UNIVERSIDADE ESTADUAL DE MARINGÁ
CENTRO DE CIÊNCIAS BIOLÓGICAS
DEPARTAMENTO DE BIOLOGIA
PROGRAMA DE PÓS-GRADUAÇÃO EM ECOLOGIA DE AMBIENTES AQUÁTICOS CONTINENTAIS

RICARDO LOURENÇO DE MORAES

# Efeitos da altitude, longitude e latitude na composição histórica e ecológica dos anfíbios da Floresta Atlântica brasileira

Maringá
2016

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Tese apresentada ao Programa de Pós-Graduação em Ecologia de Ambientes Aquáticos Continentais do Departamento de Biologia, Centro de Ciências Biológicas da Universidade Estadual de Maringá, como requisito parcial para obtenção do título de Doutor em Ciências Ambientais.
Área de concentração: Ciências Ambientais

Orientador: Prof. Dr. Rogério Pereira Bastos

Maringá
2016

"Dados Internacionais de Catalogação-na-Publicação (CIP)"
(Biblioteca Setorial - UEM. Nupélia, Maringá, PR, Brasil)

M827e

Moraes, Ricardo Lourenço de, 1976-
Efeitos da altitude, longitude e latitude na composição histórica e ecológica dos anfíbios da Floresta Atlântica brasileira / Ricardo Lourenço de Moraes.-- Maringá, 2016.
330 f. : il. (algumas color.).

Tese (doutorado em Ecologia de Ambientes Aquáticos Continentais)--Universidade Estadual de Maringá, Dep. de Biologia, 2016.
Orientador: Prof. Dr. Rogério Pereira Bastos.

1. Anfíbios - Ecologia - Distribuição - Floresta Atlântica - Brasil. 2. Anfíbios - Ecologia - Modelagem - Floresta Atlântica - Brasil. 3. Anfíbios - Evolução - Floresta Atlântica - Brasil. I. Universidade Estadual de Maringá. Departamento de Biologia. Programa de Pós-Graduação em Ecologia de Ambientes Aquáticos Continentais.

CDD 23. ed. -597.8170981
NBR/CIP - 12899 AACR/2

Maria Salete RibelattoArita CRB 9/858
João Fábio Hildebrandt CRB 9/1140

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COMISSÃO JULGADORA

Prof. Dr. Rogério Pereira Bastos
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Aprovado em: 08 de Agosto de 2016.
Local de defesa: Anfiteatro Prof. "Keshiyu Nakatani", Nupélia, Bloco G-90, *campus* da Universidade Estadual de Maringá.

*“Dedico este trabalho a*
*minha mãe que sempre*
*me apoiou, e agora lá*
*de cima, me abençoa.”*

# AGRADECIMENTOS

A minha esposa Meline por todo apoio, ajuda e parceria em todas as etapas de minha carreira cientifica;

Aos filhos Lia, Ísis e Uriel por entenderem e permitirem que eu escrevesse este trabalho;

Ao professor Dr. Rogério Pereira Bastos pela orientação, amizade, auxílio em todas as etapas deste trabalho e, principalmente, por ter acreditado no meu potencial;

As queridas e competentes Aldenir e Jucemara, Salete e João, e a todos os professores do PEA;

Aos grandes parceiros e amigos Felipe Campos, Rodrigo Ferreira, Rafael Rosa,Vinicius Batista, Leo Malagoli, Fernando Lansak-Toha, Leilaine Talita, Helen Cassia, Mileny Otani, Amanda Fernandes, Claudio Zawadzki, Gabriel Deprá, Marion Haruki, Dayani Bailly, Iuri Dias, Mirco Solé, Tiago Rangel, Amanda Covre, Renan Oliveira, Guilherme Figueiredo, Caio Carniatto, Evanilde Benedito, Weferson Graça pelas importantes contribuições nesse estudo;

Ao Nupélia e ao PEA pelo fornecimento da infra-estrutura e desenvolvimento da pesquisa;

Ao CNPq pelo apoio financeiro;

Aos meus pais, por todo amor e dedicação;

Muito obrigado!

# Efeitos da altitude, longitude e latitude na composição histórica e ecológica dos anfíbios da Floresta Atlântica brasileira

## RESUMO

Identificar quais os fatores bióticos ou abióticos que influenciam na riqueza e dispersão das espécies, são importantes ferramentas para se entender os processos ecológicos para a manutenção das espécies. A Floresta Atlântica foi altamente devastada restando poucos fragmentos da suas florestas originais. Anfíbios são considerados o grupo de vertebrados mais ameaçados e cerca de 90% das espécies que ocorrem na Floresta Atlântica brasileira, são endêmicos deste bioma. Nos avaliamos as espécies de anfíbios que ocorrem na Floresta Atlântica quanto a sua capacidade de dispersão e adaptação. Buscou-se entender os processos abióticos que influenciam a riqueza e endemismo de espécies bem como as características funcionais e filogenéticas que influenciam na distribuição das espécies. Avaliamos refúgios ecossistêmicos e evolutivos durante o presente e futuro, auxiliando estratégias de conservação no futuro. Traçamos a história evolutiva dos mecanismos antipredação bem como a sua importância na distribuição das espécies. Os resultados mostraram que espécies mais adaptadas as alterações antrópicas possuem maior distribuição geográfica. A temperatura, topografia e áreas alteradas pelo homem são uma importante barreira geográfica. Áreas de altitudes serão os novos refúgios durante a era Antropocênica e repetem as mesmas áreas que foram usadas como refugio durante a era Pleistocênica. Mecanismos antipredação podem ter origem puramente filogenética, sendo que quando isto acontece, podem determinar novos ou ajustes de mecanismos existentes, e espécies com maior diversidade de mecanismos também possuem maior capacidade de dispersão.

**Palavras-chave:** Ectotermicos. Características funcionais. Filogenia. Evolução. Dispersão.

# Effects of altitude, longitude and latitude in the historical and ecological composition of amphibians in the Brazilian Atlantic forest

## *ABSTRACT*

Identify the biotic or abiotic factors that influence species richness and dispersion, are important tools for understanding the ecological processes to maintain of the species. The Atlantic Forest was highly devastated leaving few fragments of its original forests. Amphibians are considered the most threatened group of vertebrates and about 90% of the species that occur in the Brazilian Atlantic Forest, are endemic to this biome. We evaluate amphibian species that occur in the Atlantic Forest as its ability to dispersion and adaptation. We attempted to understand the abiotic processes that influence the richness and endemism of species as well as the functional traits and phylogenetics features that influence the distribution of species. We evaluate ecosystem and evolutionary refuges for the present and future, helping conservation strategies in the future. Traced the evolutionary history of antipredator mechanisms and their importance in the distribution of species. The results showed that more adapted species to anthropogenic changes have greater geographic distribution. The temperature, topography and areas altered by humans are an important geographical barrier. Altitude areas will be the new refuges during the Antropocene age and repeat the same areas that were used as refuge during the Pleistocene age. Antipredator mechanisms may have origin purely phylogenetic may determine new or adjustments of existing mechanisms, species with the greatest diversity of mechanisms also have greater ability to dispersion.

***Keywords:*** Ectothermic. Functional traits. Phylogeny. Evolution. Dispersion.

Tese elaborada e formatada conforme as normas das publicações científicas
*Diversity and Distributions*. Disponível em:
<http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1472-4642/homepage/ForAuthors.html>,
*Global Change Biology*. Disponível em:
<http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1365-2486/homepage/ForAuthors.html>
e *Evolution*. Disponível em:
<http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1558-5646/homepage/ForAuthors.html>

## SUMÁRIO

# 1 INTRODUÇÃO GERAL

A busca pela compreensão dos fatores ambientais associados à riqueza de espécies em uma determinada área, tal qual às variações ocorrentes no espaço e tempo, tem sido um dos principais temas de pesquisa dos ecólogos (BEGON et al. 2007). Para tentar entender os fatores que influenciam a diversidade de espécies em larga escala, foi proposto por Brown & Maurer (1989) o estudo da *Macroecologia*, sendo os padrões geográficos (latitude e altitude), a característica fucional “tamanho do corpo” um dos focos principais. A variação de fatores abióticos pode influenciar a composição das comunidades ao longo de gradientes espaciais, como em relação à latitude (i.e., os fatores climáticos relacionados a ela), onde a riqueza de espécies é inversamente proporcional à latitude (PIANKA 1966; GASTON 2000). Alternativamente, a altitude (i.e., os fatores abióticos relacionados a ela) também influencia na riqueza de espécies, sendo menor nas altitudes maiores (MACARTHUR 1972; STEVENS 1992; RAHBEK 1995). Contudo, em áreas de maior altitude pode ocorrer maior número de espécies sensíveis e endêmicas, como ocorre com os anfíbios devido as temperaturas mais amenas e alta umidade (CRUZ & FEIO 2007).

Os anfíbios estão sofrendo um acentuado declínio (STEININGER et al. 2001; LIPS & DONNELLY 2002; HAYES et al. 2010; BECKER & ZAMUDIO 2011). Os principais fatores deste declínio seriam a fragmentação e a perda do hábitat, levando as pequenas populações à redução da diversidade genética, aumentando o risco de deriva genética e endogamia (YOUNG et al. 1996; BECKER et al. 2007; DIXO et al. 2009; LOURENÇO-DE-MORAES et al. 2012). Estes fatores tornam as populações mais suscetíveis aos efeitos estocásticos devido ao menor potencial evolutivo (HOLT et al. 2004). Além disso, outros fatores estão associados ao declínio de anfíbios, como o aumento da radiação ultravioleta-B (POUNDS et al. 2006; BLAUSTEIN & JOHNSON 2003), doenças letais causadas por fungos (LIPS et al. 2003), tráfico ilegal de animais (PISTONI & TOLEDO 2010), alterações da legislação ambiental (TOLEDO et al. 2010) e introdução de espécies exóticas (KATS & FERRER 2003).

A Floresta Atlântica originalmente se estendia desde a costa do Rio Grande do Norte até o Rio Grande do Sul, e devido à excessiva pressão antrópica, hoje restam alguns últimos remanescentes com um total aproximado de 98.000 $Km^2$ (MORELLATO & HADDAD 2000), representando cerca de 16% da cobertura original (RIBEIRO et al. 2009). Com uma grande concentração de espécies endêmicas de plantas e animais, é considerada um dos trinta e cinco *hot spots* mundiais mais importantes para biodiversidade (MYERS et al. 2000). A Floresta Atlântica possui um total estimado de mais de 1.800 espécies de vertebrados terrestres, sendo que aproximadamente 36% destas espécies são endêmicas deste bioma (CI 2005). Cerca de 90% das espécies de anfíbios descritas para o Brasil são endêmicos da Floresta Atlântica (HADDAD et al. 2013). Um fator que pode ser relacionado à alta riqueza deste bioma é o grande número de *habitat* e de micro-habitat, favorecendo o número de espécies hábitat-especialistas (HADDAD 1998). Além disso, é provável que exista um alto grau de isolamento entre as populações, dado pelo relevo altamente acidentado com rios e montanhas que podem representar barreiras biogeográficas, associado as suas características fisiológicas e pressões bióticas como predação (HADDAD 1998; MARQUES et al. 1998; WELLS 2007).

Muitos anfíbios que vivem restritos nas proximidades ou nos topos de morros estão sofrendo um forte impacto sob um cenário de aquecimento climático ou micro-climático, porque as condições ambientais adequadas para sua sobrevivência, podem não existir mais localmente e algumas espécies desapareceram (WAKE 2012). Estudos com anuros apontam menor riqueza em maiores altitudes (SCOTH Jr. 1976; FAUTH et al. 1989; NAVAS 2002; 2006). No Brasil os estudos testando os efeitos da altitude em comunidades são escassos, apontando redução da riqueza com o aumento da altitude (GIARETTA et al. 1997; 1999). Contudo, ainda existe uma carência de conhecimento taxonômico sobre as espécies de altitude, as quais estão sendo descritas recentemente (e.g. CRUZ et al. 2007; ALVES et al. 2009; RECODER et al. 2010; NAPOLI et al. 2011; GAREY et al. 2012; LOURENÇO-DE-MORAES et al. 2014).

Investigamos em macroescala a atual situação dos anfíbios da Floresta Atlântica brasileira. Para isso investigou-se o padrão de distribuição das espécies e relacionou-os com a topografia, referências espaciais e variáveis ambientais e analisou quais características funcionais auxiliam na dispersão das espécies promovendo o atual padrão de diversidade beta em toda a Floresta Atlântica brasileira; os atuais *hotspots* de diversidade funcional e filogenética, identificando os refúgios climáticos das espécies baseado nos padrões ecossistêmicos e evolutivos para o futuro; e a origem dos mecanismos antipredação e verificou as características funcionais que influenciam na diversidade de mecanismos antipredação bem como a diversidade destes mecanismos e sua relação com a distribuição das espécies.

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# *2* FUNCTIONAL TRAITS EXPLAIN THE CURRENT DISTRIBUTION OF THE AMPHIBIAN SPECIES IN BRAZILIAN ATLANTIC FOREST

## *Abstract*

Dispersion processes of species of the most important ways to understand how communities interact in macroecological studies. The functional abilities of the species, such as its plasticity throughout of the various environments in a macroscale, can be decisive for the dispersion process and may reflect the beta diversity of a locality or region. In this study we assessed the potential dispersion of amphibian species based on their functional traits, we analyze the influence of abiotic factors on species richness, endemism, and beta diversity pattern. Our results show that the current change of forest affect direct the beta diversity pattern because the most species adapted to this new environment altered by anthropic actions to increase their range. Species with functional characteristics such as body size (medium and large) and the habitat (open area and open/forest areas) are the main traits that explain the current pattern of beta diversity. The richness pattern is determined to historical processes in synergy with abiotic variables and species with more suitable phenotypic specializations to anthropogenic changes are the least threatened in the current geological Age.

**Key words**: Anthropocene; beta diversity; ectothermics; Anura; Gymnophiona

# CARACTERÍSTICAS FUNCIONAIS EXPLICAM A ATUAL DISTRIBUIÇÃO DAS ESPÉCIES DE ANFÍBIOS NA FLORESTA ATLÂNTICA BRASILEIRA

## Resumo

Os processos de dispersão das espécies são uma das formas mais importantes para compreender como as comunidades interagem em estudos macroecológicos. As habilidades funcionais das espécies, bem como sua plasticidade ao longo dos vários ambientes em uma macroescala, pode ser decisivo para o processo de dispersão e pode refletir a diversidade beta de uma localidade ou região. Neste estudo avaliou-se a dispersão potencial das espécies de anfíbios com base em suas características funcionais, analisamos a influência de fatores abióticos sobre a riqueza de espécies, endemismo e o padrão de diversidade beta. Os resultados mostram que a alteração original das florestas afeta diretamente o padrão de diversidade beta, isso devido a maioria das espécies adaptadas a este novo ambiente alterado pelas ações antropicas, aumentam a sua área de distribuição. Espécies com características funcionais, tais como o tamanho do corpo (médio e grande) e *habitat* (área aberta e áreas abertas/florestal) são as principais características que explicam o atual padrão de diversidade beta. O padrão de riqueza está determinado a processos históricos em sinergia com variáveis abióticas, e espécies com especializações fenotípicas mais adequadas as alterações antropicas são as menos ameaçadas na Era geológica atual.

**Key words**: Antropoceno; diversidade beta; ectotérmicos; Anura; Gymnofiona

## 2.1 INTRODUCTION

Understanding the processes of dispersion, distribution and permanence of species are likely the most studied topics of macroecologists and biogeographers. Among the processes that can address these patterns, two theories are much discussed: the niche theory (Hutchinson, 1957), where biotic and abiotic factors determine the composition patterns and distribution of species, and the neutral theory (Hugbell, 2001), where simple random stochastic processes are responsible for the distribution, extinction and dispersal of species. It is recognized that the current pattern of dispersion and distribution of species is related to a combination of historical and contemporary events (Ricklefs, 1987; Oberdorff, 1997; Svenning & Skov, 2007; Carnaval & Moritiz, 2008; Carnaval *et al.,* 2009; Baselga *et al.,* 2012; Silva *et al.,* 2014).The dispersion of a species is often related by the interactions of characteristics such as body size, local abundance, and probability of extinction with geographical range size (Brown & Maurer, 1989; Gaston, 1990; Lawton, 1993). Therefore, one of the issues to understand is how communities are organized and distributed and their ecological and evolutionary questions (Gaston, 1991).

Endothermic species with restricted ranges are more limited by local topographical features such as mountain ranges, rivers, valleys and coastal areas; whereas animals with larger geographical scale should be limited more by large climatic zones (Brown, 1995; Brown & Maurer, 1989). However, ectothermic species do not follow a pattern, is have the climatic zones as the main limiting factor, responding differently to different groups (Pfrender *et al*., 1998). Therefore, climate and dispersal limitation (e.g. body size) are both critical determinants of species ranges for a variety of taxonomic groups in different regions (Baselga *et al.*, 2012). Small species for example, can lost water for the environmental and suffer desiccation (MacLean, 1985), furthermore the interaction between species (predation and competition) and adaptive processes to the environment (generalist, specialist or opportunistic) are hypotheses that can determine the difference in the composition of species in a particular locality (Bell, 2001; Legendre *et al.*, 2005). In this sense, potential dispersal of the ectotermic species for many times, is related to their morphological and physiological characteristics as a limiting factor (Jimenez-ValVerde *et al.,* 2015) and this may be a key point to understand these processes. Functional traits may determine species composition to the characteristics of a particular ecosystem (Díaz *et al.*, 2007) and determine the species dispersion processes (Gómez-Rodrigues *et al.*, 2015). As well as body size tends to be higher in cold climates (Bergmann's role, Bergmann, 1847) but this pattern can vary depending on the taxon (Ashton & Feldman, 2003; Angilletta *et al.*, 2004; Cruz *et al.*, 2005; Pincheira-Donoso *et al.*, 2007; Shelomi, 2012). Another pattern related to body size and Rappaport's rule which the species are generally smaller at lower latitudes than at higher latitudes (Rappaport, 1982). However, this rule has generated many doubts because to be little tested, especially being a pattern observed in the northern Hemisphere (Gaston *et al.*, 1998; Whitton *et al.*, 2012).

Amphibians are sensitive to environmental changes (Blaustein *et al.*, 1994) and because of its physiological characteristics sensitive to the environment are limited to dispersal (Duellman & Trueb, 1994). Furthermore, many are prey to vertebrates and invertebrates (Wells, 2007), which makes amphibians dependent on their adaptive morphological and physiological specialization to succeed in dispersing. The Atlantic Forest is considered one of the world hotspots due to its high species diversity, endemism and degree of threat to extinction. (Myers *et al.*, 2000). Anthropogenic impacts, mostly over the last 500 years, has dramatically altered the landscape (Ribeiro *et al.*, 2009). These impacts have been responsible for the well documented decline of amphibian populations (Lambert, 1997; Lips & Donnelly, 2002; Becker *et al.*, 2007, 2010; Ferreira *et al.*, 2016). Understanding beta diversity patterns and evaluating the different compositions (turnover or nested) along of latitudinal and longitudinal gradient be an important tool for understanding the processes of dispersion of the species (Baselga, 2008, 2010).

Knowing that amphibians are limited to dispersion due to their physiological characteristics (e.g. body size), we evaluated the beta diversity of amphibians in the Atlantic Forest and evaluated the ability of species dispersion based on their functional traits. For this, we tested the hypothesis that (i) functional traits promoting greater adaptation to new environmental conditions (e.g. body size and specializations of habitat) may explain the current pattern of amphibians composition in the Atlantic Forest (Fig. 1); (ii) species that occur of Atlantic Forest are smaller in high altitudes and smaller in lower latitudes. We evaluated species composition of territories inside in this biome, and correlate the richness and endemism of species to environmental variables and check the average body size of species in different topographies and spatial references.

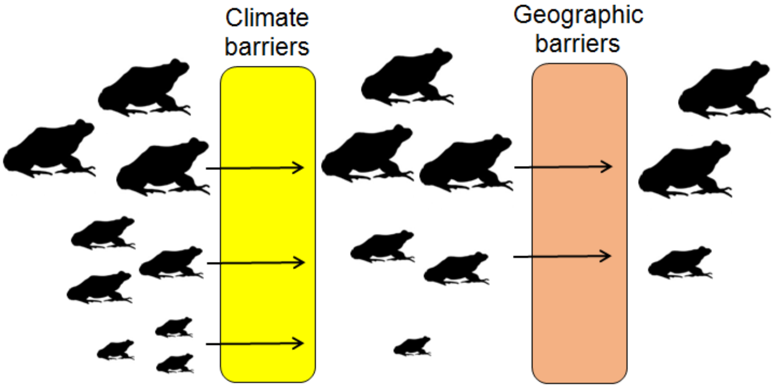

**Figure 1.** Hypothetical diagram showing that larger and more adapted species to environmental variables can be dispersed more easily in the current Atlantic Forest. Larger species lose less water to the environment than small or medium body sized species. Larger and medium species have more energy and ability to disperse by geographical barriers.

## 2.2 METHODS

### 2.2.1 Study region

The study area was the Atlantic Forest hotspot, is a biome that has latitudinal range extending into the tropical and subtropical regions (Myers *et al.*,2000; Ribeiro *et al.*, 2009). The longitudinal range favor differences in forest composition due to a diminishing gradient in rainfall from coast to interior (Ribeiro *et al.*,2009) and an altitudinal range encompassing the elevational limits of the mountain from 0-2000 m a.s.l. (Cavarzere & Silveira, 2012). Originally this biome covered around 150 million ha with heterogeneous environmental conditions provided by a wide range of climatic belts and vegetation formations (Tabarelli *et al.*, 2005; Ribeiro *et al.*, 2009) (Fig. 2).

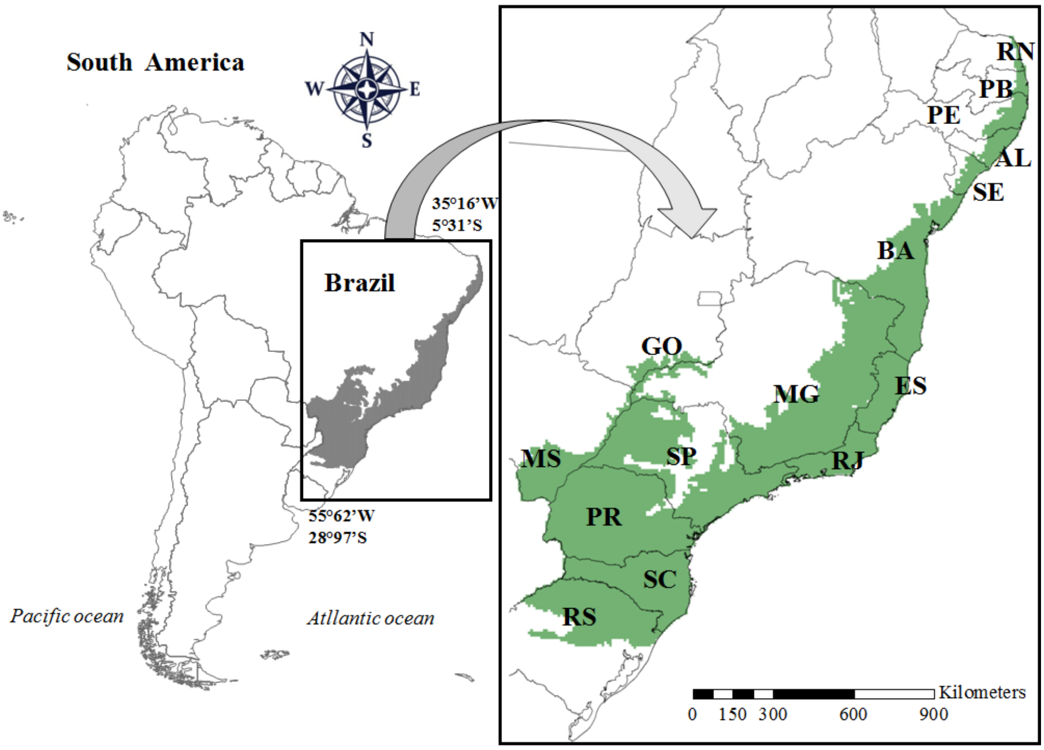

**Figure 2.** Map showed the study area of Brazilian Atlantic Forest hotspot (in gray) in South American territory. The acronyms of territories studied: RN = Rio Grande do Norte, PB = Paraíba, PE = Pernambuco, AL = Alagoas, SE = Sergipe, BA = Bahia, ES = Espirito Santo, MG = Minas Gerais, RJ = Rio de Janeiro, SP = São Paulo, GO = Góias, PR = Paraná, MS = Mato Grosso do Sul, SC = Santa Catarina, RS = Rio Grande do Sul.

The Brazilian Atlantic Forest occurs in 15 states (Fig 2). For better understand the pattern of beta diversity, we analyzed theses 15 states for aid visualize the differences of species compositions (richness and endemism) and a possible dispersion route. We divided the territories based in i) size of territory; ii) forest composition of each territory; and iii) abiotic environmental features of each territory (Olson *et al.*, 2001; Ribeiro *et al.*, 2009, Worldclim database see bellow).

Two states have all their territory included as composition of the species, RJ (Rio de Janeiro state) and ES (Espírito Santo state) because to be smaller and their forest composition similar. Four states have their territories separated in eastern and western, because of be large states and with deferent’s forest composition (eastern rain forest, western seasonal forest): EPR (Eastern of Paraná state),WPR (Western of Paraná state), ESC (Eastern of Santa Catarina state),WSC (Western of Santa Catarina state), ERS (Eastern of Rio Grande do Sul state),WRS (Western of Rio Grande do Sul state); and the “SMGM” refers to four connected states in seasonal forests (include Western of São Paulo -S, North of Mato Grosso do Sul -M, South of Góias -G and extreme South of Minas Gerais - M). The region of Mato Grosso do Sul state localized in the western of Paraná state was analyzed only, MS (Mato Grosso do Sul state). The Pernanbuco (PE), Sergipe (SE), Alagoas (AL), Paraíba (PB) and Rio Grande do Norte (RN) states were included in an only region N (Northeast), because the smaller territories (inside of biome), similar forest composition and abiotics environmental features.

Finally two states were separated and region North and South, because the large territory and different forest composition and abiotics environmental features, SBA (Southern of Bahia state), NBA (Northern of Bahia state), SMG (Southern of Minas Gerais state) and NMG (Northern of Minas Gerais state). In total sixteen territories of the study were assessed (see Fig. 3d).

### 2.2.2 Sampling

Based on the list of species that occur in the Brazilian Atlantic Forest according to Haddad *et al.* (2013), we used species range maps obtained from the International Union for Conservation of Nature (IUCN) database (http://www.iucnredlist.org/technical-documents/spatial-data) to determine the full recorded range of species distribution. In addition, we conducted amphibian sampling in 11 protected areas (PA) of Atlantic Forest (see Appendix 1, Fig. S1), as a complementary fieldwork and to supplement the dataset with observed functional traits (body size, reproductive mode, habitat, activity, poison patterns and habit).

In total, we assessed the geographical ranges of 529 amphibian species (519 Anurans and 10 Gymnophionas) covered by our grid system. We used ArcGIS 10 software (ESRI, 2010) to build presence/absence matrices from the species distribution data by superimposing a grid system with cells of 0.1 latitude/longitude degrees, creating a network with 10,359 grid cells. We followed Frost (2016) for the amphibian nomenclature.

### 2.2.3 Environmental variables

We averaged six environmental variables for each grid cell, which included one topographic (altitude), one biotic (tree cover) and four climatics (annual precipitation, mean annual temperature, annual evapotranspiration, and net primary productivity). We obtained altitude, annual precipitation and mean annual temperature from the World Clim database with 0.05° resolution (http://www.worldclim.org/). We also obtained annual evapotranspiration (AET), from the Geonetwork database (http://www.fao.org/geonetwork/srv/); net primary productivity (NPP) from the Numeral Terra dynamic Simulation Group (http://www.ntsg.umt.edu/data), and land cover from Global Forest Change 2000-2014 database (http://earthenginepartners.appspot.com/science-2013-global-forest/download_v1.2.html). All of these variables are known to represent either potential physiological limits for amphibians or barriers to dispersal (Vasconcelos *et al.*, 2010; Silva *et al.,* 2012). We draw the maps using the software and ArcGis10 (ESRI, 2010).

### 2.2.4 Functional traits

We characterized ecological traits of 529 amphibian species according to Haddad *et al.,* (2013), ecological information available in IUCN data base, literatures on the original descriptions of the species and to our field observations. Ecological traits were: body size, development mode (direct or indirect), habitat (forested areas, open areas, and both open and forested areas), activity time (nocturnal, diurnal, and both), poisonous (toxic, unpalatable or bad odour, and non-toxic), habit (arboreal, phytotelmate, terrestrial, cryptozoic, fossorial, rheophilic, semi-aquatic, and aquatic) (See Appendix 1, Table S1 for details and references).

### 2.2.5 Data Analyses

#### *2.2.5.1 Environmental variables vs species richness and species endemics*

We evaluated the response of species richness and areas with richness of species endemic (separated) to the predicted variables: altitude, annual precipitation, mean annual temperature, annual evapotranspiration, net primary productivity, and tree cover. We defined the endemic species than occur in only one of 16 territories defined above (see Fig. 3d) and calculated the richness species and richness of endemic species for each grid cell of 0.05º (10,359 cells) separately. We used permutation multivariate analysis of variance (PERMANOVA), with 1,000 permutations based on a Euclidean distance matrix through the “adonis” function in the package'vegan'e (Oksanen *et al.*,2013) in R (R Development Core Team, 2012).

#### *2.2.5.2 Distribution vs functional traits*

In order to evaluate the response of the geographical range of each species to the predicted body size (categorized - small <3cm, medium ≥3 and <10cm, large >10cm – according to Haddad *et al.*, 2013), poisonous, development mode, habit, habitat and activity for Anura and body size, development mode, habitat and habit for Gymnophiona. We also used permutation multivariate analysis of variance (PERMANOVA), with 1,000 permutations. In addition, we used Boxplots to visualize the traits that better explained species distribution. These analyzes were performed separately for Anuran and Gymnophiona due their different characteristics of ecological traits and body size (Haddad *et al.*, 2013). We calculated for each grid cell of 0.05º (10,359 cells) and performed these analyses using the package 'vegan' in R.

#### *2.2.5.3 Effects of body size vs richness*

We used simple linear models to test the association of body size (original body size of each species) of amphibians on species richness. For this, we calculated species mean of body size for each grid cell of 0.05º (10,359 cells). After, we evaluated the relationship between species mean of body size to variations of latitude, longitude and altitude. We performed these analyses using the package 'vegan' (Oksanen *et al.*, 2013) in R (R Development Core Team, 2012).

### *2.2.5.4 Similar species groups*

First, we examined whether there was independence of spatial correlation of species composition among the 16 territories (matrix of spatial data vs matrix of species composition). For this, we used Pearson correlation tests using the Mantel permutation (Legendre & Legendre, 1998).

Second, we used a similarity measure (i.e. Euclidean distance matrix) of the 16 territories to rank the groups of similar species composition. Ordination of the 16 territories was based on this faunal dissimilarity matrix, which was submitted to a nonparametric multidimensional scaling analysis (NMDS, Legendre & Legendre 1998) and the most likely solution was evaluated by Pearson correlation. The calculation of the variance is captured by a regression matrix from the original distances (Bray-Curtis) and the final array distances (Euclidean).

Third, we draw a dendrogram by taking Euclidean distance as the measure of resemblance and average linkage procedure as the linkage rule (Fig. 3c, b). These tests were computed in R using the “vegan” package.

### *2.2.5.5 Beta diversity measures*

First, we used two complementary metrics for beta diversity analysis by considering species presence and absence. In order to determine if the pattern among anuran communities is nested, we calculated a nestedness metric based on overlap and decreasing fill (index NODF) of Almeida-Neto *et al.,* (2008) and Ulrich *et al.,* (2009) across the 16 territories. The matrix in decreasing both columns and rows, columns ranking the areas according to their species richness and ordering the species in lines, the most frequent to the rarest. Creating and ordering the territories as larger biota and its subsets biota. To perform this analysis, original matrices were submitted to 1,000 simulations. We performed this analysis for all localities separately using the package “vegan” in R.

Second, we conducted beta diversity partitioning and computed distance matrices using pairwise dissimilarities βsor (i.e. measure total beta diversity), β sim (i.e. measure spatial turnover), and βnes (i.e. measure nesting) (Baselga, 2010). We computed these analyses among the 16 territories to show the directions of the species distributions. We considered larger nesting values means more species similar to the area of major species richness, and larger numbers of turnover means less similar species composition. We follow the sequence provided by NODF for analysis of beta diversity partitioning (Fig. 3a).

To available the effects of variation of species composition, we use the classification of Veloso *et al.*, (1991) based on the type of forest composition and topography. We computed the analyses in four ways: 1) all altitudes, 2) from 0-300m of altitude, 3) from 300-700m of altitude, 4) from 700-2000m of altitude. All these tests used the “betapart” package (Baselga & Orme, 2012) in R.

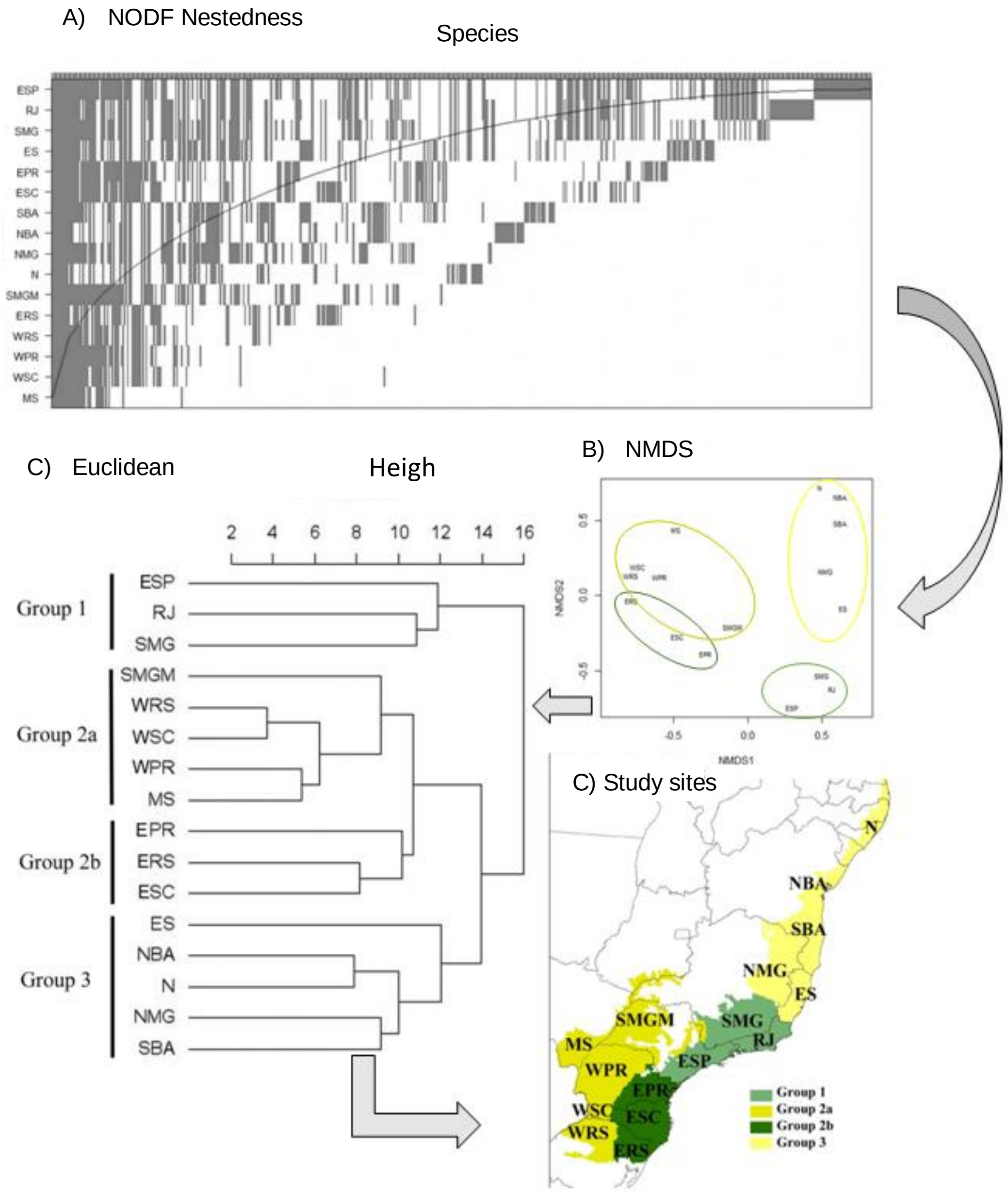

**Figure 3.** Steps designed to determine the beta diversity in Atlantic forest. A) NODF created to determine the territories with greater species richness and subset, B) NMDS used to spatially group the territories based on distance and species composition, C) visualization cluster of results obtained by NMDS, and D) created map showing groups similarities.

## 2.3 RESULTS

We found that the abiotics enviromental features explained 59.5% of the species richness distribution according to PERMANOVA values. The temperature was the main variable, (39.3%) followed by precipitation (11.4%), and NPP (8.6%) (Table 1). For territories of species endemic the abiotics enviromental features explained 26% of the endemism. Temperature was the main variable (22%), followed by altitude (2%) (Table 2 and see Fig. 4 for territories and their respective scores of species richness and endemism).

The functional traits explained 15.8% of distribution the anuran species in the Atlantic Forest according to PERMANOVA values. The habitat was responsible for about 9.0%, body size 3.0%, habit 1.0% and palatability 0.8% of the variation in the species distribution. The development mode and activity traits did not showed any significant relationship to species distribution (Table 3). For Gymnophiona, two main traits explained 88.8% of the species distribution. Habitat was responsible for about 67.4% and development mode 15.7% of the variation in the species richness distribution. The body size and habit traits did not showed any relationship to species distribution (Table 4).

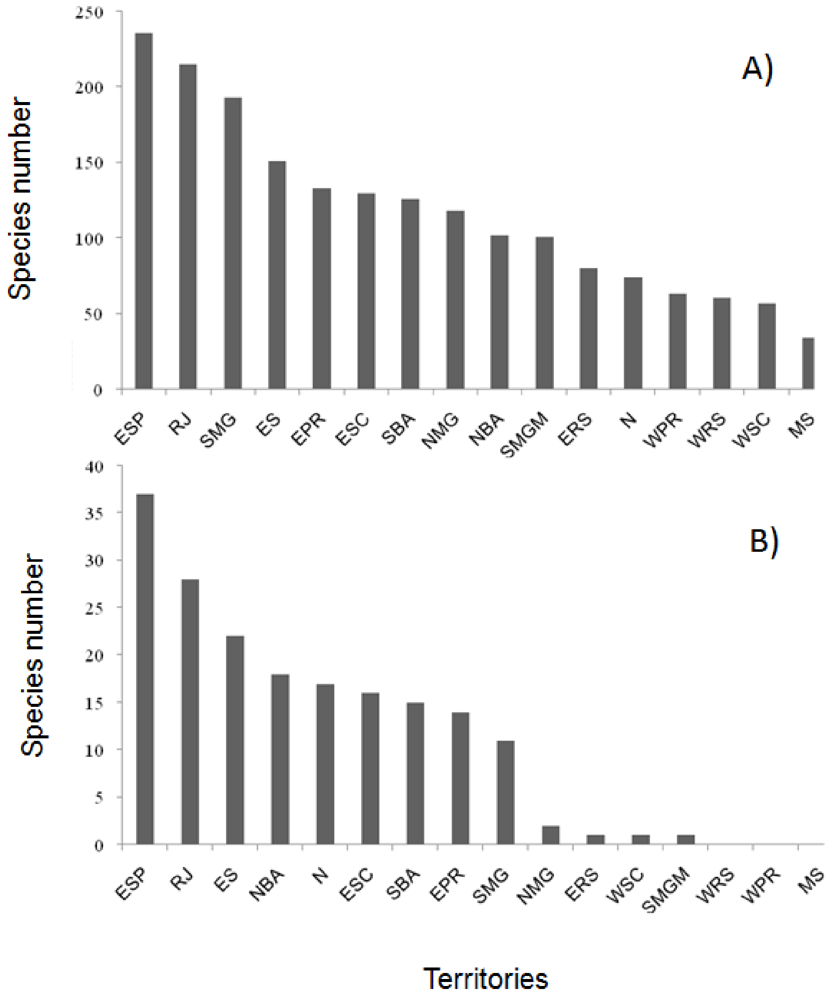

**Figure 4.** Scores of species richness (A) and endemism (B) in the territories considered as sampling units.

**Table1.** Association of amphibian species richness to environmental variables in the Brazilian Atlantic Forest by the PERMANOVA.

| Variables | df | *F* model | $R^2$ | *P* value |
|---|---|---|---|---|
| Altitude | 1 | 4.4 | 0.00017 | 0.036 |
| AET - Evapotranspiration | 1 | 38.3 | 0.0015 | 0.001 |
| NPP - Net primary production | 1 | 2198 | 0.08597 | 0.001 |
| Precipitation | 1 | 2917.4 | 0.11411 | 0.001 |
| Temperature | 1 | 10046.3 | 0.39294 | 0.001 |
| Tree cover | 1 | 10.9 | 0.00043 | 0.001 |
| Residuals | 10352 | – | 0.40489 | – |
| Total | 10358 | – | 1.00 | – |

**Table 2.** Association of amphibian species endemics to environmental variables in the Brazilian Atlantic Forest by the PERMANOVA.

| Variables | df | *F* model | $R^2$ | *P* value |
|---|---|---|---|---|
| Altitude | 1 | 413.2 | 0.02948 | 0.001 |
| AET - Evapotranspiration | 1 | 19.3 | 0.00137 | 0.001 |
| NPP - Net primary production | 1 | 4.1 | 0.00029 | 0.049 |
| Precipitation | 1 | 0.3 | 0.00002 | 0.578 |
| Temperature | 1 | 3202.0 | 0.22845 | 0.001 |
| Tree cover | 1 | 25.5 | 0.00182 | 0.001 |
| Residuals | 10352 | – | 0.73856 | – |
| Total | 10358 | – | 1.00 | – |

**Table 3.** Association of species range to the functional traits to Anuran in the Brazilian Atlantic Forest by the PERMANOVA.

| Variables | df | *F* model | $R^2$ | *P* value |
|---|---|---|---|---|
| Activity | 1 | 0.086 | 0.00014 | 0.772 |
| Body size | 1 | 22.14 | 0.03613 | 0.001 |
| Poisonous | 1 | 5.011 | 0.00818 | 0.021 |
| Habit | 1 | 12.056 | 0.01967 | 0.002 |
| Habitat | 1 | 57.575 | 0.09394 | 0.001 |
| Development mode | 1 | 1.013 | 0.00165 | 0.312 |
| Residuals | 515 | – | 0.84029 | – |
| Total | 521 | – | 1.00000 | – |

**Table 4.** Association of species range to the functional traits to Gymnophionas in the Brazilian Atlantic Forest by the PERMANOVA.

| Variables | Df | *F* model | $R^2$ | *P* value |
|---|---|---|---|---|
| Body size | 1 | 1.346 | 0.02823 | 0.282 |
| Habit | 1 | 2.674 | 0.05609 | 0.175 |
| Habitat | 1 | 32.126 | 0.67401 | 0.001 |
| Development mode | 1 | 7.519 | 0.15775 | 0.027 |
| Residuals | 4 | – | 0.08392 | – |
| Total | 8 | – | 1.00000 | – |

The Boxplot reveal the main responsible of largest distribution in Anura is found between species of open areas and species of open and forested areas, species of large body size, terrestrial and fossorial species, and toxic and non-toxic species (Fig.5a). The largest distribution in Gymnophiona is found among species of open and forested areas and species of indirect development mode (Fig. 5b).

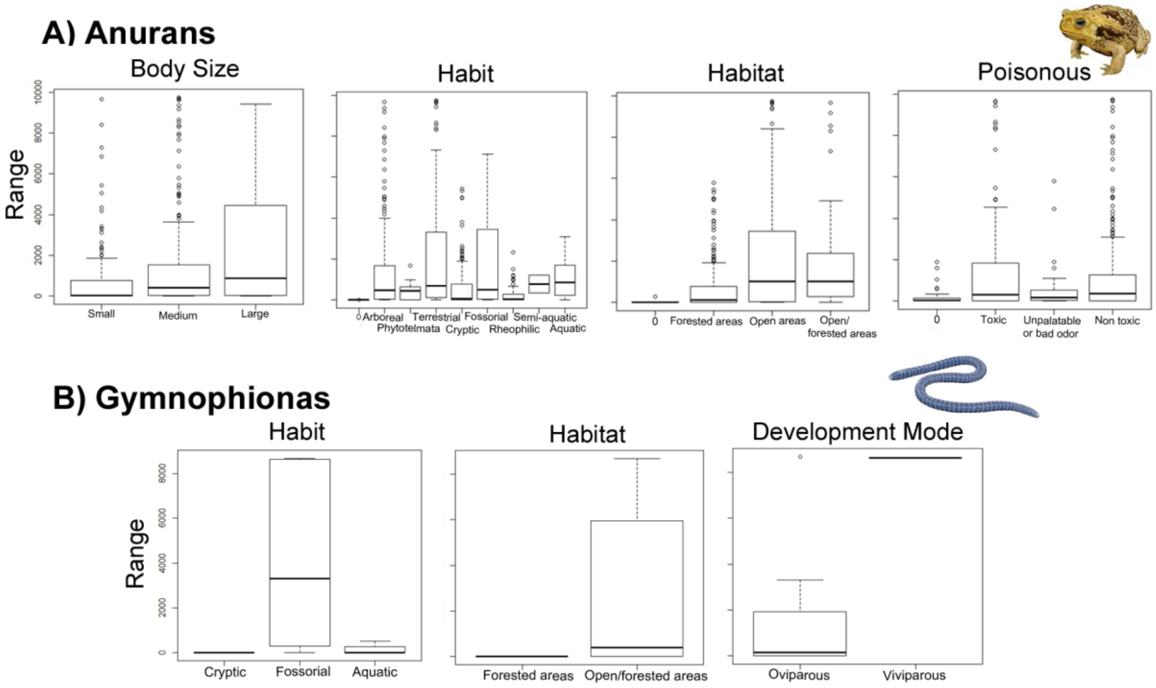

**Figure 5.** Box plot showing the traits selected by PERMANOVA and its variations that explained the distribution of species.

The body size showed high relation with distribution and species richness. Our results of linear models of mean body size was significant in all analyzes ($p<0.001$). Species richness had high relationship to smaller body size ($r^2$ = 0.398). The average body size increases by increasing longitude ($r^2$ = 0.103). The average body size decreases by increasing latitude, ($r^2$ = 0.025) and altitude ($r^2$ = 0.006) (Table 5, Fig. 6).

**Table 5.** Correlation used a linear regression of body size vs. species richness, longitude, latitude and altitude.

| | **Body size** | |
|---|---|---|
| **Variables** | $r^2$ | *P* |
| Richness | 0.398 | p< 0.001 |
| Longitude | 0.103 | p< 0.001 |
| Latitude | 0.025 | p< 0.001 |
| Altitude | 0.006 | p< 0.001 |

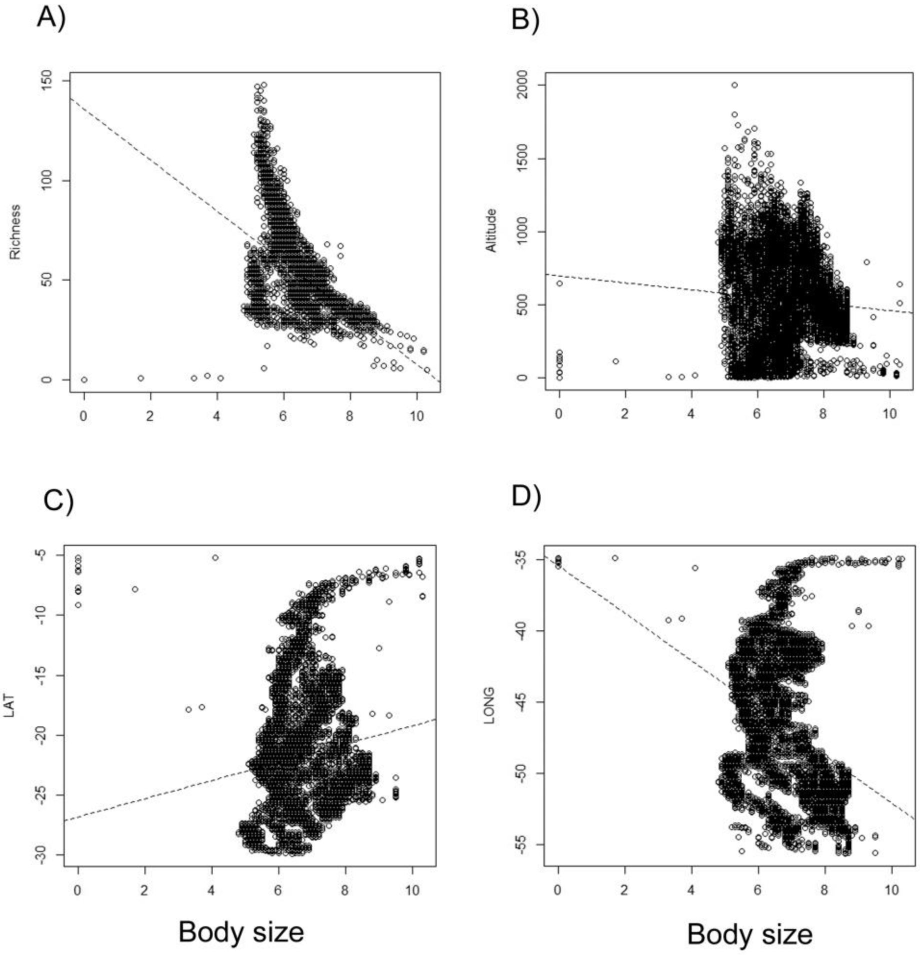

**Figure 6.** A) Relation between body size and species richness, B) altitude, C) latitude (LAT), and D) longitude (LONG).

The Mantel tests indicated spatial correlation of species composition and distance among the 16 territories ($r^2$= 0.30, p= 0.019). The dendrogram used the scores of the NMDS axes (7dimensions, $r^2$= 0.99, $p$<0.001), showed the presence of three groups of similarity faunal regions in Atlantic Forest (Fig. 3b-d). The major biota was ESP, RJ and SMG (group 1), characterized by humid forests major species richness and endemism. The group 2 was divided into two subgroups; one formed by MS, WPR, WSC WRS, and SMGM (subgroup 2a), with drier forests and seasonality with less species richness and endemism, and another one formed by EPR, ESC and ERS (subgroup 2b), characterized by humid forests with presence of Araucarias forest. The group 3 was formed by ES, NMG, SBA, NBA and N, characterized by hot forests and little or no seasonality, its second major group with species richness and endemism (see Fig. 4).

Results of the NODF values indicated significant nesting (NODF = 38.7, p< 0.001; N rows= 57.7, N coluns= 38.6) showing the areas ESP, RJ and SMG as the major biota (Fig. 3a). The beta diversity partitioning revealed that the highest values were between groups 1 and 3 (βsor mean 0.684 ± 0.093) followed by the group 2a (βsor mean 0.675 ± 0.126). Among the group 3, the values increase by increasing of the difference in species composition according to altitude, decreasing βsim and increasing βnes; wherein the territory N has highest βnes (0.281) among the species that occur 700-2000m a.s.l., and the territory SBA has highest values of βsim (0.582) among the species composition that occur in 300m a.s.l.. There is similar pattern among the group 2a, however the βnes decreases with increasing altitude and βsim decreases then increases slightly at higher altitudes, wherein the territory MS has highest values of βnes (0.669) whereas that territory WRS has highest values of βsim (0.397) both among species which occur between 300-700m a.s.l.. Among the groups 1 and 2b the values of βsor increases abruptly with increasing altitude (βsor mean 0.215-0.609). The main difference in this value of βsim (0.353-0.395) increases according to increasing the differences in the species composition between altitudes. The territory ERS had the highest value of βnes (0.281) among the species that occur from 700-2000 m a.s.l. and the highest value of βsim (0.480) among the species that occur 300-700m a.s.l. (see Table 6 and Fig. 7).

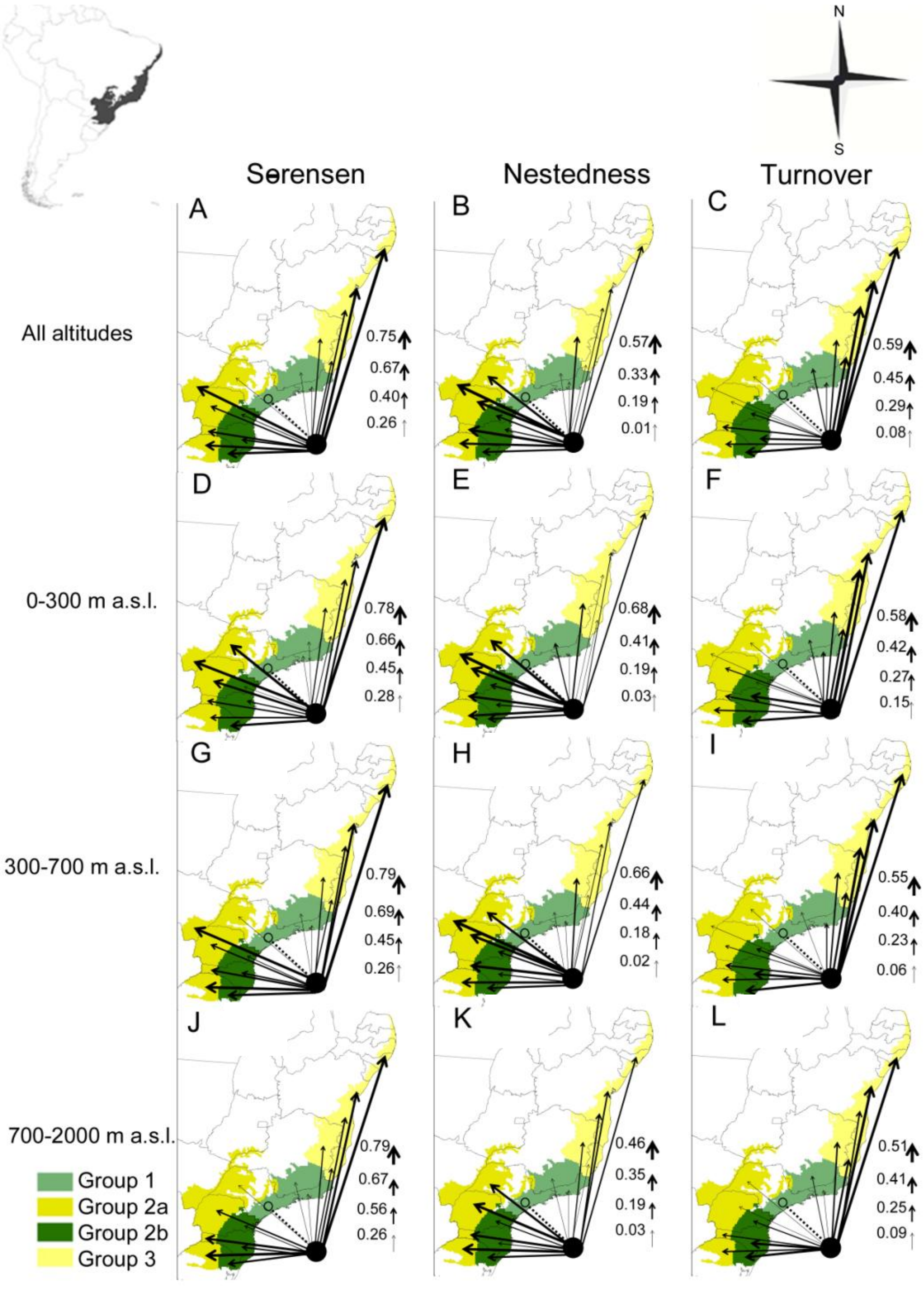

**Figure 7.** Beta diversity of amphibians in the Brazilian Atlantic Forest. Thinner arrows indicate smaller values, thicker arrows larger values. Beta diversity values are from the large biota ESP (circle) for the subsets.

