

## LISTS OF SPECIES

### Amphisbaenians, municipality of São Paulo, state of São Paulo, Southeastern Brazil.

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**Abstract:** We provide a checklist, distribution map, and key to the amphisbaenians of the municipality of São Paulo. Seven species in three genera were recorded. Between August 2003 and June 2007, 104 individuals in two genera and five species were received at the Laboratório de Herpetologia of the Instituto Butantan: *Amphisbaena alba*, *A. dubia*, *A. mertensi*, *A. trachura*, and *Leposternon microcephalum*. Records for two additional species, *Amphisbaena hogei* and *Cercolophia roberti*, were recovered at the Museu de Zoologia da Universidade de São Paulo. Two widely distributed species, *Amphisbaena dubia* and *Leposternon microcephalum*, present different distribution patterns, probably reflecting the distribution of open and forested areas in the studied region, close to contact areas between the Atlantic Forest and adjacent open formations. Most amphisbaenians seem to endure habitat modifications in urbanized areas, but some species as *A. hogei* and *C. roberti* are no longer recorded in the São Paulo area.

#### Introduction

Within the suborder Amphisbaenia, the family Amphisbaenidae includes nearly 180 species distributed in 18 genera (Gans 2005; Uetz 2007). This group is constituted by highly specialized fossorial squamates (Kearney 2003; Macey et al. 2004). They are poorly represented in museum collections due to secretive fossorial habits and difficulties in field samplings (Kearney 2003; Vanzolini 1991). Currently, six genera and 61 amphisbaenians species are recorded in Brazil (SBH 2007).

Although the municipality of São Paulo (MSP) is one of the most urbanized areas in Brazil, it still presents a rich squamate fauna (O. A. V. Marques and F. E. Barbo, unpublished data). We provide an updated checklist, distribution map, and key to the identification of amphisbaenians recorded in MSP, from 104 specimens received at the Laboratório de Herpetologia of the Instituto Butantan, between August 2003 and June 2007, and ten additional individuals of two species housed in Museu de Zoologia da Universidade de São Paulo (MZUSP).

