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Cover: Emperor Tamarin *Saguinus imperator*: a look into a better world through the mustache lens – mixed media illustration. © Maya Santhanakrishnan.



A preliminary assessment of the bat fauna (Mammalia: Chiroptera) of Murlen National Park, Mizoram, India: distribution, morphology, and echolocation

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Abstract: As part of a faunal documentation work in Murlen National Park in Mizoram, two field surveys were conducted in the park area and its immediate periphery which resulted in capture of 39 individuals of bats. Based on these captures and a previous published record, 14 bat species belonging to nine genera and three families were recorded from the study area. Despite lesser sampling coverage and shorter duration of the surveys, uncommon and little-known species like *Arielulus circumdatus*, *Kerivoula cf. hardwickii*, *Myotis annectans*, *Myotis montivagus*, and *Mirostrellus joffrei* were recorded, thereby highlighting the rich assemblage of chiropteran fauna and also the need for effective protection of the area. Based on the collected samples, five species—*Rhinolophus affinis*, *R. perniger*, *Myotis annectans*, *Pipistrellus javanicus*, and *Mirostrellus joffrei*—are first recorded from Mizoram state. The echolocation call structures of four of the recorded species from the study area are also presented. We have also provided an updated checklist of the bat fauna of Mizoram state comprising 35 species of five families.

Keywords: Bat diversity, checklist, inventory, new records, northeastern India, protected area.

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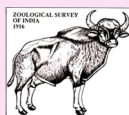
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Competing interests: The authors declare no competing interests.

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Author contributions: US conducted the field surveys, identified the specimens and wrote the first draft. RC analyzed the echolocation calls, provided inputs to the text and helped finalizing the manuscript.

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INTRODUCTION

Murlen National Park is one of the ten protected areas in Mizoram and is the second National Park in the state. Encompassing diverse vegetation from tropical, semi evergreen to sub-montane forest, the Park has a relatively pristine ecology. Considering its contiguity with Kachin Hills in Myanmar and relatively intact nature of forest, the area has the potential to harbor a rich assemblage of fauna including a high diversity of mammals (Saikia & Bal in press). However, information on faunal diversity of the Park is scanty except for a select group of vertebrates (Kaul et al. 2001; Mandal et al. 2007; Saikia et al. 2021; Bal et al. 2022a,b; Bal & Giordano 2022; Lalramsanga et al. 2022). Bats are one of the least known mammalian groups from Mizoram with only 29 authentically recorded species (Dobson 1874; Bates & Harriossn 1997; Mandal et al. 2007) and information on the bat diversity from protected areas of the state are nearly nonexistent. The only report on the bat fauna of any protected area of Mizoram pertains to Lengteng Wildlife Sanctuary, wherein nine species of bats were reported (Vanlalnghaka 2013). However, considering the inclusion of extralimital species like *Rousettus aegyptiacus* and *Rhinolophus hipposideros* and lack of taxonomic rigor of that study, the identity of several recorded species remains to be verified. In order to fill the biodiversity information gap and consequently to help the Park authorities with better management plan of the resources, a series of faunal surveys were initiated by the North Eastern Regional Centre (NERC) of Zoological Survey of India, Shillong. As part of this survey, the first author conducted sampling in the Park and its immediate surroundings during October 2018 and March 2022. Based on the collected specimens from the aforementioned surveys and record of a single species in Mandal et al. (2007), a preliminary assessment of bat diversity in Murlen National Park and its environ has been presented. Additionally, we provide the echolocation call structures of free flying individuals of four of the recorded species from the study area. An updated checklist of the bat fauna of Mizoram comprising 35 species of five families is also provided.

MATERIALS AND METHODS

Study area

Murlen National Park is located in Champhai district of Mizoram state in India adjacent to the Chin Hills of Myanmar. The Park encompasses an area of 100 km² spreading between 23.53–23.70 N and 92.21–92.45 E

(Environment, Forest and Climate Change Department, Govt of Mizoram 2017) (Image 1). It was declared as National Park vide notification No.B.12012/5/99-FST dated 24 January 2003. The Park area spreads over a significant elevation range from 400–1,900 m. Vegetation is tropical, semi-evergreen and sub montane forests dominated by *Quercus* sp., *Schima wallichai*, *Betula* sp., *Michelia champaca*, *Pinus kesiya*, *Prunus* sp., *Myrica* sp., *Rhododendron* sp., *Saccharum* sp., and varieties of orchids (Kumar et al. 2018).

