

# List of anurans (Amphibia: Anura) from the rural zone of the municipality of Maringá, Paraná state, southern Brazil

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**ABSTRACT:** We report the anurans of four locations at the rural zone from municipality Maringá, Paraná state, Brazil. Specimens were registered by acoustic and direct visual search. Twenty-one species of frogs in eight families were collected between August 2006 and July 2007: Hylidae (9), Leptodactylidae (7), Bufonidae (1), Odontophrynidae (1), Hylodidae (1), Microhylidae (1) and Ranidae (1).

DOI: 10.15560/10.4.878

## INTRODUCTION

Brazil has the greatest diversity of anuran species in the world (Frost 2014). About 50% of this richness occurs in the Atlantic Forest, one of the world's hotspots of biodiversity (Myers *et al.* 2000; Haddad *et al.* 2008). Paraná state, southern Brazil, had its original vegetation destroyed and currently has few areas where patches of natural Semi-deciduous Seasonal Forest (SSF) still remain. Currently, the majority of its territory is used for agriculture and livestock (Maack 1981; Veloso *et al.* 1991).

Although about 140 species of anurans have been recorded in Paraná state, southern Brazil (Toledo and Batista 2012), there are gaps in information on taxonomy, zoogeography and ecology (Machado *et al.* 1999). Most of the studies were conducted in a few regions along Litorânea, Tibagi and Iguazu Basins (Machado and Bernarde 2002; Lingnau and Bastos 2003; Segalla and Langone 2004; Conte and Rossa-Feres 2007) and in the vicinities of Curitiba (*e.g.* Conte and Rossa-Feres 2006, 2007; Conte *et al.* 2010). Lingnau and Bastos (2003) and Toledo *et al.* (2003) emphasize the importance of investing efforts to study inland anuran communities in Brazil, since out of Paraná studies focus on coastal areas or along major rivers.

The destruction of natural habitats and forest fragmentation contribute to the decline of the regional fauna of anurans (Peltzer *et al.* 2003; Bishop *et al.* 2012). Thus this study aims to report the anurans from the rural zone in Maringá municipality, southern Brazil.

## MATERIALS AND METHODS

### Study site

Four sites with pasture fields and anthropized forest fragments in rural zone of Maringá municipality were sampled (Figure 1). A 1.6 km<sup>2</sup> forest fragment with a small

rocky bottomed stream (30 m long, 1 m wide) and a 0.61 km<sup>2</sup> pasture field compose the sampled area at Fazenda Cesumar. Fazenda Ibiteca, Pesqueiro do Português and Condomínio Recando dos Guerreiros, were composed by similar sized forests fragments (0.22, 0.22 and 0.31 Km<sup>2</sup>, respectively) and deforested areas (0.28, 0.23 and 0.21 Km<sup>2</sup>, respectively). Two artificial permanent ponds either used for fish farming or as reservoir of water for cattle (perimeter between 175 and 215 m) are present in each of the sampling stations. Grasses and small shrubs compose the vegetation surrounding the ponds.

Local climate is considered temperate with hot summer and mild dry season, classified as Cfa in Köppen's system (Peel *et al.* 2007). The mean temperature in colder months (April to September) is below 18°C with rare frosts and above 22°C during warmer months (October to March). Most of the rainfall occurs from September to December and the least amount occurs from June to August, with a mean annual rainfall of 1.500 mm (Maack 1981).