**Table 6.** Partitioning of beta diversity. Analyses were made from the territory with greater species richness (ESP) from the other subsets. A mean of the results of each territories and each group and presented for evaluation difference between the species similarity groups. In bold are shown the greatest beta diversity values.

| | **Sorensen (**βsor) | | | | **Nestedness (**βnes) | | | | **Turnover (**βsim) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Groups** | | | | | ESP | | | | | | | |
| **Group1** | All altitudes | 0-300m | 300-700m | 700-2000m | All altitudes | 0-300m | 300-700m | 700-2000m | All altitudes | 0-300m | 300-700m | 700-2000m |
| ESP | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| RJ | 0.282 | 0.263 | 0.263 | 0.269 | 0.035 | 0.016 | 0.029 | 0.039 | 0.247 | 0.247 | 0.234 | 0.229 |
| SMG | 0.329 | **0.403** | 0.268 | 0.314 | 0.075 | 0.195 | 0.069 | 0.060 | 0.254 | **0.416** | 0.199 | 0.254 |
| Mean | 0.203 | 0.222 | 0.177 | 0.194 | 0.037 | 0.070 | 0.033 | 0.033 | 0.167 | 0.332 | 0.217 | 0.242 |
| DP ± | 0.178 | 0.205 | 0.153 | 0.170 | 0.037 | 0.108 | 0.035 | 0.031 | 0.144 | 0.119 | 0.025 | 0.017 |
| **Group2a** | | | | | | | | | | | | |
| SMGM | **0.460** | **0.751** | **0.446** | **0.448** | 0.361 | **0.551** | 0.381 | 0.357 | 0.099 | 0.200 | 0.065 | 0.091 |
| WPR | **0.666** | **0.719** | **0.736** | **0.654** | **0.459** | **0.452** | **0.444** | **0.460** | 0.206 | 0.267 | 0.210 | 0.194 |
| WSC | **0.734** | **0.713** | **0.727** | **0.741** | **0.418** | **0.436** | 0.393 | **0.447** | 0.316 | 0.277 | 0.333 | 0.294 |
| MS | **0.770** | **0.750** | **0.757** | **0.000** | **0.682** | **0.574** | **0.669** | 0.000 | 0.088 | 0.176 | 0.088 | 0.000 |
| WRS | **0.744** | **0.710** | **0.749** | **0.785** | 0.367 | 0.330 | 0.353 | **0.460** | 0.377 | 0.379 | 0.397 | 0.326 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | **0.675** | **0.729** | **0.683** | **0.657** | **0.457** | **0.469** | **0.448** | **0.431** | 0.217 | 0.260 | 0.218 | 0.226 |
| DP ± | 0.126 | 0.020 | 0.133 | 0.150 | 0.132 | 0.098 | 0.128 | 0.050 | 0.128 | 0.079 | 0.146 | 0.106 |
| **Group2b** | | | | | | | | | | | | |
| EPR | **0.491** | 0.248 | **0.457** | **0.499** | 0.197 | 0.248 | 0.237 | 0.194 | 0.293 | 0.154 | 0.220 | 0.305 |
| ESC | **0.612** | 0.148 | **0.592** | **0.595** | 0.158 | 0.148 | 0.181 | 0.168 | **0.454** | **0.429** | **0.410** | **0.427** |
| ERS | **0.747** | 0.250 | **0.736** | **0.733** | 0.247 | 0.250 | 0.256 | 0.281 | **0.500** | **0.478** | **0.480** | **0.452** |
| Mean | **0.616** | 0.215 | **0.595** | **0.609** | 0.201 | 0.215 | 0.225 | 0.214 | 0.**416** | 0.353 | 0.370 | 0.395 |
| DP ± | 0.128 | 0.058 | 0.140 | 0.118 | 0.044 | 0.058 | 0.039 | 0.059 | 0.109 | 0.175 | 0.134 | 0.079 |
| **Group3** | | | | | | | | | | | | |
| ES | **0.576** | **0.511** | **0.546** | **0.567** | 0.119 | 0.095 | 0.142 | 0.153 | **0.457** | **0.416** | **0.404** | **0.414** |
| SBA | **0.702** | **0.673** | **0.693** | **0.679** | 0.130 | 0.091 | 0.152 | 0.268 | **0.571** | **0.582** | **0.541** | **0.412** |
| NBA | **0.757** | **0.718** | **0.743** | **0.765** | 0.159 | 0.144 | 0.187 | 0.258 | **0.598** | **0.574** | **0.556** | **0.507** |
| NMG | **0.599** | **0.576** | **0.589** | **0.589** | 0.201 | 0.199 | 0.207 | 0.243 | 0.398 | 0.378 | 0.382 | 0.346 |
| N | **0.787** | **0.757** | **0.791** | **0.798** | 0.233 | 0.195 | 0.245 | 0.281 | **0.554** | **0.562** | **0.545** | **0.517** |
| Mean | **0.684** | **0.647** | **0.672** | **0.680** | 0.168 | 0.145 | 0.187 | 0.241 | **0.516** | **0.502** | **0.486** | **0.439** |
| DP ± | 0.094 | 0.102 | 0.103 | 0.103 | 0.048 | 0.052 | 0.042 | 0.051 | 0.085 | 0.098 | 0.085 | 0.072 |

## 2.4 DISCUSSION

Our results showed that mean annual temperature has high influence in the amphibian richness and endemic species of the Atlantic Forest. The temperature between 19º C and 21º C is the optimal range for amphibian, promoted high species richness. Because of their physiological characteristics, amphibians are dependent of humidity and mild temperatures (Wells, 2007; Crump, 2010), thus is expected the correlation of species richness to precipitation and temperature (Casemiro *et al.,* 2007; Ortiz-Yusty *et al.,* 2013; Vasconcelo *et al.,* 2014). The correlation of species richness with NPP and vegetation also is strongly related to rainfall; plants are strongly correlated to water-balance (Bradford *et al.,* 2003; Rueda *et al.,* 2010). Moreover, altitude areas have a higher number of endemic species that due to the milder temperature is higher humidity. However, lowland areas also have endemism, and this may be related to historical events (Carnaval *et al.,* 2012).

Because of high humidity and diversity available microhabitats, many Neotropical amphibians evolved to decrease its size and many species are miniaturized (Rittmeyer *et al.,* 2012). The miniaturized species are more susceptible to humidity loss (MacLean, 1985) and many are restricted to forest formations preserved to maintain the necessary physiological features (Lourenço-de-Moraes *et al.,* 2012, 2014, Ferreira *et al.,* 2016). Because of this, miniaturized species are concentrated in areas of milder temperatures, higher rainfall, and higher vegetation cover. For amphibians in Atlantic Forest, high latitudes, longitudes and altitudes tend to have smaller species. Therefore, the relationship between species richness to the mean body size of species is directly related to environmental conditions. This may have led to a restricted gene flow between populations and thus accelerate genetic differentiation (Pabijan *et al.,* 2012). Consequently, it may have limited these species in rainforests where such genetic differentiation is most commonly observed (Rodríguez *et al.,* 2015), is these factors may have contributed to the large number of small species in small intervals.

The association for the current dispersion or expansion of its occurrence areas, are to adaptation for live in open areas, have medium to large size and be toxic. In our study, it is the species with the largest body size have better dispersion capabilities (specialists in open areas or edge forest) as species *Rhinella shineideri*, *Odontophrynus americanus* and *Siphonops annulatus* (Haddad *et al.,* 2013). Species with the same features than this species but not toxic or unpalatable, also had higher ranges possibly because of other factors that may assist in their range expansion. Species with a variety of antipredator mechanisms may be more likely to avoid a wider range of predators (Lourenço-de-Moraes *et al.,* 2016), that allow achieve success in the dispersion. In addition, species of open areas with higher ranges also occur in drier biomes such as the Cerrado and the Caatinga.

According to our results, the current dispersion of species is directly related to their functional traits, being the habitat in which the species and adapted their biggest asset - species than tolerate high temperatures and low humidity rates. Most of the species that occur in the Atlantic Forest are under 30mm. Small species lose water more quickly to the environment (MacLean, 1985). Deforestation has limited most species of the Atlantic Forest to small scattered fragments. Even small species as *Dendropsophus nanus* and *D. minutus* have great ability to dispersion due to their ability of occurring in open areas (Haddad *et al.,* 2013). Many species of open areas are expanding or expanded their ranges due to forest destruction. Species of open areas are not found in forests, or they are found in low abundance, we suggest that these species are not generalists, but specialists of open areas and opportunistic.

Because of their functional traits our results showed that the species of open areas to disperse from West to East and North of Atlantic Forest, and this influence of the results of beta diversity (nestedness). The mountains of Serra do Mar and Mantiqueira can be limiting geographical barriers for small amphibians and strictly forest habits (Haddad, 1998; Morelato & Haddad, 2000). Moreover, the geographical barrier Rio Doce divides the territory ES and part of NMG (Bates *et al.,* 1998; Costa *et al.,* 2000) and influenced in dispersion and composition on species of group 3. ES has southern (group 1) and northern (group 3) species of the Atlantic Forest, while NMG is more related to northern (group 3) species of the Atlantic Forest. Few strictly forest species have large ranges in the Atlantic Forest. *Haddadus binotatus* is a species with great range possibly it was dispersed by the drier forests of the West, or during the Glacial period due to ocean regression (Atlantis Forest hypothesis, see Leite *et al.,* 2016). Moreover, it is possible that this is a species complex (Dias *et al.,* 2011). The same applies to small species with wide distribution as *Dendropsophus minutus* in which Gehara *et al.,* (2014) indicated through molecular techniques that is a species complex.

Due to the consequent expansion of open areas species (trait habitat), strongly reflected in the beta diversity values. Our results pointed out nesting differences between the groups 1 and 2a, showing a decrease of nesting by increasing altitude and increasing turnover for the species occurring between 700-2000m and 0-300m altitude. Between the groups 1 and 2b, there is a reduction of nesting and increased of turnover by increasing elevation which has slight increase in beta diversity between species that occur 300-700m altitude. Between the groups 1 and 3 the nesting increases with increasing altitude, reducing the turnover. These results indicate differences in the compositions according to its topographic location. The main differences between the compositions are among the species that occur in the lowland (0-300m) and hilltops (700-2000m). The group 2b indicates higher endemism rate on the mountainous region while the group 3 in the lowlands. Therefore, mountain areas are important geographical barriers to amphibian species in the Atlantic Forest.

According to our data, it is possible to separate the Atlantic Forest in three major regions of endemism (groups 1, 2b and 3). The beta diversity values corroborate the hypothesis of endemism during the Pleistocene glacial (Carnaval *et al.*, 2009; Carnaval *et al.*, 2014). The two extremes of this biome (i.e. Southern most and Northern most), have higher turnover rates compared to group 1. The group 3 has shared genera with the Amazon forest as *Pristimantis, Adelophryne* and *Alophryne* - genera that do not occur in other groups of the Atlantic Forest. These data support the hypothesis connection between the North of the Atlantic Forest and the Eastern Amazon rainforest (Batalha-Filho *et al.*, 2013; Sobral-Souza *et al.*, 2015). On the other hand, the group 3 also received species from the Atlantic Forest as *Hypsiboas faber*. The 2a and 2b group also have higher turnover rates at some territories. In the group 2a, WRS and in group 2b the territories ESC and ERS. The South of the Atlantic Forest region had a strong influence of the Western Amazon composition and the Andean forests (Batalha Filho *et al.*, 2013; Sobral-Souza *et al.*, 2015). Most *Melanophryniscus, Scythrophrys* and *Lymnomedusa* species of the genus occur in group 2. These genera tolerate colder areas of the Atlantic Forest. Moreover the nesting territories of greatest values were in group 1 and group 2a. This group has areas of warmer forests and more pronounced seasonality due to these species that occur at these points, especially in MS and WPR are mostly species of open areas. In the SMGM area, species that occur at this point are directly related to the Cerrado biome; many species of open areas and forest edges occur at this point. Finally, our data point groups 1, 2b and 3 as the areas with the highest rates of endemic and rare species.

Historical events (e.g. Pleistocene glacial) can be the main direction of the species richness of amphibians in the Atlantic Forest. This richness provided by these events direct speciation and different specializations with creating various functional traits, which depending on the specialization, will direct the dispersion of species and a current historical panorama. This process is a cycle that has been repeated for thousands of years, however the current change on the planet by human actions, can direct a mass extinction process in the Anthropocene Age (Barnoski *et al.*, 2011; Dirzo *et al.*, 2014). The current spatial composition and dispersion of species is related to anthropogenic actions and the species most suitable for the new environment prosper, while forest and exclusive species of the Atlantic Forest, are even more endemic and endangered. Our results can help define new strategies aimed at conservation of the original forests of the Atlantic Forest biome, promoting connections between the reserves and the creation of new reserves.

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# 3 PHYLOGENETIC AND FUNCTIONAL DIVERSITY REVEAL NEW CLIMATIC REFUGES FOR AMPHIBIANS IN THE BRAZILIAN ATLANTIC FOREST

## Abstract

Climate changes have occurred on Earth over millions of years. To survive these changes the species took refuge in places where the changes were less drastic. Climate change is a real panorama, and conservation strategies should be developed. Ectothermic species, are especially sensitive of the climate change, which makes them good references for studies involving climate change. Analyze the losses against the ecosystem and evolutionary values, can help to understand the processes and minimize their impact. In the present study we analyzed the functional and phylogenetic diversity of amphibians in the Atlantic Forest in the present day and for 2080. Our results showed drastic reduction in species richness, ecosystem and evolutionary function at lower latitudes and low altitudes. The species tend to disperse to areas of high latitudes and high altitudes where temperatures are milder, tending to the same points that have been suggested as refuges during the Pleistocene. Our results present new refuges for the Atlantic forest that provide aid to making decisions regarding conservation strategies.

**Key words:** Altitude; Anthropocene; climatic change; ectothermics; Anura; Gymnophiona

# A DIVERSIDADE FILOGENÉTICA E FUNCIONAL REVELAM NOVOS REFÚGIOS CLIMÁTICOS PARA ANFÍBIOS NA FLORESTA ATLÂNTICA BRASILEIRA

## Resumo

As mudanças climáticas têm ocorrido na Terra ao longo de milhões de anos. Para sobreviver a essas mudanças as espécies se refugiaram em locais onde as mudanças foram menos drásticas. A mudança climática é um panorama real e estratégias de conservação devem ser desenvolvidas. Espécies ectotérmicas, são especialmente sensíveis às mudanças do clima, o que as torna boas referências para estudos envolvendo alterações climáticas. Analisar as perdas ecossistêmicas e os valores evolutivos das espécies, pode ajudar a compreender os processos de extinção e minimizar o seu impacto. Analisou-se a diversidade funcional e filogenética dos anfíbios na Floresta Atlântica para o presente e para 2080. Os resultados mostraram redução drástica na riqueza de espécies, perda ecossistêmica e função evolutiva em latitudes e altitudes mais baixas. As espécies tendem a se dispersar para as áreas de altas latitudes e altitudes, onde as temperaturas são mais amenas, tendendo aos mesmos pontos que foram sugeridas como refúgios durante o Pleistoceno. Os resultados apresentam novos refúgios para a Floresta Atlântica e fornecem auxílio à tomada de decisões sobre estratégias de conservação no futuro.

**Palavras chaves**: Altitude; Antropoceno; mudanças climáticas; ectotermicos; Anura; Gymnophiona

## 3.1 INTRODUCTION

Over millions of years the Earth has undergone several transformations that seem to appear cyclically (Raup & Sepkoski, 1982). During these changes, the animals need to take refuge in areas with milder environments and resource availability (Haffer, 1969; Mayr & O'Hara, 1986; Bush, 1994; Bush & Oliveira, 2006; Carnaval *et al.,* 2009; Bush *et a,.,* 2011). These events lead to massive extinctions (Raup & Sepkoski1982; Bambach, 2006; Jablouski, 1994; Barnorsky *et al.,* 2011). The actual Age (Anthropocene) can to be the sixth massive species extinctions (Barnosky *et al*., 2011; Dirzo *et al.,* 2014).

Anticipated the climate changes in biogeographic patterns its important because may also result in changes to functional and phylogenetic diversity and alterations to organism-mediated ecosystem goods and services (Montoya & Raffaelli, 2010; Cardinale *et al.,* 2011; Prather *et al.,* 2012), as well as evolutionary historical processes (Thuiller *et al.,* 2011; Pio *et al.,* 2014). Because of this, studies available about climatic change should be evaluated phylogenetic and functional diversity integrated (Sobral & Ciacianruso, 2012). Thus, it is possible to have a broader view of historical and ecosystem reasoning processes. Despite the assumption that similar phylogenetically species has the same ecosystem role, it sometimes may not be true (Webb *et al.,* 2002). The phylogenetic structure of meetings depends on as the ecological characteristics evolved (Sobral & Ciacianruso, 2012). The ecosystem functioning and stability are often correlated with evolutionary process changes, producing several implications for ecological and human wellbeing on short time scales (Alberti, 2015).

Climate change is a widespread threat to global biodiversity (Thomas *et al.,* 2004; Pereira *et al.,* 2010) by continuously promoting changes in physiological and ecological processes that directly affect the distribution and persistence of species in an environment (Stenseth *et al.,* 2002; MacDonald *et al.,* 2004; Huey *et al.,* 2009). Studies evaluating how climate changes affect the individual performance (Huang *et al.,* 2013; Holt & Jorgensen, 2015), demographic dynamics (Lukoscheck *et al.,* 2013; Pomara *et al.,* 2014), composition and species richness (Lemes & Loyola, 2013; Ferro *et al.,* 2014) are examples of the complex relationship of as has been addressed from diversity of perspectives of this process with the living organisms. Predictive outcomes have included adaptation to novel conditions (Quintero & Wiens, 2013), shift, expansion or retraction of ranges (Ferro *et al.,* 2014; Lemes *et al.,* 2014), isolation to unaffected areas or climatic refuges (Puschendorf *et al.,* 2009), and species extinctions (Thomas *et al.,* 2004). Such climate change effects are the reasons for which there is a growing consensus that management decisions for biodiversity conservation must be taken in light of this phenomenon (Araújo & Rahbek, 2007).

Ecological niche models (ENMs), also referred to as species distribution models (SDMs) (Peterson *et al.,* 2011; Rangel & Loyola, 2012), have been increasingly used to estimate species ranges for future scenarios of climate change (Peterson *et al.,* 2011). These models can be used to evaluate the current and future hotpoints of phylogenetic (Thuiller *et al.,* 2011; Loyola *et al.,* 2013; Pio *et al.,* 2014) and functional diversity, acting as an efficient conservation tool (Del Toro *et al.,* 2015). Ectothermic animals are highly susceptible to climate change (Pounds *et al.,* 2006; Sinervo *et al.,* 2010) due to the interdependence of their behavioral-physiological functions in relation to external environment (Ribeiro *et al.,* 2012). Amphibians are sensible the environmental changes

(Lourenço-de-Moraes *et al.,* 2014) due their methabolic features (Duellman & Trueb, 1994) at high temperatures amphibians lose water to the atmosphere (Wells, 2007) and can suffer local extinction (Becker *et al.,* 2007). Because this, study using ENMs may be effective tools in predicting the possible dispersions than the climate change can promote for the amphibians species (Pie *et al.,* 2013; Ribeiro *et al.,* 2015) and enable advance shares to conservation.

The consequences of human activities go beyond the loss of species and various studies reported losses of both evolutionary history and functional trait diversity at different landscapes (Purvis *et al.,* 2000; Flynn *et al.,* 2009; Mayfield *et al.,* 2010). The claimed Anthropocene age, follows drastic climate change (especially warmer temperature) causing that jointly a massive defaunation (Dirzo *et al.,* 2014). Recent studies have suggested that areas of altitude may be important refuges for vertebrates during the Anthropocene Age (Loyola *et al.,* 2013; Lemes *et al.,* 2014). In this context, we tested the hypothesis that the elevation areas are refuges for amphibians, and may maintain their ecosystem and evolutionary services. For this we analyzed the potential distribution, phylogenetic and functional diversity on present and future of Atlantic Forest species. We correlated this diversity with altitude in both periods and analyzed the retraction of the species in the direction to higher areas. In addition, we evaluated the species conservation status for 2080.

## 3.2 MATERIALS AND METHODS

### *3.2.1 Study region*

Our analyses focused on the Atlantic Forest Biodiversity Hotspot (Myers *et al.,* 2000), which originally covered around 150 million ha with heterogeneous environmental conditions provided by a wide range of climatic belts and vegetation formations (Tabarelli *et al.,* 2005; Ribeiro *et al.,* 2009). This biome has an altitudinal range encompassing the elevational limits of the mountain chains of Serra do Mar and Serra da Mantiqueira (Cavarzere & Silveira, 2012) a longitudinal range harboring differences in forest composition due to a diminishing gradient in rainfall from coast to interior and a latitudinal range extending into the tropical and subtropical regions, (Ribeiro *et al.,* 2009) (Fig. 1).

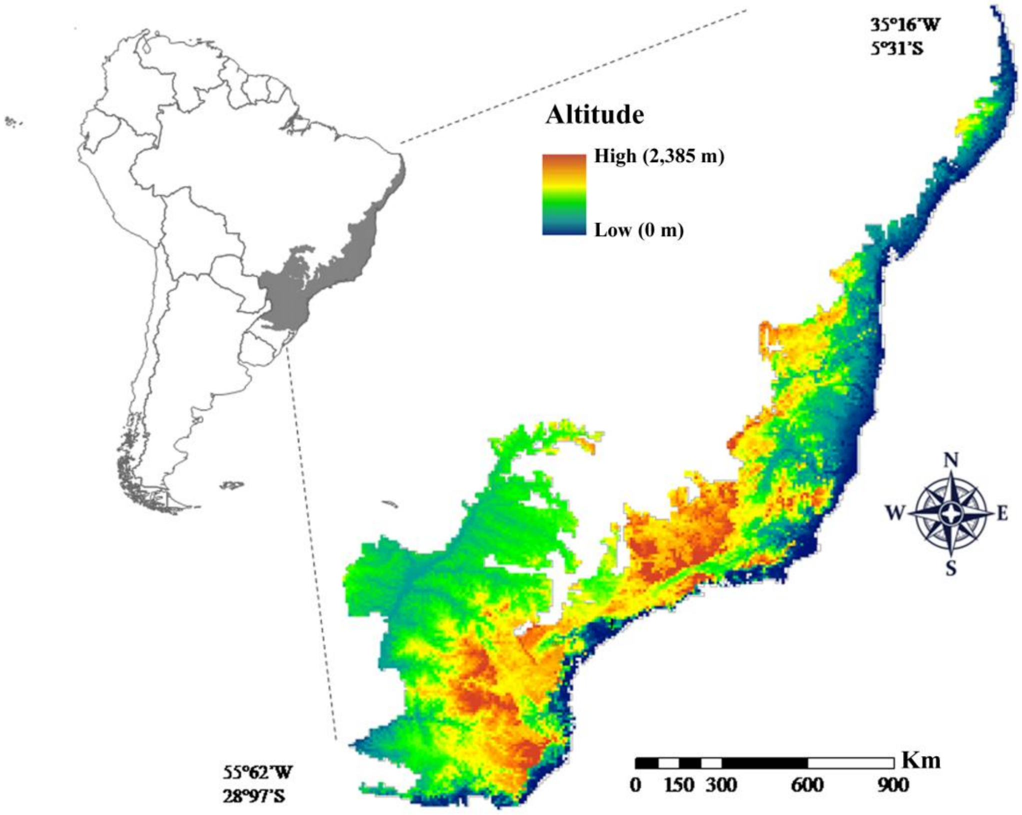

**Figure 1.** Map showed the study area of Brazilian Atlantic Forest hotspot (in gray) in South American territory.

### *3.2.2 Spatial species data*

We obtained spatial data of amphibian species from a joint research through four procedures types: (i) we built a dataset with all the species distributed in the Atlantic Forest according to Haddad *et al.* (2013); (ii) we included maps of geographical ranges for each species from the IUCN Red List of Threatened Species database (IUCN, 2015); (iii) we conducted a complementary fieldwork comprising the major Atlantic Forest remnants of Brazil, to supplement the dataset with observed functional traits, as body size, reproductive mode, habitat, activity, poison patterns, habit and calling site (see Appendix 2 Figure S1); (iv) we modelled the potential distribution for the present and future using ecological niche modeling, and calculated the diversity functional and phylogenetic diversity based on species richness generated by the model for the current time and for 2080.

### *3.2.3 Ecological niche modeling, species richness and turnover*

We used ArcGIS 10 software (ESRI, 2010) to build presence/absence matrices from the species distribution data by superimposing a grid system with cells of 0.1 latitude/longitude degrees, creating a network with 10,359 grid cells. In total, we assessed the geographical ranges 451 amphibian species (5 Gymnophionas and 446 Anurans) covered by our grid system.

Considering that species occurrence patterns are determined at large-scales by responses of organisms to different environmental conditions (reflecting the Grinellian component of the ecological niche, *sensu* Soberón, 2007), we used ecological niche models (ENMs) to predict the distribution area of amphibians species in the Atlantic Forest. For this, we used the species occurrence matrix and the layers of climatic-environmental variables, resulting on a suitability matrix, which we used to modeling and mapping the potential distribution of each species evaluated.

We used the following bioclimatic variables in the modeling process: (i) annual mean temperature, (ii) annual temperature range, (iii) precipitation of wettest month, (iv) precipitation of driest month and (v) precipitation of warmest quarter. We obtained these variables for the present and future (mean of simulations for 2080-2100) from.

CMIP5 – Coupled Models Intercomparison Project Phase 5 (http://cmip-pcmdi.llnl.gov/cmip5/; and also at http://ecoclimate.org, see Lima-Ribeiro, 2015), and downscaled to the resolution of 0.05°. We also used altitude as predictor of richness and dispersion, through the data available from the WorldClim Global Climate Data (www.worldclim.org). We assumed the temporal stationary of this variable to perform future predictions. For future, we used the greenhouse gas concentration trajectory corresponded to the Representative Concentration Pathway (RCP) 4.5, that represents a moderated emission scenario within a optimistic context. We used simulations provided by four Atmosphere-Ocean General Circulation Models (AOGCMs): CCSM, CNRM, MIROC and MRI, which were obtained from CMIP5 (Coupled Model Intercomparison Project – Phase 5). Original data resolution varied from 1° to 2.8° (in longitude and latitude) and both current and future climate variables were rescaled to fit our grid resolution.

We performed four conceptually and statistically different ENMs based on presence data (i.e. only occurrences are known, absences are unknown – pseudo-absence), using the algorithms (i) Bioclim (BIO, Busby, 1991) based on bioclimatic envelope logic; (ii) Gower Distance and Euclidean Distance (GD, EUD, Carpenter *et al.,* 1993) based on environmental distance approach; (iii) Maximum Entropy (ME, Phillips *et al.,* 2006) and random forest (RF, Breiman 2001) based on machine learning technique; and (iv) Ecological Niche Factor Analysis (ENFA, Hirzel *et al.,* 2002) based on multivariate analysis, and Genetic Algorithm for Rule set Production (GARP, Stockwell & Noble, 1992). Given the particularities of each model, different predictions have been provided, generating uncertainties about which model is more appropriate to represent the geographical distribution of species (Diniz-Filho *et al.,* 2009). To overcome this uncertainty and minimize errors, we employed the ensemble forecasting approach, which offers a consensus of multiple models (Araújo & New, 2006). The main idea of ensemble forecasting is that different sources of errors will affect each niche model in different ways and, by obtaining a consensus result of these models, errors will tend to cancel each other out and produce a trustworthy and more conservative solution (Diniz-Filho *et al.,* 2010a). Assuming that the consensual model (CONS) reduces uncertainty and error associated with alternative ENMs, we interpreted only the range sizes from the CONS model.

We randomly partitioned presence and pseudo-absence (in the case of Maxent) data of each species into 75% for calibration (or training) and 25% for evaluation (or test); repeating this process 10 times by cross-validation for all models. For each ENM, we converted the continuous predictions of suitability into a binary vector of 1/0 (presence and absence in each cell), finding the threshold that maximizes sensitivity and specificity values in the receiver operating characteristic (ROC). The ROC curve is generated by plotting the fraction of true positives vs. the fraction of false positives at various threshold settings. The distribution areas were estimated obtaining 280 predictions (7 models x 10 randomizations x 4 AOGCMs) for each species and time-period of climatic conditions (i.e. present and future). This allowed us to generate a frequency of projections in the ensemble. Then, we generated the frequency of projections weighted by the total sum of squares (TSS) statistics for the present and future (the best models according to this metric have more weight in our consensus projections). The TSS range from -1 to +1, where values equal to +1 is a perfect prediction and values equal to or less than zero is a prediction no better than random (Allouche *et al.,* 2006). We considered the species present only in cells where at least

50% of models retained in the ensemble point out the species as present. In our analyses we obtained the CONS for each AOGCM and time period (present and 2080). Thus, we obtained the final maps of richness for present, future and turnover through the average of values projected by CONS for each grid cell – considering the different GCMs. We run all models using the computational platform Bioensembles (Diniz-Filho *et al.,* 2009), and mapped results using the software SAM v.4.0 (Rangel *et al.,* 2010). To determine the species patterns of amphibians of Atlantic Forest, we employed the modeling strategy at the community level of “predict first, assemble later” (sensu Overton *et al.,* 2002), where the ranges of individual species are modeled one at a time as a function of environmental predictors and then overlapped for obtaining the species richness.

In addition, we used principal components analyses (PCA) (Legendre & Legendre, 2012) to compare species richness patterns derived from alternative ENMs and their consensus. This analyses allowed us to evaluate the degree of which different ENMs converge in estimates of regional species richness and determine which model reflects the main direction of variation among richness maps (Diniz-Filho *et al.,* 2010b). Thus, in our study, we interpreted only the results of the model reflected by the main direction of variation among suitability maps. We calculated species turnover between current and future species distributions in each cell according to formula (G+L/S)/S+G (Thuiller, 2005), where ‘‘G’’ refers to the number of species gained, ‘‘L’’ the number of species lost and ‘‘S’’ the contemporary species richness found in the cell.

### *3.2.4 Functional Diversity and Phylogenetic Diversity*

We used the following traits according to Haddad *et al.* (2013), and added complements from our fieldwork: (i) body size; (ii) appendices (apodal and tetrapod); (iii) activity (nocturnal, diurnal, and both); (iv) poison (poisonous, unpalatable or bad odor, and no poison); (v) habitat (forested area, open area, and both); (vi) habit (arboreal, phytotelmate, terrestrial, cryptozoic, fossorial, rheophilic, semi-aquatic, and aquatic); (vii) calling site (bamboo grove, swamp or lake, bromeliad, forest floor, tree canopy, caves or burrows, rock wall, backwater river, stream, river, shrubs, grasslands and not sings); and (viii) reproductive mode (1 to 39 modes; see Haddad & Prado, 2005). See Appendix 2 Table S2 for details.

We followed the protocol proposed by Petchey & Gaston (2006) to calculated the functional diversity (FD): (i) construction of a species-trait matrix; (ii) conversion of species-trait matrix into a distance matrix; (iii) clustering distance matrix into a dendrogram (UPGMA); and (iv) calculating functional diversity by summing dendrogram branch lengths of species community. To create the distance matrices, we used the method proposed by Pavoine *et al.* (2009), through the Gower distance.

We used the phylogenetic diversity index (Faith, 1992) to quantify the phylogenetic diversity (PD), which comprises the sum of the lengths of the branches lengths of the phylogenetic tree of all species assessed and is often used in the assessment of phylogenetic diversity of co-ocurrent species (e.g. Rodrigues & Gaston, 2002; Safi *et al.,* 2011; Trindade-Filho *et al.,* 2012). The PD index has appropriate ways of accounting for relatedness between taxa and evolutionary history in a conservation context (Pio *et al.,* 2011).

We based the phylogenetic distance through 208 species nucleotide sequences obtained from the GenBank (Benson *et al.,* 2013), provided by the National Center for Biotechnology Information (NCBI) (See Appendix 2, Table S3). Following the protocol proposed by Pyron and Wiens (2011) in an extant amphibian phylogeny, we used 12 genes to produce a novel estimate phylogeny for the Atlantic Forest amphibians (i.e. 11,906 bp for each species), through three mitochondrial genes were included: cytochromeb (cyt-b), and the large and small sub-units of the mitochondrial ribosome genes (12S/16S); and nine nuclear genes: C-X-C chemokine receptor type 4 (CXCR4), histone 3a (H3A), sodium–calcium exchanger (NCX1), pro-opiomelanocortin (POMC), recombination-activating gene 1 (RAG1), rhodopsin (RHOD), seventh-in-absentia (SIA), solute-carrier family 8 (SLC8A3), and tyrosinase (TYR). For the length-variable regions, we performed multiple pairwise comparisons by the online version of MAFFT v.6.8 and the G-INS-i algorithm (Katoh & Toh, 2008). After, we put together alignments of all genes in the same alignment using the software SequenceMatrix 1.7.7 (Vaidya *et al.,* 2011) to concatenate the supermatrix previously produced.

We conducted the phylogenetic relationships with Bayesian analyses in software BEAST 1.8 (Drummond & Rambaut, 2007), estimating the node supports with a fast bootstrapping mode. We performed the Bayesian analyses on the combined data matrix using a HKY model of sequence evolution for one partition for all genes, under a Yule speciation process as the tree prior and an uncorrelated relaxed clock. After removal of the burn-in, we run the Yule process for 100 million generations, ensuring that the number of generations after convergence were sufficient assessed with Tracer v1.6 (Drummond & Rambaut, 2007), combining the results with the use of Logcombiner 1.8 and Treeanotator 1.8 (Drummond & Rambaut, 2007). We considered the nodes strongly supported if they received probability (pp) support values $\geq$0.95. To solve the polytomies, we used the ‘multi2di’ function of the package ‘ape’ (Paradis, 2004) in the R software (R Development Core Team, 2010). Thus, we reconstructed a new phylogenetic tree using the Mesquite software, version 3.0 (Maddison & Maddison, 2015).

The functional diversity (FD) and phylogenetic diversity (PD) indices are often correlated with the species richness (SR) values (Devicter *et al.*, 2010). In order to overcome this problem, we used null models (Swenson, 2014) for current and future times. Hence, we tested if the functional and phylogenetic diversity were higher, equal or lower than expected by chance for each grid cell (random or non-random pattern) , assuming a random distribution in which every species could occupy any grid cell in the biome. For each pruning event (present and future), were computed 1,000 replicates of random remaining PD and FD, allowing us to obtain a *P*-value of predicted PD and FD as compared to the distribution of the random replicates. All analyses were performed using the packages “ade4”, “picante”, “FD” and “vegan” through the R software (R Development Core Team, 2009).

### *3.2.5 Species Richness, Functional Diversity and Phylogenetic Diversity vs. Topography and Spatial References*

We used correlation matrices to compare the topographic patterns and spatial references (altitude and latitude) to the values obtained by the consensus model for SR, Turnover, FD and PD in each grid cell for current and future time (2080). Thus, we correlated the values obtained for SR, FD and PD with altitude, and the turnover values with altitude and latitude, using simple linear regression models.

### *3.2.6 Threat status of species facing the climate change*

From the individual range sizes (i.e. number of occupied cells) of each species in current and future time, we estimated the threat status of amphibian species in the Atlantic Forest at 2080, according to the Criterion B established by IUCN Red List (2015) and Maiorano *et al.*, (2011). We considered the following threat categories: (i) Extinct (EX), the species whose loss of distribution area is estimated at 100% for the next 50 or 80 years; (ii) Critically Endangered (CR), the species whose loss is estimated at 80% for the projected time interval; (iii) Endangered (EN), the species whose loss is estimated at 50% for the projected time interval; (iv) Vulnerable (VU), the species whose loss is estimated at 30% for the projected time interval; and (v) Least Concern (LC), the species whose loss is estimated at below 30% for the projected time interval. It is noteworthy that this approach only considers the effects of climate change on species distribution, thus providing a synthetic view of the specific threats imposed on the species by the alteration in climatic conditions.

## 3.3 RESULTS

The TSS values for most species was 0.61 ± 0.11, indicating relatively high good fit model (Eskildsen *et al.*, 2013). The PCA axes explained a large proportion of variation between species richness maps generated by different ENMs. The accumulated proportion of variation explained by the two axes ranged from 97.1% to current time and 95.8% for species in 2080 (Table 1). Similar results were produced in both time periods by GD and EUD (Fig. 2). The predictions of ENFA produced low values: similar results between GD and GARP for the future. The values showed by BIO were similar to CONS values in the current time. However, the CONS model had the highest loading for the first PCA axis, reflecting the main direction of variation among suitability maps (Table 1). Because of this, only the outputs derived from the consensus of multiple ENMs (CONS) were retained for interpretation.

**Table 1.** Values of PCA loadings of the different ecological niche models and consensus for all amphibians species in the current time and future.

|  | Ecological Niche Models | Present |  | Future |  |
|---|---|---|---|---|---|
|  |  | PC1 | PC2 | PC1 | PC2 |
| Distance Methods | ENFA | 0.894 | 0.298 | 0.767 | -0.548 |
|  | GD | 0.937 | -0.319 | 0.930 | 0.332 |
|  | EUD | 0.902 | -0.380 | 0.909 | 0.311 |
| Machine Learning | BIO | 0.972 | -0.134 | 0.906 | 0.351 |
|  | ME | 0.924 | 0.356 | 0.867 | -0.457 |
|  | RF | 0.906 | 0.365 | 0.856 | -0.433 |
|  | GAR | 0.918 | -0.314 | 0.936 | 0.102 |
|  | CONS | **0.983** | 0.137 | **0.986** | 0.095 |
|  | Axes explanation (%) | 0.865 | 0.091 | 0.804 | 0.134 |
|  | Acummulated explanation (%) | 0.971 |  | 0.958 |  |

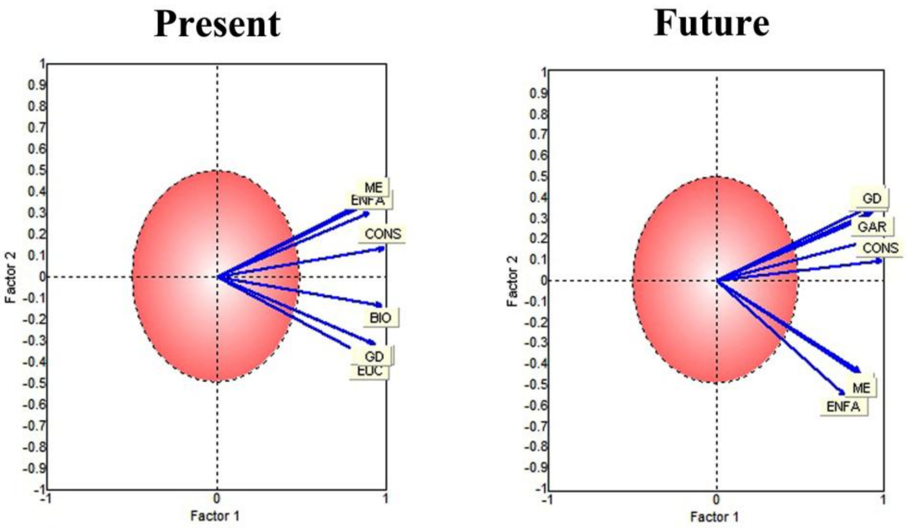

**Figure 2.** Loadings of the first two axes of the PCA performed considering the amphibians species richness predictions provided by different ENMs (ENFA = Ecological Niche Factorial Analysis; GD = Gower distance; EUD = Euclidean Distance; BIO = Bioclim; ME = Maximum Entropy; RF = Random Forest; GAR = Genetic Algorithm for Rule set Production and CONS = Consensus Model) for amphibians in the current (A) and future (B) times.

The overlap of individual species ranges generated by the CONS model evidenced that highest species richness values were restricted for almost all eastern-central portion of the Atlantic Forest in the current time (Fig. 3 and 4). The species richness pattern showed no significant relationships with the altitude (r= 0.000, $p$ = 0.182) (Fig. 4c). The future predictions produced by CONS from different AOGCMs pointed out the losses of climatically suitable areas in this region by 2080, with the species richness directed to the east-central portion of the Atlantic Forest. In this case, the species richness increases toward higher altitude (r = 0.132, $p < 0.001$ Fig. 4d). In general, CCSM and MRI showed two distinct species-rich areas and CNRM and MIROC produced more homogeneous results, with the latter more restrictive (Fig. 3a-d). By combining the results of AOGCMs in a full ensemble model, we found proof that in the future the species richness peaks will be restricted to a reduced portion of the central-eastern region of the biome, in locations closer to the mountains region of the Atlantic Forest (Fig. 2).

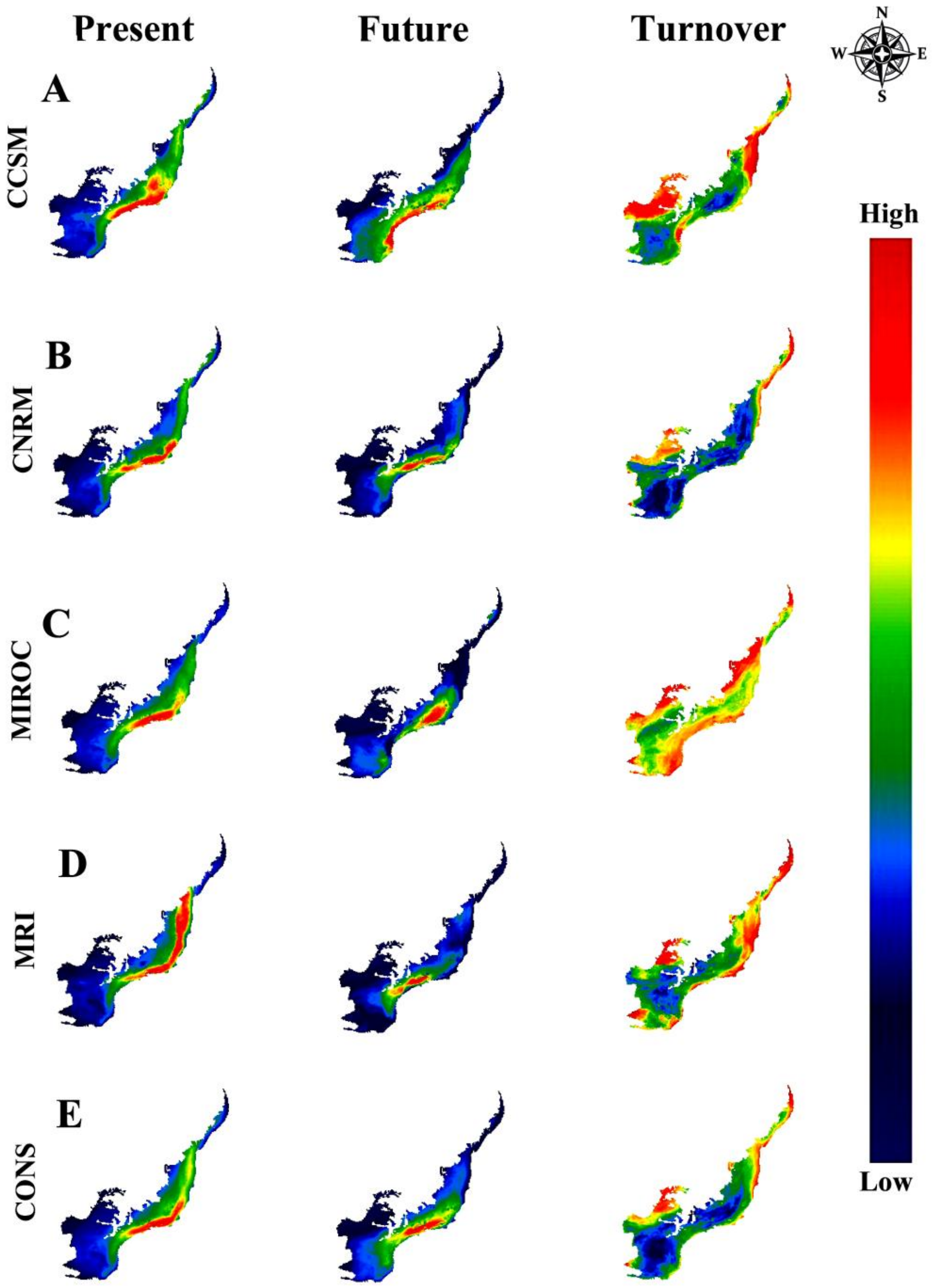

**Figure 3.** Species richness and turnover derived from different Global Circulation Models (CCSM - A, CNRM - B, MIROC - C and MRI - D) and consensus model (CONS - E) for amphibian species in the current time and for 2080.

Consequently, by combining the results of AOGCMs in a full ensemble model, we observed that the temporal turnover was high. Thus changes in the species composition are predicted to be greater on the western edge and on the northeastern edge of the biome. We found significantly higher turnover rate from high to low latitudes ($r = 0.308$, $p < 0.001$) and areas from low to high altitudes ($r = 0.307$, $p < 0.001$) (see Fig. 5a-c).

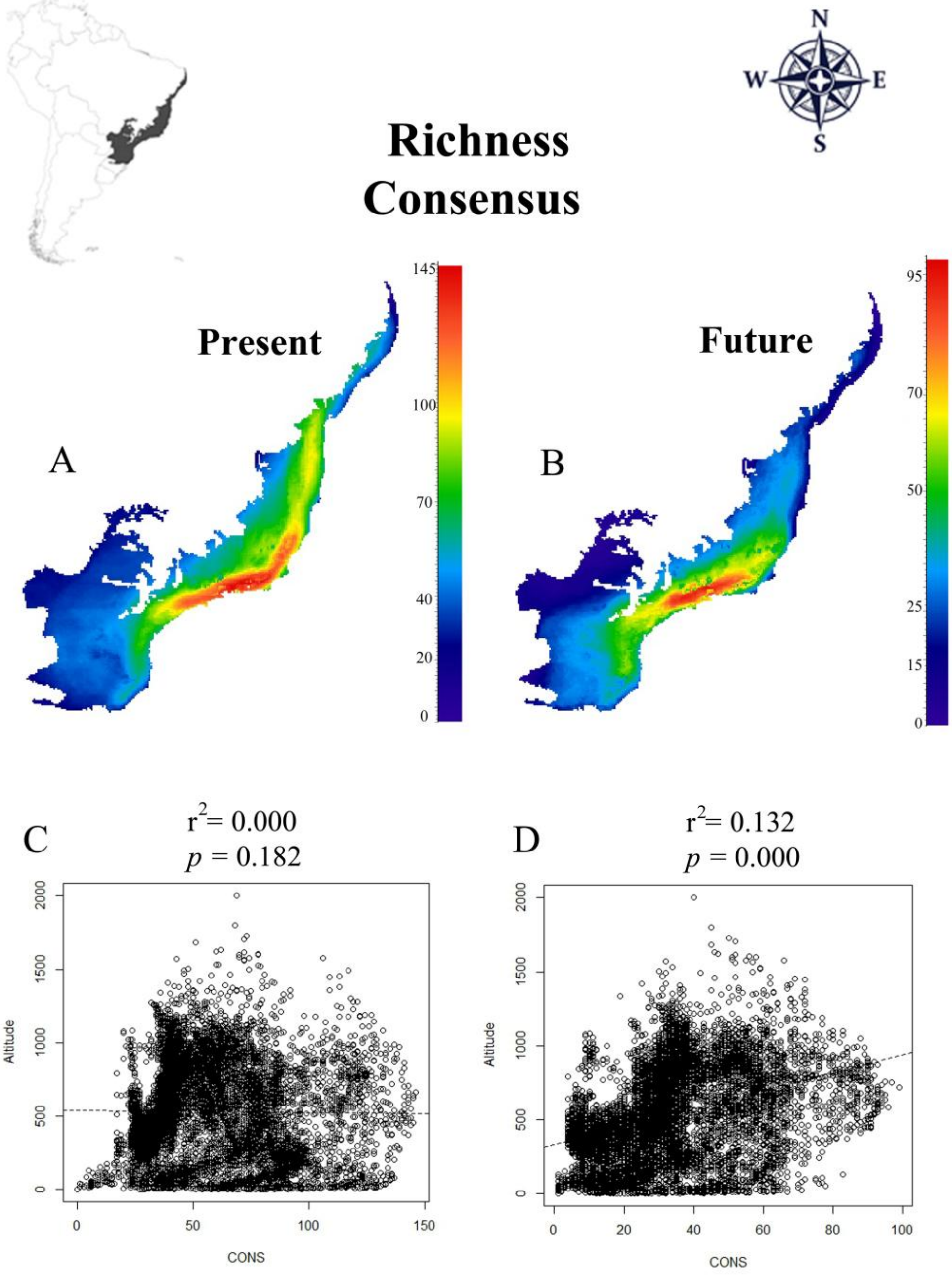

**Figure 4.** Species richness derived from consensus model Map for current time (A) and for 2080 (B). Relation between amphibians species richness consensus model (CONS) and altitude for current time (C) and for 2080 (D)

Our results showed high functional diversity (FD) in the regions of the eastern Atlantic Forest with the highest rates in the east-central region rising to the northeast in the current time (Fig. 6a, c). In 2080, these values will decrease from 17.296 to 15.532 at its maximum value (Fig. 6b), and will have a significantly higher loss in areas of lower altitudes ($r = 0.101$, $p < 0.001$, Fig. 6d). High rates were found mainly in the south of Bahia to the south of São Paulo states.

The highest values of phylogenetic diversity (PD) in the current time are distributed in the in the east-central region, mainly in the region of Serra do Mar rising to Central Corridor and a small part of Pernambuco (in high altitude areas) (Fig. 7a, c). For 2080, these values will decrease from 5.752 to 5.440 at its maximum value (Fig. 7b), which will dramatically decrease in the south and north of Bahia, increasing towards the south of the Serra do Mar portion. The regions of highest altitude will be replaced by significantly values in the future ($r = 0.121$, $p < 0.001$) (Fig. 7d). The built null models for the FD and PD in current and future time showed different values than expected by chance ($p < 0.001$), indicating a pattern of non-random of functional and phylogenetic diversity.

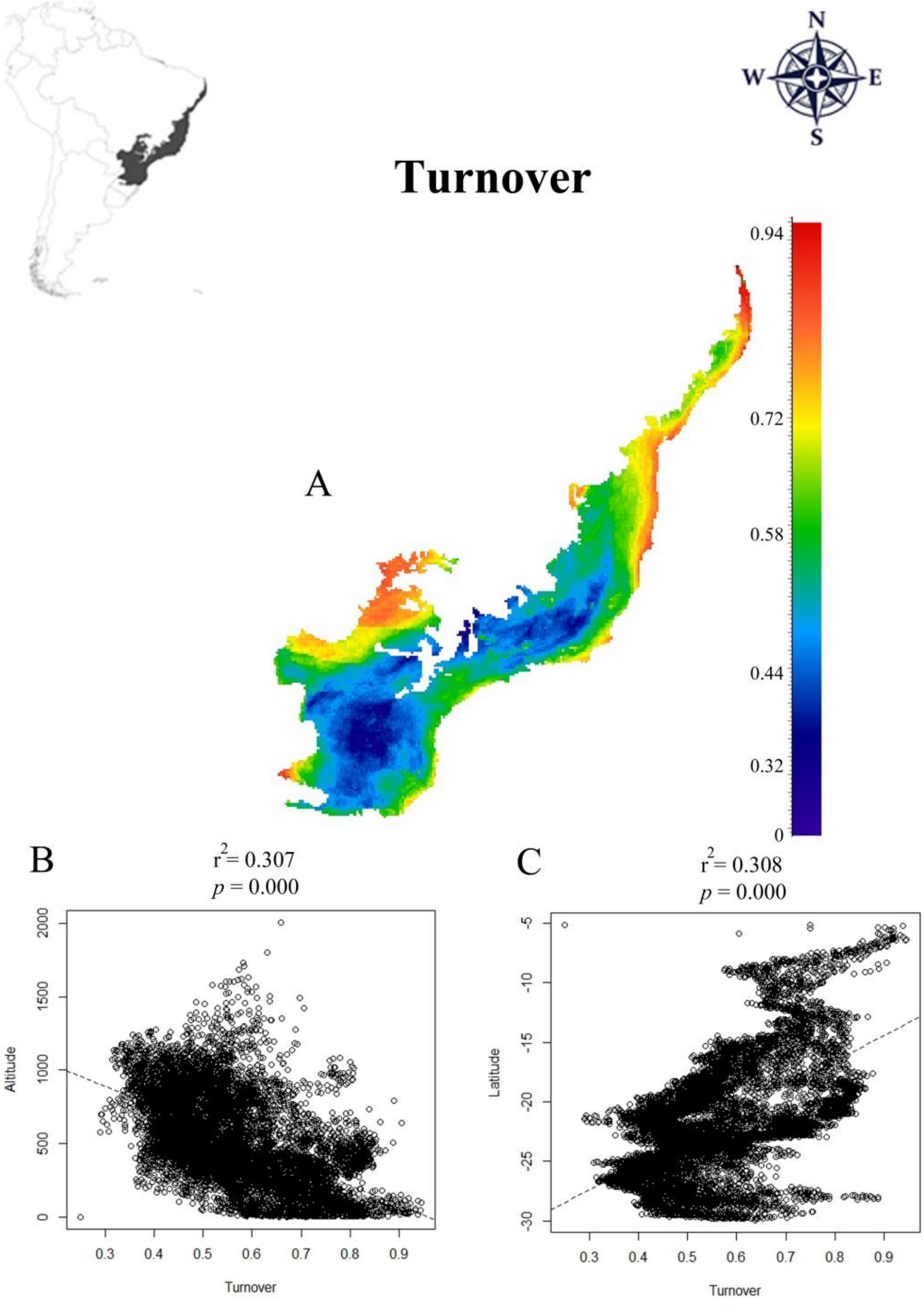

**Figure 5.** Turnover derived from consensus model Map (A). Relation between turnover consensus model and altitude (B) and for latitude (C) for amphibians species.

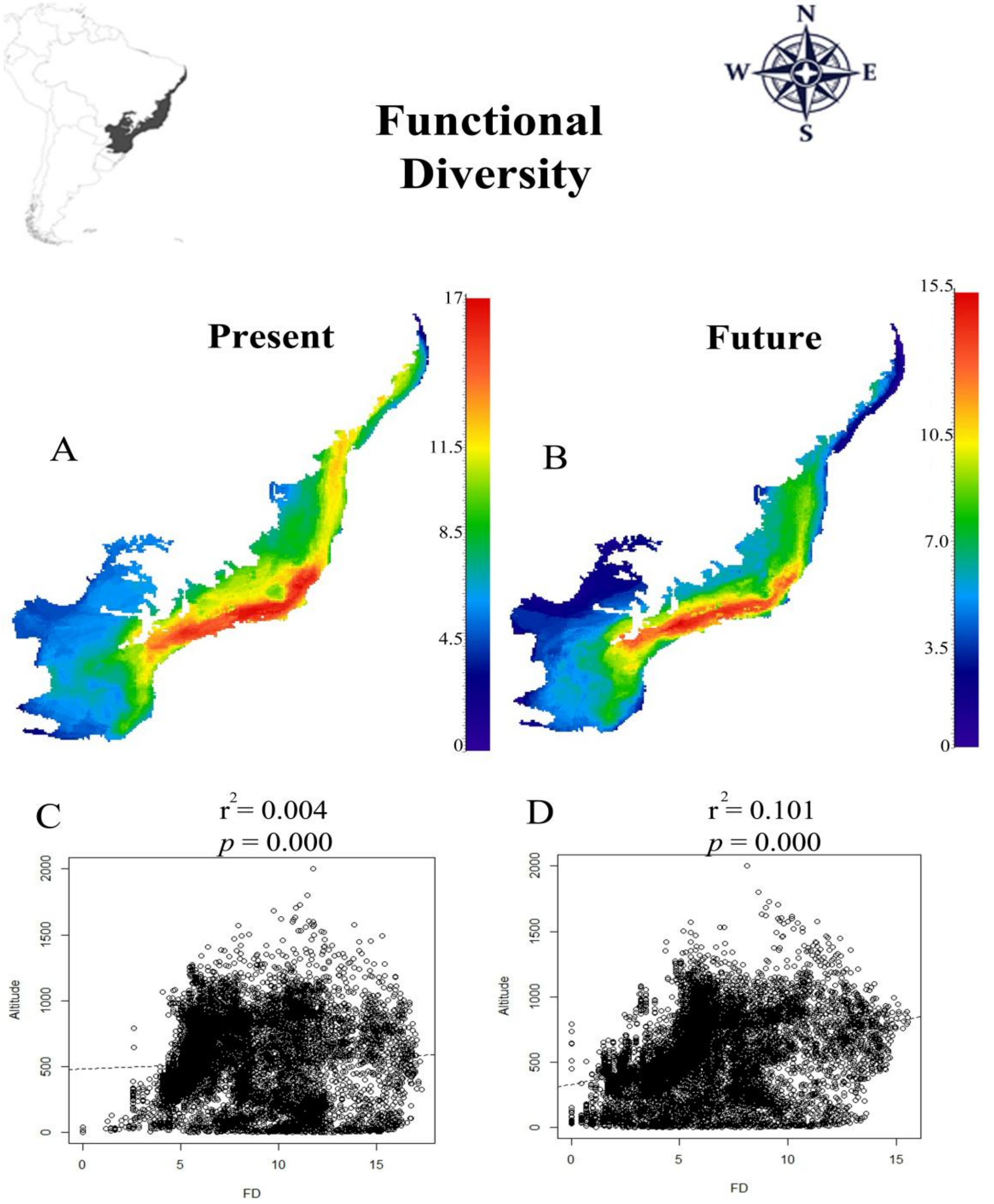

**Figure 6.** Spatial distribution of functional diversity (FD) derived from amphibians species richness consensus model Map for current time (A) and for 2080 (B). Relation between functional diversity (FD) consensus model and altitude for current time (C) and for 2080 (D).

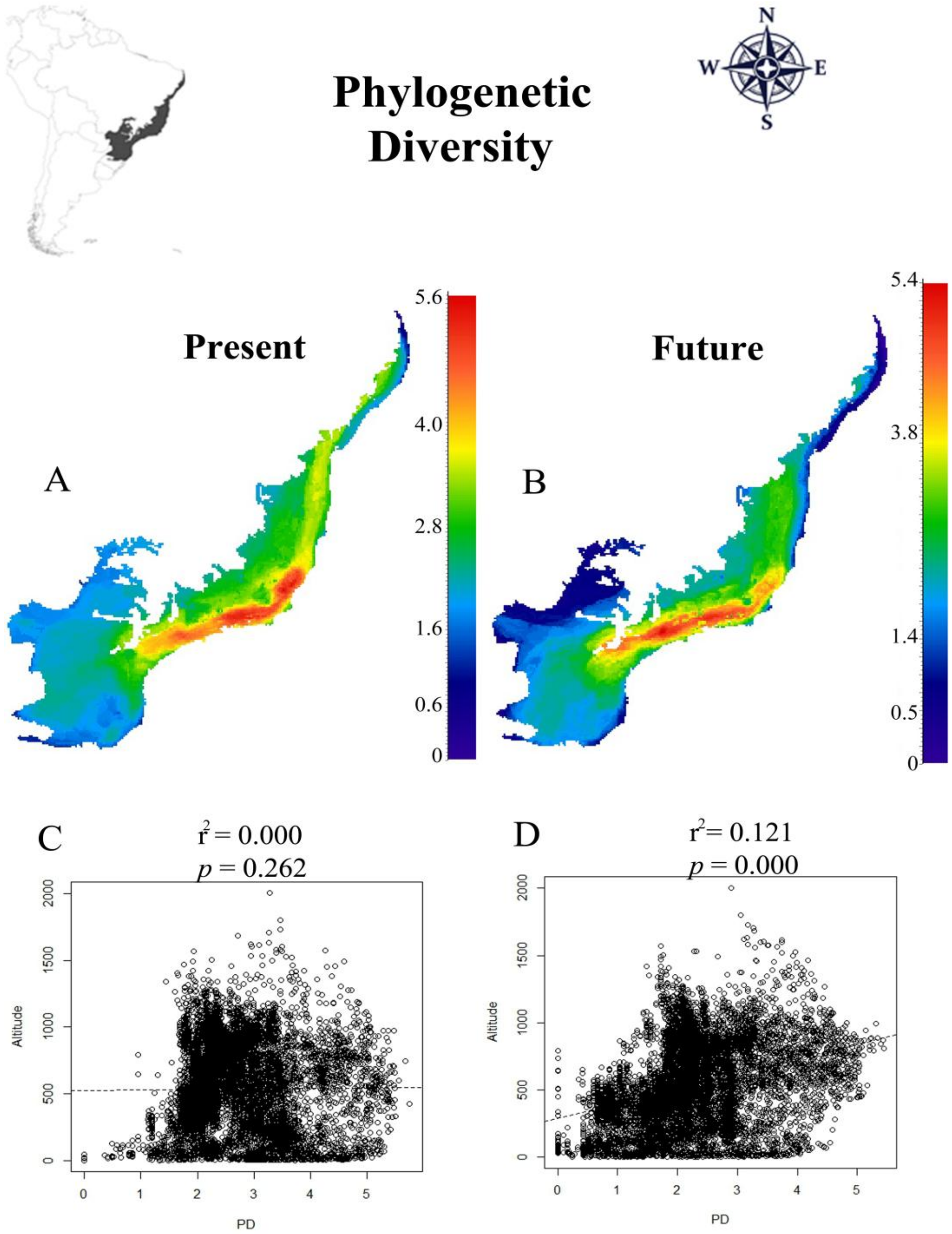

**Figure 7.** Spatial distribution of phylogenetic diversity (PD) derived from amphibians species richness consensus model Map for current time (A) and for 2080 (B). Relation between phylogenetic diversity (PD) consensus model and altitude for current time (C) and for 2080 (D).

