

2023

Conservation campaign and bat survey  
along the Tamakoshi River Corridor, Nepal  
with special focus on Hodgson's Bat  
*Myotis formosus*

FIRST RUFFORD SMALL GRANTS

FINAL REPORT  
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Photo by Varsha Rai: On the bank of Tamakoshi River in Jamune, Dolakha district

Final report submitted to Rufford Small Grants, UK

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## Abstract

Past study in an area of the Tamakoshi River Corridor had shown that there was a lack of knowledge and awareness about bats and their importance among locals that often led to roost disturbance and culling of bats. The same study had found a very rare bat species, Hodgson's bat *Myotis formosus* in the area after around two decades. In addition, Nepal is developing and several rivers including the Tamakoshi River are occupied by hydropower projects that have huge potential to negatively influence the surrounding natural environment and their wild inhabitants. Therefore, this project was carried out in four phases in June 2022, September 2022, December 2022-January 2023 and April-May 2023.

The main objective of assessing local peoples' perception about bats and conduct mass conservation outreach campaign about bats among youth communities and school children. Moreover, bat species diversity and their echolocation calls along the Tamakoshi River Corridor were also documented, focusing our search for *M. formosus*. Altogether, 12 bat species have been identified using mist nets, harp trap and roost search, while few individuals remain unidentified, awaiting their genetic confirmation. One out of 12 species identified, is *Vespertilio* sp., a species new to Nepal. However, the species confirmation requires further genetic analysis. Echolocation calls of the captured bat species were recorded and we also located few important bat roosts in the area. The recorded calls will serve as reference for non-invasive identification and monitoring of bat species in the near future.

However, we could not locate our focus species *M. formosus*. As per the locals and our experience, such caves harboring bats were generally located far up in the mountains away from the Tamakoshi River corridor. Thus, it suggests that the next study should extend the search area looking for potential cave roosts for *M. formosus* and other bat species higher uphill.

Through the scheduled survey, more than 90% of the respondents were found to have seen bats in the area, but most of them knew nothing about bats and their importance. Some people even mentioned that bat sightings have become rare in the recent times due to unknown reasons and agreed that bat population has been decreasing. However, by the end of this project, more people knew about the importance of bats and were positive and willing towards bat conservation in the area. We formed altogether nine school bat clubs and three youth bat clubs who will continue to work on spreading the conservation message. Towards the end, a sharing workshop was conducted to share the findings of the project and gather feedback and suggestion from the concerned local stakeholders. The local government bodies and local people expressed their willingness to support and collaborate in support such projects in the coming days.

## Contents

Acknowledgement .....	2
Abstract.....	3
1. Background .....	6
2. Study area: Tamakoshi River Corridor.....	8
3. Limitations of the project .....	9
4. Methods .....	10
5. Results .....	13
5.1 Bat species diversity.....	13
5.2 Acoustic survey .....	21
5.3 Scheduled survey.....	26
5.4 Bat conservation awareness.....	28
5.4.1 Outreach programs .....	28
5.4.1.1 Awareness and outreach activities in schools.....	28
5.4.1.2 Awareness and outreach activities in communities.....	30
5.4.2 Bat club formation.....	32
5.4.2.1 School Bat Clubs.....	32
5.4.2.2 Youth Bat Clubs .....	35
5.4.3 Installation of information board.....	36
5.5 Sharing Workshop .....	37
6. Human impacts on the Tamakoshi River.....	40
7. Conclusion .....	41
References.....	42
Appendices .....	44

## List of tables

Table 1: Bat roosts searched in June, July and December 2022 and April 2023 .....	14
Table 2: Bats recorded throughout the study period.....	18
Table 3: Echolocation call parameters of identified bat species along the Tamakoshi River Corridor .....	21
Table 4: List of schools where outreach program was conducted .....	28
Table 5: School Bat Clubs formed .....	32
Table 6: Youth Bat Clubs formed .....	35
Table 7: Questions asked or comments/suggestions made by the participants.....	38
Table 8: List of participants of the sharing workshop.....	48

## List of figures

Figure 1: Upper Tamakoshi Hydroelectric Project (UTKHEP) Damsite, Lamabagar, Dolakha district; A: Reservoir, B: Flow of water in the Tamakoshi River at damsite .....	6
Figure 2: Sampling sites along Tamakoshi River Corridor in Dolakha and Ramechhap districts .....	8
Figure 3: A two-bank harp trap installed in a tunnel at GCA.....	10
Figure 4: Ultrasonic detectors; SongMeter Minibat (left) and EchoMeter Touch 2 Pro (right)	11
Figure 5: A blur photograph taken of a Vesper bat roosting in a banana plant in a homestead garden in Jagat, Dolakha district .....	13
Figure 6: Habitat types surveyed I .....	15
Figure 7: Habitat types surveyed II.....	16
Figure 8: Habitat types surveyed III.....	17
Figure 9: Bat photo plates 1 .....	19
Figure 10: Bat photo plates 2 .....	20
Figure 11: Echolocation calls recorded I.....	22
Figure 12: Echolocation calls recorded II.....	23
Figure 13: Echolocation calls recorded III.....	24
Figure 14: Echolocation calls recorded IV .....	25
Figure 15: Gender of the respondents .....	26
Figure 16: Education level of the respondents .....	26
Figure 17: Occupation of the respondents.....	26
Figure 18: Scheduled survey being carried out by Ms. Sabina Koirala.....	27
Figure 19: Knowledge and perception of respondents at the beginning (left) and end (right) of the project .....	27
Figure 20: Lecture and documentary session in Kalinag Higher Secondary School, Singati..	29
Figure 21: Talking with a local about bats and their roosts .....	30
Figure 22: Community outreach in Khimti, Ramechhap district .....	31
Figure 23: Kalinag Secondary School Bat Club Meeting.....	33
Figure 24: Youth Bat Club formation program in Jagat .....	35
Figure 25: Pasting UV print flex on the metal board frame before installation with the help of locals.....	36
Figure 26: Ms. Varsha Rai during the sharing workshop .....	37
Figure 27: Group photo with the local stakeholders after the sharing workshop in front of the information board.....	39
Figure 28: Sand and gravel extraction being done in Tamakoshi River near Tamakoshi Bajar, Dolakha district .....	40
Figure 29: Bridge construction on the Tamakoshi River in Manthali, Ramechhap district.....	40
Figure 30: Bat awareness poster prepared for the project in Nepali (left) and English language (right) .....	<b>Error! Bookmark not defined.</b>
Figure 31: Bat conservation sticker prepared for the project.....	45
Figure 32: Porcelain mug prepared for the project with a photo of a bat ( <i>Myotis formosus</i> ) and conservation motto .....	45
Figure 33: Information board content in Nepali (top) and English (bottom) .....	46
Figure 34: Lamabagar, Dolakha district.....	47

## 1. Background

In a previous study of bats in southern part of Dolakha district in the Tamakoshi River watershed during 2018 (Rai et al., 2021), we found lack of awareness about bats among local people which caused disturbances to bat roosts out of curiosity and mischief. On top of that, some of the respondents still believed that bat flesh could cure bovine babesiosis, and arthritis and tuberculosis in humans; some people from Newar community admitted using dead bat soaked in oil to get healthier and shiny hair (Lohani, 2011). We found high bat species richness in a 35 sq. km. approx. area (Rai et al., 2021) but low abundance probably owing to high human disturbance at roost sites such as excavation for road construction, forest logging, school children entering caves and disturbing bats for fun. Locals also indicated decrease in bat sightings over the years. This study was the first in the area, long after field surveys at a few localities nearby Gaurishankar Conservation Area (GCA) during 1970s (Kock, 1987, 1996). Hodgson's Bat *M. formosus* is a rare species in Nepal and we successfully recorded it in the area (Rai et al., 2021) after two decades (Csorba et al., 1999). Its global conservation status is assessed Near Threatened (Huang et al., 2020) and very little is known about its ecology (Bates & Harrison, 1997; Wilson & Mittermeier, 2019), emphasizing the need of assessment of its status, distribution and ecology in Nepal.

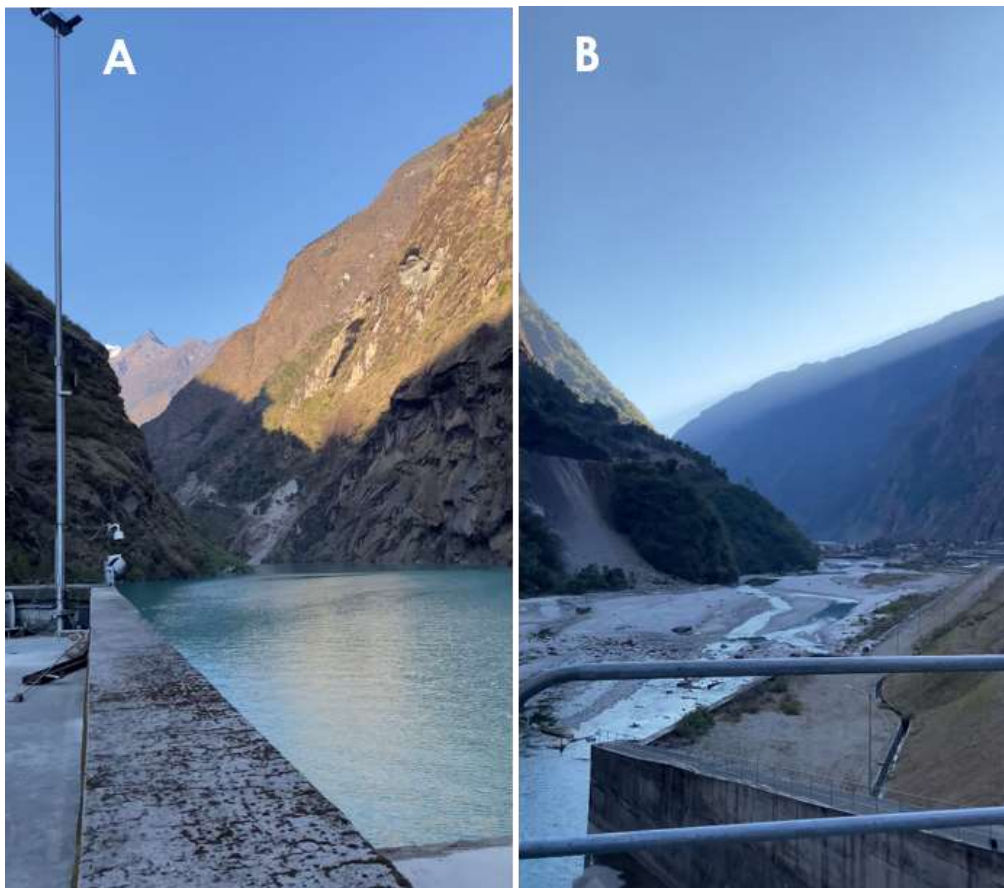


Figure 1: Upper Tamakoshi Hydroelectric Project (UTKHEP) Damsite, Lamabagar, Dolakha district; A: Reservoir, B: Flow of water in the Tamakoshi River at damsite

Nepal is developing and several rivers including the Tamakoshi River are occupied for hydropower projects (Figure 1). Freshwater ecosystem is largely impacted by the overarching encroachment of land and water resources. Moreover, alterations due to climate change are evident in the Himalayas and we lack the baseline of bat fauna distributed in this region under high pressure from construction.

