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Herpetofauna in a secondary Atlantic Forest fragment in Itanhaém municipality, Southeastern Brazil

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Abstract. We present herpetological survey results from a low altitude secondary Atlantic Forest fragment in Itanhaém municipality, southeastern Brazil. Field expeditions were conducted over 21 months, at Estação Ambiental São Camilo. We recorded 22 species of amphibians and 18 species of reptiles using three different sampling methods, pitfall traps, visual encounter survey and occasional encounter. None of the observed species are listed in the São Paulo and Brazilian list of endangered species, or in the IUCN red list. This secondary-forest fragment harbours common species for Atlantic Forest, and the endemism rate for Amphibians is 81,8%, which means these "coldspots" are important to consider as an alternative for conservation in Atlantic Forest Domain.

Keywords. Amphibians, Coastal São Paulo state, Conservation, Fauna, Reptiles, Species inventory

Introduction

One of the greatest challenges in biodiversity conservation is to estimate how many species exist on Earth (Ødegaard, 2000). Species inventories are the first step to assess local biodiversity and to assist in decision making of environmental conservation and management policies (Silveira et al., 2010). This knowledge helps to understand community dynamics and to establish how species are distributed in space and time (Rosenzweig, 1995; Lomolino et al., 2010). Therefore, it allows to model habitat suitability and to clarify environmental gaps in large and small scales, which enables to evaluate how threatened species are (Cornell and Harrison, 2014; Guisan et al., 2017; Araújo et al., 2019).

Deforestation of tropical humid forests has caused unprecedented loss of biodiversity (Mace et al., 2005), with protected areas being a fundamental tool in preventing it. However, their coverage is limited (Rodrigues et al., 2004) and their integrity is threatened in areas with widespread deforestation (Pedlowski et al., 2005). Although the importance of secondary forests for conservation are still in debate, there is a consensus regarding the lack of information about this type of area (Thompson and Donnelly, 2018). Nowadays, since over half of the world's forests are degraded (FAO, 2015), inventories of these areas are necessary to understand how species will be in future scenarios.

The Atlantic Forest Domain (*sensu* Ab'Saber, 2003) is a biodiversity hotspot with only 11.4–28% of remaining vegetation (Rezende et al., 2018; Ribeiro et al., 2009). This domain has a high longitudinal and an extensive latitudinal range with great altitudinal variation, from sea level to 2800 meters elevation (Vasconcelos et al., 2014). These features, associated with the topographical complexity, could explain the high biodiversity and endemism rates observed in its domain (Carnaval et al., 2009; Myers et al., 2000; Silva, 2017). The Atlantic Forest is under pressure by urban expansion, reforestation with exotic species, agriculture, and other exploratory activities (Ribeiro et al., 2009). Such activities have led to habitat loss and fragmentation, leaving small islands of native vegetation embedded in a poorly permeable

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matrix (Ribeiro et al., 2009; Rodrigues et al., 2004). This makes species inventories an important tool to evaluate the conservation priorities in this domain.

With 1188 species of amphibians (Segalla et al., 2021) and 796 species of reptiles described (Costa and Bérnils, 2018), Brazil is among the most biodiverse countries in the world. The Atlantic Forest has the biggest species richness and endemism rates of the country (Rossa-Feres et al., 2017; Tozetti et al., 2017), and new species of herpetofauna are continuously described (e.g., Magalhães et al., 2020; Mebert et al., 2020; Prates et al., 2020), as we are far from establishing an end of species inventories (Moura et al., 2018). Since there are regions, such as the low altitudes areas in the south coastal of São Paulo, with a low number of inventories (e.g. Marques and Sazima, 2004; Pombal Jr. and Gordo, 2004; Campos and Lourenço-de-Moraes, 2017) lacunas about biodiversity composition need to be filled.

Therefore, considering the lack of information in relation to secondary forest fragments and how the Atlantic Forest is threatened by deforestation, especially on the coastal region of São Paulo state, we present here a herpetofauna inventory of Estação Ambiental São Camilo, a low altitude secondary fragment of Atlantic Forest in the south coast of São Paulo state, southeastern Brazil.

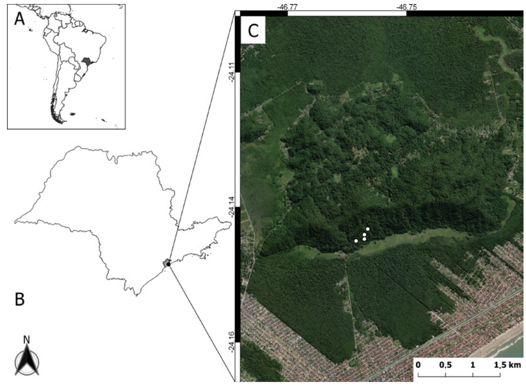

Figure 1. Geographic localisation of the Estação Ambiental São Camilo (EASC). (A) Location of the São Paulo state (in black) in relation to South America. (B) Location of Itanhaém municipality (in grey) in relation to the State of São Paulo and the EASC (black dot). (C) Sample points (white dots, as shown on Table 1) and the fragment where the work was conducted.

