

Amphibians of Alagoas State, northeastern Brazil

João Paulo Felix Augusto de Almeida^{1,2,*}, Filipe Augusto Cavalcanti do Nascimento^{2,7}, Selma Torquato², Barnagleison Silva Lisboa^{2,3}, Ingrid Carolline Soares Tiburcio^{2,3}, Cristiane Nikely Silva Palmeira^{2,6}, Marcelo Gomes de Lima⁴ and Tamí Mott^{2,5}

Abstract. Alagoas State is located in the northeast Brazil and was originally covered by Atlantic Forest and Caatinga. Nowadays, only small fragments of these two biomes remain mainly due to agricultural and pasture expansion. A few studies on amphibians in this area were conducted and a comprehensive species list is lacking precluding conservation strategies on amphibians in the state. To surmount this need, a list was compiled using both specimens housed in the herpetological collection of Museu de História Natural, Universidade Federal de Alagoas (MUFAL), and literature (species descriptions and distribution notes). Seventy-four species of amphibians allocated in 32 genera, 13 families and 2 orders were registered in Alagoas. The number of species from Atlantic Forest was about 2.6 times higher than the Caatinga. Hylidae was the richest family with 38 species (51% of total richness). Fifty-two species (70% of total) are considered as least concern according to IUCN, 11 (15%) are data deficient, one is vulnerable and five are still awaiting evaluation. Eight species have their type locality in the state, four are known only from Alagoas and two were registered in the state for the first time. Distribution patterns and taxonomic issues are discussed.

Keywords. Anura, Gymnophiona, Atlantic Forest, Caatinga, species richness.

Introduction

Deforestation is one of the main causes of the global biodiversity crisis (Brook et al., 2003; IUCN, 2014). Amphibians are one of the groups most threatened by deforestation and recent estimates have shown ca. 42% of all species had population decline over the last decades (IUCN, 2014). In Brazil, the country that hosts the highest amphibian's diversity worldwide, natural landscapes continue to be lost as seen in other tropical regions (Gibson et al., 2011). Northeast Brazil contains the Atlantic Forest hotspot and the Caatinga, a xeric environment unique to this country. However, only 8% of the Atlantic Forest is left (Ribeiro et al., 2009), and the Caatinga is one of the least known and preserved biomes in the Neotropics (Leal et al., 2005).

Alagoas is the second smallest state of Brazil (area of 27.778,506 km² – IBGE, 2014), located on the northeastern coast, and contains both Atlantic Forest and Caatinga formations. However, they remain only in small fragments mainly due to agricultural and pasture expansion (Assis, 2000). Other than descriptions of new amphibian species (e.g. Carcerelli and Caramaschi,

¹ Programa de Pós-Graduação em Diversidade Biológica e Conservação nos Trópicos, Instituto de Ciências Biológicas e da Saúde, Universidade Federal de Alagoas, 57072-970, Maceió, AL, Brazil

² Setor de Zoologia, Museu de História Natural, Universidade Federal de Alagoas, Praça Afrânio Jorge, Prado, 57010-020, Maceió, AL, Brazil

³ Programa de Pós-Graduação em Biologia Animal, Centro de Ciências Biológicas, Universidade Federal de Pernambuco, Av. Professor Nelson Chaves s/n, Cidade Universitária, 50670-420, Recife, PE, Brazil

⁴ Bioarch Consultoria e Assessoria Ltda., Av. Fernandes Lima, 1513, Sl. 201, CP H72, Pinheiro, 57057-450, Maceió, AL, Brazil

⁵ Setor de Biodiversidade, Instituto de Ciências Biológicas e da Saúde, Universidade Federal de Alagoas, 57072-970, Maceió, AL, Brazil

⁶ Programa de Pós-Graduação em Ciências Biológicas, Centro de Biociências, Universidade Federal do Rio Grande do Norte, 59078-970, Natal, RN, Brazil

⁷ Programa de Pós-Graduação em Zoologia, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, Av. Antônio Carlos, 6627, Pampulha, 31270-901, Belo Horizonte, MG, Brazil

* Corresponding author: joao.paulo.felix@hotmail.com

1993; Cruz *et al.*, 1999; Carvalho-e-Silva *et al.*, 2003; Peixoto *et al.*, 2003; Cruz *et al.*, 2011; Lima *et al.*, 2011), and range expansion of some of them (e.g. Tiburcio *et al.*, 2008; Lisboa and Haddad, 2009; Lisboa *et al.*, 2010; Nunes and Pombal, 2011; Araújo-Neto *et al.*, 2012; Silva *et al.*, 2013a), a comprehensive list of amphibians of Alagoas State is lacking. Such a list is urgently needed as a baseline for conservation strategies in this poorly known state.

Material and Methods

A list was compiled using both specimens housed in the herpetological collection of the Museu de História Natural from Universidade Federal de Alagoas (MUFAL) (the most representative collection of the state founded in 1990) and literature, such as species descriptions and distribution notes. Taxonomic nomenclature followed Frost (2015) and the conservation status of each taxon was assessed using the data of International Union for Conservation of Nature (IUCN, 2014) and the Brazilian red list of threatened species compiled by the Ministério do Meio Ambiente (MMA, 2014).

Results

Seventy-four species of amphibians allocated in 32 genera, 13 families and two orders were registered in Alagoas. Eight of them have their type locality in the state (Table 1 and Figs. 1–4), and four are known only from Alagoas: *Crossodactylus dantei*, *Physalaemus caete*, *Scinax muriciensis* and *S. skuki*. Hylidae was the richest family with 38 species in ten genera (51% of total richness of the state). With the exception of Hylidae, Bufonidae, Hemiphraetidae, Leptodactylidae, Microhylidae, Odontophrynidae and Siphonopidae, all of other six families are represented by a single species (Fig. 5A).

Fifty-two species (70% of total) are considered as least concern according to IUCN, 11 (15%) are data deficient, one is vulnerable (*Allobates olfersioides*) and five are still awaiting evaluation (*Chiasmocleis alagoana*, *Proceratophrys renalis*, *Scinax melanodactylus*, *S. muriciensis* and *S. skuki*). According to MMA (2014) one species is considered critically endangered (*Phyllodytes gyrinaethes*), three are endangered (*Crossodactylus dantei*, *Physalaemus caete* and *Chiasmocleis alagoana*) and one is vulnerable (*Agalychnis granulosa*). Three species are only known from their type locality in Alagoas (*Crossodactylus dantei*, *Scinax muriciensis*, and *S. skuki*) (Table 1).

Among the 102 municipalities of Alagoas, 42 (41.18%) have at least one amphibian voucher in the MUFAL. Twenty-seven of these were originally covered by Atlantic Forest, 11 by Caatinga and four represent ecotonal areas (Fig. 6). In the eastern side of the state (Atlantic Forest), Maceió municipality was the best represented (46 species), followed by Murici, Coruripe and Rio Largo (38, 35 and 31 species, respectively) (Fig. 5B). In the western side (Caatinga), exception to Traipu municipality where 23 species were recorded; for all other municipalities there are only occasional surveys, and fewer than ten species have been recorded. The number of amphibian species from Atlantic forest (n=69) is about 2.6 times higher than the Caatinga (n=26). From 74 amphibian species, 43 occur only in the Atlantic Forest, four (*Ceratophrys joazeirensis*, *Dendropsophus oliveirai*, *Physalaemus cicada* and *Proceratophrys cristiceps*) only in the Caatinga and 22 co-occur in both biomes. Ten species occur in ecotonal areas as well as in the Atlantic Forest and/or Caatinga, except *Pipa carvalhoi* that was only registered in an ecotonal site at Maribondo municipality (Table 1).

Discussion

Atlantic Forest

The only checklist for amphibian fauna in the Atlantic Forest of Alagoas (Silva *et al.*, 2006b) reported 54 anuran species and one caecilian. We add 13 additional amphibian species for this biome in the state: *Dendropsophus dutrai*, *Gastrotheca pulchra*, *Hypsiboas freicanecae*, *Scinax cretatus*, *S. fuscovarius*, *S. melanodactylus*, *S. muriciensis*, *S. skuki*, *Sphaenorhynchus prasinus*, *Leptodactylus vastus*, *Physalaemus albifrons*, *Elachistocleis* sp. and *Siphonops paulensis*. Moreover, we updated taxonomic status of other nine species of Silva *et al.* (2006b): *Rhinella hoogmoedi* (= *Bufo margaritifera*), *Dendropsophus haddadi* (= *D. decipiens*), *Hypsiboas exastis* (= *H. pardalis*), *Leptodactylus natalensis* (= *L. podicipinus* and *L. wagneri*), *L. mystaceus* (= *L. spixi*), *Phyllomedusa nordestina* (= *P. aff. hypocondrialis*), *Proceratophrys renalis* (= *P. boiei*) and *Pseudopaludicola mystacalis* (= *P. falcipes*). Hylidae and Leptodactylidae (38 and 13 species, respectively) are the most well represented families. This is congruent with what has been found in other neotropical sites such as Santa Cecilia in Ecuador (Duellman, 1978), the Planalto da Ibiapaba in Ceará State (Loebmann and Haddad, 2010), the Ecological Station of Serra Geral do Tocantins in Tocantins State

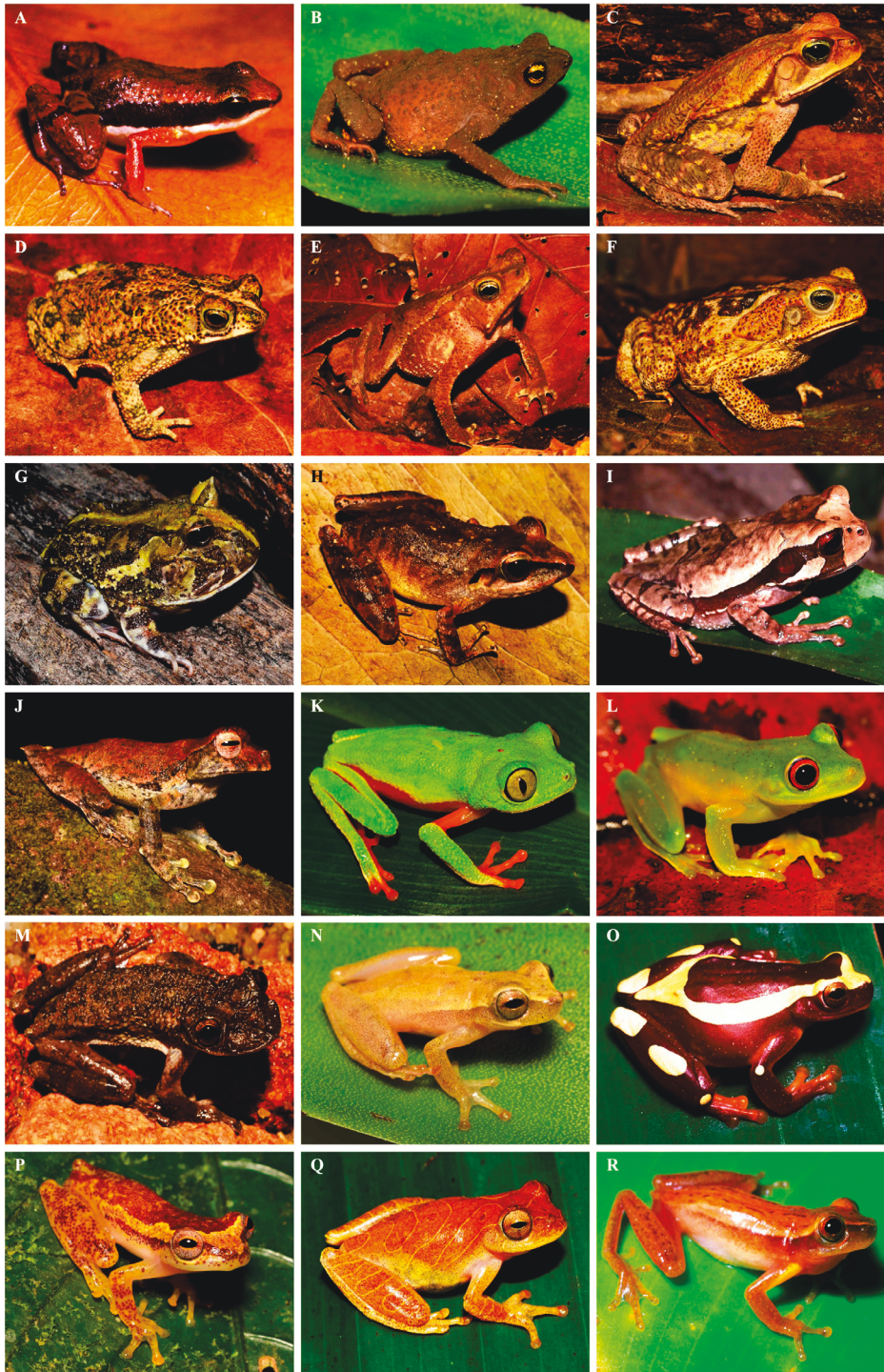


Figure 1. Amphibians of Alagoas State, Brazil. A – *Allobates olfersioides*; B – *Frostius pernambucensis*; C – *Rhinella crucifer*; D – *R. granulosa*; E – *R. hoogmoedi*; F – *R. jimi*; G – *Ceratophrys joazeirensis*; H – *Pristimantis ramagii*; I – *Gastrotheca fissipes*; J – *G. pulchra*; K – *Agalychnis granulosa*; L – *Aplastodiscus sibilatus*; M – *Corythomantis greeningi*; N – *Dendropsophus branneri*; O – *D. elegans*; P – *D. haddadi*; Q – *D. minutus*; R – *D. nanus*. Photos: A, O (G. O. Skuk); B, C, D, E, F, H, J, K, L, M, N, P, Q (B. S. Lisboa); G, I (F. A. C. Nascimento); R (M. G. Lima).

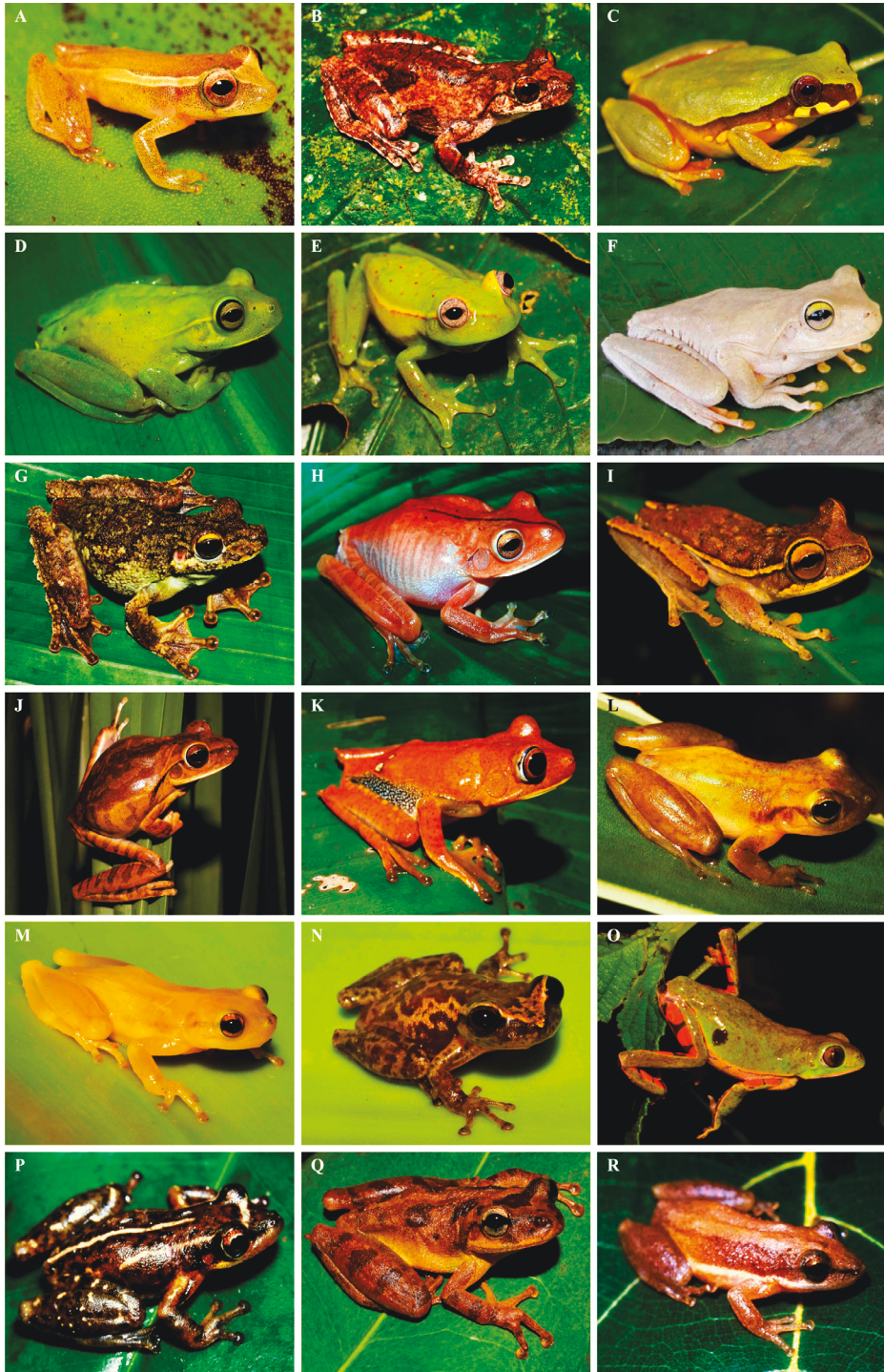


Figure 2. Amphibians of Alagoas State, Brazil. A – *Dendropsophus oliveirai*; B – *D. soaresi*; C – *D. studerae*; D – *Hypsiboas albomarginatus*; E – *H. atlanticus*; F – *H. crepitans*; G – *H. exastis*; H – *H. faber*; I – *H. freicanecae*; J – *H. raniceps*; K – *H. semilineatus*; L – *Phyllodytes acuminatus*; M – *P. edelmoi*; N – *P. gyrinaethes*; O – *Phyllomedusa nordestina*; P – *Scinax cretatus*; Q – *S. eurydice*; R – *S. fuscomarginatus*. Photos: A, B, E, G, I, M, N, O, Q (B. S. Lisboa); C (I. R. Joventino); D (F. A. C. Nascimento); F (U. Gonçalves); H, K, L, P, R (M. G. Lima); J (G. O. Skuk).



