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Thiago Arnt Dorigo[1], Carla Costa Siqueira[1,2], Jane Célia Ferreira Oliveira[1], Luciana Ardenghi Fusinatto[1], Manuela Santos-Pereira[1], Marlon Almeida-Santos[1]& Carlos Frederico Duarte Rocha[1]

[1]Departamento de Ecologia, Instituto de Biologia Roberto de Alcantara Gomes, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier 524, Maracanã, 20550-019, Rio de Janeiro, Rio de Janeiro, Brasil

[2] Corresponding author: Carla Costa Siqueira, e-mail: carlacsiqueira@yahoo.com.br

ORCID

Thiago Arnt Dorigo: https://orcid.org/0000-0002-8742-2366

Carla Costa Siqueira: https://orcid.org/0000-0002-5518-7090

Jane Célia Ferreira Oliveira: https://orcid.org/0000-0001-5084-1420

Luciana Ardenghi Fusinatto: https://orcid.org/0000-0001-9354-1698

Manuela Santos-Pereira: https://orcid.org/0000-0001-5819-8249

Marlon Almeida-Santos: https://orcid.org/0000-0001-5222-2092

Carlos Frederico Duarte Rocha: https://orcid.org/0000-0003-3000-1242

DORIGO T. A., SIQUEIRA C. C., OLIVEIRA J. C. F., FUSINATTO L. A., SANTOS-PEREIRA M., ALMEIDA-SANTOS M., ROCHA C. F. D. **Amphibians and reptiles from the Parque Nacional da Tijuca, Brazil, one of the world's largest urban forests**. Biota Neotropica.

Abstract: The Parque Nacional da Tijuca in Rio de Janeiro, Brazil, is considered to be one of the world's largest urban forests, however no systematic inventory of its herpetofauna is available. In the present study, we surveyed the amphibians and reptiles of this park to assess its species composition (including secondary data) and obtain estimates of species richness and abundance. We conducted active searches (460 hours) between January 2013 and December 2015. We identified the taxa endemic to either the Atlantic Forest or Rio de Janeiro state, and verified the conservation status of each species in the international, Brazilian, and state red lists. We also estimated the species richness and sampling sufficiency by rarefaction curves and Bootstrap richness estimator, and analyzed the distribution of the species abundance in Whittaker plots. We recorded 3,288 individuals over 36 months, representing 24 species of amphibians and 25 reptiles. The cumulative species curves, rarefaction, and the richness estimated indicated that sampling effort was adequate. Species abundance adjusted to the log-series model in both amphibians and reptiles. The four most abundant amphibians represented 70% of the individuals recorded in this group, while the two most abundant reptiles represented 60% of the total individuals. The inclusion of the secondary data raised the number of amphibian species to 38, and the number of reptiles to 36. Approximately 80% of the amphibian species and 28% of the reptile species recorded are endemic to the Atlantic Forest, and six of the amphibian species are endemic to Rio de Janeiro state. Six amphibian species and one reptile specie are classified under some threat of extinction, and two reptile species were exotic. The considerable diversity of the herpetofauna of the Parque Nacional da Tijuca, which includes endemic and threatened species, reflects the effectiveness of the reforestation of this protected area and emphasizes the importance of its conservation.
Keywords**:** *Atlantic Rainforest, Conservation, Endemism, Herpetofauna, Inventory.*

Anfíbios e répteis do Parque Nacional da Tijuca, Brasil, uma das maiores florestas urbanas do mundo

Resumo: O Parque Nacional da Tijuca, no Rio de Janeiro, Brasil, é considerado uma das maiores florestas urbanas do mundo, no entanto nenhum inventário sistemático de sua herpetofauna esteja disponível. No presente estudo, pesquisamos os anfíbios e répteis deste parque para acessar sua composição de espécies (incluindo dados secundários) e obter estimativas da riqueza e da abundância de espécies. Realizamos buscas ativas (460 horas) entre janeiro de 2013 e dezembro de 2015. Identificamos os taxa endêmicos da Mata Atlântica ou do estado do Rio de Janeiro, e verificamos o status de conservação de cada espécie nas listas vermelhas internacional, brasileira e estadual. Também estimamos a riqueza de espécies e a suficiência amostral através de curvas de rarefação e do estimador de riqueza Bootstrap, e analisamos a distribuição de abundância das espécies através de *plots* de Whittaker. Registramos 3.288 indivíduos ao longo dos 36 meses, representando 24 espécies de anfíbios e 25 de

répteis. As curvas cumulativas de espécies, a rarefação, e a riqueza estimada indicaram que o esforço amostral foi adequado. A abundância das espécies se ajustou ao modelo de série logarítmica tanto para os anfíbios como para os répteis. As quatro espécies de anfíbios mais abundantes representaram 70% dos indivíduos registrados neste grupo, enquanto as duas espécies de répteis mais abundantes representaram 60% do total de indivíduos. A inclusão dos dados secundários elevou o número de espécies de anfíbios para 38 e o de répteis para 36. Aproximadamente 80% dos anfíbios e 28% dos répteis registrados são endêmicos da Mata Atlântica e seis espécies de anfíbios são endêmicos do estado do Rio de Janeiro. Seis espécies de anfíbios e uma de réptil estão classificadas sob alguma ameaça de extinção, e dois répteis constituem espécies exóticas. A considerável diversidade da herpetofauna do Parque Nacional da Tijuca, que inclui espécies endêmicas e ameaçadas, reflete a efetividade do reflorestamento dessa área protegida e enfatiza a importância de sua conservação.
Palavras-Chave**:** *Mata Atlântica, Conservação, Endemismo, Herpetofauna, Inventário.*

Introduction

The Brazilian Atlantic Forest biome is one of the world's biodiversity hotspots (Myers et al. 2000), although it has now been reduced to only around 12% of its original cover as a result of centuries of intense deforestation (Ribeiro et al. 2011, SOS Mata Atlântica, INPE 2018). Approximately 625 amphibian species (Haddad et al. 2013, Rossa-Feres et al. 2017) and 300 reptiles (Tozetti et al. 2017) are known to occur in this biome, and new species are still being steadily described (e.g., Cruz et al. 2019, Maciel et al. 2019, Prates et al. 2019). In the state of Rio de Janeiro, 201 species of amphibian have been recorded, including 197 anurans and four caecilians (Dorigo et al. 2018), together with 149 reptiles (Oliveira et al. 2020). This state has a high rate of endemism of both amphibians (Dorigo et al. 2018, Rossa-Feres et al. 2017) and reptiles (Tozetti et al. 2017), and its metropolitan region is considered to be an important area for the conservation of Brazilian biodiversity (Oliveira et al. 2019).

The state capital, Rio de Janeiro, which has a population of more than six million inhabitants, includes one of the world's largest urban parks, the Parque Nacional da Tijuca (PNT), which is the only Brazilian national park located within an urban zone. Like other coastal ranges within the Atlantic Forest domain, the Tijuca massif has a rich network of water courses (Coelho Netto 2005), which favors the occurrence of amphibians. During the 18th and 19th centuries, however, the forest of this area was almost totally destroyed for the production of charcoal, and the establishment of sugarcane and coffee plantations (Rocha et al. 2003, Rocha 2017). As a result, many of the water sources that supplied the city began to dry up (Abreu & Rodrigues 2010, Rocha 2017). It seems likely that fragments of forest persisted in many of the more inaccessible areas within the Tijuca massif, in particular, the highest mountain peaks and the steepest valleys (Coimbra-Filho et al. 1973). In addition to providing seeds of native species for the subsequent reforestation of the area (Coimbra-Filho et al. 1973, Abreu & Rodrigues 2010), these forest remnants probably also provided important refuges for many local animal species (e.g., Rocha et al. 2003). The deforested areas once covered by plantations were almost completely reconstituted by a reforestation project – the first major project of its kind anywhere in the world – which involved the planting of 100,000 trees, beginning in the second half of the 19th century during the Brazilian Empire period. This initiative resulted in the establishment of an exuberant forest, which was converted into a national park in 1961 (Brasil 1961).

In addition to the PNT, two other large parks are found within the urban zone of Rio de Janeiro – the Parque Estadual da Pedra Branca and the Parque Natural Municipal da Serra do Mendanha (PNM Serra do Mendanha). The PNT has a long history of scientific research, first being visited by naturalists during the 19th and 20th centuries. These naturalists described a number of amphibian species based on specimens collected in this area, including *Aplastodiscus albofrenatus* (Lutz, 1924), *Dendrophryniscus brevipollicatus* Jiménez de la Espada 1870, *Ischnocnema guentheri* (Steindachner, 1864), *Ischnocnema octavioi* (Bokermann, 1965), *Phasmahyla guttata* (Lutz, 1924), and *Scinax trapicheiroi* (A. Lutz and B. Lutz, 1954). More recently, herpetofaunal researches in the park included studies of the ecology, natural history or bioacoustics of some taxa (e.g., Heyer 1973, Hepp & Carvalho-e-Silva 2011, Dorigo et al. 2014, Machado et al. 2016, Hepp et al. 2017, Silva-e-Souza 2019, Guarabyra et al. 2020). Introductory lists of amphibian species (Carvalho-e-Silva et al. 2008) and reptiles (Mocelin 2008) were compiled for the management plan of this conservation unit (ICMBIO 2008), although, up to the present time, no systematic inventory has been produced. Given this, we inventoried the herpetofauna of the PNT over a three-year period, using intensive sampling to obtain species composition and estimates of the richness and abundance of the park's amphibians and reptiles. We supplemented our inventory with records of occurrence obtained from herpetological collections and species reintroduction programs in PNT.