Our results pointed that FD and PD were highly correlated (present: r = 0.91, *p*< 0.001; Future: r = 0.94, *p*< 0.001), which was also observed when compared with the SR consensus model (present: FD – r= 0.87, *p*< 0.001, PD – r = 0.89, *p*< 0.001; future: FD - r = 0.86, *p*< 0.001, PD – r= 0.84, *p*< 0.001). Therefore, the loss of species richness in the future may be accompanied by the loss of FD and PD (Fig. 8).

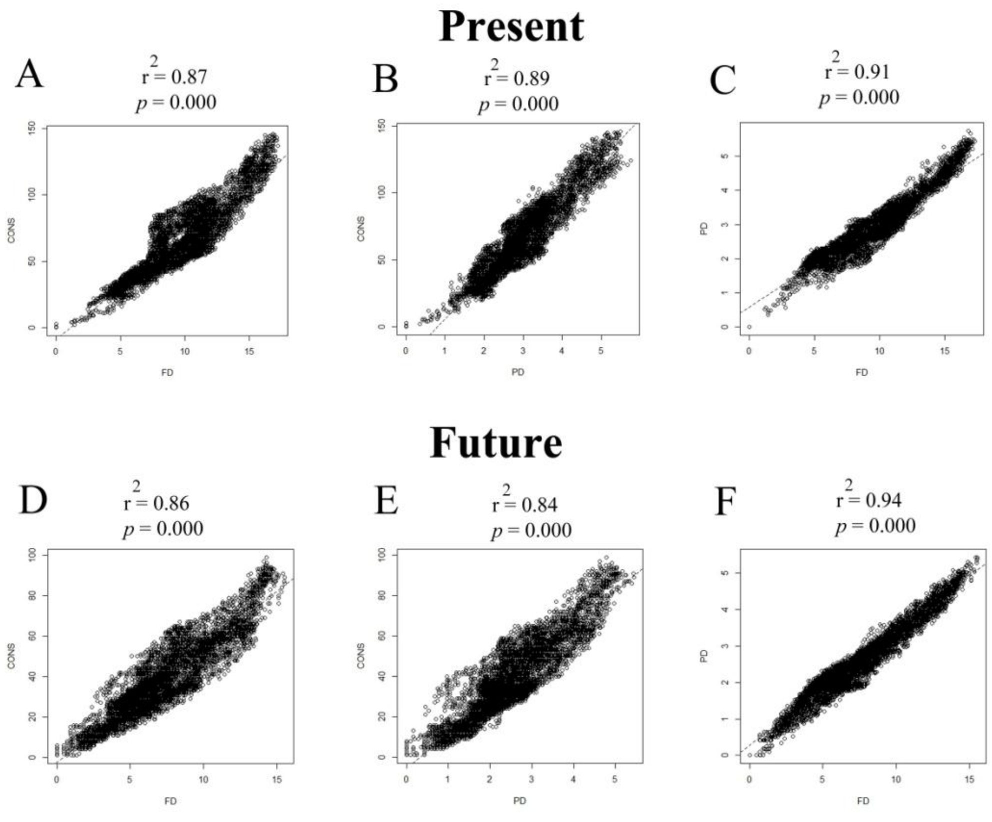

**Figure 8.** Relationships between Consensus model of richness species (CONS), Functional diversity (FD), Phylogenetic diversity (PD) of amphibians in the Brazilian Atlantic Forest. Present time: A (CONS vs FD), B (CONS vs PD) and C (FD vs. PD); Future time: D (CONS vs FD), E (CONS vs PD) and F (FD vs PD).

Our simulations revealed that due to the massive habitat suitability losses facing climate change, the vast majority of amphibians of the Atlantic Forest (62.0%) will be subject to some level of threat by 2080 (Fig. 9). Considering the projections for a moderate carbon emission scenario, our results showed that only 15% (N= 62 spp) of the species should present a low risk of extinction (i.e. less than 30% reduction from the original distribution area), given the restrictions imposed by future climatic conditions.

However, from these 15% of the species, 3.5 % even with an increase in its distribution still get a low ranges. Thus, our results also indicated that 84.9% (N= 383 spp) of the species will be threatened, and 21.5 % (N= 97 spp) of the species are expected to be extinct from the biome by 2080. The summary of the impacts of future climatic alterations on each individual species is given in Appendix 2, Table S1.

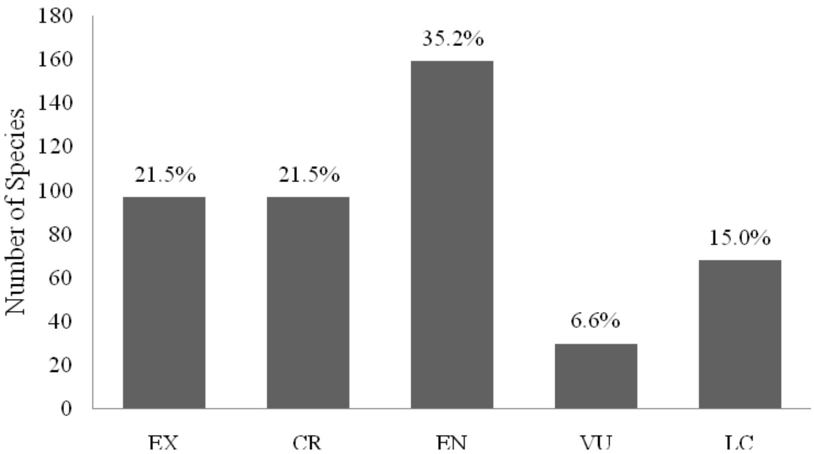

**Figure 9.** Status of threat project to 2080 in the face of climate change for amphibians of Atlantic Forest hotspot. EX = Extinct; CR = Critically Endangered; EN = Endangered; VU = Vulnerable; and LC = Leastern Concern.

## 3.4 DISCUSSION

Our data showed a dramatic reduction of species range (SR, PD and FD) for 2080. High rates of turnover in the lower latitudes and lower rates in the altitudes can strengthens the mountains of Atlantic Forest as climatic refuges (Randin *et al.,* 2009; Araújo *et al.,* 2011). The persistence of the species in their original ranges will be dependent on their degree of physiological and phenotypic plasticity, antipredator mechanisms, reproductive mode, or evolutionary adaptation of each species to changing environmental conditions, as well as the combination of these processes (Holt, 1990; Visser, 2008; Toledo *et al.,* 2012; Urban *et al.,* 2014; Ferreira *et al.,* 2016; Lourenço-de-Moraes *et al.,* 2016). As a result, some species have increased their ranges; although even features a low range in the future (lower 30%). For instance, opportunistic species adapted to warmer and drier environments also had increase of range (e.g. *Rhinella crucifer, Dendropsophus braneri, Leptodactylus troglodytes* and *Siphonops annulatus*) (Haddad *et al.,* 2013; present study). However, species that live in high altitudes and high latitudes have their ranges little affected. *Brachycephalus brunneus,* a species that due to their morphology and great dependence on abiotic factors (i.e. temperature and rainfall – 1,300 m elev.) (Ribeiro *et al.,* 2005), had low range changes in our model, which can enable this species to remain in the future. On the other hand, species from this genus that live more to north of Atlantic Forest and with similar features as *B. pulex* (Napoli *et al.*, 2011) may be extinct according to the same model.

Our results showed that FD and PD have high correlation among themselves and a nonrandom pattern of species composition for both present and future times. This pattern suggests that environmental factors may act as filters that does not allow the coexistence of similar species (Diamond, 1975; Weiher & Keddy, 1999). In addition, historical factors provided biogeographic barriers acting to determine the regional bank of some species assemblages (Ricklefs & Schluter, 1993). Our results revealed three major areas of FD and PD for the current time, which are located in the mountains of the Serra do Mar, the Central Corridor of the Atlantic Forest and the altitude areas in the Pernambuco state. Carnaval *et al.* (2009) pointed out three climatic refuges for amphibians during the Pleistocene: (i) Southern Bahia state (located in the Central Corridor of the Atlantic Forest); (ii) Pernambuco state; and (iii) east-north region of São Paulo (i.e. Serra do Mar). Our results also showed higher rates of phylogenetic and functional diversity in these areas, supporting Carnaval *et al.* (2009) hypothesis. Moreover, our data also suggest climatic refuges in the Espírito Santo state, the Serra da Mantiqueira region that corresponds to the South of Minas Gerais state, and the South of Serra do Mar that corresponds to the east of Paraná state. In the future (i.e. 2080), these same areas will continue as climatic refuges, but changing the scenery for the areas of higher altitudes as new climatic refuges. Our model clearly showed the species will disperse from lower latitudes to higher latitudes and altitudes (Fig. 2, 3). Species with access to mountainous regions may migrate to highest altitudes areas, which have lower temperatures (Colwell *et al.*, 2008), and in the case of the Atlantic Forest, should retain greater humidity by better-preserved forests cover (Ribeiro *et al.*, 2009).

Loyola *et al.* (2013) indicated high values of phylogenetic diversity in the Atlantic Forest for the future (i.e. 2080). Our data contradict these values, indicating low PD values and significant correlations with low SR consensus model for the future. Nevertheless, our results corroborate the data obtained by Thuiller *et al.* (2011), which showed that the loss of species richness may be accompanied by the loss of phylogenetic diversity. Furthermore, our data also indicates that the loss of species richness for the future will follow the loss of functional diversity.

The historical loss and their relationships do not reflect the actual proportion of loss in relation to the conservation of species. Moreover, FD reflected better the lost of ecological functions and evolutionary perspectives, because similar species from similar phylogenetic clades may not coexist due to a possible competitive exclusion (Diamond, 1975). However, species phylogenetically similar may have different effects on the ecosystem (Webb *et al.,* 2002; Gomez *et al.,* 2010). In these cases, the loss of phylogenetically similar species may coexist and may have greater losses in processes and ecosystem services.

Our results showed high species extinction rate in 2080 (21.5%) and other 63.3% species will be threatened. The Atlantic Forest was severely destroyed and fragmented, resulting on 9% remaining of its original formation (Ribeiro *et al.,* 2009). It is possible that these values can be even greater. According to our results, 84.9% of the studied species will be endangered or extinct by 2080. It is highly concerning that 94% of the species of our study are not included in any threatened status by the Brazilian Red list (Appendix 2, Table S1).

Studies in the Atlantic Forest has been warning about the need to invest in Protected Areas at altitude areas (Lemes *et al.,* 2013; Loyola *et al.,* 2013), mainly in the areas of Serra do Mar and south of Bahia (Carnaval *et al.,* 2009). Therefore, considering the dramatic evolutionary and ecological loss showed in this study, we suggest four large areas as priority for conservation efforts, the Serra do Mar, the Serra da

Mantiqueira, the Central Corridor and areas of northeastern altitude of the Atlantic Forest.

## 3.5 CONCLUSION

Many biotic and abiotic factors can influence the richness and composition of species in an environment (Diamond, 1975). Amphibians are particularly sensitive to environmental changes, and depending on the species, the dispersion may be difficult because of its specializations as diminutive size (Crump, 2010; Early & Sax, 2011; Lourenço-de-Moraes *et al.*, 2012, 2014). The use of various algorithms to reach a better consensus have been demonstrated as an effective strategy to reach outcomes closer to reality, and is one of the keys to understanding how communities can respond to climate changes (Araújo & New, 2006; Marmion *et al.*, 2009). Therefore, our consensus model showed consistent results and reflected the main direction in relation to species richness, as well as their refuges in the Antropocene age, ensured their evolutionary and ecosystem values.

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# 4 HISTÓRIA EVOLUCIONÁRIA DOS MECANISMOS ANTIPREDAÇÃO DOS ANFÍBIOS DA FLORESTA ATLÂNTICA BRASILEIRA

## Resumo

Compreender os mecanismos de antipredação é uma das principais questões para entender a diversidade e dispersão das espécies. A origem dos mecanismos de antipredação pode ter origem evolucionaria (de forma aleatória determinada geneticamente sem controle), por pressões ecológicas/etológicas (fatores bióticos e abióticos que levam o animal a aprender e repetir um determinado comportamento) ou pela união de ambos. Os anfíbios possuem alta plasticidade adaptativa e sofrem forte pressão ambiental, principalmente em relação ao seus diversos predadores. Aqui, nós investigamos a origem dos mecanismos de antipredação de 115 espécies de anfíbios da Floresta Atlântica. Analisamos as suas origens evolutivas com base nas características genéticas e suas relações entre a diversidade de mecanismos e características ecológicas funcionais. Os resultados mostraram que muitos mecanismos têm origem de forma independente em diferentes famílias e subfamílias. O mecanismo de antipredação de produzir secreções é puramente filogenético e segue um modelo de evolução Browniano e pode dirigir o ajustamento ou desenvolvimento de novos mecanismos. Características funcionais que expõem anfíbios suscetíveis à predação, agem como uma forte pressão evolutiva e em resposta as espécies tendem a ter uma maior diversidade de mecanismos, que estão em vantagem por sua vez, e aumentam a sua distribuição geográfica. Os resultados apresentam novas perspectivas e orientações para o sucesso da diversidade de anfíbios na Floresta Atlântica brasileira.

**Palavras chaves:** características funcionais; dispersão; homologia; sinal filogenético.

# EVOLUTIONARY HISTORY OF AMPHIBIANS ANTIPREDATION MECHANISMS OF THE BRAZILIAN ATLANTIC FOREST

## Abstract

Understanding antipredation mechanisms is one of the key issues to understand the diversity and dispersal of species. The origin of antipredator mechanisms may to be evolutionary (randomly, genetically determined without control), for ecological/ethological pressures (biotic and abiotic factors that cause the animal to learn and repeat a certain behavior) or the union of both. Amphibians have high adaptive plasticity and suffering strong environmental pressure, especially in relation to their various predators. Here, we investigate the origin of antipredator mechanisms of 115 amphibians species of the Atlantic Forest. We analyze their evolutionary origins based on genetic characteristics and relationships between the diversity of mechanisms and functional ecological characteristics. Our results showed that many mechanisms originate independently in different families and subfamilies. The antipredator mechanism to produce secretions is purely phylogenetic and follows a model of Brownian evolution and directs the adjustment or development of new mechanisms. Functional traits that exposes amphibians susceptible to predation, acts as a strong evolutionary pressure is in response to species tend to have a greater diversity of antipredator mechanisms and because this, increase their geographical distribution. Our results showed new perspectives and directions for the success of diversity of amphibians in the Brazilian Atlantic Forest.

**Key words**: functional traits; dispersion; homology; phylogenetic signal

## 4.1 INTRODUÇÃO

Uma das principais pressões evolutivas sobre as espécies é a corrida predador-presa. Este processo evolutivo opera em conjunto com mudanças genéticas aleatórias selecionadas, gerando fenótipos especializados através de um processo de seleção natural (Darwin 1859). Predadores afetam as presas diretamente pelo consumo e, indiretamente, pela indução de respostas antipredação energeticamente caras (Alcook 2011). Estas respostas podem incluir alterações nos traços comportamentais, morfológicos, ou no desenvolvimento das presas (Smith e Van Bus-kirk 1995; Preisser et al. 2005; Verheggen et al. 2009). Mecanismos antipredação são essenciais para a sobrevivência da presa (Lima 1998; Ruxton et al. 2004). No entanto, ambos os lados (predador e presa) podem não ter o controle dessas adaptações (Petranka et al. 1987; Podjasek et al. 2005; Alckook 2011), e às vezes o predador sai na frente desta corrida evolucionária (Brodie e Brodie 1999). Devido a isso, a evolução e a regulação de um determinado comportamento em resposta a predação pode ser rápida (Stillfried et al. 2015) e em poucas gerações (Juliano e Cascalho 2002; Zimmer et al. 2011).

O sucesso de um mecanismo antipredação é o que permite a evolução (Vermeij 1982). Correlacionar os mecanismos antipredação são particularmente importantes para a compreensão da seleção natural sobre um único mecanismo (Brodie1992). Presas que apresentam fracas respostas comportamentais a predadores, ou aparentemente abaixo do ideal, podem não sofrer predação pesada se elas apresentarem defesas morfológicas e químicas eficazes (Dewit et al. 1999; Willians 2000; Yadete et al. 2012). Neste sentido, a evolução de um mecanismo requer que as espécies possuam características filogenéticas que direcionem a ocorrência de um mecanismo eficiente para a sua sobrevivência.

A origem evolutiva do mecanismo antipredação está diretamente relacionada ao sucesso adaptativo das espécies, e pode refletir em novas estratégias defensivas ou simplesmente o ajuste de um mecanismo existente (Dewit et al. 1999; Juliano e Gravel 2002; Zimmer et al. 2011; Stillfried et al. 2015 ). Alternativamente, o comportamento e a morfologia podem ser mecanicamente independentes, e essas características muitas vezes devem ser utilizadas em combinações particulares para produzir uma resposta eficaz de antipredação (Dewit et al. 1999). Espécies filogeneticamente próximas tendem a ter características comportamentais similares herdadas de um ancestral comum (Harvey e Pagel 1991), levando-as a explorar e se estabelecer em ambientes semelhantes. Esta semelhança fenotípica entre espécies relacionadas é conhecida como sinal filogenético (Harvey e Pagel 1991; Blomberg e Garland 2002) e descreve a tendência de uma característica particular em ser conservada. No entanto, a diversidade de características fenotípicas, podem apresentar diferentes direções que irão depender da sua história evolutiva. Esta característica evolutiva pode ter origem na raiz de uma árvore filogenética, ou podem convergir e as características serem encontradas nas pontas da árvore (Pavoine et al. 2010). Além disso, a evolução destas características pode ser explicadas pelo modelo Browniano de evolução, que é um processo de deriva genética aleatória a uma taxa constante de evolução não direcional (Felsenstein 1985; Lynch 1990; Martins 1994; Pagel 1997; Diniz-Filho e Vieira 1998 ).

Características funcionais podem influenciar a área de distribuição das espécies (Brown e Maurer 1989; Díaz et al 2007; Jimenez-Val Verde et al 2015). Estas características podem conduzir a presa para ajustar sua estratégia antipredação, dependendo da atual ameaça imposta por predadores potenciais (Smith e Van Bus-kirk 1995; Relyea 2001; Ferrari et al. 2010; Higginson et al. 2012; Brown et al. 2013). Como consequência, em mecanismos evasivos (fuga) e defensivos (contato) é esperado que haja flexibilidade fenotípica em resposta ao nível do risco da predação (Kats e Dill 1998; Lass e Spaak 2003; Ferrari et al. 2010; Higginson et al. 2012; Brown et al. 2013) .

Anfíbios são predados por várias espécies de vertebrados e invertebrados em todos os seus estágios de vida (desde adultos, bem como larvas e juvenis) (Toledo 2005; Wells 2007). Esta forte pressão promovida pela predação atua como força de seleção evolucionária (Wells 2007). Vários mecanismos de antipredação foram desenvolvidos pelas espécies de anfíbios. Toledo e coloboradores (2011) listaram mais de 30 mecanismos diferentes em anuros. Muitas espécies de anuros apresentam estes comportamentos em sinergia (Lourenço-de-Moraes et al. 2014a, Figueiredo et al. no prelo) e de forma escalonada (Lourenço-de-Moraes et al. 2014b, 2016). A origem filogenética da maioria dos mecanismos de antipredação ainda são desconhecidas para os anfíbios. Correlacionar os traços destes mecanismos e, em particular, a evolução conjunta dos traços de cada mecanismo é importante para se determinar a sua historia evolutiva (Lande & Arnold 1983; Price & Langen 1992), e pode responder a perguntas sobre as vantagens e desvantagens de um traço particular em relação ao seu potencial de distribuição geográfica.

Nesse sentido, nós testamos a hipótese de que: i) mecanismos de antipredação ancestrais são puramente filogenéticos explicados pelo modelo de evolução Browniano; ii) a especialização ecológica (funcional) das espécies influencia a diversidade de mecanismos antipredação; iii) espécies com maior diversidade de mecanismos antipredação têm maior área de distribuição geográfica. Para isso, avaliamos os mecanismos ancestrais e analisamos sua origem evolutiva com base no repertorio de mecanismos de antipredação das espécies de anfíbios da Floresta Atlântica.

## 4.2 MÉTODOS

### *4.2.1 Área de estudo*

As análises foram focadas nas espécies que ocorrem na Floresta Atlântica Brasileira, considerada um dos hotspots da biodiversidade (Myers et al., 2000), que originalmente cobria cerca de 150 milhões de hectares de condições ambientais heterogêneas fornecidas por uma grande variedade de zonas climáticas e formações florestais (Tabarelli et al. 2005; Ribeiro et al. 2009) (Figura 1).

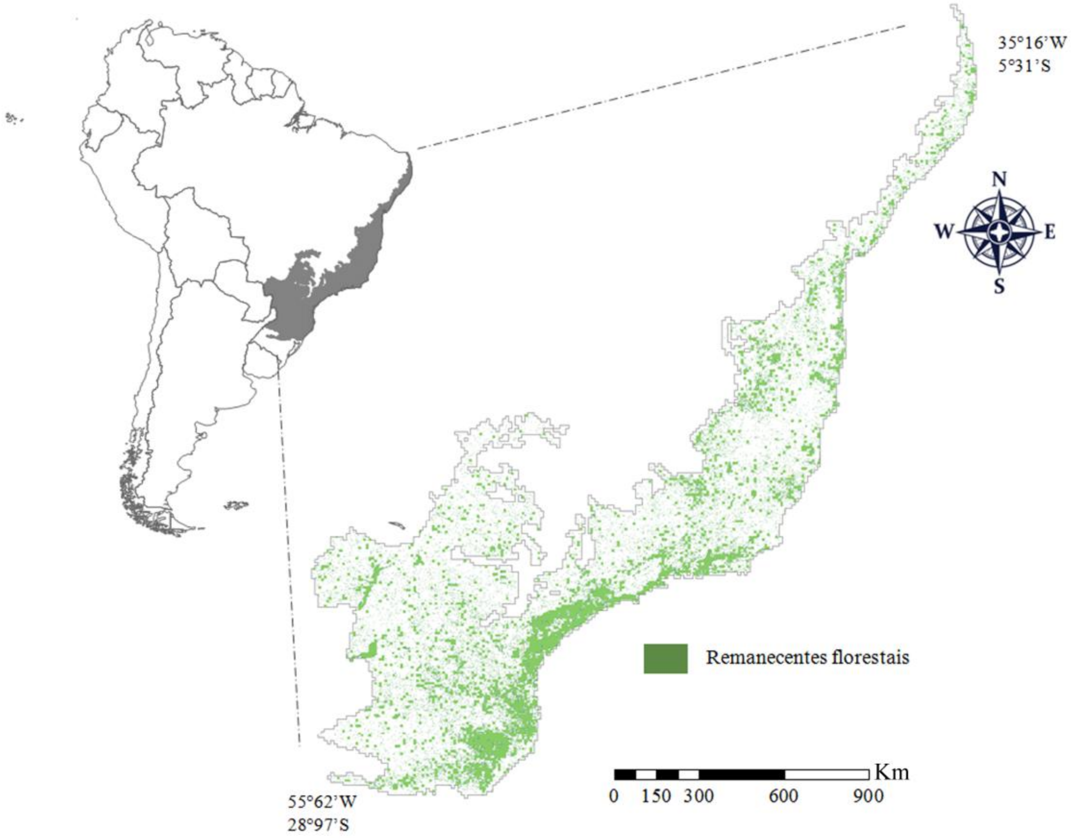


**Figura 1.** Mapa mostrando a área de estudo no hotspot Floresta Atlântica brasileira (em cinza) no território Sulamericano.

### *4.2.2 Dados das espécies*

Foram obtidos dados espaciais de espécies de anfíbios em uma pesquisa conjunta através de quatro tipos de procedimentos: (a) foi construído um conjunto de dados com todas as espécies distribuídas na Floresta Atlântica de acordo com o banco de dados de mecanismos antipredação proposto por Ferreira e colaboradores (em preparação) e o banco de dados com as características funcionais de Haddad e colaboradores (2013); (b) selecionamos as espécies baseados no banco de dados GenBank (Benson et al. 2013) para a construção da árvore filogenética; (c) realizamos trabalhos de campos complementares nos principais remanescentes da Floresta Atlântica Brasileira, para complementar o conjunto de dados de mecanismos antipredação e os atributos funcionais observados (Apêndice 3, Tabela S1 e S2); e (d) determinamos a área geográfica de cada espécie baseados na Lista Vermelha da IUCN pelo banco de dados de Espécies Ameaçadas (IUCN, 2016).

No total, foram avaliados os limites geográficos (IUCN 2016) de 115 espécies de anfíbios cobertos por nosso sistema de grid. Usamos o software ArcGIS10 (ESRI, 2010) para construir matrizes de presença/ausência de dados de distribuição de espécies por meio da sobreposição de um sistema de grade com células de 0,1 graus de latitude/longitude (10 x 10 km), criando uma rede com 10,359 células da grade. Cada célula de grade corresponde a 1 range de ocorrência.

### *4.2.3 Mecanismos antipredação*

Para cada espécie encontrada durante os levantamentos de campo (105 das 115 espécies avaliadas, veja Apêndice 3, Tabela S2) nos aplicamos os estímulos de mecanismos antipredação, utilizando a metodologia I (usando o humano como predador utilizando somente o dedo para aplicar os estímulos) proposta por Lourenço-de-Moraes e coloboradores (2016), mas adaptamos o tempo de cada aplicação em relação ao tamanho da espécie (para espécies ≤ 3 cm o tempo de cada aplicação foi de 15s, para espécies maiores o tempo foi de 30s). Os mecanismos antipredação foram classificados em 13 categorias de acordo com o sistema de classificação proposto por Ferreira, Lourenço-de-Moraes e Brodie Jr (em preparação). Estes mecanismos foram divididos nas seguintes categorias: produção de secreções, camuflagem, imobilidade, contração, inflar o corpo, elevação do corpo, manter as pernas esticadas, fuga, aposematismo, descarga cloacal, abrir a boca, vocalizações defensivas e lutar. A descrição e as variações dos mecanismos estão na Tabela 1.

**Tabela 1.** Mecanismos antipredação avaliados e suas variações dentro de cada mecanismo.

| **Mecanismos de Antipredação** | **Variações dos Mecanismos** |
|---|---|
| Produzir secreções | 0= Ausência; 1=Odorífera; 2=Adesiva; 3=Tôxica; 4=Escorregadia; 5 = Desagradavel |
| Camuflagem | 0= Ausência; 1= Presença |
| Imobilidade | 1= Imóvel agachada; 2= Imóvel alerta; 3= Tanatose |
| Contração | 0= Ausência; 1= Contração; 2= Pragmose; 3= Agachando-se; 4= Dobrando o queixo; 5=Protegendo o olho |
| Inflar o corpo | 0= Ausência; 1= Presença |
| Elevar o corpo | 0= Ausência; 1= Pernas esticadas verticalmente; 2= Pernas esticadas lateralmente; 3= Elevação; 4= Elevação lateral |
| Manter as pernas esticadas | 0= Ausência; 1= Presença |
| Escapar | 1= Único pulo; 2= Varios pulos; 3= Esconder-se |
| Aposematismo | 0= Ausência; 1= Total; 2= Parcial |
| Descarga | |
| Cloacal | 0= Ausência; 1= Líquido; 2= Sólido |
| Abrir a boca | 0= Ausência; 1= Presença |
| Vocalização defensiva | 0= Ausência;1= Canto de agônia; 2= Canto de alarme |
| Lutar contra o predador | 0= Ausência; 1= Movimentos Erráticos; 2=Lutar; 3=Agressão com espinho; 4=Avançar; 5= Cabeçada; 6=Morder |

### *4.2.4 Dados filogenéticos*

Nós baseamos a distância filogenética das 115 espécies estudadas (Apêndice 3, Tabela S3) através de sequências de nucleótideos obtidas no GenBank (Benson et al. 2013), fornecidas pelo Centro Nacional de Informações sobre Biotecnologia (NCBI). Seguindo o protocolo proposto por Pyron e Wiens (2011) baseado em uma filogenia de anfíbios existentes. Foram utilizados 12 genes para gerar a filogenia para os anfíbios da Floresta Atlântica (ou seja, 11, 906 pb para cada espécie), foram incluídos três genes mitocondriais: cytochromo b (cyt-b), e as grandes e pequenas sub-unidades dos genes mitocondriais ribossomicos (12S/16S); e nove genes nucleares: tipo C-X-C receptor de quimiocinas 4 (CXCR4), histona 3a (H3A), alternador de sódio-cálcio (NCX1), pró-opiomelanocortin (POMC), gene ativador de recombinação 1 (RAG1), rodopsina (Rhod), sétimo ausente (SIA), família soluto-carrier 8 (SLC8A3) e tirosinase (TYR). Para as regiões de comprimento variável, realizamos várias comparações de pares pela versão online do MAFFT v.6.8 e G-INS-i algoritmo (Katoh e Toh 2008). Em seguida, alinhamos todos os genes em um mesmo conjunto alinhado usando o SequenceMatrix software 1.7.7 (Vaidya 2011) para concatenar a supermatrix gerada.

Nós conduzimos as relações filogenéticas com análises Bayesiana no software BEAST 1,8 (Drummond e Rambaut 2007), estimando-se os nós suportados com uma analise de bootstrapping. Depois, foram realizadas análises Bayesianas em uma matriz de dados combinados usando um modelo de sequência evolutiva HKY que particiona todos os genes, com um processo de especiação (Yule) e um relógio molecular relaxado não correlacionado. Após a remoção dos genes considerados indispensáveis, partimos para o processo de especiação (Yule) com 100 milhões de gerações, garantindo que o número de gerações depois de convergência fosse suficientemente avaliado utilizando o uso do Tracer v1.6 (Drummond e Rambaut 2007), combinando os resultados com o uso de Logcombiner 1.8 e o Tree Anotator 1.8 (Drummond e Rambaut 2007). Consideramos que cada nó é fortemente suportado com valores de probabilidade (pp) suporte de ≥0.95. Para resolver as politomias, usamos a função 'multi2di' do pacote 'ape' (Paradis 2012) no software R (R Development Core Team 2010). Assim, reconstruímos uma nova árvore filogenética (Figura 2) usando o software Mesquite, versão 3.0 (Maddison e Maddison 2014).

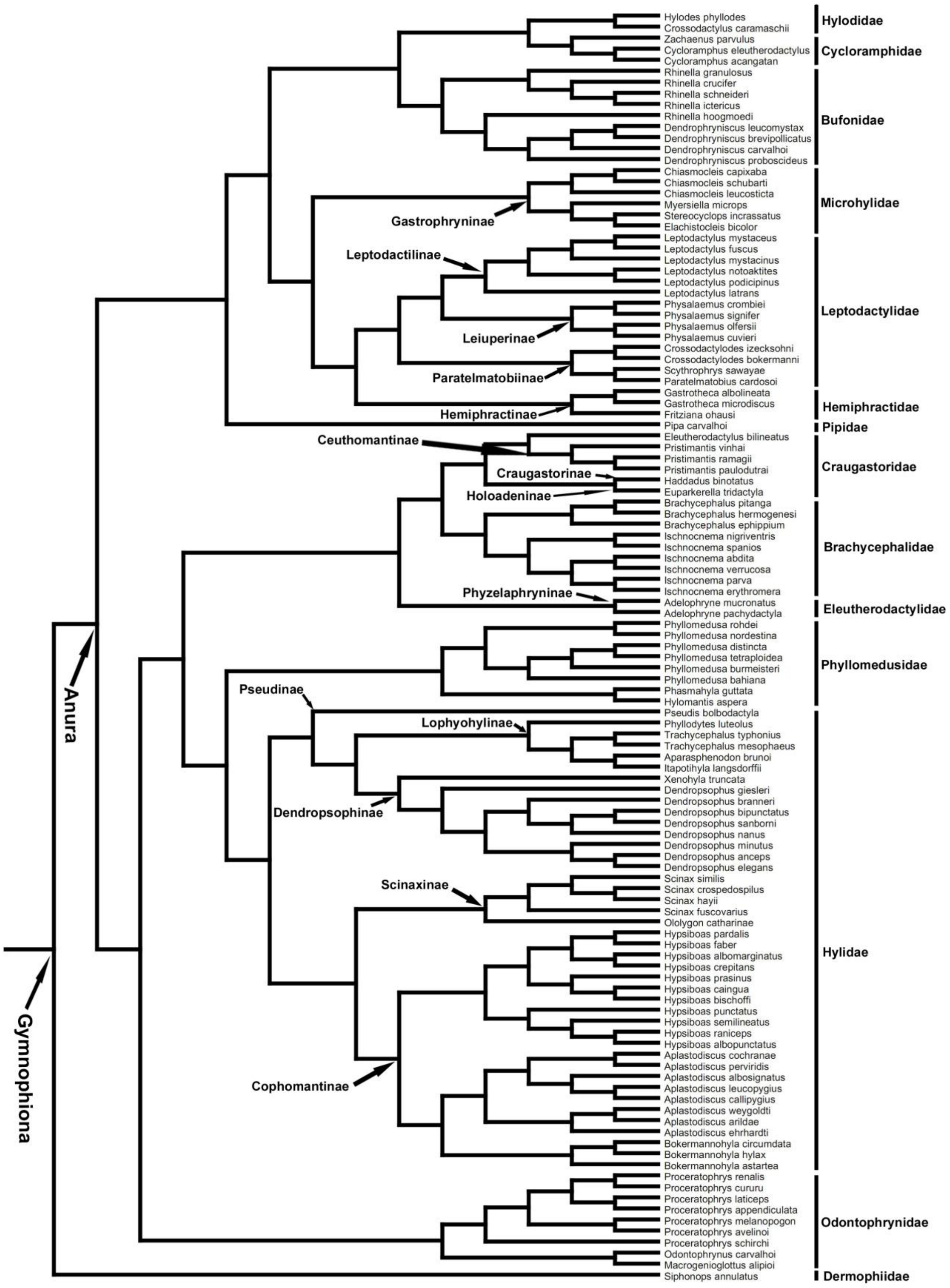


**Figura 2.** Árvore original. A nomenclatura das Famílias, Subfamílias e espécies segue Frost (2016). A árvore mostra as relações de parentesco entre as espécies. Barras laterais indicam as Famílias, flechas indicam os nós das Ordens e Subfamílias.

### *4.2.5 Características funcionais*

Nós caracterizamos as características funcionais das 115 espécies de anfíbios de acordo com Haddad e colaboradores (2013) e com as nossas observações de campo. As características funcionais avaliadas foram: tamanho do corpo (Pequeno <3 cm, Médio ≥3 e <10cm, Grande ≥10 cm), o modo de desenvolvimento reprodutivo (direto ou indireto), *Habitat* (áreas florestais, áreas abertas e áreas abertas e florestais), atividade (noturna, diurna, e ambos), e o hábito (arbóreo, fitotelmata, terrestre, criptozoico, fossorial, reofílicos, e aquáticos). Veja detalhes e características das espécies no Apêndice 3 Tabela S2.

## 4.3 Analise dos dados

### *4.3.1 Reconstrução dos estados ancestrais*

Para determinar os mecanismos antipredação ancestrais, criamos uma árvore parcimoniosa entre os mecanismos antipredação e a árvore filogenética original. As análises das árvores ancestrais foram desenvolvidas com o auxílio do software Mesquite, versão 3.0 (Maddison e Maddison, 2014). O método de reconstrução de parcimônia para encontrar os estados ancestrais, minimiza o número de etapas da mudança de um caráter dadas pela árvore original e a distribuição do traço observado. Para isso, nós utilizamos o método de "História de Rastreamento do Caractere", que pinta os ramos da árvore para mostrar a reconstrução, e o traço ancestral é definido para cada nó na árvore.

Foram avaliados os traços ancestrais dos seguintes ‘nós’ da árvore original: Ordem Anura e Gymnophiona; Famílias Brachycephalidae, Bufonidae, Craugastoridae, Cycloramphidae, Dermophiidae, Eleutherodactylidae, Hemiphractidae, Hylidae, Hylodidae, Leptodactylidae, Microhylidae, Odontophrynidae, Phyllomedusidae, e Pipidae; e as subfamílias Ceuthomantinae, Cophomantinae, Craugastorinae, Dendropsophinae, Holoadeninae, Leiuperinae, Leptodactilinae, Lophyohylinae, Paratelmatobiinae, Pseudinae e Scinaxinae (ver Figura 2). Seguimos Frost (2016) para a nomenclatura das Famílias, Subfamílias e espécies.

### *4.3.2 Sinal filogenético*

Para estimar o sinal filogenético de cada mecanismo antipredação, usamos uma medida robusta proposta por Abouheif (1999) para detectar sinal filogenético nos mecanismos antipredação. O teste de Abouheif utiliza o índice de I de Moran, mas a matriz de proximidades filogenéticas de Abouheif tem uma diagonal diferente de zero. Estas aproximações são baseadas usando tanto os testes de C de Geary e o I de Moran (Legendry e Fortin 1989). O teste foi realizado com 999 aleatorizações utilizando o pacote "adephylo" (Pavoine et al. 2008) no software R (R Development Core Team 2010).

Para testar quais os mecanismos antipredação seguem o modelo de evolução Browniano (evolução aleatória), utilizamos uma medida baseada no máximo de probabilidade de sinal filogenético, chamado de lambda (λ), desenvolvido por Pagel (1997). Esta métrica corresponde a um parâmetro de transformação da árvore que elimina gradualmente a estrutura filogenética variando de 1 a 0. Lambda transformação é realizado através da multiplicação dos elementos fora da diagonal da matriz de variância/covariância descrevendo os comprimentos da topologia da árvore e ramos. Valores de lambda igual a 1 correspondem a evolução Browniano, enquanto que para os valores de lambda igual a 0 corresponde à ausência completa da estrutura filogenética (filogenia star-like). A estimativa de lambda pode ser comparada a zero pelo cálculo de uma razão de probabilidade (likelihood) e comparando-a com uma distribuição de Qui-quadrado com um grau de liberdade. Para as análises nós usamos a função 'phylosig' do pacote 'phytools' (Revell 2012) no software R (R Development Core Team 2010).

### *4.3.3 Mecanismos antipredação vs características funcionais*

Afim de avaliar a resposta da diversidade de mecanismos antipredação de cada espécie relacionados ao tamanho do corpo, modo de desenvolvimento reprodutivo, hábito, *habitat* e atividade, nós utilizamos uma analise de permutação multivariada de variância (PERMANOVA), com 1,000 permutações com base numa matriz de distância euclidiana através da função "adonis". Além disso, usamos Boxplots para visualizar as características que melhor explicaram a diversidade de mecanismos antipredação geradas pela PERMANOVA. Realizamos as análises usando o pacate 'vegan' (Oksanen et al. 2013), em R (Team R Development Core 2012).

### *4.3.4 Distribuição geográfica vs. mecanismos antipredação*

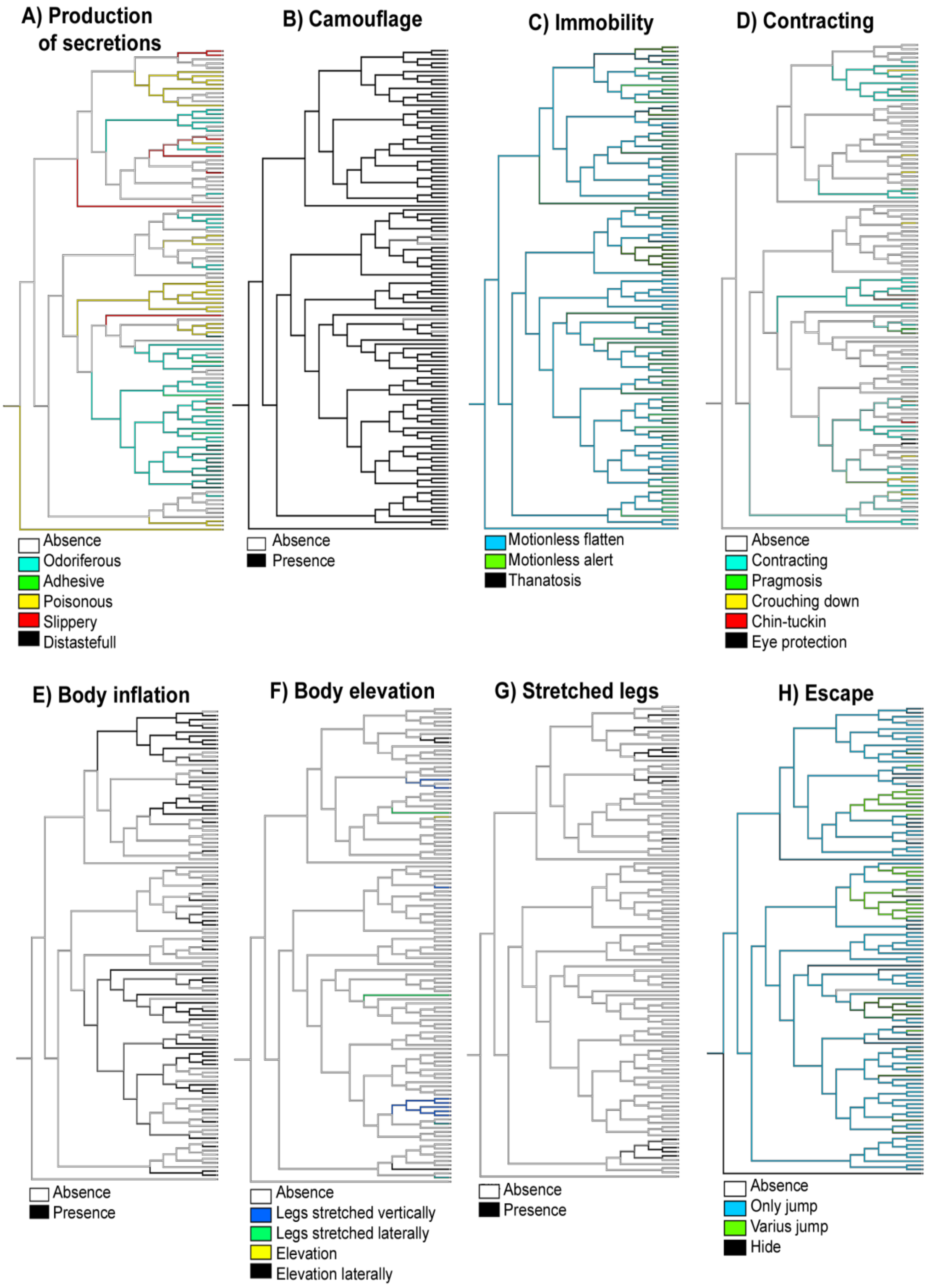
Para avaliar se as espécies com diversidade de mecanismos antipredação influenciam a área de ocorrência das espécies, usamos matrizes de correlação para comparar a diversidade de mecanismos de cada espécie e suas referências espaciais (intervalos de distribuição), utilizando modelos de regressão linear simples. Estas correlações foram realizadas para todos os mecanismos e suas variações (ver Tabela 1). As analises foram realizadas utilizando o pacote 'vegan' (Oksanen et al. 2007) em R (Team R Development Core 2012).

## 4.4 Resultados

### *4.4.1 Estados ancestrais*

Os resultados mostraram que os mecanismos antipredação de camuflagem, imobilidade, lutar, e fuga são os estados ancestrais de Anura e Gymnophiona (simplesiomórficos) com base em 115 espécies (duas ordens, 14 famílias e 12 subfamílias, ver a Figura 2, 3 e 4). O mecanismo de lutar não aparece como estado ancestral apenas para as famílias Dermophiidae, Hemiphractidae, Phyllomedusidae e Odontophrynidae. O mecanismo de fuga apresenta duas variações apomórficas em anuros "único pulo" e "vários pulos" sendo que "vários pulos" é um estado homólogo para as famílias Brachycephalidae e Eleutherodactilidae (subfamília Ceuthomantinae), tendo evoluído de forma independente na subfamília Leptodactilinae (homoplasia) (Figura 4E).

O mecanismo de inflar o corpo é um estado apomórfico que surgiu independentemente através de diferentes ancestrais, sendo considerado homoplastico em Bufonidae, Microhylidae (sinapomorfia de Gastrophryninae), Leptodactylidae (sinapomorfia de Leptodactiilinae e Leiuperinae), Craugastoridae (sinapomorfia de Holoadeninae), Hylidae (sinapomorfia de Cophomantinae) e Cycloramphidae (Figura 3E).



A) Production of secretions

B) Camouflage

C) Immobility

D) Contracting

E) Body inflation

F) Body elevation

G) Stretched legs

H) Escape

**Figura 3.** Reconstrução filogenética parcimoniosa entre os mecanismos antipredação e a árvore original.

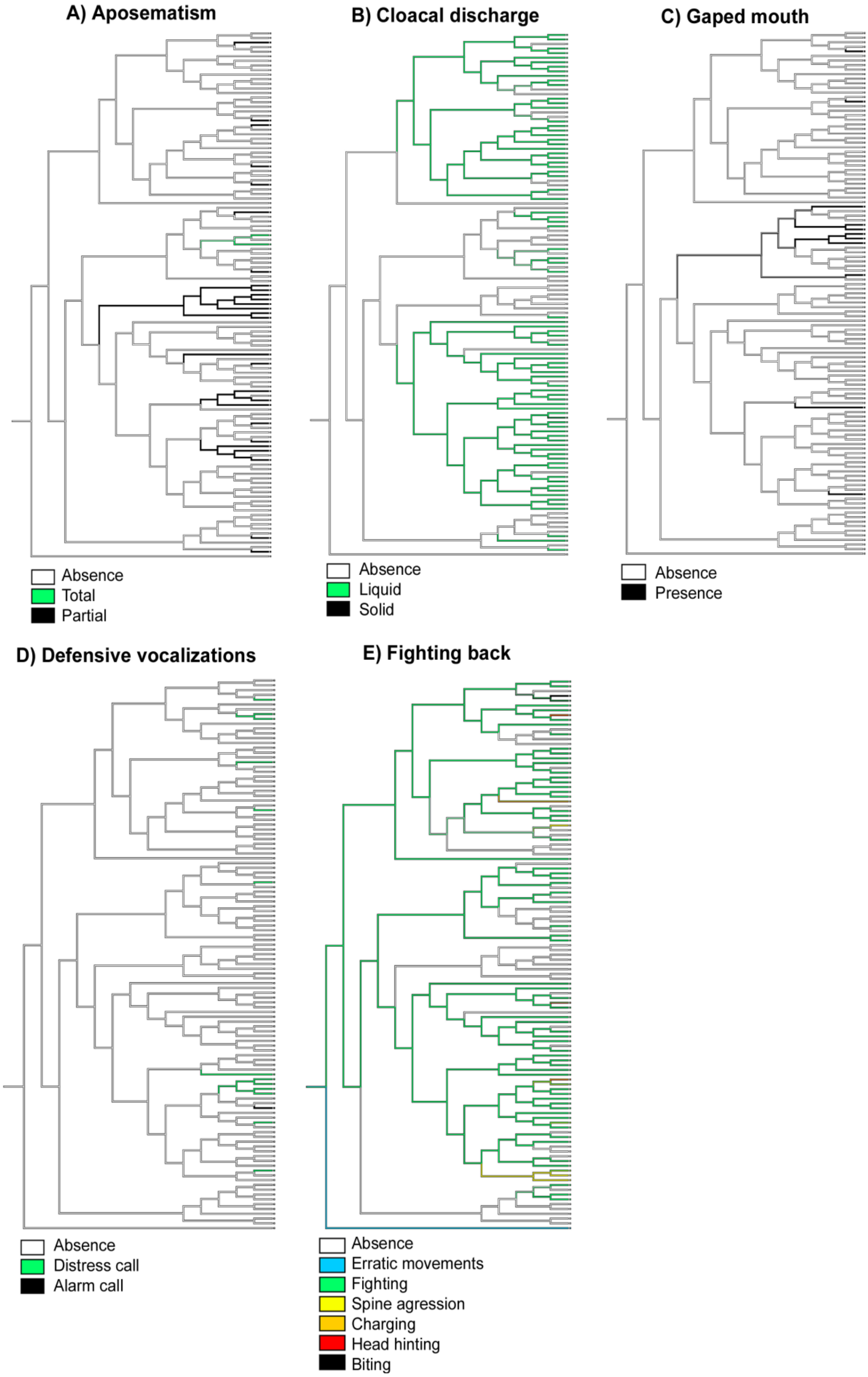


**Figura 4.** Reconstrução filogenética parcimoniosa entre os mecanismos antipredação e a árvore original.

**Tabela 4.** Lista de mecanismos antipredação ancestrais para cada Ordem, Família e Subfamília das 115 espécies de anfíbios na Floresta Atlântica geradas pelas árvores parcimoniosas.

| | **Mecanismos de Antipredação Ancestrais** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ordem/Familia/ Subfamilia** | **Produzir secreções** | **Camuflagem** | **Imobilidade** | **Contração** | **Inflar o Corpo** | **Elevar o Corpo** | **Manter as pernas esticadas** | **Escapar** | **Aposematismo** | **Discarga Cloacal** | **Abrir a Boca** | **Vocalização defensiva** | **Lutar contra o predador** |
| **Gymnophiona** | **Ausência e Tôxico** | **Presença** | **Imovel agachada** | Ausência | Ausência | Ausência | Ausência | **Esconder** | Ausência | Ausência | Ausência | Ausência | **Movimentos erraticos & Lutar** |
| **Dermophiidae** | Ausência | **Presença** | **Imovel agachada** | Ausência | Ausência | Ausência | Ausência | Ausência | Ausência | Ausência | Ausência | Ausência | Ausência |
| **Anura** | Ausência | **Presença** | **Imovel agachada** | Ausência | Ausência | Ausência | Ausência | **Único pulo** | Ausência | Ausência | Ausência | Ausência | **Lutar** |
| **Bufonidae** | **Tôxico** | **Presença** | **Imovel agachada** | **Contração** | **Presença** | Ausência | Ausência | **Único pulo** | Ausência | **Liquido** | Ausência | Ausência | **Lutar** |
| **Brachycephalidae** | Ausência | **Presença** | **Imovel agachada** | Ausência | Ausência | Ausência | Ausência | **Vários pulos** | Ausência | Ausência | **Ausência & Presença** | Ausência | **Lutar** |
| **Craugastoridae** | Ausência | **Presença** | **Imovel agachada** | Ausência | Ausência | Ausência | Ausência | **Único pulo** | Ausência | Ausência | **Ausência & Presença** | Ausência | **Lutar** |
| Ceuthomantinae | **Odorifero** | **Presença** | **Imovel agachada** | Ausência | Ausência | Ausência | Ausência | **Vários pulos** | Ausência | **Liquido** | Ausência | Ausência | **Lutar** |
| Craugastorinae e Holoadeninae | Ausência | **Presença** | **Imovel agachada** | Ausência | Ausência | Ausência | Ausência | **Único pulo** | Ausência | Ausência | **Presença** | Ausência | **Lutar** |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cycloramphidae** | Ausência | **Presença** | **Imovel agachada & Thanatosis** | Ausência | **Presença** | Ausência | Ausência | **Único pulo** | Ausência | **Liquido** | Ausência | Ausência | **Lutar & Morder** |
| **Eleutherodactylidae** | Ausência | **Presença** | **Imóvel agachada** | Ausência | Ausência | Ausência | Ausência | **Único pulo** | Ausência | Ausência | **Ausência & Presença** | Ausência | **Lutar** |
| Phyzelaphryninae | Ausência | **Presença** | **Imóvel agachada** | Ausência | Ausência | Ausência | Ausência | **Único pulo** | Ausência | Ausência | **Ausência & Presença** | Ausência | **Lutar** |
| **Hemiphractidae** | Ausência | **Presença** | **Imóvel agachada** | **Contração** | Ausência | Ausência | Ausência | **Único pulo** | Ausência | **Liquido** | Ausência | Ausência | Ausência |
| **Hylidae** | Ausência | **Presença** | **Imóvel agachada** | Ausência | **Ausência & Presença** | Ausência | Ausência | **Único pulo** | Ausência | **Liquido** | Ausência | Ausência | **Lutar** |
| Comophantinae | **Odorifero** | **Presença** | **Imóvel agachada** | **Ausência & Contração** | **Ausência & Presença** | Ausência | Ausência | **Único pulo** | Ausência | **Liquido** | Ausência | Ausência | **Lutar** |
| Dendropsodinae | Ausência | **Presença** | **Imóvel agachada** | Ausência | **Ausência & Presença** | Ausência | Ausência | **Único pulo** | Ausência | **Liquido** | Ausência | Ausência | **Lutar** |
| Lophyohylinae | Ausência | **Presença** | **Imóvel agachada** | Ausência | **Ausência & Presença** | Ausência | Ausência | **Único pulo** | Ausência | **Liquido** | Ausência | Ausência | **Lutar** |
| Pseudinae | Ausência | **Presença** | **Imóvel agachada** | Ausência | Ausência | Ausência | Ausência | **Único pulo** | Ausência | Ausência | Ausência | Ausência | **Lutar** |
| Scinaxinae | **Odorifero** | **Presença** | **Imóvel agachada** | Ausência | **Ausência & Presença** | Ausência | Ausência | **Único pulo** | Ausência | **Liquido** | Ausência | Ausência | **Lutar** |
| **Hylodidae** | **Escorregadia** | **Presença** | **Imóvel agachada & Thanatosis** | Ausência | **Presença** | Ausência | Ausência | **Único pulo** | Ausência | **Liquido** | Ausência | Ausência | **Lutar** |
| **Leptodactylidae** | Ausência | **Presença** | **Imóvel agachada** | Ausência | Ausência | Ausência | Ausência | **Único pulo** | Ausência | **Liquido** | Ausência | Ausência | **Ausência & Lutar** |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Leiuperinae | Ausência | **Presença** | **Imóvel agachada** | Ausência | Ausência | Ausência | Ausência | **Único pulo** | Ausência | **Liquido** | Ausência | Ausência | **Lutar** |
| Leptodactyliniae | **Ausência e Escorregadia** | **Presença** | **Imóvel agachada** | Ausência | **Presença** | Ausência | Ausência | **Vários pulos** | Ausência | **Liquido** | Ausência | Ausência | **Lutar** |
| Paratelmatobiinae | Ausência | **Presença** | **Imóvel agachada** | Ausência | Ausência | Ausência | Ausência | **Único pulo** | Ausência | **Liquido** | Ausência | Ausência | **Ausência & Lutar** |
| **Microhylidae** | **Odorifero** | **Presença** | **Imóvel agachada** | Ausência | Ausência | Ausência | Ausência | **Único pulo** | Ausência | **Liquido** | Ausência | Ausência | **Lutar** |
| **Odontophrynidae** | Ausência | **Presença** | **Imóvel agachada** | **Ausência & Contração** | Ausência | Ausência | Ausência | **Único pulo** | Ausência | Ausência | Ausência | Ausência | Ausência |
| **Pipidae** | Ausência | **Presença** | **Imóvel agachada** | Ausência | Ausência | Ausência | Ausência | **Único pulo** | Ausência | Ausência | Ausência | Ausência | **Lutar** |
| **Phyllomedusidae** | **Tôxico** | **Presença** | **Imóvel agachada** | **Contração** | Ausência | Ausência | Ausência | **Único pulo** | **Parcial** | Ausência | Ausência | Ausência | Ausência |

O mecanismo de produzir secreções, apesar de ser um estado simplesiomórfico, apareceu em Anura de forma homoplástica com diferentes especializações ou ajustes ao longo de sua evolução. Duas subfamílias dentro de Hylidae (Scinaxinae e Cophomantinae) apresentam uma produção de secreção do tipo odorífera como característica homóloga. O mecanismo de produzir secreções do tipo escorregadia, é uma característica homoplástica presente na família Hylidae e na subfamília Leptodactylinae. O mecanismo de produzir secreções tôxica está presente em Bufonidae e Phyllomedusidae (homoplasia) (Figura 2A).

O mecanismo de contração é apomorfico e surgiu de forma independente em Anura; ele é considerado uma homoplasia em Bufonidae, Hemipractidae, Phyllomedusidae, Odontophrynidae e na subfamília Comophantinae. O mecanismo de abrir a boca é um estado apomórfico, homólogo em Terrarana (que corresponde as Famílias Craugastoridae, Brachycephalidae e Eleutherodactylidae) e pode ser uma sinapomorfia para o grupo Terrarana (Figura 3D). O mecanismo de elevar o corpo, manter as pernas esticadas e vocalizações defensivas não foram indicados como mecanismos ancestrais em nenhum dos “nós” avaliados (ver Tabela 4).

### *4.4.2 Sinal filogenético*

Oss resultados indicaram que por meio do índice de Abouheif que a maioria dos mecanismos antipredação apresenta um sinal filogenético significativo. Os mecanismos que mostraram sinais filogenéticos fortes foram o de produzir secreções (média C = 0,43, p <0,05) e imobilidade (média C = 0,42, p <0,05), seguido por lutar (média C = 0,33, p <0,05) e manter as pernas esticadas (média C = 0,33, p <0,05) com valores ligeiramente baixos. Os mecanismos de contração (média C = 0,11, p> 0,05) e de inflar o corpo (média C = 0,08, p> 0,05), não mostraram sinais filogenéticos significativos (Tabela 2 Figura 5).

**Tabela 2.** Resultados dos indices de Pagel e Abouheif

| **Mecanismos Antipredação** | **Pagel's λ** | ***P*** | **Abouheif's C-mean** | ***P*** |
|---|---|---|---|---|
| Produzir secreções | 1.0145 | 0.0000 | 0.4273 | 0.001 |
| Camuflagem | 0.8200 | 0.0008 | 0.1707 | 0.031 |
| Imobilidade | 0.7897 | 0.0000 | 0.4204 | 0.001 |
| Contração | 0.0680 | 0.3834 | 0.0800 | 0.063 |
| Inflar o corpo | 0.0001 | 1.0000 | 0.2192 | 0.099 |
| Elevar o corpo | 0.0001 | 1.0000 | 0.3337 | 0.011 |
| Manter as pernas esticadas | 0.5073 | 0.0001 | 0.2323 | 0.001 |
| Escapar | 0.7729 | 0.0001 | 0.2465 | 0.001 |
| Aposematismo | 0.5052 | 0.0001 | 0.2973 | 0.003 |
| Descarga cloacal | 0.6911 | 0.0000 | 0.2667 | 0.001 |
| Abrir a boca | 0.7310 | 0.0000 | 0.1950 | 0.001 |
| Vocalização defensiva | 0.2065 | 0.3236 | 0.3278 | 0.006 |
| Lutar contra o predador | 0.6304 | 0.0086 | 0.4273 | 0.001 |

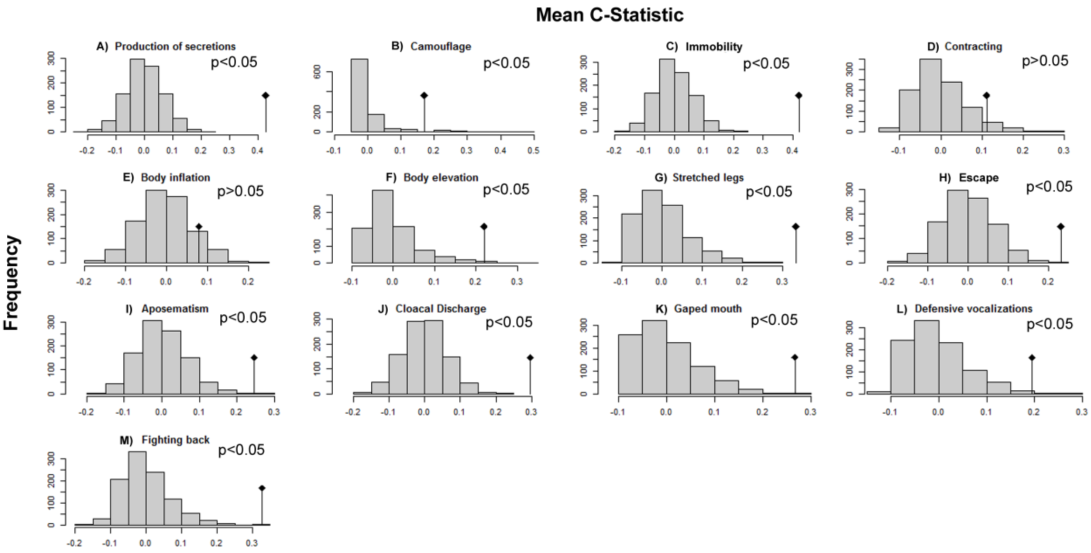


**Figura 5.** Os círculos negros indicam a posição da média observada em relação à distribuição da média estatística-C randomizados. O P-valor da estatística C média observada é significante em um alfa de 0,05. As simulações representam a média estatística-C calculada a partir dos mecanismos antipredação ao longo das pontas da filogenia.