Figure 3. Amphibians of Alagoas State, Brazil. A – *Scinax melanodactylus**; B – *S. muriciensis*; C – *S. nebulosus*; D – *S. pachycrus*; E – *S. skuki*; F – *S. aff. x-signatus*; G – *Sphaenorhynchus prasinus*; H – *Trachycephalus mesophaeus*; I – *Crossodactylus dantei*; J – *Adenomera aff. hylaedactyla*; K – *Leptodactylus fuscus*; L – *L. cf. macrosternum*; M – *L. mystaceus*; N – *L. natalensis*; O – *L. troglodytes*; P – *L. vastus* (juvenile); Q – *Physalaemus albifrons*; R – *P. cicada*. Photos: A (T. Silva-Soares); B, G, H, P (M. G. Lima); C, I, J, L, M, N, O, R (B. S. Lisboa); D (U. Gonçalves); E, F (G. O. Skuk); K, Q (F. A. C. Nascimento). *Photo of a specimen found out of state (Porto Seguro, Bahia State), but representative of the species occurring in Alagoas.



Figure 4. Amphibians of Alagoas State, Brazil. A – *Physalaemus cuvieri*; B – *Pleurodema diplolister*; C – *Pseudopaludicola mystacalis*; D – *Chiasmocleis alagoana*; E – *Dermatonotus muelleri*; F – *Elachistocleis* sp.; G – *Stereocyclops incrassatus*; H – *Macrogenioglottus alipioi*; I – *Odontophrynus carvalhoi*; J – *Proceratophrys cristiceps*; K – *P. renalis*; L – *Pipa carvalhoi*; M – *Lithobates palmipes**; N – *Siphonops annulatus**; O – *S. paulensis*. Photos: A, H, O (B. S. Lisboa); B (G. O. Skuk); C, E, F, G, J, M (M. G. Lima); D (B. Vilela); I (S. Leal); K (F. A. C. Nascimento); L (U. Gonçalves); N (A. Maciel). *Photo of a specimen found out of state (M – Cabo de Santo Agostinho, Pernambuco State; N – Itaituba, Pará State), but representative of the species occurring in Alagoas.

Amphibians of Alagoas State, northeastern Brazil

Table 1. Amphibians of Alagoas State, Brazil. DD – Data Deficient; LC – Least Concern; NE – Not Evaluated; VU – Vulnerable; AM – Amazon; AF – Atlantic Forest; CA – Caatinga; CE – Cerrado; CH – Chaco; EC – Ecotonal areas; PP – Pampas, W – Widespread. 1 – Água Branca, 2 – Arapiraca, 3 – Atalaia, 4 – Barra de Santo Antônio, 5 – Boca da Mata, 6 – Cajueiro, 7 – Campo Alegre, 8 – Chã Preta, 9 – Coruripe, 10 – Delmiro Gouveia, 11 – Flexeiras, 12 – Ibataguara, 13 – Igreja Nova, 14 – Maceió, 15 – Major Isidoro, 16 – Maragogi, 17 – Maravilha, 18 – Marechal Deodoro, 19 – Maribondo, 20 – Matriz de Camaragibe, 21 – Monteirópolis, 22 – Murici, 23 – Olho D'água das Flores, 24 – Olho D'água do Casado, 25 – Passo de Camaragibe, 26 – Penedo, 27 – Piaçabuçu, 28 – Piranhas, 29 – Porto Real do Colégio, 30 – Quebrangulo, 31 – Rio Largo, 32 – Santana do Ipanema, 33 – São José da Laje, 34 – São José da Tapera, 35 – São Luís do Quitunde, 36 – São Miguel dos Campos, 37 – São Sebastião, 38 – Satuba, 39 – Tanque D'arca, 40 – Teotônio Vilela, 41 – Traipu, 42 – Viçosa. I – Afonso et al., 2011; II – Andrade and Vaz-Silva, 2012, III – Bourgeois, 2010; IV – Campos et al., 2014; V – Caramaschi and Pombal-Jr., 2006; VI – Carcerelli and Caramaschi, 1993; VII – Carvalho-e-Silva et al., 2003; VIII – Cavalcanti et al., 2014; IX – Cruz et al., 2011; X – Cruz et al., 2012; XI – Duellman, 1999; XII – Frost, 2015; XIII – Garda et al., 2013; XIV – Godinho et al., 2013; XV – Gomes and Peixoto, 1998; XVI – Gomes and Peixoto, 1996; XVII – Haddad et al., 2013; XVIII – Juncá and Nunes, 2008; XIX – Leite-Júnior et al., 2008; XX – Lima et al., 2011; XXI – Lima et al., 2011; XXII – Linares and Mello, 2011; XXIII – Lisboa and Haddad, 2009; XXIV – Lisboa et al., 2010; XXV – Lisboa et al., 2014; XXVI – Lourenço et al., 2014; XXVII – Lutz, 1973; XXVIII – Maciel and Nunes, 2010; XXIX – Maciel et al., 2013; XXX – Magalhães et al., 2013; XXXI – Mângia et al., 2012; XXXII – Mendes-Pinto and Miranda, 2011; XXXIII – Miranda et al., 2013; XXXIV – Morais et al., 2012; XXXV – Moura et al., 2011; XXXVI – Napoli et al., 2014; XXXVII – Nascimento et al., 2009; XXXVIII – Nunes and Pombal, 2011; XXXIX – Peixoto et al., 2003; XL – Pimenta and Caramaschi, 2007; XLI – Pimenta et al., 2007; XLII – Pombal and Madureira, 1997; XLIII – Roberto and Ávila, 2013; XLIV – Roberto et al., 2013; XLV – Santana et al., 2008; XLVI – Santana et al., 2014a; XLVII – Santana et al., 2014b; XLVIII – Santos and Amorim, 2010; XLIX – Santos and Silva, 2010; L – Silva et al., 2006a; LI – Silva et al., 2013a; LII – Silva et al., 2013b; LIII – Tibúrcio et al., 2008; LIV – Toledo, 2005; LV – Trevine et al., 2014; LVI – Valdujo et al., 2011; LVII – Valdujo et al., 2012; LVIII – Verdade and Rodrigues, 2007. Species topotypic from Alagoas are in bold.

Taxon	Municipalities	Conservation status (IUCN)	Distribution/Alagoas	Distribution/literature	Source
ANURA					
Aromobatidae					
<i>Allobates ofersooides</i> (Lutz, 1925)	7, 14, 20, 31, 40	VU	AF	AF	LVIII
Bufonidae					
<i>Frostius pernambucensis</i> (Bokermann, 1962)	14, 16, 22	LC	AF	AF	XL
<i>Rhinella crucifer</i> (Wied-Neuwied, 1821)	8, 9, 11, 12, 14, 18, 22, 31, 42	LC	AF	AF	XII
<i>Rhinella granulosa</i> (Spix, 1824)	2, 3, 5, 9, 10, 12, 14, 15, 18, 20, 22, 24, 26, 27, 28, 29, 30, 31, 35, 37, 41, 42	LC	AF/CA	W	LVII
<i>Rhinella hoogmoedi</i> Caramaschi and Pombal, 2006	11, 22, 25, 31	LC	AF	AF	V
<i>Rhinella jimi</i> (Stevaux, 2002)	2, 3, 5, 7, 9, 12, 14, 17, 20, 22, 24, 26, 27, 28, 31, 34, 35, 41	LC	AF/CA	W	XXX, XXXII, LII
Ceratophryidae					
<i>Ceratophrys joazeirensis</i> Mercadal de Barrio, 1986	34	DD	CA	CA	XXXIX, XLVI, this study
Craugastoridae					
<i>Pristimantis ramagii</i> (Boulenger, 1888)	7, 9, 14, 22, 31, 40, 41	LC	AF/CA	AF/CA	XXX

Table 1. Continued

Taxon	Municipalities	Conservation status (IUCN)	Distribution/Alagoas	Distribution/literature	Source
Hemiptera: Coreidae					
<i>Gastrotheca fissipes</i> (Boulenger, 1888)	11, 14, 22	LC	AF	AF	XVIII
<i>Gastrotheca pulchra</i> Caramaschi and Rodrigues, 2007	22	DD	AF	AF	XXV
Hylidae					
<i>Agalychnis granulosa</i> (Cruz, 1989)	14, 22	LC	AF	AF	XLI
<i>Aplastodiscus sibilatus</i> Cruz, Pimenta and Silvano, 2003	22	DD	AF	AF	XX
<i>Corythomantis greeningi</i> Boulenger, 1896	11, 21, 22, 23, 28, 32, 41	LC	AF/CA	AF/CA/CE	XIV
<i>Dendropsophus branneri</i> (Cochran, 1948)	3, 5, 6, 9, 14, 25, 26, 31, 35, 41	LC	AF/CA	W	XXX, LII, LVII
<i>Dendropsophus daturai</i> (Gomes and Peixoto, 1996)	30	LC	AF	AF	XV, XVI
<i>Dendropsophus elegans</i> (Wied-Neuwied, 1824)	3, 5, 6, 9, 12, 14, 22, 25, 31, 40	LC	AF	AF/CA/CE	XII
<i>Dendropsophus haddadi</i> (Bastos and Pombal, 1996)	9, 12, 14, 22	LC	AF	AF	XVII
<i>Dendropsophus minutus</i> (Peters, 1872)	3, 6, 7, 9, 11, 14, 20, 22, 25, 31, 35, 42	LC	AF	W	XXXIV, LII
<i>Dendropsophus nanus</i> (Boulenger, 1889)	7, 9, 14, 25, 26, 31, 35, 39	LC	AF/EC	W	XLIV
<i>Dendropsophus oliveirai</i> (Bokermann, 1963)	21, 23, 31, 34, 41	LC	CA	AF/CA	XIII, XLV, LII
<i>Dendropsophus soaresi</i> (Caramaschi and Jim, 1983)	5, 9, 14, 21, 22, 31	LC	AF/CA	W	XXX, XLIV, LVII
<i>Dendropsophus staderae</i> Carvalho-e-Silva, Carvalho-e-Silva and Izecksohn, 2003	30	DD	AF	AF	VII, XXXVI
<i>Hypsiboa albomarginatus</i> (Spix, 1824)	3, 5, 6, 7, 8, 9, 11, 12, 14, 17, 20, 22, 25, 31, 39	LC	AF/CA	AF/CA/CE	XXX, LVII
<i>Hypsiboa atlantica</i> (Caramaschi and Velosa, 1996)	4, 14, 20, 22, 25	LC	AF	AF	XXXVII
<i>Hypsiboa crepitans</i> (Wied-Neuwied, 1824)	2, 3, 5, 7, 9, 11, 14, 17, 20, 22, 25, 26, 28, 29, 41, 42	LC	AF/CA	W	LII
<i>Hypsiboa exastis</i> (Caramaschi and Rodrigues, 2003)	12, 14, 22, 25	DD	AF	AF	XVII
<i>Hypsiboa fiber</i> (Wied-Neuwied, 1821)	9, 22, 39, 42	LC	AF/EC	AF/CA	XXVII, XXVII
<i>Hypsiboa freicanecae</i> (Carnaval and Peixoto, 2004)	22	DD	AF	AF	L
<i>Hypsiboa raniceps</i> Cope, 1862	7, 9, 11, 13, 14, 21, 22, 25, 26, 29, 31, 37, 41	LC	AF/CA	W	XLIV, LVII
<i>Hypsiboa semilineatus</i> (Spix, 1824)	7, 9, 11, 14, 20, 22, 25, 31, 35	LC	AF	AF	XVII
<i>Phyllodytes acuminatus</i> Bokermann, 1966	11, 14, 22	LC	AF	AF/CA	IV, XLIX

Table 1. Continued

Taxon	Municipalities	Conservation status (IUCN)	Distribution/ Alagoas	Distribution/literature	Source
<i>Phyllodytes edelmi</i> Peixoto, Caramaschi and Freire, 2003	14, 20, 22	DD	AF	AF	XXXIX
<i>Phyllodytes gyrinaethes</i> Peixoto, Caramaschi and Freire, 2003	22	DD	AF	AF	XXXIX, XLIII
<i>Phyllomedusa nordestina</i> Caramaschi, 2006	1, 2, 3, 5, 7, 9, 11, 12, 14, 17, 22, 23, 25, 28, 31, 34, 39, 40, 41	DD	AF/CA	CA/CE/EC	XXX, XLIV, LII, LVII
<i>Scinax agilis</i> (Cruz and Peixoto, 1983)	25	LC	AF	AF	LIV
<i>Scinax</i> aff. <i>auratus</i> (Wied-Neuwied, 1821)	5, 14, 20, 22, 25, 26, 31, 35, 36, 42	–	AF	–	–
<i>Scinax cretatus</i> Nunes and Pombal, 2011	14, 18, 25	LC	AF	AF	XXXVIII
<i>Scinax eurydice</i> (Bokermann, 1968)	5, 6, 9, 11, 14, 31	LC	AF	AF	LII
<i>Scinax fuscocomarginatus</i> (Lutz, 1925)	9, 25	LC	AF	W	XIX, LVI
<i>Scinax fuscovarius</i> (Lutz, 1925)	7, 14, 21, 23, 41	LC	AF/CA	W	XLIV, LIII, LVII
<i>Scinax melanodactylus</i> Lourenço, Luna, and Pombal, 2014	25	NE	AF	AF	XXXVI
<i>Scinax muriciensis</i> Cruz, Nunes and Lima, 2011	22	NE	AF	AF	IX
<i>Scinax nebulosus</i> (Spix, 1824)	5, 7, 9, 14, 20, 25, 31, 35, 40	LC	AF	AF/AM	XVII
<i>Scinax paehyerus</i> (Miranda-Ribeiro, 1937)	21, 23, 26, 27, 41	LC	AF/CA	AF/EC	XXX, LII
<i>Scinax skuki</i> Lima, Cruz and Azevedo, 2011	14	NE	AF	AF	XXI
<i>Scinax</i> aff. <i>x-signatus</i> (Spix, 1824)	5, 9, 14, 17, 20, 25, 31, 34, 35, 40, 41	–	AF/CA	–	–
<i>Sphaenorhynchus prasinus</i> Bokermann, 1973	9, 30	LC	AF	AF	LI
<i>Trachycephalus mexophaeus</i> (Hensel, 1867)	3, 8, 9, 14, 31	LC	AF	AF	XVII
Hyloidea					
<i>Crossodactylus tanteei</i> Carcerelli and Caramaschi, 1993	22	DD	AF	AF	VI
Leptodactylidae					
<i>Adenomera</i> aff. <i>hylaedactyla</i> (Cope, 1868)	5, 9, 11, 14, 20, 22, 25, 31, 35, 41	–	AF/CA	–	–
<i>Leptodactylus fuscus</i> (Schneider, 1799)	1, 3, 5, 7, 9, 11, 12, 14, 26, 31, 38, 41	LC	AF/CA	W	XLIV, LVII
<i>Leptodactylus</i> cf. <i>macrosternum</i> Miranda-Ribeiro, 1926	1, 2, 3, 5, 7, 9, 11, 14, 17, 20, 23, 25, 26, 27, 28, 31, 34, 35, 39, 41	–	AF/CA	–	–
<i>Leptodactylus mystaceus</i> (Spix, 1824)	9, 11, 14, 31, 41	LC	AF/CA	W	I

