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Amphibians from southeastern state of Pará: Carajás Region, northern Brazil

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Abstract: The region of Carajás in the southeast of the state of Pará, Brazil, harbors five reserves, with various managing categories, distributed throughout five municipalities. A list of amphibians known to occur in this region was compiled using information on the specimens deposited in the herpetological collection of the Goeldi Museum, collected during the past four decades (1969 - 2010). According to the available metadata, the species were tabulated in three environments: ombrophylous forest (rainforest), metalophic savanna (MS) and anthropic areas (AA - secondary forest - disturbed areas), resulting in 13 families and 71 species (66 anurans and 5 Gymnophiona). Ombrophylous forest has 50 species, anthropic areas has 49 species, while metalophic savanna has 38 species of anuran.

Introduction

Most of the 946 species of amphibians presently known to occur in Brazil (SBH 2012) were recorded in the last 40 years (Silvano and Segalla 2005) and approximately 250 of these species occur in the Brazilian Amazonia (Frost 2009). The description of new species in a regular basis is a strong indicator that this number may increase. However, species composition and richness data for Amazonian amphibians is still unknown for several localities (Azevedo-Ramos and Galatti 2002).

Although Amazon as a whole holds the largest diversity of amphibians in the world, the knowledge on the ecological and biogeographical factors affecting the local diversity is still limited, depending mainly on inventories with standardized collecting efforts. Most published inventories reported sampling efforts of less than two months, and were carried out on forested areas, neglecting areas of difficult access that harbor a variety of phytophysiognomies (Azevedo-Ramos and Galatti 2002). Besides, several studies as well as important data stored in collections were either not published yet or were so in non-indexed literature (Silvano and Segalla 2005). It is widely recognized that taxonomic collections are important tools to generate species lists (Shaffer *et al.* 1998), providing fundamental insights towards the understanding of biodiversity and biogeography that will ultimately allow the development of adequate conservation strategies (Haddad 1998).

The region of Carajás has five official reserves, holding two main kinds of vegetation, ombrophylous forest (dense or open) and metalophylous savanna (Amazonian savanna - composed mainly by herbs and shrubs restricted to iron ore outcrops). Several samplings of amphibians have been conducted in this region since 1969. Most of the vouchers and associated information produced by those inventories are deposited in the herpetological collection of Museu Paraense Emílio Goeldi (Emílio Goeldi Museum). Valuable information on the region is also available in unpublished documents, such as environmental assessments elaborated for mining projects permits. More recently, one book chapter was published about the amphibian species of one reserve in the region (Neckel-Oliveira *et al*. 2012). Here we report an updated list of amphibian species from the Carajás region and its surroundings in the southeast state of Pará, together with a classification of the habitats where they were collected.

Materials and Methods

The records in this study were based in the data from the herpetological collection of the Museu Paraense Emílio Goeldi (MPEG), with the exception of one species of Gymnophiona (only recorded in the collection of the Museum of Zoology, University of São Paulo-MZUSP) (Maciel and Hoogmoed 2011). To avoid misidentification issues, we checked the taxonomic identification of at least one individual per sample (i.e. species per locality). This scientific collection presents a great representation of samples from the studied region, resulting from sampling efforts conducted by several researchers during the last four decades. The region of Carajás is composed by a system of reserves from different managing categories: Carajás National Forest, Tapirapé-Aquirí National Forest, Itacaiúnas National Forest, Tapirapé Biological Reservation and "Igarapé Gelado" Environmental Protection Area (Figure 1). Together, these reserves comprise more than 1.31 million hectares (including the Xikrin Cateté Indian Reservation, integrated into Carajás region, but that not taken into account in our study).

This region is bounded in the north by the Tapirapé Biological Reservation (05°30' S, 50°16' W) and in the

south by the Carajás National Forest (05°52' - 06°33' S, 49°53' - 50°45' W) (Figure 1). This conservation system spreads along six municipalities (Marabá, Parauapebas, Canaã dos Carajás, Água Azul do Norte, São Félix do Xingu and Curionópolis (surrounding area), allowing effective landscape and biodiversity conservation through protection against land invasion, hunting, non-planned mining, illegal logging, and forest fire (Rolim *et al*. 2006). However, it is recognized that cattle raising and large-scale mining activities have been increasing the deforestation pressure in the last few years (Reis 1996; Monteiro 2005).

According to data obtained from meteorological stations located in Carajás and Tapirapé-Aquirí National Forest, the region's weather is classified as Aw - humid tropical with dry winters and average precipitation of 60 mm in the driest month (IBAMA 2004). There are two distinct seasons, a rainy season from November to April, with average precipitation of 248 mm (70% of the year's total) and a dry season, between June and September, with average precipitation of 32 mm (7% of the year's total). During the transition months (May and October) the average precipitation reaches 23% of the year's total (IBAMA 2004). The study area presents three predominant phytophysiognomies, dense and open Ombrophylous Forest (OF) and the Metalophic Savanna (MS) (known regionally as "Canga"). The canga is a non-forest, open formation that grows directly from outcrops of iron ore, being restricted to the top of hills whose average plateau surface is 650 m (Silva *et al.* 1986). Besides these three main vegetation formations, there are large areas covered with secondary vegetation, pastures, forest fragments and other anthropic landscapes, mainly in the lowlands on the surroundings of the conservation unities, here referred to as Anthropic Areas (AA).

To describe the amphibian assemblage spatial distribution at a local scale, we tabulated each recorded species according the three main habitat types occurring in Carajás region: ombrophylous forest, metalophic savanna and anthropic areas. This categorization was made using the data extracted from the labels of the specimens deposited in MPEG and updated vegetation charts of the region. Unfortunately, it was not possible to differentiate between open and dense rain forest. Additionally, this separation was made only to facilitate comparisons with other localities of the forest and savannah.

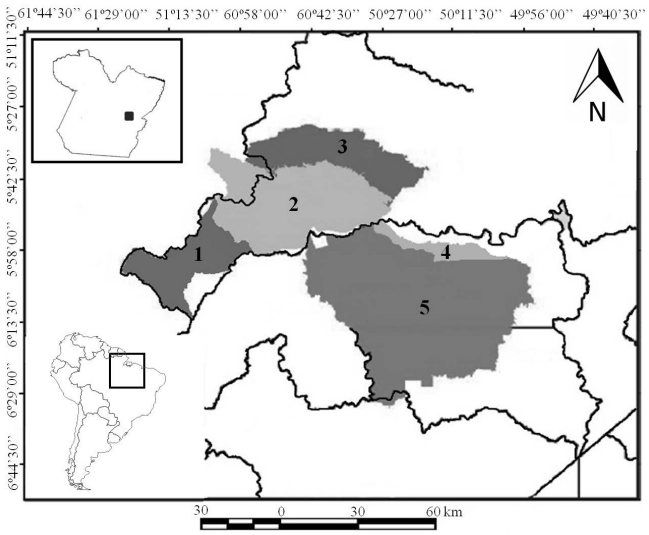

Figure 1. Study area in the region of Carajás, Pará, 1. Itacaiúnas National Forest, 2. Tapirapé-Aquirí National Forest, 3. Tapirapé-Aquirí Biological Reservation, 4. "Igarapé Gelado" Environmental Protection Area, 5. Carajás National Forest.

Results and discussion

Based on the museum records we compiled, there are 71 amphibian species in the Carajás region (Table 1), with 66 Anura and five Gymnophiona, distributed in 13 families: Aromobatidae (n=2), Bufonidae (n=6), Centrolenidae (n=2), Ceratophryidae (n=1), Cycloramphidae (n=1), Dendrobatidae (n=3), Hylidae (n=28), Leiuperidae (n=5), Leptodactylidae (n=11), Microhylidae (n=3), Pipidae (n=2), Strabomantidae (n=2) e Caeciliidae (n=5). The majority of the records were from Tapirapé-Aquiri (24, 86%) and Carajás National Forest (24, 93%), where the inventories were concentrated in the last decades (Table 1).