Material and Methods

Study Area

The Parque Nacional da Tijuca (22º55'–23º00' S, 43º11'–43º19' W) is located in the Tijuca massif in the city of Rio de Janeiro, capital of the state of Rio de Janeiro, southeastern Brazil. The park covers a total area of 3,958.38 hectares of dense ombrophilous forest at altitudes between 80 m and 1,021 m above sea level (a.s.l.). The park is divided officially into four sectors (ICMBIO 2008): Sector A – the Tijuca Forest, Sector B – the Carioca Mountains, Sector C – Pedra Bonita/Pedra da Gávea, and Sector D – Pretos-Forros/Covanca (Figure 1). The landscape of the park encompasses a range of land uses and vegetation cover, from forest encompassing distinct stages of succession, to open fields, rocky outcrops, as well as infrastructure, such as buildings and roads (Coelho Netto 2005).

The climate is of the *Aw* type (humid tropical) in the Köppen classification, with intense rains during the austral summer and drier conditions during the winter. Mean monthly temperatures range from 25°C in February to 19°C in June, with an annual mean of approximately 22°C. Annual precipitation is typically between 2,000 and 2,500 mm, although it may reach 3,300 mm in exceptionally rainy years (Coelho Netto 2005, ICMBIO 2008).

Data collection

We searched for amphibians and reptiles in the Sector A of the park over a 36-month period, between January 2013 and December 2015, at altitudes between 400 m and 800 m a.s.l. The searches were based on the Visual Encounter Survey (VES) method of Crump & Scott (1994), and resulted in a total sampling effort of 460 person-hours, with 230 hours of diurnal and 230 hours of nocturnal searches. When conducting an active search, always two researchers moved through the forest searching systematically for amphibians and reptiles in

microhabitats such as streams, ponds, bromeliads, the leaf litter, tree trunks, and rocks. The searches were conducted only in a single direction, to avoid the resampling of individuals, thus guaranteeing the independence of the records. All individuals encountered during searches were captured, identified, and most of them released at the capture site. We collected voucher specimens, which we deposited in the herpetological collection of the Museu Nacional (MNRJ), Universidade Federal do Rio de Janeiro (voucher number in Appendix 1). We complemented our inventory with secondary records, which included data from herpetological collections (Appendix 2), and from a faunal reintroduction project for the PNT. We applied the scientific nomenclature proposed by Frost (2020) for the amphibian species. For the reptiles, we used the nomenclature of Costa and Bérnils (2018), which we updated whenever necessary, based on Poe et al. (2017) and Hoogmoed et al. (2019).

Data analysis

We calculated rarefaction curves and confidence intervals (95%) with the moment-based estimator of species richness (Colwell et al. 2004) to verify the efficiency of the sampling effort in terms of the number of species recorded during the study for both amphibians and reptiles. For this analysis, one hour of VES constituted a sampling unit, with a total of 460 samples being obtained during the study period as a whole. We considered the convergence of the confidence intervals to zero as an indicator of sampling sufficiency (Colwell et al. 2004). We also estimated the number of species and standard deviation with the Bootstrap richness estimator (Smith & van Belle 1984) with 1,000 runs. Both the rarefaction curves and Bootstrap were calculated in the program EstimateS 8.2.0 (Colwell 2009). We analyzed the distribution of the species abundance, using rank abundance curves or Whittaker plots (Whittaker 1965), which show the ranked log abundance of each species (Krebs 1999). We analyzed these plots in PAST 2.17 (Hammer et al. 2001).

Species endemism in the Atlantic Forest was defined for the amphibians based on Lingnau et al. (2008), Haddad et al. (2016), and Frost (2020), and for reptiles according to Tozetti et al. (2017). We defined the conservation status of each species based on the IUCN Red List (IUCN 2020), the Red List of Threatened Brazilian Fauna (ICMBIO 2018), and the List of the Threatened Fauna of Rio de Janeiro state (Bergallo et al. 2000). The population trend for each species was obtained from IUCN (2020).

Results

We recorded a total of 74 species of herpetofauna (distributed in four orders), being 38 amphibians (37 anurans and one caecilian; Table 1) and 36 reptiles (three chelonians, one amphisbaenian, nine lizards, and 23 snakes; Table 2) at the PNT. Hylidae was the amphibian family with the highest species richness (N = 10 species), followed by Brachycephalidae (N = 5) and Cycloramphidae (N = 5) (Table 1). With the exception of Gymnophthalmidae, with two species, all lizard families were represented by only a single species. The snake family Dipsadidae was represented by 14 species, and Colubridae by five (Table 2). During our field surveys we recorded a total of 3,288 individuals in Sector A of the Parque Nacional da Tijuca, during the 36 months of the study period, representing a total of 49 species. Most (3,174) of these individuals were amphibians (Table 1), belonging to 24 species of the orders Anura (N = 23 species) and Gymnophiona (N = 1) (Figures 2-4). We recorded only 114

reptiles, although these individuals also represented 25 species (Table 2), distributed in two orders, Chelonia (N = 2) and Squamata (N = 23) (Figures 5-7). Two of these amphibian species and 11 of the reptiles were recorded opportunistically during the study period (i.e., not during standardized surveys; Tables 1 and 2).

The cumulative curve for the amphibian species reached the asymptote at 213 hours of sampling with a total richness of 22 species, while the curve for the reptiles reached the asymptote at 276 hours, with a total of 14 species, based on a total sampling effort of 460 hours (Figure 8). The confidence intervals of the rarefaction curves converged to zero for the amphibians, but not for the reptiles, for which the error was estimated as 2.3 species (Figure 8). The species richness estimated by the Bootstrap procedure was similar to that recorded by the VES method for both amphibians (estimated richness = 22.4 species) and reptiles (estimated richness = 15.6 species).

The Whittaker plots (Figure 9) revealed considerable variation in the abundance of the amphibian and reptilian species, which was best adjusted using the log-series model. The most abundant amphibian species (Table 1) were *Ischnocnema parva* (N = 617 records; 19.4% of all amphibians), *Hylodes nasus* (N = 601; 18.9%), *Ischnocnema guentheri* (N = 544; 17.1%), and *Crossodactylus gaudichaudii* (N = 500; 15.8%). The most abundant reptiles were the lizards *Enyalius brasiliensis* (N = 55; 48.2% of all reptiles) and *Ecpleopus gaudichaudii* (N = 15; 13.2%), representing 61.4% of all the reptiles recorded during the surveys (Table 2). The most abundant snakes were *Bothrops jararacussu* (N = 8; 7.0% of all reptiles), *Thamnodynastes* cf. *nattereri* (N = 7; 6.1%), and *Bothrops jararaca* (N = 6; 5.3%).

Overall, 30 of the amphibian (ca. 80% of the total) and ten of the reptile species (28%) recorded in the PNT are endemic to the Atlantic Forest biome (Tables 1 and 2). Six of these amphibians – *Aplastodiscus albofrenatus*, *Dendrophryniscus brevipollicatus*, *Euparkerella brasiliensis*, *Hylodes nasus*, *Ischnocnema guentheri*, and *Scinax trapicheiroi* – are considered endemic to the state of Rio de Janeiro. Most of the amphibian and reptile species are listed as Least Concern or Not Threatened in the three lists of conservation status (international, Brazilian, and state). Six amphibian and one reptile species recorded in the PNT are listed under some category of extinction threat. The populations of 15 amphibian species are thought to be declining (Table 1). Two of the reptile species, the lizard *Hemidactylus mabouia* and the chelonian *Trachemys scripta* are exotic (Table 2).

Discussion

Biodiversity: species richness, composition, and abundance

The results of the present study indicate that the forests of the PNT harbor for a large proportion of the herpetofaunal diversity of the Atlantic Forest of the state of Rio de Janeiro. Considering both the records obtained during our fieldwork and from secondary data, the park's amphibian species richness would amount to at least 38 species, which represent 19% of the amphibians known to occur in the state (N = 201 species; Dorigo et al. 2018), 6% of the amphibian species from Atlantic Rainforest (N = 600; Rossa-Feres et al. 2017), and 3% of the amphibian fauna of Brazil (N = 1,136; Segalla et al. 2019). The combination of primary and secondary data also indicates the occurrence of 36 reptile species in the PNT, which represent 24% of the reptiles known to occur in the whole Rio de Janeiro state (N = 149; Oliveira et al. 2020), 12% of the species recorded in the Atlantic Rainforest (N = 300; Tozetti et al. 2017), and 4% of the country's reptilian diversity (N = 795 species; Costa & Bérnils 2018). When

considering the sampled area and the effort employed, the number of amphibian and reptile species recorded during surveys in PNT is consistent with the expected. In fact, the cumulative species curves for both groups reached the asymptote by around the middle of the study period, indicating that sampling effort was adequate in both cases. Similarly, while the confidence intervals of the rarefaction curves for the amphibians converged to zero, indicating sampling sufficiency, those calculated for the reptiles approached the convergence, with reduced estimated error.

In comparison with the PNM Serra do Mendanha − other substantial remnant of dense rainforest in the urban zone of Rio de Janeiro for which systematic medium-term data are available − the results of the present study are broadly consistent. Pontes et al. (2015) recorded 45 amphibians and 39 reptiles at PNM Serra do Mendanha, values closely comparable with the 38 amphibians and 36 reptiles we recorded at PNT. The amphibian species richness recorded in the PNT is also relatively high in comparison with other forested areas in the state of Rio de Janeiro for which data are available (Table 3). While the species richness recorded at the different sites fluctuates considerably, it seems likely that much of this variation is related to differences in survey methods, sampling effort, and the study period (Table 3).

The reptilian species richness recorded in the PNT was also relatively high in comparison with the data from other Atlantic Forest remnants in the state of Rio de Janeiro, as recorded in both short-term (Morro São João, Casimiro de Abreu, N = 9 species; Almeida-Gomes et al. 2008) and medium-term studies (Reserva Ecológica de Guapiaçu, N = 37 species; Almeida-Gomes et al. 2014a), and even the short-term study of Vrcibradic et al. (2011) at the Estação Ecológica Estadual do Paraíso, which reached a total of 29 species with the inclusion of secondary data.

