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Historical collection of snakes from Brazil by herpetologist and biogeographer Paul Müller (1940–2010), deposited at the Zoological Research Museum Alexander Koenig, Germany

Coleção histórica de serpentes do Brasil do herpetólogo e biogeógrafo Paul Müller (1940–2010), depositada no Zoological Research Museum Alexander Koenig, Alemanha

Rafaela C. França^{1,*}, Frederico G.R. França², Dennis Rödder³ & Mirco Solé⁴

¹Programa de Pós-graduação em Ecologia e Conservação da Biodiversidade, Universidade Estadual de Santa Cruz, Rodovia Jorge Amado, Km 16, CEP 45662-900 Ilhéus, Bahia, Brazil

²Departamento de Engenharia e Meio Ambiente, Centro de Ciências Aplicadas e Educação, Universidade Federal da Paraíba – UFPB, Av. Santa Elizabeth, s/n – Centro, CEP 58297-000, Rio Tinto, PB, Brazil

^{3,4}Herpetology Section, Zoologisches Forschungsmuseum Alexander Koenig, Adenauerallee 160, D-53113 Bonn, Germany

⁴Departamento de Ciências Biológicas, Universidade Estadual de Santa Cruz, Rodovia Jorge Amado, Km 16, 45662-900 Ilhéus, Bahia, Brazil

*Corresponding author: Email: rcfranca@uesc.br

¹[urn:lsid:zoobank.org:author:8F44D056-3DB1-4E7B-B5D6-28BA6BD9EC36](https://zoobank.org/author:8F44D056-3DB1-4E7B-B5D6-28BA6BD9EC36)

²[urn:lsid:zoobank.org:author:D1554607-B161-41C2-905D-47DE00C728C6](https://zoobank.org/author:D1554607-B161-41C2-905D-47DE00C728C6)

³[urn:lsid:zoobank.org:author:C7D0E2AF-2147-43FA-A89A-D770AAEA150E](https://zoobank.org/author:C7D0E2AF-2147-43FA-A89A-D770AAEA150E)

⁴[urn:lsid:zoobank.org:author:C062E3CB-D966-441A-8B77-1F94DC85FA92](https://zoobank.org/author:C062E3CB-D966-441A-8B77-1F94DC85FA92)

Abstract. Natural history collections are constituted of a wide variety of biological specimens preserved around the world. They represent a continuous source of knowledge and play a fundamental role in the synthesis on the diversity, composition, distribution, and conservation of species. Paul Müller (1940–2010) was a German zoologist who collected amphibians and reptiles in Brazil between 1964 and 1976, with the aim of increasing knowledge about the Brazilian fauna and understanding the general patterns of Neotropical biogeography. We examined and re-determined all snakes found in Paul Müller's collection, deposited at the Zoological Research Museum Alexander Koenig (ZFMK), and also reconstructed the itinerary of his journeys through Brazil. We identified 556 snake specimens belonging to 80 species from six families (Aniliidae, Boidae, Colubridae, Dipsadidae, Elapidae, and Viperidae). Müller collected snake specimens from all regions of Brazil, although most are from the south (76% of the species) and southeast (14% of the species). This relevant material can contribute to historical, biogeographic and conservation studies of the Brazilian snake fauna.

Key words. Biodiversity, Reptilia, Serpentes, Southeast Brazil, South Brazil, Scientific Collections.

Resumo. As coleções de história natural são constituídas de uma grande variedade de espécimes biológicos preservados em todo mundo. Elas são fontes contínuas de novos conhecimentos e apresentam um papel fundamental na síntese sobre a diversidade, composição, distribuição e conservação das espécies. Paul Müller (1940–2010) foi um zoólogo alemão que coletou espécies de anfíbios e répteis no Brasil entre os anos de 1964 à 1976, com o intuito de aumentar o conhecimento sobre a fauna brasileira e entender os padrões gerais da biogeografia neotropical. Nós examinamos e re-determinamos todos os indivíduos encontrados na coleção de Paul Müller, depositada no Zoological Research Museum Alexander Koenig (ZFMK) e também recriamos o roteiro de suas viagens pelo Brasil. Nós identificamos 556 espécimes de serpentes de 80 espécies pertencentes a seis famílias (Aniliidae, Boidae, Colubridae, Dipsadidae, Elapidae and Viperidae). Müller coletou exemplares de serpentes de todas as regiões do Brasil, embora a maioria seja das regiões sul (76% das espécies) e sudeste (14 % das espécies). Este relevante material pode contribuir para estudos históricos, biogeográficos e conservacionistas da fauna de serpentes brasileiras.