Comparisons among different regions may raise several methodological problems, including intrinsic differences between areas, differences in the size of the areas, distances among rivers and differential sampling efforts (Duellman and Thomas 1996; Martins and Oliveira 1998). This kind of comparison is especially troubling in Carajás region since there are differences even among areas of ombrophylous vegetation (Silva *et al.* 1986). The present contribution represents the first step towards characterizing the amphibian species composition in different natural phytophysiognomies present in the study area, also depicting an effort to understand how the species are responding to the environmental modifications, as suggested by its presence or putative absence in anthropic areas. The extreme differences between the vegetation types encountered in the ombrophylous forest and the canga are a reflection of even more extreme abiotic differences. For example, metalophic savanna areas are located in more elevated sites, with shallow soils, suffering high levels of insolation and hydric stress (Almeida 1986). The characteristics found in each environment will be determinant in the presence or absence of amphibian species.

For amphibians, differences observed in species composition in different environments can be strongly related to variations in the microhabitat availability (Tocher 1998), hydric resources (Zimmerman and Bierregaard 1986), temperature and moisture gradients (Vonesh 2001; Haddad and Prado 2005), vegetation structural complexity (*e.g.* Inger and Colwell 1977; Heinen 1992; Tocher 1998; Pawar *et al*. 2004; Souza *et al*. 2008), edaphic factors (Menin *et al*. 2007) and altitude (Fauth *et al.* 1989). However, more research is necessary to understand how these environmental factors intervene in the diversity and distribution of amphibian communities.

Fifty amphibian species were recorded in the ombrophylous forest areas, nine of which were exclusive of this vegetation type. Typically, forested areas present high species richness, which could be attributed to the high environmental heterogeneity of these sites, as observed for other animals (*e.g.* Pianka 1967, Tews *et al.* 2004, Keller *et al.* 2009, Silva *et al*. 2011). This vegetation type holds more microhabitat availability, including those suitable for reproduction, allowing the occurrence of species

that are more sensitive to anthropic alterations, such as those of the families Aromobatidae e Dendrobatidae. The species recorded in forested areas exhibit a variety of reproductive strategies, ranging from the use of water bodies (*Ctenophryne geayi*, *Pipa* spp., *Ceratophrys cornuta*, *Adelphobates galactonotus*, among others) to terrestrial humid environments (*Ameerega* spp., *Phyllomedusa* spp. and *Leptodactylus andreae*).

Thirty-eight anuran species were recorded in metalophic savanna areas. Samplings from those areas are more recent than those from ombrophylous vegetation and most of them do not show distinction between the two kinds of vegetation. Brazilian Amazonia savannas are generally poor sampled with regards to amphibians (Azevedo-Ramos and Galatti 2002). Neckel-Oliveira *et al.* (2000), studied the amphibian fauna in Alter do Chão, Santarém, State of Pará, which presents vegetation types similar to those encountered in Carajás, and reported eighteen anuran species which are recorded from other areas in Brazilian Amazonia as well. These species, as well as the majority or those occurring in savanna areas in Carajás, present reproductive strategies that lead to the reduction in the dependence of forested wet environments, such as to deposit eggs directly in water bodies, which decreases considerably the risk of desiccation (Lynch 1979), ecological characteristics also found in species that live in Caatinga (dry land) (Vieira *et al*. 2008)

Forty-nine species were recorded in the anthropic areas, highlighting the importance of secondary forest maintenance, since these vegetation types are responsible for sustaining a significant component of the anuran communities in the region. Secondary forest covers more than 40% of the forested areas in the world (Wright and Muller-Landau 2006) and may represent an important alternative habitat for amphibians but its relative importance in tropical regions have been widely neglected (Heinen 1992; Neckel-Oliveira 2004; Ernst and Rödel 2005; Neckel-Oliveira and Gascon 2006). In a study conducted in two sites with preserved and altered environments, it was recorded a number of species with wide distribution, and more than 60% of the species in both sites are considered common (Caldwell and Araújo 2005). Besides that, some species can co-exist in or near disturbed areas, such as *Rhinella marina, Hypsiboas geographicus, Trachycephalus typhonius*, *Scinax ruber* and *Leptodactylus hylaedactylus.* Disturbances in the forest may cause several effects on amphibian populations, which can generate an over abundance of more generalist species to the detriment of other more specialized habitats, with several subsequent consequences (Caldwell and Araújo 2005).

The high environmental heterogeneity provided by the occurrence in the same region of undisturbed ombrophylous forest, anthropic areas, and a unique environment in Amazonia, the metalophylous savanna, could explain at least in part, the high diversity of amphibians in this region. Most of the species recorded in Carajás region present wide distributions across Amazonia and some of them occur even in other South American biomes. However, some of the species recorded here are more related to Central Brazilian biomes, such as *Ameerega flavopicta*, a species known to be endemic in Cerrado. A vicariant population of this species was already reported from Serra dos Carajás (Haddad and Martins 1994). *Pseudis tocantins*, recorded in this paper, from Marabá (05°23'52.3" S, 49°10'13.9" W), had its known distribution increased nearly 600 Km toward north from its nearest previous record (Palmas, State of Tocantins) (Brandão *et al.* 2003).

Leptodactylus syphax, found in the metalophic savanna at Carajás National Forest (50°24'27" S, 06°20'46" W), had its known distribution increased 600 Km toward north from its nearest known locality of occurrence (Ponte Alta do Tocantins/TO) (Valdujo *et al*. 2011; Neckel-Oliveira *et al*. 2012). This species is typical from open areas, being recorded from Cerrado areas in the States of Mato Grosso, Minas Gerais, Piauí and Tocantins, associated to cave environments (Cardoso and Heyer 1995; Heyer *et al*. 2004) which are common in the study area. *Pseudopaludicola canga* (Family Leiuperidae) is the solely species endemic to Carajás region, occurring only in the savanna areas in the hills of Carajás (Giaretta and Kokubum 2003).

The knowledge on the distribution of species of the family Caecilidae is still sparse. The absence of information on these animals could be assigned to several factors, including difficulties in the sampling and in the taxonomic identification. As a rule, the known distributions are punctual or even restrict to the localities type. For example, Maciel *et al.* (2009) described a new species of genus *Brasilotyphlus*, *B. guarantus*, previously identified as *B. braziliensis*. Its type locality is located in the far north of State of Mato Grosso (Guarantã do Norte municipality) but it is also recorded in the municipality of Parauapebas, state of Pará. *Caecilia gracilis* was recorded in Carajás (Municipality of Marabá), but only for records at Museum of Zoology University of Sao Paulo (Maciel and Hoogmoed 2011). Since information on particular habitats is normally scarce in material collection, we could not characterize these species in relation to the environment they occur.

Recently, Maciel and Hoogmoed (2011) published a list of caecilian amphibians of Brazilian Amazon with 15 species, of which five occur in Carajás region. Although it is often assumed that the species of Gymnophiona are rare, many species are well represented in scientific collections, such as *Microcaecilia taylori, Caecilia gracilis Typhlonectes compressicauda, Potomotyphlus kaupii* and *Rhinetrema ron*, suggesting that some species are not as rare as they seem to be, but it may reflect the methodology adopted (Maciel and Hoogmoed 2011).

Besides this article, Neckel-Oliveira *et al.* (2012) published a book this year about the species of Carajás National Forest, where 60 species were recorded. This number is relatively high and may reflect the similarity in species composition among the reserves, but this can only be demonstrated with further analysis.

