
Diversity of Bat Fauna in States of Northeast and Around Western Ghats of India with Reference to Its Conservation

10

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Abstract

Diversity of bat fauna was studied in the states of Northeast India and states around Western Ghats, as both regions are recognized global hot spots for their biological values. The diversity of bat fauna from the tropical and semitropical forests of hilly area of the two regions is compiled on the basis of available literature mentioning their taxonomical details, distribution in the regions, and IUCN status. Thirty-six genera and ninety-two bat species reported from these regions comprise about 79% of the total bat species diversity reported from India. Sixty-eight bat species are reported from states of Northeast India and 58 bat species from the states around Western Ghats. Fifty percent of bat species reported from Northeast region of India is common to those reported from states around Western Ghats. The bat fauna of these two regions is dominated by evening bats of the family Vespertilionidae, representing 45 species, which comprise about 49% of bat species reported from the two regions. For conservation of the bat species in the area, endemism of bat species, species diversity richness, and evenness in the regions are taken into consideration. The states of Western Ghats have more number of endemic bat species, while states of Northeast India have higher value for diversity indices indicating higher diversity and evenness in distribution of bat species in the area. Thus both regions are to be considered seriously for the conservation of bat fauna and their habitats.

Keywords

Bat · Distribution · Endemism of Northeast India · Western Ghats

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10.1 Introduction

Among mammals of the world, bats make up 25% of the total number (Mickleburgh et al. 2002). Bats have lived for the past 60 million years as a successful group of mammals both in terms of species diversity and the area of the earth inhabited by them. However the bats are not reported from the polar region, extreme deserts, and a few isolated oceanic islands (Ronald and Nowak 1994).

The order Chiroptera is further classified as suborders (1) Megachiroptera (fruit bats) and (2) Microchiroptera (mostly insectivorous bats) on the basis of feeding habits, mode of perception, orientation, and morphological adaptations. The members of the suborder Megachiroptera belong to the single family Pteropodidae, which includes Old World fruit bats of tropical regions of Africa, Asia, and Indo-Australia (Hill and Smith 1984). They have large eyes, the sense of smell is well developed, the ears are simple in form, and muzzle and jaws are strongly built. The tail is short or absent, and the dentition is reduced in general. The fruit bats feed almost exclusively on plants and consume the soft, pulpy, and juicy parts including leaves, flowers, pollens, fruits, and often seeds. The megachiropteran bats feed upon at least 145 genera of fruit plants of 30 families, which are widely distributed throughout the world (Marshall 1985).

The fruit bats are very important pollinators and seed dispersers in tropical forests throughout the world (Marshall 1983, 1985; Fleming et al. 1987; Pierson and Rainey 1992) and have shared a long evolutionary history with angiosperms. Fujita and Tuttle (1991) reported that at least 443 products useful to mankind derive from 143 plant species that rely to some extent on bats for pollination or seed dispersal.

The suborder Microchiroptera includes bats of medium to small size and depends on power of echolocation for their orientation and feeding. In general, these bats have small to remarkably big ears and have genus-specific nose leaf complex aiding in echolocation. It is the well-diversified group feeding mostly on insects; but some are phytophagous, carnivorous, piscivorous, or sanguivorous.

About 103 species of microchiropteran bats found in India are all insectivorous. The insectivorous bats are reported to consume insects in large volumes up to 100% of their body weight per night (Eckrich and Neuweiler 1988; Davison and Zubaid 1992). They play a major role in regulating the insect population and thus become very important components of the food web of the forest as well as of agroecosystem. These bats consume insects of the order Lepidoptera, Diptera, Orthoptera, Hemiptera, Homoptera, Trichoptera, and Coleoptera (Kunz 1988; Swift et al. 1985; Whitekar 1993, 1995; Whitekar et al. 1997, 1999). Most of the Indian agricultural crop and forest pests belong to aforementioned orders of class Insecta, and thus the insectivorous microchiropteran bats play a vital role in the biological control of them. In the urban area, mosquitoes comprise the important and prime dietary item for these bats.

The bats, though mammals, are poor in thermoregulation. They are very sensitive to climatic conditions, particularly temperature and humidity of the atmosphere. With few exceptions, most of the bat species prefer cool and dark places, which maintain more or less static relative humidity and temperature as their diurnal biotopes.

Roost site fidelity is generally high in those genera of bats that roost communally (Marshall 1983). And those bat genera roosting singly or in small groups show less site fidelity but may use the same perch for considerable period (Marshall 1983). Bats are often observed shifting their roosting sites, as they are sensitive to the disturbance to their habitats. Therefore, abundance of the bat fauna and their species diversity indicate the “well-being” condition of the ecosystem.

The study of diversity of bat fauna in the states of Northeast India and states in periphery of Western Ghats of India is very important from various aspects. Both the states of Northeast and Western Ghats of India are the regions, which are recognized as biodiversity hot spots (Myers et al. 2000). The present study aims at reporting of Chiroptera species from states of Northeast India and states in periphery of Western Ghats of India. The endemism and IUCN status of these species will be considered and discussed from the conservation point of view.

