

Amphibians and Reptiles of the Refúgio de Vida Silvestre Mata do Junco, municipality of Capela, state of Sergipe, northeastern Brazil

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ABSTRACT: The Brazilian Atlantic Rainforest has high diversity levels of amphibians and reptiles, but there is a lack of richness survey at several areas, while a high level of deforestation is already known. The biome is highly endangered in northeastern Brazil, and few protected areas have been the main mechanism for providing the habitat conservation. We studied the Refúgio da Vida Silvestre Mata do Junco, a recently established conservation unit in this biome, at the Capela municipality, in the state of Sergipe. Field surveys and literature review were conducted between 2007-2009, revealing 33 species of anuran amphibians and 26 of reptiles (one turtle, ten lizards and 15 snakes). The presence of rare and endemic species suggests an important role of this area as a source remnant of the northeastern Atlantic Forest herpetological community.

INTRODUCTION

The Brazilian herpetofauna is one of the richest in the World (Duellman 1990), and the Atlantic Forest stands as the most important domain regarding endemic species of both amphibians and reptiles in Brazil (Pombal and Gordo 2004; Marques and Sazima 2004). In northeastern Brazil, at least 82 species of anurans, one cecilian, 94 snakes, two crocodylians, 44 lizards, nine amphisbaenians and eight turtles are known to the biome (Argôlo 2004; Freitas and Silva 2005). However, the amphibians and reptiles at large areas of the region remain unknown, which includes the state of Sergipe. Few studies on the herpetofauna species community in this state were already conducted at the Serra de Itabaiana National Park (Carvalho et al. 2005) and at Crasto Forest (Arzabe et al. 1998). Additionally, recent records of species in Sergipe state were made (e.g. Arzabe and Loebmann 2006; Delfim et al. 2006; Santana et al. 2009; Noronha-Oliveira et al. 2010; Caldas et al. 2011; Ferreira and Faria 2011).

The Refúgio da Vida Silvestre Mata do Junco (RVSMJ) is a conservation unit created in 2007, in order to protect a population of the titi monkey *Callicebus coimbrai* (Pitheciidae), an endangered and endemic species of the northeastern Atlantic Forest. For the management strategies establishment in this conservation unit, studies on several taxonomic groups were required, such

as a herpetological survey and the definition of many management actions. This paper presents the results of the survey on the herpetofauna of the RVSMJ. This study had focused on the occurrence and spatial distribution of amphibians and reptiles species, which allow us to suggest further research and management actions for this area.

MATERIALS AND METHODS

Study area

The RVSMJ (Figure 1) comprises ca. of 9 km², and is located in the Capela municipality, at the Sergipe state, northeastern Brazil (37°03'30" W, 10°32'30" S). Originally, the Capela surrounding area was covered by Atlantic Forest, but currently it is composed primarily by agriculture and livestock activities. The RVSMJ area includes two isolated forest fragments, mostly covered by secondary forest remnants, although altered open areas also occur (ca. 25% of the area). One small reservoir is found in the Lagartixo River, the main hydrological resource of the reserve, belonging to the Japarutuba River basin.

Data collection

Data were acquired *ad libitum* and by occasional observations of some of the authors (S.F.Gouveia, J.P. Souza-Alves, R.G. Faria and M.J. Silva) between 2007-2009,

and also by a field survey conducted at 15-19 September, 2009, following the Ecological Rapid Assessment (ERA) (Sobrevilla and Bath 1992). During the ERA, amphibians and reptiles were recorded by active search and manual capture, and by pitfall traps with drift-fence (Campbell and Christman 1982; Fitch 1992; Franco and Salomão 2002). Three collectors actively searched for specimens at day (from 9:00h to 12:00h and from 15:00 to 18:00h) and at night (from 20:00h to 00:00h), in distinctive habitat types and local potential breeding sites, using several tracks inside and at the surrounding area of the RVSMJ (forests; wetlands, marshes and riparian vegetation; altered open areas).

Pitfall traps were set up in secondary forests at two

sites (Figure 1) as an auxiliary method. One pitfall station with ten 40 liters buckets was built at each site, with eight meters between each bucket, connected by a 50 cm height polyethylene fence-guide (drift-fence). Traps were checked daily, totaling 100 buckets-day of total effort. Voucher specimens collected during the ERA were fixed in 10% formalin and later preserved in 70% ethanol, and stored at the Museu de História Natural Capão da Imbuia (MHNCI) in municipality of Curitiba, Paraná state, Brazil. Specimens collected previously to the ERA were stored at the Coleção Herpetológica da Universidade Federal de Sergipe (CHUFS). Sampling was performed under the ICMBio/SISBIO permit number 20518. Voucher specimens are listed in the Appendix 1.

