ASSESSMENT OF VERTEBRATE DIVERSITY IN SHERPUR RESERVE FOREST, BANGLADESH

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Abstract

Bangladesh is known for its rich biodiversity and wide variety of animal species. Identifying these species and understanding their abundance is a critical step in conserving its biological flora and fauna. Detailed knowledge of each species and its ecological requirements are essential for effective conservation efforts. In this context, the present study was conducted in Mymensingh's Sherpur Reserve Forest from November 27, 2023 to March 11, 2024 employing methods such as field observation, questionnaires and community-based approaches for data collection. The study revealed an impressive diversity of species, including 22 species of fishes, 13 amphibians, 16 reptiles and 11 mammals. The Simpson's Diversity Index demonstrated high levels of diversity across these groups, with amphibians scoring 97%, fish 93%, reptiles 84% and mammals 77%. This investigation not only highlights the faunistic variety of Sherpur Reserve Forest and its surroundings but also aids in identifying key faunal elements of high conservation significance and assessing their potential risk of extinction. As preserving biological diversity remains Bangladesh's top environmental priority, the findings of this study will play a pivotal role in guiding future conservation strategies.

Key words: Biodiversity; Red list; Forest; Conservation; Sherpur Reserve Forest.

INTRODUCTION

Bangladesh, a South Asian nation, is known for its diverse wildlife, despite having only 16% of its land covered by forests. The country has several national parks and wildlife sanctuaries, essential for preserving its varied ecosystems. Notable regions include the Chittagong Hill Tracts, known for their evergreen forests and Hakaluki Haor, famous for its freshwater marshes. These protected areas offer habitats for a diverse range of wild species, such as hoolock gibbons, Asian elephants and clouded leopards. As a result, Bangladesh is widely acknowledged for its significant biodiversity and the rich variety of flora and fauna present within its borders.

Bangladesh is estimated to have 2.52 million hectares of forestland, with approximately 1.52 million hectares under the administration of the Forest Department (Chowdhury and Koike 2010). A diverse range of animal species, including mammals, reptiles, birds and amphibians has been recorded from these forests (Islam *et al*. 2017). Currently, more than 100,000 hectares of former forestland are now used for crop cultivation; nevertheless, a wide variety of mammals, such as elephants, jackals and foxes, along with numerous vertebrates, including fish, amphibians, reptiles and birds, continue to inhabit these forests. However, the full extent of their biodiversity remains largely unknown. According to the International

Union for Conservation of Nature (IUCN), a total of 15,589 species worldwide are at risk of extinction, including 32% of amphibians, 23% of mammals and 12% of all known bird species (Baillie *et al*. 2004).

The present study was conducted in the Sherpur Reserve Forest (SRF), a deciduous Sal Forest located in the Mymensingh Division in northeastern Bangladesh. Despite its ecological significance, SRF has largely remained unexplored regarding vertebrate diversity. While previous research, such as Islam *et al.* (2017), focused on Modhutila Eco Park within Sherpur, this study extends its scope to encompass the entire SRF area. Notably, the vertebrate diversity of this forest had not been comprehensively assessed before this study. To address this gap, the research aimed to identify vertebrate species within SRF and assess their frequencies (diversity) using the Simpson's Diversity Index (SID) parameter (Simpson 1949). The findings are expected to enhance the current understanding of SRF's biodiversity, providing valuable insights that will contribute to conservation efforts and support the effective management of wildlife by relevant authorities.

MATERIAL AND METHODS

Study area

The Sherpur Reserve Forest (SRF) in Bangladesh, located at 25°07'46" N latitude and 90°14'95" E longitude, serves as an ideal site for wildlife observation. It is bordered by the Indian state of Meghalaya to the north and the districts of Mymensingh, and Jamalpur to the south and west, respectively. The SRF is primarily divided into three restricted forest ranges: Balijuri, Rangtia, and Modhutila (Islam *et al.* 2017). All relevant data collected for this study were stored in the Evolution and Diversity Research Laboratory (EDRL) at the Jamalpur Science and Technology University (JSTU), Jamalpur.

