Herpetofauna of the Northwest Amazon forest in the state of Maranhão, Brazil, with remarks on the Gurupi Biological Reserve

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Abstract

Understanding the biodiversity of an area is the first step for establishing effective interventions for conservation, especially when it comes to herpetofauna, since 4.1% and 9.2%, respectively, of Brazilian amphibians and reptiles are endangered. The aim of this study is to identify the composition of the herpetofauna occurring in the Northwest Amazonian state of Maranhão, with a focus on the Gurupi Biological Reserve and surrounding areas. Samples were collected between May 2012 and October 2013 (18 months), through pitfall traps, time constrained active search, and opportunistic encounters, and these records
were supplemented by specimens collected by third parties and by bibliographic records. A total of 131 species were recorded: 31 species of amphibians and 100 species of reptiles (six testudines, 30 lizards, two amphisbaenias, 60 snakes and two alligators), including some species new to the state of Maranhão and the northeast region of Brazil. This inventory contributes to the knowledge of the herpetofauna for the Belém Endemism Center, the most devastated region of the Brazilian Amazon, and considered poorly sampled.

**Keywords**
Amphibians, Belém Center of Endemism, inventory, new records, reptiles

**Introduction**

Conservation units in the Amazon (National Parks, ecological stations, extractive reserves, national forests, biological reserves, etc.) are of fundamental importance for the conservation of biodiversity in this biome (Peres 2005; Silva 2005).

With regard to formulating effective management plans, it is of fundamental importance for biodiversity conservation to know the composition of the fauna and flora. Faunal lists, especially in regions that represent sampling gaps and that refer to groups with a high percentage of endangered species should be emphasized (Peres 2005).

In this context, regarding the herpetofauna, there are in Brazil 1080 known species of amphibians and 773 species of reptiles of which 4.1% and 9.2% are endangered, respectively (Costa and Bérnils 2015; Segalla et al. 2016).

Biodiversity inventories enable us to identify the degree of regional endemism, new trigger points, new species and the actual conservation status of the species recorded, besides enriching regional and national scientific collections (Moura et al. 2014).

It is noteworthy that species lists are highly important for our understanding of the environmental conservation, since the occurrence of bioindicator species (either opportunistic or vulnerable) can be used to determine the effects of environmental disturbance in the area, and therefore, pave a way to efficient interventions and conservation policies (Brown and Freitas 2002).

The state of Maranhão is known for its rich biodiversity (Martins and Oliveira 2011), lack of researchers and extensive sampling gaps, especially regarding the herpetofauna in the Amazon biome of northwestern Maranhão.

Among the indicators of the need for wildlife studies in Maranhão are the articles of the last decades that describe new species in Amazonia, especially in the eastern Amazon (Caramaschi 2010; Vaz-Silva et al. 2015), as well as the few publications, concentrated mainly on snakes (Cunha and Nascimento 1993; Freitas et al. 2014), lizards (Avila-Pires and Vitt 1998; Avila-Pires 1995; Freitas et al. 2013) and anurans (Andrade et al. 2003; Rodrigues et al. 2003; Andrade et al. 2011; Barreto et al. 2011; Miranda et al. 2012; Miranda et al. 2013; Matavelli et al. 2013; Freitas et al. 2014b, c, d; Vaz-Silva et al. 2015).

This study aims to record the composition of amphibians and reptiles of the REBIO Gurupi and adjacent regions of the northwest Amazon of Maranhão state, a conservation unit of utmost importance, composing the largest and last block of continuous forests in the Belém Endemism Center (Martins and Oliveira 2011).
Materials and methods

Study Area: The Gurupi Biological Reserve (03°58'32"S 46°46'52"W) (Figure 1), was created by Law 95 614 1988 and occupies an original area of 341,650 hectares in the municipalities of Bom Jardim, Centro Novo do Maranhão and São João do Caru, in the state of Maranhão (IBAMA 2006). The climate is humid type B2, with moderate water deficit in the summer, average annual rainfall exceeding 2,000 and average temperature greater than 24°C, with the soil type being argisoil (Martins and Oliveira 2011). This work was performed and focused only in Gurupi and the adjacent rainforests of the State of Maranhão, northwest Amazon.

