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SNAKE ASSEMBLAGE IN AN UNFLOODED FOREST IN WESTERN BRAZILIAN AMAZON

ASSEMBLEIA DE SERPENTES EM UMA FLORESTA NÃO INUNDADA NO OESTE DA AMAZÔNIA BRASILEIRA

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RESUMO

Apresentamos dados sobre a história natural de uma assembleia de serpentes no Alto Rio Juruá (Estado do Acre, Brasil). Amostramos as serpentes usando uma busca visual limitada pelo tempo, armadilhas de interceptação e queda e observação ocasional. Registramos 179 espécimes de 42 espécies. À noite, a maioria das serpentes foi observada na vegetação ou ativa (em movimento ou forrageando) ou em repouso. Em termos de período de atividade, 49,6% das espécies foram diurnas, 42% noturnas e 8,2% ativas durante o dia e a noite. Quarenta e três por cento das serpentes eram terrestres, 33% semi-arborícolas e arbóreas, 20% criptozoicas e fossoriais e 4% aquáticas. As presas mais comuns utilizadas por esta assembleia de serpentes são lagartos (43% das espécies), anfíbios (32%), mamíferos (30%), aves (19%) e outras serpentes (13%). A riqueza de espécies ainda pode ser considerada subestimada, revelando a necessidade de novas pesquisas e também estudos de possíveis impactos antrópicos negativos sobre as populações de serpentes.
Palavras-chave: Squamata. Microhabitat. Dieta. Estado do Acre.

ABSTRACT

We present data on the natural history of a snake assemblage in the Upper Juruá River (State of Acre, Brazil). We sampled the snakes using time constrained visual search, pitfall traps, and accidental sighting. We collected 179 specimens of 42 species. At night, most snakes were recorded on the vegetation either active (moving or foraging) or resting. In terms of activity time, 49.6% of the species were diurnal, 42% were nocturnal, and 8.2% were active during day and night. Forty-three percent of the snakes were terrestrial, 33% were semi-arboreal and arboreal, 20% were cryptozoic and fossorial and 4% were aquatic. The most common prey utilized by this snake assemblage were lizards (43% of the species), amphibians (32%), mammals (30%), birds (19%) and snakes (13%). The species richness can still be considered to be underestimated, illustrating the need for further surveys and also studies of possible negative impacts of human activities on snake populations.
Key words: Squamata. Microhabitat. Diet. State of Acre.

1. INTRODUCTION

In the Brazilian Amazon, studies on community structure of snakes have mainly been carried out in the states of Amazonas [1,2,3,4,5], Rondônia [6,7,8,3], and Pará [9,10,11,12,3,13,14]. However, despite an increase in the number of snake studies in the Amazon in the past decade [e.g. 4,15,16,14,17,18,19,20], there are stills in our knowledge about the natural history of many species and some regions remain poorly sampled [e. g., 3,13,18].

Brazil houses 405 species of snakes [21], but there is lack of information on the natural history of many of these species. For example, in the "Floresta Nacional do Caxiuanã (PA)",

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information on natural history (daily activity and microhabitat, feeding, reproductive biology, and defensive behaviors) is known for 53 of the 70 species recorded in the region [13]. In the western Brazilian Amazon (State of Acre), a snake checklist was published by [22], who reported the occurrence of 42 species in Rio Branco and 26 species in Cruzeiro do Sul, while for the other municipalities nine species or fewer were listed, demonstrating the existence of several under-sampled regions.

Only a handful of snake surveys have been carried out in the Upper Juruá River region: including in the municipality of Porto Walter [3,23], in the Riozinho da Liberdade Extractive Reserve [24], in the forest of the Lower Moa River [25]. The Upper Juruá has a rich snake fauna [3,24,25] with a critical need for natural history studies on the species in this region.

Snakes are important predators in ecosystems, feeding on various animal groups [26,2]. In the Amazon, deforestation causes a decrease in the richness of anurans and lizards [27,28], the main prey of snakes, which likely affects populations of these predators. Therefore, studies that provide information about why snakes are important set the groundwork for future conservation strategies [2], especially in extractive reserves [e.g.18], since areas of complete protection avoid deforestation more than those of sustainable use [29]. Here we provide information about species composition and aspects of the natural history (seasonality, daily activity, microhabitat use and diet) of snakes in the "Reserva Extrativista Riozinho da Liberdade", a sustainable area located in the Upper Juruá River region of the western Brazilian Amazon.

2. FUNDAMENTALS AND METHODOLOGICAL COURSE

We carried this study at Riozinho da Liberdade Extractive Reserve, located on the left bank of the Liberdade River, a tributary of the Juruá River (Figure 1). The Reserve is located inside the limits of the states of Acre and Amazonas and comprises 325,602 hectares. Sampling was focused on an area of 200 ha of the reserve near Esperança Stream (57°21.4" S, 72°38.8" W) in the municipality of Tarauacá, state of Acre, western Brazil.

