Snakes from coastal islands of State of São Paulo, Southeastern Brazil

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Abstract

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There are relatively few studies on snake fauna from coastal islands of the State of São Paulo (SSP), Southeastern Brazil and the number of species housed in Brazilian institutional zoological collections is relatively limited. In Brazil, for the first time, a snake inventory for eighteen islands of coastal SSP is presented. Here we record data from sampling on eleven islands as well information on vouchered species in the main herpetological collections. Thirty-six species from four families: one Boidae, thirty Colubridae, one Elapidae and four Viperidae from eighteen islands are listed as well as the thirteen new island records for snakes. Relative abundance categories were used for species rarity: common, infrequent and rare; 44.4% of the snakes with voucher specimens were considered rare. The most common species in twelve of the eighteen islands was *Micrurus corallinus*; in eleven of the eighteen islands were *Bothrops jararaca* and *Liophis miliaris*; in ten of the eighteen islands were *B. jararacussu* and *Chironius bicarinatus*. The most common snake species on coastal islands were *Micrurus corallinus* which was found in twelve of the eighteen islands, followed by *Bothrops jararaca* and *Liophis miliaris* found on eleven of the eighteen islands and *B. jararacussu* and *Chironius bicarinatus* which were found in ten of the eighteen islands studied. There are seven new records of snake species for Cardoso Island (25° 05' S and 047° 59' W): *C. bicarinatus*, *C. multiventris*, *Dipsas petersi*, *Echinanthera bilineata*, *E. cephalostriata*, *Helicops carinicaudus* and *Xenodon neuwiedii*; three new records for Comprida Island (24° 54' S and 47° 48' W): *B. jararacussu, C. bicarinatus* and *H. carinicaudus;* one for Anchieta Island (23° 32' S and 045° 03' W): *Spilotes pullatus*; one for Couves Island (23° 25' S and 44° 52' W): *L. miliaris*; one for Porcos Island (23° 23' S and 44° 54' W), *B. jararaca*. The endemic species *B. alcatraz* from Alcatrazes Island and *B. insularis* from Queimada Grande Island are considered endangered species by IUCN. Snake fauna on Monte de Trigo Island are extinct. The fragility of insular snake fauna needs more attention for environmental conservation, since 52.0% of snake species preys on amphibians, highlighting the importance of forest conservation.

Keywords: *snakes, coastal islands, inventory, conservation, diversity.*

Resumo

Cicchi, P.J.P.; De Sena, M.A. Peccinini-Seale, D.M. and Duarte, M.R. **Serpentes das ilhas costeiras do Estado de São Paulo, Sudeste do Brasil**. *Biota Neotrop*. May/Aug 2007 vol. 7, no. 2. http://www.biotaneotropica.org.br/v7n2/pt/abstract?inventory+bn03907012007. ISSN 1676-0603.

Há poucos estudos sobre a fauna de serpentes em ilhas costeiras do Estado de São Paulo, Sudeste do Brasil e um baixo número de espécies depositadas em coleções zoológicas. No Brasil, pela primeira vez, foi realizado um inventário em 18 ilhas do litoral paulista a partir de pesquisa de registros nas coleções herpetológicas do Sudeste do Brasil. Também foram realizadas coletas de campo em onze ilhas. Trinta e seis espécies de quatro famílias foram registradas: uma espécie de Boidae, trinta de Colubridae, uma de Elapidae e quatro de Viperidae. Os dados de campo apresentaram treze ocorrências novas de espécies sem registro nas coleções. Para estimar a raridade das espécies utilizaram-se categorias de abundância relativa: comum, não-freqüente e rara. Das espécies amostradas, 44,4% foram consideradas raras. As espécies mais comuns foram *Micrurus corallinus*, presente em doze ilhas; *Bothrops jararaca e Liophis miliaris*, presentes em onze ilhas, *B. jararacussu* e *Chironius bicarinatus*, presentes em 10 ilhas. Foram efetuados sete novos registros para a Ilha do Cardoso (25° 05' S e 47° 59' W): *C. bicarinatus*, *C. multiventris*, *Dipsas petersi*, *Echinanthera bilineata*, *E. cephalostriata*, *Helicops carinicaudus* e *Xenodon neuwiedii;* três para Ilha Comprida (24° 54' S e 47° 48' W): *B. jararacussu, C. bicarinatus* e *H. carinicaudus*; um para Ilha Anchieta (23° 32' S e 45° 03' W): *Spilotes pullatus*; um para a Ilha das Couves (23° 25' S e 44° 52' W): *L. miliaris*; um para a Ilha dos Porcos (23° 23' S e 44° 54' W): *B. jararaca*. *B. alcatraz* e *B. insularis*, endêmicos à Ilha de Alcatrazes e à Ilha da Queimada Grande, respectivamente, são considerados criticamente em perigo

segundo IUCN. Foi registrada a extinção da fauna de serpentes na Ilha Monte de Trigo. Os ecossistemas insulares, mais vulneráveis que os continentais, carecem de uma proteção mais efetiva. A maioria destas espécies (cerca de 52%) preda anfíbios, reforçando a necessidade de conservação das florestas.

Palavras-chave: *serpentes, ilhas, inventário, diversidade, conservação.*

Introduction

Studies on island herpetological fauna are relevant since there is a significant human impact on these threatened environments, mainly by mismanagement of natural resources and predatory tourism. Few islands are unaltered by human action, and often anthropogenic alterations have taken place on a scale even greater than in most continental systems (Vitousek et al. 1995).

The coastal area of the State of São Paulo (SSP), southeastern Brazil, encompasses 106 islands isolated from the mainland by distances which vary from a few meters up to 38 km (Ângelo 1989), with a wide range of anthropogenic alterations.

As commented by Ângelo (1989), less than 10% of the insular environment in SSP has some official environmental protection. In fact, the relatively low representation of island species in the lists of threatened and endangered species around the world is emblematic (Vitousek et al. 1995). In Brazil, snake inventories on this set of coastal islands has still not been addressed, except for some studies made on a relatively small number of coastal islands of SSP (Ihering 1897; Amaral 1921; Luederwaldt 1923; Hoge 1950; Mertens 1955; Hoge et al. 1959; Müller 1968; Vanzolini 1973; Duarte et al. 1995, Marques et al. 2002; Centeno 2003; Cicchi 2004) which addressed specific biological aspects rather than snake inventories. As in Rodrigues (2005), except for the Crocodylia, the richness of the Brazilian reptile fauna is still underestimated because of insufficient inventories and too few taxonomists. The study of these insular faunas, comparing the fauna among themselves and with those from the adjacent mainland must, therefore, afford insight into several evolutionary mechanisms that have determined the formation of complex tropical biota (Vanzolini 1973). This study presents a first general approach for snakes living on coastal islands of Sao Paulo, based on fieldwork on nine different islands of SSP in Brazil and the lists of vouchered specimens of snake species from eighteen islands in the main herpetological collections of Brazilian Institutions. The fragility of insular snake fauna needs more attention for environmental conservation.