Material and Methods

Study area. Extensive fieldwork was conducted at the *Estação Ambiental São Camilo* (EASC) (-24.14305º, -46.76028º), a private reserve located in the Itanhaém municipality, São Paulo State (Fig. 1). The EASC belongs to a fragment of ~1500 ha (altitude range 5–290 m) of the Atlantic Forest Domain, characterised by Flooded Restinga and Submontane Atlantic Rainforest transition, in proximity to the Serra do Mar mountain range (Sartori and Vercellino, 2018). This area can be divided into three occupation categories: anthropic use (pasture and swamp areas, used for the ranching of African buffaloes - *Syncerus caffercaffer*); hotel research structure, a regeneration area with exotic vegetation, *Pinus* sp. and *Eucaliptus* sp.; and an area of Submontane Atlantic Rainforest in regeneration for over 20 years (until the beginning of our fieldwork) reserved for environmental education and research activities.

Data sample. We conducted 40 field expeditions during 21 months, between October 2011 and June 2013, regular sampling lasted two days per expedition for a total of 80 sampling days. During these expeditions, three different sampling methods were employed: pitfall traps (PT), visual encounter surveys (VES), and occasional encounters (OE) (Crump and Scott-Jr, 1994; Martins and Oliveira, 1998; Cechin and Martins, 2000). The VES occurred during night and day, once per expedition and always conducted by two people, and in three different sampling points: one in the forest area and two adjacent to water bodies. The PT method consisted of three pitfall trap arrays, composed by three

Table 1. Sampling points in the EASC, municipality of Itanhaém, state of São Paulo, Brazil. Sample method: VES. Visual encounter survey; PT. pitfall traps. See text and Figure 1 for details.

Point	Coordinates	Sample Method	Description
1	-24.1409°S, -46.7583°W	PT/VES	Pond in secondary forest
2	-24.1406°S, -46.7568°W	PT/VES	Perennial stream in secondary forest
3	-24.1399°S, -46.7568°W	VES	Pond in secondary forest
4	-24.1390°S, -46.7562°W	PT	Secondary forest

stations with 15 buried buckets of 30 litres with a total of 45 buckets (Table 1). The buckets were checked every day and kept open for 30 hours per expedition. Specimens recorded outside of the VES and PT efforts were considered as OE: including individuals registered along the transect, between the sample points, and the swamps closed to the building of the EASC.

Voucher specimens and tissues were housed in the Museu de Zoologia da Universidade de São Paulo (MZUSP) (Appendix S1). Specimens were collected according to permits granted by ICMBio (31557-2). Nomenclature follows: Duellman et al. (2016) for Hylidae, and Frost (2021) for the other families of amphibians, and Uetz et al. (2020) for reptiles. To determine the endemism of species in the Atlantic Forest, we follow Rossa-Feres et al. (2017) for amphibians and Tozetti et al. (2017) for reptiles. To determine the level of threat, lists of global (IUCN, 2021), national (MMA, 2018) and state (SMA, 2018) level of endangered species were used.

Analysis. An individual-based dataset accumulation curve analysis (Gotelli and Colwell, 2001) was performed through 1000 randomisations of an abundance matrix. Each column of the matrix represents a species, and each row represents a method in a sampled day for amphibians, and a sample day for reptiles. Species richness estimator Jackknife 1 was used to determine the expected richness of both amphibians and reptiles curves (Colwell and Coddington, 1994; Colwell, 2009). This analysis was performed using EstimateS v.9.1.0 (Gotelli and Colwell, 2001), and graphics were made in Excel (v.2010).

Results

We recorded 22 species of amphibians (Figs. 2, 3) of the following families: Brachycephalidae (n = 2), Bufonidae (n=1), Craugastoridae (n = 1), Cycloramphidae (n = 1), Hylidae (n = 11), Hylodidae (n = 1), Leptodactylidae (n = 3), Microhylidae (n = 1) and Odontophrynidae (n = 1) (Table 2). The most common species was *Adenomera marmorata* (n = 54) followed by *Physalaemus moreirae* (n = 43) and *Ischnocnema* gr. *parva* (n = 35). The rarest species were *Pithecopus rohdei* and *Itapotihyla langsdorffii,* both with only a single record. Among the 22 species of amphibians sampled in EASC, 18 (81.8%) are endemic from Atlantic Forest Domain.

Eighteen species of reptiles were recorded (Figs. 4, 5) along 11 families: Chelidae (n = 1), Amphisbaenidae (n = 1), Anguidae (n = 1), Gekkonidae (n = 1), Gymnophthalmidae (n = 2), Leiosauridae (n = 1), Teiidae (n = 1), Colubridae (n = 3), Dipsadidae (n=4), Elapidae (n = 1) and Viperidae (n = 2) (Table 2). The most common species was *Bothrops jararaca* (n = 11), followed by *Enyalius iheringii* (n = 8) and *Helicops carinicaudus* (n = 7). Some species had only one specimen recorded, such as *Hydromedusa tectifera*, *Leposternon microcephalum*, *Ophiodes* sp., *Placosoma glabellum*, *Chironius bicarinatus*, and *Micrurus corallinus*. Among the 18 species of reptiles sampled in EASC, seven (38.8%) are endemic from Atlantic Forest Domain.