Table 1. Continued

Taxon	Municipalities	Conservation status (IUCN)	Distribution/Alagoas	Distribution/literature	Source
<i>Leptodactylus natalensis</i> Lutz, 1930	5, 7, 9, 11, 12, 14, 18, 22, 26, 31	LC	AF	AF/CA	XXX
<i>Leptodactylus troglodytes</i> Lutz, 1926	1, 2, 5, 7, 9, 11, 14, 22, 24, 28, 34, 36, 41	LC	AF/CA	AF/CA/CE	VIII, XXX, XLIV
<i>Leptodactylus vastus</i> Lutz, 1930	3, 5, 7, 9, 11, 12, 14, 20, 21, 22, 25, 26, 27, 41	LC	AF/CA	CA/CE	XLIV, LVII
<i>Physalaemus albifrons</i> (Spix, 1824)	5, 9, 21, 34, 41	LC	AF/CA	CA/CE/EC	XXX, XLIV, LVII
<i>Physalaemus cuete</i> Pombal and Madureira, 1997	22, 25	DD	AF	AF	XLII
<i>Physalaemus cicada</i> Bokermann, 1966	17, 34	LC	CA	CA	XXIII, XXII
<i>Physalaemus cuvieri</i> Fitzinger, 1826	1, 3, 5, 7, 9, 12, 14, 18, 20, 22, 28, 31, 34, 35, 36, 41, 42	LC	AF/CA	W	XLIV, LIII, LVII
<i>Pleurodema diplolister</i> (Peters, 1870)	2, 9, 21, 23, 24, 28, 34, 40, 41	LC	AF/CA	AF/CA/CE	II, XXVIII
<i>Pseudopaludicola mystacalis</i> (Cope, 1887)	5, 7, 9, 11, 12, 14, 20, 26, 27, 31, 35	LC	AF	W	XLIV, LVII
Microhylidae					
<i>Chiasmocleis atagoana</i> Cruz, Caramaschi and Freire, 1999	14, 31	NE	AF	AF	XLVIII
<i>Dermatonotus muelleri</i> (Boettger, 1885)	9, 14, 18, 31, 41	LC	AF/CA	CA/CE/CH	XI
<i>Elachistocleis</i> sp.	9	-	AF	-	-
<i>Stereocyclops incrassatus</i> Cope, 1870	9, 18, 33	LC	AF	AF	XXXV
Odontophrynidae					
<i>Macrogenioltatus alipioi</i> Carvalho, 1946	7, 12, 14, 22	LC	AF	AF	III, LIII
<i>Odontophrynus carvalhoi</i> Savage and Cei, 1965	12	LC	AF	AF/CA/CE	XXIV
<i>Proceratophrys cristiceps</i> (Muller, 1883)	23, 24, 28, 41	LC	CA	CA	X
<i>Proceratophrys renallii</i> (Miranda-Ribeiro, 1920)	8, 11, 14, 22, 25, 31	NE	AF	AF	XXXI
Pipidae					
<i>Pipa carvalhoi</i> (Miranda-Ribeiro, 1937)	19	LC	EC	AF/CA	XLVII
Ranidae					
<i>Lithobates palmipes</i> (Spix, 1824)	7, 11, 13, 14, 22, 37, 42	LC	AF/EC	AF/AM/CE	XLIV, LVII
GYMNOPHIONA					
Siphonopidae					
<i>Siphonops annulatus</i> (Mikan, 1820)	31	LC	AF	AF/AM/CE/PP	XXIX
<i>Siphonops paulensis</i> Boettger, 1892	14, 22, 31	LC	AF	W	XXXIII, LVI, this study

Amphibians of Alagoas State, northeastern Brazil

(Valdujo et al., 2011), and in Piauí State (Roberto et al., 2013).

The majority of surveys in Alagoas has been conducted in Atlantic Forest fragments. However, there are still many gaps regarding amphibian diversity in the southern part of the state [e.g., Área de Proteção Ambiental (APA) da Marituba do Peixe and APA de Piaçabuçu] as well as in the northern part (e.g., Reserva Biológica de Pedra Talhada). Indeed, in the Reserva Biológica de Pedra Talhada only *Rhinella granulosa* has a voucher-specimen in the MUFAL. Three other species were registered there, *Dendropsophus dutrai*, *D. studerae* and *Sphaenorhynchus prasinus*, but only have voucher specimens in the Departamento de Zoologia of Universidade Federal do Rio de Janeiro (ZUF RJ) (see Gomes and Peixoto, 1998; Carvalho-e-Silva et al., 2003 and Silva et al., 2013a, respectively).

Caatinga

Amphibians from Caatinga biome in Alagoas are poorly known, with the exception of Traipu municipality (where all specimens of 23 species of anurans were obtained in Serra da Mão, an area of forested plateaus known as “brejo de altitude”) and the area of Xingó hydroelectric power plant installed between Alagoas and Sergipe States (where 10 anuran species were collected). Rodrigues (2003) reported 12 anuran species for the Caatinga biome in Alagoas, although recent surveys indicated a much higher richness of anurans for other areas in this biome. Arzabe et al. (2005) reported 21 anurans for Curimataú, state of Paraíba; Borges-Nojosa and Santos (2005) recorded 18 species for Serra das Almas (state of Ceará) and 19 species for Betânia e Floresta (state of Pernambuco); Garda et al. (2013) recorded 21 species for the Estação Ecológica do Raso da Catarina (state of Bahia), and Pedrosa et al. (2014) recorded 21 species for the Parque Nacional de Catimbau (state of Pernambuco). These studies were short inventories, and none was conducted in Alagoas State. In Alagoas, no amphibian species has even been registered in 66.7% of municipalities within the Caatinga, although there are three integral protection areas there (IMA, 2015). The anuran diversity in this region of the biome is certainly underestimated.

Amphibian distribution patterns and taxonomic issues

Most of the species richness of amphibians in Alagoas is concentrated in the Atlantic Forest. This is expected regarding the heterogeneity, humidity and availability of microhabitats in this biome, providing conditions for

amphibians' diversification (Haddad et al., 2013). In contrast, the dry climate of Caatinga is an environment with severe conditions for amphibians due to its water dependent features (Duellman and Trueb, 1986). However, the higher concentration of surveys in Atlantic Forest combined with the lack of studies in the Caatinga region may be overestimating these differences in amphibian richness between biomes in Alagoas.

The distribution pattern of amphibian species within biomes in Alagoas matches with the known range of each species with the exception of *Scinax fuscomarginatus*. Although this species has been recorded only for two locations (Coruripe and Passo de Camaragibe municipalities) in Alagoas' Atlantic Forest (Table 1), it has a wide distribution (Leite Jr. et al., 2008; Brusquetti et al., 2014).

Some species in our list are taxonomically uncertain and await more detailed systematic study. *Scinax auratus* (reported by Alves et al., 2004) shows striking morphological variation throughout its distributional range (Lutz, 1973; Nunes and Pombal, 2011) and is also very similar to *S. cretatus* (a sympatric species) and *S. juncae* (Nunes and Pombal, 2011). It is possible that some specimens are misidentified. Another similar case is the occurrence of *Adenomera* aff. *hylaedactyla* in Alagoas (reported by Silva et al., 2006b). Fouquet et al. (2014) included a sample from Alagoas (Passo de Camaragibe municipality) in their phylogenetic analysis of the genus *Adenomera* and recovered this specimen deeply nested within *Adenomera hylaedactyla*. However, they suggested that *A. hylaedactyla* is a species complex and need a taxonomic revision. Therefore, we limit ourselves to record the occurrence of *A. aff. hylaedactyla* in Alagoas.

Leptodactylus cf. *macrosternum* was named with uncertainty due to lack of knowledge about the relationship within the *L. latrans* group. De Sá et al. (2014) suggested that until this question is clarified the occurrence of *L. macrosternum* must be restricted to its type locality (Salvador, Bahia). Heyer (2014) performed an analysis of morphological variation within *L. latrans* species complex and revealed that there are probably two species in Alagoas.

Scinax agilis was previously registered in Alagoas in the municipality of Passo de Camaragibe by Toledo (2005). However, Lourenço et al. (2014) described a similar species, *S. melanodactylus*, and also registered it in Passo de Camaragibe. The authors suggested that these records of *S. agilis* from Alagoas and some records from Bahia and Sergipe States could be in fact *S. melanodactylus*. They examined the *S. agilis* specimens

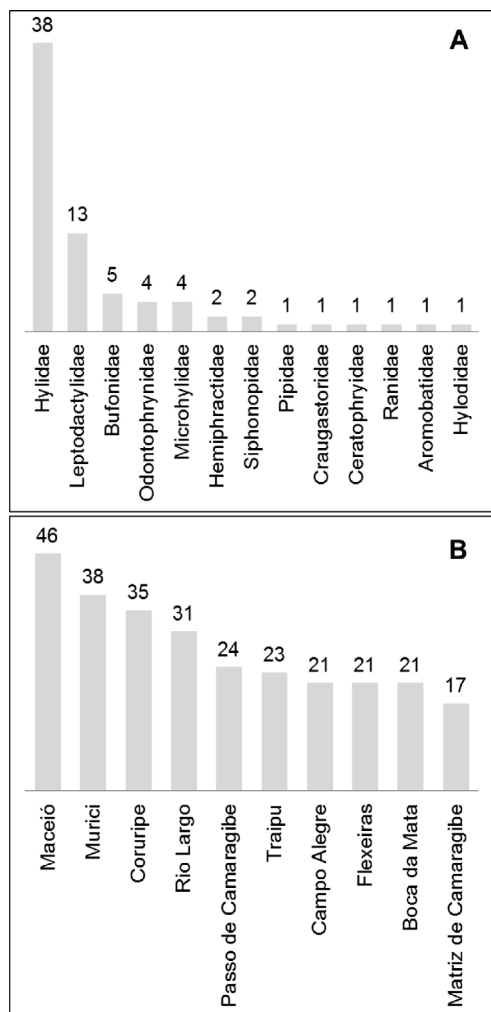


Figure 5. Families (A) and the ten municipalities (B) with higher amphibian species richness in Alagoas State, Brazil.

collected in Alagoas by Toledo (2005) but all are females and the diagnostic character that distinguishes *S. melanodactylus* from *S. agilis* is only observed in males. Thus, they could not confirm the identity of the specimens collected by Toledo (2005). Until this issue is resolved we prefer to keep *S. agilis* on the state list.

Elachistocleis sp. has specimens in MUFAL from the municipality of Coruripe (Atlantic Forest biome), and is related to the species group with immaculate ventral coloration pattern (Caramaschi, 2010). This species could be related to *E. ovalis* according to

the definition of Lavilla *et al.* (2003), but recently Caramaschi (2010) considered this taxon as a “nomen dubium” (name of doubtful application), associated to the “species inquirenda” (species of doubtful identity). Moreover, it is important to mention that the species of the genus *Elachistocleis* have very similar morphology, a condition that makes it difficult to distinguish between them. This makes the taxonomy of the genus complex and confusing, requiring a revision and making difficult to determine the specific identification (Lavilla *et al.*, 2003; Caramaschi, 2010; Nunes-de-Almeida and Toledo, 2012).

First state records

The occurrence of *Ceratophrys joazeirensis* in the municipality of São José da Tapera, inside Caatinga (9.537778° S, 37.406944° W; 384 m above sea level; MUFAL 11370, 11438), represents the first state record of this rare species and extends its known distribution in ca. 32 kilometers northeast from the nearest point at the municipality of Canindé do São Francisco in Sergipe State (Fig. 7; Santana *et al.*, 2014). The specimen was collected on a farm in vicinities of the city and the identification was confirmed by the presence of a blot between the interocular region to the nostrils and upper eyelids fairly pronounced (Mercadal, 1986).

Siphonops paulensis was also registered in Alagoas for the first time. This caecilian species was recorded in the municipalities of Maceió (in the city; 9.535278° S, 35.783889° W; 104 m above sea level; MUFAL 10715), Murici (Estação Ecológica de Murici; 9.20972° S, 35.86108° W; 463 m above sea level; MUFAL 11079) and Rio Largo (Mata do Cedro, 9.532222° S, 35.914444° W; 120 m above sea level; MUFAL 2307), inside Atlantic Forest biome, nearly 249 kilometers northeast from the nearest point of occurrence in Simão Dias municipality, Sergipe State (Fig. 8; Santana *et al.*, 2015). The species was identified by having the tentacle closer to the eye than to the nostril or the margin of the mouth, eye visible as a grayish dot, two evident nuchal collars with grooves visible on superior view, a blue-brownish coloration with cream grooves along of the body, over 98 corporal annuli (100-102) and a distinct terminal shield (Taylor, 1968).

Conclusions

The vast majority of specimens from Alagoas housed in the MUFAL were obtained from short and medium-term surveys resulting from environmental

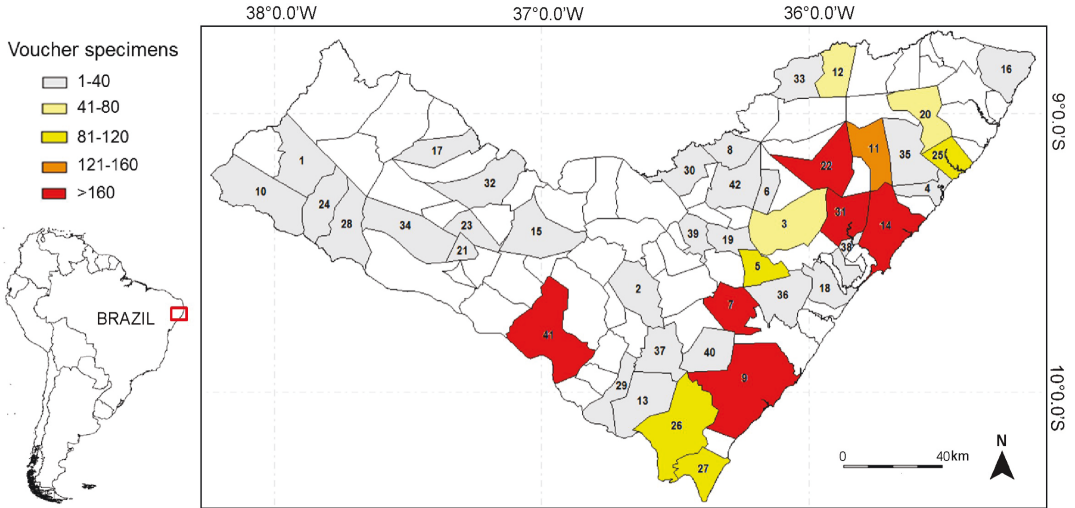


Figure 6. Voucher specimens of amphibians collected in Alagoas State and housed in Museu de História Natural, Universidade Federal de Alagoas (MUFAL). Municipalities names are the same as in table 1.