Sampling: Samples were collected between May 2012 and October 2013 (18 months), with pitfall traps, time constrained active search, and opportunistic encounters in the forested areas and access roads to REBIO (road killed individuals). They also included those collected by third parties and bibliographic records.

The pitfall traps were composed of seven lines of five buckets (60 L) connected by a plastic canvas with a length of 10m, totaling 70 meters of intercept lines (Line 1: 03°59'14"S, 46°47'53"W; Line 2: 03°59'11"S, 46°47'50"W; Line 3: 03°59'05 "S, 46°47'27"W; Line 4: 03°59'06"S, 46°47'25 "W; Line 5: 03°59'07"S, 46° 47'15"W; Line 6: 03°59'03"S, 46°47'04"W; Line 7: 03°58'32"S, 46°46'52"W), each line was about 3 km distant from one another. Traps were open around the clock for five days during each sampling campaign. These were concentrated in the rainy season, December 2012, January and May 2013, totaling an effort of 5400 hours/ bucket.

The time-constrained active search was conducted over three campaigns for three nights in December 2012, January and May 2013, by a team made up of five collectors, totaling an effort of 135 man hours according to the methodologies of Martins and Oliveira (1998), and Bernarde and Abe (2006). The search was concentrated in the area adjacent to aquatic environments near the southern tip of REBIO Gurupi (04°00'20"S, 46°46'41"W).

The collected amphibians were euthanized by applying lidocaine ointment (lidocaine) on the ventral region and the reptiles through overdosing with ether (Callefo, 2002; Franco and Salomão 2002). All specimens were fixed with 10% formalin and then preserved in 70% ethanol.

Voucher specimens were deposited in the collection of Herpetology and Paleontology of the Federal Rural University of Pernambuco CHP-UFRPE (tumble numbers in Appendix 1) and the University of São Paulo Museum of Zoology MZUSP (tumble numbers in Appendix 1). Important bibliographic databases added to this work were Cunha and Nascimento (1993) for snakes, Avila-Pires (1995) for lizards and Barreto et al. (2011) for amphibians and reptiles.

Data analysis: In order to evaluate the efficiency of the collection effort in the analyzed fragment, species rarefaction curves were constructed with 1000 randomizations generated based on the data matrix of the relationship between richness and abundance (ICE index) through the statistical program Ecosim version 7.0 (Gotelli and Enstminger 2003).
Figure 1. Map with the location of the study area, in the Gurupi Biological Reserve, Maranhão, Brazil.
Results

A total of 131 species composing the local herpetofauna was recorded: 31 species of amphibians (seven families) and 100 species of reptiles, which included six testudines, 30 lizards, two amphisbaenians, 60 snakes and two crocodylians (Figure 3, 4).

Of the 131 species recorded for the northwest Amazon in Maranhão, 78 species (62%) were recorded in this study and 53 (38%) included results from previously published data (Cunha and Nascimento 1993; Avila-Pires 1995; Barreto et al. 2011).

Discussion

The Belém Endemism Center (EC) is the smallest among the eight EC in the Amazon region, and has the largest loss of forest cover, with about 70% of its total area already destroyed (Silva et al. 2005; Fearnside 2006).

The diversity of amphibians and reptiles of the Belém Endemism Center is very high, as in other endemic centers, especially those of the eastern Amazon region, such as the ECs Guyana, Xingu and Tapajós: 85 species of snakes further down the Amazon River, in Santarem, state of Pará at EC Tapajós (Frota et al. 2005); 62 species of amphibians and reptiles in the Biological Reserve Tapirape, also at Pará, in the EC Xingu (Bernardo et al. 2012); 71 species of amphibians in the National Forest of Carajás, also at the EC Xingu (Pinheiro et al. 2012); 175 species of amphibians and reptiles in the National Forest of Saracá-Taquera, in the EC Guiana at Pará (Morato et al. 2014.); 53 species of snakes for the National Forest of Caxiuanã (at the EC Xingu (Santos-Costa et al. 2015); 78 species of amphibians and reptiles in the northern part of the state of

![Figure 2. Thinning curves representing the accumulated richness of species of frogs and lizards at REBIO Gurupi. The richness was recorded by passive and active collection between December 2012 and May 2013. The center line is the average (randomizing 1000 times) and the lines on the side represent the associated standard deviation.](image-url)
Figure 3. Some amphibians and reptiles recorded in the Gurupi Biological Reserve, Maranhão, Brazil. 