Palavras-chave. Biodiversidade, Reptilia, Serpentes, Sudeste do Brasil, Sul do Brasil, Coleções científicas.

INTRODUCTION

Natural history collections are made up of a wide variety of biological specimens preserved around the world and

their purpose is to document biodiversity and its distribution and to serve as a resource for research and education (Winker 2004). This set of specimens comprise an invaluable record of the evolution of life and is the basis

for many biological researches such as taxonomy and systematics, ecology, biogeography, mapping and monitoring (Renner & Ricklefs 1994; O'Connell et al. 2004; Winker 2004; Pyke & Ehrlich 2010; Ballard et al. 2017).

Paul Müller (1940–2010) was a German zoologist who studied and collected amphibians and reptiles in Brazil from 1964 to 1976. His main interests were related to zoogeographical-ecological issues and problems of the evolutionary genetics of amphibians and reptiles of the Neotropics (Müller 1971). Müller visited different regions of Brazil and gathered a huge collection of vertebrates, including more than 6000 herpetological specimens (Monzel 2016). His research on the Neotropical herpetofauna focused on processes of differentiation of amphibians and reptiles on islands on the east coast of Brazil, such as the island of São Sebastião in São Paulo and the island of Santa Catarina (e.g., Müller 1968a, c, 1969b, c). Biogeographical studies on the island of São Sebastião resulted in his PhD thesis (see Müller 1968). In addition, his research on islands has resulted in a large number of new species distribution records (e.g., Müller 1968b, c, d, 1974, 1975, 1978). He also studied important Brazilian herpetological collections, such as the Museu Goeldi in Belém (Pará), the Museu Nacional in Rio de Janeiro, and the Instituto Butantan in São Paulo, where he collected data to obtain an overview of the morphological variability of the species he collected in the field (Monzel & Böhme 2010). Müller published in 1973 his famous work “Dispersal centres of terrestrial vertebrates in the Neotropic realm“ (see Müller 1973), which was the result of his major field research from 1964 until 1970 and his investigations in Neotropical biogeography.

Throughout his research in Brazil, Paul Müller met important Brazilian herpetologists such as Paulo Emílio Vanzolini, Afrânio do Amaral, Alphonse Richard Hoge, Thales de Lema and Paulo Sawaya, the latter became a friend and, to some extent, his “Brazilian supervisor” (Monzel & Böhme 2010). On his return to Germany, Paul Müller took his collection of amphibians and reptiles to the University of Saarbrücken, where he was a professor and appointed head of the Institute of Biogeography in 1971, and later, in 1999, moved his collection to the University of Trier, where he accepted an offer to establish a new biogeographic institute (Monzel & Böhme 2010). After he retired in 2006, Paul Müller donated his important herpetological collection to the Zoological Research Museum Alexander Koenig, Germany (Monzel & Böhme 2010).

In this study, we have examined and re-determined all snake individuals found in Paul Müller’s collection and also reconstructed Paul Müller’s journey through Brazil over the years.

MATERIAL AND METHODS

We identified all snake specimens following the current nomenclature (e.g., Campbell & Lamar 2004; Grazziotin et al. 2012; Pyron et al. 2013; Hoogmoed et al. 2019). In addition, we recovered some of the material that was poorly preserved, changed all the containers that were damaged and renewed the alcohol. After having carefully analyzed all the samples, we inserted the museum label (ZFMK), but we also kept Paul Müller’s original field labels. We then entered the field information of the specimens into the museum’s database.

For the construction of the map with Paul Müller’s travel itinerary through Brazil, we used the information of the location, and the date on which the snake specimens were collected. We georeferenced the points of the locations where Paul Müller collected the species, that is, in this process we considered only the snake specimens that were collected by him. Then, we inserted all the information in ArcGIS 10.1 (ESRI 2004) and built a map.

RESULTS

We identified 80 snake species distributed in 556 specimens and six families (Aniliidae, Boidae, Colubridae, Dipsadidae, Elapidae, and Viperidae) in Paul Müller’s collection (Table 1, Fig. 1). The family Dipsadidae is the most represented in the collection, with the largest



Fig. 1. Paul Müller’s Snake Collection deposited at the Zoological Research Museum Alexander Koenig, Germany. *Pholidryas olfersii* Günther, 1885 (ZFMK 102104), collected in Rio Grande do Sul (A), snake specimens from the collection (B), *Bothrops alternatus* Duméril, Bibron & Duméril, 1854 (ZFMK 102119) collected in Rio Grande do Sul (C).