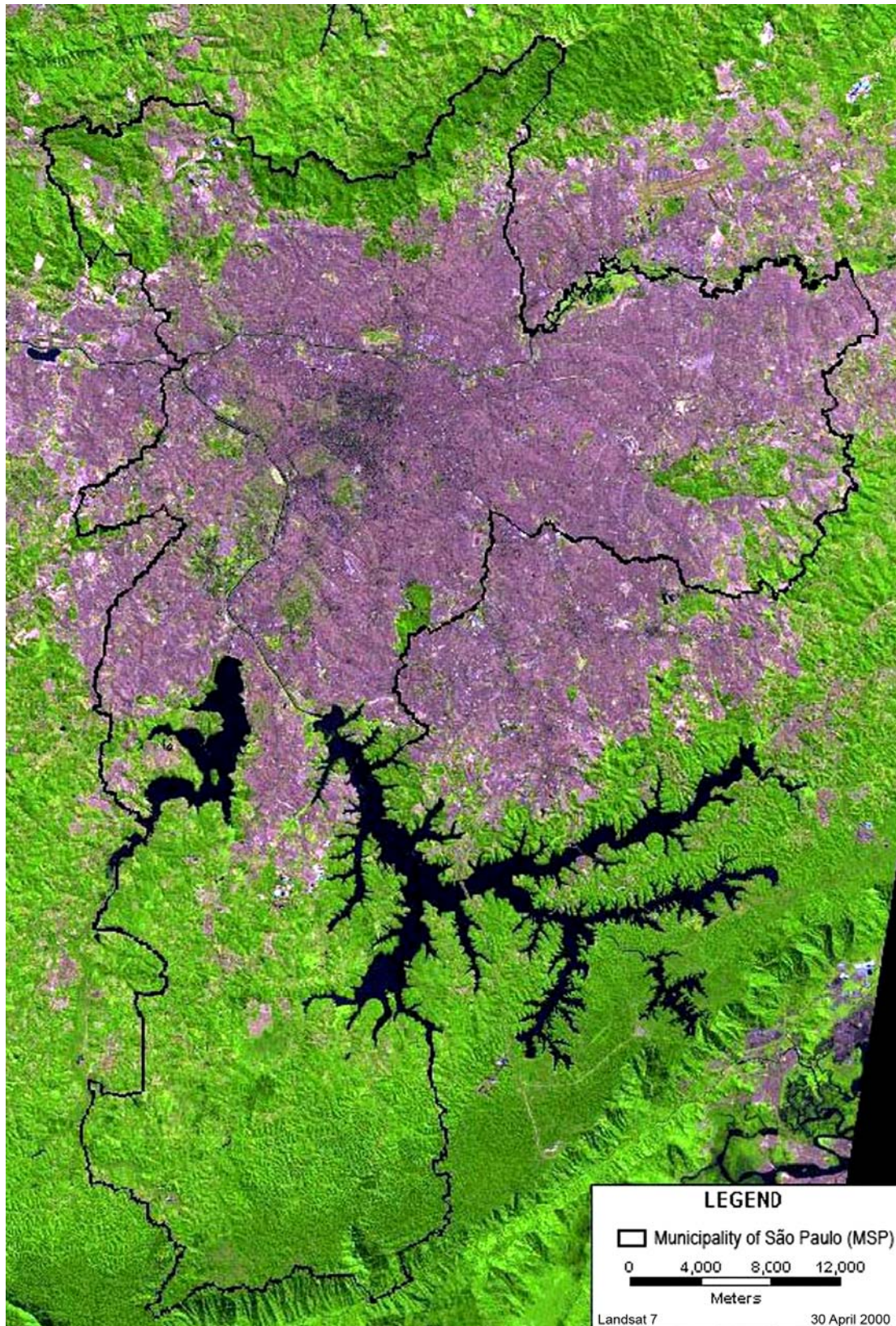
#### Materials and methods

##### Study Site

The MSP has 62,356 ha of total area, of which about 57 % are disturbed and/or urbanized, harboring at least 10 million people (Prefeitura do Município de São Paulo 2002). Only 16.4 % of the MSP area corresponds to sites with some vegetation, which 10.2 % (6,360 ha) are in the metropolitan area and 6.1 % (3,803 ha) are in the rural zone (Prefeitura do Município de São Paulo 2002).

Historically, the MSP original area was covered by forests, altitude fields, savannas, flooded riparian areas (*várzea*), and some sites with occurrence of *Araucaria angustifolia* (Usteri 1911). The MSP presents nowadays mainly secondary vegetation fragments, which resisted to the urban expansion process, but the native dense forests remnants are confined to the limits of the city (Figure 1). The climate is subtropical (Cwa type by Köppen), with mean annual temperature of 18.3 °C and annual mean precipitation of 1,317 mm.

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**Figure 1.** Landsat Image of the municipality of São Paulo, showing the remnants of forested vegetation (in green) and urbanized central areas (in purple).