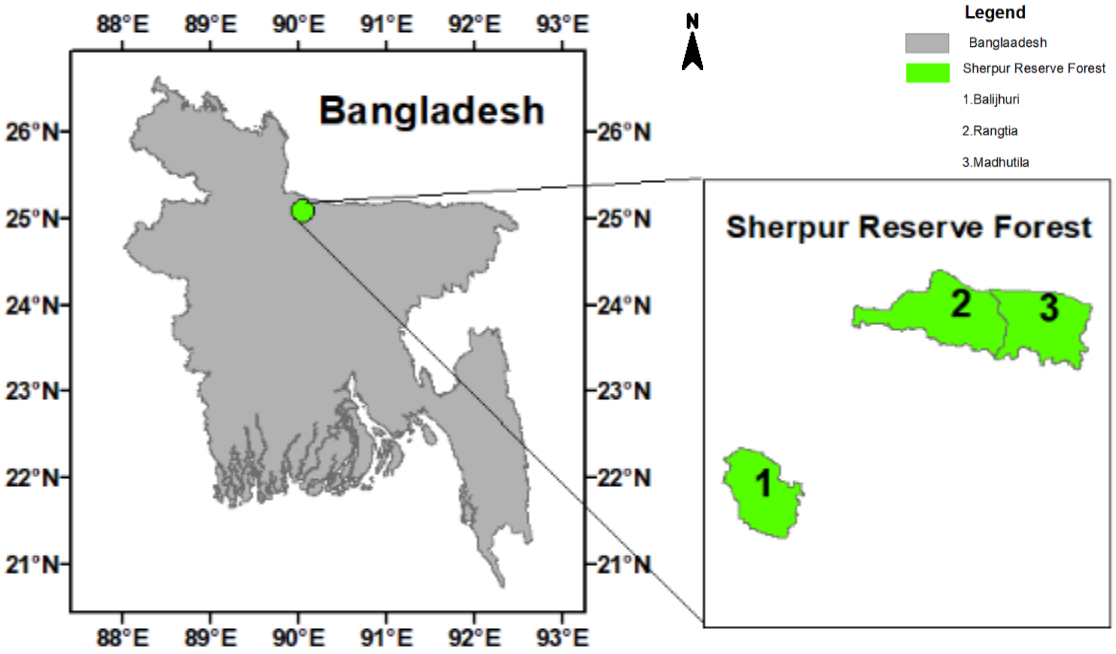

Fig.1. Map showing the study area Sherpur Reserve Forest (SRF); green circle (left) and the forest ranges (right) Balijuri, Rangtia and Modhutila.

Data collection method

This study was conducted to explore the wildlife diversity of the Sherpur Reserve Forest (SRF) from 27 November, 2023 to 11 March, 2024. Surveys were carried out from Monday to Wednesday, every week, from morning to evening during the stipulated period. Fifty sites were randomly selected for intensive observation and investigation. Data collection relied on both direct field observations and community-based information. The data were subsequently analyzed using Microsoft Excel. During the field surveys, species were observed in their natural settings, and additional information about the species was gathered. In addition, community-based data were collected through questionnaires administered to local communities, stakeholders and experts. Furthermore, fundamental, eventful, and qualitative data were obtained from range offices, bit officers, the general public and ethnic communities. Species identification followed the literature provided by Hamilton (1822), Rahman (2005), Hasan *et al*. (2014) and Khan (2015).

Data analysis

The status of vertebrate diversity was assessed using the Diversity Index (D), as established by Simpson (1949). To calculate this index, the study area was divided into quadrates. The number of vertebrate species present in each quadrate and the number of individuals of each species were recorded. The Diversity Index (D) ranges from 0 to 1. A value of 0 indicates infinite diversity, while 1 signifies no diversity. In other words, as the value of D increases, the level of diversity decreases.

Diversity Index (D) measures evenness in species abundance.

$$D = \sum n\ (n-1)/N\ (N-1)$$

Where, n = Number of individuals of each species and N = Total number of individuals.