This project aims to assess local peoples' perception about bats and identify areas for implementation of mass conservation outreach campaign to increase the level of awareness about the role of bats in maintaining ecosystems, benefits to humans and mitigate the negative attitude towards bats among youth communities and school children. Through this project, we also aim to document baseline data on assemblage and abundance of bat species focusing *M. formosus* along the elevational gradient in the Tamakoshi River corridor, a fragile and difficult terrain. The acoustic survey is expected to add several reference calls and also contribute to Nepal Bat call library which will be an effective tool for non-invasive identification and monitoring of bat species in the near future.



## 2. Study area: Tamakoshi River Corridor

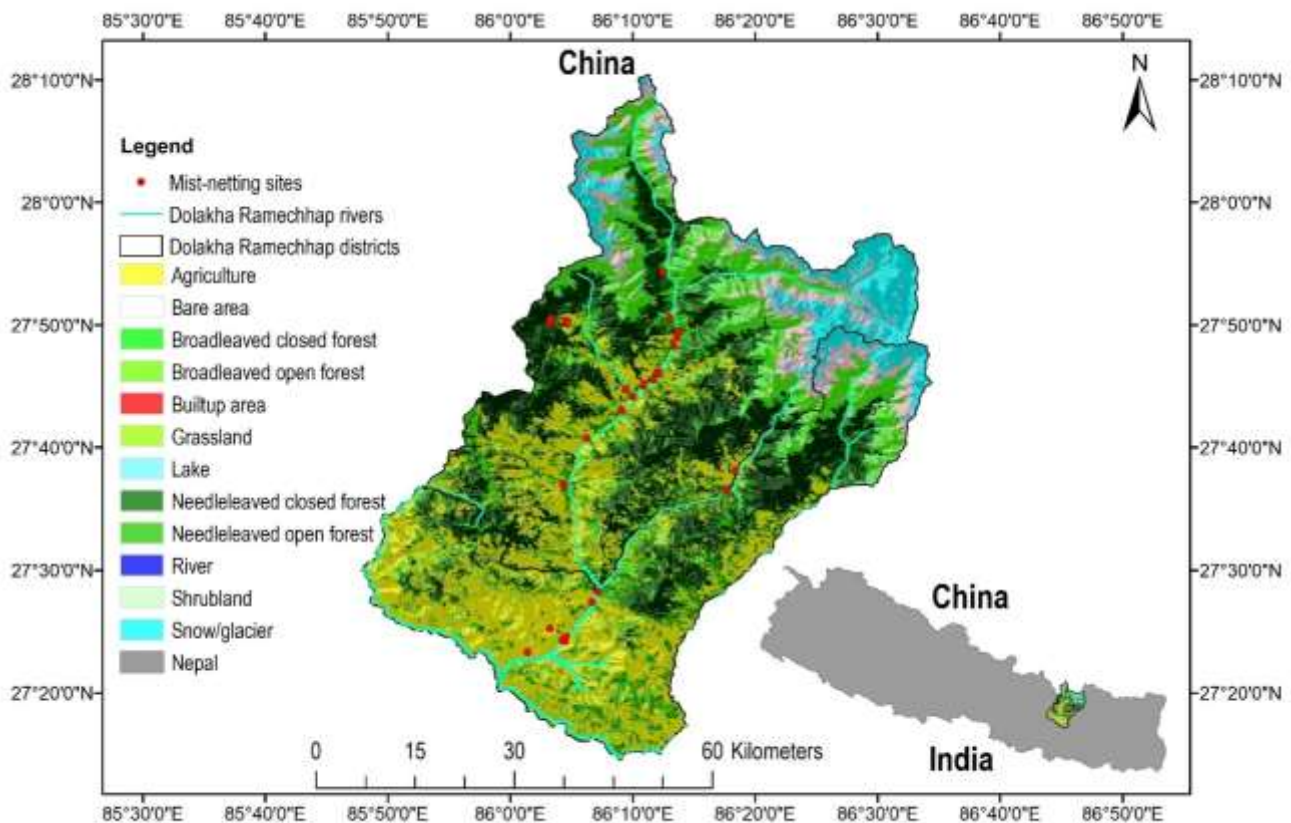


Figure 2: Sampling sites along Tamakoshi River Corridor in Dolakha and Ramechhap districts

The project site is located in the Tamakoshi River Basin in Dolakha and Ramechhap districts, Bagmati Province, central Nepal. The study area extends from the Upper Tamakoshi Hydroelectric Project (UTKHEP), Dolakha district (2000 masl) to Benighat, Ramechhap district (460 masl) where the Tamakoshi meets the Sunkoshi River (Figure 2). The Tamakoshi River is one of the seven major tributaries of the largest river basin of Nepal, the Sapta Koshi River Basin. It originates in the southern part of the Tibetan plateau of China entering Nepal through Rolwaling Himalayan Range. Within Nepal, the river flows in the southern direction through the mountainous and hilly areas of Dolakha and Ramechhap districts. The study area lies between 27°55'19.87"N 86°12'55.03"E and 27°21'04.84"N 85°59'10.30"E with Gaurishankar Conservation Area (GCA) in its north. Forest is dominated by *Pinus roxburgii* at higher elevation while *Shorea robusta* at lower elevation. Several villages and urban settlements reside alongside the river along with agricultural lands. There are currently three hydropower projects under operation in Tamakoshi River corridor with UTKHEP being the largest hydropower project in Nepal.

Nepal is a geographically diverse country making it a biodiversity hotspot and rich in natural resources. However, haphazard development leads to unforeseen consequences making biodiversity vulnerable. Hydropower projects, one of the

renewable sources of energy, influence the surrounding natural environment to a great extent without proper consideration of the likely negative impacts they may have on the aquatic species and others that depend on such riparian habitats.

### 3. Limitations of the project

- **Delay in permits:** Research permits from the Department of National Parks and Wildlife Conservation (DNPWC) and the Department of Forests and Soil Conservation (DoFSC) had been obtained by the end of March 2022. However, it took additional two months to get permit from the Social Welfare Council (SWC) which was issued during the first week of June 2022. This delayed the start of our project.
- **Unfavorable weather:** On top of late permits, monsoon highly affected our first field period in June 2022 and was cut short. Frequent rainfall also affected the second phase in September 2022 and once it rained continuously for four days. December observes late autumn in Nepal and the onset of winter with much colder northern areas close to the Himalayas. Bat activity generally started from around 5:00 PM in the evening which peaked for about half an hour and then almost stopped with only a few bat calls thereafter. The ambient temperature was usually less than 15°C in the evening, which dropped well below 10°C at the northern sites such as Lamabagar (2000 masl) (Figure 34) during the third phase in December 2022. In addition, due to continuous rainfall, the roads reaching several remote sites were wrecked, landslide-prone and water level in river and streams was unsafe for deploying mist nets. Caves or crevices are mostly situated at high cliffs and hilly slopes, mostly unreachable due to the treacherous terrain or unfavorable weather.
- **Holiday season:** In addition to unfavorable weather during the second phase, by the time we reached the southern part of our study area, schools were closed due to the arrival of festival of Dashain and Tihar, the biggest festivals of Hindus, as per the Nepalese Lunar Calendar generally around the month of September. This led us to postpone our awareness and outreach activities in some schools and communities through the next phase in December 2022. And in the higher elevation and northern sites, winter vacations during December and January hampered our plan for school awareness in those sites.
- **Other:** It was noticeable that the water level in Tamakoshi River increased a lot during the evening every day. As per the locals and Gaurishankar Conservation Area (GCA) officials, the UTKHEP released water in the river during the evening. Due to this, we were not able to conduct mist-netting along the Tamakoshi river even during the winter month when the water level in the rivers is supposed to be low.

## 4. Methods

The project was carried out in four phases – the first phase (17<sup>th</sup> to 23<sup>rd</sup> June 2022), second phase (11<sup>th</sup> to 24<sup>th</sup> September 2022), third phase (06<sup>th</sup> to 23<sup>rd</sup> December 2022 and 30<sup>th</sup> December 2022 to 03<sup>rd</sup> January 2023) and the last phase (20<sup>th</sup> to 23<sup>rd</sup> April and 29<sup>th</sup> to 31<sup>st</sup> May 2023). During the first phase of the project, our team met with the officials of local government bodies, forest offices, GCAP, Conservation Area Management Committee (CAMC) and local communities. Key informant survey and informal interviews were conducted to identify the key-sites for bat surveys.

- **Bat survey and identification**

Mist net and harp trap: Two Ecotone monofilament mist-nets (9m\*3m and 6m\*3m, 16 mm mesh size) were deployed in different categorized habitats such as primary and secondary forests, cropland, within hydropower dams and plants, caves and water bodies (Collins, 2016; USFWS, 2010) for a total of 39 net nights during the whole study period. We only installed a two banks harp trap near the entrance of a Hydropower testing tunnel for one night (Figure 3) as we could not find any appropriate site to administer harp trap in the study area.



Figure 3: A two-bank harp trap installed in a tunnel at GCA

Standard bat capture and handling methods were adopted (Kunz & Parsons, 2009). Species were identified in the field based upon morphology and morphometrics and if unidentified, 3mm patagium tissue was sampled for further genetic work to confirm the species. Polymerase Chain Reaction (PCR) has been successful on the unidentified species

following Mammalian Tissue and Rodent Tail Genomic DNA Purification Protocol (Thermo Fisher Scientific Inc. 2016) at the Molecular lab of Central Department of Zoology (CDZ), Tribhuvan University, Kathmandu, Nepal, while DNA sequencing will be done in the following months in National Academy of Science and Technology (NAST), Lalitpur, Nepal.

Roost search: Roosts were surveyed for bats and indirect evidence such as bat guano. Bats were captured carefully with gloved hands occasionally and mostly using hand-held scoop nets (Collins, 2016).

- **Acoustic survey**



Figure 4: Ultrasonic detectors; SongMeter Minibat (left) and EchoMeter Touch 2 Pro (right)

Ultrasonic detectors: An active detector EchoMeter Touch 2 Pro for iOS (Figure 4) was used to detect the presence of bats at probable sites and recorded bat echolocation calls during handheld and release. Echolocation calls were also recorded using passive recorders, i.e., one to two Song Meter Mini Bats (Figure 4).

Echolocation call analysis: Kaleidoscope 5.4.8 (Wildlife Acoustics Inc., USA) was used to analyze echolocation calls and assess bat activity (Collins, 2016). There is no Auto-ID classifier for bat calls in Nepal, so all calls need to manually analyzed.

- **Scheduled survey**

Semi-structured questionnaires were prepared and filled during the scheduled survey amongst respondents that are 18 years old and above (volunteer-based or chosen opportunistically). Consent of the respondents was taken beforehand. Especially, people living nearby bat roosts were surveyed.

- **Community outreach**

Bat conservation awareness activities were conducted that included lectures, documentary shows, open art competition, fun quiz in schools, community workshops, distribution of conservation posters (Figure 30), stickers (Figure 31), informal interaction with the local communities and formation of school and youth bat clubs. The school bat clubs also carried out at least one awareness activity such as essay competition, or poem competition or poster information sharing in their respective schools. The youth bat clubs, however, were engaged in a couple of evening bat surveys and demonstrated how a bat survey was done. At least one meeting was organized with school and youth bat clubs and had a discussion on how they shared their learning with others around them and about any new bat sightings.

An information board was prepared that contains information on the importance of bats and their habitats along with the bat species recorded in the area through this study. It has been installed along Tamakoshi River in Jagat village on the roadside in coordination with the locals and concerned authorities.

- **Sharing workshop**

A sharing workshop was conducted with the objective of disseminating the findings of the project till date and interact with the participants for their comments and feedback. Participants included the officials of GCA, local government bodies, members of Community Forest User Groups (CFUGs), Conservation Area Management Committee (CAMC), teachers and members of the school bat clubs, youth bat club members and local people.