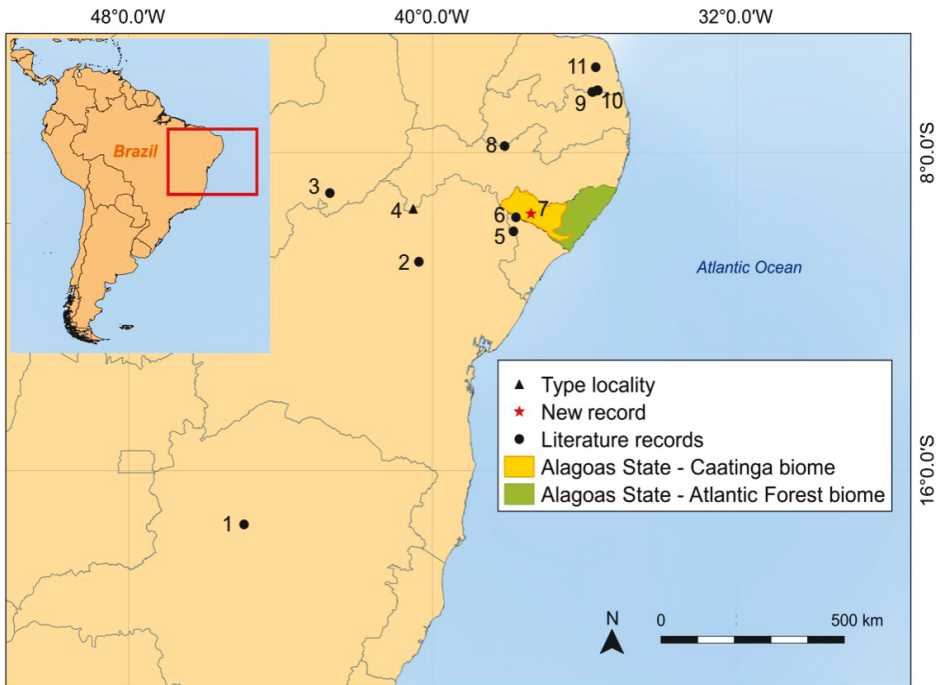


Figure 7. Geographic distribution map of *Ceratophrys joazeirensis*. 1 – Buritizeiro, MG (Maciel et al., 2013); 2 – Pindobaçu, BA (Zaidan and Leite, 2012); 3 – São Raimundo Nonato, PI (Roberto et al., 2013); 4 – Juazeiro, BA (Mercadal, 1986); 5 – Poço Redondo, SE (Santana et al., 2014); 6 – Canindé do São Francisco, SE (Santana et al., 2014); 7 – São José da Tapera, AL (new record); 8 – Triunfo, PE (Santos et al., 2009); 9 – Araruna, PB (Vieira et al., 2006); 10 – Passa-e-Fica, RN (Vieira et al., 2006); 11 – Santa Maria, RN (Jorge et al., 2012).

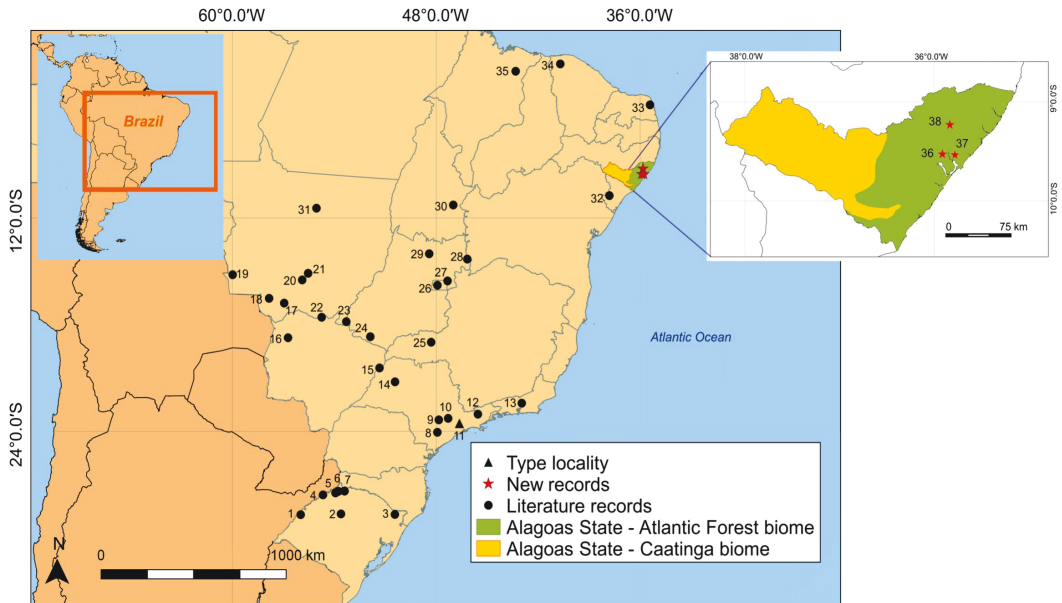


Figure 8. Geographic distribution map of *Siphonops paulensis*. 1 – São Borja, RS (Braun and Braun, 1980); 2 – Cruz Alta, RS (Braun and Braun, 1980); 3 – Bom Jesus, RS (Species Link); 4 – Porto Mauá, RS (Species Link); 5 – Três Passos, RS (Species Link); 6 – Tenente Portela, RS (Braun and Braun, 1980); 7 – Frederico Westphalen, RS (Lema and Martins, 2011); 8 – São Miguel Arcanjo, SP (Forlani *et al.*, 2010); 9 – Tatuí, SP (Species Link); 10 – Itú, SP (Species Link); 11 – São Paulo, SP (Boettger, 1892); 12 – Taubaté, SP (Dunn, 1942); 13 – Teresópolis, RJ (Sawaya, 1937); 14 – Araçatuba, SP (Species Link); 15 – Ilha Solteira, SP (Species Link); 16 – Corumbá, MS (Dunn, 1942); 17 – Poconé, MT (Faria and Mott, 2011); 18 – Cácere, MT (Faria and Mott, 2011); 19 – Vila Bela da Santíssima Trindade, MT (Faria and Mott, 2011); 20 – Cuiabá, MT (Faria and Mott, 2011); 21 – Chapada dos Guimarães, MT (Faria and Mott, 2011); 22 – Sonora, MS (Silva *et al.*, 2009); 23 – Alto Taquarí, MT (Faria and Mott, 2011); 24 – Aporé, GO (Vaz-Silva *et al.*, 2007); 25 – Uberlândia, MG (Kokubum and Menin, 2001); 26 – Brasília, DF (Kokubum and Menin, 2001); 27 – Formosa, GO (Schwartz *et al.*, 2003); 28 – Mabaí, GO (Cintra *et al.*, 2009); 29 – Minaçu, GO (Souza *et al.*, 2002); 30 – Almas, TO (Valdujo *et al.*, 2011); 31 – Cláudia, MT (Faria and Mott, 2011); 32 – Simão Dias, SE (Santana *et al.*, 2015); 33 – Ceará Mirim, RN (Schmidt and Inger, 1951); 34 – Ibiapaba, CE (Loebmann and Haddad, 2010); 35 – Chapadinha, MA (Miranda *et al.*, 2013); 36 – Rio Largo, AL (new record); 37 – Maceió, AL (new record); 38 – Murici, AL (new record).

consultancies and undergraduate/graduate projects. Although these surveys improved our understanding of amphibian composition in Alagoas, access to this information is very limited because most studies have not been published. In addition, many regions have not been adequately surveyed.

The amphibian species list presented here is certainly underestimated for this taxonomic group in Alagoas, since there are still many municipalities without a single registered specimen. Certainly, further studies in these areas should increase the number of amphibian species. Such information is essential to improve knowledge of baseline biology and distribution of amphibians in these disturbed and deforested regions of Atlantic Forest and

Caatinga, and is the first step for the development of appropriate conservation strategies.

Acknowledgments. JPFAA and TM thank to Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Fundação de Amparo à Pesquisa do Estado de Alagoas (FAPEAL-PPP 20110827-011-0025-0005) and Pró-reitoria de Extensão at Universidade Federal de Alagoas for financial support provided during the development of this work. We thank Ana Malhado and Richard Ladle for english revision and an anonymous reviewer for his/her constructive comments. We are grateful to the friends and colleagues who kindly gave us some photographs that illustrate this paper: Adriano Maciel, Bruno Vilela, Gabriel Skuk (*in memoriam*), Igor Roberto Joventino, Sérgio Leal, Thiago Silva-Souares, and Ubiratan Gonçalves. We would like to also thank all

the collectors and friends who have contributed and contribute to the growth of the herpetological collection of MUFAL.

References

- Affonso, I.P., Delariva, R.L., Navarro, M.P. (2011): Amphibia, Anura, Leptodactylidae, *Leptodactylus mystaceus* (Spix, 1824): Distribution extension. Check list 7: 198–199.
- Alves, A.C.R., Gomes, M.R., Silva, S.P.C. (2004): Description of the tadpole of *Scinax auratus* (Wied–Neuwied) (Anura, Hylidae). Revista Brasileira de Zoologia 21: 315–317.
- Andrade, S.P., Vaz-Silva, W. (2012): First state record and distribution extension of *Pleurodema dipolister* (Peters 1870) (Anura: Leiuperidae) from state of Goiás, Brazil. Check List 8: 149–151.
- Araújo-Neto, J.V., Silva, B.V.M., Galdino, J.Y.A., Nascimento, F.A.C., Lisboa, B.S. (2012): New records and geographic distribution map of *Dendropsophus haddadi* (Bastos and Pombal, 1996) (Anura: Hylidae) with comments on color patterns. Check List 8: 248–250.
- Arzabe, C., Skuk, G., Santana, G.G., Delfin, F.R., Lima, Y.C.C., Abrantes, S.H.F. (2005): Herpetofauna da área do Curimataú, Paraíba. In: Análise das variações da biodiversidade do Bioma Caatinga: suporte a estratégias regionais de conservação, p. 264–280. Araújo, F.S., Rodal, M.J.N., Barbosa, M.R.V., Eds., Ministério do Meio Ambiente, Brasília, Brasil.
- Assis, J.S. (2000): Biogeografia e conservação da biodiversidade: projeções para Alagoas. Maceió–São Paulo, Brasil, Edições Catavento.
- Boettger, O. (1892). Katalog der Batrachier-Sammlung im Museum der Senckenbergischen Naturforschenden Gesellschaft in Frankfurt am Main. Frankfurt a. M.: Gebrüder Knauer.
- Borges-Nojosa, D.M., Santos, E.M. (2005): Herpetofauna da área de Betânia e Floresta, Pernambuco. In: Análise das variações da biodiversidade do bioma Caatinga, p. 275–289. Araújo, F.S., Rodal, M.J.N., Barbosa, M.R.V., Eds., Ministério do Meio Ambiente, Brasília, Brasil.
- Bourgeois, P.A. (2010): Amphibia, Anura, Cycloramphidae, *Macrogenioglottus alipioi* Carvalho, 1946: Distribution extension, state of Alagoas, northeastern Brazil. Check List 6: 187–188.
- Braun, P.C., Braun, C.A.S. (1980): Lista prévia dos anfíbios do Estado do Rio Grande do Sul, Brasil. Iheringia Série Zoologia 56:121–146.
- Brook, B.W., Sodhi, N.S., Ng, P.K.L. (2003): Catastrophic extinctions follow deforestation in Singapore. Nature 424: 420–423.
- Brusquetti, F., Jansen, M., Barrio-Amorós, C., Segalla, M., Haddad, C.F.B. (2014): Taxonomic review of *Scinax fuscomarginatus* (Lutz, 1925) and related species (Anura; Hylidae). Zoological Journal of the Linnean Society 171: 783–821.
- Campos, T.F., Lima, M.G., Nascimento, F.A.C., Santos, E.M. (2014): Larval morphology and advertisement call of *Phyllodytes acuminatus* Bokermann, 1966 (Anura: Hylidae) from Northeastern Brazil. Zootaxa 3779: 93–100.
- Caramaschi, U., Pombal-Jr, J.P. (2006): A new species of *Rhinella* Fitzinger, 1826 from the Atlantic Rain Forest, Eastern Brazil (Amphibia, Anura, Bufonidae). Papéis Avulsos de Zoologia 46: 251–259.
- Caramaschi, U. (2010): Notes on the taxonomic status of *Elachistocleis ovalis* (Schneider 1799) and description of five new species of *Elachistocleis* Parker, 1927 (Amphibia, Anura, Microhylidae). Boletim do Museu Nacional, Nova Série, Zoologia 527: 1–32.
- Carcerelli, L.C., Caramaschi, U. (1993): Ocorrência do gênero *Crossodactylus* Duméril & Bibron, 1841 no nordeste brasileiro, com descrição de duas espécies novas (Amphibia, Anura, Leptodactylidae). Revista Brasileira de Biologia 52: 415–422.
- Carvalho-e-Silva, S.P., Carvalho-e-Silva, A.M.P.T., Izecksohn, E. (2003): Nova espécie de *Hyla Laurenti* do grupo *H. microcephala* Cope (Amphibia, Anura, Hylidae) do nordeste do Brasil. Revista Brasileira de Zoologia 20: 553–558.
- Cavalcanti, L.B.Q., Costa, T.B., Colli, G.R., Costa, G.C., França, F.G.R., Mesquita, D.O., Palmeira, C.N.S., Pelegrin, N., Soares, A.H.B.S., Tucker, D.B., Garda, A.A. (2014): Herpetofauna of protected areas in the Caatinga II: Serra da Capivara National Park, Piauí, Brazil. Check List 10: 18–27.
- Cintra, C.E.D., Silva, H.L.R., Silva-Júnior, N.J. (2009). Herpetofauna, Santa Edwiges I and II hydroelectric power plants, state of Goiás, Brazil. Check List 5: 570–576.
- Cruz, C.A.G., Nunes, I., Juncá, F.A. (2012): Redescription of *Proceratophrys cristiceps* (Müller, 1883) (Amphibia, Anura, Odontophrynidae), with description of two new species without eyelid appendages from Northeastern Brazil. South American Journal of Herpetology 7: 110–122.
- Cruz, C.A.G., Nunes, I., Lima, M.G. (2011): A new *Scinax* Wagler belonging to the *S. catharinae* clade (Anura: Hylidae) from the state of Alagoas, northeastern Brazil. Zootaxa 3096: 18–26.
- Cruz, C.A.G., Caramaschi, U., Freire, E.M.X. (1999): Occurrence of the genus *Chiasmocleis* (Anura: Microhylidae) in the State of Alagoas, north-eastern Brazil, with a description of a new species. Journal of Zoology 249: 123–126.
- De Sá, R.O., Grant, T., Camargo, A., Heyer, W.R., Ponssa, M. L., Stanley, E. (2014): Systematics of the Neotropical genus *Leptodactylus* Fitzinger, 1826 (Anura: Leptodactylidae): Phylogeny, the relevance of non-molecular evidence, and species accounts. South American Journal of Herpetology 9: 1–128.
- Duellman, W.E. (1978): The biology of an Equatorial Herpetofauna of Amazonian Ecuador. Miscellaneous Publication, University of Kansas 65: 1–352.
- Duellman, W.E. (1999): Distribution Patterns of Amphibians in South America. pp. 255–327 in: Duellman, W.E. (ed): Patterns of Distribution of Amphibians. The Johns Hopkins University Press, Baltimore, USA and London, England.
- Duellman, W.E., Trueb, L. (1986): Biology of Amphibians. New York, USA, McGraw-Hill.
- Dunn, E.R. (1942). The American caecilians. Bulletin of the Museum of Comparative Zoology 91: 437–540.
- Faria, H.A.B., Mott, T. (2011): Geographic distribution of caecilians (Gymnophiona, Amphibia) in the state of Mato Grosso, Brazil with a new state record for *Caecilia mertensi* Taylor 1973. Herpetology Notes 4: 053–056.
- Forlani, M.C., Bernardo, P.H., Haddad, C.B.F., Zaher, H. (2010): Herpetofauna do Parque Estadual Carlos Botelho, São Paulo,