Table 1. Number of specimens (N) of each snake species in Paul Müller's collection, the respective catalogue number of the Zoological Research Museum Alexander Koenig (ZFMK) and the location where the species was collected. The abbreviations in the localities column correspond to the following Brazilian states: AM (Amazonas), BA (Bahia), MG (Minas Gerais), MT (Mato Grosso), PA (Pará), RJ Rio de Janeiro, RS (Rio Grande do Sul), SC (Santa Catarina) and SP (São Paulo).

Family/Species	N	(ZFMK)	Localities
Aniliidae			
<i>Anilius scytale</i> (Linnaeus, 1758)	1	102325	AM: Manaus
Boidae			
<i>Boa constrictor</i> Linnaeus, 1758	10	091896; 096323-28; 096357-59	AM: Manaus, Careiro; PA: Santarém, Belém, Marituba, Ilha de Marajo
<i>Epicrates crassus</i> Cope, 1862	1	102405	MG: Pedro Leopoldo
Colubridae			
<i>Chironius bicarinatus</i> (Wied-Neuwied, 1820)	7	102129-34; 102453	RS: São Leopoldo; SP: Ilha de São Sebastião, São Sebastião
<i>Chironius exoletus</i> (Linnaeus, 1758)	6	102374; 102448; 102463; 102591-92; 102609	RS: São Leopoldo, SC: Florianópolis; Ecuador
<i>Chironius fuscus</i> (Linnaeus, 1758)	1	102607	Brazil
<i>Chironius quadricarinatus</i> Boie, 1827	1	102608	MT: Cuiabá
<i>Drymarchon corais</i> (Boie, 1827)	1	102407	RS: Taquari
<i>Leptophis ahaetulla</i> (Linnaeus, 1758)	2	102380-81	AM: Uaupés, Manaus
<i>Palusophis bifossatus</i> (Raddi, 1820)	2	102170; 102624	RS: São Leopoldo
<i>Spilotes pullatus</i> (Linnaeus, 1758)	3	102110; 102602-03	RS: São Leopoldo; SC: Florianópolis; SP: Ilha de São Sebastião
<i>Spilotes sulphureus</i> (Wagler, 1824)	2	102090-91	AM: Manaus
Dipsadidae			
<i>Apostolepis assimilis</i> (Reinhardt, 1861)	1	102120	SC: Florianópolis
<i>Atractus paraguayensis</i> Werner, 1924	5	102191; 102439-43	RS: Taquara; SC: Florianópolis
<i>Atractus reticulatus</i> (Boulenger, 1885)	2	102140-102534	RS: São Leopoldo
<i>Cercophis auratus</i> (Schlegel, 1837)	2	102484-85	SC: Florianópolis
<i>Dipsas albifrons</i> (Sauvage, 1884)	2	102510; 102517	SP: Ilha de São Sebastião
<i>Dipsas indica</i> Laurenti, 1768	1	102201	RS: São Leopoldo
<i>Dipsas mikanii</i> (Schlegel, 1837)	1	102458	RS: São Leopoldo
<i>Dipsas neuwiedi</i> (Ihering, 1911)	11	102660-69; 102671	SC: Ilha de Santa Catarina
<i>Dipsas turgida</i> Cope, 1868	6	102203-04; 102541; 102459; 102613-14	SC: Ilha de Santa Catarina; RS: Campo Bom, Morro Reuter, São Leopoldo
<i>Dipsas ventrimaculatus</i> (Boulenger, 1885)	18	102193; 102198; 102460-62; 102569-79; 102606; 102622	RS: Santa Cruz do Sul; São Leopoldo
<i>Echianthera cephalostriata</i> Di Bernardo, 1996	2	102491-92	SP: Ilha de São Sebastião
<i>Echianthera cyanopleura</i> (Cope, 1885)	5	102449; 102530; 102610; 102615; 102617	RS: Campo Bom, São Leopoldo, Taquara; SC: Florianópolis
<i>Echianthera melanostigma</i> (Wagler, 1824)	1	102092	SP: Ilha de São Sebastião
<i>Erythrolamprus aesculapii</i> (Linnaeus, 1758)	2	102178; 102383	MT: Cuiabá; SP: São Sebastião
<i>Erythrolamprus almadensis</i> (Wagler, 1824)	9	102207; 102209; 102445; 102475; 102483; 102493-94; 102513; 102605	MT: Cuiabá, RS: São Leopoldo; SC: Florianópolis; SP: Ilha de São Sebastião
<i>Erythrolamprus jaegeri</i> (Günther, 1858)	9	102126; 102206; 102496; 102542-43; 102600; 102648; 102673-74	RS: São Leopoldo, Taquara

Table 1. continued.