Hylidae (N = 10) was the most diverse amphibian family in the PNT, followed by Brachycephalidae and Cycloramphidae, with five species. A similar predominance of hylids in the amphibian assemblage has been recorded not only at other Atlantic Forest sites (e.g., Heyer et al. 1990, Almeida-Gomes et al. 2014a, Silva et al. 2017), but also at other localities in the Neotropical region (e.g., Toft & Duellman 1979, Duellman 1988, Menin et al. 2017). The high diversity of hylids in South America has been explained by the fact that this region is considered to be the center of origin and diversification of this clade (Wiens et al. 2006).

With 14 species, Dipsadidae was the most diverse reptilian family in the PNT, which is consistent with the pattern typically found for the Squamata in Atlantic Forest remnants in the state of Rio de Janeiro (e.g., Pontes et al. 2009, Rocha et al. 2018, Martins et al. 2019). The family Dipsadidae, which is widely distributed in the Americas and West Indies (Hedges et al. 2009, Zaher et al. 2009, Grazziotin et al. 2012), includes the vast majority of the snakes of the Neotropical region, with more than 700 species (see Uetz et al. 2019).

The PNT and the PNM Serra do Mendanha (Pontes et al. 2015) shared 25 amphibian species (Sørensen index of similarity = 0.6; Magurran & McGill 2011) and 29 reptiles (= 0.8). Despite these similarities, 13 amphibian species were exclusive to the PNT, while 27 were exclusive to the Serra do Mendanha. Similarly, seven species of reptiles were exclusive to PNT and ten to the Serra do Mendanha. Similarities of the herpetofauna between these two areas would be accounted at least partly because they would have originally been part of a single continuous forest in the past, and can also be indicative of the effectiveness of the reforestation of the Tijuca massif, carried out during the 19th century (Rocha et al. 2003, Rocha 2017). However, the existence of a unique fauna in both areas

also reinforces the importance of the preservation of both forests for the protection of the herpetofauna of the Atlantic Forest in general.

The relative abundance of both amphibian and reptilian species in the PNT was adjusted to a log-series model, a pattern typical of communities of medium diversity, showing certain degree of equilibrium between the rare and dominant species (Magurran & McGill 2011). In this model, most species are relatively rare in comparison with the more abundant taxa (Magurran 2004). The four most abundant amphibian species (*I. parva*, *H. nasus*, *I. guentheri*, and *C. gaudichaudii*) contributed to around 70% of the total records of amphibians obtained in the park. The genus *Ischnocnema* belongs to the superfamily Brachycephaloidea (*sensu* Padial et al. 2014), which spawn on the moist forest floor and have direct development, so they do not depend on bodies of water for their breeding and development (Haddad & Prado 2005, Pombal & Haddad 2007). Species that have direct development tend to be dominant in leaf litter-dwelling anuran communities in Neotropical rainforests (e.g., Crump 1971, Allmon 1991, Donnelly 1994, Rocha et al. 2001, Siqueira et al. 2014). Two stream-dwelling frog species, *Hylodes nasus* and *C. gaudichaudii*, were the most abundant species recorded at the PNT. Hylodidae species are generally abundant in small streams in preserved Atlantic Rainforest areas (e.g., Weygoldt 1989, Patto & Pie 2001, Almeida-Gomes et al. 2008, Siqueira et al. 2011b).

The most abundant reptiles in the PNT were *Enyalius brasiliensis* and *Ecpleopus gaudichaudii*, and accounted for approximately 60% of the total reptilian abundance recorded in the present study. *Enyalius brasiliensis* is typical of forested environments, and was relatively abundant in the area in comparison with other forest remnants in the state of Rio de Janeiro, based on short-term (Morro São João; Almeida-Gomes et al. 2008) or mid-term studies (Guapiaçu Ecological Reserve; Almeida-Gomes & Rocha 2014a). *Ecpleopus gaudichaudii* is a Gymnophtalmidae endemic to the Atlantic Forest, which is typically a major component of local leaf-litter reptile communities (e.g., Dixo & Verdade 2006, Almeida-Gomes & Rocha 2014a, Cruz et al. 2014).

Two of the three most abundant snakes recorded during our surveys were members of the family Viperidae (*B. jararaca* and *B. jararacussu*), whose representatives are common in areas of mainland Atlantic Forest (Marques & Sazima 2004, Pontes et al. 2009). The Dipsadidae *Thamnodynastes* cf. *nattereri* was the second most abundant snake in the PNT, and was also one of the most abundant in the PNM Serra do Mendanha (Pontes et al. 2009).

Conservation: endemism, threat status, and exotic species

Most (ca. 80%) of the amphibian species recorded in the PNT are endemic to the Atlantic Forest (Rossa-Feres et al. 2017). This was somewhat expected, as that biome has a high degree of endemism for amphibians (Haddad et al. 2013). By contrast, only 28% of the reptilian species recorded are endemic to the Atlantic Forest, although this is also typical for this group (Tozetti et al. 2017). Six of the amphibians are also considered to be endemic to the state of Rio de Janeiro, including two (*H. nasus* and *I. guentheri*) that are endemic to the municipality of Rio de Janeiro. *Hylodes nasus* is known to be restricted to the forests of this municipality, and has, in fact, only been recorded, up to now, in the PNT (Nascimento et al. 2001, Lingnau et al. 2008) and the PNM Serra do Mendanha (Pontes et al. 2015). However, Canedo (2008) has analyzed specimens that may be associated with *H. nasus*, which were collected in the municipality of Volta Redonda, in the state of Rio de Janeiro, and also in

Cachoeiro de Itapemirim, in the state of Espírito Santo, although further research is required to confirm the identity of the taxon. *Ischnocnema guentheri* is currently considered to be a species complex (Kwet & Solé 2005, Gehara et al. 2013). Based on mitochondrial and nuclear sequences, combined with bioacoustic data, Gehara et al. (2013) identified *I. guentheri sensu stricto* as a lineage restricted to the PNT, although it seems likely that this form is also present in adjacent areas.

Overall, only six of the species recorded in the PNT (*Allobates olfersioides*, *Cycloramphus eleutherodactylus*, *Scinax trapicheiroi*, *Thoropa lutzi*, *Vitreorana eurygnatha*, and *V. uranoscopa*) are listed under some category of extinction threat (Bergallo et al. 2000, ICMBIO 2018, IUCN 2020), although the populations of 15 species are thought to be declining (IUCN 2020). Of these six species, we recorded only one, *S. trapicheiroi*, during our field surveys. However, although *S. trapicheiroi* is listed as Near Threatened by the IUCN due to its greatly reduced area of occurrence of less than 20,000 km^2 (Rodrigues & Carvalho-e-Silva 2004), it is assigned to the Least Concern category in the Brazilian red list (ICMBIO 2018). Verdade and Rodrigues (2007) allocated three other specific names for geographically widespread populations into synonymy of *Allobates olfersioides* (Lutz, 1925): *A. alagoanus* (Bokermann, 1967), *A. capixaba* (Bokermann, 1967), and *A. carioca* (Bokermann, 1967). According to this arrangement, *A. olfersioides* is widely distributed along much of the eastern coast of Brazil, between Rio de Janeiro and the state of Alagoas, 2,000 km to the north. However, Haddad et al. (2013) still considered these disconnected populations as different species: *A. olfersioides* in the state of Rio de Janeiro, *A. capixaba* in the states of Espírito Santo, and *A. alagoanus* in the state of Alagoas. The clarification of whether these populations are distinct species or lineages of the same species is essential (Forti et al. 2017). In their assessment of the conservation status of this amphibian, Haddad et al. (2016) considered only *A. carioca* to be a synonym of *A. olfersioides*, which restricted the species distribution to the metropolitan region of Rio de Janeiro. In this case, the reduction of the area of occurrence of the taxon to approximately 7,730 km², the lack of records from some localities, including the PNT, over the past 30 years, and the loss of habitat quality over this period has led to the classification of this species as Vulnerable in both the Brazilian red list (ICMBIO 2018) and that of the IUCN (2020).

Thoropa lutzi is classified as Endangered by the IUCN (2020), but as Data Deficient in Brazil (ICMBIO 2018). This species is known to occur only in the states of Rio de Janeiro and Espírito Santo. Populations have not been observed in Rio de Janeiro over the past 30 years, however, including PNT (Sabbag et al. 2018). The other three species, *Cycloramphus eleutherodactylus*, *Vitreorana eurygnatha*, and *V. uranoscopa*, are listed only at the state level (Bergallo et al. 2000), as Presumably Threatened, and only *C. eleutherodactylus* is listed by the IUCN (2020), as Data Deficient. *Cycloramphus eleutherodactylus* is known to occur in the Brazilian states of Paraná, São Paulo, Rio de Janeiro, and Minas Gerais (Rossa-Feres et al. 2017, Santos-Pereira et al. 2018), although some studies have reported its disappearance by the beginning of the 20th century (Izecksohn & Carvalho-e-Silva 2001, Eterovick et al. 2005). We did not collect *C. eleutherodactylus* during fieldwork and it has not been found at PNT since 1972 (Matos 2011). Nevertheless, Lima *et al.* (2012) concluded that this species may be relatively abundant in some cave environments, and emphasized the importance of including these habitats in amphibian inventories.

Hylodidae species of three genera, *Crossodactylus*, *Hylodes* and *Megaelosia*, are rheophilic and endemic to the Atlantic Forest (Laia & Rocha 2012), where they are typically found in well-preserved forest fragments (e.g.,

Santos-Pereira et al. 2016, Malagoli et al. 2017). These species are strongly associated with this type of environment, and depend on streams throughout their life cycle (eggs, tadpoles, and adults), being thus vulnerable to the loss of riparian forest (Almeida-Gomes et al. 2014b). These anurans are particularly relevant to conservation initiatives, given that their effective area of occupation is normally restricted to water courses, a minor fraction of the total area of most forests, which makes them especially vulnerable to extinction (Almeida-Gomes et al. 2014b).