No registered species of amphibian or reptile is listed in the São Paulo, nor on the Brazilian list of endangered species, or is threatened according to the IUCN red list. However, *Proceratophrys pombali* is listed as a Data Deficient species in the Brazilian list, due to its restricted distribution and the lack of information about natural history (Haddad et al., 2016).

The richness estimator Jackknife 1 recovered 25 species of amphibians suggesting three more than we recorded. The curve for reptiles presents an ascending format and does not show any tendency to an asymptote. The estimated richness for the area was 27 species, nine species more than we recorded (18 species) (Fig. 7).

Discussion

The accumulation curve showed that sampling efforts were effective for amphibians, almost reaching its asymptote, in contrast to the reptile curve which was much higher (n = 27) than the one we recorded (n = 18) (Fig. 7). It is important to highlight that accumulation curves rarely stabilise, especially in tropical environments (Santos, 2004). As seen above for *Chiasmocleis leucosticta*, a species with explosive breeding, other species with similar behaviour may not be sampled. Besides, some species from the Atlantic Forest have their activity in unusual periods of the day, such as *Scinax cardosoi* which calls a few hours before the sunrise; different from other regional species (Moroti et al., 2017). In addition, given that reptiles have secretive habits and most species' records depends on fortunate events, the accumulation curve for this group rarely reaches an asymptote (Steen, 2010; Oda et al., 2017).

Some species recorded in the present study belong to species complexes usually associated with problematic identification. The species referred here as *Adenomera marmorata* may correspond to "*Adenomera* sp. J" (*sensu* Fouquet et al., 2014), since it is in the limits of this lineage' distribution. Nevertheless, to maintain a

