Proceedings Academic Universitas Jambi
Volume 2, Issue 2, Juli, 2026

Identification of Amphibians of the Order Anura in Muhammad Sabki Urban Forest Park, Jambi City

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Abstract

Background: Green Open Spaces (Ruang Terbuka Hijau, RTH) play an important role in maintaining urban ecosystems and provide ecological, social, and economic benefits for local communities. Muhammad Sabki Urban Forest Park in Jambi City is one of the green open spaces that still contains a relatively natural forest ecosystem and supports anuran amphibians as environmental bioindicators. **Objective:** This study aimed to characterize the morphology and assess the species diversity of the order Anura in Muhammad Sabki Urban Forest Park. **Methods:** Anurans were surveyed using the Visual Encounter Survey (VES) method across high-utilization, medium-utilization, and low-utilization zones. Data were collected at 07.00-10.00 and 19.00-22.00 Western Indonesian Time. Individuals were photographed and identified based on morphological characters using field guides. **Results:** A total of 40 individuals representing 10 species and five families were recorded. The families encountered were Bufonidae, Dicroglossidae, Ranidae, Microhylidae, and Rhacophoridae. The recorded species were *Hylarana erythraea*, *Hylarana baramica*, *Hylarana glandulosa*, *Limnonectes microdiscus*, *Limnonectes blythii*, *Duttaphrynus melanostictus*, *Polypedates leucomystax*, *Kurixalus chaseni*, *Microhyla mantheyi*, and *Microhyla mukhlesuri*. **Conclusion:** Muhammad Sabki Urban Forest Park supports a diverse anuran community and functions as an important urban refuge for amphibian diversity in the Jambi lowlands.

Keywords: Anura; bioindicator; diversity; green open space; Muhammad Sabki Urban

Cite This Article

Anggit Prima Nugraha, Tia Wulandari, Dawam Suprayogi, Andini Vermita Bestari, Rizky Desryan Syah, Verataty Gultom, Louisa Bella Br Tampubolon, and Despita. (2026). Identification of Amphibians of the Order Anura in Muhammad Sabki Urban Forest Park, Jambi City. Proceedings Academic Universitas Jambi, 2(2): e55590. DOI: 10.22437/proca.v2i2.55590

Editor

Kevin Waldo, M.Pd

Article info

Received: Mei 15, 2026 · Revised: Juli 06, 2026 · Accepted: Juli 11, 2026

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INTRODUCTION

Green Open Spaces (Ruang Terbuka Hijau, RTH) play a role in maintaining the balance of urban ecosystems while also providing ecological, social, and economic benefits for the community. The presence of RTH makes them a key element of sustainable urban landscapes, improving environmental quality, serving as spaces for social interaction, and enhancing the quality of life of urban residents [1]. Another equally important role is that RTH function as the "lungs of the city" through green areas that absorb pollutants, regulate temperature, and provide essential habitat for flora and fauna [2]. Jambi Province has several strategically important green open spaces, one of which is Muhammad Sabki Urban Forest Park, located in Jambi City.

The relatively intact forest ecosystem in the Muhammad Sabki Urban Forest Park area serves as a habitat for various animal and plant species with important ecological roles [3]. One of the faunal groups with particularly important ecological functions is herpetofauna, which includes amphibians and reptiles. Herpetofauna play a key role as environmental bioindicators, especially in conservation areas such as green open spaces, because their presence and species diversity reflect the quality and stability of the existing ecosystem [4-6]. Ecosystem stability is also supported by herpetofaunal diversity through their roles in nature as both predators and prey, thereby contributing to natural pest control and maintaining environmental health [4,6]. Therefore, biodiversity inventories, particularly for herpetofauna, are important for understanding population dynamics and conservation status. This study aimed to identify the amphibians of the order Anura in Muhammad Sabki Urban Forest Park, Jambi City, and to describe their species composition, morphology, habitat association, and conservation status.

METHODS

Research Design and Setting

This study employed a descriptive quantitative research design to assess the diversity and species composition of the order Anura in Muhammad Sabki Urban Forest Park (THKMS), Jambi City, Indonesia. The data collected consisted of records of occurrence, abundance, morphological characteristics, and habitat characteristics of Anura across different management zones within THKMS. The THKMS area is divided into three management zones, namely a high-utilization zone, a medium-utilization zone, and a low-utilization zone.

