

Study on Population and Roosting Ecology of Bats in and Around Chikkamagaluru

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ABSTRACT

Bats spend over half of their lives in their roost environment, so these eventually play a prominent role in their ecology and evolution. Roosts are vital to the bats as it is plays where they actively get involved in mating, rearing offspring's and facilitate the social living. With this background, the present study has been planned to evaluate the ecobiology of the bats in the vicinity of Chikkamagaluru. It is situated roughly in the south western part of Karnataka exists in mid-Western Ghats. The population dynamics of bat roosts were studied by emergence Count and direct roost count method. The roosting trees were identified by using standard botanical taxonomic keys. Bats roosted much more in trees belonging

to Fabaceae family (1,527) followed by Myrtaceae family (1,180), Moraceae family (519), Bignoniaceae family (253), Sapindiaceae family (202), Proteaceae family (103), and very less population found in Poaceae family (21). Bat roosted much more in Pipal tree (40.72%), Red buckeye (26.03%), Banyan tree (19.97%), Rubber tree (6.18%), Avenue tree (3.22%), Bamboo (2.7%) and very less population in Tamarind tree (1.15%) in rural side of the study area. Where as in the city premises bats roosted much more in Nilgiri tree (38.19%), followed by Blue jacaranda tree (29.72%), White locust tree (25.26%) and very less roosting of bats in Silver tree (6.81%). In the present survey the population of bats and hosting trees varies from one locality to another locality. This is because of variation in vegetation, environmental condition and more or less adoptability of food and water and the less or more predators. The present study showed that bats preferred to roost in taller and larger trees having greater canopy areas as roosting sites, because these trees could provide more space for their large colonies.

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INTRODUCTION

Bats are indispensable for maintaining ecosystem services (Beilke and O'Keefe 2023), they adapted to urban landscapes with uncharacteristic living conditions (Francis and Chadwick 2012, Tzortzakaki *et al.* 2019). Bats are about 1400 known species with

second largest order of mammals (Wilson and Mittermeier 2019). In past 2 centuries human induced environment have resulted in mass extinction of global species (IPCC 2022). Genomic data will help us to reconstruct the changes in population size (Beichman *et al.* 2018). They form one of the largest nonhuman aggregations and the most abundant groups of mammals when measured in numbers of individuals (Jones *et al.* 2009). In fact these are gentle creatures having great ecological importance (Fenton 2003) and are considered as keystone species in many ecosystems (McConkey and Drake 2006, Kunz *et al.* 2011).

Bats are both taxonomically and ecologically extremely diverse inhabits many ecosystems (Kunz and Fenton 2005). Indian flying fox, *Pteropus giganteus*, one of the largest bats, is widely distributed throughout the Indian subcontinent (Bates and Harrison 1997). Bats utilize roosting sites within forests, such as tree hollows, exposed bark, and clusters of dead leaves, as daytime shelters throughout the summer (Drake *et al.* 2020). Beyond urban and suburban zones, the intensification of agriculture is causing additional fragmentation of forests (Billeter *et al.* 2007). Bats play an important role in the health function of forested ecosystem. They consume vast numbers of insects nightly and are probably the primary predators of nocturnal flying insects in many areas (Williams-Guillen *et al.* 2008). The present study has been carried out to evaluate the diversity and ecobiology of bats of Chikkamagaluru city.

MATERIALS AND METHODS

Study area

Chikkamagaluru is situated roughly in the south western part of Karnataka state. A large are at this district in Malnad i.e. forested hilly region of heavy rain fall. Chikkamagaluru is located between $13^{\circ} 15' 53''$ north latitude and between $75^{\circ} 04' 46''$ and $76^{\circ} 21' 50''$ east latitude (Fig. 1). Its greatest length from east to west is 138.4 km and from north to south east 88.5 km. It is located at an elevation of 3400 feet. The temperature at ranges between $11-20^{\circ}$ C during winter and $25-34^{\circ}$ C during summer.