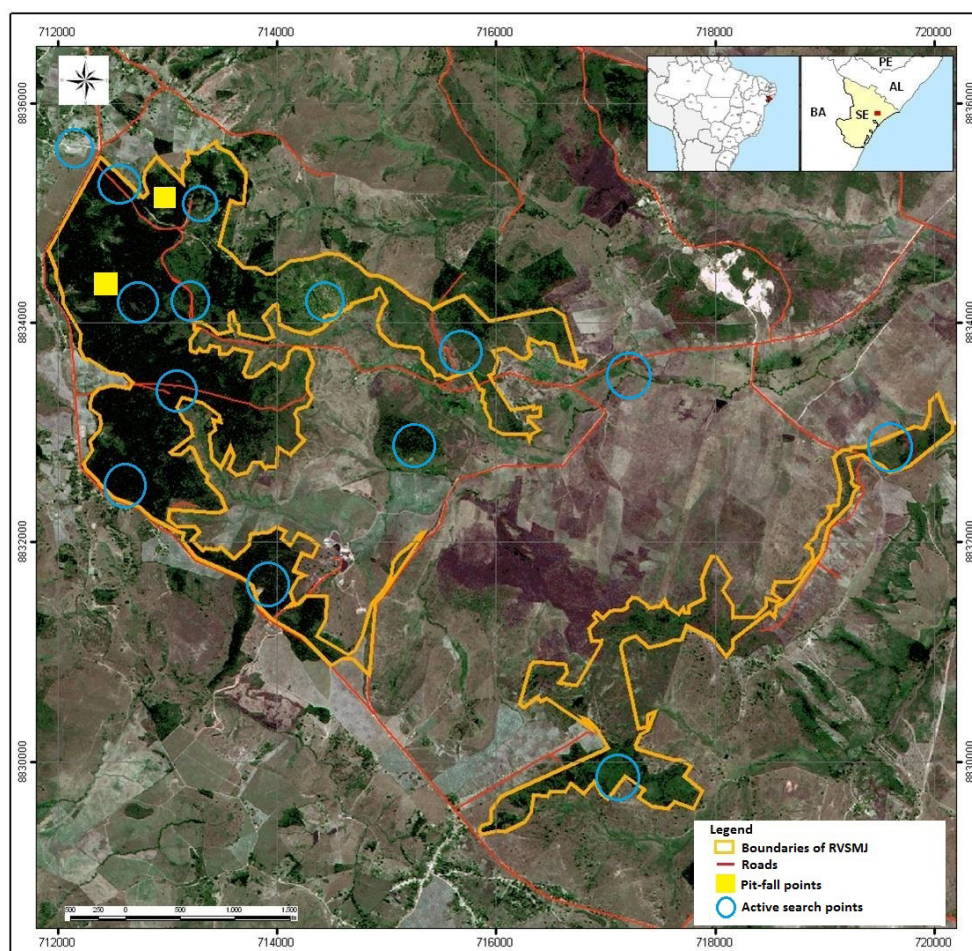


FIGURE 1. The Refúgio da Vida Silvestre Mata do Junco, Capela municipality, state of Sergipe, Brazil, with the pit-fall traps sites (yellow squares) and the active search sites (blue circles).

RESULTS AND DISCUSSION

A total of 59 species were found at RVSMJ (Table 1), which 26 were reptile and 33 were amphibian species. Figures 3-5 present some of the collected taxa. Only anuran species were found among the amphibians (12 genera of seven families). Among reptiles, one chelid turtle, 10 lizards (from 10 genera and seven families) and 15 snakes (14 genera, six families) were recorded. The richness we found is similar to other localities in the Atlantic Forest of Sergipe, or even among other states of the northeastern Brazil. At the Serra de Itabaiana National Park, Carvalho *et al.* (2005) found 55 species (23 amphibians and 32 reptiles); in the Crasto forest, 17 anurans were found (Arzabe *et al.* 1998). In other states, the richness is somewhat different. Atlantic

Forest remnants at southern Bahia had revealed between 13-39 species per fragment (Silvano and Pimenta 2003). In the Paraíba state, 14 amphibians and 37 reptiles were found at Mata do Buraquinho, João Pessoa (Santana *et al.* 2008).

