

A Review of the Distribution of Bats in Eastern Region of Maharashtra – India and Conservations Recommendations

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Abstract: The present survey carried out in the eastern region of Maharashtra, India, 16 bat species were reported. From the study area. The area comprised 04 tehsil of Chandrapur district Maharashtra. It was also found that all the bat species mentioned in this paper are much more widely distributed than was previously recorded and populations occur in areas for which only single or scattered records were previously available. Conversion of habitats of bats for various purposes by humans was found as one of the important threats to bats in region.

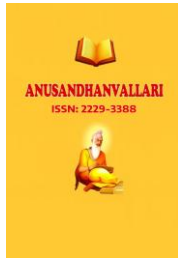
Keywords: Chiroptera, Greater Short-nosed Fruit Bat, Indian Flying Fox, Ecology

Introduction:

Bats form some of the largest non-human aggregations of mammals, and may be among the most abundant groups of mammals when measured in numbers of individuals. Among the mammals of the world, bats comprise 25% (Mickleburgh et al., 2002). The Megachiroptera includes fruit bats and flying foxes of the tropical forests (Hill & Smith, 1984), Megachiropterans have a claw on the second finger of the wing. They have longer muzzles than micro-chiropterans and, while a few species can navigate by echolocation, fruit bats generally navigate by sight and have large, light-sensitive eyes. Most fruit bats are helpless in total darkness but can see very well in dim light. About 97 species of Microchiropteran bats found in India are insectivorous. They are important components of forest as well as agricultural ecosystems. They consume insects in large volumes up to 100% of their body weight per night (Davison & Zubaid, 1992; Eckrich & Neuweiler, 1988; Kunz, 1982; Rainey & Pierson, 1992). The chiropteran diversity of India is comparable to any other region of the world with similar climatic conditions & topography. The bat fauna of the country is very diverse & is represented by 110 species, 33 genera and 08 families (Bates and Harrison, 1997). The bat fauna has been well studied in the Western Ghats and parts of Marathwada (especially Aurangabad and Nanded districts) region of Maharashtra (Brosset, 1962a,b,c,d; Gaikwad, 2007; Korad & Gaikwad, 2006; Korad et al., 2007; Wroughton, 1912; 1913a,b,c, 1916a,b,c). Most of the reports published in the early 20th century are restricted to bat species reported along with other mammals of the region. Nevertheless, information for many species was based only on museum or literature references, with very little information on population or distribution patterns (Molur et al., 2002). Our main objective was to understand the distribution of bat species in Eastern region of Maharashtra during the study period from March 2022-February 2023.

Study Area: The study area, the Chandrapur district of Eastern Maharashtra, India includes southern tropical dry and deciduous forest. The mean sea level elevation of Chandrapur is approximately 189.90 meters and receives high rainfall, with 1200 mm to 1578 mm most of this rainfall occurs during the South West monsoon season from June to September. Our surveys covered the majority of the areas from Chandrapur district are Rajura-Gadchandur, Nagbhirh-Bramhapuri, and Chimur-Sindewahi Tehsil respectively

Materials and methods: Species checklist from published literature was compiled. A previous project Assessment of bat diversity in the Central Western Ghats of Maharashtra, funded by Ministry of Environment



and Forests at Fergusson College, Pune, India, during 2002-05. First survey in study area was carried out in summer 2022-023. Selected areas were revisited every month, when. Bats were typically found in large colonies, avoiding winter hibernation and the breeding season. Identification of the bat roosts in study area was also based on the information collected from local people and field visits were arranged, accordingly. Initial site assessment was done at less disturbed areas by humans and also at other potential bat areas, such as large trees, temples, forts, and old buildings. Bat signs such as droppings, urine stains along with cracks, holes and crevices were also observed.

