

Geographic distribution of caecilians (Gymnophiona, Amphibia) in the state of Mato Grosso, Brazil with a new state record for *Caecilia mertensi* Taylor 1973

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Caecilians are currently limbless amphibians (Order Gymnophiona) distributed predominately throughout the tropics (Taylor, 1968; Nussbaum and Wilkinson, 1989). They are mainly fossorial animals (except for a few aquatic forms), causing biological studies of this group very difficult (Taylor, 1968; Gower and Wilkinson, 2005). Actually 183 species are known (Frost, 2010), distributed into three families. In Brazil, two families have been recorded, Rhinatrematidae and Caeciliidae (SBH, 2010). The first includes one described species for Brazil, and the latter, the most diverse family includes 12 genera and ca. 26 species (SBH, 2010). Fifty percent of the known Brazilian caecilians are identified only from their type-series and this situation is alarming considering the fast alteration of the natural landscapes in this tropical country. Certainly, many other species are awaiting description in Brazil.

Mato Grosso is located in the Midwest of Brazil (Figure 1), and is the third largest state covering 903,357 Km², including portions of three biomes, Amazonian (54% of its original extension), Cerrado (a savannah-like vegetation, 48%) and Pantanal (7%). Natural landscapes in this state have been lost due to the growth of agriculture (mainly soy and cotton), livestock and timber (IBGE, 2010). Besides this, in Mato Grosso, many hydroelectric power plants have been installed (ANEEL, 2010) and during the filling of a reservoir, many hectares of native vegetation became flooded and were consequently destroyed. At this time, fossorial

fauna emerged from the flooded area and through scientific faunal rescue, new species of fossorial fauna has been identified (Maciel et al., 2009), and new data on the distribution of many fossorial species have been detected (Mott, Morais, Kawashita-Ribeiro, 2008; Strüssmann and Mott, 2009).

Herein we present data on the geographic distribution of caecilians in the state of Mato Grosso deposited in the Brazilian collections: *Coleção Zoológica de Vertebrados, Universidade Federal de Mato Grosso* (UFMT, 137 specimens), *Museu de Zoologia da Universidade de São Paulo* (MZUSP, 13 specimens), *Museu Paraense Emilio Goeldi* (MPEG, nine specimens), *Coleção Herpetológica da Universidade de Brasília* (CHUNB, 15 specimens) and *Museu de Zoologia, Universidade Estadual de Campinas* (ZUEC, two specimens) (Table 1). All specimens were identified according to Taylor (1968, 1973) and Maciel et al (2009). In total, three genera and five species, all belonging to the family Caeciliidae (Table 2) were collected in 17 municipalities in the state of Mato Grosso (Figure 1) and were studied.

Brasilotyphlus guarantanus Maciel, Mott and Hoogmoed 2009 was represented from 49 specimens (Table 1), all obtained from their type-locality, Guarantã do Norte, Mato Grosso, Brazil. This locality was originally covered by semi-deciduous forest before the filling of the reservoir. In this locality, two species of caecilians (*B. guarantanus* and *Caecilia* aff. *tentaculata*) were found in sympatry. *Caecilia* aff. *tentaculata* Linnaeus 1758 was obtained from four municipalities, Campo Novo dos Parecis (56 specimens), Guarantã do Norte (three), Apiacás (one, the northernmost record of this species), and Juruena (one). It was the most abundant species of caecilian in Mato Grosso state found in the Brazilian collections (61 specimens). Probably *Caecilia* aff. *tentaculata* is an undescribed species, and there is a need to analyze the type series of *Caecilia tentaculata* Taylor 1973 in order to confirm and describe this new taxon. All localities were covered originally

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Table 1. Specimens of caecilians studied. Museum acronyms are as following. *Coleção Zoológica de Vertebrados da Universidade Federal do Mato Grosso* (UFMT), *Museu de Zoologia da Universidade de São Paulo* (MZUSP), *Museu Paraense Emílio Goeldi* (MPEG), *Coleção Herpetológica da Universidade de Brasília* (CHUNB) and *Museu de Zoologia, Universidade Estadual de Campinas* (ZUEC).