Field sampling and species identification

Field samplings in the National Park area and its immediate surroundings were conducted in October–November 2018 and March 2022. Bats were trapped at several localities in the immediate periphery of the Park, i.e., Murlen village and adjacent agricultural areas (23.64561 °N, 93.296179 °E, 1,580 m; 23.66166 °N, 93.28333 °E, 1,345 m) and along the Vapar–Murlen road (23.66403 °N, 93.29623 °E, 1,430 m) and a Forest Camp (Tuikual Duty Post) in the Park area (23.64464 °N, 93.29786 °E, 1,640 m) (Image 1). Mist nets (6 x 2.5 m and mesh size 16 x 16 mm, Ecotone Poland) and one two bank harp trap (Austbat, Australia) were deployed. Mist nets were set near water holes, across streams especially during the dry period of March 2022 and kept open for about three hours after sunset (Image 2). The harp trap was set across possible flight paths inside forest and forest openings and placed overnight. A total of nine nights of bat trapping were conducted. Thirty-nine individuals of bats were captured. Almost all the bats were captured in mist nets except for one individual of *Kerivoula* cf. *hardwickii* and two *Rhinolophus affinis*. Fifteen of those individuals were retained as vouchers and rest were released at the capture sites. No visibly pregnant or lactating females were retained as vouchers. Captured animals were handled following standard methods in mammalogy (Sikes & Animal Care and Use Committee of the American Society of Mammalogists 2016) and vouchers were deposited into the North Eastern Regional Centre of Zoological Survey of India, Shillong for further investigations.

The acronyms for measurements are: Ear length (E); Tragus length (TR); Hindfoot length, including claw (HF c.u.); Forearm length (FA); Tibia length (TB); 3rd metacarpal length (3MT); 4th metacarpal length (4MT); 5th metacarpal length (5MT); Greatest length of skull including incisors (GTLi); Condylacanine length (CCL); Maxillary tooththrow length (CM³); Width across third molars (M³M³); Width across canines (C¹C¹); Zygomatic breadth (ZB); Postorbital constriction (POC); Breadth

