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## Amphibians of the state of Piauí, Northeastern Brazil: a preliminary assessment

Igor Joventino Roberto<sup>1,4</sup>, Samuel Cardozo Ribeiro<sup>2</sup> & Daniel Loebmann<sup>3</sup>

<sup>1</sup>Laboratório de Zoologia, Programa de Pós-graduação em Bioprospecção Molecular, Departamento de Ciências Físicas e Biológicas, Universidade Regional do Cariri – URCA, Rua Coronel Antônio Luiz Pimenta, 1161, CEP 63105-000, Crato, CE, Brasil

<sup>2</sup>Programa de Pós-graduação em Ciências Biológicas (Zoologia), Departamento de Sistemática e Ecologia, Universidade Federal da Paraíba – UFPB, Cidade Universitária, Campus I, CEP 58059-900, João Pessoa, PB, Brasil

<sup>3</sup>Laboratório de Vertebrados Ectotérmicos, Instituto de Ciências Biológicas, Universidade Federal do Rio Grande – FURG, Av. Itália Km 8, Carreiros, CEP 96203-900, Rio Grande, RS, Brasil

<sup>4</sup>Corresponding author: Igor Joventino Roberto, e-mail: igorjoventino@yahoo.com.br

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**Abstract:** The state of Piauí is located between the Caatinga and Cerrado biomes in Northeastern Brazil, having a rich heterogeneity of habitats. However, publications regarding the amphibians of this state are scarce. We compiled literature data and complemented it with amphibian inventories in some municipalities of Piauí and present a list of 55 species (54 anurans and one caecilian). Ten of them are endemic to the Cerrado biome (*Rhinella veredas*, *R. cerradensis*, *R. mirandaribeiroi*, *R. rubescens*, *Dendropsophus rubicundulus*, *Phyllomedusa azurea*, *Leptodactylus pustulatus*, *Eupemphix nattereri*, *Physalaemus centralis*, and *Proceratophrys goyana*) and two endemic to the Caatinga (*Rhinella jimi* and *Ceratophrys joazeirensis*). We also present data about species richness of 18 sampled municipalities, species distribution patterns, and conservation status.

**Keywords:** Amphibia, Cerrado, Caatinga, distributional patterns, conservation.

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**Resumo:** O estado do Piauí está inserido nos Biomas Caatinga e Cerrado no nordeste do Brasil, ocasionando em uma rica heterogeneidade ambiental ao longo do seu território. Entretanto, estudos publicados sobre os anfíbios desse estado são escassos. Nós realizamos uma compilação de dados na literatura e complementamos com inventários faunísticos em algumas localidades do Piauí, e apresentamos uma lista de 55 espécies de anfíbios (54 anuros e uma cecília). Destas, dez espécies são endêmicas do Cerrado (*Rhinella veredas*, *R. cerradensis*, *R. mirandaribeiroi*, *R. rubescens*, *Dendropsophus rubicundulus*, *Phyllomedusa azurea*, *Leptodactylus pustulatus*, *Eupemphix nattereri*, *Physalaemus centralis* e *Proceratophrys goyana*) e duas endêmicas da Caatinga (*Rhinella jimi* e *Ceratophrys joazeirensis*). Apresentamos dados sobre a riqueza de anfíbios de 18 municípios amostrados do Estado e fazemos considerações sobre os padrões de distribuição das espécies e seu estado de conservação.

**Palavras-chave:** Amphibia, Cerrado, Caatinga, padrões de distribuição, conservação.

## Introduction

Amphibians are considered the most threatened animal group worldwide (Stuart et al. 2004). Over the past decades the increasing number of population declines and extinctions are alarming the scientific communities, especially due to the fact that these number are more than likely underestimated because of several undescribed taxa that could become extinct without ever being discovered (Young et al. 2001, Carnaval et al. 2009). In this context, the knowledge of species diversity and distribution and the determinant factors which lead to these biogeographic patterns are essential for conservation planning, providing effective tools in the identification of priority areas (Figueiredo et al. 2006).

The Brazilian territory is known for housing the highest amphibian diversity worldwide. According to Brazilian Society of Herpetology a total of 946 described species has been recognized to the country so far (Segalla et al. 2012). However, the vast degradation of natural habitats increases the extinction rates of populations at higher levels (Silvano & Segalla 2005) and several regions remain unknown regarding the diversity of amphibian species and their distribution, especially in northeastern Brazil (Loebmann & Haddad 2010). In this sense we provide the first assessment regarding amphibian diversity and biogeographic patterns in the state of Piauí, a region situated between the Cerrado and the Caatinga biomes in northeastern Brazil.