The region's climate is tropical, hot and humid, with an average annual temperature of 24˚C [30], including dry periods from June to September. Annual rainfall varies from 1,140 to 2,700 mm. The phytophysiognomy of the study area is an open rainforest, which is characterized by an open canopy and high abundance of palms, lianas, and bamboos [31].

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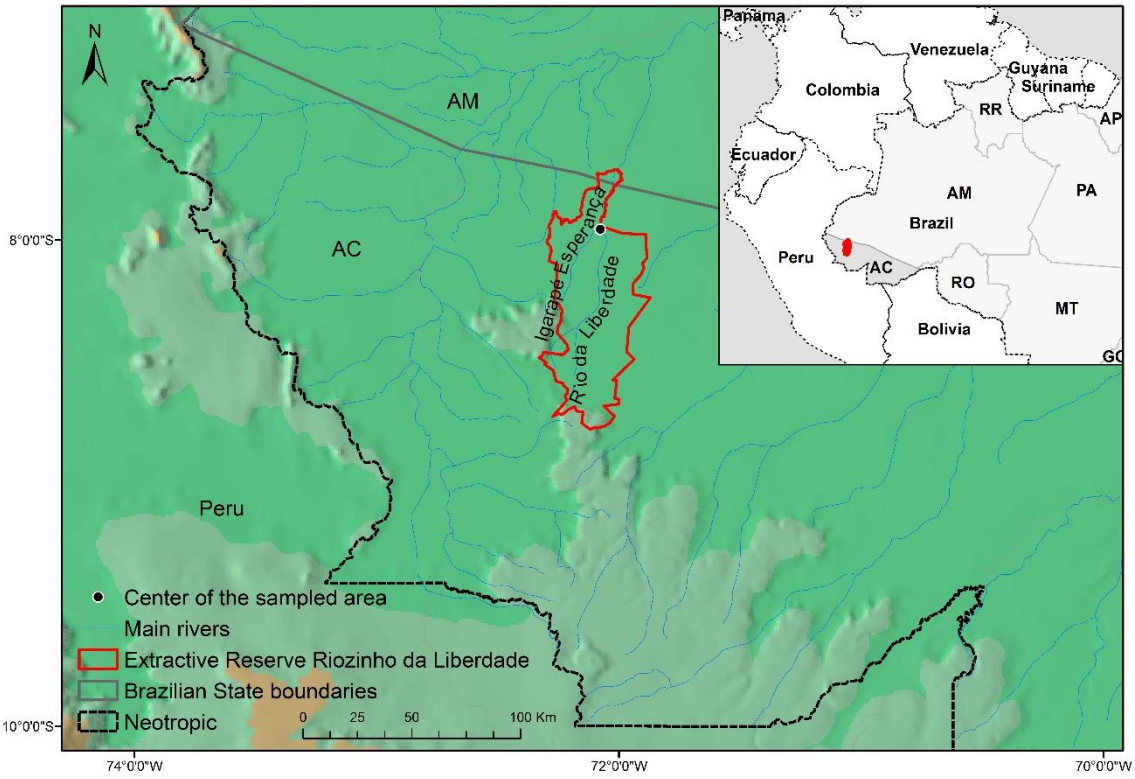

Figure 1. Geographical location of the Riozinho da Liberdade Extractive Reserve, Upper Juruá River Basin, Brazil

In the fieldwork was performed from August 2006 to June 2008. From August to December 2006 we explored the study area, opened trails in the forest and built pitfalls. From January 2007 to June 2008 (18 months) we made monthly six-day trips to sample snakes using time constrained searching (TCS), monitoring of pitfall traps, with drift fences and incidental observations.

During TCS [see 2,7], we walked three trails (400 - 500 m) that passed through aquatic environments, such as igapó forests, streams (locally known as “igarapés”), and temporary ponds. The transects were carried out during the night (18:00 - 23:00 h) and in the morning (7:00 - 11:00 h), for a total of 720 search h: 540 h at night and 180 h in the morning. The snake encounter rate was calculated as the number of snakes found divided by the number of hours searched, i.e., the number of specimens found per hour/observer.

Each pitfall trap station was composed of four 100 L buckets, buried 10 m apart from each other, and connected by a 1-m high black canvas fence that passed over the buckets [32]. We installed 10 stations, comprising a total of 40 buckets: five stations in a Y-shaped arrangement and five stations in a straight line. The traps remained open for five days a month over 18 months, and totaled 90 days of sampling (total effort: 40 buckets x 5 days x 18 months

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= 3,600 pitfall-days 2,160h with the traps open). All the traps were monitored once per day in the morning.

Incidental observations were any and all specimens that were collected or observed opportunistically in the field, when not performing TCS [33].