## 5. Results

### 5.1 Bat species diversity

Bats were surveyed in 35 different sampling sites along the Tamakoshi river corridor in Dolakha and Ramechhap districts. Different types of habitats/roosts included caves, trees, manmade structures and water sources (Figures 6, 7 & 8). However, bats were captured from 15 of those sites, while low to moderate bat activity was observed from the remaining sites. Mist netting was done in most of the sites and we located five bat roosts (Table 1). Survey was highly affected by unfavorable weather, remoteness and lack of transportation throughout the project period.

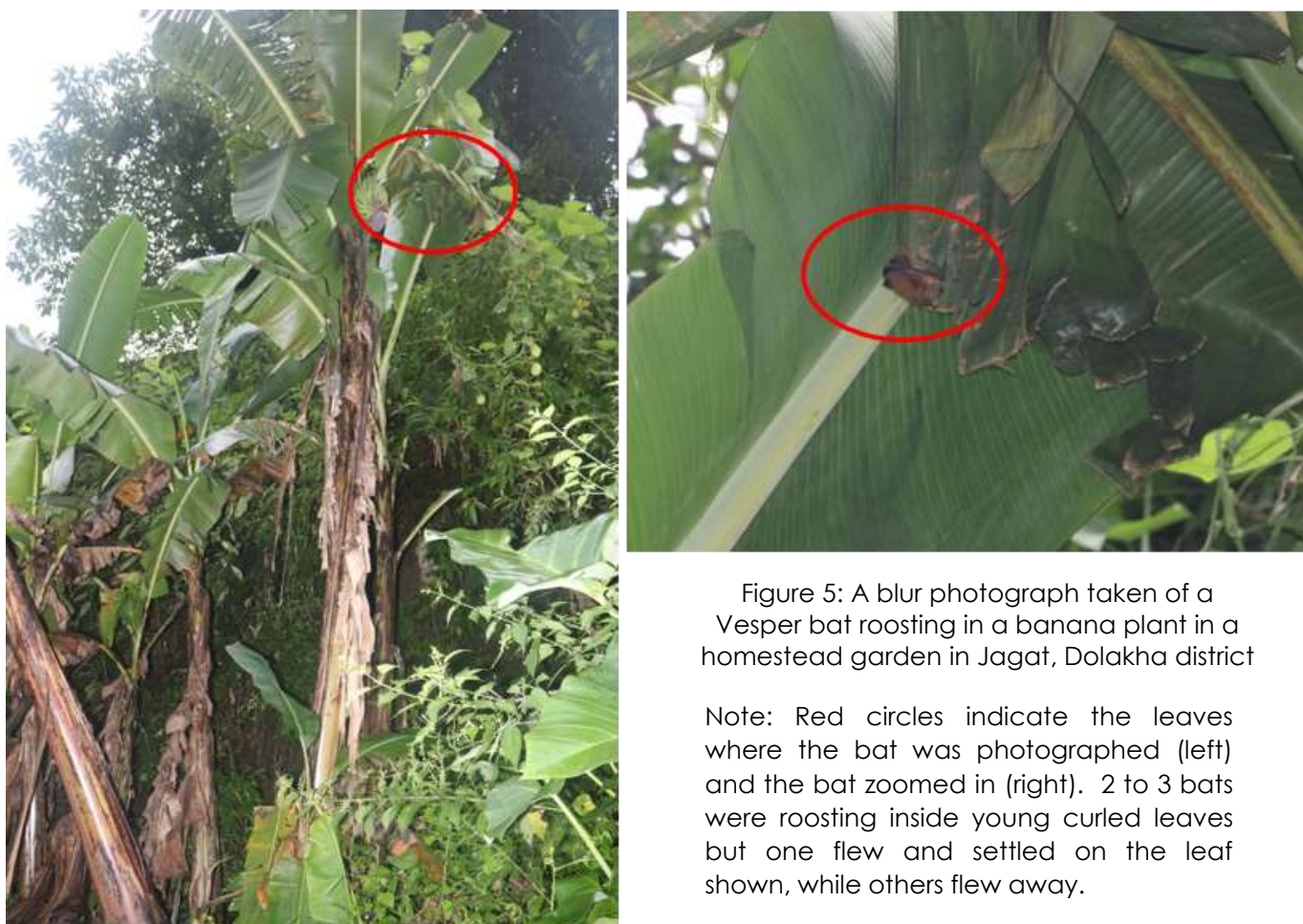


Figure 5: A blur photograph taken of a Vesper bat roosting in a banana plant in a homestead garden in Jagat, Dolakha district

Note: Red circles indicate the leaves where the bat was photographed (left) and the bat zoomed in (right). 2 to 3 bats were roosting inside young curled leaves but one flew and settled on the leaf shown, while others flew away.

Table 1: Bat roosts searched in June, July and December 2022 and April 2023

(Note: Hip. arm.: *Hipposideros armiger*, Hip. gen.: *Hipposideros gentilis*, Rh. fer.: *Rhinolophus ferrumequinum*, Rh. sin: *Rhinolophus sinicus*, Rh. pe.: *Rhinolophus pearsonii*, Cy. sp.: *Cynopterus sphinx*, Ly. Ly: *Lyroderma lyra*, NA: Not surveyed)

Location name	Roost type	Elev. (masl)	Sp. name	No. of inds.				Remarks
				Jun	Sept	Dec	Apr	
Suri Dobhan	Hydropower testing tunnel	1009	Hip. arm., Hip. gen.	20 to 25	20 to 25	7 to 8	NA	500 m deep tunnel as per the locals, however could access only 50 m as water inside got deeper and deeper ahead. So, more bats could be potentially roosting in the deeper parts. Water also seeped through its walls and ceiling. It was on the bank of Tamakoshi River, below the vehicle road. A dead juvenile <i>H. gentilis</i> was found on the floor in June 2022. A Songmeter Mini bat also recorded a <i>Rhinolophus</i> species inside the tunnel with peak frequency (Fppeak or FME) at 99.58 kHz on 7 <sup>th</sup> December 2022.
Hariyo daha cave	Cave	2352	Rh. fer.	NA	40 to 50	Nil	20 to 25	A small cave system on the rocky side of a hill with two different sections - one of which is just 6m deep and 3m high, while the other one is huge with a very narrow entrance (need to crawl) and a bigger interior and few stalagmite features – had 3 to 4 big and small compartments. The cave system was wet in September and dry in December and April. Our acoustic detector also recorded few calls of other <i>Rhinolophus</i> species with FME at 84.45 kHz during cave search on 21 <sup>st</sup> September 2022.
Rupthang cave	Cave	2241	Rh. sin, Rh. pe.	NA	NA	Nil	20 to 25	An underground cave with a steep and slippery vertical entrance inside forest. There were no bats in December but guano pile was present on the floor.
Jagat banana plants	Tree/plant	1150	Cy. sp.	NA	1 to 7	Nil	Nil	Evidence of bats roosting on banana leaves was found in the area. Three banana plants had bats roosting on them during the day – two had one and seven individuals of <i>C. sphinx</i> each under the midrib of the leaves. The other one had 2 to 3 individuals of a vespertilionid bat roosting inside its young curled leaves. However, it could not be captured (Figure 5).
Charnawati temple	Manmade structure	871	Ly. ly	NA	3 to 4	3 to 4	Nil	A Shiva temple in a small human settlement at the confluence of Tamakoshi river and Charange river (or Charnwati river). Bats were using it as night roost. The call of <i>H. armiger</i> was also recorded from 23:49-23:52 hrs inside the temple, on the same night as <i>L. lyra</i> .



Figure 6: Habitat types surveyed I

(Left: A small artificial pond in a private agricultural land; Right: A small garden having banana, guava, coffee plants; on the bottom right corner – Unripe coffee fruits on the plant)





Figure 7: Habitat types surveyed II

(A: Hariyo daha cave, B: Singati river; C: Hydropower testing tunnel, D: Siprin river meeting Tamakoshi River, E: A pool made by Khani khola stream, F: A small stream flowing through an open grazing area into the Tamakoshi River)





Figure 8: Habitat types surveyed III

(A: Khahare stream, B: Buffalo shed, C: Shiva temple, D: Banana plant - Red circle shows chewed midrib of banana leaves as an evidence of bats using it as a roost, E: *R. luctus* observed roosting on a *Ficus bengalensis* tree for sometime, F: Bridge over Bhattauli river on the side of agricultural fields and haypiles)



Altogether, 14 species of bats were recorded during this study (Figures 9 &10; Table 2). However, we were unable to locate our focus species *Myotis formosus* during the whole study period.

Table 2: Bats recorded throughout the study period  
(Note: '( )' indicate the number of individuals measured; N = Number of individuals captured/observed)

SN	Species name	Family	N	Method used	Habitat type	Forearm (FA in mm)
1	<i>Cynopterus sphinx</i>	Pteropodidae	15	Direct observation, Mist net	Banana leaves, fruit garden	63.80±3.32 (8)
2	<i>Lyroderma lyra</i>	Megadermatidae	3	Mist net	Temple in the forest edge in a small human settlement besides a river	67.29±1.46 (3)
3	<i>Rhinolophus ferrumequinum</i>	Rhinolophidae	5	Roost search, direct capture	Cave inside forest	60.87±1.92 (5)
4	<i>Rhinolophus lepidus</i>	Rhinolophidae	4	Mist net	River with huge rocky cliffs nearby human inhabited area	38.22 ± 1.18 (4)
5	<i>Rhinolophus luctus</i>	Rhinolophidae	1	Direct observation	Small human settlement with huge fig trees and old abandoned thatched houses	NA
6	<i>Rhinolophus pearsonii</i>	Rhinolophidae	1	Roost search, direct capture	Cave inside forest	55.05 (1)
7	<i>Rhinolophus sinicus</i>	Rhinolophidae	2	Roost search, direct capture	Cave inside forest	48.49±0.29 (2)
8	<i>Hipposideros armiger</i>	Hipposideridae	5	Roost search, scoop net, harp trap	Hydropower testing tunnel	91.9±2.35 (5)
9	<i>Hipposideros gentilis</i>	Hipposideridae	2	Roost search, scoop net	Hydropower testing tunnel	41.04±0.91 (2)
10	<i>Barbastella darjeelingensis</i>	Vespertilionidae	1	Mist net	Open grassland with small stream on the bank of Tamakoshi River nearby human settlement	40.33 (1)
11	<i>Eptesicus serotinus</i>	Vespertilionidae	1	Mist net	A smaller river with huge rocky cliffs flowing into Tamakoshi River	51.28 (1)
12	<i>Pipistrellus javanicus</i>	Vespertilionidae	2	Mist net	A smaller river with huge rocky cliffs flowing into Tamakoshi River; a small artificial pond in an agricultural land	31.05±2.19 (2)
13	<i>Pipistrellus coromandra</i>	Vespertilionidae	1	Mist net	Small pool of water formed by a flowing stream near roadside	31.03 (1)
14	<i>Vespertilio</i> sp.	Vespertilionidae	1	Mist net	A smaller river with huge rocky cliffs flowing into Tamakoshi River	47.84 (1)



Figure 9: Bat photo plates 1

(A: *Cynopterus sphinx*; B: *Lyroderma lyra*; C: *Rhinolophus ferrumequinum*; D: *Rhinolophus lepidus*;  
 E: *Rhinolophus luctus*; F: *Rhinolophus pearsonii*; G: *Rhinolophus sinicus*; H: *Hipposideros armiger*;  
 I: *Hipposideros gentilis*)

