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The Herpetofauna from Ilha Grande (Angra dos Reis, Rio de Janeiro, Brazil): updating species composition, richness, distribution and endemisms

Carlos Frederico Duarte Rocha[1,4]; Felipe Bottona da Silva Telles[1,5]; Davor Vrcibradic[2] & Paulo Nogueira-Costa[3]

[1] Universidade do Estado do Rio de Janeiro (UERJ), Instituto de Biologia (IBRAG), Departamento de Ecologia (DECOL), Laboratório de Ecologia de Vertebrados. Rio de Janeiro, RJ, Brasil.
[2] Universidade Federal do Estado do Rio de Janeiro (UNIRIO), Centro de Ciências Biológicas e da Saúde (CCBS), Instituto de Biociências (IBIO), Departamento de Zoologia. Rio de Janeiro, RJ, Brasil. ORCID: 0000-0002-6355-3441. E-mail: davor.vrcibradic@gmail.com
[3] Universidade Federal do Sul e Sudeste do Pará (UNIFESSPA), Instituto de Estudos em Saúde e Biológicas (IESB), Faculdade de Ciências da Saúde e Biológicas (FACISB). Marabá, PA, Brasil. ORCID: 0000-0002-2194-7397. E-mail: nogueiracostap@gmail.com
[4] ORCID: 0000-0003-3000-1242. E-mail: cfdrocha@gmail.com
[5] E-mail: fbottona@yahoo.com.br

Abstract. Ilha Grande is a large continental island (total area of 19,300 ha) situated at the southern coast of the state of Rio de Janeiro, in southeast Brazil, within the Atlantic Forest Biome. Here we provide an update to the previous knowledge of the fauna of amphibians and reptiles occurring in Ilha Grande, based on primary data from our own fieldwork and on secondary data (from institutional collections and from the literature). We report the occurrence at Ilha Grande of a total of 74 species, being 34 amphibians (all of them anurans) and 40 reptiles (27 snakes, 11 lizards, one amphisbaenian and one crocodylian). Our survey added 14 species to the herpetofaunal list of Ilha Grande (three of amphibians and eleven of reptiles) and removed one species (the amphibian *Cycloramphus fuliginosus*) from the previous list. The data indicated that Ilha Grande houses a considerable portion of the Atlantic Forest amphibian and reptile diversity (*ca.* 6% and 19%, respectively, of the species occurring in this biome) together with high occurrence of species endemic to this biome plus a few amphibian species endemic to this island. Ilha Grande is thus an important reservoir of both biodiversity and endemism of amphibians and reptiles of the Atlantic Forest of Brazil, which highlights the importance of the conservation of the island and of its different habitats along the insular landscape.

Key-Words. Anura; Reptile; Atlantic Rain Forest; Diversity.

INTRODUCTION

Knowing the species composition occurring in an environment is a prerequisite for the approach of the knowledge of local biodiversity and biogeographical and ecological processes, as well as for mapping conservation and management plans in protected areas. For island communities this knowledge is particularly relevant so that one can select study models for species or populations that provide potential for evaluating the effects of geographical isolation on gene flow (Bittencourt-Silva & Silva, 2013). Insular herpetofaunas constitute good research subjects in this sense because the local species richness and the individual abundance of organisms usually result from historical processes and from their species-specific capacity to transpose geographical barriers.

Ilha Grande is a continental island situated at the southern coast of the state of Rio de Janeiro, in southeast Brazil. With a total area of 19,300 ha, it is the third largest island on the Brazilian coast. Like the other continental islands on the eastern Brazilian coast, Ilha Grande is inserted within the Atlantic Forest Biome, which is one of the world's biodiversity "hotspots" (Mittermeier *et al.,* 2011). Ilha Grande represents one of the areas of the Atlantic Forest for which the knowledge on the vertebrate fauna has continually improved with time, especially since the establishment, in 1996, of a research station there: the Centro de Estudos Ambientais e Desenvolvimento Sustentável – CEADS of the Universidade do Estado do Rio de Janeiro. There are published introductory species lists for non-volant mammals (Pereira *et al.,* 2001), bats (Esbérard *et al.,* 2006), birds (Alves & Vecchi, 2009), squamatan reptiles (Rocha & van Sluys, 2006) and amphibians (Bittencourt-Silva & Silva, 2013) occurring in that island.

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Regarding the herpetofauna, Rocha *et al.* (2009) updated the previous reptile list of Rocha & van Sluys (2006) by adding representatives of the Orders Crocodylia (one species of caiman) and Chelonia (three species of marine turtles) and three more species of Squamata (the lizards *Anolis punctatus* and *Tropidurus torquatus* and the snake *Corallus hortulanus*), as well as providing the first amphibian list for the area. However, no museum vouchers or photos were provided along with those lists. Later, Winck *et al.* (2011) gave details about the records of *Anolis punctatus* and *Tropidurus torquatus,* providing voucher numbers for both taxa. Bittencourt-Silva & Silva (2013) compiled amphibian lists for some islands in the Angra dos Reis Bay, on the Rio de Janeiro coast, including Ilha Grande, providing voucher numbers for most records (except for *Cycloramphus fuliginosus* Tschudi, 1838) and adding seven species to the previous list of Rocha *et al.* (2009). Considering all those studies, the herpetofaunal list of Ilha Grande currently includes 32 reptiles (including sea turtles) and 32 amphibians (all of them anurans).

Since 1995 a research team from the Laboratório de Vertebrados of the Departamento de Ecologia from Universidade do Estado do Rio de Janeiro has conducted fieldwork at Ilha Grande (Rocha *et al.,* 2009). Part of the results of those efforts have produced the herpetofaunal lists of Rocha & van Sluys (2006) and Rocha *et al.* (2009). But, since the publication of these lists, the ongoing studies of our team have added more species records to the island's herpetofauna. Thus, in the present article we provide an update to the knowledge of amphibians and reptiles occurring in Ilha Grande, based on both primary and secondary data.

