Composition of herpetofauna in the ecotone between the Cerrado and Atlantic Forest with ecotourism activity around the Itambé Cave and Waterfall, Altinópolis – SP

Composição da herpetofauna no ecótono entre o Cerrado e a Mata Atlântica com atividade de ecoturismo ao redor da Gruta e Cachoeira do Itambé, Altinópolis – SP

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ABSTRACT
São Paulo state is renowned for its extensive research on herpetofauna. However, there are still unexplored areas within the state, creating knowledge gaps in biodiversity. This study focused on the Itambé cave and waterfall in Altinópolis, São Paulo, which is an ecotone between the Cerrado and Atlantic Forest and popular among ecotourists. The research aimed to describe the herpetofauna composition in this area. Data collection occurred from April 2022 to January 2023, utilizing various methods. The study assessed the influence of climate variables and seasons on species richness and abundance. The findings identified eight herpetofauna species distributed across six genera. Among them, three lizard species and five anuran species were classified as generalists. Lizard richness peaked in winter, while anuran richness was highest in spring. Precipitation significantly influenced anuran abundance throughout the data collection period. Lizards were evenly distributed between the Cerrado and Atlantic Forest, while anurans were predominantly found in the Atlantic Forest. The research highlights the diverse herpetofauna present in the Itambé cave and waterfall region. However, all species encountered were generalists, suggesting potential human activity impacts on species with specific habitat requirements.

Keywords: amphibians, conservation, environmental education, fauna, reptiles.

RESUMO
O estado de São Paulo é conhecido pela extensa pesquisa em herpetofauna. No entanto, ainda existem áreas inexploradas dentro do estado, o que gera lacunas no conhecimento da biodiversidade. Este estudo concentrou-se na gruta e cachoeira do Itambé, em Altinópolis, São Paulo, que é um ecótono entre o Cerrado e a Mata Atlântica e é popular entre os ecoturistas. O objetivo da pesquisa foi descrever a composição da herpetofauna dessa área. A coleta de dados ocorreu de abril de 2022 a janeiro de 2023, utilizando diversos métodos. O estudo avaliou a influência de variáveis climáticas e estações do ano na riqueza e abundância de espécies. Os resultados identificaram oito espécies de herpetofauna distribuídas em seis gêneros. Entre elas, três espécies de lagartos e cinco espécies de anuros foram classificadas como generalistas. A riqueza de lagartos atingiu o pico no inverno, enquanto a riqueza de anuros foi maior na primavera. A precipitação teve um impacto significativo na abundância de anuros durante todo o período de coleta de dados. Os lagartos apresentaram distribuição equilibrada entre o Cerrado e a Mata Atlântica, enquanto os anuros foram predominantemente encontrados na Mata Atlântica. A pesquisa destaca a diversidade de herpetofauna presente na região da gruta e cachoeira do Itambé. No entanto, todas as espécies encontradas foram classificadas como generalistas, o que sugere possíveis impactos das atividades humanas nas espécies com requisitos específicos de habitat.

Palavras-chave: anfíbios, conservação, fauna, educação ambiental, répteis.
1 INTRODUCTION

Brazil is globally recognized for its remarkable biodiversity, hosting two of the 34 priority hotspots for biological conservation: the Cerrado and the Atlantic Forest (MITTERMEIER et al., 2004). The Cerrado, the country's second largest biome, spans approximately 21% of Brazil's landmass and boasts a diverse range of vegetation types, supporting a unique biota characterized by a high level of endemism and anthropogenic pressure (IBGE, 2004; RIBEIRO; WALTER, 1998). In contrast, the Atlantic Forest stands as the second largest tropical rainforest in the Americas, harboring an impressive array of over 8,000 endemic species. Regrettably, only 10% of its original extent remains intact (MYERS et al., 2000).

Within the state of São Paulo, there exist ecotones—areas of convergence between the Cerrado and the Atlantic Forest. These ecotones hold a special allure for scientists engaged in ecological research and conservation efforts, as well as for tourists seeking captivating landscapes. Nonetheless, these areas also present challenges concerning the interaction between ecotourists and wildlife, particularly about the herpetofauna, encompassing amphibians and reptiles.

