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A SNAKE COMMUNITY AT ESPIGÃO DO OESTE, RONDÔNIA, SOUTHWESTERN AMAZON, BRAZIL

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ABSTRACT: A snake richness of 56 species was recorded at Espigão do Oeste (Rondônia), with a faunal composition very similar to that of the closely located area of the Hydroelectric Power Plant of Samuel (Rondônia). The most abundant species were *Liophis reginae* (18.6% of the total), *Oxyrhopus melanogenys* (8.4%), *Chironius exoletus* (6%), *Boa constrictor* (5.8%), *Dipsas catesbyi* (5.6%), and *Drymarchon corais* (5.6%). A smaller number of snakes was recorded during the driest months (from June to August). Most species feed on lizards (55.3% of the species), followed by anurans (48.2%), mammals (26.8%), birds (12.5%), and snakes (12.5%). A cluster analysis was carried out to produce a dendrogram with information on size (snout-vent length), feeding habits, activity time, and foraging substratum. Eight guilds of snakes were found, according to similarities in resources use. The cluster analysis grouped together both closely or distantly related species, showing that both historical and ecological factors were important in structuring the assemblage.

KEY WORDS: Reptilia, Squamata, Serpentes, Rondônia, Amazon.

INTRODUCTION

The herpetofauna of the Neotropics, in special the Amazon region, is considered to be among the richest of the planet (Vitt, 1987; Duellman, 1990; Vogt *et al.,* 2001). Only in the Brazilian Amazon, 138 species of snakes are known (Rodrigues, 2005). Despite such richness, most regions of the Amazon remain under-sampled (Cunha and Nascimento, 1993; Vogt *et al.,* 2001). An indication of the lack of studies on snakes in the area is the frequent description of new species (*e.g.,* Carvalho, 2002; Hoogmoed and Prudente, 2003) and report of new occurrences on the region (*e.g.,* Bernarde and Moura-Leite, 1999; Franco and Ferreira, 2003).

In Brazil, studies on snake communities were done in various biomes such as the Atlantic Forest (Marques *et al.,* 2000), Pantanal (Strüssmann and Sazima, 1993), and Caatinga (Vitt and Vangilder, 1983). These studies analyzed the resource utilization by the species related to the kind of prey explored, substratum, and foraging pattern as well as seasonal acivity patterns. Other features, such as snake size and the importance of historical factors (phylogeny in special) in species composition, have also been considered. Differences in resource utilization and phylogenetic composition among these communities have been reported, some of which could be partially explained by historical factors, and others by habitat structure and prey availability (see Vitt and Vangilder, 1983; Cadle and Greene, 1993; Strüssmann and Sazima, 1993).

However, beside studies providing checklists, few studies have been carried out on the structure of snake assemblages in the Amazon (Zimmermann and Rodrigues, 1990; Martins and Oliveira, 1998). Information about the biology of Soutwestern Amazonian snakes are even more scarce when compared to the Central (Martins and Oliveira, 1998 and references therein), and Eastern (Cunha and Nascimento, 1993 and references therein) parts of the biome. The few publications available on Amazonian snake fauna are checklists with emphasis on taxonomy (*e.g.,* Amaral, 1948; Vanzolini, 1986; Nascimento *et al.,* 1988; Jorge-da-Silva, 1993; Yuki *et al.,* 1999; Brandão, 2002).

The present study reports on the faunistic composition and resource utilization (habitat, microhabitat, food, daily and seasonal activity) of a snake assemblage in Southwestern Amazon, Rondônia State, Brazil.

MATERIAL AND METHODS

Study Area

The area is located in the Southwest of the Amazon, Municipality of Espigão do Oeste (11°30'S; 60°40'W),

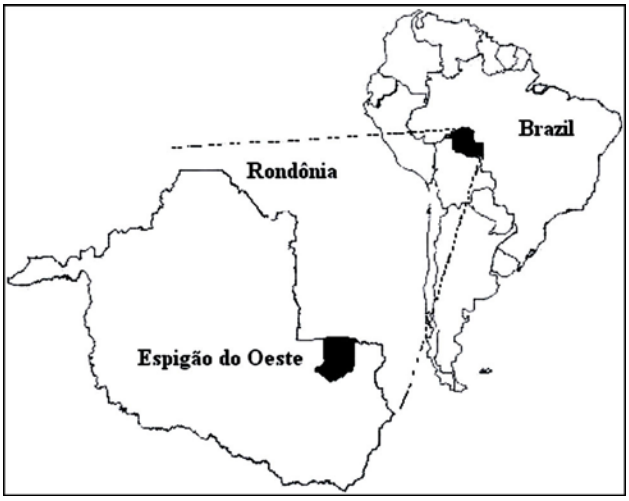

Figure 1: Map of South America showing the Municipality of Espigão do Oeste in Rondônia State, Brazil.