The difficulty in reaching precise identifications of several taxa that probably represent complexes of multiple species is a common problem involving Amazonian species (Peloso 2010). This issue prevents us from drawing explicit comparisons between different areas and conclusions on the actual distribution of some amphibian species. Some examples of doubtful identification are *Pristimantis* aff. *conspicillatus, P. fenestratus, Leptodactylus marmoratus* species group, *Allobates marchesianus* species group, *Dendropsophus microcephalus* species group, and several

other species with wide distributions in Amazonia (Peloso 2010). Further considering morphological and molecular data might reveal complexes of cryptic species studies within these groups and bring new insights into their taxonomic limits.

As a result of these taxonomic uncertainties, more precise comparisons among areas in Amazonia and, consequently, conservation measures based in the observed diversity of a given area, are threatened, reflecting severe biases regarding the actual compositional similarity among areas to be selected for conservation purposes.

Figure 2. A = *Allobates* gr. *marchesianus*, B = *Amazophrynella minuta*, C = *Rhinella mirandaribeiroi*, D = *Rhinella* gr. *margaritifera*, E = *Dendropsophus leucophyllatus*, F = *Dendropsophus minutus*, G = *Dendropsophus melanargyreus*, H = *Hypsiboas boans*.

Figure 3. A = *Hypsiboas puntatus*, B = *Pseudopaludicola canga*, C = *Physalaemus ephippifer*, D = *Leptodactylus syphax*, E = *Pristimantis fenestratus*, F = *Elachistocleis carvalhoi*, G = *Pipa arrabali*, H = *Caecilia tentaculata* (Photo: Adriano Maciel).

Table 1. Species list of Carajás region found in different habitat types and their geographic distribution in Brazil (Brandão *et al.* 2003; Caramaschi 2010; Peloso and Sturaro 2008; Frost 2009; IUCN 2009; Narvaes and Rodrigues 2009; Maciel and Hoogmoed 2011). Habitat types = OF: Ombrophylous Forest (dense or open); MS: Metalophic Savanna; AA: Anthropic Areas.

Family/Species	Environment			Geographical Distribution (Acronym State and Regions)
	OF	MS	AA	
Allophrynidae				
Allophryne ruthveni Gaige, 1926	x		x	AM, AP, PA, RR
aromobatidae				
Allobates femoralis (Boulenger, 1884)	x			AC, AM, AP, PA, RO, RR, MA, TO, MT
Allobates gr. *marchesianus*	x	x	x	AC, AM, PA, RO, MT
bufonidae				
Amazophrynella minuta (Melin, 1941)	x			AC, AM, AP, PA, RO, RR, MA, TO, MT
Atelopus spumarius Cope 1871	x		x	AM, AP, PA
Rhaebo guttatus (Schneider, 1799)	x	x	x	AC, AM, AP, PA, RO, RR, MA, TO, MT
Rhinella mirandaribeiroi (Gallardo, 1965)	x	x	x	PA, RO, BA, MA, PI, MT, MS, MG
Rhinella margaritifera (Laurenti, 1768)	x		x	North and Northeast regions, ES, RJ, MG
Rhinella marina (Linnaeus, 1758)	x	x	x	Amazon and surroundings
Centrolenidae				
Vitreorana sp.	x		x	-
Ceratophryidae				
Ceratophrys cornuta (Linnaeus, 1758)	x			AC, AM, AP, PA, RO, RR
Cycloramphidae				
Proceratophrys concavitympanum Giaretta, Bernarde and Kokubum, 2000	x	x	x	AC, AM, PA, RO
Dendrobatidae				
Adelphobates galactonotus (Steindachner, 1864)	x		x	PA, MA, TO
Ameerega flavopicta (Lutz, 1925)	x	x	x	PA, MA, TO, GO, MG
Ameerega hahneli (Boulenger, 1884)	x			AC, AM, PA, RO, RR
Hylidae				
Dendropsophus leucophyllatus (Beireis, 1783)		x	x	AC, AM, AP, PA, RO, RR, MT
Dendropsophus melanargyreus (Cope, 1887)	x	x		AM, AP, PA, RO, TO, MT, MS
Dendropsophus gr. *microcephalus*		x	x	AC, AM, AP, PA, RO, RR, MT
Dendropsophus minutus (Peters, 1872)	x	x	x	AP, PA, RO, TO, MT, MS, PR
Dendropsophus nanus (Boulenger, 1889)		x	x	Except extreme South and Southeast
Hypsiboas cinerascens (Spix, 1824)	x	x	x	AC, AM, AP, PA, RO, RR, MT
Hypsiboas boans (Linnaeus, 1758)	x	x	x	AC, AM, AP, PA, RR, RO, MT
Hypsiboas fasciatus (Günther, 1859)	x		x	AC, AM, AP, PA, RO, RR, MT
Hypsiboas geographicus (Spix, 1824)	x	x	x	Except RS e SC
Hypsiboas multifasciatus (Günter, 1859)	x	x	x	AP, PA, RR, MA
Hypsiboas punctatus (Schneider, 1799)	x		x	Except South and Southeast regions
Hypsiboas raniceps Cope, 1862		x	x	Except AL, ES, PB, PE, RN, SE, RJ, RS, SC
Osteocephalus leprieurii (Duméril and Bibron, 1841)			x	AC, AM, RR
Osteocephalus oophagus (Jungfer and Schiesari, 1995)		x		AM, AP, PA
Osteocephalus taurinus (Steindachner, 1862)	x	x	x	AC, AM, AP, PA, RO, RR, MA, TO
Phyllomedusa bicolor (Boddaert, 1772)	x			AC, AM, AP, PA, RO, RR, MA, TO
Phyllomedusa hypochondrialis (Daudin, 1800)	x	x	x	Except AL, PE, PB, RN, SE, ES, RJ, RS, SC
Phyllomedusa vaillantii Boulenger, 1882	x	x		AC, AM, AP, PA, RO, RR, MT
Pseudis tocantins (Caramaschi and Cruz, 1988)			x	PA, TO, GO, MT
Scinax boesemani (Goin, 1966)	x		x	AC, AM, AP, PA, RO, RR, MT
Scinax fuscomarginatus (Lutz, 1925)	x	x	x	Except AC, AM, AP, RR
Scinax garbei (Miranda-Ribeiro, 1926)	x			AC, AM, RO, RR, west of the State of Pará
Scinax gr. *ruber*	x	x	x	AC, AM, AP, PA, RO, RR, MA, PI, TO, MT
Scinax nebulosus (Spix, 1824)			x	AC, AM, AP, PA, RR, RO, MT
Scinax x-signatus (Spix, 1824)		x		Except PR, RS, SC
Sphaenorhynchus lacteus (Daudin, 1800)	x		x	AC, AM, AP, PA, RO, RR
Trachycephalus resinifictrix (Goeldi, 1907)	x			AC, AM, AP, PA, RO, RR, MT, PA, AP, RR
Trachycephalus typhonius (Linnaeus, 1758)	x		x	The whole Brazilian territory
Leiuperidae				
Pseudopaludicola canga Giaretta and Kokubum, 2003		x		PA – Hills of Carajás
Pseudopaludicola sp.			x	-
Physalaemus cuvieri Fitzinger, 1826	x	x	x	Except AC, RR