MATERIALS AND METHODS

Study area

Ilha Grande (23°04'31" - 23°13'36"S; 44°05'27" - 44°22'43"W) lies on the southern coast of the state of Rio de Janeiro, inside Ilha Grande Bay, and belongs to the municipality of Angra dos Reis (Fig. 1). Its last connection with the continent has been around 5,100 years ago (Gama *et al.,* 2009), and its nearest point to the mainland is currently separated from it by *ca.* 2 km of sea. It contains two terrestrial conservation units of integral protection: Parque Estadual da Ilha Grande (PEIG), with 12,052 ha, and Reserva Biológica da Praia do Sul (RBEPS), with 3,502 ha (INEA, 2013). The vegetation of Ilha Grande is part of the Atlantic Forest that covers the Serra do Mar region; the predominant type of vegetation is Dense Umbrophilous Forest, with other types of formation such as restingas (coastal habitats with sandy soils and xerophyllous vegetation), flooded forests and mangroves being also present, in a smaller scale (Alho *et al.,* 2002; Callado *et al.,* 2009). The climate of Ilha Grande is wet and warm, with total annual rainfall around 2,200 mm at the coastal lowland areas, and mean annual temperature of 21°C (INEA, 2013).

Data collection

To provide an update of the previous information regarding amphibian and reptile species occurring in Ilha Grande, we used primary data from our own fieldwork, supplemented with secondary data (obtained from the

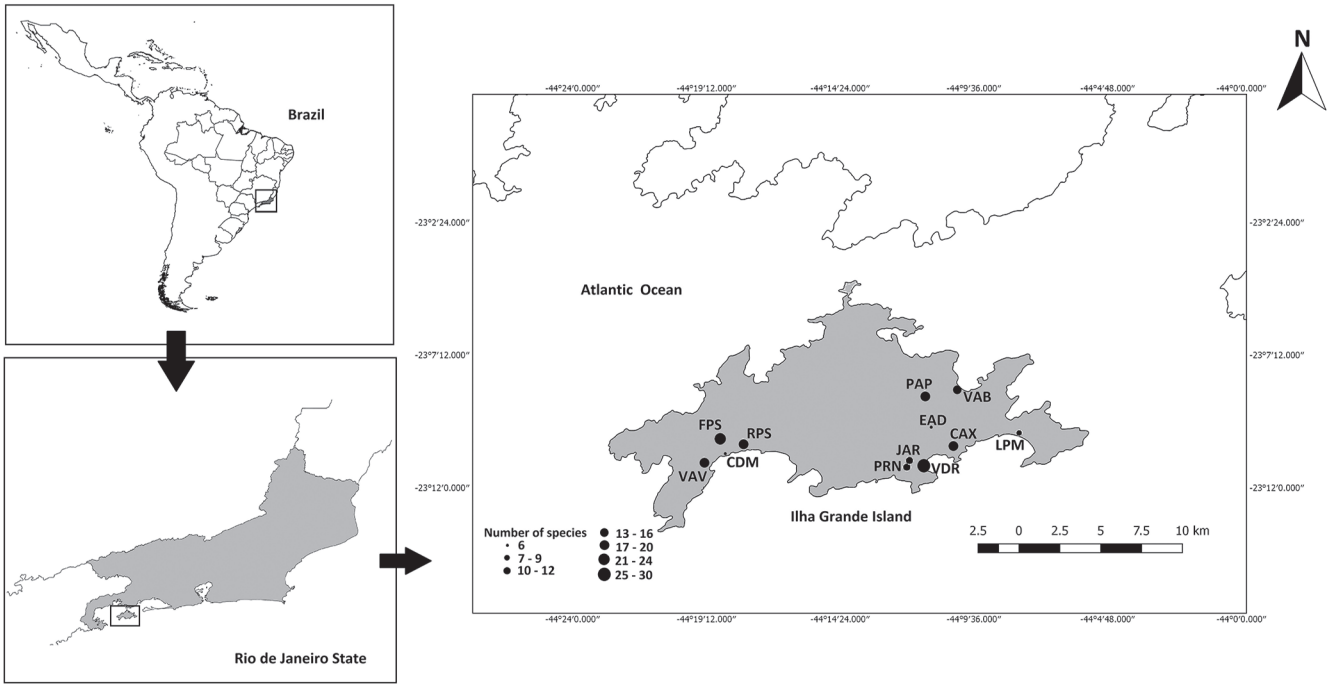

Figure 1. Image of Ilha Grande with the localities where the species were recorded, and their respective density points of species. CAX = Caxadaço trail; CDM = Costão do Demo, RBEPS; EAD = Abraão-Dois Rios road; FPS = Forest of Praia do Sul; JAR = Jararaca trail, Dois Rios; LPM = Lopes Mendes; PAP = Pico do Papagaio; PRN = Parnaioca trail; RPS = Restinga of Praia do Sul; VAB = Vila do Abraão; VAV = Vila do Aventureiro; VDR = Vila Dois Rios.

literature and from institutional collections). Primary data were obtained from field research conducted along 21 years (1995-2015) by the Laboratório de Vertebrados do Departamento de Ecologia da Universidade do Estado do Rio de Janeiro. Most of the fieldwork has been carried out in the surroundings of the Vila Dois Rios village (23°11'09"S, 44°11'26"W) and along forest trails leading from there to other parts of the island. But some intensive collecting has been conducted more recently (2008-2015) in other portions of the island such as Pico do Papagaio mountain, Lopes Mendes beach, and the Reserva Biológica Estadual da Praia do Sul. In the latter locality, systematic samplings were carried out between 2012 and 2014 on both restinga (23°10'29"S, 44°17'56"W) and umbrophilous forest (23°10'25"S, 44°18'45"W) formations using two sampling methodologies: time-constrained (one hour per person) visual searches (Crump & Scott Jr., 1994) and quadrat sampling (Jaeger & Inger, 1994). Visual surveys totaled 408 h of sampling (204 h each on restinga and forest) and quadrat sampling was performed using 80 plots of 16 m^2 (4 m × 4 m) set with nylon mesh fences on the floor of the forest and restinga (40 plots on each habitat), totaling 1,280 m^2 of sampled area.