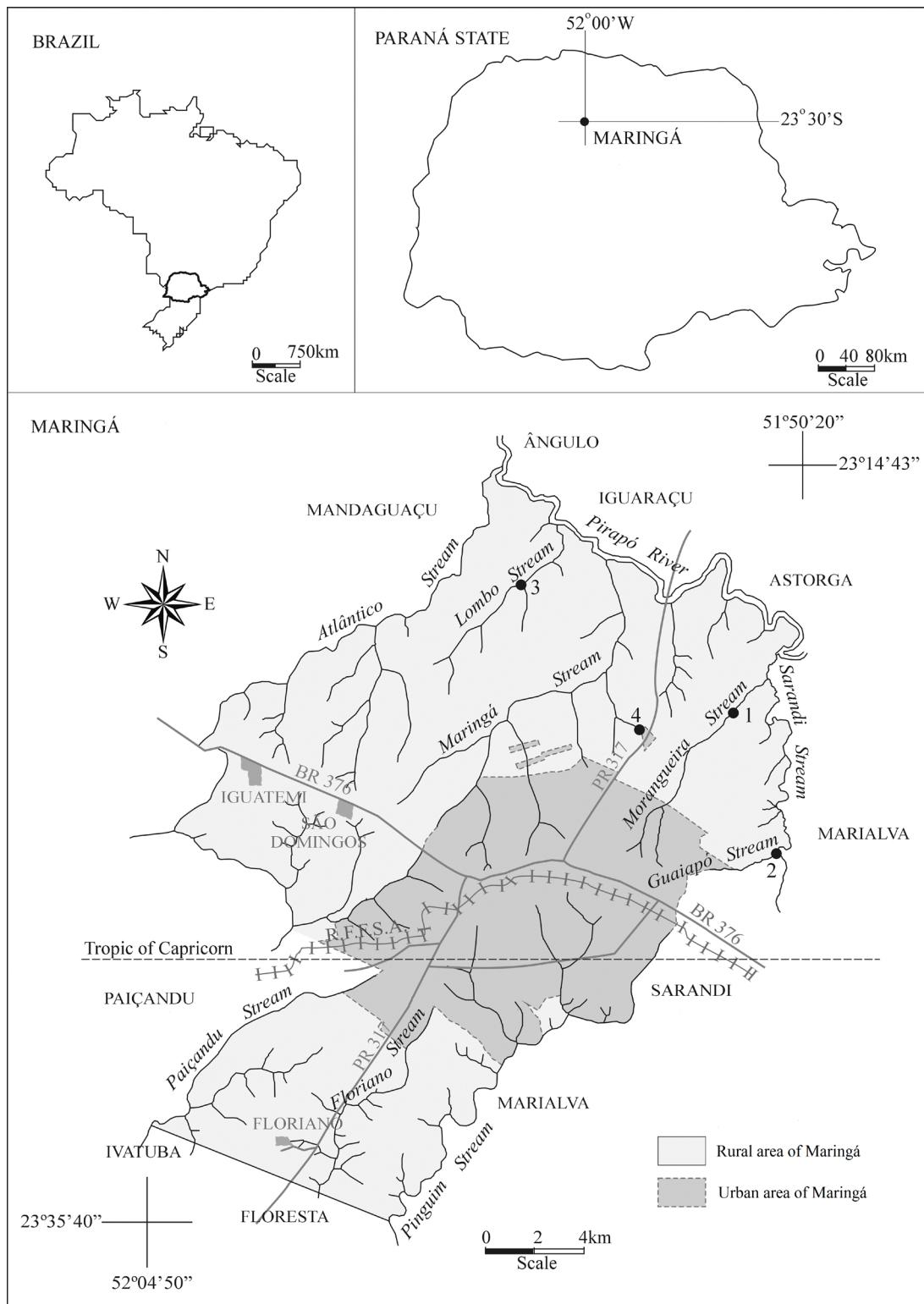
### Data collection

Each of the sampling sites was visited once monthly between August 2006 and July 2007 between the sunsets until midnight, resulting in a total of 12 samplings per site. All specimens were registered by direct visual search (Crump and Scott Junior 1994) and acoustic identification (Zimmerman 1994) in a way to cover the entire perimeter of water bodies. At least one specimen of each species were preserved in 10% formalin, later transferred to 70% ethanol and deposited at the Amphibians Collection from the Zoology Department, I.B., UNESP, Rio Claro, São Paulo state (CBFH). Instituto Brasileiro do Meio Ambiente e Recursos Naturais Renováveis (current Instituto Chico Mendes de Conservação da Biodiversidade - ICMBio) have granted the collection license under number 0071/2006. The nomenclature of species followed Frost (2014).