For each snake found we recorded the time of observation, microhabitat type (water, leaf litter, ground or vegetation), activity (moving or sit-and-wait hunting, resting - when the snake was inactive). Regarding the microhabitat use of snake species, we adopted an "ecological species" concept [according to 34,2] which means that a given species may be included in more than one category if it uses more than one resource state. For the collected snakes, we also recorded information on diet and sex. Voucher specimens were deposited in the Herpetological Collection (UFACF) of the Federal University of Acre - UFAC, Campus Floresta at Cruzeiro do Sul municipality. Specimen collection was authorized by the Sisbio 12178-2. The list of the specimens collected is given in the Appendix I. The cumulative sample effort (X-axis) with the cumulative number of species sampled (Y-axis) was used to compute the species accumulation curve [35].

We identified the stomach contents of snakes at a high taxonomic level (Phylum, Class or Order) such as mollusks, rodents and birds. Anurans, lizards, and snakes were identified at genus or species level whenever possible. We did not analyze the diet of specimens captured in pitfalls trap, because of the possibility that the snakes might have ingested prey in the pitfall trap. We used a Pearson correlation to test the relationship among the number of recorded snakes, rainfall and temperature on a monthly basis [36]. These climatic data were obtained from the National Institute of Meteorology (INMET), located in the municipality of Tarauacá (state of Acre). Differences in the number of individual snakes recorded between rainy and dry seasons were tested with a Chi-square test [36]. Differences were considered statistically significant at $p<0.05$.

3. RESULTS

We recorded 179 snake specimens (106 collected; see Appendix) of 42 species and six families: Aniliidae (1), Boidae (3), Colubridae (11), Dipsadidae (22), Elapidae (3), and Viperidae (2). The most abundant snakes, which together represented 64.1% of the total, were *Imantodes cenchoa* (12.3%), *Dipsas catesbyi* (9%), *Xenoxybelis argenteus* (9%), *Atractus major* (7.3%), *Chironius carinatus* (5%), *Corallus hortulana* (5%), *Bothrops atrox* (4.5%),

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Drepanoides anomalus (4%), *Erythrolamprus dorsocorallinus* (4%), and *Oxyrhopus melanogenys* (4%).

Most specimens (88) were recorded during time constrained visual searches, followed by incidental observations (73 specimens), and pitfall traps with drift fences (18) (Table 1). The species accumulation curve did not stabilize (Figure 2).

Table 1. Species of snakes recorded in the Riozinho da Liberdade Extractive Reserve, Upper Juruá River Basin, Brazil. Using N: total number of specimens; number of specimens recorded by time constrained visual search, (TCP) pitfall traps with drift fences (PT) and incidental observation (IO).

SPECIES	N	TCP	PT	IO
Aniliidae				
Anilius scytale (Linnaeus, 1758)	2		2	
Boidae				
Boa constrictor constrictor Linnaeus, 1758	1			1
Corallus hortulana (Linnaeus, 1758)	9	7		2
Eunectes murinus (Linnaeus, 1758)	2			2
Colubridae				
Chironius carinatus (Linnaeus, 1758)	9	6		3
Chironius fuscus (Linnaeus, 1758)	1			1
Chironius scurrulus (Wagler *in* Spix, 1824)	5			5
Drymarchon corais (Boie, 1827)	2			2
Drymobius rhombifer (Günther, 1860)	4	1		3
Drymoluber dichrous (Peters, 1863)	6	3		3
Leptophis ahaetulla ahaetulla (Linnaeus, 1758)	1	1		
Oxybelis fulgidus (Daudin, 1803)	1			1
Phrynonax polylepis (Peters, 1867)	1			1
Spilotes pullatus pullatus (Linnaeus, 1758)	3	2		1
Tantilla melanocephala (Linnaeus, 1758)	1		1	
Dipsadidae				
Atractus major Boulenger, 1894	13	5	2	6
Atractus schach (Boie, 1827)	1		1	

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Clelia clelia (Daudin, 1803)	1	1		
Dipsas catesbyi (Sentezen, 1796)	16	8		8
Dipsas indica indica Laurenti, 1768	3	2		1
Drepanoides anomalus (Jan, 1863)	7	4	2	1
Erythrolamprus dorsocorallinus (Esqueda, Natera, La Marca & Ilija-Fistar, 2007)	7	1	5	1
Erythrolamprus pygmaeus (Cope, 1868)	1			1
Erythrolamprus reginae semilineatus (Wagler *in* Spix, 1824)	1			1
Erythrolamprus taeniogaster (Jan, 1863)	1			1
Erythrolamprus typhlus typhlus (Linnaeus, 1758)	1			1
Helicops angulatus (Linnaeus, 1758)	1			1
Imantodes cenchoa (Linnaeus, 1758)	22	16		6
Leptodeira annulata annulata (Linnaeus, 1758)	1	1		
Oxyrhopus melanogenys melanogenys (Tschudi, 1845)	7	3	2	2
Oxyrhopus occipitalis Wagler *in* Spix, 1824	3	2	1	
Oxyrhopus petolarius digitalis (Reuss, 1834)	5	5		
Siphlophis compressus (Daudin, 1803)	2	2		
Taeniophallus brevirostris (Peters, 1863)	1		1	
Xenodon severus (Linnaeus, 1758)	1			1
Xenopholis scalaris (Wucherer, 1861)	1	1		
Xenoxybelis argenteus (Daudin, 1803)	16	11		5
Elapidae				
Micrurus hemprichii hemprichii (Jan, 1858)	2	1	1	
Micrurus lemniscatus lemniscatus (Linnaeus, 1758)	2	1		1
Micrurus annellatus bolivianus Roze, 1987	5	3		2
Viperidae				
Bothrops atrox (Linnaeus, 1758)	8	3		5
Lachesis muta (Linnaeus, 1766)	2			2