Since the data we had gathered and the other studies were performed at singular ways, this data collection does not allow conclusive comparisons between the species richness of the RVSMJ and other previously studied sites. Even though, we have made some inferences on it, as a trial to understand the richness pattern over this region. Following this statement, by anecdotal comparison with the species richness presented above, we suggest that the richness presented for the RVSMJ perhaps would be close

to the total richness of the area. We only had comparative sampling effort for the five days of the ERA at RVSMJ (including active search and pitfall methods), that had shown a reduction in the increase of the species among the last days (day 1 = 23 species; day 2 = 28; day 3 = 30; day 4 = 33; day 5 = 35) (Figure 2). The species accumulation curve indicates that the ERA alone was not sufficient to record the amphibians and reptiles in the area, since 24 species (40%) were found only by other methods. However, the 59 species records obtained by the ERA together with the occasional observations seem to be representative for the RVSMJ herpetological community, based on the herpetofaunal richness verified from the other studied sites in the Atlantic Forest of northeastern Brazil cited above. Future studies must be carried on to confirm this hypothesis.

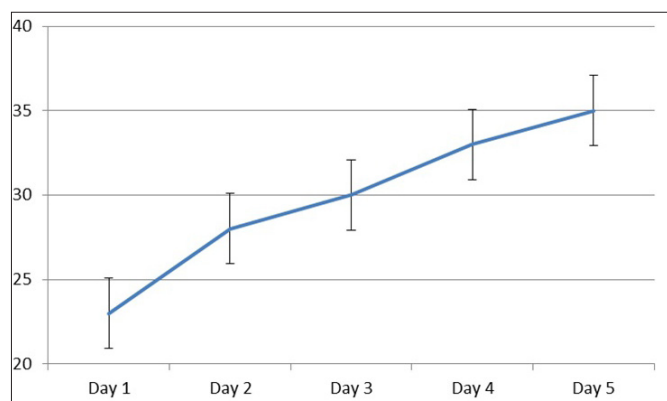


FIGURE 2. Species accumulation curve obtained during the Ecological Rapid Assessment conducted between 15 to 19 September, 2009, at the Refúgio da Vida Silvestre Mata do Junco, Capela municipality, state of Sergipe, Brazil.

Anyway, some increase in this richness must be expected. The occurrence of others conspicuous groups, like crocodylians (such as *Caiman latirostris*) and amphisbaenians, was advised by local people at the RVSMJ and surrounding area, and certainly further assessment will enlarge the present richness. Perhaps every other study in Sergipe, just as this one, has its amphibian and reptile richness potentially underestimated, since any study had really stressed out the sampling methods at distinctive seasons, what would likely increase the richness of each study site. Another issue that certainly would favor for increasing the species richness is related to the demand of studies with taxonomic approaches. We were unable to identify specimens of two anuran taxa: *Dendropsophus* sp. (Figure 3E) and *Ischnocnema* sp. (Figure 4G). Also, a *Pseudopaludicola* sp. was recorded only by hearing. These three genera have an intricate taxonomy, but it seems that

at least the two first species were not described yet.

Ecologically, the local herpetological assemblage suggests a complex composition, including species with distinct requirements, as usual for Atlantic Forest sites (Marques and Sazima 2004; Pombal-Jr. and Gordo 2004). The majority of recorded species is ubiquitous in the study area, inhabiting more than one kind of habitat, although some species were found exclusively in the litter of the forests (e.g. *Ischnocnema* spp., *Proceratophrys renalis*, *Coleodactylus meridionalis* and *Taeniophallus occipitalis*), in aquatic habitats (*Mesoclemmys tuberculata* and *Eunectes murinus*), or in the open altered areas (Table 1). In other hand, due to the existence of larval stages in life history of most of the amphibian species, it might be expected a local hydrological resources dependency for this group, with few exceptions (i.e. *Ischnocnema* spp. [Pombal and Gordo 2004; Carvalho et al. 2005]). In addition, the record of *Ischnocnema vinhai* (Figure 4H) achieves an expansion on the known distribution range of this species, which were already recorded at Porto Seguro region, state of Bahia (e.g. Lynch and Duellman 1997; Frost 2010), at a distance ca. of 670 km southward.