## RESULTS

We recorded a total of 21 species in eight families. Hylidae and Leptodactylidae were the richest with nine and seven species, respectively. Bufonidae, Hylodidae, Microhylidae, Odontophryinidae and Ranidae had one species each. Most of the species were observed in calling activity during the warmer and wetter months, which goes from October to March. The colder and drier months (June, July and August) showed a low number of species in calling activity (Table 1).

The reference specimens can be found at CBFH under numbers: *Rhinella schneideri* (CBFH 17179, 17187, 17233, 17234, 17235), *Odontophrynus americanus* (CBFH 17195, 17245), *Dendropsophus minutus* (CBFH 17161, 17206, 17225, 17248), *Dendropsophus nanus* (CBFH 17162, 17163, 17164, 17165, 17207), *Hypsiboas albopunctatus* (CBFH 17246, 17247, 17250, 17251), *Hypsiboas faber* (CBFH 17168, 17169, 17184, 17185, 17229), *Hypsiboas raniceps* (CBFH 17166, 17167, 17236, 17239, 17240), *Lysapsus limellum* (CBFH 17228), *Phyllomedusa tetraploidea*



**FIGURE 1.** Brazil, Paraná state, municipality of Maringá and the sampling sites: 1 – Fazenda Cesumar ( $23^{\circ}23'40''$  S,  $51^{\circ}52'22''$  W); 2 – Fazenda Ibiteca ( $23^{\circ}28'40''$  S,  $51^{\circ}54'30''$  W); 3 – Pesqueiro do Português ( $23^{\circ}21'20''$  S,  $51^{\circ}54'13''$  W); 4 – Condomínio Recanto dos Guerreiros – ( $23^{\circ}19'56''$  S,  $51^{\circ}52'48''$  W).

(CFBH 17190, 17191, 17192, 17193, 17194), *Scinax fuscovarius* (CBFH 17205, 17221, 17222, 17232, 17261), *Trachycephalus typhonius* (CBFH 17226), *Crossodactylus schmidti* (CFBH 17174, 17175, 17176, 17177, 17178), *Leptodactylus fuscus* (CFBH 17263, 17264, 17218), *Leptodactylus mystaceus* (CFBH 17170, 17241, 17242, 17262), *Leptodactylus mystacinus* (CFBH 17243, 17244), *Leptodactylus latrans* (CFBH 17186, 17219, 17249), *Leptodactylus podicipinus* (CFBH 17171, 17172, 17173), *Physalaemus cuvieri* (CFBH 17188, 17189, 17200, 17201, 17202), *Eupemphix nattereri* (CFBH 17196), *Elachistocleis cf. bicolor* (CFBH 17252, 17253, 17254, 17255, 17256) e *Lithobates catesbeianus* (CFBH 17180, 17181, 17182, 17197, 17198).

## DISCUSSION

Faunal lists exist for a few other locations at the northern region of Paraná state. At Londrina, a municipality around 100 Km far from Maringá, 24 anuran species were reported by Machado *et al.* (1999) and Bernarde and Anjos (1999), with an overlap of 13 species. The difference between Londrina and Maringá species, probably do occur for two main reasons: the difference between conservation of the sampled areas and the size of the samples, which was bigger in Londrina. Most of the species found in this study are common to open areas and more adaptable to anthropogenic changes. Most species were observed

surrounding or in ponds in open areas, where the majority of species were in reproduction activity. Only two species were seen reproducing in a small rocky bottom and shores stream in Fazenda Cesumar, *Crossodactylus schmidti* and *Lithobates catesbeianus*, and the first one was seen exclusively in streams. *Crossodactylus schmidti* is classified as "near threatened" by IUCN due to the decline of its habitat and its area of occurrence is less than 20.000 km<sup>2</sup> (Segalla *et al.* 2004). Such species, according to Bastiani *et al.* (2012), is common small streams, and occurs in Misiones, Argentina; western Paraná, northern Rio Grande do Sul, and western Santa Catarina, Brazil; southeastern Paraguay, between 300-750 m elevation (Segalla *et al.* 2004; Caldart *et al.* 2013; Frost 2014). This species was not found vocalizing during the samplings, but in the morning after. As in present study only one population of *C. schmidti* was found we suggest more attention for the ecology of this species.