During TCP, 24 species were recorded (57.14% of the total rickness) and the snake encounter rate was higher at night: 0.225 snakes/observer-h, i.e., one snake every 4 h and 44 min of search and 0.038 snakes/h-observer during the day (one snake every 25 h and 7 min of search).

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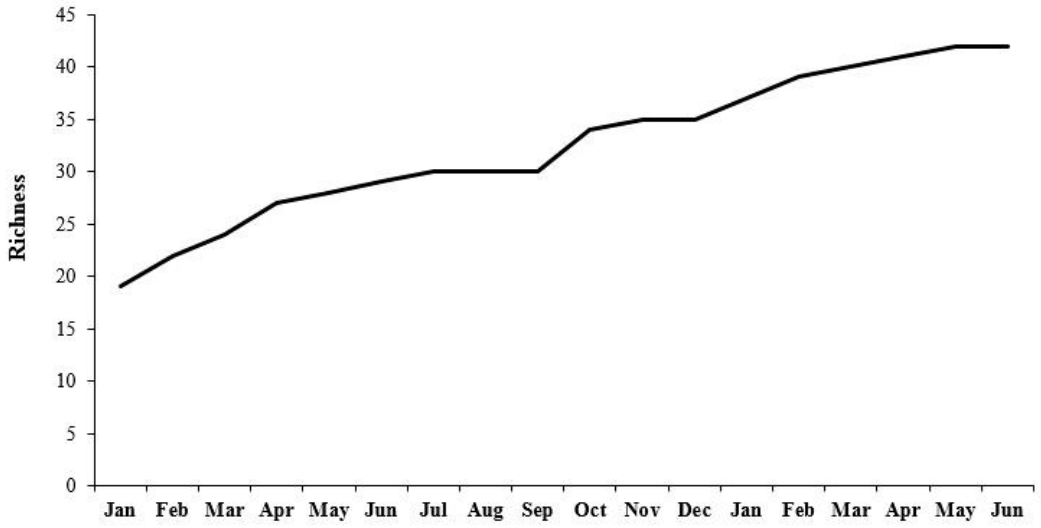

Figure 2. Species accumulation curve made by pooling data from the three sampling methods time constrained visual search, pitfall traps with drift fences and incidental observation.

Six species (*Leptophis ahaetulla*, *Clelia clelia*, *Leptodeira annulata*, *Oxyrhopus petolarius*, *Siphlophis compressus*, and *Xenopholis scalaris*) were recorded exclusively by this method. Ten species were recorded in the pitfall traps (23.8% of the total richness), four species which (*Anilius scytale*, *Atractus schach*, *Taeniophallus brevirostris*, and *Tantilla melanocephala*) were detected exclusively by this method. The largest number of species (30 species, 71.42% of the total) was recorded from incidental observations, of which 14 species were recorded exclusively by this method.

In the snake assemblage, 49.6% of the species were diurnal, 42.2% nocturnal, and 8.2% had both diurnal and nocturnal habits.

Snakes were found active on the vegetation (58.2%) and on the leaf litter (37%) (Table 2). Forty-two individuals were found resting on the vegetation (N = 40) and on fallen trees (N = 2). *Bothrops atrox* juveniles were found active on the vegetation (N = 5), while the adults were found active on the ground (N = 2) on nocturnal periods. *Chironius scurrulus* juveniles were found on the vegetation when active (N = 2) and resting (N = 2), the active adults were found on the ground near the margin of a stream (N = 2). One *Oxyrhopus petolarius* adult was found active at night on a tree (ca. 7 m above the ground) and four juveniles were found on the ground. *Atractus major* were found active on the ground (N = 3) and we also found a couple copulating on the vegetation (30 cm above the ground) (Figure 3). Nine species (40 individuals) of diurnal colubrids and dipsadids were found at night resting on the vegetation. Two nocturnal dipsadids (*Dipsas catesbyi* and *D. indica*, the last one after ingesting a slug) were recorded resting for a short time on the vegetation at night.