A Adelphobates galactonotus B Phyllomedusa vaillanti C Lithodytes lineatus D Leptodactylus paraensis 
E Ctenophryne geayi F Platemys platicephala G Paleosuchus trigonatus H Cercosaura argulus. Photo credit of 
P. trigonatus (G) belong to Eloisa Mendonça and M. A. de Freitas for others.
Figure 4. Some amphibians and reptiles recorded in the Gurupi Biological Reserve, Maranhão, Brazil. 

A Leposoma percarinatum  B Neusticurus bicarinatus  C Coleodactylus septentrionalis  D Cnemidophorus cryptus  E Stenocercus dumerilii  F Phrynonax poecilonotus  G Rhinobothryum lentiginosum  H Sibynomorphus mikanii septentrionalis  I Micrurus spixii martiusi  J Rhinella gildae. Photo credits of P. poecilonotus (F) belong to Eloisa Mendonça, R. lentiginosum (G) to Saymon Albuquerque and M. A. de Freitas for others.
Table 1. Herpetofauna recorded between May 2012 and October 2013 in the Gurupi Biological Reserve, Maranhão, Brazil. (Type of record: EO = Opportunistic Encounter; BA = Constrained active search; Pitfalls = pitfall trap, DS = secondary data).

* First occurrence for the state of Maranhão and northeast Brazil.
** Species endemic to the Belém center of endemism.