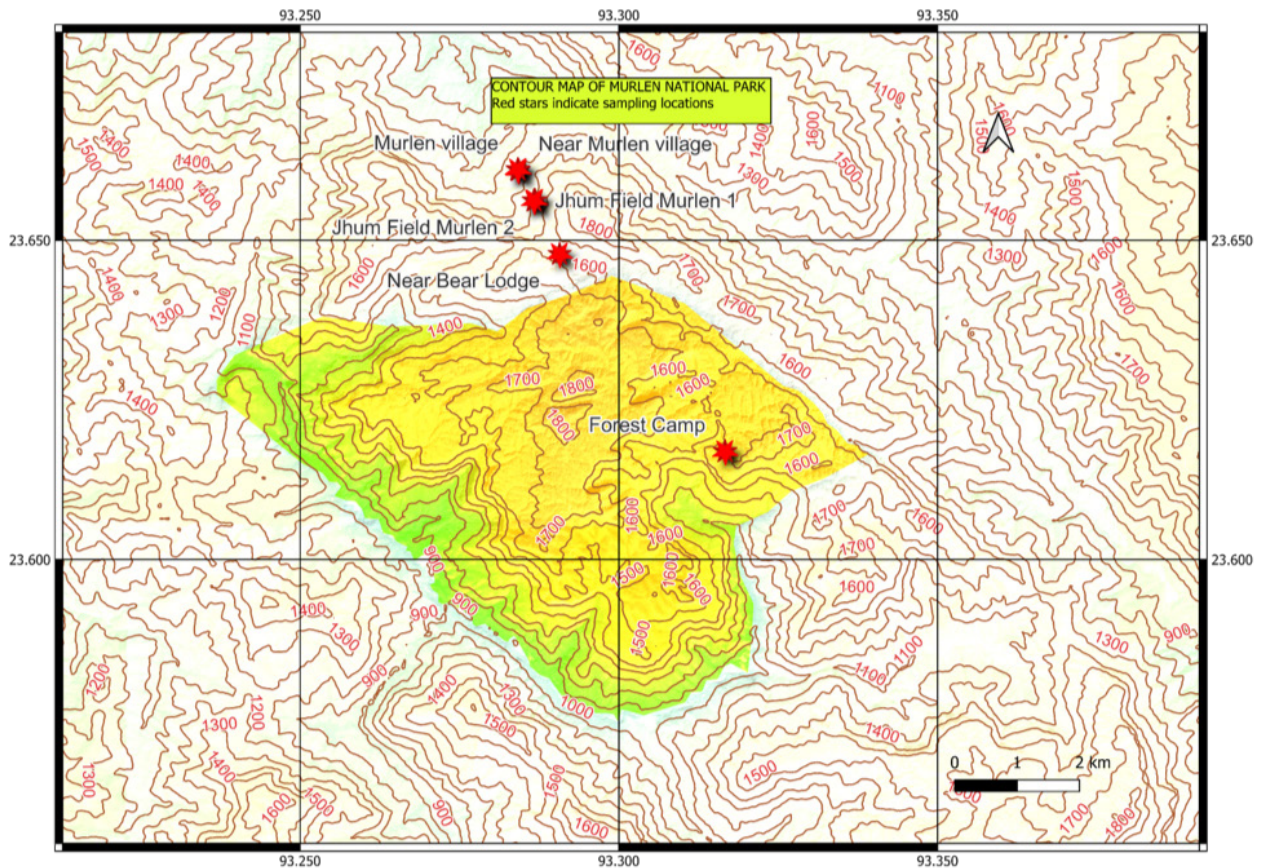


Image 1. Map of Murlen National Park and surrounding areas showing sampled areas (red stars).

of braincase (BB); Mastoid breadth (MAB); Length of mandible including incisors (MLi); Mandibular tooththrow length (CM_3); Coronoid height (COH). These measurements generally follow definitions by Bates & Harrison (1997).

Echolocation call analysis

The ultrasonic calls at the sampling site were recorded with an Anabat Walkabout detector (Titly Scientific, Brendale, Australia). As the primary purpose of the survey was to document and provide unambiguous identification of species through specimens, we recorded calls by placing the bat detector in front of the nets. Calls recorded before captures were attributed to that particular individual. Although this method is prone to ambiguity in call identification and attribution, the benefit is that the calls recorded were more representative of search phase calls. Calls that are recorded upon release (the standard protocol) are rarely representative of search phase calls rendering them less useful for acoustic identification of bats recorded in free flight.

The recordings were carried at a sampling rate of 500 KHz and analyzed using Raven Pro 1.5.0 (Cornell

Lab of Ornithology, Ithaca, USA). From up to 15 pulses that appeared to represent search phase calls (with short terminal narrowband FM tails), we measured start frequency (high frequency, SF), end frequency (low frequency, EF), peak frequency (PF), bandwidth (BW) and duration (D) from a spectrogram of FFT size 1024 with 95% overlap and a Hanning window. For rhinolophid bats, the measurements were extracted from the second harmonic, whereas for all other species, the first harmonic pulses were measured.

The checklist

The updated checklist of the bat fauna of Mizoram state is based on all published records till October 2023. The locality records mentioned are essentially based on Bates & Harrison (1997) and Mandal et al. (2007) updated with any succeeding publications. The chiropteran collection at NERC, Shillong is also examined and included wherever applicable. Only those published records authenticated by vouchers are taken into consideration.



Image 2. Landscape in some of the sampling localities. © Uttam Saikia.

RESULTS

Thirteen bat species belonging to three families were recorded from inside the Park and its immediate surroundings. Photos of the species are in Images 3 & 4, and their morphological and anatomical measurements are provided in Tables 1 & 2, respectively. The echolocation

call parameters of four species, viz., *Rhinolophus affinis*, *Mirotrellus joffrei*, *Myotis annectans* and *Myotis montivagus* have been provided in Table 3.

We have also provided a consolidated checklist of bats of Mizoram in Appendix 1.

Systematic accounts**Order: Chiroptera****Family: Pteropodidae****1. *Eonycteris spelaea* (Dobson, 1871)****(Dawn Bat)**

Material examined: 1♂, V/M/ERS/532 (Figure 3A), 3♀ (released), 09.xi.2018, along Vapar-Murlen Road (1,662 m), Champhai district, Mizoram.

Remarks: The individuals were caught in a mist net set across a forest opening in the early evening hours possibly en route to foraging places.

Family: Rhinolophidae**2. *Rhinolophus affinis* Horsfield, 1823****(Intermediate Horseshoe Bat)**

Material examined: 2♂, V/M/ERS/702 (Figure 3B), 703, 18.iii.2022, near Bear Lodge (1587 m), Murlen National Park.

Echolocation call: The average echolocation call peak frequency was recorded at 88.79 kHz (Table 3; Image 5) which is similar to that recorded in western Himalaya (88 kHz, Chakravarty et al. 2020) and southeastern China (Jiang et al. 2008).

Remarks: First report of this species from Mizoram state. Apparently widespread in the area as call signatures matching the above described structure were recorded in several other places in the periphery of the Park.

3. *Rhinolophus rouxii* Temminck, 1835**(Rufous Horseshoe Bat)**

Material examined: 3♂, V/M/ERS/533, 534, 542,

08–09.xi.2018, along Vapar-Murlen Road (1,463 m), Champhai district, Mizoram.

