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SEASONAL DISTRIBUTION AND ENVIRONMENTAL OCCUPATION OF ANURAN AMPHIBIAN FAUNA IN AN IMPACTED SAVANNAH AREA IN LAVRAS, MINAS GERAIS

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Abstract: In this study, we investigated the diversity of anuran amphibians in the region of Lavras - MG, an impacted savannah area. Understanding the seasonal distribution and environmental occupation of these animals is essential to assess the effects of human activities on local biodiversity. We recorded six species of adult anuran amphibians, belonging to the families Hylidae and Leptodactylidae. The presence of these species indicates significant diversity, despite human impacts. Seasonal analysis revealed variations in species occurrence throughout the year, with greater diversity between November and January. In some periods, such as August and June, the occurrence was reduced, with only one species recorded. Amphibian environmental occupation also varied, with some species restricted to marshes and others moving to lakes and streams during the dry season. The results provide insights into the diversity and occupation of anuran amphibians in an impacted savannah area, supporting adequate conservation and management strategies to protect biodiversity and sustainability.

Keywords: Anurans, Conservation, Biodiversity, Sustainability.

INTRODUCTION

Biodiversity is one of the main pillars that sustain life on planet Earth, playing key roles in maintaining ecosystems and environmental balance. Among the groups of animals that make up this immense diversity, anuran amphibians are especially important due to their sensitivity to aquatic and terrestrial environments, and because they serve as indicators of environmental health.

However, in areas impacted by the advance of human activities, such as the Savannah de Lavras - MG, it is crucial to understand the seasonal distribution and environmental occupation of the anuran amphibian fauna, in order to assess the effects of these changes on

biodiversity. local.

According to Wilson (2012), biological diversity is the basis for the sustainability and future survival of species. This statement reinforces the importance of studying the fauna of anuran amphibians in impacted areas, such as the Savannah of Lavras - MG, where anthropic pressures have significantly modified the natural environment. Understanding the seasonal distribution patterns of these animals is essential to identify critical areas for their conservation and proper management.

Previous studies have highlighted the importance of the savannah as one of the richest biomes in terms of biodiversity in Brazil (DE ANDRADE et al., 2018; GAMBALE et al., 2014; RIBEIRO-JÚNIOR; BERTOLUCI, 2009). Its unique flora and fauna have been widely accepted by deforestation, habitat fragmentation, combustion and climate change (ARAUJO; ALMEIDA-SANTOS, 2013; DE-CARVALHO et al., 2008; MAFFEI, 2014). In the case of anuran amphibians, the loss of aquatic habitats for reproduction and the degradation of terrestrial environments have impacted their capacity (HADDAD, 1987; RIBEIRO-JÚNIOR; BERTOLUCI, 2009; SOLINO-CARVALHO et al., 2015).

When investigating the seasonal distribution and environmental occupation of the anuran amphibian fauna in Lavras - MG, it is expected to obtain relevant information about the relationship of these animals with the different periods of the year and with the effects of human activities. Studies carried out by (KOPP; SIGNORELLI; BASTOS, 2010) in the region found that the diversity and abundance of anuran amphibians coincided throughout the seasons, being influenced mainly by the availability of water, temperature and air humidity.

The environmental occupation of the impacted savannah areas in Lavras - MG is

also a determining factor for the distribution of the anuran amphibian fauna. According to in the literature (BATISTA, 2022; MOURA; SILVA, 2021; OLIVEIRA, 2012), the proximity of urban environments and the presence of anthropic activities, such as intensive agriculture and livestock, can affect the reception of anurans, due to habitat fragmentation, pollution and changes in water quality.

Understanding the seasonal distribution and environmental occupation of anuran amphibian fauna in impacted areas of the Savannah de Lavras - MG is essential for the conservation of these animals and the ecosystem as a whole. In addition, these studies initiated the development of more effective management and conservation strategies that consider the ecological needs of these sensitive organisms. Therefore, this article aims to investigate the seasonal distribution patterns and the environmental occupation of anuran amphibian fauna in an impacted savannah area in Lavras - MG, in order to provide scientific privileges for the conservation and proper management of this important biome.

MATERIAL AND METHODS

PLACE OF STUDY

The Reserve of the Environmental Education Center - Ecolândia of the 8th Military Police Battalion in the 8th Specialized Company of Minas Gerais (CEA-E - 8th BPM - 8th CIA ESPZ) is a place that faces great challenges on its margins due to the intense population occupation and the anthropic influence, such as the presence of different types of waste, loud noises and domestic animals.

