

Final Evaluation Report

Your Details	
Full Name	Md Ashraf Ul Hasan
Project Title	Bats of Bangladesh: Bat Assemblage Structure and Species Responses to Land-Use Change
Application ID	33839-1
Date of this Report	September 2023

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Describe bat diversity in the biological transition zone of Northeast Bangladesh, using complementary intensive methods that capture different ensembles of bats e.g., mist nets, harp traps, acoustic recordings				In 2022 and 2023, a total of 134 harp traps and 56 mist nets (varying in lengths and heights) were deployed. A total of 17 species have been recorded in five families. The echolocation call recordings will be analysed in the next few months.
Characterize the response of forest-dependent bats to landscape modifications				The study design aimed to investigate bats across three land use types, unmodified forest, slightly modified areas (involving agricultural encroachment within the forest), and highly modified areas (tea plantations), across three protected areas in northeast Bangladesh. They are Kalenga Wildlife Sanctuary (KWS), Satchari National Park (SNP), and Lawachara National Park (LNP). The outcome of the study found bat species diversity decreases with land use modifications, although unmodified (natural land covers), and modified (agriculture, timber plantations, tea) habitats play an important role in bat species diversity. Species richness is more in the modified habitat (total no. of species = 10), than in the unmodified habitat (total no. of species = 13). In addition, there were four species exclusively captured in the unmodified habitat (<i>Hipposideros fulvus</i> , <i>Hipposideros pomona</i> , <i>Murina</i> sp., and <i>Pipistrellus</i> sp.). Moreover, six species were captured solely in the modified habitat (<i>Macroglossus sobrinus</i> , <i>Scotophilus heathii</i> , <i>Pipistrellus javanicus</i> , <i>Pipistrellus tenuis</i> , <i>Myotis</i>

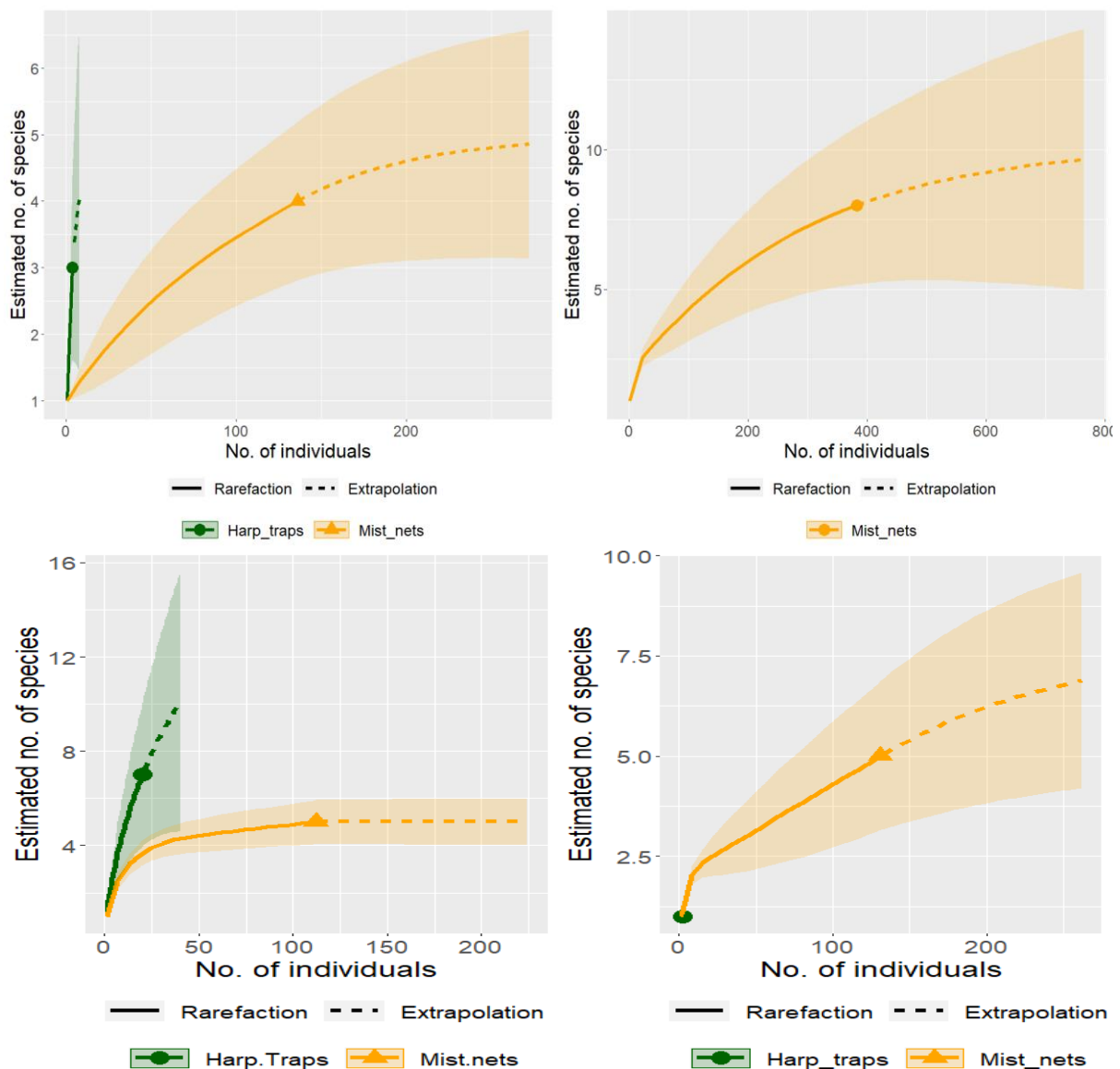
			<p><i>muricola</i>, <i>Hesperoptenus tickelli</i>). However, species diversity is more in the unmodified habitat (Inverse Simpson's Index = 2.08), compared to the modified habitat (Inverse Simpson's Index = 1.92). There are 43% dissimilarity (Bray Curtis Dissimilarity Index = 0.43) in two different habitats.</p>
Build capacity to support long-term bat research by training researchers in field survey and identification techniques and involving local people as forest guides and assistants so they can guide future bat researchers			<p>This project facilitated 10 young and prospective researchers to engage in the fieldwork. I provided the field training among the 10 researchers. Meanwhile, Dr Tigga Kingston, Professor, Dept. of Biological Sciences, Texas Tech University, and Co-Chair, IUCN Bat Specialist Group (Old-World Bat) visited Bangladesh in 2022 to observe the feasibility of the study methods and assist the PI in initial training (the training associated with setting up harp trap and mist nets, bat handling, understand the taxonomy of bats, morphometric data collection of bats) of the team members associated to the project. In addition, the project involved local eco-tour guides and members of the Community Patrolling Group of the protected areas.</p>
Increase awareness of the importance of bats in the general public and dispel misconceptions about the relationships between bats and SARS-CoV-2			<p>Three community awareness programmes targeting three age group classes: (i) people aged above 40 years; (ii) Secondary school students (grade: 9 and 10); (iii) Elementary school students (grade 4 and 5) was arranged. Local stakeholders, community forest users, and teachers were present at the programmes.</p>