Climate

The temperature in the valley ranges from 10° C to 32° C. Bulk of the rain fall occurs during the south west monsoon between June and September. The annual precipitation is 2000-2540mm and considerably higher than the 750-1000mm.

This study was done primarily in and around Chikkamagaluru during the study period, bat colonies that were located on different types of trees and on artificial structure.

Information regarding the bat population was counted by visiting different localities frequently. The population dynamics of bat roosts were studied

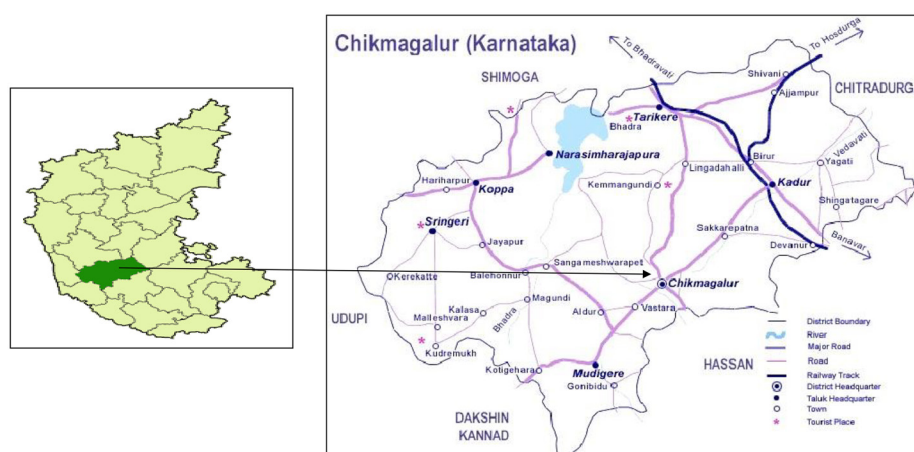


Fig. 1. Map showing the study area.

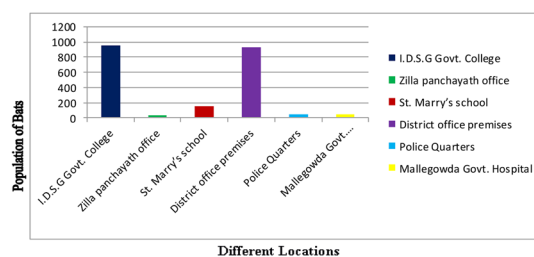
by emergence count (Swift 1980) and direct roost count method (Thomas *et al.* 1979). The roosting trees were identified by using standard botanical taxonomic keys (Cope 1976). The survey was conducted during the early hours in the morning and late evening. For the present study to identify the bats types and its locality, population estimation in field we collected information from different persons, experts of the respected areas. Day roosts were identified from earlier records through informal discussion with inhabitants (Sankaran 1998). At each roost the species present and the roost type were recorded. Population sizes were estimated by counting the individual of each species. Bat photographs were taken by using digital camera and also counted by binocular. Host plants, population were identified and recorded (Kunz 1982).

The survey of roosts included caves, bridges, crevices, road culverts, abandoned buildings, and trees. To comprehend the attitude of the locals regarding conservation of bats in their vicinity, randomly 10 persons in each locality were asked to reply a simple questionnaire of five questions regarding; whether bats are present (observed roosting, foraging) in their vicinity, Any observable change in the number of bats in the recent past (last 10-15 years), Whether people hunt bats for consumption, Instances of persecutions of bats by villagers, Whether people are willing to live in harmony with bats. The responses of the respondents were recorded and augmented with field observations as given by Saikia *et al.* (2015).

RESULTS AND DISCUSSION

In the present study area mainly two important bat types were identified, namely fruit bat and insectivores bat. Comparatively in Chikkamagaluru city according to survey the fruit eating bats population were more. For the current study the survey has been conducted to know the bats population, host plants in different localities of Chikkamagaluru. The bats roosting was found in 14 localities which was categorized into three different regions viz., Municipal office premises, Government building vicinity, and Rural Chikkamagaluru.