- Brasil. *Biota Neotropica* **10**: 265-309.
- Fouquet, A., Cassini, C.S., Haddad, C.F.B., Pech, N., Rodrigues, M. T. (2014): Species delimitation, patterns of diversification and historical biogeography of the Neotropical frog genus *Adenomera* (Anura, Leptodactylidae). *Journal of Biogeography* **41**: 1–16.
- Frost, D.R. (2015): *Amphibian Species of the World: an Online Reference*. Version 6.0. – American Museum of Natural History, New York, USA. Available at: <http://research.amnh.org/herpetology/amphibia/index.html/>. Accessed on 19 May 2015.
- Garda, A.A., Costa, T.B., Faria, R.G., Mesquita, D.O., Conceição, B.M., Silva, I.R.S., Ferreira, A.S., Rocha, S.M., Palmeira, C.N.S., Rodrigues, R., Torquato, S. (2013): Herpetofauna of protected areas in the Caatinga I: Raso da Catarina Ecological Station. *Check List* **9**: 405–414.
- Gibson, L., Lee, T.M., Koh, L.P., Brook, B.W., Gardner, T.A., Barlow, J., Peres, C.A., Bradshaw, C.J.A., Laurence, W.F., Lovejoy, T.E., Sodhi, N.S. (2011): Primary forest are irreplaceable for sustaining tropical biodiversity. *Nature* **478**: 378–381.
- Godinho, L.B., Moura, M.R., Feio, R.N. (2013): New records and geographic distribution of *Corythomantis greeningi* Boulenger, 1896 (Amphibia: Hylidae). *Check List* **9**: 148–150.
- Gomes, M.R., Peixoto, O.L. (1996): Nova espécie de *Hyla* do grupo marmorata de Sergipe, Nordeste do Brasil (Amphibia, Anura, Hylidae). *Iheringia Série Zoologia* **80**: 33–38.
- Gomes, M.R., Peixoto, O.L. (1998): *Hyla dutraei*. *Herpetological Review* **29**: 172–173.
- Haddad, C.F.B., Toledo, L.F., Prado, C.P.A., Loebmann, D., Gasparini, J. L., Sazima, I. (2013): *Guia dos anfíbios da Mata Atlântica: Diversidade e Biologia*. São Paulo, Brazil, Anolisbooks.
- Heyer, W.R. (2014): Morphological analyses of frogs of the *Leptodactylus latrans* complex (Amphibian, Leptodactylidae) from selected localities in South America. *Proceedings of the Biological Society of Washington* **126**: 369–378.
- IMA (2015): Instituto do Meio Ambiente: Unidades de Conservação. Available at: <http://www.ima.al.gov.br/unidades-de-conservacao>. Accessed on 25 May 2015.
- IBGE (2014): Instituto Brasileiro de Geografia e Estatística. Available at: <http://www.ibge.gov.br>. Accessed on 04 June 2014.
- IUCN (2014): The IUCN Red List of Threatened Species. Version 2014.3. – International Union for Conservation of Nature. Available at: <http://www.iucnredlist.org>. Accessed on 19 May 2015.
- Jorge, J.S., Kokubum, M.N.C., Sales, R.D.F., Freire, E.M.X. (2012): Geographic distribution: *Ceratophrys joazeirensis*. *Herpetological Review* **43**: 297–298.
- Juncá, F.A., Nunes, I. (2008): A new species of marsupial frog of the genus *Gastrotheca* Fitzinger (Anura: Amphignatodontidae) from the state of Bahia, northeastern Brazil. *Zootaxa* **1907**: 61–68.
- Kokubum, M.N.C., Menin, M. (2001). Geographic Distribution. *Siphonops paulensis*. *Herpetological Review* **32**: 53–53.
- Lavilla, E.O., Vaira, M., Ferrari, L. (2003): A new species of *Elachistocleis* (Anura: Microhylidae) from the Andean Yungas of Argentina, with comments on the *Elachistocleis ovalis* – *bicolor* controversy. *Amphibia–Reptilia* **24**: 269–284.
- Leal, I.R., Silva, J.M.C., Tabarelli, M., Lacher, T.E. (2005): Mudando o curso da conservação da biodiversidade na Caatinga do Nordeste do Brasil. *Megadiversidade* **1**: 139–146.
- Leite-Júnior, J.M.A., Sampaio, J.M.S., Silva-Leite, R.R., Toledo, L.F., Loebmann, D., Leite, J.R.S.A. (2008): Amphibia, Anura, Hylidae, *Scinax fuscomarginatus*: Distribution extension. *Check List* **4**: 475–477.
- Lema, T., Martins, L.A. (2011). Anfíbios do Rio Grande do Sul. Catálogo, Diagnose, Distribuição e Iconografia. Porto Alegre, ediPUCRGS.
- Lima, M.G., Cruz, C.A.G., Azevedo, S.M. (2011): A new species belonging to the *S. catharinae* group from the state of Alagoas, northeastern Brazil (Amphibia, Anura, Hylidae). *Boletim do Museu Nacional, Nova Série, Zoologia* **529**: 1–11.
- Lima, M.G., Skuk, G.O., Silva, M.C.C. (2006): *Aplastodiscus* (= *Hyla*) *sibilatus*. *Herpetological Review* **37**: 485.
- Linares, A.M., Mello, H.E.S. (2011): *Physalaemus cicada* Bokermann, 1966 (Anura: Leiuperidae): Distribution extension with new south limit and geographic distribution map. *Check List* **7**: 859–861.
- Lisboa, B.S., Haddad, C.F.B. (2009): Amphibia, Anura, Leiuperidae, *Physalaemus cicada* Bokermann, 1966: Distribution extension and geographic distribution map. *Check List*, **5**: 699–701.
- Lisboa, B.S., Guarnieri, M.C., Mott, T. (2014): Geographic Distribution: *Gastrotheca pulchra* (Marsupial treefrog). *Herpetological Review* **45**: 86–87.
- Lisboa, B.S., Silva, U.G., Haddad, C.F.B. (2010): Amphibia, Anura, Cycloramphidae, *Odontophrynus carvalhoi* Savage and Cei, 1965: Distribution extension and geographic distribution map. *Check List* **6**: 493–494.
- Loebmann, D., Haddad, C.F.B. (2010): Amphibians and reptiles from a highly diverse area of the Caatinga domain: composition and conservation implications. *Biota Neotropica*, **10**: 227–256.
- Lourenço, A.C.C., Luna, M. C., Pombal-Jr, J. P. (2014): A new species of the *Scinax catharinae* group (Anura: Hylidae) from northeastern Brazil. *Zootaxa* **3889**: 259–276.
- Lutz, B. (1973): *Brazilian Species of Hyla*. Austin, USA, University of Texas Press.
- Maciel, D.B., Nunes, I. (2010): A new species of four-eyed frog genus *Pleurodema* Tschudi, 1838 (Anura: Leiuperidae) from the rock meadows of Espinhaço range, Brazil. *Zootaxa* **2640**: 53–61.
- Maciel, N.M., Kokubum, M.N.C., Braga, P.H.P., Queiróz– Júnior, A.T., Matsushita, R.H. (2013): Distribution extension, new state record and geographic distribution map of *Ceratophrys joazeirensis* Mercadal, 1986 (Anura: Ceratophryidae). *Herpetology Notes* **6**: 447–450.
- Magalhães, F.M., Dantas, A.K.B.P., Brito, M.R.M., Medeiros, P.H.S., Oliveira, A.F., Pereira, T.C.S.O., Queiroz, M.H.C., Santana, D.J., Silva, W.P., Garda, A.A. (2013): Anurans from an Atlantic Forest–Caatinga ecotone in Rio Grande do Norte State, Brazil. *Herpetology Notes* **6**: 1–10.
- Mângia, S., Guimarães, C., Feio, R.N. (2012): Distribution extension and geographic distribution map of *Proceratophrys renalis* (Miranda–Ribeiro, 1920) (Anura, Odontophryniidae). *Check List* **8**: 298–299.

- Mendes-Pinto, T.J., Miranda, I.M. (2011): Levantamento Herpetofaunístico de uma área de Cerrado em Alto Araguaia, Mato Grosso, Brasil. *Revista de Biologia e Farmácia* **6**: 129–137.
- Mercadal de Barrio, I.T. (1986): *Ceratophrys joazeirensis* sp. n. (Ceratophryidae, Anura) del noreste de Brazil. *Amphibi Reptilia* **7**: 313–334.
- Miranda, J.P., Matos, R.F., Scarpa, F.M., Rocha, C.F.D. (2013): New record and distribution extension of *Siphonops paulensis* (Gymnophiona: Siphonopidae) in the State of Maranhão, northeastern Brazil. *Herpetology Notes* **6**: 327–329.
- MMA (2014): Ministério do Meio Ambiente: Lista nacional de espécies da fauna ameaçadas de extinção. Available at: <http://pesquisa.in.gov.br/imprensa/jsp/visualiza/index.jsp?jornal=1&pagina=121&data=18/12/2014>. Accessed on 19 May 2015.
- Morais, A.R., Bastos, R.P., Vieira, R., Signorelli, L. (2012): Herpetofauna da Floresta Nacional de Silvânia, um remanescente de Cerrado no Brasil Central. *Neotropical Biology and Conservation* **7**: 114–121.
- Moura, G.J.B., Andrade, E.V.E., Freire, E.M.X. (2011): Amphibia, Anura, Microhylidae, *Stereocyclops incrassatus* Cope, 1870: Distribution extension. *Check List* **6**: 859–861.
- Myers, N., Mittermeier, R.A., Mittermeier, C.G., Fonseca, G.A.B., Kent, J. (2000): Biodiversity hotspots for conservation priorities. *Nature* **403**: 853–858.
- Napoli, M.F., De Abreu, R.O., Cruz, D., Herrera, J.B., Petersen, E., Klein, W. (2014): Advertisement call of *Dendropsophus studevae* (Carvalho-e-Silva, Carvalho-e-Silva and Izecksohn, 2003) (Anura: Hylidae), with new record and geographic distribution extension. *Zootaxa* **3878**: 593–596.
- Nascimento, F.A.C., Lima, M.G., Skuk, G.O., De Sá, R.O. (2009): The tadpole of *Hypsiboas atlanticus* (Anura, Hylidae) from northeastern Brazil. *Iheringia, Série Zoologia* **99**: 431–436.
- Nunes, I., Pombal, J.P. (2011): A new snouted treefrog of the speciose genus *Scinax* wagler (Anura, Hylidae) from northeastern Brazil. *Herpetologica* **67**: 80–88.
- Nunes-de-Almeida, C.H.L., Toledo, L.F. (2012): A new species of *Elachistocleis* Parker (Anura, Microhylidae) from the state of Acre, northern Brazil. *Zootaxa* **3424**: 43–50.
- Pedrosa, I.M.M., Costa, T.B., Faria, R.G., França, F.G.R., Laranjeiras, D.O., Pereira, T.C.S.O., Palmeira, C.N., Torquato, S., Vieira, G.H.C., Garda, A.A. (2014): Herpetofauna of protected areas in the Caatinga III: The Catimbau National Park, Pernambuco, Brazil. *Biota Neotropica* **14**: 1–12.
- Peixoto, O.L., Caramaschi, U., Freire, E. M. X. (2003): Two new species of *Phyllodytes* (Anura: Hylidae) from the state of Alagoas, northeastern Brazil. *Herpetologica* **59**: 235–246.
- Pimenta, B.V.S., Caramaschi, U. (2007): New species of toad, genus *Frostius* Cannatella, 1986, from the Atlantic Rain Forest of Bahia, Brazil (Amphibia, Anura, Bufonidae). *Zootaxa* **1508**: 61–68.
- Pimenta, B.V.S., Nunes, I., Cruz, C.A.G. (2007): Notes on the poorly known Phyllomedusine Frog *Hylomantis aspera* Peters, 1872 (Anura, Hylidae). *South American Journal of Herpetology* **2**: 206–214.
- Pombal-Jr., J.P., Madureira, C.A. (1997): A new species of *Physalaemus* (Anura, Leptodactylidae) from the Atlantic rain forest of northeastern Brazil. *Alytes* **15**: 105–112.
- Ribeiro, M.C., Metzger, J.P., Martensen, A.C., Ponzoni, F., Hirota, M.M. (2009): Brazilian Atlantic forest: how much is left and how is the remaining forest distributed? Implications for conservation. *Biological Conservation* **142**, 1141–1153.
- Roberto, I. J., Ávila, R.W. (2013): The advertisement call of *Phyllodytes gyrinaethes* Peixoto, Caramaschi & Freire, 2003 (Anura, Hylidae). *Zootaxa* **3669**, 193–196.
- Roberto, I.J., Ribeiro, S.C., Loebmann, D. (2013): Amphibians of the state of Piauí, Northeastern Brazil: a preliminary assessment. *Biota Neotropica* **13**: 322–329.
- Rodrigues, M.T. (2003): Herpetofauna da Caatinga. in: *Ecologia e Conservação da Caatinga*, p. 181–236. Leal, I.R., Tabarelli, M., Silva, J. M. C. Eds, Recife, Brasil, Universidade Federal de Pernambuco.
- Santana, D.O., De-Carvalho, C. B., Freitas, E. B., Nunes, G. S. S., Faria, R. G. (2015): First record of *Siphonops paulensis* Boettger, 1892 (Gymnophiona: Siphonopidae) in the state of Sergipe, northeastern Brazil. *Check List* **11**: 1531.
- Santana, D.O., Faria, R. G., Caldas, F.L.S., De-Carvalho, C.B. (2014a): *Ceratophrys joazeirensis* Mercadal, 1986 (Anura: Ceratophryidae): New state record. *Check List* **10**: 386–387.
- Santana, D.O., Franco, S.C., Rocha, S.M., Freitas, E.B., De-Carvalho, C.B., Faria, R.G. (2014b): First record of *Pipa carvalhoi* (Miranda-Ribeiro, 1937) (Anura: Pipidae) in the state of Sergipe, northeastern Brazil. *Check List* **10**: 407–408.
- Santana, G.G., Vieira, W.L.S., Pereira-Filho, G.A., Delfim, F.R., Lima, Y.C.C., Vieira, K.S. (2008): Herpetofauna em um fragmento de Floresta Atlântica no Estado da Paraíba, Região Nordeste do Brasil. *Biotemas* **21**: 75–84.
- Santos, E.M., Amorim, F.O. (2010): Geographic distribution, *Chiasmocleis alagoanus* (NCN). *Herpetological Review* **41**: 103.
- Santos, E.M., Silva, G.L. (2010): Geographic distribution: *Phyllodytes acuminatus*. *Herpetological Review* **41**: 104.
- Santos, E.M., Silva, G.L., Campo, T.F., Quirino, M.S. (2009): Geographic distribution: *Ceratophrys joazeirensis*. *Herpetological Review* **40**: 107.
- Sawaya, P. (1937): Sobre o gênero *Siphonops* Wagler 1828 – Amphibia Apoda – com descrição de duas variedades novas: *S. annulatus* (Mikan) var. *marmoratus* e *S. paulensis* Boettg. var. *maculatus*. *Boletim da Faculdade de Filosofia Ciências e Letras da Universidade de São Paulo* **1**: 225–263.
- Schmidt, K.E., Inger, R.F. (1951): Amphibians and reptiles of the Hopkins–Branner expedition to Brazil. *Fieldiana, Zoology* **31**: 439–465.
- Schwartz, E.F., Stucchi-Zucchi, A., Schwartz, C.A., Salomão, L.C. (2003): Skin secretion of *Siphonops paulensis* (Gymnophiona, Amphibia) forms voltage-dependent ionic channels in lipid membranes. *Brazilian Journal of Medical and Biological Research* **36**: 1279–1282.
- Silva, G. R., Luna-Dias, C., Carvalho-e-Silva, S.P. (2013a): Amphibia, Anura, Hylidae, *Sphaenorhynchus prasinus* Bokermann, 1973: First record of the genus and species for the State of Alagoas, Brazil. *Check List* **9**: 1519–1520.
- Silva, A.S.F.L., Júnior, S.S., Zina, J. (2013b). Checklist of amphibians in a transitional area between the Caatinga and the

- Atlantic Forest, central-southern Bahia, Brazil. Check List **9**: 725–732.
- Silva, M.C.C., Cruz, C.A.G., Lima, M.G., Skuk, G.O. (2006a): *Hypsiboas freicanecae* (NCN). Herpetological Review **37**: 489.
- Silva, S. T., Silva, U. G., Sena, G.A.B., Nascimento, F.A.C. (2006b): A biodiversidade da Mata Atlântica alagoana: anfíbios e répteis. in: A Mata Atlântica em Alagoas, pp. 65–75, Moura, F.B.P., Ed., Maceió, Brasil, EDUFAL, Universidade Federal de Alagoas.
- Silva-Júnior, N.J., Cintra, C.E.D., Silva, H.L.R., Costa, M.C., Souza, C.A., Pachêco-Júnior, A.A., Gonçalves, F.A. (2009). Herpetofauna, Ponte de Pedra Hydroelectric Power Plant, states of Mato Grosso and Grosso do Sul, Brazil. Check List **5**: 518–525.
- Souza, I.F., Silva, H.L.R., Silva-Jr, N.J. (2002). Geographi Distribution. *Siphonops paulensis*. Herpetological Review **33**: 146–47.
- Species link. Available at: <http://splink.cria.org.br>. Accessed on 12 September 2015.
- Taylor, E. H. (1968): Caecilians of the world. Lawrence, KS. University of Kansas Press.
- Tiburcio, I.C.S., Lisboa, B.S., Haddad, C.F.B. (2008): Amphibia, Anura, Cycloramphidae, *Macrogenioglottus alipioi*: Distribution extension, state of São Paulo and Alagoas, Brazil. Check List **4**: 455–457.
- Toledo, L.F. (2005): Geographic distribution, *Scinax agilis* (NCN). Herpetological Review **36**: 77.
- Trevine, V., Forlani, M.C., Haddad, C.F.B., Zaher, H. (2014): Herpetofauna of Paranapiacaba: expanding our knowledge on a historical region in the Atlantic forest of southeastern Brazil. Zoologia **31**: 126–146.
- Valdujo, P.H., Silvano, D.L., Colli, G., Martins, M. (2012): Anuran Species Composition and Distribution Patterns in Brazilian Cerrado, a Neotropical Hotspot. South American Journal of Herpetology **7**: 63–78.
- Valdujo, P.H., Camacho, A., Recoder, R.S., Junior, M.T., Ghellere, J.M.B., Mott, T., Nunes, P.M.S., Nogueira, C., Rodrigues, M.T. (2011): Anfíbios da Estação Ecológica Serra Geral do Tocantins, região do Jalapão, Estados do Tocantins e Bahia. Biota Neotropica **11**: 251–262.
- Vaz-Silva, W., Guedes, A.G., Azevedo-Silva, P.L., Gontijo, F.F., Barbosa, R.S., Aloisio, G.R., Oliveira, F.C.G. (2007). Herpetofauna, Espora Hydroelectric Power Plant, state of Goiás, Brazil. Check List **3**: 338–345.
- Verdade, V.K., Rodrigues, M.T. (2007): Taxonomic Review of *Allobates* (Anura, Aromobatidae) from the Atlantic Forest, Brazil. Journal of Herpetology **41**: 566–580.
- Vieira, K.S., Arzabe, C., Vieira, W.L.S. (2006): Amphibia, Ceratophryidae, Ceratophryinae, *Ceratophrys joazeirensis*: distribution extension. Check List **2**: 28–29.
- Zaidan, B.F., Leite, F.S.F. (2012): Advertisement call of the rare, explosive breeding caatinga horned frog *Ceratophrys joazeirensis* Mercadal de Barrio, 1986 (Anura, Ceratophryidae). Zootaxa **3540**: 65–66.