Simpson's Index (SID) reflects the probability that two individuals randomly selected belong to different species.

$$SID = 1 - D$$

Higher SID values indicate greater biodiversity.

RESULTS AND DISCUSSION

Wildlife diversity

Several vertebrate categories were observed during the study period, including fish, amphibians, reptiles, and wild mammals (Table 1). Based on the data collected, it can be concluded that amphibian diversity is higher compared to other wildlife groups. According to the IUCN Red List of Bangladesh (IUCN 2015), the Asian elephant (*Elephas maximus*) from the family Elephantidae is listed as critically endangered, while the barking deer (*Muntiacus muntjak*) from the family Cervidae and the jungle cat (*Felis chaus*) from the family Felidae are categorized as endangered species. The rhesus macaque (*Macaca mulatta*) from the family Cercopithecidae is listed as vulnerable, while the remaining species appear to be relatively abundant in the forest.

Table 1. List of vertebrate species recorded from Sherpur Reserve Forest (SRF) from 27 November, 2023 to 11 March, 2024, including their family, local name, scientific name and ecological status.

Family	Scientific name	Local name	Status
	CLASS: OSTEICHTHYES		
	Amblypharyngodon mola	Mola mach	LC
	Osteobrama cotio	Dhela mach	NT
	Chela cachius	Chela mach	VU
	Danio rerio	Zebra mach	NT
Cyprinidae	*Labeo rohita*	Rui mach	LC
	Catla catla	Katla mach	LC
	Cirrhinus cirrhosus	Mrigel mach	NT
	Esomus danricus	Darkina mach	LC
	Puntius sophore	Punti mach	LC
Mastacembelidae	*Mastacembelus armatus*	Baim mach	EN
Botiidae	*Botia dario*	Bou mach	EN
	Channa orientalis	Cheng mach	LC
Channidae	*C. punctata*	Taki mach	LC
	C. striata	Shol mach	LC
	C. marulius	Gajar mach	EN
Cobitidae	*Lepidocephalichthys annandalei*	Gutum mach	VU
Bagridae	*Batasio tengara*	Tengra mach	EN
	Mystus cavasius	Gulsha mach	NC
Siluridae	*Wallago attu*	Boal mach	NT
Heteropneustidae	*Heteropneustes fossilis*	Shing mach	LC
Anabantidae	*Anabas cobojius*	Koi mach	LC
Belonidae	*Xenentodon cancila*	Kakila mach	LC
	CLASS: AMPHIBIA		
Bufonidae	*Duttaphrynus melanostictus*	Kuno bang	LC
Ranidae	*Hylarana tytleri*	Bangla pana bang	LC
	H. leptoglossa	Murgi daka bang	LC
	Euphlyctis cyanophlyctis	Katkati bang	LC
Dicroglossidae	*Fejervarya limnocharis*	Jhi jhi bang	LC
	Hoplobatrachus tigerinus	Kola bang	LC
	Occidozyga lima	Chhagal daka bang	LC
	Microhyla ornata	China bang	LC
	M. rubra	Lal pith laubichi bang	LC
Microhylidae	*M. berdmorei*	Bado laubichi bang	LC
	Kaloula pulchra	Venpu bang	NT
	K. taprobanica	Chittrito venpu bang	VU
Rhacophoridae	*Polypedates leucomystax*	Dorakata gecho bang	LC
	CLASS: REPTILIA		
	Gekko gecko	Tokkhok	NT
Gekkonidae	*Hemidactylus frenatus*	Mosrin tiktiki	LC
	H. brookii	Khoskhose tuktiki	LC
	H. platyurus	Chaptalej tiktiki	LC
Varanidae	*Varanus bengalensis*	Guishap	NT
Elapidae	*Naja naja*	Cobra/Gokhra shap	LC
	Gerardia prevostiana	Maita shap	LC
Colubridae	*Oligodon cyclurus*	Cantorer kukri shap	LC
	Xenochrophis piscator	Dhora shap	LC
Homalopsidae	*Enhydris enhydris*	Huria	LC
Agamidae	*Calotes versicolor*	Roktochosha	LC
Scincidae	*Mabuya carinata*	Anjoni	LC
	Euprepes macul	Tamatey anjon	LC
Pythonidae	*Python molurus*	Ojogor	LC
Geomydidae	*Pangshura smithii*	Bora korikaitta	NT
Typhiopidae	*Argyrophis diardii*	Baro dumukho shap	LC
	CLASS: MAMMALIA		
Cercopithecidae	*Macaca mulatta*	Banor	VU