The population of small bat colonies was recorded by direct count (Swift, 1980). Large colonies were visited at the time of emergence of bats and counting was done by snap shot method (observing bats at a particular moment) and noting down the time period required by the bats for leaving the roosting site (Hallam et al., 2010). In the majority of the cases the bats were found in crevices at least 5 m above the ground, on roofs and walls. Most were identifiable at some distance. It was known that colonies of other cliff crevice dwelling vertebrates such as white-throated swift, *Aeronautes saxatalis* were found in vicinity to bat colonies (Pierson & Rainey, 1998). House swifts *Apus affinis* are also known to inhabit old buildings, temples, forts, etc. in India. Therefore, based on earlier experience we refined our survey method and selected comparatively undisturbed areas, where house swifts *Apus affinis* can easily be observed flying. We got good results and could find out more than 30% of our bat roosts with help of this method. Bat identification follows Srinivasulu et al. (2010) and Bates & Harrison (1997). The threat status indicated is based on the global assessments for endemics of South Asia, or national assessment.

Results: Species specific information about earlier records (Bates & Harrison, 1997, Molur et al., 2002) has been given along with a map to highlight the previously reported sites of the bats in Maharashtra, relative to the results of the present study. Mapping of the colony sites was done for understanding distribution of bats in the study area. Identification keys such as dental formula of the bat species which are difficult to identify without measurements have been provided for selected cases.

1) Indian Flying Fox (*Pteropus giganteus*)

This species is a medium to large sized fruit bat without a tail. The patagium arises from sides of the dorsum and back of the 2nd toe. Its ventral surface was pale tan to deep orange or chestnut brown. It is one of the common species in Maharashtra, but its roosting areas were not previously recorded from the study area.

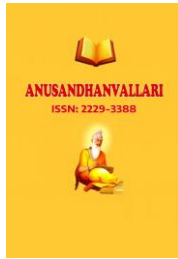
During our study we observed 16 colonies of *P. giganteus*, numbering between 100 and 500 individuals. Bat colonies were found roosting large old trees such as figs (*Ficus* sp.), mango (*Mangifera indica*) and tamarind (*Tamarindus indica*). Flying foxes were observed dispersing several kilometres from their roosting site for foraging.

Fewer individuals' locations: Bramhapuri, Nagbhid, Chimur and Sindewahi

Locations Previous records from Maharashtra: Rajwadi, Patan; Pili Sipna Valley (Wroughton, 1912); Panshet backwater, Pune (Wroughton & Davidson, 1920a); Mumbai, Malad, Kalyan; Thane, Belapur; Ahmednagar (McCann, 1934); Near Umbraj, Satara; Nagpur, Amranti (Moghe, 1951); Chanda; Pune (Korad & Yardi, 1998-2011: Natepute; Akluj; Malinagar, Maloli; Bhalvani, Pandharpur; Rambaug, Pandharpur; Tembhurni; Karmala; Barshi; Pangaon, Solapur city: Kati; Sindfal; Kini, Jagji; Mangalvedha.(2011)

2) Short-nosed Fruit bat (*Cynopterus sphinx*)

This species is a small sized fruit bat with a short tail (half enclosed within the interfemoral membrane). Both the first and second fingers have distinct claws. *Cynopterus sphinx* has larger ears with paler anterior and posterior borders than its close relative *C. brachyotis*. This bat species was recorded from all over the study area



and observed roosting at day time in groups of 4-20, mainly on trees like Ashoka (*Polyalthia longifolia*). In the late evening, bats were found in greater numbers, foraging on nearby fruiting trees.

Fewer individuals' locations: Bramhapuri ,Nagbhid ,Chimur and Sindewahi

Previous records from Maharashtra: Bandra-Mumbai: Nashik: Chanda (Wroughton, 1913a); Pune (Wroughton & Davidson, 1920a); Nagpur (Das & Sinha, 1971; Korad & Yardi, 1998-2001); Junnar, Bhor, Purandar, Saswad; Mulshi; Malshej (Gaikwad, 2007); Lonar (Joshi, In Molur et al., 2002)

3) Fulvons Fruit Bat (*Rousettus leschenaultia*)

This species is a medium sized bat and can be recognized by its large claw on first digit and a smaller one on the second, a short tail and rostrum. of the skull moderately elongated. The muzzle is heavy and has deep emargination between. Projecting nostrils. The 2 phalanx of the 3" metacarpal is smaller than in *R. aegyptiacus*. This bat was observed in large, underground water tunnels of more than one 500 m length. Colonies of more than 15,000 was observed at Naldurga and Paranda forts while alongside roads at Nimblak, Mangalwedha and Kegaon their population was found to be between 5000 and 10000 individuals. We found that the population of this bat species was associated with the age of tunnel, which means recently developed tunnel holds comparatively