Regarding secondary data, we sought records of specimens of amphibians and reptiles from Ilha Grande deposited in herpetological collections of different institutions in the state of Rio de Janeiro, as well as published records from the literature. More specifically, we searched the catalogs of the collections of the Museu Nacional (MNRJ), the Universidade Federal Rural do Rio de Janeiro (RU), the Universidade Federal do Rio de Janeiro (ZUFRJ) and the Universidade Federal do Estado do Rio de Janeiro (UNIRIO). The site *"Species Link"* (www.splink.cria.org.br) was also accessed in order to verify the existence of specimens from Ilha Grande in other institutional collections, namely those of the Instituto Butantan (IBSP), of the Departamento de Zoologia de São José do Rio Preto (DZSJRP), and the Célio F.B. Haddad amphibian collection (CFBH) of the Universidade Estadual Paulista, all in the state of São Paulo. We also sought records in published articles and books in different databases for bibliographic research, such as ISI Web of Science (www.portal.isiknowledge.com), Scopus, Wilson Web, Biological Abstracts (www.periodicos.capes.gov.br) and SciELO – Scientific Electronic Library Online (www.scielo.br).

In order to evaluate the occurrence of the amphibian and reptile species within Ilha Grande, we aimed to obtain the locations of occurrence on the island as accurately as possible for specimens in scientific collections and also from the literature, when such data was available. All records without identification at the specific level were disregarded, except for those involving individuals believed to belong to undescribed taxa or when such unidentified specimens were the only members of a given genus recorded at the area. The same applied for specimens identified through the taxonomic artifices "gr.", "cf." and "aff.". Nomenclature used throughout the text follows Segalla *et al.* (2016) and Frost (2017) for amphibians, and Costa & Bérnils (2015) for reptiles, unless otherwise noted.

RESULTS AND DISCUSSION

The records we obtained for the non-marine herpetofauna of Ilha Grande indicated presently the occurrence of a total of 74 species, being 34 amphibians (all of them anurans) and 40 reptiles (27 snakes, 11 lizards, one amphisbaenian and one crocodilian) (Table 1). Our survey added 14 species to the herpetofaunal list of Ilha Grande, being three of amphibians (*Ischnocnema bolbodactyla, Leptodactylus flavopictus* and *Leptodactylus latrans;* Fig. 2) and eleven of reptiles [*Boa constrictor, Dipsas albifrons, D. alternans, D. indica* (Fig. 3A), *Echinantera cephalostriata* (Fig. 3B), *Erythrolamprus aesculapii, Liotyphlops wilderi, Mastigodryas bifossatus, Ophiodes* cf. *striatus, Philodryas olfersii* and *Xenodon merremi*] (see Appendix 1 for voucher specimens). Additionally, one species (the frog *Cycloramphus fuliginosus;* see below) is herein removed from the previous list. We also confirm the occurrence of the snake *Corallus hortulanus* in the island on the basis of vouchered specimens in collections (see Appendix 1) and one individual photographed (but not collected) in the Vila do Aventureiro village during our fieldwork (Fig. 4).

The amphibian richness presently registered for Ilha Grande corresponds to 3.1% of the amphibian species known to occur in Brazil (Segalla *et al.,* 2016), to 6.3% of the species known from the Atlantic Forest domain (Haddad *et al.,* 2013) and to *ca.* 18% of the species reported for the state of Rio de Janeiro (Rocha *et al.,* 2004a; Vrcibradic *et al.,* 2011). The richness of non-marine reptiles occurring in Ilha Grande corresponds to *ca.* 5% of that of Brazil (Costa & Bérnils, 2015), to 19% of that of the Atlantic Forest (Martins & Molina, 2008) and to *ca.* 30% of that of the state of Rio de Janeiro (Rocha *et al.* 2004a; Vrcibradic *et al.,* 2011). These numbers indicate that Ilha Grande is an important reservoir of the biodiversity of Atlantic rainforest amphibians and reptiles and point out the importance of the conservation of the different environments along the island landscape.

Rocha *et al.* (2009) remarked that the Park Management Directive Plan (UFRRJ/IEF/PRONATURA, 1992) of the PEIG cited three amphibian species not present in their list: *Leptodactylus ocellatus* (Linnaeus, 1758) (currently *L. latrans*), *Hyla albofrenata* Lutz, 1924 (currently *Aplastodiscus albofrenatus*) and *Ololygon perpusilla* (Lutz & Lutz, 1939). The occurrence of *L. latrans* in Ilha Grande is here confirmed through both primary and secondary data. The record of *A. albofrenatus* was almost certainly based on *A. eugenioi,* a taxon that had not yet been described at the time of the report and was then considered as part of *A. albofrenatus* (see Carvalho-e-Silva & Carvalho-e-Silva, 2005). Finally, the record of *Ololygon perpusilla* is probably referable to an apparently undescribed species of the *O. perpusilla* group (referred to as *Scinax* gr. *perpusillus* by Bittencourt-Silva & Silva, 2013).

Two of the species reported as new records in our study have been recorded only through photographs, as physical specimens could not be secured. This was the case of the frog *Leptodactylus flavopictus* (whose record was based on a specimen that evaded capture) and of

Figure 2. New records of amphibians for Ilha Grande. (A) *Ischnocnema bolbodactyla;* (B) *Leptodactylus latrans;* (C) *Leptodactylus flavopictus* (Photos by F.B.S. Telles).