2. Describe the three most important outcomes of your project.

a). Bat research in Bangladesh experienced new tools for the country: This is the first ever well designed ecological study of bats in Bangladesh that included all the complementary field techniques to capture bats, such as mist nets, harp traps and bat detectors. No other documented research in Bangladesh has employed harp traps and gathered echolocation calls. I have deployed 134 harp traps throughout the field seasons that covered ~1200 hours in total. A total of three species were exclusively captured in harp traps, *Hipposideros pomona*, *Hipposideros fulvus*, and *Murina* sp. In addition, nine species were exclusively captured in mist nets (*Cynopterus sphinx*, *Macroglossus sobrinus*, *Rousettus leschenaultii*, *Hesperoptenus*

tickelli, *Myotis muricola*, *Myotis sp.*, *Pipistrellus javanicus*, *Pipistrellus tenuis*, *Scotophilus heathii*) and four species were caught in both mist nets and harp traps (*Hipposideros lankadiva*, *Lyroderma lyra*, *Rhinolophus lepidus*, and *Pipistrellus sp.*). In addition, *Pteropus medius* was observed roosting in the study areas.

Furthermore, I've conducted recordings of echolocation data across 36 point transects, each spanning 1 km. One complete point transect = 1 km from first point to the sixth point (each point is 200 m away from the next one (surveyed in one dusk)) + 1 km from the sixth point to the first point (surveyed in another dusk). These recordings encompass three distinct land-use types—unmodified, slightly modified, and highly modified land covers.