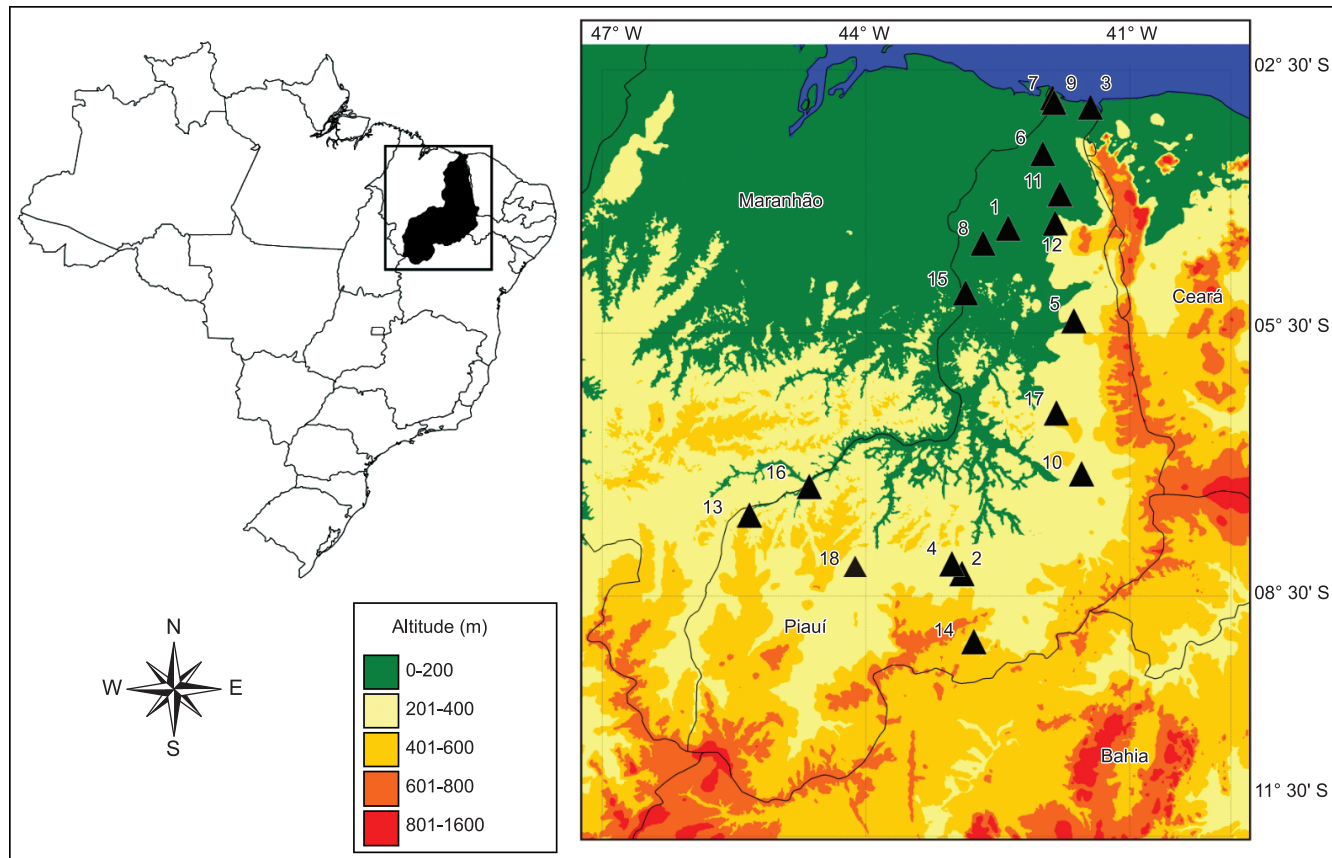
## Materials and Methods

### 1. Study area

Located in an ecotonal area between the Cerrado and the Caatinga domains, the state of Piauí covers an area of 251,529 km<sup>2</sup>. Most areas

of the state present low relief with elevations below 500 meters, but in the extreme southwest, on the border of the states of Tocantins, Maranhão and Bahia, mountainous areas reach up to 900 m (Figure 1). The main landscapes that are found in the state are: 1) Extensive areas of palm tree forests are found in patches. Three dominant species are found in these forests: *Mauritia* sp. L. f. (Buriti), *Orbignya* sp. Mart. ex Endl. (Babaçu) and *Copernicia prunifera* (Mill.) H.E. Moore (Carnaúba) (Liliopsida, Arecales, Arecaceae). However, due to their distinct physiological tolerances regarding soil moisture these species are not syntopic. 2) Cerrado formations comprise the widest natural areas covering the state of Piauí. These areas are predominantly composed by herbaceous, shrub or forested formations. 3) Caatinga formations can be found in areas from northeast of the state, associated with drier areas. 4) In the extreme north of the state a narrow strip of coastal zone form a complex mosaic of several habitats such as coastal dunes, rocky shores, mangrove forests, estuaries, and sandy beaches (see Loebmann et al. 2010a).