Table 1. ***Continued.***

Family/Species	Environment			Geographical Distribution (Acronym State and Regions)
	OF	MS	AA	
Physalaemus ephippifer (Steindachner, 1864)	x	x	x	AM, AP, PA, RR, TO
Engystomops petersi Jiménez de la Espada, 1872	x		x	AM, RO
Leptodactylidae				
Leptodactylus andreae Müller, 1923	x	x	x	AC, AM, AP, PA, RO, RR, MT
Leptodactylus fuscus (Schneider, 1799)	x	x	x	Except PR, RS, SC
Leptodactylus hylaedactylus (Cope, 1868)		x	x	Except South and Southeast regions
Leptodactylus macrosternum Miranda-Ribeiro, 1926			x	North region
Leptodactylus mystaceus (Spix, 1824)	x	x	x	North region, AL, PE, PB, SE, MT
Leptodactylus paraensis Heyer, 2005	x	x	x	PA
Leptodactylus pentadactylus (Laurenti, 1768)	x		x	AC, AM, AP, PA, , RO, MT
Leptodactylus petersii (Steindachner, 1864)	x	x	x	AC, AM, AP, PA, RO, TO, MT
Leptodactylus pustulatus (Peters, 1870)			x	PA, MA, TO, CE, MA, GO, MT
Leptodactylus rhodomystax Boulenger, 1884	x	x		AC, AM, AP, PA, RO, RR, MT
Leptodactylus syphax Bokermann, 1969		x		PA, PI, TO, MT, MG
Microhylidae				
Chiasmocleis avilapiresae Peloso and Sturaro, 2008	x		x	AM, PA, RO, MT
Ctenophryne geayi Mocquard, 1904	x			AC, AM, AP, PA, RO, RR
Elachistocleis carvalhoi Caramaschi, 2010	x	x	x	Except PR, RS, SC
Pipidae				
Pipa arrabali Izecksohn, 1976	x	x		AC, AM, PA, RR
Pipa pipa (Linnaeus, 1758)	x			AC, AM, AP, PA, RO, RR, MA, MT
Strabomantidae				
Pristimantis aff. *conspicillatus* (Günther, 1858)		x	x	AC, AM
Pristimantis fenestratus (Steindachner, 1864)	x	x	x	AC, AM, PA, RO
Caecilidae				
Brasilotyphlus guarantus Maciel, Mott, and Hoogmoed, 2009				PA, MT
Caecilia gracilis Shaw, 1802				AP, AM, MA, PA, RO, TO
Caecilia tentaculata Linnaeus, 1758				AC, AM, AP, PA, MA, MT
Microcaecilia taylori Nussbaum and Hoogmoed, 1979				AM, PA
Potomotyphlus kaupii (Berthold, 1859)				AC, AM, PA, RR, GO

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Literature Cited

Almeida, J.M.G. 1986. *Carajás: desafio político, ecologia e desenvolvimento*. São Paulo: Brasiliense/ CNPq. 633 p.

Azevedo-Ramos, C. and U. Galatti. 2002. Patterns of diversity in Brazilian Amazonia: conservation implications. *Biological Conservation* 103: 103-111.

Brandão, R., G.R. Colli, A.K. Peres Jr. and T.L. Abreu. 2003. Two new records of *Pseudis tocantins* Caramaschi and Cruz 1998 (Anura: Pseudidae) in Central Brazil. *Phyllomedusa* 2(1): 69-70.

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). *Zoologia* 527: 1-30.

Cardoso, A.J. and W.R Heyer. 1995. Advertisement, aggressive, and possible seismic signals of the frog *Leptodactylus syphax* (Amphibia, Leptodactylidae). *Alytes* 13: 67-73.

Caldwell, J.P. and M.C. Araújo. 2005. Amphibian faunas of two eastern Amazonian rainforest sites in Pará, Brazil. *Occasional Papers Sam Noble Oklahoma Museum of Natural History* 16: 1-41.

Duellman, W.E. and R. Thomas. 1996. Anuran Amphibians from a seasonally dry forest in Southeastern Peru and comparisons of the Anurans among sites in the Upper Amazon Basin. *Occasional Papers of the Museum of Natural History of the University of Kansas* 180: 1-34.

Ernst, R. and M. Rödel. 2005. Anthropogenically induced changes of predictability in tropical anuran assemblages. *Ecology* 86: 3111-3118.

Fauth, J.E., I. Crother and J.B. Slowinski. 1989. Elevation patterns of species richness, eveness and abundance of the Costa Rican leaf-litter herpetofauna. *Biotropica* 21: 178-185.

Frost, D.R. 2009. *Amphibian Species of the World: an Online Reference. Version 5.5. American Museum of Natural History, New York, USA* (http://research.amnh.org/ herpetology /amphibia/index.php). Captured on 15 August 2009.

Giaretta, A.A. and M.N.D.C. Kokubum. 2003. A New Species of *Pseudopaludicola* (Anura, Leptodactylidae) from Northern Brazil. *Zootaxa* 383: 1-8.

Haddad, C.F.B. 1998. Biodiversidade dos anfíbios no Estado de São Paulo; p. 15-26 *In* R.M.C. Castro (ed.). *Biodiversidade do Estado de São Paulo, Brasil: síntese do conhecimento ao final do século XX, 6: Vertebrados*. São Paulo: FAPESP.

Haddad, C.F.B. and M. Martins. 1994. Notes on four species of frogs related to *Epipedobates pictus*. *Herpetologica* 50: 282-295.

Haddad, C.F.B. and C.P.A. Prado. 2005. Reproductive modes in frogs and their unexpected diversity in the Atlantic Forest of Brazil. *BioScience* 55: 207-217.

Heinen, J.T. 1992. Comparisons of the leaf litter herpetofauna in abandoned cacao plantations and primary rain forest in Costa Rica: some implications for faunal restoration. *Biotropica* 24(3): 431-439.

Heyer, R., S. Reichle, D. Silvano and L. Aquino. 2004. *Leptodactylus syphax*. *In* IUCN 2009. *IUCN Red List of Threatened Species. Version 2009.1.* (www.iucnredlist.org). Captured on August 2009.

IBAMA - Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis. 2004. *Plano de manejo para uso múltiplo da Floresta Nacional de Carajás*. Brasília: Ministério do Meio Ambiente. 101 p.

Inger, R.F. and R.K. Colwell. 1977. Organization of contiguous communities of amphibians and reptiles in Thailand. *Ecological Monographs* 47: 229-253.

IUCN 2009. *IUCN Red List of Threatened Species. Version 2011.2.* (www.iucnredlist.org). Captured on 15 December 20092.

Keller, A., M.O. Rödel and K.E. Linsenmair, T.U. Grafe. 2009. The importance of environmental heterogeneity for species diversity and assemblage structure in Bornean stream frogs. *Journal of Animal Ecology* 78: 305-314.

Lynch, J.D. 1979. The amphibians of the lowland tropical forests; p. 189-215. *In* W.E. Duellman (ed.). *The South American herpetofauna: its origin, evolution, and dispersal*. Kansas City: Museum Natural History. University of Kansas.

Maciel, A.O., T. Mott and M.S. Hoogmooed. 2009. A second species of *Brasilotyphlus* (Amphibia: Gymnophiona: Caeciliidae) from Brazilian Amazonia. *Zootaxa* 2226: 19-27.

Maciel, A.O and M. S. Hoogmoed. 2011. Taxonomy and distribution of caecilian amphibians (Gymnophiona) of Brazilian Amazonia, with a key to their identification. *Zootaxa* 2984: 1-53.

Martins, M. and M.E. Oliveira. 1998. Natural history of snakes in forests of the Manaus region, Central Amazonia, Brazil. *Herpetological Natural History* 6(2): 78-150.

Menin, M., A.P. Lima, W.E. Magnusson and F. Waldez. 2007. Topographic and edaphic effects on the distribution of terrestrially reproducing in Central Amazonia: mesoscale spatial patterns. *Journal of Tropical Ecology* 23: 539-547

Monteiro, M.A. 2005. Meio século de mineração industrial na Amazônia e suas implicações para o desenvolvimento regional. *Estudos Avançados* 19(53): 187-207.