Only one of the reptiles recorded in the present study, the tortoise *Chelonoidis denticulatus*, is considered to be under some threat of extinction, being classified as Vulnerable by the IUCN (2020), although it is considered to be Least Concern in Brazil (ICMBIO 2018). The occurrence of *Chelonoidis denticulatus* was recorded in the Atlantic Forest of Rio de Janeiro in 1820 by Prince Maximilian zu Wied-Neuwied, who found carapaces of this species on the sandy plains in the north of the municipality of Cabo Frio (Vanzolini 1994, Vargas-Ramírez et al. 2010, Vanzolini & Myers 2015). While *C. denticulatus* was originally recorded in the Atlantic Forest, it appears to have been eradicated subsequently from the forests of eastern Brazil (Vanzolini & Myers 2015). This species is being reintroduced into the PNT by the Refauna Project (Refauna 2019).

One important question that has yet to be answered regards the original occurrence of the tortoise *Chelonoidis carbonarius* in the state of Rio de Janeiro. This species was originally described by Spix (1824) from specimens obtained from the region of the Amazon River. Pritchard and Trebbau (1984), Vanzolini (1994), Ernst and Leuteritz (1999) and Vargas-Ramírez et al. (2010) described the geographic distribution of the species in Brazil, and in particular, indicated its absence in the state of Rio de Janeiro. While a number of studies have indicated the presence (e.g., Rocha et al. 2004, Köhler 2008) or possible occurrence (Tozetti et al. 2017) of *C. carbonarius* in Rio de Janeiro, it is difficult to establish whether this region was part of the original distribution of the species, or whether its occurrence in the region (if confirmed) is due to the deliberate release into the wild of animals raised as pets or for food.

Two of the species of the herpetofauna recorded in the PNT – *Hemidactylus mabouia* and *Trachemys scripta* – are exotic invaders. The house gecko, *H. mabouia*, was originally introduced into Brazil from Africa during the colonial period, and has since expanded its area of distribution considerably in the country's natural environments (Rocha & Bergallo 2011, Telles et al. 2015, Oliveira et al. 2016, Winck et al. 2017). *Hemidactylus mabouia* was observed in the built-up areas of the PNT, which is typical of its occurrence at other localities (Rocha et al. 2011, Oliveira et al. 2016). The presence of this lizard in the vicinity of the park's natural habitats demands special attention due to the potential for the species to become invasive (Rocha et al. 2011).

The pond slider, *Trachemys scripta*, was originally found in the southern United States and northern Mexico, but since the 1970s, large numbers have been raised in the United States for the pet trade, and this resulted in the introduction of the species in many places around the world (e.g., Ramsay et al. 2007, van Dijk et al. 2011). The presence of *T. scripta* in natural environments has negative impacts on the native freshwater turtles (e.g., Cadi & Joly 2004, Hidalgo-Vila et al. 2009). *Trachemys scripta* has been recorded in disturbed areas within the PNT, probably as the result of intentional release of animals raised as pets. It is still unclear whether this exotic species has established a viable population in the state of Rio de Janeiro (Oliveira et al. 2020).

A number of amphibian and reptile species of interest occur in the PNT, including those endemics to either the Atlantic Forest or to Rio de Janeiro state and/or municipality, those under some threat of extinction, and those with declining populations. The presence of all those taxa reinforces the importance of the park for the conservation of the region's herpetofauna. The considerable diversity of reptiles and amphibians found in the PNT also testifies to the success of the reforestation program of this protected area, which now provides an important refuge for species of both groups. The results of our inventory, which recorded a total of 74 species, constitute the first comprehensive published overview of the composition and abundance of the herpetofauna of the Parque Nacional da Tijuca.

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Author Contributions

Thiago Arnt Dorigo: Substantial contribution in the concept and design of the study; contribution to data collection; contribution to data analysis and interpretation; contribution to manuscript preparation; contribution to critical revision, adding intellectual content.

Carla Costa Siqueira: Substantial contribution in the concept and design of the study; contribution to data analysis and interpretation; contribution to manuscript preparation; contribution to critical revision, adding intellectual content.

Jane Célia Ferreira Oliveira: Substantial contribution in the concept and design of the study; contribution to data analysis and interpretation; contribution to manuscript preparation; contribution to critical revision, adding intellectual content.

Luciana Ardenghi Fusinatto: Substantial contribution in the concept and design of the study; contribution to manuscript preparation; contribution to critical revision, adding intellectual content.

Manuela Santos-Pereira: Substantial contribution in the concept and design of the study; Contribution to data analysis and interpretation; contribution to manuscript preparation; contribution to critical revision, adding intellectual content.

Marlon Almeida-Santos: Substantial contribution in the concept and design of the study; contribution to data analysis and interpretation; contribution to manuscript preparation; contribution to critical revision, adding intellectual content.

Carlos Frederico Duarte Rocha: Substantial contribution in the concept and design of the study; contribution to data analysis and interpretation; contribution to manuscript preparation; contribution to critical revision, adding intellectual content.

Conflicts of interest

The authors declare that they have no conflict of interest related to the publication of this manuscript.

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Table 1. Amphibian species recorded in Parque Nacional da Tijuca in the municipality of Rio de Janeiro, state of Rio de Janeiro, southeastern Brazil, with data on total abundance (Ab; number of records) and relative abundance (RA; percentage of all recorded amphibians) for the species recorded during the Visual Encounter Surveys are given. Other information include: the conservation status of each species based on their category of threat in the international (IUCN 2020), Brazilian (ICMBIO/MMA 2018), and Rio de Janeiro (RJ) state lists (Bergallo et al. 2000); whether they are endemic (End) to the Atlantic Forest (AF) or to Rio de Janeiro state (RJ) or exotic (Ex); their population trend (PT; IUCN 2020); and Sectors of PNT (ICMBIO 2008) where each species was recorded based on primary (P; see Appendix 1) or secondary (S; see Appendix 2) data. * Species recorded in non-standardized encounters. Conservation status: DD = Data Deficient, LC = Least Concern, VU = Vulnerable, EN = Endangered, and PA = Presumably Threatened ("Presumivelmente Ameaçada"). Population trend: D = Decreasing; St = Stable; U = Unknown.

TAXA	Ab (RA)	Category of threat			End / Ex		PT	Sectors			
		Global	National	RJ	AF	RJ		A	B	C	D
ANURA											
Aromobatidae											
Allobates olfersioides (A. Lutz, 1925)	-	VU	VU	PA	End		D	S			S
Brachycephalidae											
Brachycephalus didactylus (Izecksohn, 1971)	9 (0.3)	LC	LC	-	End		D	P, S			
Brachycephalus ephippium (Spix, 1824)	158 (5.0)	LC	LC	-	End		St	P, S	S		
Ischnocnema guentheri (Steindachner, 1864)	544 (17.1)	LC	LC	-	End	End	St	P, S	S		
Ischnocnema octavioi (Bokermann, 1965)	6 (0.2)	LC	LC	-	End		D	P	S	S	
Ischnocnema parva (Girard, 1853)	617 (19.4)	LC	LC	-	End		D	P, S	S		
Bufonidae											
Dendrophryniscus brevipollicatus Jiménez de la Espada, 1870	15 (0.5)	LC	LC	-	End	End	St	P, S			
Rhinella ornata (Spix, 1824)	15 (0.5)	LC	LC	-	End		U	P, S	S		
Centrolenidae											
Vitreorana eurygnatha (A. Lutz, 1925)	-	LC	LC	PA	End		D	S	S		
Vitreorana uranoscopa (Müller, 1924)	-	LC	LC	PA			D	S	S		

Craugastoridae											
Euparkerella brasiliensis (Parker, 1926)	76 (2.4)	LC	LC	-	End	End	D	P, S	S	S	
Haddadus binotatus (Spix, 1824)	328 (10.3)	LC	LC	-	End		St	P, S	S	S	
Cycloramphidae											
Cycloramphus eleutherodactylus (Miranda-Ribeiro, 1920)	-	DD	LC	PA	End		U		S		
Cycloramphus fuliginosus Tschudi, 1838	-	LC	DD		End		D	S	S		
Thoropa lutzi Cochran, 1938	-	EN	DD	PA	End		D		S		
Thoropa miliaris (Spix, 1824)	8 (0.3)	LC	LC	-	End		St	P, S	S	S	
Zachaenus parvulus (Girard, 1853)	29 (0.9)	LC	LC	-	End		D	P, S	S		
Hemiphractidae											
Fritziana goeldii (Boulenger, 1895)	1 (0.1)	LC	LC	-	End		St	P, S	S		
Hylidae											
Aplastodiscus albofrenatus (A. Lutz, 1924)	46 (1.4)	LC	LC	-	End	End	St	P, S	S	S	
Boana albomarginata (Spix, 1824)*	-	LC	LC	-	End		St	P, S	S		
Boana faber (Wied-Neuwied, 1821)	-	LC	LC	-			St	S	S		
Bokermannohyla circumdata (Cope, 1871)	32 (1.0)	LC	LC	-	End		D	P, S	S		
Dendropsophus elegans (Wied-Neuwied, 1824)	-	LC	LC	-			St		S		
Dendropsophus minutus (Peters, 1872)	-	LC	LC	-			St	S	S		
Scinax cuspidatus (A. Lutz, 1925)	-	LC	LC	-	End		St	S	S		
Scinax fuscovarius (A. Lutz, 1925)*	-	LC	LC	-			St	P, S	S		
Scinax perpusillus (A. Lutz and B. Lutz, 1939)	10 (0.3)	LC	LC	-	End		St	P	S		
Scinax trapicheiroi (A. Lutz and B. Lutz, 1954)	47 (1.5)	NT	LC	-	End	End	D	P, S	S	S	
Hylodidae											
Crossodactylus gaudichaudii Duméril and Bibron, 1841	500 (15.8)	LC	LC	-	End		D	P, S	S	S	
Hylodes nasus (Lichtenstein, 1823)	601 (18.9)	LC	LC	-	End	End	D	P, S	S	S	S
Leptodactylidae											