The main data for the elaboration of the amphibian list was gathered through literature research and inventory collections from various localities in Piauí. Data obtained from literature and their respective localities are available at Table 1. Additionally we performed collections in three municipalities, Caxingó, Ribeiro Gonçalves and São Raimundo Nonato. To sampled amphibians in Ribeiro Gonçalves, we used two methodologies as follow: pitfall traps arrays, consisted of eleven 60-liter plastic buckets, arranged in a linear design, with a drift fence of 1.0 meter height; totaling an effort of 231 pitfall traps/nights, and visual encounter survey, totaling 36 man/hour of effort. In the municipalities of Caxingó and São Raimundo Nonato our samples consisted of visual encounter



**Figure 1.** Map of State of Piauí showing the sampled localities: Municipalities of 1- Barras, 2- Brejo do Piauí; 3- Cajueiro da Praia; 4-Canto do Buriti; 5-Castelo do Piauí; 6-Caxingó; 7-Ilha Grande de Santa Isabel; 8-Lagoa Alegre; 9-Parnaíba; 10-Picos; 11-Piracuruca; 12-Piripiri; 13-Ribeiro Gonçalves; 14-São Raimundo Nonato; 15-Teresina; 16-Uruçuí; 17-Valença; 18 – Gurgueia.

**Table 1.** List of amphibians known for the state of Piauí. Municipalities recorded: 1- Barras, 2- Brejo do Piauí, 3- Cajueiro da Praia, 4- Canto do Buriti, 5- Castelo do Piauí, 6- Caxingó, 7- Ilha Grande de Santa Isabel, 8- Lagoa Alegre, 9- Parnaíba, 10- Picos, 11- Piracuruca, 12- Piripiri, 13- Ribeiro Gonçalves, 14- São Raimundo Nonato, 15- Teresina, 16- Uruçuí-Una, 17- Valença, 18 - Gurgueia. (\*) Species records in present study. Distributional Pattern: AMC = species that occur both in Amazon Rain Forest and Cerrado biomes; CA = species that occur only in Caatinga biome; CAC = species that occur both in Caatinga and Cerrado biomes; CE = species endemic to Cerrado biome; O = species that occur in open domains; W = widespread species. The conservation status of the species was classified according to IUCN (2012): LC (least concern); DD (Data deficient).