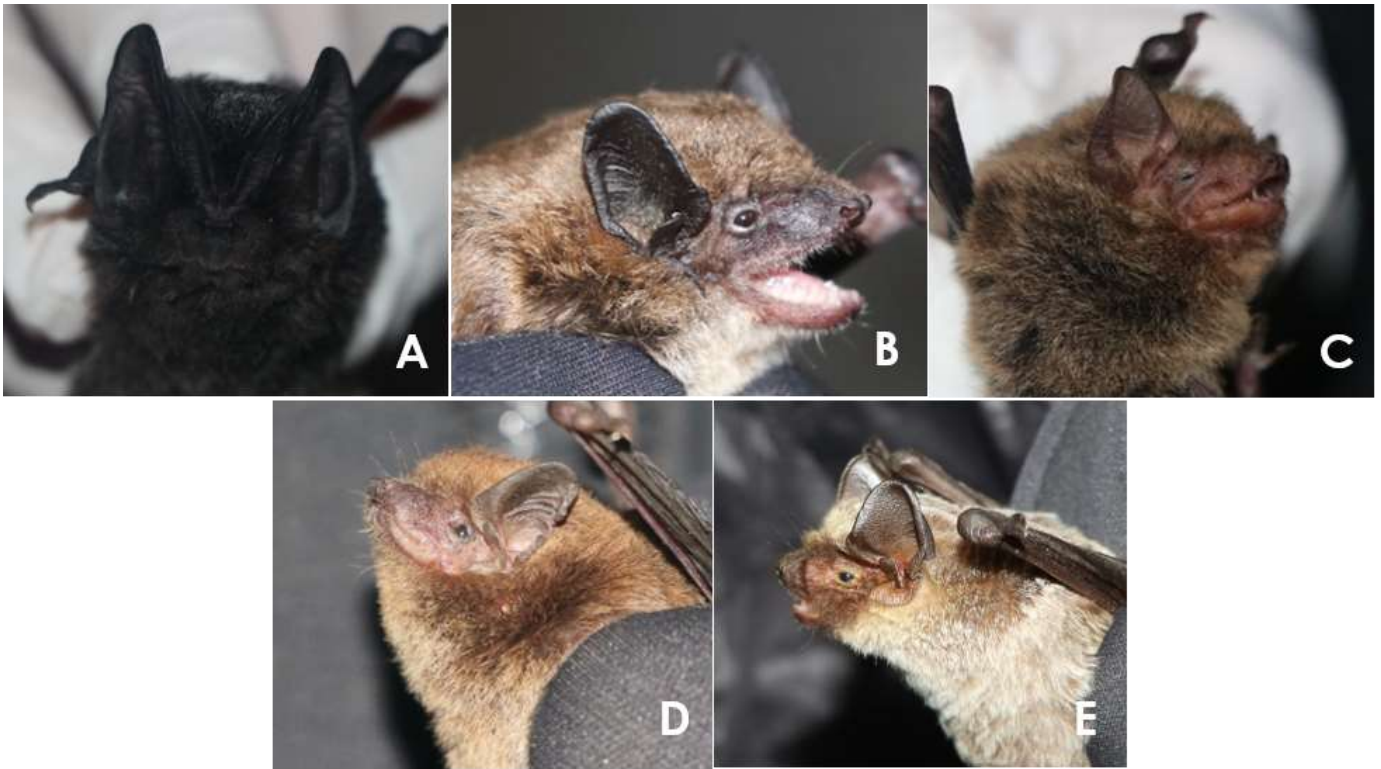


Figure 10: Bat photo plates 2

(A: *Barbastella darjeelingensis*; B: *Eptesicus serotinus*; C: *Pipistrellus javanicus*; D: *Pipistrellus coromandra*; E: *Vespertilio* sp.)

Among 14 bat species identified, *Vespertilio* sp. is a species new to Nepal (Figure 10). However, the species is yet to be confirmed through genetic analysis as it appears similar to both *V. sinensis* or *V. murinus* morphologically. This is the first ever record of *Vespertilio* sp. (or Parti-Colored Bat) in Nepal. One female individual was caught via mist net over Sipurin river. It had whitish grey or silver dorsal pelage.

There are two known species of Parti-colored Bats in the world – *Vespertilio sinensis* and *Vespertilio murinus*. The former species has a widespread distribution in East Asia that includes China, Mongolia, Japan, Taiwan and some parts of south east Russia, in forests, wetlands, rocky cliffs and mountain area, caves and subterranean habitats (Fukui et al., 2019). The latter, on the other hand, has been recorded from the northern Palaearctic region, extending from France, Britain and the Netherlands through central, northern and eastern Europe and Siberia to the Pacific coast (Coroiu, 2016). This species also tends to use similar habitats to that of *V. sinensis*. Both the species have been listed as Least Concern in the IUCN Red List of Threatened Species (Coroiu, 2016; Fukui et al., 2019).

In addition, we had also captured seven individuals of Pipistrelle bats that could not be identified morphologically. So, genetic confirmations of these are also needed.

## 5.2 Acoustic survey

Echolocation calls of captured bat species were recorded (Figure 11, 12, 13 & 14; Table 3). However, *C. sphinx* is a fruit bat, so does not echolocate. Unfortunately, we lost all the call recordings of *R. luctus*.

Table 3: Echolocation call parameters of identified bat species along the Tamakoshi River Corridor

(Note: Fstart = start frequency; Fend = end frequency; FME = frequency with maximum energy; FM = frequency modulation; QCF = quasi-constant frequency; CF = constant frequency; iFM = initial frequency modulation; tFM = terminal frequency modulation; '( )' indicates the number of pulses analyzed)

Species	Recording condition	Call structure	FME (kHz)	Fmax (kHz)	Fmin (kHz)	Bandwidth (kHz)	Fstart (kHz)	Fend (kHz)	Duration (ms)
<i>Cynopterus sphinx</i>	-	-	-	-	-	-	-	-	-
	Handheld (3)	Multi-harmonic FM	42.27 ± 3.04	110.14 ± 2.01	15.76 ± 0.64	94.38 ± 2.5	106.24 ± 1.47	20.4 ± 0.32	1.17 ± 0.14
<i>Lyroderma lyra</i>	Inside roost (3)	Multi-harmonic FM	58.76 ± 0.11	106.76 ± 0.83	15.04 ± 0.31	91.71 ± 1.13	102.23 ± 2.37	19.21 ± 0.83	2.82 ± 0.25
<i>Rhinolophus ferrumequinum</i>	Hand release (3)	iFM-CF-tFM	72.16 ± 0.03	75.5 ± 0.11	58.19 ± 1.03	17.31 ± 1.03	69.06 ± 1.36	62 ± 3.19	55.92 ± 1.91
	Inside roost (5)	iFM-CF-tFM	71.73 ± 0.01	74.57 ± 0.07	58.87 ± 1.15	15.69 ± 1.2	67.08 ± 1.5	63.09 ± 0.82	53.05 ± 10.78
<i>Rhinolophus lepidus</i>	Hand release (4)	iFM-CF-tFM	102.21 ± 0.11	106.34 ± 0.36	77.73 ± 1.01	28.62 ± 1.12	93.66 ± 4.26	80.33 ± 1.35	31.66 ± 3.51
	Handheld (4)	iFM-CF-tFM	99.87 ± 0.06	103.73 ± 0.23	74.04 ± 3.01	29.69 ± 3.08	91.68 ± 6.96	76.24 ± 2.84	24.63 ± 3.12
<i>Rhinolophus luctus</i>	-	iFM-CF-tFM	-	-	-	-	-	-	-
<i>Rhinolophus pearsonii</i>	Handheld (4)	iFM-CF-tFM	59.48 ± 0.01	63.7 ± 0.46	42.22 ± 1.12	21.48 ± 0.66	50.92 ± 1.58	45.85 ± 1.68	38.33 ± 1.38
<i>Rhinolophus sinicus</i>	Handheld (3)	iFM-CF-tFM	83.24 ± 0.02	87.33 ± 0.17	61.54 ± 0.36	25.78 ± 0.27	75.89 ± 6.72	66.09 ± 1	41.83 ± 13.95
<i>Hipposideros armiger</i>	Inside tunnel (3)	CF-tFM	68.88 ± 0.02	68.88 ± 0.02	68.88 ± 0.02	68.88 ± 0.02	68.88 ± 0.02	68.88 ± 0.02	68.88 ± 0.02
	Handheld (3)	CF-tFM	67.89 ± 0.03	71.85 ± 0.13	55.73 ± 0.91	16.13 ± 1.01	68.33 ± 0.52	59.25 ± 0.91	11.53 ± 1
<i>Hipposideros gentilis</i>	Inside roost (3)	CF-tFM	118.08 ± 0.05	120.45 ± 0.28	99.83 ± 0.21	20.61 ± 0.32	118.32 ± 0.28	101.78 ± 0.66	7.61 ± 0.11
<i>Barbastella darjeelingensis</i>	Hand release (4)	Alternating FM	23.02 ± 0.52	84.39 ± 4.62	18.62 ± 0.38	65.77 ± 4.9	44.23 ± 0.93	23.05 ± 0.27	3.66 ± 0.21
<i>Eptesicus serotinus</i>	Handheld (4)	FM	32.74 ± 1.39	117.94 ± 1.41	19.63 ± 0.85	98.3 ± 1.9	54.38 ± 2.62	25 ± 2.46	2.62 ± 0.08
<i>Pipistrellus javanicus</i>	Hand release (3)	FM	56.64 ± 0.38	112.52 ± 1.12	34.94 ± 0.93	77.58 ± 1.24	79.01 ± 2.69	41.57 ± 4.03	2.07 ± 0.11
<i>Pipistrellus coromandra</i>	Hand release (3)	FM	47.88 ± 1.06	109.85 ± 1.57	37.21 ± 0.28	72.64 ± 1.29	72.96 ± 1.49	43.55 ± 0.28	2.24 ± 0.37
<i>Vespertilio</i> sp.	Handheld (2)	Multi-harmonic FM	49.53 ± 3.3	71.3 ± 3.73	9.55 ± 0.86	61.75 ± 4.6	68.25 ± 0.57	12.59 ± 0.57	11.19 ± 0.27