The tadpole of *Hypsiboas atlanticus* (Anura, Hylidae) from northeastern Brazil

Filipe A. C. do Nascimento¹, Marcelo G. de Lima^{1,2}, Gabriel O. Skuk^{1,3} & Rafael O. de Sá⁴

1. Setor de Zoologia, Museu de História Natural, Universidade Federal de Alagoas, 57051-090 Maceió, Alagoas, Brazil. (filipe.bio@uol.com.br)
2. Departamento de Zoologia, Universidade Federal de Pernambuco, Programa de Pós-graduação em Biologia Animal, 50670-420, Recife, Pernambuco, Brasil. (delimamg@yahoo.com.br)
3. Setor de Biodiversidade e Ecologia, Instituto de Ciências Biológicas e da Saúde, Universidade Federal de Alagoas, 57010-020 Maceió, Alagoas, Brazil. (gabrielsskuk@terra.com.br)
4. Department of Biology, University of Richmond, Richmond, Virginia 23173, USA. (rdesa@richmond.edu)

ABSTRACT. The tadpole of *Hypsiboas atlanticus* (Caramaschi & Velosa, 1996) is described from the municipality of Maceió, State of Alagoas, Brazil. At stage 36 the larvae have an overall elliptical body in lateral and dorsal views, oral disc anteroventral, spiracular tube sinistral, and labial tooth row formula 2(1,2)/3(1). The oral disc is surrounded, almost completely (anterior medial gap present) by a single row of marginal papillae. Described tadpoles of the *H. punctatus* species group can be differentiated by a combined disc oral features. Additional descriptions of *H. punctatus* (Schneider, 1799) tadpoles from populations throughout South America may be helpful in determining the status of these populations.

KEYWORDS. Amphibia, *Hypsiboas*, larval forms, internal oral anatomy, Atlantic Rain Forest.

RESUMO. O girino de *Hypsiboas atlanticus* (Anura, Hylidae) do nordeste do Brasil. O girino de *Hypsiboas atlanticus* (Caramaschi & Velosa, 1996) é descrito a partir de indivíduos coletados em Maceió, Estado de Alagoas, Brasil. No estágio 36 o corpo é elíptico em vistas lateral e dorsal, o disco oral é anteroventral e o espiráculo é sinistro. A fórmula dental é 2(1,2)/3(1). O disco oral é rodeado por uma única fileira de papilas marginais, ausentes anteriormente. Os girinos do grupo de *H. punctatus* podem ser diferenciados por um conjunto de características do disco oral. Descrições adicionais de girinos de populações de *H. punctatus* (Schneider, 1799) em toda América do Sul poderá ser útil em determinar seus status.

PALAVRAS-CHAVE. Amphibia, *Hypsiboas*, formas larvais, anatomia oral interna, Floresta Atlântica.

The genus *Hypsiboas* Wagler, 1930 was resurrected by FAIVOVICH *et al.* (2005) based on molecular evidence to accommodate all species formerly included in the *Hyla albopunctata*, *H. boans*, *H. geographica*, *H. granosa*, *H. pulchella*, and *H. punctata* species groups, the *H. albomarginata* complex, and several species previously unassigned to any group. KOLENC *et al.* (2008) provided a summary of the main external morphology traits and oral cavity features of *Hypsiboas* tadpoles, including the *H. punctatus* group; however, the study did not provide synapomorphies for the genus *Hypsiboas*. Following FAIVOVICH *et al.* (2005), the former *H. granosa* and *H. punctata* groups form a monophyletic group named *Hypsiboas punctatus* species group: *H. alemani* (Rivero, 1964), *H. atlanticus* (Caramaschi & Velosa, 1996), *H. cinerascens* (Spix, 1824), *H. hobbsi* (Cochran & Goin, 1970), *H. jimenezi* Señaris & Ayarzagüena, 2006, *H. ornaticus* (Noble, 1923), *H. picturatus* (Boulenger, 1899), *H. punctatus* (Schneider, 1799) and *H. sibleszi* (Rivero, 1972) (FAIVOVICH *et al.*, 2005; SEÑARIS & AYARZAGÜENA, 2006).

Hypsiboas punctatus is highly variable in coloration, but predominantly green (DUELLMAN, 1974); it is found in Guyana and Trinidad, in the Amazon Basin of Ecuador, Peru, Bolivia, and Brazil, in the Orinoco Basin of Venezuela and Colombia, at Central Brazil and Chaco areas of Paraguay and Argentina (FROST, 2009). Although DUELLMAN (1974) considered a single species throughout its range and called it *H. punctatus*, the color variability

and extensive geographic distribution of this taxon resulted in a nomenclatorial confusion (see CARAMASCHI & VELOSA, 1996, for names applied to this taxon throughout its range).

Hypsiboas atlanticus was described for the populations from northeastern Brazil, previously referred as *H. punctatus*. This species is closely related to *H. punctatus*, but differs in its larger head and shorter snout, two short and contiguous groups of vomerian teeth (elongated and separated in *H. punctatus*), and approximately circular choanae (elliptical and elongated in *H. punctatus*) (CARAMASCHI & VELOSA, 1996); the species inhabits open flooded areas in the Atlantic Rain Forest from the State of Pernambuco to southern State of Bahia (CARAMASCHI & VELOSA, 1996; SANTOS & CARNAVAL, 2002; SILVANO & PIMENTA, 2002). Herein, we describe the external morphology and the internal oral anatomy of the tadpole of *H. atlanticus* and compared it with the tadpole of *H. punctatus* and with others species of the group with described tadpoles.

MATERIAL AND METHODS

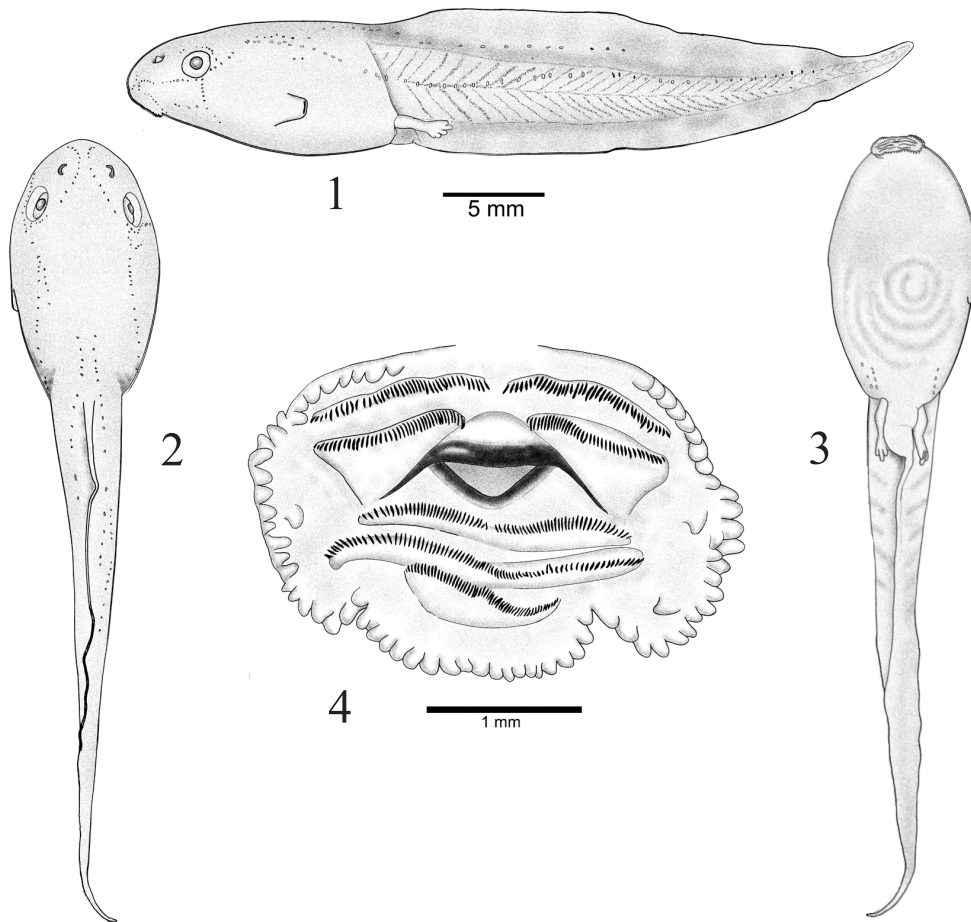
Tadpoles were collected at the Mata do Catolé (9°32'S; 35°47'W), a remnant of Atlantic Rain Forest situated in the municipality of Maceió, State of Alagoas, northeastern Brazil, in August and December 2005, and January and February 2006. The tadpoles were collected with a dip net, carried to the laboratory where they were

anesthetized in 0.1 % chloretone and preserved in 5 % formalin (commercial grade), except two specimens that were kept alive until they reached metamorphosis and compared with adults for species identification. The measurements and remarks on ontogenetic changes were based on 31 tadpoles ranging from stages 27 to 41 (GOSNER, 1960); tadpole description and illustration were based on a specimen at stage 36. Terminology and measurements follow ALTIG (1970) and ALTIG & McDIARMID (1999), with exception of interorbital distance, which was taken between the inner edges of the eyes. All measurements were taken using an ocular micrometer installed on a stereomicroscope, except for total length, height, and width of the body, which were measured with calipers (0.01 mm). For description of internal oral anatomy, one tadpole at stage 36 was dissected for scanning electronic microscope analysis. Specimen was prepared following SÁ *et al.* (2007) and terminology follows WASSERSUG (1976) and WASSERSUG & HEYER (1988). All specimens examined are deposited at the Museu de História Natural, Universidade Federal de Alagoas, Brazil (MUFAL 2969, 3775, 3776, 4755, 6481, 7160).

RESULTS AND DISCUSSION

External morphology. Illustrated tadpole (stage 36, MUFAL 7160, Figs. 1-4) measures (in mm): total length

36.2, body length 13.1, body height 6.3, body width 7.0, tail length 23.1, tail height 7.3, dorsal fin height 2.6, ventral fin height 1.6, tail musculature height 3.7, snout-nostril distance 1.2, internostril distance 2.0, nostril-eye distance 1.1, eye diameter 1.7, interorbital distance 3.5, oral disc width 2.7, spiracle length 1.8, and anal tube length 3.1. Body elliptical in lateral, dorsal, and ventral views, longer than high; maximum body height near the spiracle, maximum width behind of the eyes. In this specimen, body length about 36 % of total length. Snout slightly arched in lateral view, rounded in dorsal and ventral views. Eyes dorsolateral, directed laterally, situated at the end of the first third of body, eyes correspond to about 48.6 % of the interorbital distance and 4.6 % of the body length. Nostrils kidney-shaped, situated halfway between the tip of snout and eyes, internostril distance about 57 % of interorbital distance, external opening directed anterolaterally, the medial rim of the external nares possessing a cutaneous extension (Figs. 5, 6). Spiracle sinistral, lateral, located at the end of the middle third and below the main horizontal axis of the body, with opening directed posteriorly and inner wall present as a slight ridge. Anal tube wide, medial, with a dextral opening, and a skin-fold connecting the body with the ventral fin. Oral disc anteroventral, representing 38.7 % of the body width, with two emarginations on the lower labium. A single row of marginal papillae, with a gap on the upper labium;



Figures 1-4. Tadpole of *Hypsiboas atlanticus* (Caramaschi & Velosa, 1996) (MUFAL 7160) at stage 36 (Gosner, 1960). 1, lateral view; 2, dorsal view; 3, ventral view; 4, oral disc.

scattered submarginal papillae on posterolateral and lateral areas of oral disc. Labial tooth row formula (LTRF) 2(1,2)/3(1). A-1 and A-2 of approximately equal length; A-1 with a short medial gap approximately five teeth wide; A-2 with a medial gap about four times wider than that of A-1. P-1 with a narrow medial gap (two teeth wide). P-1 somewhat smaller than P-2; P-3 about one-third the length of P-2. Jaw sheaths pigmented and finely serrate; upper jaw arch-shaped; lower jaw V-open shaped. Caudal musculature well developed, becoming progressively thinner caudally. Maximum caudal height greater than the body height. Miosepta partially visible. Dorsal fin higher and more curved than ventral fin, beginning behind the body; ventral fin beginning at posterior edge of the body; tail ending narrow and acute. A summary of larval measurements is provided in table I.

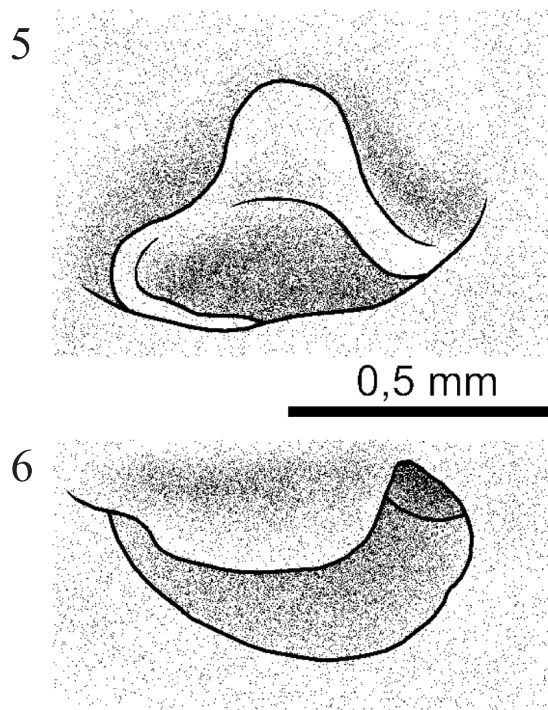
Coloration. In life, dorsum and lateral surfaces of body dark brown; ventral surface appears lighter. Caudal musculature light brown and caudal fins almost transparent; developing limbs and anal tube similar to

body coloration (Fig. 7). Color in preservative is similar to live coloration, except on the ventral surface of the body where the intestine becomes partially visible.

Variation. Variation of tadpole external morphology was observed in the oral disc of one individual, which showed an atypical labial tooth row formula 2(2)/2(1,2) (MUFAL 6481, stage 37).

Remarks. At stage 25 the oral disc already showed the characteristic LTRF whereas by stage 41 only vestiges of P-1 remained visible; the anal tube disappears and the coloration becomes clearer.