Rondônia State, Brazil (Figure 1). The elevation is around 280 m above sea level, and covers an area of 4.523,8 km^2. The municipality is bordered by the state of Mato Grosso on the North, by the Municipality of Pimenta Bueno on the South, by Vilhena on the East, and by the municipalities of Cacoal and Pimenta Bueno on the West (all of municipalities are in the state of Rondônia). The general vegetation is Amazon rain forest (mainly open rain forest, cf. Veloso *et al.,* 1991). However, most of this region has been deforested and transformed into pasture and farming areas. This is a consequence of the colonization process of the state of Rondônia, that occurred mainly along the highway BR 364 during the 1980s (Vanzolini, 1986; Oliveira, 2002). The average annual rainfall is of 2100 mm with a drier period generally between April and September. The average annual temperature is 26°C (climatic data from the city hall).

Field Work and Sampling Methods

Field work was carried out from February 2001 to December 2002. Four sampling methods were used simultaneously to survey snakes in the area of study: time constrained search, pitfall traps with drift fences, captures by local inhabitants, and accidental sightings. The four methods were used from April 2001 to March 2002. Throughout the remaining months, only two methods were carried out: capture by local inhabitants and accidental sightings. Each of these methods are described below.

1) Time constrained search (Campbell and Christman, 1982; see Martins and Oliveira, 1998): 300 to 400 m of trails were walked in four hours. A total of 960 hours of snake search was performed through the forest and in pasture areas during one year, of which 768 hours by night (18:00-22:00 h) and 192 by day (morning and afternoon).
2) Pitfall traps with drift fences (Fitch, 1987; Cechin and Martins, 2000): in this method, plastic buckets (200 L) were buried every 10 meters and connected by a 1 m high plastic fence. Six trap sequences were built with four buckets and a fence 44 m long in each trap. The traps were placed in three different habitats, with two traps in each habitat: inside the forest, far from permanent water bodies; in the forest about 100 m away from a stream (about 4 m wide and 0,8 m deep); and in pasture areas far from permanent water bodies. Each fence system was built at least 1800 m from each other, and in each habitat the traps were at least 200 m from each other. Traps remained open during one entire year and were monitored three to four times every week.
3) Captures by local inhabitants (Cunha and Nascimento, 1978; Vanzolini, 1986): this method consisted of distributing 20 L plastic containers containing formalin solution at 10% to rural inhabitants for preserving the snakes they normally kill. Containers were delivered to 20 farms and these were visited monthly from April 2001 to December 2002. During these visits, data on habitat and time of the day were recorded for each snake captured. In every site, the meaning of the study and the importance of the snakes in nature was explained to the collectors.
4) Accidental sightings (see Martins and Oliveira, 1998): included in this method are those snakes found during other activities, such as moving along roads (road killed specimens) and in occasional searches.

The time constrained search and the pitfall traps with drift fences methods were carried out in Jaburi farm (11°35', 11°38'S; 60°41', 60°45'W). This farm is located on Km 32 of Calcário Road, and has an area of 4000 ha 50% of which are preserved Amazon rainforest.

We also present data gathered in this region during seven previous trips of about two weeks each, in which a herpetofaunal survey was carried on (see Bernarde *et al.,* 1999; Giaretta *et al.,* 2000). These trips took

place in July 1994, January 1995, July 1995, January 1996, January 1997, and January 1998. During these trips, 76 individual snakes were recorded and included in this study.

Voucher Specimens

The specimens collected during this study are housed in the following herpetological collections: Instituto Butantan (IB), São Paulo (SP), Museu Paraense Emílio Goeldi (MPEG), Belém (PA), and Instituto Nacional de Pesquisa da Amazônia (INPA), Manaus (AM). Specimens collected in previous trips were deposited in the collections of the Universidade Estadual de Londrina (UEL), Londrina (PR), and the Museu De História Natural Capão da Imbuia, Curitiba (PR). All specimens collected had their stomachs and intestinal contents examined.

Resource Utilization and Statistical Analyses

To summarize community structure, the information on microhabitat use, diel activity, diet, and body size were analyzed together with a cluster analysis of qualitative data (presence/absence). The information on diet, activity period, foraging substratum and body size was obtained in this study and in the literature (Michaud and Dixon, 1989; Duellman, 1990; Jorge-da-Silva, 1993; Cunha and Nascimento, 1993; Martins and Oliveira, 1998). The cluster analysis was performed in JMP 5.0.1 (SAS Institute).

A comparison was made between species compositions of the studied community and those of other communities using the Coefficient of Biogeographic Similarity of Duellman (1990). A Spearman correlation was performed to test a possible relation between the occurrence of snakes and rainfall.

Results and Discussion

A total of 462 individual snakes representing 56 species were found in Espigão do Oeste. These snakes belong to the following families (Table 1): Typhlopidae (one species), Leptotyphlopidae (one), Boidae (five), Aniliidae (one), Colubridae (42), Elapidae (three), and Viperidae (three). This species richness is within the range of observed richness for a single location in other regions in the Amazon (*e.g.,* Dixon and Soini, 1986; Duellman, 1978; Martins and Oliveira, 1998). The region with the highest coefficient of biogeographic similarity to Espigão do Oeste was that of the Hydroeletric Power Plant of Samuel (CBS = 0,69) (Table 2), which is also the closest site used in the comparison (about 400 km). Meanwhile, the region of the Amazon basin-with the lowest similarity was Cuzco Amazonico in Peru (CBS = 0,49) (about 1.200 km). The studied area has a closer similarity to two other distant areas (about 1200 and 1600 km), located in Pará (Tucuruí and Eastern Pará) but south of the Solimões/Amazonas river, than to Manaus, about 800 km away but north of the Solimões/Amazonas river. This result indicates that large rivers may represent important geographic barriers to the snake fauna.