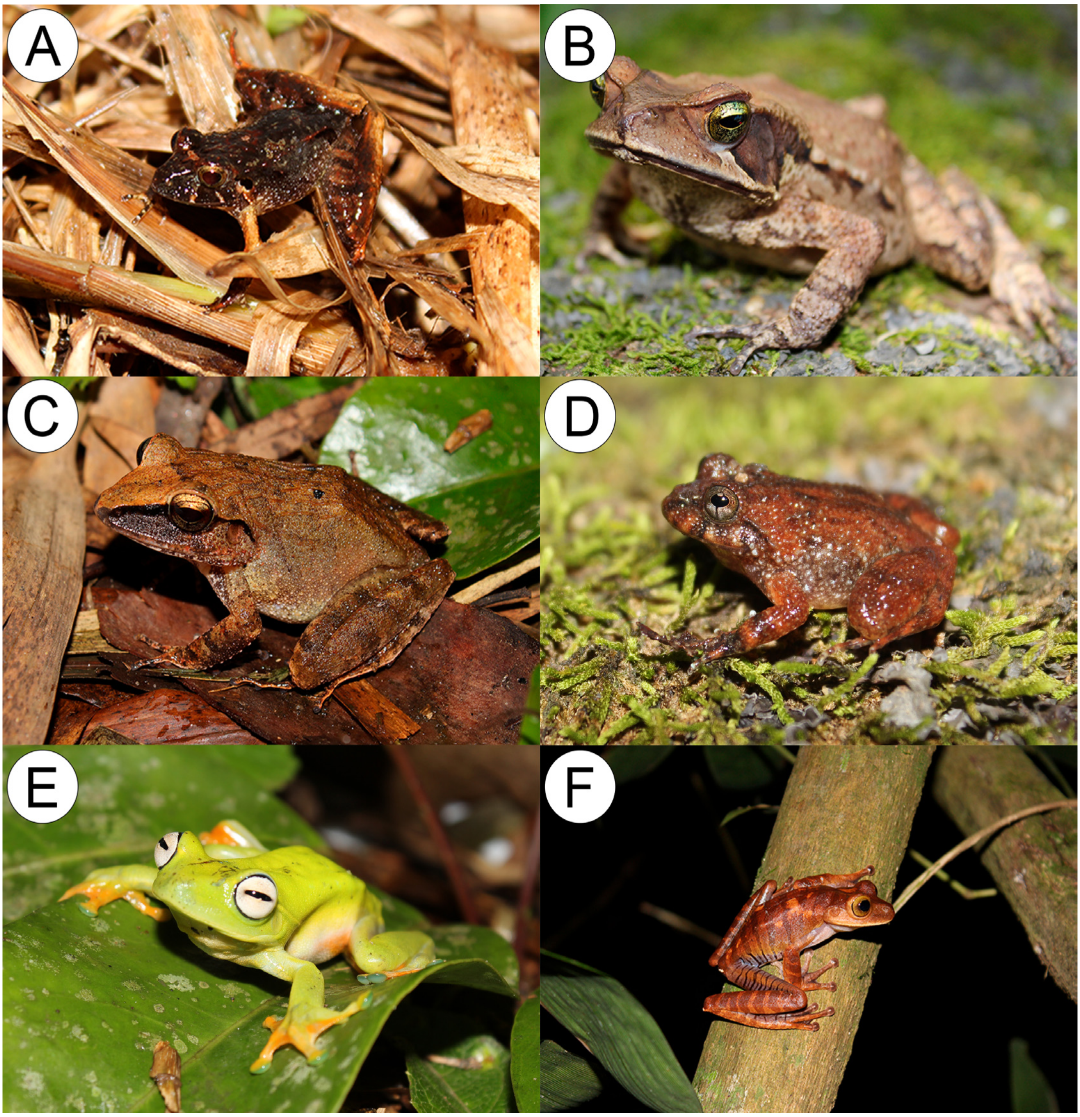

Figure 2. Some amphibian species sampled in the EASC, Itanhaém, Brazil. (A) *Ischnocnema* cf. *henselii*; (B) *Rhinella ornata*; (C) *Haddadus binotatus*; (D) *Cycloramphus dubius*; (E) *Boana albomarginata*; (F) *Bokermannohyla hylax*. Photos by Raissa M. S. Siqueira.

conservative decision it was identified as *A. marmorata* following Cassini et al. (2020). *Ischnocnema* cf. *henselii* may correspond to the lineage "CS 3" *sensu* Gehara et al. (2013). However, as its call was not recorded, which is the diagnostic characteristic, its identity was not confirmed. The *I. parva* complex was demonstrated to correspond of six different lineages, with the lineage that occurs in EASC might correspond to "SP1", given its distribution, *sensu* Gehara et al. (2017). Thus, we opt to mention this identity as *I.* gr. *parva*. Recently, a review of the *Leptodactylus latrans* complex led to the recognition of four new species (Magalhães et al., 2020). In our study area only *L. paranaru* is known, with *L. latran*s being restricted to the north coastal zone of the state. Even with the morphologic similarity and without the advertisement call (diagnostic character), it was identified as *L. paranaru*, following Magalhães et al. (2020).

When *P. pombali* was described, no information about its natural history was given (see Mângia et al.,

