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Diversity of Species and Habitat Selection of Amphibian Fauna in Samastipur District, Bihar

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Abstract: The current study aimed to document amphibian diversity and their habitat preferences over one year. The survey was carried out from January 2024 to December 2024 across three distinct study sites in the Samastipur district of Bihar. A total of nine amphibian species, classified into four families and seven genera, were identified at various locations, namely Magardahi Ghat, Mathurapur Ghat, and Simariya Ganga Ghat area within the Samastipur district. All nine species were recorded in and around the Magardahi Ghat (Site I). In comparison, seven species were noted in the vicinity of Mathurapur Ghat (Site-II), and five species were observed in the Simariya Ganga Ghat (Site-III) area. Four species (D. melanostictus, D. stomaticus, H. tigerinus, and P. maculatus) were present at all study sites, whereas two species (S. braviceps and F. limnocharis) were exclusive to Site I. The statistical analysis of the amphibian diversity data indicated that the Shannon-Wiener species diversity index was lowest, 1.547, at Site III and highest, 2.090, at Site I. The Margalef richness index showed a minimum value of 0.8836 and a maximum of 1.555 at Site I. Conversely, the evenness index was highest (0.9474) at Site III and lowest (0.9105) at Site I.

Keywords: Amphibian species, Shannon Diversity Index, Habitat Preference, Margalef Richness Index

I. INTRODUCTION

Amphibians represent a category of animals characterized by their dual lifestyle, inhabiting both aquatic and terrestrial environments. This group encompasses frogs, toads, salamanders, and newts. The class Amphibia comprises a total of 8865 species, including over 200 species of caecilians, around 760 species of salamanders, and approx. 7800 species of anurans globally. In India, the class Amphibia is represented by 454 documented species, which include 39 caecilians, 2 salamanders, and 450 frogs [1,2]. Notably, the Bihar province, including Jharkhand, is home to only 14 documented amphibian species. Research into the habitat requirements and preferences of various amphibian species poses significant challenges and is a primary focus within conservation biology [3]. The patterns of habitat, distribution, abundance, and ecology of amphibian species have been less extensively studied compared to larger wildlife. In the case of amphibians, our understanding of how habitat quality and quantity influence the distribution and abundance of anurans is limited. To effectively implement and adopt specific conservation strategies, it is crucial to comprehend the various factors influencing the diversity and distribution of amphibians in a given region [4]. Due to their dual lifestyle, amphibians often encounter adverse conditions when changes occur in either or both ecosystems, which can negatively impact their diversity [5]. The present study was conducted in and around various habitats in the Samastipur district of Bihar to assess amphibian diversity and habitat preferences in this area. Amphibians, being delicate creatures, are particularly susceptible to adverse environmental changes and habitat degradation. They are more vulnerable to any detrimental alterations in their habitat, whether caused by human activities or other factors. Industrialization and urbanization have significantly impacted amphibian habitats, thereby affecting amphibian diversity [6].

Amphibians hold significant ecological and economic value. They serve as effective environmental indicators and function as natural agents for pest control, acting as proficient biological controllers. Additionally, amphibians are crucial components of the food web and are recognized as reliable ecological indicators [7].

These studies have thoroughly recorded the variety and microhabitats of amphibian species and present a list of amphibians in the state fauna series of ZSI and offer taxonomical descriptions of 14 amphibian species from Bihar [8]. However, to date, no researchers have provided a comprehensive overview of the amphibian diversity in the Samastipur district of Bihar. The current study was conducted in and around various habitat areas of Samastipur city, Bihar to assess the diversity of amphibians and their habitat preferences.

Amphibians are sensitive creatures that are particularly vulnerable to environmental degradation and habitat loss. We conducted a survey and collected samples of amphibian diversity in both unpolluted and heavily polluted regions of this district.

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Human activities have a detrimental impact on amphibian diversity due to habitat destruction and pollution [9]. In the Samastipur district (Bihar), amphibian species are exclusively represented by the order Anura. We documented 9 species of Anuran amphibians across 4 families and 7 genera in this district, which exhibit a fragmented and uneven distribution. The primary aim of this study was to assess the species diversity and habitat preferences of amphibians in Samastipur district (Bihar), marking a pioneering effort in the North Bihar region.

II. MATERIALS AND METHOD

Samastipur is located on global map between 25°51' North latitude and 85°46' East longitudes. The district occupies an area of 2,904 square kilometres flora of the research area primarily consists of dry deciduous species, predominantly including Mangifera indica, Shorea robusta, Litchi chinensis, and Moringa chinensis.