The most abundant species, accounting for 60% of the total sample (n = 462), were: *Liophis reginae* (18.6% of the total), *Oxyrhopus melanogenys* (8.4%), *Chironius exoletus* (6%), *Boa constrictor* (5.8%), *Dipsas catesbyi* (5.6%), *Drymarchon corais* (5.6%), *Leptodeira annulata* (3.6%), *Epicrates cenchria* (3.4%), and *Xenopholis scalaris* (3.0%) (Table 1; Figure 2). A comparison of our results with those of two other studies in Amazonian localities showed some differences, perhaps due to the different sampling methods used. Anuran-eating snakes of the genera *Liophis, Leptodeira,* and *Xenoxybelis* are among the most abundant species in Espigão do Oeste (19.5% of the specimen total), in the Hydroeletric Power Plant of Samuel (19,9%), and in Manaus (19,9%) (Table 3). However, the pitviper *Bothrops atrox,* usually one of most frequently seen snakes in Amazonian communities (Jorge-da-Silva, 1993; Martins and Oliveira, 1998; Oliveira and Martins, 2001), was scarce in this study. The frequency of *Bothrops* capture of the Animal Rescue Program during the filling of the dam of the Hydroeletric Power Plant of Samuel (RO) was also lower (9% of specimens) than that registered in Manaus, central Amazonia (16,9%) (Table 3). This can either reflect differences in sampling methods or actual abundance differences in these localities.

Some abiotic (*e.g.,* rainfall, temperature, and humidity) and biotic factors (*e.g.,* prey availability, reproductive cycles) may influence the period of activity of snakes throughout the year (Henderson *et al.,* 1978; Vitt, 1987; Gibbons and Semlitsch, 1987; Marques *et al.,* 2000). In the Amazon, the incidence of snakes is probably related to rainfall and its effects, such as humidity and an increase in the availability of some types of prey (*e.g.,* anurans) (Henderson *et al.,* 1978; Mar-

Table 1: Distribution of individual snakes in forest, secondary vegetation, and pasture areas in Espigão do Oeste, Rondônia state, Brazil (n = 462). The specimens registered in secondary vegetation (= SEC. VEG.) were captured during clear cutting in 1995.

	FOREST	SEC. VEG.	PASTURE
TYPHLOPIDAE			
Typhlops reticulatus (Linnaeus, 1776)	2	1	
LEPTOTYPHLOPIDAE			
Leptotyphlops macrolepis (Peters, 1857)	2	1	3
ANILIIDAE			
Anilius scytale (Linnaeus, 1758)	1		3
BOIDAE			
Boa constrictor (Linnaeus, 1758)	4		23
Corallus caninus (Linnaeus, 1758)	2		
Corallus hortulanus (Linnaeus, 1758)	3		
Epicrates cenchria (Linnaeus, 1758)	8		8
Eunectes murinus (Linnaeus, 1758)	1		1
COLUBRIDAE			
Atractus albuquerquei Cunha and Nascimento, 1983			3
Atractus latifrons Günther, 1868	4	1	3
Atractus snethlageae Cunha and Nascimento, 1983			1
Chironius exoletus (Linnaeus, 1758)	14	1	13
Chironius multiventris Schmidt and Walker, 1943			1
Chironius scurrulus (Wagler, 1824)	2		
Clelia sp.	3		1
Dendrophidion dendrophis (Schlegel, 1837)	7		2
Dipsas catesbyi (Sentzen, 1796)	13	8	5
Dipsas indica Laurenti, 1768	4		1
Dipsas pavonina Schlegel, 1837	1		
Drepanoides anomalus (Jan, 1863)	4		
Drymarchon corais (Boie, 1827)	1		25
Drymobius rhombifer (Günther, 1860)	2		
Drymoluber dichrous (Peters, 1863)	8	2	1
Echinanthera occipitalis (Jan, 1863)			2
Erythrolamprus aesculapii (Linnaeus, 1766)			2
Helicops angulatus (Linnaeus, 1758)	3		2
Hydrodynastes gigas Duméril, Bibron e Duméril, 1854	2		
Imantodes cenchoa (Linnaeus, 1758)	1		1
Leptodeira annulata (Linnaeus, 1758)	10		7
Leptophis ahaetulla (Linnaeus, 1758)	4		3
Liophis almadensis (Wagler, 1824)			2
Liophis breviceps Cope, 1861			2
Liophis reginae (Linnaeus, 1758)	31		55
Masticophis mentovarius (Duméril, Bibron e Duméril, 1854)			1
Mastigodryas boddaerti (Sentzen, 1796)	2		3
Ninia hudsoni Parker, 1940	1		
Oxybelis fulgidus (Daudin, 1803)	1		1
Oxyrhopus melanogenys (Tschudi, 1845)	13		26
Oxyrhopus petola (Linnaeus, 1758)	1	2	2
Philodryas olfersii (Lichtenstein, 1823)	1	1	6
Pseustes poecilonotus (Günther, 1858)	1		
Rhinobothryum lentiginosum (Scopoli, 1785)	3		1
Siphlophis compressus (Daudin, 1803)	2		
Siphlophis worontzowi Prado, 1939	3		3
Spilotes pullatus (Linnaeus, 1758)	2		7
Tantilla melanocephala (Linnaeus, 1758)	1	1	1
Xenodon rabdocephalus (Wied, 1824)	2		2
Xenodon severus (Linnaeus, 1758)	2		
Xenopholis scalaris (Wücherer, 1861)	14		
Xenoxybelis argenteus (Daudin, 1803)	1		
ELAPIDAE			
Micrurus hemprichii (Jan, 1858)	1		
Micrurus spixii Wagler, 1824	1		10
Micrurus surinamensis (Cuvier, 1817)	1		4
VIPERIDAE			
Bothriopsis bilineatus (Wied, 1825)	1		
Bothrops atrox (Linnaeus, 1758)	4	1	4
Lachesis muta (Linnaeus, 1766)	4	1	1
TOTAL SPECIES	48	11	40
TOTAL INDIVIDUALS	202	2	240