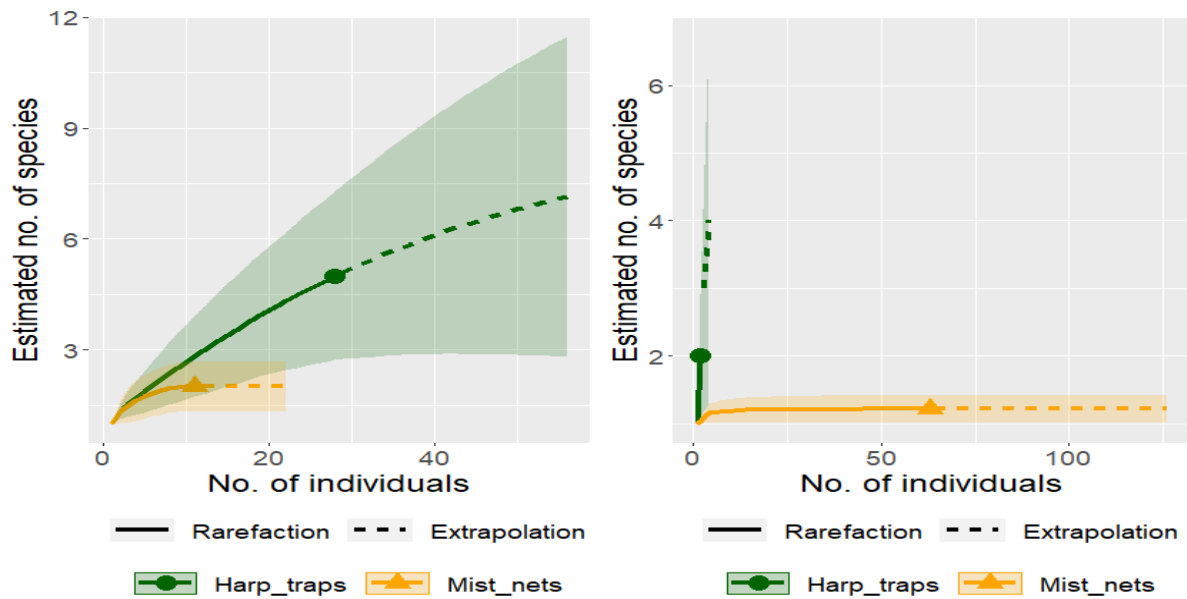


Figure 1. Rarefaction curve for species captured in (Top) Kalenga Wildlife Sanctuary (KWS), (Middle) Satchari National Park (SNP), and (Bottom) Lawachara National Park (LNP): left - unmodified forest; right – modified habitat. Shaded area represent 95% Confidence Intervals for each curve.

b). Bat research capacity building: A total of 10 people was actively involved in the project. I trained all of them on setting up mist nets and harp traps, echolocation data collection, environmental data collection, bat handling and taking morphometric measurements, bat taxonomy, and species identification. At the beginning of the fieldwork under this project in 2022, Dr. Tigga Kingston, Professor, Dept. of Biological Sciences, Texas Tech University, and Co-Chair, IUCN Bat Specialist Group (Old-World Bat) visited Bangladesh to observe the feasibility of the study methods and assist the PI in initial training of team members associated to the project.

c). Conservation education and awareness campaign: I conducted three community awareness programmes targeting three age group classes: (i) people aged above 40 years; (ii) secondary school students (grade: 9 and 10); and (iii) elementary school students (grade 4 and 5). At the beginning of the programme, we learnt from the participants that what did they know about bats, known roosting sites of bats, benefit and damages caused by bats. We sorted out common misconceptions among the participants were: (i) bats are blind; (2) bats eat and defaecate through mouth only; (iii) bats are birds; (iv) bats lay eggs; (v) only fruit eating bats are considered as bats but not the insectivorous ones; (vi) bats are responsible for spreading SARS-CoV-2. Then we addressed all the queries and disseminated knowledge on bats: why bats are mammals, bats life cycle, echolocation of bats, ecosystem services provided by bats (seed dispersal by bats, forest regeneration, pollination, arthropod suppression and help reduce crop damage, importance of guano in agriculture), and bats neither responsible for spreading SARS-CoV-2 virus nor in charge of recent global pandemic. In addition, we explained what we could do to cut the risk of rabies transmission.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

This is what we faced in 2022 during the first season of the fieldwork, as I explained in the last report: "We did not able to start the project at the scheduled time due to the global pandemic, and travel restrictions. In addition, it took a few more weeks to get all the equipment and supplies ready to go to the field (i.e., harp traps, mist net poles, bat bags, sundry supplies) because of the fact that the PI brought two harp traps from Malaysia and ordered four harp traps in Bangladesh. It took more than the expected time to get the copies delivered as the raw materials of the harp traps were sparsely available in the country. The project was intermittently paused due to the massive flood and rain in the study areas. That flooding was featured on international news (read more: <https://www.nytimes.com/2022/06/24/world/asia/sylhet-bangladesh-floods.html>).