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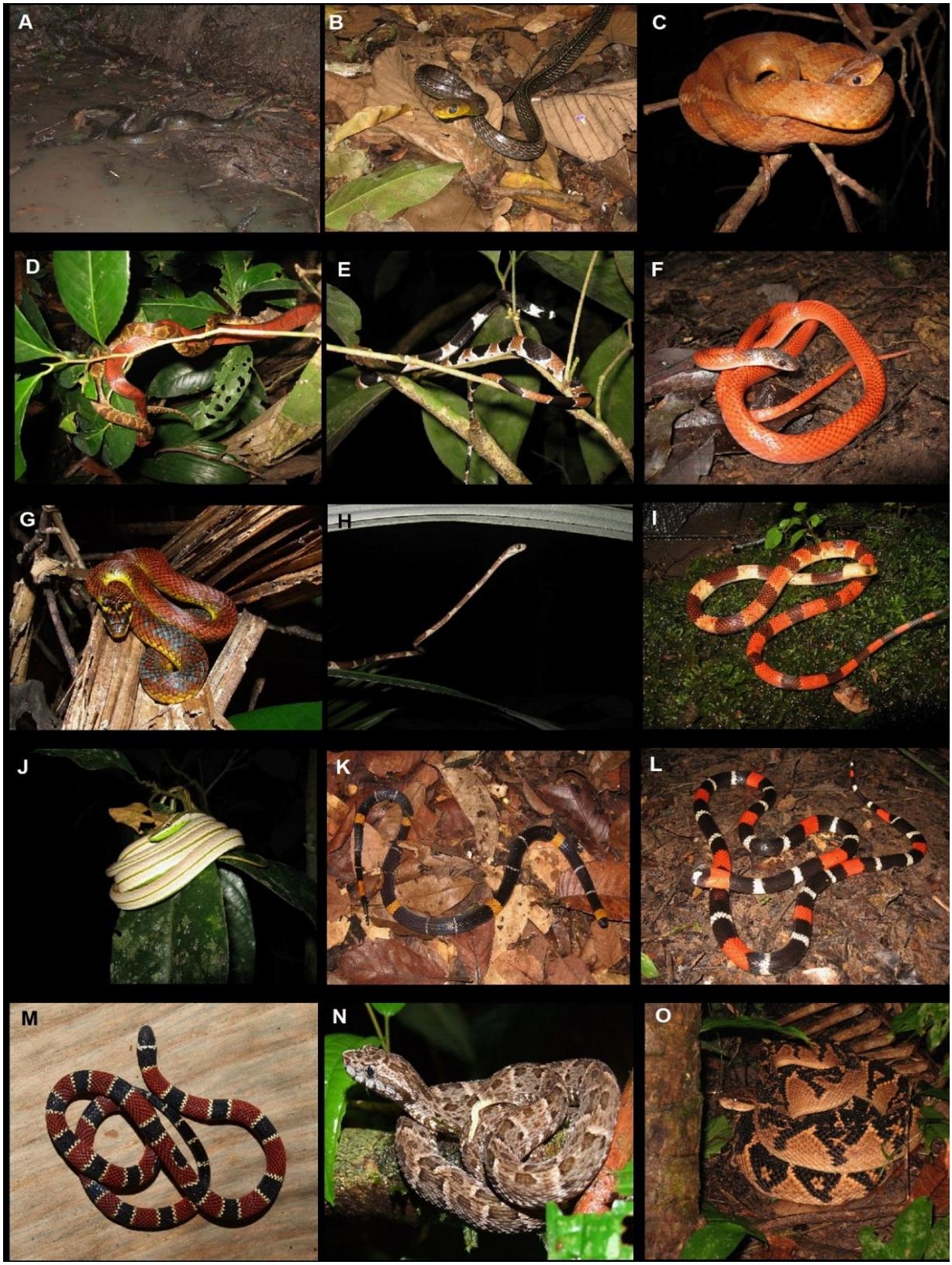

Figure 3. Snakes recorded in the Riozinho da Liberdade Extractive Reserve, Upper Juruá River Basin, Brazil: (**A**) *Eunectes murinus*; (**B**) *Chironius carinatus*; (**C**) *Drymobius rhombifer*; (**D**) Copulating pair of *Atractus major*; (**E**) *Dipsas catesbyi*; (**F**) *Drepanoides anomalus*; (**G**) *Erythrolamprus dorsocorallinus*; (**H**) *Imantodes cenchoa*; (**I**) *Oxyrhopus occipitalis*; (**J**) *Xenoxybelis argenteus*; (**K**) *Micrurus hemprichii*; (**L**) *Micrurus lemniscatus*; (**M**) *Micrurus annellatus bolivianus*; (**N**) *Bothrops atrox* (juvenile); (**O**) *Lachesis muta.*

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Table 2. Substrates types where active snakes were found (total = 110 specimens) in the Riozinho da Liberdade Extractive Reserve, Upper Juruá River Basin, Brazil. d = during the day; n = during the night.