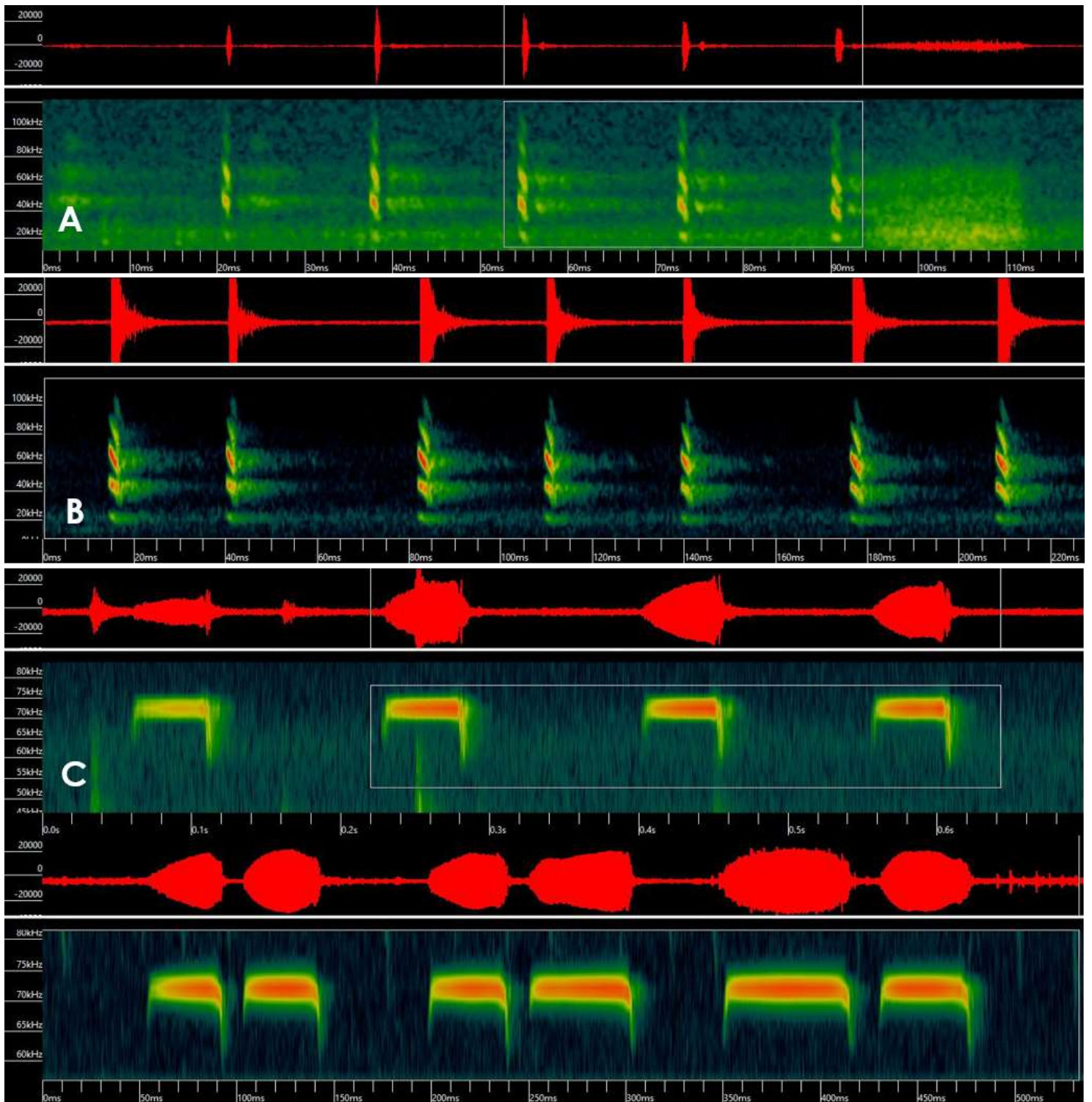


Figure 11: Echolocation calls recorded I

(A – *L. lyra* while handheld; B – *L. lyra* inside roost; C – *R. ferrumequinum* during hand release;  
 D – *R. ferrumequinum* inside roost)



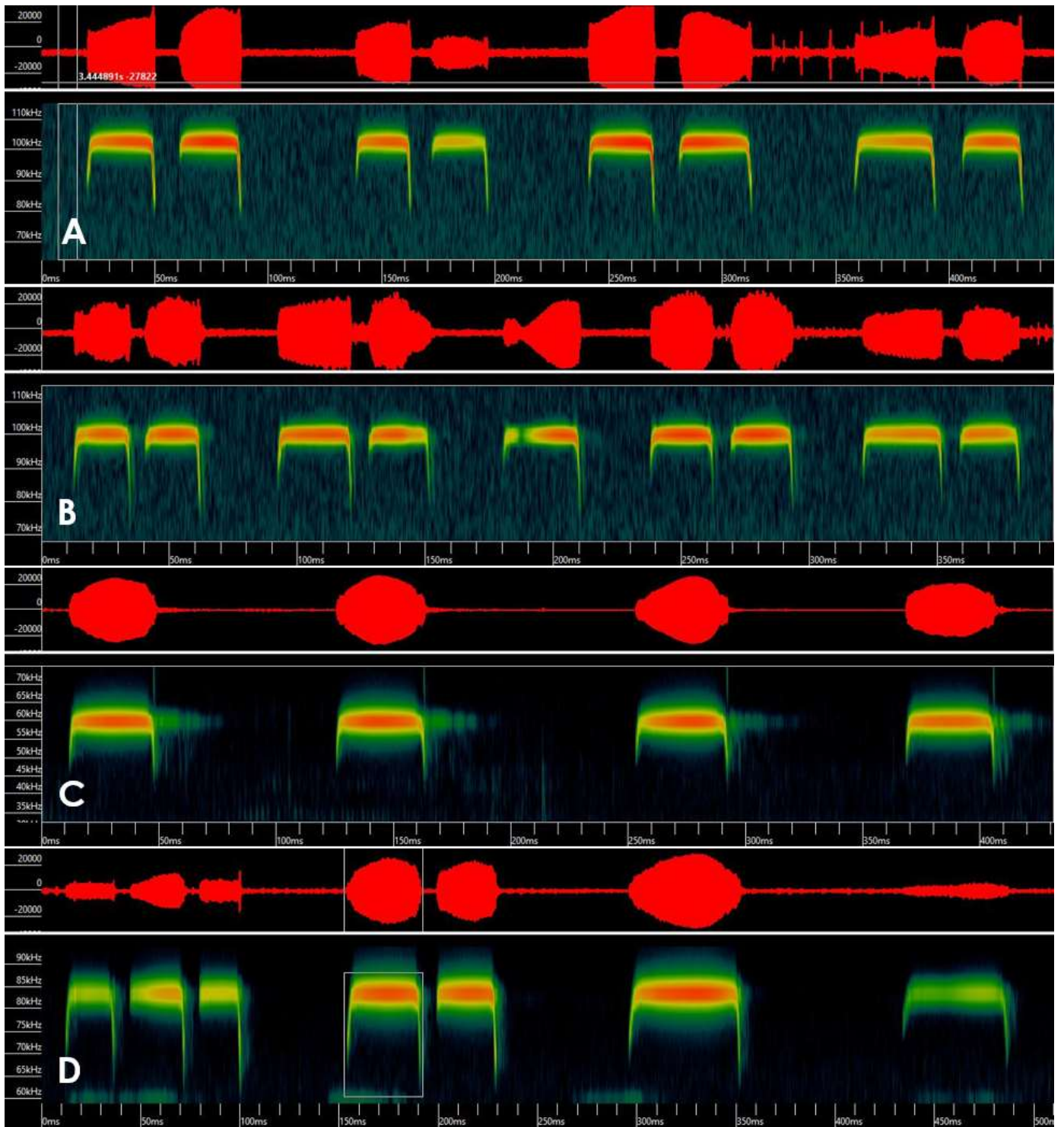


Figure 12: Echolocation calls recorded II

(A – *R. lepidus* during hand release; B – *R. lepidus* while handheld; C – *R. pearsonii* while handheld; D – *R. sinicus* while handheld)

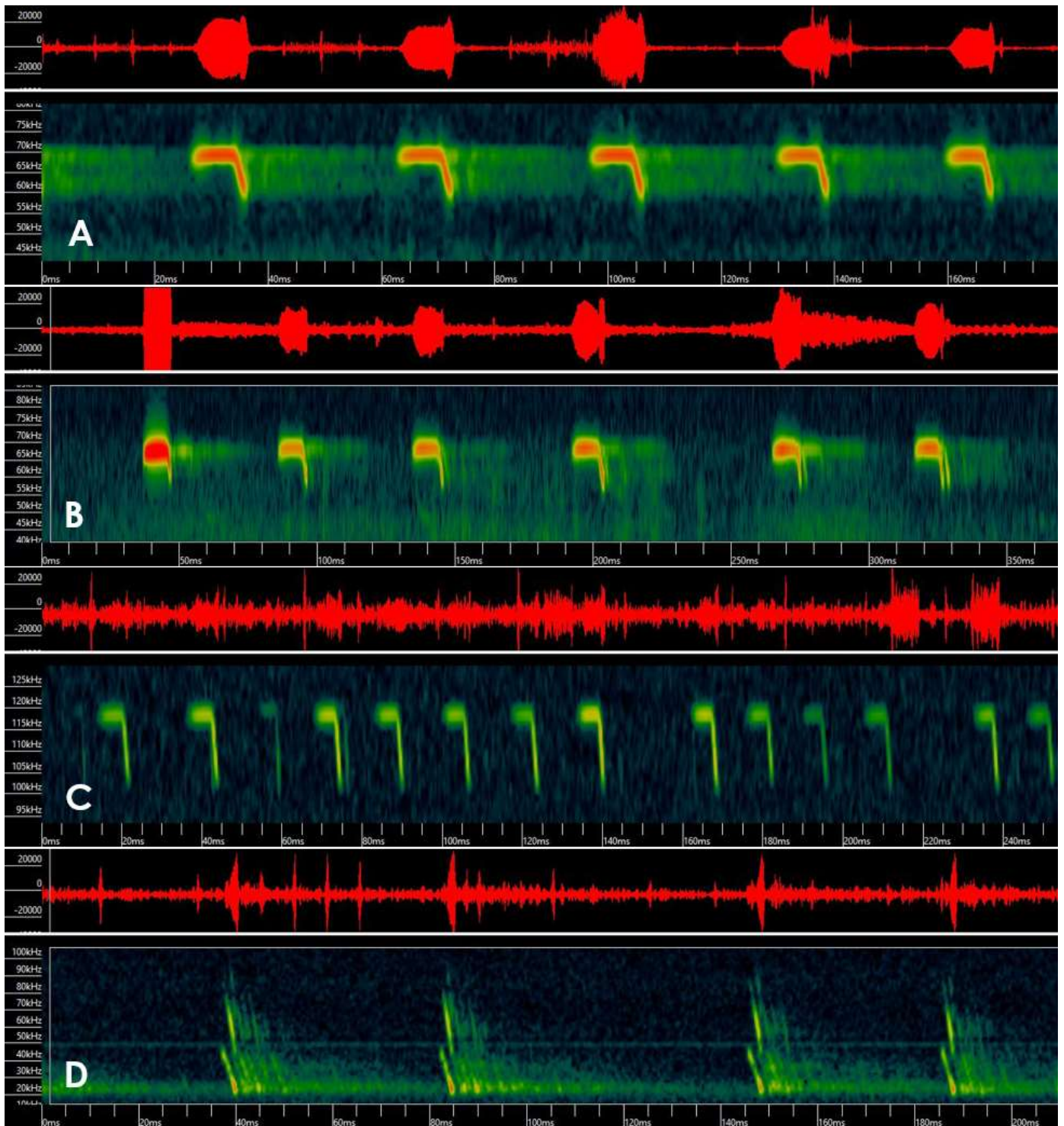


Figure 13: Echolocation calls recorded III

(A – *H. armiger* inside roost; B – *H. armiger* while handheld; C – *H. gentilis* inside roost; D – *B. darjeelingensis* during hand release)