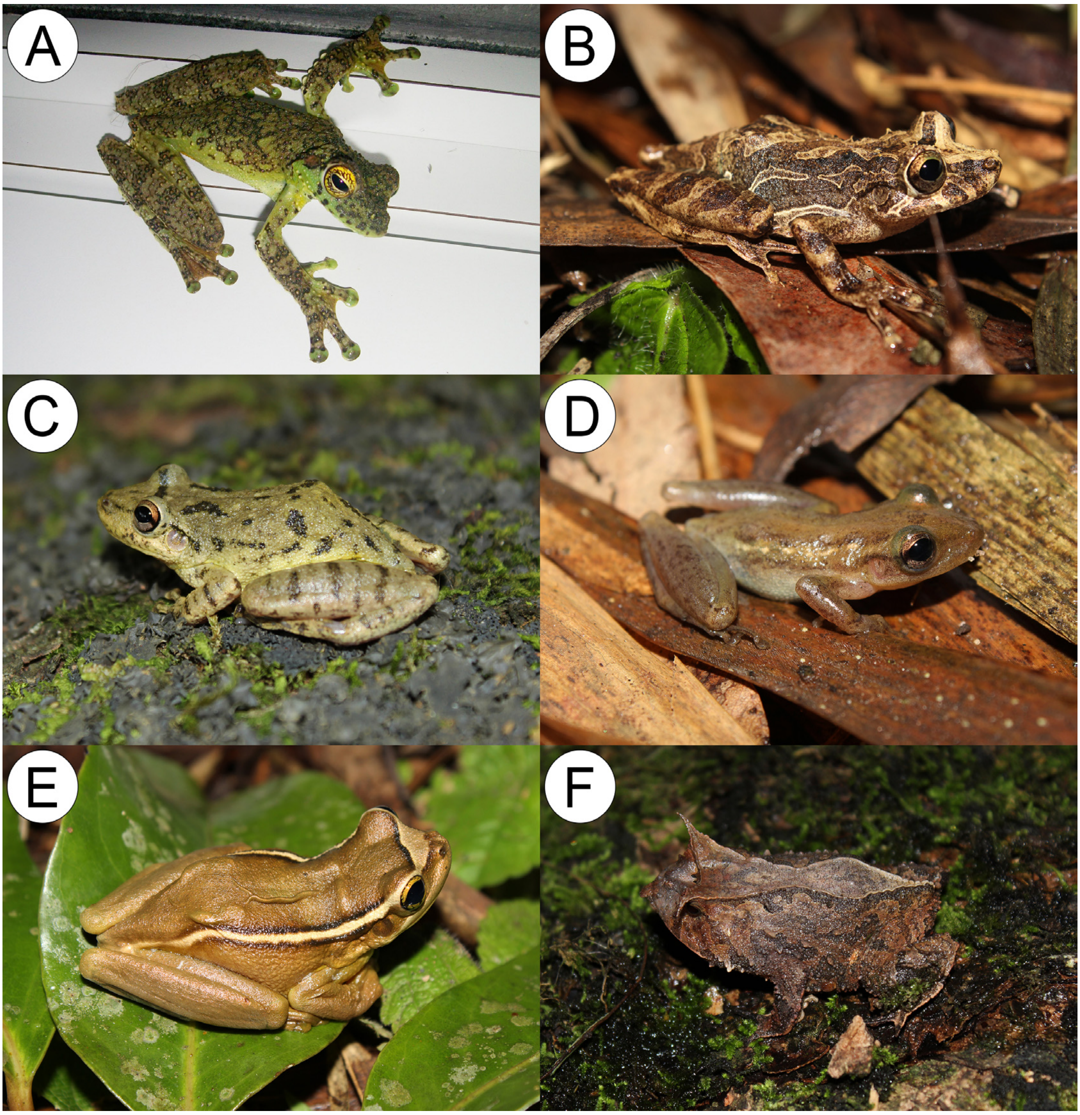

Figure 3. Some amphibian species sampled in the EASC, Itanhaém, Brazil. (A) *Itapotihyla langsdorffii*; (B) *Ololygon littoralis*; (C) *Scinax fuscovarius*; (D) *Scinax tymbamirim*; (E) *Trachycephalus mesophaeus*; (F) *Proceratophrys pombali*. Photos by Raissa M. S. Siqueira.

2014). Posteriorly, Malagoli et al. (2016) contributed to a better understanding of its distribution, indicating that the holotype and part of the range falls within a protected area (Núcleo Curucutu do Parque Estadual da Serra do Mar). In EASC we recorded three specimens in the secondary forest, and one of them was in the forest border. Of our collected vouchers, two individuals were used as paratypes. We sampled two specimens during the crepuscular period and one during the night, which were all found active on the dry forest floor. When handled no defensive behaviour was reported.

Except for *Boana faber* and *Scinax fucovarius*, all recorded amphibian species are endemic to the Atlantic Forest (Rossa-Feres et al., 2017). Nevertheless, almost all are considered to be generalists, common and tolerant to anthropized areas, except *P. pombali* and *Cycloramphus dubius*, which are both less common and have a restricted distribution (Haddad et al., 2013; Mângia et al., 2014; Malagoli et al., 2016). Species such as *Boana albomarginata*, *Dendropsophus werneri* and