Species	In the leaf litter	On the ground on leaf litter	Vegetation	Water bodies
Boidae				
Corallus hortulana	-	-	8 (n)	-
Eunectes murinus	-	-	-	1 (d)
Colubridae				
Chironius carinatus	-	1 (d)	2 (d)	-
Chironius scurrulus	-	1 (d)	2 (d)	
Drymarchon corais	-	2 (d)	-	-
Drymobius rhombifer	-	1 (d)	1(d)	-
Drymoluber dichrous	-	3 (d)	-	-
Oxybelis fulgidus	-	-	1(d)	-
Spilotes pullatus	-	2 (d)	-	-
Dipsadidae				
Atractus major	-	3 (n)	-	-
Clelia clelia	-	-	1 (n)	-
Dipsas catesbyi	-	3 (n)	11(n)	-
Dipsas indica	-	-	2 (n)	-
Drepanoides anomalus	-	5 (n)	-	-
Erythrolamprus pygmaeus	-	1 (n)	-	-
Helicops angulatus	-	-	-	1(n)
Imantodes cenchoa	-	1 (n)	21 (n)	-
Leptodeira annulata	-	1(n)	-	-
Oxyrhopus occipitalis	-	-	2 (n)	-
Oxyrophus melanogenys	-	5 (n)	-	-
Oxyrhopus petolarius	-	4 (n)	2 (n)	-
Siphlophis compressus	-	-	2 (n)	-
Xenopholis scalaris	1 (n)	-	-	-
Xenoxybelis argenteus	-	-	2 (d)	-
Elapidae				
Micrurus hemprichii	-	1 (n)	-	-
Micrurus lemniscatus	-	2 (n)	-	-
Micrurus a. bolivianus	2 (d)	3 (n)	-	-
Viperidae				
Bothrops atrox	-	1 (d)	5 (n)	-
Lachesis muta	-	2 (n)	-	-

Two nocturnal species were recorded during the day resting for a long time under a tree trunk (*Bothrops atrox*) and inside a trunk cavity (*Corallus hortulana*). *Xenoxybelis argenteus* was found resting on palm leaves (11 out of 14 records).

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Data on diet were collected from 32 specimens (17.87% of all snakes collected) of 18 species. We recorded a total of 35 food items, mostly anurans (37.15%), lizards (17.15%), rodents (8.58%) and mollusks (8.58%) (Table 3).

Table 3. Food items found in the stomachs of 32 snake specimens (total = 35 prey items): in the Riozinho da Liberdade Extractive Reserve, Upper Juruá River Basin, Brazil. Using N: total number of specimens analyzed: earthworms (*Ew*), mollusks (*Mo*), anuran eggs (*A*e), anurans (*An*), squamata eggs (*Se*), lizards (*Li*), snakes (*Sn*), rodents (*Ro*), marsupials (*Ma*), and chiropterans (*Ch*).

		Prey									
Snakes	*N*	*Ew*	*Mo*	*Ae*	*An*	*Se*	*Li*	*Sn*	*Ro*	*Ma*	*Ch*
Corallus hortulana	1										2
Eunectes murinus	1									1	
Atractus major	3	3									
Chironius carinatus	3				3						
Chironius scurrulus	1				1						
Dipsas indica	1		1								
Dopsas catesbyi	2		2								
Drymoluber dichrous	5				3		2	1			
Imantodes cenchoa	2						2				
Leptophis ahaetulla	1				1						
Erythrolamprus dorsocorallinus	3			1	3						
Oxyrhopus occipitalis	1								1		
Oxyrhopus melanogenys	1								1		
Oxyrhopus petolarius	1								1		
Siphlophis compressus	1					1					
Xenoxybelis argenteus	3				1		2				
Micrurus a. bolivianus	1							1			
Bothrops atrox	1				1						

We did not found correlation between snake frequency and monthly rainfall ($r = 0.0460$, $p = 0.3925$, d.f. = 16) (Figure 4), or a difference in the number of specimens recorded between the wet and dry seasons ($X^2 = 9.83$, $p = 0.2766$, d.f. = 8).

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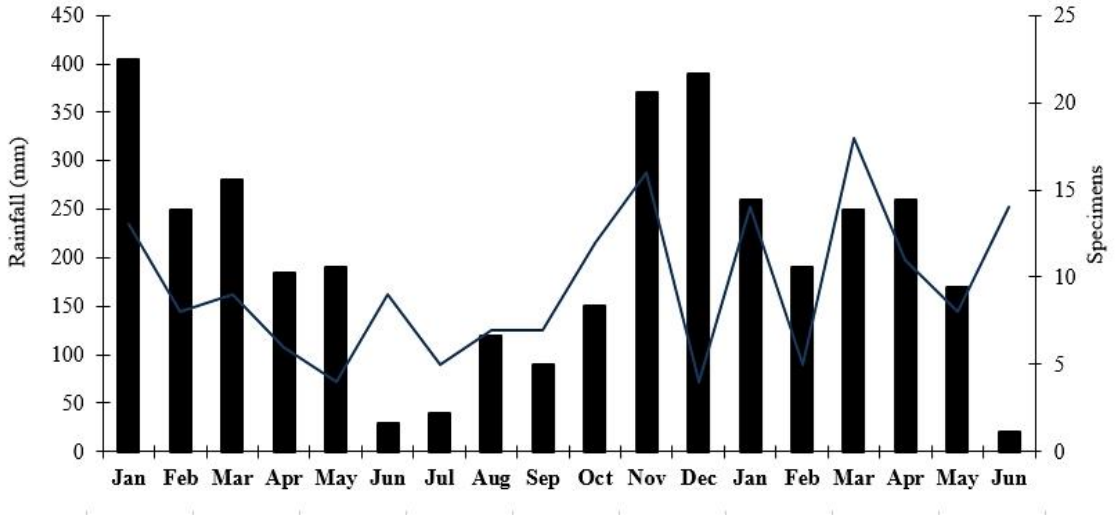