Taxon	Municipalities	Reference	Distributional pattern	IUCN Red list criteria
<b>Ordem ANURA</b>				
<b>Bufonidae</b>				
<i>Rhinella cerradensis</i> Maciel, Brandão, Campos, & Sebben, 2007	16	Maciel et al. (2007)	CE	DD
<i>Rhinella granulosa</i> (Spix, 1824)	2,3,4,6,7,8,10,14	Narvaes & Rodrigues (2009), Loebmann & Mai (2008), Silva et al. (2007), *	W	LC
<i>Rhinella jimi</i> (Stevaux, 2002)	2,3,6, 10,7	Stevaux (2002), Loebmann & Mai (2008), Silva et al. (2007), *	CA	LC
<i>Rhinella mirandaripei</i> (Gallardo, 1965)	3,11,12,13,16,17	Narvaes & Rodrigues (2009), Loebmann et al. (2010b), *	CE	LC
<i>Rhinella rubescens</i> (A. Lutz, 1925)	?	Frost (2012)	CE	LC
<i>Rhinella schneideri</i> (Werner, 1894)	13	Freitas (2011), *	W	LC
<i>Rhinella veredas</i> (Brandão, Maciel & Sebben, 2007)	16	Brandão et al. (2007)	CE	LC
<b>Ceratophryidae</b>				
<i>Ceratophrys joazeirensis</i> Mercadal de Barrio, 1986	14	*	CA	LC
<b>Hylidae</b>				
<i>Corythomantis greeningi</i> Boulenger, 1896	6,9,11,13,14	Loebmann et al. (2010b), *	CAC	LC
<i>Dendropsophus minusculus</i> (Rivero, 1971)	2,6,9	Loebmann & Mai (2008), *	W	LC
<i>Dendropsophus minutus</i> (Peters, 1872)	6,9,13	Loebmann & Mai (2008), *	W	LC
<i>Dendropsophus nanus</i> (Boulenger, 1899)	2,3,6,7,13	Loebmann & Mai (2008), Silva et al. (2007), *	W	LC
<i>Dendropsophus rubicundulus</i> (Reinhardt & Lütken, 1862)	2,3,6,11,13,16	Annunziata et al. (2007), Napoli & Caramaschi (1999), Loebmann et al. (2010b)	CE	LC
<i>Dendropsophus soaresi</i> (Caramaschi and Jim, 1983)	2,6,10,13,14	Caramaschi & Jim (1983a), *	CAC	LC
<i>Hypsiboas boans</i> (Linnaeus, 1758)	13	Freitas (2011), *	AMC	LC
<i>Hypsiboas multifasciatus</i> (Günther, 1859)	13	*	AMC	LC
<i>Hypsiboas punctatus</i> (Schneider, 1799)	9,13	Loebmann et al. (2010b), *	W	LC
<i>Hypsiboas raniceps</i> Cope, 1862	2,6,7,9	Loebmann & Mai (2008), Silva et al. (2007), *	W	LC
<i>Osteocephalus taurinus</i> Steindachner, 1862	13	*	AMC	LC
<i>Phyllomedusa azurea</i> Cope, 1862	13	*	CE	LC
<i>Phyllomedusa noredestina</i> Caramaschi, 2006	2,3,6,7,10,14	Silva et al. (2007), Loebmann & Mai (2008), Caramaschi (2006), *	CAC	LC
<i>Scinax fuscimarginatus</i> (Lutz, 1925)	6,7,9,11,13	Leite Junior et al. (2008), Annunziata et al. (2009), *	W	LC
<i>Scinax fuscovarius</i> (Lutz, 1925)	13	*	W	LC
<i>Scinax</i> gr. <i>ruber</i>	3	Loebmann & Mai (2008)	?	?
<i>Scinax nebulosus</i> (Spix, 1824)	9,13	Loebmann & Mai (2008), *	W	LC
<i>Scinax x-signatus</i> (Spix, 1824)	2,6,7,9,10,14	Silva et al. (2007), Loebmann & Mai (2008), Caramaschi & Jim (1983b), *	W	LC
<i>Sphaenorhynchus lacteus</i> (Daudin, 1800)	1	Benício et al. (2011)	AMC	LC
<i>Trachycephalus typhonius</i> (Linnaeus, 1758)	6,9	Loebmann & Mai (2008), *	W	LC

Table 1. Continued...