Family/Species	N	(ZFMK)	Localities
<i>Erythrolamprus miliaris</i> (Linnaeus, 1758)	35	102128; 102136; 102137-39; 102165-69; 102438; 102456- 57; 102473-74; 102488- 90; 102535-39; 102580; 102594-99; 102626; 102675- 76; 102682-83	RS: Campo Bom, São Francisco de Paula, São Leopoldo, Taquara; SC: Florianópolis; SP: Ilha de São Sebastião
<i>Erythrolamprus poecilogyrus</i> (Wied-Neuwied, 1825)	56	102187; 102189; 102199; 102200; 102205; 102350-51; 102379; 102436-37; 102447; 10245052; 10246467; 102477; 102482; 102486-87; 102514; 102524-29; 102544- 48; 102618; 102625-28; 102640; 102649-58; 102677- 80; 102684-87	MT: Cuiabá, PA: Marajó; RS: Balneário Pinhal, Campo Bom, São Leopoldo, Novo Hamburgo, Panambi, Passo Fundo, Portão, Porto Alegre, Santa Cruz do Sul, São Francisco de Paula, São Leopoldo, Taquara, Viamão, SC: Florianópolis
<i>Erythrolamprus semiaureus</i> (Cope, 1862)	3	102497-98; 102516	RS: São Leopoldo, São Sebastião do Caí
<i>Erythrolamprus typhlus</i> (Linnaeus, 1758)	1	102320	RS: Taquara
<i>Helicops carinicaudus</i> (Wied-Neuwied, 1825)	16	102153-58; 102384; 102469; 102499; 102500; 102504-58; 102561	RS: São Leopoldo
<i>Helicops infrataeniatus</i> Jan, 1865	27	102159-64; 102501-09; 102515; 102559; 102612; 102616; 102630	RS: Campo Bom, Porto Alegre, São Leo- poldo
<i>Lygophis anomalus</i> (Günther, 1858)	2	102152; 102468	RS: São Leopoldo, SC: Ilha de Santa Catarina
<i>Lygophis flavifrenatus</i> Cope, 1862	2	102481; 102672	RS: Passo Fundo, Viamão
<i>Lygophis lineatus</i> (Linnaeus, 1758)	4	102551-54	PA: Marajó
<i>Oxyrhopus clathratus</i> Duméril, Bibron & Duméril, 1854	6	102478-83	RS: São Leopoldo
<i>Oxyrhopus formosus</i> (Wied-Neuwied, 1820)	1	102633	AM: Manaus
<i>Oxyrhopus guibeii</i> Hoge & Romano, 1977	1	102173	RS: São Sebastião do Caí
<i>Oxyrhopus petolarii</i> (Linnaeus, 1758)	1	102202	SP: São Sebastião
<i>Oxyrhopus rhombifer</i> Duméril, Bibron & Duméril, 1854	12	102143-51; 102195-97	RS: Morro Reuter, Novo Hamburgo, San- ta Cruz do Sul, São Leopoldo
<i>Phalotris lemniscatus</i> (Duméril, Bibron & Duméril, 1854)	1	102194	RS: São Leopoldo
<i>Phalotris reticulatus</i> (Peters, 1860)	1	102639	RS: São Leopoldo
<i>Philodryas aestiva</i> (Duméril, Bibron & Duméril, 1854)	12	102121; 102122; 102171; 102179; 102454; 102471; 102495; 102587-90; 102643	RS: São Leopoldo, SC: Florianópolis, Ilha de Santa Catarina, SP: Ilha de São Sebastião
<i>Philodryas argentea</i> (Daudin, 1803)	3	102406; 102619-20	AM: Manaus; Ecuador
<i>Philodryas olfersii</i> (Lichtenstein, 1823)	19	102093-99; 102104; 102109; 102172; 102180; 102442; 102455; 102470; 102480; 102549; 102550; 102644; 102647	SC: Ilha de Santa Catarina; RS: General Câmara, Morro Reuter, Panambi, Portão, Santa Cruz do Sul, São Leopoldo, Taquara
<i>Philodryas patagoniensis</i> (Girard, 1858)	9	102135; 102446; 102472; 102476; 102547; 102611; 102631-32; 102670	RS: Passo Fundo, São Leopoldo, SC: Florianópolis; SP: Ilha de São Sebastião, São Sebastião
<i>Pseudoboa haasi</i> (Boettger, 1905)	1	102208	RS: São Leopoldo
<i>Pseudoboa newwiedii</i> (Duméril, Bibron & Duméril, 1854)	1	102531	AM: Manaus
<i>Siphlophis pulcher</i> (Raddi, 1820)	1	102638	SC: Florianópolis

Table 1. continued.