Remarks: Several *Rhinolophus rouxii* individuals were also caught at the same location where *Eonycteris spelaea* were caught.

4. *Rhinolophus perniger* Hodgson, 1843**(Northern Woolly Horseshoe Bat)**

Material examined: 1♀, V/M/ERS/706 (Figure 3C), 18.iii.2022, near Bear Lodge (1,587 m), adjacent to Murlen National Park, Champhai district, Mizoram.

Remarks: The specimen was caught in a mist net set around an abandoned forest house. The current record constitutes the first mention of this species from Mizoram.

Family: Vespertilionidae**5. *Arielulus circumdatus* (Temminck, 1840)****(Bronze sprite)**

Material examined: 2♀, V/M/ERS/685 (Figure 3D), 699, 19.iii.2022 & 21.iii.2022, Jhum field near Murlen village (1,490 m), Champhai district, Mizoram.

Remarks: Individuals were caught in mist nets while coming to drink around an artificial water source.

6. *Barbastella darjelingensis* (Hodgson, 1855)**(Eastern Barbastille)**

Material examined: 1♀, V/M/ERS/698 (Figure 3E), 18.iii.2022, near Bear Lodge (1,587 m), Murlen National Park.

Remarks: Caught in a mist net set across an open

Table 1. Morphological data of the measured bat specimens from Murlen NP and its environ.

Species	HF	TB	FA	E	TR	3MT	4MT	5MT	No. of examples measured
<i>Eonycteris spelaea</i>	15.2–20.1 (17.3)	29.8–34.5 (32.6)	65.1–74.7 (70.8)	16.7–18.4 (17.5)	-	-	-	-	4
<i>Rhinolophus affinis</i>	11.2, 12	23.4, 24.2	53.0, 53.5	15.4, 16.8	-	39.8, 40.4	41.5, 42.4	42.9, 43.7	2
<i>R. perniger</i>	17.9	69.4	37.6	36.5	-	48.2	56.3	57	1
<i>R. rouxii</i>	11.0, 11.7	23.3, 23.8	52.9, 53.4	17.9, 18.4	-	39.8, 41	41.8, 42.6	43.0, 43.9	2
<i>Arielulus circumdatus</i>	8.6, 9.1	16.5, 17.5	39.4, 39.9	10.6, 11.0	4.6, 5.2	37.6, 38.9	36.3, 37.8	35.1, 35.6	2
<i>Barbastella darjelingensis</i>	8.1	19.3	40.0	13.5	6.1	41.1	38.8	37.2	1
<i>Kerivoula</i> sp.	8.0	16.2	34.8	12.5	6.4	37.0	36.5	34.9	1
<i>Mirotrellus joffrei</i>	7.6, 8.7	14.7, 16.7	36.7, 38.4	11.5	3.6, 4.3	37.0, 39.4	36.8, 38.0	32.2, 34.6	2
<i>Myotis annectans</i>	8.3	19.3	44.25	13.1	6.0	42.3	40.9	39.7	1
<i>M. montivagus</i>	8.7, 9.0	15.9, 17.4	39.4, 40.2	12.1, 12.9	6.3, 6.9	37.8	36.6	35.8	2
<i>M. muricla</i>	8.9	17.5	35.0	11.3	5.4	32.8	32.0	31.4	1
<i>Pipistrellus javanicus</i>	6.9	13.5	32.4	10.2	4.8	32.2	32.4	31.7	1
<i>Tylonycteris malayana</i>	6.4	13.0	30.5	10.5	3.5	28.9	28.3	27.2	1

space surrounded by trees.

7. *Kerivoula cf. hardwickii* (Horsfield, 1824)

Material examined: 1♂, V/M/ERS/698 (Figure 3F), 18.iii.2022, near Bear Lodge (1,587 m), Murlen National Park

Remarks: The specimen was caught in a harp trap set across a narrow forest trail dominated by bamboo. Our specimen apparently belongs to the *K. hardwickii* complex and actual identity of the specimen is still under investigation.

8. *Mirostrellus joffrei* (Thomas, 1915) (Joffre's Pipistrelle)

Material examined: 2♀, V/M/ERS/684, 687 (Figure 4G), 19.iii.2022 & 23.iii.2022, Jhum field at Murlen village (1,345 m), Champhai district, Mizoram

Remarks: An IUCN Data Deficient species, this is the first record of this bat from Mizoram. Recently reported from Manipur (Saikia & Meetei 2022) indicating a broader distribution and relatively common occurrence than previously thought

Echolocation: Relatively narrowband (27–45 kHz) FM-QCF calls were recorded with an average peak frequency of 29.78 kHz (Table 3; Image 5). The calls were similar to those reported from western Himalaya (Chakravarty et al. 2020) and northern Vietnam (Görföl et al. 2020).