Taxon	Municipalities	Reference	Distributional pattern	IUCN Red list criteria
<b>Leptodactylidae</b>				
<i>Adenomera hylaedactyla</i> (Cope, 1868)	6, 9	Loebmann et al. (2010b)	AMC	LC
<i>Adenomera</i> sp. (aff. <i>andreae</i> )	2,13	Freitas (2011), *	?	?
<i>Eupemphix nattereri</i> Steindachner, 1863	13	Freitas (2011), *	CE	LC
<i>Leptodactylus fuscus</i> (Schneider, 1799)	2,4,6,7,9,13,14	Silva et al. (2007), Loebmann & Mai (2008), *	W	LC
<i>Leptodactylus macrosternum</i> Miranda-Ribeiro, 1926	2,3,6,7,9,10,13,14	Caramaschi & Jim (1983a), Loebmann & Mai (2008), Silva et al. (2007), Loebmann et al. (2010b), *	CAC	LC
<i>Leptodactylus mystaceus</i> (Spix, 1824)	13	*	W	LC
<i>Leptodactylus troglodytes</i> Lutz, 1926	2,3,6,9,13,14,17	Loebmann & Mai (2008), Loebmann et al. (2010b), Heyer (1978), *	CAC	LC
<i>Leptodactylus podicipinus</i> (Cope, 1862)	15	Heyer (1994)	O	LC
<i>Leptodactylus pustulatus</i> (Peters, 1870)	2,6,7,9	Silva et al. (2007), *	CE	LC
<i>Leptodactylus syphax</i> Bokermann, 1969	12,13,14,15	Cardoso & Heyer (1995), Andrade et al. (2011), *	O	LC
<i>Leptodactylus vastus</i> Lutz, 1930	2,6,7,9,10,13,14,17	Caramaschi & Jim (1983a), Heyer (2005), Silva et al. (2007), Loebmann & Mai (2008), *	CAC	LC
<i>Physalaemus albifrons</i> (Spix, 1824)	2,6,7,9,10,11	Caramaschi & Jim (1983b), Loebmann & Mai (2008), Loebmann et al. (2010b), Silva et al. (2007), *	CAC	LC
<i>Physalaemus centralis</i> Bokermann, 1962	13,14	*	CE	LC
<i>Physalaemus cicada</i> Bokermann, 1966	2,10	Benício et al. 2012	CAC	LC
<i>Physalaemus cuvieri</i> Fitzinger, 1826	2,6,9,11,13,14	Loebmann & Mai (2008), *	W	LC
<i>Pleurodema diplolister</i> (Peters, 1870)	2,3,6,7,9,10,11	Caramaschi (2008), Loebmann & Mai (2008), Silva et al. (2007), *	CAC	LC
<i>Pseudopaludicola mystacalis</i> (Cope, 1887)	2,6,7,9,10,12,16	Caramaschi (2008), Caramaschi & Jim (1983b), Loebmann & Mai (2008), Silva et al. (2007), *	W	LC
<i>Pseudopaludicola parnaíba</i> Roberto, Cardozo & Ávila, 2013	13	Roberto et al. (2013), *	?	?
<b>Microhylidae</b>				
<i>Dermatonotus muelleri</i> (Boettger, 1885)	2,6,10,13,14	Caramaschi & Jim (1983a), *	O	LC
<i>Elachistocleis piauiensis</i> Caramaschi and Jim, 1983	2,5,6,7,9,10,13	Caramaschi (2008), Loebmann & Mai (2008), Silva et al. (2007), *	O	LC
<b>Odontophrynidae</b>				
<i>Odontophrynus carvalhoi</i> Savage and Cei, 1965	16	Lisboa et al. (2010)	W	LC
<i>Proceratophrys</i> cf. <i>caramaschii</i>	3,6	Loebmann & Mai (2008), *	?	?
<i>Proceratophrys concavitympnum</i> Giaretta, Bernarde & Kokubum, 2000	13	*	AMC	DD
<i>Proceratophrys goyana</i> (Miranda-Ribeiro, 1937)	10	Ávila et al. (2011)	CE	LC
<b>Ranidae</b>				
<i>Lithobates palmipes</i> (Spix, 1824)	13	Ramalho et al. (2011)	AMC	LC
<b>Strabomantidae</b>				
<i>Pristimantis</i> gr. <i>conspicillatus</i>	18	Freitas (2011)	?	?
<b>Ordem GYMINOPHIONA</b>				
<b>Caeciliidae</b>				
<i>Siphonops</i> sp. (aff. <i>paulensis</i> )	13	*	?	?



surveys only, with a total effort of 60 hours in Caxingó and 56 hours in São Raimundo Nonato. It is important to emphasize that sampling efforts were unequal among sites. Therefore, differences among species richness in each site should be carefully interpreted. Collection permits were issued by Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio 26171-1, 4301-1, 36995-1).

Species distributional patterns as well as their association with the major Brazilian biomes were determined according to Valdujo et al. (2012) as following: AMC = species that occur both in the Amazon Rainforest and the Cerrado biomes; CA = species that occur only in the Caatinga biome; CAC = species that occur both in the Caatinga and the Cerrado biomes; CE = species endemic to the Cerrado biome; O = species that occur in open domains; W = widespread species. The conservation status of the species was classified according to the IUCN (2012). Taxonomic arrangement is as in Frost (2013).

## Results

We recorded a total of 55 amphibian species in the state of Piauí from information available in the literature and from field collections carried out in this study (Table 1, Appendix 1), distributed in the orders Anura (54 species) and Gymnophiona (one species). Anurans were represented by seven families as follows: Bufonidae (seven species; one genus); Ceratophryidae (one species); Hylidae (20 species; eight genera); Leptodactylidae (18 species; six genera); Microhylidae (two species; two genera); Odontophrynidae (four species; two genera); Ranidae and Strabomantidae (both with one species). Gymnophiona was represented only by *Siphonops* sp. (aff. *paulensis*) (Caeciliidae). Among species recorded three are potentially undescribed taxa: *Adenomera* sp. (aff. *andreae*), *Scinax* gr. *ruber* and *Siphonops* sp. (aff. *paulensis*).

We registered 18 municipalities with at least one amphibian recorded (Figure 1), which represent 17.6% of the municipalities of Piauí (n = 224). Ribeiro Gonçalves (n = 32, 62% of the Piauí's species), Caxingó (n = 26, 52%), Brejo do Piauí (n = 22, 40%), Parnaíba (n = 19, 36%) and Ilha Grande de Santa Isabel (n = 15, 30%) were the municipalities with highest number of recorded species (Figure 2).