Family/Species	N	(ZFMK)	Localities
<i>Taeniophallus bilineatus</i> (Fischer, 1885)	2	102601; 102645	SC: Ilha de Santa Catarina; SP: Ilha de São Sebastião
<i>Thamnodynastes</i> sp.	1	102681	RS: São Leopoldo
<i>Thamnodynastes nattereri</i> (Mikan, 1828)	9	102182-86; 102511-12; 102532; 102584	SP: Ilha de São Sebastião
<i>Thamnodynastes hypoconia</i> (Cope, 1860)	1	102192	SP: Ilha de São Sebastião
<i>Thamnodynastes lanei</i> Bailey, Thomas & Silva-Jr, 2005	1	102533	PA: Ilha de Marajó
<i>Tomodon</i> sp.	1	102659	RS: Taquara
<i>Tropidodryas serra</i> (Schlegel, 1837)	3	102117; 102634-35	SC: Florianópolis
<i>Tropidodryas striaticeps</i> (Cope, 1870)	1	102636	SC: Florianópolis
<i>Xenodon dorbignyi</i> (Bibron, 1854)	13	102174-77; 102518-23; 102540; 102593; 102637	RS: Campo Bom, Praia da Pinhal, São Leopoldo; SC: Florianópolis; SP: Ilha de São Sebastião
<i>Xenodon matogrossensis</i> (Scrocchi & Cruz, 1993)	1	102604	MT: Rondonópolis
<i>Xenodon merremii</i> (Wagler, 1824)	26	102101-07; 102333-36; 102382; 102391-04; 102444	RS: Santa Cruz do Sul, São Francisco de Paula, São Leopoldo, Taquara
<i>Xenodon neuwiedii</i> Günther, 1863	4	102123; 102127; 102181; 102646	RS: Morro Reuter, São Leopoldo; SC: Florianópolis, Ilha de Santa Catarina
Elapidae			
<i>Micrurus altirostris</i> (Cope, 1860)	18	096392-01; 102111-15; 102188; 102190; 102621	RS: Campo Bom, Portão, Santa Cruz do Sul, São Leopoldo
<i>Micrurus averyi</i> Schmidt, 1939	1	102629	AM: Manaus
<i>Micrurus corallinus</i> (Merrem, 1820)	30	102141; 102387-90; 102408-32	SC: Florianópolis; SP: Ilha de São Sebastião
<i>Micrurus frontalis</i> Duméril, Bibron & Duméril, 1854	3	102386; 102623; 102108	MT: Cuiabá; SP: São Sebastião
<i>Micrurus spixii</i> Wagler, 1824	1		AM: Manaus
Viperidae			
<i>Bothrops alternatus</i> Duméril, Bibron & Duméril, 1854	9	102119; 102319; 102329; 102338-39; 102341; 102346; 102355; 102372	RS: Portão, São Leopoldo; SP: São Sebastião
<i>Bothrops atrox</i> (Linnaeus, 1758)	2	102142	AM: Manaus
<i>Bothrops bilineatus</i> (Wied-Neuwied, 1821)	1	102378	Ecuador: Quito
<i>Bothrops cotiara</i> (Gomes, 1913)	3	102118; 102310-11	RS: São Leopoldo
<i>Bothrops diporus</i> Cope, 1862	3	102124; 102125; 102344	RS: Erval seco, Portão
<i>Bothrops insularis</i> (Amaral, 1921)	1	93234	SP: Ilha de Queimada Grande
<i>Bothrops jararaca</i> (Wied-Neuwied, 1824)	65	32540; 102100; 102321-24; 102337; 102342; 102345; 102347; 102352-54; 102356-60; 102362-71; 102377; 102433-35; 102688-99	RJ: Rio de Janeiro; RS: São Leopoldo; SC: Florianópolis; SP: Ilha de São Sebastião, São Sebastião; Ecuador: Quito
<i>Bothrops jararacussu</i> Lacerda, 1884	3	102326; 102327; 102373	SP: Ilha de São Sebastião
<i>Bothrops leucurus</i> Wagler, 1824	1	102116	BA: Costa Oeste da Bahia
<i>Bothrops moojeni</i> Hoge, 1966	2	102328; 102343	MG: Pedro Leopoldo
<i>Bothrops pubescens</i> (Cope, 1870)	14	102312-18; 102330-32; 102340; 102348-49; 102361	RS: Panambi, Portão, São Leopoldo
<i>Crotalus durissus</i> Linnaeus, 1758	7	093229-33; 102375-76	MG: Belo Horizonte; RS: São Leopoldo; SP: Campinas