Roosts selection criteria of these flying foxes are strongly influenced by food availability and food

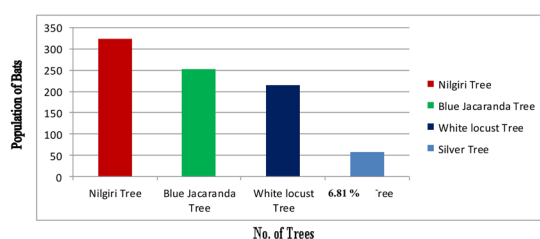


Graph 1. Population of bats near government vicinity roosted on different trees.

proximity (Palmer and Woinarski 1999). Gorresen and Willig (2004) observed that abundance of generalist frugivorous bats was positively associated with fragmentation of the landscape and their ability to feed on a variety of plant species that allowed them to utilize heterogeneous landscapes. Moreover, other explanation for their roosting preference in forest near areas of high human density is that homestead gardens provide a diversity of food resources that may not be present in natural forest. However, the growing human populations and consequent demands for food and housing lead to the decline and destruction of bat habitat worldwide (Fujita and Turtle 1991).

In government vicinity region the roosting of both the species were much more compare to other two regions. The Graph 1 shows the population of bats and different location on which bat roosted and percentage. Among the different location, much more population of bats was found in IDSG College (44.07%), followed by district office premises (42.92%), St Mary's school (7.02%), Police quarters (2.29%), Mallegowda government hospital (2.06%), and very less roosting population found in Zilla Panchayath office premises (1.60%). The population of bats in the area may be more in number because availability of varieties of trees and rich availability of food and water in area.

Graph 2 explains the population of bats near Municipal office premises and also shows the population of bats, types of trees and percentage among different trees, on which the bat roosted. Bats roosted much more in Nilgiri tree (38.19%), followed by Blue jacaranda tree (29.72%), White locust tree (25.26%) and very less roosting of bats in Silver tree (6.81%).

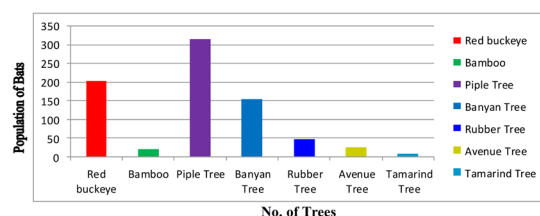


Graph 2. Population of bats near municipal office premises roosted on different.

It indicates that the bat selection of trees for roosting probably it selects hard and very tall trees.

Graph 3 shows the population of bats, types of trees and percentage among the different trees and also explain the population of bats near Rural Chikkamagaluru. In this localities bat roosting in many tree species. Bat roosted much more in Piple tree (40.72%), Red buckeye (26.03%), Banyan tree (19.97%), Rubber tree (6.18%), Avenue tree (3.22%), Bamboo (2.7%) and very less population in Tamarind tree (1.15%). The population of bats is more may be due to the availability of food.

Table 1 and Graph 4 shows the population of bats in different families of tree. On which the bat roosted shows that much more in Fabaceae family (1,527) followed by Myrtaceae family (1,180), Moraceae family (519), Bignoniaceae family (253), Sapindiaceae family (202), Proteaceae family (103), and very less population found in Poaceae family (21). It indicates that the populations of bats more in Fabaceae family because the tree belongs to Fabaceae families are shading trees and also thick vegetative tree, helps them to protect themselves from predators and for the survival. Indiana bats depend significantly



Graph 3. Population of bats in rural Chikkamagaluru roosted on different trees.

Table 1. Roosting and population of bats in different families of Trees.