We had to take a break on the 2nd and 3rd week of July 2022 because of the religious event, the Eid-UI-Adha. We were not able to leave the harp traps open overnight for a few reasons: (1) it rained heavily at night – so it was plausible that bats avoid foraging during rain, thus we could not be able to catch bats during rain; (2) we did not stay close to the traps till dawn for the security issue" (please see project updates). In 2023, our fieldwork was interrupted by the heavy rain as well. We took a 2-week break for the Eid-UI-Adha religious event. Finally, as a result of the economic inflation in Bangladesh in 2022 and 2023, most of the costs exceeded the budget.

4. Describe the involvement of local communities and how they have benefited from the project.

- The field assistants (six in total) involved in the field season were actively involved in the project, can be able to serve as parabiologists to guide bat researchers in future and any research related to nocturnal animals.
- The participants of the conservation education and awareness programme were the local communities. Our education programme helped them understand the benefits of bats in the nature and dismiss different misconceptions about bats. In addition, two out of the three awareness programmes were arranged targeting elementary and secondary school students. These programmes educated them about the significance of bats and how important these forests are for conservation. Bat painting competition and quizzes based on the lecture provided encouraged students to learn about bats and their conservation.
- We purchased food and sundries from local stores which helped the local communities financially.

5. Are there any plans to continue this work?

Yes, while the study areas exhibit notably low diversity, there's still significant potential in extending this study with the same design and increasing the number of

replicates. This approach could be crucial in potentially reaching an asymptote (Figure 1). In addition, there are 43% dissimilarity (Bray Curtis dissimilarity) comparing two different habitats (unmodified vs modified), but there are a few species persisting in both habitats, for example, *Lyroderma lyra*. *Lyroderma lyra* is an insectivorous bat, feeds on large insects and small mammals, functions as an arthropod suppressor. Based on the findings from this project, I found *Lyroderma lyra* roost and commonly caught in mist nets in unmodified and modified habitats, play as a habitat generalist species. However, the rapid alteration of the study areas to anthropogenic land covers has turned this region into a mosaic landscape. Therefore, this raises another important question to work on, how does a habitat generalist species (*Lyroderma lyra*) persist in the mosaic landscape and select habitat within this landscape? In addition, this project covered only three protected areas of northeast Bangladesh. It would be great if this work could continue to cover the remaining protected areas of that region followed by the same study design. It is imperative to keep continuing the acoustic data collection to develop an in-country call library, or contribute to the existing call library, such as Chirovox.

6. How do you plan to share the results of your work with others?

The outcomes of 2022 have already been submitted to the Forest Department, Bangladesh. The overall results will be submitted to them shortly. The updates of the outreach programmes have already been shared in the social media (X and Facebook). The results will be analysed and submitted to peer-reviewed journals. I will present the outcomes at the 52nd North American Society for Bat Research, Mexico 2024, and Texas Tech Annual Biological Sciences Symposium in early 2024 and other conferences.

7. Looking ahead, what do you feel are the important next steps?

Bangladesh's natural land covers are rapidly changing due to human activities like agriculture, timber plantations, and infrastructure development. These actions are causing a significant shift, ultimately shaping a mosaic-like landscape.

The swift alteration of natural landscapes is compelling wildlife to inhabit human-modified landscapes for dispersal, foraging, and reproduction. In return, some species (bats for an example) provide critical ecosystem services through pollination and natural pest control in agricultural land covers. Investigating the resources preferred by species in human-dominated landscapes is crucial. It helps in comprehending how adaptable species are to these emerging land covers and contributes significantly to biodiversity conservation efforts. One conservation effort that integrates natural and modified (agricultural) land covers, is the land-sharing conservation. As the natural remnants in Bangladesh are altering into agricultural lands and there are a very few natural land covers remain, the important next step is to understand how the species that are persisting in both natural and modified habitats (habitat generalist species) thrive in the mosaic landscape and fits in the land-sharing conservation approach. Therefore, the results obtained from this project suggest that *Lyroderma lyra* serves as an ideal model species (or as a habitat generalist species) to explore the adaptability within the mosaic landscape.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

During all three bat conservation education and awareness campaigns, I showcased the Rufford Foundation logo. Moreover, the logo featured in a presentation I delivered at the Texas Tech Annual Biological Sciences Symposium in 2023. I also shared project updates on social media platforms like X and Facebook, acknowledging the support of The Rufford Foundation. The Kingston lab (<https://kingstonlab.org/>) circulated the project updates twice (<https://kingstonlab.org/2022/09/21/ashrafs-first-field-season-yields-550-bats-and-17-species/> and <https://kingstonlab.org/2021/05/03/a-brilliant-semester-for-the-kingston-lab/>) and credited The Rufford Foundation.