Although the study site is located at the Atlantic Forest biome, some of the recorded species (e.g. *Epicrates assisi*, *Mabuya heathi* and *Cnemidophorus occelifer*) are typical from open habitats of northeastern Brazil, such as Caatinga, the nearest biome (see Vanzolini et al. 1980; Freitas and Silva 2005, 2007), or have a widespread distribution (e.g. *Ameiva ameiva*; see Vitt and Colli 1994). There is not any previous and similar survey that would allow one to infer on the original distribution of these species, what suggests two hypothesis: (1) the actual distribution range of those species are a result of natural and historical conditions; or (2) the species would have been following habitats shifts driven by human colonization.

According to our data, despite the several impacts this area has been suffering throughout the human colonization, what remains from its original structure has still maintaining essential environmental conditions, which allow the safeguarding of some Atlantic Forest amphibian and reptiles species of the state of Sergipe. Finally, we pointed out suggestions that should be taken as the management prime actions for the RVSMJ and surrounding area, in order to avoid any population decline. The emphasis should be applied for the establishment of forest corridors, concerning metapopulation viability. Forest restoration certainly will be required, and some of the species recorded herein (with priority for those forest dependents) must be used as models for evaluating the success of the management actions, as indicative species.

TABLE 1. Herpetofaunal species recorded at Refúgio de Vida Silvestre Mata do Junco, state of Sergipe, Brazil, related to habitat types of record. Habitat types: F = Forests; W = Wetlands (marshes and margins of lake and reservoir); R = rivers and streams; OA = Open areas (including the altered ones); Sample method: M = Manual; PF = Pit-fall trap; V = Visual record; A = Auditory record; PH = Photographed by M.J.Silva.
* Species recorded during the Ecological Rapid Assessment method from 15 to 19 September, 2009.

TAXA	HABITAT TYPE	SAMPLE METHOD
AMPHIBIA		
ANURA		
Brachycephalidae		
<i>Ischnocnema ramagii</i> (Boulenger, 1888)	F	M, PF *
<i>Ischnocnema vinhai</i> (Bokermann, 1975 "1974")	F	M *
<i>Ischnocnema</i> sp.	F	M, PF *
Bufo		
<i>Rhinella granulosa</i> (Spix, 1824)	F, W	M *
<i>Rhinella jimi</i> (Stevaux, 2002)	F, W, OA	M *
Cycloramphidae		
<i>Proceratophrys renalis</i> (Miranda-Ribeiro, 1920)	F	M, PF *
Hylidae		
<i>Corythomantis greeningi</i> Boulenger, 1896	OA	M
<i>Dendropsophus branneri</i> (Cochran, 1948)	W	M *
<i>Dendropsophus</i> sp.	F	M *
<i>Dedropsophus decipiens</i> (A. Lutz, 1925)	W, R, OA	M
<i>Dedropsophus elegans</i> (Wied, 1824)	W, OA	M
<i>Dedropsophus minutus</i> (Peters, 1872)	W, OA	M
<i>Dedropsophus nanus</i> (Boulenger, 1889)	W, R	M
<i>Hypsiboas albomarginatus</i> (Spix, 1824)	F, W	M *
<i>Hypsiboas crepitans</i> (Wied, 1824)	F, W	M *
<i>Hypsiboas faber</i> (Wied, 1821)	W	M *
<i>Hypsiboas raniceps</i> Cope, 1862	W	M *
<i>Phyllomedusa bahiana</i> A. Lutz, 1925	F, W	M *
<i>Phyllomedusa nordestina</i> Caramaschi, 2006	F, W	M
<i>Scinax auratus</i> (Wied, 1821)	F, OA	M
<i>Scinax</i> cf. <i>eurydice</i>	F	M
<i>Scinax</i> cf. <i>x-signatus</i>	F, OA	M
<i>Scinax</i> gr. <i>ruber</i>	W, OA	M *
Leiuperidae		
<i>Physalaemus albifrons</i> (Spix, 1824)	F, W	M, PF *
<i>Physalaemus cuvieri</i> Fitzinger, 1826	W, OA	M *
<i>Pseudopaludicola</i> sp.	W, OA	A *
Leptodactylidae		
<i>Leptodactylus fuscus</i> (Schneider, 1799)	OA	A *
<i>Leptodactylus natalensis</i> A. Lutz, 1930	F	M *
<i>Leptodactylus latrans</i> (Steffen, 1815)	W	M *
<i>Leptodactylus</i> cf. <i>spixii</i>	F, OA	M
<i>Leptodactylus troglodytes</i> A. Lutz, 1926	OA	M
<i>Leptodactylus vastus</i> A. Lutz, 1930	F, W	M *
Microhylidae		
<i>Dermatonotus muelleri</i> (Boettger, 1885)	W, OA	M *
REPTILIA		
TESTUDINES		
Chelidae		
<i>Mesoclemmys tuberculata</i> (Lüderwaldt, 1926)	R	V *
SQUAMATA		
Iguanidae		
<i>Iguana iguana</i> (Linnaeus, 1758)	F	V, PH *
Polychrotidae		
<i>Anolis ortonii</i> Cope, 1868	F	M
Tropiduridae		
<i>Tropidurus hispidus</i> (Spix, 1825)	OA	M *
Gekkonidae		
<i>Hemidactylus mabouia</i> (Moreau de Jonnés, 1818)	OA	V *
Sphaerodactylidae		
<i>Coleodactylus meridionalis</i> (Boulenger, 1888)	F	M *
Teiidae		
<i>Ameiva ameiva</i> (Linnaeus, 1758)	OA	V *
<i>Cnemidophorus</i> cf. <i>ocellifer</i>	OA	V *