Regarding the distributional patterns of species, we found 10 species endemic to the Cerrado biome (*Rhinella veredas* (Brandão, Maciel & Sebben, 2007), *R. cerradensis* Maciel, Brandão,

Campos & Sebben, 2007, *Rhinella mirandaribeiroi* (Gallardo, 1965), *R. rubescens* (A. Lutz, 1925), *Dendropsophus rubicundulus* (Reinhardt & Lütken, 1862 "1861"), *Phyllomedusa azurea* Cope, 1862, *Leptodactylus pustulatus* (Peters, 1870), *Eupemphix nattereri* Steindachner, 1863, *Physalaemus centralis* Bokermann, 1962) and *Proceratophrys goyana* Miranda-Ribeiro, 1937; (fifteen species with widespread distribution; two endemic to the Caatinga biome, *Rhinella jimi* (Stevaux, 2002) and *Ceratophrys joazeirensis* Mercadal de Barrio, 1986); ten species occurring both in the Caatinga and the Cerrado biomes; four occurring in open domains (Caatinga, Cerrado, Pantanal) and six species occurring in the Cerrado and the Amazon Rainforest (Table 1; Figure 3).

According to the IUCN (2012) red list of threatened species, 85% (n = 47) of the species that occurs in the Piauí were classified as Least Concern. Only *Rhinella cerradensis* and *Proceratophrys concavitympanum* are classified as Data Deficient. *Adenomera* sp. (aff. *andreae*), *Proceratophrys* cf. *caramaschii*, *Pristimantis* gr. *conspicillatus*, *Pseudopaludicola parnaíba*, *Scinax* gr. *ruber*, and *Siphonops* sp. (aff. *paulensis*) have no IUCN red list status so far.

## Discussion

Caramaschi & Jim (1983a, b) provide a preliminary list of amphibians from the municipality of Picos, Piauí, where 10 species were recorded, including two new species: *Dendropsophus soaresi* and *Elachistocleis piauiensis*, which were formally described by these authors. Rodrigues (2003) mentions the occurrence of three and eight amphibian species for the municipalities of Piripiri and Valença, respectively; however, species identification is not provided. Recent new research inventories, most of them along the coastal zone of Piauí (Silva et al. 2007, Loebmann & Mai 2008, Loebmann et al. 2010b), increased the known amphibian fauna by 30 species. Recent new records of distribution such *Lithobates palmipes* (Ramalho et al. 2011), *Odontophrynus carvalhoi* (Lisboa et al. 2010), *Sphaenorhynchus lacteus* (Benício et al. 2011) and *Physalaemus cicada* (Benício et al. 2012) have also contributed to the increased knowledge of the amphibian fauna of the state.

Besides species presented in this article, Freitas (2011) reports the occurrence of *Leptodactylus caatingae* Heyer & Juncá, 2003, *Leptodactylus labyrinthicus* (Spix, 1824), *Leptodactylus* sp., *Physalaemus marmoratus* (Reinhardt & Lütken, 1862 "1861"), and