Material and Methods

Our inventory of the snakes inhabiting coastal islands of the SSP (between the latitudes 23° 20' S to 25° 15' and longitudes 44° 45' W to 48° 00', Figure 1; Climatic data Figure 2) was based on literature, on field inventory on some costal islands and on recorded specimens in the following institutional collections: Coleção Herpetológica "Alphonse Richard Hoge", Instituto Butantan, São Paulo, Brazil (IBSP); Museu de Zoologia da Universidade de São Paulo (MZUSP), Museu de História Natural "Prof. Dr. Adão José Cardoso" da Universidade Estadual de Campinas, SP, Brazil (ZUEC), Museu Nacional, Rio de Janeiro, RJ, Brazil (MNRJ) (Appendix 1). Fieldwork was conducted between 2000 and 2005 by opportunistic visual search on the following islands: Alcatrazes, Anchieta, Bom Abrigo, Buzios, Cananéia, Cardoso, Comprida, Couves, Queimada Grande, São Sebastião and Vitória (Figures 3-9). Snake specimens were also donated by

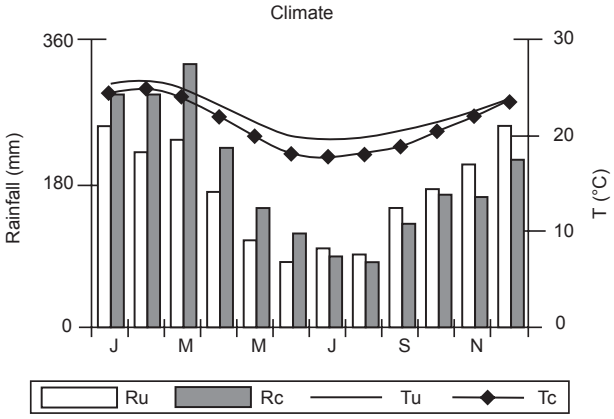

Figure 2. The graph presents monthly average rainfall and temperature (1980-1988) in extreme sites of the study area: north — Ubatuba and south — Cananéia. Ru: rainfall in Ubatuba, Rc: rainfall in Cananéia, Tu: temperature in Ubatuba, Tc: temperature in Cananéia. Modified from Marques et al. 2000.

Figura 2. O gráfico apresenta a média mensal de temperatura e precipitação (1980-1988) em locais extremos da área de estudo: norte – Ubatuba e Sul – Cananéia. Ru: precipitação em Ubatuba, Rc: precipitação em Cananéia, Tu: temperatura em Ubatuba, Tc: temperatura em Cananéia. Modificado de Marques et al. 2000.

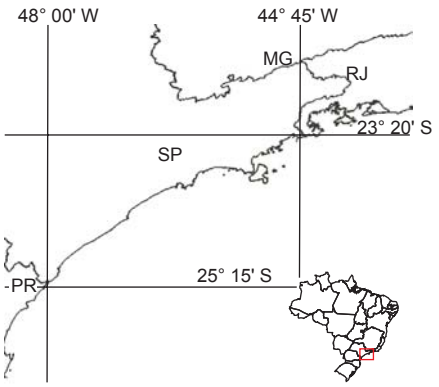

Figure 1. Map of Study Area. Coast of the State of São Paulo, Brazil.

Figura 1. Mapa da área de estudo. Costa do Estado de São Paulo, Brasil.

Figure 3. Armação da Baleia, Bom Abrigo Island. Photo: Marcelo R. Duarte.

Figura 3. Armação da Baleia, Ilha do Bom Abrigo. Foto: Marcelo R. Duarte.

island inhabitants. Relative abundance categories (RAC) were used for species rarity: **Common**: occurrence on more than five islands; **Infrequent**: occurrence on four distinct islands and **Rare**: occurrence on three or less islands. The RAC for snake species were compared with data from the SSP Atlantic Forest mainland available in the literature. Supplementary information on species occurrence on the islands was provided by experienced herpetologists.

Results

With the combined information obtained in the literature, specimens housed in Institutional collections and from field collections by the authors of the present study, a total of 36 species was recorded for the eighteen studied islands: one Boidae, 30 Colubridae, one Elapidae and four Viperidae (Table 1, Figures 10-40 and Appendix 1). An aster-

Figure 4. Erosion, Bom Abrigo Island. Photo: Marcelo R. Duarte.
Figura 4. Erosão. Ilha do Bom Abrigo. Foto: Marcelo R. Duarte.

Figure 7. Búzios Island. Photo: Marcelo R. Duarte.
Figura 7. Ilha de Búzios. Foto: Marcelo R. Duarte.

Figure 5. Alcatrazes Island. Photo: Marcelo R. Duarte.
Figura 5. Ilha de Alcatrazes. Foto: Marcelo R. Duarte.

Figure 8. Vitória Island. Photo: Marcelo R. Duarte.
Figura 8. Ilha de Vitória. Foto: Marcelo R. Duarte.

Figure 6. Cardoso Island. Photo: Marcelo R. Duarte.
Figura 6. Ilha do Cardoso. Foto: Marcelo R. Duarte.

Figure 9. Queimada Grande Island. Photo: Marcelo R. Duarte.
Figura 9. Ilha da Queimada Grande. Foto: Marcelo R. Duarte.

isk marks each one of the 13 new records of snakes. There are seven new records of snake species for Cardoso Island (25° 05' S and 47° 59' W): *C. bicarinatus*, *C. multiventris*, *Dipsas petersi*, *Echinanthera bilineata*, *E. cephalostriata*, *Helicops carinicaudus* and *Xenodon neuwiedii*; three new records for Comprida Island (24° 54' S and 47° 48' W): *B. jararacussu, C. bicarinatus* and *H. carinicaudus;* one for Anchieta Island (23° 32' S and 45° 03' W): *Spilotes pullatus*; one for Couves Island (23° 25' S and 44° 52' W): *L. miliaris*; one for Porcos Island (23° 23' S and 44° 54' W), *B. jararaca*.

Data on the area of the islands of the SSP having voucher snake species in institutional herpetological collections or in the literature, distance of the island from the mainland, threats and category of use are shown in Table 2. Comparative studies on island areas and the number of snake species (Figure 41) showed a strong positive

Table 1. Thirty-six species of snakes from 18 islands from SSP (23° 20' S to 25° 15' and 44° 45' W to 48° 00') with an asterisk representing a new island record. Species with an asterisk representing a new island record. Figures 3-9, some islands visited; Figures 11-41, some species collected.

Tabela 1. Trinta e seis espécies de serpentes em 18 ilhas no SSP (23° 20' S até 25° 15' e 44° 45' W até 48° 00'). Espécies com asterisco representam novo registro para a ilha. Figuras 3-9, algumas ilhas visitadas; Figuras 11-41, algumas espécies coletadas.