TABLE 1. CONTINUED.

TAXA	HABITAT TYPE	SAMPLE METHOD
<i>Kentropyx calcarata</i> Spix, 1825	F, OA	M
<i>Tupinambis merianae</i> (Duméril and Bibron, 1839)	F, OA	V, PH *
Scincidae		
<i>Mabuya heathi</i> Schmidt and Inger, 1951	OA	M, PF *
Typhlopidae		
<i>Typhlops brongersmianus</i> Vanzolini, 1976	F	M *
Boidae		
<i>Boa constrictor</i> Linnaeus, 1758	F	PH
<i>Corallus hortulanus</i> (Linnaeus, 1758)	F	M
<i>Epicrates assisi</i> Machado, 1945	F, OA	PH
<i>Eunectes murinus</i> (Linnaeus, 1758)	W	PH
Colubridae		
<i>Chironius bicarinatus</i> (Wied, 1820)	F	M
<i>Chironius exoletus</i> (Linnaeus, 1758)	F	M
<i>Spilotes pullatus</i> (Linnaeus, 1758)	F	V
Dipsadidae		
<i>Erythrolamprus aesculapii</i> (Linnaeus, 1766)	F, OA	M
<i>Helicops angulatus</i> (Linnaeus, 1758)	W	M
<i>Oxyrhopus petola</i> (Linnaeus, 1758)	F, OA	M
<i>Philodryas nattereri</i> Steindachner, 1870	OA	V *
<i>Taeniophallus occipitalis</i> (Jan, 1863)	F	M *
Elapidae		
<i>Micrurus ibiboboca</i> (Merrem, 1820)	F, OA	M *
Viperidae		
<i>Bothrops leucurus</i> Wagler, 1824	F	M



FIGURE 3. Some amphibian species recorded from Refúgio da Vida Silvestre Mata do Junco, state of Sergipe, Brazil. (A) *Rhinella granulosa* (B) *Rhinella jimi*; (C) *Proceratophrys renalis*; (D) *Dendropsophus branneri*; (E) *Dendropsophus* sp.; (F) *Hypsiboas albomarginatus*; (G) *Hypsiboas crepitans*; (H) *Hypsiboas raniceps*; Photographs by S.A.A. Morato.



FIGURE 4. Some amphibian species recorded from Refúgio da Vida Silvestre Mata do Junco, state of Sergipe, Brazil. (A) *Phyllomedusa bahiana*; (B) *Scinax gr. ruber*; (C) *Physalaemus cuvieri*; (D) *Leptodactylus natalensis*; (E) *Leptodactylus vastus*; (F) *Dermatoneotus muelleri*; (G) *Ischnocnema* sp.; (H) *Ischnocnema vinhai*; Photographs by S.A.A. Morato.



FIGURE 5. Some reptile species recorded from Refúgio da Vida Silvestre Mata do Junco, state of Sergipe, Brazil. (A) *Mesoclemmys tuberculata*; (B) *Iguana iguana*; (C) *Tropidurus hispidus*; (D) *Coleodactylus meridionalis*; (E) *Mabuya heathi*; (F) *Cnemidophorus ocellifer*; (G) *Typhlops brongersmianus*; (H) *Epicrates assisi*; (I) *Boa constrictor*; (J) *Philodryas nattereri*; (K) *Taeniophallus occipitalis*; (L) *Micrurus ibiboboca*; Photographs by S.A.A. Morato.