Adenomera marmorata Steindachner, 1867	13 (0.4)	LC	LC	-		St	P, S	S		S
Leptodactylus latrans (Steffen, 1815)	-	LC	LC	-		St		S		
Physalaemus signifer (Girard, 1853)	6 (0.2)	LC	LC	-	End	St	P, S	S		
Microhylidae										
Myersiella microps (Duméril and Bibron, 1841)	-	LC	LC	-	End	St	S	S		
Odontophrynidae										
Proceratophrys boiei (Wied-Neuwied, 1824)	-	LC	LC	-	End	St	S	S		
Phyllomedusidae										
Phasmahyla guttata (Lutz, 1924)	108 (3.4)	LC	LC	-	End	D	P, S	S		
Phyllomedusa burmeisteri Boulenger, 1882	-	LC	LC	-		St	S	S		S
GYMNOPHIONA										
Siphonopidae										
Siphonops hardyi Boulenger, 1888	5 (0.2)	LC	LC	-	End	St	P			

Table 2. Reptile species recorded in Parque Nacional da Tijuca in the municipality of Rio de Janeiro, state of Rio de Janeiro, southeastern Brazil, with data on total abundance (Ab; number of records) and relative abundance (RA; percentage of all recorded amphibians) for the species recorded during the Visual Encounter Surveys are given. Other information include: the conservation status of each species based on their category of threat in the international (IUCN 2020), Brazilian (ICMBIO/MMA 2018), and Rio de Janeiro (RJ) state lists (Bergallo et al. 2000); whether they are endemic (End) to the Atlantic Forest (AF) or to Rio de Janeiro state (RJ), or exotic (Ex); their population trend (PT; IUCN 2020); and Sectors of PNT (ICMBIO 2008) where each species was recorded based on primary (P; see Appendix 1) or secondary (S; see Appendix 2) data. * Species recorded in non-standardized encounters. **Visual record only (no specimens collected). *** Refauna Project (Refauna 2019). Conservation status: NE = Not Evaluated, DD = Data Deficient, LC = Least Concern, VU = Vulnerable, EN = Endangered, and PA = Presumably Threatened ("Presumivelmente Ameaçada"). Population trend: D = Decreasing, I = Increasing, St = Stable, U = Unknown or Unspecified.

TAXA	Ab (RA)	Category of threat			End / Ex		PT	Sectors			
		Global	National	RJ	AF	RJ		A	B	C	D
CHELONIA											
Emydidae											
Trachemys scripta (Thunberg in Schoepff, 1792)*	-	LC	-	-	Ex	Ex	St	P**			
Testudinidae											
Chelonoidis carbonarius (Spix, 1824)*	-	-	LC	-			-	P**			
Chelonoidis denticulatus (Linnaeus, 1766)	-	VU	LC	-			Unsp	S***			
SQUAMATA											
AMPHISBAENIA											
Família Amphisbaenidae											
Leposternon microcephalum Wagler, 1824*	-	-	LC	-			Unk	P			
LACERTILIA											
Dactyloidae											
Anolis punctatus Daudin, 1802*	-	LC	-	-			Unk	P**	S		
Gekkonidae											

Hemidactylus mabouia (Moreau de Jonnès, 1818)*	-	-	-	-	Ex	Ex	-	P**, S	S
Gymnophthalmidae									
Ecpleopus gaudichaudii Duméril and Bibron, 1839	15 (13.2)	LC	LC	-	End		Unk	P, S	S
Placosoma glabellum (Peters, 1870)*	-	LC	LC	-	End		Unk	P	
Leiosauridae									
Enyalius brasiliensis (Lesson, 1830)	55 (48.2)	LC	LC	-			Unk	P, S	S
Mabuyidae									
Psychosaura macrorhyncha (Hoge, 1946)*	-	LC	LC	-	End		Unk	P	
Phyllodactylidae									
Gymnodactylus darwinii (Gray, 1845)	1 (0.9)	LC	LC	-	End		Unk	P, S	S
Teiidae									
Salvator merianae Duméril and Bibron, 1839	4 (3.5)	LC	LC	-			St	P**, S	
Tropiduridae									
Tropidurus torquatus (Wied, 1820)*	-	LC	LC	-			Unk	P**	
SERPENTES									
Boidae									
Boa constrictor Linnaeus, 1758*	-	-	LC	-			-	P**	
Colubridae									
Chironius bicarinatus (Wied-Neuwied, 1820)	-	LC	LC	-			D	S	S
Chironius foveatus Bailey, 1955	5 (4.4)	LC	LC	-	End		Unk	P, S	
Chironius fuscus (Linnaeus, 1758)	-	LC	-	-			St	S	S
Spilotes pullatus (Linnaeus, 1758)	2 (1.8)	LC	LC	-			St	P**, S	
Spilotes sulphureus (Wagler, 1824)	-	LC	-	-			St		S
Dipsadidae									
Cercophis auratus (Schlegel, 1837)*	-	DD	-	-			Unk	P	
Dipsas indica Laurenti, 1768	2 (1.8)	LC	LC	-			St	P, S	

Echinanthera cephalostriata Di-Bernardo, 1996	2 (1.8)	LC	LC	-	End	Unk	P, S		S		
Echinanthera melanostigma (Wagler, 1824)	-	LC	LC	-		Unk	S				
Elapomorphus quinquelineatus (Raddi, 1820)	-	LC	LC	-		Unk	S	S	S		
Erythrolamprus miliaris (Linnaeus, 1758)	-	LC	LC	-		St	S	S		S	
Erythrolamprus poecilogyrus (Wied-Neuwied, 1825)	-	LC	-	-		I	S	S		S	
Philodryas olfersii (Lichtenstein, 1823)*	-	LC	LC	-		St	P**				
Siphlophis compressus (Daudin, 1803)	-	LC	-	PA		St	S				
Siphlophis pulcher (Raddi, 1820)	-	LC	LC	-		Unk	S	S			
Taeniophallus affinis (Günther, 1858)	5 (4.4)	LC	LC	-	End	Unk	P, S	S			
Taeniophallus persimilis (Cope, 1869)	-	LC	LC	-		Unk	S				
Thamnodynastes cf. *nattereri* (Mikan, 1828)	7 (6.1)	-	LC	-		-	P, S				
Xenodon neuwiedii Günther, 1863	1 (0.9)	LC	LC	-		Unk	P, S				
Elapidae											
Micrurus corallinus (Merrem, 1820)	1 (0.9)	LC	LC	-	End	Unk	P, S	S			
Viperidae											
Bothrops jararaca (Wied, 1824)	6 (5.3)	LC	LC	-	End	Unk	P, S	S			
Bothrops jararacussu Lacerda, 1884	8 (7.0)	LC	LC	-	End	Unk	P, S				

Table 3. The species richness (S) of amphibians recorded in forest remnants in the state of Rio de Janeiro, Brazil. The information provided is: location, municipality, sampling period, total effort employed in the visual survey (VES, in hours), quadrat (m^2), and pitfall trap methods (with the bucket volume in liters), other methods or sources used (OMS), and the respective reference. * Information on sampling period or effort was not available. PNM = Parque Natural Municipal, RPPN = Reserva Particular do Patrimônio Natural. In the pitfall trap column, BD = bucket-days, BH = bucket-hours. Other methods/sources included zoological collections [CC1 = Centro de Primatologia do Rio de Janeiro (CPRJ), CC2 = Coleção de Anfíbios da Universidade Federal do Estado do Rio de Janeiro (UNIRIO), CC3 = Coleção Eugenio Izecksohn da Universidade Federal Rural do Rio de Janeiro (EI), CC4 = Coleção de Anfíbios do Museu Nacional (MNRJ), CC5 = Coleção de Anfíbios do Departamento de Zoologia da Universidade Federal do Rio de Janeiro (ZUFRJ)], acoustic searches (AS), funnel traps for tadpoles (FT), tube traps (TT), and Management Plan (MP).

Local	**Municipality**	**Date**	**VES (h)**	**Quadrats (m^2)**	**Pitfall traps (liters)**	**OMS**	**S**	**Reference**
Reserva Ecológica de Guapiaçu	Cachoeiras de Macacu	Sep/2004, Jul/2007-Feb/2014	2631	4750	6600 BD (30 and 60)		73	Almeida-Gomes et al. 2014a
Centro Marista São José das Paineiras	Mendes	Apr/2009-Dec/2013	*			CC[2,3,4,5] AS, FT	51	Folly et al. 2014
PNM Taquara	Duque de Caxias	Sep/2006-Oct/2008, monthly	*				50	Salles et al. 2009
PNM Serra do Mendanha	Rio de Janeiro	2002-2014	*	*	*	AS, TT	45	Pontes et al. 2015
Espraiado, Serra do Mato Grosso	Maricá, Saquarema, Tanguá	Jan/2011-Dec/2012, monthly	411	180			44	Martins et al. 2014
Serra da Tiririca	Niterói e Maricá	Jul/2008-Jun/2010	435			CC[4]	42	Pontes & Pontes 2016
Parque Nacional da Tijuca	Rio de Janeiro	Jan/2013-Dec/2015	460			CC[4]	38	This study
Reserva Rio das Pedras	Mangaratiba	May/1997-Sep/2006	*				41	Carvalho-e-Silva et al. 2008
RPPN Campo Escoteiro Geraldo Hugo Nunes	Guapimirim	Nov/1983-2010	*			CC[2,3,4]	40	Silva-Soares et al. 2010