Species/Islands	Alcatrazes	Anchieta	Barnabé	Bom Abrigo	Búzios	Cananéia	Cardoso	Comprida	Couves
Boidae									
Corallus hortulanus									
Colubridae									
Chironius bicarinatus		+			+	+	+*	+*	
C. exoletus						+	+	+	
C. fuscus							+		
C. laevicollis							+	+	
C. multiventris						+	+*		
Clelia plumbea							+		
Dipsas albifrons	+								
D. alternans									
D. petersi							+*		
D. neivai						+			
Echinanthera bilineata							+*		
E.cephalostriata							+*		
E. melanostigma									
E. undulata								+	
Erythrolamprus aesculapii			+			+			
Helicops carinicaudus						+	+*	+*	
Imantodes cenchoa							+		
Liophis miliaris		+		+		+	+	+	+*
L. poecilogyrus							+		
Oxyrhopus clathratus						+	+		
Sibynomorphus neuwiedii						+	+		
Siphlophis pulcher	+				+	+			
Sordellina punctata								+	
Spilotes pullatus		+*				+	+	+	
Thamnodynastes cf. *nattereri*								+	
Tomodon dorsatus						+	+		
Tropidodryas serra							+		
T. striaticeps							+		
Xenodon neuwiedii						+	+*		
Waglerophis merremii									
Elapidae									
Micrurus corallinus	+	+	+		+	+	+	+	
Viperidae									
Bothrops alcatraz	+								
B. insularis									
B. jararaca		+			+	+	+	+	
B. jararacussu		+		+		+	+	+*	

correlation, (r = 0.72; p = 0.007; n =18). Data on distances from the continent and snake species richness (Figure 42) showed a negative correlation, (r = –0.39; p = 0.1; n =18).

From the total of snake species with voucher specimens deposited in institutional collections, 44.4%were considered rare, 25.0% were considered infrequent and 30.6% were considered common. The fragility of insular snake fauna needs greater attention for environmental conservation, since 52.0% of snake species preys on amphibians, highlighting the importance of forest conservation. (Table 3). Frequency of snake species in the SSP islands is shown in

Table 1. Continued...

Species/Islands	Mar Virado	Monte de Trigo[1]	Porchat[2]	Porcos	Queimada Grande	Santo Amaro	São Sebastião	São Vicente	Vitória
Boidae									
Corallus hortulanus						+			
Colubridae									
Chironius bicarinatus	+		+			+	+	+	
C. exoletus	+		+			+		+	
C. fuscus			+			+		+	
C. laevicollis							+	+	
C. multiventris						+	+	+	
Clelia plumbea							+	+	
Dipsas albifrons					+		+		
D. alternans							+		
D. petersi						+	+	+	
D. neivai							+		
Echinanthera bilineata									
E.cephalostriata						+	+	+	
E. melanostigma						+		+	
E. undulata								+	
Erythrolamprus aesculapii							+	+	
Helicops carinicaudus			+			+		+	
Imantodes cenchoa									
Liophis miliaris			+			+	+	+	+
L. poecilogyrus						+		+	
Oxyrhopus clathratus							+	+	
Sibynomorphus neuwiedi						+	+	+	
Siphlophis pulcher						+	+	+	
Sordellina punctata									
Spilotes pullatus			+			+	+	+	
Thamnodynastes cf. *nattereri*							+		
Tomodon dorsatus			+					+	
Tropidodryas serra						+			
T. striaticeps						+			
Xenodon neuwiedii						+	+		
Waglerophis merremii						+			
Elapidae									
Micrurus corallinus			+			+	+	+	+
Viperidae									
Bothrops alcatraz	+								
B. insularis					+				
B. jararaca			+	+*		+	+	+	+
B. jararacussu			+			+	+	+	+

[1]Snake population of Monte de Trigo Island extirpated by locals (MFD Furtado, pers. communication); and [2]Presumed Porchat Island (*error*; originally vouchered Paranapuã Island, name of the continental beach beside Porchat Island).

[1]População de serpentes da Ilha do Monte de Trigo dizimada pela população humana local. (MFD Furtado, com. pess.); e [2]Suposta Ilha Porchat (*erro*: originalmente tombada como Ilha de Pararnapuã, nome dado a uma praia continental próxima a Ilha Porchat).

Figure 10. *Corallus hortulanus*, Family Boidae. Photo: Marcelo R. Duarte.

Figura 10. *Corallus hortulanus*, Família Boidae. Foto: Marcelo R. Duarte.

Figure 14. *Chironius multiventris*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 14. *Chironius multiventris*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 18. *Echinanthera bilineata*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 18. *Echinanthera bilineata*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 11. *Chironius bicarinatus*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 11. *Chironius bicarinatus*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 15. *Dipsas albifrons*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 15. *Dipsas albifrons*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 19. *Echinanthera cephalostriata*, Family Colubridae. Photo: Ricardo J. Sawaya.

Figura 19. *Echinanthera cephalostriata*, Família Colubridae. Foto: Ricardo J. Sawaya.

Figure 12. *Chironius fuscus*, Family Colubridae. Photo: Antônio Bordignon.

Figura 12. *Chironius fuscus*, Família Colubridae. Foto: Antônio Bordignon.

Figure 16. *Dipsas neivai*, Family Colubridae. Photo: Antônio Bordignon.

Figura 16. *Dipsas neivai*, Família Colubridae. Foto: Antônio Bordignon.

Figure 20. *Echinanthera undulata*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 20. *Echinanthera undulata*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 13. *Chironius laevicollis*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 13. *Chironius laevicollis*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 17. *Dipsas petersi*, Family Colubridae. Photo: Antônio Bordignon.

Figura 17. *Dipsas petersi*, Família Colubridae. Foto: Antônio Bordignon.

Figure 21. *Erythrolamprus aesculapii*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 21. *Erythrolamprus aesculapii*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 22. *Helicops carinicaudus*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 22. *Helicops carinicaudus*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 26. *Oxyrhopus clathratus*, Family Colubridae. Photo: Antônio Bordignon.

Figura 26. *Oxyrhopus clathratus*, Família Colubridae. Foto: Antônio Bordignon.

Figure 30. *Spilotes pullatus*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 30. *Spilotes pullatus*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 23. *Imantodes cenchoa*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 23. *Imantodes cenchoa*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 27. *Sibynomorphus neuwiedi*, Family Colubridae. Photo: Antônio Bordignon.

Figura 27. *Sibynomorphus neuwiedi*, Família Colubridae. Foto: Antônio Bordignon.

Figure 31. *Tomodon dorsatus*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 31. *Tomodon dorsatus*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 24. *Liophis miliaris*, Family Colubridae. Photo: Antônio Bordignon.

Figura 24. *Liophis miliaris*, Família Colubridae. Foto: Antônio Bordignon.

Figure 28. *Siphlophis pulcher*, Family Colubridae. Photo: Antônio Bordignon.

Figura 28. *Siphlophis pulcher*, Família Colubridae. Foto: Antônio Bordignon.

Figure 32. *Tropidodryas serra*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 32. *Tropidodryas serra*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 25. *Liophis poecilogyrus*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 25. *Liophis poecilogyrus*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 29. *Sordellina punctata*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 29. *Sordellina punctata*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 33. *Tropidodryas striaticeps*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 33. *Tropidadryas striaticeps*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 34. *Waglerophis merremii*, Family Colubridae. Photo: Marcelo R. Duarte.