### *4.4.3 Valores de lambda (λ): evolução Browniano*

Os valores de Pagel lambda indicaram que os mecanismos de produzir secreção (λ = 1,01, p <0,001) valor acima de 1, camuflagem (λ = 0,82, p <0,001) e imobilidade (λ = 0,79 p <0,001) mostraram valores próximos de 1. Os mecanismos de contração (λ = 0,07, p >0,001), inflar o corpo (λ = 0,00, p >0,001) e elevação do corpo (λ = 0,00, p >0,001) não apresentaram valores significativos de evolução Browniano (Tabela 2; Figura 6).

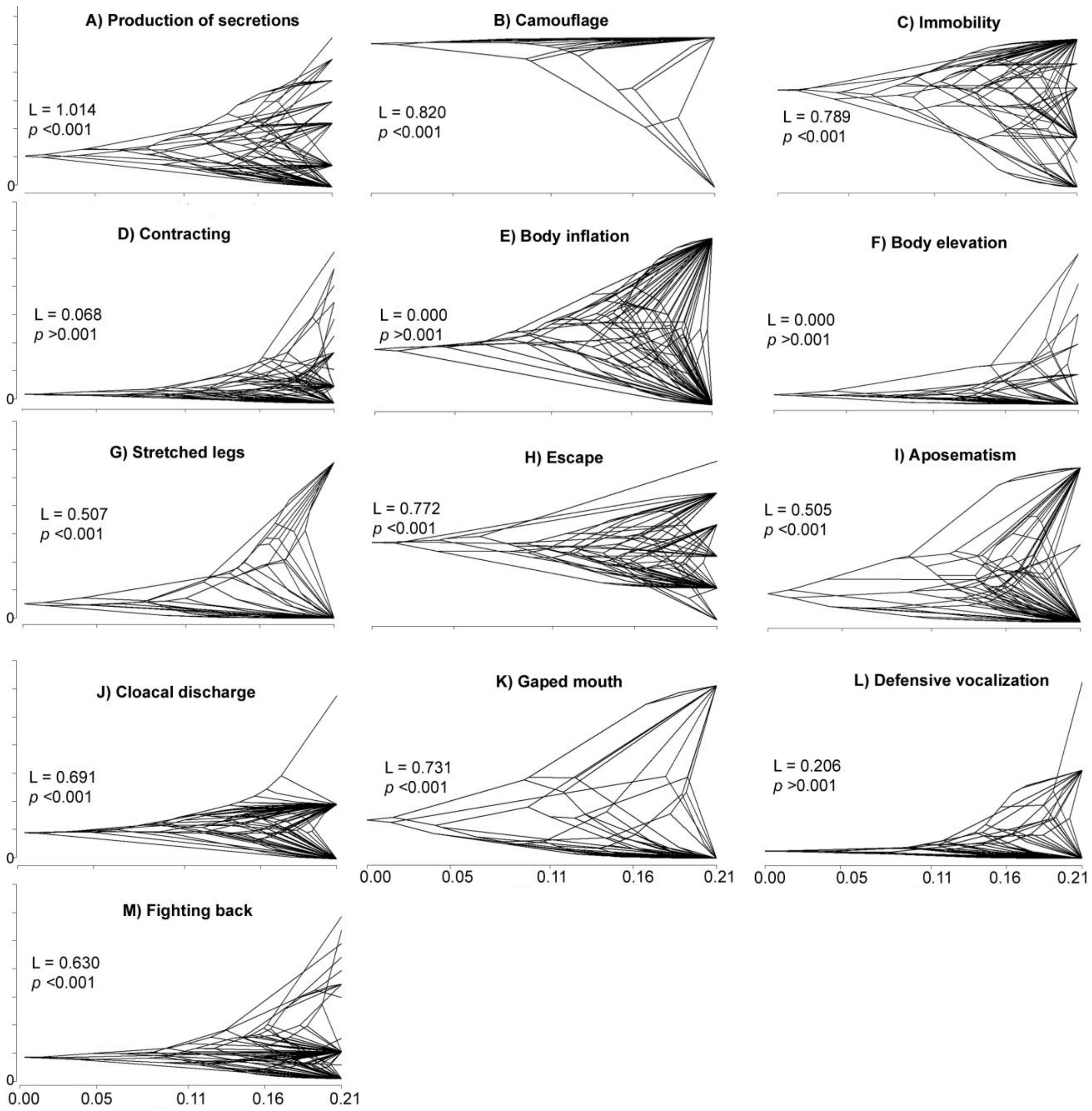


**Figura 6.** Os fenogramas mostra as simulações e os valores lambda Pagel (λ). Eixo 'x' indica o número de tipos de mecanismos antipredação, o eixo 'y' a escala de tempo em milhões de anos. O P-valor do teste lambda (L) é estatisticamente significante em um alfa de 0,001.

### *4.4.4 Mecanismos antipredação vs. características funcionais*

Os resultados mostraram que as características funcionais explicaram 40,4% da diversidade de mecanismos antipredação de acordo com as analises de PERMANOVA.

O hábito foi responsável por cerca de 25,1%, o tamanho do corpo de 5,2%, a atividade de 5,0% e *habitat* 4,9%. O modo de desenvolvimento reprodutivo não mostrou qualquer relação significativa com a diversidade de mecanismos antipredação (Tabela 3). O Boxplot mostrou que as espécies arbóreas e fossoriais, espécies médias e grandes, espécies noturnas e de áreas abertas possuem maior diversidade de mecanismos antipredação (Figura 7).

**Tabela 3** Associação da diversidade de mecanismos antipredação as características funcionais dos anfíbios da Floresta Atlântica Brasileira pela PERMANOVA.

| Variáveis | df | $F$ model | $R^2$ | $P$ value |
|---|---|---|---|---|
| Atividade | 1 | 9.463 | 0.05060 | 0.002 |
| Tamanho do corpo | 1 | 9.857 | 0.05271 | 0.001 |
| Habito | 1 | 47.100 | 0.25187 | 0.001 |
| *Habitat* | 1 | 9.306 | 0.04976 | 0.001 |
| Desenvolvimento reprodutivo | 1 | 2.275 | 0.01217 | 0.108 |
| Resíduos | 109 |  | 0.58289 | – |
| Total | 114 | – | 1.00000 | – |

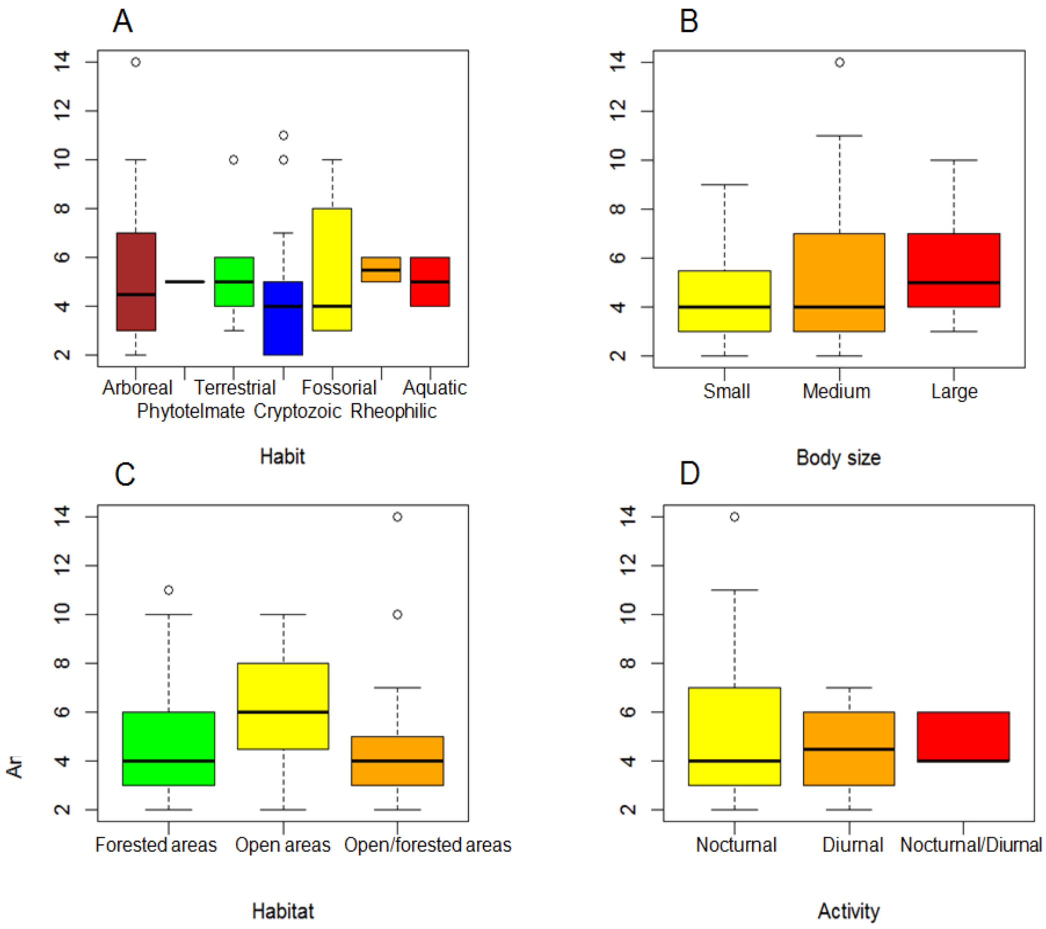


**Figura 7.** O Boxplot mostra a relação entre as características funcionais e a diversidade de mecanismos antipredação.

### *4.4.5 Distribuição geográfica vs mecanismos antipredação*

Os resultados do modelo linear mostraram valores significativos em relação à diversidade de mecanismos antipredação ($r^2 = 0,15$, $p < 0,001$). Espécies que tem mais mecanismos apresentam maior distribuição geográfica na Floresta Atlântica (Figura 8).

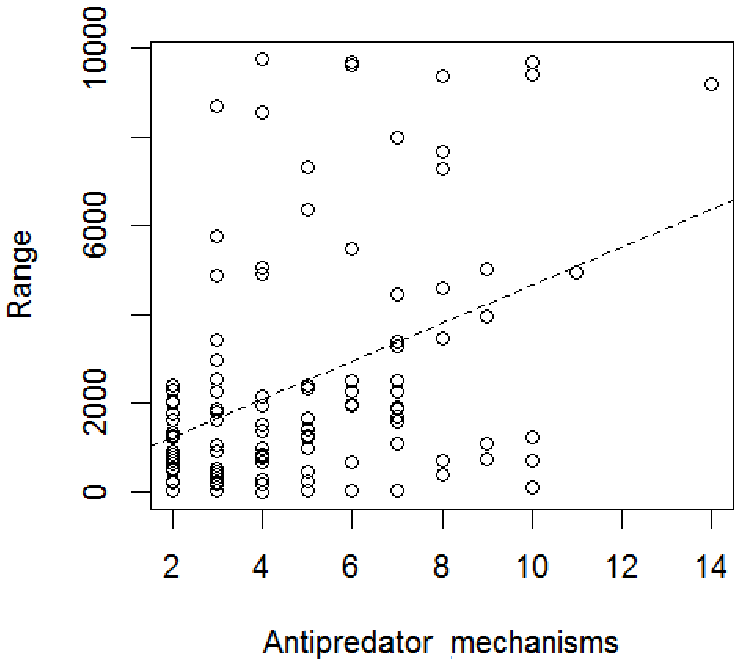


**Figura 8.** Relação entre os mecanismos antipredação e a distribuição geográfica de 115 espécies analisadas. Cada range representa uma grade de 10 x 10 km.

## 4.5 DISCUSSÃO

Mecanismos ancestrais que possuem um forte sinal filogenético (produzir secreções e imobilidade) são simplesiomórficos e sua evolução ocorreu de forma independente em diferentes grupos taxonômicos (homoplásticos). Os resultados mostraram que a evolução destes mecanismos é aleatória, seguindo um modelo de evolução Browniano. Para o mecanismo de produzir secreções, os resultados mostraram que é puramente filogenética e também sugere um nível mais forte nas raízes das árvores do que nas pontas.

De acordo com Brodie (1977, 1983), o mecanismo de produzir secreções pode direcionar a diversidade de mecanismos antipredação. Dependendo da eficiência da secreção que a espécie libera, pode determinar uma redução na diversidade de mecanismos antipredação devido ao sucesso deste mecanismo (Meyers et al. 1978, 1986 Sih, Harvell 1990, 1992 Bronmark e Miner, Yadete et al. 2012). Os dados mostraram que as espécies que produzem secreções podem direcionar a evolução e surgimento de novos mecanismos em sinergia. De acordo com os resultados, famílias com espécies tóxicas geralmente têm mecanismos de contração atuando em sinergia. Por exemplo, as espécies da família Phyllomedusidae têm mecanismos antipredação mais passivos (ou seja, não apresentam contato agressivo com o predador). Para as espécies desta família a combinação dos mecanismos de produzir secreções tóxicas, aposematismo parcial, imobilidade do tipo encolhido, camuflagem e contração parecem ter chegado a um sucesso contra a predação. Entretanto, o mecanismo de produzir secreções do tipo escorregadia (Família Hylodidae), dirige espécies a desenvolverem estratégias sinergéticas pós-predador (lutar, fugir "vários pulos", camuflagem e imobilidade “alerta”).

O mecanismo de camuflagem curiosamente não apresenta um forte sinal filogenético, mas uma forte influência sobre o modelo Browniano de evolução. Mecanismos comuns entre Gymnophiona e Anura (como camuflagem e imobilidade) são simplesiomórficos e, possivelmente, os primeiros mecanismos de defesa em anfíbios. O mecanismo de camuflagem apresenta pouca mudança evolutiva, com poucas espécies totalmente aposemáticas na Floresta Atlântica, enquanto que a imobilidade sofreu alterações mais recentes (como imobilidade do tipo “tanatose”). Ambos os mecanismos (ou seja, camuflagem e imobilidade) têm forte influência a uma evolução aleatória, mas não com um forte sinal, sugerindo influências ecológicas como pressões evolutivas seletoras.

O mecanismo de contração é usado em sinergia com algum tipo de mecanismo de produzir secreções que pode causar ou fornecer a regurgitação da presa pelo predador (Sazima 1974, Toledo et al 2010). Contração é um mecanismo ancestral para as famílias Bufonidae, Phyllomedusidae, Odontophrynidae e Hemipractidae e Subfamília Cophamantinae (sinapomorfia para esta subfamília) e sua evolução é homoplástica (ver Tabela 4 e Figura 3D). No entanto, não apresenta sinais de evolução Browniano, e suas origens são concentradas nas pontas das árvores (Figura 6D). Isto sugere que a evolução deste mecanismo pode ter surgido através da ocorrência na espécie ancestral de um tipo de mecanismo de produzir secreção dos tipos tóxicos ou desagradáveis.

O mecanismo de manter as pernas esticadas apresenta sinal filogenético, mas um fraco sinal de evolução aleatória (Browniano). Este mecanismo é homoplastico para Cycloramphidae, Bufonidae, Microhylidae (sinapomorfia em Gastrophryninae), Leptodactylidae (sinapomorfia em Paratelmatobinae) e Odontophrynidae. Sua evolução parece ser recente surgindo de forma independente (homoplásticos) nas diferentes famílias e subfamílias de anuros (mecanismo apomórfico).

De acordo com Gingras e Ficth (2013) o canto de anúncio tem forte relação filogenética entre os gêneros de anuros. Entretanto, os dados não mostram esse padrão para o mecanismo de vocalização defensiva. Este mecanismo é um estado apomórfico com origem homoplástica em Cycloramphidae, Bufonidae, Microhylidae (Gastrophryninae), Leptodactylidae (Leiuperinae) e Hylidae (Scinaxinae e Cophomantinae). O mecanismo de vocalização defensiva "alarme" foi registrado em estudos recentes (Toledo et al. 2015 e Lourenço-de-Moraes et al. 2016), sugerindo que os mecanismos de vocalização defensiva tenham origens etológicas. Este mecanismo é uma sinapomorfia nas subfamílias Comophantinae (Figura 4D) e Hemiphractinae (veja Toledo et al. 2015; Lourenço-de-Moraes et al. 2016).

O mecanismo de abrir a boca é um estado apomórfico e homólogo em Terrarana (Brachycephalidae, Craugastoridae e Eleutherodactylidae). Este grupo tem espécies diminutas e seus principais predadores são os artrópodes (Toledo 2005; Lourenço-de-Moraes e Pertel 2011). Este mecanismo deve desorientar estes pequenos predadores; com um forte sinal filogenético apresenta alta tendência a um modelo de evolução Browniano concentrado nas raízes da árvore em Terrarana (Figura 4C e 6K). A miniaturização das espécies deste grupo pode ter influenciado origem deste mecanismo (Hedges et al. 2008; Carvalho et al. 2011). No entanto, esse comportamento também foi observado (mas não foi incluído na nossa árvore) em famílias de espécies maiores como Hemiphractidae e Ceratophryidae (Duellman e Trueb 1994; Toledo et al. 2011). Mas esse mecanismo geralmente é exibido por espécies maiores aparecendo em sinergia com os mecanismos de inflar o corpo, lutar (do tipo morder) e vocalização defensiva (ver Toledo et al. 2011; Lourenço-de-Moraes et al. 2016). Em espécies diminutas de Terrarana estes mecanismos não aparecem em sinergia com outros comportamentos (veja Lourenço-de-Moraes et al. 2014b) que sugerem que este mecanismo evoluiu de forma homoplástica nos diferentes grupos.

Os mecanismos sem sinais filogenéticos (inflar o corpo e contração) também não seguem um modelo de evolução aleatória, estes mecanismos evoluíram de forma independente. Estes mecanismos parecem ser recentes em termos evolutivos (ver Figura 6 D, F) principalmente o mecanismo de contração. No entanto, aparecem como mecanismos ancestrais surgidos de forma homoplástica em algumas famílias e subfamílias. O surgimento de mecanismos com origens filogenéticas recentes sugere origens etológicas. A capacidade de memorizar um determinado recurso defensivo que obteve sucesso é que ajuda o animal a manter este comportamento, está presente mesmo em invertebrados (Punzo 2004). Demonstrando a capacidade de aprendizagem em resposta a um estímulo de ameaça, essa característica seletora é necessária para a sobrevivência da presa. Espécies que vivem próximas apresentam repertório similar de mecanismos antipredação (presente estudo), mas ainda são necessários mais testes.

Os resultados revelam que o mecanismo de lutar apresenta um sinal filogenético fraco e um valor baixo para uma evolução Browniano. Toledo e colaboradores (2011) sugeriram que o mecanismo de lutar do tipo morder pode estar relacionado ao cuidado parental. Lourenço-de-Moraes e colaboradores (2016) encontraram evidências de que morder pode realmente ser de cuidado parental. Figueiredo e colaboradores (no prelo) registraram uma fêmea grávida de *Ischnocnema henseli* realizando o mecanismo de lutar do tipo “morder”. Esta espécie apresenta desenvolvimento reprodutivo direto, espécies deste grupo foram encontradas desempenhando cuidado parental (Townsend et al. 1996; Ryan et al. 2010). É possível que este mecanismo tenha origem etológica com base em pressões ecológicas devido às suas características filogenéticas ancestrais. A família Cycloramphidae tem o mecanismo de lutar do tipo “morder” com origem homoplástica.

As especializações ecológicas das espécies de anfíbios apresentam de um modo geral, uma forte pressão evolutiva em relação aos seus mecanismos antipredação. Os resultados mostraram que características funcionais explicam 40,4% da diversidade de mecanismos. A característica funcional "hábito" foi a que mais explicou a diversidade de mecanismos antipredação. As características funcionais podem ajudar a explicar a distribuição das espécies (Gaston 1990; Lawton 1993; Diaz et al. 2007; Gomes-Rodrigues 2015), portanto, as espécies que estão mais expostas aos predadores, como as espécies arbóreas (Figura 7A), consequentemente apresentam maior diversidade de predadores, como aves, répteis, mamíferos e invertebrados (Toledo 2005, 2007; Pombal Jr 2007), devido a isso espera-se que esta pressão ecológica influencie as respostas rápidas e eficazes para a sobrevivência da espécie selecionando os mais aptos. Espécies fossoriais apresentam redução dos membros posteriores que foram adaptados a escavação (Haddad et al. 2013), e por causa disso, perderam uma das principais defesas das espécies terrestres, como o mecanismo de fugir com vários saltos. Devido a isso, eles desenvolveram uma maior diversidade de mecanismos antipredação (Figura 7A). Os resultados mostram que as espécies com tamanho corporal médio e grande têm maior diversidade de mecanismos antipredação. Isto sugere que estas espécies, devido ao tamanho, se tornam mais expostas a predação que as espécies pequenas e portanto, desenvolveram uma maior diversidade de mecanimos antipredação, bem como espécies de áreas abertas.

É amplamente documentada a influência das características funcionais na dispersão de espécies, tais como o tamanho do corpo e especializações ecológicas

(Brown e Maurer 1989; Bell 2001). Os resultados confirmam a hipótese sugerida por Lourenço-de-Moraes et al. (2016) de que as espécies com uma diversidade de mecanismos antipredação apresentam maior distribuição geográfica. Uma das principais barreiras bióticas para dispersão dos anfíbios são o número de predadores (Toledo et al. 2007) uma maior diversidade de mecanismos antipredação fornece a uma presa em potencial maior capacidade de sobreviver a diversidade de predadores que consomem anfíbios.

Apesar das diferenças de mecanismos antipredação que podem ocorrer entre populações, e alguns indivíduos podem apresentar mais mecanismos do que outros (com. pessoal), as características filogenéticas das espécies podem influenciar ou direcionar espécies de diferentes populações, mas sob pressões ecológicas semelhantes a apresentarem o mesmo comportamento, isso devido à alta plasticidade dos anfíbios (Lawler 1989; Horat e Semlitsch 1994; Relyea 2001; Urban et al. 2014).

Os resultados mostram que a origem dos mecanismos antipredação e sua diversificação é altamente plástico e rápido. As diferentes estratégias entre os anfíbios proporcionam maior sobrevida aos predadores e, consequentemente, a dispersão das espécies. Especializações as várias características funcionais, agem como uma forte pressão seletiva e adaptativa em anfíbios. Mecanismos antipredação podem ter origem puramente filogenética ou origens etológicas/ecológicas selecionados por um processo de “seleção natural”, através da aprendizagem em resposta a possíveis predadores no passado. Sendo assim fornecemos novas perspectivas sobre os mecanismos antipredação e a plasticidade dos anfíbios.

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# 5 CONCLUSÕES GERAIS

Neste trabalho confirmamos os efeitos das alterações antrópicas na distribuição das espécies de anfíbios na Floresta Atlântica. A riqueza de espécies esta associado a características abióticas ideais, devido as suas características fisiológicas dependentes de umidade e temperatura amenas e relacionada com eventos históricos como o Pleistoceno glacial. Espécies menores estão relacionadas a suas sensibilidades fisiológicas as alterações abióticas, e espécies maiores e mais adaptadas tem maior dispersão dos que as espécies menores. Em média, as áreas com maiores altitudes possuem menores espécies e endêmicas, ao passo que áreas com menores latitudes possuem média de espécies maiores. As análises de diversidade filogenética e funcional mostraram os principais *hotspots* são a Serra do Mar e o Corredor Central da Floresta Atlântica e confirmaram que as áreas de altitude podem servir como um refúgio climático para as espécies em um cenário de aquecimento global durante o Atropoceno. Além disso, mostramos alta relação entre diversidade filogenética e funcional respondendo da mesma forma quanto a riqueza de espécies e distribuição. Apresentamos também, a origem dos mecanismos antipredação, bem como a influência das adaptações ecológicas na diversidade de mecanismos bem como a diversidade destes mecanismos influenciando na distribuição das espécies de anfíbios na ameaçada Floresta Atlântica brasileira. Esta tese demonstra principalmente os diversos fatores bióticos e abióticos que trabalhando em sinergia explicam a riqueza, origem e permanência das espécies nas florestas do Bioma Floresta Atlântica.

APÊNDICE 1- **Table S1.** List of species studied in alphabetical order with their respective distribution area (range = grid of 10 x 10 km) and functional traits.

| **Species** | **Range** | **Activity** | **Body size (cm)** | **Poisonous** | **Habit** | **Habitat** | **Development mode** | **References** |
|---|---|---|---|---|---|---|---|---|
| *Adelophryne glandulata* | 3 | Nocturnal | 1.2 | Non-toxic | Cryptozoic | Forest areas | Direct | Lourenço-de-Moraes *et al.*, 2014; present study |
| *Adelophryne meridionalis* | 2 | Nocturnal | 1.1 | Non-toxic | Cryptozoic | Forest areas | Direct | Santana *et al.*, 2012; present study |
| *Adelophryne mucronatus* | 38 | Nocturnal | 1.4 | Non-toxic | Cryptozoic | Forest areas | Direct | Lourenço-de-Moraes *et al.*, 2012a; Haddad *et al.*,2013; present study |
| *Adelophryne pachydactyla* | 301 | Nocturnal | 1.4 | Non-toxic | Cryptozoic | Forest areas | Direct | Lourenço-de-Moraes *et al.*, 2012; Haddad *et al.*,2013; present study |
| *Adenomera ajurauna* | 27 | Nocturnal | 1.9 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Adenomera araucaria* | 66 | Nocturnal | 1.9 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Adenomera bokermanni* | 2624 | Nocturnal | 2.4 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Adenomera engelsi* | 45 | Diurnal/nocturnal | 2.2 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Adenomera marmorata* | 2378 | Diurnal/nocturnal | 2.1 | Non-toxic | Cryptozoic | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Adenomera nana* | 224 | Nocturnal | 1.8 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Adenomera thomei* | 299 | Nocturnal | 2.4 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Allobates alagoanus* | 6 | Diurnal | 1.5 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Allobates* | 578 | Diurnal | 1.6 | Non-toxic | Rheophilic | Open and | Indirect | Haddad *et al.*, 2013; present study |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *capixaba* | | | | | | Forest areas | | |
| *Allobates olfersioides* | 2322 | Diurnal | 1.6 | Non-toxic | Rheophilic | Open and Forest areas | Indirect | Haddad *et al.*, 2013; Lourenço-de-Moraes *et al.*, 2013; present study |
| *Aparasphenodon arapapa* | 842 | Nocturnal | 4.5 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; Lourenço-de-Moraes *et al.*, 2013; present study |
| *Aparasphenodon bokermanni* | 2 | Nocturnal | 4.6 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Aparasphenodon brunoi* | 2532 | Nocturnal | 8 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Aplastodiscus albofrenatus* | 435 | Nocturnal | 3.9 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Aplastodiscus albosignatus* | 1077 | Nocturnal | 4.3 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Aplastodiscus arildae* | 1903 | Nocturnal | 3.7 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Aplastodiscus callipygius* | 404 | Nocturnal | 4.6 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Aplastodiscus cavicola* | 587 | Nocturnal | 3.7 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Aplastodiscus cochranae* | 173 | Nocturnal | 4.5 | Unpalatable or bad odour | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Aplastodiscus ehrhardti* | 395 | Nocturnal | 3.1 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Aplastodiscus eugenioi* | 269 | Nocturnal | 3.5 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Aplastodiscus flumineus* | 9 | Nocturnal | 4.5 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Aplastodiscus ibirabitanga* | 519 | Nocturnal | 4.1 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *Aplastodiscus leucoeygius* | 1588 | Nocturnal | 4.5 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Aplastodiscus musicus* | 13 | Nocturnal | 5 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Lutz 1949; Cruz *et al.*, .2004; present study |
| *Aplastodiscus perviridis* | 5781 | Nocturnal | 4.5 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Aplastodiscus sibilatus* | 271 | Nocturnal | 3.2 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Aplastodiscus weygoldti* | 34 | Nocturnal | 3.8 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Arcovomer passarellii* | 779 | Nocturnal | 2.4 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Bokermannohyla ahenea* | 2 | Nocturnal | 5.2 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Bokermannohyla astartea* | 1101 | Nocturnal | 4.4 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Bokermannohyla capra* | 32 | Nocturnal | 6.1 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Bokermannohyla caramaschii* | 358 | Nocturnal | 6.2 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Bokermannohyla carvalhoi* | 168 | Nocturnal | 6.4 | Unpalatable or bad odour | Terrestrial | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Bokermannohyla circumdata* | 1109 | Nocturnal | 5.4 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Bokermannohyla claresignata* | 101 | Nocturnal | 6.1 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Lutz and Lutz 1939; Carvalho-e-Silva and Caramaschi 2004; present study |
| *Bokermannohyla clepsydra* | 67 | Nocturnal | 4 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Lutz 1925; Carvalho-e-Silva and Telles 2004a; present study |
| *Bokermannohyla diamantina* | 6 | Nocturnal | 4.9 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |

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|---|---|---|---|---|---|---|---|---|
| *Bokermannohyla gouveai* | 41 | Nocturnal | 6.9 | Unpalatable or bad odour | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Bokermannohyla hylax* | 979 | Nocturnal | 6.6 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Bokermannohyla ibitipoca* | 2 | Nocturnal | 3.9 | Unpalatable or bad odour | Terrestrial | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Bokermannohyla itapoty* | 25 | Nocturnal | 4.1 | Unpalatable or bad odour | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Bokermannohyla izecksohni* | 2 | Nocturnal | 3.1 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Bokermannohyla langei* | 4 | Nocturnal | 6.6 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Bokermann 1965; Segalla and Silvano 2004; present study |
| *Bokermannohyla lucianae* | 1 | Nocturnal | 4.7 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Bokermannohyla luctuosa* | 450 | Nocturnal | 6.7 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Bokermannohyla martinsi* | 224 | Nocturnal | 7.3 | Unpalatable or bad odour | Terrestrial | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Bokermannohyla nanuzae* | 121 | Nocturnal | 4.4 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Bokermannohyla oxente* | 1 | Nocturnal | 4.9 | Unpalatable or bad odour | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Brachycephalus alipioi* | 9 | Diurnal | 1.4 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus auroguttatus* | 4 | Diurnal | 1.3 | Toxic | Cryptozoic | Forest areas | Direct | Ribeiro *et al.*,. 2015 |
| *Brachycephalus boticario* | 2 | Diurnal | 1.2 | Toxic | Cryptozoic | Forest areas | Direct | Ribeiro *et al.*, 2015 |
| *Brachycephalus brunneus* | 1 | Diurnal | 1.2 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |

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|---|---|---|---|---|---|---|---|---|
| *Brachycephalus didactylus* | 474 | Diurnal | 0.8 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus ephippium* | 1863 | Diurnal | 1.9 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013; present study |
| *Brachycephalus ferruginus* | 16 | Diurnal | 1.4 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus fuscolineatus* | 2 | Diurnal | 1.2 | Non-toxic | Cryptozoic | Forest areas | Direct | Ribeiro *et al.*,. 2015 |
| *Brachycephalus garbeanus* | 9 | Diurnal | 1.7 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus guarani* | 23 | Diurnal | 1.3 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus hermogenesi* | 653 | Diurnal | 1.1 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus izecksohni* | 4 | Diurnal | 1.3 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus leopardus* | 2 | Diurnal | 1.2 | Toxic | Cryptozoic | Forest areas | Direct | Ribeiro *et al.*, 2015 |
| *Brachycephalus margaritatus* | 10 | Diurnal | 1.7 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus mariaterezae* | 2 | Diurnal | 1.3 | Toxic | Cryptozoic | Forest areas | Direct | Ribeiro *et al.*, 2015 |
| *Brachycephalus nodoterga* | 6 | Diurnal | 1.3 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus olivaceus* | 2 | Diurnal | 1.3 | Toxic | Cryptozoic | Forest areas | Direct | Ribeiro *et al.*, 2015 |
| *Brachycephalus pernix* | 2 | Diurnal | 1.5 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus pitanga* | 8 | Diurnal | 1.3 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |

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|---|---|---|---|---|---|---|---|---|
| *Brachycephalus pombali* | 10 | Diurnal | 1.5 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus pulex* | 10 | ___ | 0.8 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus toby* | 7 | Diurnal | 1.4 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus tridactylus* | 14 | Diurnal | 1.4 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Brachycephalus verrucosus* | 2 | Diurnal | 1.3 | Toxic | Cryptozoic | Forest areas | Direct | Ribeiro *et al.*, 2015 |
| *Brachycephalus vertebralis* | 66 | Diurnal | 1.4 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ceratophrys aurita* | 5003 | Nocturnal | 14.9 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Chiasmocleis alagoana* | 5 | Nocturnal | 2.7 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Chiasmocleis atlantica* | 562 | Nocturnal | 3.2 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Chiasmocleis capixaba* | 495 | Nocturnal | 1.5 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Chiasmocleis carvalhoi* | 741 | Nocturnal | 2.3 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Chiasmocleis cordeiroi* | 1 | Nocturnal | 2.2 | Non-toxic | Cryptozoic | Forest areas | Indirect | Caramaschi and Pimenta 2003, 2004 |
| *Chiasmocleis crucis* | 1 | Nocturnal | 2 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Chiasmocleis gnoma* | 1 | Nocturnal | 1.6 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Chiasmocleis leucosticta* | 1533 | Diurnal/nocturnal | 2.5 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |

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|---|---|---|---|---|---|---|---|---|
| *Chiasmocleis mantiqueira* | 2 | Nocturnal | 2.2 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Chiasmocleis sapiranga* | 3 | Nocturnal | 2.5 | Non-toxic | Cryptozoic | Forest areas | Indirect | Cruz *et al.*, 2007; Ângulo 2008 |
| *Chiasmocleis schubarti* | 1398 | Nocturnal | 3.3 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Chthonerpeton indistinctum* | 528 | ___ | 43.5 | ___ | Aquatic | Open and forest areas | Direct | Haddad *et al.*, 2013 |
| *Chthonerpeton noctinectes* | 3 | ___ | 34.5 | ___ | Aquatic | Open and forest areas | Direct | Silva *et al.*, 2003; Wilkinson 2004 |
| *Chthonerpeton viviparum* | 12 | ___ | 55.8 | ___ | Aquatic | Open and forest areas | Direct | Taylor 1968; Measey *et al.*, 2004 |
| *Crossodactylodes bokermanni* | 36 | Nocturnal | 1.4 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Crossodactylodes izecksohni* | 4 | Nocturnal | 1.5 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Crossodactylodes pintoi* | 4 | Nocturnal | 1.7 | Non-toxic | Arboreal | Forest areas | Indirect | Cochran 1938; Peixoto *et al.*, 2004 |
| *Crossodactylus aeneus* | 1212 | ___ | 2.3 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Crossodactylus bokermanni* | 2 | ___ | 2.7 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Crossodactylus caramaschii* | 672 | Diurnal/nocturnal | 2.3 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Crossodactylus cyclospinus* | 8 | ___ | 2.9 | Non-toxic | Rheophilic | Forest areas | Indirect | Nascimento and Cruz 2005; Ângulo 2008 |
| *Crossodactylus dantei* | 2 | ___ | 2.2 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Crossodactylus dispar* | 1187 | Diurnal | 3.1 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |

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|---|---|---|---|---|---|---|---|---|
| *Crossodactylus gaudichaudii* | 783 | Diurnal/nocturnal | 3.1 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Crossodactylus grandis* | 133 | Diurnal | 4.2 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Crossodactylus lutzorum* | 4 | ___ | 2.6 | Non-toxic | Rheophilic | Forest areas | Indirect | Carcereli and Caramaschii 1993; Silvano and 2004b; Pimenta *et al.*, 2014 |
| *Crossodactylus schmidti* | 255 | Nocturnal | 2.8 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Crossodactylus trachystomus* | 25 | ___ | 2.5 | Non-toxic | Rheophilic | Forest areas | Indirect | Cocrhan 1955; Pimenta and Nascimento 2010 |
| *Cycloramphus acangatan* | 125 | Nocturnal | 4.3 | ___ | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Cycloramphus asper* | 188 | Nocturnal | 3.5 | ___ | Rheophilic | Forest areas | Indirect | Cochran 1955; Heyer *et al.*, 2004 |
| *Cycloramphus bandeirensis* | 5 | ___ | 4.5 | ___ | Rheophilic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Cycloramphus bolitoglossus* | 306 | Nocturnal | 3.8 | ___ | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Cycloramphus boraceiensis* | 571 | Nocturnal | 4.7 | ___ | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Cycloramphus brasiliensis* | 340 | Nocturnal | 6.2 | ___ | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Cycloramphus carvalhoi* | 5 | ___ | 5.6 | ___ | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Cycloramphus catarinensis* | 2 | Nocturnal | 3.5 | ___ | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Cycloramphus cedrensis* | 9 | ___ | 4.9 | ___ | Rheophilic | Forest areas | Indirect | Heyer 1983; Heyer and Silvano 2004a |
| *Cycloramphus diringshofeni* | 53 | ___ | 3.1 | ___ | Rheophilic | Forest areas | Indirect | Bokermann 1965; Heyer *et al.*, 2004 |

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|---|---|---|---|---|---|---|---|---|
| *Cycloramphus dubius* | 32 | Nocturnal | 4.9 | ___ | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Cycloramphus duseni* | 9 | ___ | 3.7 | ___ | Rheophilic | Forest areas | Indirect | Heyer 1983; Verdade and Segalla 2004 |
| *Cycloramphus eleutherodactylus* | 1891 | Nocturnal | 4.8 | ___ | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Cycloramphus fulginosus* | 1052 | Nocturnal | 3.3 | ___ | Rheophilic | Forest areas | Indirect | Cochran 1955; Verdade and Carvalho-e-Silva 2004 |
| *Cycloramphus granulosus* | 104 | ___ | 4.2 | ___ | Rheophilic | Forest areas | Indirect | Bokermann 1951; Heyer and Verdade 2004 |
| *Cycloramphus izecksohni* | 226 | Nocturnal | 4 | ___ | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Cycloramphus juimirim* | 5 | Nocturnal | 3 | ___ | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Cycloramphus lithomimeticus* | 62 | Nocturnal | 3.1 | ___ | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Cycloramphus lutzorum* | 634 | Nocturnal | 4.1 | ___ | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Cycloramphus migueli* | 24 | ___ | 4.2 | ___ | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Cycloramphus mirandaribeiroi* | 4 | ___ | 6.9 | ___ | Rheophilic | Forest areas | Indirect | Heyer 1983; Heyer and Silvano 2004b |
| *Cycloramphus ohausi* | 17 | ___ | 3.8 | ___ | Rheophilic | Forest areas | Indirect | Cochran 1955; Rodrigues and Carvalho-e-Silva 2004b |
| *Cycloramphus organensis* | 31 | Nocturnal | 3.2 | ___ | Rheophilic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Cycloramphus rhyakonastes* | 17 | Nocturnal | 4.2 | ___ | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Cycloramphus semipalmatus* | 108 | ___ | 5 | ___ | Rheophilic | Forest areas | Indirect | Heyer 1983; Verdade and Heyer 2004a |

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|---|---|---|---|---|---|---|---|---|
| *Cycloramphus stejnegeri* | 17 | ___ | 5.6 | ___ | Cryptozoic | Forest areas | Indirect | Heyer 1983; Verdade and Heyer 2004b |
| *Cycloramphus valae* | 96 | ___ | 3.6 | ___ | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Dasypops schirchi* | 186 | Nocturnal | 5.2 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Dendrophryniscus berthalutzae* | 374 | Nocturnal | 2.4 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Dendrophryniscus brevipollicatus* | 758 | Nocturnal | 2 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Dendrophryniscus carvalhoi* | 31 | ___ | 1.9 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Dendrophryniscus krausae* | 8 | ___ | 2.3 | Non-toxic | Fossorial | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Dendrophryniscus leucomystax* | 905 | Nocturnal | 2.5 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Dendrophryniscus oreites* | 29 | ___ | 2.5 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Dendrophryniscus proboscideus* | 1353 | Nocturnal | 4.1 | Toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Dendrophryniscus stawiarskyi* | 2 | ___ | 2.2 | ___ | ___ | Forest areas | Indirect | Izecksohn 1994; Silvano *et al.*, 2004 |
| *Dendropsophus anceps* | 2294 | Nocturnal | 4.2 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Dendropsophus berthalutzae* | 998 | Nocturnal | 2.4 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Dendropsophus bipunctatus* | 1622 | Nocturnal | 2.6 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Dendropsophus branneri* | 3285 | Nocturnal | 2.3 | Unpalatable or bad odour | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *Dendropsophus decipiens* | 4178 | Nocturnal | 1.9 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Dendropsophus dutrai* | 44 | Nocturnal | 3.8 | ___ | Arboreal | Forest areas | Indirect | Gomes and Peixoto 1996; Silvano and Peixoto 2004a |
| *Dendropsophus elegans* | 5047 | Nocturnal | 3.1 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Dendropsophus giesleri* | 855 | Nocturnal | 2.7 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Dendropsophus haddadi* | 1029 | Nocturnal | 2.3 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Lourenço-de-Moraes *et al.*, 2012b; Haddad *et al.*, 2013; present study |
| *Dendropsophus limai* | 4 | Nocturnal | 1.9 | ___ | Arboreal | Forest areas | Indirect | Bokermann 1962; Carvalho-e-Silva 2004 |
| *Dendropsophus meridianus* | 248 | Nocturnal | 1.8 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Dendropsophus microps* | 3122 | Nocturnal | 2.9 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Dendropsophus minutus* | 9676 | Nocturnal | 2.5 | Unpalatable or bad odour | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Dendropsophus nahderere* | 288 | Nocturnal | 4.6 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Dendropsophus nanus* | 7282 | Nocturnal | 2.3 | Unpalatable or bad odour | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Dendropsophus novaisi* | 40 | Nocturnal | 3.4 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Dendropsophus oliveirai* | 811 | Nocturnal | 1.9 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Dendropsophus pseudomeridianus* | 200 | Nocturnal | 1.7 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Dendropsophus ruschii* | 26 | Nocturnal | 2.8 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |

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|---|---|---|---|---|---|---|---|---|
| *Dendropsophus sanorni* | 3410 | Nocturnal | 2 | Unpalatable or bad odour | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Dendropsophus seniculus* | 2681 | Nocturnal | 3.8 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Dendropsophus soaresi* | 315 | Nocturnal | 3.5 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Dendropsophus studerae* | 2 | Nocturnal | 2.8 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Dendropsophus werneri* | 923 | Nocturnal | 1.9 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Elaschitocleis bicolor* | 3457 | Nocturnal | 3.8 | Non-toxic | Fossorial | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Elaschitocleis cesarii* | 7121 | Nocturnal | 3.2 | Non-toxic | Fossorial | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Elaschitocleis erythrogaster* | 37 | Nocturnal | 3.5 | Non-toxic | Fossorial | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Eleutherodactylus bilineatus* | 550 | Nocturnal | 2.6 | Non-toxic | Fossorial | Forest areas | Direct | Haddad *et al.*, 2013; present study |
| *Euparkerella brasiliensis* | 369 | Diurnal/nocturnal | 1.7 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Euparkerella cochranae* | 186 | Diurnal/nocturnal | 1.6 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013; present study |
| *Euparkerella cryptica* | 2 | Diurnal/nocturnal | 1.9 | Non-toxic | Cryptozoic | Forest areas | Direct | Izecksohn 1998 |
| *Euparkerella robusta* | 2 | Diurnal/nocturnal | 2.3 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Euparkerella tridactyla* | 2 | Diurnal/nocturnal | 1.5 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Fritziana fissilis* | 934 | Nocturnal | 2.8 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *Fritziana goeldii* | 1825 | Nocturnal | 3.7 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Fritziana ohausi* | 977 | Nocturnal | 3.1 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Frostius erythrophthalmus* | 435 | Nocturnal | 2.3 | Toxic | Fossorial | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Frostius pernambucensis* | 1008 | Nocturnal | 2.1 | Toxic | Fossorial | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Gastrotheca albolineata* | 703 | Nocturnal | 6 | Non-toxic | Arboreal | Forest areas | Direct | Haddad *et al.*, 2013; present study |
| *Gastrotheca ernestoi* | 321 | Nocturnal | 6.9 | Non-toxic | Arboreal | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Gastrotheca fissipes* | 1550 | Nocturnal | 7.2 | Non-toxic | Arboreal | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Gastrotheca flamma* | 1 | Nocturnal | 5.5 | Non-toxic | Arboreal | Forest areas | Direct | Juncá and Nunes 2008 |
| *Gastrotheca fulvorufa* | 495 | Nocturnal | 6.9 | Non-toxic | Arboreal | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Gastrotheca megacephala* | 895 | Nocturnal | 10.1 | Non-toxic | Arboreal | Forest areas | Direct | Haddad *et al.*, 2013;Lourenço-de-Moraes *et al.*, 2016; present study |
| *Gastrotheca microdiscus* | 1645 | Nocturnal | 5.9 | Non-toxic | Arboreal | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Gastrotheca prasina* | 12 | Nocturnal | 9.7 | Non-toxic | Arboreal | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Gastrotheca pulchra* | 5 | Nocturnal | 3.3 | Non-toxic | Arboreal | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Gastrotheca recava* | 6 | Nocturnal | 7.6 | Non-toxic | Arboreal | Forest areas | Direct | Haddad *et al.*, 2013; Lourenço-de-Moraes *et al.*, 2016; present study |
| *Haddadus aramunha* | 2 | Nocturnal | 6.2 | Non-toxic | Cryptozoic | Open areas | Direct | Haddad *et al.*, 2013 |
| *Haddadus* | 4965 | Nocturnal | 6.5 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *binotatus* | | | | | | | | |
| *Haddadus plicifer* | 1 | Nocturnal | 1.7 | ___ | ___ | ___ | Direct | Hedges *et al.,*. 2008 |
| *Holoaden bradei* | 26 | ___ | 2.5 | Toxic | Cryptozoic | Open and Forest areas | Direct | Haddad *et al.*, 2013 |
| *Holoaden luederwaldti* | 473 | Nocturnal | 4.6 | Toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Holoaden pholeter* | 14 | Nocturnal | 4.6 | Toxic | Cryptozoic | Open and Forest areas | Direct | Haddad *et al.*, 2013 |
| *Hylodes amnicola* | 8 | Diurnal | 2.7 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes asper* | 967 | Diurnal | 4.7 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hylodes babax* | 32 | Diurnal | 3.2 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes cardosoi* | 65 | Diurnal | 4 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes charadranaetes* | 73 | Diurnal | 4.3 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes dactylocinus* | 19 | Diurnal | 2.7 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hylodes fredi* | 1 | Diurnal | 3.7 | Non-toxic | Rheophilic | Forest areas | Indirect | Canedo and Pombal 2007 |
| *Hylodes glaber* | 7 | Diurnal | 2.9 | Non-toxic | Rheophilic | Forest areas | Indirect | Miranda-Ribeiro 1926; Rocha *et al.*, 2004[a] |
| *Hylodes heyeri* | 291 | Diurnal | 4.3 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes lateristrigatus* | 989 | Diurnal | 3.5 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes magalhaesi* | 46 | Diurnal | 3.4 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes meridionalis* | 102 | Diurnal | 4.8 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hylodes mertensi* | 8 | Diurnal | 5.4 | Non-toxic | Rheophilic | Forest areas | Indirect | Bokermann 1956; Rocha *et al.*, 2004b |
| *Hylodes nasus* | 1510 | Diurnal | 3.8 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes ornatus* | 318 | Diurnal | 2.7 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |

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|---|---|---|---|---|---|---|---|---|
| *Hylodes otavioi* | 7 | Diurnal | 3.4 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes perere* | 30 | Diurnal | 2.7 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes perplicatus* | 83 | Diurnal | 4.4 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes phyllodes* | 468 | Diurnal | 3 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes pipilans* | 5 | Diurnal | 2.8 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hylodes regius* | 61 | Diurnal | 3.5 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes sazimai* | 228 | Diurnal | 2.8 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylodes uai* | 24 | Diurnal | 3.8 | Non-toxic | Rheophilic | Forest areas | Indirect | Nascimento *et al.*, 2001; Nascimento and Pimenta 2010 |
| *Hylodes vanzolinii* | 4 | Diurnal | 2.9 | Non-toxic | Rheophilic | Forest areas | Indirect | Heyer 1982; Heyer and Peixoto 2004 |
| *Hylomantis aspera* | 234 | Nocturnal | 4.4 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hylomantis granulosa* | 383 | Nocturnal | 4.8 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hyophryne histrio* | 9 | Nocturnal | 4.8 | ___ | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas albomarginatus* | 4594 | Nocturnal | 5.8 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hypsiboas albopunctatus* | 7663 | Nocturnal | 6.5 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hypsiboas atlanticus* | 1007 | Nocturnal | 4 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hypsiboas bischoffi* | 2422 | Nocturnal | 5.9 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hypsiboas caingua* | 1241 | Nocturnal | 3.9 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hypsiboas caipora* | 14 | Nocturnal | 4 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas crepitans* | 7978 | Nocturnal | 6.2 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *Hypsiboas curupi* | 121 | Nocturnal | 4.5 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas cymbalum* | 8 | Nocturnal | 4.9 | Non-toxic | Arboreal | Open areas | Indirect | Bokermann 1963; Garcia and Rodrigues 2004 |
| *Hypsiboas exastis* | 47 | Nocturnal | 9.2 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hypsiboas faber* | 9183 | Nocturnal | 8.9 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hypsiboas freicanecae* | 1 | Nocturnal | 4 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas guentheri* | 373 | Nocturnal | 4.6 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas joaquini* | 158 | Nocturnal | 5.4 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas latistriatus* | 24 | Nocturnal | 4.7 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas leptolineatus* | 1499 | Nocturnal | 3.3 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas lundii* | 3083 | Nocturnal | 6.9 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas marginatus* | 205 | Nocturnal | 5.3 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas pardalis* | 2279 | Nocturnal | 6.8 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas poaju* | 7 | Nocturnal | 3.9 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas polytaenius* | 1685 | Nocturnal | 3.6 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas pombali* | 1055 | Nocturnal | 5.7 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hypsiboas prasinus* | 2974 | Nocturnal | 4.8 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *Hypsiboas pulchellus* | 2241 | Nocturnal | 4.5 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas punctatus* | 6355 | Nocturnal | 3.9 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas raniceps* | 3978 | Nocturnal | 7.1 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hypsiboas secedens* | 129 | Nocturnal | 4.9 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas semiguttatus* | 222 | Nocturnal | 4.1 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas semilineatus* | 5012 | Nocturnal | 5.6 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Hypsiboas stellae* | 164 | Nocturnal | 4.6 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Hypsiboas stenocephalus* | 7 | Nocturnal | 2.7 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Ischncnema lactea* | 2020 | Nocturnal | 3.2 | Non-toxic | Cryptozoic | Forest areas | Direct | Miranda-Ribeiro 1923; Hedges *et al.*, 2008; present study |
| *Ischncnema paranaesis* | 1 | ___ | 1.8 | Non-toxic | Cryptozoic | Forest areas | Direct | Langone and Segalla 1996; Hedges *et al.*, 2008 |
| *Ischnocnema abdita* | 23 | ___ | 1.6 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema bolbodactyla* | 410 | ___ | 1.9 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema concolor* | 4 | Nocturnal | 2 | Non-toxic | Cryptozoic | Open and Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema epipeda* | 2 | ___ | 2.9 | Non-toxic | Cryptozoic | Forest areas | Direct | Heyer 1984; Silvano and Peixoto 2004b |
| *Ischnocnema erythromera* | 35 | Nocturnal | 3 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *Ischnocnema gehrti* | 1 | ___ | 1.5 | Non-toxic | Cryptozoic | Forest areas | Direct | Pombal and Cruz 1999; Van Luiz and Cruz 2004; Hedges *et al.*, 2008 |
| *Ischnocnema gualteri* | 19 | ___ | 4 | Non-toxic | Cryptozoic | Forest areas | Direct | Lutz 1974; Carvalho-e-Silva *et al.*, 2004; present study |
| *Ischnocnema guentheri* | 3635 | Nocturnal | 4 | Non-toxic | Fossorial | Forest areas | Direct | Haddad *et al.*, 2013; present study |
| *Ischnocnema henselii* | 1233 | Nocturnal | 3.6 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013; present study |
| *Ischnocnema hoehnei* | 422 | ___ | 2.9 | Non-toxic | Fossorial | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema holti* | 6 | Nocturnal | 1.7 | Non-toxic | Fossorial | Open and Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema izecksohni* | 82 | ___ | 4.7 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema juipoca* | 2010 | ___ | 2.3 | Non-toxic | Cryptozoic | Open and Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema karst* | 7 | ___ | 2.3 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema manezinho* | 247 | Nocturnal | 3.3 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema melanopygia* | 1 | ___ | 2 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema nasuta* | 3936 | ___ | 3.9 | Non-toxic | Fossorial | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema nigriventris* | 4 | ___ | 1.9 | Non-toxic | Fossorial | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema octavioi* | 342 | ___ | 3.2 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema oea* | 2 | Nocturnal | 2.2 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema* | 1423 | Nocturnal | 2 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *parva* | | | | | | | | |
| *Ischnocnema pusilla* | 11 | Nocturnal | 1.6 | Non-toxic | Cryptozoic | Forest areas | Direct | Bokermann 1967; Cruz and Carvalho-e-Silva 2004a; Hedges *et al.*, 2008 |
| *Ischnocnema randorum* | 5 | Nocturnal | 1.8 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema sambaqui* | 34 | Nocturnal | 3.7 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema spanios* | 190 | ___ | 2.1 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema venancioi* | 76 | ___ | 2 | Non-toxic | Cryptozoic | Forest areas | Direct | Lutz 1958; Carvalho-e-Silva 2004[a] |
| *Ischnocnema verrucosa* | 855 | Nocturnal | 2.4 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Ischnocnema vizottoi* | 40 | Nocturnal | 2 | Non-toxic | Fossorial | Forest areas | Direct | Haddad *et al.*, 2013 |
| *Itapotihyla langsdorffii* | 4454 | Nocturnal | 10.3 | Unpalatable or bad odour | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Leptodactylus cupreus* | 12 | Nocturnal | 5.7 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Leptodactylus flavopictus* | 1014 | Nocturnal | 13.2 | Toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Leptodactylus furnarius* | 3093 | Nocturnal | 4.2 | Non-toxic | Aquatic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Leptodactylus fuscos* | 9759 | Nocturnal | 4.4 | Non-toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Leptodactylus gracilis* | 3623 | Nocturnal | 4.4 | Non-toxic | Cryptozoic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Leptodactylus hylodes* | 2 | ___ | 2.5 | ___ | ___ | ___ | ___ | Heyer 2000 |

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|---|---|---|---|---|---|---|---|---|
| *Leptodactylus jolyi* | 7 | Nocturnal | 5.4 | Non-toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Leptodactylus labyrinthicus* | 4539 | Nocturnal | 15.5 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Leptodactylus latrans* | 9670 | Nocturnal | 9.6 | Toxic | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Leptodactylus macrosternum* | 8302 | Nocturnal | 9 | Toxic | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Leptodactylus marambaiae* | 4 | ___ | 4.1 | ___ | ___ | ___ | Indirect | Izecksohn 1976; Carvalho-e-Silva and Cruz 2004b |
| *Leptodactylus mystaceus* | 830 | Nocturnal | 5.2 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Leptodactylus mystacinus* | 9605 | Nocturnal | 5.5 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Leptodactylus natalensis* | 2132 | Nocturnal | 5.2 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Leptodactylus notoaktites* | 2253 | Nocturnal | 5 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Leptodactylus plaumanni* | 2141 | Nocturnal | 3.8 | Non-toxic | Cryptozoic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Leptodactylus podicipinus* | 2529 | Nocturnal | 4.2 | Non-toxic | Cryptozoic | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Leptodactylus spixii* | 3808 | Nocturnal | 5.2 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Leptodactylus troglodytes* | 1011 | Nocturnal | 5.1 | Non-toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Leptodactylus vastus* | 886 | Nocturnal | 15 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Leptodactylus viridis* | 234 | Nocturnal | 7.2 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013 |

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|---|---|---|---|---|---|---|---|---|
| *Limnomedusa macroglossa* | 1590 | Nocturnal | 5.4 | ___ | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Lithobates catesbeianus* | 1198 | Nocturnal | 8.9 | Non-toxic | Semi-aquatic | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Lithobates palmipes* | 346 | Nocturnal | 11.3 | Non-toxic | Semi-aquatic | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Luetkenotyphlus brasiliensis* | 3313 | ___ | 27 | ___ | Fossorial | Open and forest areas | Direct | Haddad *et al.*, 2013 |
| *Macrogenioglottus alipioi* | 2512 | Nocturnal | 9.1 | Toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Megaelosia apuana* | 2 | Diurnal | 8.1 | Non-toxic | Rheophilic | Forest areas | Indirect | Pombal *et al.*, 2003; Pombal 2004 |
| *Megaelosia bocainensis* | 5 | Diurnal | 10.1 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Megaelosia boticariana* | 3 | ___ | 7.8 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Megaelosia goeldii* | 451 | Diurnal | 10 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Megaelosia lutzae* | 7 | Diurnal | 9.6 | Non-toxic | Rheophilic | Forest areas | Indirect | Izecksohn and Gouvêa 1987; Carvalho-e-Silva and Telles 2004b |
| *Megaelosia massarti* | 38 | Diurnal | 11.5 | Non-toxic | Rheophilic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Melanophryniscus admirabilis* | 7 | Diurnal | 3.8 | Toxic | Terrestrial | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Melanophryniscus alipioi* | 5 | Diurnal | 2.5 | Toxic | Phytotelmate | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Melanophryniscus cambaraensis* | 22 | Diurnal/nocturnal | 3.5 | Toxic | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Melanophryniscus dorsalis* | 110 | Diurnal | 2.5 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013 |