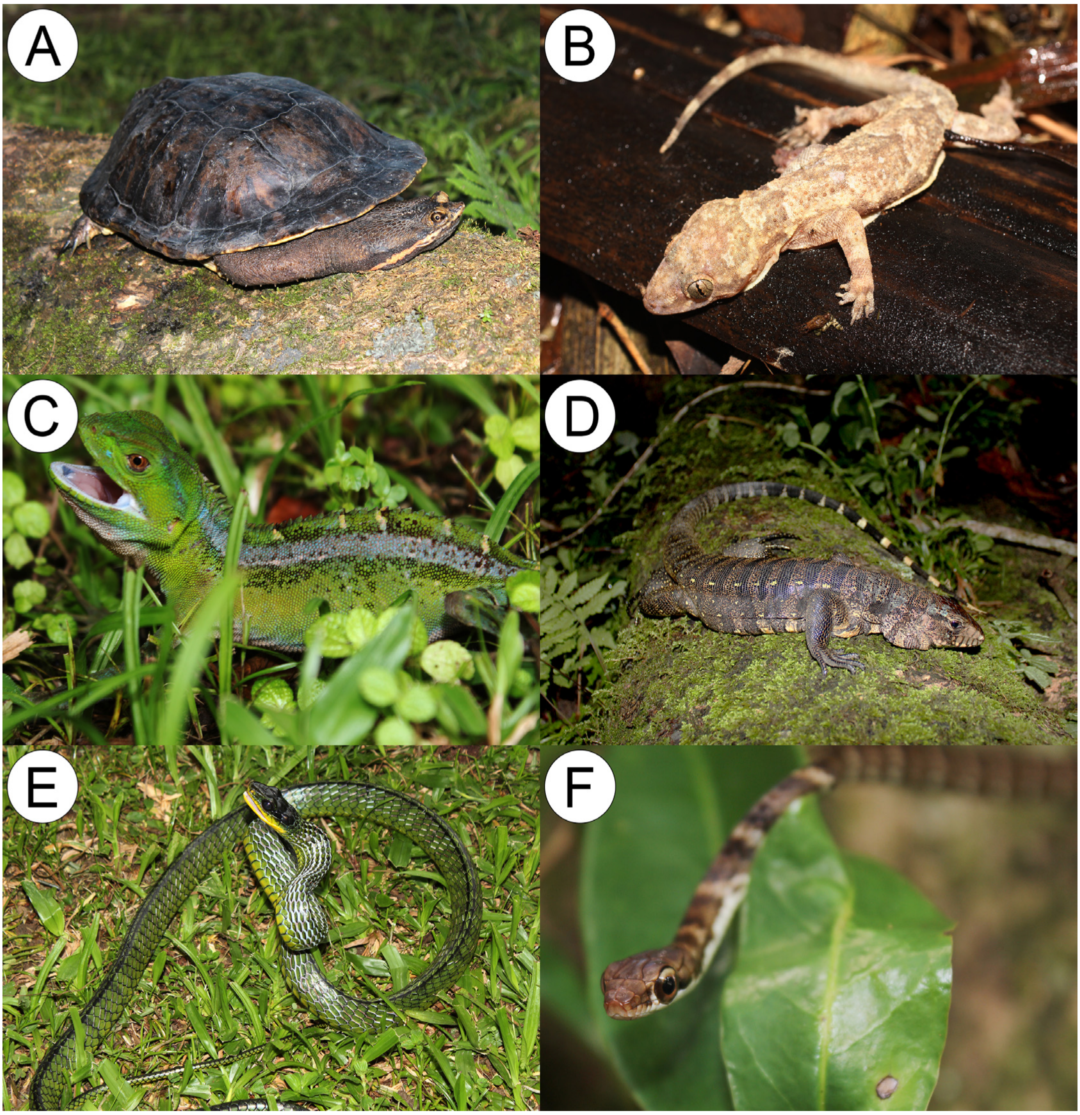

Figure 4. Some reptile species sampled in the EASC, Itanhaém, Brazil. (A) *Hydromedusa tectifera*; (B) *Hemidactylus mabouia*; (C) *Enyalius iheringii*; (D) *Salvator merianae*; (E) *Chironius bicarinatus*; (F) *Chironius fuscus*. Photos by Raissa M. S. Siqueira.

Scinax tymbamirim were frequently registered near the building of the EASC, calling in a swamp area with high anthropogenic impact. *Chiasmocleis leucosticta* was registered only on a torrential rainy day, which reflects its explosive breeding behaviour, common for this genus (Haddad and Hödi, 1997). One individual was captured in a pitfall trap in an interspecific amplexus with *A. marmorata* (Fig. 6).

All recorded reptiles are common and widely distributed in the Atlantic Forest, and seven species are considered endemic (Marques et al., 2001; Cicchi et al., 2007; Tozetti et al., 2017). *Ophiodes* sp. was the only species that was not identified at the species level given the advanced stage of decomposition when we found it. This genus has an intricated taxonomic history regarding to its species (Entiauspe-Neto et al., 2017), leading other researchers to adopt similar decisions (e.g., Condez et al., 2009; Souza Filho and Verrastro, 2012; Trevine et al., 2014).

The swamp area, used by African buffaloes and local fisherman, was the only site where we recorded semi-aquatic species of snakes such as *Erythrolamprus*

Figure 5. Some reptile species sampled in the EASC, Itanhaém, Brazil. (A) *Spilotes pullatus*; (B) *Echinanthera cephalostriata*; (C) *Erythrolamprus miliaris*; (D) *Helicops carinicaudus*; (E) *Bothrops jararaca*; (F) *Bothrops jararacussu*. Photos by Raissa M. S. Siqueira.

miliaris and *Helicops carinicaudus*. Usually, specimens of *H. carinicaudus* are caught by mistake and killed by fishers (see Siqueira et al., 2015); fishers commonly use pieces of the fish *Geophagus brasiliensis* as bait for *Hoplias* spp, and as *Helicops* spp. are known for their necrophagic feeding, these baits are attacked (Sazima and Strussman, 1990).

Brasil et al. (2018) provided a check list of 21 species from EASC, 16 amphibians and five reptiles, based on visual encounter surveys during 18 days of fieldwork. These authors recorded two species not sampled at this work, one anuran and one snake, *Scinax crospedospilus* and *Dipsas alternans*, respectively. Their results pointed to a low herpetofauna diversity and the suggestion of new methods and longer survey times to identify the true diversity of EASC. With more species recorded, the richness of anurans inventoried here is compatible with other inventories in low elevation of south coastal of São Paulo (e.g., Pombal Jr. and Gordo, 2004, n = 26; Campos and Lourenço-de-Moraes, 2017, n = 29). However, the

Table 2. List of herpetofauna species recorded for the EASC, municipality of Itanhaém, state of São Paulo, southeastern Brazil. with information about the sample method and Atlantic Forest endemism. Endemic species are indicated with a "X". OE. Occasional encounters; VES. Visual encounter survey; PT. pitfall traps.