The research activities comprised a preliminary survey and determination of observation sites in THKMS, field data collection using area-constrained visual encounter surveys, and specimen preservation and detailed identification in the laboratory of the Department of Mathematics and Natural Sciences, Faculty of Science and Technology, Universitas Jambi. The research was conducted from September to November 2025.

Research Target/Subject

The subjects of this study were all individuals of the order Anura (frogs and toads) encountered within the THKMS area during the observation period. Observations focused on microhabitats that potentially serve as anuran habitats, such as water bodies, riparian areas, moist leaf litter, and low vegetation around aquatic areas. For all anuran individuals observed, the species, number of individuals, habitat, and activity at the time of encounter were

recorded. Several individuals were taken as voucher specimens for identification and verification purposes in the laboratory.

Research Procedure

A preliminary survey was conducted to identify potential anuran habitats within the three management zones of THKMS. At this stage, the locations of water bodies, moist areas, and the transects or trail networks to be used for surveys were determined. The coordinates of each habitat were recorded using a GPS.

Field observations were carried out using an area-constrained Visual Encounter Survey (VES) [7]. Surveys were conducted during the active periods of anurans, namely diurnal observations at 07.00-10.00 Western Indonesian Time and nocturnal observations at 19.00-22.00 Western Indonesian Time. Surveys were conducted in all management zones of THKMS. For each anuran individual encountered, the following data were recorded: species, number of individuals, activity (calling, resting, swimming, and other observed activities), substrate or microhabitat (for example, on leaves, in leaf litter, on the water surface, or on rocks), and environmental condition [8].

Individuals encountered were documented using a camera. Identification was performed using relevant anuran identification keys and field guides, including Kamsi et al. [9] and Kaprawi et al. [10]. Snout-vent length (SVL) was measured for all sampled individuals of each species. Several individuals per species were collected as voucher specimens for identification verification. Specimens designated as vouchers were preserved following standard procedures, including anaesthesia, fixation in 4% formalin, storage in 70% ethanol, and permanent labelling [7].

Field and laboratory data were entered into data sheets containing information on species, number of individuals, location, date, time, and habitat characteristics. The data were checked again before analysis for the preparation of taxonomic descriptions and species composition.

Data Analysis

Data analysis focused on taxonomic description and species composition. Taxonomic descriptions were prepared for each anuran species based on morphological characters, including head shape, shape and proportions of the limbs, structure of finger and toe tips, webbing formula, body colour, and other diagnostic traits. Representative photographic documentation was provided for each species.

Species composition was analysed by compiling a species list of all anuran taxa recorded in THKMS, including the number of individuals for each species. Simple abundance and relative abundance were calculated as the proportion of each species relative to the total number of individuals observed. The resulting species composition was then summarised by management zone and/or habitat type and visualised in tables and figures to highlight dominant species and species that were rarely encountered.

RESULTS

Research on the identification of anurans was carried out in all zones within Muhammad Sabki Urban Forest Park. Based on the study, a total of 40 individuals belonging to five families and ten species were recorded. These species are presented in Table 1.

Table 1. Diversity of amphibians of the order Anura in Muhammad Sabki Urban Forest Park.

No.	Taxon	Local name	High-use zone	Medium-use zone	Low-use zone	Conservation status
1	Bufonidae Duttaphrynus melanostictus	Asian common toad	11	2	1	Least Concern
2	Dicroglossidae Limnonectes microdiscus	Indonesian wart frog	2	-	-	Least Concern
3	Limnonectes blythii	Blyth's giant frog	2	-	1	Near Threatened
4	Microhylidae Microhyla mantheyi	Manthey's narrow-mouthed frog	-	1	-	Least Concern
5	Microhyla mukhlesuri	Mukhlesur's narrow-mouthed frog	-	2	-	Least Concern
6	Ranidae Hylarana erythraea	Common green frog	6	-	1	Least Concern
7	Hylarana baramica	Baram River frog	1	1	-	Least Concern
8	Hylarana glandulosa	Rough-sided frog	-	-	1	Least Concern
9	Rhacophoridae Polypedates leucomystax	Common tree frog	3	3	-	Least Concern
10	Kurixalus chaseni	Malay frilled tree frog	-	2	-	Least Concern
	Total individuals		**25**	**11**	**4**	

From Table 1, it is evident that THKMS provides habitat conditions that support almost all major families of the order Anura, with five families being recorded. This indicates that the area contains a variety of suitable microhabitats. The recorded species represent multiple ecological guilds, including aquatic, semi-aquatic, arboreal, and terrestrial leaf-litter frogs, suggesting that a broad range of ecological niches is available within the site [11-13]. Such guild diversity implies that the anuran community in THKMS is still relatively complex, rather than a highly degraded assemblage dominated by only a few disturbance-tolerant species.