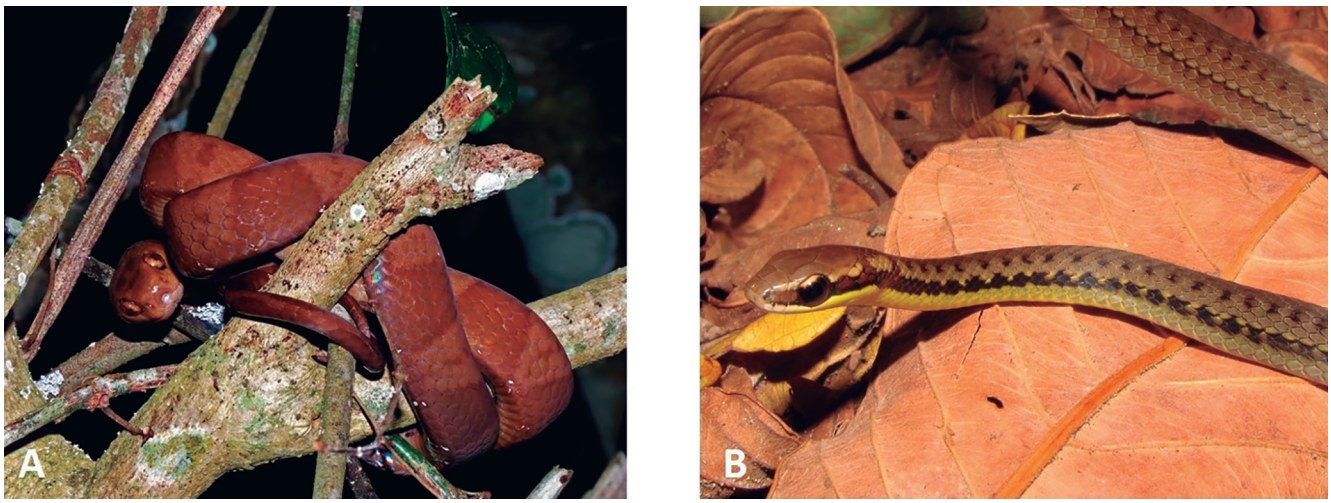

Figure 3. New records of snakes for Ilha Grande. (A) *Dipsas indica* (Photo by D. Cunha-Passos); (B) *Echinantera cephalostriata* (Photo by P. Fatorelli).

the snake *Dipsas indica*. The latter species was recorded by a colleague who photographed one specimen but could not collect it since he did not have a collecting permit. A previous record based only on a photograph was that of the toad *Rhinella icterica* reported by Bittencourt-Silva & Silva (2013). Since all those species are relatively large-bodied and can be easily told apart from other congeners occurring in the Atlantic Forest of southeastern Brazil, it was possible to identify them accurately from the images.

The only exotic species registered in the island's herpetofauna was *Hemidactylus mabouia,* an invasive species in Brazil that is commonly associated to anthropic and peri-anthropic environments and also occurs in

Table 1. Species of amphibians and reptiles recorded at Ilha Grande (Angra dos Reis, Rio de Janeiro, Brazil). New records for Ilha Grande are marked with an asterisk (*). Taxa whose species epithets have changed since they appeared in the lists of Rocha *et al.* (2009) and in Bittencourt-Silva & Silva (2013) are marked with letters. EN = Endemism; AF = Atlantic Forest; IG = Ilha Grande. Sources for new records (and for previously cited but unvouchered records) are given as: p = primary data; s = secondary data (from specimens in collections); ph = photographic record; Literature sources for previous records are: 1 = Rocha *et al.,* 1997; 2 = Rocha *et al.,* 1998; 3 = Rocha *et al.,* 1999; 4 = van Sluys & Rocha, 1999; 5 = Boquimpani-Freitas *et al.,* 2001; 6 = van Sluys *et al.,* 2001; 7 = Rocha *et al.,* 2001; 8 = Hatano *et al.,* 2002; 9 = Boquimpani-Freitas *et al.,* 2002; 10 = Rocha *et al.,* 2002; 11 = Rocha & Vrcibradic, 2003; 12 = van Sluys *et al.,* 2004; 13 = Rico *et al.,* 2004; 14 = Rocha *et al.,* 2004b; 15 = Marra *et al.,* 2004; 16 = Siqueira *et al.,* 2006a; 17 = Siqueira *et al.,* 2006b; 18 = Ariani *et al.,* 2006; 19 = Bursey *et al.,* 2006; 20 = Vrcibradic *et al.,* 2006; 21 = van Sluys *et al.,* 2006; 22 = Rocha & van Sluys, 2006; 23 = Almeida-Gomes *et al.,* 2007a; 24 = Almeida-Gomes *et al.,* 2007b; 25 = Almeida-Gomes *et al.,* 2007c; 26 = Almeida-Gomes *et al.,* 2007d; 27 = Borges-Junior *et al.,* 2007; 28 = Hatano *et al.,* 2007; 29 = van Sluys *et al.,* 2007; 30 = Boquimpani-Freitas *et al.,* 2007; 31 = Rocha *et al.,* 2009; 32 = Fatorelli *et al.,* 2010; 33 = Laia *et al.,* 2010; 34 = Rocha & Bergallo, 2011; 35 = Winck *et al.,* 2011; 36 = van Sluys *et al.,* 2012; 37 = Goyannes-Araújo *et al.,* 2015; 38 = Jackson, 1978; 39 = Heyer, 1983; 40 = Carvalho-e-Silva & Carvalho-e-Silva, 2005; 41 = Canedo & Pombal Jr., 2007; 42 = Prado & Pombal Jr., 2008; 43 = Bittencourt-Silva & Silva, 2013; 44 = Telles *et al.,* 2015; 45 = INEA, 2013. Sites of occurrence (based on both primary and secondary data): CAX = Caxadaço trail; CDM = Costão do Demo, RBEPS; EAD = Abraão-Dois Rios road; FPS = Praia do Sul forest; JAR = Jararaca trail, Dois Rios; LPM = Lopes Mendes; PAP = Pico do Papagaio; PRN = Parnaioca trail; RPS = Praia do Sul restinga; VAB = Vila do Abraão; VAV = Vila do Aventureiro; VDR = Vila Dois Rios.