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Appendix 1. Collected specimens.

AMPHIBIANS: *Ischnocnema ramagii*: CHUFS.986; MHNCI.7247, MHNCI.7248, MHNCI.7249, MHNCI.7250, MHNCI.7251, MHNCI.7252, MHNCI.7253, MHNCI.7254, MHNCI.7255; *Ischnocnema vinhai*:

MHNCL.7261; *Ischnocnema* sp.: MHNCL.7262, MHNCL.7263, MHNCL.7264, MHNCL.7265, MHNCL.7266, MHNCL.7267, MHNCL.7268; *Rhinella granulosa*: CHUFS.1249, MHNCL.7270, MHNCL.7271, MHNCL.7272, MHNCL.7273, MHNCL.7274; *Rhinella jimi*: CHUFS.1248, MHNCL.7231, MHNCL.7232; *Proceratophrys renalis*: CHUFS.978, MHNCL.7246; *Corythomantis greening*: CHUFS.981; *Dendropsophus branneri*: CHUFS.989, MHNCL.7258, MHNCL.7259, MHNCL.7260; *Dendropsophus* sp.: MHNCL.7243, MHNCL.7244, MHNCL.7245; *Dedropsophus decipiens*: CHUFS.993; *Dedropsophus elegans*: CHUFS.682; *Dedropsophus minutus*: CHUFS.685; *Dedropsophus nanus*: CHUFS.991; *Hypsiboas albomarginatus*: CHUFS.970, MHNCL.7287, MHNCL.7288, MHNCL.7289, MHNCL.7290, MHNCL.7291; *Hypsiboas crepitans*: CHUFS.969, MHNCL.7297, MHNCL.7298, MHNCL.7299, MHNCL.7300, MHNCL.7301, MHNCL.7302, MHNCL.7303, MHNCL.7304; *Hypsiboas faber*: CHUFS.681, MHNCL.7237; *Hypsiboas raniceps*: CHUFS.966, MHNCL.7275; *Phyllomedusa bahiana*: CHUFS.968, MHNCL.7233, MHNCL.7234, MHNCL.7235, MHNCL.7236; *Phyllomedusa nordestina*: CHUFS.684; *Scinax auratus*: CHUFS.664; *Scinax* cf. *eurydice*: CHUFS.687; *Scinax* cf. *x-signatus*: CHUFS.671; *Scinax* gr. *ruber*: MHNCL.7256, MHNCL.7257; *Physalaemus albifrons*: MHNCL.7292,

MHNCL.7293, MHNCL.7294, MHNCL.7295, MHNCL.7296; *Physalaemus cuvieri*: CHUFS.973, MHNCL.7276, MHNCL.7277, MHNCL.7278; *Leptodactylus fuscus*: CHUFS.977; *Leptodactylus natalensis*: CHUFS.690, MHNCL.7279, MHNCL.7280, MHNCL.7281, MHNCL.7282, MHNCL.7283, MHNCL.7284, MHNCL.7285, MHNCL.7286; *Leptodactylus latrans*: CHUFS.608, MHNCL.7238, MHNCL.7239, MHNCL.7240, MHNCL.7241, MHNCL.7242; *Leptodactylus* cf. *spixii*: CHUFS.985; *Leptodactylus troglodytes*: CHUFS.660; *Leptodactylus vastus*: CHUFS.963, MHNCL.7228, MHNCL.7230; *Dermatonotus muelleri*: MHNCL.7269.

REPTILES: *Anolis ortonii*: CHUFS.1221; *Tropidurus hispidus*: CHUFS.1226, MHNCL.13387, MHNCL.13388; *Coleodactylus meridionalis*: CHUFS.1222, MHNCL.13391, MHNCL.13392; *Ameiva ameiva*: CHUFS.1218; *Kentropyx calcarata*: CHUFS.1220; *Mabuya heathi*: CHUFS.1224, MHNCL.13389; *Typhlops brongersmianus*: MHNCL.13386; *Corallus hortulanus*: CHUFS.521; *Chironius bicarinatus*: CHUFS.352; *Chironius exoletus*: MHNCL.13393; *Erythrolamprus aesculapii*: CHUFS.350; *Helicops angulatus*: CHUFS.349; *Oxyrhopus petola*: CHUFS.351; *Taeniophallus occipitalis*: MHNCL.13384, MHNCL.13385; *Micrurus ibiboboca*: MHNCL.13390, MHNCL.13394; *Bothrops leucurus*: CHUFS.2323.