Municipality	Species	Voucher numbers
Alto Taquari	<i>Siphonops paulensis</i>	UFMT 6389
Apiacás	<i>Caecilia</i> aff. <i>tentaculata</i>	MZUSP 80926
		UFMT 4741, UFMT 4744, UFMT 6287, UFMT 6289, UFMT 6291-6292, UFMT 6296, UFMT 6299, UFMT 6304, UFMT 6307, UFMT 6320-6321, UFMT 6324, UFMT 6327, UFMT 6329-6330, UFMT 6333-6335, UFMT 6789, UFMT 6792
Araputanga	<i>Caecilia mertensi</i>	
Cáceres	<i>Siphonops paulensis</i>	UFMT 6825
		UFMT 4981-5007, UFMT 5018-5021, UFMT 6011-6020, UFMT 6022-6025, MPEG 16756, MPEG 16766, CHUNB 30691-30702
Campo Novo dos Parecis	<i>Caecilia</i> aff. <i>tentaculata</i>	
	<i>Siphonops annulatus</i>	UFMT 1619
Chapada dos Guimarães	<i>Siphonops paulensis</i>	UFMT 1616-1618, UFMT 1620, UFMT 6829-6834
Cláudia	<i>Siphonops paulensis</i>	UFMT 6765
		UFMT 3576-3577, UFMT 5365, UFMT 5474, UFMT 5509, UFMT 5700
Cuiabá	<i>Siphonops paulensis</i>	
		UFMT 5008, UFMT 5012-5013, UFMT 5015-5017, UFMT 5571-5578, UFMT 5581-5593, UFMT 6648-6655, MPEG 16767-16768, MPEG 22383-22387, CHUNB 30703-30707
Guarantã do Norte	<i>Brasilotyphlus guarantanus</i>	
	<i>Caecilia</i> aff. <i>tentaculata</i>	UFMT 5594-5595, UFMT 6021
		UFMT 6294-6295, UFMT 6297, UFMT 6302-6303, UFMT 6305-6306, UFMT 6308, UFMT 6328, UFMT 6332
Jauru	<i>Caecilia mertensi</i>	
Juruena	<i>Caecilia</i> aff. <i>tentaculata</i>	MZUSP 86335
Nortelândia	<i>Caecilia mertensi</i>	UFMT 4019
Paranaíta	<i>Caecilia mertensi</i>	ZUEC 16023
Parque do Xingu	<i>Siphonops annulatus</i>	MZUSP 49643
Poconé	<i>Siphonops paulensis</i>	UFMT 988, ZUEC 8519
Vale de São Domingos	<i>Caecilia mertensi</i>	UFMT 4742, UFMT 6793, MZUSP 138446-138455
Vila Bela da Santíssima Trindade	<i>Siphonops paulensis</i>	UFMT 4142

by semi-deciduous forests, the first two localities had hydroelectric power plants installed. *Caecilia mertensi* Taylor 1973 was obtained from five localities, Paranaíta (one specimen), Nortelândia (one), Araputanga (21), Jauru (10), and Vale de São Domingos (12). All these localities were situated either in the transition areas between Amazon and Cerrado or in the Amazonia. Except for the municipality of Nortelândia, all these localities had hydroelectric power plants built during the time where caecilians were collected. *Siphonops annulatus* Mikan 1820 was represented by two

specimens, one from UFMT (Chapada dos Guimarães) and one from MZUSP (Parque do Xingu). This species was also found in sympatry with *S. paulensis* in Chapada dos Guimarães, corroborating the suggestion of Taylor (1968). *Siphonops paulensis* Boettger, 1892 was the most widespread species of caecilian found in this study, seven localities more than 1000 km apart. Alto Taquari (one specimen, the southernmost record of this species in the state of Mato Grosso), Cáceres (one), Chapada dos Guimarães (10), Cláudia (one, the northernmost record of this species in the state), Cuiabá (six), Poconé

Table 2. Caecilian species from Mato Grosso state, their known distribution and conservation status obtained from IUCN.