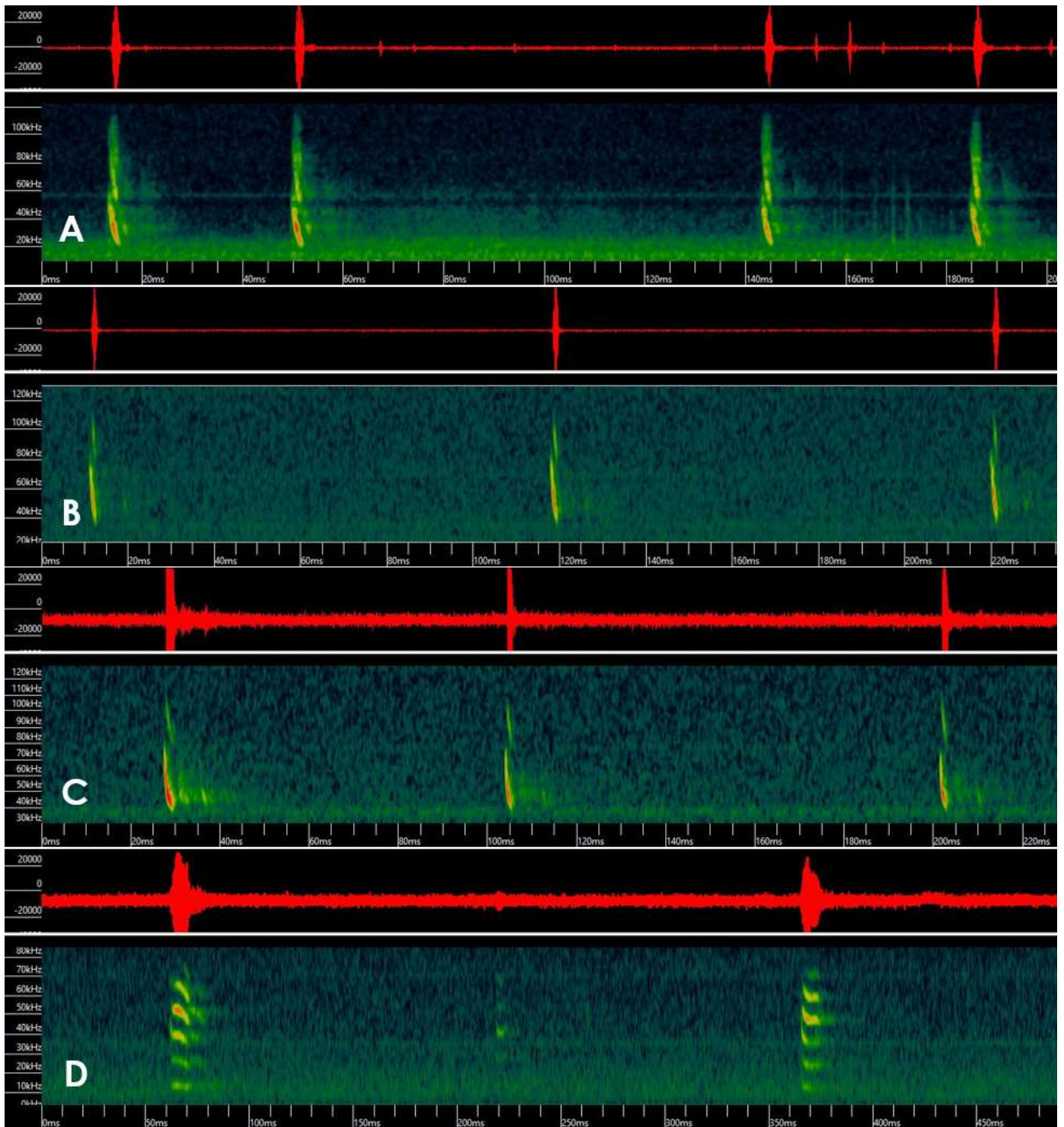


Figure 14: Echolocation calls recorded IV

(A – *E. serotinus* while handheld; B – *P. javanicus* during hand release; C – *P. coromandra* during hand release; D – *Vespertilio* sp. while handheld)

In addition, other bat species have also been recorded using the ultrasonic recorders at mist netting sites during free flying condition, potentially *Tadarida* sp., *Myotis* sp., *Submyotodon* sp., *Pipistrellus* sp., *Nyctalus* sp., etc, however, these species could not be captured.

### 5.3 Scheduled survey

#### Pre-project

A semi-structured questionnaire survey was carried out during the first phase of the project to assess the perception of local towards bats in their area and the level of basic knowledge and importance of bats. Total of 50 people were interviewed nearby sampling sites (Figure 18) belonging to different ethnicities such as Tamang, Sherpa, Newar, Brahmin and Chhetri.

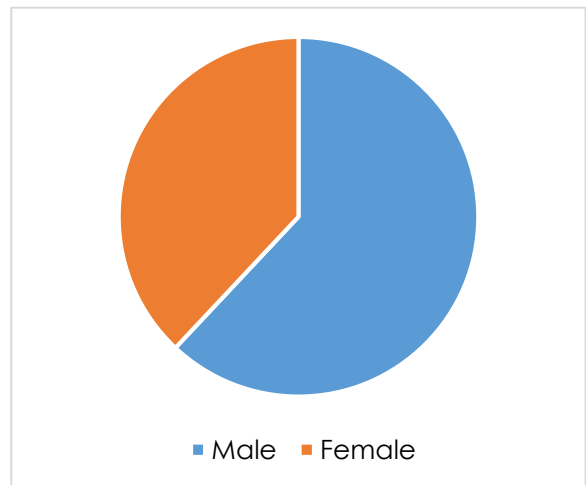


Figure 15: Gender of the respondents

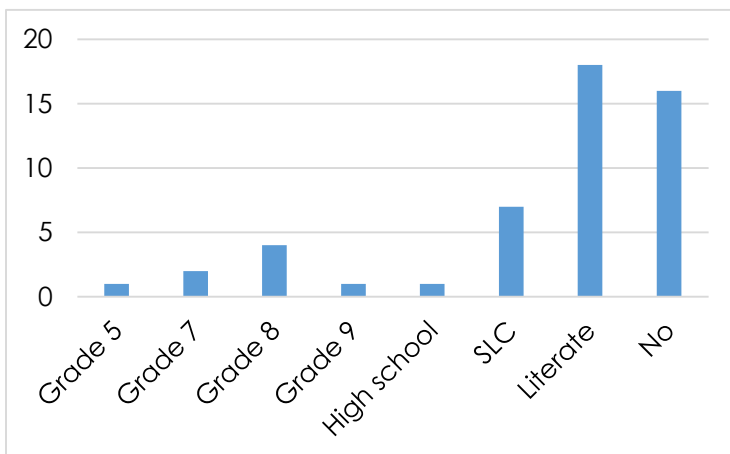


Figure 16: Education level of the respondents

Majority of the respondents were male (Figure 15). More than 30% had at least primary level education, while 36% of them were literate (Figure 16). More than 50% of the respondents were farmers (Figure 17).

More than 90% of them had seen bats in the area. However, most of them knew nothing about bats and their importance. Some people even mentioned that bat sightings have become rare in the recent times due to unknown reasons and agreed that bat population has been decreasing.

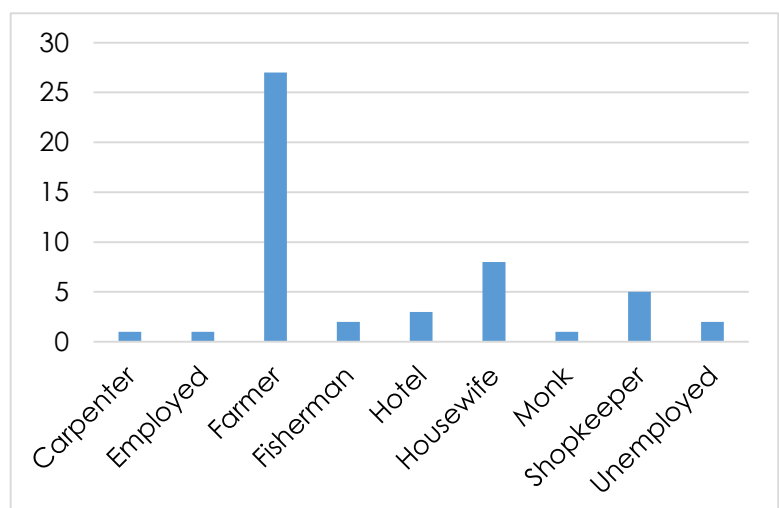


Figure 17: Occupation of the respondents





Figure 18: Scheduled survey being carried out by Ms. Sabina Koirala

### Post-project

Based on this information, awareness programs were conducted during the next phases. We also carried out post-project scheduled survey towards the end using the same semi-structured questionnaire used at the beginning of the project with 59 people. This was done to know if there was any change in the knowledge and perception of the locals about bats at the end of this project.

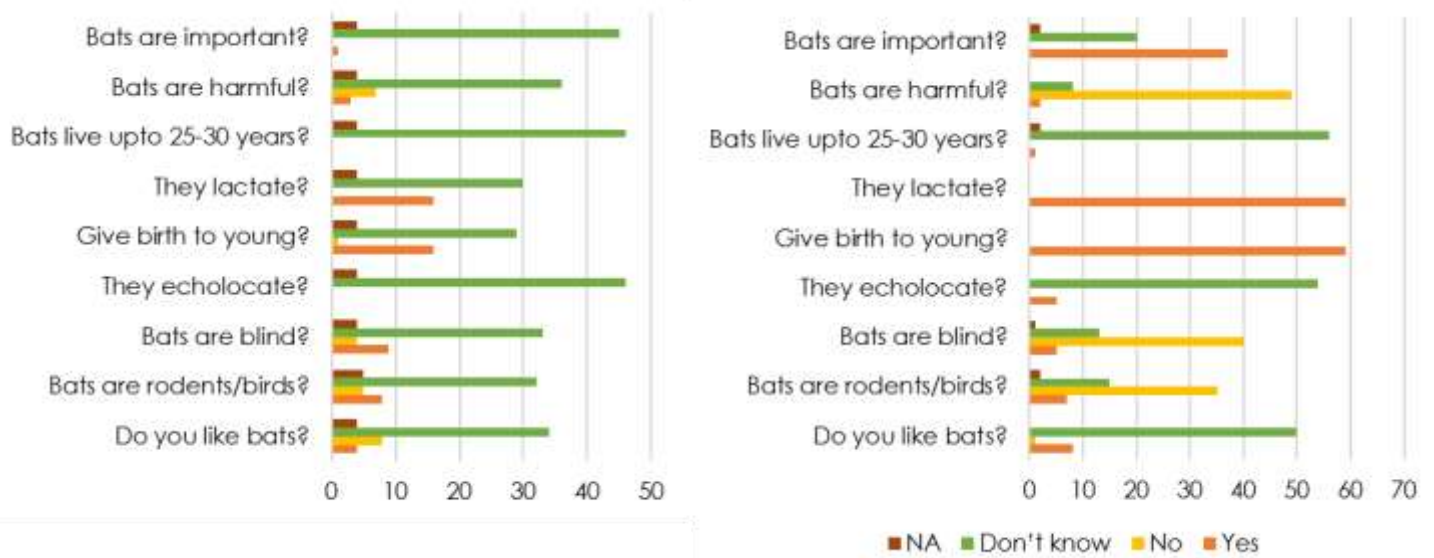


Figure 19: Knowledge and perception of respondents at the beginning (left) and end (right) of the project

The results showed that there was a significant positive change in the knowledge and perception of the locals due to the project (Figure 19).

## 5.4 Bat conservation awareness

### 5.4.1 Outreach programs

Through the pre-project scheduled survey, we had found that even though majority people had seen bats but knew nothing about them and their importance. People also pointed out the fact that bat sightings have become rare, and perhaps the bat population has decreased. Based on these findings, we conducted various outreach activities in schools (Table 4) and communities to increase the level of awareness about the role of bats in maintaining the ecosystems, benefit to humans while trying to mitigate the negative attitude towards bats among youth and school children.