Fewer individuals locations: Bramhapuri ,Nagbhid ,Chimur and Sindewahi

Previous records from Maharashtra: Ghatmatha. (Wroughton, 1916b); Jogeshwari; Kanchri; Elephanta: Alibag; Khopoli; Khandala; Ratnagiri; Aurangabad, Chikaldara (Brosset, 1962a); Mulshi; Mahabaleshwar; Wai, Satara; Bhor, Pune; Shivneri ,Nimblak-Phaltan: Mangalvedha; Kegaon road, Naldurga Fort; Paranda Fort.

4) Greater False Vampire (*Megaderma lyra*)

This bat species is commonly found in the study area. This is a robust species with an average fore arm length 66mm and the upper tooth row averages 11mm, thus exceeding *M. spasma* considerably in size. The oval ears have fringe of white hairs on the inner margins and the two lobes are joined between one third and half their length. The snout is naked and flesh colored. The lower jaw extends beyond the upper one. The nose leaf is straight and erect, about 10 mm in height and with a longitudinal. median ridge.

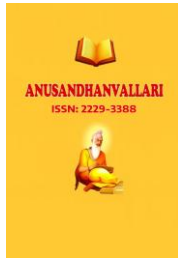
The base is simple and horizontal, but in *M. spasma* it is smaller, with convex side and distinctly heart shaped base. Dorsally the pelage is soft, moderately long and mouse colored, while ventrally it is almost white. They were found in various places in study area in groups of 40-200.. In Pothare, the population in a temple backyard was high,. In 2023, at Bramhapuri forest and abandoned quarters and an old house, the bat colony was found.

Fewer individuals locations: Bramhapuri ,Nagbhid ,Chimur and Sindewahi

Previous records from Maharashtra: Chinchpali, Bulapur (Wroughton 1913b); Ramane Wadi, Khed (Wroughton, 1916a); Pune (McCann, 1934); Powai lake; Ellora, Aurngabad; Ajanta, Aurngabad; Ghodasgaum; Kanheri, Borivali (Brosset, 1962b); Ratnagiri, Gorthan, Nashik (Sinha, 1970); Bandra (Gopalakrishna & Badwaik, 1989); Junnar, Panshet: Mahad; Mulshi, Haveli; Bhor Rajewadi: Satara (Gaikwad, 2007).

5) Long-winged Tomb bat (*Taphozous longimanus*):

This species is a small medium sized sheath-tailed bat, with a semicircular gular sac on the throat. Each ear has a tragus with a club-shaped extremity. The wing is attached to the ankle, and the abdomen is hairy. The tail is enclosed in an interfemoral membrane and the tail tip projects from the upper surface of the membrane at about the midpoint. The wings are long and narrow, and the second digit has no phalanges. The forearm length (FA) is



about 60 mm; the third metacarpal is almost equal in length i.e. almost 95.9% to 98.83% of FA. The condylocanine length of the skull is about 20 mm. Colonies typically have a strong smell. It is one of the cave dwelling bats observed in small groups of 10-12, at four areas such as Nagbhid, Bramhapuri, Chimur and Sindewahi.

Fewer individuals locations: Bramhapuri, Nagbhid, Chimur and Sindewahi

Previous records from Maharashtra: Patas; Dhamangaon, Solapur; Osmanabad caves; Apsinga; Naldurga. Previous records from Maharashtra: Arnala (Brosset 1962a); Bandra, Mumbai; Chanda; Malvan; Panchgani (Wroughton, 1913b); Amraoti; Nagpur (Gopalakrishna, 1954); Elephanta; Khandala; Ratnagiri (Brosset, 1962a); Ahmednagar (Joshi, In Molur et al., 2002); Rakeshwadi, Lonavala (Gaikwad, 2007). Previous records from Maharashtra: Arnala (Brosset 1962a); Bandra, Mumbai; Chanda; Malvan; Panchgani (Wroughton, 1913b); Amraoti; Nagpur (Gopalakrishna, 1954); Elephanta; Khandala; Ratnagiri (Brosset, 1962a); Ahmednagar (Joshi, In Molur et al., 2002); Rakeshwadi, Lonavala (Gaikwad, 2007).