The current study was conducted across three locations Magardahi Ghat, Mathurapur Ghat and Simariya Ganga Ghat from February 2024 to March 2025, encompassing the consecutive post-monsoon, monsoon, and pre-monsoon periods. Various microhabitats were surveyed and sampled, including Leaf Litter and Bamboo Grooves (LL & BG), Tree Holes (TH), Human Residential Areas (HRA), Cultivated Fields (CF), Patchy Grasslands (PG), Forest and Hilly Areas (FHA), Terrestrial Land (TL), and Water Bodies (WB). The extensive survey data collected has been compiled into a checklist of amphibians found in the Samastipur district of Bihar.

Throughout the entire survey and sampling process, we employed visual encounter surveys (VES) and acoustic encounter surveys (AES) for the swift assessment and evaluation of extensive areas. The visual encounter survey (VES) and road transect survey (RTS) were the predominant techniques utilized during the study, applied across all terrestrial sites examined and sampled [10]. Our primary focus was to assess the various types of suitable habitats where anuran amphibian species predominantly flourish. Additionally, we conducted various active searches, including turning over rocks and logs, peeling back bark, sifting through leaf litter, and excavating burrows and termite mounds to obtain accurate and reliable results. Acoustic searches were also occasionally carried out along wooded trails, degraded forest edges, and near water bodies where visual encounters were not feasible [11]. The study was conducted between 7:00 AM to 11:00 AM and 5:00 PM to midnight.

Flashlights were utilized to identify anuran species during nighttime. The diversity of anurans was assessed by observing the eggs laid during the breeding season. Information regarding nesting sites, nest types, and egg clusters proved valuable for species identification. Field data for each individual encountered, including locality, date, time, weather conditions, habitat, microhabitat, and reproductive status (when ascertainable), as well as any co-existing species and additional behavioral observations, were meticulously recorded. Taxonomic details of individuals captured during fieldwork, along with morphometric measurements, were also documented [12]. We computed the Shannon–Wiener diversity index, Pielou's evenness index, Margalef's richness index, and Simpson's dominance index.

III. RESULTS AND DISCUSSION

A total of nine species of anurans, classified into four families and seven genera from various study locations within the Samastipur district of Bihar. Numerous anuran species are known to spend a significant portion of their lives concealed, either submerged in water beneath detritus or on land beneath leaf litter, rocks, logs, and even within underground burrows and termite mounds. Consequently, as the number of microhabitats and breeding sites for amphibians increases, so does the diversity of anuran species. Nevertheless, the overall amphibian diversity in the northern region of Bihar remains relatively low.

The survey revealed the presence of only nine amphibian species belonging to four families, i.e., Bufonidae, Dicroglossidae, Microhylidae, and Rhacophoridae. The identified species included Duttaphrynus melanostictus,

Duttaphrynus stomaticus, Hoplobatrachus tigerinus, Hoplobatrachus crassus, Sphaerotheca braviceps, Fejervarya limnocharis, Euphlyctis cyanophlyctis, Microhyla ornate, and Polypedates maculatus. Duttaphrynus melanostictus was the most prevalent species, recorded at all study sites. Its life cycle is biphasic, with breeding observed during the monsoon season (early July to early October) and the spring season (end of January to end of March). Duttaphrynus stomaticus, primarily a ground-dwelling species, was found in dry and moist terrestrial habitats, including dump-yards, leaf litter, and wood logs, particularly near human settlements [13]. This species was most commonly observed during dawn and nighttime and was frequently found as a 'road-killed' anuran throughout the year. The Indian Bullfrog (H. tigerinus) was often encountered during the rainy season in and around lentic water bodies, paddy fields, and occasionally in residential areas.

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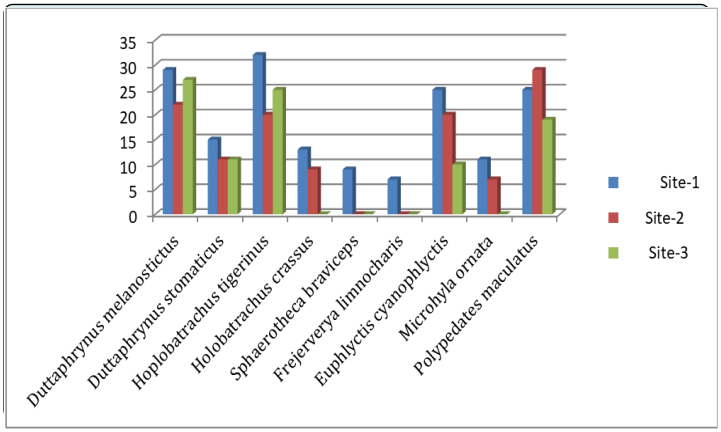

Figure 1. Species wise abundance at different sites of Samastipur, Bihar

These species were also noted year-round near human habitats, such as pools, ditches, and drains. During the rainy season, when this species was abundant, residents collected live specimens for sale in markets (particularly in northeastern states) due to the delicacy of their legs.