Figure 4. Number of snake specimens recorded (line) and monthly rainfall (bars; in mm) in the Riozinho da Liberdade Extractive Reserve, Upper Juruá River Basin, Brazil.

4. DISCUSSION

The species richness recorded in our study area, is lower than that observed in other studies in the Amazon [2,7] and the species accumulation curve showed that more species remain to be discovered at the Riozinho da Liberdade Extractive Reserve. Similar to other studies [e.g. 37,3,18], our results have also shown that long-term surveys are needed to thoroughly sample snakes from a locality. Among the species with highest numbers of records, three of them (*I. cenchoa*, *D. catesbyi*, and *X. argenteus*) were also the most abundant in other studies [38,2,7]. *Bothrops atrox* is usually one of the most abundant species in studies on snake communities in the Amazon [2,39] and the same trend was observed for Riozinho da Liberdade Extractive Reserve. The encounter rate of snakes was higher during the night (0.255 snakes/observer-hour) than during the day (0.038 snakes/observer), as previously reported for the Amazon region [2,40]. The higher encounter rate during the night is explained by the prevalence of finding diurnal species resting at night resting on the vegetation [41,2], as well as by the higher activity of cryptically-colored (and consequently hard to detect) species during the day and of species with contrasting colors (which are presumably easier to detect) at night [42]. The snake species captured in pitfall traps had fossorial, cryptozoic or terrestrial habits, which confirms the ability of the method to sample species that move on the ground [32,43]. Some species were recorded exclusively by one of the methods adopted, highlighting the importance of the use of

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complementary methods in studies on snake communities for more complete sampling [32,2,43,40].

Substrate use and foraging activity in the studied snake community were similar to those of other Amazonian snake communities [2,7]. The tendency of active *Bothrops atrox* juveniles to use the vegetation and the adults to use the ground may be related to food availability (anurans) and to the pressure of terrestrial predators [39,44]. Another example of a species where juveniles use vegetation more than adults is *Chironius scurrulus* [2] and this study, juveniles of which are green in color, in contrast to dark-colored adults that forage mainly on the ground [45]. In the present study, we also observed two adults of *Oxyrhopus petolarius* foraging at night at ca. 7 m and 3.5 m above the ground, whereas four juveniles were found on the ground, contradicting the observations of Alencar *et al*. [46] that this species rarely uses vegetation. The observation of an active adult at night 2 m above the ground in Rondônia (personal observation) and records of birds in the diet of this species [47] provide evidence that this snake also forages in the vegetation. *Oxyrhopus occipitalis* is considered to be a terrestrial (occasionally cryptozoic) snake that sometimes uses low vegetation [2] and is poorly known [46]. We observed two individuals active on the vegetation (30 cm and 1.10 m above the ground), both during the night. The snake *Atractus major*, which is primary fossorial and occasionally cryptozoic and terrestrial (and sometimes also climbs into vegetation), may be active during both night and day [2]. In the present study, we observed three individuals active on the ground at night and two snakes copulating on the vegetation (30 cm above the ground). *Imantodes cenchoa* was active at night, mostly on palm tree leaves (9 records) and on branches and leaves of shrubs (12), as has been observed in other studies [38,2,7]. We observed 40 diurnal snakes of the families Colubridae and Dipsadidae at rest on the vegetation during the night, which should be interpreted as a strategy to avoid terrestrial predators [41,2,7]. One species (*Xenoxybelis argenteus*) showed a preference for sleeping on palm tree leaves.

Contrary to other studies in the Amazon [48,7], we found no correlation between snake occurrence and rainfall. However, similar to data on reproduction (juvenile occurrence and females with ovarian follicles and eggs), the sample size obtained in the present study may be insufficient for this kind of analysis. There is a tendency to find more snakes during the recruitment period in the rainy season in the Amazon [2,7], which is probably related to higher prey availability (anurans and lizards).