Taxa	Sample Method	Endemic
Brachycephalidae		
Ischnocnema cf. *henselii* (Peters,1870)	OE, VES, PT	
Ischnocnema gr. *parva* (Girard, 1853)	OE, VES, PT	
Bufonidae		
Rhinella ornata (Spix, 1824)	OE, VES, PT	X
Craugastoridae		
Haddadus binotatus (Spix, 1824)	OE, VES, PT	X
Cycloramphidae		
Cycloramphus dubius (Miranda-Ribeiro, 1920)	OE, VES	X
Hylidae		
Boana albomarginata (Spix, 1824)	OE	X
Boana faber (Wied-Neuwied, 1821)	OE, VES	
Bokermannohyla hylax (Heyer, 1985)	OE, VES	X
Dendropsophus werneri (Cochran, 1952)	OE	X
Itapotihyla langsdorffii (Duméril & Bibron, 1841)	OE	X
Ololygon littoralis (Pombal & Gordo, 1991)	OE, VES	X
Pithecopus rohdei (Mertens, 1926)	OE	X
Scinax fuscovarius (Lutz, 1925)	OE	
Scinax hayii (Barbour, 1909)	OE	X
Scinax tymbamirim Nunes et al., 2012	OE	X
Trachycephalus mesophaeus (Hensel, 1867)	OE	X
Hylodidae		
Hylodes phyllodes Heyer & Cocroft, 1986	OE, VES	X
Leptodactylidae		
Adenomera marmorata Steindachner, 1867	OE, VES, PT	X
Leptodactylus paranaru Magalhães et al., 2020	OE, VES	X
Physalaemus moreirae (Miranda-Ribeiro, 1937)	OE, VES, PT	X
Odontophrynidae		
Proceratophrys pombali Mângia et al., 2014	OE	X
Microhylidae		
Chiasmocleis leucosticta (Boulenger, 1888)	PT	X
Ordem Testudines		
Chelidae		
Hydromedusa tectifera Cope, 1869	OE	
Ordem Squamata		
Amphisbaenidae		
Leposternon microcephalum Wagler, 1824	OE	
Anguidae		
Ophiodes sp.	OE	
Gekkonidae		
Hemidactylus mabouia (Moreau De Jonnès, 1818)	OE	
Gymnophthalmidae		
Ecpleopus gaudichaudii Duméril & Bibron, 1839	OE, PT	X
Placosoma glabellum (Peters, 1870)	OE	X

Table 2. Continued.

Taxa	Sample Method	Endemic
Leiosauridae		
Enyalius iheringii Boulenger, 1885	OE, PT	X
Teiidae		
Salvator merianae Duméril & Bibron, 1839	OE	
Colubridae		
Chironius bicarinatus (Wied-Neuwied, 1820)	OE	
Chironius fuscus (Linnaeus, 1758)	VES	
Spilotes pullatus (Linnaeus, 1758)	VES	
Dipsadidae		
Echinanthera cephalostriata Di Bernardo, 1996	VES	X
Erythrolamprus miliaris (Linnaeus, 1758)	OE	
Helicops carinicaudus (Wied-Neuwied, 1825)	OE	X
Dipsas neuwiedi (Ihering, 1911)	OE	
Elapidae		
Micrurus corallinus (Merrem, 1820)	OE	X
Viperidae		
Bothrops jararaca (Wied-Neuwied, 1824)	OE, VES, PT	
Bothrops jararacussu Lacerda, 1884	OE	X

richness of reptiles was considerably smaller when compared with a previous inventory in the same region (Marques and Sazima, 2004, n = 36). This difference might be due to the reduced size of the secondary-forest fragment, its low elevation, associated with the size of the area investigated during our fieldwork.

The study area is located within the Serra do Mar mountain range, which is considered as one of the most biodiverse forests, with the largest number of endemic species for several taxonomic groups (Garcia and Pirani, 2005; Ribeiro et al., 2006; Field et al., 2014; Malagoli, 2018). Malagoli (2018) conducted a detailed study in Serra do Mar and mapped 170 endemic anurans in this mountain range, also pointing out its extraordinarily megadiversity. Regions with topographic complexity present climatic heterogeneity (Hawkins et al., 2003; Qian et al., 2007; Hoorn et al., 2010; Pie et al., 2013; Godinho and Silva, 2018), which provide different habitats and consequently higher species diversity (Loyola et al., 2013; Lemes et al., 2014; Campos et al., 2017). The historical degradation around the study area, and the use of EASC for different activities, such as agriculture and livestock, since 1914 (Santos et al., 2004; Sartori and Vercellino, 2018), might contribute to understanding the low diversity of reptiles. Conservation programs should consider also small fragments, like the Estação Ambiental São Camilo, within Atlantic Forest Domain given these may act as habitat refuges and dispersal corridors, harbouring a considerable richness of herpetofauna (Silva et al., 2011; Lion et al., 2016; Delaney et al., 2021).

Figure 6. An interspecific axillary amplexus between *Chiasmocleis leucosticta* and *Adenomera marmorata* recorded at EASC, in municipality of Itanhaém, São Paulo, Brazil. Photo by Raissa M. S. Siqueira.

Since there are few inventories from secondary forests (see Thompson and Donnelly, 2018), and the known sampling gap along the southern coast of São Paulo, this list contributes to better understanding of the local herpetofauna diversity in a 20-year-old secondary forest. The number of endemic amphibians, including new species (see Mângia et al., 2014), and the richness