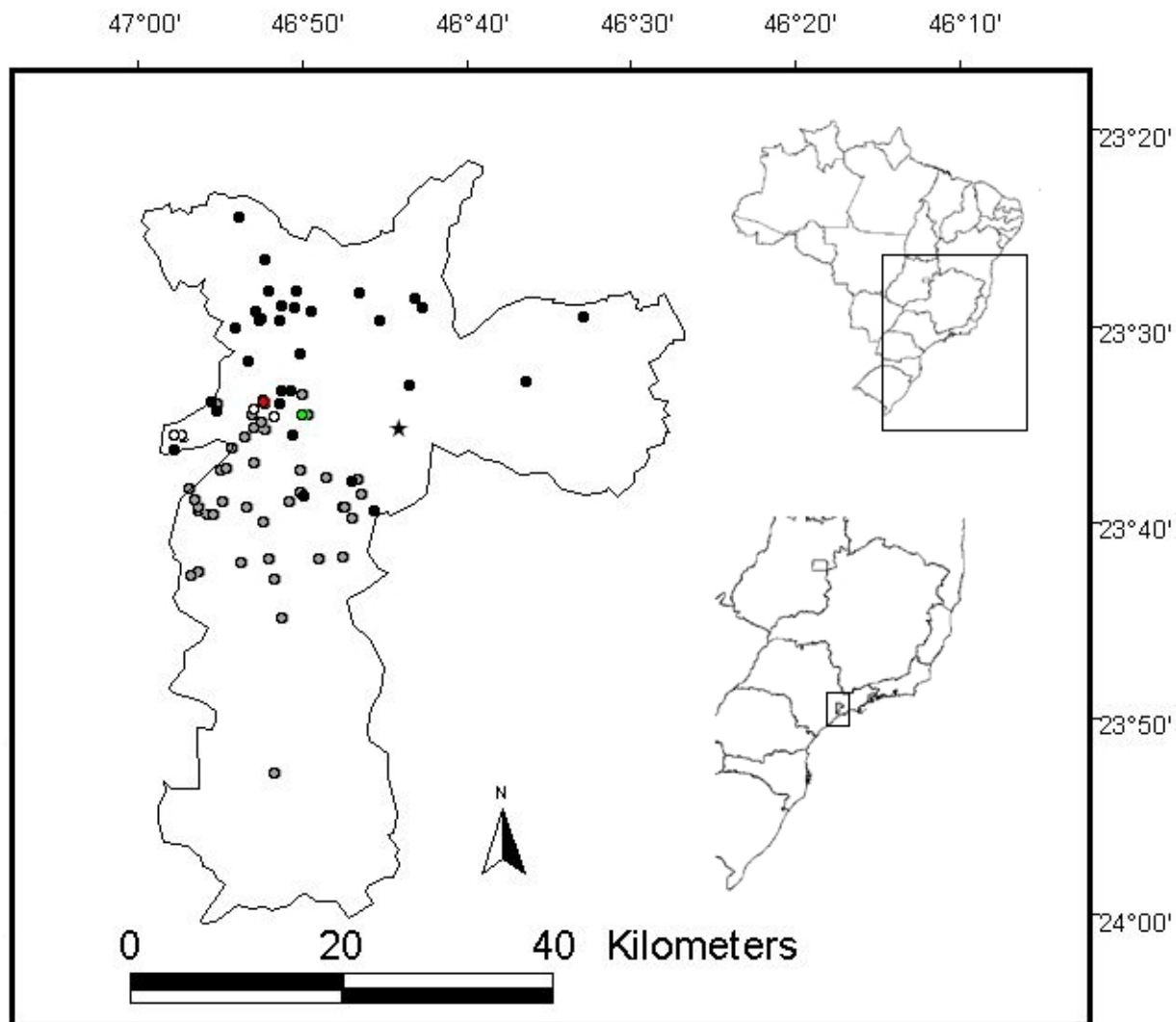
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### Data collection

A total of five species were received by the Laboratório de Herpetologia of the Instituto Butantan, between August 2003 and June 2007, and two additional species were recorded in Museu de Zoologia da Universidade de São Paulo (MZUSP). A distribution map and a key to the species, based mainly on Vanzolini (2002) diagnosis (genus *Amphisbaena*) are presented. The key allows a fast and reliable identification for the MSP's amphisbaenian species.

The species distribution was determined by plotting the geographic coordinates from the capture localities in DIVA-GIS® software (v. 5.2.0.4)

obtained from 104 specimens of the five species recorded in MSP and received at Instituto Butantan (Figure 2). The records were georeferenced in Maplink software, freely available online (<http://maplink.uol.com.br>). The addresses of localities were inserted directly in the software and allowed to determine the precise geographic coordinates. The MZUSP records usually did not include precise information regarding the collection localities and were not georeferenced. The holotype of *Cercolophia roberti* was collected in Ipiranga neighborhood (Gans 1964; 2005), which is also indicated in Figure 2.