The division of the reserve is only marked by low walls, as shown in figure 4, which contributes to the strong influence of neighbors in the studied area. In addition,

in recent months, the study area has been extensively modified due to the construction of a theme park, including deforestation and construction of information centers.

The region's climate is characterized by two distinct seasons: hot and rainy, from September to March, and cold and dry, from April to August.

FIELD ACTIVITIES

The field activities were carried out during the modifications made for the construction of the theme park, as mentioned above. Data collection on adult frogs took place between 6 pm and 10 pm, from August 2004 to June 2005.

The anurans were located through visual and auditory observation, with the aid of a focal light. Some specimens were collected for identification purposes.

An initial daytime visit was carried out to mark the collection points and determine the exact location of the CEA-E - 8º BPM – 8ª CIA ESPZ reserve using a GPS. The other visits, to verify the frog species in the region, were carried out during the night.

The collected animals were placed in transparent plastic bags, duly labeled with information about the place, date and time of collection. These specimens were later fixed, conserved and stored according to the methodology described by (JIM; FROEHLICH, 1981).

Each animal was accompanied by a tag with its registration number and relevant information.

The collected species were sent to the reference collection of the Museum of Natural Sciences at PUC Minas, where they were identified and cataloged, remaining available for future studies.

STUDY OF THE SEASONAL OCCURRENCE OF SPECIES

To study the seasonal occurrence of species, all species found at the collection site were considered, regardless of whether they were vocal or not, also taking into consideration, the number of visits to the field.

The constancy of species occurrence was evaluated using the DAJOZ index (1973):

$$C = (w/w) \times 100$$

Where: C - constancy of occurrence

p - number of surveys containing the species

P - total number of surveys

Based on the C values, the species were classified into three categories:

1. Constant species: present in more than 50% of surveys
2. Accessory species: present in 25% to 50% of surveys
3. Accidental species: present in less than 25% of surveys.

RESULTS

REGISTERED SPECIES

During the study period, adults of six species of anuran amphibians, belonging to two families: Hylidae and Leptodactylidae, were recorded.

Class: Amphibia Linnaeus, 1758 Order: Anura Rafinerque, 1815 Family: Hylidae (Rafinesque, 1815) Genus: Hyla Laurenti, 1768)

1. *Hypsiboas lundii* Burmeister, 1856
2. *Hypsiboas polytaenius* (Cope, 1870"1869")
Family: Leptodactylidae Werner, 1896 Genus: *Leptodactylus* Fitzinger, 1826
3. *Leptodactylus labyrinthicus* (Spix, 1824)
4. *Leptodactylus ocellatus* (Linnaeus, 1758)
5. *Odontophrynus cultripes* Reinhardt & Lütken, 1861"1862" Gender: *Physalaemus*

Fitzinger, 1826

6. *Physalaemus cuvieri* Fitzinger, 1826

These six species represent the diversity of frogs found in the study area. The Hylidae and Leptodactylidae families are well represented, demonstrating the presence of different genera within these families.

Each species has its specific geographical distribution and has distinct morphological and behavioral characteristics.

This information is important to understand the environmental occupation of the anuran amphibian fauna in the impacted savannah area of Lavras - MG. Studies on the presence and distribution of these species are essential to assess the impact of environmental changes and provide rights for the conservation of these animals.

It is important to emphasize that the results obtained are related only to adult anuran amphibians and do not include other stages of the life cycle, such as tadpoles. Furthermore, further research may reveal the presence of other species that were not recorded during this study.

This information on the diversity of anuran species is fundamental for the knowledge and conservation of the local fauna, especially in areas impacted by human development.

OCCURRENCE OF SPECIES

The occurrence of species was investigated through 20 visits to the study site, from August 2004 to June 2005. Note that there were periods with limited occurrence, in which only one species, *Hypsiboas polytaenius*, has been recorded. On the other hand, the period from November to January presented the maximum number of species found, including *Hypsiboas lundii*, *Hypsiboas polytaenius*, *Odontophrynus cultripes*, *Leptodactylus ocellatus*, *Leptodactylus labyrinthicus* and *Physalaemus cuvieri*.