| FAMILY          | SPECIES | TYPE OF RECORD |
|-----------------|---------|----------------|
| Bufonidae       | *Rhinella gildae* Vaz-Silva, Maciel, Bastos & Pombal Jr, 2015** | EO - DS (Vaz-Silva et al. 2015) |
|                 | *Rhinella marina* (Linnaeus, 1758) | EO/Pitfalls/BA |
| Craugastoridae  | *Pristimantis fenestratus* (Steindachner, 1864) | BA |
| Dendrobatidae   | *Adelphobates galiotonicus* (Steindachner, 1864)** | BA |
| Dendropsophinae | *Dendropsophus marmoratus* (Laurenti, 1768) | EO |
|                 | *Dendropsophus cf. minusculus* | DS (Barreto et al. 2011) |
|                 | *Dendropsophus nanus* (Boulenger, 1889) | DS (Barreto et al. 2011) |
|                 | *Dendropsophus minutus* (Peters, 1872) | DS (Barreto et al. 2011) |
|                 | *Dendropsophus rubicundulus* (Reinhardt & Lütken, 1862) | DS (Barreto et al. 2011) |
| Hylidae         | *Hypisoboa boani* (Linnaeus, 1758) | EO |
|                 | *Hypisoboa fasciatus* (Günther, 1859 "1858") | DS (Barreto et al. 2011) |
|                 | *Hypisoboa punctata* (Schneider, 1799) | BA |
|                 | *Hypisoboa multifasciatus* (Günther, 1859) | DS (Barreto et al. 2011) |
|                 | *Osteocephalus taurinus* Steindachner, 1862 | BA |
|                 | *Scinax fuscomarginatus* (A. Lutz, 1925) | DS (Barreto et al. 2011) |
|                 | *Scinax nebuliosus* (Spix, 1824) | DS (Barreto et al. 2011) |
|                 | *Scinax ruber* (Laurenti, 1768) | EO |
|                 | *Sphaenorhynchus lacteus* (Daudin, 1800) | DS (Benício et al. 2011) |
|                 | *Trachycephalus typhonius* (Linnaeus, 1758) | EO |
|                 | *Phyllomedusa vaillantii* Bouleneger, 1882 * | BA (Freitas et al. 2014) |
| Leptodactylidae | *Adenomera andreae* (Müller, 1923) | BA/Pitfalls/EO |
|                 | *Leptodactylus fuscus* (Schneider, 1799) | EO |
|                 | *Leptodactylus mystaceus* (Spix, 1824) | BA/Pitfalls/EO |
|                 | *Leptodactylus rhodomystax* Boulenger, 1884 | DS (Sá et al. 2014) |
|                 | *Leptodactylus paracutus* Heyer, 2005 ** | EO |
|                 | *Leptodactylus troglodytes* A. Lutz, 1926 | EO |
|                 | *Leptodactylus gr. latrans* | DS (Barreto et al. 2011) |
|                 | *Lithobates lineatus* (Schneider, 1799)* | (Freitas et al. 2014) |
| Leiuperidae     | *Physalaemus cuvieri* Fitzinger, 1826 | BA/Pitfalls |
| Microhylidae    | *Caecephalea geysi* Mocquard, 1904 * | (Freitas et al. 2014) |
| Chelidae        | *Platemys platycephala* (Schneider, 1792)* | EO |
| Geoemydidae     | *Rhinoclemmys punctulata* (Daudin, 1801) | EO |
| Kinosternidae   | *Kinosternon scorpioides* (Linnaeus, 1766) | EO |
| Podocnemididae  | *Podocnemis unifilis* Troeschel, 1848 | EO |
| Testudinidae    | *Chelonoidis carbonarius* (Spix, 1824) | EO |
|                 | *Chelonoidis denticulatus* (Linnaeus, 1766) | EO |
| Alligatoridae   | *Caiman crocodilus* (Linnaeus, 1758) | EO |
|                 | *Paleosuchus trigonatus* (Schneider, 1801) * | EO |
| Dactyloidae     | *Dactylorhiza punctata* (Daudin, 1802) | BA |
|                 | *Norops fuscauratus* (D’Orbigny, 1837) | BA/Pitfalls/EO |
|                 | *Norops tandai* (Avila-Pires, 1995) | DS (Avila-Pires 1995) |
| FAMILY             | SPECIES                                                                 | TYPE OF RECORD |
|--------------------|-------------------------------------------------------------------------|----------------|
| Gekkonidae         | *Hemidactylus mabouia* (Moreau de Jonnès, 1818)                         | EO             |
|                    | *Micablephorus maximilliani* (Reinhardt & Luetken, 1862)                 | EO             |
|                    | *Cercosaura argulus* Peters, 1863                                        | (Freitas et al. 2013) |
|                    | *Cercosaura ocellata* Wagler, 1830                                      | DS (Ávila-Pires 1995) |
|                    | *Colobosauro modesta* (Reinhardt & Luetken, 1862)                       | DS (Ávila-Pires 1995) |
|                    | *Arthroaura reticulata* (O’Shaughnessy, 1881)                           | DS (Ávila-Pires 1995) |
|                    | *Leposoma percinnatun* Müller, 1923 *                                   | Pitfalls       |
|                    | *Neusticurus bicarinnatu* (Linnaeus, 1758)**                             | DS (Ávila-Pires 1995) |
| Gymnophthalmidae   |                                                                         |                |
|                    | *Gekkonidae*                                                            |                |
|                    | *Hemidactylus mabouia* (Moreau de Jonnès, 1818)                         | EO             |
|                    | *Micablephorus maximilliani* (Reinhardt & Luetken, 1862)                 | EO             |