Narvaes, P. and M.T. Rodrigues. 2009. Taxonomic revision of *Rhinella granulosa* species group (Amphibia, Anura, Bufonidae), with a description of a new species. *Arquivos de Zoologia* 40 (1): 1-73.

Neckel-Oliveira, S., W.E. Magnusson, A.P. Lima and A.L.K. Albernaz. 2000. Diversity and Distribution of frogs in an Amazonian savanna in Brazil. *Amphibia-Reptilia* 21: 317-326.

Neckel-Oliveira, S. 2004. Effects of landscape change on clutches of *Phyllomedusa tarsius*, a neotropical treefrog. *Biological Conservation* 118:109-116.

Neckel-Oliveira, S. and C. Gascon. 2006. Abundance, body size and movement patterns of a tropical treefrog in continuous and fragmented forests in the Brazilian Amazon. *Biological Conservation* 128: 308-315.

Neckel-Oliveira, S., U. Galatti, M. Gordo, L.P.C. Pinheiro and G.F. Maschio. 2012. Anfíbios; p. 67-79 *In* F.D. Martins, A.F. Castilho, J. Campos, F.M. Hatano and S. Rolim. (org.). *Fauna da Floresta Nacional de Carajás: Estudos Sobre Vertebrados Terrestres*. São Paulo: Editora Rona.

Pawar, S.S., S.R. Rawar and B.C. Choudhury. 2004. Recovery of frog and lizard communities following primary habitat alteration in Mizoram, Northeast India. *Ecology* 4: 10.

Pianka, E.R. 1967. On lizards species diversity: North American flatand deserts. *Ecology* 48: 333-351.

Peloso, P.L.V. 2010. A safe place for amphibians? A cautionary tale on the taxonomy and conservation of frogs, caecilians, and salamanders in the Brazilian Amazonia. *Zoologia* 27(5): 667-673.

Peloso, P.L.V. and M.J. Sturaro. 2008. A new species of narrow-mouthed frog of the genus *Chiasmocleis* Méhelÿ 1904 (Anura, Microhylidae) from the Amazonian rainforest of Brazil. *Zootaxa* 1947: 39-52.

Reis, E. 1996. Os impactos do pólo siderúrgico de Carajás no desflorestamento da Amazônia brasileira. *A economia brasileira em perspectiva* 2: 691-715.

Rolim, S.G., H.T.Z. Couto, R.M. Jesus and J.T. França. 2006. Modelos volumétricos para a Floresta Nacional do Tapirapé-Aquirí, Serra dos Carajás (PA). *Acta Amazonica* 36(1): 107-114.

Segalla, M.V., U. Caramaschi, C.A.G. Cruz, P.C.A. Garcia, T. Grant and C.F.B. J. Langone. 2012. *Brazilian amphibians – List of species*. Elctronic Database Accessible at http://www.sbherpetologia.org.br. Sociedade Brasileira de Herpetologia. Captured on 18 June 2012.

Shaffer, H.B., R.N. Fisher and C. Davidson. 1998. The role of natural history collections in documenting species declines. *Trends in Ecology and Evolution* 13: 27-30.

Silva, M.F.F., N.L. Menezes, P.B. Cavalcante and C.A. Joly. 1986. Estudos botânicos: histórico, atualidade e perspectiva; p. 169-187 *In* J.M.G. Almeida (ed.). *Carajás: desafio político, ecologia e desenvolvimento*. São Paulo: Brasiliense/ CNPq.

Silva, R.A., I.A. Martins and D.C. Rossa-Feres. 2011. Environmental heterogeneity: Anuran diversity in homogeneous environments. *Zoologia* 28(5): 610-618.

Silvano, D.L. and M.V. Segalla. 2005. Conservação de anfíbios no Brasil. *Megadiversidade* 1(1): 79-86.

Souza, V.M., M.B. Souza and E.F. Morato. 2008. Efeitos da sucessão florestal sobre a anurofauna (Amphibia: Anura) da Reserva Catuaba e seu entorno, Acre, Amazônia sul-ocidental. *Revista Brasileira de Zoologia* 25(1): 49–57.

Tews, J., U. Brose, V. Grimm, K. Tielbörger, M.C. Wichmann, M.E. Schwager and F. Jeltsch. 2004. Animal species diversity driven by habitat heterogeneity/diversity: the importance of keystone structures. *Journal of Biogeography* 31: 79-92.

Tocher, M. 1998. Diferenças na composição de espécies de sapos entre três tipos de floresta e campo de pastagem na Amazônia Central; p. pp 219-232 *In* C. Gascon and P. Moutinho (ed.). *Floresta Amazônica: Dinâmica, regeneração e manejo*. Manaus: Ministério da Tecnologia e Ciência.

Valdujo, P.H, A. Camacho, R.S. Recoder, M. Teixeira, J.M.B. Ghellere, T. Motti, P.M.S. Nunes, C. Nogueira, M.T. Rodrigues. 2011. Anfíbios da Estação Ecológica Serra Geral do Tocantins, região do Jalapão, Estados do Tocantins e Bahia. *Biota Neotropica* 11(1): 251-262.

Vieira, W.L.S., G.G. Santana and C. Arzabe. 2008. Diversity of reproductive modes in anurans communities in the Caatinga (dryland) of northeastern Brazil. *Biodiversity and Conservation* 18: 55-66.

Vonesh, J.R. 2001. Patterns of richness and abundance in a tropical leaf-litter herpetofauna. *Biotropica* 33: 502-510.

Wright, S.J. and H.C. Muller-Landau. 2006. The future of tropical forest species. *Biotropica* 38: 287-301.

Zimmerman, B.L. and R.O. Bierregaard. 1986. Relevance of the Equilibrium Theory of Island Biogeography and Species-Area relations to Conservation with a case from Amazonia. *Journal of Biogeography* 13(2): 133-143.

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Appendix 1. Institutional catalogue number of the vouchers