Species	Distribution	IUCN status
<i>Caecilia mertensi</i> Taylor, 1973	Known only from the holotype without detailed locality, presumably South America	Data Deficient
<i>Caecilia tentaculata</i> Linnaeus 1758	The majority part of wet-forested South America east of Andes, south to central Peru and Brazilian Amazon	Least Concern
<i>Siphonops annulatus</i> (Mikan, 1820)	Widely distributed from east of Andes northern Colombia, Venezuela, and Guyana through Bolivia and probably through eastern Paraguay (where there are no record) into northeastern Argentina	Least Concern
<i>Siphonops paulensis</i> Boettger, 1892	Tropical dry forest of Brazil south of the Amazon basin, northern Argentina, Paraguay, and eastern Bolivia	Least Concern
<i>Brasilotyphlus guarantanus</i> Maciel, Mott e Hoogmoed 2009	Known only from the type locality (Municipality of Guarantã do Norte) in Mato Grosso, and the municipality of Parauapebas, in the state of Pará, Brazil	Without information

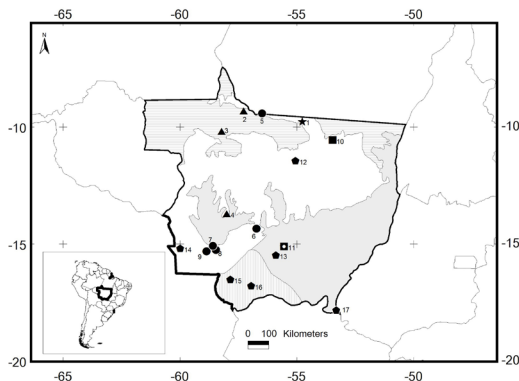


Figure 1. Geographical distribution of caecilians in the state of Mato Grosso. Star = *Brasilotyphlus guarantanus* and *Caecilia aff. tentaculata*. Triangle= *Caecilia aff. tentaculata*. Circle= *Caecilia mertensi*. Square= *Siphonops annulatus*. Round square= *Siphonops annulatus* and *S. paulensis*. Pentagon=*Siphonops paulensis*. Municipality numbers: 1= Guarantã do Norte (9° 40' 59" S and 54° 57' 46" W), 2= Apicacás (8° 45' 10" S and 57° 49' 37" W), Alto Taquarí (17° 49' 40" S and 53° 17' 38" W), Araputanga (15° 15' 20" S and 58° 27' 25" W), Cáceres (16° 30' 59" S and 57° 50' 12"), Campo Novo dos Parecis (13° 42' 36" S and 57° 59' 33" W), Chapada dos Guimarães (15° 6' 25" S and 55° 32' 22" W), Cláudia (11° 26' 46" S and 55° 2' 57" W), Cuiabá (15° 28' 48" S and 55° 53' 21" W), Jauru (15° 19' 2" S and 58° 51' 42" W), Juruena (10° 19' 33" S and 58° 35' 52" W), Nortelândia (14° 20' 50" S and 56° 43' 10" W), Poconé (16° 47' 4" S and 56° 56' 54.6" W), Vale de São Domingos (15° 5' 60" S and 58° 34' 48" W), Xingu (10° 33' 48" S and 53° 27' 50" W) and Vila Bela da Santíssima Trindade (15° 11' 15" S e 59° 58' 58" W).

(two) and Vila Bela de Santíssima Trindade (one, the westernmost record of this species in the state). Among these five caecilian species so far known to occur in Mato Grosso, *Brasilotyphlus guarantanus* is the only one with a restricted geographical range. All others seem to be abundant and widespread in the state.

Cerrado is the only hotspot that consists largely of savanna, woodland/savanna and dry forest ecosystems (Myers, 2000; Mittermeier et al., 2005). Ecotone zones have been indicated as very important for biodiversity maintenance (Endler, 1982) and caecilians distribution knowledge is still in its infancy. The scenario that Mato Grosso state faces today is unfavorable for maintenance of this unknown fossorial biodiversity (many areas have not been surveyed adequately and these areas are where caecilians have been obtained, are nowadays flooded). In fact, the majority of these voucher caecilian specimens (85%) were obtained during the filling of the dam for the hydroelectric power plants. This fact is threatening, considering that these terrestrial microhabitats where caecilians used to live are nowadays flooded and probably these populations became locally extinct. The distribution knowledge of the majority of caecilians is scant (Gower and Wilkinson, 2005) and unfortunately the highest diversity of caecilians is in tropical countries where deforestation occurs in large steps.