|                    | *Cercosaura argulus* Peters, 1863                                        | (Freitas et al. 2013) |
|                    | *Cercosaura ocellata* Wagler, 1830                                      | DS (Ávila-Pires 1995) |
|                    | *Colobosauro modesta* (Reinhardt & Luetken, 1862)                       | DS (Ávila-Pires 1995) |
|                    | *Arthroaura reticulata* (O’Shaughnessy, 1881)                           | DS (Ávila-Pires 1995) |
|                    | *Leposoma percinnatun* Müller, 1923 *                                   | Pitfalls       |
|                    | *Neusticurus bicarinnatu* (Linnaeus, 1758)**                             | DS (Ávila-Pires 1995) |
| Iguanidae          | *Iguana iguana* (Linnaeus, 1758)                                        | EO             |
| Leiosauridae       | *Enyalius leechii* (Boulenger, 1885)                                     | DS (Ávila-Pires 1995) |
| Mabuyidae          | *Copeoglossum nigrum (Spix, 1825)                                       | Pitfalls       |
| Phyllodactylidae   | *Thecadactylus nigrum (Spix, 1825)                                       | Pitfalls       |
|                    | *Polychrus acutirostris* Spix, 1825                                      | DS (Ávila-Pires 1995) |
|                    | *Polychrus marmoratus* (Linnaeus, 1758)                                  | EO             |
| Polychrotidae      | *Coleodactylus septentrionalis* (Vanzolini, 1980)**                      | Pitfalls       |
|                    | *Gonatodes hensleri* (Guichenet, 1855)                                  | Pitfalls/BA    |
| Sphaerodactylidae  | *Ameiva ameiva* (Linnaeus, 1758)                                        | Pitfalls/EO/BA |
|                    | *Cnemidophorus cryptus* Cole & Dessauer, 1993 *                          | EO             |
|                    | *Keratophryx calcanae* Spix, 1825                                       | Pitfalls/BA    |
|                    | *Salvator meridionalis* (Duméril & Bibron, 1839)                        | EO/BA          |
|                    | *Tupinambis mexicanus* (Linnaeus, 1758)                                 | DS (Ávila-Pires 1995) |
|                    | *Dracaena guianensis* Daudin, 1801                                       | DS (Ávila-Pires 1995) |
|                    | *Amphisbaena alba* Linnaeus, 1758                                       | DS (Barreto et al. 2011) |
| Amphibiaenidae     | *Amphisbaena alba* Linnaeus, 1758                                       | DS (Barreto et al. 2011) |
| Typhlopidae        | *Amerotyphlops brongersii* (Vanzolini, 1976)                             | Pitfalls       |
| Aniliidae          | *Anilius scytale* (Linnaeus, 1758)                                       | EO             |
| Boidae             | *Boa constrictor* Linnaeus, 1758                                         | EO             |
|                    | *Corallus horridus* (Linnaeus, 1758)                                    | EO             |
|                    | *Epicrates cenchria* (Linnaeus, 1758)                                   | EO             |
|                    | *Eunectes murinus* (Linnaeus, 1758)                                     | DS (Cunha and Nascimento 1993) |
|                    | *Chironius carinatus* (Linnaeus, 1758)                                  | EO             |
|                    | *Chironius eoxaletus* (Linnaeus, 1758)                                  | EO             |
|                    | *Chironius fuscus* (Linnaeus, 1758)                                     | DS (Cunha and Nascimento 1993) |
|                    | *Chironius multiventris* Schmidt & Walker, 1943                         | DS (Cunha and Nascimento 1993) |
|                    | *Chironius scurruclus* (Wagler in Spix, 1824)                           | DS (Cunha and Nascimento 1993) |
|                    | *Drymarchon corais* (Boie, 1827)                                        | EO             |
|                    | *Drymarchon dichrous* (Peters, 1863)                                   | DS (Cunha and Nascimento 1993) |
|                    | *Leptophis ahaetulla* (Linnaeus, 1758)                                 | EO             |
|                    | *Mastigodryas bifosatus* (Raddi, 1820)                                 | DS (Cunha and Nascimento 1993) |
| FAMILY       | SPECIES                                           | TYPE OF RECORD |
|--------------|--------------------------------------------------|----------------|
| Colubridae   | Mastigodryas boddaerti (Sentzen, 1796)            | EO             |
|              | Oxybelis aeneus (Wagler in Spix, 1824)           | DS (Barreto et al. 2011) |
|              | Oxybelis fulgidus (Daudin, 1803)                 | EO             |
