

# Snakes from Canoa Quebrada Hydroelectric Power Plant, state of Mato Grosso, Brazil

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**Abstract.** We herein provide a species list of the snakes located at PCH Canoa Quebrada, a small hydroelectric power plant built on the Rio Verde, Brazil. The power plant is located on the border of the Lucas do Rio Verde and Sorriso municipalities, mid-southern Mato Grosso state. Thirty-seven species of snakes distributed in 29 genera of seven families were recorded between 17 February and 15 November 2006, after faunal rescue activities carried out during deforestation and filling of the reservoir.

**Keywords.** Reptiles, Cerrado, Species list, Power plant reservoir, Environments impacts

## Introduction

The herpetofauna of the Brazilian Cerrado ecoregion (see Olson et al., 2001), one of the 34 global biodiversity hotspots (Mittermeier et al., 2004), is considered still poorly known, with many areas being not yet adequately sampled (Strüssmann, 2000; Colli, Bastos and Araújo, 2002). Recently, more detailed studies based on systematized data revealed that at least 237 Squamate species are found in this ecoregion, including at least 68 lizards, 145 snakes and 24 amphisbaenians (Costa et al., 2007). On a local scale, lizard assemblages in this region are usually better characterized in literature than snakes or amphisbaenians, with species richness varying greatly among different areas (Valdujo et al., 2009). There is a growing number of studies describing snake

communities in Cerrado localities (e.g. Strüssmann, 2000; Pavan and Dixo, 2004; Vitt et al., 2005; Vaz-Silva et al., 2007; França et al., 2008; Sawaya, Marques and Martins, 2008; Silva Jr. et al., 2009; Cintra, Silva and Silva-Jr., 2009; Araujo, Corrêa Filho and Sawaya, 2010). Some of these studies resulted from faunal rescue operations during flooding of areas that are currently occupied by hydroelectric impoundments. Despite usually leading to enormous environmental impacts, the filling of hydroelectric power plant reservoirs can generate unique opportunities to improve the knowledge on regional herpetofauna within the affected area (Cintra, Silva and Silva-Jr., 2009; see also Strüssmann and Mott, 2009).

The present study offers additional information on the herpetofauna from the Cerrado region by providing a checklist of snakes from the area directly impacted by the construction of Canoa Quebrada hydroelectric power plant, in mid-southern Mato Grosso. The list is based on specimens collected during faunal rescue operations conducted during deforestation and flooding of the local reservoir.

## Materials and Methods

The Canoa Quebrada hydroelectric power plant (PCH Canoa Quebrada) is located on the Rio Verde (12°47'49" S, 56°00'38" W), which borders the municipalities of Lucas do Rio Verde and Sorriso, mid-southern state of Mato Grosso, Brazil (Fig. 1). The original vegetation in the region consisted largely of different physiognomies characteristic for the Cerrado, including open savanna (*cerrado típico* and *veredas*) and forested environments (*cerradão* and *mata ciliar*; for habitat descriptions, see Ribeiro and Walter, 1998). Average annual temperature is 26°C (with a minimum of 15°C, in June, and a maximum of 37°C, in October).

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**Figure 1.** Location of PCH Canoa Quebrada in the state of Mato Grosso, Brazil (black circle). The Cerrado phytogeographic domain is displayed in dark green.

Local climate is considered tropical humid, classified as type Aw in Köppen's system (see Peel, Finlayson and McMahon, 2007), with annual rainfall of 2.233 mm (SAMA, 2011).

Faunal rescue activities during deforestation and filling of the reservoir of PCH Canoa Quebrada were carried out between 17 February and 15 November 2006. Collecting efforts consisted of daily surveys (between 7:00 to 11:00 h am and 13:00 to 17:00 h pm) in all accessible microhabitats throughout deforestation and reservoir areas. Animals were captured by hand or by using herpetological hooks, nets and dip nets, transferred to plastic boxes or bags and carried to the laboratory at the rescue base. Voucher specimens were preserved in 10% formalin and later transferred to 70% ethanol. They will be deposited at the Museu de Zoologia de Tangará da Serra - Coleção Herpetológica at Universidade Estadual de Mato Grosso, Tangará da Serra, state of Mato Grosso, Brazil (collecting permit 006/06 IBAMA/GEREX I/MT).

## Results and Discussion

Thirty-seven species in 29 genera of snakes were recorded at PCH Canoa Quebrada, representing seven families (Table 1): Typhlopidae (2.7% of the total number of species, 1.7% of the total number of individuals recorded), Aniliidae (2.7%, 0.4%), Boidae (8.1%, 4.2%), Colubridae (29.7%, 19.2%), Dipsadidae (48.6%, 31.5%), Elapidae (2.7%, 0.8%), and Viperidae (5.4%, 42.1%). The total number of species recorded in this study is somewhat lower than that found after studies in other hydroelectric power plants located in the Cerrado from Central Brazil: APM Manso, Chapada dos

Guimarães, Mato Grosso state (44 species; Strüssmann, 2000), UHE Espora, Aporé, Mato Grosso do Sul state (43 species; Vaz-Silva *et al.*, 2007) and UHE Ponte de Pedra (39 species; Silva Jr. *et al.*, 2009), Itiquira, Mato Grosso. Other sites show lower richness than PCH Canoa Quebrada: UHE Santa Edwiges I and UHE Santa Edwiges II (28 species; Cintra, Silva and Silva-Jr., 2009), and Estação Ecológica de Santa Bárbara (Araujo, Corrêa Filho and Sawaya, 2010), a protected Cerrado remnant in São Paulo, southeastern Brazil. In the same state, another protected Cerrado remnant - Estação Ecológica de Itirapina, harbors roughly the same richness than at PCH Canoa Quebrada (36 species; Sawaya, Marques and Martins, 2008).