Municipality of Parauapebas - *Adelphobates galactonotus* (MPEG 2858), *Allobates* gr. *marchesianus* (MPEG 2872, 2873, 3049, 3181, 3184), *Allophryne ruthveni* (MPEG 27750), *Ameerega flavopicta* (MPEG 2860, 2864, 2861, 3206, 3207, 3208, 3266, 3267, 3268, 3303, 3310, 3313, 2865, 27687, 27688, 27689), *Atelopus spumarius* (MPEG 2989, 3085, 3171, 3172, 3329, 3719, 3720, 3783, 2875, 2886, 2894, 2902, 2903, 2904), *Brasilotyphlus guarantanus* (MPEG 22170), Caecilia tentaculata (MPEG 22068, 22069, 22070, 22071, 22072, 22073, 22811), *Ceratophrys cornuta* (MPEG 3921), *Amazophrynella minuta* (MPEG 5962, 17764, 17765), *Dendropsophus* gr. *microcephalus* (MPEG 3177, 3180, 27757, 27758, 27759, 27760), *Dendropsophus leucophyllatus* (MPEG 3779, 3918), *Dendropsophus minutus* (MPEG 2870, 3772), *Elachistocleis ovalis* (MPEG 3079, 3081, 3200, 3258, 3259, 3260, 3261, 3262, 3264, 3265, 3301, 3302, 3307, 3308, 3309, 3331), *Engystomops petersii* (MPEG 27749), *Hypsiboas boans* (MPEG 16956, 16957, 16965, 16966, 27704, 27705), *Hypsiboas cinerascens* (MPEG 16962, 16963, 16968), *Hypsiboas fasciatus* (MPEG 27751, 27752, 27754, 27761), *Hypsiboas geographicus* (MPEG 27716, 27717, 27718, 28139, 28140, 28141, 28142, 28143, 28143, 28143), *Hypsiboas multifasciatus* (MPEG 27603, 27604, 27605, 27606, 27607, 27622, 27751, 27752, 27753, 27754), *Hypsiboas raniceps* (MPEG 16944, 16944, 27608, 27609, 27610, 27611, 27612, 27613, 27614, 27615, 27616, 27617, 27618, 27619, 27620, 27621, 27623, 27624, 27625), *Leptodactylus andreae* (MPEG 2871, 2876, 2877, 3053, 3084, 3784), *Leptodactylus fuscus* (MPEG 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3270, 3285, 3300, 3204, 3217, 27699, 27703), *Leptodactylus hylaedactylus* (MPEG 2897, 2898), *Leptodactylus macrosternum* (MPEG 27709, 27710, 27711, 27712), *Leptodactylus mystaceus* (MPEG 27713, 27714, 27715), *Leptodactylus pentadactylus* (MPEG 2862, 2891), *Leptodactylus petersii* (MPEG 27626, 27627, 27628, 27630, 27632, 27633, 27634, 27635, 27636, 27637, 27638, 27639, 27640, 27641, 27642, 27643, 27644), *Leptodactylus rhodomystax* (MPEG 3185), *Microcaecilia taylori* (MPEG/PSH 007, 014, 7350, 7351, 7352, 7353, 16230, 22074-22169, 22171, 22172), *Osteocephalus taurinus* (MPEG 3773, 27719, 27720), *Phyllomedusa hypochondrialis* (MPEG 27588, 27602), *Physalaemus cuvieri* (MPEG 27566, 27567, 27568, 27569, 27570, 27571, 27572, 27573, 27574, 27575, 27576, 27577, 27578, 27579, 27580, 27581, 27582, 27583, 27584, 27585, 27586, 27587), *Physalaemus ephippifer* (MPEG 3089, 5963), *Pristimantis cf. conspicillatus* (MPEG 16952, 16958, 16959, 16960), *Pristimantis fenestratus* (MPEG 913, 2901, 3166, 3173, 3174, 3175, 16943, 16945, 16947, 16951, 16969, 16970, 16971, 16972, 27658, 27659, 27660, 27661, 27662, 27663, 27664, 27665, 27666, 27667, 27668, 27669, 27670, 27671, 27672, 27673, 27674), *Proceratophrys concavitympanum* (MPEG 28283, 28284), *Rhaebo guttatus* (MPEG 2980, 2982, 2988, 3216, 3217, 3218, 3219, 3230, 3231, 3232, 3233, 3234, 27646, 27647, 27648, 27649, 27650, 27651, 27652, 27653, 27654, 27655, 27656, 27657), *Rhinella margaritifera* (MPEG 2879, 2881, 2882, 8290, 2892, 2895, 2896, 2899, 2991, 2990, 3077, 3083, 3320, 3850, 3852, 3860), *Rhinella marina* (MPEG 3220, 3221, 3222, 3223, 3224, 3225, 3226, 3160, 16941, 16955, 16967, 27741, 27747), *Rhinella mirandaribeiroi* (MPEG 2854, 2855, 2856, 2859, 2867,

2868, 2869, 3051, 3201, 3202, 3203, 3209, 3210, 3211, 3223, 3927, 3928, 3929, 3930, 3937, 3938, 3939, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3271, 3272, 3273, 3274, 3275, 3276, 3277, 3278, 3279, 3280, 3281, 3282, 3283, 3284, 27730, 27731), *Scinax fuscomarginatus* (MPEG 3864), *Scinax* gr. *ruber* (MPEG 2857, 3168, 3169, 3777, 3304, 3305, 3306, 3776, 3170, 3205, 3213, 3775, 16945, 16949, 16950, 16953, 27675, 27676, 27677, 27678, 27675, 27676, 27677, 27678, 27755), *Scinax nebulosus* (MPEG 27688), *Trachycephalus resinifictrix* (MPEG 16961), *Trachycephalus typhonius* (MPEG 27736, 27737, 27738, 27739, 27740).

Municipality of Canaã dos Carajás - *Adelphobates galactonotus* (MPEG16264, 16269, 16271, 21169, 21170, 27748), *Dendropsophus* gr. *microcephalus* (MPEG 16234, 16235, 21200, 21269, 21270, 21271, 21272, 21273, 21274, 27756), *Dendropsophus leucophyllatus* (MPEG 17815, 17816, 17817, 17818, 17819), *Dendropsophus minutus* (16238, 21231, 21232, 21233, 21234, 21235, 17790, 17791, 17792, 17793, 17794, 17795, 17796, 17797, 17798, 17799, 17800, 17801, 17802, 17803, 17804, 17805, 17806, 17807, 17808, 17809, 17810, 17811, 17812, 17813, 17814, 27679), *Dendropsophus nanus* (MPEG 21300), *Elachistocleis ovalis* (MPEG 17869, 17870, 17871, 16241, 16265, 16266, 21227, 21228, 21229, 21230), *Hypsiboas boans* (MPEG 16267, 27706), *Hypsiboas fasciatus* (MPEG 27753), *Hypsiboas geographicus* (MPEG 17820, 17821, 17822, 17823, 17824, 17825, 17826, 17827, 17828, 17829, 17830, 17831, 17832, 17833, 17834, 17835, 17836, 17837, 17838, 17839, 17840, 17841, 17842, 17843, 17844, 17845, 17846, 17847, 17848, 17849, 17850, 17851, 17852, 17853, 17854, 17855, 17856, 21167, 21168, 3167), *Hypsiboas multifasciatus* (MPEG 17881, 17882, 17883, 17884, 17885, 17886, 17887, 17888, 17889, 17890, 17891, 17892, 17893, 21199, 21200, 21202, 21207, 21208, 21211, 21297, 21298, 27613, 277610), *Hypsiboas raniceps* (MPEG 17958, 17913, 17917, 17957, 17959, 17960, 17961, 17962, 17963, 17964, 17965, 17966, 17967, 21209, 21210, 21212, 21213, 21214, 21215, 21216, 21217, 21218, 21219, 21220, 21221, 21222, 21223, 21224, 21225, 21197, 21198, 21201, 21203, 21206, 21306, 21306, 21197, 21198, 21201, 21203, 21206, 21209, 21210, 21212, 21213, 21214, 21215, 21216, 21217, 21218, 21219, 21220, 21264, 21265, 21266, 21267, 21268, 21264, 21265, 21266, 21267, 21268), *Leptodactylus fuscus* (MPEG 16255, 16256, 16244, 16245, 17894, 17895, 17896, 21174, 21175, 21176), *Leptodactylus hylaedactylus* (MPEG 17880), *Leptodactylus macrosternum* (MPEG 17918, 17919, 17920, 17921, 17922, 17923, 17924, 17925, 17926, 17927, 17928, 17929, 26258, 21184, 21185, 21186, 21187, 21188, 21189, 21190, 21191, 21192, 21193, 21194, 21195, 21196), *Leptodactylus mystaceus* (16257, 16249, 16250, 17877, 17878), *Leptodactylus pentadactylus* (MPEG 17873, 17874, 17875, 17876, 21301, 31302), *Leptodactylus petersii* (MPEG 18061, 18062, 18063, 18064, 18065, 18066, 18067, 18068, 18069, 18070, 18071, 18072, 18073, 18074, 18075, 18076, 18077, 18078, 18079, 18080, 18081, 18082, 18083, 18084, 18085, 18086, 18087, 18088, 18089, 18090, 18091, 18092, 18093, 18094, 18095, 18096, 18097, 18098, 18099, 18100, 18101, 18102, 18103, 18104, 18105, 18106, 21244, 21245, 21246, 21247, 21248, 21249, 21250, 21251, 21252, 21253, 21254, 21255, 21256, 21257, 21258, 21259, 21260, 21261, 21262, 21263), *Leptodactylus petersii* (MPEG 27629, 27631, 27645), *Phyllomedusa hypochondrialis* (MPEG 16237, 17908, 17909, 17910, 17911, 17912, 21307, 21309), *Physalaemus cuvieri* (MPEG 16243, 16270), *Physalaemus ephippifer* (MPEG 17968, 17969, 17970, 17971, 17986, 17987, 17988, 18028, 18030, 18031, 18032, 18033, 18034, 18035, 18036, 18037, 18038, 18040, 18041, 18042, 18043, 18044, 18045, 18046, 18047, 18048, 18049, 18050, 18051, 18052, 18053, 18054, 18057, 18058, 18059, 18060, 21177, 21178, 21179, 21180, 21181, 21182, 21183), *Pristimantis cf. conspicillatus* (MPEG 16242), *Pristimantis fenestratus* (MPEG 21221, 21222, 21223, 21224, 21225, 21226), *Proceratophrys concavitympanum* (MPEG 16233, 16263), *Pseudopaludicola canga* (MPEG 21275, 21276, 21277, 21278, 21279, 21280, 21281, 21282, 21283, 21284, 21285, 21286, 21287, 21288, 19714, 19718), *Rhinella margaritifera* (MPEG 16261, 16236, 17872, 27721, 27722, 27723), *Rhinella marina* (MPEG 17857, 17868, 18106, 21303, 21325), *Rhinella mirandaribeiroi* (MPEG 17872, 16236, 11261), *Scinax* gr. *ruber* (MPEG 16231, 16253, 16254, 16232, 17166, 17167, 17168, 17169, 17170, 17171, 17172, 17173, 17174, 17175, 17176, 17177, 17178, 17179, 17180, 17181, 17182, 17183, 17184, 17185, 17186, 17187, 17188, 17189, 21236, 21237, 21238, 21239, 21240, 21241), *Scinax nebulosus* (MPEG 21243, 21289, 21290, 21291, 21292, 21293), *Scinax x-signatus* (MPEG 21294, 21296), *Trachycephalus typhonius* (MPEG 16262, 21171, 21173).