Internal oral anatomy. *Hypsiboas atlanticus* has an overall circular roof, with a relatively small prenarial arena. A blunt, rectangular-shaped ridge in the prenarial arena. Nares wide, oriented in an oblique angle (about 45°), placed about one-third way back on the buccal roof (Fig. 8). Anterior edge of each naris with a low narial wall, its rim bearing equally distanced prenarial papillae; posterior narial edge with an extensive, posteriorly convex narial valve; without narial-valve projections. Postnarial arena simple, with pustulations scattered over the entire area (about 25 pustulations); anterior pustulations shorter and gradually increase in size towards the medial ridge; the ones closer to the median ridge could be considered postnarial papillae. Median ridge large, with papillae on the free edge; overall the median ridge has three “peaks” with the medial one being the taller. Lateral ridge papillae single, simple, conical, oriented transversely on each side of the median ridge. Buccal roof arena (BRA) rounded, wide, bounded anteriorly by the median ridge and latero-posteriorly by a row of pustulations forming a wide V-shaped edge. The BRA field is evenly scattered with pustulations. Dorsal velum long, curving gradually towards the midline. Glandular zone present on the edge of the dorsal velum, clearly separated from the BRA by an area without pustulations or glands. Buccal floor overall triangular, broad (Fig. 9). Two pairs of infralabial papillae present, the most anterior pair slightly oblique but almost perpendicular to the transversely oriented second pair. First pair of infralabial papillae deeply forked, with a larger posterior branch. Second infralabial papilla divided into four blunt papillae connected basally. Although not clearly distinct (due to damage during SEM preparation), it seems that four attenuate lingual papillae are present. Buccal floor arena (BFA) U-shaped, with small and medium size pustulations homogenously scattered within the BFA; a few smaller papillae present among these pustulations. Velar surface free, relative short, in a smooth



Figures 5,6. Narial opening of the tadpole of *Hypsiboas atlanticus* (Caramaschi & Velosa, 1996) (MUFAL 7160) at stage 36 (Gosner, 1960). 5, lateral view; 6, dorsal view.

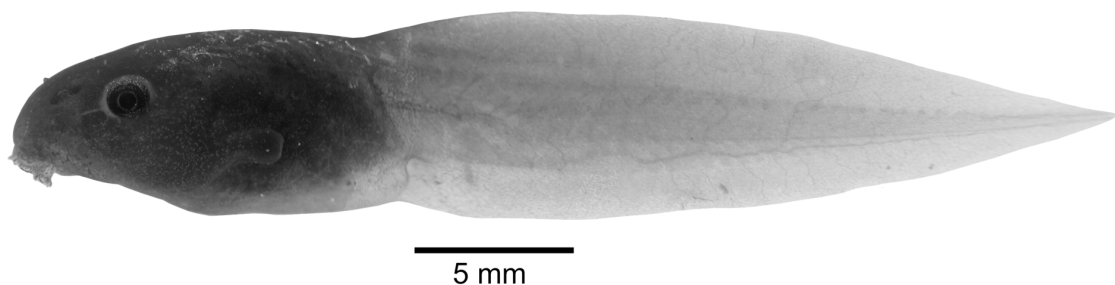
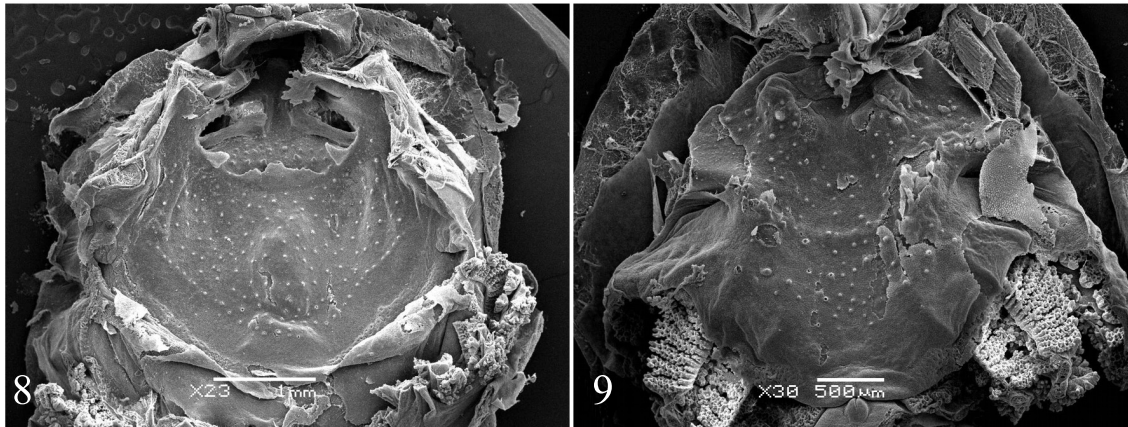


Figure 7. Tadpole of *Hypsiboas atlanticus* (Caramaschi & Velosa, 1996) (MUFAL 7160) at stage 31 (Gosner, 1960).

Table I. Measurements (in mm) of *Hypsiboas atlanticus* (Caramaschi & Velosa, 1996) larvae (mean \pm standard deviation).

Character	Stage 27 (N = 8)	Stage 29 (N = 5)	Stage 34 (N = 2)	Stage 35 (N = 2)	Stage 37 (N = 7)	Stage 40 (N = 4)	Stage 41 (N = 3)
Total length	25.25 \pm 6.72	31.88 \pm 1.47	34.26 \pm 5.24	35.85 \pm 0.86	35.77 \pm 1.99	38.35 \pm 2.48	41.75 \pm 3.10
Body length	8.22 \pm 2.22	10.24 \pm 0.49	10.22 \pm 1.81	11.35 \pm 0.00	10.63 \pm 0.42	11.90 \pm 0.86	12.85 \pm 0.41
Body height	4.13 \pm 1.17	5.03 \pm 0.30	4.38 \pm 0.73	4.56 \pm 0.25	4.41 \pm 0.76	4.31 \pm 0.90	5.06 \pm 0.61
Body width	5.13 \pm 1.47	6.42 \pm 0.47	5.94 \pm 0.53	6.29 \pm 0.32	6.13 \pm 0.24	6.60 \pm 0.94	7.17 \pm 0.71
Tail length	17.03 \pm 4.53	21.64 \pm 1.28	24.04 \pm 3.43	24.49 \pm 0.85	25.13 \pm 1.95	26.45 \pm 2.55	28.89 \pm 2.70
Tail height	4.85 \pm 1.18	6.32 \pm 0.26	6.30 \pm 1.41	6.68 \pm 0.45	6.01 \pm 0.69	6.40 \pm 1.00	6.63 \pm 1.43
Dorsal fin height	1.75 \pm 0.43	2.24 \pm 0.18	1.95 \pm 0.64	2.15 \pm 0.07	1.81 \pm 0.21	2.10 \pm 0.42	1.90 \pm 0.60
Ventral fin height	1.35 \pm 0.42	1.70 \pm 0.16	1.30 \pm 0.42	1.50 \pm 0.14	1.20 \pm 0.18	1.22 \pm 0.40	1.33 \pm 0.45
Tail musculature height	2.48 \pm 0.69	2.88 \pm 0.22	3.30 \pm 0.42	3.50 \pm 0.14	3.13 \pm 0.48	3.35 \pm 0.67	3.70 \pm 0.17
Snout-nostril distance	1.04 \pm 0.27	1.24 \pm 0.13	1.60 \pm 0.28	1.45 \pm 0.07	1.51 \pm 0.12	1.55 \pm 0.12	1.40 \pm 0.17
Internostril distance	1.41 \pm 0.33	1.70 \pm 0.10	1.75 \pm 0.35	1.90 \pm 0.14	1.77 \pm 0.24	1.82 \pm 0.18	1.37 \pm 0.30
Nostril-eye distance	0.76 \pm 0.24	0.98 \pm 0.09	0.80 \pm 0.14	0.95 \pm 0.07	0.86 \pm 0.09	0.85 \pm 0.12	1.20 \pm 0.00
Eye diameter	0.98 \pm 0.23	1.26 \pm 0.09	1.45 \pm 0.07	1.50 \pm 0.00	1.60 \pm 0.08	1.80 \pm 0.08	1.87 \pm 0.25
Interorbital distance	2.37 \pm 0.51	3.10 \pm 0.10	3.15 \pm 0.49	3.20 \pm 0.14	3.38 \pm 0.17	3.57 \pm 0.17	3.67 \pm 0.23
Oral disc width	1.90 \pm 0.38	2.36 \pm 0.15	2.20 \pm 0.42	2.45 \pm 0.21	2.34 \pm 0.13	2.60 \pm 0.29	2.47 \pm 0.35
Spiracle length	1.00 \pm 0.32	1.12 \pm 0.11	1.35 \pm 0.21	1.25 \pm 0.07	1.23 \pm 0.38	1.35 \pm 0.19	0.67 \pm 0.25
Anal tube length	1.68 \pm 0.65	2.06 \pm 0.35	1.55 \pm 0.21	1.30 \pm 0.28	1.58 \pm 0.48	1.10 \pm 0.29	-----

Figures 8,9. Internal oral anatomy of the tadpole of *Hypsiboas atlanticus* (Caramaschi & Velosa, 1996) (MUFAL 7160) at stage 36 (Gosner, 1960), scanning electron photograph: 8, buccal roof; 9, buccal floor.

posterior margin. Median notch barely noticeable, secretory pits present, not extensive, mostly limited to posterolateral edges. Gill filters of moderate size with an average filter mesh.

Habits and habitat. The tadpoles of *Hypsiboas atlanticus* were found at the edge of the forest, in two sites, one of them formed by small puddles of water approximately one square meter and 0.2 m deep; the other site was a rain-filled puddle with a diameter about five square meters and 0.5 m in depth. At both sites the water was clear with a lot of sediment on the bottom and dense semi-aquatic vegetation. The tadpoles are benthonic, have cryptic coloration, and do not form aggregations.

The larvae of five of the nine species of the *Hypsiboas punctatus* group have been previously described: *H. alemani* (MIJARES-URRUTIA, 1992), *H. cinerascens* (DUELLMAN, 1978 (from Ecuador); HERO, 1990 (from Amazonas, Brazil); MIJARES-URRUTIA, 1993 (from Venezuela)), *H. jimenezi* (MYERS & DONNELLY, 2008), *H. punctatus* (KENNY, 1969 (from Trinidad); DUELLMAN, 1978 (from Ecuador); HOOGMOED, 1979 (from Suriname)), and *H.*

sibleszi (HOOGMOED, 1979). The tadpole of *H. punctatus rubrolineatus* Brusquetti & Lavilla, 2006 was described and recognized as a valid taxon based on LTRF differences (KOLENC *et al.*, 2008). A summary of larval characteristics for tadpoles of *H. punctatus* group is given in table II. The external larval morphology of the *H. punctatus* group is similar and resembles that of a generalist type larvae (ALTIG & JOHNSTON, 1989). These characteristics include: body depressed in lateral view, caudal musculature not strongly marked, low caudal fins, and eyes dorsolaterally located, agree with the ecomorphological guild of benthic tadpoles that live in lentic environments. The only exceptions known would be *H. punctatus* from Ecuador, that was reported to have laterally positioned eyes (DUELLMAN, 1978), *H. sibleszi*, which was reported to inhabit lotic environments (“... the majority was calling from leaves and twigs above the water of slow flowing creeks...,” HOOGMOED, 1979) and *H. punctatus* from Trinidad that was found in both habitats (KENNY, 1969).

Hypsiboas atlanticus, *H. alemani*, and *H. sibleszi* have a wide anal tube, formed by a skin-fold connecting

Table II. Comparison of larval characters among species in the *Hypsiboas punctatus* group. Characters followed by the word "supposition" in parentheses were inferred from the illustrations, but not stated in the text by the authors. (ª, MIJARES-URRUTIA (1992); º, This study; ¸, MIJARES-URRUTIA (1993); ¸, DUELLMAN (1978); ¸, HERO (1990); ¸, MYERS & DONNELLY (2008); ¸, KENNY (1969); ¸, DUELLMAN (1978); ¸, HOOGMOED (1979); ¸, KOLENC *et al.* (2008); ¸, HOOGMOED (1979)).

Species	Eyes	Cutaneous flap in nares	Skin-fold on the anal tube	Orientation of the oral disc/presence of submarginal papillae	Labial tooth row formula	Habitats types
<i>H. alemani</i> ^ª (Rivero, 1964)	Dorsolateral	Yes	Yes	Ventral/no	2(1-2)/4	Pond
<i>H. atlanticus</i> ^º (Caramaschi & Velosa, 1996)	Dorsolateral	Yes	Yes	Anteroventral/yes	2(1,2)/3(1)	Pond
<i>H. cinerascens</i> [¸] (Spix, 1824)	Dorsolateral	Yes	?	Ventral/no	2(2)/4(1)	?
<i>H. cinerascens</i> [¸]	Dorsolateral	?	?	Anteroventral/?	1(1)/2	Pond
<i>H. cinerascens</i> [¸]	Dorsolateral	Yes	?	Ventral (supposition)/ no (supposition)	2(1,2)/3- 4(1)[2]	Pond and streamside pond
<i>H. jimenezi</i> [¸] (Señaris & Ayarzagüena, 2006)	Dorsolateral	Yes (supposition)	?	Ventral/yes	2/4; 3/4; 2/5; 3/5	Pond
<i>H. punctatus</i> [¸] (Schneider, 1799)	Dorsolateral	Yes	?	Anteroventral (supposition)/ no (supposition)	2(2)/3	Pond and stream
<i>H. punctatus</i> ^º	Lateral	?	?	Anteroventral/?	2(2)/3	Pond
<i>H. punctatus</i> [¸]	Dorsolateral	Yes	?	Anteroventral (supposition)/ no (supposition)	2(1,2)/3(1)	Pond
<i>H. punctatus rubrolineatus</i> [¸] (Brusquetti & Lavilla, 2006)	Dorsolateral	Yes	?	Ventral/yes	2(2)/4(1)	?
<i>H. sibleszi</i> [¸] (Rivero, 1972)	Dorsolateral	Yes	Yes	Ventral (supposition)/ no (supposition)	2(2)/5(1)	Stream

the body and the ventral fin; there is no comparative information about this character in other species of the group. The oral disc of *H. atlanticus*, *H. cinerascens* (from Ecuador) and *H. punctatus* have anteroventrally oral discs (ventrally in the others species), these differences can be correlated with habitat and feeding mechanics (ALTIG & MCDIARMID, 1999). Only *H. cinerascens* from Venezuela and *H. jimenezi* have a double row of marginal papillae (single row in the others species), submarginal papillae were reported for *H. atlanticus*, *H. jimenezi*, and *H. punctatus rubrolineatus* (absent in the others species). All tadpoles of the *H. punctatus* species group can be differentiated by a combination of oral disc features (i.e., LTRF, number of rows of marginal papillae, and presence/absence of submarginal papillae (Tab. II); *H. atlanticus* and *H. punctatus* from Suriname are differentiated from each other by the presence and absence of submarginal papillae, respectively. All species in the group possesses a projection on the medial rim of the external nares (except that this character has not been reported in *H. punctatus* and *H. cinerascens* from Ecuador) as previously reported for other species of the tribe Cophomantini (e.g., *H. albomarginatus* (Spix, 1824), *Aplastodiscus albosignatus* (Lutz & Lutz, 1924), and *A. albobrenatus* (Lutz, 1924), PEIXOTO & CRUZ, 1983). This extension may function as an external narial valve and may regulate or direct water current. This character needs further evaluation before it can be considered a synapomorphy for the tribe (FAIVOVICH *et al.*, 2005)

The anatomy of the oral cavity was described for only two species of the *Hypsiboas punctatus* species group: *H. cinerascens* (HEURSEL & HADDAD, 2007) and *H. punctatus rubrolineatus* (KOLENC *et al.*, 2008). *Hypsiboas*

atlanticus seems to have two pair of lingual papillae, whereas *Hypsiboas cinerascens* and *H. punctatus rubrolineatus* were reported to have one pair of lingual papillae. *Hypsiboas p. rubrolineatus* has seven projections on the lateral ridge papillae whereas those of *H. cinerascens* were reported to have rugose margins; in *H. atlanticus* they are simple and conical. The presence of a high square-shaped median ridge with undulations on the ends, with lateral borders free of serrations, and one short papilla at each side of the base was considered diagnostic for the *H. punctatus* species group (KOLENC *et al.*, 2008). In *H. atlanticus* the median ridge is large but not tall, with papillae on its free edge, and a lateral border free of serrations only on the base. There are no papillae at the each side of the base. Tadpoles of the tribe Cophomantini possess a buccal roof with vacuities anterior to the internal nares (HEURSEL & HADDAD, 2007), this character was suggested as a synapomorphy of the tribe (FAIVOVICH *et al.*, 2005); the presence or absence could not be assessed in *H. atlanticus*.