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In the Amazon, snake communities are represented mainly by species that feed on anurans and lizards, followed by mammals, birds, and other snakes [2,7], this was also observed in the present study. According to our results and the information obtained in the literature [e.g., 10,2,8], the most common prey utilized by this snake assemblage are lizards (43% of the species), amphibians (32%), mammals (30%), birds (19%) and snakes (13%). One specimen of *E. murinus* regurgitated an opossum (*Didelphis marsupialis*) when handled. Marsupials are part of the diet of this generalist snake [2]. A subadult smoky jungle frog (*Leptodactylus pentadactylus*) was found in the stomach of an adult *C. scurrulus*; this prey was already recorded for this species [2]. One *C. hortulana* juvenile, which had preyed on two bats (Vespertilionidae), was captured inside a hollow trunk that had fallen into a river; bats are known in the diet of this generalist species [49,50].

However, there is little information about the hunting strategy of this snake when capturing bats. In the present study a specimen of *C. hortulana* was found resting inside a bat roost, which is evidence that the snake may be actively searching for this kind of prey. We observed ophiophagy in two species: a *Micrurus annellatus bolivianus* which fed on a juvenile *Erythrolamprus typhlus,* and a *Drymoluber dichrous* which ingested a juvenile *E. typhlus* as well as an amphibian (*Leptodactylus* sp.). The snake *E. typhlus* had not been recorded in the diet of *M. a. bolivianus* [51] or *D. dichrous* [2]. The three *Oxyrhopus* species had rodents in their stomachs. This food item was known for *O. melanogenys* and *O. petolarius* [47,8], but was recorded for the first time in the diet of *O. occipitalis* [46]. We recorded a squamate egg in the diet of *S. compressus*, a food item known for other species of Pseudoboini (*Drepanoides anomalus*, *Oxyrhopus melanogenys*, *O. trigeminus*, *Pseudoboa nigra* and *Siphlophis pulcher*) [46].

FINAL CONSIDERATIONS

Detailed aspects of the natural history on Amazonian snakes are crucial for future conservation and management. Our study produced list of species for the locality, also, new data about the diet of some species (e. g., *E. dorsocorallinus*, *M. a. bolivianus O. occipitalis*, *S. compressus*) and substrate use of others (e. g. *A. major*, *O. petolarius*), highlighting the importance of conducting such studies in the region. This conservation area is of sustainable use, where some human activities (hunting, clearing of forest for agriculture) are carried out. In other extractive reserves, there are no studies on possible impacts on the herpetofauna. The

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Riozinho da Liberdade Extractive Reserve species richness can still be considered underestimated, showing the need for further surveys and also studies of possible negative impacts of human activities on snake populations. The Juruá region is composed of anthropized areas (crops, pastures), floodplain forests and unflooded forests, and the latter ecosystem is characterized by its greater richness of snake species. The management plan of this conservation unit must be properly followed in order for development to occur along with preservation.

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APPENDIX

Specimens examined, deposited in the Herpetological Collection of the University Federal do Acre, Campus de Cruzeiro do Sul, Acre state, Brazil. Snakes – Aniliidae: *Anilius scytale* (UFACF 777); Boidae: *Corallus hortulana* (UFACF 738, 747, 766); Colubridae: *Chironius carinatus* (UFACF 652, 684, 759, 769, 896, 928); *Drymobius rhombifer* (UFACF 417, 666, 906); *Drymoluber dichrous* (UFACF 663, 720, 741, 801, 880, 1333); *Leptophis ahaetulla* (UFACF 756); *Oxybelis fulgidus* (UFACF 783); *Spilotes pullatus* (UFACF 607); *Tantilla melanocephala* (UFACF 547); Dipsadidae: *Atractus major* (UFACF 553, 616, 618, 653, 677, 686, 700, 703, 736, 757); *Atractus schach* (UFACF 416); *Clelia clelia* (UFACF 667); *Dipsas indica* (UFACF 606, 719, 960); *Dipsas catesbyi* (UFACF 650, 651, 656, 657, 710, 752, 796, 799, 956, 1207); *Drepanoides anomalus* (UFACF 654, 704, 764); *Helicops angulatus* (UFACF 189); *Imantodes cenchoa* (UFACF 609, 670, 691, 708, 724, 730, 731, 744); *Erythrolamprus dorsocorallinus* (UFACF 405, 635, 655, 664, 918); *Erythrolamprus pygmaeus* (UFACF 804); *Erythrolamprus reginae* (UFACF 548); *Erythrolamprus taeniogaster* (UFACF 1803); *Oxyrhopus melanogenys* (UFACF 619, 693, 696, 713, 733, 774, 775, 946); *Oxyrhopus petolarius* (UFACF 555, 570, 617, 695); *Oxyrhopus occipitalis* (UFACF 770, 862, 1798); *Siphlophis compressus* (UFACF 739); *Taeniophallus brevirostris* (UFACF 788); *Xenopholis scalaris* (UFACF 637); *Xenoxybelis argenteus* (UFACF 665, 717, 734, 740, 743, 771, 784, 1771); Elapidae: *Micrurus hemprichii* (UFACF 575, 727); *Micrurus lemniscatus* (UFACF 668, 726); *Micrurus annellatus bolivianus* (UFACF 605, 620, 758, 782); Viperidae: *Bothrops atrox* (UFACF 608, 672, 678, 1790).