While many species of the herpetofauna evoke fascination and appreciation, others may evoke fear or aversion, primarily due to the general public's lack of understanding regarding the biological significance and ecological role of these animals. This knowledge gap can engender hazardous encounters between ecotourists and wildlife, resulting in detrimental environmental consequences and population decline. The herpetofauna, comprising amphibians and reptiles, plays a vital role in the conservation of diverse biomes by actively contributing to various biological cycles and maintaining environmental equilibrium (VITT; CALDWELL, 2013). In the state of São Paulo, the amphibian and reptile diversity hold significant importance, representing a substantial portion of both Brazilian and global biodiversity (ARAÚJO et al., 2009; BÉRNILS, 2010; ZAHER et al., 2011; ROSSA-FERES et al., 2011). However, despite extensive research, there remain unsampled areas within São Paulo,
including ecotourism sites, leading to knowledge gaps in biodiversity understanding.

In this context, the objective of this study was to document the herpetofauna inhabiting the Itambé cave and waterfall located in Altinópolis, São Paulo state. This area represents an ecotone where the Cerrado and the Atlantic Forest converge, and it experiences significant ecotourism activities.

**2 MATERIAL AND METHODS**

**2.1 STUDY AREA CHARACTERIZATION**

Altinópolis, located in the northeastern region of São Paulo state, is a renowned tourist destination famous for its waterfalls and caves. The city boasts extensive forest remnants, establishing itself as an ecotone between the Cerrado and the Atlantic Forest, characterized by distinct phytophysiognomies. The Itambé cave features an impressive facade spanning 28 m, with galleries extending approximately 350 m and hosting an interior watercourse. Accessible via a lateral trail near the cave’s entrance, the Itambé waterfall stands at a height of around 50 m.

Before commencing the research, a preliminary study of the Itambé cave and waterfall area was conducted. During this study, typical Cerrado characteristics were observed in higher elevated areas and in the immediate vicinity of the cave. Sandy formations and sandy loam soils predominated in this area, accompanied by low-lying vegetation, grasses, and emblematic climax trees like the Cerrado Yellow Tabebuia (*Tabebuia ochracea*). Conversely, lower areas and the initial sections of trails leading to the cave and near the waterfall exhibited characteristics of the Atlantic Forest. Soils in these locations were identified as latosols and clayey soils, while the typical vegetation consisted of abundant seedlings, bamboo species, ferns, semi-climbing plants (*Philodendron hederaceum*), and shrubs (*Piper aduncum*).
2.2 DATA COLLECTION

Between April 2022 and January 2023, a total of ten field campaigns were conducted, with each campaign involving three researchers, aiming to collect data within the study area. All collections were authorized by the “Sistema de Autorização e Informação em Biodiversidade” (ICMBio/SISBIO) under protocol number 80737. The campaigns occurred once a month, spanning four consecutive days, and employed two sampling methods: pitfall traps and limited time visual search (LTVS). Additionally, data obtained from occasional encounters were also included. The total sampling effort amounted to 1,152 hours, and the climatic conditions during the data collection periods are presented in Fig. 1.

Figure 1 – Climate chart showing the minimum temperature (°C), maximum temperature (°C), and precipitation (mm) in Altinópolis, São Paulo, during the periods of primary data collection.

During the data collection campaigns, all encountered animals were manually recorded in a control spreadsheet. To aid in species identification and taxonomic confirmation, specimens described in the “Reptile Database“ and taxonomic keys from various reference sources such as books, texts, monographs, catalogs, reviews, and periodic references were utilized (HEYER et al., 1990).
2.2.1 Pitfall traps

The pitfall traps employed in this study involved burying containers in the ground and connecting them with guide fences (CORN, 1994). Ten 20-liter buckets were used for this purpose, arranged radially with a 10 m spacing between them and linked by a plastic guide fence approximately 1 m tall, positioned centrally over the bucket openings. To facilitate drainage during rainy periods, the bottoms of the buckets were perforated.

Two traps were set up in the designated sampling area, with installation occurring on Tuesdays and removal on Thursdays. Inspections were conducted in the morning (8 am – 9 am) and afternoon (4 pm – 5 pm). A total of 270 collections were made, corresponding to 27 days of sampling per bucket.

The selection of trap locations took into consideration their geographical coordinates and specific characteristics, including the presence of suitable vegetation, previous sightings of target species, and a minimum distance from areas of human disturbance:

Point 1: The first sampling point was situated at coordinates -21.06993 and -47.43442, with an elevation of 604 m. The vegetation in this area was dense, mainly composed of bamboo, and included remnants of seasonal semideciduous forest. A substantial amount of organic matter in the form of leaf litter was present, and the soil type was identified as latosol.

Point 2: The second sampling point was located at coordinates -21.06917 and -47.43725, with an elevation of 641 m. The prevailing vegetation consisted of low-lying herbaceous and shrubby species, with patches of large climax trees interspersed. The soil type in this area was classified as neosol quartzarenic.