9. *Myotis annectans* Dobson, 1871 (Hairy-faced Bat)

Material examined: 1♂, V/M/ERS/686 (Figure 4H), 19.03.2022, Jhum field at Murlen village (1345 m), Champhai district, Mizoram

Echolocation calls: The calls were relatively

broadband (32–68 kHz), relatively long (7.2 ms), largely FM but with a short QCF ending, typical of some Himalayan and Southeast Asian *myotids* (for example, *Myotis siligorensis*, Surlykke et al. 1993). End frequency (EF) which is less variable than peak frequency in *Myotis* spp. was recorded at an average of 32.27 kHz (Table 3; Image 5), which is lower than that recorded in western Himalayas (36.22 kHz, Chakravarty et al. 2020) and Cambodia (38 kHz, Sophany et al. 2013). However, the western Himalayan specimens are likely to be revised to *M. sicarius* (Görföl et al. in prep). Nonetheless, the differences in call frequencies are likely due to the different recording scenarios. The calls recorded in western Himalaya and Cambodia come from hand-released bats while our calls were recorded in free flight.

Remarks: This is the first report of this species from Mizoram and recently been reported from neighboring Manipur (Saikia & Meetei 2022).

10. *Myotis montivagus* (Dobson, 1874) (Burmese-whiskered Myotis)

Material examined: 1♂, 1♀, V/M/ERS/697 (Fig 4I), 704, 20.iii.2022, near Murlen village, Vapar-Murlen road (1,480 m), Champhai district, Mizoram

Remarks: A globally Data Deficient species, this bat was reported only from Mizoram state in India thus far. A possible specimen of this species has been recorded recently from Siju cave in Meghalaya (Kharkongor et al. 2024)

Echolocation: Short duration (2.6 ms), broadband calls (43–95 kHz) calls were recorded with a mean peak frequency of 51 kHz (Table 3; Image 5). The calls presented here are the first recordings of this species from India and are similar in structure and frequencies to closely related

Table 2. Craniodental measurements of some of the species recorded from the study area.

Species	GTli	CCL	ZW	BW	POC	CM ³	C ¹ -C ¹	M ³ -M ³	MAB	MLi	CM ₃	COH	No. of exs.
<i>Arielulus circumdatus</i>	15.45	14.78	11.05	8.12	4.43	5.84	4.83	7.14	8.80	11.94	6.12	3.85	1
<i>Barbastella darjelingensis</i>	15.0	13.55	7.53	7.26	3.87	4.70	3.42	5.28	8.32	9.61	5.12	2.68	1
<i>Kerivoula cf. hardwickii</i>	14.25	12.77	8.72	7.24	3.32	5.50	3.57	5.40	7.52	10.25	5.90	3.17	1
<i>Mirostrellus joffrei</i>	14.90	14.12	10.82	7.73	4.58	5.08	5.16	7.43	8.68	10.74	5.68	4.00	1
<i>Myotis annectans</i>	16.88	16.68	11.63	7.80	4.33	6.93	4.63	7.55	8.67	12.27	7.21	4.55	1
<i>M. montivagus</i>	15.51	14.28	10.82	7.36	4.10	6.25	4.22	7.17	7.60	11.90	6.55	4.00	1
<i>M. muricloa</i>	13.37	12.82	-	6.68	3.60	4.90	2.86	5.82	7.12	9.67	5.40	2.85	1
<i>Pipistrellus javanicus</i>	12.46	11.37	7.80	5.92	3.28	4.48	4.26	5.67	6.64	8.46	4.87	2.75	1
<i>Tylonycteris malayana</i>	13.66	11.84	9.34	7.16	4.76	4.17	4.25	5.60	7.66	9.25	4.27	2.66	1



Image 3. Bat species recorded from Murlen NP and its periphery: A—*Eonycteris spelaea* | B—*Rhinolophus affinis* | C—*Rhinolophus perniger* | D—*Arielulus circumdatus* | E—*Barbastella darjelingensis* | F—*Kerivoula cf. hardwickii*. © Uttam Saikia.



Image 4. G—*Mirostrellus joffrei* | H—*Myotis annectans* | I—*Myotis montivagus* | J—*Myotis muricola* | K—*Pipistrellus javanicus* | L—*Tylonycteris malayana*.