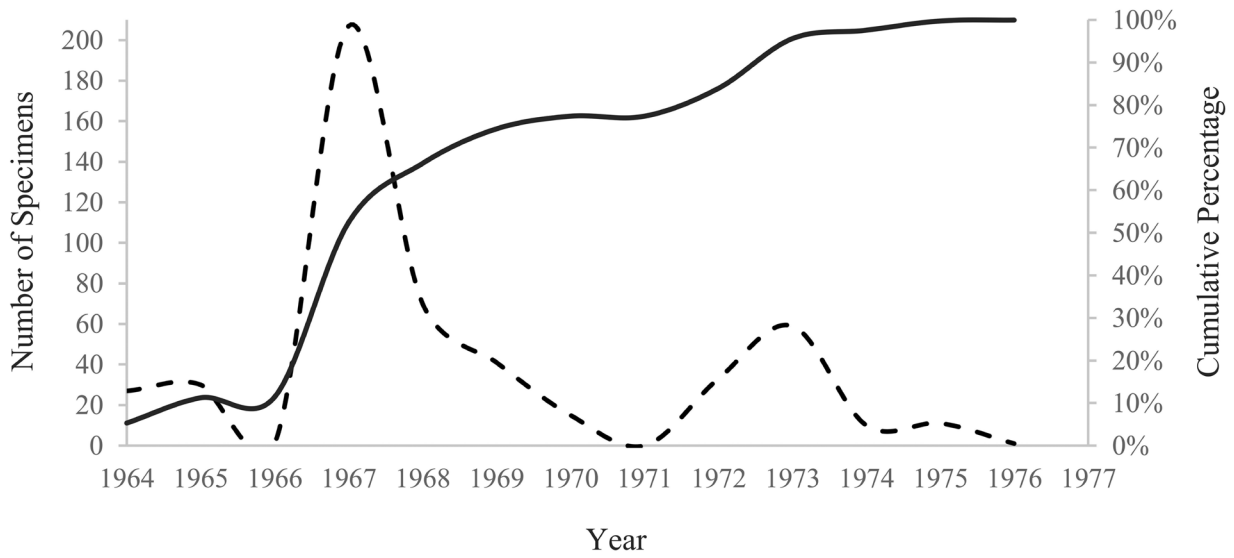


Fig. 2. Number of specimens collected per year (dotted line) and the cumulative percentage of specimens from Paul Müller’s collection between 1964 and 1976 (non-dotted line).