All of the 21 species occurred at the locality Fazenda Cesumar (Figure 1), followed by Fazenda Ibiteca, with 18 species, Condomínio Recanto dos Guerreiros, with 15, and Pesqueiro do Português, with 13 species. The main factor that possibly explains the highest species richness in Fazenda Cesumar is the presence of a large forest fragment (1.6 Km<sup>2</sup>) not more than 20 m far from the ponds. In general, forests are known to provide resources for many anurans, which in turn show a low displacement

**TABLE 1.** Family and Species, sampling sites in map and calling activities of anurans from Maringá region, Paraná state, during sampled months from August 2006 to July 2007. (+) presence of calling activity; (-) absence of calling activity.

FAMILY/SPECIES	SAMPLING SITES	CALLING ACTIVITIES/MONTHS													
		A	S	O	N	D	J	F	M	A	M	J	J		
Bufonidae															
<i>Rhinella schneideri</i> (Werner, 1894)	1, 2, 3, 4	+	+	+	+	+	-	-	-	-	-	-	-		
Cycloramphidae															
<i>Odontophrynus americanus</i> (Duméril & Bibron, 1841)	1, 2, 4	-	+	+	+	+	+	+	-	-	-	-	-		
Hylidae															
<i>Dendropsophus minutus</i> (Peters, 1872)	1, 2, 3, 4	+	+	+	+	+	+	+	+	+	+	-	-		
<i>Dendropsophus nanus</i> (Boulenger, 1889)	1, 2, 3, 4	+	+	+	+	+	+	+	+	+	+	+	-		
<i>Hypsiboas albopunctatus</i> (Spix, 1824)	1, 2	-	-	-	+	+	+	+	+	+	+	+	-		
<i>Hypsiboas faber</i> (Wied-Neuwied, 1821)	1, 2, 3, 4	-	+	+	+	+	+	+	+	-	-	-	-		
<i>Hypsiboas raniceps</i> Cope, 1862	1, 2, 3, 4	-	+	+	+	+	+	+	+	+	+	+	-		
<i>Lysapsus limellum</i> Cope, 1862	1	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Phyllomedusa tetraploidea</i> Pombal & Haddad, 1992	1, 2, 4	-	-	+	+	+	+	+	+	+	+	+	-		
<i>Scinax fuscovarius</i> (Lutz, 1925)	1, 2, 3, 4	+	+	+	+	+	+	+	+	+	+	+	-		
<i>Trachycephalus typhonius</i> (Linnaeus, 1758)	1, 2, 4	-	+	-	+	+	+	+	-	-	-	-	-		
Hydrolidae															
<i>Crossodactylus schmidti</i> Gallardo, 1961	1	-	-	-	-	-	-	-	-	-	-	-	-		
Leiuperidae															
<i>Eupemphix nattereri</i> Steindachner, 1863	1, 2	+	+	+	+	+	+	+	+	+	+	+	-		
<i>Physalaemus cuvieri</i> Fitzinger, 1826	1, 2, 3	-	-	-	+	+	+	+	-	+	-	-	-		
Laptodactylidae															
<i>Leptodactylus fuscus</i> (Schneider, 1799)	1, 2, 3, 4	-	-	+	+	+	-	-	-	-	-	-	-		
<i>Leptodactylus mystaceus</i> (Spix, 1824)	1	-	+	+	+	+	+	+	+	+	-	-	-		
<i>Leptodactylus mystacinus</i> (Burmeister, 1861)	1, 2, 3, 4	-	-	+	+	+	+	+	+	+	+	+	-		
<i>Leptodactylus latrans</i> (Linnaeus, 1758)	1, 2, 3, 4	+	+	+	+	+	+	+	+	+	+	+	-		
<i>Leptodactylus podicipinus</i> (Cope, 1862)	1, 2, 3, 4	-	-	+	-	+	+	+	+	+	-	-	-		
Microhylidae															
<i>Elachistocleis cf. bicolor</i> (Guérin-Méneville, 1838)	1, 2, 3, 4	-	+	+	+	+	+	+	+	-	-	-	-		
Ranidae															
<i>Lithobates catesbeianus</i> (Shaw, 1802)	1, 2, 3, 4	-	-	+	+	+	+	+	+	+	+	+	-		
<b>Total</b>		-		7	13	17	18	19	18	17	14	12	8	5	0