tins and Oliveira, 1998; Oliveira and Martins, 2001; but see an alternative hypothesis in Oliveira and Martins, 2001). Fewer snakes were found during June and August, which were the driest months (Figure 3). However, there was no significant correlation between the occurrence of snakes and rainfall (rs = 0.3585; p = 0.2525; n = 12). The same lack of correlation between snake occurrence and rainfall was previously reported for other Amazonian localities (Henderson *et al.,* 1978; Martins, 1994).

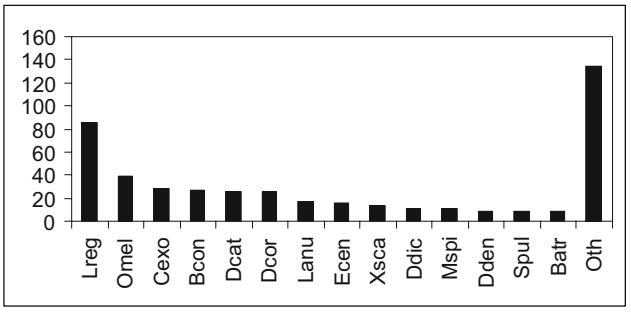

Figure 2: Relative abundance of snakes in Espigão do Oeste, Rondônia, Brasil (n = 462 specimens). Abbreviations correspond to the first letter of the genus and the first three letters of the species; Oth = other species.

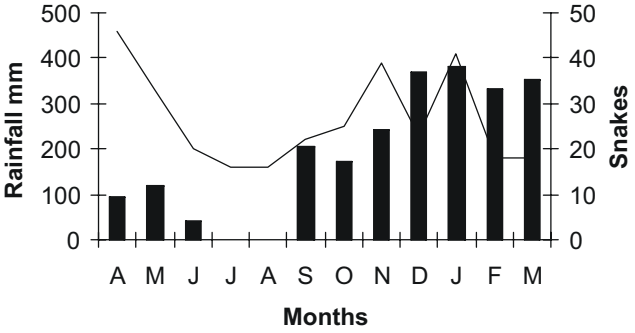

Figure 3: Relationship between the monthly frequency of snakes (line) and rainfall (bar) from April 2001 to March 2002 (n = 317) at Espigão do Oeste (RO).

Table 2: Biogeographic similarity coefficients among eleven Amazonian locations. Number of common species is underlined; **total species is in bold;** and Biogeographic Similarity Coefficients are in italic (following Duellman, 1990).

	ES	HP	TU	PA	MA	SC	IQ	PE	CO	VE
ES	**56**	44	43	46	43	33	45	26	34	39
HP	*0,69*	**70**	53	59	52	37	53	36	48	43
TU	*0,67*	*0,74*	**72**	69	56	39	58	36	48	53
PA	*0,64*	*0,75*	*0,87*	**86**	66	43	64	40	56	57
MA	*0,62*	*0,68*	*0,72*	*0,78*	**82**	42	62	40	53	52
SC	*0,60*	*0,60*	*0,62*	*0,61*	*0,62*	**53**	48	36	39	40
IQ	*0,62*	*0,67*	*0,72*	*0,73*	*0,63*	*0,68*	**88**	43	56	60
PE	*0,49*	*0,60*	*0,59*	*0,59*	*0,61*	*0,70*	*0,62*	**49**	35	35
CO	*0,56*	*0,71*	*0,70*	*0,74*	*0,72*	*0,66*	*0,73*	*0,61*	**65**	49
VE	*0,60*	*0,66*	*0,72*	*0,71*	*0,66*	*0,62*	*0,74*	*0,56*	*0,70*	**74**