Table 3. Echolocation calls measurements of the species whose calls were definitively recorded. All measurements are given as mean \pm standard deviation.

Species	No. of pulses	Start frequency (SF, kHz)	End frequency (EF, kHz)	Peak frequency (PF, kHz)	Bandwidth (kHz)	Duration (ms)
<i>Rhinolophus affinis</i>	15	90.15 \pm 0.42	70.28 \pm 3.06	88.79 \pm 0.2	-	46.08 \pm 5.2
<i>Mirostrellus joffrei</i>	15	45.07 \pm 5.36	27.61 \pm 0.27	29.78 \pm 0.48	17.45 \pm 5.35	9.08 \pm 0.93
<i>Myotis annectans</i>	15	68.69 \pm 7.79	32.27 \pm 1.10	35.74 \pm 2.02	36.41 \pm 6.97	7.24 \pm 1.96
<i>Myotis montivagus</i>	9	95.01 \pm 4.52	43.23 \pm 1.01	50.1 \pm 3.12	51.78 \pm 5.08	2.6 \pm 0.26

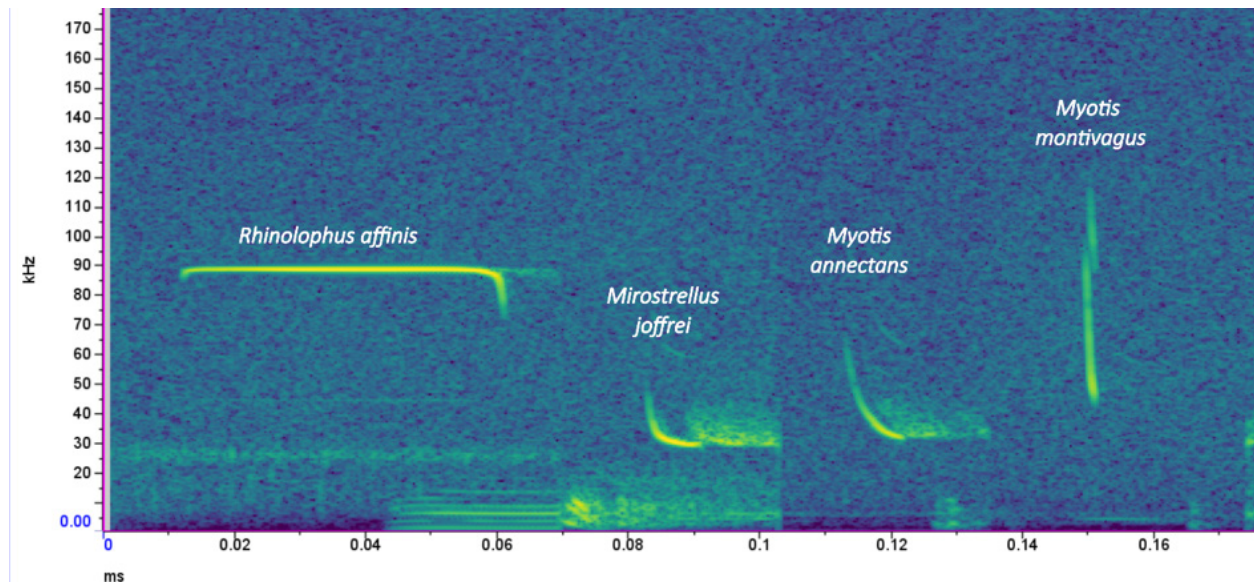


Image 5. Spectrogram depicting the echolocation calls of the four species of bats whose calls were recorded in our survey.

M. peytoni from the Western Ghats (Wordley et al. 2014; Raman et al. 2020)

11. *Myotis muricola* (Gray, 1846) (Nepalese Whiskered Myotis)

Material examined: 1♂, V/M/ERS/709 (Fig 4J), 23.iii.2022, Jhum field at Murlen village (1,345 m), Champhai district, Mizoram.

12. *Pipistrellus javanicus* Gray, 1838 (Java Pipistrelle)

Material examined: 1♂, V/M/ERS/705 (Fig 4K), 22.iii.2022, near Murlen village, Vapar-Murlen road (1,480 m), Champhai district, Mizoram

Remarks: The individual was caught in a mist net near an artificial water source. A few other non-reproductive females were also caught at the same spot and were released. This is the first record of this species from Mizoram.

13. *Tylonycteris malayana* Chasen, 1840 (Malayan Bamboo Bat)

Material examined: 1♂, V/M/ERS/701 (Fig 4L) 23.iii.2022, Jhum field at Murlen village (1,345 m), Champhai district, Mizoram

Remarks: Also caught in mist nest around a water hole.