Figura 34. *Waglerophis merremii*, Família Colubridae. Foto: Marcelo R. Duarte.

Figure 35. *Xenodon neuwiedii*, Family Colubridae. Photo: Antônio Bordignon.

Figura 35. *Xenodon neuwiedii*, Família Colubridae. Foto: Antônio Bordignon.

Figure 36. *Micrurus corallinus*, Family Elapidae. Photo: Antônio Bordignon.

Figura 36. *Micrurus corallinus*, Família Elapidae. Foto: Antônio Bordignon.

Figure 37. *Bothrops alcatraz*, Family Viperidae. Photo: Marcelo R. Duarte.

Figura 37. *Bothrops alcatraz*, Família Viperidae. Foto: Marcelo R. Duarte.

Figure 38. *Bothrops insularis*, Family Viperidae. Photo: Marcelo R. Duarte.

Figura 38. *Bothrops insularis*, Família Viperidae. Foto: Marcelo R. Duarte.

Figure 39. *Bothrops jararaca*, Family Viperidae. Photo: Antônio Bordignon.

Figura 39. *Bothrops jararaca*, Família Viperidae. Foto: Antônio Bordignon.

Figure 40. *Bothrops jararacussu*, Family Viperidae. Photo: Luís Coelho.

Figura 40. Bothrops jararacussu, Família Viperidae. Foto: Luís Coelho.

Figure 43. The most common species in twelve of the eighteen islands was *Micrurus corallinus*; in eleven of the eighteen islands *Bothrops jararaca* and *Liophis miliaris* were found; in ten of the eighteen *B. jararacussu* and *Chironius bicarinatus* were found.

Field trips, number of collection, and sampling effort are shown in Table 4. The islands which had a greater sampling effort were Queimada Grande Island (2,260 total hours/sampling effort), with the number of collectors in the crew varying from one to thirteen per trip; Anchieta Island (1,870 total hours/sampling effort), with one to nine collectors and Cardoso Island (1,516 total hours/sampling effort), with one to six collectors. There was a small positive correlation among sampling effort and the number of new records per island ($r = 0.30$; $p = 0.36$; $n = 11$), (Figure 44).

Table 2. Area of the islands of the SSP with vouchered snakes in herpetological collections or in the literature, distance from mainland (km), threats and category of use.

Tabela 2. Área das ilhas no SSP com as espécies de serpentes tombadas nas coleções herpetológicas ou na literatura, distância das ilhas ao continente (km), ameaças e categoria de uso.

Island (number of species)	Area (ha)	Distance from mainland (km)	Threats[2]	Category of use
Alcatrazes (n = 4)	135	33.40	D	Inhabited
Anchieta (n = 6)	828	0.49	E	State Park
Barnabé (n = 2)	173.4	0.01	∅	Wide
Bom Abrigo (n = 2)	154	3.55	A,B,C	Populated
Búzios (n = 4)	755	24.09	A,B,C	Populated
Cananéia (n = 15)	13.7	0.24	A,B,C,G	Wide
Cardoso (n = 23)	22,500	0.08	A,B,F	State Park
Comprida (n = 12)	20,000	0.31	A,B,C,G	Wide
Couves (North) (n = 1)	64.5	2.53	A,B,C	Populated
Mar Virado (n = 2)	119	2.00	B	Populated
Monte de Trigo (*)	130	10.20	∅	Populated
Porchat[1] (n = 10)	15	0.23	∅	Wide
Porcos (n = 1)	24.2	0.74	A,B	Populated
Queimada Grande (n = 2)	430	34.80	A	Inhabited
Santo Amaro (n = 21)	14,000	0.05	A,B,G	Wide
São Sebastião (n = 20)	33,600	1.76	A,B,E,G	State Park/Wide
São Vicente (n = 23)	6,000	0.12	∅	Wide
Vitória (n = 4)	221.3	37.97	A,B	Populated

[1]Presumed Porchat Island (*error*; originally voucher specimens recorded as from Paranapuã Island, name of the continental beach beside Porchat Island); [2]Threat categories: A) Deforestation & Fire B) Domestic animals C) Erosion D) Military target E) Wild exotic fauna introduced F) Indians harvest G) Urban expansion ∅) Extremely impacted; and *Snake population of Monte de Trigo Island extirpated by locals (MFD Furtado, pers. communication).

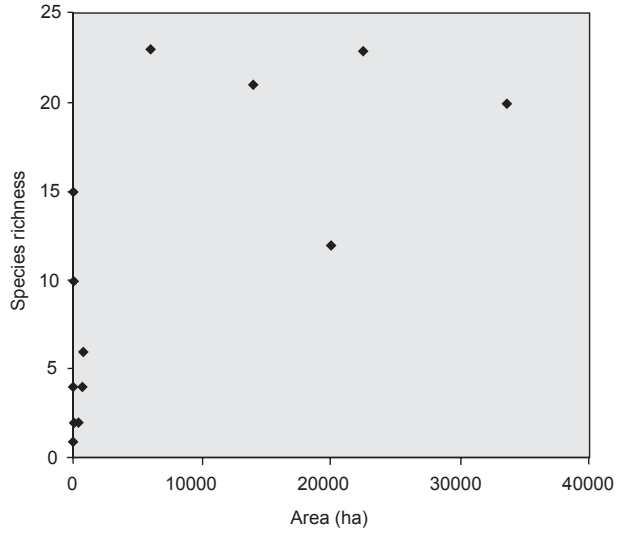

Figure 41. The graph shows a positive correlation between island areas and the number of species collected.

Figura 41. O gráfico demonstra a correlação positiva entre a área das ilhas e o número de espécies coletadas.

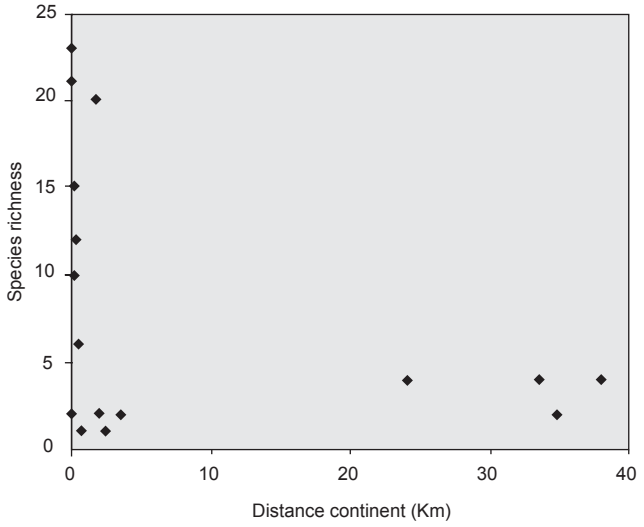

Figure 42. The graph shows a negative correlation between the distance island-mainland and the number of species.