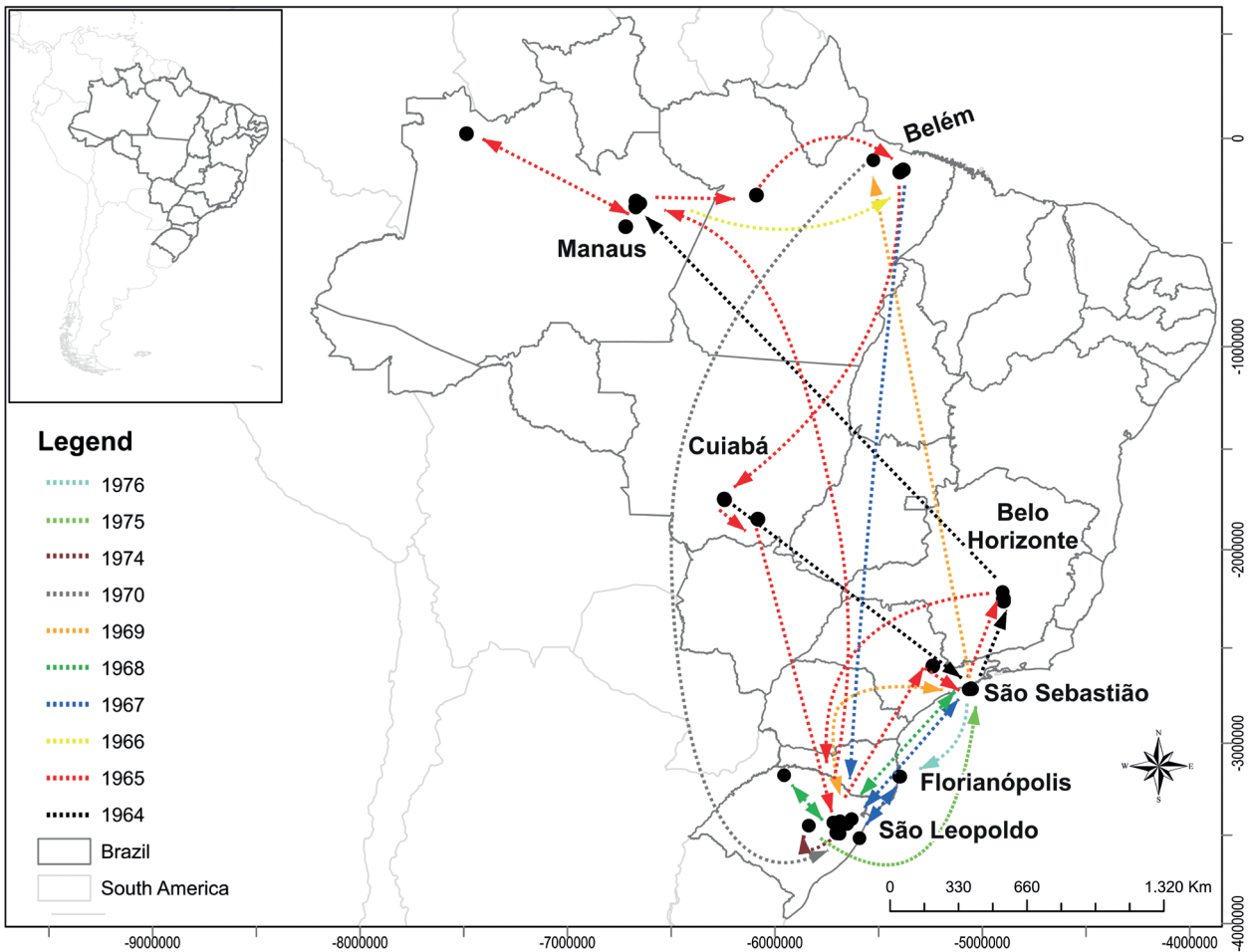


Fig. 3. Paul Müller’s journey through Brazil between 1964 and 1976 based on records of dates and locations of snake specimens. The color of the dotted lines represents the year of the journey and the arrow indicates the direction of movement throughout the year.

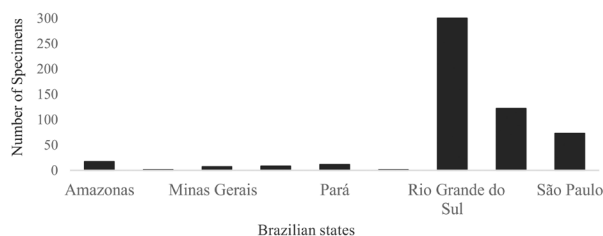


Fig. 4. Number of snake specimens from Paul Müller's collection collected in nine Brazilian states (Amazonas, Bahia, Minas Gerais, Mato Grosso, Pará, Rio de Janeiro, Rio Grande do Sul, Santa Catarina and São Paulo).

number of species (50 spp.) and specimens ($N = 357$), followed by the family Viperidae, with 12 species and 109 specimens. *Bothrops jararaca* ($N = 65$) and *Erythrolamprus poecilogyrus* ($N = 56$) are the species with the highest number of specimens in the collection.

Most of the specimens (86%) were collected in Brazil between 1964 and 1976 (Fig. 2). During this period, Paul Müller made several herpetological expeditions to different states of the country (Fig. 3). However, Paul Müller did not collect all specimens himself, 29% of the specimens were collected by collaborators. In the collection, there are five specimens of the genus *Bothrops* (*B. jararaca*, *B. leucurus*, *B. insularis*, *B. cotiara*, and *B. pubescens*) collected in Brazil, between 1909 and 1963, which were donations, as well as five other specimens (*Bothrops bilineatus*, *Bothrops jararaca*, *Chironius exoletus*, and *Philodryas argentea* ($N = 2$) which are from Ecuador.

In Paul Müller's collection there are snake specimens from all regions of Brazil, although most are from the south ($N = 422$; 76%) and southeast ($N = 81$; 14%). Most of the specimens in the collection were captured in the state of Rio Grande do Sul (53%), in the municipalities of São Leopoldo, Campo Bom, Portão and Taquara, in the state of Santa Catarina (22%), on the island of Santa Catarina, and in the state of São Paulo (13%), on the island of São Sebastião (Fig. 4). There is only one specimen from the Northeast region, a *Bothrops leucurus* collected in Bahia in 1912 which was donated to the collection.