**Figure 2.** Geographic distribution of amphisbaenians species from the municipality of São Paulo: *Leposternon microcephalum* (gray dots); *Amphisbaena dubia* (black dots); *A. mertensi* (open dots); *A. trachura* (green dot); *Amphisbaena alba* (red dot); *Cercolophia roberti* (star). There are no precise toponyms available for *A. hoguei*.

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### Results and discussion

We recorded a total of three genera and seven amphisbaenian species in the municipality of São Paulo (Table 1). Among them, five species were received by the Laboratório de Herpetologia of the Instituto Butantan, between August 2003 and June 2007, and the other two species, *Amphisbaena hoguei* (N = 5) and *Cercolophia roberti* (N = 5), were recorded only in MZUSP and are cited by Gans (2005).

**Table 1.** Amphisbaenians recorded from the municipality of São Paulo, received by Instituto Butantan (IB) between August 2003 and June 2007, and Museu de Zoologia da Universidade de São Paulo (MZ) in the last century.

Species	IB	MZ
<i>Amphisbaena alba</i> Linnaeus, 1758,	1	2
<i>Amphisbaena dubia</i> Müller, 1924	37	5
<i>Amphisbaena hoguei</i> Vanzolini, 1950		5
<i>Amphisbaena mertensi</i> Strauch, 1881	12	3
<i>Amphisbaena trachura</i> Cope, 1885	1	
<i>Cercolophia roberti</i> (Gans, 1964)		5
<i>Leposternon microcephalum</i> Wagler, 1824	53	6

*Leposternon microcephalum* (N = 59; Figure 3A) is a common species in the Atlantic Rain Forest, mainly in Serra do Mar portion, where it could represent the main prey item for some coral snakes as *Micrurus corallinus* (Marques and Sazima 1997). It is distributed in central and southern portions of MSP (Figure 2), which could be related to the Serra do Mar forests influence.

*Amphisbaena dubia* (N = 42; Figure 3B) is distributed in central and northern portions of MSP (Figure 2), and it is probably related to both forested and open areas. A specimen from the forested area of the Parque Estadual das Fontes do Ipiranga, and erroneously identified as *Amphisbaena mertensi* by Barbo and Marques (2003), was found in a stomach of the colubrid snake *Taeniophallus affinis*.

*Amphisbaena mertensi* (N = 15; Figure 3C) is found mainly in open areas of the Cerrado region (Ribeiro et al. 2007), with some marginal records in transition areas with the Atlantic Forest. It was recorded only in the central and west portions of MSP (Figure 2).

*Amphisbaena alba* (N = 3; Figure 3D) is usually abundant in some Brazilian open areas (T. Mott, pers. comm.), and its wide distribution in South America is relatively well-known (Gans 1962; Vanzolini 1968). The unique record of Instituto Butantan, between August 2003 and June 2007, is from the central portion of the municipality (Figure 2). In addition, two other individuals were recorded in MZUSP. Despite the large body length, and the abundance in other localities, few individuals were registered in MSP.