Localities: ES = Espigão do Oeste (this study); HP = Hydroeletric Power Plant of Samuel, RO, Brasil (Jorge-da-Silva Jr., 1993); TU = Tucuruí, PA, Brasil (Jorge-da-Silva Jr. and Sites, 1995); PA = Eastern of Pará (Cunha and Nascimento, 1993), Brasil; MA = Manaus region, AM, Brasil (Jorge-da-Silva Jr. and Sites, 1995; Martins and Oliveira, 1998); SC = Santa Cecília, Ecuador (Duellman, 1978); IQ = Iquitos, Peru (Dixon and Soini, 1986); PE = Cuzco Amazónico, Peru (Duellman and Salas, 1991); CO = Letícia, Colombia (Jorge-da-Silva and Sites, 1995); VE = Amazonas, Venezuela (Péfaur and Rivero, 2000).

Table 3: Relative abundance of the seven most abundant genera (462 individuals) obtained in this study and in two others: Hydroeletric Power Plant of Samuel, RO, Brasil (Jorge-da-Silva, 1993), where a faunal rescue was carried out during the flooding of the reservoir (1562 individuals); Manaus, AM, Brasil (Martins, 1994), where snakes were found accidentally or during time constrained search (508 individuals).

ESPIGÃO DO OESTE	H.P.P. OF SAMUEL – RO	MANAUS – AM
Liophis (19.5%)	*Leptodeira* (19.9%)	*Xenoxybelis* (19.9%)
Oxyrhopus (9.5%)	*Atractus* (9.6%)	*Bothrops* (16.9%)
Dipsas (7.0%)	*Liophis* (9.2%)	*Helicops* (12.4%)
Chironius (6.7%)	*Bothrops* (9%)	*Dipsas* (7.3%)
Boa (5.8%)	*Micrurus* (7.6%)	*Imantodes* (4.7%)
Drymarchon (5.6%)	*Oxyrhopus* (5.6%)	*Leptodeira* (3.7%)
Leptodeira (3.7%)	*Typhlops* (4.6%)	*Liophis* (3.6%)

Along the year, male and female snakes may have differences in activity due to reproductive cycles (males searching for females and females searching for places to lay their eggs and thermoregulate) (*e.g.,* Marques *et al.,* 2000). In this study females outnumbered males during rainy months, and at the beginning of the dry season (January to July), and males were found in higher numbers from the driest months to the beginning of the rainy season (July to November) (Figure 4). While Duellman (1978) observed recruitment along the year, in Manaus the incidence of juveniles occurred mainly during the rainy months (Martins and Oliveira, 1998). In this study, juveniles were found mainly during the rainy season (Table 4). Recruitment in this period can be related to the higher availability of prey (Martins and Oliveira, 1998) and/or due to other environmental factors (*e.g.,* increase in humidity and temperature) (Oliveira and Martins, 2001; Valdujo *et al.,* 2002). However, further studies are necessary to understand the possible causes of higher occurrence of juveniles during rainy season (Valdujo *et al.,* 2002). Females with vitellogenic follicles and eggs occurred mainly in the dry season and at the beginning of rainy season, respectively (Table 4).

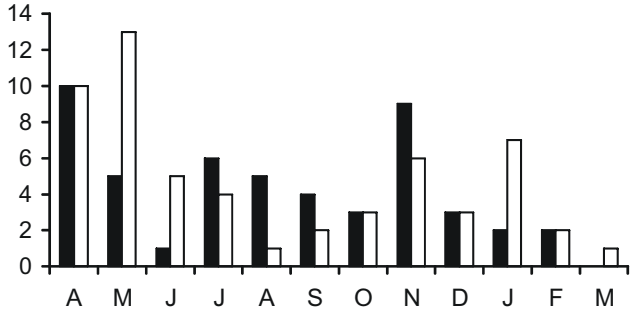

Figure 4: Occurrence of adult males (black bars) and females (white bars) from April 2001 to March 2002 at Espigão do Oeste (RO).

Information on gut contents was obtained for 89 specimens belonging to 31 species (Table 5). The majority of the 114 items found were anurans (38%), followed by mammals (16%), lizards (15%), mollusks (13%), birds (5%), and snakes (5%). The majority of

Table 4: Summary of the data collected on reproduction for the snakes in Espigão do Oeste, Rondônia, Brasil. F = presence of females with vitellogenic follicles; E = presence of females with eggs; J = presence of juveniles. Small numbers correspond to the number of females containing follicles, eggs or juveniles.