10.2 Methods

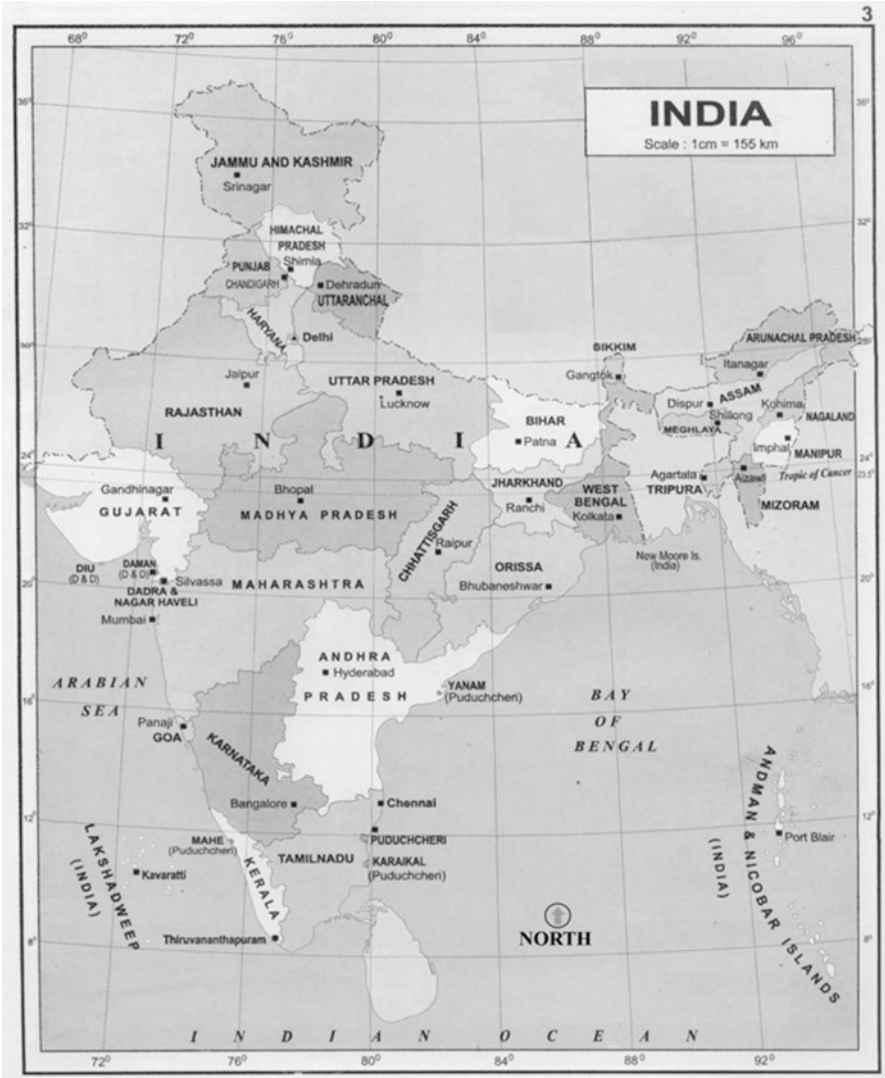
10.2.1 Study Area

Northeast states of India represent the easternmost region of India connected to East India via a narrow corridor squeezed between Nepal and Bangladesh. It comprises the contiguous Seven Sister States (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura), plus the Himalayan state of Sikkim (Maps 10.1 and 10.2). The Northeast India (22°–30° N and 89°–97° E) spreads over 2,62,379 km² and represents the transition zone between the Indian, Indo-Malayan, and Indo-Chinese biogeographic regions and a meeting place of the Himalayan Mountains and Peninsular India.

Western Ghats of India runs 1600 km from just north of Mumbai and south through the states of Maharashtra, Goa, Karnataka, and Kerala and then extends little eastern side bordering the state of Tamil Nadu (Maps 10.1 and 10.3). This mountain range runs almost parallel to the western coast of Peninsular India and separates the Deccan Plateau from the narrow coastal plains. The major hill range in the north is referred as Sahyadri, and in the south it is known as Sahya Parvatam. The Nilgiris, an offshoot of the Western Ghats, is located northwest of the state of Tamil Nadu.

10.2.2 Compilation of Data

Data regarding the presence and distribution of bat species from states of Northeast and around Western Ghats of India is compiled from the available published literature (Corbet and Hill 1992; Bates and Harrison 1997; Nameer et al. 2001; Nameer 2008; Pradhan 2008; Molur et al. 2002; Wilson and Reeder 2005; Korad et al. 2007; Talmale and Pradhan 2009; Pradhan and Talmale 2012, 2013; Korad 2014).



Map 10.1 Map of India showing states and general layout

10.2.3 Statistical Analysis of Data

The data is presented in tabular and graphical forms. The data is further analyzed by using Shannon-Weaver Index and compared for understanding of the species diversity richness and evenness in the two regions.

The bat species reported from previous literature are systemically listed in Table 10.1. This table includes three parts: (I) bat species common to both the regions (states of Northeast India and states around Western Ghats), (II) bat species reported additionally from states of Northeast India, and (III) additional list of bat

Map 10.2 States of Northeast India referred for the present study (Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, and Sikkim)



Map 10.3 States around Western Ghats of India (State of Maharashtra, Goa, Karnataka, Kerala, and Tamil Nadu)

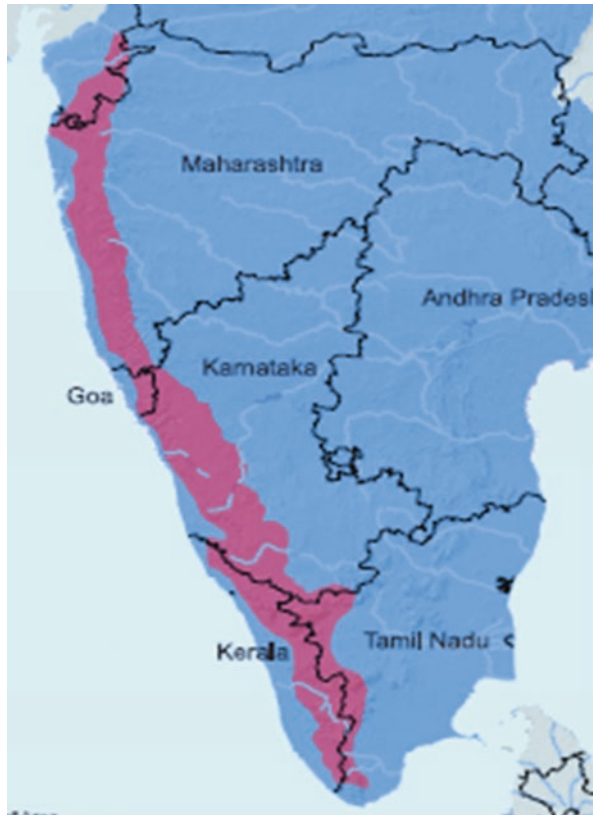


Table 10.1 Bat species diversity reported from states of Northeast and states around Western Ghats of India