DISCUSSION

Paul Müller's first expeditions to Brazil were aimed at obtaining as much information as possible about the vertebrate fauna and butterflies from all over the country and thus increasing knowledge about the diversity of the fauna and inferring patterns from Neotropical biogeography (Müller 1971; Monzel & Böhme 2010). According to Müller (1971), Brazil is of extreme zoogeographical interest, since it is the largest country in South America, with a tropical climate and a much differentiated vegetation zoning. It presents a transition between

the humid forests of Ecuador, Colombia and Guyanas, on the one hand, and the dry areas of the Argentinean Pampa and Paraguay, on the other. Although Müller had a vast knowledge of several groups of animals, most of his studies were in the area of herpetology (Monzel & Böhme 2010).

During his expeditions to Brazil, Müller visited several states, but concentrated his collections on the Brazilian coastal states, mainly Rio Grande do Sul, São Paulo and Santa Catarina. Of these, Rio Grande do Sul was the state with the largest number of snake specimens collected. Although the focus of Paul Müller's work in Brazil was on island fauna (e.g., Müller 1968a, b, c, 1969a, b, c), most of the collection sites in Rio Grande do Sul are not islands. The number of specimens collected both in Rio Grande do Sul and Santa Catarina is also due to the help of Paul Müller's friends, who supported him in collecting the specimens and whom he thanked in his work, namely Erno Böhler and Flavio Silva (both from São Leopoldo) and Canisius Ritter (Florianópolis) (e.g., Müller 1968c, 1971).

The most numerous species in Paul Müller's collection were *Bothrops jararaca* and *Erythrolamprus poecilogyrus*. *B. jararaca* is a species widely distributed in the South and Southeast of Brazil (Sazima 1992; Graziotin et al. 2006; Monzel & Wüster 2008) and common in the Serra do Mar region (Centeno et al. 2008). *E. poecilogyrus* is common and widely distributed throughout Brazil (Dixon & Markezich 1992; Alencar & Nascimento 2014). No species registered in Paul Müller's collection is in the threatened species category of the Brazilian red list of threatened species, except *B. insularis*, which is Critically Endangered (ICMBio 2018). Among the snakes in the collection are two specimens of *Uromacerina ricardinii*, used by Paul Müller to report the first record of the species for the state of Santa Catarina (see Müller 1978). Recently the species underwent a synonymization process and today it is known as *Cercophis auratus* (Hoogmoed et al. 2019).

In the collection, there are some species that provide information from interesting collection locations. For example, there are two specimens of *Dipsas turgidus* collected in Florianópolis, Santa Catarina. In Brazil, the distribution of *D. turgidus* covers the states of Mato Grosso, Minas Gerais, Rio de Janeiro, Rio Grande do Sul and São Paulo (Wallach et al. 2014). There are four individuals of *Xenodon dorbignyi* from São Sebastião Island, in São Paulo. This species has a known distribution in the extreme south of Brazil, Uruguay, southern Paraguay and central-northern Argentina (Orejas-Miranda 1966; Giraudo 2001; Nenda & Cacivio 2007; Kunz et al. 2011; Cacciali et al. 2016). In addition, other species with location information for São Sebastião and São Sebastião Island, in São Paulo, have not yet been registered in these locations. For example, *B. alternatus* ($N = 4$), *Micrurus frontalis* ($N = 1$) and *Oxyrhopus petolarius* ($N = 1$) col-

lected in São Sebastião, and the species *Philodryas aestiva* (N = 1), *Echinanthera melanostigma* (N = 1) and *Erythrolamprus almadensis* (N = 1) collected on São Sebastião Island (see Cicchi et al. 2007; Centeno et al. 2008). The absence of records of these species for these locations can be explained by a variety of factors, such as the rarity of some species in the region or the preference of habitats of some species. Errors may have occurred in the records of the collection locations of these species or even some of these species may have disappeared from these locations due to changes in land use in recent decades.

The analysis of snake specimens from Paul Müller's collection can contribute to historical biogeographic and conservationist studies of the Brazilian snake fauna. In addition, given the current scenario of material loss caused by recent incidents in large Brazilian collections, such as the fires at the Instituto Butantan in 2010 and the Museu Nacional in 2018 (see Mega 2019), these collections can provide valuable information and help to soften the impact of material loss.

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