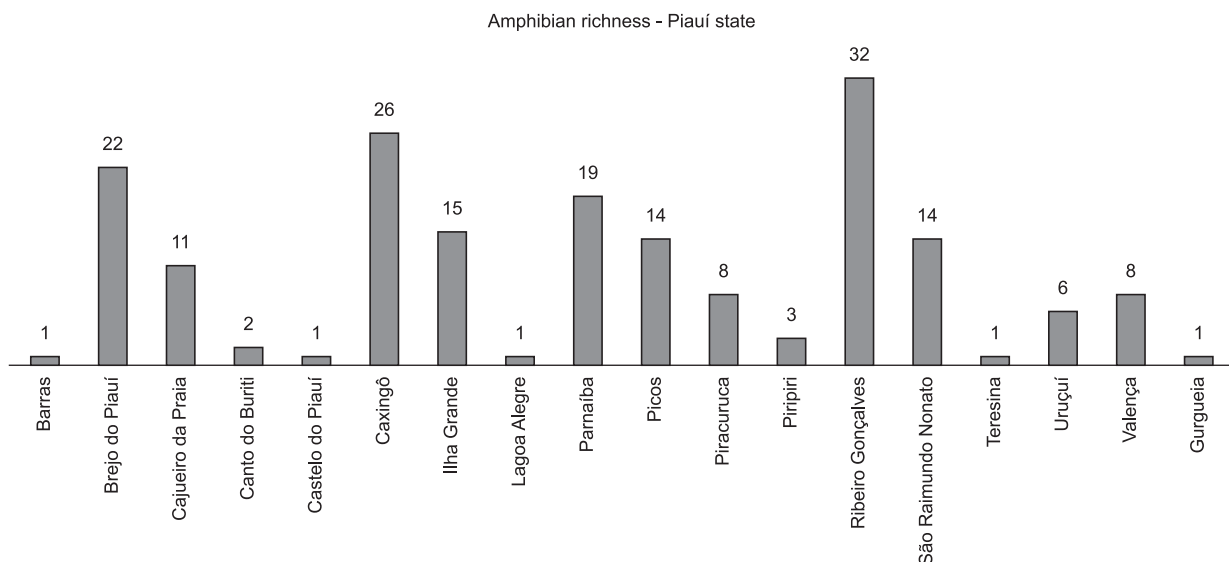
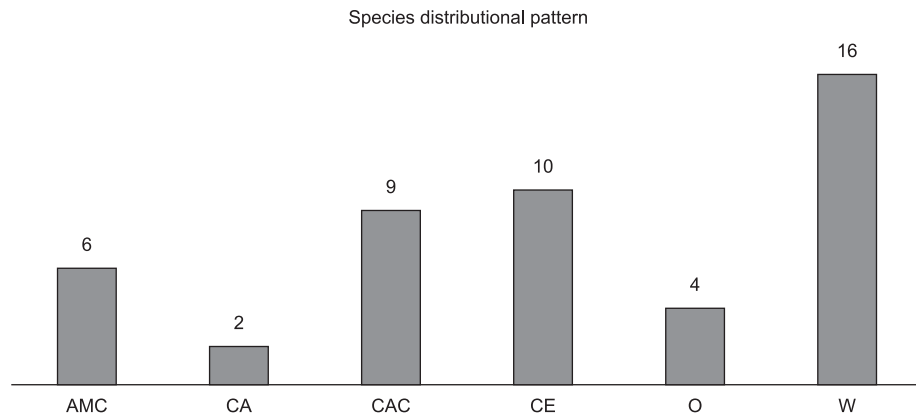


Figure 2. Amphibian richness for the municipalities of the State of Piauí.

## Amphibians of Piauí State



**Figure 3.** Amphibians Distributional Pattern in the state of Piauí: AMC = species that occur both in Amazon Rain Forest and Cerrado biomes; CA = species that occur only in Caatinga biome; CAC = species that occur both in Caatinga and Cerrado biomes; CE = species endemic to Cerrado biome; O = species that occur in open domains; W = widespread species.

*Pristimantis fenestratus* (Steindachner, 1864) for Piauí. However, neither references nor voucher specimens are provided in order to confirm species identification. Among species mentioned by Freitas (2011), we consider that *Leptodactylus* sp. is the same species here presented as *Adenomera* sp. (aff. *andreae*) (see Table 1), an undescribed species broadly distributed in Piauí. We considered that because we also consider the record of a species of *Pristimantis* for the state, once that Freitas (2011) provided a photograph of a specimen of *Pristimantis* from Gurgueia region. Additionally, it is known that a species from this genus occurs in the frontier with Maranhão and Piauí (R.W. Ávila, personal communication). However, considering the available information is weakly supported to confirm identification at the species level, we opted to assign the name *Pristimantis* gr. *conspicillatus* to the species that occurs in the Cerrado of southern Piauí. The presence of *L. labyrinthicus*, *L. caatingae* and *Physalameus marmoratus* for Piauí still need further evidence in order to confirming the presence of these species in state. For that reason, we preferred to exclude these records in the present study.

The state of Piauí does not have any endemic species detected so far; however, its localization between the Caatinga in the east and the Cerrado in the west shows endemic species for both biomes. For instance, *Rhinella veredas*, *R. cerradensis*, *R. rubescens*, *Eupemphix nattereri*, *Physalaemus centralis*, and *Phyllomedusa azurea* occur in savannas areas from Uruçuí and Ribeiro Gonçalves municipalities (Brandão et al. 2007, Maciel et al. 2007, present study), being considered species typical from Cerrado. In contrast, *Rhinella mirandaribeiroi*, *Dendropsophus rubicundulus*, *Proceratophrys goyana*, *Leptodactylus pustulatus* have wider distribution in the state, occurring in Cerrado areas but also in coastal zone and ecotonal areas of Caatinga and Cerrado (see Silva et al. 2007, Loebmann & Mai 2008, Loebmann et al. 2010b, Narvaes & Rodrigues 2009). For the Caatinga endemics, *Rhinella jimi* occurs in the north of the state in the coastal zone (Silva et al. 2007, Loebmann & Mai 2008) and in the Caatinga areas of Caxingó municipality, while *Ceratophrys joazeirensis* was reported in the municipality of São Raimundo Nonato.