Sl. No.	Name of species	Presence in states of India	IUCN status in South Asia and India
I. Bat species common to states of Northeast and states around Western Ghats of India			
A. Suborder: Megachiroptera			
Family: Pteropodidae Gray, 1821 (Old World fruit bats)			
Genus: <i>Rousettus</i> Gray, 1821			
1	<i>Rousettus leschenaulti</i> (Desmarest, 1820)	All states	LC
Genus: <i>Pteropus</i> Brisson, 1762			
2	<i>Pteropus giganteus</i> Brunnich, 1782	All states	LC
Genus: <i>Cynopterus</i> Cuvier, F., 1824			
3	<i>Cynopterus sphinx</i> Vahl, 1797	All states except Sikkim	LC
Genus: <i>Eonycteris</i> Dobson, 1873			
4	<i>Eonycteris spelaea</i> (Dobson, 1871)	KS, TN, Asm, Sik, Megh, NE	LC
B. Suborder: Microchiroptera			
Family: Rhinolophidae Gray, 1825 (horseshoe bats)			
Genus: <i>Rhinolophus</i> Lacepede, 1799			
5	<i>Rhinolophus rouxii</i> Temminck, 1835	MS, Goa, KS, Ker, TN, Sik, Arn, NE	NT
6	<i>Rhinolophus sinicus</i> (Andersen, 1905)	KS, Ker, Sik, Arn, NE	LC
7	<i>Rhinolophus pusillus</i> Temminck, 1834	KS, Ker, Sik, Arn, NE	LC
8	<i>Rhinolophus lepidus</i> Blyth, 1844	MS, KS, Ker, TN, Asm, Megh	LC
9	<i>Rhinolophus luctus</i> Temminck, 1835	MS, Asm, Sik, NE	NT
Family: Hipposideridae Lydekker, 1891 (leaf-nosed bats)			
Genus: <i>Hipposideros</i> Gray, 1831			
10	<i>Hipposideros ater</i> Templeton, 1848	MS, KS, Ker, TN, Megh	LC
11	<i>Hipposideros cineraceus</i> Blyth 1853	TN, Arn, Megh	NT
12	<i>Hipposideros pomona</i> Andersen, 1918	MS, KS, Ker, TN, Asm, Sik, Arn, NE	LC
13	<i>Hipposideros lankadiva</i> Kelaart, 1850	MS, KS, NE	LC#
Family: Megadermatidae H. Allen, 1864 (false vampire bats)			
Genus: <i>Megaderma</i> E. Geoffroy, 1810			
14	<i>Megaderma lyra</i> E. Geoffroy, 1810	MS, KS, Ker, TN, Asm, Arn, Megh	LC
15	<i>Megaderma spasma</i> Linneus, 1758	MS, Goa, KS, Ker, TN, Asm, NE	LC

(continued)

Table 10.1 (continued)

Sl. No.	Name of species	Presence in states of India	IUCN status in South Asia and India
Family: Emballonuridae Gervais, 1855 (sheath-tailed bats)			
Subfamily Taphozoinae Jerdon, 1867			
Genus: <i>Saccolaimus</i> Temminck, 1838			
16	<i>Saccolaimus saccolaimus</i> Temminck, 1838	MS, KS, Ker, TN, Megh	LC
Genus: <i>Taphozous</i> E. Geoffroy, 1818			
17	<i>Taphozous longimanus</i> Hardwicke, 1825	MS, KS, Ker, TN, NE	LC
18	<i>Taphozous nudiventris</i> Cretzschmer, 1830	MS, KS, TN, Sik	LC
Family: Molossidae Gervais, 1856 (free-tailed bats)			
Subfamily Molossinae Gervais, 1856			
Genus: <i>Chaerephon</i> Dobson, 1874			
19	<i>Chaerephon plicata</i> (Buchana, 1800)	MS, Goa, TN, Megh	LC
Genus: <i>Otomops</i> Thomas, 1913			
20	<i>Otomops wroughtoni</i> (Thomas, 1913)	KS, Megh	CR
Family: Vespertilionidae Gray, 1821 (evening bats)			
Subfamily Vespertilioninae Gray, 1821			
Tribe Nycticeiini Gervais, 1855			
Genus: <i>Scotophilus</i> Leach, 1821			
21	<i>Scotophilus heathii</i> Horsfield, 1831	MS, KS, Ker, TN, Asm, Megh	LC
22	<i>Scotophilus kuhlii</i> Leach, 1821	MS, KS, Ker, TN, NE	LC
Tribe Pipistrellini Tate, 1942			
Genus: <i>Pipistrellus</i> Kaup, 1829			
23	<i>Pipistrellus pipistrellus</i> (Schreber, 1774)	MS, TN, Asm	LC
24	<i>Pipistrellus javanicus</i> (Gray, 1838)	MS, Asm, Sik, Arn, NE	LC
25	<i>Pipistrellus coromandra</i> (Gray, 1838)	MS, Goa, KS, TN, Asm, Sik, Arn, Megh, NE	LC
26	<i>Pipistrellus tenuis</i> (Temminck, 1840)	MS, KS, Ker, TN, all states of NE except Arn	LC
27	<i>Pipistrellus kuhlii</i> (Kuhl, 1819)	MS, KS, Ker, TN, Asm, Megh	LC
Tribe Vespertilionini Gray, 1821			
Genus: <i>Hypsugo</i> Kolenati, 1856			
28	<i>Hypsugo savii</i> (Bonaparte, 1837)	MS, Megh	VU
Genus: <i>Tylonycteris</i> Peters, 1872			
29	<i>Tylonycteris pachypus</i> (Temminck, 1840)	KS, Ker, Sik, Megh, NE	NT