Caledônia, Parque Estadual dos Três Picos	Nova Friburgo	Mar/2008-Mar/2010	400				35	Siqueira et al. 2011b
Estação Ecológica Estadual do Paraíso	Guapimirim	Sep/2004	107	700	600 BD (30)	CC[1]	30	Vrcibradic et al. 2011
Parque Estadual do Cunhambebe	Itaguaí	Jan-Nov/2010	128				28	Ouvernay et al. 2012
Pedra do Sino, Parque Nacional da Serra dos Órgãos	Teresópolis	2009-2013, 15 days	*	*	*	AS	28	Folly et al. 2016
Floresta Nacional Mário Xavier	Seropédica	Feb/2010-Jan/2011, Apr/2012	416				26	Caram et al. 2016
Parque Estadual do Cunhambebe	Angra dos Reis	*	82		1440 BH (2)		21	Lima et al. 2014
Monte Verde	Cambuci	Sep/2006	75	750	450 BD (30)		20	Almeida-Gomes et al. 2010
Morro São João	Casimiro de Abreu	May-Jun/2005	60	750	450 BD (30)		16	Almeida-Gomes et al. 2008
Parque Estadual do Desengano	Santa Maria Madalena	May-Jun/2006, 11 days	75	750	330 (30)		13	Siqueira et al. 2011a

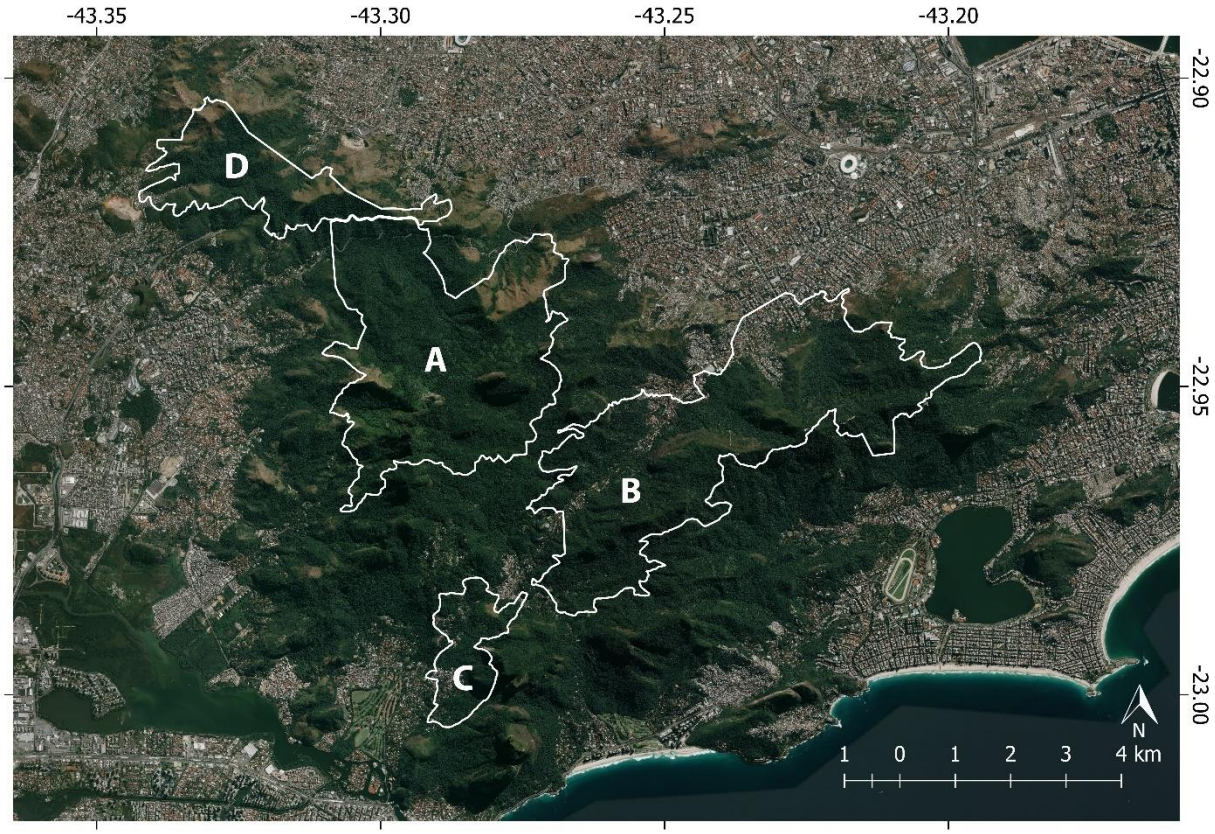

Figure 1. Location of Parque Nacional da Tijuca in the municipality of Rio de Janeiro, state of Rio de Janeiro, southeastern Brazil. The area of the park is divided officially into four sectors: A) Tijuca Forest; B) Carioca Mountains; C) Pedra Bonita/Pedra da Gávea; D) Pretos-Forros/Covanca. Map created with QGIS software (www.qgis.org), using a shapefile from ICMBIO (www.icmbio.gov.br).

Figure 2. Examples of the anurans recorded during the present study in the Parque Nacional da Tijuca, southeastern Brazil: A) *Brachycephalus didactylus*; B) *Brachycephalus ephippium*; C) *Ischnocnema guentheri*; D) *Ischnocnema octavioi*; E) *Ischnocnema parva*; F) *Dendrophryniscus brevipollicatus*; G) *Rhinella ornata*; H) *Euparkerella brasiliensis*. Photographs by T. A. Dorigo.

Figure 3. Examples of the anurans recorded during the present study in the Parque Nacional da Tijuca, southeastern Brazil: A) *Haddadus binotatus*; B) *Thoropa miliaris*; C) *Zachaenus parvulus*; D) *Fritziana goeldii*; E) *Aplastodiscus albofrenatus*; F) *Bokermannohyla circumdata*; G) *Boana albomarginata*; H) *Scinax perpusillus*. Photographs by T. A. Dorigo.

Figure 4. Examples of the amphibians recorded during the present study in the Parque Nacional da Tijuca, southeastern Brazil: A) *Scinax trapicheiroi*; B) *Phasmahyla guttata*; C) *Crossodactylus gaudichaudii*; D) *Hylodes nasus*; E) *Adenomera marmorata*; F) *Physalaemus signifer*; G) *Siphonops hardyi* (Gymnophiona). Photographs by T. A. Dorigo.

Figure 5. Examples of the reptiles recorded during the present study in the Parque Nacional da Tijuca, southeastern Brazil: A) *Trachemys scripta*; B) *Chelonoidis carbonarius*; C) *Hemidactylus mabouia*; D) *Ecpleopus gaudichaudii*; E) *Placosoma glabellum*; F) *Enyalius brasiliensis*; G) *Psychosaura macrorhyncha*; H) *Gymnodactylus darwinii*. Photograph by T. A. Dorigo.

Figure 6. Examples of the reptiles recorded during the present study in the Parque Nacional da Tijuca, southeastern Brazil: A) *Tropidurus torquatus*; B) *Chironius foveatus*; C) *Cercophis auratus*; D) *Dipsas indica*; E) *Echinanthera cephalostriata*; F) *Taeniophallus affinis*; G) *Thamnodynastes* cf. *nattereri*; H) *Xenodon neuwiedii*. Photograph by T. A. Dorigo.