#### 5.4.1.1 Awareness and outreach activities in schools

Table 4: List of schools where outreach program was conducted

SN	Name of the School	Type	Number of classes run by the school
1	Kalinag Higher Secondary School, Singati	Govt.	Up to grade 12
2	Shree Gaurishankar Secondary School, Jagat	Govt.	Up to grade 10
3	Gaurishankar International Academy, Singati	Private	Up to grade 7
4	Basnet Academy English Boarding School, Singati	Private	Up to grade 8
5	Shree Tashi Chhime Gastal Basic School, Bigu	Run by monastery	Up to grade 7
6	Shree Gaurishankar Secondary School, Bigu	Govt.	Up to grade 10
7	Shree Himalayan Region Welfare English School, Bigu	Private	Up to grade 5
8	Vidyashram Basic School, Manthali	Govt.	Up to grade 8
9	Shree Bhimeshwor Rudra Secondary School, Manthali	Govt.	Up to grade 12
10	Karkaladevi English Boarding Secondary School, Manthali	Private	Up to grade 10
11	Shree Tamakoshi Janajagriti Secondary School, Khimti	Govt.	Up to grade 12

School children of grade six to eight were targeted for outreach activities, however, only grades six and seven were included for the lower-secondary schools that taught till grade seven. The program included an interactive 30-minutes lecture followed by a 30-minutes documentary “Secret world of Bats” about bats, their importance, threats and ways to protect them (Figure 20). We shortly verbally disseminated the message from the documentary in Nepali language as the documentary was in English. A short discussion session and fun bat quiz was conducted at the end. One student from Basnet Academy English Boarding School asked “How can we convince our parents, elders and others to not harm bats when they see bats feeding on their banana and other fruits?” It was indeed

wonderful to see young children be fascinated by bats and be willing to protect them.



Figure 20: Lecture and documentary session in Kalinag Higher Secondary School, Singati

### Questions asked during Bat Quiz

1. Bats belong to what family or group - Mammals, Birds, Insects, Reptiles?
2. The largest bat in the world is the size of a?
3. World's smallest bat is the size of a?
4. Give two advantages of bats.
5. What is the process by which bats disperse seeds of plants called?
6. What is the process by which bats aid plants to produce fruits called?
7. How many mosquitoes can one bat eat per night?
8. What do bats eat? Any three.
9. How many species of bats are found in the world?
10. How many species of bats are found in Nepal?
11. How many species of vampire bats are found in the world?
12. Vampire bats are found in?
13. How long do bats generally live for?
14. How many pups does a bat give birth at a time?
15. A group of bats is called: a bat group, a winged troop, a colony
16. What is the name of the process that bats use to find their prey in the dark?
17. The world's smallest bat is from Thailand. What is it called?
18. What is the world's largest bat called?
19. What places do bats live? Any three.

The total number of school children in grade six-eight varied from 20 to 150 individuals (male and female 50-50 approx.) in each school. We found that government schools had the largest number of students than private schools probably due to the nominal fee and better and equipped infrastructure such as buildings, classrooms and playground in government managed schools. We were also informed that the quality of education in government schools has improved since the past.

### 5.4.1.2 Awareness and outreach activities in communities



Figure 21: Talking with a local about bats and their roosts

We distributed posters and interacted with the locals about anything they knew about bats (Figure 21). We were able to conduct four community outreach sessions in Jagat, Bhorle, Bigu villages and Khimti (Figure 22). It involved a short lecture, open group discussion, documentary show and distribution of bat conservation materials such as posters and stickers. The people who gathered, enthusiastically took part in the program and interacted about bats and their importance. The participants expressed their happiness about getting to learn so much about bats and were so amazed by the fact that these small species played a huge role in nature.

#### Questions asked by the participants in the discussion session:

1. How many kinds of bats are found in the world?
2. How do bats look like from up close?
3. What kind of places does a bat like to live?
4. What kind of nest does a bat make?
5. How does a bat hang upside down?
6. Are bats birds or rodents?
7. How many babies does a bat give birth to at a time?
8. Is it true that bat meat can be used as medicine for treating urinary problem in cattle 'Laumutta' (Babesiosis)?
9. Is it true that bats spread COVID 19 in humans?
10. Do bats drink blood?
11. What animals hunt bats?
12. How can we help to protect bats?



The most important question in most of these sessions was about the relationship between bats and COVID-19. The participants were curious that if bats were actually responsible for the spread of this disease. Our team tried its best to tackle the questions/misconceptions/misinformation of the participants. Through the discussion, we found that some people still believed that bat meat could be used to cure Babesiosis "*Laumutta*" in cattle. Also, participants mentioned that some had seen bats living in bamboo of the bamboo thatched houses and one had seen a couple of bats roosting inside old shoes hung on the entrance of houses (to ward off the evil eye) a very long time ago.



Figure 22: Community outreach in Khimti, Ramechhap district

## 5.4.2 Bat club formation

### 5.4.2.1 School Bat Clubs

In coordination with the school management, we formed altogether nine school bat clubs each including school children from grade six to eight/seven as per their interest in nine schools (Table 5).

Table 5: School Bat Clubs formed

SN	Name of the School	School children of grade involved	Number of members
1	Kalinag Higher Secondary School Bat Club, Singati	6-8	13
2	Shree Gaurishankar Secondary School Bat Club, Jagat	6-8	10
3	Gaurishankar International Academy Bat Club, Singati	6-7	9
4	Basnet Academy English Boarding School Bat Club, Singati	6-8	10
5	Shree Gaurishankar Secondary School Bat Club, Bigu	6-7	10
6	Vidyashram Basic School Bat Club, Manthali	6-8	10
7	Shree Bhimeshwor Rudra Secondary School Bat Club, Manthali	6-8	10
8	Karkaladevi English Boarding Secondary School Bat Club, Manthali	6-7	10
9	Shree Tamakoshi Janajagriti Secondary School Bat Club, Khimti	6-8	10

Soon after bat clubs were formed, the members were delivered information on bat club management and activities the club needed to do. Open art competition was conducted within the members of each bat club where they drew bats or anything relating to them. Necessary materials such as art paper, pencil, crayon colors, etc. was provided to them. The session was followed by bat origami making where Varsha Rai and Prahesh Chalise demonstrated and the club members followed. Towards the end, a winner was announced for the Open Art Competition who was awarded with a gift hamper that included educational materials such as a notebook, pen, pencil, posters, stickers, etc. At the end of the two-hours program, we conducted a fun quiz about bats. A teacher from respective school was assigned to each school bat club to mentor the bat club members to conduct club activities. The bat clubs were presented with some stationery and booklets on

conservation of different animals by Small Mammals Conservation and Research Foundation (SMCRF) along with 20 bat conservation posters and 20 stickers each.

Quarterly bat club meetings were also conducted in their respective schools (Figure 23). Stationeries such as an attendance register, diaries, pen, pencil, etc. and conservation materials that included several conservation posters and booklets were also distributed to the clubs.



Figure 23: Kalinag Secondary School Bat Club Meeting

Agenda of the meeting was to discuss the following:

1. How did the perception of the club members change towards bats?
2. How should we handle and rescue bats, if necessary?
3. Whom did they share their learnings with?
4. Any roosts or bats observed?
5. How can the club members contribute for bat conservation?

Almost all the school bat club members were present in the meeting. Everyone was given an opportunity to speak of themselves. The members shared that they were no more afraid of bats and realized the importance of bats in nature and that bats should be protected. We were glad that they remembered that bats help in pollination, seed dispersal and controlling harmful insects and agricultural pests. We reminded them that bats, if sick or found lying on the ground, should not be touched with bare hands, and should be picked up with gloved hands and left on

a tree higher from the ground. In case of dead bats, they should be buried immediately as there is always a high risk of spread of zoonotic diseases if eaten by pet or feral animals. They informed us that they shared about the importance of bats with their parents, grandparents, visiting relatives, friends and even in their neighborhood. During the session, we also asked each member if they had seen bats or any roosts recently. Many had seen them in their homes flying in the evening, roosting under banana leaves while some had seen a bat hanging on a branch of a walnut tree in the evening, two bats hanging on a wire in front of the house, in caves and flying around school premises in the evening. The school club members suggested that they can help to conserve bats by conducting small outreach programmes and sharing what they knew personally with others. During the meeting, one of the members from the Basnet English Academy School Bat Club asked, "Are bats really the culprit for the spread of the coronavirus as people say?" We replied, "It is not yet proved that bats were responsible for the coronavirus outbreak. However, there is always a high risk of spread of zoonotic diseases from wildlife to humans and vice-versa, in case of unnecessary contact or mishandling. Same is true with our pet and domestic animals, too. We still do not know how exactly COVID-19 happened, but we can definitely say that such outbreak of diseases will lessen if humans learn to live in harmony with nature and be appreciative of what it has to offer. We, as researchers, have been working with bats for many years following strict protocols such that no animal is harmed and have not contracted any such disease till now. Thus, we should not fear bats, but learn and teach others to appreciate what bats do for us and let them be."

The school bat clubs also carried out at least one bat awareness activity such as essay competition, poem competition, speech competition and poster information sharing in their respective schools. Certificates were provided to the club members for their active participation in bat club activities. The winners of essay, poem and speech competitions were also provided with a porcelain mug that had a bat photo and the motto of bat conservation printed on it (Figure 32), as a token of appreciation.



### 5.4.2.2 Youth Bat Clubs



Figure 24: Youth Bat Club formation program in Jagat

Four youth clubs were formed during the project as per the interest of the locals (Figure 24; Table 6). We briefed the club members on their roles and activities need to be done.

The youth club members were mostly farmers by profession in Dolakha district while Manthali Youth Bat Club consists of enthusiastic youths who have been involved in environmental and social causes from time to time engaged in professions like teaching, business, civil service, etc. However, it was difficult for us to engage the members in bat walks in the evening to demonstrate bat survey in the field environment due to their other work commitments or rain.

Table 6: Youth Bat Clubs formed

SN	Youth Bat Club	Number of members
1	Jagat Youth Bat Club	4
2	Bhorle Youth Bat Club	10
3	Bigu Youth Bat Club	9
4	Manthali Youth Bat Club	6

We conducted meetings with our youth bat clubs, too. In Youth Bat Club meetings, the President and few of the members were present. Through the similar discussion with the Youth clubs, it was clear that our outreach sessions had a positive impact on the perception of the people towards bat conservation. The club members were happy and eager to help raise awareness in the smallest possible ways. The

club members are responsible to locate bat roosts in the area and also report us along with any bat related incidences during the project and afterwards. Sajana Thami from Bhorle Youth Bat Club mentioned that she had seen 5-6 bats emerge and fly from the young curled leaves of banana, while cutting the sick banana plant recently. The club members said that in the past they did not care if bats flew around or where they roosted, however, now they have started noticing bats.

### 5.4.3 Installation of information board

An information board standing 10 ft. tall with a UV print flex (7×4.5 sq. ft.; Figure 33) was installed at Jagat (Figure 25) along the Tamakoshi River on the roadside in GCA, Dolakha district on 30<sup>th</sup> May 2023 in the presence of Mr. Pramod Raj Regmi, the Natural Resource Conservation Assistant of GCA. The information board contains the list and photos of bat species recorded during this project along with the information on their importance and ways to protect them.



Figure 25: Pasting UV print flex on the metal board frame before installation with the help of locals

## 5.5 Sharing Workshop

During the final phase of the project, a sharing workshop was conducted for two-hours. This programme was organized at the premises of Shree Gaurishankar Secondary School in Jagat, Dolakha district in GCA on 31<sup>st</sup> May 2023. Altogether, 23 local people participated in the workshop (Table 8) including officials from GCA, local government bodies, members of Community Forest User Groups (CFUGs), Conservation Area Management Committee (CAMC), teachers and members from the school bat clubs, youth bat club members and other local stakeholders. The primary objective of this workshop was to disseminate the findings of the project till date and interact with the participants for their comments and feedback.