NAPOLI & CRUZ (2005) described the advertisement call of *Hypsiboas atlanticus* from Bahia (northeastern Brazil) and compared it with reported advertisement call of *H. punctatus* from other populations in South America concluding that: the calls of *H. atlanticus* and *H. punctatus* from Manaus (Amazonas, Brazil; HÖDL, 1977), Santa Cecilia (Ecuador, DUELLMAN, 1978), and Puerto Almacén (Bolivia; MÁRQUEZ *et al.*, 1993) are similar, which does not support *H. atlanticus* as a valid species, and analyses of the call of *H. punctatus* from Bolivia and French Guiana (MARTY & GAUCHER, 1999; MÁRQUEZ *et al.*, 2002; recordings commercially available) and one from Maranhão (Brazil; recorded by G. V. Andrade, pers. comm.)

indicated the presence of at least three distinct species: *H. atlanticus* in Bahia, Brazil, *H. punctatus* in northern South America, and a potential undescribed third species occurring in Bolivia, Acre (Brazil) and the Chaco of Argentina. The present description of the tadpole of *H. atlanticus* provides additional support to the validity of this taxon.

Recently, *H. punctatus* was found to occur in the Atlantic Rain Forest from Southeastern and Northeastern Brazil (VASCONCELOS *et al.*, 2006), the same biome of *H. atlanticus*. Additional descriptions and illustrations of *H. punctatus* tadpoles and calls analyses from populations throughout South America are needed and may be helpful in determining the status of these populations.

Acknowledgments. We thank Ulysses Caramaschi (MNRJ) and an anonymous reviewer for helpful contributions on the manuscript; José A. Langone (MNH) assisted us with relevant literature. This work was supported by Fundação de Amparo à Pesquisa do Estado de Alagoas (FAPEAL) (proc. 2002.08.110-02 and 2004.04.29864-02). RdS was supported by NSF award 0342918.

REFERENCES

- ALTIG, R. 1970. A key to the tadpoles of the continental United States and Canada. *Herpetologica* **26**(2):180-207.
- ALTIG, R. & JOHNSTON, G. F. 1989. Guilds of anuran larvae: relationships among developmental modes, morphologies, and habitats. *Herpetological Monographs* **3**:81-109.
- ALTIG, R. & McDIARMID, R. W. 1999. Body plan: development and morphology. In: McDIARMID, R. W. & ALTIG, R. eds. *Tadpoles: The Biology of Anuran Larvae*. Chicago, University of Chicago. p.24-51.
- CARAMASCHI, U. & VELOSA, A. 1996. Nova espécie de *Hyla* Laurenti, 1768 do leste brasileiro (Amphibia, Anura, Hylidae). *Boletim do Museu Nacional, Nova Série, Zoologia* (365):1-7.
- DUCELLMAN, W. E. 1974. A reassessment of the taxonomic status of some neotropical frogs. *Occasional Papers of the Museum of Natural History, University of Kansas* **27**:1-27.
- _____. 1978. The biology of an equatorial herpetofauna in Amazonian Ecuador. *Miscellaneous Publication, University of Kansas* **65**:1-352.
- FAIVOVICH, J.; HADDAD, C. F. B.; GARCIA, P. A.; FROST, D. R.; CAMPBELL, J. A. & WHEELER, W. C. 2005. Systematic review of the frog family Hylidae, with special reference to Hylinae: phylogenetic analysis and taxonomic revision. *Bulletin of the American Museum of Natural History* **294**:1-240.
- FROST, D. R. 2009. *Amphibian Species of the World: an Online Reference. Version 5.3*. American Museum of Natural History. Available at: <<http://research.amnh.org/herpetology/amphibia/index.php>>. Access on: 05.12.2009.
- GOSNER, K. L. 1960. A simplified table for staging anuran embryos and larvae with notes on identification. *Herpetologica* **16**(3):183-190.
- HERO, J. M. 1990. An illustrated key to tadpoles occurring in the Central Amazon rainforest, Manaus, Amazonas, Brazil. *Amazoniana* **11**:201-262.
- HEURSEL, A. D' & HADDAD, C. F. B. 2007. Anatomy of the oral cavity of Hylid larvae from the genera *Aplastodiscus*, *Bokermannohyla*, and *Hypsiboas* (Amphibia, Anura): description and systematic implications. *Journal of Herpetology* **41**:458-468.
- HÖLD, W. 1977. Call differences and calling site segregation in anuran species from Central Amazonian floating meadows. *Oecologia* **28**:351-363.
- HOOGMOED, M. S. 1979. Resurrection of *Hyla ornatissima* Noble (Amphibia: Hylidae) and remarks on related species of green tree frogs from the Guiana area. Notes of the herpetofauna of Suriname VI. *Zoologische Verhandlungen* **172**:1-46.
- KENNY, J. S. 1969. The Amphibia of Trinidad. *Studies of the Fauna of Curaçao and other Caribbean Islands* **108**:1-78.
- KOLENC, F.; BORTEIRO, C.; ALCALDE, L.; BALDO, D.; CARDOZO, D. & FAIVOVICH, J. 2008. Comparative larval morphology of eight species of *Hypsiboas* Wagler (Amphibia, Anura, Hylidae) from Argentina and Uruguay, with a review of the larvae of this genus. *Zootaxa* **1927**:1-66.
- MÁRQUEZ, R.; RIVA, I. DE LA & BOSCH, J. 1993. Advertisement calls of Bolivian species of *Hyla* (Amphibia, Anura, Hylidae). *Biotropica* **25**(4):426-443.
- MÁRQUEZ, R.; RIVA, I. DE LA; BOSCH, J. & MATHEU, E. eds. 2002. *Sounds of frogs and toads of Bolivia*. Barcelona, Alosa. (CD-ROM).
- MARTY, C. & GAUCHER, P. 1999. *Sound guide to the tailless amphibians of French Guiana*. Paris, Centre Bioacoustique (CD-ROM).
- MIJARES-URRUTIA, A. E. M. 1992. Sobre el renacuajo de *Hyla alemanni* Rivero (Anura: Hylidae). *Acta Biologica Venezuelica* **13**(3-4):35-39.
- _____. 1993. The tadpole of *Hyla granosa* (Anura: Hylidae) from southeastern Venezuela. *Revista Chilena de Historia Natural* **66**:143-147.
- MYERS, C. W. & DONNELLY, M. A. 2008. The summit herpetofauna of Auyantepui, Venezuela: report from the Robert G. Golet American Museum-Terramar Expedition. *Bulletin of the American Museum of Natural History* **308**:1-147.
- NAPOLI, M. F. & CRUZ, I. C. S. 2005. The advertisement call of *Hyla atlantica* Caramaschi & Velosa, 1996, with considerations on its taxonomic status (Amphibia, Anura, Hylidae). *Arquivos do Museu Nacional* **63**(2):283-288.
- PEIXOTO, O. L. & CRUZ, C. A. G. 1983. Girinos de espécies de *Hyla* do grupo "albomarginata" do sudeste brasileiro (Amphibia, Anura, Hylidae). *Arquivos da Universidade Federal Rural do Rio de Janeiro* **6**(2):155-163.
- SÁ, R. O. DE; LANGONE, J. A. & SEGALLA, M. V. 2007. The tadpole of *Leptodactylus notoaktites* Heyer, 1978 (Anura, Leptodactylidae). *South American Journal of Herpetology* **2**(1):69-75.
- SANTOS, E. M. & CARNAVAL, A. C. O. Q. 2002. Anfíbios anuros do Estado de Pernambuco. In: TABARELLI, M. & SILVA, J. M. C. eds. *Diagnóstico da Biodiversidade de Pernambuco*. Recife, SECTMA/Massangana. p.529-536.
- SEÑARIS, C. J. & AYARZAGÜENA, J. 2006. A new species of *Hypsiboas* (Amphibia; Anura; Hylidae) from the Venezuelan Guayana, with notes on *Hypsiboas sibleszi* (Rivero 1972). *Herpetologica* **62**:308-318.
- SILVANO, D. & PIMENTA, B. V. S. 2002. *Hyla atlantica*. *Herpetological Review* **33**(3):145.
- VASCONCELOS, T. S.; SANTOS, T. G. & HADDAD, C. F. B. 2006. Amphibia, Anura, Hylidae, *Hypsiboas punctatus*: distribution extension and filling distribution gaps. *Check List* **2**(2):61,62.
- WASSERSUG, R. J. 1976. Oral morphology of anuran larvae: terminology and general description. *Occasional Papers of the Museum of Natural History, University of Kansas* **48**:1-23.
- WASSERSUG, R. J. & HEYER, W. R. 1988. A survey of internal oral features of leptodactyloid larvae (Amphibia: Anura). *Smithsonian Contributions to Zoology* **457**:1-99.

ter – Fredrick and Amye Geier Research and Collections Center, 1301 Western Avenue, Cincinnati, Ohio 45203-1130, USA (e-mail: anura@fuse.net); and **DONNA S. MCCOLLUM**, School of Interdisciplinary Studies, Miami University, Oxford, Ohio 45056, USA (e-mail: mccollds@muohio.edu).

HYSIBOAS FREICANECAE (NCN). BRAZIL: ALAGOAS: Murici, Fazenda Bananeiras (09°13'S, 35°52'W). 14–18 November 2005. Museu Nacional, Universidade Federal do Rio de Janeiro, Brazil (MNRJ 40896–40900). Verified by U. Caramaschi. Previously known only for the type locality: Municipality of Jaqueira, Pernambuco, Brazil (Carnaval and Peixoto 2004. *Herpetologica* 60[3]:387–395). First state record, extends southern range ca. 56 km airline from the type locality.

Submitted by **MONICA C. S. CARDOSO** (e-mail: monicardoso@click21.com.br) and **CARLOS ALBERTO G. CRUZ** (e-mail: cagcruz@uol.com.br), Departamento de Vertebrados, Museu Nacional/UFRJ, Quinta da Boa Vista, 20940-040 Rio de Janeiro, RJ, Brazil; **MARCELO G. DE LIMA** (e-mail: delima@graffiti.net) and **GABRIEL SKUK** Departamento de Zoologia, Universidade Federal de Alagoas, Praça Afrânio Jorge, 57072-970, Maceió, AL, Brazil (e-mail: gabrielskuk@aol.com).

PSEUDACRIS CRUCIFER (Spring Peeper). USA: ILLINOIS: McDONOUGH Co.: Campus of Western Illinois University, Macomb, Illinois in an ephemeral pool, ca. 50 m from a branch of the Lamoine River (N 0695928 and W 4482919, zone 15 using NAD27 CONUS map datum in UTM's). 31 March 2006. James T. Lamer and John K. Tucker. Illinois Natural History Survey in Champaign/Urbana, Illinois (INHS 19979–80). Verified by Chris Phillips. Specimens are first county records (Phillips 1999. *Field Guide to Amphibians and Reptiles of Illinois*). The frogs were found in amplexus at an air temperature of 10°C at 2322 h. Both *P. triseriata* and *P. crucifer* were calling from this site.

Submitted by **JAMES T. LAMER**, **JOHN K. TUCKER**, and **CHAD R. DOLAN**, Illinois Natural History Survey, 8450 Montclair Ave, Brighton, Illinois 62012, USA.

PSEUDACRIS CRUCIFER (Spring Peeper). USA: ILLINOIS: PIKE Co.: Illinois Rt. 104, E of Meredosia, Illinois (N 0700965 and W 4410073, zone 15 using NAD27 CONUS map datum in UTM's). 30 March 2006, 2339 h, during a slow, steady rain. James T. Lamer, John K. Tucker, and Chad R. Dolan. Illinois Natural History Survey in Champaign/Urbana (INHS 19978). Verified by Chris Phillips. Specimen is a first county record (Phillips 1999. *Field Guide to Amphibians and Reptiles of Illinois*).

Submitted by **JAMES T. LAMER**, **CHAD R. DOLAN**, and **JOHN K. TUCKER**, Illinois Natural History Survey, 8450 Montclair Ave, Brighton, Illinois 62012, USA.

PHYLLODYTES LUTEOLUS. BRAZIL: RIO DE JANEIRO: MUNICIPALITY OF SÃO JOÃO DA BARRA: Grussaí (21°44'S, 41°02'W). 8–10 November 1999. F. H. Hatano, C. F. D. Rocha, and D. Vrcibradic. Museu Nacional, Rio de Janeiro (MNRJ 42416–19). Verified by José P. Pombal Jr and Mônica C. S. Cardoso. Individuals were collected in restinga habitat, inside ground bromeliads. The species appeared to be locally abundant, as numerous individuals were heard calling from inside bromeliads. *Phyllodytes*

luteolus is reported to occur from the states of Paraíba to Espírito Santo (Frost 2004. *Amphibian Species of the World: An Online Reference*. Version 3.0, <http://research.amnh.org/herpetology/amphibia/index.html>). First record for the state of Rio de Janeiro and southernmost record for the species (and for the genus as well), extending its distribution ca. 125 km to the southwest of Guarapari, in the state of Espírito Santo, the previous southernmost reported locality (Bokermann 1966. *An. Acad. Bras. Ciênc.* 38:335–344; Peixoto and Cruz 1988. *Rev. Brasil. Biol.* 48:265–272).

Submitted by **DAVOR VRCIBRADIC**, **FÁBIO H. HATANO**, **CARLOS FREDERICO D. ROCHA**, and **MONIQUE VAN SLUYS**, Departamento de Ecologia, Universidade do Estado do Rio de Janeiro, 20550-011, Rio de Janeiro, RJ, Brazil.

RANA AREOLATA (Crawfish Frog). USA: ILLINOIS: FRANKLIN Co.: DOR, Fitzgerald Park road within Wayne Fitzgerald State Park (N 0330390 and W 4219034, zone 16 using NAD27 CONUS map datum in UTM's). 9 March 2006. Chad R. Dolan and James T. Lamer. Illinois Natural History Survey in Champaign/Urbana, Illinois (INHS 20030). Verified by Chris Phillips. First county record (Phillips 1999. *Field Guide to Amphibians and Reptiles of Illinois*). This frog and several conspecifics were found dead on the road during heavy rainfall at 13.9°C air temperature at 0249 h. No *Rana areolata* were heard calling, only large choruses of Western Chorus Frogs (*Pseudacris triseriata*).

Submitted by **CHAD R. DOLAN**, **JAMES T. LAMER**, and **JOHN K. TUCKER**, Illinois Natural History Survey, 8450 Montclair Ave, Brighton, Illinois 62012, USA.

RANA CAPITO AESOPUS (Florida Gopher Frog). USA: FLORIDA: GILCHRIST Co.: Ft. White Mitigation Park (29°54.94'N, 82°46.88'W). November 2005. Florida Museum of Natural History (UF 145525, photo voucher). Verified by K. L. Krysko. New county record. Near mouth of active Gopher Tortoise (*Gopherus polyphemus*) burrow in sandhill habitat.

Submitted by **MELISSA P. TUCKER** and **CATHY R. HANDRICK**, Florida Fish and Wildlife Conservation Commission, 3377 East U.S. Highway 90, Lake City, Florida 32055, USA (e-mail: cathy.handrick@myfwc.com).

RANA CATESBEIANA (American Bullfrog). USA: TEXAS: MADISON Co.: 9.12 road km N FM 1696 on TX 90 (30°51'24.5"N; 95°56'38.8"W). 3 May 2006. Toby J. Hibbitts and David Laurencio. Verified by James R. Dixon. Texas Cooperative Wildlife Collections, TCWC 90924. New county record (Dixon 2000. *Amphibians and Reptiles of Texas*. Second Ed. Univ. of Texas A&M Press, viii + 421 pp.).

Submitted by **TOBY J. HIBBITTS** and **DAVID LAURENCIO**, Texas Cooperative Wildlife Collections, Department of Wildlife and Fisheries Sciences, Texas A&M University, 2258 Tamu, College Station, Texas 77843-2258, USA (e-mail: thibbitts@tamu.edu).

RANA PALUSTRIS (Pickerel Frog). USA: TENNESSEE: HARDIN Co.: Stream within Jerrolds Cave (Tennessee Cave Survey Num. HR15) (35°12'26"N, 87°59'24"W). 2 July 2006. Matthew L. Niemiller and Brian T. Miller. Verified by Vincent A. Cobb. Herpetology Collection at Middle Tennessee State University (MTSU)