(continued)

Table 10.1 (continued)

Sl. No.	Name of species	Presence in states of India	IUCN status in South Asia and India
Subfamily Myotinae Tate, 1942			
Genus: <i>Myotis</i> Kaup, 1829			
30	<i>Myotis formosus</i> (Hodgson, 1835)	MS, Asm, Sik, Megh	LC
Genus: <i>Harpiocephalus</i> Gray, 1842			
31	<i>Harpiocephalus harpia</i> (Temminck, 1840)	Ker, TN, Asm, Sik, Megh, NE	NT
Genus: <i>Murina</i> Gray, 1842			
32	<i>Murina cyclotis</i> Dobson, 1872	TN, Sik, Megh	LC
Subfamily Kerivoulinae Miller, 1907			
Genus: <i>Kerivoula</i> Gray, 1842			
33	<i>Kerivoula picta</i> (Pallas, 1767)	MS, Goa, KS, TN, Asm, Sik	LC
34	<i>Kerivoula hardwickii</i> (Horsfield, 1824)	KS, Asm, Megh, NE	LC
II. Additional list of bat species reported from states of North-East of India			
A. Suborder: Megachiroptera			
Family: Pteropodidae Gray, 1821 (Old World fruit bats)			
Genus: <i>Megaerops</i> Peters, 1865			
35	<i>Megaerops niphanae</i> Yenbutra & Felten, 1983	Arn	NT
Genus: <i>Sphaerias</i> Miller, 1906			
36	<i>Sphaerias blanfordi</i> (Thomas, 1891)	Arn	NT
Genus: <i>Macroglossus</i> F. Cuvier, 1824			
37	<i>Macroglossus sobrinus</i> (K. Andersen, 1911)	Sik, Arn, Megh, NE	NT
B. Suborder: Microchiroptera			
Family: Rhinolophidae Gray, 1825 (horseshoe bats)			
Genus: <i>Rhinolophus</i> Lacepede, 1799			
38	<i>Rhinolophus ferrumequinum</i> (Schreber, 1774)	Sik, Arn, NE	VU#
39	<i>Rhinolophus affinis</i> Horsfield, 1823	Arn, NE	LC
40	<i>Rhinolophus shortridgei</i> K. Andersen, 1918	NE	NE
41	<i>Rhinolophus subbadius</i> Blyth, 1844	Arn, Megh	VU
42	<i>Rhinolophus macrotis</i> Blyth, 1844	Arn, Megh	NT
43	<i>Rhinolophus pearsonii</i> Horsfield, 1851	Sik, Megh	LC
44	<i>Rhinolophus yunanensis</i> Dobson, 1872	Arn, NE	VU

(continued)

Table 10.1 (continued)

Sl. No.	Name of species	Presence in states of India	IUCN status in South Asia and India
Family: Hipposideridae Lydekker, 1891 (leaf-nosed bats)			
Genus: <i>Coelops</i> Blyth, 1848			
45	<i>Coelops frithi</i> Blyth, 1848	NE	NT
Genus: <i>Hipposideros</i> Gray, 1831			
46	<i>Hipposideros armiger</i> Hodgson, 1835	Sik, NE	LC
Family: Vespertilionidae Gray, 1821 (evening bats)			
Subfamily Vespertilioninae Gray, 1821			
Tribe Eptesicini Volleth and Heller, 1994			
Genus: <i>Arielulus</i> Hill and Harrison, 1987			
47	<i>Arielulus circumdatus</i> (Temminck, 1840)	Megh	LC
Genus: <i>Eptesicus</i> Rafinesque, 1820			
48	<i>Eptesicus serotinus</i> (Schreber, 1774)	Asm, NE	NT
49	<i>Eptesicus pachyotis</i> (Dobson, 1871)	Megh	DD
Tribe Nycticeiini Gervais, 1855			
Genus: <i>Scotomanes</i> Dobson, 1875			
50	<i>Scotomanes ornatus</i> (Blyth, 1851)	Sik, Arn, Megh, NE	LC
Tribe Pipistrellini Tate, 1942			
Genus: <i>Nyctalus</i> Bowditch, 1825			
51	<i>Nyctalus noctula</i> (Schreber, 1774)	Sik, NE	LC
Genus: <i>Pipistrellus</i> Kaup, 1829			
52	<i>Pipistrellus paterculus</i> Thomas, 1915	Asm, NE	LC
53	<i>Pipistrellus abramus</i> (Temminck, 1838)	Arn	DD
Tribe Plecotini Gray, 1866			
Genus: <i>Barbastella</i> Gray, 1821			
54	<i>Barbastella leucomelas</i> (Cretzschmar, 1830/31)	Sik, Megh	NT
Tribe Vespertilionini Gray, 1821			
Genus: <i>Ia</i> Thomas, 1902			
55	<i>Ia io</i> Thomas, 1902	Megh	EN
Genus: <i>Tylonycteris</i> Peters, 1872			
56	<i>Tylonycteris robustula</i> Thomas, 1915	NE	NE
Subfamily Myotinae Tate, 1942			
Genus: <i>Myotis</i> Kaup, 1829			
57	<i>Myotis sicarius</i> Thomas, 1915	Sik	VU#
58	<i>Myotis mystacinus</i> (Kuhl, 1819)	Sik, Megh	VU

(continued)

Table 10.1 (continued)