2.2.2 Limited time visual search (LTVS)

The LTVS method involved systematically traversing a predetermined area for a specific period to conduct a comprehensive search for specimens across their diverse habitats, with the aim of determining species richness or composition.
To execute the LTVS, three researchers conducted walking studies within sampling plots organized as linear transects, measuring 100 m in length and 4 m in width. The arrangement of these plots was determined based on the availability of the area. Each researcher dedicated one hour per plot, conducting searches during two distinct time periods: 9 am to 1 pm and 2 pm to 6 pm. To quantify the encounter rate of specimens, the fundamental parameter utilized was the number of animals found per researcher per hour (MARTINS; OLIVEIRA, 1999). The total sampling effort for this method amounted to 288 hours per researcher, resulting in a cumulative total of 864 hours.

2.2.3 Occasional encounters

Occasional encounters included all animal records and sightings obtained through methods other than those previously mentioned. This category encompassed animals observed outside the designated plots or time frame of the LTVS method. The sampling effort for this method was calculated based on the total number of field activity days, which amounted to 27 days.

2.3 DATA ANALYSIS

The nomenclature for amphibians and reptiles followed the recommendations of the Brazilian Society of Herpetology (SEGALLA et al., 2019; COSTA; BÉRNILS, 2018). Conservation status classification relied on the criteria established by the Red Book of Threatened Brazilian Fauna, specifically volumes IV - reptiles (ICMBio 2018a) and V - amphibians (ICMBio 2018b). Species richness was determined by the total number of species, while abundance was quantified by the total number of individuals per species.

To investigate herpetofauna seasonality, an unpaired t-test was conducted to compare the total number of reptile and amphibian species and individuals across the months of data collection. Additionally, the sampling period was divided into autumn, winter, spring, and summer seasons, and their relationship to the reptile and amphibian richness was examined. The influence of climatic variables (minimum and maximum temperatures and precipitation) on species
richness and abundance during the sampling period was evaluated using Pearson correlation matrices ($r$). The species accumulation curve was constructed for the entire herpetofauna, without taxonomic categorization of the sampled individuals.

All statistical analyses were performed using GraphPad Prism® software, version 9.4.0, San Diego, CA, USA. A significance level of $P < 0.05$ was adopted for all statistical tests.

3 RESULTS AND DISCUSSION

This study represents the first comprehensive checklist of herpetofauna compiled for the Itambé cave and waterfall region (Table 1), which serves as an ecotone between the Cerrado and the Atlantic Forest and is a popular destination for ecotourism. We could not find any previous studies specifically focused on the study area, except for a 2003 study conducted in the "Vale das Grutas" of Altinópolis, which solely examined the caves without considering the surrounding vegetation (ZEPPELINI FILHO et al., 2003). The previous study reported no amphibian or lizard species but documented two snake species (Bothrops sp. and Eunectes murinus).

Table 1 – Species richness encountered, between April 2022 and January 2023, in the Itambé cave and waterfall, in Altinópolis, SP, distributed among the groups of amphibians or reptiles, considering the observation method and the status of the specimens.

<table>
<thead>
<tr>
<th>Species</th>
<th>Group</th>
<th>LTVS</th>
<th>Pitfall trap</th>
<th>Occasional encounter</th>
<th>living</th>
<th>dead</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. ameiva</td>
<td>lizard</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>C. nigropunctata</td>
<td>lizard</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>S. meriana</td>
<td>lizard</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. labyrinthicus</td>
<td>anuran</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>P. nattereri</td>
<td>anuran</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R. icterica</td>
<td>anuran</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>R. ornata</td>
<td>anuran</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>R. schneideri</td>
<td>anuran</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>R. schneideri</td>
<td>JUVENILE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R. schneideri</td>
<td>ADULT</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

Source: The authors
In our study, the LTVS method yielded the highest number of recorded species and individuals, followed by occasional encounters. It is worth noting that occasional encounters served as an additional sampling method, with all species recorded through this method already having been identified in previous studies, except for the adult *Rhinella icterica*. However, the use of pitfall traps proved to be inefficient in sampling the herpetofauna, as they mainly captured representatives from various invertebrate groups and small rodent mammals.