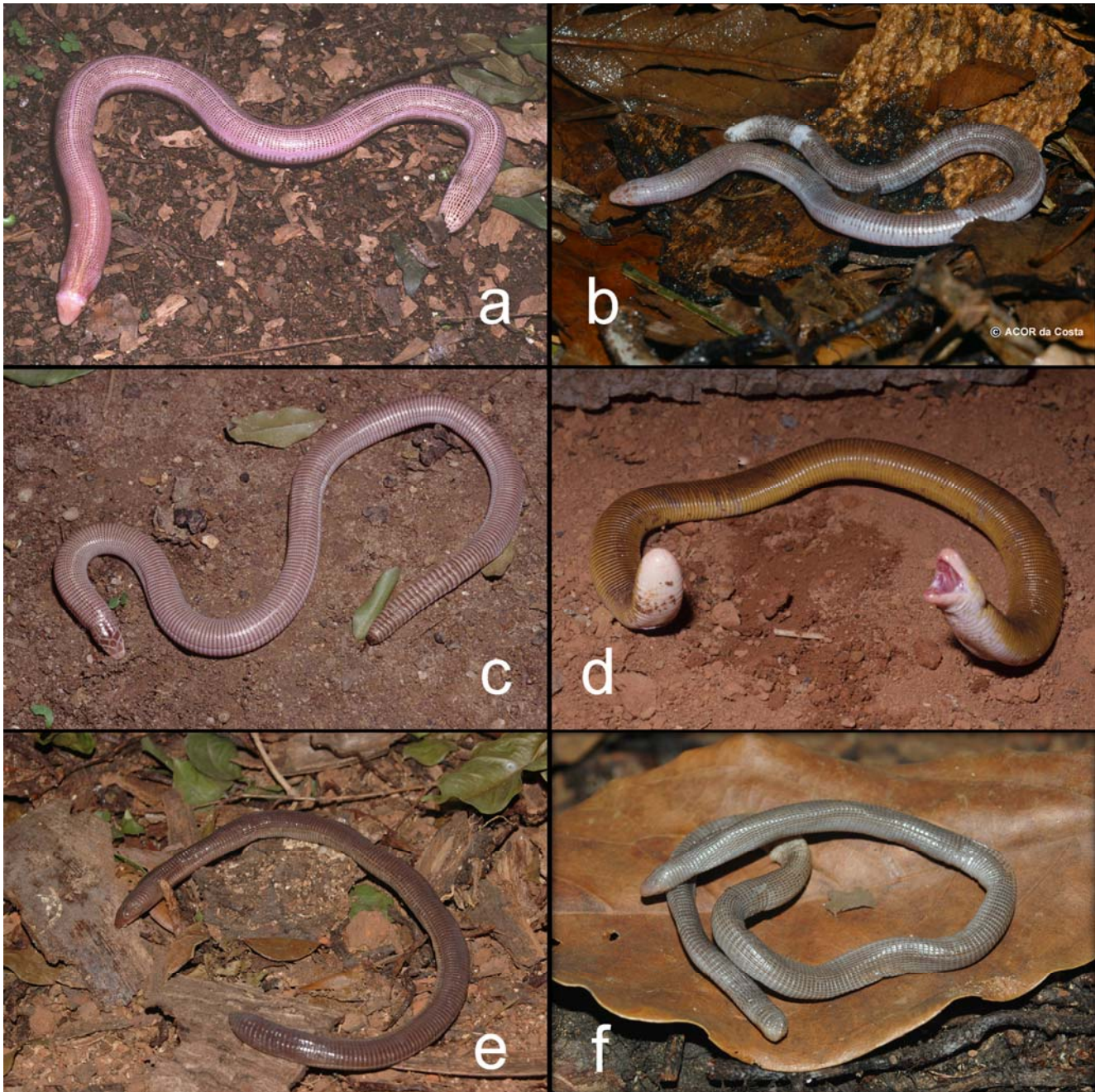
*Amphisbaena trachura* (N = 1; Figure 3E), was recorded only in Instituto Butantan, and it was collected in the central portion of MSP (Figure 2).

### Key for amphisbaenian species of the municipality of São Paulo:

- 1 - Rounded Snout .....2
- 1' - Shovel-shaped Snout...*Leposternon microcephalum*
- 2 - Terminal vertical caudal keel absent.....3
- .....Genus *Amphisbaena*.....3
- 2' - Terminal vertical caudal keel present.....4
- .....*Cercolophia roberti*\*
- 3 - Tail autotomy (or constriction) absent.....4
- 3' - Tail autotomy (or constriction) present.....5
- 4 - Precloacal pores 0-2.....*Amphisbaena dubia*
- 4' - Precloacal pores 4-10.....*Amphisbaena alba*
- 5 - Tail annuli up to 22.....6
- 5' - Tail annuli more than 25.....*Amphisbaena mertensi*
- 6 - Dorsal and ventral segments 14-21/17-23.....7
- .....*Amphisbaena trachura*
- 6' - Dorsal and ventral segments 10-13/14-18.....8
- .....*Amphisbaena hoguei*\*

(\*) Specimens recorded in MZUSP.