Figure 1. Some species of the order Anura in Muhammad Sabki Urban Forest Park: (a) *Duttaphrynus melanostictus*, (b) *Hylarana erythraea*, (c) *Polypedates leucomystax*, (d) *Hylarana baramica*, (e) *Kurixalus chaseni*, (f) *Microhyla mukhlesuri*, and (g) *Microhyla mantheyi*.

DISCUSSION

The results show that THKMS provides habitat conditions that support almost all major families of the order Anura, with five families being recorded. This indicates that the area contains a variety of suitable microhabitats. The recorded species represent multiple ecological guilds, including aquatic, semi-aquatic, arboreal, and terrestrial leaf-litter frogs, suggesting that a broad range of ecological niches is available within the site [11-13]. Such guild diversity implies that the anuran community in THKMS is still relatively complex rather than a highly degraded assemblage dominated by a few disturbance-tolerant species.

The high-utilization zone harboured the highest number of anuran species and individuals. However, the majority of individuals in this zone were dominated by *Duttaphrynus melanostictus* and *Hylarana erythraea*. *Duttaphrynus melanostictus* is a cosmopolitan member of the family Bufonidae that is highly tolerant of disturbance and commonly associated with human-modified and urban environments [14,15]. The high-utilization zone in THKMS is the area most strongly intersecting with human activities, as indicated by the presence of facilities such as pavilions, footpaths, fish therapy ponds, animal enclosures, canteens, and other recreational structures.

Despite this concentration of built structures and intensive human use, the zone still contains aquatic habitats in the form of small reservoirs and flowing water. These water bodies provide suitable breeding and foraging sites for several species, particularly those belonging to Ranidae and Dicroglossidae, which are typically associated with ponds, ditches, marshes, and other freshwater habitats [16,17]. This pattern is reflected in the relatively high number of species and individuals from these two families in the high-utilization zone, especially *Hylarana erythraea*, which is widely recognized as a common green frog in disturbed wetlands, rice fields, artificial ponds, and irrigation channels across Southeast Asia.

The medium-utilization zone is the largest management zone within THKMS. This zone exhibits relatively high habitat heterogeneity; in addition to areas used for pavilions and other facilities, it still contains semi-natural forest habitat with multi-layered vegetation and relatively thick leaf litter in several parts. Under these conditions, several species were recorded exclusively in the medium-utilization zone, namely *Kurixalus chaseni*, *Microhyla mantheyi*, and *Microhyla mukhlesuri*. This pattern indicates that the medium-utilization zone retains forest-like habitat characterised by a developed mid-storey and a leaf-littered forest floor, which is particularly important for arboreal rhacophorids such as K. chaseni and small leaf-litter microhylids such as M. mantheyi and M. mukhlesuri.

More generally, the combination of vertical structural complexity and deep leaf litter has been shown to enhance amphibian richness by maintaining favourable microclimatic conditions, such as moisture and lower temperature fluctuations, and by providing numerous refuges and foraging sites [18-20]. The presence of zone-restricted species such as K. chaseni, M. mantheyi, and M. mukhlesuri in this structurally complex part of THKMS therefore underscores the role of medium-utilization forest patches within urban green spaces as important refugia for forest-associated anuran assemblages.

The low-utilization zone is the area with minimal human intervention. This zone is characterised by a closed canopy, relatively thick leaf litter, and the presence of a small stream. The survey in this zone was conducted before rainfall became frequent, so the forest floor was still relatively dry, which likely affected species detectability and calling activity because many

amphibians increase surface activity and vocalisation after rain events [12,21]. Under these relatively dry conditions, only four species were recorded in the low-utilization zone, namely *Duttaphrynus melanostictus*, *Limnonectes blythii*, *Hylarana glandulosa*, and *Hylarana erythraea*.

Duttaphrynus melanostictus is a disturbance-tolerant species that commonly occurs in a wide range of habitats, including agricultural land, villages, and urban areas [14,22]. In contrast, the other three species were observed exclusively near water bodies, consistent with their ecology as stream- or pond-associated frogs that depend on permanent or semi-permanent aquatic habitats for breeding and foraging [16]. The co-occurrence of a highly tolerant generalist with more water-dependent ranids, such as L. blythii, H. glandulosa, and H. erythraea, suggests that despite limited sampling under dry conditions, the low-utilization zone still provides structurally intact forest and aquatic microhabitats that are important for both generalist and more habitat-specialised anurans.