Sl. No.	Name of species	Presence in states of India	IUCN status in South Asia and India
59	<i>Myotis muricola</i> (Gray, 1846)	Asm, Sik, Megh	LC
60	<i>Myotis siligorensis</i> (Horsfield, 1855)	Sik, Megh	NT
61	<i>Myotis annectans</i> (Dobson, 1871)	NE	VU
62	<i>Myotis longipes</i> (Dobson, 1873)	Megh	NT
63	<i>Myotis laniger</i> Peters, 1871	Megh	EN
Genus: <i>Miniopterus</i> Bonaparte, 1837			
64	<i>Miniopterus magnater</i> Sanborn, 1931	NE	NE
Genus: <i>Harpiocephalus</i> Gray, 1842			
65	<i>Harpiocephalus mordax</i> Thomas, 1923	NE	DD
Genus: <i>Murina</i> Gray, 1842			
66	<i>Murina aurata</i> Milne-Edwards, 1872	Sik, Megh	NT
67	<i>Murina tubinaris</i> (Scully, 1881)	Sik, Arn, Megh, NE	NT
68	<i>Murina huttonii</i> (Peters, 1872)	Asm	LC
III. Additional list of bat species reported from states around Western Ghats of India			
Suborder: Megachiroptera			
Family: Pteropodidae Gray, 1821 (Old World fruit bats)			
Genus: <i>Cynopterus</i> Cuvier, F., 1824			
69	<i>Cynopterus brachiotis</i> (Muller, 1838)	MS, Goa, KS, TN	LC
Genus: <i>Latidens</i> Thonglongya, 1972			
70	<i>Latidens salimalii</i> Thonglongya, 1972	TN	EN#
Suborder: Microchiroptera			
Family: Rhinolophidae Gray, 1825 (horseshoe bats)			
Genus: <i>Rhinolophus</i> Lacepede, 1799			
71	<i>Rhinolophus cognatus</i> Andesen, 1906	MS	VU#
72	<i>Rhinolophus beddomei</i> Andersen, 1905	MS, KS, Ker, TN	NT#
Family: Hipposideridae Lydekker, 1891 (leaf-nosed bats)			
Genus: <i>Hipposideros</i> Gray, 1831			
73	<i>Hipposideros fulvus</i> Gray, 1838	MS, KS, Ker, TN	LC
74	<i>Hipposideros hypophyllus</i> Kock & Bhat, 1994	KS	EN#
75	<i>Hipposideros galeritus</i> Cantor, 1846	MS, KS	NT
76	<i>Hipposideros speoris</i> (Schneider, 1800)	MS, KS, Ker, TN	LC#

(continued)

Table 10.1 (continued)

Sl. No.	Name of species	Presence in states of India	IUCN status in South Asia and India
Family: Rhinopomatidae Bonaparte, 1838 (mouse-tailed bats)			
Genus: <i>Rhinopoma</i> E. Geoffroy, 1818			
77	<i>Rhinopoma microphyllum</i> (Brinich, 1782)	MS, TN	LC
78	<i>Rhinopoma hardwickii</i> Gray, 1831	MS, KS, TN	LC
79	<i>Rhinopoma muscatellum</i> Thomas, 1903	TN	NT
Family: Emballonuridae Gervais, 1855 (sheath-tailed bats)			
Subfamily Taphozoinae Jerdon, 1867			
Genus: <i>Taphozous</i> E. Geoffroy, 1818			
80	<i>Taphozous melanopogon</i> Temminck, 1841	MS, Goa, KS, Ker, TN	LC
81	<i>Taphozous perforatus</i> E. Geoffroy, 1818	MS	LC#
82	<i>Taphozous theobaldi</i> Dobson, 1872	KS	VU
Family: Molossidae Gervais, 1856 (free-tailed bats)			
Subfamily Molossinae Gervais, 1856			
Genus: <i>Tadarida</i> Rafinesque, 1814			
83	<i>Tadarida aegyptiaca</i> (E. Geoffroy, 1818)	MS, KS, Ker, TN	LC
Family: Vespertilionidae Gray, 1821 (evening bats)			
Subfamily Vespertilioninae Gray, 1821			
Tribe Eptesicini Volleth and Heller, 1994			
Genus: <i>Hesperoptenus</i> Peters, 1868			
84	<i>Hesperoptenus tickelli</i> (Blyth, 1851)	MS, Goa, KS, TN	LC
Tribe Pipistrellini Tate, 1942			
Genus: <i>Pipistrellus</i> Kaup, 1829			
85	<i>Pipistrellus ceylonicus</i> (Kelaart, 1852)	MS, KS, Ker, TN	LC
Genus: <i>Scotozous</i> Dobson, 1875			
86	<i>Scotozous dormeri</i> (Dobson, 1875)	MS, Goa, KS, Ker, TN	LC#
Tribe Vespertilionini Gray, 1821			
Genus: <i>Falsistrellus</i> Troughton, 1943			
87	<i>Falsistrellus affinis</i> Dobson, 1871	MS, Ker, TN	NT
Subfamily Myotinae Tate, 1942			
Genus: <i>Myotis</i> Kaup, 1829			
88	<i>Myotis montivagus</i> (Dobson, 1874)	MS, KS, Ker, TN	VU
89	<i>Myotis horsfieldii</i> (Temminck, 1840)	MS, KS, Ker, TN	LC

(continued)

Table 10.1 (continued)

Sl. No.	Name of species	Presence in states of India	IUCN status in South Asia and India
Genus: <i>Miniopterus</i> Bonaparte, 1837			
90	<i>Miniopterus schreibersii</i> (Kuhl, 1819)	MS, TN	LC
91	<i>Miniopterus pusillus</i> Dobson, 1876	KS, TN	VU
Subfamily Kerivoulinae Miller, 1907			
Genus: <i>Kerivoula</i> Gray, 1842			
92	<i>Kerivoula lenis</i> Thomas, 1916	TN	NT