6) Schneider's Leaf-nosed Bat (*Hipposideros speoris*):

The supplementary leaflets are diagnostic for many *Hipposideros* species. The nose-leaf of *H. speoris* has three supplementary leaflets; the outer one inconspicuous. The median emargination of the anterior leaf-nose is not prominent. The upper edge of the intermediate leaf is concave. The posterior leaf is divided into four cells by three vertical septa and with slightly thickened upper edge. *H. speoris* was found using pilgrimage and historical places and caves.

Fewer individuals locations: Bramhapuri, Nagbhid, Chimur and Sindewahi

Previous records from Maharashtra: Bhimanagar; Indapur; Nira Narsingpur; Pothare, Karmala; Bhalavani, Pandharpur; Osmanabad caves; Kurduwadi. Previous records from Maharashtra: Bhor, Pune; Saswad, Pune; Satara (Hills, 1976); Borivali, Kanheri; Elephanta; Alibag; Asgani; Pune (Shivkumara et al., 1984); Chanda (Blanford, 1988-91) Ranjangaon, Mawal, Pune; Saralgaon, Shirur; Ellora (Bates et al., 1994); Nanded; Chatushrungi cave, Pune; Shivneri Fort, Junnar; Matheran (Gaikwad, 2007).

7) Asiatic Greater Yellow House Bat (*Scotophilus heathii*):

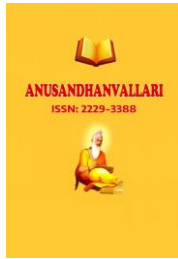
This species is medium-sized with relatively small ears that have a peculiar tragus with the tip projecting forwards. The braincase is narrow and deep. The second upper incisor (I3) is absent and the first two upper molars have their main cusps displaced outwards, thus the usual "W" pattern is distorted. It was also one of the cave dwelling bats which was observed in small groups of 1-3 individuals, at five areas such as fort (Rajura) and Gadchandur (Buddhist Cave).

Fewer individuals locations: Rajura and Gadchandur

Previous records from Maharashtra: Nagpur (Khajuria, 1953); Panchgani; (Khajuria, 1953); Thana (Brosset, 1962c); Ajanta (Brosset, 1962c); Bandra; Andheri; Pune; Dhule; Chanda (BMNH); Elephanta (Brosset, 1962c); Bhor; Purandar Fort, Pune; Deoghar-poladpur; Khed Shivapur; KarjatRaigad (Gaikwad, 2007).

8) The black-bearded tomb bat's :

A pointed muzzle with a distinct blackish beard (a "goatee" on males), light brown to black dorsal fur, and grayish ventral fur. Other key features are its flattened body, a prominent tail tip, and a wingspan of about 370–400 mm. Sexual dimorphism is evident, as males have a gular sac and are generally larger than females in some measurements. Dorsal fur ranges from light brown to dark, while the ventral fur is grayish. The lower back and abdomen are often bare, earning it the name "naked-rumped tomb bat". Head: Features a pointed muzzle with a blackish beard in males. The muzzle is relatively long and cone-shaped, with a shallow depression between the



large eyes. Body: The body is somewhat flattened and measures 90–100 mm in length. Limbs: The forearm measures approximately 60 mm. The wing membrane is dark brown. Tail: Has a prominent tip, with the tail measuring 20–35 mm in length. Claws: Claws are light violet with a white tip. Sexual dimorphism Size: Males are generally larger than females in most dimensions except for total length and forearm length. Glands: Males have a gland on the upper chest and a gular sac, which is absent in females. During the breeding season, the male's "beard" can become wet from this gland.

Other characteristics Flight: Possesses wings with a high aspect ratio, high loading, and pointed tips, which are traits associated with fast flight in open spaces. Measurements: Body length (90–100 mm), forearm length (60 mm), and wingspan (370–400 mm) are key measurements.

Fewer individuals locations: Rajura and Gadchandur

Previous records from Maharashtra: Ajanta (Brosset, 1962c); Bandra; Andheri; Pune; Dhule; Chanda (BMNH); Elephanta (Brosset, 1962c); Bhor; Purandar Fort, Pune; Deoghar-poladpur; Khed Shivapur; Karjat Raigad (Gaikwad, 2007).