Population of bats in Fabaceae family		
Scientific name	Common name	Population
<i>Acacia philoda</i>	Acacia	1193
<i>Albizia labaq</i>	Flat crown tree	35
<i>Pongamia pinnata</i>	Avenue tree	25
<i>Rubinia pseudoacacia</i>	White locust tree	215
<i>Tamarindus indica</i>	Tamarind tree	09
<i>Leucaena leucocephala</i>	Subhabula tree	50
	Total	1527

Population of bats in Moraceae family

Scientific name	Common name	Population
<i>Ficus benghalensis</i>	Banyan tree	155
<i>Ficus elastic</i>	Piple tree	48
<i>Ficus eligiosa</i>	Rubber tree	316
	Total	519

Population of bats in Myrtaceae family

Scientific name	Common name	Population
<i>Eucalyptus globulus</i>	Nilgiri tree	1180

Population of bats in Proteaceae family

Scientific name	Common name	Population
<i>Leucadendron argenteum</i>	Silver tree	103

Population of bats in Bignoniaceae family

Scientific name	Common name	Population
<i>Jacarand mimosifolia</i>	Blue jacaranda tree	253

Population of bats in Sapindiaceae family

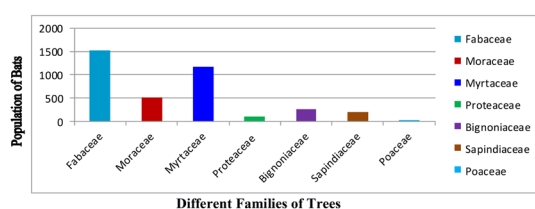
Scientific name	Common name	Population
<i>Aesculu spavia</i>	Red buckeye	202

Population of bats in Poaceae family

Scientific name	Common name	Population
<i>Bambusa vulgaris</i>	Bamboo	21

on the peeling bark of snags exposed to sunlight, while northern long-eared bats prefer a combination of shaded live trees and dead trees (Bergeson *et al.* 2021 and 2018).

Bats are the most gregarious and long lived mammals that are likely to live and learn socially. The flying foxes that roost in taller and larger trees having greater canopy areas are preferred as roosting



Graph 4. Roosting and population of bats in different families of tree.

sites; because these trees could provide more space for these large colonies. According to Pierson and Rainey (1992), larger bats prefer to roost in taller trees because they need space to free-fall during takeoff. Within forests, it is important to promote roost trees with a range of microclimates, including solar-exposed snags, which benefit maternity colonies and are important for the recruitment of new individuals in a population (Burrell and Bergeson (2022).

Most of the colonies of Indian flying foxes are either moderately or strongly colonial (Pierson and Rainey 1992). These flying foxes roosts as colony and some flying fox colonies up to a few hundred thousand bats and may have increased to millions of individual (Nowak 1999). The current largest aggregation of the genus *Pteropus* consists of more than 15,000 individuals in Borneo and 9000-21000 in the Island of Palau Rambut (Kunz and Jones 2000). Katsis *et al.* (2020) highlighted their findings that brown long eared bats male and non breeding females of the same species avoid lactating females to some extent due to high cost involved associating with these groups i.e. chances of high level of parasitism. Similar congregations were reported by the roosting patterns of bats other than trees were found in rocks near Dambaradahalli.

CONCLUSION

In the preliminary survey of bats, the population of bats, hosting trees and foraging behavior varies from one locality to another locality. This is because of variation in vegetation, environmental condition and more or less adoptability of food and water and the less or more predators. Indian flying fox spends the day sleeping in a tree with its head down. They usually choose a “Home Tree”. They active during

night time because of searching food. In the evening, the bat become increasingly restless and at one point they all take off and find a finding place.

According to the present studies, total 14 localities of bat roosting was identified. More number of bat found in near government vicinity compare to other localities, this may be probably it is because in government vicinity area having a maximum number and varieties of trees. The present survey indicates that bat preferred large trees like Eucalyptus, Acasia, Piple tree, and Banyan tree.

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