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**Figure 3.** Amphisbaenians from the municipality of São Paulo: a) *Leposternon microcephalum* (photo by O. A. V. Marques); b) *Amphisbaena dubia* (photo by A. C. O. R. da Costa); c) *Amphisbaena mertensi* (photo by O. A. V. Marques); d) *Amphisbaena alba* (photo by O. A. V. Marques); e) *Amphisbaena trachura* (photo by F. E. Barbo); and f) *Cercolophia roberti* (photo by F. E. Barbo).



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The fast urbanization process deeply modifies original environmental conditions, causing habitat loss and, consequently, affecting most of the arboreal and terrestrial species of squamate reptiles. Due to their fossorial habits, some amphisbaenians seem to endure these modifications. On the other hand, some species, such as *Cercolophia roberti* and *Amphisbaena hogei*, which were registered some decades ago in MSP (O. A. V. Marques, unpublished data), are no longer recorded in the study area.

*Cercolophia roberti* (Figure 3F) was described originally as *Amphisbaena roberti* by Gans (1964), from five specimens of the type series, all of them from municipality of São Paulo. The type locality was recorded as “Ypiranga” by Gans (1964) (nowadays Ipiranga neighborhood; Figure 2). The precise localities of the other four paratypes are not provided by Gans (1964). Vanzolini (1992) refers the distribution of *C. roberti* to the Cerrado domain in Brazil. Possibly, this species disappeared from MSP after the

disturbance and habitat loss of the Cerrado areas in the municipality. Currently, only very small and isolated patches of original Cerrado habitat remain within the São Paulo region (SMA 2005).

The restricted and isolated condition of open natural habitats in the study area may also be related to the rarity of *Amphisbaena alba* in São Paulo, that deeply contrasts with the fact that this is the most common species of amphisbaenian in most localities in Central Brazil, dominated by large tracts of natural, open Cerrado savannas.

*Amphisbaena hogei* is only represented in MSP by five specimens housed at MZUSP (O. A. V. Marques, unpublished data), without any additional information on its original distribution in MSP. The type locality of the species is Ilha dos Alcatrazes, a continental island of the state of São Paulo, in the Atlantic Rain Forest domain. So it probably still occurs in native forested areas of the state, and in those few scattered fragments that persists in the municipality of São Paulo.

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### Appendix

Amphisbaenians specimens from the municipality of São Paulo, deposited in the herpetological collections of Instituto Butantan (MSP) and Museu de Zoologia da Universidade de São Paulo (MZUSP). “MSP” is an acronym of the reptiles recorded from the municipality of São Paulo and housed in the herpetological collection of the Instituto Butantan.

***Amphisbaena alba*: MSP 1356; MZUSP 77582, 91344.**

***Amphisbaena dubia*: MSP 226, 360, 476, 537, 556, 568, 574, 603, 662, 718, 720, 754, 806, 877, 906, 968, 1002, 1027, 1032-33, 1141, 1153, 1161, 1175, 1204, 1215, 1478, 1543, 1566, 1646, 1669, 1780, 1798, 1829, 1986, 1991, 1995; MZUSP 87767, 87768, 87769, 87771, 89663.**

***Amphisbaena hogei*: MZUSP 6633, 6634, 6675, 6691, 17003.**

***Amphisbaena mertensi*: MSP 249, 264, 293-94, 436, 469, 999, 1144, 1173, 1378, 1640, 1962; MZUSP 8770, 79685, 90931, 88661.**

***Amphisbaena trachura*: MSP 1634**

***Cercolophia roberti*: MZUSP (previous DZ) 755, 1257, 1937, 1946-47.**

***Leposternon microcephalum*: MSP 55, 58, 79, 83, 98, 108, 110, 122, 180, 230, 261, 345, 354, 405, 573, 601-02, 615, 619, 721, 728, 735, 764, 784, 797, 833, 859-60, 892, 933, 997, 1143, 1217, 1321, 1334, 1354, 1369, 1382, 1411, 1454, 1495, 1544, 1593-95, 1663, 1665, 1680, 1751, 1761, 1865, 1918, 1993; MZUSP 77011, 77517, 79348, 79688, 88894, 89140.**