Figure 26: Ms. Varsha Rai during the sharing workshop

The workshop was moderated by Mr. Prahesh Chalise and was formally started by welcoming the Chair, Chief guest and other participants. Following that, Ms. Varsha Rai gave a power point presentation about the project, its challenges and results (Figure 26), followed by a discussion session (Table 7). The programme was chaired by Mr. Mem Bahadur Tamang, Chair of Ward-01, Bigu Rural Municipality.



Table 7: Questions asked or comments/suggestions made by the participants

SN	Participant's name and affiliation	Questions/comments/suggestions
1	Mem Bahadur Tamang, Bigu-1, Ward Chair	<ul style="list-style-type: none"> <li>We are appreciative of this very important work. And, we are hopeful and ready to directly collaborate in such studies from now on.</li> </ul>
2	Nimgyel Sherpa, Gaurishankar-9, Ward Chair	<ul style="list-style-type: none"> <li>We would like to thank you for this initiation. Prior to this, we did not know the importance of bats and how they looked from up close. But, now we know that bats have their own significance in nature and they directly or indirectly help humans. We will now definitely convey this message to conserve bats in our area.</li> <li>We would like also like to request you to involve us in the project so that we can provide you with the help you need for its effective implementation at local level.</li> </ul>
3	Hiramani Gautam, Principal, Shree Gaurishankar School Jagat	<ul style="list-style-type: none"> <li>Thank you so much for all the effort to document such neglected species in our area along with creating awareness about bat conservation. We are confident that our students have learnt a lot from you and our bat club members will continue to work for this cause.</li> <li>There are so many hydropower stations being operated or under construction in the area along the Tamakoshi River. So, in addition to documenting biodiversity, I would like to suggest you to also look into the impacts such developmental projects are having on the environment and wildlife.</li> </ul>
4	Pahalman Tamang, President, Conservation Area Management Committee (CAMC)	<ul style="list-style-type: none"> <li>We would like to thank you for letting us know about bats. They seem to be amazing, providing important services in nature helping humans. I have seen bats coming into our homes and in caves for as long as I can remember, however, their appearance has become rare these days. And, now we know why.</li> <li>There are a few potential bat caves that I have heard of, a little away from your current study area. These sites can be certainly explored in the future.</li> <li>We would like to suggest you to involve us in project fieldwork and mobilize our team, too, in the coming days.</li> </ul>
5	Basanta Basnet, Principal, Basnet English Academy School Singati	<ul style="list-style-type: none"> <li>Thank you so much for this commendable work. We are always ready to encourage and support researchers/students to carry out such work. The bat club that you have started at our school will keep working to spread this message of conservation in any small way possible.</li> </ul>

The programme formally ended with the closing remarks of our Programme Chair. The participants expressed their appreciation towards our initiative to carry out such work in the area. For them, this study was novel and they were amazed to learn about bats. They were surprised that bats were that important. They said that they will definitely share the learnings from this workshop and persuade others to protect bats. They suggested that we need to extend our study area as the caves that harbor bats are present in higher hills and slopes from the Tamakoshi River. They were excited to know that a bat species new to Nepal has been recorded in their area through this study. The participants expressed that they were motivated and were ready to collaborate in such projects in the future.

Token of appreciation (Figure 32) was handed over to our guests and participants along with the bat conservation posters and stickers. Before parting, we also visited the site where our information board was installed where Ms. Varsha Rai thanked everyone for their contribution towards this project.



Figure 27: Group photo with the local stakeholders after the sharing workshop in front of the information board

## 6. Human impacts on the Tamakoshi River

Other than hydropower project construction, other two major human activities impacting the ecosystem of Tamakoshi River were also observed such as Sand and gravel extraction, and bridge construction (Figure 28 & 29).



Figure 28: Sand and gravel extraction being done in Tamakoshi River near Tamakoshi Bajar, Dolakha district



Figure 29: Bridge construction on the Tamakoshi River in Manthali, Ramechhap district

## 7. Conclusion

Tamakoshi River Corridor is an important area for bat species diversity as this region remains unexplored for bats. Thus, it is very likely that we discover new bat species for Nepal in this region. However, we could not locate our focus species *M. formosus* during this project. Not much is known about its ecology, however, few studies have found that it is a foliage and cave roosting species. Along the Tamakoshi river corridor, almost no caves were present. As per the locals and our experience, such caves harboring bats were generally located far up in the mountains away from the Tamakoshi River corridor. Thus, it suggests that the next study should extend the search area looking for potential cave roosts for *M. formosus* and other bat species higher uphill above 2000 masl.

We found some positive change in the knowledge and perception the locals towards bats and their importance at the end of the project. However, it is unlikely that people's behavior or attitude towards bat conservation has changed in such a short period of time. Thus, outreach activities need to be conducted from time to time and collaboration with the local stakeholders for research and conservation is very important.



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# Appendices



Figure 30: Bat awareness poster prepared for the project in Nepali (left) and English language (right)



Figure 31: Bat conservation sticker prepared for the project



Figure 32: Porcelain mug prepared for the project with a photo of a bat (*Myotis formosus*) and conservation motto



**"स्वस्थ जनजीवन तथा पृथ्वीका लागि चमेरा र यसका बासस्थान जोगाऔं !"**

**तामाकोशी नदी क्षेत्रमा पाईने चमेराहरू**

लामाबगर (दोलखा) देखि मन्थली (रामेछाप) सम्म तामाकोशी नदी किनार क्षेत्रमा १२ प्रजातीका चमेराहरूको पहिचान भएको छ ।



*Cynopterus sphinx*  
नेटे चमेरो



*Lyroderma lyra*  
बाबुलो औंटे चमेरो



*Rhinolophus ferrumequinum*  
ठूलो घोइनाले चमेरो



*Rhinolophus lepidus*  
ब्लाइडको घोइनाले चमेरो



*Rhinolophus luctus*  
जुङ्गली घोइनाले चमेरो



*Rhinolophus pearsonii*  
पिचरसनको घोइनाले चमेरो



*Hipposideros armiger*  
ठूलो पातनाको चमेरो



*Hipposideros gentilis*  
ठूलो गोलपाटे चमेरो



*Barbastella darjeelingensis*  
शुङ्गिलिङ्गे चमेरो



*Eptesicus serotinus*  
ठूलो लागपुच्छे चमेरो



*Pipistrellus javanicus*  
ठूलो गौधुली चमेरो



*Pipistrellus coromandra*  
गौधुली चमेरो

**तपाईंलाई चमेराका बारेमा थाहा छ ?**

- एक मात्र उड्ने स्तनधारी
- संसारमा १४०० भन्दा बढी प्रजाती
- नेपालमा ५३ भन्दा बढी प्रजाती
- अँध्यारोमा उड्ने र छरि-छरण गर्ने
- मानिस जस्तै वर्षमा एउटा मात्र बच्चा जन्माउने

**चमेराको महत्त्व**

- परागरोचन
- कीरा फत्याइया नियन्त्रण
- बीज वितरण
- चमेरा पर्यावरण
- विद्या उत्कृष्ट प्राङ्गारिक मल

Photo credit: Varsha Rai, Prakash Chalise, Sanjan Thapa, Chien I oo/Minden Pictures, Bat Conservation International, Christian Ziegler/Minden Pictures, Bat Conservation International, Diemer Nill/oto Nature/Minden Pictures, Bat Conservation International.





पप बालकरीको सारि  
साना सानाघारी पानी बरक्षम तथा अडुबन्धन  
फाउन्डेसन (SMCRF) काठमाडौं, नेपाल  
वेबसाईट: [www.smcrf.org](http://www.smcrf.org)  
ईमेल: [info@smcrf.org](mailto:info@smcrf.org)

**"Conserve the world's bats and their ecosystems to ensure a healthy planet."**

**Bats in the Tamakoshi River Corridor**

From Lamabagar (Dolakha) to Manthali (Ramechhap), 12 species of bats have been identified in the area.



*Cynopterus sphinx*  
Greater short-nosed fruit bat



*Lyroderma lyra*  
Greater false vampire bat



*Rhinolophus ferrumequinum*  
Greater horseshoe bat



*Rhinolophus lepidus*  
Blyth's horseshoe bat



*Rhinolophus luctus*  
Great Woolly horseshoe bat



*Rhinolophus pearsonii*  
Pearson's horseshoe bat



*Hipposideros armiger*  
Himalayan greater hoar-nosed bat



*Hipposideros gentilis*  
Anderson's roundleaf bat



*Barbastella darjeelingensis*  
Eastern barbastelle



*Eptesicus serotinus*  
Serotine



*Pipistrellus javanicus*  
Javan pipistrelle



*Pipistrellus coromandra*  
Coromandel pipistrelle

**Do you know about Bats**

- The only flying mammal
- More than 1400 species in the world
- More than 53 species in Nepal
- Nocturnal animals

**Importance of Bats**

- Pollination
- Biological pest control
- Seed dispersal
- Bat guano as excellent organic fertilizer
- Bat eco-tourism

Photo credit: Varsha Rai, Prakash Chalise, Sanjan Thapa, Chien I oo/Minden Pictures, Bat Conservation International, Christian Ziegler/Minden Pictures, Bat Conservation International, Diemer Nill/oto Nature/Minden Pictures, Bat Conservation International.





For more information:  
Small Mammals Conservation and  
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Website: [www.smcrf.org](http://www.smcrf.org)  
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Figure 33: Information board content in Nepali (top) and English (bottom)





Figure 34: Lamabagar, Dolakha district

Table 8: List of participants of the sharing workshop

<b>SN</b>	<b>Name of the participant</b>	<b>Affiliation</b>	<b>Contact</b>
1	Mem Bahadur Tamang	Bigu-01, Ward Chair	
2	Pahalman Tamang	Bigu-01, CAMC	9846003190
3	Netra Tamang	Bigu-01	9860494407
4	Pahalman Tamang	Bigu-01	9843658012
5	Krishna Prasad Bhattarai	Shree Gaurishankar Secondary School, Jagat, Conservation Education Teacher	9849374733
6	Basanta Basnet	Basnet English Academy, Singati	9844322743
7	Pramod Raj Regmi	NTNC-GCAP	9846113398
8	Aayush Thapaliya	Shree Gaurishankar Secondary School Jagat Bat Club	
9	Devlal Tamang	Shree Gaurishankar Secondary School Jagat Bat Club	
10	Netra Kumar Shrestha	Shree Gaurishankar Secondary School Jagat Bat Club	
11	Sabita Tamang	Shree Gaurishankar Secondary School Jagat Bat Club	
12	Dilli Bahadur Magar	Bigu-01, Lamabagar, CFUG	
13	Santa Tamang	Bigu-01, Lamabagar, CFUG	9860533849
14	Lopsang Tamang	Bigu-01, Lamabagar, CFUG	9851249420
15	Puskar Tamang	Bigu-01, Lamabagar, CFUG	
16	Ashim Shrestha	Bigu-01, Lamabagar, CFUG	
17	Shree Krishna Thakuri	Bigu-01, Lamabagar, CFUG	
18	Dil Kumar Tamang	Bigu-01, Lamabagar, CFUG	
19	Nir Bahadur Tamang	Shree Gaurishankar Secondary School, Jagat	
20	Dipika Thakuri	Shree Gaurishankar Secondary School Jagat Bat Club	
21	Lakpa Lamu Sherpa	Shree Gaurishankar Secondary School Jagat Bat Club	
22	Nimgyel Sherpa	Gaurishankar-01, Ward Chair	
23	Hiramani Gautam	Shree Gaurishankar Secondary School, Jagat, Principal	