Name of states: *Arn* Arunachal Pradesh, *Assm* Assam, *Goa, Ker* Kerala, *KS* Karnataka State, *Megh* Meghalaya, *MS* Maharashtra State, *NE* states of Northeast India, *TN* Tamil Nadu

IUCN status: *LC* least concern, *NT* near threatened, *VU* vulnerable, *EN* endangered, *CR* critically endangered, *DD* data deficient, *NE* not evaluated, # endemic to South Asia and India

Table 10.2 Distribution of chiropteran fauna in Northeast (NE) and Western Ghats (WG) regions of India

Sl. No.	Family	No. of genera reported	No. of species common to two regions	No. of species reported from NE region	No. of species reported from WG region
1	Pteropodidae	8	4	7	6
2	Rhinolophidae	1	5	12	7
3	Hipposideridae	2	4	6	8
4	Megadermatidae	1	2	2	2
5	Rhinopomatidae	1	0	0	3
6	Emballonuridae	2	3	3	6
7	Molossidae	3	2	2	3
8	Vespertilionidae	18	14	36	23
	Total	36	34	68	58

species reported from states around Western Ghats. This table also mentions the distribution of bat species in the study area and its IUCN status. The distribution of bat species in these two regions is summarized in Table 10.2. The number of species per bat family reported from study area is presented in Fig. 10.1. IUCN status of bat species reported from states of Northeast and states around Western Ghats of India is summarized graphically in Fig. 10.2. IUCN status of bat species reported from these two regions is reported separately in Figs. 10.3 and 10.4 for comparison. Table 10.3 mentions the endemic bat species reported from states of Northeast India, and those from states around Western Ghats is mentioned in Table 10.4. For evaluation of the bat species diversity richness, and evenness in the two regions,; the data is analyzed by Shannon-Weaver Index. The results are presented in Fig. 10.5.

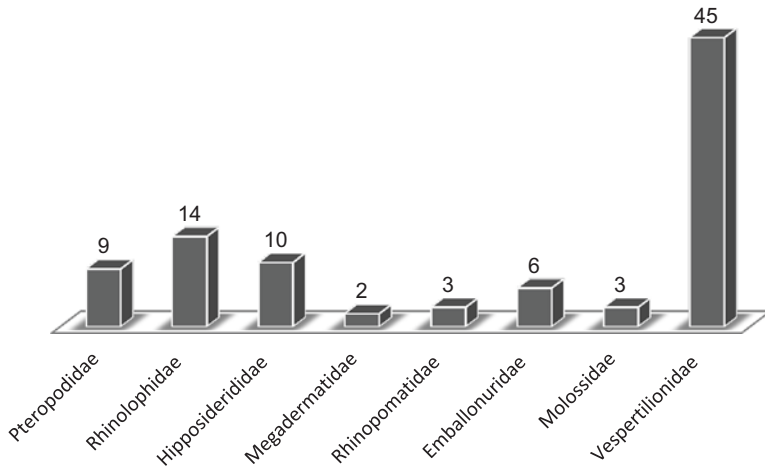


Fig. 10.1 Bat species reported from Northeast and Western Ghats regions of India

Fig. 10.2 IUCN status of bat species reported from states of Northeast and around Western Ghats of India

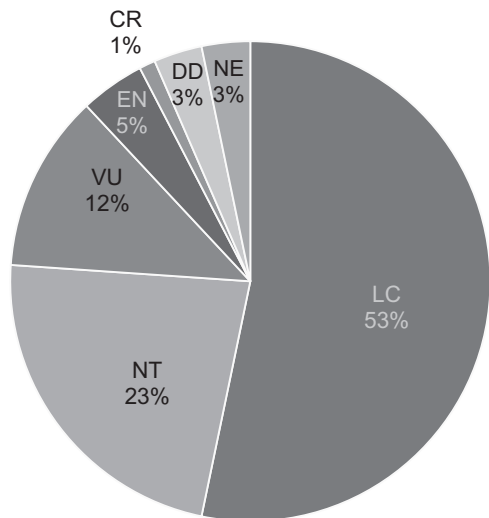
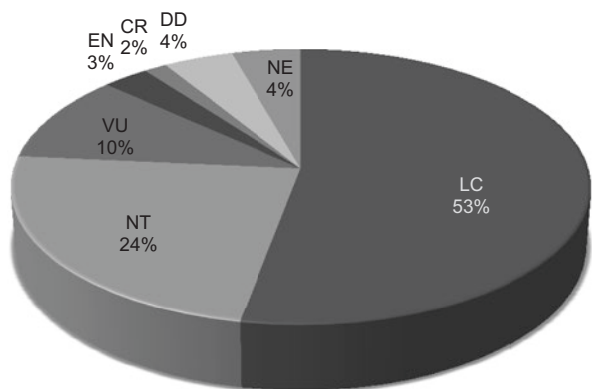


Fig. 10.3 IUCN status of bat species reported from states of Northeast India



Western Ghats can be seen as a belt running from the north (Maharashtra) to the south (on the border of Kerala and Tamil Nadu) on the western border of the Peninsular India.

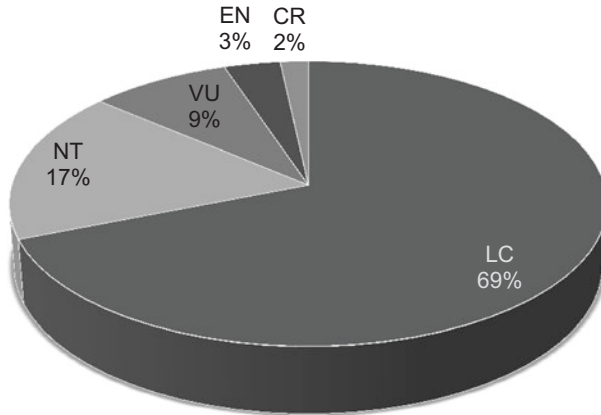


Fig. 10.4 IUCN status of bat species reported from states around Western Ghats of India. *LC* least concern, *NT* near threatened *VU* vulnerable, *EN* endangered, *CR* critically endangered, *DD* data deficient, *NE* not evaluated, # endemic to South Asia and India