Based on the species data, Muhammad Sabki Urban Forest Park is clearly important for the local anuran community. Within THKMS, the Asian common toad *Duttaphrynus melanostictus* was recorded as a widespread generalist that thrives in disturbed lowland habitats, including agricultural land, villages, and urban areas. Its presence indicates that the site has experienced anthropogenic pressure. At the same time, THKMS still supports forest-associated species such as *Kurixalus chaseni*, *Microhyla mantheyi*, and *Microhyla mukhlesuri*. The occurrence of these taxa indicates that patches of relatively natural forest structure are still present within this urban green space.

Microhyla mantheyi and M. mukhlesuri are two narrow-mouthed frogs that have been the focus of recent taxonomic revisions concerning their identity and natural distribution. *Microhyla mantheyi* was long considered restricted to the Malay Peninsula region, with records from southern Myanmar, southern Thailand, Peninsular Malaysia, and Singapore. However, Atmaja et al. [23] demonstrated, based on molecular and morphological data, that a specimen from Hutan Harapan National Forest in Jambi belongs to M. mantheyi, thereby extending the confirmed range of this species to Sumatra. Similarly, populations previously reported as "*Microhyla fissipes*" from Sumatra have recently been reassigned to M. mukhlesuri following phylogenetic and morphological analyses of the M. fissipes complex. Although M. mantheyi and M. mukhlesuri were recorded at relatively low abundance in THKMS, their presence in this small lowland forest fragment underscores the importance of the park as part of a broader network of lowland habitats for Microhylidae on Sumatra.

A limitation of this study is that field surveys were conducted during a relatively dry period before frequent rainfall. This condition may reduce the detectability of anurans, especially species that are highly dependent on rainfall-triggered calling and surface activity. Therefore, repeated surveys across wet and dry seasons are recommended to obtain a more comprehensive estimate of anuran species richness and abundance in THKMS.

CONCLUSIONS

Based on the observations, 40 individuals representing 10 species from five families were recorded. The five families encountered in this survey were Bufonidae, Dicroglossidae, Ranidae, Microhylidae, and Rhacophoridae. The ten species recorded were *Hylarana erythraea*, *Hylarana baramica*, *Hylarana glandulosa*, *Limnonectes microdiscus*, *Limnonectes blythii*, *Duttaphrynus melanostictus*, *Polypedates leucomystax*, *Kurixalus*

chaseni, *Microhyla mantheyi*, and *Microhyla mukhlesuri*. These findings indicate that Muhammad Sabki Urban Forest Park functions as an important urban refuge for both disturbance-tolerant and forest-associated anurans in the Jambi lowlands. Further seasonal surveys are recommended to strengthen biodiversity monitoring and conservation planning in this urban forest.

AUTHOR CONTRIBUTIONS

Conceptualization, AVB, APN, TW, and DS; Methodology, APN; Validation, APN; Formal Analysis, APN; Investigation, AVB, APN, TW, RDS, VG, LBT, and D; Resources, TW, RDS, VG, and APN; Data Curation, VG and D; Writing - Original Draft Preparation, AVB, APN, and TW; Writing - Review and Editing, AVB, APN, and TW; Visualization, APN; Project Administration, AVB and TW; Funding Acquisition, AVB and TW.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest, whether financial or personal, that could have influenced the research, analysis, or conclusions presented in this study.

FUNDING

This research was supported by PNBP funds from the Faculty of Science and Technology, Universitas Jambi.

ACKNOWLEDGMENT

The authors express their gratitude to the Environmental Agency of Jambi City and the Muhammad Sabki Urban Forest Technical Implementation Unit (UPTD Hutan Kota Muhammad Sabki) for granting permission to conduct the study at the site. The authors thank Ikhsan Nurdin Koto for his assistance in carrying out the anuran surveys, Vestidhia Yunisya Atmaja for her help in confirming species of the genus Microhyla, and the Biology Study Program students who assisted in the anuran surveys.

DECLARATION OF ARTIFICIAL INTELLIGENCE USE

AI-based language models were used for language refinement, reference-style conversion, and template formatting support during manuscript preparation. We confirm that all AI-assisted processes must be critically reviewed by the authors to ensure the integrity and reliability of the results. The final decisions and interpretations presented in this article remain the responsibility of the authors.

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