	J	F	M	A	M	J	J	A	S	O	N	D
B. constrictor											J[1]	
C. hortulanus												J[1]
E. cenchria											J[1]	
C. exoletus	F[1]	J[1]	F[1]								E[1]J[1]	F[1]
D. dichrous				J[2]		J[1]						
D. anomalus					E[1]							
D. corais											J[2]	
D. catesbyi	E[2]					F[1]				J[1]		
D. indica										J[1]		
H. angulatus	J[1]	J[1]										J[1]
L. annulata					F[1]							
L. ahaetulla									F[1]		F[1]	
L. almadensis.											J[1]	
L. breviceps	J[1]											
L. reginae			F[1]J[1]								E[1]	J[1]
P. olfersii	J[3]								E[1]			
O. melanogenys		J[3]						J[2]				
S. pullatus										J[1]	J[1]	
X. severus		J[1]							J[1]			
X. scalaris					F[1]			E[1]				
M. hemprichii											J[1]	
M. spixii					F[1]							
M. surinamensis						J[1]						
B. atrox			J[1]							J[1]		
with follicles	1	0	2	0	3	1	0	0	1	0	1	1
with eggs	2	0	0	0	1	0	0	1	1	0	2	0
Juveniles	5	6	2	2	0	2	0	2	1	4	9	3

Table 5: Summary of the data collected on feeding habits of the snakes in Espigão do Oeste, RO. MO = mollusks; AC = anuran clutches; TA = tadpoles; AN = anurans, LE = lizard eggs; LI = lizards; SN = snakes; BE = bird eggs; BI = birds; MA = mammals.

	MO	AC	TA	AN	LE	LI	SN	BE	BI	MA
B. constrictor						1			2	4
C. hortulanus									2	1
E. cenchria										3
E. murinus										3
C. exoletus				10						
C. scurrulus				1						
C. plúmbea							1			
D. dendrophis				3						
D. catesbyi	4									
D. indica	11									
D. anomalus					1					
D. corais				5		2	2	1		2
D. dichrous				1						
E. aesculapii							1			
L. annulata		1		3		1				
L. almadensis				1						
L. reginae			1	16						
M. boddaerti						1				
M. mentovarius				1						
O. melanogenys						7			1	5
O. fulgidus						1				
P. olfersii										1
P. poecinolotus									1	
R. lentiginosum						1				
S. worontzowi						3				
X. scalaris				1						
X. argenteus				1						
M. spixii							1			
B. atrox							1			1
L. muta										1
TOTAL PREY	15	1	1	43	1	17	6	1	6	21

Table 6: Proportion of species of snakes that consumed each type of prey in Espigão do Oeste (RO) and Manaus (AM) (Martins and Oliveira, 1998). AN = anurans; LI = lizards; MA = mammals; BI = birds; SN = snakes.

	AN	LI	MA	BI	SN
Espigão do Oeste, RO	48%	55%	27%	12%	12%
Manaus, AM	39%	58%	23%	18%	16%

snake species from Espigão do Oeste feed on lizards and/or anurans, although mammals, birds, and snakes are also important preys (see Table 6). Martins and Oliveira (1998) also recorded lizards as the most consumed prey item by snakes in Manaus (AM).

Of the whole sample, 26 individuals belonging to 11 species were found resting (sleeping or inactive) (Table 7), ten of these, on vegetation. Martins (1993) suggested that snakes in the Amazonian region sleep on vegetation as a form of avoiding being preyed upon by terrestrial predators. The snakes found during the day were resting underneath fallen logs in areas of pastures (11 snakes), within roots of trees (one in a pasture and another in the forest), and underneath leaf litter in the forest (3). These microhabitats may be chosen to escape predation by visuallly oriented, diurnal predators (see, *e.g.,* Bernarde *et al.,* 2000). One individual of *Boa constrictor* was observed during two consecutive days resting on a tree about 4 m above ground in an area of pasture during the day.

During foraging activity, most (52%) snake species from Espigão do Oeste are terrestrial), followed by arboreals (26%), fossorials (10%), aquatics (8%), and cryptozoics (4%) (Table 8). A higher proportion of fossorials and cryptozoics occur in Manaus (Martins and Oliveira, 1998) (Table 8). This could be due to the higher number of species of the genus *Atractus* (eight) in Manaus (Martins and Oliveira, 1998). Historical factors may be the cause for the higher number of fossori-

Table 7: Snakes found resting in Espigão do Oeste (RO). SPP = species; Abbreviations corresponds to the first letter of the genus and the first three letters of the species; Tot = total species.

species	under of trunks fallen – day	between roots of trees – day	inside leaf litter – day	on vegetation – night	on the vegetation – day
Bcon					2
Ccan					1
Ecen	2				
Cexo				3	
Dden				3	
Dcat				1	
Dind			1		
Ddic				1	
Drho				1	
Lann	2	1			
Laha				1	
Omel	6	1			
Xsca	1		2		
Tot	11	2	3	10	3

Table 8: Proportion of species of snakes that use each foraging microhabitat in Espigão do Oeste (RO) and Manaus (AM) (Martins and Oliveira, 1998). AQU = Aquatics; FOS = Fossorials; CRY = Cryptozoics; TER = Terrestrials; ARB = Arboreals.

	AQU	FOS + CRY	TER	ARB
Espigão do Oeste	8%	14%	52%	26%
Manaus	6%	25%	50%	19%

als species (*Atractus* spp.) in localities north of Espigão do Oeste (*e.g.,* Manaus and Hydroeletric Power Plant of Samuel, with 7 species), which are closer to Central America, from where the Dipsadinae colonized South America (see Cadle and Greene, 1993).