Municipality of Curionópolis - *Adelphobates galactonotus* (MPEG 23771, 23772), *Allobates* gr. *marchesianus* (MPEG 16874, 16875, 16876, 16887, 16896, 19662, 19663, 19665, 23773, 23774, 23775), *Ameerega flavopicta* (MPEG 16901, 16920), *Dendropsophus* gr. *microcephalus* (MPEG 16895, 16841, 16842, 16843, 16844, 16845, 16878, 23776, 23777, 23778, 23393, 23394, 23395, 23396, 23397, 23398), *Dendropsophus minutus* (MPEG 16863, 16864, 16866, 16867, 16868, 16869, 16870, 16872, 16912, 16913, 16914, 16654, 23390, 23391, 23392, 23779, 23780, 23781, 23782), *Dendropsophus nanus* (MPEG 16895), *Elachistocleis ovalis* (MPEG 16904, 16916, 23785), *Hypsiboas boans* (MPEG 16910), *Hypsiboas fasciatus* (MPEG 23789), *Hypsiboas geographicus* (MPEG 16883, 16884, 16908, 16655, 16661, 23400, 23786, 23787), *Hypsiboas multifasciatus* (MPEG 23401, 23402, 23403, 23404, 27788), *Hypsiboas raniceps* (MPEG 16855, 16909, 16855, 16909, 19640, 19640), *Leptodactylus andreae* (MPEG 16840, 16848, 19634, 19635, 19649, 19653, 19666, 23790, 23791, 23414, 23415, 23416, 23417, 23418, 23419, 23420, 23421, 23422, 23423, 23424, 23425, 23426, 23427), *Leptodactylus fuscus* (MPEG 23428, 23430, 16834, 16882, 16892, 16919), *Leptodactylus mystaceus* (MPEG 23796, 23797, 23798), *Leptodactylus paraensis* (MPEG 23799), *Leptodactylus pentadactylus* (MPEG 16927, 16856, 16881), *Leptodactylus petersi* (MPEG 16865, 16888, 16889, 16890, 16891, 16923, 16924, 16925), *Leptodactylus petersii* (MPEG 19641, 19642, 19660, 23800, 23801, 23439), *Leptodactylus rhodomystax* (MPEG 16857), *Osteocephalus oophagus* (MPEG 19657, 19665), Osteocephalus taurinus (MPEG 2382), *Phyllomedusa bicolor* (MPEG 23805), *Phyllomedusa hypochondrialis* (MPEG 16846, 16657, 23471, 23472, 23806), *Physalaemus cuvieri* (MPEG 19650), *Physalaemus ephippifer* (MPEG 16862, 16877, 16880), *Physalaemus ephippifer* (MPEG 23445, 23446, 23447, 23448, 23449, 23450, 23451, 23452, 23453, 23454, 23455, 23456, 23457, 23458, 23459, 23460, 23461, 23462, 23463, 23464, 23465, 23466, 23467, 23803, 23804), *Pristimantis cf. conspicillatus* (MPEG 16859, 16879), *Pristimantis fenestratus* (MPEG 16943, 16945, 16947, 16951, 16969, 16970, 16971, 16972, 16833, 16851, 16852, 16853, 16860, 19637, 19643, 19648, 19651, 19652, 19657, 23405, 23406, 23407, 23408, 23409, 23783, 23784), *Proceratophrys concavitympanum* (MPEG 16902, 16903, 16932, 16933, 16936, 23473, 23474, 23475), *Pseudopaludicola canga* (MPEG 19639, 23807), *Rhinella margaritifera* (MPEG 19646, 19656), *Rhinella marina* (MPEG 16839, 23808, 23384), *Rhinella mirandaribeiroi* (MPEG 23809, 23385, 23388, 23389, 19893), *Scinax boesemani* (MPEG 23810), *Scinax* gr. *ruber* (MPEG 16871, 16905, 16915, 23477, 23811), *Scinax nebulosus* (MPEG 18837, 18838, 16850), *Scinax x-signatus* (MPEG 19644), *Trachycephalus typhonius* (MPEG 16861, 23812, 23478).