Taxa	EN	Source	Site of occurrence
AMPHIBIA			
ANURA			
Brachycephalidae			
Brachycephalus didactylus (Izecksohn, 1971)	AF	7, 29, 31, 37, 43	JAR, PAP
Ischnocnema bolbodactyla (A. Lutz, 1925)*	AF	p	FPS, RPS, VAV
Ischnocnema guentheri (Steindachner, 1864)	AF	7, 18, 29, 31, 37, 43	CAX, FPS, JAR, PAP, VAV
Ischnocnema octavioi (Bokermann, 1965)	AF	31, 43	CAX, VAV
Ischnocnema parva (Girard, 1853)	AF	7, 15, 29, 30, 31, 36, 37, 43	FPS, JAR, LPM, PAP, RPS, VAV
Bufonidae			
Dendrophryniscus brevipollicatus Jiménez de la Espada, 1870	AF	7, 29, 31, 37, 43	CAX, EAD, FPS, JAR, LPM, PAP, RPS, VAV
Rhinella icterica (Spix, 1824)	AF	43	VAB
Rhinella ornata (Spix, 1824)	AF	31, 37, 43	CAX, CDM, EAD, FPS, JAR, LPM, PAP, RPS, VAB, VAV, VDR
Centrolenidae			
Vitreorana eurygnatha (Lutz, 1925)	AF	43	?
Craugastoridae			
Haddadus binotatus (Spix, 1824)	AF	7, 31, 37, 43	CAX, EAD, FPS, JAR, LPM, PAP, RPS, VAV, VDR
Cycloramphidae			
Cycloramphus boraceiensis Heyer, 1983	AF	31, 39, 43	FPS, VAB
Thoropa miliaris (Spix, 1824)	AF	10, 16, 17, 31, 37, 43	CAX, CDM, FPS, JAR, LPM, PAP, PRN, RPS, VAV, VDR
Zachaenus parvulus (Girard, 1853)	AF	2, 6, 7, 29, 31, 37, 43	JAR, PAP, PRN
Hemiphractidae			
Fritziana sp.	AF	37, 43	PAP
Hylidae			
Aplastodiscus eugenioi (Carvalho-e-Silva & Carvalho-e-Silva, 2005)	AF	30, 31, 36, 37, 40, 43	CAX, EAD, FPS, PAP, PRN, VAV
Boana albomarginata (Spix, 1824)	AF	31, 43	VAB, VDR
Boana faber (Wied-Neuwied, 1821)	AF	31, 43	VDR
Bokermannohyla circumdata (Cope, 1871)	AF	3, 31, 43	PAP, VDR
Itapotihyla langsdorffii (Duméril & Bibron, 1841)	AF	31, 43	CAX, FPS, PRN, RPS, VAB, VAV, VDR
Ololygon trapicheiroi (A. Lutz & B. Lutz, 1954)	AF	13, 18, 21, 27, 30, 31, 36, 43	CAX, EAD, FPS, PAP, PRN
Ololygon sp. (gr. *perpusillus*)	IG	31, 43	CDM, RPS, VAV
Scinax fuscovarius (Lutz, 1925)		43	?
Scinax hayii (Barbour, 1909)	AF	30, 31, 36, 43	EAD, JAR, PRN, VDR
Hylodidae			
Crossodactylus gaudichaudii Duméril & Bibron, 1841	AF	24, 25, 26, 31, 37, 43	CAX, EAD, FPS, PAP
Hylodes asper (Müller, 1924)	AF	37, 43	PAP
Hylodes fredi Canedo & Pombal, 2007[a]	IG	1, 8, 19, 25, 28, 31, 33, 37, 41, 43	CAX, FPS, JAR, PAP, PRN
Leptodactylidae			
Adenomera marmorata (Steindachner, 1867)	AF	7, 23, 29, 30, 31, 36, 37, 43	CAX, EAD, FPS, JAR, RPS, PAP, PRN, VAV
Leptodactylus flavopictus Lutz, 1926*	AF	p (ph)	FPS
Leptodactylus latrans (Steffen, 1815)*		p, s	CDM, LPM, VAB
Physalaemus signifer (Girard, 1853)	AF	18, 30, 31, 36, 37, 43	CAX, EAD, FPS, LPM, PAP, PRN, RPS, VAV
Microhylidae			
Chiasmocleis lacrimae Peloso, Sturaro, Forlani, Gaucher, Motta & Wheeler, 2014[b]	AF	7, 18, 29, 31, 37, 43	EAD, FPS, JAR, PAP, PRN, RPS, VAV, VDR
Myersiella microps (Duméril & Bibron, 1841)	AF	31, 37, 43	JAR, PAP, VAV
Odontophrynidae			
Proceratophrys tupinamba Prado & Pombal, 2008[c]	IG	3, 5, 7, 9, 31, 32, 37, 42, 43	JAR, PAP, VDR
Phyllomedusidae			
Phasmahyla guttata (Lutz, 1924)	AF	37, 43	PAP

Taxa	EN	Source	Site of occurrence
REPTILIA			
CROCODYLIA			
Alligatoridae			
Caiman latirostris (Daudin, 1802)		31, 45	LPM
SQUAMATA – LACERTILIA			
Anguidae			
Diploglossus fasciatus (Gray, 1831)		22, 31	VAV, VDR
Ophiodes cf. *striatus* (Spix, 1825)*		s	?
Dactyloidae			
Anolis punctatus Daudin, 1802		31, 35	CAX
Gekkonidae			
Hemidactylus mabouia (Moureau de Jonnès, 1818)		22, 31, 34, 44	CDM, RPS, VAV, VDR
Gymnophthalmidae			
Placosoma glabellum (Peters, 1870)	AF	22, 31	VDR
Ecpleopus gaudichaudii Duméril & Bibron, 1839	AF	22, 31	VDR
Leiosauridae			
Enyalius brasiliensis (Lesson, 1828)	AF	12, 22, 31, 38	FPS, VDR
Mabuyidae			
Brasiliscincus agilis (Raddi, 1823)	AF	11, 14, 20, 22, 31	RPS, VDR
Phyllodactylidae			
Gymnodactylus darwinii (Gray, 1845)	AF	18, 22, 31	RPS, VAB, VDR
Teiidae			
Salvator merianae Duméril & Bibron, 1839		4, 22, 31	FPS, RPS, VDR, VAV
Tropiduridae			
Tropidurus torquatus (Wied, 1820)		31, 35	LPM
SQUAMATA – AMPHISBAENIA			
Amphisbaenidae			
Leposternon microcephalum (Wagler in Spix, 1824)		22, 31	FPS, VDR
SQUAMATA – SERPENTES			
Anomalepididae			
Liotyphlops wilderi (Garman, 1883)*	AF	s	?
Boidae			
Boa constrictor (Linnaeus, 1758)*		s	?
Corallus hortulanus (Linnaeus, 1758)		p (ph), s, 31	VAB, VAV
Colubridae			
Chironius bicarinatus (Wied, 1820)		22, 31	VAB, VDR
Chironius exoletus (Linnaeus, 1758)		22, 31	VDR
Chironius foveatus Bailey, 1955		3, 22, 31	VDR
Spilotes pullatus (Linnaeus 1758)		22, 31	FPS, RPS, VAB, VAV, VDR
Dipsadidae			
Clelia plumbea (Wied, 1820)		22, 31	VDR
Dipsas albifrons (Sauvage, 1884)*		s	VAB
Dipsas alternans (Fischer, 1885)*	AF	s	?
Dipsas indica (Fischer, 1885)*		p (ph)	VDR
Echinantera cephalostriata Di-Bernardo, 1996*	AF	p	CAX
Erythrolamprus aesculapii (Linnaeus, 1766)*		s	?
Erythrolamprus miliaris (Linnaeus, 1758)		22, 31	VAB, VDR
Erythrolamprus poecilogyrus (Wied, 1825)		22, 31	VAB, VDR
Imantodes cenchoa (Linnaeus, 1758)		22, 31	VDR
Mastigodryas bifossatus (Raddi, 1820)*		s	?
Oxyrhopus clathratus Duméril, Bibron & Duméril, 1854	AF	22, 31	VAV, VDR
Philodryas olfersii (Liechtenstein, 1823)*		s	VAB
Sibynomorphus neuwiedi (Ihering, 1911)		22, 31	FPS, VAB, VAV, VDR
Siphlophis pulcher (Raddi, 1820)	AF	22, 31	VAV, VDR
Thamnodynastes cf. *nattereri* (Mikan, 1828)[d]		18, 22, 31	CAX, FPS, RPS, VAB, VDR
Xenodon merremii (Wagler in Spix, 1824)*		s	?
Xenodon neuwiedii Günther, 1863		22, 31	VDR
Elapidae			
Micrurus corallinus (Merrem, 1820)	AF	22, 31	FPS, JAR, PRN, VAB, VDR
Viperidae			
Bothrops jararaca (Wied, 1824)	AF	22, 31	FPS, JAR, VAB, VDR
Bothrops jararacussu Lacerda, 1884		22, 31	VDR