capability and are vulnerable to environmental changes (Haddad and Prado 2005; Rossa-Feres *et al.* 2008, Becker *et al.* 2010).

With exception of *Leptodactylus mystaceus* and *Lysapsus limellum*, all sampled species had already been registered in Paraná state (Machado and Bernarde 2002; Segalla and Langone 2004; Frost 2014). The distribution of *L. mystaceus* was expanded on approximately 550 Km to the west, as reported by Affonso *et al.* (2011). *Lysapsus limellum* is known to have its distribution on Uruguay, Paraguay, Bolivia, northern Argentina and Mato Grosso state, Brazil (Lavilla *et al.* 2004; Frost 2014). The municipality of Maringá is approximately 725 Km far in a straight line from the southernmost limit of the state of Mato Grosso and 1140 Km far from the northern Argentina. *Lysapsus limellum* was not observed vocalizing and it seems to be very rare in this region, once only one individual was found.

*Lithobates catesbeianus*, a non-native and widespread species in Brazil (Both *et al.* 2011), is known to reproduce in lentic water bodies, such as ponds (Kaefer *et al.* 2007). Despite the majority of the individuals in reproduction activities was found in ponds, we recorded males vocalizing in a stream at Fazenda Cesumar in October 2006, which suggests that this species is able to use streams as a breeding site. Considering that this species is exotic, a competitor and/or predator that possibly takes many advantages on other organisms and can be dangerous for other frog populations (Kiesecker and Blaustein 1998; Cunha and Delariva 2009; Kraus 2009), we suggest further studies to understand the ecological relationships of *L. catesbeianus* with the local fauna.

The pattern of distribution of species along the year follows a commonly found pattern in southern Brazil, with most of the species in calling activity in the warm and wet season (*e.g.* Bernarde and Anjos 1999; Machado *et al.* 1999; Bernarde and Machado 2000; Conte and Rossa-Feres 2006).

This species list is the first to document the composition of anurans in a highly anthropized area at the northern Paraná state. Furthermore, we encourage investing in research on herpetofauna in the northern Paraná. As there is a lack of studies in this region, we believe that many species are yet to be discovered or may have their geographic distributions expanded, especially if other sampling methods are considered, such as pitfall traps and/or sampling the inner reminiscent forest fragments.

**ACKNOWLEDGMENTS:** Eduardo Ribeiro da Cunha was a supportive field companion. We are very grateful to Dr. Célio F. B. Haddad and his team for the identification of the species and to the anonymous reviewers for the valuable comments. Centro de Ensino Superior de Maringá (Unicesumar) has granted gears required and National Counsel of Technological and Scientific Development (CNPq) has granted graduation scholarships to IPA and EGC. RLM thanks CNPq (process 140710/2013-2) for scholarship.

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RECEIVED: November 2013

ACCEPTED: June 2014

PUBLISHED ONLINE: September 2014

EDITORIAL RESPONSIBILITY: Marcelo N. de C. Kokubum