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|---|---|---|---|---|---|---|---|---|
| *Melanophryniscus macrogranulosus* | 2 | ___ | 3.5 | Toxic | Terrestrial | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Melanophryniscus moreirae* | 17 | Diurnal | 2.9 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Melanophryniscus peritus* | 2 | Diurnal | 4 | Toxic | ___ | ___ | Indirect | Caramaschi and Cruz 2011; |
| *Melanophryniscus setiba* | 67 | Diurnal | 1.5 | Toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Melanophryniscus simplex* | 9 | Nocturnal | 2.8 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Melanophryniscus spectabilis* | 1 | Diurnal | 3.1 | Toxic | Terrestrial | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Melanophryniscus tumifrons* | 1480 | ___ | 3.1 | Toxic | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Melanophryniscus vilavelhensis* | 13 | Nocturnal | 1.7 | Toxic | Phytotelmate | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Mimosiphonops vermiculatus* | 4 | ___ | 18.7 | ___ | Cryptozoic | Forest areas | Direct | Taylor 1968; Silvano *et al.*, 2004[a] |
| *Myersiella microps* | 1236 | Nocturnal | 3.1 | Non-toxic | Fossorial | Forest areas | Direct | Haddad *et al.*, 2013; present study |
| *Odontophrynus americanus* | 8662 | Nocturnal | 4.9 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Odontophrynus carvalhoi* | 657 | Nocturnal | 6.7 | Toxic | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Odontophrynus maisuma* | 8390 | Nocturnal | 4.1 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon agilis* | 825 | Diurnal/nocturnal | 1.8 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Ololygon albicans* | 464 | Nocturnal | 3 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *Ololygon angrensis* | 102 | Diurnal/nocturnal | 3.4 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon arduous* | 2 | Diurnal/nocturnal | 2.1 | Non-toxic | Phytotelmate | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Ololygon argyrornatus* | 2218 | Nocturnal | 2.1 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Ololygon ariadne* | 60 | Nocturnal | 4.1 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon aromothyella* | 10 | Nocturnal | 2.6 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon atrata* | 31 | ___ | 2 | Non-toxic | Arboreal | ___ | Indirect | Peixoto 1989 |
| *Ololygon belloni* | 5 | Nocturnal | 3.9 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon brieni* | 805 | Nocturnal | 3.5 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon carnevallii* | 960 | Nocturnal | 3.2 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon catharinae* | 716 | Nocturnal | 4.5 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Ololygon cosenzai* | 10 | Nocturnal | 2.3 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon flavoguttata* | 1911 | Nocturnal | 4.5 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Ololygon heyeri* | 30 | Nocturnal | 3.9 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon hiemalis* | 964 | Nocturnal | 3.5 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon humilis* | 851 | Nocturnal | 2.6 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon insperata* | 5 | Nocturnal | 2.3 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon jureia* | 5 | Nocturnal | 3 | Non-toxic | Arboreal | Forest areas | Indirect | Pombal and Gordo 1991; Rodrigues and Cruz 2004a |
| *Ololygon kautskyi* | 1 | ___ | 2.8 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon littoralis* | 300 | Nocturnal | 3.8 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *Ololygon littoreus* | 113 | Nocturnal | 2.2 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon longilinea* | 861 | Nocturnal | 4.2 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon luizotavioi* | 1178 | Nocturnal | 2.5 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon machadoi* | 908 | Nocturnal | 2.4 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon melloi* | 19 | ___ | 1.9 | Non-toxic | Arboreal | ___ | Indirect | Peixoto 1989; Cruz and Telles 2004 |
| *Ololygon obtriangulata* | 1574 | Nocturnal | 3.5 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon peixotoi* | 34 | Nocturnal | 2.3 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon perpusilla* | 861 | Nocturnal | 2 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Ololygon ranki* | 76 | Nocturnal | 2.3 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon rizibilis* | 1817 | Diurnal/nocturnal | 3 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon strigilata* | 310 | Nocturnal | 3.8 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Ololygon x-signata* | 7889 | Nocturnal | 4.1 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Oscaecilia hypereumeces* | 1 | ___ | 64 | ___ | Cryptozoic | Forest areas | Direct | Taylor 1968; Silvano *et al.*, 2004b |
| *Paratelmatobius cardosoi* | 28 | Nocturnal | 1.7 | ___ | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Paratelmatobius gaigeae* | 5 | Nocturnal | 1.8 | ___ | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Paratelmatobius lutzii* | 2 | ___ | 2.4 | ___ | Cryptozoic | Open areas | Indirect | Haddad *et al.*, 2013 |

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|---|---|---|---|---|---|---|---|---|
| *Paratelmatobius mantiquera* | 4 | ___ | 1.6 | ___ | Terrestrial | Forest areas | Indirect | Pombal and Haddad 1999 |
| *Paratelmatobius poecilogaster* | 34 | Nocturnal | 2.7 | ___ | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Paratelmatobius yepiranga* | 16 | Nocturnal | 2.1 | ___ | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Phasmahyla cochranae* | 1126 | Nocturnal | 3.2 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Phasmahyla exilis* | 438 | Nocturnal | 2.9 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Phasmahyla guttata* | 917 | Nocturnal | 3.8 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Phasmahyla jandaia* | 230 | Nocturnal | 3.6 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Phasmahyla spectabilis* | 127 | Nocturnal | 4.6 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Phasmahyla timbo* | 5 | Nocturnal | 3.5 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Phrynomedusa appendiculata* | 20 | ___ | 3.5 | Toxic | Arboreal | Forest areas | Indirect | Cruz 1991; Garcia *et al.*, 2004 |
| *Phrynomedusa bokermanni* | 4 | ___ | 4.6 | Toxic | Arboreal | Forest areas | Indirect | Cruz ruz and Caramaschi 2004 |
| *Phrynomedusa fimbriata* | 4 | ___ | 4.5 | Toxic | Arboreal | Forest areas | Indirect | Cruz 1991; Cruz and Pimenta 2004 |
| *Phrynomedusa marginata* | 747 | Nocturnal | 3.1 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Phrynomedusa vanzolinii* | 229 | ___ | 3.6 | Toxic | Arboreal | Forest areas | Indirect | Cruz 1991; Cruz and Carvalho-e-Silva 2004b |
| *Phyllodytes acuminatus* | 996 | ___ | 2.4 | Non-toxic | Phytotelmate | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Phyllodytes* | 4 | ___ | 2.4 | Non-toxic | Phytotelmate | Forest areas | Indirect | Peixoto and Cruz 1998; Skuk *et al.*, 2004 |

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|---|---|---|---|---|---|---|---|---|
| *brevirostris* | | | | | | | | |
| *Phyllodytes edelmoi* | 196 | ___ | 2.6 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Phyllodytes gyrinaethes* | 105 | ___ | 2.6 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Phyllodytes kautskyi* | 657 | Diurnal/nocturnal | 4 | Non-toxic | Phytotelmate | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Phyllodytes luteolus* | 1671 | Nocturnal | 2.5 | Non-toxic | Phytotelmate | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Phyllodytes maculosus* | 435 | Nocturnal | 4.9 | Non-toxic | Phytotelmate | Forest areas | Indirect | Haddad *et al.*, 2013; Ferreira *et al.*, 2016; present study |
| *Phyllodytes melanomystax* | 547 | Nocturnal | 2.3 | Non-toxic | Phytotelmate | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Phyllodytes punctatus* | 1 | ___ | 2.1 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Phyllodytes tuberculosus* | 42 | Nocturnal | 2.4 | Non-toxic | Phytotelmate | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Phyllodytes wuchereri* | 615 | Nocturnal | 2.7 | Non-toxic | Phytotelmate | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Phyllomedusa bahiana* | 337 | Nocturnal | 7.5 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Phyllomedusa burmeisteri* | 4892 | Nocturnal | 6 | Toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Phyllomedusa distincta* | 1766 | Nocturnal | 6 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Phyllomedusa iheringii* | 47 | Nocturnal | 6.8 | Toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Phyllomedusa nordestina* | 1805 | Nocturnal | 3.7 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *Phyllomedusa rohdei* | 2021 | Nocturnal | 4.6 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Phyllomedusa tetraploidea* | 3440 | Nocturnal | 6.6 | Toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Physalaemus aguirrei* | 976 | Nocturnal | 2.7 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus angrensis* | 2 | ___ | 2 | Non-toxic | Cryptozoic | Forest areas | Indirect | Weber *et al.*, 2006 |
| *Physalaemus atlanticus* | 1 | Nocturnal | 2.1 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus barrioi* | 6 | Nocturnal | 2.9 | Non-toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus bokermanni* | 4 | Nocturnal | 1.7 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus caete* | 37 | ___ | 2.5 | Non-toxic | Cryptozoic | Forest areas | Indirect | Pombal and Madureira 1997; Freire and Silvano 2004 |
| *Physalaemus camacan* | 1 | Nocturnal | 2.4 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Physalaemus crombiei* | 1267 | Nocturnal | 2.3 | Non-toxic | Terrestrial | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus cuvieri* | 9704 | Nocturnal | 3.1 | Non-toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Physalaemus erikae* | 222 | Nocturnal | 2.6 | Non-toxic | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus feioi* | 400 | Nocturnal | 2.8 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus insperatus* | 2 | ___ | 2.6 | Non-toxic | Cryptozoic | Forest areas | Indirect | Cruz *et al.*, 2008; Ângulo 2009 |
| *Physalaemus irroratus* | 6 | ___ | 2.3 | Non-toxic | Cryptozoic | Forest areas | Indirect | Cruz *et al.*, 2007 |

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|---|---|---|---|---|---|---|---|---|
| *Physalaemus jordanensis* | 363 | Nocturnal | 2.8 | Non-toxic | Cryptozoic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus kroyeri* | 769 | Nocturnal | 2.9 | Non-toxic | Cryptozoic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus lateristriga* | 185 | Nocturnal | 3.5 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus lisei* | 681 | Nocturnal | 3 | Non-toxic | Cryptozoic | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus maculiventris* | 1481 | Nocturnal | 2.3 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus maximus* | 114 | Nocturnal | 4.8 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus moreirae* | 86 | Nocturnal | 2.6 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus nanus* | 573 | Nocturnal | 2.1 | Non-toxic | Cryptozoic | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus obtectus* | 482 | Nocturnal | 2.8 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus olfersii* | 2346 | Nocturnal | 3.8 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus signifer* | 1688 | Nocturnal | 2.2 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Physalaemus soaresi* | 6 | Nocturnal | 2.1 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Physalaemus spiniger* | 286 | Nocturnal | 2.2 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Pipa carvalhoi* | 2152 | Diurnal/nocturnal | 5.5 | Non-toxic | Aquatic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Pristimantis paulodutrai* | 708 | Nocturnal | 3.6 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *Pristimantis ramagii* | 1272 | Nocturnal | 2.4 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013; present study |
| *Pristimantis vinhai* | 763 | Nocturnal | 2.5 | Non-toxic | Cryptozoic | Forest areas | Direct | Haddad *et al.*, 2013; present study |
| *Proceratophrys appendiculata* | 1226 | Nocturnal | 6.3 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Proceratophrys avelinoi* | 2412 | Nocturnal | 2.6 | Non-toxic | Cryptozoic | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Proceratophrys bigibbosa* | 913 | Nocturnal | 5.3 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Proceratophrys boiei* | 5334 | Nocturnal | 5.7 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Proceratophrys brauni* | 410 | Diurnal/nocturnal | 3.9 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Proceratophrys cristiceps* | 722 | Nocturnal | 6.4 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Proceratophrys cururu* | 1 | Nocturnal | 5.4 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Proceratophrys laticeps* | 1287 | Nocturnal | 6.7 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Proceratophrys melanopogon* | 532 | Nocturnal | 5.1 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Proceratophrys minuta* | 11 | Nocturnal | 3 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Proceratophrys moehringi* | 66 | Nocturnal | 6.3 | Non-toxic | Cryptozoic | Forest areas | Indirect | Weygoldt and Peixoto 1985; Peixoto and Silvano 2004a |
| *Proceratophrys paviotii* | 2 | Nocturnal | 4.7 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Proceratophrys phyllostoma* | 4 | Nocturnal | 5.6 | Non-toxic | Cryptozoic | Forest areas | Indirect | Izecksohn *et al.*, 1999; Peixoto and Silvano 2004b |

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|---|---|---|---|---|---|---|---|---|
| *Proceratophrys renalis* | 1366 | Nocturnal | 5.5 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Proceratophrys sanctaritae* | 10 | Nocturnal | 4.1 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Proceratophrys schirchi* | 1531 | Nocturnal | 5 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Proceratophrys subguttata* | 309 | Nocturnal | 4.8 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Pseudis bolbodactyla* | 1951 | Nocturnal | 4.5 | Non-toxic | Aquatic | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Pseudis cardosoi* | 257 | Nocturnal | 4.5 | Non-toxic | Aquatic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Pseudis fusca* | 221 | Nocturnal | 4.1 | Non-toxic | Aquatic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Pseudis minuta* | 795 | Nocturnal | 3.7 | Non-toxic | Aquatic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Pseudis paradoxa* | 1464 | Nocturnal | 5.3 | Non-toxic | Aquatic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Pseudopaludicola falcipes* | 5436 | Diurnal/nocturnal | 1.8 | Non-toxic | Cryptozoic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Rhinella abei* | 531 | Nocturnal | 9.3 | Toxic | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Rhinella achavali* | 306 | Nocturnal | 12 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Rhinella crucifer* | 1943 | Nocturnal | 10.1 | Toxic | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Rhinella dorbignyi* | 57 | Nocturnal | 5.6 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Rhinella fernandezae* | 971 | Nocturnal | 5.7 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Rhinella granulosa* | 8540 | Nocturnal | 5.3 | Toxic | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Rhinella henseli* | 940 | Nocturnal | 7 | Toxic | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *Rhinella hoogmoedi* | 2257 | Nocturnal | 5.6 | Toxic | Terrestrial | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Rhinella icterica* | 7322 | Nocturnal | 13.7 | Toxic | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Rhinella jimi* | 2658 | Nocturnal | 14.5 | Toxic | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Rhinella ornata* | 2158 | Nocturnal | 7.9 | Toxic | Terrestrial | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Rhinella pygmaea* | 305 | Nocturnal | 4.1 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Rhinella schneideri* | 9416 | Nocturnal | 13 | Toxic | Terrestrial | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Scinax alter* | 3319 | Nocturnal | 2.8 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Scinax auratus* | 956 | ___ | 2.6 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Scinax caldarum* | 1052 | Nocturnal | 2.9 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Scinax cardosoi* | 282 | ___ | 2.6 | Non-toxic | Arboreal | ___ | Indirect | Carvalho-e-Silva and Peixoto 1991; Carvalho-e-Silva and Caramaschi 2004 |
| *Scinax cretatus* | 66 | Nocturnal | 3.2 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Scinax crospedospilus* | 777 | Nocturnal | 3.1 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Scinax cuspidatus* | 2246 | Nocturnal | 3.1 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Scinax duartei* | 1040 | Nocturnal | 3 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Scinax eurydice* | 3145 | Nocturnal | 5.3 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Scinax fuscomarginatus* | 6859 | Nocturnal | 2.2 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Scinax fuscovarios* | 9363 | Nocturnal | 4.5 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Scinax granulatus* | 2971 | Nocturnal | 4.1 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Scinax hayii* | 1965 | Nocturnal | 5.1 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |

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|---|---|---|---|---|---|---|---|---|
| *Scinax imbegue* | 16 | Nocturnal | 3.2 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Scinax juncae* | 23 | Nocturnal | 2.4 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Scinax pachycrus* | 820 | Nocturnal | 3.2 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Scinax perereca* | 3047 | Nocturnal | 4.3 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Scinax similis* | 451 | Nocturnal | 3.8 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013; present study |
| *Scinax squalitostris* | 8423 | Nocturnal | 2.7 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Scinax trapicheiroi* | 239 | Nocturnal | 2.9 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Scinax tymbamirim* | 12 | Nocturnal | 2.6 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Scinax uruguayus* | 1520 | Nocturnal | 2.8 | Non-toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Scinax v-signatus* | 767 | Nocturnal | 2.7 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Scythroehrys sawayae* | 226 | Nocturnal | 2.1 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Siphonops annulatus* | 8685 | ___ | 45.4 | Toxic | Fossorial | Open and forest areas | Direct | Haddad *et al.*, 2013; present study |
| *Siphonops hardyi* | 288 | ___ | 17.8 | ___ | Fossorial | Open and forest areas | Direct | Haddad *et al.*, 2013 |
| *Siphonops insulanus* | 19 | ___ | 19 | ___ | Fossorial | Open and forest areas | Direct | Taylor 1968; Caramaschi *et al.*, 2004 |
| *Siphonops paulensis* | 8614 | ___ | 30 | ___ | Fossorial | Open and forest areas | Inirect | Haddad *et al.*, 2013 |
| *Sphaenorhynchus botocudo* | 13 | Nocturnal | 2.7 | Non-toxic | Aquatic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Sphaenorhynchus bromelicola* | 2 | Nocturnal | 2.8 | Non-toxic | Phytotelmate | Forest areas | Indirect | Bokermann 1966; Silvano and Peixoto 2004c |

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|---|---|---|---|---|---|---|---|---|
| *Sphaenorhynchus caramaschii* | 846 | Nocturnal | 2.7 | Non-toxic | Aquatic | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Sphaenorhynchus mirim* | 9 | Nocturnal | 1.7 | Non-toxic | Aquatic | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Sphaenorhynchus orophilus* | 732 | Nocturnal | 3.2 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Sphaenorhynchus palustris* | 1398 | Nocturnal | 3.1 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Sphaenorhynchus pauloalvini* | 424 | Nocturnal | 1.9 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Sphaenorhynchus planicola* | 1008 | Nocturnal | 2 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Sphaenorhynchus prasinus* | 2031 | Nocturnal | 2.8 | Non-toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Sphaenorhynchus surdus* | 1046 | Nocturnal | 2.8 | Non-toxic | Aquatic | Open and Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Stereocyclops incrassatus* | 2051 | Nocturnal | 6.2 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Stereocyclops parkeri* | 258 | Nocturnal | 6 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Thoropa lutzi* | 703 | Nocturnal | 2.6 | Non-toxic | Terrestrial | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Thoropa miliaris* | 3966 | Nocturnal | 6.3 | Non-toxic | Terrestrial | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Thoropa petropolitana* | 209 | ___ | 7.5 | ___ | Terrestrial | Forest areas | Indirect | Cochrann 1955; Carvalho-e-Silva and Peixoto 2004 |
| *Thoropa saxatilis* | 145 | Nocturnal | 5.9 | Non-toxic | Terrestrial | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Thoropa taophora* | 499 | Nocturnal | 6.3 | Non-toxic | Terrestrial | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Trachycephalus atlas* | 323 | Nocturnal | 10.7 | Toxic | Arboreal | Open areas | Indirect | Haddad *et al.*, 2013 |
| *Trachycephalus* | 809 | Nocturnal | 7.8 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *dibernardoi* | | | | | | | | |
| *Trachycephalus imitatrix* | 2792 | Nocturnal | 7.1 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Trachycephalus lepidus* | 4 | Nocturnal | 5.9 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Trachycephalus mesophaeus* | 5477 | Diurnal/nocturnal | 6.9 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Trachycephalus nigromaculatus* | 3490 | Nocturnal | 9.2 | Toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Trachycephalus typhonius* | 4913 | Nocturnal | 9.2 | Toxic | Arboreal | Open and Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Vitreorana eurygnatha* | 4334 | Nocturnal | 2.4 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Vitreorana uranoscopa* | 5065 | Nocturnal | 2.7 | Non-toxic | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013; present study |
| *Xenohyla eugenioi* | 147 | Nocturnal | 4.5 | ___ | Arboreal | Open and Forest areas | Indirect | Caramaschi 1998; Silvano and Pimenta 2004a |
| *Xenohyla truncata* | 218 | Nocturnal | 5 | ___ | Arboreal | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Zachaenus carvalhoi* | 2 | Nocturnal | 2.8 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013 |
| *Zachaenus parvulus* | 268 | Nocturnal | 2.9 | Non-toxic | Cryptozoic | Forest areas | Indirect | Haddad *et al.*, 2013; present study |

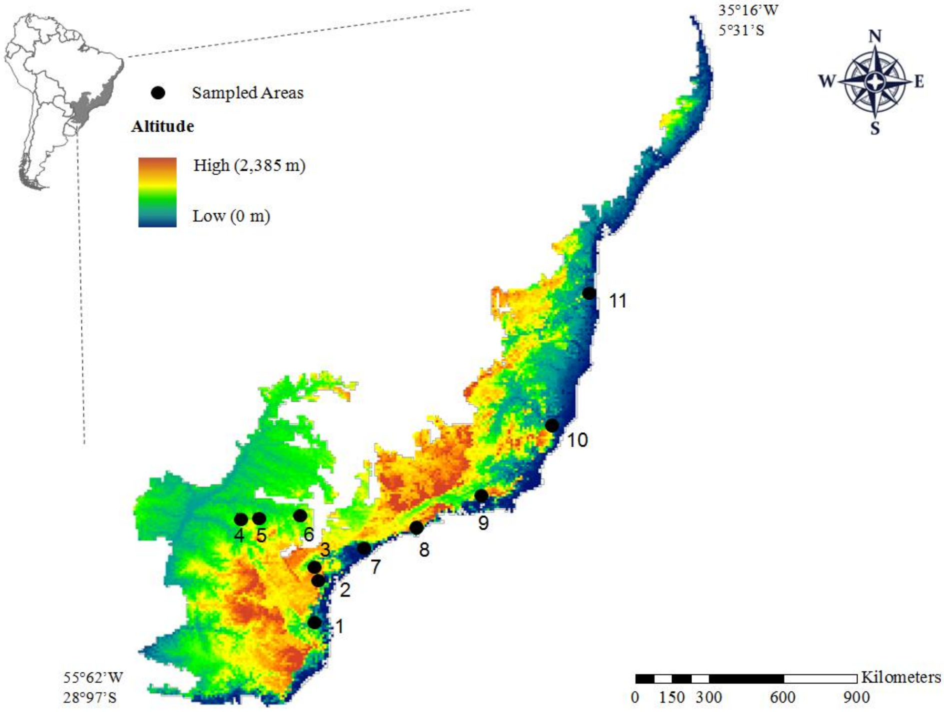

**Figure S1.** Map showed the location of Brazilian Atlantic Forest hotspot (in gray) in South American territory. The black circle indicates the Protected areas visited as complementary field works. 1. Parque Ecológico Spitzkopf, SC; 2. Parque Estadual Pico do Marumbi, PR; 3. Parque estadual de Campinhos, PR; 4. Parque municipal das Perobas, PR; 5. Parque Estadual Mata dos Godoy, PR; 6. Refugio municipal da vida Silvestre, Horto Florestal de Jacarezinho, PR; 7. Estação Ecológica de Juréia-Itatins, SP; 8. Parque Estadual da Serra do Mar Núcleo Caraguatatuba, SP; 9. Parque Nacional da Serra dos Órgãos, RJ; 10. Reserva Biológica Augusto Ruschi, ES; 11. Reserva Biológica de Una, BA. From January of 2014 (PA 8 five days), July 2014 (PA 6 three days), November 2014 (PAs 4, 6 three days in each), December 2014 (PA 4 two days), January to March 2015 (PAs 1, 2, 7-11 seven days in each), May 2015 (PA 6 three days), November 2015 (PA 4 two days), December 2015 (PA 3 five days), February 2016 (PAs 5 two days, 6 three days), March 2016 (PA 4 one day, 5 two days). We sampled amphibians using acoustic and visual nocturnal and diurnal surveys (Crump & Scott Jr, 1994; Zimmerman, 1994). We searched at the margins of water bodies, in the streams, and along 2000 m forest transects. The species collected were euthanized with hydrochloride benzocaine> or = 250 mg / L (ASH, 2004). Number of authorization / license SISBIO - 30344.

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APÊNDICE 2 - **Table S1.** List of studied amphibians species of Atlantic Forest with the summarization of the climate change effects on species geographical range.

| Order/Family/Species | **Brazilian Red List** | **Projections Future** | **Range Present** | **Range Future** | **% of lost (-) and gained (+) of cells** |
|---|---|---|---|---|---|
| **Gymnophiona** | | | | | |
| **Typlonectidae** | | | | | |
| *Chthonerpeton indistinctum* | Not Evaluated | Critically Endangered | 551,25 | 52 | -90,57 |
| **Siphonopidae** | | | | | |
| *Luetkenotyphlus brasiliensis* | Not Evaluated | Vulnerable | 3337,25 | 1718 | -48,52 |
| *Siphonops annulatus* | Not Evaluated | Least Concern | 8681,75 | 7889,25 | -9,13 |
| *Siphonops hardyi* | Not Evaluated | Endangered | 562,5 | 124 | -77,96 |
| *Siphonops paulensis* | Not Evaluated | Least Concern | 8264,75 | 6087,75 | -26,34 |
| **Anura** | | | | | |
| **Alsodidae** | | | | | |
| *Limnomedusa macroglossa* | Not Evaluated | Endangered | 1553,25 | 570,5 | -63,27 |
| **Aromobatidae** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| *Allobates alagoanus* | Not Evaluated | Extinct | 5,5 | 0 | -100,00 |
| *Allobates capixaba* | Not Evaluated | Critically Endangered | 449,25 | 22,25 | -95,05 |
| *Allobates olfersioides* | Vulnerable | Vulnerable | 2704,75 | 1816,75 | -32,83 |
| **Brachycephalidae** | | | | | |
| *Brachycephalus alipioi* | Not Evaluated | Critically Endangered | 13,25 | 0,75 | -94,34 |
| *Brachycephalus brunneus* | Not Evaluated | Least Concern | 3,75 | 25,25 | 573,33 |
| *Brachycephalus didactylus* | Not Evaluated | Endangered | 623,5 | 141 | -77,39 |
| *Brachycephalus ephipium* | Not Evaluated | Endangered | 2200,25 | 830 | -62,28 |
| *Brachycephalus ferruginus* | Not Evaluated | Extinct | 15,5 | 0 | -100,00 |
| *Brachycephalus garbeanus* | Not Evaluated | Critically Endangered | 9,75 | 0,5 | -94,87 |
| *Brachycephalus guarani* | Not Evaluated | Critically Endangered | 65,25 | 2 | -96,93 |
| *Brachycephalus hermogenesi* | Not Evaluated | Endangered | 505 | 141 | -72,08 |
| *Brachycephalus izecksohni* | Not Evaluated | Extinct | 4,25 | 0 | -100,00 |
| *Brachycephalus margaritatus* | Not Evaluated | Critically Endangered | 11,75 | 0,5 | -95,74 |
| *Brachycephalus nodoterga* | Not Evaluated | Critically Endangered | 22,75 | 0,25 | -98,90 |
| *Brachycephalus pernix* | Critically Endangered | Extinct | 2 | 0 | -100,00 |
| *Brachycephalus pitanga* | Not Evaluated | Endangered | 12,25 | 4,5 | -63,27 |

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|---|---|---|---|---|---|
| *Brachycephalus pombali* | Not Evaluated | Extinct | 12 | 0 | -100,00 |
| *Brachycephalus pulex* | Not Evaluated | Extinct | 12,25 | 0 | -100,00 |
| *Brachycephalus toby* | Not Evaluated | Critically Endangered | 8,5 | 0,25 | -97,06 |
| *Brachycephalus tridactylus* | Not Evaluated | Extinct | 11,25 | 0 | -100,00 |
| *Brachycephalus vertebralis* | Not Evaluated | Critically Endangered | 147 | 12,25 | -91,67 |
| *Ischnocnema abdita* | Not Evaluated | Extinct | 14,25 | 0 | -100,00 |
| *Ischnocnema bolbodactyla* | Not Evaluated | Endangered | 409,5 | 135,75 | -66,85 |
| *Ischnocnema concolor* | Not Evaluated | Extinct | 5,25 | 0 | -100,00 |
| *Ischnocnema erythromera* | Not Evaluated | Critically Endangered | 35,75 | 3,5 | -90,21 |
| *Ischnocnema guenteri* | Not Evaluated | Endangered | 3776 | 1237,75 | -67,22 |
| *Ischnocnema henselli* | Not Evaluated | Endangered | 1305,75 | 587 | -55,04 |
| *Ischnocnema hoehnei* | Not Evaluated | Critically Endangered | 469,25 | 87,75 | -81,30 |
| *Ischnocnema holti* | Not Evaluated | Extinct | 9,25 | 0 | -100,00 |
| *Ischnocnema izecksoni* | Not Evaluated | Extinct | 55,5 | 0 | -100,00 |
| *Ischnocnema juipoca* | Not Evaluated | Endangered | 1924,25 | 947,25 | -50,77 |
| *Ischnocnema karst* | Not Evaluated | Extinct | 6,5 | 0 | -100,00 |
| *Ischnocnema manezinho* | Vulnerable | Endangered | 217,25 | 99,75 | -54,09 |

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|---|---|---|---|---|---|
| *Ischnocnema melonopygia* | Not Evaluated | Extinct | 1 | 0 | -100,00 |
| *Ischnocnema nasuta* | Not Evaluated | Vulnerable | 3837,25 | 1990 | -48,14 |
| *Ischnocnema nigriventris* | Not Evaluated | Extinct | 5,25 | 0 | -100,00 |
| *Ischnocnema octavioi* | Not Evaluated | Critically Endangered | 445,5 | 71,5 | -83,95 |
| *Ischnocnema oea* | Not Evaluated | Least Concern | 4 | 81,5 | 1937,50 |
| *Ischnocnema parva* | Not Evaluated | Endangered | 1828,75 | 688,25 | -62,37 |
| *Ischnocnema randorum* | Not Evaluated | Extinct | 4,75 | 0 | -100,00 |
| *Ischnocnema sambaqui* | Not Evaluated | Least Concern | 29,25 | 22 | -24,79 |
| *Ischnocnema spanios* | Not Evaluated | Critically Endangered | 178,75 | 14,5 | -91,89 |
| *Ischnocnema verrucosa* | Not Evaluated | Endangered | 998,25 | 307,25 | -69,22 |
| *Ischnocnema vizottoi* | Not Evaluated | Extinct | 62,75 | 0 | -100,00 |
| **Bufonidae** | | | | | |
| *Dendrophryniscus berthalutzae* | Not Evaluated | Endangered | 341,25 | 130,5 | -61,76 |
| *Dendrophryniscus brevipollicatus* | Not Evaluated | Endangered | 939,75 | 426,75 | -54,59 |
| *Dendrophryniscus carvalhoi* | Not Evaluated | Extinct | 40,75 | 0 | -100,00 |
| *Dendrophryniscus krause* | Not Evaluated | Extinct | 8,5 | 0 | -100,00 |
| *Dendrophryniscus leucomystax* | Not Evaluated | Endangered | 970,5 | 332,75 | -65,71 |

| | | | | | |
|---|---|---|---|---|---|
| *Dendrophryniscus oreites* | Not Evaluated | Extinct | 24,75 | 0 | -100,00 |
| *Dendrophryniscus proboscideus* | Not Evaluated | Endangered | 786,25 | 282 | -64,13 |
| *Frostius erythrophthalmus* | Not Evaluated | Critically Endangered | 290,5 | 3 | -98,97 |
| *Frostius pernambucensis* | Not Evaluated | Endangered | 911,5 | 398,5 | -56,28 |
| *Melanophryniscus admirabilis* | Critically Endangered | Extinct | 7 | 0 | -100,00 |
| *Melanophryniscus alipioi* | Not Evaluated | Extinct | 5,5 | 0 | -100,00 |
| *Melanophryniscus cambaraensis* | Vulnerable | Extinct | 26,75 | 0 | -100,00 |
| *Melanophryniscus dorsalis* | Vulnerable | Endangered | 97,5 | 23 | -76,41 |
| *Melanophryniscus macrogranulosus* | Endangered | Endangered | 2 | 0,5 | -75,00 |
| *Melanophryniscus moreirae* | Not Evaluated | Extinct | 47,25 | 0 | -100,00 |
| *Melanophryniscus setiba* | Critically Endangered | Endangered | 66 | 24,75 | -62,50 |
| *Melanophryniscus simplex* | Not Evaluated | Least Concern | 7,75 | 23,25 | 200,00 |
| *Melanophryniscus spectabilis* | Not Evaluated | Extinct | 1 | 0 | -100,00 |
| *Melanophryniscus tumifrons* | Not Evaluated | Critically Endangered | 1569,75 | 117,25 | -92,53 |
| *Melanophryniscus vilavelhenis* | Not Evaluated | Extinct | 13 | 0 | -100,00 |
| *Rhinella abei* | Not Evaluated | Endangered | 480 | 190 | -60,42 |
| *Rhinella achavali* | Not Evaluated | Critically Endangered | 329,5 | 7,5 | -97,72 |

| | | | | | |
|---|---|---|---|---|---|
| *Rhinella crucifer* | Not Evaluated | Least Concern | 2093,75 | 2257 | 7,80 |
| *Rhinella dorbignyi* | Not Evaluated | Extinct | 72,25 | 0 | -100,00 |
| *Rhinella fernadezae* | Not Evaluated | Endangered | 814,75 | 194 | -76,19 |
| *Rhinella granulosa* | Not Evaluated | Least Concern | 8672,75 | 9151,25 | 5,52 |
| *Rhinella henseli* | Not Evaluated | Critically Endangered | 1001 | 189,5 | -81,07 |
| *Rhinella hoogmoedi* | Not Evaluated | Least Concern | 2764,25 | 1987,75 | -28,09 |
| *Rhinella icterica* | Not Evaluated | Endangered | 7554 | 3402,75 | -54,95 |
| *Rhinella jimi* | Not Evaluated | Least Concern | 2805,25 | 2781,25 | -0,86 |
| *Rhinella ornata* | Not Evaluated | Endangered | 2202,75 | 915,25 | -58,45 |
| *Rhinella pygmaea* | Not Evaluated | Endangered | 392,25 | 166 | -57,68 |
| *Rhinella schneideri* | Not Evaluated | Least Concern | 9288,75 | 7128,25 | -23,26 |
| **Ceratophryidae** | | | | | |
| *Ceratophrys aurita* | Not Evaluated | Vulnerable | 4893,5 | 2584,25 | -47,19 |
| **Craugastoridae** | | | | | |
| *Eleutherodactylus bilineata* | Not Evaluated | Critically Endangered | 468,75 | 91,5 | -80,48 |
| *Euparkerella brasiliensis* | Not Evaluated | Endangered | 443,5 | 105,5 | -76,21 |
| *Euparkerella cochranae* | Not Evaluated | Endangered | 251,25 | 69,5 | -72,34 |

| | | | | | |
|---|---|---|---|---|---|
| *Euparkerella robusta* | Not Evaluated | Extinct | 2,25 | 0 | -100,00 |
| *Euparkerella tridactyla* | Not Evaluated | Endangered | 5,75 | 1,25 | -78,26 |
| *Haddadus aramunha* | Not Evaluated | Least Concern | 3,5 | 175,75 | 4921,43 |
| *Haddadus binotatus* | Not Evaluated | Endangered | 4876,5 | 2366 | -51,48 |
| *Holoaden bradei* | Critically Endangered | Critically Endangered | 44,75 | 2,75 | -93,85 |
| *Holoaden luederwaldti* | Endangered | Endangered | 490,75 | 105,25 | -78,55 |
| *Holoaden pholeter* | Not Evaluated | Least Concern | 6 | 82,25 | 1270,83 |
| *Pristimantis paulodutrai* | Not Evaluated | Critically Endangered | 650,75 | 120 | -81,56 |
| *Pristimantis ramagii* | Not Evaluated | Least Concern | 1295,25 | 1170 | -9,67 |
| *Pristimantis vinhai* | Not Evaluated | Endangered | 967,25 | 322,75 | -66,63 |
| **Cycloramphidae** | | | | | |
| *Cycloramphus acangatan* | Not Evaluated | Critically Endangered | 161 | 27,5 | -82,92 |
| *Cycloramphus bandeirensis* | Not Evaluated | Least Concern | 4,5 | 26,5 | 488,89 |
| *Cycloramphus bolitoglossus* | Not Evaluated | Endangered | 289,5 | 98,75 | -65,89 |
| *Cycloramphus boraceiensis* | Not Evaluated | Endangered | 649,25 | 229,75 | -64,61 |
| *Cycloramphus brasiliensis* | Not Evaluated | Critically Endangered | 389 | 57,25 | -85,28 |
| *Cycloramphus carvalhoi* | Not Evaluated | Critically Endangered | 11,25 | 0,5 | -95,56 |

| | | | | | |
|---|---|---|---|---|---|
| *Cycloramphus catarinensis* | Not Evaluated | Critically Endangered | 2,5 | 0,5 | -80,00 |
| *Cycloramphus dubius* | Not Evaluated | Critically Endangered | 67 | 2,5 | -96,27 |
| *Cycloramphus eleutherodactylus* | Not Evaluated | Endangered | 1879,25 | 472,5 | -74,86 |
| *Cycloramphus izecksohni* | Not Evaluated | Endangered | 240,5 | 53,25 | -77,86 |
| *Cycloramphus juimirim* | Not Evaluated | Extinct | 5,75 | 0 | -100,00 |
| *Cycloramphus lithomimeticus* | Not Evaluated | Extinct | 118,75 | 0 | -100,00 |
| *Cycloramphus lutzorum* | Not Evaluated | Critically Endangered | 616,25 | 119,75 | -80,57 |
| *Cycloramphus migueli* | Not Evaluated | Extinct | 30,25 | 0 | -100,00 |
| *Cycloramphus organensis* | Not Evaluated | Critically Endangered | 28 | 3,25 | -88,39 |
| *Cycloramphus rhyakonastes* | Not Evaluated | Extinct | 14 | 0 | -100,00 |
| *Cycloramphus valae* | Not Evaluated | Critically Endangered | 97,5 | 1 | -98,97 |
| *Thoropa lutzi* | Not Evaluated | Endangered | 695,25 | 278 | -60,01 |
| *Thoropa miliaris* | Not Evaluated | Vulnerable | 3967,5 | 2586,75 | -34,80 |
| *Thoropa saxatilis* | Vulnerable | Endangered | 123,75 | 30,75 | -75,15 |
| *Thoropa taophora* | Not Evaluated | Endangered | 492,25 | 117 | -76,23 |
| *Zachaenus carvalhoi* | Not Evaluated | Least Concern | 5,25 | 73,75 | 1304,76 |
| *Zachaenus parvulus* | Not Evaluated | Endangered | 343 | 103 | -69,97 |

| | | | | | |
|---|---|---|---|---|---|
| **Eleutherodactylidae** | | | | | |
| *Adelophryne mucronatus* | Not Evaluated | Extinct | 34,5 | 0 | -100,00 |
| *Adelophryne pachydactyla* | Not Evaluated | Extinct | 220,75 | 0 | -100,00 |
| **Hemiphractidae** | | | | | |
| *Flectonotus fissilis* | Not Evaluated | Endangered | 1175,75 | 398,75 | -66,09 |
| *Flectonotus goeldii* | Not Evaluated | Endangered | 2162 | 787,5 | -63,58 |
| *Flectonotus ohausi* | Not Evaluated | Endangered | 1091,5 | 418,75 | -61,64 |
| *Gastrotheca albolineata* | Not Evaluated | Endangered | 790,25 | 269,25 | -65,93 |
| *Gastrotheca ernestoi* | Not Evaluated | Critically Endangered | 398 | 47,75 | -88,00 |
| *Gastrotheca fissipes* | Not Evaluated | Vulnerable | 1722,5 | 1005,5 | -41,63 |
| *Gastrotheca fulvorufa* | Not Evaluated | Critically Endangered | 475,25 | 38,5 | -91,90 |
| *Gastrotheca megacephala* | Not Evaluated | Endangered | 769 | 162,75 | -78,84 |
| *Gastrotheca microdiscus* | Not Evaluated | Endangered | 2005,75 | 862 | -57,02 |
| *Gastrotheca prasina* | Not Evaluated | Extinct | 9,25 | 0 | -100,00 |
| *Gastrotheca pulchra* | Not Evaluated | Extinct | 4,25 | 0 | -100,00 |
| *Gastrotheca recava* | Not Evaluated | Extinct | 4,5 | 0 | -100,00 |
| **Hylidae** | | | | | |

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|---|---|---|---|---|---|
| *Aparasphenodon arapapa* | Not Evaluated | Endangered | 1179,5 | 377,75 | -67,97 |
| *Aparasphenodon bokermani* | Not Evaluated | Least Concern | 5,25 | 11 | 109,52 |
| *Aparasphenodon brunoi* | Not Evaluated | Vulnerable | 2804,5 | 1425,75 | -49,16 |
| *Aplastodiscus albofrenatus* | Not Evaluated | Endangered | 518,75 | 136,5 | -73,69 |
| *Aplastodiscus albosignatus* | Not Evaluated | Endangered | 1281 | 453,75 | -64,58 |
| *Aplastodiscus arildae* | Not Evaluated | Endangered | 2218,5 | 868 | -60,87 |
| *Aplastodiscus callipygius* | Not Evaluated | Endangered | 429 | 112 | -73,89 |
| *Aplastodiscus cavicola* | Not Evaluated | Endangered | 738 | 169,25 | -77,07 |
| *Aplastodiscus cochranae* | Not Evaluated | Endangered | 152,5 | 41,75 | -72,62 |
| *Aplastodiscus ehrhardti* | Not Evaluated | Endangered | 357,25 | 142,5 | -60,11 |
| *Aplastodiscus eugenioi* | Not Evaluated | Critically Endangered | 278,5 | 38,5 | -86,18 |
| *Aplastodiscus flumineus* | Not Evaluated | Extinct | 8 | 0 | -100,00 |
| *Aplastodiscus ibirapitanga* | Not Evaluated | Critically Endangered | 468 | 50,75 | -89,16 |
| *Aplastodiscus leucopygius* | Not Evaluated | Endangered | 1692 | 539,75 | -68,10 |
| *Aplastodiscus perviridis* | Not Evaluated | Vulnerable | 5880,75 | 3162,25 | -46,23 |
| *Aplastodiscus sibilatus* | Not Evaluated | Extinct | 180,75 | 0 | -100,00 |
| *Aplastodiscus weygoldti* | Not Evaluated | Critically Endangered | 29,5 | 0,75 | -97,46 |

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|---|---|---|---|---|---|
| *Bokermanohyla ahenea* | Not Evaluated | Extinct | 3,75 | 0 | -100,00 |
| *Bokermanohyla astartea* | Not Evaluated | Endangered | 1333,75 | 439,75 | -67,03 |
| *Bokermanohyla capra* | Not Evaluated | Extinct | 33,5 | 0 | -100,00 |
| *Bokermanohyla caramaschii* | Not Evaluated | Endangered | 488,5 | 230,75 | -52,76 |
| *Bokermanohyla carvalhoi* | Not Evaluated | Endangered | 295,25 | 85,25 | -71,13 |
| *Bokermanohyla circumdata* | Not Evaluated | Critically Endangered | 1085,75 | 156,25 | -85,61 |
| *Bokermanohyla diamantina* | Not Evaluated | Least Concern | 4,5 | 304,75 | 6672,22 |
| *Bokermanohyla gouveiai* | Not Evaluated | Least Concern | 32,75 | 57,5 | 75,57 |
| *Bokermanohyla hylax* | Not Evaluated | Endangered | 923,25 | 381,75 | -58,65 |
| *Bokermanohyla ibitipoca* | Not Evaluated | Extinct | 5,5 | 0 | -100,00 |
| *Bokermanohyla itapoty* | Not Evaluated | Extinct | 26,25 | 0 | -100,00 |
| *Bokermanohyla izecksohni* | Not Evaluated | Extinct | 2 | 0 | -100,00 |
| *Bokermanohyla lucianae* | Not Evaluated | Extinct | 1 | 0 | -100,00 |
| *Bokermanohyla luctuosa* | Not Evaluated | Critically Endangered | 345,5 | 36 | -89,58 |
| *Bokermanohyla martinsi* | Not Evaluated | Critically Endangered | 155,75 | 12,75 | -91,81 |
| *Bokermanohyla nanuzae* | Not Evaluated | Extinct | 73,25 | 0 | -100,00 |
| *Bokermanohyla oxente* | Not Evaluated | Extinct | 1,25 | 0 | -100,00 |

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|---|---|---|---|---|---|
| *Dendropsophus anceps* | Not Evaluated | Endangered | 2420,5 | 1161,5 | -52,01 |
| *Dendropsophus berthalutzae* | Not Evaluated | Endangered | 1429 | 541 | -62,14 |
| *Dendropsophus bipunctatus* | Not Evaluated | Least Concern | 1739,75 | 1571,25 | -9,69 |
| *Dendropsophus branneri* | Not Evaluated | Least Concern | 3339,25 | 3774 | 13,02 |
| *Dendropsophus decipiens* | Not Evaluated | Least Concern | 4244,25 | 3150,75 | -25,76 |
| *Dendropsophus elegans* | Not Evaluated | Least Concern | 4965 | 4342,75 | -12,53 |
| *Dendropsophus giesleri* | Not Evaluated | Endangered | 949,25 | 391 | -58,81 |
| *Dendropsophus haddadi* | Not Evaluated | Endangered | 838,75 | 253,75 | -69,75 |
| *Dendropsophus meridianus* | Not Evaluated | Endangered | 281,5 | 96,5 | -65,72 |
| *Dendropsophus microps* | Not Evaluated | Endangered | 3272,75 | 1526,25 | -53,36 |
| *Dendropsophus minutus* | Not Evaluated | Least Concern | 9520,5 | 7160,5 | -24,79 |
| *Dendropsophus nahdereri* | Not Evaluated | Endangered | 321,5 | 113,25 | -64,77 |
| *Dendropsophus nanus* | Not Evaluated | Least Concern | 7355,5 | 6269,25 | -14,77 |
| *Dendropsophus novaisi* | Not Evaluated | Least Concern | 51 | 60,25 | 18,14 |
| *Dendropsophus oliveirai* | Not Evaluated | Endangered | 758 | 230,5 | -69,59 |
| *Dendropsophus pseudomeridianus* | Not Evaluated | Critically Endangered | 329,75 | 47,25 | -85,67 |
| *Dendropsophus ruschii* | Not Evaluated | Vulnerable | 39,25 | 22 | -43,95 |

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|---|---|---|---|---|---|
| *Dendropsophus samborni* | Not Evaluated | Endangered | 3494,75 | 1726,5 | -50,60 |
| *Dendropsophus seniculus* | Not Evaluated | Endangered | 2934,75 | 1435 | -51,10 |
| *Dendropsophus soaresi* | Not Evaluated | Endangered | 475,75 | 227,5 | -52,18 |
| *Dendropsophus studarae* | Not Evaluated | Extinct | 2 | 0 | -100,00 |
| *Dendropsophus werneri* | Not Evaluated | Endangered | 754,75 | 288,75 | -61,74 |
| *Hypsiboas albomarginatus* | Not Evaluated | Least Concern | 4933 | 3602,75 | -26,97 |
| *Hypsiboas albopunctatus* | Not Evaluated | Vulnerable | 7665,5 | 4659,5 | -39,21 |
| *Hypsiboas atlanticus* | Not Evaluated | Endangered | 893,75 | 306,75 | -65,68 |
| *Hypsiboas bichoffi* | Not Evaluated | Endangered | 2497,5 | 790 | -68,37 |
| *Hypsiboas caingua* | Not Evaluated | Endangered | 1273,25 | 280,5 | -77,97 |
| *Hypsiboas caipora* | Not Evaluated | Extinct | 22,75 | 0 | -100,00 |
| *Hypsiboas crepitans* | Not Evaluated | Least Concern | 7944,75 | 7303,75 | -8,07 |
| *Hypsiboas curupi* | Vulnerable | Critically Endangered | 125,5 | 14,5 | -88,45 |
| *Hypsiboas exastis* | Not Evaluated | Extinct | 49,25 | 0 | -100,00 |
| *Hypsiboas faber* | Not Evaluated | Vulnerable | 9042 | 5090,25 | -43,70 |
| *Hypsiboas freicanecae* | Not Evaluated | Extinct | 1 | 0 | -100,00 |
| *Hypsiboas guenteri* | Not Evaluated | Vulnerable | 383,75 | 195 | -49,19 |

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|---|---|---|---|---|---|
| *Hypsiboas joaquini* | Not Evaluated | Endangered | 177,5 | 52,5 | -70,42 |
| *Hypsiboas latistriatus* | Not Evaluated | Critically Endangered | 16 | 2,5 | -84,38 |
| *Hypsiboas leptolineatus* | Not Evaluated | Critically Endangered | 1557,75 | 128,25 | -91,77 |
| *Hypsiboas lundii* | Not Evaluated | Vulnerable | 3080,25 | 1593,25 | -48,28 |
| *Hypsiboas marginatus* | Not Evaluated | Endangered | 187,5 | 39,5 | -78,93 |
| *Hypsiboas pardalis* | Not Evaluated | Endangered | 2630 | 1298,25 | -50,64 |
| *Hypsiboas poaju* | Not Evaluated | Extinct | 7,5 | 0 | -100,00 |
| *Hypsiboas polytaenius* | Not Evaluated | Endangered | 1764,75 | 643,25 | -63,55 |
| *Hypsiboas pombali* | Not Evaluated | Endangered | 1060,25 | 481,25 | -54,61 |
| *Hypsiboas prasinus* | Not Evaluated | Endangered | 2845,75 | 825,25 | -71,00 |
| *Hypsiboas pulchellus* | Not Evaluated | Endangered | 2232,5 | 588,75 | -73,63 |
| *Hypsiboas punctatus* | Not Evaluated | Least Concern | 6546 | 6312,25 | -3,57 |
| *Hypsiboas raniceps* | Not Evaluated | Least Concern | 3436 | 3689 | 7,36 |
| *Hypsiboas secedens* | Not Evaluated | Critically Endangered | 732,75 | 90,5 | -87,65 |
| *Hypsiboas semiguttatus* | Endangered | Endangered | 215,5 | 102,25 | -52,55 |
| *Hypsiboas semilineatus* | Not Evaluated | Least Concern | 4980 | 3730,25 | -25,10 |
| *Hypsiboas stellae* | Not Evaluated | Extinct | 193,75 | 0 | -100,00 |

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|---|---|---|---|---|---|
| *Hypsiboas stenocephalus* | Not Evaluated | Extinct | 7 | 0 | -100,00 |
| *Itapotihyla langsdorffii* | Not Evaluated | Least Concern | 4504,5 | 3469,75 | -22,97 |
| *Ololygon agilis* | Not Evaluated | Critically Endangered | 631,5 | 50 | -92,08 |
| *Ololygon albicans* | Not Evaluated | Endangered | 583,5 | 148,25 | -74,59 |
| *Ololygon angrensis* | Not Evaluated | Critically Endangered | 100,75 | 20 | -80,15 |
| *Ololygon arduous* | Not Evaluated | Least Concern | 6,75 | 8,25 | 22,22 |
| *Ololygon argyreornata* | Not Evaluated | Vulnerable | 2665,25 | 1373 | -48,49 |
| *Ololygon ariadne* | Not Evaluated | Endangered | 92,5 | 24 | -74,05 |
| *Ololygon aromothyella* | Not Evaluated | Extinct | 10,5 | 0 | -100,00 |
| *Ololygon belloni* | Not Evaluated | Extinct | 5,5 | 0 | -100,00 |
| *Ololygon brieni* | Not Evaluated | Critically Endangered | 831,25 | 161,5 | -80,57 |
| *Ololygon carnevalli* | Not Evaluated | Critically Endangered | 584 | 81,75 | -86,00 |
| *Ololygon catharinae* | Not Evaluated | Vulnerable | 815 | 447 | -45,15 |
| *Ololygon cosenzai* | Not Evaluated | Extinct | 13 | 0 | -100,00 |
| *Ololygon flavoguttata* | Not Evaluated | Endangered | 2204 | 957,75 | -56,54 |
| *Ololygon heyeri* | Not Evaluated | Vulnerable | 45,25 | 24,5 | -45,86 |
| *Ololygon hiemalis* | Not Evaluated | Endangered | 855,75 | 227,25 | -73,44 |

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|---|---|---|---|---|---|
| *Ololygon humilis* | Not Evaluated | Endangered | 918 | 347,25 | -62,17 |
| *Ololygon insperata* | Not Evaluated | Extinct | 5,5 | 0 | -100,00 |
| *Ololygon kautskyi* | Not Evaluated | Endangered | 1,25 | 0,5 | -60,00 |
| *Ololygon litoralis* | Not Evaluated | Critically Endangered | 225,75 | 32 | -85,83 |
| *Ololygon littoreus* | Not Evaluated | Critically Endangered | 187 | 23,5 | -87,43 |
| *Ololygon longilinea* | Not Evaluated | Critically Endangered | 787 | 73,5 | -90,66 |
| *Ololygon luizotavioi* | Not Evaluated | Critically Endangered | 1045 | 156,5 | -85,02 |
| *Ololygon machadoi* | Not Evaluated | Critically Endangered | 668 | 38,25 | -94,27 |
| *Ololygon obtriangulata* | Not Evaluated | Critically Endangered | 1589,75 | 300,75 | -81,08 |
| *Ololygon peixotoi* | Critically Endangered | Critically Endangered | 64 | 0,5 | -99,22 |
| *Ololygon perpusilla* | Not Evaluated | Endangered | 1109,5 | 459,25 | -58,61 |
| *Ololygon ranki* | Not Evaluated | Extinct | 67,5 | 0 | -100,00 |
| *Ololygon rizibilis* | Not Evaluated | Endangered | 1670,5 | 649,75 | -61,10 |
| *Ololygon strigilata* | Not Evaluated | Critically Endangered | 234,5 | 0,75 | -99,68 |
| *Ololygon v-signata* | Not Evaluated | Endangered | 741,5 | 284,75 | -61,60 |
| *Phasmahyla cochranae* | Not Evaluated | Critically Endangered | 1097 | 170,75 | -84,43 |
| *Phasmahyla exilis* | Not Evaluated | Critically Endangered | 536 | 50 | -90,67 |

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|---|---|---|---|---|---|
| *Phasmahyla guttata* | Not Evaluated | Endangered | 1085 | 369,25 | -65,97 |
| *Phasmahyla jandaia* | Not Evaluated | Critically Endangered | 211,25 | 9,25 | -95,62 |
| *Phasmahyla spectabilis* | Not Evaluated | Critically Endangered | 191 | 3,5 | -98,17 |
| *Phasmahyla timbo* | Not Evaluated | Extinct | 4,75 | 0 | -100,00 |
| *Phrynomedusa marginata* | Not Evaluated | Endangered | 891 | 366,5 | -58,87 |
| *Phyllodytes acuminatus* | Not Evaluated | Critically Endangered | 797 | 130 | -83,69 |
| *Phyllodytes edelmoi* | Not Evaluated | Critically Endangered | 102,75 | 0,25 | -99,76 |
| *Phyllodytes gyrinaethes* | Critically Endangered | Extinct | 61 | 0 | -100,00 |
| *Phyllodytes kautskyi* | Not Evaluated | Critically Endangered | 616,75 | 110 | -82,16 |
| *Phyllodytes luteolus* | Not Evaluated | Least Concern | 1780,5 | 1451 | -18,51 |
| *Phyllodytes maculosus* | Not Evaluated | Critically Endangered | 350 | 7,5 | -97,86 |
| *Phyllodytes melanomystax* | Not Evaluated | Endangered | 518,25 | 104 | -79,93 |
| *Phyllodytes punctatus* | Not Evaluated | Least Concern | 2 | 7,75 | 287,50 |
| *Phyllodytes tuberculosus* | Not Evaluated | Extinct | 31,75 | 0 | -100,00 |
| *Phyllodytes wuchereri* | Not Evaluated | Critically Endangered | 377,5 | 28 | -92,58 |
| *Pseudis bolbodactyla* | Not Evaluated | Least Concern | 2409,5 | 1758 | -27,04 |
| *Pseudis cardosoi* | Not Evaluated | Critically Endangered | 286 | 24,5 | -91,43 |

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|---|---|---|---|---|---|
| *Pseudis fusca* | Not Evaluated | Critically Endangered | 233 | 9,25 | -96,03 |
| *Pseudis minuta* | Not Evaluated | Endangered | 735 | 268 | -63,54 |
| *Pseudis paradoxa* | Not Evaluated | Least Concern | 1579 | 1423,25 | -9,86 |
| *Scinax alter* | Not Evaluated | Vulnerable | 3630,5 | 2190 | -39,68 |
| *Scinax auratus* | Not Evaluated | Least Concern | 844,75 | 720,25 | -14,74 |
| *Scinax caldarum* | Not Evaluated | Critically Endangered | 1009,75 | 118,75 | -88,24 |
| *Scinax cretatus* | Not Evaluated | Extinct | 46,5 | 0 | -100,00 |
| *Scinax crospedospilus* | Not Evaluated | Endangered | 827 | 260,75 | -68,47 |
| *Scinax cuspidatus* | Not Evaluated | Endangered | 2502,25 | 1152,25 | -53,95 |
| *Scinax duartei* | Vulnerable | Critically Endangered | 781,75 | 77,5 | -90,09 |
| *Scinax eurydice* | Not Evaluated | Least Concern | 3276,75 | 2694,75 | -17,76 |
| *Scinax fuscomarginatus* | Not Evaluated | Least Concern | 6943 | 5660,5 | -18,47 |
| *Scinax fuscovarius* | Not Evaluated | Vulnerable | 9273 | 6189,25 | -33,26 |
| *Scinax granulatus* | Not Evaluated | Endangered | 3019,75 | 1048,25 | -65,29 |
| *Scinax hayii* | Not Evaluated | Endangered | 2290 | 974,75 | -57,43 |
| *Scinax imbegue* | Not Evaluated | Extinct | 15 | 0 | -100,00 |
| *Scinax juncae* | Not Evaluated | Extinct | 18,75 | 0 | -100,00 |

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|---|---|---|---|---|---|
| *Scinax pachychrus* | Not Evaluated | Least Concern | 845,75 | 1225,25 | 44,87 |
| *Scinax perereca* | Not Evaluated | Endangered | 3227,75 | 1364 | -57,74 |
| *Scinax similis* | Not Evaluated | Endangered | 541,25 | 175,75 | -67,53 |
| *Scinax squalirostris* | Not Evaluated | Endangered | 8474,25 | 4132,75 | -51,23 |
| *Scinax trapicheiroi* | Not Evaluated | Endangered | 269,5 | 58,5 | -78,29 |
| *Scinax tymbamirim* | Not Evaluated | Extinct | 12 | 0 | -100,00 |
| *Scinax uruguayus* | Not Evaluated | Critically Endangered | 1468,25 | 71,75 | -95,11 |
| *Scinax x-signatus* | Not Evaluated | Least Concern | 7916,25 | 6995,25 | -11,63 |
| *Sphaenorhynchus botucudo* | Not Evaluated | Extinct | 18 | 0 | -100,00 |
| *Sphaenorhynchus caramaschii* | Not Evaluated | Endangered | 793,5 | 338,5 | -57,34 |
| *Sphaenorhynchus mirim* | Not Evaluated | Endangered | 9 | 2,25 | -75,00 |
| *Sphaenorhynchus orophilus* | Not Evaluated | Endangered | 943,25 | 284,25 | -69,86 |
| *Sphaenorhynchus palustris* | Not Evaluated | Vulnerable | 1311,25 | 692 | -47,23 |
| *Sphaenorhynchus pauloalvini* | Not Evaluated | Critically Endangered | 420,75 | 3,5 | -99,17 |
| *Sphaenorhynchus planicola* | Not Evaluated | Endangered | 879,75 | 282 | -67,95 |
| *Sphaenorhynchus prasinus* | Not Evaluated | Vulnerable | 1982,25 | 1300,75 | -34,38 |
| *Sphaenorhynchus surdus* | Not Evaluated | Endangered | 983,25 | 317,25 | -67,73 |