9) The Indian pipistrelle (*Pipistrellus coromandra*):

It is a small, brown bat with blackish-brown wings and ears, and a head and body length of 8–9 cm. Key characteristics include its short, dense fur, blunt muzzle, and small, triangular ears. It is known for roosting near human structures, being active at dusk, and feeding on insects.

Physical characteristics Size: Head and body length is 8–9 cm, with a wingspan of 19–22 cm. Weight: Weighs between 9 and 13 grams. Fur: Short and dense, with a color ranging from blackish-brown to reddish-brown on the back and a grayish-brown underside. Face: Features a blunt muzzle and small eyes. Ears: Small, triangular, and blackish-brown, with a prominent tragus. Wings: Wing membranes are blackish-brown, often with a pale margin.

Fewer individuals locations: Rajura and Gadchandur

Previous records from Maharashtra: Tadoba-Andhari Tiger Reserve (Chandrapur district), Gondia district, Chikalda, Ajanta, Nashik, Nalganga, Kopargaon, and Talegaon-Dabhade

10) The naked-rumped tomb (*Taphozous nudiventris*):

Bat is a medium-sized bat with a distinctive naked rump, short light brown fur, and a flattened head. It features a long snout, a grooved protuberance on the lower lip, and triangular, backward-pointing ears. Males have a large throat sac (gular sac) and a chest gland, both less pronounced or absent in females. They are fast fliers that hunt insects like moths and beetles in open air and roost in caves, cliffs, and buildings.

Fewer individuals locations: Rajura and Gadchandur

Previous records from Maharashtra: Tadoba-Andhari Tiger Reserve (Chandrapur district), Gondia district, Chikalda, Ajanta, Nashik, Nalganga, Kopargaon, and Talegaon-Dabhade

11) The Kachin sheath-tailed bat (*Taphozous kachinensis*):

It is a relatively large, nocturnal bat species characterized by its grayish-brown fur, large hairless ears, and a flattened skull that suggests it roosts in tight spaces. It is a relatively large member of its genus, with a forearm length of approximately 41.3 mm (1.63 in). Individuals weigh around 7 g. It has large, hairless ears and a long, narrow tragus (a fleshy lobe in the ear). Its skull has a distinctly flattened appearance. The tail is approximately 54 mm (2.1 in) long. Its dental formula results in a total of 38 teeth.

Fewer individuals locations: Rajura and Gadchandur

12) The Lesser Mouse-tailed Bat (*Rhinopoma hardwickii*) :

Is a small bat with a long, thin, hairless tail that is longer than its body, giving it a mouse-like appearance in flight. Other characteristics include a sand-colored coat, a pig-like snout, and ears connected across the forehead by a band of skin. These nocturnal bats primarily eat flying insects, use echolocation to hunt, and roost in caves, ruins, and other man-made structures. Tail is long, thin, hairless tail that is typically longer than the rest of its body. It has Soft, short, and sand-colored, with paler, hairless lower parts. Head is A pig-like snout and large, rhomboid-shaped ears with transverse ridges. The ears are connected to each other by a band of skin across the forehead. Wingspan is approximately 17–25 cm (6.7–9.8 in). Size of Body length of 6–8 cm (2.4–3.1 in) and a weight of 6–14 grams.

Fewer individuals locations: Bramhapuri ,Nagbhid ,Chimur ,Rajura ,Gadchandur and Sindewahi

Previous records from Maharashtra: Tadoba rest house

- 13) **Fulvous roundleaf bat (*Hipposideros fulvus*):** Is a small bat (8–9 grams) with a forearm length of 38–44 mm, rounded ears, and variable fur color (pale yellow, golden orange, or pale gray). It is a gregarious species that roosts in groups and has a distinctive nose leaf with supplementary leaflets. It is also known to roost in caves, tunnels, and old buildings, and can fly significant distances to forage in vegetated areas. **Size:** Forearm length is 38–44 mm (1.5–1.7 in); weight is 8–9 grams. **Fur:** Color varies significantly, ranging from pale yellow to golden orange or pale gray. The ventral fur is typically white or fulvous-white. **Ears:** Large and rounded at the tips. **Nose leaf:** Distinctive and complex, with a large central leaf and supplementary leaflets on the sides.