Arnold (1972) pointed out four factors that could lead to food partitioning in sympatric snakes: (1) habitat differences which coincide with prey habitat differences, (2) temporal differences in foraging activity which coincide with temporal differences in prey activity or availability, (3) differences in prey sizes eaten which coincide with different-sized species of prey, and (4) innate differences in the tendency to strike different species of prey. However, considerable overlap in the utilization of prey by snakes of the same community may exist (see Martins and Oliveira, 1998; Table 9), indicating that other factors such as abundance of prey and predation can prevent competition from occurring among syntopic species (see Cadle and Greene, 1993). The cluster analysis (Figure 5) with 56 species from Espigão do Oeste resulted in groups of snakes which reflect similarities in habits, representing guilds related to resource use (see Martins and Oliveira, 1998). These guilds may include phylogenetically close species (*e.g., Dipsas* spp.; *Atractus* spp.; and pseudoboines), as well as phylogenetically distant species that converge to similar habits (*e.g., A. scytale* and *M. surinamensis; B. constrictor* and *L. muta*). These results indicate that both historical and ecological factors were important for the structure of this community (see Martins and Oliveira, 1998).

Resumo

Em Espigão do Oeste (Rondônia) foi registrada uma riqueza de 56 espécies de serpentes, apresentando uma maior similaridade faunística com a Usina Hidrelétrica de Samuel (RO), localizada próxima à área de estudo. As serpentes mais comuns foram *Liophis reginae* (18,6% do total), *Oxyrhopus melanogenys* (8,4%), *Chironius exoletus* (6%), *Boa constrictor* (5,8%), *Dipsas catesbyi* (5,6%) e *Drymarchon corais* (5,6%). Um menor número de serpentes foi registrado durante os meses mais secos (junho – agosto). A maioria das espécies alimenta-se de lagartos (55,3% das espécies), seguidos de anuros (48,2%), mamíferos (26,8%), aves (12,5%) e serpentes (12,5%). Uma análise de agrupamento utilizando dados de tamanho (comprimento rostro-cloacal) e de utilização de recursos (hábitos alimentares, período e substrato de forrageio) originou oito grupos ("guildas") de serpentes. Nesta análise de agrupamento, foram reunidas tanto espécies próximas como distantes filogeneticamente, denotando a importância de fatores históricos e ecológicos na estruturação desta comunidade.

Table 9: Summary of resource use (microhabitat and period of foraging, and diet) by snakes in Espigão do Oeste (RO). AQ = aquatic; FO = fossorial; CR = cryptozoic; TE = terrestrial; AR = arboreal; D = diurnal; N = noturnal; MO = mollusks; EA = earthworms; AR = arthropods (or their eggs and larvae); FI = fish; TA = tadpoles; AN = anurans; CA =caecilians; LI = lizards; LE = lizard eggs; AM = anphisbaenians; SN = snakes; BI = birds; MA = mammals. The acronyms in lower case indicate that the resource is used sporadically.

Species	Substrate	Activity	Diet
T. reticulatus	FO	D/N	AR
L. macrolepis	FO	D/N	AR
A. scytale	FO, aq, te	D/N	FI, CA, AM, SN
B. constrictor	TE, AR	N d	LI, BI, MA
C. caninus	AR	N	MA, li
C. hortulanus	AR, TE	N	AN, LI, BI, MA
E. cenchria	TE	N	AN, LI, BI, MA
E. murinus	AQ	N	FI, AN, LI, SN, BI, MA
A. albuquerquei	FO	D/N	EA
A. latifrons	FO	D/N	EA
A. snethlageae	FO	D/N	EA
C. exoletus	TE, AR	D	AN
C. multiventris	TE, AR	D	AN
C. scurrulus	TE, AR	D	AN
Clelia sp.	TE	N	LI, SN, MA
D. dendrophis	TE	D	AN
D. catesbyi	TE, AR	N	MO
D. indica	AR	N	MO
D. pavonina	TE, AR	N	MO
D. anomalus	TE	N	LE
D. corais	TE	D	AN, LI, SN, BI, MA
D. rhombifer	TE	D	LI
D. dichrous	TE	D	AN, LI
E. occipitalis	CR, TE	D	AN, LI
E. aesculapii	TE	D	SN, li, fi
H. angulatus	AQ	D/N	FI, TA, AN
H. gigas	AQ	D	FI, AN
I. cenchoa	AR, te	N	AN, LA
L. annulata	TE, AR	N	AN
L. ahaetulla	TE, AR	D	AN, LA
L. almadensis	TE	D	AN
L. breviceps	TE, aq	D	AR, EA, FI, TA, AN,
L. reginae	TE	D	AN
M. mentovarius	TE	D	AN
M. boddaerti	TE	D	AN, LA
N. hudsoni	CR?	?	?
O. fulgidus	TE, AR	D	LI, BI
O. melanogenys	TE	N	LI, MA, bi
O. petola	TE	N	LI, MA, bi
P. olfersii	TE, AR	D	AN, LI, SN, BI, MA
P. poecilonotus	TE, AR	D	LI, BI, MA
R. lentiginosum	TE	N	LI
S. compressus	TE, AR	N	LI
S. worontzowi	TE, AR	N	LI
S. pullatus	TE, AR	D	AN, LI, BI, MA
T. melanocephala	TE	D	AR
X. rabdocephalus	TE	D	AN
X. severus	TE	D	AN
X. scalaris	TE, cr	D/N	AN
X. argenteus	AR	D	AN
M. hemprichii	FO, CR, te	D/N	AR, LI, AM, SN
M. spixii	FO, CR, TE	D	LI, AM, SN
M. surinamensis	AQ	D/N	FI, la
B. bilineatus	AR	N	AN, LI, MA
B. atrox	TE, AR	D/N	AR, AN, LI, SN, BI, MA
L. muta	TE	N	MA