The LTVS method and occasional encounters were found to be less affected by environmental limitations compared to pitfall traps, which likely contributed to their higher efficiency in species sampling (CENTENO, 2008). According to Melo et al. (2003), different sampling methods can introduce biases depending on factors such as sample size, study duration, and timing. Additionally, the successful capture of these animals can be influenced by their morphology, lifestyle, behavior, and their ability to evade or conceal themselves from traps, as highlighted by Gibbons & Semlitsch (1982). Snakes, for instance, exhibit elusive behaviors and tend to have low population densities, posing significant challenges to their sampling (SAZIMA; HADDAD, 1992). The absence of snakes in the present study may be a consequence of these challenges. Furthermore, the effectiveness of pitfall traps in capturing snakes relies on the height of the containers used, which could have compromised the sampling of these animals due to the size of the pitfalls employed in this study (BERNARDE, 2012).

In the study area, we observed three lizard species belonging to three different genera: *Ameiva ameiva*, *Copeoglossum nigropunctata*, and *Salvator merianae* (Fig. 2). Additionally, five amphibian species from three genera of the Anura family were identified: *Leptodactylus labyrinthicus*, *Physalaemus nattereri*, *R. icterica*, *R. ornata*, and *R. schneideri* (Fig. 3). These species exhibit a broad distribution, indicating their generalist nature, and are currently classified as having a low conservation concern.

To analyze the temporal variation in species richness, we examined the data collected during different months, and the results are presented in Table 2.
September 2022 showed the highest reptile diversity, with three species recorded in the study area. Regarding anuran amphibians, December 2022 had the highest species richness, with three out of the five identified species present.

Among the lizards, *A. ameiva* showed higher abundance in August and October, while *C. nigropunctata* and *S. meriana* were more abundant in September 2022, which coincided with the drier period in the sampled region. In the case of anuran amphibians, *L. labyrinthicus* was the most abundant species in December, a period characterized by higher precipitation frequency in 2022. We also observed the juvenile phase of *R. schneideri* in April 2022, a month associated with climatic transition.

Figure 2 – Photographic images of reptile specimens recorded in the Itambé cave and waterfall, Altinópolis, São Paulo. In A, *S. meriana* (Spix, 1825). In B, *A. ameiva* (Duméril; Bibron, 1839). In C, *C. nigropunctata* (Linnaeus, 1758). Source: The authors

Table 2 – Species richness and abundance, month by month, in Itambé cave and waterfall, Altinópolis, São Paulo, between April 2022 and January 2023.

<table>
<thead>
<tr>
<th>Species</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T</td>
<td>A</td>
</tr>
<tr>
<td><em>A. ameiva</em></td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td><em>C. nigropunctata</em></td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td><em>S. merianae</em></td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td><em>L. labyrinthicus</em></td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td><em>P. nattereri</em></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><em>R. icterica</em></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><em>R. ornata</em></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><em>R. schneideri</em></td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><em>R. schneideri</em></td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

T, total number of individuals; A, April; M, May; JN, June; JL, July; A, August; S, September; O, October; N, November; D, December; J, January.

Source: The authors

The analysis using an unpaired t-test showed significant differences in the seasonality of reptiles/lizards and amphibians/anurans, with lizards exhibiting
higher monthly richness and abundance compared to anurans (Fig. 4). This finding can be attributed, at least in part, to the fact that anuran populations often have more specific environmental requirements, especially during the reproductive period (SMITH; BALLINGER, 2001; CONDRATI, 2009).

Figure 4 – Representative graphs of the seasonality of amphibians and reptiles, considering the species richness and abundance in each group. *, P < 0.05; ** P < 0.001.

Table 3 presents the abundance of reptile and amphibian species across different seasons. Winter showed higher reptile richness, with all three species present, while spring exhibited the highest amphibian richness, with the occurrence of four species (P. nattereri, L. labyrinthicus, R. ornata, and R. schneideri). These amphibian observations are partially supported by a previous study conducted in the Nascentes de Paranapiacaba Municipal Natural Park (Atlantic Forest), Santo André, SP, which reported a peak in individuals between September and December (spring) (TREVINI et al., 2014). However, conflicting results regarding reptile seasonality can be found in the literature due to variations in species composition across studies, including the lizards analyzed in this study. Furthermore, the mild winter during the data collection period may have influenced the likelihood of recording reptiles, as the temperature variations between months were subtle. Another factor to consider is that data collection primarily occurred during daylight hours, aligning with the opening hours of Itambé cave and waterfall for visitors, where temperatures tend to be higher.
compared to twilight and nighttime periods when herpetofauna studies are typically conducted.

Table 3 – Species abundance identified in the Itambé cave and waterfall region, Altinópolis, São Paulo, according to the seasons.