Elephantidae	*Elephas maximus*	Hati	CE
Suidae	*Sus scrofa*	Bon shukor	LC
Canidae	*Canis aureus*	Shiyal	LC
Viveriidae	*Paradoxurus hermaphroditus*	Ghondo gokul	NT
Carvidae	*Muntiacus muntjak*	Maya horin	EN
Felidae	*Felis chaus*	Bon biral	EN
Herpestidae	*Urva edwardsii*	Boro beji	LC
Sciuridae	*Sciurus niger*	Kath birali	LC
Leporidae	*Oryctolagus cuniculus*	Khorgos	LC
Pteropodidae	*Pteropus giganteus*	Badur	DF

LC = Least Concern; NT = Near Threatened; EN = Endangered; CE = Critically Endangered; VU = Vulnerable; and DF = Data Deficient.

The graphical representation (Fig. 2) clearly shows the distribution of individuals across the classes. Amphibians recorded the highest number of individuals, totaling 443, reflecting their dominance in terms of abundance within the Sherpur Reserve Forest (SRF). On the other hand, reptiles exhibited the lowest count, with only 102 individuals observed, indicating their relatively lower abundance compared to other vertebrate classes surveyed. Fishes and mammals fall in between, with 248 and 264 individuals, respectively.

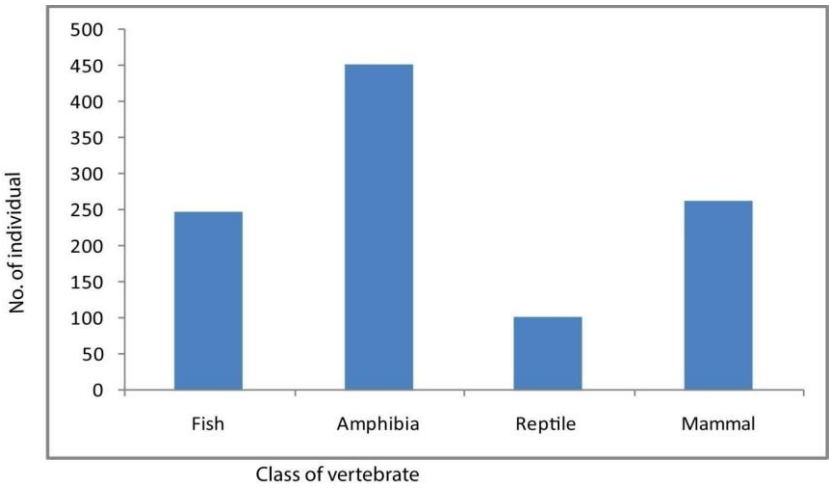

Fig. 2. Graphical representation shows the diversity and abundance of vertebrate species of different classes recorded during the present study in the Sherpur Reserve Forest (SRF).

This variation in abundance across classes could be attributed to their habitat preference, ecological niches, or anthropogenic influences. A comprehensive representation of the vertebrate diversity recorded in the SRF is shown in Table 2.

Table 2. Vertebrate diversity in the Sherpur Reserve Forest (SRF).