There is a need to increase the efforts to know the distribution, diversity and many biological aspects of these fascinating creatures, otherwise they will be extinct before we can even describe them.

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References

- ANEEL. 2010. Accessible at http://www.aneel.gov.br/area.cfm?id_area=104. Agência Nacional de Energia Elétrica. Accessible at 10/06/2010
- Aquino, L., Reichle, S., Colli, G., Scott, N., Faivovich, J., Wilkinson, M., Measey, J. (2004): *Siphonops paulensis*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.1. <www.iucnredlist.org>. Downloaded on 08 June 2010
- Coloma, L., Ron, S., Marca, E., Hoogmoed, M., Castro, F., Lynch, J., Wilkinson, M. (2004): *Caecilia tentaculata*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.1. <www.iucnredlist.org>. Downloaded on 08 June 2010.
- Endler J.A. (1982): Pleistocene forest refuges: fact or fancy. In Biological Diversification in the Tropics, ed. G.T. Prance. New York: Columbia Univ. Press.
- Frost, D.R. (2010): Amphibian Species of the World: an Online Reference. Version 5.4 (8 April, 2010). Electronic Database accessible at <http://research.amnh.org/vz/herpetology/amphibia/> American Museum of Natural History, New York, USA.
- Gower, D.J., Wilkinson, M. (2005): Conservation biology of caecilian amphibians. *Conservation Biology*, **19**(1):45-55.
- Lavilla, E., Hoogmoed, M., Reichle, S., Baldo, D., Wilkinson, M., Measey, J. (2004): *Siphonops annulatus*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.1. <www.iucnredlist.org>. Downloaded on 08 June 2010
- Maciel, A.O., Mott, T. and Hoogmoed, M.S. (2009): A second species of *Brasilotyphlus* (Amphibia: Gymnophiona: Caeciliidae) from Brazilian Amazonia, *Zootaxa* **2226**: 19–27.
- Mittermeier, R.A., Gil, P.R., Hoffman, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J., da Fonseca, A. B. (2005). Hotspots Revisited: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions. CEMEX, 341p.
- Myers, N., Mittermeier, R.A., Mittermeier, C.G., da Fonseca, G.A.B., Kent, J. (2000): Biodiversity hotspots for conservation priorities. *Nature* **403**:853-858.
- Mott, T., Morais, D.H., Kawashita-Roberto, R.A. (2008): Notes on geographic distribution, Reptilia, Squamata, Amphisbaenidae, *Anops bilabialatus*. Check List (UNESP) **4**:146-150.
- Nussbaum, R.A.; Wilkinson, M. (1989): On the classification and phylogeny of caecilians (Amphibia: Gymnophiona), a critical review. *Herpetological Monographs* **3**:1-42.
- SBH (2010): Brazilian amphibians – List of species. Accessible at <http://www.sberpetologia.org.br>. Sociedade Brasileira de Herpetologia. Captured on 09/06/2010.
- Strüssmann, C., Mott, T. (2009): Notes on Sympatric Amphisbaenids in the region under the influence of Manso Dam (upper Paraguay river basin, western Brazil), with the description of a new two-pored species of *Amphisbaena* (Squamata, Amphisbaenidae). *Studies on Neotropical Fauna and Environment* **44**:37-46.
- Taylor, E.H. (1968): The caecilians of the world. A taxonomic review.: University of Kansas Press. 848 p.
- Taylor, E.H. (1973): A Caecilian Miscellany. The University of Kansas Science Bulletin. **50**:187-231.
- Wilkinson, M. (2004): *Caecilia mertensi*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.1. <www.iucnredlist.org>. Downloaded on 08 June 2010.