9. Provide a full list of all the members of your team and their role in the project.

The following team members participated in the 2022 and 2023 field season of the project. They all were involved in field data collection, such as setting up mist nets and harp traps, echolocation data through point transects, vegetation data, morphometric data of the captured bats, and helped in community outreach program arrangement. The names are in alphabetical order:

Adnan Ahmed (Involved in 2022 and 2023 field season): Graduate Student, Department of Medicine, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Akash Mojumdar (Involved in 2022 and 2023 field season): Undergraduate student, Department of Computer Science and Information Technology, Shanto-Mariam University of Creative Technology, Dhaka, Bangladesh.

Foyjullah Numan (Involved in 2022 and 2023 field season): Eco-tour guide, Rema-Kelanga Wildlife Sanctuary, Habiganj, Bangladesh.

Mukim Mahmud (Involved in 2022 field season): Graduate Student, Department of Botany, Government Azizul Haque College, Bogura, Bangladesh.

Naim Rashid (Involved in 2023 field season): Graduate Student, Department of Environmental Science, Stamford University, Dhaka, Bangladesh.

Nokul Satwal (Involved in 2023 field season): Community Patrolling Group (CPG) member, Satchari National Park, Habiganj, Bangladesh.

Rasel Debbarma (Involved in 2022 and 2023 field season): Eco-tour guide, Satchari National Park, Habiganj, Bangladesh.

Rifat Hasan (Involved in 2022 field season): Graduate Student, Department of Zoology, Government Azizul Haque College, Bogura, Bangladesh.

Tania Akhter (Involved in 2022 and 2023 field season): MSc, Department of Zoology, Jagannath University, Dhaka, Bangladesh.

Tuli Mandal (Involved in 2022 field season): Undergraduate student, Department of Zoology, Jagannath University, Dhaka, Bangladesh.

10. Any other comments?

After a 2-year study across three protected areas, I encountered that local communities and forest department staff in these regions possess limited knowledge about bats. People typically recognise fruit-eating bats as 'bats,' but their understanding of insectivorous bats is quite limited. The idea that bats inhabit forests is relatively new to them; instead, local people commonly believe that frugivorous bats and bat-like animals (insectivorous bats) reside in banana gardens or thatched houses, respectively. Furthermore, there are prevailing misconceptions among these communities, such as the belief that bats are blind and that they lay eggs. To impart fundamental knowledge about bat biology, it is essential to continue awareness initiatives tailored for various age groups.

I'm grateful to The Rufford Foundation for funding the project, enabling me to work through 2022 and 2023, even extending it without additional costs. I am grateful to the Forest Department, Bangladesh for the research permission. I cannot thank enough to the Kingston Lab at Texas Tech University for the equipment support. My gratitude goes to Department of Zoology, Jagannath University, Bangladesh for the logistic support. I am indebted to all the schools who have supported us to conduct the conservation education and awareness campaigns. Thanks to all the local communities of the Satchari National Park, Lawachara National Park, and Rema-kalenga Wildlife Sanctuary for their immense cooperation.

Photo Gallery



Photo: Ashraf (I) took notes on the participants perception toward bats, and then discussed on the ecosystem services provided by bats. I also talked about the forest regeneration services, pollination, pest suppression, and overall, the economic importance of bats.



Photo: A member of the team, Dr Adnan Ahmed, a veterinary practitioner, discussed with different age groups, and disseminated different pragmatic approaches to reduce human-fruit bats interaction to halt rabies transmission in Bangladesh. In addition, he discussed the global pandemic of COVID-19 originated from the live wildlife trade in China, with the Huanan Seafood market serving as the epicentre of the pandemic. However, conclusive evidence establishing bats as the direct source of SARS-CoV-2 transmitting to humans is still lacking. Therefore, it's crucial not to underestimate the ecosystem services that bats provide because of misconceptions.



Photo: Ashraf (I) described the biology of bats (bats as a true flying mammal, bat life cycle, movement of bats using eyes and echolocation), and dissipated misconceptions about bats among the elementary school (class 4 and 5, on the left photo) and secondary school (class 9 and 10, on the right photo) going students.