Previous studies point habitat diversity as an important determinant of herpetofauna diversity in the Cerrado (Colli, Bastos and Araújo, 2002; Nogueira, Valdujo and França, 2005). Habitat diversification along the reservoir area of PCH Canoa Quebrada might have contributed to the local number of species recorded during our study. However, being the second largest grain producer in the state of Mato Grosso, the municipality of Lucas do Rio Verde presently has only a minimal proportion of its original vegetation still intact. Moreover, local soybean plantations are subjected to intense utilization of pesticides (Pignati, Machado and Cabral, 2007).

*Bothrops moojeni* was the most abundant species encountered during the study period ( $n = 218$ ; 41.9%). This high abundance can be explained by the fact this species occurs mainly in and around *mata ciliar* (the main phytophysiognomy along the reservoir), which sustains a high abundance of potential prey, such as anurans and rodents (Nogueira, Sawaya and Martins, 2003).

Our study represents an important addition to the knowledge of the herpetofauna of the Cerrado, especially in view of the massive and rapid habitat loss in the occidental portion of the ecoregion. The entire region is poorly studied, which precludes a better understanding of the distributions of Cerrado snakes, and therefore, the establishment of more effective conservation plans, as seems to be the case at Lucas do Rio Verde.

**Acknowledgments.** We thank ATIAIA Energia S/A for financial and logistical support during fieldwork.

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**Table 1.** Snake species recorded at PCH Canoa Quebrada, municipalities of Lucas do Rio Verde/Sorriso, Mato Grosso state, Brazil.

Family	Species	N	%
Typhlopidae	<i>Typhlops brongersmianus</i> Vanzolini, 1976	9	1.7
Aniliidae	<i>Anilius scytale</i> (Linnaeus, 1758)	2	0.4
Boidae	<i>Boa constrictor</i> Linnaeus, 1758	1	0.2
	<i>Epicrates cenchria</i> (Linnaeus, 1758)	7	1.3
	<i>Eunectes murinus</i> (Linnaeus, 1758)	14	2.7
Colubridae	<i>Chironius flavolineatus</i> (Boettger, 1885)	15	2.9
	<i>Chironius laurenti</i> Dixon, Wiest & Cei, 1993	16	3.1
	<i>Drymarchon corais</i> (Boie, 1827)	2	0.4
	<i>Leptophis ahaetulla</i> (Linnaeus, 1758)	29	5.6
	<i>Mastigodryas bifossatus</i> (Raddi, 1820)	1	0.2
	<i>Mastigodryas boddaerti</i> (Santzen, 1796)	3	0.6
	<i>Oxybelis aeneus</i> (Wagler, 1824)	5	1.0
	<i>Oxybelis fulgidus</i> (Daudin, 1803)	15	2.9
	<i>Pseustes sulphureus</i> (Wagler, 1824)	7	1.3
	<i>Spilotes pullatus</i> (Linnaeus, 1758)	3	0.6
	<i>Tantilla melanocephala</i> (Linnaeus, 1758)	4	0.8
Dipsadidae	<i>Atractus albuquerquei</i> Cunha & Nascimento, 1983	27	5.2
	<i>Atractus latifrons</i> (Günther, 1868)	15	2.9
	<i>Erythrolamprus aesculapii</i> (Linnaeus, 1766)	2	0.4
	<i>Erythrolamprus reginae</i> (Linnaeus, 1758)	7	1.3
	<i>Helicops angulatus</i> (Linnaeus, 1758)	20	3.8
	<i>Hydrops triangularis</i> (Wagler, 1824)	5	1.0
	<i>Hydrodynastes gigas</i> (Duméril, Bibron & Duméril, 1854)	3	0.6
	<i>Leptodeira annulata</i> (Linnaeus, 1758)	20	3.8
	<i>Oxyrhopus melanogenys</i> (Tschudi, 1845)	10	1.9
	<i>Oxyrhopus petolaris</i> (Linnaeus, 1758)	5	1.0
	<i>Oxyrhopus rhombifer</i> Duméril, Bibron & Duméril, 1854	1	0.2
	<i>Philodryas olfersii</i> (Lichtenstein, 1823)	27	5.2
	<i>Philodryas patagoniensis</i> (Girard, 1858)	1	0.2
	<i>Phimophis guerini</i> (Duméril, Bibron & Duméril, 1854)	4	0.8
	<i>Pseudoboa nigra</i> (Duméril, Bibron & Duméril, 1854)	1	0.2
	<i>Taeniophallus occipitalis</i> (Jan, 1863)	1	0.2
	<i>Thamnodynastes hypoconia</i> (Cope, 1860)	1	0.2
	<i>Xenodon merremii</i> (Wagler, 1824)	14	2.7
Elapidae	<i>Micrurus surinamensis</i> (Cuvier, 1817)	4	0.8
Viperidae	<i>Bothrops moojeni</i> Hoge, 1966	218	41.9
	<i>Crotalus durissus</i> (Linnaeus, 1758)	1	0.2
	Number of individuals	520	
	Number of species	37	

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