Figura 42. O gráfico demonstra a correlação negativa entre a distância ilha-continente e o número de espécies.

Discussion

In fact, the SSP coast was one of the gateways to continental explorations since the beginning of the 15th century (Dean 1996). Deforestation and fire are commonplace on several islands both for occupation and survival by local population, including natives (Olmos et al. 2004) or due to an economy based on tourism. An associated tenet for conservation on both the SSP and several Brazilian coastal islands was the dependence on the unchanging mind set of the owner whether favorable or unfavorable for conservation of the native veg-

Table 3. SSP Islands species, habitat, preys, and relative abundance categories.

Tabela 3. Espécies das ilhas do SSP, hábitats, presas e categorias de abundância relativa.

Species	Habitat	Preys*	Relative abundance (SSP Islands)	Relative abundance (SSP Shore)*
Boidae				
Corallus hortulanus	Arboreal	Rodents and birds	Rare	Rare
Colubridae				
Chironius bicarinatus	Arboreal	Amphibians	Common	Common
C. exoletus	Arboreal	Amphibians	Common	Common
C. fuscus	Arboreal	Amphibians	Infrequent	Common
C. laevicollis	Arboreal	Amphibians	Infrequent	Infrequent
C. multiventris	Arboreal	Amphibians	Common	Infrequent
Clelia plumbea	Terrestrial	Lizards & Snakes	Rare	Rare
Dipsas albifrons	Terr/Arb	Snails	Infrequent	Absent
D. alternans	Arboreal	Snails	Rare	Rare
D. petersi	Arboreal	Snails	Infrequent	Rare
D. neivai	Arboreal	Snails	Rare	Rare
Echinanthera bilineata	Terrestrial	Amphibians	Rare	Rare
E. cephalostriata	Terrestrial	Amphibians	Infrequent	Rare
E. melanostigma	Terrestrial	Amphibians	Rare	Rare
E. undulata	Terrestrial	Amphibians	Rare	Common
Erythrolamprus aesculapii	Terrestrial	Snakes	Infrequent	Common
Helicops carinicaudus	Aquatic	Amphibians & Fishes	Common	Common
Imantodes cenchoa	Arboreal	Lizards & Amphibians	Rare	Rare
Liophis miliaris	Aqua/Terr	Amphibians & Fishes	Common	Common
L. poecilogyrus	Terrestrial	Amphibians	Rare	Common
Oxyrhopus clathratus	Terrestrial	Rodents & Lizards	Infrequent	Common
Sibynomorphus neuwiedi	Terrestrial	Snails	Common	Common
Siphlophis pulcher	Arboreal	Lizards & Snakes	Common	Rare
Sordellina punctata	Aqua/Terr	Earthworms	Rare	Rare
Spilotes pullatus	Arboreal	Rodents, Birds, Eggs, Bats	Common	Common
Thamnodynastes cf. *nattereri*	Terrestrial	Rodents & Amphibians?	Rare	Rare
Tomodon dorsatus	Terrestrial	Snails	Infrequent	Common
Tropidodryas serra	Arboreal	Rodents & Lizards	Rare	Infrequent
T. striaticeps	Arboreal	Rodents & Lizards	Rare	Infrequent
Xenodon neuwiedii	Terrestrial	Amphibians	Infrequent	Common
Waglerophis merremii	Terrestrial	Amphibians	Rare	Rare
Elapidae				
Micrurus corallinus	Fossorial	Amphisbaenians & Snakes	Common	Common
Viperidae				
Bothrops alcatraz	Terrestrial	Centipedes & Amphibians	Rare/Endemic	Absent
B. insularis	Arboreal	Birds & Amphibians	Rare/Endemic	Absent
B. jararaca	Terrestrial	Rodents	Common	Common
B. jararacussu	Terrestrial	Rodents & Amphibians?	Common	Common

Marques et al., 2001; Marques & Sazima, 2003.

etation. Probably the only exception is where snake fauna extinction is definitive (e.g., Monte de Trigo Island) and where several wild carnivore predators were deliberately introduced and probably caused extinction of some representative species (e.g., Anchieta Island).

Studies of global extinctions of reptiles during the last 10,000 years demonstrate two clear patterns: the majority of extinctions occurred on islands and usually are associated with anthropic disturbances (Case et al. 1992). Whittaker (1998) presents four main problems resulting in island species being threatened by human action. The first is direct predation which in Table 2 corresponds to threat category F and G. The second threat is the introduction of non-native species; categories B and D. The third is contact with new diseases and parasites of exotic species (for example, the gekkonid lizard *Hemidactylus mabouia*) which is widely distributed along the

Table 4. Sample effort.

Tabela 4. Esforço amostral.

Islands	Trips	Work Group	Days in field	Total hours in the field
Alcatrazes	1	4 people	4	36
Anchieta	12	1-9 people	62	1877
Bom Abrigo	5	1-4 people	9	104
Búzios	2	4-5 people	5	146
Cananéia	30	3-6 people	39	1386
Cardoso	15	1-6 people	110	1516
Comprida	27	3-6 people	27	768
Couves	1	5 people	4	40
Ilhabela	2	3-6 people	7	386
Queimada Grande	29	3-13 people	50	2260
Vitória	1	5 people	1	20

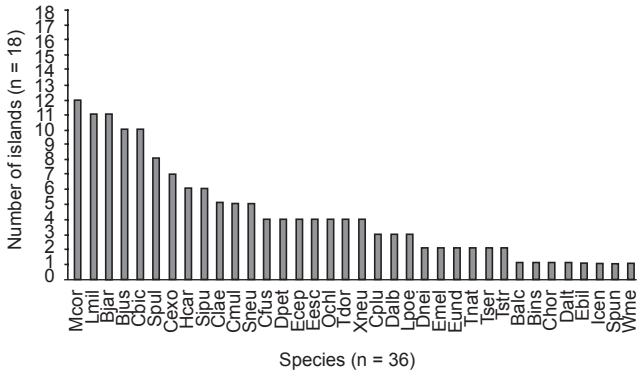

Figure 43. Frequency of 36 snakes species on the eighteen islands of the state of São Paulo. *Mcor = Micrurus corallinus*; *Lmil = Liophis miliaris*; *Bjar = Bothrops jararaca*; *Bjus = Bothrops jararacussu*; *Cbic = Chironius bicarinatus*; *Spul = Spilotes pullatus*; *Cexo = Chironius exoletus*; *Hcar = Helicops carinicaudus*; *Sipu = Siphlophs pulcher*; *Clae = Chironius laevicollis*; *Cmul = Chironius multiventris*; *Sneu = Sibynomorphus neuwiedii*; *Cfus = Chironius fuscus*; *Dpet = Dipsas petersi*; *Ecep = Echinanthera cephalostriata*; *Eesc = Erythrolamprus aesculapii*; *Ochl = Oxyrhopus clathratus*; *Tdor = Tomodon dorsatus*; *Xneu = Xenodon neuwiedii*; *Cplu = Clelia plumbea*; *Dalb = Dipsas albifrons*; *Lpoe = Liophis poecilogyrus*; *Dnei = Dipsas neivai*; *Emel = Echinanthera melanostigma*; *Eund = Echinanthera undulata*; *Tnat = Thamnodynastes* cf. *nattereri*; *Tser = Tropidodryas serra*; *Tstr = Tropidodryas striaticeps*; *Balc = Bothrops alcatraz*; *Bins = Bothrops insularis*; *Chor = Corallus hortulanus*; *Dalt = Dipsas alternans*; *Ebil = Echinanthera bilineata*; *Icen = Imantodes cenchoa*; *Spun = Sordellina punctata*; *Wme = Waglerophis merremii*.