|              | Phrynonax paeleonotus (Peters, 1867)*             | EO             |
|              | Rhinobothrium lentiginae (Scopoli, 1785) *       | EO             |
|              | Spilotes pullatus (Linnaeus, 1758)               | EO             |
|              | Tantilla melanochepala (Linnaeus, 1758)          | Pitfalls       |
|              | Mastigodryas boddaerti (Sentzen, 1796)           | EO             |
|              | Oxybelis aeneus (Wagler in Spix, 1824)           | DS (Barreto et al. 2011) |
|              | Oxybelis fulgidus (Daudin, 1803)                 | EO             |
|              | Phrynonax paeleonotus (Peters, 1867)*             | EO             |
|              | Rhinobothrium lentiginae (Scopoli, 1785) *       | EO             |
|              | Spilotes pullatus (Linnaeus, 1758)               | EO             |
|              | Tantilla melanochepala (Linnaeus, 1758)          | Pitfalls       |
|              | Mastigodryas boddaerti (Sentzen, 1796)           | EO             |
|              | Oxybelis aeneus (Wagler in Spix, 1824)           | DS (Barreto et al. 2011) |
|              | Oxybelis fulgidus (Daudin, 1803)                 | EO             |
|              | Phrynonax paeleonotus (Peters, 1867)*             | EO             |
|              | Rhinobothrium lentiginae (Scopoli, 1785) *       | EO             |
|              | Spilotes pullatus (Linnaeus, 1758)               | EO             |
|              | Tantilla melanochepala (Linnaeus, 1758)          | Pitfalls       |
|              | Mastigodryas boddaerti (Sentzen, 1796)           | EO             |
|              | Oxybelis aeneus (Wagler in Spix, 1824)           | DS (Barreto et al. 2011) |
|              | Oxybelis fulgidus (Daudin, 1803)                 | EO             |
|              | Phrynonax paeleonotus (Peters, 1867)*             | EO             |
|              | Rhinobothrium lentiginae (Scopoli, 1785) *       | EO             |
|              | Spilotes pullatus (Linnaeus, 1758)               | EO             |
|              | Tantilla melanochepala (Linnaeus, 1758)          | Pitfalls       |
| Dipsadidae   | Atractus alphonsehogei Cunha & Nascimento, 1983  | DS             |
|              | Atractus schach (Boie, 1827)                     | DS             |
|              | Atractus smithiae Cunha & Nascimento, 1983       | DS             |
|              | Diphas catesbyi (Sentzen, 1796)                  | EO             |
|              | Diphas variegata (Duméril, Bibron & Duméril, 1854) | DS             |
|              | Erythrolamprus aesculapii (Linnaeus, 1766)       | DS             |
|              | Erythrolamprus cobella (Linnaeus, 1758)          | DS             |
|              | Erythrolamprus miliaris chrysostomus (Griffin, 1916) | DS             |
|              | Erythrolamprus oleoglopi (Bouleneger, 1905)      | DS             |
|              | Erythrolamprus poecilogyrus (Wied, 1825)         | EO             |
|              | Sibon nebulatus (Linnaeus, 1758)                 | DS             |
|              | Sibonomorphus mikanii septentrionalis Cunha, Nascimento & Hoge, 1980 ** | EO (Freitas et al. 2014) |
|              | Imantodes cenchae (Linnaeus, 1758)               | DS             |
|              | Leptodeina annulata (Linnaeus, 1758)             | EO/BA          |
|              | Helicops angulatus (Linnaeus, 1758)              | DS (Barreto et al. 2011) |
|              | Hydropro martii (Wagler in Spix, 1824)           | DS             |
|              | Pseudoeryx plicatilis (Linnaeus, 1758)           | DS             |
|              | Philodryas olfersii (Liechtenstein, 1823)        | EO             |
|              | Philodryas viridissima (Linnaeus, 1758)          | EO             |
|              | Cidisia plumbea (Wied, 1820)                     | EO             |
|              | Oxysrhops melanogenys Cunha & Nascimento, 1983   | BA             |
|              | Oxysrhops petolarius (Reuss, 1834)               | EO             |
|              | Pseudoboa coronata Schneider, 1801               | DS             |
|              | Pseudoboa neuwiedi (Duméril, Bibron & Duméril, 1854) | DS             |
|              | Pseudoboa nigra (Duméril, Bibron & Duméril, 1854) | DS             |
|              | Siphlophis cervinus (Laurenti, 1768)             | DS             |
|              | Tantilophus quadriocellatus Santos-Jr, Di-Bernardo & Lema, 2008 | DS (Cunha and Nascimento 1993) |
Maranhão (Barreto et al. 2011). It is noteworthy that the last of these studies includes species of open areas, which are present due to the strong influence of Cerrado vegetation in northern Maranhão, as seen in the inventory of Miranda et al. (2012), which lists 42 species of reptiles for the coastal region of Maranhão, which is characterized by open vegetation and the predominance of coastal dunes.