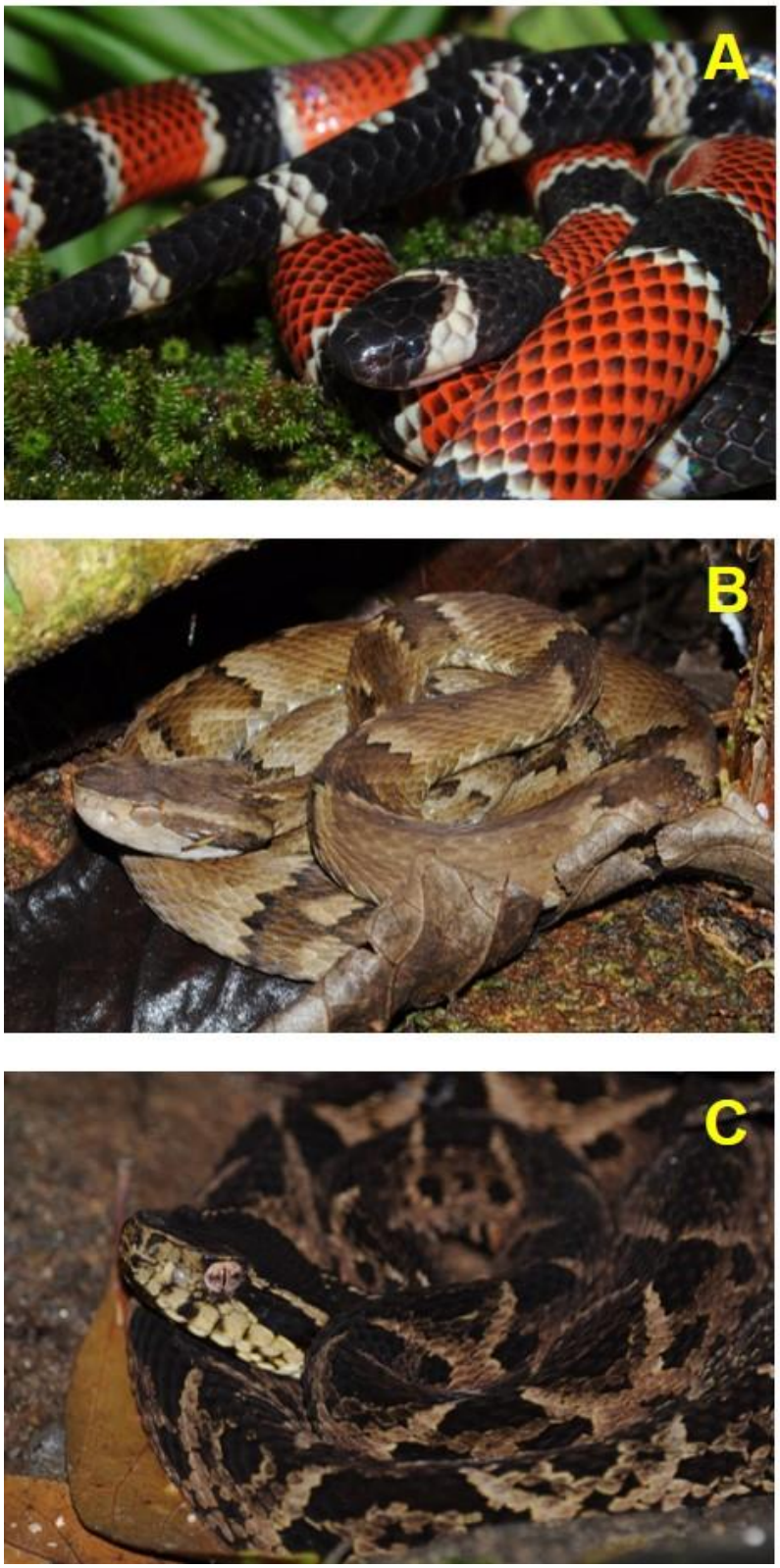

Figure 7. Examples of the reptiles recorded during the present study in the Parque Nacional da Tijuca, southeastern Brazil: A) *Micrurus corallinus*; B) *Bothrops jararaca*; C) *Bothrops jararacussu*. Photograph by T. A. Dorigo.

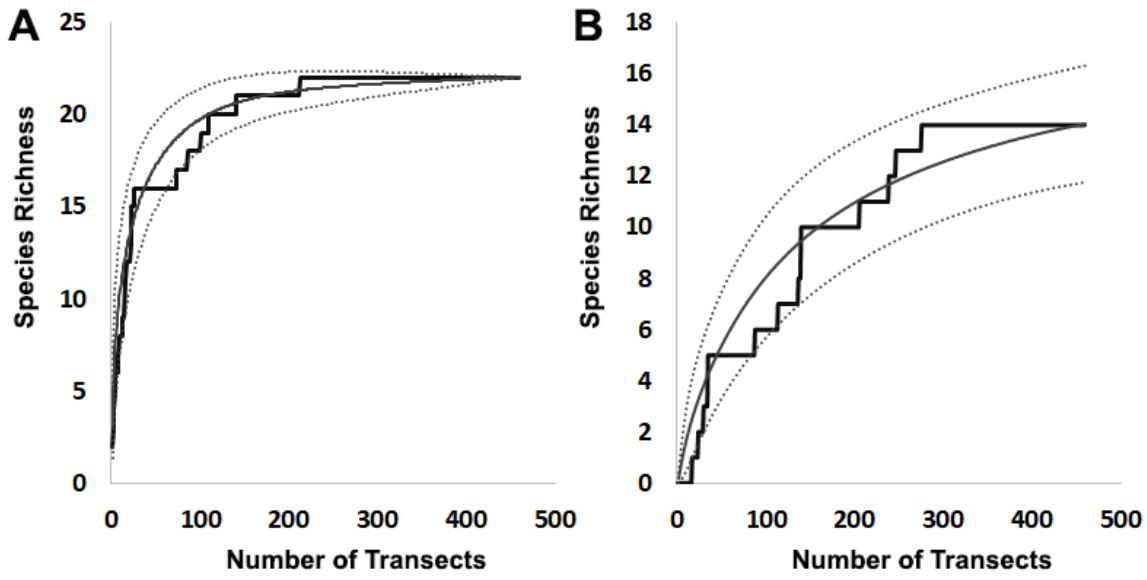

Figure 8. Cumulative (black line) and rarefaction (gray line, with 95 % confidence intervals shown by the dotted lines) curves for the (A) amphibians and (B) reptiles recorded in the Parque Nacional da Tijuca, southeastern Brazil, according to the VES sampling effort (number of hours).

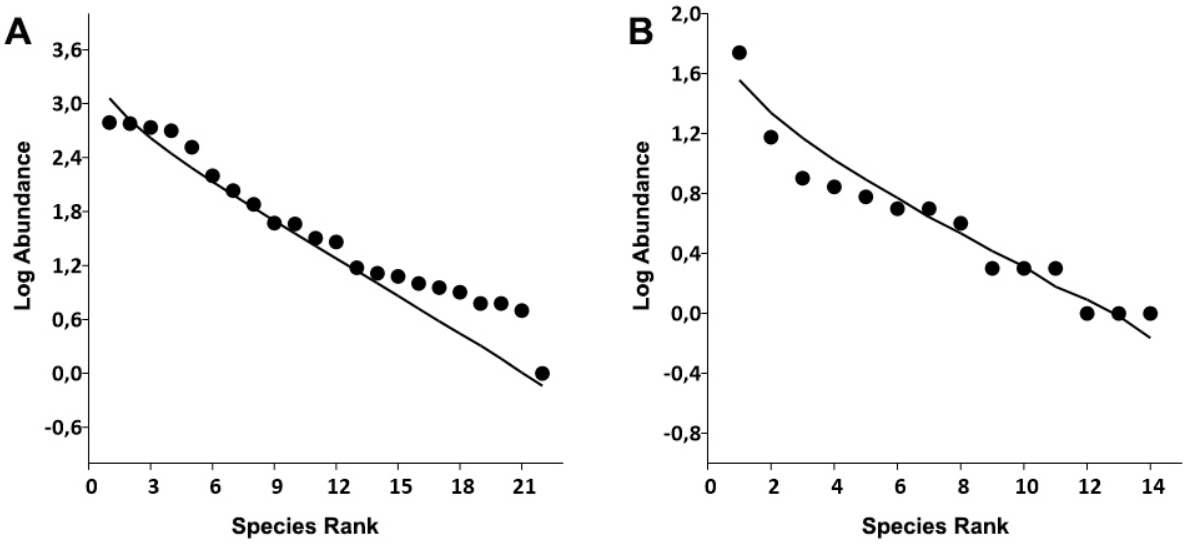

Figure 9. Rank-abundance curves (black dots) with the trend line of the species of (A) amphibians and (B) reptiles recorded by the VES method in the Parque Nacional da Tijuca, southeastern Brazil.

Biota Neotropica

Supplementary Material to "Amphibians and reptiles from the Parque Nacional da Tijuca, Brazil, one of the world's largest urban forests"

Appendix 1

Voucher specimens of amphibians and reptiles from the Parque Nacional da Tijuca deposited at the Museu Nacional, Rio de Janeiro (MNRJ)

AMPHIBIANS:

ANURA. Brachycephalidae: *Brachycephalus didactylus*: MNRJ 93741; *Brachycephalus ephippium*: MNRJ 93742; *Ischnocnema guentheri*: MNRJ 93748; *Ischnocnema octavioi*: MNRJ 93749; *Ischnocnema parva*: MNRJ 93750. **Bufonidae:** *Rhinella ornata*: MNRJ 93753; *Dendrophryniscus brevipollicatus*: MNRJ 93807-9. **Craugastoridae:** *Euparkerella brasiliensis*: MNRJ 93744; *Haddadus binotatus*: MNRJ 93747. **Cycloramphidae:** *Thoropa miliaris*: MNRJ 93812; *Zachaenus parvulus*: MNRJ 93758. **Hemiphractidae:** *Fritziana goeldii*: MNRJ 93745-6. **Hylidae:** *Aplastodiscus albofrenatus*: MNRJ 93739; *Bokermannohyla circumdata*: MNRJ 93740; *Scinax perpusillus*: MNRJ 93810; *Scinax trapicheiroi*: MNRJ 93754. **Hylodidae:** *Crossodactylus gaudichaudii*: MNRJ 93743. **Leptodactylidae:** *Physalaemus signifer*: MNRJ 93752. **Phyllomedusidae:** *Phasmahyla guttata*: MNRJ 93751. **GYMNOPHIONA. Siphonopidae:** *Siphonops hardyi*: MNRJ 93755-7, 93811.

REPTILES:

SQUAMATA. AMPHISBAENIA. Amphisbaenidae: *Leposternon microcephalum*: MNRJ 27477. **LACERTILIA. Gymnophthalmidae:** *Ecpleopus gaudichaudii*: MNRJ 27471; *Placosoma glabellum*: MNRJ 27480. **Leiosauridae:** *Enyalius brasiliensis*: MNRJ 27472-4. **Mabuyidae:** *Psychosaura macrorhyncha*: MNRJ 27478. **Phyllodactylidae:** *Gymnodactylus darwinii*: MNRJ 27475-6. **SERPENTES: Colubridae:** *Chironius foveatus*: MNRJ: 27468. **Dipsadidae:** *Cercophis auratus*: MNRJ 27467; *Dipsas indica*: MNRJ 27469; *Echinanthera cephalostriata*: MNRJ 27470; *Taeniophallus affinis*: MNRJ 27481; *Xenodon neuwiedii*: MNRJ 27482. **Elapidae:** *Micrurus corallinus*: MNRJ 27479. **Viperidae:** *Bothrops jararaca*: MNRJ 27465; *Bothrops jararacussu*: MNRJ 27466.