Figura 43. Freqüência das 36 espécies nas 18 ilhas no Estado de São Paulo. *Mcor = Micrurus corallinus; Lmil = Liophis miliaris; Bjar = Bothrops jararaca; Bjus = Bothrops jararacussu; Cbic = Chironius bicarinatus; Spul = Spilotes pullatus; Cexo = Chironius exoletus; Hcar = Helicops carinicaudus; Sipu = Siphlophs pulcher; Clae = Chironius laevicollis; Cmul = Chironius multiventris; Sneu = Sibynomorphus neuwiedii; Cfus = Chironius fuscus; Dpet = Dipsas petersi; Ecep = Echinanthera cephalostriata; Eesc = Erythrolamprus aesculapii; Ochl = Oxyrhopus clathratus; Tdor = Tomodon dorsatus; Xneu = Xenodon neuwiedii; Cplu = Clélia plumbea; Dalb = Dipsas albifrons; Lpoe = Liophis poecilogyrus; Dnei = Dipsas neivai; Emel = Echinanthera melanostigma; Eund = Echinanthera undulata; Tnat = Thamnodynastes cf. nattereri; Tser = Tropidodryas serra; Tstr = Tropidodryas striaticeps; Balc = Bothrops alcatraz; Bins = Bothrops insularis; Chor = Corallus hortulanus; Dalt = Dipsas alternans; Ebil = Echinanthera bilineata; Icen = Imantodes cenchoa; Spun = Sordellina punctata; Wme = Waglerophis merremii.*

coast and is a host for some protozoarians (Lainson & Paperna 1999), helminths (Anjos et al. 2005) and mites (Rivera et al. 2003) (category E). There are cases of parasite transport from reptiles to the islands (Goldberg & Bursey 2000; Rocha & Vrcibradic 2003). And finally there is the loss or degradation of habitat corresponding to categories A, C, D of Table 2. Corke (1987) documented the local extinction of *Clelia clelia* and *Liophis ornatus* in the Lesser Antilles.

As expected from the classical theory of island biogeography (MacArthur & Wilson 1967), coastal islands of São Paulo State with a larger area tend to have a larger number of species. However, the data showed that the number of snake species decreased significantly with the distance of the island from mainland.

Thirteen species of snakes given as new records were sampled during the exiguous period, eventhough the capture effort has not been homogeneous for eleven of the field surveyed islands. Many other snake species are likely to exist and our findings should be considered preliminary, since during the brief fieldwork period we vouchered a specimen of *Bothrops jararacussu* from Bom Abrigo Island in the IBSP collection forty three years after the last specimen was recorded. Five of the six more common species of the eighteen islands had a wide range of distribution on the continent also. At the present time two insular species are endemic and threatened, *Bothrops alcatraz* (Marques et al. 2002) and *Bothrops insularis* (Duarte et al. 1995).

An interesting disjunct distribution occurs for *Dipsas albifrons* which is present on Alcatrazes, São Sebastião and Queimada Grande Island. The known distribution of *D. albifrons* includes a large gap along most of the continental portion of the State of São Paulo. Considering that São Paulo State has one of the largest populations in Brazil and that the Instituto Butantan has been receiving constant from São Paulo for more than a hundred years, it is likely that the disjunct distribution is not an artifact of poor sampling (Passos et al. 2005). Porto & Fernandes (1996) found the same pattern for *Dipsas neivai*, and suggested that natural events that caused regional extinctions, were caused by transgression of the sea level in the Quaternary (cf. Müller 1969; Vanzolini 1973).

Similarly, two voucher specimens of *Waglerophis merremii* were recorded in two different herpetological collections (IBSP and

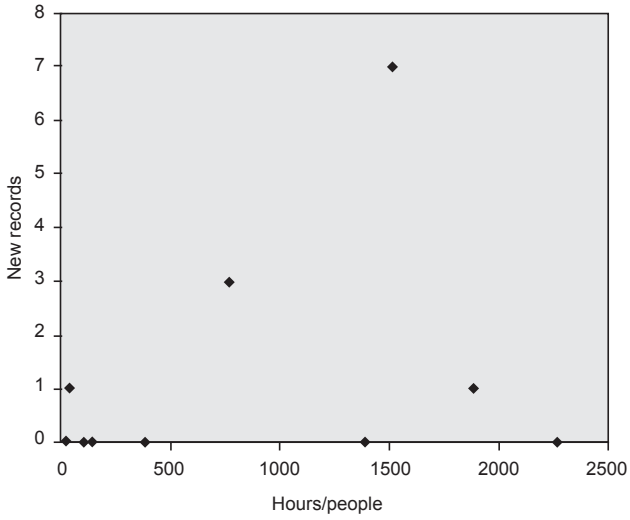

Figure 44. Positive correlation between total sampling effort, hours of fieldwork, and the number of the new records of species.

Figura 44. correlação positiva entre esforço amostral total, horas de trabalho de campo e número de novos registros de espécies.

MZUSP) from Santo Amaro Island during the 1930´s. This colubrid snake is typical of open areas, but cannot be found in this kind of landscape along the southeastern coast of Brazil. This is not the case for some open area species along the coast of Bahia State, northeastern Brazil that inhabits areas close to the seashore (*Crotalus durissus cascavella* from Itaparica Island), *Boa constrictor constrictor* (Argôlo 2004; MRDuarte, pers. observation) and *Waglerophis merremii*.

A single specimen of Boidae (*Corallus hortulanus*) was recorded for SSP islands. Conversely, *Corallus hortulanus* and *Boa constrictor* are species commonly found on Ilha Grande (Grande Island) in Rio de Janeiro State (Soares et al. 1987). Two voucher specimens of *Boa constrictor* from Santos (São Vicente Island) (IBSP 8.641 and 17.428) in 1934 and 1958 respectively, were excluded because they were collected in the neighborhood of the largest harbor of South America and passive transportation must be considered.

The integrity and preservation of SSP island herpetofauna is limited since, with few exceptions (e.g., Queimada Grande and Alcatrazes Islands), many of these island environments are under uncontrolled human occupation and few of them are under legal protection (see Table 2). A striking appeal for SSP island preservation is the fact that 52% of the voucher specimens of snake species inhabiting these islands preys on amphibians that are sensitive to environmental disturbance.

