-8; *Scinax albicans*: MNRJ 51488, MNRJ 61212; *Scinax flavoguttatus*: MNRJ 51481-2; *Scinax fuscovarius*: MNRJ 57298; *Scinax* cf. *obtriangulatus*: MNRJ 66346; *Scinax* cf. *perereca*: MNRJ 65771-2; *Scinax v-signatus*: MNRJ 53880-1, MNRJ 56495-6; *Zachaenus parvulus*: MNRJ 55452-4.