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|---|---|---|---|---|---|
| *Trachycephalus atlas* | Not Evaluated | Least Concern | 225,75 | 251,5 | 11,41 |
| *Trachycephalus dibernadoi* | Not Evaluated | Endangered | 795,5 | 248 | -68,82 |
| *Trachycephalus imitatrix* | Not Evaluated | Endangered | 2866,75 | 922,25 | -67,83 |
| *Trachycephalus lepidus* | Not Evaluated | Extinct | 4 | 0 | -100,00 |
| *Trachycephalus mesophaeus* | Not Evaluated | Least Concern | 5320,25 | 4459 | -16,19 |
| *Trachycephalus nigromaculatus* | Not Evaluated | Vulnerable | 3510,75 | 1916 | -45,42 |
| *Trachycephalus typhonius* | Not Evaluated | Least Concern | 4572,75 | 4346,5 | -4,95 |
| *Vitreorana eurygnathum* | Not Evaluated | Endangered | 4170 | 1776 | -57,41 |
| *Vitreorana uranoscopa* | Not Evaluated | Endangered | 4987,25 | 2008,75 | -59,72 |
| *Xenohyla truncata* | Endangered | Endangered | 341,25 | 84,25 | -75,31 |
| **Hylodidae** | | | | | |
| *Crossodactylus aeneus* | Not Evaluated | Endangered | 1346,75 | 559,75 | -58,44 |
| *Crossodactylus bokermani* | Not Evaluated | Least Concern | 3 | 6,5 | 116,67 |
| *Crossodactylus caramaschii* | Not Evaluated | Endangered | 600 | 207 | -65,50 |
| *Crossodactylus dantei* | Endangered | Extinct | 2 | 0 | -100,00 |
| *Crossodactylus dispar* | Not Evaluated | Endangered | 1074 | 224,5 | -79,10 |
| *Crossodactylus gaudichaudii* | Not Evaluated | Endangered | 1154,75 | 458,75 | -60,27 |

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|---|---|---|---|---|---|
| *Crossodactylus grandis* | Not Evaluated | Critically Endangered | 188,75 | 19,75 | -89,54 |
| *Crossodactylus schmidti* | Not Evaluated | Least Concern | 235 | 297,75 | 26,70 |
| *Hylodes amnicola* | Not Evaluated | Extinct | 6,5 | 0 | -100,00 |
| *Hylodes asper* | Not Evaluated | Endangered | 1263 | 424,75 | -66,37 |
| *Hylodes babax* | Not Evaluated | Least Concern | 31,5 | 42,25 | 34,13 |
| *Hylodes cardosoi* | Not Evaluated | Critically Endangered | 80,5 | 3,5 | -95,65 |
| *Hylodes charadranaetes* | Not Evaluated | Critically Endangered | 133 | 19 | -85,71 |
| *Hylodes dactylocinus* | Not Evaluated | Critically Endangered | 28 | 1,5 | -94,64 |
| *Hylodes heyeri* | Not Evaluated | Endangered | 287,25 | 94,5 | -67,10 |
| *Hylodes lateristrigatus* | Not Evaluated | Endangered | 1229,75 | 462,5 | -62,39 |
| *Hylodes magalhaesi* | Not Evaluated | Critically Endangered | 66,5 | 0,5 | -99,25 |
| *Hylodes meridionalis* | Not Evaluated | Critically Endangered | 99 | 10,75 | -89,14 |
| *Hylodes nasus* | Not Evaluated | Endangered | 1664,25 | 754,25 | -54,68 |
| *Hylodes ornatus* | Not Evaluated | Critically Endangered | 255,5 | 13,75 | -94,62 |
| *Hylodes otavioi* | Not Evaluated | Extinct | 3,5 | 0 | -100,00 |
| *Hylodes perere* | Not Evaluated | Extinct | 20,75 | 0 | -100,00 |
| *Hylodes perplicatus* | Not Evaluated | Endangered | 97 | 41,75 | -56,96 |

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|---|---|---|---|---|---|
| *Hylodes phyllodes* | Not Evaluated | Critically Endangered | 493,75 | 84 | -82,99 |
| *Hylodes pipilans* | Not Evaluated | Extinct | 4,75 | 0 | -100,00 |
| *Hylodes regius* | Not Evaluated | Critically Endangered | 53 | 0,5 | -99,06 |
| *Hylodes sazimai* | Not Evaluated | Critically Endangered | 169,5 | 2,25 | -98,67 |
| *Megaelosia apuana* | Not Evaluated | Least Concern | 4 | 26,75 | 568,75 |
| *Megaelosia bocainensis* | Not Evaluated | Extinct | 5 | 0 | -100,00 |
| *Megaelosia goeldii* | Not Evaluated | Endangered | 520,75 | 148,25 | -71,53 |
| *Megaelosia massarti* | Not Evaluated | Extinct | 42,5 | 0 | -100,00 |
| **Leptodactylidae** | | | | | |
| *Adenomera ajurauna* | Not Evaluated | Extinct | 42 | 0 | -100,00 |
| *Adenomera araucaria* | Not Evaluated | Critically Endangered | 72,25 | 0,5 | -99,31 |
| *Adenomera bokermani* | Not Evaluated | Endangered | 2855,75 | 1013 | -64,53 |
| *Adenomera engelsi* | Not Evaluated | Extinct | 46 | 0 | -100,00 |
| *Adenomera marmorata* | Not Evaluated | Endangered | 2715,5 | 856 | -68,48 |
| *Adenomera nana* | Not Evaluated | Endangered | 234,5 | 70,5 | -69,94 |
| *Adenomera thomei* | Not Evaluated | Endangered | 309,25 | 78,25 | -74,70 |
| *Crossodactylodes bokermanni* | Not Evaluated | Endangered | 39,25 | 14,75 | -62,42 |

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|---|---|---|---|---|---|
| *Crossodactylodes izecksohni* | Not Evaluated | Extinct | 4,25 | 0 | -100,00 |
| *Leptodactylus cupreus* | Not Evaluated | Extinct | 8,5 | 0 | -100,00 |
| *Leptodactylus flavopictus* | Not Evaluated | Endangered | 1280,75 | 586 | -54,25 |
| *Leptodactylus furnarius* | Not Evaluated | Vulnerable | 3487,25 | 2277,25 | -34,70 |
| *Leptodactylus fuscus* | Not Evaluated | Least Concern | 9581 | 7854,5 | -18,02 |
| *Leptodactylus gracilis* | Not Evaluated | Endangered | 3689 | 1525,5 | -58,65 |
| *Leptodactylus jolyi* | Not Evaluated | Extinct | 6,75 | 0 | -100,00 |
| *Leptodactylus labyrinthicus* | Not Evaluated | Least Concern | 4822,5 | 3809,75 | -21,00 |
| *Leptodactylus latrans* | Not Evaluated | Least Concern | 9425,25 | 7312,25 | -22,42 |
| *Leptodactylus macrosternum* | Not Evaluated | Vulnerable | 8249,75 | 5416,25 | -34,35 |
| *Leptodactylus mystaceus* | Not Evaluated | Endangered | 556 | 253 | -54,50 |
| *Leptodactylus mystacinus* | Not Evaluated | Least Concern | 9607 | 7031,75 | -26,81 |
| *Leptodactylus natalensis* | Not Evaluated | Least Concern | 2429,5 | 2202 | -9,36 |
| *Leptodactylus noaktites* | Not Evaluated | Endangered | 2266 | 552,5 | -75,62 |
| *Leptodactylus plaumanni* | Not Evaluated | Endangered | 2050,5 | 946,25 | -53,85 |
| *Leptodactylus podicipinus* | Not Evaluated | Least Concern | 2605,75 | 2322 | -10,89 |
| *Leptodactylus spixi* | Not Evaluated | Least Concern | 3893,5 | 3768,5 | -3,21 |

| | | | | | |
|---|---|---|---|---|---|
| *Leptodactylus troglodytes* | Not Evaluated | Least Concern | 1142,75 | 1274,75 | 11,55 |
| *Leptodactylus vastus* | Not Evaluated | Vulnerable | 585 | 378,75 | -35,26 |
| *Leptodactylus viridis* | Not Evaluated | Critically Endangered | 242,5 | 13 | -94,64 |
| *Paratelmatobius cardosoi* | Not Evaluated | Extinct | 31,5 | 0 | -100,00 |
| *Paratelmatobius gaigeae* | Not Evaluated | Extinct | 6,25 | 0 | -100,00 |
| *Paratelmatobius lutzii* | Critically Endangered | Critically Endangered | 4,75 | 0,25 | -94,74 |
| *Paratelmatobius poecilogaster* | Not Evaluated | Extinct | 47 | 0 | -100,00 |
| *Paratelmatobius yepiranga* | Not Evaluated | Extinct | 22 | 0 | -100,00 |
| *Physalaemus aguirrei* | Not Evaluated | Endangered | 997,5 | 246,5 | -75,29 |
| *Physalaemus atlanticus* | Not Evaluated | Extinct | 1 | 0 | -100,00 |
| *Physalaemus barrioi* | Not Evaluated | Extinct | 10 | 0 | -100,00 |
| *Physalaemus bokermanni* | Not Evaluated | Extinct | 4,75 | 0 | -100,00 |
| *Physalaemus camacan* | Not Evaluated | Extinct | 1 | 0 | -100,00 |
| *Physalaemus crombiei* | Not Evaluated | Endangered | 1214,25 | 339 | -72,08 |
| *Physalaemus cuvieri* | Not Evaluated | Least Concern | 9574 | 7430,75 | -22,39 |
| *Physalaemus erikae* | Not Evaluated | Critically Endangered | 278,5 | 9 | -96,77 |
| *Physalaemus feioi* | Not Evaluated | Critically Endangered | 336,75 | 3,5 | -98,96 |

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|---|---|---|---|---|---|
| *Physalaemus jordanensis* | Not Evaluated | Critically Endangered | 382 | 14,5 | -96,20 |
| *Physalaemus kroyeri* | Not Evaluated | Least Concern | 944 | 1291 | 36,76 |
| *Physalaemus lateristriga* | Not Evaluated | Critically Endangered | 176,75 | 28,75 | -83,73 |
| *Physalaemus lisei* | Not Evaluated | Critically Endangered | 690,5 | 119,75 | -82,66 |
| *Physalaemus maculiventris* | Not Evaluated | Endangered | 1716,25 | 560,5 | -67,34 |
| *Physalaemus maximus* | Vulnerable | Extinct | 118,25 | 0 | -100,00 |
| *Physalaemus moreirae* | Not Evaluated | Critically Endangered | 99,25 | 7,75 | -92,19 |
| *Physalaemus nanus* | Not Evaluated | Endangered | 521,25 | 126 | -75,83 |
| *Physalaemus obtectrus* | Not Evaluated | Endangered | 753,75 | 225,25 | -70,12 |
| *Physalaemus olfersii* | Not Evaluated | Endangered | 2669 | 1184,25 | -55,63 |
| *Physalaemus signifer* | Not Evaluated | Endangered | 1911 | 747,75 | -60,87 |
| *Physalaemus soaresi* | Critically Endangered | Extinct | 4,75 | 0 | -100,00 |
| *Physalaemus spiniger* | Not Evaluated | Endangered | 250,5 | 59 | -76,45 |
| *Pseudopaludicola falcipes* | Not Evaluated | Endangered | 5582 | 2564,5 | -54,06 |
| *Scythrophrys sawayae* | Not Evaluated | Endangered | 226,25 | 96,75 | -57,24 |
| **Microhylidae** | | | | | |
| *Arcomover passareli* | Not Evaluated | Endangered | 951,75 | 364,5 | -61,70 |

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|---|---|---|---|---|---|
| *Chiasmocleis alagoanus* | Endangered | Extinct | 5,25 | 0 | -100,00 |
| *Chiasmocleis atlantica* | Not Evaluated | Endangered | 674,25 | 175,25 | -74,01 |
| *Chiasmocleis capixaba* | Not Evaluated | Critically Endangered | 444,75 | 12 | -97,30 |
| *Chiasmocleis carvalhoi* | Not Evaluated | Critically Endangered | 883,75 | 154 | -82,57 |
| *Chiasmocleis crucis* | Not Evaluated | Extinct | 1 | 0 | -100,00 |
| *Chiasmocleis gnoma* | Not Evaluated | Extinct | 1 | 0 | -100,00 |
| *Chiasmocleis leucosticta* | Not Evaluated | Endangered | 1414,5 | 480 | -66,07 |
| *Chiasmocleis mantiqueira* | Not Evaluated | Extinct | 6,5 | 0 | -100,00 |
| *Chiasmocleis schubarti* | Not Evaluated | Endangered | 1390,75 | 677 | -51,32 |
| *Dasypops schirchi* | Not Evaluated | Critically Endangered | 187,75 | 0,25 | -99,87 |
| *Elachistocleis bicolor* | Not Evaluated | Endangered | 3509,25 | 1374,5 | -60,83 |
| *Elachistocleis cesarii* | Not Evaluated | Least Concern | 6902 | 5254,25 | -23,87 |
| *Elachistocleis erythrogaster* | Not Evaluated | Extinct | 49,5 | 0 | -100,00 |
| *Myersiella microps* | Not Evaluated | Endangered | 1479,75 | 563 | -61,95 |
| *Stereocyclops histrio* | Not Evaluated | Critically Endangered | 11 | 1 | -90,91 |
| *Stereocyclops incrassatus* | Not Evaluated | Endangered | 2158,75 | 1133,25 | -47,50 |
| *Stereocyclops parkeri* | Not Evaluated | Critically Endangered | 377,25 | 64,25 | -82,97 |

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| **Odontophrynidae** | | | | | |
| *Macrogenioglottus alipioi* | Not Evaluated | Vulnerable | 2874 | 2012 | -29,99 |
| *Odontophrynus americanus* | Not Evaluated | Vulnerable | 8798 | 4404 | -49,94 |
| *Odontophrynus carvalhoi* | Not Evaluated | Least Concern | 707,25 | 1145,5 | 61,97 |
| *Odontophrynus maisuma* | Not Evaluated | Vulnerable | 8250 | 5381,25 | -34,77 |
| *Proceratophrys appendiculata* | Not Evaluated | Endangered | 1587,25 | 675,75 | -57,43 |
| *Proceratophrys avelinoi* | Not Evaluated | Vulnerable | 2365,5 | 1317 | -44,32 |
| *Proceratophrys bigibbosa* | Not Evaluated | Critically Endangered | 674,5 | 122,25 | -81,88 |
| *Proceratophrys boiei* | Not Evaluated | Least Concern | 5307,25 | 4325 | -18,51 |
| *Proceratophrys brauni* | Not Evaluated | Critically Endangered | 384,25 | 28,75 | -92,52 |
| *Proceratophrys cristiceps* | Not Evaluated | Endangered | 736,25 | 347,75 | -52,77 |
| *Proceratophrys cururu* | Not Evaluated | Extinct | 1 | 0 | -100,00 |
| *Proceratophrys laticeps* | Not Evaluated | Endangered | 1213,75 | 345,25 | -71,56 |
| *Proceratophrys melanopogon* | Not Evaluated | Endangered | 600 | 135,25 | -77,46 |
| *Proceratophrys minuta* | Not Evaluated | Least Concern | 3,5 | 73,75 | 2007,14 |
| *Proceratophrys paviotti* | Not Evaluated | Extinct | 3,25 | 0 | -100,00 |
| *Proceratophrys renalis* | Not Evaluated | Vulnerable | 1530 | 1058,5 | -30,82 |

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|---|---|---|---|---|---|
| *Proceratophrys sanctarictae* | Critically Endangered | Least Concern | 13,25 | 77,75 | 486,79 |
| *Proceratophrys schirchi* | Not Evaluated | Endangered | 1633,25 | 490,75 | -69,95 |
| *Proceratophrys subguttata* | Not Evaluated | Endangered | 312,5 | 133,5 | -57,28 |
| **Pipidae** | | | | | |
| *Pipa carvalhoi* | Not Evaluated | Least Concern | 2311,75 | 1841,75 | -20,33 |
| **Phyllomedusidae** | | | | | |
| *Hylomantis aspera* | Not Evaluated | Endangered | 174 | 52 | -70,11 |
| *Hylomantis granulosa* | Vulnerable | Critically Endangered | 267 | 16,75 | -93,73 |
| *Phyllomedusa bahiana* | Not Evaluated | Critically Endangered | 303,25 | 10,5 | -96,54 |
| *Phyllomedusa burmeisteri* | Not Evaluated | Least Concern | 4791,75 | 4257,25 | -11,15 |
| *Phyllomedusa distincta* | Not Evaluated | Endangered | 1487,75 | 625,5 | -57,96 |
| *Phyllomedusa iheringii* | Not Evaluated | Extinct | 56,5 | 0 | -100,00 |
| *Phyllomedusa nordestina* | Not Evaluated | Least Concern | 1889,75 | 2180 | 15,36 |
| *Phyllomedusa rohdei* | Not Evaluated | Endangered | 2174,75 | 916,5 | -57,86 |
| *Phyllomedusa tetraploidea* | Not Evaluated | Vulnerable | 3144,25 | 2068,5 | -34,21 |
| **Ranidae** | | | | | |
| *Lithobates catesbeianus* | Not Evaluated | Least Concern | 1315,25 | 1032,5 | -21,50 |

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|---|---|---|---|---|---|
| *Lithobates palmipes* | Not Evaluated | Critically Endangered | 272,25 | 6 | -97,80 |

**Table S2.** List of studied amphibians species and their respectives functional traits.

| Species | Activity | Members | Body Size(cm) | Calling site | Poisonous | Habit | Habitat | Reproductive mode | References |
|---|---|---|---|---|---|---|---|---|---|
| *Adelophryne mucronatus* | Nocturnal | Tetrapod | 1,4 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Lourenço-de-Moraes et al 2012; Haddad et al. 2013; present study |
| *Adelophryne pachydactyla* | Nocturnal | Tetrapod | 1,4 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Lourenço-de-Moraes et al 2012; Haddad et al. 2013; present study |
| *Adenomera ajurauna* | Nocturnal | Tetrapod | 1,9 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 32 | Haddad et al 2013 |
| *Adenomera araucaria* | Nocturnal | Tetrapod | 1,9 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 32 | Haddad et al 2013 |
| *Adenomera bokermanni* | Nocturnal | Tetrapod | 2,4 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 32 | Haddad et al 2013 |
| *Adenomera engelsi* | Nocturnal and Diurnal | Tetrapod | 2,2 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 32 | Haddad et al 2013 |
| *Adenomera marmorata* | Nocturnal and Diurnal | Tetrapod | 2,1 | Forest floor; Low vegetation | Non toxic | Cryptic | Open or forested areas | Reproductive mode 32 | Haddad et al 2013; present study |
| *Adenomera nana* | Nocturnal | Tetrapod | 1,8 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 32 | Haddad et al 2013; present study |
| *Adenomera thomei* | Nocturnal | Tetrapod | 2,4 | Forest floor | Non toxic | Cryptic | Forested | Reproductive | Haddad et al 2013 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | areas | mode 32 | |
| *Allobates alagoanus* | Diurnal | Tetrapod | 1,5 | Stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 20 | Haddad et al 2013 |
| *Allobates capixaba* | Diurnal | Tetrapod | 1,6 | Stream or rivulet | Non toxic | Rheophilic | Open or forested areas | Reproductive mode 20 | Haddad et al 2013 |
| *Allobates olfersioides* | Diurnal | Tetrapod | 1,6 | Stream or rivulet | Non toxic | Rheophilic | Open or forested areas | Reproductive mode 20 | Haddad et al 2013; present study |
| *Aparasphenodon arapapa* | Nocturnal | Tetrapod | 4,5 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013; Lourenço-de-Moraes et al 2013; present study |
| *Aparasphenodon bokermanni* | Nocturnal | Tetrapod | 4,6 | Swamp or pond | Non toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Aparasphenodon brunoi* | Nocturnal | Tetrapod | 8 | Swamp or pond | Non toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Aplastodiscus albofrenatus* | Nocturnal | Tetrapod | 3,9 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 5 | Haddad et al 2013; present study |
| *Aplastodiscus albosignatus* | Nocturnal | Tetrapod | 4,3 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 5 | Haddad et al 2013; present study |
| *Aplastodiscus arildae* | Nocturnal | Tetrapod | 3,7 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 5 | Haddad et al 2013; present study |

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|---|---|---|---|---|---|---|---|---|---|
| *Aplastodiscus callipygius* | Nocturnal | Tetrapod | 4,6 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 5 | Haddad et al 2013 |
| *Aplastodiscus cavicola* | Nocturnal | Tetrapod | 3,7 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 5 | Haddad et al 2013 |
| *Aplastodiscus cochranae* | Nocturnal | Tetrapod | 4,5 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Open or forested areas | Reproductive mode 5 | Haddad et al 2013 |
| *Aplastodiscus ehrhardti* | Nocturnal | Tetrapod | 3,1 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 5 | Haddad et al 2013; present study |
| *Aplastodiscus eugenioi* | Nocturnal | Tetrapod | 3,5 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 5 | Haddad et al 2013 |
| *Aplastodiscus flumineus* | Nocturnal | Tetrapod | 4,5 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 5 | Haddad et al 2013 |
| *Aplastodiscus ibirabitanga* | Nocturnal | Tetrapod | 4,1 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 5 | Haddad et al 2013; present study |
| *Aplastodiscus leucoeygius* | Nocturnal | Tetrapod | 4,5 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 5 | Haddad et al 2013 |
| *Aplastodiscus perviridis* | Nocturnal | Tetrapod | 4,5 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 5 | Haddad et al 2013; present study |

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|---|---|---|---|---|---|---|---|---|---|
| *Aplastodiscus sibilatus* | Nocturnal | Tetrapod | 3,2 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 5 | Haddad et al 2013 |
| *Aplastodiscus weygoldti* | Nocturnal | Tetrapod | 3,8 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 5 | Haddad et al 2013; present study |
| *Arcovomer passarellii* | Nocturnal | Tetrapod | 2,4 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Bokermannohyla ahenea* | Nocturnal | Tetrapod | 5,2 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013 |
| *Bokermannohyla astartea* | Nocturnal | Tetrapod | 4,4 | Bromeliad; | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013; present study |
| *Bokermannohyla capra* | Nocturnal | Tetrapod | 6,1 | Bromeliad; Stream or rivulet | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Bokermannohyla caramaschii* | Nocturnal | Tetrapod | 6,2 | River, stream or rivulet | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013; present study |
| *Bokermannohyla carvalhoi* | Nocturnal | Tetrapod | 6,4 | River, stream or rivulet | Unpalatable or bad odor | Terrestrial | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Bokermannohyla circumdata* | Nocturnal | Tetrapod | 5,4 | Swamp or pond | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 2 and 4 | Haddad et al 2013; present study |
| *Bokermannohyla diamantina* | Nocturnal | Tetrapod | 4,9 | River, stream or rivulet | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Bokermannohyla gouveai* | Nocturnal | Tetrapod | 6,9 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open or forested | 0 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | areas | | |
| *Bokermannohyla hylax* | Nocturnal | Tetrapod | 6,6 | Swamp or pond | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 4 | Haddad et al 2013; present study |
| *Bokermannohyla ibitipoca* | Nocturnal | Tetrapod | 3,9 | River, stream or rivulet | Unpalatable or bad odor | Terrestrial | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Bokermannohyla itapoty* | Nocturnal | Tetrapod | 4,1 | River, stream or rivulet | Unpalatable or bad odor | Arboreal; Terrestrial | Open areas | Reproductive mode 2 | Haddad et al 2013 |
| *Bokermannohyla izecksohni* | Nocturnal | Tetrapod | 3,1 | ----- | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Bokermannohyla lucianae* | Nocturnal | Tetrapod | 4,7 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |
| *Bokermannohyla luctuosa* | Nocturnal | Tetrapod | 6,7 | Swamp or pond | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 2 and 4 | Haddad et al 2013 |
| *Bokermannohyla martinsi* | Nocturnal | Tetrapod | 7,3 | River, stream or rivulet | Unpalatable or bad odor | Terrestrial | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Bokermannohyla nanuzae* | Nocturnal | Tetrapod | 4,4 | Stream or rivulet | Unpalatable or bad odor | Arboreal | Forested areas | 0 | Haddad et al 2013 |
| *Bokermannohyla oxente* | Nocturnal | Tetrapod | 4,9 | River, stream or rivulet | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 2 | Haddad et al 2013 |
| *Brachycephalus alipioi* | Diurnal | Tetrapod | 1,4 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Brachycephalus brunneus* | Diurnal | Tetrapod | 1,2 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *Brachycephalus didactylus* | Diurnal | Tetrapod | 0,8 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Brachycephalus ephippium* | Diurnal | Tetrapod | 1,9 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |
| *Brachycephalus ferruginus* | Diurnal | Tetrapod | 1,4 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Brachycephalus garbeanus* | Diurnal | Tetrapod | 1,7 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Brachycephalus guarani* | Diurnal | Tetrapod | 1,3 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Brachycephalus hermogenesi* | Diurnal | Tetrapod | 1,1 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Brachycephalus izecksohni* | Diurnal | Tetrapod | 1,3 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Brachycephalus margaritatus* | Diurnal | Tetrapod | 1,7 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Brachycephalus nodoterga* | Diurnal | Tetrapod | 1,3 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Brachycephalus pernix* | Diurnal | Tetrapod | 1,5 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Brachycephalus pitanga* | Diurnal | Tetrapod | 1,3 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |
| *Brachycephalus pombali* | Diurnal | Tetrapod | 1,5 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *Brachycephalus pulex* | ----- | Tetrapod | 0,8 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Brachycephalus toby* | Diurnal | Tetrapod | 1,4 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Brachycephalus tridactylus* | Diurnal | Tetrapod | 1,4 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Brachycephalus vertebralis* | Diurnal | Tetrapod | 1,4 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Ceratophrys aurita* | Nocturnal | Tetrapod | 14,9 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Chiasmocleis alagoana* | ----- | Tetrapod | 2,7 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Chiasmocleis atlantica* | Nocturnal | Tetrapod | 3,2 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Chiasmocleis capixaba* | Nocturnal | Tetrapod | 1,5 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Chiasmocleis carvalhoi* | Nocturnal | Tetrapod | 2,3 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Chiasmocleis crucis* | Nocturnal | Tetrapod | 2 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Chiasmocleis gnoma* | Nocturnal | Tetrapod | 1,6 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Chiasmocleis leucosticta* | Nocturnal and | Tetrapod | 2,5 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 10 | Haddad et al 2013; present study |

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|---|---|---|---|---|---|---|---|---|---|
| | Diurnal | | | | | | | | |
| *Chiasmocleis mantiqueira* | Nocturnal | Tetrapod | 2,2 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Chiasmocleis schubarti* | Nocturnal | Tetrapod | 3,3 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Chthonerpeton indistinctum* | ----- | Apod | 43,5 | Do not Call | ----- | Fossorial; Aquatic | Open or forested areas | Reproductive mode 39 | Haddad et al 2013 |
| *Crossodactylodes bokermanni* | Nocturnal | Tetrapod | 1,4 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013 |
| *Crossodactylodes izecksohni* | Nocturnal | Tetrapod | 1,5 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013 |
| *Crossodactylus aeneus* | ----- | Tetrapod | 2,3 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Crossodactylus bokermanni* | ----- | Tetrapod | 2,7 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Crossodactylus caramaschii* | Nocturnal and Diurnal | Tetrapod | 2,3 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013; present study |
| *Crossodactylus dantei* | ----- | Tetrapod | 2,2 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Crossodactylus dispar* | Diurnal | Tetrapod | 3,1 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Crossodactylus* | Nocturnal | Tetrapod | 3,1 | River, stream or | Non toxic | Rheophilic | Forested | Reproductive | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *gaudichaudii* | and Diurnal | | | rivulet | | | areas | mode 3 | |
| *Crossodactylus grandis* | Diurnal | Tetrapod | 4,2 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Crossodactylus schmidti* | Nocturnal | Tetrapod | 2,8 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013; present study |
| *Cycloramphus acangatan* | Nocturnal | Tetrapod | 4,3 | Forest floor | ----- | Cryptic | Forested areas | Reproductive mode 21 | Haddad et al 2013; present study |
| *Cycloramphus bandeirensis* | ----- | Tetrapod | 4,5 | ----- | ----- | Rheophilic | Open areas | Reproductive mode 19 | Haddad et al 2013 |
| *Cycloramphus bolitoglossus* | Nocturnal | Tetrapod | 3,8 | Forest floor | ----- | Cryptic | Forested areas | Reproductive mode 21 | Haddad et al 2013 |
| *Cycloramphus boraceiensis* | Nocturnal | Tetrapod | 4,7 | River, stream or rivulet | Unpalatable or bad odor | Rheophilic | Forested areas | Reproductive mode 19 | Haddad et al 2013; present study |
| *Cycloramphus brasiliensis* | Nocturnal | Tetrapod | 6,2 | River, stream or rivulet | ----- | Rheophilic | Forested areas | Reproductive mode 19 | Haddad et al 2013; present study |
| *Cycloramphus carvalhoi* | ----- | Tetrapod | 5,6 | Forest floor | ----- | Cryptic | Forested areas | Reproductive mode 21 | Haddad et al 2013 |
| *Cycloramphus catarinensis* | Nocturnal | Tetrapod | 3,5 | River, stream or rivulet | ----- | Rheophilic | Forested areas | Reproductive mode 19 | Haddad et al 2013 |
| *Cycloramphus dubius* | Nocturnal | Tetrapod | 4,9 | River, stream or rivulet | ----- | Rheophilic | Forested areas | Reproductive mode 19 | Haddad et al 2013 |
| *Cycloramphus eleutherodactylus* | Nocturnal | Tetrapod | 4,8 | Caves, burrows | ----- | Cryptic | Forested areas | Reproductive mode 21 | Haddad et al 2013; present study |

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|---|---|---|---|---|---|---|---|---|---|
| *Cycloramphus izecksohni* | Nocturnal | Tetrapod | 4 | River, stream or rivulet | ----- | Rheophilic | Forested areas | Reproductive mode 19 | Haddad et al 2013 |
| *Cycloramphus juimirim* | Nocturnal | Tetrapod | 3 | River, stream or rivulet | ----- | Rheophilic | Forested areas | Reproductive mode 19 | Haddad et al 2013 |
| *Cycloramphus lithomimeticus* | Nocturnal | Tetrapod | 3,1 | River, stream or rivulet | ----- | Rheophilic | Forested areas | Reproductive mode 19 | Haddad et al 2013 |
| *Cycloramphus lutzorum* | Nocturnal | Tetrapod | 4,1 | River, stream or rivulet | ----- | Rheophilic | Forested areas | Reproductive mode 19 | Haddad et al 2013 |
| *Cycloramphus migueli* | ----- | Tetrapod | 4,2 | ----- | ----- | Cryptic | Forested areas | Reproductive mode 21 | Haddad et al 2013 |
| *Cycloramphus organensis* | Nocturnal | Tetrapod | 3,2 | ----- | ----- | ----- | Open areas | ----- | Haddad et al 2013 |
| *Cycloramphus rhyakonastes* | Nocturnal | Tetrapod | 4,2 | River, stream or rivulet | ----- | Rheophilic | Forested areas | Reproductive mode 19 | Haddad et al 2013 |
| *Cycloramphus valae* | ----- | Tetrapod | 3,6 | River, stream or rivulet | ----- | Rheophilic | Forested areas | Reproductive mode 19 | Haddad et al 2013 |
| *Dasypops schirchi* | Nocturnal | Tetrapod | 5,2 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Dendrophryniscus berthalutzae* | Nocturnal | Tetrapod | 2,4 | Bromeliad | Non toxic | Cryptic | Forested areas | Reproductive mode 8 | Haddad et al 2013 |
| *Dendrophryniscus brevipollicatus* | Nocturnal | Tetrapod | 2 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 8 | Haddad et al 2013; present study |
| *Dendrophryniscus carvalhoi* | ----- | Tetrapod | 1,9 | Bromeliad | Non toxic | Cryptic | Forested areas | Reproductive mode 8 | Haddad et al 2013 |

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| *Dendrophryniscus krausae* | ----- | Tetrapod | 2,3 | ----- | Non toxic | Arboreal; Cryptic | Forested areas | Reproductive mode 8 | Haddad et al 2013 |
| *Dendrophryniscus leucomystax* | Nocturnal | Tetrapod | 2,5 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Dendrophryniscus oreites* | ----- | Tetrapod | 2,5 | ----- | Non toxic | Arboreal | Forested areas | ----- | Haddad et al 2013 |
| *Dendrophryniscus proboscideus* | Nocturnal | Tetrapod | 4,1 | ----- | Toxic | Cryptic | Forested areas | ----- | Haddad et al 2013; present study |
| *Dendropsophus anceps* | Nocturnal | Tetrapod | 4,2 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Dendropsophus berthalutzae* | Nocturnal | Tetrapod | 2,4 | Swamp or pond | Non toxic | Arboreal | Forested areas | Reproductive mode 24 | Haddad et al 2013 |
| *Dendropsophus bipunctatus* | Nocturnal | Tetrapod | 2,6 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Dendropsophus branneri* | Nocturnal | Tetrapod | 2,3 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Dendropsophus decipiens* | Nocturnal | Tetrapod | 1,9 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 24 | Haddad et al 2013; present study |
| *Dendropsophus elegans* | Nocturnal | Tetrapod | 3,1 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Dendropsophus giesleri* | Nocturnal | Tetrapod | 2,7 | Swamp or pond | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |

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| *Dendropsophus haddadi* | Nocturnal | Tetrapod | 2,3 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 24 | Lourenço-de-Moraes et al 2012; Haddad et al 2013; present study |
| *Dendropsophus meridianus* | Nocturnal | Tetrapod | 1,8 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Dendropsophus microps* | Nocturnal | Tetrapod | 2,9 | Swamp or pond | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Dendropsophus minutus* | Nocturnal | Tetrapod | 2,5 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Dendropsophus nahderere* | Nocturnal | Tetrapod | 4,6 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Dendropsophus nanus* | Nocturnal | Tetrapod | 2,3 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Dendropsophus novaisi* | Nocturnal | Tetrapod | 3,4 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Dendropsophus oliveirai* | Nocturnal | Tetrapod | 1,9 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Dendropsophus pseudomeridianus* | Nocturnal | Tetrapod | 1,7 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Dendropsophus ruschii* | Nocturnal | Tetrapod | 2,8 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 25 | Haddad et al 2013 |
| *Dendropsophus sanborni* | Nocturnal | Tetrapod | 2 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |

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|---|---|---|---|---|---|---|---|---|---|
| *Dendropsophus seniculus* | Nocturnal | Tetrapod | 3,8 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Dendropsophus soaresi* | Nocturnal | Tetrapod | 3,5 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Dendropsophus studerae* | Nocturnal | Tetrapod | 2,8 | Swamp or pond | Non toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Dendropsophus werneri* | Nocturnal | Tetrapod | 1,9 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Elaschitocleis bicolor* | Nocturnal | Tetrapod | 3,8 | Swamp or pond | Non toxic | Fossorial | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Elaschitocleis cesarii* | Nocturnal | Tetrapod | 3,2 | Swamp or pond | Non toxic | Fossorial | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Elaschitocleis erythrogaster* | Nocturnal | Tetrapod | 3,5 | Swamp or pond | Non toxic | Fossorial | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Eleutherodactylus bilineatus* | Nocturnal | Tetrapod | 2,6 | ----- | Non toxic | Arboreal; Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |
| *Euparkerella brasiliensis* | Nocturnal and Diurnal | Tetrapod | 1,7 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Euparkerella cochranae* | Nocturnal and Diurnal | Tetrapod | 1,6 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |
| *Euparkerella robusta* | Nocturnal and | Tetrapod | 2,3 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| | Diurnal | | | | | | | | |
| *Euparkerella tridactyla* | Nocturnal and Diurnal | Tetrapod | 1,5 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |
| *Fritziana fissilis* | Nocturnal | Tetrapod | 2,8 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 36 | Haddad et al 2013; present study |
| *Fritziana goeldii* | Nocturnal | Tetrapod | 3,7 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 36 | Haddad et al 2013 |
| *Fritziana ohausi* | Nocturnal | Tetrapod | 3,1 | Bamboo Grove | Non toxic | Arboreal | Forested areas | Reproductive mode 36 | Haddad et al 2013; present study |
| *Frostius erythrophthalmus* | Nocturnal | Tetrapod | 2,3 | Vegetation | Toxic | Arboreal; Cryptic | Forested areas | ----- | Haddad et al 2013; present study |
| *Frostius pernambucensis* | Nocturnal | Tetrapod | 2,1 | Bromeliad | Toxic | Arboreal; Cryptic | Forested areas | Reproductive mode 8 | Haddad et al 2013; present study |
| *Gastrotheca albolineata* | Nocturnal | Tetrapod | 6 | Tree crown | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 37 | Haddad et al 2013; present study |
| *Gastrotheca ernestoi* | Nocturnal | Tetrapod | 6,9 | Tree crown | Non toxic | Arboreal | Forested areas | Reproductive mode 37 | Haddad et al 2013 |
| *Gastrotheca fissipes* | Nocturnal | Tetrapod | 7,2 | Tree crown | Non toxic | Arboreal | Forested areas | Reproductive mode 37 | Haddad et al 2013 |
| *Gastrotheca fulvorufa* | Nocturnal | Tetrapod | 6,9 | Tree crown | Non toxic | Arboreal | Forested areas | Reproductive mode 37 | Haddad et al 2013 |
| *Gastrotheca megacephala* | Nocturnal | Tetrapod | 10,1 | Tree crown | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 37 | Haddad et al 2013; present study |

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|---|---|---|---|---|---|---|---|---|---|
| *Gastrotheca microdiscus* | Nocturnal | Tetrapod | 5,9 | Tree crown | Non toxic | Arboreal | Forested areas | Reproductive mode 37 | Haddad et al 2013 |
| *Gastrotheca prasina* | Nocturnal | Tetrapod | 9,7 | Tree crown | Non toxic | Arboreal | Forested areas | Reproductive mode 37 | Haddad et al 2013 |
| *Gastrotheca pulchra* | Nocturnal | Tetrapod | 3,3 | Tree crown | Non toxic | Arboreal | Forested areas | Reproductive mode 37 | Haddad et al 2013 |
| *Gastrotheca recava* | Nocturnal | Tetrapod | 7,6 | Tree crown | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 37 | Haddad et al 2013; present study |
| *Haddadus aramunha* | Nocturnal | Tetrapod | 6,2 | Forest floor | Non toxic | Cryptic | Open areas | Reproductive mode 23 | Haddad et al 2013 |
| *Haddadus binotatus* | Nocturnal | Tetrapod | 6,3 | Forest floor | Unpalatable or bad odor | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |
| *Holoaden bradei* | ----- | Tetrapod | 2,5 | ----- | Toxic | Cryptic | Open or forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Holoaden luederwaldti* | Nocturnal | Tetrapod | 4,6 | Forest floor | Toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Holoaden pholeter* | Nocturnal | Tetrapod | 4,6 | ----- | Toxic | Cryptic | Open or forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Hylodes amnicola* | Diurnal | Tetrapod | 2,7 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Hylodes asper* | Diurnal | Tetrapod | 4,7 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013; present study |

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|---|---|---|---|---|---|---|---|---|---|
| *Hylodes babax* | Diurnal | Tetrapod | 3,2 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Hylodes cardosoi* | Diurnal | Tetrapod | 4 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Hylodes charadranaetes* | Diurnal | Tetrapod | 4,3 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Hylodes dactylocinus* | Diurnal | Tetrapod | 2,7 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013; present study |
| *Hylodes heyeri* | Diurnal | Tetrapod | 4,3 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Hylodes lateristrigatus* | Diurnal | Tetrapod | 3,5 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Hylodes magalhaesi* | Diurnal | Tetrapod | 3,4 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Hylodes meridionalis* | Diurnal | Tetrapod | 4,8 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013; present study |
| *Hylodes nasus* | Diurnal | Tetrapod | 3,8 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Hylodes ornatus* | Diurnal | Tetrapod | 2,7 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Hylodes otavioi* | Diurnal | Tetrapod | 3,4 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Hylodes perere* | Diurnal | Tetrapod | 2,7 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |

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| *Hylodes perplicatus* | Diurnal | Tetrapod | 4,4 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Hylodes phyllodes* | Diurnal | Tetrapod | 3 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013; present study |
| *Hylodes pipilans* | Diurnal | Tetrapod | 2,8 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013; present study |
| *Hylodes regius* | Diurnal | Tetrapod | 3,5 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Hylodes sazimai* | Diurnal | Tetrapod | 2,8 | River, stream or rivulet | Non toxic | Rheophilic | Forested areas | Reproductive mode 3 | Haddad et al 2013 |
| *Hylomantis aspera* | Nocturnal | Tetrapod | 4,4 | Swamp or pond | Toxic | Arboreal | Forested areas | Reproductive mode 18 | Haddad et al 2013; present study |
| *Hylomantis granulosa* | Nocturnal | Tetrapod | 4,8 | River, stream or rivulet | Toxic | Arboreal | Forested areas | Reproductive mode 25 | Haddad et al 2013 |
| *Hyophryne histrio* | Nocturnal | Tetrapod | 4,8 | Swamp or pond | ----- | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Hypsiboas albomarginatus* | Nocturnal | Tetrapod | 5,8 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Hypsiboas albopunctatus* | Nocturnal | Tetrapod | 6,5 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Hypsiboas atlanticus* | Nocturnal | Tetrapod | 4 | Swamp or pond; River or stream backwaters | Non toxic | Arboreal | Open areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |
| *Hypsiboas* | Nocturnal | Tetrapod | 5,9 | Swamp or pond | Unpalatable | Arboreal | Open areas | Reproductive | Haddad et al 2013; present |

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| *bischoffi* | | | | | or bad odor | | | mode 1 | study |
| *Hypsiboas caingua* | Nocturnal | Tetrapod | 3,9 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Hypsiboas caipora* | Nocturnal | Tetrapod | 4 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Hypsiboas crepitans* | Nocturnal | Tetrapod | 6,2 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 4 | Haddad et al 2013; present study |
| *Hypsiboas curupi* | Nocturnal | Tetrapod | 4,5 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Hypsiboas exastis* | Nocturnal | Tetrapod | 9,2 | Swamp or pond; River or stream backwaters | Non toxic | Arboreal | Forested areas | Reproductive mode 4 | Haddad et al 2013; present study |
| *Hypsiboas faber* | Nocturnal | Tetrapod | 8,9 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open or forested areas | Reproductive mode 1 and 4 | Haddad et al 2013; present study |
| *Hypsiboas freicanecae* | Nocturnal | Tetrapod | 4 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Hypsiboas guentheri* | Nocturnal | Tetrapod | 4,6 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Hypsiboas joaquini* | Nocturnal | Tetrapod | 5,4 | River, stream or rivulet | Non toxic | Arboreal | Open or forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Hypsiboas latistriatus* | Nocturnal | Tetrapod | 4,7 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *Hypsiboas leptolineatus* | Nocturnal | Tetrapod | 3,3 | Swamp or pond; River or stream backwaters | Non toxic | Arboreal | Open areas | Reproductive mode 1 and 2 | Haddad et al 2013 |
| *Hypsiboas lundii* | Nocturnal | Tetrapod | 6,9 | Stream or rivulet | Non toxic | Arboreal | Open or forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Hypsiboas marginatus* | Nocturnal | Tetrapod | 5,3 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Hypsiboas pardalis* | Nocturnal | Tetrapod | 6,8 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open or forested areas | Reproductive mode 4 | Haddad et al 2013; present study |
| *Hypsiboas poaju* | Nocturnal | Tetrapod | 3,9 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Hypsiboas polytaenius* | Nocturnal | Tetrapod | 3,6 | ----- | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Hypsiboas pombali* | Nocturnal | Tetrapod | 5,7 | Swamp or pond; River or stream backwaters | Non toxic | Arboreal | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |
| *Hypsiboas prasinus* | Nocturnal | Tetrapod | 4,8 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Open or forested areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |
| *Hypsiboas pulchellus* | Nocturnal | Tetrapod | 4,5 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Hypsiboas punctatus* | Nocturnal | Tetrapod | 3,9 | Swamp or pond; River or stream | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |

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| | | | | backwaters | | | | | |
| *Hypsiboas raniceps* | Nocturnal | Tetrapod | 7,1 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Hypsiboas secedens* | Nocturnal | Tetrapod | 4,9 | ----- | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Hypsiboas semiguttatus* | Nocturnal | Tetrapod | 4,1 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013 |
| *Hypsiboas semilineatus* | Nocturnal | Tetrapod | 5,6 | Swamp or pond; River or stream backwaters | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |
| *Hypsiboas stellae* | Nocturnal | Tetrapod | 4,6 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013 |
| *Hypsiboas stenocephalus* | Nocturnal | Tetrapod | 2,7 | Swamp or pond; River or stream backwaters | Non toxic | Arboreal | Open areas | Reproductive mode 1 and 2 | Haddad et al 2013 |
| *Ischnocnema abdita* | ----- | Tetrapod | 1,6 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |
| *Ischnocnema bolbodactyla* | ----- | Tetrapod | 1,9 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Ischnocnema concolor* | Nocturnal | Tetrapod | 2 | Forest floor; Low vegetation | Non toxic | Cryptic | Open or forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Ischnocnema erythromera* | Nocturnal | Tetrapod | 3 | Forest floor | Unpalatable or bad odor | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |

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|---|---|---|---|---|---|---|---|---|---|
| *Ischnocnema guentheri* | Nocturnal | Tetrapod | 4 | Forest floor | Unpalatable or bad odor | Arboreal; Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |
| *Ischnocnema henselii* | Nocturnal | Tetrapod | 3,6 | Forest floor | Unpalatable or bad odor | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |
| *Ischnocnema hoehnei* | ----- | Tetrapod | 2,9 | Forest floor | Non toxic | Arboreal; Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Ischnocnema holti* | Nocturnal | Tetrapod | 1,7 | Forest floor; Low vegetation | Non toxic | Arboreal; Cryptic | Open or forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Ischnocnema izecksohni* | ----- | Tetrapod | 4,7 | Forest floor | Non toxic | Cryptic | Forested areas | ----- | Haddad et al 2013 |
| *Ischnocnema juipoca* | ----- | Tetrapod | 2,3 | Forest floor; Low vegetation | Non toxic | Cryptic | Open or forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Ischnocnema karst* | ----- | Tetrapod | 2,3 | Forest floor | Non toxic | Cryptic | Forested areas | ----- | Haddad et al 2013 |
| *Ischnocnema manezinho* | Nocturnal | Tetrapod | 3,3 | River, stream or rivulet | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Ischnocnema melanopygia* | ----- | Tetrapod | 2 | Forest floor | Non toxic | Cryptic | Forested areas | ----- | Haddad et al 2013 |
| *Ischnocnema nasuta* | ----- | Tetrapod | 3,9 | Bromeliad | Non toxic | Arboreal; Cryptic | Forested areas | Reproductive mode 27 | Haddad et al 2013 |
| *Ischnocnema nigriventris* | ----- | Tetrapod | 1,9 | Forest floor | Non toxic | Arboreal; Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *Ischnocnema octavioi* | ----- | Tetrapod | 3,2 | Forest floor | Non toxic | Cryptic | Forested areas | ----- | Haddad et al 2013 |
| *Ischnocnema oea* | Nocturnal | Tetrapod | 2,2 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Ischnocnema parva* | Nocturnal | Tetrapod | 2 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |
| *Ischnocnema randorum* | Nocturnal | Tetrapod | 1,8 | Forest floor; Low vegetation | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Ischnocnema sambaqui* | Nocturnal | Tetrapod | 3,7 | River, stream or rivulet | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Ischnocnema spanios* | ----- | Tetrapod | 2,1 | Forest floor | Non toxic | Cryptic | Forested areas | ----- | Haddad et al 2013; present study |
| *Ischnocnema verrucosa* | Nocturnal | Tetrapod | 2,4 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Ischnocnema vizottoi* | Nocturnal | Tetrapod | 2 | Forest floor; Low vegetation | Non toxic | Arboreal; Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013 |
| *Itapotihyla langsdorffii* | Nocturnal | Tetrapod | 10,3 | Swamp or pond | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Leptodactylus cupreus* | Nocturnal | Tetrapod | 5,7 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 30 | Haddad et al 2013 |
| *Leptodactylus flavopictus* | Nocturnal | Tetrapod | 13,2 | Swamp or pond | Toxic | Cryptic | Forested areas | Reproductive mode 13 | Haddad et al 2013 |
| *Leptodactylus furnarius* | Nocturnal | Tetrapod | 4,2 | Swamp or pond | Non toxic | Arboreal; Aquatic | Open areas | Reproductive mode 30 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *Leptodactylus fuscos* | Nocturnal | Tetrapod | 4,4 | Swamp or pond | Non toxic | Terrestrial | Open areas | Reproductive mode 30 | Haddad et al 2013; present study |
| *Leptodactylus gracilis* | Nocturnal | Tetrapod | 4,4 | Swamp or pond | Non toxic | Cryptic | Open areas | Reproductive mode 30 | Haddad et al 2013 |
| *Leptodactylus jolyi* | Nocturnal | Tetrapod | 5,4 | Swamp or pond | Non toxic | Arboreal; Aquatic | Open areas | Reproductive mode 30 | Haddad et al 2013 |
| *Leptodactylus labyrinthicus* | Nocturnal | Tetrapod | 15,5 | Swamp or pond | Toxic | Terrestrial | Open areas | Reproductive mode 11 | Haddad et al 2013; present study |
| *Leptodactylus latrans* | Nocturnal | Tetrapod | 9,6 | Swamp or pond | Toxic | Terrestrial | Open or forested areas | Reproductive mode 11 | Haddad et al 2013; present study |
| *Leptodactylus macrosternum* | Nocturnal | Tetrapod | 9 | Swamp or pond | Toxic | Terrestrial | Open or forested áreas | Reproductive mode 11 | Haddad et al 2013 |
| *Leptodactylus mystaceus* | Nocturnal | Tetrapod | 5,2 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 30 | Haddad et al 2013; present study |
| *Leptodactylus mystacinus* | Nocturnal | Tetrapod | 5,5 | Swamp or pond | Toxic | Terrestrial | Open areas | Reproductive mode 30 | Haddad et al 2013; present study |
| *Leptodactylus natalensis* | Nocturnal | Tetrapod | 5,2 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 13 | Haddad et al 2013; present study |
| *Leptodactylus notoaktites* | Nocturnal | Tetrapod | 5 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 30 | Haddad et al 2013; present study |
| *Leptodactylus plaumanni* | Nocturnal | Tetrapod | 3,8 | Swamp or pond | Non toxic | Cryptic | Open areas | Reproductive mode 30 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *Leptodactylus podicipinus* | Nocturnal | Tetrapod | 4,2 | Swamp or pond | Non toxic | Cryptic | Open areas | Reproductive mode 13 | Haddad et al 2013; present study |
| *Leptodactylus spixii* | Nocturnal | Tetrapod | 5,2 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 30 | Haddad et al 2013 |
| *Leptodactylus troglodytes* | Nocturnal | Tetrapod | 5,1 | Swamp or pond | Non toxic | Terrestrial | Open areas | Reproductive mode 30 | Haddad et al 2013 |
| *Leptodactylus vastus* | Nocturnal | Tetrapod | 15 | Swamp or pond | Toxic | Terrestrial | Open areas | Reproductive mode 11 | Haddad et al 2013 |
| *Leptodactylus viridis* | Nocturnal | Tetrapod | 7,2 | Swamp or pond | Toxic | Terrestrial | Open areas | Reproductive mode 11 | Haddad et al 2013 |
| *Limnomedusa macroglossa* | Nocturnal | Tetrapod | 5,4 | Stream or rivulet | ----- | Terrestrial | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Lithobates catesbeianus* | Nocturnal | Tetrapod | 8,9 | Swamp or pond | Non toxic | Semi-aquatic | Open or forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Lithobates palmipes* | Nocturnal | Tetrapod | 11,3 | Swamp or pond | Non toxic | Semi-aquatic | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Luetkenotyphlus brasiliensis* | ----- | Apod | 27 | Do not Call | ----- | Fossorial | Open or forested areas | Reproductive mode 38 | Haddad et al 2013 |
| *Macrogenioglottus alipioi* | Nocturnal | Tetrapod | 9,1 | Swamp or pond | Toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Megaelosia* | Diurnal | Tetrapod | 8,1 | ----- | Non toxic | Rheophilic | Forested | ----- | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *apuana* | | | | | | | areas | | |
| *Megaelosia bocainensis* | Diurnal | Tetrapod | 10,1 | ----- | Non toxic | Rheophilic | Forested areas | ----- | Haddad et al 2013 |
| *Megaelosia goeldii* | Diurnal | Tetrapod | 10 | ----- | Non toxic | Rheophilic | Forested areas | ----- | Haddad et al 2013; present study |
| *Megaelosia massarti* | Diurnal | Tetrapod | 11,5 | ----- | Non toxic | Rheophilic | Forested areas | ----- | Haddad et al 2013 |
| *Melanophryniscus admirabilis* | Diurnal | Tetrapod | 3,8 | Swamp or pond | Toxic | Terrestrial | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Melanophryniscus alipioi* | Diurnal | Tetrapod | 2,5 | Bromeliad | Toxic | Phytotelmata | Open areas | Reproductive mode 6 | Haddad et al 2013; present study |
| *Melanophryniscus cambaraensis* | Nocturnal and Diurnal | Tetrapod | 3,5 | Swamp or pond | Toxic | Terrestrial | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Melanophryniscus dorsalis* | Diurnal | Tetrapod | 2,5 | Swamp or pond | Toxic | Terrestrial | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Melanophryniscus macrogranulosus* | ----- | Tetrapod | 3,5 | River, stream or rivulet | Toxic | Terrestrial | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Melanophryniscus moreirae* | Diurnal | Tetrapod | 2,9 | Swamp or pond | Toxic | Terrestrial | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Melanophryniscus setiba* | Diurnal | Tetrapod | 1,5 | ----- | Toxic | Cryptic | Forested areas | ----- | Haddad et al 2013 |
| *Melanophryniscus simplex* | Nocturnal | Tetrapod | 2,8 | River, stream or rivulet | Toxic | Terrestrial | Open areas | Reproductive mode 2 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *Melanophryniscus spectabilis* | Diurnal | Tetrapod | 3,1 | River, stream or rivulet | Toxic | Terrestrial | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Melanophryniscus tumifrons* | ----- | Tetrapod | 3,1 | Swamp or pond | Toxic | Terrestrial | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Melanophryniscus vilavelhensis* | Nocturnal | Tetrapod | 1,7 | Vegetation | Toxic | Phytotelmata | Open areas | Reproductive mode 6 | Haddad et al 2013 |
| *Myersiella microps* | Nocturnal | Tetrapod | 3,1 | Forest floor | Non toxic | Fossorial | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |
| *Odontophrynus americanus* | Nocturnal | Tetrapod | 4,9 | Swamp or pond | Toxic | Terrestrial | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Odontophrynus carvalhoi* | Nocturnal | Tetrapod | 6,7 | River, stream or rivulet | Toxic | Terrestrial | Open or forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Odontophrynus maisuma* | Nocturnal | Tetrapod | 4,1 | ----- | Toxic | Terrestrial | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Ololygon agilis* | Nocturnal and Diurnal | Tetrapod | 1,8 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Ololygon albicans* | Nocturnal | Tetrapod | 3 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013; present study |
| *Ololygon angrensis* | Nocturnal and Diurnal | Tetrapod | 3,4 | Swamp or pond | Non toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Ololygon arduous* | Nocturnal | Tetrapod | 2,1 | Bromeliad | Unpalatable | Arboreal | Forested | Reproductive | Haddad et al 2013; present |

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| | and Diurnal | | | | or bad odor | | areas | mode 6 | study |
| *Ololygon argyrornata* | Nocturnal | Tetrapod | 2,1 | Swamp or pond | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Ololygon ariadne* | Nocturnal | Tetrapod | 4,1 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Ololygon aromothyella* | Nocturnal | Tetrapod | 2,6 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Ololygon belloni* | Nocturnal | Tetrapod | 3,9 | Bromeliad | Non toxic | Arboreal | Open or forested areas | Reproductive mode 6 | Haddad et al 2013 |
| *Ololygon brieni* | Nocturnal | Tetrapod | 3,5 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Ololygon carnevallii* | Nocturnal | Tetrapod | 3,2 | Swamp or pond | Non toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Ololygon catharinae* | Nocturnal | Tetrapod | 4,5 | Swamp or pond | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Ololygon cosenzai* | Nocturnal | Tetrapod | 2,3 | Bromeliad | Non toxic | Arboreal | Open areas | Reproductive mode 6 | Haddad et al 2013 |
| *Ololygon flavoguttata* | Nocturnal | Tetrapod | 4,5 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013; present study |
| *Ololygon heyeri* | Nocturnal | Tetrapod | 3,9 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Ololygon hiemalis* | Nocturnal | Tetrapod | 3,5 | Swamp or pond | Non toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *Ololygon humilis* | Nocturnal | Tetrapod | 2,6 | Swamp or pond | Non toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Ololygon insperata* | Nocturnal | Tetrapod | 2,3 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013 |
| *Ololygon kautskyi* | ----- | Tetrapod | 2,8 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Ololygon littoralis* | Nocturnal | Tetrapod | 3,8 | Swamp or pond | Non toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Ololygon littoreus* | Nocturnal | Tetrapod | 2,2 | Bromeliad | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013 |
| *Ololygon longilinea* | Nocturnal | Tetrapod | 4,2 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Ololygon luizotavioi* | Nocturnal | Tetrapod | 2,5 | Swamp or pond; River or stream backwaters | Non toxic | Arboreal | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013 |
| *Ololygon machadoi* | Nocturnal | Tetrapod | 2,4 | River, stream or rivulet | Non toxic | Arboreal | Open or forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Ololygon obtriangulata* | Nocturnal | Tetrapod | 3,5 | River, stream or rivulet | Non toxic | Arboreal | Open or forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Ololygon peixotoi* | Nocturnal | Tetrapod | 2,3 | Bromeliad | Non toxic | Arboreal | Open or forested areas | Reproductive mode 6 | Haddad et al 2013 |
| *Ololygon* | Nocturnal | Tetrapod | 2 | Bromeliad | Unpalatable | Arboreal | Forested | Reproductive | Haddad et al 2013; present |