Class	Number of species	Number of individuals	Diversity Index (D)	Simpson's Index
Osteichthyes	22	248	0.07	0.93
Amphibians	13	443	0.03	0.97
Reptiles	16	102	0.16	0.84
Mammals	11	264	0.23	0.77
Total	62	1057	0.302	0.698

A total of 62 species, comprising 1,057 individuals, were observed across four vertebrate classes. The diversity index (D) and Simpson's Diversity Index (SID) values for each class

highlight significant variations in diversity. Amphibians exhibited the highest diversity among all classes, with a D value of 0.03 and a SID value of 0.97, indicating a 97% probability that two randomly selected individuals belong to different species. This richness and evenly distribution reflect the relatively undisturbed amphibian habitats within SRF. Fishes, although having the highest number of species (22), recorded a moderate population (248 individuals). The D value of 0.07 and SID value of 0.93 suggest robust diversity within aquatic ecosystems, though species distribution is less even compared to amphibians. Reptiles showed moderate species richness (16 species) but a smaller population size (102 individuals), resulting in a D value of 0.16 and a SID value of 0.84. The uneven distribution is indicative of ecological pressures affecting reptile populations in the SRF. Mammals, with the lowest species richness (11 species) and a D value of 0.23, displayed the least diversity. The SID value of 0.77 indicates a declining mammalian population due to habitat loss, poaching, and other human activities.

The combined diversity index (D) for all classes is 0.302, while Simpson's Index (SID) is 0.698. These values indicate a moderate overall diversity, with nearly a 70% chance of randomly selecting two individuals from different species. Amphibians emerged as the most diverse class in SRF, highlighting the ecological stability of amphibian habitats. However, cryptic traits and the lack of expert herpetologists suggest potential underreporting, warranting further investigation. The low diversity among mammals, evidenced by the highest D value (0.23), is a cause for concern. Anthropogenic activities, such as habitat destruction, poaching, and human-wildlife conflict exacerbate this decline, necessitating immediate conservation efforts. Despite robust diversity in aquatic ecosystems, targeted studies on fish populations could provide insights into the ecological balance of aquatic habitats in the SRF. The low number of reptile individuals (102) highlights the vulnerability of this class, likely due to habitat fragmentation and limited prey availability.

This study marks the first herpetological and ichthyological survey in SRF, providing preliminary data for future research. However, the limited accessibility of dense forest regions and security concerns restricted the scope of the investigation. Deeper exploration of SRF, particularly "no man's land" between Bangladesh and Meghalaya (India), could uncover additional species. Security measures are essential to facilitate such studies. Leveraging molecular, morphological, and ecological data could address cryptic traits in amphibians and identify new species. Previous studies, e.g. Hasan *et al*. (2014, 2014a, 2014b), Al-Razi *et al.* (2020, 2021) and Trageser *et al*. (2021), demonstrate the potential for such discoveries.

The present study reveals an alarming decline in vertebrate diversity, particularly among mammals and reptiles, necessitating targeted conservation efforts. Continuous monitoring, community education and government intervention are essential to protect the unique biodiversity of the Sherpur Reserve Forest. Additionally, training local and tribal communities in biodiversity conservation is crucial for reducing human-wildlife conflict and maintaining the ecological balance of the reserve. This study establishes a foundation for future research, with the hope that further surveys and thorough explorations will lead to the discovery of more species.

The number of species in the Sherpur Reserve Forest (SRF) may exceed current estimates, underscoring the forest's unexplored biodiversity potential. This research provides the first comprehensive assessment of herpetological (reptiles and amphibians) and

ichthyological (fish) diversity in the SRF, documenting species richness and abundance across these groups. The study establishes a critical baseline for understanding the ecological value of this relatively understudied region. The findings highlight SRF's ecological significance, offering insights to guide conservation efforts and further research initiatives aimed at safeguarding its unique fauna. Local tribal communities could benefit from targeted training on sustainable biodiversity conservation practices to align their livelihoods with environmental preservation goals. However, the ineffective enforcement of existing regulations poses a serious threat to the forest's flora and fauna, exacerbated by harmful activities from both residents and visitors. To address these challenges, authorities must regularly monitor changes in species populations and diversity trends. Implementing community-focused educational programs can raise awareness among rural populations about the importance of preserving the biodiversity of SRF. Proactive measures in conservation and education are essential to mitigate biodiversity loss and ensure the ecological integrity of this critical reserve forest.

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