Municipality of Marabá - *Allobates femoralis* (MPEG 8603, 8620, 8621, 8622, 8623, 8624, 8625, 8626, 8675, 25024), *Allobates* gr. *marchesianus* (MPEG 8663, 8664, 8665, 8666, 8721, 8722, 8723, 8724, 8725, 8726, 8727, 8591, 8592, 8667, 8668, 8669, 8670, 8728, 8729, 8730, 8731, 8732, 8733, 27725, 27729, 25085, 25086), *Ameerega hahneli* (MPEG 25076, 25077, 25078, 25079, 25080, 25081, 25082, 25083), *Atelopus spumarius* (MPEG 8737, 8587, 8588, 8671, 8672), *Caecilia gracilis* (MZUSP 57068-57070), *Chiasmocleis avilapiresae* (MPEG 28121, 28122), *Ceratophrys cornuta* (MPEG 8633, 8634, 25113), *Dendropsophus* gr. *microcephalus* (MPEG 8532, 8595, 8647, 8654, 8655, 8656, 8674), *Dendropsophus leucophyllatus* (MPEG 8385, 8386, 8387, 8388, 8389, 8390, 8391, 8392, 8393, 8755, 8756, 8757), *Dendropsophus melanargyreus* (MPEG 8513, 8514, 8515, 8516, 8517, 8518, 8519, 8520, 8521, 8526), *Dendropsophus minutus* (MPEG 28123), *Dendropsophus nanus* (MPEG 28124, 28125, 28126, 28127, 28128, 28129), *Elachistocleis ovalis* (MPEG 28130, 28131, 28132), *Engystomops petersii* (MPEG 8594, 8598, 25141, 25142, 25143, 25144, 25145, 25146, 25147, 25148, 25149, 25150, 25151, 25152, 28133, 28134, 28135, 28136, 28137), *Hypsiboas boans* (MPEG 28137, 28138), *Hypsiboas cinerascens* (MPEG 8527, 8531), *Hypsiboas fasciatus* (MPEG 8485, 8486, 8487, 8488, 8489, 8490, 8491, 8492, 8493, 8494, 8495, 8496, 8497, 8498, 8499, 8500, 8501, 8502, 8503, 8504, 8505, 8506, 8507, 8508, 8509, 8510, 8511, 8512, 8604), *Hypsiboas multifasciatus* (MPEG 8651, 8652, 8653, 28144, 28145, 28146, 28147, 28148, 28149, 28161, 28162, 28163, 28164, 28165, 28166, 28167, 28168), *Hypsiboas punctatus* (MPEG 28106, 28169, 28170, 28171, 28172, 28173, 28174), *Hypsiboas raniceps* (MPEG 8651, 8652, 8653), *Hypsiboas raniceps* (MPEG 17958, 17913, 17914, 17915, 17916, 17917, 17957, 17959, 17960, 17961, 17962, 17963, 17964, 17965, 17966, 17967, 28150, 28151, 28152, 28153, 28154, 28155, 28156, 28157, 28158, 28159, 28160), *Leptodactylus andreae* (MPEG 8593, 8605, 8606, 8607, 8608, 8609, 8610, 8611, 8612, 8613, 8614, 8615, 8616, 8617, 8618, 8619, 8695, 8696, 8697, 8734, 8735, 8736, 28175, 28176, 28177, 28178, 28179, 28180, 28181, 28182, 28183, 28246, 28325, 27550, 27565), *Leptodactylus fuscus* (MPEG 28321, 28322), *Leptodactylus hylaedactylus* (MPEG 28184, 28185, 28186, 28187, 28188, 28189, 28190, 28191, 28192, 28193, 28194, 28195, 28196, 28197, 28198, 28199), *Leptodactylus macrosternum* (MPEG 2820028217, 28219, 28220, 28221, 28222, 28223, 28224, 28225, 28226, 28227, 28228, 28229, 28230, 28231, 28232, 28233, 28234), *Leptodactylus mystaceus* (MPEG 8394, 8395, 8404, 8405, 8406, 8407, 8408, 8409, 8410, 8411, 8412, 8413, 8414, 8415, 8416, 8417, 8418, 8419, 8420, 8421, 8422, 8423, 8424, 8425, 8426, 8427, 8428, 8429, 25129, 25130), *Leptodactylus paraensis* (MPEG 25161, 28320), *Leptodactylus pentadactylus* (MPEG 8748, 8430, 8431, 8432, 8433, 8440, 8441, 8446, 8450, 8601, 8662), *Leptodactylus petersii* (MPEG

8437, 8438, 8439, 8442, 8444), *Leptodactylus pentadactylus* (MPEG 25133, 28218, 28235, 28236, 28237, 28238, 28239, 28240, 28241, 28242, 28243, 28244, 28245), *Leptodactylus rhodomystax* (MPEG 8434, 8445), *Leptodactylus pustulatus* (MPEG 28107, 28247, 28248, 28249, 28250, 28251, 28252, 28253, 28254, 28323), *Osteocephalus taurinus* (MPEG 8522, 8525, 8743), *Phyllomedusa bicolor* (MPEG 8574, 8575, 8755, 26140), *Phyllomedusa hypochondrialis* (MPEG 8374, 8380, 8383, 8384, 8400, 8401, 8402, 8403, 8754), *Phyllomedusa vaillantii* (MPEG 8373, 8381, 8382, 8397, 8399, 25135, 25136, 25137, 25138, 25139), *Physalaemus ephippifer* (MPEG 8536, 8537, 8538, 8539, 8540, 8541, 8542, 8543, 8544, 8545, 8546, 8547, 8548, 8549, 8550, 8599, 8600, 8677, 8678, 8679, 8680, 8681, 8682, 25153, 25154), *Physalaemus ephippifer* (MPEG 28259, 28260, 28261, 28262, 28263, 28264, 28265, 28266), *Pipa arrabali* (MPEG 25155, 25158), *Pipa pipa* (MPEG 8749), *Pristimantis fenestratus* (MPEG 8395, 8451, 8484, 8551, 25114, 25115, 25116, 25117, 25118, 25119, 25120, 25121, 25122, 25123, 25124, 25125, 25126, 25127, 25128, 28269, 28270, 28271, 28272, 28273, 28274, 28275, 28276, 28277, 28278, 28279, 28280, 28281, 28282), *Proceratophrys concavitympanum* (MPEG 28283, 28284), *Pseudis tocantins* (MPEG 28111), *Rhaebo guttatus* (MPEG 8579, 8580, 8628, 8629, 8630, 8631, 8632), *Rhaebo guttatus* (MPEG 25104, 25105, 25106, 25107, 25108, 25109, 25110, 25111, 25112), *Rhinella margaritifera* (MPEG 8568, 8569, 8570, 8571, 8683, 8684, 8685, 8686, 8687, 8688, 8689, 8690, 8691, 8692, 8693, 8694, 25088, 25089, 25090, 25091, 25092, 25093, 25094, 25095, 25096, 25097, 25098, 25099, 25100, 25101, 25102, 25103), *Rhinella marina* (MPEG 9740, 8742, 8558, 8567, 25160), *Rhinella mirandaribeiroi* (MPEG 25087), *Scinax boesemani* (MPEG 28109), *Scinax garbei* (MPEG 8556, 8557), *Scinax* gr. *ruber* (MPEG 8553, 8554, 8555, 28324), *Scinax nebulosus* (MPEG 28310, 28311, 28312, 28313, 28314), *Sphaenorhynchus lacteus* (MPEG 8589, 8590, 28315, 28316), *Trachycephalus resinifictrix* (MPEG 8650), *Trachycephalus typhonius* (MPEG 8572, 8573, 8640, 8646, 28317, 28318, 28319).

Municipality of São Félix do Xingu - *Caecilia tentaculata* (MPEG 9256), *Dendropsophus* gr. *microcephalus* (MPEG 9392, 9393), *Dendropsophus leucophyllatus* (MPEG 9334, 9335, 9336, 9337, 9338, 9339, 9340, 9341, 9342, 9343, 9344, 9345), *Dendropsophus minutus* (MPEG 9353, 9354), *Leptodactylus andreae* (MPEG 9370, 9391), *Leptodactylus mystaceus* (MPEG 9292, 9293, 9294, 9330, 9325, 9326), *Leptodactylus pentadactylus* (MPEG 9275, 9257, 9373, 9349, 9350, 9351), *Leptodactylus rhodomystax* (MPEG 9375), *Pipa arrabali* (MPEG 7620), *Pristimantis fenestratus* (MPEG 9339, 9340, 9380, 9382), *Scinax boesemani* (MPEG 9327, 9328, 9329), *Scinax* gr. *ruber* (MPEG 9346, 9371), *Scinax nebulosus* (MPEG 9296, 9299, 9374, 9402, 9403, 9404, 9405, 9406).

Municipality of Serra dos Carajás - *Hypsiboas boans* (MPEG 3076, 3165, 8576, 8597, 8648, 8640), *Hypsiboas geographicus* (MPEG 2878, 2880, 2991, 8533, 8534, 8535), *Phyllomedusa vaillantii* (MPEG 3082, 3330), *Potomotyphlus kaupii* (MPEG 7346, locality of "Cachoeira da Carreira"), *Scinax* gr. *ruber* (MPEG 16873, 16906, 16907, 16922).