Table 10.3 Diversity and IUCN status of endemic (to South Asia) bat species of Northeast India

Sl. No.	Bat species	IUCN status
1	<i>Rhinolophus ferrumequinum</i> (Schreber, 1774)	VU
2	<i>Hipposideros lankadiva</i> Kelaart, 1850	LC
3	<i>Myotis sicarius</i> Thomas, 1915	VU

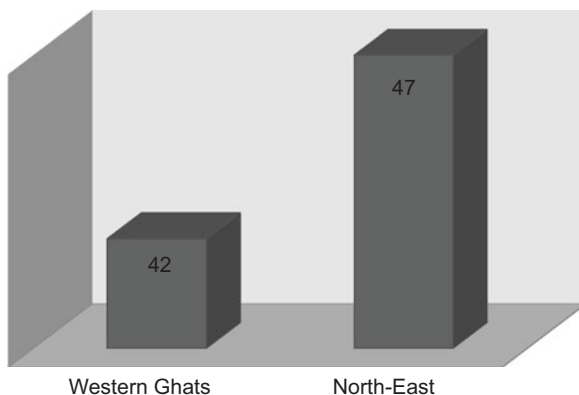
LC least concern, *VU* vulnerable

Table 10.4 Endemic bat species reported from states around Western Ghats of India

Sl. No.	Bat species	IUCN status
1	<i>Latidens salimalii</i> Thonglongya, 1972	EN
2	<i>Taphozous perforatus</i> Geoffroy, 1818	LC
3	<i>Hipposideros speoris</i> (Schneider, 1800)	LC
4	<i>Hipposideros hypophyllus</i> Kock & Bhatt, 1994	EN
5	<i>Hipposideros lankadiva</i> Kelaart, 1850	LC
6	<i>Scotozous dormeri</i> (Dobson, 1875)	LC
7	<i>Rhinolophus beddomei</i> Andesen, 1905	NT
8	<i>Rhinolophus cognatus</i> Andersen, 1906	VU

IUCN status: *LC* least concern, *NT* near threatened, *VU* vulnerable, *EN* endangered

Fig. 10.5 Comparison of bat species diversity by Shannon-Weaver Index in states of Northeast and around Western Ghats of India



10.3 Results and Discussion

Northeast India is at the confluence of Indo-Malayan, Indo-Chinese, and Indian biogeographical realms. Northeast India forms one of the major regions, particularly its tropical rain forests. The tropical semievergreen and moist deciduous forests in the lowlands of this region extend south and west into the subcontinent. The hilly region is known for the presence of deep crevices and caves, which serve as the natural abode for many species of wild fauna of the region. The area is one of the richest in biological values, high in endemism and holds a large number of rare species that are now under serious threat. On the other hand, the biome of Western Ghats is formed of tropical and semitropical moist broad-leaved forests. The Nilgiris in the south of Western Ghats is known for dense grassy table lands, dense evergreen forests, and Sholas. Similar Sholas are also present in the area of Anaimalai Hills, Palni Hills, Kudremukh, and other south Indian ranges. They provide the main shelter to wild elephants, gaur, and other large animals. The forests of the Western Ghats and the south Indian hill ranges have a richer fauna than the remaining areas of the peninsular region and known as home to numerous **endemic** species.

Thus for the study of species diversity of bat fauna, states of Northeast India and states around Western Ghats are found to be the most appropriate regions as both these regions are globally recognized biological hot spots. Comparing the area occupied by these two regions, the states around Western Ghats occupy about 2.4 times bigger area (633,264 km²) than that of states of Northeast India (262,379 km²). The bat fauna is the largest aggregation of mammals in India and is represented by 8 families, 39 genera, 117 species, and 100 subspecies (Wilson and Reeder 2005; Talmale and Pradhan 2009).

The suborder Megachiroptera of the order Chiroptera is represented by the sole family Pteropodidae (Old World fruit bats) including eight genera and nine species. The suborder Microchiroptera is represented by 7 families, 28 genera, and 83 species. Thus total 36 genera and 92 species of the order Chiroptera reported from states of Northeast and states around Western Ghats of India comprise about 79% of

the total bat species diversity reported from the country. Of the 92 bat species reported from states of Northeast India and states around Western Ghats, 34 bat species are common to both regions (Table 10.2). The states of Northeast India harbor 68 bat species, and 58 bat species are reported from the states around Western Ghats. As mentioned before, though the area of Northeast region of India is about 2.4 times lesser than that of the Western Ghats region, this region seems to be richer in bat species diversity.

Secondly it is also found that 50% of bat species diversity reported from states of Northeast India is common to those of Western Ghats regions, while states of Western Ghats share about 59% similarity regarding bat species with those of states of Northeast region. Further it is found that of 36 genera were reported from the two regions; the presence of about ten genera, i.e., *Megaerops* Peters 1865, *Sphaerias* Miller 1906, *Macroglossus* F. Cuvier 1824 (all belong to the family Pteropodidae of the suborder Megachiroptera), *Coelops* Blyth 1848 (belongs to the suborder Microchiroptera and the family Hipposideridae), *Barbastella* Gray 1821, *Scotomanes* Dobson 1875, *Eptesicus* Rafinesque 1820, *Ia* Thomas 1902, *Arielulus* Hill and Harrison 1987, and *Nyctalus* Bowditch 1825 (all belong to the family Vespertilionidae of the suborder Microchiroptera), is the characteristic of the Northeast region of India.