a = Referred to *Hylodes phyllodes* Heyer & Cocroft, 1986 prior to 2007;
b = Previously cited as *Chiasmocleis carvalhoi* Cruz, Caramaschi &. Izecksohn, 1997 or as *Chiasmocleis* sp.;
c = Referred to *Proceratophrys appendiculata* (Günther, 1873) prior to 2008;
d = Previously cited as *Thamnodynastes strigilis* (Thunberg, 1787).

Figure 4. Specimen of *Corallus hortulanus* (not collected) found in Vila do Aventureiro village, Ilha Grande (Photo by F.B.S. Telles).

open natural areas (Rocha *et al.,* 2011). In Ilha Grande, it was considered as an exotic species but not as invasive in natural environments (Rocha & Bergallo, 2011). Recent systematic surveys on different environments within the island have failed to record the occurrence of this gecko outside anthropic and peri-antropic habitats (Rocha & Bergallo, 2011; Winck, 2012). However, more recent surveys carried out by our research team have recorded 17 individuals (and two eggs) of *H. mabouia* in natural environments of Praia do Sul, in the RBEPS, thus evidencing that this species has become an invasive exotic in that area (Telles *et al.,* 2015). Considering the two previous surveys in the island that did not find this lizard in natural environments, we suggest that the invasion of the restinga habitat in Praia do Sul by this gecko may be quite recent. According to our data, *Rhinella ornata, Thoropa miliaris* and *Haddadus binotatus* were the most widely distributed anurans in Ilha Grande, occurring, respectively, in eleven, ten and nine different localities throughout the island (Table 1). Bittencourt-Silva & Silva (2013), sampling seven islands along the coast of Rio de Janeiro State, found that the rupicolous frog *T. miliaris* was the only amphibian inhabiting all the islands analyzed. Thus, this species appears to have a great potential for dispersal and colonization. Among reptiles, the species registered in the most localities were *Spilotes pullatus* and *Thamnodynastes* cf. *nattereri,* both being recorded in five different sites (Table 1). Of the 33 reptiles for which specific locality data were available, 15 (45.4%) had their occurrence reported from a single locality (Table 1), which probably reflects mostly a deficit of survey efforts rather than geographic restriction of taxa within the island.

The oldest representative of the Ilha Grande herpetofauna found by us in the scientific collections surveyed was an individual of the cycloramphid frog *Thoropa miliaris* collected in Praia do Sul in 1941, which is currently deposited in the amphibian collection of Museu Nacional (MNRJ 58941; collector unknown). There are other specimens of various amphibian and reptile taxa in the collections of Museu Nacional and Universidade Federal do Rio de Janeiro that have been collected in the 1940s by the German ornithologist Helmut Sick, during his stay at the prison of Vila dos Dois Rios village between 1942 and 1945 (Vuilleumier, 1998). Some of those specimens constitute the sole representatives of their species recorded so far for Ilha Grande, like the glass frog *Vitreorana eurygnatha,* the lizard *Ophiodes* cf. *striatus,* and the snakes *Boa constrictor, Dipsas alternans, Erythrolamprus aesculapii, Liotyphlops wilderi* and *Mastigodryas bifossatus.* The fact that no further specimens of those taxa have been collected in the island in over seven decades may have a number of different causes, such as: low density of those taxa in Ilha Grande, low detectability (*e.g.,* in the case of the fossorial snake *Liotyphlops*), occurrence of those taxa in undersampled regions of the island, local extinction and/or possible mislabeling of specimens (see below).

The knowledge about the Ilha Grande herpetofauna has been amassed over the last seven decades, starting with the first deposits in scientific collections of specimens collected in the 1940s. There has been a consistent increase in the last two decades since the creation of the Centro de Estudos Ambientais e Desenvolvimento Sustentável of the Universidade do Estado do Rio de Janeiro (CEADS/UERJ) in 1996, which is located in Vila Dois Rios village. The creation of CEADS allowed the development of new research projects with various groups of fauna and flora of the island (Callado *et al.,* 2009; Rocha *et al.,* 2009). However, the logistical facility provided by the CEADS potentially promoted a bias in the research on herpetofauna (and also on other groups of animals and plants), concentrating most of the studies in the forests around Vila Dois Rios village, on the seaward side of the island. Indeed, Vila Dois Rios was the locality with the highest number of herpetofaunal species recorded for Ilha Grande (see Fig. 1).