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| *perpusilla* | | | | | or bad odor | | areas | mode 6 | study |
| *Ololygon ranki* | Nocturnal | Tetrapod | 2,3 | Swamp or pond | Non toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Ololygon rizibilis* | Nocturnal and Diurnal | Tetrapod | 3 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 11 | Haddad et al 2013 |
| *Ololygon strigilata* | Nocturnal | Tetrapod | 3,8 | Swamp or pond; River or stream backwaters | Non toxic | Arboreal | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013 |
| *Ololygon v-signata* | Nocturnal | Tetrapod | 2,7 | Bromeliad | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013; present study |
| *Paratelmatobius cardosoi* | Nocturnal | Tetrapod | 1,7 | Swamp or pond | ----- | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Paratelmatobius gaigeae* | Nocturnal | Tetrapod | 1,8 | Swamp or pond | ----- | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Paratelmatobius lutzii* | ----- | Tetrapod | 2,4 | ----- | ----- | Cryptic | Open areas | ----- | Haddad et al 2013 |
| *Paratelmatobius poecilogaster* | Nocturnal | Tetrapod | 2,7 | Swamp or pond | ----- | Cryptic | Forested areas | Reproductive mode 18 | Haddad et al 2013 |
| *Paratelmatobius yepiranga* | Nocturnal | Tetrapod | 2,1 | Swamp or pond | ----- | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Phasmahyla cochranae* | Nocturnal | Tetrapod | 3,2 | River, stream or rivulet | Toxic | Arboreal | Forested areas | Reproductive mode 25 | Haddad et al 2013 |
| *Phasmahyla exilis* | Nocturnal | Tetrapod | 2,9 | River, stream or | Toxic | Arboreal | Forested | Reproductive | Haddad et al 2013 |

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| | | | | rivulet | | | areas | mode 25 | |
| *Phasmahyla guttata* | Nocturnal | Tetrapod | 3,8 | River, stream or rivulet | Toxic | Arboreal | Forested areas | Reproductive mode 25 | Haddad et al 2013; present study |
| *Phasmahyla jandaia* | Nocturnal | Tetrapod | 3,6 | River, stream or rivulet | Toxic | Arboreal | Forested areas | Reproductive mode 25 | Haddad et al 2013 |
| *Phasmahyla spectabilis* | Nocturnal | Tetrapod | 4,6 | River, stream or rivulet | Toxic | Arboreal | Forested areas | Reproductive mode 25 | Haddad et al 2013 |
| *Phasmahyla timbo* | Nocturnal | Tetrapod | 3,5 | River, stream or rivulet | Toxic | Arboreal | Forested areas | Reproductive mode 25 | Haddad et al 2013 |
| *Phrynomedusa marginata* | Nocturnal | Tetrapod | 3,1 | River, stream or rivulet | Toxic | Arboreal | Forested areas | Reproductive mode 18 | Haddad et al 2013 |
| *Phyllodytes acuminatus* | ----- | Tetrapod | 2,4 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013 |
| *Phyllodytes edelmoi* | ----- | Tetrapod | 2,6 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013 |
| *Phyllodytes gyrinaethes* | ----- | Tetrapod | 2,6 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013 |
| *Phyllodytes kautskyi* | Nocturnal and Diurnal | Tetrapod | 4 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013 |
| *Phyllodytes luteolus* | Nocturnal | Tetrapod | 2,5 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013; present study |
| *Phyllodytes maculosus* | ----- | Tetrapod | 4,9 | ----- | Non toxic | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013; Ferreira et al 2016; present study |

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| *Phyllodytes melanomystax* | Nocturnal | Tetrapod | 2,3 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013; present study |
| *Phyllodytes punctatus* | ----- | Tetrapod | 2,1 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013 |
| *Phyllodytes tuberculosus* | Nocturnal | Tetrapod | 2,4 | Bromeliad | Non toxic | Arboreal | Open areas | Reproductive mode 6 | Haddad et al 2013; present study |
| *Phyllodytes wuchereri* | Nocturnal | Tetrapod | 2,7 | Bromeliad | Non toxic | Arboreal | Forested areas | Reproductive mode 6 | Haddad et al 2013 |
| *Phyllomedusa bahiana* | Nocturnal | Tetrapod | 7,5 | Swamp or pond | Toxic | Arboreal | Forested areas | Reproductive mode 24 | Haddad et al 2013; present study |
| *Phyllomedusa burmeisteri* | Nocturnal | Tetrapod | 6 | Swamp or pond | Toxic | Arboreal | Open or forested areas | Reproductive mode 24 | Haddad et al 2013; present study |
| *Phyllomedusa distincta* | Nocturnal | Tetrapod | 6 | Swamp or pond | Toxic | Arboreal | Forested areas | Reproductive mode 24 | Haddad et al 2013; present study |
| *Phyllomedusa iheringii* | Nocturnal | Tetrapod | 6,8 | Swamp or pond | Toxic | Arboreal | Open areas | Reproductive mode 24 | Haddad et al 2013 |
| *Phyllomedusa nordestina* | Nocturnal | Tetrapod | 3,7 | Swamp or pond | Toxic | Arboreal | Forested areas | Reproductive mode 24 | Haddad et al 2013; present study |
| *Phyllomedusa rohdei* | Nocturnal | Tetrapod | 4,6 | Swamp or pond | Toxic | Arboreal | Forested areas | Reproductive mode 24 | Haddad et al 2013; present study |
| *Phyllomedusa tetraploidea* | Nocturnal | Tetrapod | 6,6 | Swamp or pond | Toxic | Arboreal | Open or forested areas | Reproductive mode 24 | Haddad et al 2013; present study |

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| *Physalaemus aguirrei* | Nocturnal | Tetrapod | 2,7 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 11 | Haddad et al 2013 |
| *Physalaemus atlanticus* | Nocturnal | Tetrapod | 2,1 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 11 and 28 | Haddad et al 2013 |
| *Physalaemus barrioi* | Nocturnal | Tetrapod | 2,9 | Swamp or pond | Non toxic | Terrestrial | Open areas | Reproductive mode 11 | Haddad et al 2013 |
| *Physalaemus bokermanni* | Nocturnal | Tetrapod | 1,7 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 11 and 28 | Haddad et al 2013 |
| *Physalaemus camacan* | Nocturnal | Tetrapod | 2,4 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 11 | Haddad et al 2013; present study |
| *Physalaemus crombiei* | Nocturnal | Tetrapod | 2,3 | Swamp or pond | Non toxic | Terrestrial | Forested areas | Reproductive mode 11 and 28 | Haddad et al 2013 |
| *Physalaemus cuvieri* | Nocturnal | Tetrapod | 3,1 | Swamp or pond | Non toxic | Terrestrial | Open areas | Reproductive mode 11 | Haddad et al 2013; present study |
| *Physalaemus erikae* | Nocturnal | Tetrapod | 2,6 | Swamp or pond | Non toxic | Terrestrial | Open or forested areas | Reproductive mode 11 | Haddad et al 2013 |
| *Physalaemus feioi* | Nocturnal | Tetrapod | 2,8 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 11 | Haddad et al 2013 |
| *Physalaemus jordanensis* | Nocturnal | Tetrapod | 2,8 | Swamp or pond | Non toxic | Cryptic | Open areas | Reproductive mode 11 | Haddad et al 2013 |
| *Physalaemus* | Nocturnal | Tetrapod | 2,9 | Swamp or pond | Non toxic | Cryptic | Open areas | Reproductive | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *kroyeri* | | | | | | | | mode 11 | |
| *Physalaemus lateristriga* | Nocturnal | Tetrapod | 3,5 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 11 | Haddad et al 2013 |
| *Physalaemus lisei* | Nocturnal | Tetrapod | 3 | Swamp or pond | Non toxic | Cryptic | Open or forested areas | Reproductive mode 11 | Haddad et al 2013 |
| *Physalaemus maculiventris* | Nocturnal | Tetrapod | 2,3 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 11 | Haddad et al 2013 |
| *Physalaemus maximus* | Nocturnal | Tetrapod | 4,8 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 11 | Haddad et al 2013 |
| *Physalaemus moreirae* | Nocturnal | Tetrapod | 2,6 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 11 | Haddad et al 2013 |
| *Physalaemus nanus* | Nocturnal | Tetrapod | 2,1 | Swamp or pond | Non toxic | Cryptic | Open or forested areas | Reproductive mode 11 and 28 | Haddad et al 2013 |
| *Physalaemus obtectus* | Nocturnal | Tetrapod | 2,8 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 11 | Haddad et al 2013 |
| *Physalaemus olfersii* | Nocturnal | Tetrapod | 3,8 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 11 | Haddad et al 2013 |
| *Physalaemus signifer* | Nocturnal | Tetrapod | 2,2 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 11 and 28 | Haddad et al 2013; present study |
| *Physalaemus soaresi* | Nocturnal | Tetrapod | 2,1 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 11 | Haddad et al 2013 |
| *Physalaemus* | Nocturnal | Tetrapod | 2,2 | Swamp or pond | Non toxic | Cryptic | Forested | Reproductive | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *spiniger* | | | | | | | areas | mode 11, 14 and 28 | |
| *Pipa carvalhoi* | Nocturnal and Diurnal | Tetrapod | 5,5 | Swamp or pond | Non toxic | Aquatic | Open areas | Reproductive mode 15 | Haddad et al 2013; present study |
| *Pristimantis paulodutrai* | Nocturnal | Tetrapod | 3,6 | Forest floor; Low vegetation | Unpalatable or bad odor | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |
| *Pristimantis ramagii* | Nocturnal | Tetrapod | 2,4 | Forest floor; Low vegetation | Unpalatable or bad odor | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |
| *Pristimantis vinhai* | ----- | Tetrapod | 2,5 | Forest floor | Unpalatable or bad odor | Cryptic | Forested areas | Reproductive mode 23 | Haddad et al 2013; present study |
| *Proceratophrys appendiculata* | Nocturnal | Tetrapod | 6,3 | Swamp or pond; River or stream backwaters | Non toxic | Cryptic | Forested areas | ----- | Haddad et al 2013; present study |
| *Proceratophrys avelinoi* | Nocturnal | Tetrapod | 2,6 | River, stream or rivulet | Non toxic | Cryptic | Open or forested areas | Reproductive mode 2 | Haddad et al 2013; present study |
| *Proceratophrys bigibbosa* | Nocturnal | Tetrapod | 5,3 | River, stream or rivulet | Non toxic | Cryptic | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Proceratophrys boiei* | Nocturnal | Tetrapod | 5,7 | Swamp or pond; River or stream backwaters | Non toxic | Cryptic | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |
| *Proceratophrys brauni* | Nocturnal and Diurnal | Tetrapod | 3,9 | River, stream or rivulet | Non toxic | Cryptic | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Proceratophrys* | Nocturnal | Tetrapod | 6,4 | River, stream or | Non toxic | Cryptic | Forested | Reproductive | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *cristiceps* | | | | rivulet | | | areas | mode 2 | |
| *Proceratophrys cururu* | Nocturnal | Tetrapod | 5,4 | River or stream backwaters | Non toxic | Cryptic | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Proceratophrys laticeps* | Nocturnal | Tetrapod | 6,7 | Swamp or pond; River or stream backwaters | Non toxic | Cryptic | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |
| *Proceratophrys melanopogon* | Nocturnal | Tetrapod | 5,1 | Swamp or pond; River or stream backwaters | Non toxic | Cryptic | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013 |
| *Proceratophrys minuta* | Nocturnal | Tetrapod | 3 | River, stream or rivulet | Non toxic | Cryptic | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Proceratophrys paviotii* | Nocturnal | Tetrapod | 4,7 | River, stream or rivulet | Non toxic | Cryptic | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Proceratophrys renalis* | Nocturnal | Tetrapod | 5,5 | River, stream or rivulet | Non toxic | Cryptic | Forested areas | Reproductive mode 2 | Haddad et al 2013; present study |
| *Proceratophrys sanctaritae* | Nocturnal | Tetrapod | 4,1 | River, stream or rivulet | Non toxic | Cryptic | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Proceratophrys schirchi* | Nocturnal | Tetrapod | 5 | River, stream or rivulet | Non toxic | Cryptic | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Proceratophrys subguttata* | Nocturnal | Tetrapod | 4,8 | River, stream or rivulet | Non toxic | Cryptic | Forested areas | Reproductive mode 2 | Haddad et al 2013 |
| *Pseudis bolbodactyla* | Nocturnal | Tetrapod | 4,5 | Swamp or pond | Non toxic | Aquatic | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Pseudis cardosoi* | Nocturnal | Tetrapod | 4,5 | Swamp or pond | Non toxic | Aquatic | Open areas | Reproductive mode 1 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *Pseudis fusca* | Nocturnal | Tetrapod | 4,1 | Swamp or pond | Non toxic | Aquatic | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Pseudis minuta* | Nocturnal | Tetrapod | 3,7 | Swamp or pond | Non toxic | Aquatic | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Pseudis paradoxa* | Nocturnal | Tetrapod | 5,3 | Swamp or pond | Non toxic | Aquatic | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Pseudopaludicola falcipes* | Nocturnal and Diurnal | Tetrapod | 1,8 | Swamp or pond | Non toxic | Cryptic | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Rhinella abei* | Nocturnal | Tetrapod | 9,3 | Swamp or pond; River or stream backwaters | Toxic | Terrestrial | Open or forested areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |
| *Rhinella achavali* | Nocturnal | Tetrapod | 12 | Swamp or pond | Toxic | Terrestrial | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Rhinella crucifer* | Nocturnal | Tetrapod | 10,1 | Swamp or pond; River or stream backwaters | Toxic | Terrestrial | Open or forested areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |
| *Rhinella dorbignyi* | Nocturnal | Tetrapod | 5,6 | Swamp or pond | Toxic | Terrestrial | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Rhinella fernandezae* | Nocturnal | Tetrapod | 5,7 | Swamp or pond | Toxic | Terrestrial | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Rhinella granulosa* | Nocturnal | Tetrapod | 5,3 | Swamp or pond | Toxic | Terrestrial | Open or forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Rhinella henseli* | Nocturnal | Tetrapod | 7 | Swamp or pond | Toxic | Terrestrial | Open or | Reproductive | Haddad et al 2013; present |

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|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | forested areas | mode 1 and 2 | study |
| *Rhinella hoogmoedi* | Nocturnal | Tetrapod | 5,6 | Swamp or pond | Toxic | Terrestrial | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Rhinella icterica* | Nocturnal | Tetrapod | 13,7 | Swamp or pond; River or stream backwaters | Toxic | Terrestrial | Open or forested areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |
| *Rhinella jimi* | Nocturnal | Tetrapod | 14,5 | Swamp or pond | Toxic | Terrestrial | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Rhinella ornata* | Nocturnal | Tetrapod | 7,9 | Swamp or pond; River or stream backwaters | Toxic | Terrestrial | Open or forested areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |
| *Rhinella pygmaea* | Nocturnal | Tetrapod | 4,1 | Swamp or pond | Toxic | Terrestrial | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Rhinella schneideri* | Nocturnal | Tetrapod | 13 | Swamp or pond; River or stream backwaters | Toxic | Terrestrial | Open areas | Reproductive mode 1 and 2 | Haddad et al 2013; present study |
| *Scinax alter* | Nocturnal | Tetrapod | 2,8 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Scinax auratus* | ----- | Tetrapod | 2,6 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Scinax caldarum* | Nocturnal | Tetrapod | 2,9 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Scinax cretatus* | Nocturnal | Tetrapod | 3,2 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | mode 1 | |
| *Scinax crospedospilus* | Nocturnal | Tetrapod | 3,1 | Swamp or pond | Unpalatable or bad odor | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Scinax cuspidatus* | Nocturnal | Tetrapod | 3,1 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Scinax duartei* | Nocturnal | Tetrapod | 3 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Scinax eurydice* | Nocturnal | Tetrapod | 5,3 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Scinax fuscomarginatus* | Nocturnal | Tetrapod | 2,2 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Scinax fuscovarios* | Nocturnal | Tetrapod | 4,5 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Scinax granulatus* | Nocturnal | Tetrapod | 4,1 | Swamp or pond | Unpalatable or bad odor | Arboreal; Terrestrial | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Scinax hayii* | Nocturnal | Tetrapod | 5,1 | Swamp or pond | Unpalatable or bad odor | Arboreal; Terrestrial | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Scinax imbegue* | Nocturnal | Tetrapod | 3,2 | Swamp or pond | Non toxic | Arboreal; Terrestrial | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Scinax juncae* | Nocturnal | Tetrapod | 2,4 | Swamp or pond | Non toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Scinax pachycrus* | Nocturnal | Tetrapod | 3,2 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *Scinax perereca* | Nocturnal | Tetrapod | 4,3 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open or forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Scinax similis* | Nocturnal | Tetrapod | 3,8 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Scinax squalitostris* | Nocturnal | Tetrapod | 2,7 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Scinax trapicheiroi* | Nocturnal | Tetrapod | 2,9 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013 |
| *Scinax tymbamirim* | Nocturnal | Tetrapod | 2,6 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Scinax uruguayus* | Nocturnal | Tetrapod | 2,8 | Swamp or pond | Non toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Scinax x-signatus* | Nocturnal | Tetrapod | 4,1 | Swamp or pond | Unpalatable or bad odor | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Scythroehrys sawayae* | Nocturnal | Tetrapod | 2,1 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Siphonops annuatus* | ----- | Apod | 45,4 | Do not Call | ----- | Fossorial | Open or forested areas | Reproductive mode 38 | Haddad et al 2013; present study |
| *Siphonops hardyi* | ----- | Apod | 17,8 | Do not Call | ----- | Fossorial | Open or forested areas | Reproductive mode 38 | Haddad et al 2013 |
| *Siphonops paulensis* | ----- | Apod | 30 | Do not Call | ----- | Fossorial | Open or forested | Reproductive mode 38 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | areas | | |
| *Sphaenorhynchus botocudo* | Nocturnal | Tetrapod | 2,7 | Swamp or pond | Non toxic | Arboreal; Aquatic | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Sphaenorhynchus caramaschii* | Nocturnal | Tetrapod | 2,7 | Swamp or pond | Non toxic | Arboreal; Aquatic | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Sphaenorhynchus mirim* | Nocturnal | Tetrapod | 1,7 | Swamp or pond | Non toxic | Arboreal; Aquatic | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Sphaenorhynchus orophilus* | Nocturnal | Tetrapod | 3,2 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Sphaenorhynchus palustris* | Nocturnal | Tetrapod | 3,1 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Sphaenorhynchus pauloalvini* | Nocturnal | Tetrapod | 1,9 | Swamp or pond | Non toxic | Arboreal | Forested areas | Reproductive mode 24 | Haddad et al 2013 |
| *Sphaenorhynchus planicola* | Nocturnal | Tetrapod | 2 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Sphaenorhynchus prasinus* | Nocturnal | Tetrapod | 2,8 | Swamp or pond | Non toxic | Arboreal | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Sphaenorhynchus surdus* | Nocturnal | Tetrapod | 2,8 | Swamp or pond | Non toxic | Arboreal; Aquatic | Open or forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Stereocyclops* | Nocturnal | Tetrapod | 6,2 | Swamp or pond | Non toxic | Cryptic | Forested | Reproductive | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *incrassatus* | | | | | | | areas | mode 1 | |
| *Stereocyclops parkeri* | Nocturnal | Tetrapod | 6 | Swamp or pond | Non toxic | Cryptic | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Thoropa lutzi* | Nocturnal | Tetrapod | 2,6 | Rock wall | Unpalatable or bad odor | Terrestrial | Forested areas | Reproductive mode 19 | Haddad et al 2013 |
| *Thoropa miliaris* | Nocturnal | Tetrapod | 6,3 | Rock wall | Non toxic | Terrestrial | Forested areas | Reproductive mode 19 | Haddad et al 2013; present study |
| *Thoropa saxatilis* | Nocturnal | Tetrapod | 5,9 | Rock wall | Non toxic | Terrestrial | Forested areas | Reproductive mode 19 | Haddad et al 2013 |
| *Thoropa taophora* | Nocturnal | Tetrapod | 6,3 | Rock wall | Non toxic | Terrestrial | Forested areas | Reproductive mode 19 | Haddad et al 2013 |
| *Trachycephalus atlas* | Nocturnal | Tetrapod | 10,7 | Swamp or pond | Toxic | Arboreal | Open areas | Reproductive mode 1 | Haddad et al 2013 |
| *Trachycephalus dibernardoi* | Nocturnal | Tetrapod | 7,8 | Swamp or pond | Toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Trachycephalus imitatrix* | Nocturnal | Tetrapod | 7,1 | Swamp or pond | Toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Trachycephalus lepidus* | Nocturnal | Tetrapod | 5,9 | Swamp or pond | Toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Trachycephalus mesophaeus* | Nocturnal and Diurnal | Tetrapod | 6,9 | Swamp or pond | Toxic | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Trachycephalus nigromaculatus* | Nocturnal | Tetrapod | 9,2 | Swamp or pond; River or stream backwaters | Toxic | Arboreal | Forested areas | Reproductive mode 1 and 2 | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|---|---|
| *Trachycephalus typhonius* | Nocturnal | Tetrapod | 9,2 | Swamp or pond | Toxic | Arboreal | Open or forested areas | Reproductive mode 1 | Haddad et al 2013; present study |
| *Vitreorana eurygnatha* | Nocturnal | Tetrapod | 2,4 | River, stream or rivulet | Non toxic | Arboreal | Forested areas | Reproductive mode 25 | Haddad et al 2013; present study |
| *Vitreorana uranoscopa* | Nocturnal | Tetrapod | 2,7 | River or stream backwaters | Non toxic | Arboreal | Forested areas | Reproductive mode 25 | Haddad et al 2013; present study |
| *Xenohyla truncata* | Nocturnal | Tetrapod | 5 | Swamp or pond | ----- | Arboreal | Forested areas | Reproductive mode 1 | Haddad et al 2013 |
| *Zachaenus carvalhoi* | Nocturnal | Tetrapod | 2,8 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 21 | Haddad et al 2013 |
| *Zachaenus parvulus* | Nocturnal | Tetrapod | 2,9 | Forest floor | Non toxic | Cryptic | Forested areas | Reproductive mode 21 | Haddad et al 2013; present study |

**Table S3.** GenBank accession numbers for 208 sampled amphibian taxa. (*) indicates outgroup.

| **Species** | **12S** | **16S** | **Cytb** | **CXCR4** | **H3A** | **NCX1** | **POMC** | **RAG1** | **RHOD** | **SIA** | **SLC8A3** | **TYR** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Adelophryne mucronatus* | -- | JX298291.1 | JX298385.1 | -- | -- | -- | JX298112.1 | JX298158.1 | -- | -- | -- | JX298213.1 |
| *Adelophryne pachydactyla* | JX298259.1 | JX298294.1 | JX298387.1 | -- | -- | -- | JX298115.1 | JX298161.1 | -- | -- | -- | JX298216.1 |
| *Adenomera araucaria* | KC470091.1 | KC477241.1 | KC603969.1 | -- | -- | -- | KC604065.1 | KC604019.1 | KC604099.1 | -- | -- | KC604089.1 |
| *Adenomera bokermani* | KC470107.1 | KC477243.1 | KF548072.1 | -- | -- | -- | -- | -- | KF613580.1 | -- | -- | -- |
| *Adenomera engelsi* | KC603940.1 | -- | KC603970.1 | -- | -- | -- | KC604066.1 | KC604020.1 | KC604100.1 | -- | -- | KC604090.1 |
| *Adenomera thomei* | KC603945.1 | KC603946.1 | KC603971.1 | -- | -- | -- | KC604067.1 | KC604021.1 | KC604101.1 | -- | -- | KC604091.1 |
| *Allobates alagoanus* | DQ502126.1 | -- | DQ502557.1 | -- | DQ502342.1 | -- | -- | -- | DQ503232.1 | DQ503093.1 | -- | -- |
| *Aparasphenodon brunoi* | AY843567.1 | -- | AY843789.1 | -- | -- | -- | -- | AY844364.1 | AY844541.1 | AY844769.1 | -- | AY844023.1 |
| *Aplastodiscus albofrenatus* | AY819422.1 | AY819539.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Aplastodiscus albosignatus* | AY843596.1 | -- | AY843817.1 | -- | -- | -- | -- | AY844385.1 | AY844570.1 | AY844796.1 | -- | AY844042.1 |
| *Aplastodiscus arildae* | AY843604.1 | -- | AY843825.1 | -- | -- | -- | -- | AY844392.1 | AY844578.1 | AY844803.1 | -- | AY844049.1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Aplastodiscus callipygius* | AY843614.1 | AY843614.1 | AY843840.1 | -- | -- | -- | -- | AY844402.1 | AY844592.1 | AY844813.1 | -- | AY844058.1 |
| *Aplastodiscus cavicola* | AY843617.1 | AY843617.1 | AY843843.1 | -- | -- | -- | -- | AY844405.1 | AY844594.1 | AY844814.1 | -- | -- |
| *Aplastodiscus cochranae* | AY843568.1 | AY843568.1 | AY843790.1 | -- | -- | -- | -- | AY844365.1 | AY844542.1 | AY844770.1 | -- | AY844024.1 |
| *Aplastodiscus ehrhardti* | -- | -- | -- | -- | -- | -- | -- | AY844456.1 | -- | -- | -- | -- |
| *Aplastodiscus eugenioi* | AY843669.1 | AY843669.1 | AY843913.1 | KF751465.1 | -- | -- | -- | AY844456.1 | AY844660.1 | AY844875.1 | -- | -- |
| *Aplastodiscus leucopygius* | AY843638.1 | AY843638.1 | AY843873.1 | KF751466.1 | -- | -- | -- | AY844425.1 | AY844622.1 | AY844840.1 | -- | AY844084.1 |
| *Aplastodiscus perviridis* | AY843569.1 | AY843569.1 | AY843791.1 | KF751467.1 | DQ284044.1 | -- | -- | AY844366.1 | AY844543.1 | AY844771.1 | -- | AY844025.1 |
| *Aplastodiscus weygoldti* | AY843685.1 | AY843685.1 | AY843931.1 | -- | -- | -- | -- | AY844467.1 | AY844678.1 | AY844887.1 | -- | -- |
| *Bokermanohyla astartea* | AY549322.1 | AY549322.1 | AY843827.1 | -- | -- | -- | AY819113.1 | -- | AY844580.1 | -- | -- | -- |
| *Bokermanohyla circumdata* | AY549328.1 | -- | AY843847.1 | KF751468.1 | -- | -- | -- | AY844409.1 | AY844598.1 | AY844817.1 | -- | AY844064.1 |
| *Bokermanohyla hylax* | AY549338.1 | AY549338.1 | AY843865.1 | -- | -- | -- | -- | AY844419.1 | AY844614.1 | AY844832.1 | -- | AY844077.1 |
| *Bokermanohyla martinsi* | AY843641.1 | AY843641.1 | AY843878.1 | -- | -- | -- | -- | -- | AY844626.1 | AY844844.1 | -- | AY844086.1 |
| *Brachycephalus* | HQ435676.1 | HQ435690.1 | HQ435703.1 | -- | -- | -- | -- | HQ435718.1 | -- | -- | -- | HQ435732.1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *alipioi* | | | | | | | | | | | | |
| *Brachycephalus brunneus* | HQ435677.1 | HQ435691.1 | HQ435704.1 | -- | -- | -- | -- | HQ435719.1 | -- | -- | -- | HQ435733.1 |
| *Brachycephalus ephipium* | HM216368.1 | HM216369.1 | HM216367.1 | GQ345180.1 | GQ345212.1 | GQ345228.1 | GQ345256.1 | HM216370.1 | DQ283808.1 | DQ282673.1 | GQ345326.1 | HQ435735.1 |
| *Brachycephalus ferruginus* | HQ435681.1 | HQ435695.1 | HQ435708.1 | -- | -- | -- | -- | HQ435723.1 | -- | -- | -- | HQ435737.1 |
| *Brachycephalus garbeanus* | HQ435680.1 | HQ435694.1 | HQ435707.1 | -- | -- | -- | -- | HQ435722.1 | -- | -- | -- | HQ435736.1 |
| *Brachycephalus hermogenesi* | HQ435682.1 | -- | HQ435709.1 | -- | -- | -- | -- | HQ435724.1 | -- | -- | -- | HQ435738.1 |
| *Brachycephalus izecksohni* | HQ435683.1 | HQ435696.1 | HQ435710.1 | -- | -- | -- | -- | HQ435725.1 | -- | -- | -- | HQ435739.1 |
| *Brachycephalus pernix* | HQ435685.1 | HQ435698.1 | HQ435712.1 | -- | -- | -- | -- | HQ435727.1 | -- | -- | -- | HQ435741.1 |
| *Brachycephalus pitanga* | HQ435686.1 | HQ435699.1 | HQ435713.1 | -- | -- | -- | -- | HQ435728.1 | -- | -- | -- | HQ435742.1 |
| *Brachycephalus pombali* | HQ435687.1 | HQ435700.1 | HQ435714.1 | -- | -- | -- | -- | HQ435729.1 | -- | -- | -- | HQ435743.1 |
| *Brachycephalus toby* | HQ435688.1 | HQ435701.1 | HQ435715.1 | -- | -- | -- | -- | HQ435730.1 | -- | -- | -- | HQ435744.1 |
| *Brachycephalus vertebralis* | HQ435689.1 | HQ435702.1 | HQ435716.1 | -- | -- | -- | -- | HQ435731.1 | -- | -- | -- | HQ435745.1 |
| *Brahycephalus didactylus* | JX267389.1 | JX267467.1 | HQ435705.1 | -- | -- | -- | -- | JX267544.1 | -- | -- | -- | JX267681.1 |

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| *Chiasmocleis capixaba* | -- | KC180044.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | KC180235.1 |
| *Chiasmocleis leucosticta* | -- | KC180039.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | KC180243.1 |
| *Chiasmocleis schubarti* | -- | KC180071.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | KC180247.1 |
| *Chthonerpeton indistinctum* | -- | EF107202.1 | -- | -- | -- | EF107266.1 | -- | EF107325.1 | -- | -- | EF107428.1 | -- |
| *Crossodactylodes bokermanni* | KF534640.1 | KF534650.1 | KF534668.1 | -- | -- | -- | -- | -- | KF534677.1 | -- | -- | KF534683.1 |
| *Crossodactylodes izecksohni* | KF534633.1 | KF534646.1 | KF534664.1 | -- | -- | -- | -- | -- | KF534673.1 | -- | -- | KF534680.2 |
| *Crossodactylus caramaschii* | AY143346.1 | AY263235.1 | KC603961.1 | -- | -- | -- | KC604072.1 | KC604005.1 | -- | -- | -- | -- |
| *Cycloramphus acangatan* | HQ634162.1 | FJ685683.1 | FJ685663.1 | -- | -- | -- | -- | HQ634170.1 | KF214198.1 | -- | -- | -- |
| *Cycloramphus bandeirensis* | HQ634161.1 | HQ634166.1 | -- | -- | -- | -- | -- | HQ634169.1 | -- | -- | -- | -- |
| *Cycloramphus eleutherodactylus* | HQ634160.1 | HQ634165.1 | -- | -- | -- | -- | -- | HQ634168.1 | -- | -- | -- | -- |
| *Cycloramphus organensis* | HQ634159.1 | HQ634164.1 | -- | -- | -- | -- | -- | HQ634167.1 | -- | -- | -- | -- |
| *Dendrophryniscus berthalutzae* | JN867524.1 | JN867551.1 | -- | -- | -- | -- | -- | JN867497.1 | -- | -- | -- | -- |
| *Dendrophryniscus* | AF375490.1 | AF375515.1 | -- | -- | -- | -- | -- | JN867499.1 | -- | -- | -- | -- |

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| *brevipollicatus* | | | | | | | | | | | | |
| *Dendrophryniscus carvalhoi* | JN867539.1 | JN867564.1 | -- | -- | -- | -- | -- | JN867512.1 | -- | -- | -- | -- |
| *Dendrophryniscus krause* | JN867541.1 | JN867569.1 | -- | -- | -- | -- | -- | JN867515.1 | -- | -- | -- | -- |
| *Dendrophryniscus leucomystax* | JN867525.1 | JN867552.1 | -- | -- | -- | -- | -- | JN867498.1 | -- | -- | -- | -- |
| *Dendrophryniscus oreites* | JN867531.1 | JN867558.1 | -- | -- | -- | -- | -- | JN867504.1 | -- | -- | -- | -- |
| *Dendrophryniscus proboscideus* | JN867540.1 | JN867567.1 | -- | -- | -- | -- | -- | JN867513.1 | -- | -- | -- | -- |
| *Dendropsophus anceps* | AY843597.1 | AY843597.1 | AY843818.1 | -- | -- | -- | -- | AY844386.1 | AY844571.1 | AY844797.1 | -- | AY844043.1 |
| *Dendropsophus berthalutzae* | AY843607.1 | AY843607.1 | AY843831.1 | -- | -- | -- | -- | AY844397.1 | AY844584.1 | AY844807.1 | -- | AY844052.1 |
| *Dendropsophus bipunctatus* | AY843608.1 | AY843608.1 | AY843832.1 | -- | -- | -- | -- | -- | AY844585.1 | AY844808.1 | -- | AY844053.1 |
| *Dendropsophus branneri* | -- | -- | AF549336.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Dendropsophus elegans* | DQ380355.1 | AF308102.1 | AF308124.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Dendropsophus giesleri* | AY843629.1 | AY843629.1 | AY843860.1 | -- | -- | -- | -- | AY844417.1 | -- | AY844827.1 | -- | AY844075.1 |
| *Dendropsophus minutus* | AY549345.1 | AY549345.1 | AY843883.1 | -- | DQ284046.1 | -- | -- | AY844432.1 | DQ283758.1 | -- | -- | AY844089.1 |

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| *Dendropsophus nanus* | AY549346.1 | AY549346.1 | AY843888.1 | GQ365985.1 | DQ284051.1 | -- | AY819123.1 | AY844437.1 | AY844634.1 | AY844852.1 | -- | EF376132.1 |
| *Dendropsophus samborni* | AY843663.1 | AY843663.1 | AY843906.1 | -- | -- | -- | -- | AY844450.1 | AY844653.1 | AY844868.1 | -- | AY844106.1 |
| *Dendropsophus seniculus* | AY843666.1 | AY843666.1 | AY843910.1 | -- | -- | -- | -- | AY844454.1 | AY844657.1 | AY844872.1 | -- | AY844109.1 |
| *Elachistocleis bicolor* | JF836935.1 | KC180005.1 | -- | -- | -- | -- | -- | -- | JF837037.1 | -- | -- | KC180318.1 |
| *Eleutherodactylus bilineata* | JX267323.1 | JX267323.1 | -- | -- | -- | -- | -- | JX267556.1 | -- | -- | -- | JX267691.1 |
| *Euparkerella brasiliensis* | JX267390.1 | JX298316.1 | JX298402.1 | -- | -- | -- | JX298137.1 | KF625104.1 | -- | -- | -- | KF625126.1 |
| *Euparkerella cochranae* | -- | -- | -- | -- | -- | -- | -- | KF625094.1 | -- | -- | -- | KF625116.1 |
| *Euparkerella robusta* | -- | -- | -- | -- | -- | -- | -- | KF625089.1 | -- | -- | -- | KF625111.1 |
| *Euparkerella tridactyla* | -- | -- | -- | -- | -- | -- | -- | KF625088.1 | -- | -- | -- | KF625110.1 |
| *Fritziana fissilis* | -- | JN157630.1 | -- | -- | -- | -- | JN157628.1 | -- | -- | -- | -- | -- |
| *Fritziana goeldii* | -- | JN157631.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Fritziana ohausi* | -- | JN157635.1 | -- | -- | -- | -- | JN157629.1 | KC844991.1 | -- | -- | -- | -- |
| *Gastrotheca albolineata* | -- | KC844924.1 | -- | -- | -- | -- | KC844971.1 | KC844992.1 | -- | -- | -- | -- |
| *Gastrotheca* | -- | KC844927.1 | -- | -- | -- | -- | KC844975.1 | KC844995.1 | -- | -- | -- | -- |

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| *ernestoi* | | | | | | | | | | | | |
| *Gastrotheca fulvorufa* | -- | KC844929.1 | -- | -- | -- | -- | KC844977.1 | KC844997.1 | -- | -- | -- | -- |
| *Gastrotheca microdiscus* | -- | KC844933.1 | -- | -- | -- | -- | KC844981.1 | KC845000.1 | -- | -- | -- | -- |
| *Haddadus binotatus* | KF740846.1 | KF740846.1 | JX298405.1 | GQ345183.1 | DQ284142.1 | GQ345231.1 | GQ345259.1 | JX267548.1 | DQ283807.1 | GQ345309.1 | GQ345329.1 | JX267685.1 |
| *Holoaden bradei* | -- | -- | JX298403.1 | -- | -- | -- | JX298138.1 | EF493449.1 | -- | -- | -- | EU186779.1 |
| *Holoaden luederwaldti* | EU186728.1 | EU186710.1 | -- | -- | -- | -- | -- | JX267549.1 | -- | -- | -- | EU186768.1 |
| *Hylodes nasus* | -- | -- | -- | GQ345194.1 | -- | GQ345242.1 | GQ345272.1 | GQ345289.1 | -- | -- | GQ345340.1 | -- |
| *Hylodes phyllodes* | DQ283096.1 | DQ283096.1 | DQ502587.1 | -- | DQ284146.1 | -- | -- | KC604006.1 | DQ283812.1 | DQ282674.1 | -- | DQ282923.1 |
| *Hylomantis aspera* | GQ366222.1 | -- | -- | GQ365978.1 | -- | -- | -- | -- | GQ366098.1 | -- | -- | -- |
| *Hylomantis granulosa* | AY843687.1 | GQ366292.1 | AY843933.1 | GQ365979.1 | -- | -- | GQ366032.1 | AY844469.1 | AY844680.1 | -- | -- | AY844127.1 |
| *Hyophryne histrio* | -- | KC180064.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Hypsiboas albomarginatus* | AY549316.1 | AY549316.1 | AY843815.1 | -- | -- | -- | -- | AY844384.1 | AY844568.1 | AY844794.1 | -- | -- |
| *Hypsiboas albopunctatus* | AY549317.1 | AY549317.1 | AY843816.1 | -- | -- | -- | -- | -- | AY844569.1 | AY844795.1 | -- | AY844041.1 |
| *Hypsiboas bichoffi* | AY549324.1 | AY549324.1 | AY843833.1 | -- | -- | -- | -- | AY844398.1 | AY844586.1 | -- | -- | -- |
| *Hypsiboas caingua* | AY549326.1 | AY549326.1 | AY843838.1 | KF751479.1 | -- | -- | -- | -- | AY844591.1 | AY844812.1 | -- | AY844057.1 |

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| *Hypsiboas crepitans* | AY843621.1 | AY843621.1 | AY843850.1 | KF751482.1 | -- | -- | -- | AY844412.1 | AY844601.1 | -- | -- | AY844067.1 |
| *Hypsiboas curupi* | -- | -- | -- | KF751483.1 | -- | -- | -- | -- | -- | -- | -- | -- |
| *Hypsiboas faber* | AY549334.1 | AY549334.1 | AY843857.1 | -- | -- | -- | -- | -- | AY844607.1 | AY844825.1 | -- | -- |
| *Hypsiboas guenteri* | AY843631.1 | AY843631.1 | AY843863.1 | -- | -- | -- | -- | -- | AY844612.1 | AY844830.1 | -- | -- |
| *Hypsiboas joaquini* | AY549340.1 | AY549340.1 | AY843867.1 | KF751484.1 | -- | -- | -- | AY844421.1 | AY844616.1 | AY844834.1 | -- | -- |
| *Hypsiboas latistriatus* | AY549360.1 | AY549360.1 | AY843921.1 | -- | -- | -- | -- | -- | AY844668.1 | -- | -- | -- |
| *Hypsiboas leptolineatus* | AY549341.1 | AY549341.1 | AY843872.1 | -- | -- | -- | -- | AY844424.1 | AY844621.1 | AY844839.1 | -- | AY844083.1 |
| *Hypsiboas lundii* | AY843639.1 | AY843639.1 | AY843874.1 | -- | -- | -- | -- | -- | AY844623.1 | AY844841.1 | -- | AY844085.1 |
| *Hypsiboas marginatus* | AY549342.1 | AY549342.1 | AY843875.1 | KF751486.1 | -- | -- | -- | AY844426.1 | AY844624.1 | AY844842.1 | -- | -- |
| *Hypsiboas pardalis* | AY843651.1 | AY843651.1 | AY843891.1 | -- | -- | -- | -- | -- | AY844637.1 | AY844855.1 | -- | AY844096.1 |
| *Hypsiboas polytaenius* | AY843655.1 | AY843655.1 | AY843895.1 | -- | -- | -- | AY819124.1 | AY844443.1 | AY844641.1 | AY844859.1 | -- | -- |
| *Hypsiboas prasinus* | AY549347.1 | AY549347.1 | AY843896.1 | -- | -- | -- | -- | -- | AY844642.1 | AY844860.1 | -- | AY844100.1 |
| *Hypsiboas pulchellus* | AY549352.1 | AY549352.1 | AY843898.1 | -- | -- | -- | -- | AY844445.1 | AY844644.1 | AY844862.1 | -- | AY844102.1 |
| *Hypsiboas* | AY549353.1 | AY549353.1 | AY843899.1 | -- | -- | -- | -- | -- | AY844645.1 | -- | -- | -- |

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| *punctatus* | | | | | | | | | | | | |
| *Hypsiboas raniceps* | AY843657.1 | AY843657.1 | AY843900.1 | KF751489.1 | -- | -- | AY819125.1 | -- | JQ023459.1 | AY844863.1 | -- | AY844103.1 |
| *Hypsiboas semiguttatus* | AY549358.1 | AY549358.1 | AY843908.1 | -- | -- | -- | -- | AY844452.1 | AY844655.1 | AY844870.1 | -- | -- |
| *Hypsiboas semilineatus* | AY843779.1 | AY843779.1 | AY843909.1 | KF751491.1 | -- | -- | -- | AY844453.1 | AY844656.1 | AY844871.1 | -- | AY844108.1 |
| *Ischnocnema abdita* | JX267325.1 | JX267471.1 | -- | -- | -- | -- | -- | JX267551.1 | -- | -- | -- | JX267687.1 |
| *Ischnocnema bolbodactyla* | JX267327.1 | JX267476.1 | -- | -- | -- | -- | -- | JX267557.1 | -- | -- | -- | JX267692.1 |
| *Ischnocnema concolor* | JX267366.1 | JX267366.1 | -- | -- | -- | -- | -- | JX267595.1 | -- | -- | -- | JX267728.1 |
| *Ischnocnema erythromera* | JX267340.1 | JX267340.1 | -- | -- | -- | -- | -- | JX267596.1 | -- | -- | -- | JX267730.1 |
| *Ischnocnema hoehnei* | JX267347.1 | -- | -- | -- | -- | -- | -- | JX267616.1 | -- | -- | -- | JX267752.1 |
| *Ischnocnema holti* | JX267306.1 | JX267306.1 | -- | -- | -- | -- | -- | JX267617.1 | -- | -- | -- | JX267754.1 |
| *Ischnocnema izecksoni* | JX267307.1 | JX267307.1 | -- | -- | -- | -- | -- | JX267618.1 | -- | -- | -- | JX267756.1 |
| *Ischnocnema juipoca* | DQ283093.1 | DQ283093.1 | -- | -- | DQ284143.1 | -- | -- | JX267624.1 | DQ283809.1 | -- | -- | JX267762.1 |
| *Ischnocnema melonopygia* | JX267430.1 | JX267292.1 | -- | -- | -- | -- | -- | JX267634.1 | -- | -- | -- | JX267771.1 |

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| *Ischnocnema nasuta* | JX267311.1 | JX267311.1 | -- | -- | -- | -- | -- | JX267636.1 | -- | -- | -- | JX267775.1 |
| *Ischnocnema nigriventris* | JX267398.1 | JX267483.1 | -- | -- | -- | -- | -- | JX267568.1 | -- | -- | -- | JX267704.1 |
| *Ischnocnema octavioi* | JX267334.1 | JX267521.1 | -- | -- | -- | -- | -- | JX267639.1 | -- | -- | -- | JX267777.1 |
| *Ischnocnema parva* | JX267446.1 | KC569989.1 | HQ435717.1 | -- | -- | -- | -- | JX267657.1 | -- | -- | -- | JX267796.1 |
| *Ischnocnema randorum* | JX267448.1 | JX267381.1 | -- | -- | -- | -- | -- | JX267660.1 | -- | -- | -- | JX267800.1 |
| *Ischnocnema sambaqui* | JX267449.1 | JX267531.1 | -- | -- | -- | -- | -- | JX267661.1 | -- | -- | -- | JX267801.1 |
| *Ischnocnema spanios* | JX267407.1 | JX267490.1 | -- | -- | -- | -- | -- | JX267584.1 | -- | -- | -- | JX267717.1 |
| *Ischnocnema verrucosa* | JX267457.1 | JX267538.1 | -- | -- | -- | -- | -- | JX267670.1 | -- | -- | -- | JX267810.1 |
| *Ischnocnema vizottoi* | JX267350.1 | -- | -- | -- | -- | -- | -- | JX267672.1 | -- | -- | -- | JX267812.1 |
| *Itapotihyla langsdorffii* | JQ868500.1 | AY819511.1 | AY843951.1 | -- | -- | -- | KF002003.1 | -- | AY844697.1 | -- | -- | AY844137.1 |
| *Leptodactylus furnarius* | KC470108.1 | KC477257.1 | KF548085.1 | -- | -- | -- | -- | -- | KF613595.1 | -- | -- | -- |
| *Leptodactylus fuscus* | AY905715.1 | AY911284.1 | KF548074.1 | -- | -- | -- | -- | AY323770.1 | KF613583.1 | -- | -- | AY341760.1 |
| *Leptodactylus* | -- | HQ259119.1 | AY332229.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |

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| *gracilis* | | | | | | | | | | | | |
| *Leptodactylus jolyi* | KC470093.1 | KC477250.1 | KF548066.1 | -- | -- | -- | -- | -- | KF613581.1 | -- | -- | -- |
| *Leptodactylus latrans* | AY143353.1 | AY162395.1 | KC603976.1 | DQ306492.1 | DQ284104.1 | -- | KC604055.1 | KC604026.1 | AY844681.1 | -- | -- | KC604082.1 |
| *Leptodactylus macrosternum* | KC470106.1 | KC477255.1 | KF548084.1 | -- | -- | -- | -- | -- | KF613594.1 | -- | -- | -- |
| *Leptodactylus mystaceus* | KC470101.1 | KC477252.1 | KF548080.1 | -- | -- | -- | KC604058.1 | KC604036.1 | KF613589.1 | -- | -- | JN706737.1 |
| *Leptodactylus mystacinus* | KC470105.1 | KC477256.1 | KF548067.1 | -- | -- | -- | -- | AY323771.1 | AY323747.1 | -- | -- | -- |
| *Leptodactylus notoaktites* | -- | KC477254.1 | KF548083.1 | -- | -- | -- | -- | -- | KF613592.1 | -- | -- | -- |
| *Leptodactylus plaumanni* | -- | -- | AY332231.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Leptodactylus podicipinus* | KC470094.1 | KC477245.1 | KF548073.1 | -- | -- | -- | -- | -- | KF613582.1 | -- | -- | -- |
| *Lithobates palmipes* | DQ347037.1 | DQ283384.1 | -- | -- | DQ284369.1 | -- | -- | DQ347263.1 | DQ347382.1 | DQ282847.1 | -- | DQ347170.1 |
| *Luetkenotyphlus brasiliensis* | -- | EF107198.1 | -- | EF107483.1 | -- | EF107262.1 | -- | EF107321.1 | -- | -- | EF107424.1 | -- |
| *Macrogenioglottus alipioi* | KF214098.1 | FJ685685.1 | FJ685665.1 | -- | -- | -- | -- | FJ685705.1 | KF214200.1 | -- | -- | -- |
| *Melanophryniscus setiba* | JX961679.1 | JX961679.1 | -- | JX961675.1 | -- | -- | -- | -- | JX961677.1 | -- | -- | -- |

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| *Myersiella microps* | -- | KC179973.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | KC180279.1 |
| *Odontophrynus carvalhoi* | KF214100.1 | FJ685687.1 | FJ685667.1 | -- | -- | -- | -- | FJ685707.1 | KF214202.1 | -- | -- | -- |
| *Ololygon catharinae* | AY843756.1 | AY843756.1 | AY844001.1 | -- | -- | -- | AY819140.1 | AY844517.1 | AY844742.1 | AY844941.1 | -- | -- |
| *Ololygon obtriangulata* | GQ896259.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Paratelmatobius cardosoi* | EU224404.1 | EU224404.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Paratelmatobius gaigeae* | EU224397.1 | EU224397.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Paratelmatobius poecilogaster* | EU224400.1 | EU224400.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Phasmahyla cochranae* | -- | GQ366309.1 | -- | GQ365996.1 | -- | -- | GQ366038.1 | GQ366076.1 | GQ366105.1 | GQ366164.1 | -- | -- |
| *Phasmahyla exilis* | GQ366231.1 | GQ366310.1 | GQ365920.1 | GQ365997.1 | -- | -- | GQ366039.1 | GQ366077.1 | GQ366106.1 | GQ366165.1 | -- | -- |
| *Phasmahyla guttata* | GQ366232.1 | GQ366232.1 | GQ365921.1 | -- | -- | -- | GQ366040.1 | -- | GQ366107.1 | -- | -- | -- |
| *Phasmahyla jandaia* | GQ366233.1 | GQ366312.1 | GQ365922.1 | GQ365999.1 | -- | -- | GQ366042.1 | -- | GQ366108.1 | GQ366166.1 | -- | -- |
| *Phrynomedusa marginata* | GQ366234.1 | GQ366313.1 | GQ365923.1 | -- | -- | -- | -- | GQ366078.1 | GQ366109.1 | GQ366167.1 | -- | GQ366199.1 |
| *Phyllodytes luteolus* | AY843721.1 | AY843721.1 | AY843966.1 | -- | -- | -- | GQ366043.1 | AY844494.1 | AY844708.1 | AY844913.1 | -- | AY844150.1 |

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| *Phyllomedusa bahiana* | GQ366251.1 | GQ366251.1 | GQ365940.1 | -- | -- | -- | -- | -- | GQ366126.1 | GQ366177.1 | -- | GQ366205.1 |
| *Phyllomedusa burmeisteri* | GQ366255.1 | GQ366324.1 | GQ365944.1 | GQ366011.1 | -- | -- | GQ366052.1 | GQ366087.1 | GQ366130.1 | GQ366180.1 | -- | GQ366207.1 |
| *Phyllomedusa distincta* | GQ366263.1 | GQ366326.1 | GQ365951.1 | GQ366013.1 | -- | -- | GQ366056.1 | -- | GQ366135.1 | -- | -- | GQ366210.1 |
| *Phyllomedusa iheringii* | GQ366264.1 | GQ366328.1 | GQ365952.1 | -- | -- | -- | GQ366057.1 | -- | GQ366136.1 | GQ366185.1 | -- | -- |
| *Phyllomedusa nordestina* | GQ366271.1 | GQ366330.1 | GQ365959.1 | GQ366016.1 | -- | -- | -- | GQ366091.1 | GQ366143.1 | -- | -- | GQ366215.1 |
| *Phyllomedusa rohdei* | GQ366238.1 | GQ366316.1 | GQ365927.1 | GQ366001.1 | -- | -- | -- | GQ366081.1 | GQ366113.1 | -- | -- | -- |
| *Phyllomedusa tetraploidea* | GQ366284.1 | GQ366334.1 | GQ365972.1 | GQ366021.1 | -- | -- | GQ366066.1 | GQ366096.1 | GQ366155.1 | GQ366194.1 | -- | GQ366218.1 |
| *Physalaemus atlanticus* | KC692081.1 | KC692081.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Physalaemus barrioi* | DQ337213.1 | DQ337213.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Physalaemus crombiei* | KC692082.1 | KC692082.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Physalaemus cuvieri* | AY843729.1 | AY162399 | AY843975 | -- | -- | -- | AY819096 | AY844499 | -- | AY844922 | -- | -- |
| *Physalaemus olfersii* | KC692085.1 | KC692085.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Physalaemus* | DQ337209.1 | DQ337209.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

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| *signifer* | | | | | | | | | | | | |
| *Physalaemus spiniger* | KC692086.1 | KC692086.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Pipa carvalhoi* | DQ283251 | DQ283251 | -- | -- | DQ284277 | -- | -- | -- | DQ283922 | DQ282774 | -- | -- |
| *Pristimantis paulodutrai* | JX267399.1 | JX267360.1 | -- | -- | -- | -- | -- | JX267573.1 | -- | -- | -- | JX267707.1 |
| *Pristimantis ramagii* | JX267319.1 | JX267319.1 | -- | -- | -- | -- | -- | JX267659.1 | -- | -- | -- | JX267798.1 |
| *Pristimantis vinhai* | X267411.1 | -- | -- | -- | -- | -- | -- | JX267592.1 | -- | -- | -- | JX267725.1 |
| *Proceratophrys appendiculata* | KF214131.1 | -- | KF214173.1 | -- | -- | -- | -- | KF214190.1 | KF214232.1 | -- | -- | -- |
| *Proceratophrys avelinoi* | KF214102.1 | FJ685691.1 | FJ685671.1 | -- | -- | -- | -- | FJ685711.1 | KF214204.1 | -- | -- | -- |
| *Proceratophrys bigibbosa* | KF214103.1 | FJ685692.1 | FJ685672.1 | -- | -- | -- | -- | FJ685712.1 | KF214205.1 | -- | -- | -- |
| *Proceratophrys cristiceps* | KF214106.1 | FJ685695.1 | FJ685675.1 | -- | -- | -- | -- | FJ685715.1 | KF214208.1 | -- | -- | -- |
| *Proceratophrys cururu* | KF214107.1 | FJ685696.1 | FJ685676.1 | -- | -- | -- | -- | FJ685716.1 | KF214209.1 | -- | -- | -- |
| *Proceratophrys laticeps* | KF214109.1 | FJ685698.1 | FJ685678.1 | -- | -- | -- | -- | FJ685718.1 | KF214211.1 | -- | -- | -- |
| *Proceratophrys melanopogon* | KF214120.1 | KF214142.1 | KF214164.1 | -- | -- | -- | GQ345270.1 | KF214181. | KF214217.1 | -- | -- | -- |

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| *Proceratophrys minuta* | KF214113.1 | -- | JX982962.1 | -- | -- | -- | -- | JX982970.1 | KF214215.1 | -- | -- | -- |
| *Proceratophrys renalis* | KF214111.1 | JN814584.1 | JN814523.1 | -- | -- | -- | -- | JN814664.1 | KF214213.1 | -- | -- | -- |
| *Proceratophrys schirchi* | KF214112.1 | FJ685701.1 | FJ685681.1 | -- | -- | -- | -- | FJ685721.1 | KF214214.1 | -- | -- | -- |
| *Pseudis bolbodactyla* | EF153007.1 | EF153007.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Pseudis cardosoi* | EF152997.1 | EF152997.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Pseudis fusca* | EF153003.1 | EF153003.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Pseudis minuta* | AY843739.1 | AY843739.1 | AY843985.1 | -- | -- | -- | -- | -- | -- | AY844929.1 | -- | -- |
| *Pseudis paradoxa* | AY819353.1 | AY819483.1 | AY843986.1 | -- | DQ284128.1 | -- | AY819102.1 | AY844506.1 | AY844727.1 | -- | -- | AY844167.1 |
| *Rhinella crucifer* | DQ158447 | DQ158447 | DQ415596 | -- | -- | -- | DQ158288 | -- | -- | -- | -- | -- |
| *Rhinella granulosa* | DQ158458.1 | DQ158458.1 | HM159225.1 | FJ882728.1 | -- | FJ882673.1 | DQ158299.1 | DQ158380.1 | -- | -- | -- | -- |
| *Rhinella hoogmoedi* | JN867545.1 | JN867571.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Rhinella icterica* | DQ158462.1 | DQ158462.1 | JN594575.1 | -- | -- | -- | DQ158303.1 | DQ158384.1 | HM159240.1 | -- | -- | -- |
| *Rhinella schneideri* | DQ158480.1 | DQ158480.1 | HM159235.1 | -- | -- | FJ882674.1 | -- | DQ158399.1 | -- | -- | -- | -- |
| *Scinax crospedospilus* | AY819391.1 | AY819523.1 | -- | -- | -- | -- | AY819141.1 | -- | -- | -- | -- | -- |
| *Scinax duartei* | GQ896255.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

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| *Scinax fuscovarius* | AY843758.1 | AY843758.1 | AY844003.1 | -- | -- | -- | -- | AY844519.1 | AY844744.1 | AY844943.1 | -- | AY844179.1 |
| *Scinax hayii* | GQ896257.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Scinax similis* | GQ896263.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Scinax squalirostris* | AY843760.1 | AY843760.1 | -- | -- | -- | -- | -- | AY844522.1 | AY844747.1 | AY844945.1 | -- | AY844182.1 |
| *Scinax uruguayus* | AY843681.1 | AY843681.1 | AY843927.1 | -- | -- | -- | -- | -- | AY844674.1 | AY844884.1 | -- | AY844123.1 |
| *Scythrophrys sawayae* | DQ283099.1 | DQ283099.1 | -- | -- | DQ284149.1 | -- | -- | -- | DQ283815.1 | -- | -- | DQ282926.1 |
| **Siphonops annulatus* | -- | EU753986.1 | EU754003.1 | -- | -- | -- | -- | DQ320064.1 | -- | -- | -- | -- |
| *Siphonops paulensis* | -- | EF107203.1 | -- | EF107487.1 | -- | -- | -- | EF107326.1 | -- | -- | EF107429.1 | -- |
| *Stereocyclops incrassatus* | -- | KC180014.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | KC180231.1 |
| *Trachycephalus imitatrix* | EU034036.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Trachycephalus mesophaeus* | AY843718.1 | AY843718.1 | AY843963.1 | -- | -- | -- | -- | AY844491.1 | AY844705.1 | AY844910.1 | -- | AY844147.1 |
| *Trachycephalus nigromaculatus* | AY843772.1 | AY843772.1 | AY844016.1 | -- | -- | -- | -- | -- | AY844759.1 | -- | -- | AY844191.1 |
| *Trachycephalus typhonius* | JX847093.1 | JX875626.1 | -- | -- | -- | -- | JX875780.1 | -- | -- | -- | -- | -- |
| *Xenohyla truncata* | AY843775.1 | AY843775.1 | AY844018.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |

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| *Zachaenus parvulus* | KC593362.1 | KC593362.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

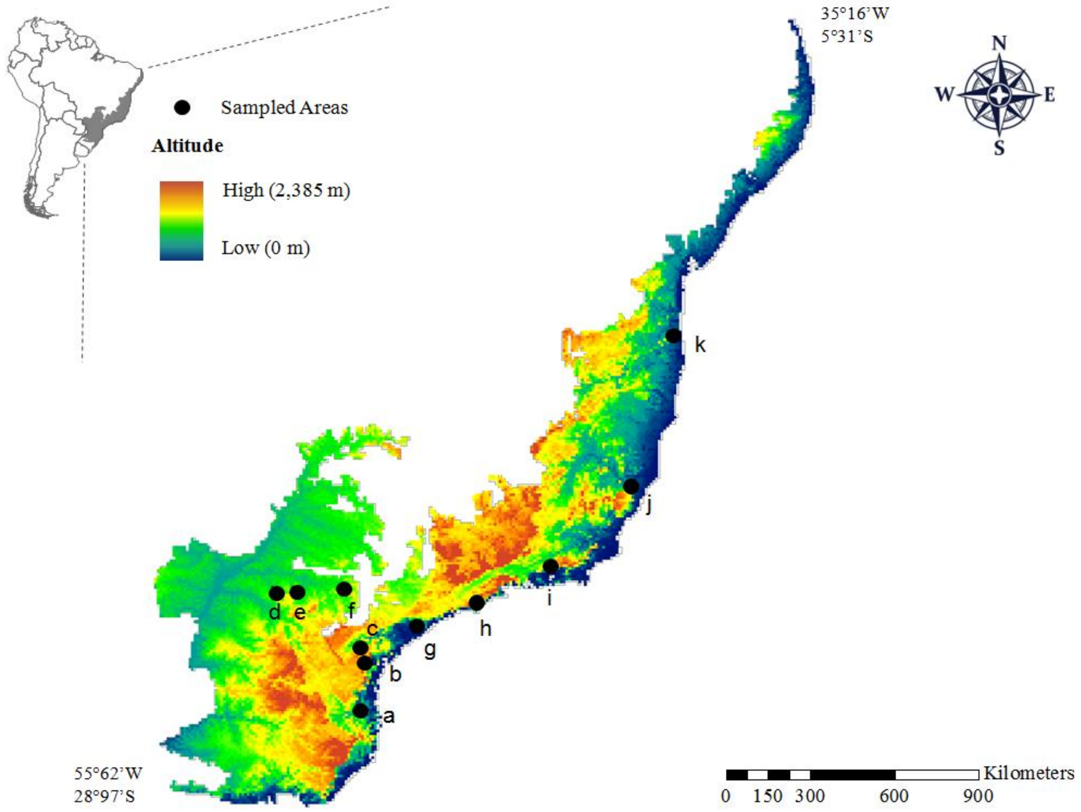

**Figure S1.** Map showed the lacalition of Brazilian Atlantic Forest hotspot (in gray) in South American territory. The black circle indicates the Protected areas visited as complementary field works. a. Parque Ecológico Spitzkopf, SC; b. Parque Estadual Pico do Marumbi, PR; c. Parque estadual de Campinhos, PR; d. Parque municipal das Perobas, PR; e. Parque Estadual Mata dos Godoy, PR; f. Refugio municipal da vida Silvestre, Horto Florestal de Jacarezinho, PR; g. Estação Ecológica de Juréia-Itatins, SP; h. Parque Estadual da Serra do Mar Núcleo Caraguatatuba, SP; i. Parque Nacional da Serra dos Órgãos, RJ; j. Reserva Biológica Augusto Ruschi, ES; k. Reserva Biológica de Una, BA. From January of 2014 (PA h five days), July 2014 (PA f three days), November 2014 (PAs d, f three days in each), December 2014 (PA d two days), January to March 2015 (PAs a, b, g-k seven days in each), May 2015 (PA f three days), November 2015 (PA d two days), December 2015 (PA c five days), February 2016 (PAs e two days, f three days), March 2016 (PA d one day, e two days). We sampled amphibians using acoustic and visual nocturnal and diurnal surveys (Crump & Scott Jr, 1994; Zimmerman, 1994). We searched at the margins of water bodies, in the streams, and along 2000 m forest transects. The species collected were euthanized with hydrochloride benzocaine> or = 250 mg / L (ASH, 2004). Number of authorization / license SISBIO: 30344.