As mentioned in Fig. 10.1, the two regions of India are dominated by the species of the family Vespertilionidae, which is represented by 45 bat species, which comprises about 49% of bat species reported from the two regions. These hilly areas among forests are natural homes for the evening bats, which prefer mostly the crevices and narrow gaps in the rocks. The second large aggregation is of the family Rhinolophidae (a monogeneric group as mentioned by Corbet and Hill 1992) and is represented by 14 species. These species are known to depend exclusively on forest for roosting and foraging. The third large group is of Old World fruit bats of the family Pteropodidae in these regions and is represented by eight genera and nine species (Table 10.2, Fig. 10.1), which depend on wild plants of the forest.

As per the IUCN status (Fig. 10.2), about 53% of bat species reported from the regions of Northeast India and Western Ghats are categorized as *least concern*, and 23% of bat species is considered as *near threatened*. However, 18% of bat species are threatened in one way or other (12% as *vulnerable*, 5% as *endangered*, and 1% as *critically endangered*), while 3% of bat species are reported as *data deficient* and 3% as *not evaluated*.

In states of Northeast India, the percentage of nonthreatened categories of bat species is almost similar (bat species of LC category-53%, and NT category-24%). Among the threatened taxa, 10% bat species come under vulnerable category; 3% bat species is categorized as endangered and 2% under critically endangered (Fig. 10.3). Three bat species, namely, *Rhinolophus shortridgei* Andersen, *Tylonycteris robustula* Thomas, and *Miniopterus magnater* Sanborn, reported from states of Northeast India are categorized as not evaluated and three bat species, viz., *Eptesicus pachyotis* (Dobson), *Pipistrellus abramus* (Temminck), and *Harpiocephalus mordax* Temminck, as data deficient. Thus about 8% of bat species reported from states of Northeast India need special attention and intensive field survey pertaining to the distribution and roosting habits of these species.

The bat species diversity in the states around Western Ghats seems to be in better condition, as 69% of bat fauna belong to least concern (Fig. 10.4) and 17% bat species is reported to be near threatened. Remaining 14% of bat species reported from this region are threatened (9% bat species is considered as vulnerable, 3% as endangered, and 2% as critically endangered). The characteristic of the bat fauna of this region is that none of the bat species is data deficient or comes under the category not evaluated. This indicates that the bat fauna in the states around Western Ghats region is relatively well surveyed.

It is further observed that the diversity of Old World fruit bats is remarkable in the states of Northeast India, representing seven species under seven genera. But of these, three species, *Megaerops niphanae* Yenbutra & Felten, *Sphaerias blanfordi* (Thomas), and *Macroglossus sobrinus* (Andersen), are categorized as near threatened. This might be due to uncontrolled disturbing anthropogenic activities in the natural forests including deforestation.

In the Western Ghats region, the Old World fruit bats are represented by six species. Among these species, Salim Ali's fruit bat (*Latidens salimalii* Thonglongya) is endemic to South Asia and categorized as endangered, due mainly to the restricted extent and area as well as continuing decline in the quality of habitat.

Wroughton's free-tailed bat *Otomops wroughtoni* (Thomas 1913) is reported from Meghalaya state of Northeast as well as from Karnataka state of Western India. This is the only bat species of these two regions, which is categorized as critically endangered, due to restricted extent and continuing decline in the quality of habitat.

Further, the insectivorous bat of the genus *Rhinolophus* is represented by 12 species from states of Northeast India. This number of species is remarkably high, and all are truly forest species, indicating high sustainability of the forests of this region. Similarly the species diversity of water bats of the genus *Myotis* is also high (eight species) in this region and needs special attention to conserve natural water bodies. The species diversity of the family Vespertilionidae in the hilly area of states of Northeast India is remarkable, represented by 36 species, comprising about 56% of total bat species diversity of this region.

As far as endemism of bat fauna is concerned, only three species (Table 10.3) reported from states of Northeast India (*Rhinolophus ferrumequinum* (Schreber), *Hipposideros lankadiva* Kelaart, and *Myotis sicarius* Thomas) are endemic to South Asia. *Rhinolophus ferrumequinum* and *Myotis sicarius* are categorized as vulnerable endemic species to South Asia, but *Myotis sicarius* is categorized as endemic endangered species in India, while *Hipposideros lankadiva*, the species common to both regions, is the endemic species in South Asia and categorized as least concern.

The endemism of bat fauna is far greater in states of Western Ghats (Table 10.4) than that from states of Northeast India. The states around Western Ghats harbor eight bat species, which are endemic to South Asia. Of these four species belong to least concern category, and one species (*Rhinolophus beddomei*) is categorized as near threatened. Thus about 63% of endemic species reported from states around Western Ghats belong to nonthreatened categories. Among the threatened endemic taxa of this region, *Rhinolophus cognatus* is categorized as vulnerable, and *Latidens salimalii*

and *Hipposideros hypophyllus* are categorized as endangered due to their restricted extent and continual decline in habitats

The bat species diversity richness and evenness are evaluated using Shannon-Weaver Index. The values are used for comparison of the bat fauna in two regions. The results indicate that the value of index is greater for the states of Northeast India than that of states around Western Ghats. This is probably due to the greater number of bat species reported from comparatively smaller area of states of Northeast India. This result further tempts to suggest that the states of Northeast India are to be surveyed systematically and conserved for the well-being of the wild fauna of this region, which is peculiar due mainly to the exclusiveness of bat genera and topography, climatic conditions and vegetation of the region as well.

The Western Ghats region is relatively well surveyed for bat fauna. While surveying the forest area of Western Ghats it is found that the rate of decline in habitats and foraging grounds of the fauna is reported to be high. Decline in atmospheric relative humidity due to deforestation in this region seems to be additional restriction factor for the bat fauna. For the conservation of the wild fauna of bats, inclusion of native varieties of broad-leaved plants under the schemes of afforestation is essential. These plants not only provide shelter and food to the wild fauna of the forest but also help to maintain the atmospheric relative humidity in the area, which promotes life to both the flora and fauna of the forests.

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