Taxonomic remarks

Amphibia

Chiasmocleis – Specimens of this genus recorded at Ilha Grande have been usually referred as *Chiasmocleis* sp. (Rocha *et al.,* 2000, 2001, 2004a, 2009; Ariani *et al.,* 2006; van Sluys *et al.,* 2007; Goyannes-Araújo *et al.,* 2015). Rocha *et al.* (2004a) and Goyannes-Araújo *et al.* (2015) commented that the *Chiasmocleis* from Ilha Grande was an undescribed species. Bittencourt-Silva & Silva (2013), on the other hand, referred to the species occurring in Ilha Grande as *C. carvalhoi* (now *C. lacrimae;* see Peloso *et al.,* 2014). Tonini *et al.* (2014), in a molecular phylogenetic analysis of the *C. lacrimae* and *C. capixaba* complexes, used DNA sequences of three specimens of *Chiasmocleis* from "Angra dos Reis, Rio de Janeiro" housed at the herpetological collection of the Universidade Federal Rural do Rio de Janeiro. Those specimens (RU 7003-05; referred as RN 7003-05 in Tonini *et al.,* 2014) are actually from Ilha Grande, and are determined as *Chiasmocleis* gr. *carvalhoi* in that collection's catalog (curiously, they are not listed in the Appendix I of Bittencourt-Silva & Silva, 2013). In Tonini *et al.*'s (2014) phylogeny their DNA sequences grouped with other samples from the states of Rio de Janeiro and São Paulo in a clade that those authors

considered to be assignable to *C. lacrimae* (*sensu stricto*). Thus, the species of *Chiasmocleis* that occurs in Ilha Grande can be referred to *C. lacrimae* (assuming that only one species of that genus occurs there).

Cycloramphus – Both Rocha *et al.* (2009) and Bittencourt-Silva & Silva (2013) listed two species of the genus *Cycloramphus* for Ilha Grande: *Cycloramphus boraceiensis* and *C. fuliginosus.* In the Appendix of their article, Bittencourt-Silva & Silva (2013) cite a voucher number for *C. boraceiensis* but none for *C. fuliginosus,* instead referring to the citation by Rocha *et al.* (2009) to justify its presence on the list (indeed, *C. fuliginosus* is the only species in their list for which no voucher specimens are mentioned). The specimen cited in that work (MNRJ 48118) was checked by the authors at the collection of the Museu Nacional. The name *C. boraceiensis* was written in the label inside the vial in which it is kept, but in the museum catalog this same specimen is referred as *C. fuliginosus.* Thus, it seems that the records of two species of *Cycloramphus* for Ilha Grande are based on a single specimen. *Cycloramphus boraceiensis* is the only species of the genus previously reported for Ilha Grande (Heyer, 1983). Heyer's (1983) record of this species for the island is based on an individual in the Museu Nacional (MNRJ 2241, also examined by us) that had been collected by H. Sick in 1944. During fieldwork at the RBEPS one of us (FBST) collected three individuals of *Cycloramphus* (subsequently deposited at the Museu Nacional under the numbers MNRJ 89138-40). Using Heyer's (1983) dichotomic key to the species of *Cycloramphus* known at the time and making direct comparisons with MNRJ 2241 we were able to confirm the identification of MNRJ 48118 as *C. boraceiensis* and to determine that our three new specimens were *C. boraceiensis* as well. Thus, it seems that *C. boraceiensis* is currently the only species of the genus known to occur at Ilha Grande and, therefore, *C. fuliginosus* should be excluded from the island's list of amphibians.

Ischnocnema – *Ischnocnema octavioi* was first reported for Ilha Grande by Rocha *et al.* (2000, 2001), but that record was later found to be based on two misidentified specimens of *I guentheri* (Vrcibradic *et al.,* 2008). Bittencourt-Silva & Silva (2013) reported the occurrence of *I octavioi* in Ilha Grande based on a third specimen, MNRJ 60158 (the two previously mentioned specimens, MNRJ 47972-73, were correctly listed by them under *I guentheri*). The specimen MNRJ 60158 was collected by a colleague and is, in fact, *I octavioi,* which confirms the occurrence of this species in the island.

Physalaemus – There were two specimens at the Museu Nacional determined as *Physalamus angrensis* (MNRJ 56473-74), having been collected at Praia do Sul. Those specimens were re-examined and re-identified as young individuals of *Physalaemus signifer* (M. Woitovicz-Cardoso, *pers. comm.*), a relatively common species in Ilha Grande, where it occurs in various localities, including the RBEPS (Table 1).

Reptilia

Ophiodes – The lizard genus *Ophiodes* is currently a problematic taxon, requiring a comprehensive review. One individual at the collection of Museu Nacional is labeled *Ophiodes fragilis* (Raddi, 1820). The name *O. fragilis* has been widely used for specimens from southeastern Brazil and portions of Argentina and Paraguay (Pizzatto, 2005; Avila *et al.,* 2013; Cacciali & Scott, 2015). Nevertheless, a proper redescription and revalidation of *O. fragilis* has not yet been published (Costa & Bérnils, 2015). Thus, we follow Montechiaro *et al.* (2011) and take a conservative stance by referring to the specimen from Ilha Grande as *Ophiodes* cf. *striatus.*

Thamnodynastes – Snakes from the genus *Thamnodynastes* from Ilha Grande present another taxonomic problem. They have been referred to as *Thamnodynastes strigilis* by Ariani *et al.* (2006) and Rocha *et al.* (2009), and as *Thamnodynastes* cf. *strigilis* by Rocha & van Sluys (2006), but *T. strigilis* is currently considered a synonym of *T. pallidus,* a species that does not occur in southeastern Brazil (Bailey *et al.,* 2005). The name *T. nattereri* (or *T.* cf. *nattereri*) have also been recently attributed to the Atlantic Forest *Thamnodynastes* commonly referred to *"strigilis"* or "cf. *strigilis*" in the literature (Dorigo *et al.,* 2014; Franco *et al.,* 2017). Indeed, the specimens from Ilha Grande deposited in the institutional collections we surveyed are all labeled as either *T.* cf. *nattereri, Thamnodynastes* sp., or (in one case) *T. pallidus nattereri.* For the present list we conventionally follow the most recent authors and attribute the name *Thamnodynastes* cf. *nattereri* for the specimens from Ilha Grande, though we are aware that this is a provisional designation, given the current nomenclatural problems involving the epithet *"nattereri"* (Franco & Ferreira, 2002; Bellini *et al.,* 2014; Dorigo *et al.,* 2014; Franco *et al.,* 2017).