The constant species, that is, those

present in more than 50% of the visits, were *Odontophrynus cultripes* and *Hypsiboas lundii*. Among these, *Hypsiboas lundii* was the most frequent species, occurring in 95% of collections (Table II). The species considered accessory, present in 25% to 50% of the visits, were *Leptodactylus ocellatus*, *Leptodactylus labyrinthicus* and *Physalaemus cuvieri*. The species *Hypsiboas polytaenius* was classified as accidental, as it occurred in less than 25% of the visits (Table II).

These results show the temporal variation in the occurrence of anuran species in the study area. The presence of constant and accessory species reveals the diversity and adaptability of these amphibians to the impacted savannah environment. In addition, it is important to emphasize that the seasonal occurrence of species is subject to several factors, such as climatic conditions, resource availability and reproduction activities. The constant presence of *Odontophrynus cultripes* and *Hypsiboas lundii* demonstrate that these species are adapted to the environment of the study area. On the other hand, accessory and accidental species may have a more punctual presence or be less adapted to local conditions.

It is important to emphasize that these results are specific to the mentioned study period. Additional studies may provide more comprehensive information on species occurrence over different seasonality and subsequent years. This information is fundamental to understand the population dynamics and the environmental occupation of the anuran amphibian fauna in the impacted savannah area of Lavras - MG. Additional studies may deepen the analysis of the influence of these factors on the distribution and abundance of species, providing titles for the conservation and proper management of these animals in areas impacted by human development.

SPATIAL DISTRIBUTION

The spatial distribution of the tested species showed variations, with some occurring exclusively in the swamp, others in the artificial lake and swamp close to the forest, and some species occupying both environments. The microenvironments where the species were observed in activity are detailed in Table III.

Hypsiboas lundii: The males of this species were found vocalizing on branches in the vegetation, often leaving the forest and going to the emergent vegetation of the marsh. On some occasions, they were seen more than 2 meters above the ground, on top of trees. During the rainy season, they were found in almost all microenvironments, being the species that occupied the highest number of them.

Hypsiboas polytaenius: The males of this species vocalized over the herbaceous vegetation of the marsh. During the wet season they have been seen in leaf litter in the swamp area.

Physalaemus cuvieri: Males of this species vocalized in large numbers during the rainy season in temporary pools and permanent pools, generally located in marshes. When the temporary pools dried up, individuals of this species migrated to the permanent swamp area. This species is difficult to visualize, as it vocalizes in pools with dense vegetation. It was recorded in the following microenvironments: puddles in the marsh, temporary puddles and inside the forest, where there are streams that carry water from springs and flow into artificial lakes.

Leptodactylus labyrinthicus: Males of this species call on the ground, in open areas, on the edges of artificial lakes and in flooded areas during periods of high rainfall. During this time, the behavior of females guarding their nests was also observed.

Leptodactylus ocellatus: It was also found vocalizing on the ground, in open areas, in a

small artificial lake and in the larger lake, but it was not seen in flooded areas or temporary pools.

Odontophrynus cultripes: Males of this species vocalize on the ground, in marsh areas that are heavily waterlogged, in streams and flooded areas. This species is difficult to see, as the area has a very dark soil, which makes them very camouflaged in the black clay soil.

Table III demonstrates which species were exclusive to the marsh, that is, they were only recorded in this environment, while other species moved to the artificial lake and streams during the dry period. species like *P. cuvieri* and *O. cultripes*, which were constant in the swamp, migrated to streams and flooded areas, where there is a waterfall that comes out of the second artificial lake.

This information highlights the importance of different microenvironments in the spatial distribution of the anuran species studied.

DISCUSSION

The results of this study on the occurrence and spatial distribution of anuran species provide relevant information to understand the ecology of these animals and their relationships with different microenvironments. Analysis of data collected over 20 visits to the study site revealed interesting patterns that may contribute to the conservation of these species.

One of the most observed discoveries was the presence of periods of low occurrence, with only one species recorded, and the maximum number of species observed between November and January. This pattern may be related to seasonal factors, such as the availability of food resources and the accepted environmental conditions for reproduction (ANDREANI; GRANDE, 2022; DA COSTA et al., 2016; GONÇALVES et al., 2023; VIEIRA, 2022). In these months, the presence of *Hypsiboas lundii*, *Hypsiboas polytaenius*, *Odontophrynus cultripes*, *Leptodactylus*

ocellatus, *Leptodactylus labyrinthicus* and *Physalaemus cuvieri*, which indicates a greater diversity of species during this period.