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Appendix 1

BOIDAE

1. Corallus hortulanus Santo Amaro Island **IBSP** *62926*

COLUBRIDAE

Chironius bicarinatus: Anchieta Island **IBSP** 16023. Búzios Island **IBSP** 56236, 56951. **MZUSP** 3941-44, 4831-75. Cananéia Island **IBSP** Field no. 2791. *Cardoso Island **IBSP** Field no. 1873. *Comprida Island **IBSP** 70529 **IBSP** Field no. 2740. Mar Virado Island (Vieitas, 1995). Porchat Island[1] **IBSP** 14265, 14435. Santo Amaro Island **IBSP** 22250, 68184. São Sebastião Island **IBSP** 56009, 58723. São Vicente Island **IBSP** 15850, 18761.

Chironius exoletus: Cananéia Island **IBSP** Field no. 0671. Cardoso Island **IBSP** 55876, 70748, 72186, 72187 **IBSP** Field no. 1873, 0095-96, 1247. Comprida Island **IBSP** 11472-73, 11479, 31887. Mar Virado Island (Vieitas, 1995). Porchat Island[1]. **IBSP** 14436, 14439, 14544-46. Santo Amaro Island **IBSP** 22386, 22392, 28106, 29519, 29542, 29691. **MZUSP** 5611. São Vicente Island **IBSP** 704, 13934-35, 18135, 22090-91, 22249, 22571, 37375, 57389, 58363, 70043.

Chironius fuscus: Cardoso Island **IBSP** 43488, 43626, 70749, 71393, 71711, 72188 **IBSP** Field no. 1873, 3693, 0098. Porchat Island[1] **IBSP** 14437-38. Santo Amaro Island **IBSP** 8285, 21488, 23977, 26309, 40870, 42456, 43632, 44125, 44334. **MZUSP** 3177. São Vicente Island **IBSP** 2588, 13932, 13936, 15481, 23847, 27990, 30960, 32671.

Chironius laevicollis: Cardoso Island **IBSP** 56135, 71001 **IBSP** Field no. 2454, 1247. **MZUSP** 8866. Comprida Island **IBSP** 11468-69, 55973. São Sebastião Island **IBSP** 54190, 57433. **ZUEC** 1061. São Vicente Island **IBSP** 63635.

Chironius multiventris: Cananéia Island **IBSP** Field no. 4458, 0671. *****Cardoso Island **IBSP** 71710, 71855, 72185, 72190 **IBSP** Field no. 3692, 0093-94. Santo Amaro Island **IBSP** 22042-43, 22106, 22387, 22571, 24326-28, 24590, 25349, 40870, 42707, 45115, 45913, 58409. São Sebastião Island **IBSP** 54190, 57096, 57353. **ZUEC** 1062. São Vicente Island **IBSP** 8069, 22089, 29085, 33459.

Clelia plumbea: Cardoso Island **IBSP** Field no. 955. São Sebastião Island **IBSP** 20420, 21696, 26977, 43981, 56932. São Vicente Island **IBSP** 21996, 22497, 29852.

Dipsas albifrons: Alcatrazes Island **IBSP** 13029, 62175. Queimada Grande Island **IBSP** 11488, 15808, 15809, 17151, 17213, 18426-27, 29727, 30088-90, 30092, 30094-95, 52670, 55723. São Sebastião Island **IBSP** 60345.

Dipsas alternans: São Sebastião Island **IBSP** 55951.

Dipsas petersi: *Cardoso Island **IBSP** Field no. 3171. Santo Amaro Island **IBSP** 24165, 24478-80, 24636, 25934, 26040, 26091, 42458, 43999, 49231, 57302, 64909. São Sebastião Island **IBSP** 53647, 57090. São Vicente Island **IBSP** 9244, 10391, 13938-40, 25934, 41093, 55345, 55946-47.

Dipsas neivai: Cananéia Island **IBSP** 41999. São Sebastião Island **IBSP** 41027, 55877, 56628.

Echinanthera bilineata: *Cardoso Island **IBSP** Field no. 1247.

Echinanthera cephalostriata: *Cardoso Island **IBSP** Field no. 2103. Santo Amaro Island **IBSP** 22572, 44127. São Sebastião Island **IBSP** 56933, 57089. São Vicente Island **IBSP** 22251, 54814.

Echinanthera melanostigma: Santo Amaro Island **IBSP** 42336. São Vicente Island **IBSP** 22572.

Echinanthera undulata: Comprida Island **IBSP** 52204. São Vicente Island **IBSP** 56343.

Erythrolamprus aesculapii: Barnabé Island **IBSP** 28268. Cananéia Island **IBSP** Field no. 3367. São Sebastião Island **IBSP** 12902, 13584. São Vicente Island **IBSP** 22215, 28968, 30043.

Helicops carinicaudus: Cananéia Island **IBSP** Field no. 2726, 2021, 2531. *Cardoso Island **IBSP** Field no. 3371. *****Comprida Island **IBSP** Field no. 0670. Porchat Island[1] **IBSP** 14267. Santo Amaro Island **IBSP** 43013, 45160, 63032, 67814, 68295. São Vicente Island **IBSP** 800, 14267, 22094, 30965, 32484-86, 34095, 66996, 68118, 68307.

Imantodes cenchoa: Cardoso Island **IBSP** Field no. 152.

Liophis miliaris: Anchieta Island **IBSP** 15818-21. Bom Abrigo Island 22723-24. Cananéia Island **IBSP** Field no. 0260, 0671, 1863, 1869, 2531, 2677, 2796, 3106. Cardoso Island **IBSP** 56129, 71020 **IBSP** Field no. 2454, 2521, 3171. **MZUSP** data missing. Comprida Island **IBSP** 11477-78, 71175, 71313 **IBSP** Field no. 2740, 3035, 3171. *Couves Island (North coast) **IBSP** 70127. Porchat Island[1] **IBSP** 14263, 14337-40, 14422-34, 14548, 59220. Santo Amaro Island **IBSP** 18287, 20856, 23992, 28001, 30234, 67349, 68401. **MZUSP** data missing. São Sebastião Island **IBSP** 11611, 27541.

São Vicente Island **IBSP** 2607, 13933, 14263-64, 14337-40, 14422-35, 14548-49, 19723, 22072-73, 22076-78, 61395, 68306, 69189. **MZUSP** 4072; 4155-56, 4594-95, 4597, 4570-71, 788-9. Vitória Island **IBSP** 15822-26.

Liophis poecilogyrus: Cardoso Island **IBSP** Field no. 955. Santo Amaro Island **IBSP** 5304, 73190. São Vicente Island **IBSP** 7284. **MZUSP** 4596.

Oxyrhopus clathratus: Cananéia Island **IBSP** Field no. 3265, 1877. Cardoso Island **IBSP** 62463 **IBSP** Field no. 3171. São Sebastião Island **IBSP** 10064, 26877, 57724, 68430, 69919. São Vicente Island **IBSP** 5778.