Probable erroneous records

Some of the records from Ilha Grande based on secondary data are problematic, as the species involved are not known to occur in the state of Rio de Janeiro or even in the Atlantic Forest biome. We believe those records contain erroneous information and, therefore, they were not included in the list. This is the case of two lizard specimens at the reptile collection of the Museu Nacional. One of them (MNRJ 19748), referred to *Anolis auratus* in the museum's catalog, has been collected in 1986 by the personnel of the "Projeto Ilha Grande". Unfortunately, that specimen could not be located at the museum's collection, so we could not verify its identity. Nevertheless, since *A. auratus* is a species confined to the Amazon region (Ávila-Pires, 1995), we assume the specimen must have been misidentified. The other problematic specimen is MNRJ 15512, identified as *Tropidurus spinulosus* and collected by H. Sick in 1944, according to the catalog. That specimen was examined by us and is indeed a member of the *T. spinulosus* group. However, species of the *T. spinulosus* group do not occur in the Atlantic for-

ests of southeastern Brazil (Carvalho, 2013, 2016), which indicates that the locality of collection given for MNRJ 15512 is probably erroneous.

Conservation issues

Among the herpetofauna species recorded for Ilha Grande, amphibians had a high rate of endemism for the Atlantic Forest Biome (94% of the species were endemic). This high degree of endemism is characteristic of the amphibian fauna of this biome, in which 88% of the species are endemic according to Haddad *et al.* (2013). Regarding reptiles, 12 species were endemic to the Atlantic Forest (five lizards and seven snakes), representing about a third of the species recorded for the island.

In spite of the high rate of endemism among amphibians, most species are categorized as being of "Least Concern" in terms of their conservation status in the global scope (according to criteria of the IUCN – International Union for the Conservation of Nature). The only species from Ilha Grande included in an actual threat category by the IUCN is *Chiasmocleis lacrimae,* which is currently considered as "Endangered", mainly due to habitat degradation within its area of occurrence and the presumed trend for decline of its populations [see Stuart *et al.,* 2008 (as *C. carvalhoi*)]. The only other species of the Ilha Grande herpetofauna not categorized as "Least Concern" is the hylodid *Hylodes fredi,* a species endemic to the island, which is considered as "Data Deficient" (DD) due to the lack of information on "its extent of occurrence, area of occupancy, status and ecological requirements" (Angulo, 2008). Nevertheless, we caution that, in terms of conservation, particular attention should be paid to hylodids, as well as to any other species whose life is restricted to forest streams, as we believe those species are particularly vulnerable to environmental disturbances. Hylodids have had their real threat status underestimated since the current form of extinction risk assessment by IUCN for species restricted to streams seems to overestimate the actual area of occupation for these species which is likely much more spatially limited (Almeida-Gomes *et al.,* 2014). The other frog species endemic to Ilha Grande, the odontophrynid *Proceratophrys tupinamba,* is not yet categorized by IUCN, probably because its description is relatively recent (Prado & Pombal Jr., 2008). However, we think these two species that occur only in Ilha Grande carry conservation concern because they have a very restricted distribution and depend on the effective conservation of that particular insular environment.

Among the reptiles, only two species of lizards (*Salvator merianae* and *Tropidurus torquatus*), three of snakes (*Siphlophis pulcher, Xenodon neuwiedii* and *Bothrops jararacussu*) and one crocodilian (*Caiman latirostris*) are categorized by the IUCN, but all in the category of "Least Concern". The broad-snouted caiman (*C. latirostris*), although believed to be an introduced species in Ilha Grande (INEA, 2013), is the only taxon on the island that is included in the Rio de Janeiro state list of threatened fauna (classified as "Endangered"; Bergallo *et al.* 2000). However, at the national level, none of the species of the Ilha Grande reptile fauna is categorized as having a conservation risk (Haddad, 2008; Martins & Molina, 2008).

In conclusion, our data indicated that Ilha Grande houses a considerable portion of Atlantic Forest amphibian and reptile diversity together with a predominance of species endemic to this biome, plus a few species endemic to that island. This indicates that Ilha Grande is an important reservoir of both biodiversity and endemism of amphibians and reptiles of the Atlantic Forest of southeastern Brazil, which points out the importance of the conservation of this island and its different habitats along the insular landscape. We also point out that several portions of Ilha Grande remain unexplored, particularly in respect to the herpetofauna (as is evident from Fig. 1), and that still more species of amphibians and reptiles are likely to be added to the present list if field surveys in that island are intensified.

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APPENDIX 1

Voucher specimens of taxa representing new or previously unvouchered records for Ilha Grande.

Amphibia:

Ischnocnema bolbodactyla: MNRJ 89141-42
Leptodactylus latrans: MNRJ 31743, MNRJ 31748-49, MNRJ 46869, MNRJ 68698-700, MNRJ 75815

Reptilia:

Boa constrictor: ZUFRJ 800
Corallus hortulanus: IBSP 28941, IBSP 30056, IBSP 30232, IBSP 30394, IBSP 30449, IBSP 30610, IBSP 43770, MNRJ 8868, MNRJ 24212
Dipsas albifrons: IBSP 27608
Dipsas alternans: MNRJ 8060
Echinantera cephalostriata: MNRJ 19183
Erythrolamprus aesculapii: MNRJ 4936
Liotyphlops wilderi: MNRJ 7853
Mastigodryas bifossatus: MNRJ 8404
Ophiodes cf. *striatus:* MNRJ 16059
Philodryas olfersii: IBSP 27093, MNRJ 8440
Xenodon merremi: MNRJ 8161

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