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APÊNDICE 3 - **Table S1.** Lista das espécies estudadas e seus mecanismos antipredação.

| **Espécies** | **Produzir Secreções** | **Camuflagem** | **Imobilidade** | **Contrair** | **Inflar o corpo** | **Elevar o corpo** | **Esticar as pernas** | **Escapar** | **Aposematismo** | **Descarga Cloacal** | **Abrir a boca** | **Vocalizações defensivas** | **Luta contra o predador** | **Referências** |
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| *Adelophryne mucronatus* | ___ | Presença | Encolhido& Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo& Esconder | Ausência | ___ | Presença | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Adelophryne pachydactyla* | ___ | Presença | Encolhido& Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo& Esconder | Ausência | ___ | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Aparasphenodon brunoi* | Venenosa | Ausência | Encolhido& Alerta& Tanatose | Fragmose | Presença | Ausência | Ausência | Único pulo | Ausência | ___ | Ausência | ___ | Lutar& Cabeçada | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Aplastodiscus albosignatus* | Odorifera& Desagradavel | Presença | Encolhido | ___ | Ausência | Pernas esticadas verticalmente | Ausência | Único pulo | Ausência | ___ | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Aplastodiscus arildae* | Odorifera& Desagradavel | Presença | Encolhido& Alerta | Contração | Presença | Pernas esticadas verticalmente &Pernas esticadas lateralmente | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); |

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| *Aplastodiscus callipygius* | Odorifera& Desagradavel | Presença | Encolhido | ___ | Ausência | Pernas esticadas verticalmente | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Aplastodiscus cochranae* | Odorifera& Desagradavel | Presença | Encolhido | Proteger o olho | Ausência | Pernas esticadas verticalmente | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Aplastodiscus ehrhardti* | Odorifera& Desagradavel | Presença | Encolhido& Tanatose | Contração | Ausência | Ausência | Ausência | Varios pulos& Esconder | Ausência | Liquida | Presença | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Aplastodiscus leucopygius* | Odorifera& Desagradavel | Presença | Encolhido | Agachar | Presença | Pernas esticadas verticalmente | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Aplastodiscus perviridis* | Odorifera& Desagradavel | Presença | Encolhido& Alerta | ___ | Ausência | Pernas esticadas verticalmente | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Aplastodiscus weygoldti* | Odorifera& Desagradavel | Presença | Encolhido | ___ | Ausência | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação) |
| *Bokermannohyla astartea* | Odorifera& Desagradavel | Presença | Encolhido& Alerta | Contração | Presença | Ausência | Ausência | Varios pulos&Esconder | Ausência | Liquida | Ausência | ___ | Agredir com espinho | Haddad et al 2013; Ferreira et al (em preparação); |

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| *Bokermannohyla circumdata* | Odorifera& Desagradavel | Presença | Encolhido& Alerta& Tanatose | Agachar | Ausência | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | Grito de agônia | Lutar& Agredir com espinho | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Bokermannohyla hylax* | Odorifera& Desagradavel | Presença | Encolhido& Alerta | Agachar | Ausência | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | Agredir com espinho | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Brachycephalus ephippium* | Venenosa | Ausência | Encolhido& Tanatose | ___ | Presença | Ausência | Ausência | Varios pulos& Esconder | Total | ___ | Presença | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Brachycephalus hermogenesi* | ___ | Presença | Encolhido | ___ | Ausência | Ausência | Ausência | ___ | Ausência | ___ | Presença | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação) |
| *Brachycephalus pitanga* | Venenosa | Ausência | Encolhido | ___ | Ausência | Ausência | Ausência | Varios pulos& Esconder | Total | ___ | Presença | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Chiasmocleis capixaba* | Odorifera | Presença | Encolhido& Tanatose | ___ | Ausência | Ausência | Ausência | Varios pulos | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |

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| *Chiasmocleis leucosticta* | Odorifera | Presença | Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo& Esconder | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Chiasmocleis schubarti* | Odorifera | Presença | Encolhido& Alerta& Tanatose | ___ | Presença | Ausência | Ausência | Único pulo | Ausência | Liquida | Presença | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Crossodactylodes bokermanni* | ___ | Presença | Encolhido | ___ | Ausência | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação) |
| *Crossodactylodes izecksohni* | ___ | Presença | Encolhido | Agachar | Ausência | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | Agredir com espinho | Haddad et al 2013; Ferreira et al (em preparação) |
| *Crossodactylus caramaschii* | Escorregadia | Presença | Alerta& Tanatose | ___ | Presença | Ausência | Ausência | Único pulo& Esconder | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Cycloramphus acangatan* | ___ | Presença | Encolhido& Tanatose | Contração | Presença | Ausência | Ausência | Único pulo | Ausência | Liquida | Presença | Grito de agônia | Lutar& Morder | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Cycloramphus eleutherodactylus* | ___ | Presença | Alerta | ___ | Ausência | Ausência | Ausência | ___ | Ausência | Liquida | Ausência | ___ | Morder | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |

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| *Dendrophryniscus brevipollicatus* | ___ | Presença | Encolhido& Alerta& Tanatose | Contração& Agachar | Ausência | Ausência | Presença | Varios pulos& Esconder | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Dendrophryniscus carvalhoi* | ___ | Presença | Encolhido& Alerta& Tanatose | Contração | Presença | Ausência | Presença | Único pulo | Ausência | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Dendrophryniscus leucomystax* | ___ | Presença | Encolhido& Alerta | Contração | Ausência | Ausência | Presença | Único pulo | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Dendrophryniscus proboscideus* | Venenosa | Presença | Encolhido& Alerta | Contração | Ausência | Ausência | Ausência | Único pulo | Ausência | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Dendropsophus anceps* | ___ | Presença | Encolhido& Alerta | Contração | Ausência | Ausência | Ausência | Único pulo | Ausência | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Dendropsophus bipunctatus* | ___ | Presença | Encolhido& Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo | Parcial | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Dendropsophus branneri* | Odorifera | Presença | Encolhido& Alerta& | ___ | Presença | Ausência | Ausência | Varios pulos& | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et |

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| | | | Tanatose | | | | | Esconder | | | | | | al (em preparação); Presente estudo |
| *Dendropsophus elegans* | ___ | Presença | Encolhido& Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Dendropsophus giesleri* | Odorifera | Presença | Encolhido& Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo | Parcial | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Dendropsophus minutus* | Odorifera | Presença | Encolhido& Alerta& Tanatose | ___ | Presença | Ausência | Ausência | Varios pulos& Esconder | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Dendropsophus nanus* | Odorifera& Adesiva | Presença | Encolhido& Alerta& Tanatose | ___ | Presença | Ausência | Ausência | Varios pulos& Esconder | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Dendropsophus sanborni* | Odorifera | Presença | Encolhido& Alerta& Tanatose | ___ | Presença | Ausência | Ausência | Varios pulos& Esconder | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Elachistocleis bicolor* | Odorifera | Presença | Encolhido& Tanatose | ___ | Presença | Pernas esticadas verticalmente | Ausência | Único pulo& Esconder | Parcial | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |

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| *Eleutherodactylus bilineatus* | ___ | Presença | Encolhido& Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo | Ausência | ___ | Presença | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Euparkerella tridactyla* | ___ | Presença | Encolhido | ___ | Ausência | Pernas esticadas verticalmente | Ausência | Único pulo | Ausência | ___ | Presença | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Fritziana ohausi* | ___ | Presença | Encolhido& Alerta& Tanatose | Contração | Ausência | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Gastrotheca albolineata* | Odorifera | Presença | Encolhido& Tanatose | Contração& Agachar | Presença | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Gastrotheca microdiscus* | ___ | Presença | Encolhido | Contração | Ausência | Ausência | Ausência | Único pulo | Ausência | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação) |
| *Haddadus binotatus* | Odorifera | Presença | Encolhido& Alerta& Tanatose | Agachar | Presença | Ausência | Ausência | Único pulo& Esconder | Ausência | Liquida | Presença | Grito de agônia | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Hylodes phyllodes* | Escorregadia | Presença | Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo& Esconder | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); |

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| *Hylomantis aspera* | Venenosa | Presença | Encolhido | Contração | Ausência | Ausência | Ausência | Único pulo | Parcial | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Hypsiboas albomarginatus* | Odorifera&<br>Adesiva | Presença | Encolhido&<br>Alerta&<br>Tanatose | Contração | Presença | Ausência | Ausência | Único pulo | Parcial | Liquida | Ausência | Grito de agônia | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Hypsiboas albopunctatus* | Odorifera | Presença | Encolhido&<br>Alerta&<br>Tanatose | Contração&<br>Proteger o olho | Presença | Ausência | Ausência | Único pulo | Parcial | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Hypsiboas bischoffi* | Odorifera | Presença | Encolhido&<br>Alerta&<br>Tanatose | Abaixar o queixo | Ausência | Ausência | Ausência | Único pulo | Parcial | Liquida | Ausência | Grito de alarme | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Hypsiboas caingua* | Odorifera | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Ausência | Ausência | Ausência | Varios pulos&<br>Esconder | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Hypsiboas crepitans* | Odorifera&<br>Adesiva | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Presença | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | Grito de agônia | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |

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| *Hypsiboas faber* | Odorifera&<br>Escorregadia | Presença | Encolhido&<br>Alerta&<br>Tanatose | Contração&<br>Agachar&Abaixar o queixo | Presença | Ausência | Ausência | Varios pulos&<br>Esconder | Ausência | Liquida&<br>Sólida | Ausência | Grito de agônia | Lutar&<br>Agredir com espinho | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Hypsiboas pardalis* | Odorifera | Presença | Encolhido&<br>Alerta | ___ | Presença | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | Grito de agônia | Agredir com espinho&<br>Cabeçada | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Hypsiboas prasinus* | Odorifera | Presença | Encolhido&<br>Alerta | ___ | Ausência | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Hypsiboas punctatus* | Odorifera | Presença | Encolhido&<br>Alerta | Contração | Ausência | Ausência | Ausência | Varios pulos&<br>Esconder | Parcial | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Hypsiboas raniceps* | Odorifera | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Presença | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | Grito de agônia | Lutar&<br>Agredir com espinho | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Hypsiboas semilineatus* | Odorifera&<br>Adesiva | Presença | Encolhido&<br>Alerta&<br>Tanatose | Contração | Presença | Ausência | Ausência | Único pulo | Parcial | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Ischnocnema* | ___ | Presença | Alerta& | ___ | Presença | Ausência | Ausência | Varios | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et |

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| *abdita* | | | Tanatose | | | | | pulos | | | | | | al (em preparação); Presente estudo |
| *Ischnocnema erythromera* | Odorifera | Presença | Alerta& Tanatose | ___ | Presença | Ausência | Ausência | Único pulo& Esconder | Parcial | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Ischnocnema nigriventris* | ___ | Presença | Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo& Esconder | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Ischnocnema parva* | Odorifera | Presença | Alerta& Tanatose | ___ | Presença | Ausência | Ausência | Varios pulos | Ausência | ___ | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Ischnocnema spanios* | ___ | Presença | Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Varios pulos | Ausência | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Ischnocnema verrucosa* | ___ | Presença | Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Varios pulos | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Itapotihyla langsdorffii* | Odorifera& Desagradavel | Presença | Encolhido& Alerta& Tanatose | Contração& Agachar&Proteger o olho | Ausência | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |

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| *Leptodactylus fuscus* | Escorregadia | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Ausência | Ausência | Ausência | Varios pulos | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Leptodactylus latrans* | Escorregadia | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Presença | Pernas esticadas lateralmente | Ausência | Varios pulos | Ausência | Liquida | Ausência | ___ | Lutar&<br>Agredir com espinho&<br>Avançar&<br>Cabeçada | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Leptodactylus mystaceus* | ___ | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Ausência | Ausência | Ausência | Varios pulos | Parcial | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Leptodactylus mystacinus* | Venenosa | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Presença | Ausência | Ausência | Varios pulos | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Leptodactylus notoaktites* | Odorifera | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Presença | Ausência | Ausência | Varios pulos | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Leptodactylus podicipinus* | Odorifera | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Presença | Ausência | Ausência | Único pulo&<br>Esconder | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); |

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| *Macrogenioglottus alipioi* | Venenosa | Presença | Encolhido | Contração | Presença | Pernas esticadas verticalmente<br>&Pernas esticadas lateralmente | Ausência | Único pulo | Parcial | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Myersiella microps* | Odorifera | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Presença | Pernas esticadas verticalmente | Presença | Único pulo&<br>Esconder | Ausência | ___ | Ausência | Grito de agônia | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Odontophrynus carvalhoi* | Venenosa | Presença | Encolhido | Contração | Presença | Ausência | Ausência | Único pulo | Ausência | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Ololygon catharinae* | Odorifera&<br>Adesiva | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Presença | Ausência | Ausência | Único pulo&<br>Esconder | Ausência | Liquida | Presença | Grito de agônia | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Paratelmatobius cardosoi* | ___ | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo&<br>Esconder | Parcial | ___ | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Phasmahyla guttata* | Venenosa | Presença | Encolhido | Contração | Ausência | Ausência | Ausência | Único pulo | Parcial | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |

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| *Phyllodytes luteolus* | ___ | Ausência | Encolhido& Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo& Esconder | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Phyllomedusa bahiana* | Venenosa | Presença | Encolhido | Contração& Abaixar o queixo | Ausência | Ausência | Ausência | Único pulo | Parcial | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Phyllomedusa burmeisteri* | Venenosa | Presença | Encolhido | Contração& Abaixar o queixo | Ausência | Ausência | Ausência | Único pulo | Parcial | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Phyllomedusa distincta* | Venenosa | Presença | Encolhido | Contração | Ausência | Ausência | Ausência | Único pulo | Parcial | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Phyllomedusa nordestina* | Venenosa | Presença | Encolhido | Contração | Presença | Ausência | Ausência | Único pulo | Parcial | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Phyllomedusa rohdei* | Venenosa | Presença | Encolhido | Contração | Ausência | Ausência | Ausência | Único pulo | Parcial | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Phyllomedusa tetraploidea* | Venenosa | Presença | Encolhido | Contração | Presença | Ausência | Ausência | Único pulo | Parcial | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et |

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| *Physalaemus crombiei* | ___ | Presença | Encolhido& Alerta& Tanatose | Agachar | Ausência | Elevação | Ausência | Varios pulos | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Physalaemus cuvieri* | Escorregadia | Presença | Encolhido& Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo& Esconder | Parcial | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Physalaemus olfersii* | ___ | Presença | Encolhido& Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo& Esconder | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação) |
| *Physalaemus signifer* | ___ | Presença | Encolhido& Alerta& Tanatose | ___ | Presença | Ausência | Ausência | Único pulo& Esconder | Ausência | Liquida | Ausência | Grito de agônia | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Pipa carvalhoi* | Escorregadia | Presença | Encolhido& Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo& Esconder | Ausência | ___ | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Pristimantis paulodutrai* | Odorifera | Presença | Encolhido& Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Varios pulos | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |

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| *Pristimantis ramagii* | Odorifera | Presença | Encolhido& Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Varios pulos | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Pristimantis vinhai* | Odorifera | Presença | Encolhido& Alerta& Tanatose | ___ | Ausência | Ausência | Ausência | Varios pulos | Parcial | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Proceratophrys appendiculata* | ___ | Presença | Encolhido& Alerta | ___ | Ausência | Ausência | Presença | Único pulo | Ausência | ___ | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Proceratophrys avelinoi* | ___ | Presença | Encolhido& Alerta | Contração | Ausência | Ausência | Ausência | Único pulo | Parcial | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Proceratophrys cururu* | Odorifera | Presença | Encolhido& Alerta | Agachar | Presença | Ausência | Ausência | Único pulo | Ausência | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação) |
| *Proceratophrys laticeps* | ___ | Presença | Encolhido& Alerta | Contração | Ausência | Ausência | Presença | Único pulo | Ausência | ___ | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Proceratophrys melanopogon* | ___ | Presença | Encolhido& Alerta | ___ | Ausência | Ausência | Presença | Único pulo | Ausência | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); |

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| *Proceratophrys renalis* | ___ | Presença | Encolhido& Alerta& Tanatose | Contração | Ausência | Ausência | Presença | Único pulo | Ausência | ___ | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Proceratophrys schirchi* | ___ | Presença | Encolhido& Alerta | ___ | Ausência | Elevação lateral | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); |
| *Pseudis bolbodactyla* | Escorregadia | Presença | Encolhido& Alerta& Tanatose | ___ | Presença | Ausência | Ausência | Único pulo& Esconder | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Rhinella crucifer* | Venenosa | Presença | Encolhido& Alerta | Agachar | Presença | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Rhinella granulosus* | Venenosa | Presença | Encolhido& Alerta | Contração | Presença | Ausência | Presença | Único pulo | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Rhinella hoogmoedi* | Venenosa | Presença | Encolhido& Alerta | Contração | Presença | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |

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| *Rhinella ictericus* | Venenosa | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Presença | Elevação lateral | Ausência | Único pulo | Ausência | Liquida | Ausência | Grito de agônia | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Rhinella schneideri* | Venenosa | Presença | Encolhido&<br>Alerta&<br>Tanatose | Contração | Presença | Elevação lateral | Ausência | Único pulo | Ausência | Liquida | Ausência | Grito de agônia | Avançar&<br>Cabeçada | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Scinax crospedospilus* | Odorifera | Presença | Encolhido&<br>Alerta | ___ | Ausência | Ausência | Ausência | Varios pulos | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Scinax fuscovarius* | Odorifera | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Presença | Ausência | Ausência | Único pulo&<br>Esconder | Parcial | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Scinax hayii* | Odorifera | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Presença | Ausência | Ausência | Único pulo&<br>Esconder | Parcial | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Scinax similis* | ___ | Presença | Encolhido&<br>Alerta&<br>Tanatose | ___ | Ausência | Ausência | Ausência | Único pulo&<br>Esconder | Parcial | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Scythrophrys sawayae* | ___ | Presença | Encolhido&<br>Alerta | ___ | Ausência | Ausência | Presença | ___ | Ausência | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et |

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| *Siphonops annulatus* | Venenosa | Presença | Encolhido | ___ | Ausência | Ausência | Ausência | Esconder | Ausência | ___ | Ausência | ___ | Movimentos erraticos | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Stereocyclops incrassatus* | ___ | Presença | Encolhido | ___ | Ausência | Ausência | Presença | ___ | Ausência | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Trachycephalus mesophaeus* | Venenosa | Presença | Encolhido& Alerta | Contração | Presença | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | Lutar | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Trachycephalus typhonius* | Venenosa | Presença | Encolhido& Alerta& Tanatose | ___ | Presença | Ausência | Ausência | Único pulo | Ausência | Liquida | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |
| *Xenohyla truncata* | ___ | Presença | Encolhido& Alerta | ___ | Presença | Pernas esticadas lateralmente | Ausência | ___ | Ausência | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação) |
| *Zachaenus parvulus* | ___ | Presença | Encolhido& Tanatose | ___ | Presença | Ausência | Presença | Único pulo | Parcial | ___ | Ausência | ___ | ___ | Haddad et al 2013; Ferreira et al (em preparação); Presente estudo |

**Table S2.** Lista das espécies estudadas e suas respectivas características funcionais.

| **Espécies** | **Range** | **Atividade** | **Tamanho** | **Habito** | ***Habitat*** | **Modo de desenvolvimento reprodutivo** | **Referências** |
|---|---|---|---|---|---|---|---|
| *Adelophryne mucronatus* | 38 | Noturno | Pequeno | Criptozoico | Áreas florestais | Direto | Lourenço-de-Moraes et al 2012; Haddad et al. 2013; presente estudo |
| *Adelophryne pachydactyla* | 301 | Noturno | Pequeno | Criptozoico | Áreas florestais | Direto | Lourenço-de-Moraes et al 2012; Haddad et al. 2013; presente estudo |
| *Aparasphenodon brunoi* | 2532 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Aplastodiscus albosignatus* | 1077 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Aplastodiscus arildae* | 1903 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Aplastodiscus callipygius* | 404 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013 |
| *Aplastodiscus cochranae* | 173 | Noturno | Médio | Arborea | Áreas florestal/área aberta | indireto | Haddad et al 2013 |
| *Aplastodiscus ehrhardti* | 395 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Aplastodiscus leucoeygius* | 1588 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013 |
| *Aplastodiscus perviridis* | 5781 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |

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|---|---|---|---|---|---|---|---|
| *Aplastodiscus weygoldti* | 34 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Bokermannohyla astartea* | 1101 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013 |
| *Bokermannohyla circumdata* | 1109 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Bokermannohyla hylax* | 979 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Brachycephalus ephippium* | 1863 | Diurno | Pequeno | Criptozoico | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Brachycephalus hermogenesi* | 653 | Diurno | Pequeno | Criptozoico | Áreas florestais | Direto | Haddad et al 2013 |
| *Brachycephalus pitanga* | 8 | Diurno | Pequeno | Criptozoico | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Chiasmocleis capixaba* | 495 | Noturno | Pequeno | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Chiasmocleis leucosticta* | 1533 | Noturno e diurno | Pequeno | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Chiasmocleis schubarti* | 1398 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Crossodactylodes bokermanni* | 36 | Noturno | Pequeno | Arborea | Áreas florestais | indireto | Haddad et al 2013 |
| *Crossodactylodes izecksohni* | 4 | Noturno | Pequeno | Arborea | Áreas florestais | indireto | Haddad et al 2013 |

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|---|---|---|---|---|---|---|---|
| *Crossodactylus caramaschii* | 672 | Noturno e diurno | Pequeno | Reofilico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Cycloramphus acangatan* | 125 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Cycloramphus eleutherodactylus* | 1891 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Dendrophryniscus brevipollicatus* | 758 | Noturno | Pequeno | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Dendrophryniscus carvalhoi* | 31 | ___ | Pequeno | Criptozoico | Áreas florestais | indireto | Haddad et al 2013 |
| *Dendrophryniscus leucomystax* | 905 | Noturno | Pequeno | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Dendrophryniscus proboscideus* | 1353 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Dendropsophus anceps* | 2294 | Noturno | Médio | Arborea | Áreas aberta | indireto | Haddad et al 2013 |
| *Dendropsophus bipunctatus* | 1622 | Noturno | Pequeno | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Dendropsophus branneri* | 3285 | Noturno | Pequeno | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Dendropsophus elegans* | 5047 | Noturno | Médio | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Dendropsophus giesleri* | 855 | Noturno | Pequeno | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |

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|---|---|---|---|---|---|---|---|
| *Dendropsophus minutus* | 9676 | Noturno | Pequeno | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Dendropsophus nanus* | 7282 | Noturno | Pequeno | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Dendropsophus sanorni* | 3410 | Noturno | Pequeno | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Elaschitocleis bicolor* | 3457 | Noturno | Médio | Fossorial | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Eleutherodactylus bilineatus* | 550 | Noturno | Pequeno | Fossorial | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Euparkerella tridactyla* | 2 | Noturno e diurno | Pequeno | Criptozoico | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Fritziana ohausi* | 977 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Gastrotheca albolineata* | 703 | Noturno | Médio | Arborea | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Gastrotheca microdiscus* | 1645 | Noturno | Médio | Arborea | Áreas florestais | Direto | Haddad et al 2013 |
| *Haddadus binotatus* | 4965 | Noturno | Médio | Criptozoico | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Hylodes phyllodes* | 468 | Diurno | Pequeno | Reofilico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Hylomantis aspera* | 234 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Hypsiboas albomarginatus* | 4594 | Noturno | Médio | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Hypsiboas albopunctatus* | 7663 | Noturno | Médio | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |

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|---|---|---|---|---|---|---|---|
| *Hypsiboas bischoffi* | 2422 | Noturno | Médio | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Hypsiboas caingua* | 1241 | Noturno | Médio | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Hypsiboas crepitans* | 7978 | Noturno | Médio | Arborea | Áreas aberta | indireto | Haddad et al 2013 |
| *Hypsiboas faber* | 9183 | Noturno | Médio | Arborea | Áreas florestal/área aberta | indireto | Haddad et al 2013; presente estudo |
| *Hypsiboas pardalis* | 2279 | Noturno | Médio | Arborea | Áreas florestal/área aberta | indireto | Haddad et al 2013; presente estudo |
| *Hypsiboas prasinus* | 2974 | Noturno | Médio | Arborea | Áreas florestal/área aberta | indireto | Haddad et al 2013; presente estudo |
| *Hypsiboas punctatus* | 6355 | Noturno | Médio | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Hypsiboas raniceps* | 3978 | Noturno | Médio | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Hypsiboas semilineatus* | 5012 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Ischnocnema abdita* | 23 | ___ | Pequeno | Criptozoico | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Ischnocnema erythromera* | 35 | Noturno | Médio | Criptozoico | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Ischnocnema nigriventris* | 4 | ___ | Pequeno | Fossorial | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Ischnocnema parva* | 1423 | Noturno | Pequeno | Criptozoico | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Ischnocnema spanios* | 190 | ___ | Pequeno | Criptozoico | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Ischnocnema* | 855 | Noturno | Pequeno | Criptozoico | Áreas florestais | Direto | Haddad et al 2013; presente estudo |

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|---|---|---|---|---|---|---|---|
| *verrucosa* | | | | | | | |
| *Itapotihyla langsdorffii* | 4454 | Noturno | Grande | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Leptodactylus fuscos* | 9759 | Noturno | Médio | Terrestre | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Leptodactylus latrans* | 9670 | Noturno | Médio | Terrestre | Áreas florestal/área aberta | indireto | Haddad et al 2013; presente estudo |
| *Leptodactylus mystaceus* | 830 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Leptodactylus mystacinus* | 9605 | Noturno | Médio | Terrestre | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Leptodactylus notoaktites* | 2253 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Leptodactylus podicipinus* | 2529 | Noturno | Médio | Criptozoico | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Macrogenioglottus alipioi* | 2512 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Myersiella microps* | 1236 | Noturno | Médio | Fossorial | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Odontophrynus carvalhoi* | 657 | Noturno | Médio | Terrestre | Áreas florestal/área aberta | indireto | Haddad et al 2013 |
| *Ololygon catharinae* | 716 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Paratelmatobius cardosoi* | 28 | Noturno | Pequeno | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |

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|---|---|---|---|---|---|---|---|
| *Phasmahyla guttata* | 917 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Phyllodytes luteolus* | 1671 | Noturno | Pequeno | Fitotelmata | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Phyllomedusa bahiana* | 337 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Phyllomedusa burmeisteri* | 4892 | Noturno | Médio | Arborea | Áreas florestal/área aberta | indireto | Haddad et al 2013; presente estudo |
| *Phyllomedusa distincta* | 1766 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Phyllomedusa nordestina* | 1805 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Phyllomedusa rohdei* | 2021 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Phyllomedusa tetraploidea* | 3440 | Noturno | Médio | Arborea | Áreas florestal/área aberta | indireto | Haddad et al 2013; presente estudo |
| *Physalaemus crombiei* | 1267 | Noturno | Pequeno | Terrestre | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Physalaemus cuvieri* | 9704 | Noturno | Médio | Terrestre | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Physalaemus olfersii* | 2346 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013 |
| *Physalaemus signifer* | 1688 | Noturno | Pequeno | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Pipa carvalhoi* | 2152 | Noturno e diurno | Médio | Aquáico | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Pristimantis paulodutrai* | 708 | Noturno | Médio | Criptozoico | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Pristimantis ramagii* | 1272 | Noturno | Pequeno | Criptozoico | Áreas florestais | Direto | Haddad et al 2013; presente estudo |

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|---|---|---|---|---|---|---|---|
| *Pristimantis vinhai* | 763 | Noturno | Pequeno | Criptozoico | Áreas florestais | Direto | Haddad et al 2013; presente estudo |
| *Proceratophrys appendiculata* | 1226 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Proceratophrys avelinoi* | 2412 | Noturno | Pequeno | Criptozoico | Áreas florestal/área aberta | indireto | Haddad et al 2013; presente estudo |
| *Proceratophrys cururu* | 1 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013 |
| *Proceratophrys laticeps* | 1287 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Proceratophrys melanopogon* | 532 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Proceratophrys renalis* | 1366 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Proceratophrys schirchi* | 1531 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013 |
| *Pseudis bolbodactyla* | 1951 | Noturno | Médio | Aquáico | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Rhinella crucifer* | 1943 | Noturno | Grande | Terrestre | Áreas florestal/área aberta | indireto | Haddad et al 2013; presente estudo |
| *Rhinella granulosa* | 8540 | Noturno | Médio | Terrestre | Áreas florestal/área aberta | indireto | Haddad et al 2013; presente estudo |
| *Rhinella hoogmoedi* | 2257 | Noturno | Médio | Terrestre | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Rhinella icterica* | 7322 | Noturno | Grande | Terrestre | Áreas florestal/área aberta | indireto | Haddad et al 2013; presente estudo |

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|---|---|---|---|---|---|---|---|
| *Rhinella schneideri* | 9416 | Noturno | Grande | Terrestre | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Scinax crospedospilus* | 777 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013 |
| *Scinax fuscovarios* | 9363 | Noturno | Médio | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Scinax hayii* | 1965 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Scinax similis* | 451 | Noturno | Médio | Arborea | Áreas aberta | indireto | Haddad et al 2013; presente estudo |
| *Scythroehrys sawayae* | 226 | Noturno | Pequeno | Criptozoico | Áreas florestais | indireto | Haddad et al 2013 |
| *Siphonops annulatus* | 8685 | ___ | Grande | Fossorial | Áreas florestal/área aberta | Direto | Haddad et al 2013; presente estudo |
| *Stereocyclops incrassatus* | 2051 | Noturno | Médio | Criptozoico | Áreas florestais | indireto | Haddad et al 2013 |
| *Trachycephalus mesophaeus* | 5477 | Noturno e diurno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013; presente estudo |
| *Trachycephalus typhonius* | 4913 | Noturno | Médio | Arborea | Áreas florestal/área aberta | indireto | Haddad et al 2013; presente estudo |
| *Xenohyla truncata* | 218 | Noturno | Médio | Arborea | Áreas florestais | indireto | Haddad et al 2013 |
| *Zachaenus parvulus* | 268 | Noturno | Pequeno | Criptozoico | Áreas florestais | indireto | Haddad et al 2013; presente estudo |

**Table S3.** Lista das 115 espécies estudadas e suas respectivas números de acesso ao GenBank. (*) indica o grupo externo.

| **Especies** | **12S** | **16S** | **Cytb** | **CXCR4** | **H3A** | **NCX1** | **POMC** | **RAG1** | **RHOD** | **SIA** | **SLC8A3** | **TYR** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Adelophryne mucronatus* | -- | JX298291.1 | JX298385.1 | -- | -- | -- | JX298112.1 | JX298158.1 | -- | -- | -- | JX298213.1 |
| *Adelophryne pachydactyla* | JX298259.1 | JX298294.1 | JX298387.1 | -- | -- | -- | JX298115.1 | JX298161.1 | -- | -- | -- | JX298216.1 |
| *Aparasphenodon brunoi* | AY843567.1 | -- | AY843789.1 | -- | -- | -- | -- | AY844364.1 | AY844541.1 | AY844769.1 | -- | AY844023.1 |
| *Aplastodiscus albosignatus* | AY843596.1 | -- | AY843817.1 | -- | -- | -- | -- | AY844385.1 | AY844570.1 | AY844796.1 | -- | AY844042.1 |
| *Aplastodiscus arildae* | AY843604.1 | -- | AY843825.1 | -- | -- | -- | -- | AY844392.1 | AY844578.1 | AY844803.1 | -- | AY844049.1 |
| *Aplastodiscus callipygius* | AY843614.1 | AY843614.1 | AY843840.1 | -- | -- | -- | -- | AY844402.1 | AY844592.1 | AY844813.1 | -- | AY844058.1 |
| *Aplastodiscus cochranae* | AY843568.1 | AY843568.1 | AY843790.1 | -- | -- | -- | -- | AY844365.1 | AY844542.1 | AY844770.1 | -- | AY844024.1 |
| *Aplastodiscus ehrhardti* | -- | -- | -- | -- | -- | -- | -- | AY844456.1 | -- | -- | -- | -- |
| *Aplastodiscus leucopygius* | AY843638.1 | AY843638.1 | AY843873.1 | KF751466.1 | -- | -- | -- | AY844425.1 | AY844622.1 | AY844840.1 | -- | AY844084.1 |
| *Aplastodiscus perviridis* | AY843569.1 | AY843569.1 | AY843791.1 | KF751467.1 | DQ284044.1 | -- | -- | AY844366.1 | AY844543.1 | AY844771.1 | -- | AY844025.1 |
| *Aplastodiscus weygoldti* | AY843685.1 | AY843685.1 | AY843931.1 | -- | -- | -- | -- | AY844467.1 | AY844678.1 | AY844887.1 | -- | -- |
| *Bokermanohyla astartea* | AY549322.1 | AY549322.1 | AY843827.1 | -- | -- | -- | AY819113.1 | -- | AY844580.1 | -- | -- | -- |
| *Bokermanohyla circumdata* | AY549328.1 | -- | AY843847.1 | KF751468.1 | -- | -- | -- | AY844409.1 | AY844598.1 | AY844817.1 | -- | AY844064.1 |
| *Bokermanohyla hylax* | AY549338.1 | AY549338.1 | AY843865.1 | -- | -- | -- | -- | AY844419.1 | AY844614.1 | AY844832.1 | -- | AY844077.1 |
| *Brachycephalus ephipium* | HM216368.1 | HM216369.1 | HM216367.1 | GQ345180.1 | GQ345212.1 | GQ345228.1 | GQ345256.1 | HM216370.1 | DQ283808.1 | DQ282673.1 | GQ345326.1 | HQ435735.1 |
| *Brachycephalus hermogenesi* | HQ435682.1 | -- | HQ435709.1 | -- | -- | -- | -- | HQ435724.1 | -- | -- | -- | HQ435738.1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Brachycephalus pitanga* | HQ435686.1 | HQ435699.1 | HQ435713.1 | -- | -- | -- | -- | HQ435728.1 | -- | -- | -- | HQ435742.1 |
| *Chiasmocleis capixaba* | -- | KC180044.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | KC180235.1 |
| *Chiasmocleis leucosticta* | -- | KC180039.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | KC180243.1 |
| *Chiasmocleis schubarti* | -- | KC180071.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | KC180247.1 |
| *Crossodactylodes bokermanni* | KF534640.1 | KF534650.1 | KF534668.1 | -- | -- | -- | -- | -- | KF534677.1 | -- | -- | KF534683.1 |
| *Crossodactylodes izecksohni* | KF534633.1 | KF534646.1 | KF534664.1 | -- | -- | -- | -- | -- | KF534673.1 | -- | -- | KF534680.2 |
| *Crossodactylus caramaschii* | AY143346.1 | AY263235.1 | KC603961.1 | -- | -- | -- | KC604072.1 | KC604005.1 | -- | -- | -- | -- |
| *Cycloramphus acangatan* | HQ634162.1 | FJ685683.1 | FJ685663.1 | -- | -- | -- | -- | HQ634170.1 | KF214198.1 | -- | -- | -- |
| *Cycloramphus eleutherodactylus* | HQ634160.1 | HQ634165.1 | -- | -- | -- | -- | -- | HQ634168.1 | -- | -- | -- | -- |
| *Dendrophryniscus brevipollicatus* | AF375490.1 | AF375515.1 | -- | -- | -- | -- | -- | JN867499.1 | -- | -- | -- | -- |
| *Dendrophryniscus carvalhoi* | JN867539.1 | JN867564.1 | -- | -- | -- | -- | -- | JN867512.1 | -- | -- | -- | -- |
| *Dendrophryniscus leucomystax* | JN867525.1 | JN867552.1 | -- | -- | -- | -- | -- | JN867498.1 | -- | -- | -- | -- |
| *Dendrophryniscus proboscideus* | JN867540.1 | JN867567.1 | -- | -- | -- | -- | -- | JN867513.1 | -- | -- | -- | -- |
| *Dendropsophus anceps* | AY843597.1 | AY843597.1 | AY843818.1 | -- | -- | -- | -- | AY844386.1 | AY844571.1 | AY844797.1 | -- | AY844043.1 |
| *Dendropsophus bipunctatus* | AY843608.1 | AY843608.1 | AY843832.1 | -- | -- | -- | -- | -- | AY844585.1 | AY844808.1 | -- | AY844053.1 |
| *Dendropsophus branneri* | -- | -- | AF549336.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Dendropsophus elegans* | DQ380355.1 | AF308102.1 | AF308124.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |

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| *Dendropsophus giesleri* | AY843629.1 | AY843629.1 | AY843860.1 | -- | -- | -- | -- | AY844417.1 | -- | AY844827.1 | -- | AY844075.1 |
| *Dendropsophus minutus* | AY549345.1 | AY549345.1 | AY843883.1 | -- | DQ284046.1 | -- | -- | AY844432.1 | DQ283758.1 | -- | -- | AY844089.1 |
| *Dendropsophus nanus* | AY549346.1 | AY549346.1 | AY843888.1 | GQ365985.1 | DQ284051.1 | -- | AY819123.1 | AY844437.1 | AY844634.1 | AY844852.1 | -- | EF376132.1 |
| *Dendropsophus samborni* | AY843663.1 | AY843663.1 | AY843906.1 | -- | -- | -- | -- | AY844450.1 | AY844653.1 | AY844868.1 | -- | AY844106.1 |
| *Elachistocleis bicolor* | JF836935.1 | KC180005.1 | -- | -- | -- | -- | -- | -- | JF837037.1 | -- | -- | KC180318.1 |
| *Eleutherodactylus bilineata* | JX267323.1 | JX267323.1 | -- | -- | -- | -- | -- | JX267556.1 | -- | -- | -- | JX267691.1 |
| *Euparkerella tridactyla* | -- | -- | -- | -- | -- | -- | -- | KF625088.1 | -- | -- | -- | KF625110.1 |
| *Fritziana ohausi* | -- | JN157635.1 | -- | -- | -- | -- | JN157629.1 | KC844991.1 | -- | -- | -- | -- |
| *Gastrotheca albolineata* | -- | KC844924.1 | -- | -- | -- | -- | KC844971.1 | KC844992.1 | -- | -- | -- | -- |
| *Gastrotheca microdiscus* | -- | KC844933.1 | -- | -- | -- | -- | KC844981.1 | KC845000.1 | -- | -- | -- | -- |
| *Haddadus binotatus* | KF740846.1 | KF740846.1 | JX298405.1 | GQ345183.1 | DQ284142.1 | GQ345231.1 | GQ345259.1 | JX267548.1 | DQ283807.1 | GQ345309.1 | GQ345329.1 | JX267685.1 |
| *Hylodes phyllodes* | DQ283096.1 | DQ283096.1 | DQ502587.1 | -- | DQ284146.1 | -- | -- | KC604006.1 | DQ283812.1 | DQ282674.1 | -- | DQ282923.1 |
| *Hylomantis aspera* | GQ366222.1 | -- | -- | GQ365978.1 | -- | -- | -- | -- | GQ366098.1 | -- | -- | -- |
| *Hypsiboas albomarginatus* | AY549316.1 | AY549316.1 | AY843815.1 | -- | -- | -- | -- | AY844384.1 | AY844568.1 | AY844794.1 | -- | -- |
| *Hypsiboas albopunctatus* | AY549317.1 | AY549317.1 | AY843816.1 | -- | -- | -- | -- | -- | AY844569.1 | AY844795.1 | -- | AY844041.1 |
| *Hypsiboas bichoffi* | AY549324.1 | AY549324.1 | AY843833.1 | -- | -- | -- | -- | AY844398.1 | AY844586.1 | -- | -- | -- |
| *Hypsiboas caingua* | AY549326.1 | AY549326.1 | AY843838.1 | KF751479.1 | -- | -- | -- | -- | AY844591.1 | AY844812.1 | -- | AY844057.1 |
| *Hypsiboas crepitans* | AY843621.1 | AY843621.1 | AY843850.1 | KF751482.1 | -- | -- | -- | AY844412.1 | AY844601.1 | -- | -- | AY844067.1 |
| *Hypsiboas faber* | AY549334.1 | AY549334.1 | AY843857.1 | -- | -- | -- | -- | -- | AY844607.1 | AY844825.1 | -- | -- |

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| *Hypsiboas pardalis* | AY843651.1 | AY843651.1 | AY843891.1 | -- | -- | -- | -- | -- | AY844637.1 | AY844855.1 | -- | AY844096.1 |
| *Hypsiboas prasinus* | AY549347.1 | AY549347.1 | AY843896.1 | -- | -- | -- | -- | -- | AY844642.1 | AY844860.1 | -- | AY844100.1 |
| *Hypsiboas punctatus* | AY549353.1 | AY549353.1 | AY843899.1 | -- | -- | -- | -- | -- | AY844645.1 | -- | -- | -- |
| *Hypsiboas raniceps* | AY843657.1 | AY843657.1 | AY843900.1 | KF751489.1 | -- | -- | AY819125.1 | -- | JQ023459.1 | AY844863.1 | -- | AY844103.1 |
| *Hypsiboas semilineatus* | AY843779.1 | AY843779.1 | AY843909.1 | KF751491.1 | -- | -- | -- | AY844453.1 | AY844656.1 | AY844871.1 | -- | AY844108.1 |
| *Ischnocnema abdita* | JX267325.1 | JX267471.1 | -- | -- | -- | -- | -- | JX267551.1 | -- | -- | -- | JX267687.1 |
| *Ischnocnema erythromera* | JX267340.1 | JX267340.1 | -- | -- | -- | -- | -- | JX267596.1 | -- | -- | -- | JX267730.1 |
| *Ischnocnema nigriventris* | JX267398.1 | JX267483.1 | -- | -- | -- | -- | -- | JX267568.1 | -- | -- | -- | JX267704.1 |
| *Ischnocnema parva* | JX267446.1 | KC569989.1 | HQ435717.1 | -- | -- | -- | -- | JX267657.1 | -- | -- | -- | JX267796.1 |
| *Ischnocnema spanios* | JX267407.1 | JX267490.1 | -- | -- | -- | -- | -- | JX267584.1 | -- | -- | -- | JX267717.1 |
| *Ischnocnema verrucosa* | JX267457.1 | JX267538.1 | -- | -- | -- | -- | -- | JX267670.1 | -- | -- | -- | JX267810.1 |
| *Itapotihyla langsdorffii* | JQ868500.1 | AY819511.1 | AY843951.1 | -- | -- | -- | KF002003.1 | -- | AY844697.1 | -- | -- | AY844137.1 |
| *Leptodactylus fuscus* | AY905715.1 | AY911284.1 | KF548074.1 | -- | -- | -- | -- | AY323770.1 | KF613583.1 | -- | -- | AY341760.1 |
| *Leptodactylus latrans* | AY143353.1 | AY162395.1 | KC603976.1 | DQ306492.1 | DQ284104.1 | -- | KC604055.1 | KC604026.1 | AY844681.1 | -- | -- | KC604082.1 |
| *Leptodactylus mystaceus* | KC470101.1 | KC477252.1 | KF548080.1 | -- | -- | -- | KC604058.1 | KC604036.1 | KF613589.1 | -- | -- | JN706737.1 |
| *Leptodactylus mystacinus* | KC470105.1 | KC477256.1 | KF548067.1 | -- | -- | -- | -- | AY323771.1 | AY323747.1 | -- | -- | -- |
| *Leptodactylus notoaktites* | -- | KC477254.1 | KF548083.1 | -- | -- | -- | -- | -- | KF613592.1 | -- | -- | -- |
| *Leptodactylus podicipinus* | KC470094.1 | KC477245.1 | KF548073.1 | -- | -- | -- | -- | -- | KF613582.1 | -- | -- | -- |
| *Macrogenioglottus alipioi* | KF214098.1 | FJ685685.1 | FJ685665.1 | -- | -- | -- | -- | FJ685705.1 | KF214200.1 | -- | -- | -- |

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| *Myersiella microps* | -- | KC179973.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | KC180279.1 |
| *Odontophrynus carvalhoi* | KF214100.1 | FJ685687.1 | FJ685667.1 | -- | -- | -- | -- | FJ685707.1 | KF214202.1 | -- | -- | -- |
| *Ololygon catharinae* | AY843756.1 | AY843756.1 | AY844001.1 | -- | -- | -- | AY819140.1 | AY844517.1 | AY844742.1 | AY844941.1 | -- | -- |
| *Paratelmatobius cardosoi* | EU224404.1 | EU224404.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Phasmahyla guttata* | GQ366232.1 | GQ366232.1 | GQ365921.1 | -- | -- | -- | GQ366040.1 | -- | GQ366107.1 | -- | -- | -- |
| *Phyllodytes luteolus* | AY843721.1 | AY843721.1 | AY843966.1 | -- | -- | -- | GQ366043.1 | AY844494.1 | AY844708.1 | AY844913.1 | -- | AY844150.1 |
| *Phyllomedusa bahiana* | GQ366251.1 | GQ366251.1 | GQ365940.1 | -- | -- | -- | -- | -- | GQ366126.1 | GQ366177.1 | -- | GQ366205.1 |
| *Phyllomedusa burmeisteri* | GQ366255.1 | GQ366324.1 | GQ365944.1 | GQ366011.1 | -- | -- | GQ366052.1 | GQ366087.1 | GQ366130.1 | GQ366180.1 | -- | GQ366207.1 |
| *Phyllomedusa distincta* | GQ366263.1 | GQ366326.1 | GQ365951.1 | GQ366013.1 | -- | -- | GQ366056.1 | -- | GQ366135.1 | -- | -- | GQ366210.1 |
| *Phyllomedusa nordestina* | GQ366271.1 | GQ366330.1 | GQ365959.1 | GQ366016.1 | -- | -- | -- | GQ366091.1 | GQ366143.1 | -- | -- | GQ366215.1 |
| *Phyllomedusa rohdei* | GQ366238.1 | GQ366316.1 | GQ365927.1 | GQ366001.1 | -- | -- | -- | GQ366081.1 | GQ366113.1 | -- | -- | -- |
| *Phyllomedusa tetraploidea* | GQ366284.1 | GQ366334.1 | GQ365972.1 | GQ366021.1 | -- | -- | GQ366066.1 | GQ366096.1 | GQ366155.1 | GQ366194.1 | -- | GQ366218.1 |
| *Physalaemus crombiei* | KC692082.1 | KC692082.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Physalaemus cuvieri* | AY843729.1 | AY162399 | AY843975 | -- | -- | -- | AY819096 | AY844499 | -- | AY844922 | -- | -- |
| *Physalaemus olfersii* | KC692085.1 | KC692085.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Physalaemus signifer* | DQ337209.1 | DQ337209.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Pipa carvalhoi* | DQ283251 | DQ283251 | -- | -- | DQ284277 | -- | -- | -- | DQ283922 | DQ282774 | -- | -- |
| *Pristimantis paulodutrai* | JX267399.1 | JX267360.1 | -- | -- | -- | -- | -- | JX267573.1 | -- | -- | -- | JX267707.1 |
| *Pristimantis ramagii* | JX267319.1 | JX267319.1 | -- | -- | -- | -- | -- | JX267659.1 | -- | -- | -- | JX267798.1 |

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| *Pristimantis vinhai* | X267411.1 | -- | -- | -- | -- | -- | -- | JX267592.1 | -- | -- | -- | JX267725.1 |
| *Proceratophrys appendiculata* | KF214131.1 | -- | KF214173.1 | -- | -- | -- | -- | KF214190.1 | KF214232.1 | -- | -- | -- |
| *Proceratophrys avelinoi* | KF214102.1 | FJ685691.1 | FJ685671.1 | -- | -- | -- | -- | FJ685711.1 | KF214204.1 | -- | -- | -- |
| *Proceratophrys cururu* | KF214107.1 | FJ685696.1 | FJ685676.1 | -- | -- | -- | -- | FJ685716.1 | KF214209.1 | -- | -- | -- |
| *Proceratophrys laticeps* | KF214109.1 | FJ685698.1 | FJ685678.1 | -- | -- | -- | -- | FJ685718.1 | KF214211.1 | -- | -- | -- |
| *Proceratophrys melanopogon* | KF214120.1 | KF214142.1 | KF214164.1 | -- | -- | -- | GQ345270.1 | KF214181. | KF214217.1 | -- | -- | -- |
| *Proceratophrys renalis* | KF214111.1 | JN814584.1 | JN814523.1 | -- | -- | -- | -- | JN814664.1 | KF214213.1 | -- | -- | -- |
| *Proceratophrys schirchi* | KF214112.1 | FJ685701.1 | FJ685681.1 | -- | -- | -- | -- | FJ685721.1 | KF214214.1 | -- | -- | -- |
| *Pseudis bolbodactyla* | EF153007.1 | EF153007.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Rhinella crucifer* | DQ158447 | DQ158447 | DQ415596 | -- | -- | -- | DQ158288 | -- | -- | -- | -- | -- |
| *Rhinella granulosa* | DQ158458.1 | DQ158458.1 | HM159225.1 | FJ882728.1 | -- | FJ882673.1 | DQ158299.1 | DQ158380.1 | -- | -- | -- | -- |
| *Rhinella hoogmoedi* | JN867545.1 | JN867571.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Rhinella icterica* | DQ158462.1 | DQ158462.1 | JN594575.1 | -- | -- | -- | DQ158303.1 | DQ158384.1 | HM159240.1 | -- | -- | -- |
| *Rhinella schneideri* | DQ158480.1 | DQ158480.1 | HM159235.1 | -- | -- | FJ882674.1 | -- | DQ158399.1 | -- | -- | -- | -- |
| *Scinax crospedospilus* | AY819391.1 | AY819523.1 | -- | -- | -- | -- | AY819141.1 | -- | -- | -- | -- | -- |
| *Scinax fuscovarius* | AY843758.1 | AY843758.1 | AY844003.1 | -- | -- | -- | -- | AY844519.1 | AY844744.1 | AY844943.1 | -- | AY844179.1 |
| *Scinax hayii* | GQ896257.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Scinax similis* | GQ896263.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Scythrophrys sawayae* | DQ283099.1 | DQ283099.1 | -- | -- | DQ284149.1 | -- | -- | -- | DQ283815.1 | -- | -- | DQ282926.1 |

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| **Siphonops annulatus* | -- | EU753986.1 | EU754003.1 | -- | -- | -- | -- | DQ320064.1 | -- | -- | -- | -- |
| *Stereocyclops incrassatus* | -- | KC180014.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | KC180231.1 |
| *Trachycephalus mesophaeus* | AY843718.1 | AY843718.1 | AY843963.1 | -- | -- | -- | -- | AY844491.1 | AY844705.1 | AY844910.1 | -- | AY844147.1 |
| *Trachycephalus typhonius* | JX847093.1 | JX875626.1 | -- | -- | -- | -- | JX875780.1 | -- | -- | -- | -- | -- |
| *Xenohyla truncata* | AY843775.1 | AY843775.1 | AY844018.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| *Zachaenus parvulus* | KC593362.1 | KC593362.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

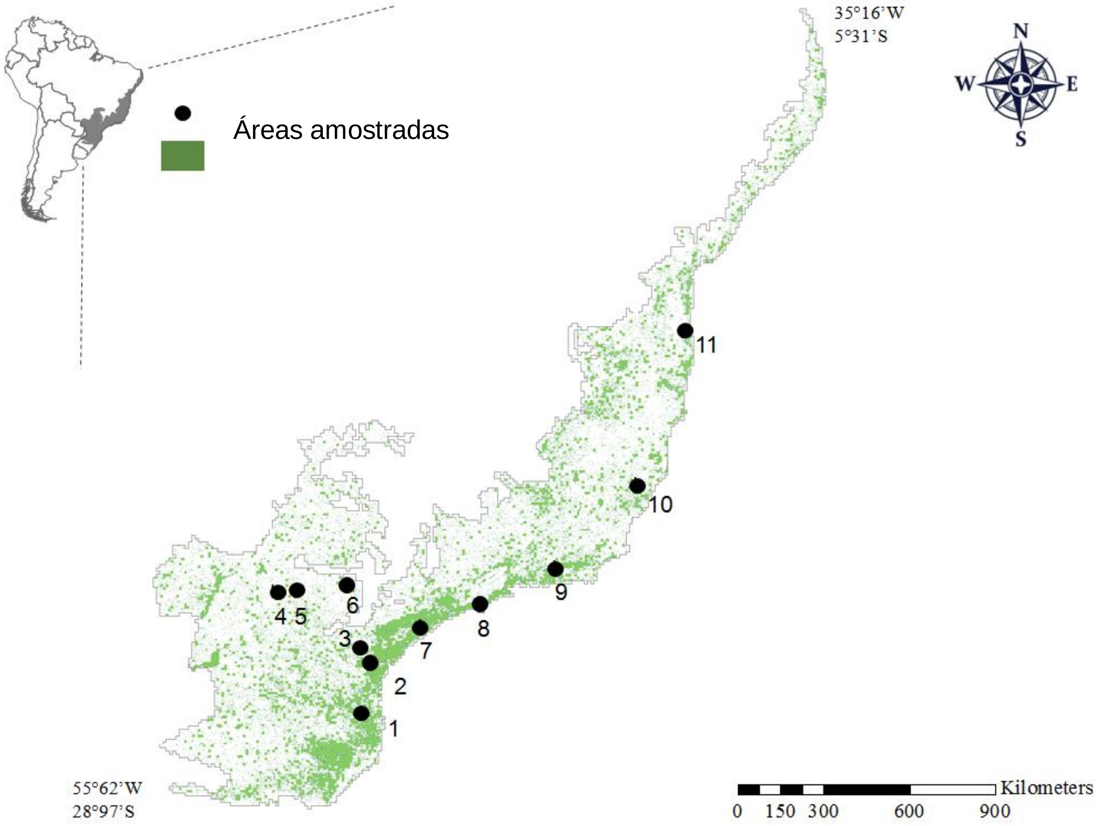

**Figura S1.** Mapa mostrando a área de estudo no hotspot Floresta Atlântica brasileira (em cinza) no território sulamericano. Os pontos negros indicam as Áreas protegidas que foram amostradas como dados complementares. 1. Parque Ecológico Spitzkopf, SC; 2. Parque Estadual Pico do Marumbi, PR; 3. Parque estadual de Campinhos, PR; 4. Parque municipal das Perobas, PR; 5. Parque Estadual Mata dos Godoy, PR; 6. Refugio municipal da vida Silvestre, Horto Florestal de Jacarezinho, PR; 7. Estação Ecológica de Juréia-Itatins, SP; 8. Parque Estadual da Serra do Mar Núcleo Caraguatatuba, SP; 9. Parque Nacional da Serra dos Órgãos, RJ; 10. Reserva Biológica Augusto Ruschi, ES; 11. Reserva Biológica de Una, BA. De janeiro de 2014 (PA 8 de cinco dias), em julho de 2014 (PA 6 três dias), em novembro de 2014 (PAs 4, 6 três dias em cada), dezembro de 2014 (PA 4 dois dias), de janeiro-março de 2015 (PAs 1, 2, 7-11 sete dias em cada), Maio de 2015 (PA 6 três dias), em novembro de 2015 (PA 4 dois dias), dezembro de 2015 (PA 3 cinco dias), em fevereiro de 2016 (PAs 5, dois dias, três dias 6) , março de 2016 (PA 4 um dia, dois dias 5). Foram amostrados anfíbios utilizando inquéritos noturnos e diurnos acústicos e visuais (Crump & Scott Jr, 1994; Zimmerman, 1994). Foram pesquisados nas margens de corpos d'água, nos rios, e ao longo de 2000 transectos m florestais. As espécies encontradas foram testados seus mecanismos de defesa ultilizado o método I proposto por

Lourenço-de-Moraes et al (2016). Todas as suas características funcionais foram registradas. As espécies coletadas foram eutanásiadas com hidrocloreto de benzocaína > ou = 250mg/L(ASH, 2004). Nº da autorização/licença SISBIO: 30344.

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