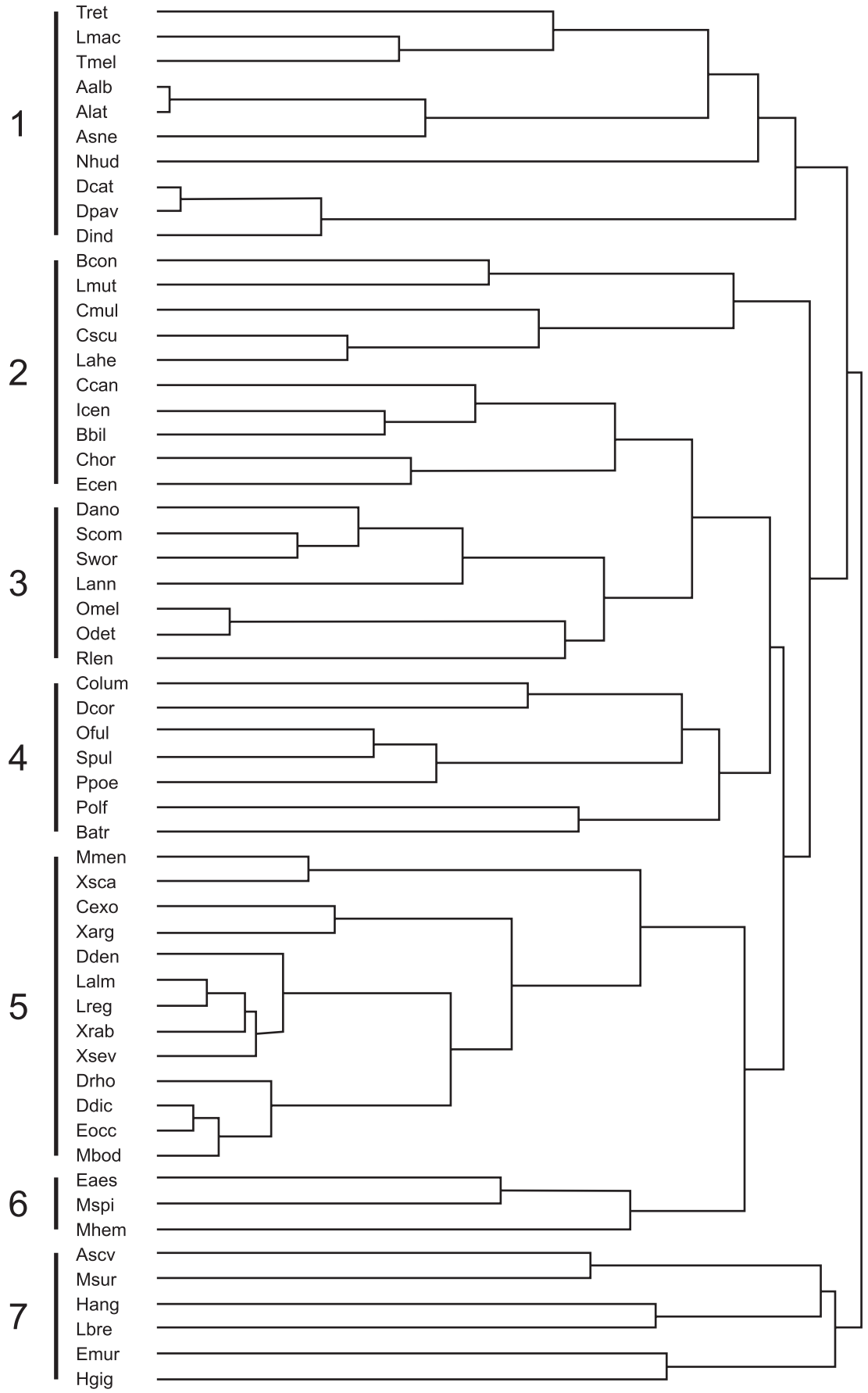

Figure 5: Cluster analysis using data on size, diet, microhabitat, and period of foraging activity of snakes in Espigão do Oeste (RO).

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