Jerdon's Bullfrog (H. crassus) exhibited significant morphological similarities to the Indian Bullfrog. In the northeastern states, the legs of Jerdon's Bullfrog were utilized as a food source. Both species of bullfrogs demonstrated impressive long-distance jumping abilities. The Indian burrowing frog (Sphaerotheca braviceps) was frequently observed in Samastipur, primarily inhabiting temporary water bodies and burrowing into soil, leaf litter, and logs. The skipper frog (E. cyanophlyctis) was prevalent in both flowing and stagnant water bodies within this district. Its life cycle was biphasic, mirroring the pattern of D. melanostictus [14]. During January to March, we encountered millions of skipper frog tadpoles in nearby water bodies. The Grass Frog (F. limnocharis) was also commonly found in the Samastipur district of Bihar, primarily in temporary lentic water bodies, agricultural fields, degraded forests, and along the wet banks of water bodies. The Common Indian Tree Frog (P. maculatus) was another frequently encountered species, residing in tree holes, banana tree stems, and damp areas of domestic environments, including bathrooms and wells. During the breeding season, they were often located in and around lentic water bodies, particularly in temporary rainwater pools and puddles [15]. This species of Common Indian Tree Frog is easily observed in Samastipur, where they construct foam nests suspended in vegetation above the water level. Similar to other rhacophorids, they lay their eggs in foam nests attached to vegetation either above or close to water.

The Ornate Narrow-Mouth Frog (M. ornate) was observed exclusively during the breeding season, which coincides with the Monsoon period, in temporary lentic water bodies. This species is the smallest frog recorded in Samastipur, measuring between 30 and 33 mm. Its call is notably loud and characterized by a high frequency. According to Das et al., the chorus of this species is frequently heard in proximity to human settlements, as well as along the edges of forests and in agricultural plantations [16]. Throughout the research, F. limnocharis and S. braviceps were absent from sites II and III, but were present in site I. This absence may be attributed to the lack of suitable hilly terrain and preferred forest habitats in sites II and III. Similarly, H. crassus and M. ornate were not detected in site III, yet were commonly found in sites I and II, likely due to the availability of appropriate habitat and microhabitat conditions. The presence of Duttaphrynus melanostictus, D. stomaticus, H. tigerinus, and Polypedates maculatus across all study sites can be linked to the existence of suitable microhabitats and favorable ecological conditions. The absence of Sphaerotheca braviceps, Frejerverya limnocharis, and Microhyla ornate in site III suggests a lack of adequate habitat, likely due to the absence of suitable water bodies in that area. Between February and April, a significant number of tadpoles of E. cyanophlyctis and D. stomaticus were observed in sites I and II. This moist environment, characterized by a large lentic water body and several small streams, was noted to be the least disturbed, making it an excellent habitat for anuran species. Site I lacked additional water bodies connected to the main pond, prompting the anuran species to migrate to nearby agricultural fields during their mating season. Species diversity, as defined by E. Mayr, is a fundamental ecological concept used to describe the structure and functioning of communities and ecosystems [17].

Diversity serves as a fundamental concept that represents the structure of a community. It is quantified through various indices. Whittaker and Woodwell define alpha diversity as the diversity within a habitat or intra-community, which is the focus of this discussion. They recommend employing the Simpson index to indicate the relative concentration of dominance, which measures the slope of the importance value sequence, while distinguishing between Simpson's index

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for dominance concentration and Shannon's formula as a measure of equitability. The diversity indices for amphibians recorded at different sites are presented in Table 1.

Table 1. Calculated diversity indices of various study sites of Samastipur, Bihar

Diversity Index	SITE- I Magardahi Ghat	SITE- II Mathurapur Ghat	SITE -III Simariya Ganga Ghat
Shannon-Wiener Diversity Index (H')	2.090	1.87	1.547
Simpson's Dominance Index (D_{SIMP})	0.868	0.836	0.779
Margalef Richness Index (D_{MARG})	1.555	1.258	0.883
Pielou's Evenness Index (J')	0.9105	0.927	0.947

IV. CONCLUSION

Samastipur is a City and Municipal Corporation in Bihar, India. It is the headquarter of Samastipur district and comes under Darbhanga division. The Burhi Gandak River flows through the city. This district is characterized by numerous water bodies and extensive waterlogged areas, which contribute to a rich diversity of flora and fauna. Additionally, a significant number of water bodies in the region have been found to support nine species of amphibians, which have been identified and documented from various study sites within the district. This report serves as the inaugural account of the amphibian diversity and habitat preferences in this area.

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