When analyzing the frequency of occurrence of the species, it was observed that *Hypsiboas lundii* was the most frequent species, recorded in 95% of collections. This high frequency can be attributed to the adaptation of this species to a variety of habitats, occupying different microenvironments, including emergent swamp vegetation and tree branches (GAMBALE et al., 2014). On the other hand, *Hypsiboas polytaenius* was considered an accidental species, occurring in specific periods and presenting a lower frequency of occurrence.

Analysis of the spatial distribution revealed that each species had heard of different microenvironments. *Hypsiboas lundii* was recorded vocalizing on branches in the vegetation, leaving the forest and moving to the emergent vegetation of the marsh, while *Hypsiboas polytaenius* vocalized over the herbaceous vegetation of the marsh. *Physalaemus cuvieri* was observed vocalizing in temporary and permanent pools, preferring the swamp environment, but migrating to streams and flooded areas when the temporary pools dried up. *Leptodactylus labyrinthicus* called on the ground, in open areas, on the edges of artificial lakes and in flooded areas, where females were also observed observing their nests. *Leptodactylus ocellatus* was recorded calling on the ground, in open areas and in artificial lakes, but it was not found in flooded areas or temporary pools. *Odontophrynus cultripes* vocalized on the ground, in areas of muddy marshes, streams and flooded areas.

These spatial distribution patterns may be related to the ecological preferences of the species, as influenced by specific types of microenvironments for reproduction and search for food resources (FERREIRA;

SPECIES	NUMBER OF OCCURRENCES	CONSTANCES OF OCCURRENCE (%)
<i>L. labyrinthicus</i>	08	40
<i>L. ocellatus</i>	05	25
<i>P. curvieri</i>	10	50
<i>O. cultripes</i>	16	80
<i>H. lundii</i>	19	95
<i>H. polytaenius</i>	03	15

Table II - Total number of occurrences and frequency of occurrence (%) of amphibian species recorded in the CEA-E Reserve area - 8th BPM - 8th CIA ESPZ over the 22 field visits carried out during the study period.

Species	Altered swamps	Swamps associated with the forest	artificial lakes	On top of dry forest vegetation branches	Brejo associated with the savannah sensu strictu area	Close to springs inside and outside the forest
<i>L. labyrinthicus</i>	X	x				
<i>L. ocellatus</i>	X	x	x			
<i>O. cultripes</i>	X	x	x			
<i>P. curvieri</i>	X	x	x			
<i>H. lundii</i>	X	x	x	x	x	
<i>H. polytaenius</i>	X	x	x	x		

Table III - Microenvironments occupied by the species during the study flooded areas. This species is difficult to see, as the area has a very dark soil, which makes them very camouflaged in the black clay soil.

DANTAS; TONINI, 2012; PEREIRA; LIRA; SANTOS, 2016; SILVA et al., 2002).

In addition, habitat characteristics, such as vegetation, water availability and environment structure, can also influence the presence and distribution of anuran species (LIPINSKI; SANTOS, 2014; MAGESKI; COUTINHO; CLEMENTE-CARVALHO, 2014).

To understand the spatial distribution of anuran species is essential to guide conservation actions and appropriate management of these animals. The information transmitted in this study can support the creation of strategies to preserve the different microenvironments used by these species and minimize the impacts of human activities on these animals and their habitats.

CONCLUSIONS

This study provided important information about the occurrence and spatial distribution of six species of anuran amphibians in a given area. The results revealed interesting patterns of occupation of microenvironments by the tested species.

Note that some species had a wide spatial distribution, occupying diverse microenvironments, while others were restricted to specific habitats. These patterns may be related to different ecological trends, feeding behavior, resource availability and reproduction strategies of each species.

To understand these spatial distribution patterns is essential for the conservation and proper management of anuran amphibian populations. These animals play important roles in ecosystems, such as pest control, nutrient cycling and indication of environmental quality.

Furthermore, the results of this study highlight the importance of considering the diversity of microenvironments in conservation programs. The preservation of different habitats, such as swamps, wetlands,

artificial lakes and streams, is essential to ensure the survival and survival of experienced anuran amphibian species.

It is important to emphasize that the results of this study are specific to the area and period of study. Therefore, additional studies in other regions and at different times of the year are needed to obtain a more comprehensive view of the spatial distribution of these species.

In summary, this study contributes to knowledge about the ecology and spatial distribution of the anuran amphibians studied, providing privileges for the conservation and proper management of these animals in their respective habitats.

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