Species with influence of the Amazon Rainforest such as *Hypsiboas boans*, *Osteocephalus taurinus*, *Sphaenorhynchus lacteus*, *Proceratophrys concavitympanum*, *Leptodactylus hylaedactylus* and *Lithobates palmipes* are found in ecotone areas on the border with Maranhão state, suggesting a possible dispersal route for these species. The low level of endemism confirms the earlier studies

of Nogueira et al. (2009) for lizards and Valdujo et al. (2012) for amphibians, however we believe that new inventories, especially at the border of the states of Tocantins and Maranhão on the southwestern region, can substantially increase the diversity in Piauí. Those region encompass one of richest amphibian diversity areas in Cerrado, and are considered priority areas for conservation (Diniz-Filho et al. 2005). Undescribed species such as *Adenomera* sp. (aff. *andreae*) (A. Fouquet, unpublished data) reinforce the need for conserving these areas to protect these species.

The lack of endangered species in the state, and only two 'data deficient' species, *Rhinella cerradensis* and *Proceratophrys concavitympanum*, does not minimize the importance of conservation of the pristine habitats, especially due to the increased deforestation rate that occurs in Piauí, for soy and eucalyptus cultures.

Strict protection conservation units are well represented in the state of Piauí: Estação Ecológica de Uruçuí-Una, Parque Nacional da Serra da Capivara, Parque Nacional da Serra das Confusões, Parque Nacional de Sete Cidades, and Parque Nacional das Nascentes do Parnaíba, however, inventories in some of these areas are available only in gray literature, like Management Plans. Knowledge about species diversity and composition is mandatory for the functionality and effectiveness of a protected area and to access the efficacy of the protected area in conserving these species (Rylands & Brandon 2005). Strict protection conservation units, such as national parks and ecological stations aim to conserve biodiversity and promoting scientific research. Research should be encouraged by the policy makers and the scientific community, following the examples of Uetanabaro et al. (2007) and Valdujo et al. (2011). We hope that in the near future new articles related to these topics will strengthen the conservation of these regions and, consequently, the biodiversity present in those areas.

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## Appendix

### Appendix 1.

*Ceratophrys joazeirensis* – ZUEC-AMP 9141; *Corythomantis greeningi* – URCA 2344; *Dendropsophus minusculus* – UFPB 4518; *Dendropsophus minutus* – URCA 2339; *Dendropsophus nanus* – URCA 234; *Dendropsophus rubicundulus* – URCA 2356; *Dendropsophus soaresi* – URCA 2340; *Dermatonotus muelleri* – URCA 2366; *Elachistocleis piauiensis* – MNRJ 66848; *Eupemphix nattereri* – URCA 2354; *Hypsiboas boans* – MNRJ 71656; *Hypsiboas multifasciatus* – URCA 2194; *Hypsiboas punctatus* – URCA 2225; *Hypsiboas raniceps* – UFPB 4522; *Adenomera* sp. (aff. *andreae*) – URCA 2229; *Leptodactylus macrosternum* – URCA 2193; *Leptodactylus fuscus* – URCA 2364; *Leptodactylus podicipinus* – MZUSP 25015; *Leptodactylus pustulatus* – UESPI 38; *Leptodactylus syphax* – ZUEC-AMP 8829; *Leptodactylus troglodytes* – URCA 2346; *Leptodactylus vastus* – UFPB 4524; *Lithobates palmipes* – CH-UFRRJ/ RU7278; *Osteocephalus taurinus* – URCA 2334; *Phyllomedusa azurea* – URCA 2353; *Phyllomedusa nordestina* – UFPB 4525; *Physalaemus albifrons* – CFBH 18322; *Physalaemus centralis* – URCA 2359; *Physalaemus cuvieri* – URCA 2198; *Pleurodema diplolister* – MNRJ 50381; *Proceratophrys* cf. *caramaschii* – UFPB 4529; *Proceratophrys concavumpanum* – URCA 2358; *Pseudopaludicola parnaíba* – URCA 2158; *Pseudopaludicola mystacalis* – URCA 2367; *Rhinella granulosa* – UFPB 4515; *Rhinella jimi* – UFPB 4517; *Rhinella mirandaribeiroi* – URCA 2345; *Rhinella schneideri* – URCA 2368; *Rhinella veredas* – MNRJ 39050; *Scinax fuscomarginatus* – URCA 2200; *Scinax fuscovarius* – URCA 2329; *Scinax nebulosus* – URCA 2224; *Scinax x-signatus* – UFPB 4532; *Trachycephalus typhonius* – URCA 2235.