Biota Neotropica

Supplementary Material to "Amphibians and reptiles from the Parque Nacional da Tijuca, Brazil, one of the world's largest urban forests"

Appendix 2

List of species of amphibians and reptiles recorded from herpetological collections, and respective voucher numbers, from Parque Nacional da Tijuca, Rio de Janeiro, Brazil

AMPHIBIANS:

ANURA. Aromobatidae: *Allobates olfersioides*: MNRJ 23729-34, 51976-85, 70142-46, 78782-83, 79396-98, 80226-39. **Brachycephalidae:** *Brachycephalus didactylus*: MNRJ 86308; *Brachycephalus ephippium*: MNRJ 17431, 25346, 25368-71, 25412-14, 40782-807; *Ischnocnema guentheri*: MNRJ 31053, 31665-66, 31668, 31976, 32437-38, 35508-13, 36482-83, 39044, 45326, 47174-76, 48237-42, 74086-87, 77348-51, 78448-50, 79111, 81774-75, 87540-48, 91897; *Ischnocnema octavioi*: MNRJ 3977, 16135-36, 17190-91; *Ischnocnema parva*: MNRJ 48221-22, 73102-04, 78451-59, 80396-97, 86304-07, 91902. **Bufonidae:** *Dendrophryniscus brevipollicatus*: MNRJ 3163, 3239, 22065-67, 32989, 39747, 42861-65, 42874-78; *Rhinella ornata*: MNRJ 22023-29, 22032-38, 22312, 42289, 43156-64, 78717, 78941, 84980-84, 91909-10. **Centrolenidae:** *Vitreorana eurygnatha*: MNRJ 3739, 46680, 51576, 51801-10, 52693-702, 73128-34; *Vitreorana uranoscopa*: MNRJ 64814-16, 72448-49, 74036, 74431, 77337, 77352-62, 82680, 82692, 88714-15. **Craugastoridae:** *Euparkerella brasiliensis*: MNRJ 3978, 15350-54, 19343-44, 35454, 38940, 52381, 78443-45, 86250-57, 88228; *Haddadus binotatus*: MNRJ 31052, 35122, 35297, 35455, 43165-67, 46681, 54029-31, 54035-38, 54040-44, 54050, 54055-57, 58249, 66163, 78446-47, 81762-64, 81768-69, 84990-94. **Cycloramphidae:** *Cycloramphus eleutherodactylus*: MNRJ 60503, 60520-22, 90916; *Cycloramphus fuliginosus*: MNRJ 32502, 37070, 47335, 73595, 76112-13, 89915, 90919-23; *Thoropa lutzi*: MNRJ 23481, 23484-85, 24024; *Thoropa miliaris*: MNRJ 22872-78, 23104, 23106-12, 23490-91, 26442-45, 26499-503, 27079, 34770, 35453, 38839-41, 38894, 74077-78, 74664, 77374, 84995, 86301-02, 89896; *Zachaenus parvulus*: MNRJ 3979, 15355, 18492, 19345, 38933-34, 38939, 40424, 44050, 59914, 59916-18, 78462, 89897. **Hemiphractidae:** *Fritziana goeldii*: MNRJ 24907-11, 48176-78, 48181, 49317-19, 49323-25, 49342-44, 49355-57, 50496, 59160, 72130-37, 91158-61, 91907, 93096. **Hylidae:** *Aplastodiscus albofrenatus*: MNRJ 3558, 16065-66, 16806, 23473, 30173, 34767-68, 34886, 36923-28, 39029-32, 39362, 40781, 40800, 41686, 43510-16, 48029, 48031-34, 48043-49, 53394-95, 53436-38, 53442, 53449, 69172, 74075-37, 77345-47, 78092, 78464, 81340, 81345, 81347, 81351, 81353, 81359, 81365, 81368, 81375, 86668-83, 88526, 91625, 91903-06, 93090-92, 93100-05; *Boana albomarginata*: MNRJ 3570, 3767, 16740, 38909, 48015, 48017-18, 48022-23, 84985-89, 86155-57; *Boana faber*: MNRJ 3576, 3803, 3806, 3865, 15207, 84977-79; *Bokermannohyla circumdata*: MNRJ 18869-74, 37005-06, 78463; *Dendropsophus elegans*: MNRJ 84996-85000; *Dendropsophus minutus*: MNRJ 3220-21, 3687, 14660, 34830, 43917, 85022-23; *Scinax cuspidatus*: MNRJ 48908-09, 48911-12, 48915-39, 85010-21, 93098; *Scinax fuscovarius*: MNRJ 69787-90; *Scinax perpusillus*: MNRJ 85024-

28; *Scinax trapicheiroi*: MNRJ 3325, 3615-25, 16035-48, 16967-73, 28410-11, 30172, 31695-99, 32247, 32503, 34779-80, 34883-85, 35121, 35852-62, 39436-42, 41685, 47166, 47172-73, 53439, 57599, 70569-70, 74622, 76552, 77363-72, 78117, 78379-82, 79275, 82430, 85001-05, 86303, 91888-91. **Hylodidae:** *Crossodactylus gaudichaudii*: MNRJ 13686-90, 13691-95, 15447-57, 15467-76, 15901-03, 26930-34, 30170, 30325-31, 31864-70, 31917-25, 31937, 31975, 33394-97, 33399, 34771-78, 35073, 35076, 35087-88, 35300-02, 35448-49, 35495-507, 35957-60, 36539-40, 37077-78, 38361, 38958-60, 39192, 39540-43, 44049, 40551-60, 40586, 40750-68, 46682-83, 47171, 47980-85, 53440, 53645, 53896-99, 57598, 66165, 68343, 70560-68, 74088-89, 74436, 74665, 74696-700, 75401, 76103, 77343-44, 78441-42, 78715, 79271-74, 81346, 81349, 81352, 81357-58, 81364, 81369, 82432, 83205-06, 93099, 93106, 91911; *Hylodes nasus*: MNRJ 13696-709, 18478-84, 26894-98, 29204-12, 30276-77, 30332, 31853-63, 31875-911, 31932-36, 31938-40, 32075-85, 33398, 33743-44, 34198-206, 35054, 35113, 35298-99, 35434-35, 35485-90, 37037, 38362, 38937, 40425, 40550, 41896-99, 41901-10, 42277-80, 43719, 44039-47, 53441, 53443, 53446, 55832, 68309-12, 74438, 74722-41, 74905-06, 77338-39, 80824, 81339, 81343, 81350, 81354-55, 81360, 81367, 88527, 93094-95, 93107-10. **Leptodactylidae:** *Adenomera marmorata*: MNRJ 39124-32, 64771-72, 64755-60, 93097; *Leptodactylus latrans*: MNRJ 88240-44; *Physalaemus signifer*: MNRJ 45439-42, 78460-61, 89898, 91892-96, 91908. **Microhylidae:** *Myersiella microps*: MNRJ 40808, 71507. **Odontophrynidae:** *Proceratophrys boiei*: MNRJ 41841-43, 41845-47, 41856. **Phyllomedusidae:** *Phasmahyla guttata*: MNRJ 21892, 30171, 38363, 41687-92, 49229-30, 49234, 49237-38, 49243-44, 49247, 49251-54, 49290, 54631-43, 74079-85, 74090-91, 74663, 77340-42, 77373, 81341-44, 81348, 81356, 81361, 81363, 81366, 82431, 86667, 88525, 91898-901, 93093; *Phyllomedusa burmeisteri*: MNRJ 56841, 67309, 67494, 67496, 67500-09, 68424-25.

REPTILES:

SQUAMATA. LACERTILIA. Dactyloidae: *Anolis fuscoauratus*: MNRJ 4832; *Anolis punctatus*: MNRJ 14635. **Gekkonidae:** *Hemidactylus mabouia*: MNRJ 3666, 10186, 25390. **Gymnophthalmidae:** *Ecpleopus gaudichaudii*: MNRJ 4521, 9586. **Leiosauridae:** *Enyalius brasiliensis*: MCP 5355; MNRJ 3461, 10402, 20129, 21061. **Phyllodactylidae:** *Gymnodactylus darwinii*: MNRJ 3718, 9869, 17523. **Teiidae:** *Salvator merianae*: MNRJ 6324, 6328, 25986. **SERPENTES: Colubridae:** *Chironius bicarinatus*: MNRJ 5764, 9066, 25255, 25389, 25988; ZUFRJ 844; *Chironius foveatus*: MNRJ 24876; ZUFRJ 843; MCP 19407; *Chironius fuscus*: MNRJ 4814, 4822, 10827; *Spilotes pullatus*: MNRJ 4823, 4829, 14304; *Spilotes sulphureus*: MNRJ 8392. **Dipsadidae:** *Dipsas indica*: MNRJ 3996; *Echinanthera cephalostriata*: IB 59760; MNRJ 24858; ZUFRJ 554; *Echinanthera melanostigma*: MNRJ 25472; *Elapomorphus quinquelineatus*: IB 795; MCN 9498; MCP 1348; MNRJ 6472, 10184, 23603, 24646, 25578; ZUFRJ 929, 1346; *Erythrolamprus miliaris*: MNRJ 14632, 22618, 24647, 25526; *Erythrolamprus poecilogyrus*: MNRJ 7634, 9349, 10159; *Siphlophis compressus*: MNRJ 9758; *Siphlophis pulcher*: MNRJ 4805, 7685, 11550; *Taeniophallus affinis*: IB 8578; MNRJ 9804, 24648; ZUFRJ 863; *Taeniophallus persimilis*: MNRJ 4808; ZUFRJ 866; *Thamnodynastes* cf. *nattereri*: MNRJ 14823, 14825, 14827, 22990; *Xenodon neuwiedii*: MNRJ 9355, 25258. **Elapidae:** *Micrurus corallinus*: MNRJ 4290, 4293, 4806, 7687, 8247-8, 14251, 17111, 23612, 25257; ZUEC 37-8; ZUFRJ 890; **Viperidae:** *Bothrops jararaca*: IVB 1671; MNRJ 3493, 4807, 4809, 7892, 7952, 14432, 17530, 19695,

21014, 25256; ZUEC 1493; *Bothrops jararacussu*: IVB 1100, 1304, 1847, 1959, 2184, 2723, 2757, 2824; MNRJ 4740, 4810, 9077, 14101, 25987, 25989; IB 33185.