Fewer individuals locations: Bramhapuri ,Nagbhid ,Chimur ,Rajura ,Gadchandur and Sindewahi

Previous records from Maharashtra: Aurangabad ,Nagpur and Nanded .

- 14) **The Indian roundleaf bat (*Hipposideros lankadiva*):** is a large leaf-nosed bat with yellowish-brown to dark brown fur that is darker on the head and shoulders and lighter on the belly. It is distinguished by a specific nose-leaf structure with four supplementary leaflets, the fourth being reduced, and has large, pointy ears. Key characteristics include an average forearm length of 83.5 mm (3.29 in) and an average weight of 59 g . It is an insectivore, primarily eating beetles, and has a relatively long lifespan of 10-12 years.

Fewer individuals locations: Rajura and Gadchandur

Previous records from Maharashtra: Mahabaleshwar .

- 15) **Blyth's Horseshoe Bat (*Rhinolophus lepidus*) :** is a small, insectivorous bat characterized by a distinctive horseshoe-shaped noseleaf and broad wings for agile flight. It has gray-brown to lighter upperparts with a white or cream underside, and uses high-frequency echolocation, with calls typically ranging from 91 to 111 kHz. This species is widespread across South and Southeast Asia and primarily hunts insects in cluttered environments.

Fewer individuals locations: Rajura and Gadchandur

Previous records from Maharashtra: Pratapgarh village ,Arjuni (Gondia)

- 16) **Indian Pygmy Bat (*Pipistrellus ceylonicus indicus*):** also known as Kelaart's Pipistrelle, is a large pipistrelle bat with a forearm length of 33–42 mm. Its characteristics include a coat that varies from grey-

brown to golden-brown or reddish-brown, with darker brown ears, face, and membranes. The species has a robust skull, a relatively straight ventral profile, and a tail that partially projects from the tail membrane.

Fewer individuals locations: Bramhapuri ,Nagbhid ,Chimur and Sindewahi

Previous records from Maharashtra: Pune city (Sangam Bridge area, Kothrud, Uttamnagar, Aundh), Junnar, Lonawala, Karla, Maval, Mulshi, Ambegaon, Khed, Karjat, and Mahad, Bombay (Mumbai), Bandra, and Thane, Nasik and Ajanta, Satara, Panchgani, Lanje, and Nalganga, Nagpur, Chikalda, Andhari, and a recent 2021 record from Deori in the Gondia district, Nanded, Aurangabad, Kopargaon, and Talegaon-Dabhade

Observation tables:

Sr.no	Family	Species	Common name	Feeding guild	Conservation status IUCN
1	Pteropodidae	Cynopterus sphinx (Vahl, 1797)	Greater Short-nosed Fruit Bat	F	LC
2	Pteropodidae	Pteropus giganteus (Brunnich, 1782)	Indian Flying Fox	F	LC
3	Pteropodidae	Rousettus leschenaultii (Desmarest, 1820)*	Fulvous Fruit Bat	F	LC
4	Rhinolophidae	Rhinolophus lepidus Blyth, 1844*	Blyth's Horseshoe Bat	I	LC
5	Hipposideridae	Hipposideros lankadiva	Indian roundleaf Bat	I	LC
6	Hipposideridae	Hipposideros fulvus	fulvus roundleaf Bat	I	LC
7	Hipposideridae	Hipposideros speoris (Schneider, 1800)*	Schneider's Leaf-nosed Bat	I	LC
8	Rhinopomatidae	Rhinopoma hardwickii Gray, 1831*	Lesser Mouse-tailed Bat	I	LC
9	Megadermatidae	Megaderma lyra E. Geoffroy, 1810*	Greater False Vampire Bat	C	LC
10	Emballonuridae	Taphozous longimanus Hardwicke, 1825*	Long-winged Tomb Bat	I	LC
11	Emballonuridae	Taphozous melanopogon Temminck, 1841*	Black-bearded Tomb Bat	I	LC
12	Vespertilionidae	Taphozous Kachensis	Kachin sheath-tailed Bat	I	LC
13	Vespertilionidae	Taphozous nudiventris	Naked rumped tomb Bat	I	LC
14	Vespertilionidae	Pipistrellus coromandra (Gray, 1838)*	Indian Pipistrelle	I	LC
15	Vespertilionidae	Scotophilus heathii (Horsfield, 1831)*	Asiatic Greater Yellow House Bat	I	LC