The species richness of REBIO Gurupi is second only to the richness sampled in the National Forest of Saracá-Taquera in northern Pará, located in the Guyana Endemism Center, more than 1000 km from REBIO Gurupi (Morato et al. 2014).

Regarding sampling efficiency, the collection effort and methods used were not effective, as not all niches were sampled. As a result, the curve implied 33 amphibian species and 78 reptile species at the site. As the curves did not reach an asymptote, we believe that there is potential for species that have not yet been recorded. This is borne out by the additional 58 species not found during the field work but recorded in the literature for the area (Cunha and Nascimento 1993; Avila-Pires 1995; Barreto et al. 2011) (Figure 2). Regarding collection methods, pitfall traps yielded only 33 species of the 78 found in the field, chiefly amphibians, frogs, and fossorial lizards.

**Conclusion**

Since only 38% of the recorded species included in this inventory were obtained from literature (Table 1), it is possible to ascertain that our sampling reflects a great share of the total herpetofauna from Northwestern Maranhão. With this richness, the Gurupi Biological Reserve stands out as a biodiversity hotspot in the Amazon, reinforcing the need for its protection, and its position as the most important restricted use conservation unit of the Belém Endemism Center.
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Appendix 1

Specimens examined

*Rhinella marina* CHP-UFRPE 1810 – *Rhinella gildae* CHP-UFRPE 1848  *Leptodactylus paraensis* CHP-UFRPE 1811-1845 – *Leptodactylus petersii* MZUSP – 154062 – *Lithodytes lineatus* CHP-UFRPE 1815 – *Leptodactylus mystaceus* CHP-UFRPE 1838-44-1863-64-1878 – *Physalaemus cuvieri* CHP-UFRPE 1834-37 - *Pristimantis fenestra-tus* CHP-UFRPE 1862-2042, MZUSP 154061 - *Phyllomedusa vaillantii* CHP-UFRPE 1874-2621 - *Hypsiboas punctatus* CHP-UFRPE 1877 - *Ctenophryne geayi* CHP-UFRPE 1820-1859-1876 - *Scinax ruber* CHP-UFRPE 1816 - *Dentrosophus marmoratus* CHP-UFRPE 1818 - *Trachycephalus tyfonius* CHP-UFRPE 1824-25 – *Adenomera andræae* MZUSP 154063-69 *Cercosaura argulus* CHP-UFRPE 2622 - *Amphisbaena amazonica* CHP-UFRPE 2065 - *Plica umbra* CHP-UFRPE 1826-28-1873 - *Iguana iguana* CHP-UFRPE 1870 - *Micrablepharus maximiliani* CHP-UFRPE 1866-69 - *Norops fuscoauratus* CHP-UFRPE 1817-1865 - *Tropidurus hispidus* CHP-UFRPE 1846 - *Copelogsium nigropunctatum* CHP-UFRPE 1832-33 - *Gonatodes humeralis* CHP-UFRPE 1821-23 - *Coleo-dactylus septentrionalis* CHP-UFRPE 1819 - *Uranoscodon superciliosus* CHP-UFRPE 1815 - *Polychrus marmoratus* CHP-UFRPE 1856 - *Kentropys calcanata* CHP-UFRPE 1830-31-MZUSP 104280 – *Leposoma percarinatum* MZUSP 104278 – *Stenocercus dumerilii* MZUSP 104279 – *Cnemidophorus cryptus* MZUSP 104281 – *Salvator merianae* MZUSP-MTR 23332 - *Platemys platicephala* CHP-UFRPE 1814 - *Kinosternum scorpioides* CHP-UFRPE 2126 - *Amerotyphlops brongersmianus* CHP-UFRPE 1850 - *Anilius scytale* CHP-UFRPE 1860 - *Boa constrictor* CHP-UFRPE 2439 - *Corallus hortulanus* CHP-UFRPE 2457 - *Spilotes pullatus* CHP-UFRPE 1873 - *Lepto-phis ahaetulla* CHP-UFRPE 2267 - *Tantila melanocophala* CHP-UFRPE 1829 - *Sibynomorpus mikani septentrionalis* CHP-UFRPE 1858-2234-38 - *Oxyrhopus pelotarius* CHP-UFRPE 2220 - *Oxyrhopus melanogenys* CHP-UFRPE 1829 - *Pseudoboa nigra* CHP-UFRPE 1852-53 - *Pseudoboa newiedii* CHP-UFRPE 1860 - *Erythrolamprus poecilogyrus* CHP-UFRPE 1875-1851 - *Leptodeira annulata* CHP-UFRPE 1847 - *Philor- dryas olfersii* CHP-UFRPE 1854 - *Dipsas catesbyi* CHP-UFRPE 1872 - *Micrurus spixii martiusi* CHP-UFRPE 1812 - *Bothrops atrox* CHP-UFRPE 1855.