DISCUSSION

Water is a critical resource for wildlife. During the drier period of January–April, most of the water sources in Murlen National Park and its surroundings dry out except for scattered water puddles in the streambeds. The villagers also construct some ponds in the Jhum fields for irrigation and fishery purposes. These water sources attract a number of bat species offering excellent opportunity of studying bats. In spite of our limited area coverage and short study period, we could record 12 species of bats in three families out of which five namely *Rhinolophus affinis*, *R. perniger*, *Myotis annectans*, *Pipistrellus javanicus* and *Mirostrellus joffrei* are new additions to the state of Mizoram. *Sphaerias blanfordi* was already reported from the Park (Mandal et al. 2007) indicating a very diverse bat community in the study area. Among the presently recorded species, *Mirostrellus joffrei* was considered as a rare species and only represented by a few museum specimens until recent times. The IUCN Red List still considers it as a ‘Data Deficient’ species (Görföl et al. 2016). However, after its discovery from Meghalaya, Sikkim, and from Nepal (Saikia et al. 2017), it was subsequently reported from Uttarakhand (Chakravarty et al. 2020) and Manipur (Saikia & Meetei 2022). The current record from Murlen further underscores the fact that this bat is more widely distributed in the Himalayan region and in the southeastern Asia. Another little-known species recorded in the study area is *Myotis montivagus* which is also currently recognized as ‘Data Deficient’ by the IUCN

Red List (Görföl 2020). Primarily known from scattered records from southern China, Myanmar, Vietnam, and Laos, this species is thus far definitively known only from a few localities of Mizoram in India. We characterize the echolocation call structure of free flying individual of this species from the area. It may be noted that another two species with taxonomic ambiguity, e.g., *Hipposideros* cf. *larvatus* and *Kerivoula* cf. *hardwickii* have also been recorded from Mizoram during the aforementioned surveys. However, the taxonomic status of *H. larvatus* s.l. in northeastern India is uncertain (Thabah et al. 2006) and a thorough integrative taxonomic reassessment is required. Similarly, the identity of *Kerivoula* specimen from Murlen NP also needs careful investigations as apparently it belongs to the cryptic *K. hardwickii* complex. As a derivative of the study, we also recorded the bat echolocation calls at our sampling sites although it was not meant for an echolocation call library. Even though a large number of calls were recorded in each sampling sites, due to difficulty in attributing a particular call to a free flying species, we provided the call structure details of only four species which we could attribute with a fair degree of certainty. Standardizing the recording protocols to obtain the “most natural” search phase calls remains another avenue of future research.

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Appendix 1. Checklist of the bat fauna of Mizoram state.