Table 1. Bats checklist in Rajura, Gadchandur, Bramhapuri, sindewahi, Chimur and Nagbhid

Sr.	Species	Common	Family	Colony	Habitat and
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No.		name		Size	occurrence
1	<i>Pteropus giganteus</i>	Indian Flying Fox	Pteropodidae	34–450	Large trees , Mango, ficus ,Tamarind .
2	<i>Cynopterus sphinx</i>	Short-nosed Fruit Bat	Pteropodidae	2–27	Palm trees , Banana tree
3	<i>Rousettus leschenaultii</i>	Fulvous Fruit Bat	Pteropodidae	45–250	Caves,
4	<i>Megaderma lyra</i>	Greater False Vampire	Megadermatidae	35–64	Forest, settlements, abandoned quarters
5	<i>Rhinolophus lepidus</i>	Blyth's Horseshoe Bat	Rhinolophidae	14–560	Caves, Forests (
6	<i>Pipistrellus ceylonicus indicus</i>	Indian Pygmy Bat	Vespertilionidae	20-28	Tree Cavities
7	<i>Hipposideros speoris</i>	Leaf nosed bat	Hipposideridae	6–7	Caves
8	<i>Rhinopoma hardwickii</i>	Lesser Mouse tailed Bat	Rhinopomatidae	11–64	Caves, Crevices
9	<i>Taphozous longimanus</i>	Long Winged Tomb Bat	Emballonuridae	13–17	Crevices Ambai Nimbai

Table 2. Bats checklist in Bramhapuri ,sindewahi,Chimur and Nagbhid

Discussion: In the present survey 16 bat species were reported from the study area. We believe that the relative humidity and type of habitat are crucial factors for these bats. Large old trees were usually preferred by *Pteropus giganteus* and small trees such as Ashoka *Polyalthia longifolia* and other fruit trees were used by *Cynopterus spinx*. Old buildings, temples, tunnels and forts, which mainly include similar ecological conditions, are highly suitable to cave bats. The disturbed natural habitats have also compelled the cave bats to occupy some manmade constructions as their habitat, where these species were sustained successfully. It was apparent that the entire above mentioned bat species are much more widely distributed than was previously recorded and populations occur in areas for which only single or scattered records were previously available. Nevertheless, as we observed at several sites, even these species were sensitive to disturbance from people. Rapid developmental activities might still be an important factor for the survival of bats in the study area. We therefore recommend further studies to document the current status and distribution of the bats.

Threats: In the recent study it was observed that many old structures as houses, caves, temples were under renovation. Road ways construction, township projects, tourism, development of agricultural land removing natural vegetation etc. are also affecting bat fauna. Thus it is important to study the impact of changing habitat and loss of suitable areas on survival of bats in the region (Jones et al., 2009) with the help of a continuous bat monitoring programme. The uncontrolled use of chemical fertilizers and insecticides may have an effect on the food source of insectivorous bats. Pesticides may pose some detrimental effects on bat populations as seen in Clark et al. (1983). Extermination of colonies by pest control operators and Public Health Departments has also

been responsible for the elimination of many bats in urban areas. We observed that availability of natural water was also one of the influential factors for distribution of bat species in the study area.

Conservation recommendations: Forts, temples, devrai or sacred groves were found as important habitats for bats and should remain untouched by the activities such as renovation. Care needs to be taken to protect the natural roosting habitats. Survey and monitoring of the bat colonies from study area should be encouraged with help of volunteers and local NGOs. Under the process of afforestation, indigenous plant species should be preferred over exotic plants. Ecosystem services provided by the bats should be studied and conservation of bats should be promoted as the important bio-indicators (Jones et al., 2009).



Pteropus giganteus (Indian Flying Fox)



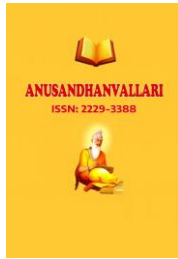
Rousettus leschenaultia (Fulvous fruit bat)



Megaderma lyra (Greater false vampire bat)

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