Sibynomorphus neuwiedi: Cananéia Island **IBSP** Field no. 2781, 4246, 4458, 0258, 2793, 2799. Cardoso Island **IBSP** 56134 **IBSP** Field no. 3371. Santo Amaro Island **IBSP** 18288, 22044, 70108. São Sebastião Island **IBSP** 31157, 56245, 56440, 55950, 67857, 69129. São Vicente Island **IBSP** 19029, 43235.

Siphlophis pulcher: Alcatrazes Island **IBSP** 13030. Búzios Island **MZUSP** 3945-46. **ZUEC** 2226. Cananéia Island **IBSP** Field no. 2799. Santo Amaro Island **IBSP** 22398, 22465, 33119, 51902, 56637, 63235. São Sebastião Island **IBSP** 58492, 58621, 62854. São Vicente Island **IBSP** 10449, 13937, 41222, 45793.

Sordellina punctata: Comprida Island **IBSP** 40851.

Spilotes pullatus: *Anchieta Island **IBSP** 74439, 74440. Cananéia Island **IBSP** Field no. 2025, 2041. Cardoso Island **IBSP** 29199 **IBSP** Field no. 1259, 1131, 2454, 3171, 0099. **MZUSP** 10254. Comprida Island **IBSP** 11470-71, 67752-53 **IBSP** Field no. 3266. Porchat Island[1] **IBSP** 14460-61. Santo Amaro Island **IBSP** 8492, 19660. São Sebastião Island **IBSP** 12237, 57535. São Vicente Island **IBSP** 13260, 13942, 13962-63, 14907, 15416, 15418, 30905.

Thamnodynastes cf. *nattereri*: Comprida Island **IBSP** 45873, 52203, 69182. São Sebastião Island **IBSP** 23677,40921,40926, 40927, 42945, 44776, 44778, 53736, 54215, 55118, 57092, 57494, 57725, 62020, 64084, 68482, 70741.

Tomodon dorsatus: Cananéia Island **IBSP** Field no. 0673. Cardoso Island **IBSP** Field no. 1143. Porchat Island[1] **IBSP** 14440-48. São Vicente Island **IBSP** 7892, 14342, 14460-61, 15686, 18425, 22095-96, 56208, 67558.

Tropidodryas serra: Cardoso Island **IBSP** 56209, 56521, 57423, 59463 **IBSP** Field no. 3171, 4228. **MZUSP** 10240. Santo Amaro Island **IBSP** 27126, 28226, 31943, 42240, 47052, 47103.

Tropidodryas striaticeps: Cardoso Island **IBSP** Field no. 3643. Santo Amaro Island **IBSP** 18650.

Xenodon neuwiedii: Cananéia Island **IBSP** Field no. 0263, 0671. *****Cardoso Island **IBSP** Field no. 0699. Santo Amaro Island **IBSP** 68620. São Sebastião Island **MZUSP** 2607.

Waglerophis merremii: Santo Amaro Island **IBSP** 8644. **MZUSP** 3594.

ELAPIDAE

Micrurus corallinus: Alcatrazes Island **IBSP** 62274-75. Anchieta Island **IBSP** 417-18, 2653. Barnabé Island **IBSP** 29684. Búzios Island **IBSP** 56223. **MZUSP** 3935-39. Cananéia Island **IBSP** Field no. 2454. Cardoso Island **IBSP** 70752 **IBSP** Field no. 1873, 1844. **MZUSP** 9970, 10239. Comprida Island **IBSP** 7184, 8468, 11476, 31891, 41697, 42212, 42302, 42306, 42352, 42602, 42608, 42688, 42891, 42987, 43010, 43266, 43769, 43936, 45879, 46250, 46317, 49256, 50498, 71151 **IBSP** Field no. 1691, 0250. **MZUSP** 8209, 12404. Porchat Island[1] **IBSP** 14268, 14464-65. Santo Amaro Island **IBSP** 21329, 24396, 31892, 41831, 42174, 45435, 46379, 46557, 49484, 51563. **MZUSP** 3539, 10499-500, 11591. São Sebastião Island **IBSP** 12219, 12455, 12789-90, 12811, 12901, 13589, 14221, 25044, 42568, 45307, 49722, 56309, 57404, 60871, 61106, 62825, 68481. São Vicente Island **IBSP** 11312, 14268, 14341, 14464-65, 14614, 15415, 22498, 22526, 23654, 23831, 24164, 29444, 30948, 30979, 32260, 32974, 37322, 40263, 40400, 42359, 42373, 42985, 44261, 45983, 47674, 50697, 53394, 53402, 55725, 62383, 62434, 68684. Vitória Island **MZUSP** 3947.

VIPERIDAE

Bothrops alcatraz (Endemic): Alcatrazes Island **IBSP** 584-88, 13031-32, 13126, 13135, 13183, 16211-12, 56133, 55124, 55578-81, 55791, 57105, 57107, 62238, 62290, 62392. **MZUSP** 1453. **ZUEC** 2224-25.

Bothrops insularis (Endemic): Queimada Grande Island **IBSP** n > 500. **ZUEC** 1869-72.

Bothrops jararaca: Anchieta Island **IBSP** 417-18, 655. Búzios Island **IBSP** 13133, 26160-63, 56256, 56952, 57253. **MZUSP** 3862, 3934. **ZUEC** 2713. Cananéia Island **IBSP** Field no. 3698-99, 2016, 2054, 2799, 3366. Cardoso Island **IBSP** 56302, 56388, 57106, 57475 **IBSP** Field no. 1502, 2454, 3171, 3265. Comprida Island **IBSP** 11474. *Porcos Island (Ricardo Janini Sawaya, personal communication). Porchat Island[1] **IBSP** 14450-59, 14562-64. Santo Amaro Island **IBSP** 55524, 55863-64, 57246, 64763, 69008. **MZUSP** 3583-84. São Sebastião Island **IBSP** n > 200. São Vicente Island **IBSP** 10459, 13922, 14262, 14450-59, 14562-64, 15840, 18722, 58322, 61373, 62316, 62765. Vitória Island **IBSP** 18866-82. **MZUSP** 3949-52, 5577-85.

Bothrops jararacussu: Anchieta Island **IBSP** 16307-09, 62833, 64672, 64917-18. Bom Abrigo Island **IBSP** 22720-22 **IBSP** Field no. 3370. Cananéia Island **IBSP** Field no. 0671, 0673, 2531, 2544, 2740, 3699. Cardoso Island **IBSP** 53807, 56210, 56429, 56472, 70750-51, 71225 **IBSP** Field no. 1259, 1845-46, 2017, 2031, 2788, 3371, 3908. *Comprida Island **IBSP** Field no. 2723. Porchat Island[1] **IBSP** 14462-63. Santo Amaro Island **IBSP** 55536. São Sebastião Island **IBSP** 10547, 12092, 12238, 12239, 12521, 12788, 13235, 54205, 55573, 57603, 61366, 61715-16, 61943, 64457. São Vicente Island **IBSP** 2621-24, 13961, 14462-63, 15484, 15752, 22528, 23979, 52494, 52536, 52553, 63728. Vitória Island **IBSP** 18864-65.