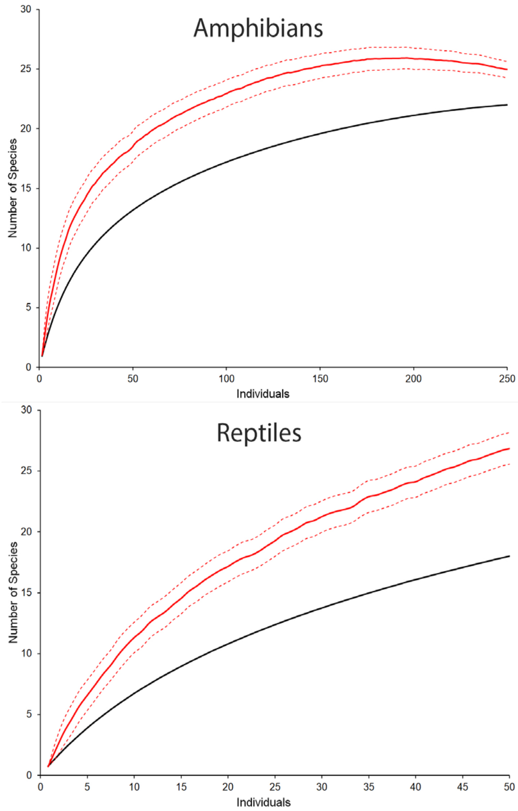

Figure 7. Accumulation curve for amphibians (above) and reptiles (below) sampled at the municipality of Itanhaém, state of São Paulo, southeastern Brazil. Black lines represent the accumulation curves, red lines represent species estimates based on Jackknife1 and red dashed lines represent its interval of confidence.

as found in well-preserved areas (see Campos and Lourenço-de-Moraes, 2017) indicates the importance to study these zones as an alternative to preserve the Atlantic Forest diversity. "Low" diversity areas in other parts of Brazil have proven to be essential when observed from a wide perspective, demonstrating how these "coldspots" must be considered (e.g. Almeida et al., 2011; Lourenço-de-Morais et al., 2018). More fieldwork in areas considered as having "low diversity" may further elucidate questions about the real importance of these spots and how they could contribute to mitigate the impact of deforestation in the Atlantic Forest. Alternatively, monitoring these areas over the course of forest succession might bring light to how herpetofauna deal with local changes.

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Appendix S1. Specimens of amphibians and reptiles collected at EASC, municipality of Itanhaém, State of São Paulo, Brazil.

Ischnocnema cf. *henselii* – MZUSP 153722, MZUSP 153723, MZUSP 153724, MZUSP 153725, MZUSP 153726; *Ischnocnema* gr. *parva* – MZUSP 153717 , MZUSP 153718, MZUSP 153719, MZUSP 153720, 153721; *Rhinella ornata* – MZUSP 153615, MZUSP 153616, MZUSP 153617, MZUSP 153618, MZUSP 153619; *Haddadus binotatus* – MZUSP 153635, MZUSP 153636; *Cycloramphus dubius* – MZUSP 153631, MZUSP 153632, MZUSP 153632, MZUSP 153633, MZUSP 153634; *Proceratophrys pombali* – MZUSP 148085, MZUSP 148114; *Boana albormaginatus* – MZUSP 153622, MZUSP 153623; *Boana faber* – MZUSP 153620, MZUSP 153621; *Bokermannohyla hylax* – MZUSP 153653, MZUSP 153654, MZUSP 153655; *Dendropsophus werneri* – MZUSP 153641, MZUSP 153642, MZUSP 153643; *Itapotihyla langsdorffii* – MZUSP 153640, MZUSP 153641; *Scinax tymbamirim* – MZUSP 153627, MZUSP 153628; *Scinax fuscovarius* – MZUSP 153629, MZUSP 153630 *Scinax hayii* – MZUSP 153651, MZUSP 153652; *Ololygon littoralis* – MZUSP 153624, MZUSP 153625, MZUSP 153626; *Trachycephalus mesophaeus* – MZUSP 153637, MZUSP 153638; *Hylodes phyllodes* – MZUSP 153639, MZUSP 153640; *Physalaemus moreirae* – MZUSP 153727, MZUSP 153728, MZUSP, 153729, MZUSP 153730, MZUSP 153731; *Leptodactylus paranaru* – MZUSP 153644, MZUSP, 153645, MZUSP 153646, MZUSP 153647, MZUSP 153648; *Adenomera marmorata* – MZUSP 153737, MZUSP 153738, MZUSP 153739, MZUSP 153740, MZUSP 153741; *Chiasmocleis leucosticte* – MZUSP 153656, MZUSP 153657; *Hydromedusa tectifera* – MZUSP 4588; *Leposternon microcephalum* – MZUSP 104212; *Ophiodes* sp. – MZUSP 104224; *Hemidactylus mabouia* – MZUSP 104213; *Ecpleopus gaudichaudii* – MZUSP 104221, MZUSP 104222; *Placosoma glabellum* – MZUSP 104223; *Enyalius iheringii* – MZUSP 104214, MZUSP 104215, MZUSP 104216, MZUSP 104217, MZUSP 104218; *Salvator merianae* – MZUSP 104219, 104220; *Chironius fuscus* – MZUSP 21244; *Chironius bicarinatus* – MZUSP 21243; *Spilotes pullatus* – MZUSP 21236; *Echinanthera cephalostriata* – MZUSP 21245, MZUSP 21246; *Erythrolamprus miliaris* – MZUSP 21249, MZUSP 21250, MZUSP 21251; *Helicops carinicaudus* – MZUSP 21252, MZUSP 21255, MZUSP 21256, MZUSP 21257, MZUSP 21258; *Dipsas neuwiedi* – MZUSP 21248; *Micrurus corallinus* – MZUSP 21247; *Bothrops jararaca* – MZUSP 21237, MZUSP 21238, MZUSP 21239, MZUSP 21240; *Bothrops jararacussu* – MZUSP 21242, MZUSP 21243

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