	Species	Locality records	Reference
1	<i>Cynopterus sphinx</i> (Vahl)	Aibawk (c.800 m), North Khawbubg (c.1500 m) and Dampa (c.250 m) in Aizawl district; Ngengpui (200 m) in Lawngtlai district and Sairep (1500 m) in Lunglei district	Mandal et al. 2007
2	<i>Cynopterus brachyotis</i> (Muller)	Ngengpui (200 m) in Lawngtlai district	Mandal et al. 2007
3	<i>Eonycteris spelaea</i> (Dobson)	Dampa (c.250 m) in Aizawl district; Lungsen (c. 650 m) in Lunglei district; 4 km from Tui-Pui, Champhai Aizawl Road in Champhai district	Mandal et al. 2007; V/M/ERS/529-531
4	<i>Macroglossus sobrinus</i> Anderson	Ngengpui (c.200 m) in Lawngtlai district	Mandal et al. 2007
5	<i>Megaerops niphanae</i> Yenbutra & Felten	North Khawbubg (c.1500 m) in Aizawl district and Sairep (1500 m) in Lunglei district	Mandal et al. 2007
6	<i>Pteropus medius</i> Temminck	North Khawbubg (c.1500 m) and Dampa (c.250 m) in Aizawl district	Mandal et al. 2007
7	<i>Rousettus leschenaulti</i> (Desmarest)	Aibawk (c.800 m), North Khawbubg (c.1500 m) and Dampa (c.250 m) in Aizawl district; 4 km from Tui-Pui (830 m), Champhai Aizawl Road in Champhai district	Mandal et al. 2007; V/M/ERS/527-528
8	<i>Sphaerias blanfordi</i> (Thomas)	Tuikual Duty Post (c.850 m), Murlen NP in Champhai district and Sairep (1500 m) in Lunglei district	Mandal et al. 2007
9	<i>Rhinolophus affinis</i> Horsfield	Near Bear Lodge, Murlen-Vapar Road, Champhai district	Present study
10	<i>Rhinolophus lepidus</i> Blyth	Dampa (c.250 m) in Aizawl district; Lungsen (c. 650 m) in Lunglei district	Mandal et al. 2007
11	<i>Rhinolophus perniger</i> Hodgson	Near Bear Lodge (1587 m), adjacent to Murlen NP in Champhai district	Present study
12	<i>Rhinolophus pearsonii</i> Horsfield	Sairep (c.1500 m), Lunglei district	Mandal et al. 2007
13	<i>Rhinolophus rouxii</i> Temminck	Dampa (c.250 m) in Aizawl district; Lungsen (c. 650 m) in Lunglei district; 4 km from Tui-Pui, Champhai Aizawl Road, and along Vapar-Murlen Road in Champhai district	Present study; Mandal et al. 2007; V/M/ERS/537, 538
14	<i>Rhinolophus yunanensis</i> Dobson	Areas adjacent to Tipaimukh in Aizawl district	Dobson, 1874;
15	<i>Hipposideros cineraceus</i> Blyth	Dampa (c.250 m) in Aizawl district; Sairep (1500 m) in Lunglei district	Mandal et al. 2007
16	<i>Hipposideros lankadiva</i> Kelaart	Dampa (c.250 m) in Aizawl district	Mandal et al. 2007
17	<i>Hipposideros cf. larvatus</i> Horsfield	Tuival Bridge (480 m) in Champhai district	V/M/ERS/521-524
18	<i>Megaderma spasma</i> Linnaeus	Paikla? (most probably Paikhai c.760 m in Aizawl district)	Bates & Harrison, 1997
19	<i>Arielulus circumdatus</i> (Temminck)	Sairep (1500 m) in Lunglei district and Murlen village (1490 m) in Champhai district	Mandal et al. 2007; present study
20	<i>Barbastella darjelingensis</i> Hodgson	Sairep (1500 m) in Lunglei district and Near Bear Lodge (1587 m), adjacent to Murlen NP in Champhai district	Mandal et al. 2007; present study
21	<i>Eptesicus pachyotis</i> (Dobson)	Sairep (1500 m) in Lunglei district	Mandal et al. 2007
22	<i>Harpiocephalus harpia</i> (Temminck)	Sairep (1500 m) in Lunglei district and Sangau (c. 1380 m) in Lawngtlai district	Bates and Harrison, 1997; Mandal et al. 2007 as <i>H. mordax</i>
23	<i>Harpiola grisea</i> (Peters)	Sairep (1500 m) in Lunglei district	Mandal et al. 2007
24	<i>Kerivoula cf. hardwickii</i> (Horsfield)	Sangau (c. 1270 m) in Lawngtlai district and Near Bear Lodge (1587 m), adjacent to Murlen NP in Champhai district	Bates & Harrison, 1997; Present study
25	<i>Mirostrellus joffrei</i> (Thomas)	Near Murlen village (1490 m), Champhai district	Present study
26	<i>Murina cyclotis</i> (Dobson)	Sairep (1500 m) in Lunglei district	Mandal et al. 2007
27	<i>Murina tubinaris</i> (Scully)	Sairep (1500 m) in Lunglei district and Sangau (c. 1380) in Lawngtlai district	Bates & Harrison, 1997; Mandal et al. 2007
28	<i>Myotis formosus</i> (Hodgson)	Sairep (1500 m) in Lunglei district	Mandal et al. 2007
29	<i>Myotis annectans</i> (Dobson)	Near Murlen village (1490 m) in Champhai district	Present study
30	<i>Myotis montivagus</i> (Dobson)	Sairep (1500 m) in Lunglei district and Near Murlen village (1490 m) in Champhai district	Mandal et al. 2007; Present study
31	<i>Pipistrellus javanicus</i> (Gray)	Near Murlen village (1490 m) in Champhai district	Present study
32	<i>Scotozous dormeri</i> (Dobson)	Lungsen (c. 650 m) in Lunglei district	Mandal et al. 2007
33	<i>Myotis muricola</i> (Gray)	Sairep (c.15000 m) and Lungsen (c. 650 m) in Lunglei district and Murlen village (1490 m) in Champhai district	Mandal et al. 2007; Present study
34	<i>Tylonycteris fulvida</i> (Blyth)	Sangau (c.1380 m) in Lawngtlai district	Bates & Harrison, 1997 (as <i>T. pachypus</i>)
35	<i>Tylonycteris malayana</i> Chasen	Sangau (c.1380 m) in Lawngtlai district; Murlen village (1490 m) in Champhai district	Bates & Harrison, 1997 (as <i>T. robustula</i>); present study

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