<table>
<thead>
<tr>
<th>Species</th>
<th>autumn</th>
<th>winter</th>
<th>spring</th>
<th>summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. ameiva</td>
<td>3</td>
<td>14</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>C. nigropunctata</td>
<td>3</td>
<td>18</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>S. Merianae</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>L. labyrinthicus</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>P. nattereri</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>R. icterica</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Rh. ornata</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>R. schneider JUVENILE</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>R. schneider ADULT</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: The authors

Table 4 presents the results of the analysis examining the impact of variations in minimum and maximum temperatures (°C) and precipitation (mm) on reptile and amphibian richness and abundance. For amphibians/anurans, precipitation showed a significant correlation with species richness ($P = 0.03$). This outcome aligns with previous studies that have highlighted the annual precipitation volume as the primary climatic factor influencing anuran species richness in Brazilian locations (VASCONCELOS et al., 2010b).

Table 4 – Effects of climatic variables on the richness and abundance of reptiles and amphibians in the Itambé cave and waterfall region, Altinópolis, São Paulo.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Reptiles</th>
<th>Amphibians</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Richness/abundance</td>
<td>Richness/abundance</td>
</tr>
<tr>
<td>Minimum temperature (°C)</td>
<td>0.110 / -0.045</td>
<td>0.313 / 0.568</td>
</tr>
<tr>
<td>Maximum temperature (°C)</td>
<td>0.313 / 0.622</td>
<td>0.319 / -0.481</td>
</tr>
<tr>
<td>Precipitation (mm)</td>
<td>0.319 / -0.481</td>
<td>0.706 / 0.148</td>
</tr>
</tbody>
</table>

$r$, Pearson correlation; *, significant

Source: The authors

We results showed that the species $A. ameiva$ displayed variations in occupancy patterns throughout the day, with individuals being found in different parts of the study area during distinct time periods. During the first LTVS conducted from 9 a.m. to 1 p.m., the lizards were predominantly observed in the left portion of the area, whereas during the second LTVS conducted from 2 p.m.
to 6 p.m., they were observed in the right portion of the area. This distribution pattern corresponded to the solar irradiation in the area, which angled more towards the left in the first half of the day and towards the right in the second half. This suggests that these lizards may be following the sunlight to locate areas with suitable temperatures throughout the day.

Our study found that lizards were similarly distributed in both the Cerrado and the Atlantic Forest, with all identified species present in both biomes. However, anuran species of the genus *Rhinella sp.* were predominantly concentrated in Atlantic Forest areas characterized by higher humidity and ground cover, particularly near or adjacent to water bodies. Notably, we observed an adult specimen of *R. schneideri* in a region close to the entrance of Itambé cave, which had sandy soil but had water bodies both inside and around the cave. In contrast, the specimen of *P. nattereri* was found in an open area along the trail to the cave, featuring Cerrado vegetation, grasses, and low-growing plants, but without any water bodies or sources of moisture.

Furthermore, we found representatives of the species *L. labyrinthicus* at various depths within the rock formation inside Itambé cave (Fig. 5). One individual was observed inhabiting a cavity or fissure in the cave wall, along with arthropods *Loxoceles sp.* and *Lycosa sp.*, suggesting that this environment may provide both shelter and a potential food source. Another individual was observed utilizing water seepage in one of the innermost points of the rock formation.
Figure 5 – Representatives of *L. labyrinthicus* found inside the Itambé cave, Altinópolis, São Paulo, at different depths of the rocky structure. In A, an individual occupying a fissure on the inner wall of the cave. In B, C, and D, an individual utilizing a water outcrop present inside the cave.

Source: The authors

Figure 6 – Species accumulation curve of the herpetofauna in the Itambé cave and waterfall, Altinópolis, São Paulo.

Source: The authors
We constructed a single species accumulation curve (Fig. 6) considering all representatives of the herpetofauna without discrimination by groups. However, the curve did not reach an asymptote, indicating that if the research continues with a larger sampling effort and extends data collection to include periods beyond daylight hours, more species are likely to be discovered in the Itambé cave and waterfall region. By increasing the sample size and incorporating nighttime surveys, additional species richness may be revealed in this area.

4 CONCLUSIONS

Our study identified a total of eight herpetofauna species in the Itambé cave and waterfall region, belonging to six different genera. We found that climatic conditions influenced the abundance of anurans, but all the species we identified exhibited a generalist behavior. This suggests that human activities may be interfering with the presence of species that have specific habitat requirements in the area. To further our understanding of the herpetofauna composition, it is essential to continue conducting studies that encompass data collection at different time periods. Additionally, ongoing monitoring of herpetofauna groups in the area is crucial for biodiversity conservation and the preservation of local biomes.
REFERENCES


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