Chapter 4: Material and Methods

Studies on the Ecobiology of Indian flying fox Pteropus giganteus Brunnich, 1782 of Assam was carried out in three districts, Kamrup, Barpeta and Dhubri following the neo-classical methodology.

The Physiography of the roosting areas of the districts was studied following the methodology of Bhattacharjee and Deka (1977), Dutta and Deka (1992) and Changkakoti and Deka (2001). Physiographical studies reveal that the areas experiences an annual mean temperature of 24.4°C followed by 77.8% of relative humidity and 126.21mm rainfall. The mean maximum and minimum temperature were recorded at 28.7 and 20.1°C respectively (Table 1a in Chapter 3). General climatic condition of the Brahmaputra Valley is muggy characterized by high humidity and moderate temperature (Figure 2 in Chapter 3).

For taxonomical explanation of the Indian flying fox, works of Corbet and Hill (1992) was followed. The morphological studies had been done following the works of Bates and Harrison (1997) and Sinha (1999). For the morphological studies, 30 individuals were captured using mist net in the feeding ground, and after carefully recording the data, they were released back to the environment.

The habitat studies were carried out independently by the present worker at the roosting sites in particular and the districts of roosting sites in general.
The roosting sites were identified through survey and interviewing local people. Tree heights (H), girth at breast height (GBH) and canopy cover (C) were studied following the works of Goyal and Sale (1992). For tree heights and girth a clinometer and a 50 meter measuring tape were used. The forest types of the study areas were studied from the reference books and from the informatics of the forest department of Assam established in the district head quarter and also collected from the division of wildlife of state forest department of Assam and compared with the information gathered and data collected by the worker. Sometimes plant taxonomists of the Department of Botany, Gauhati University, Guwahati, Assam were also consulted for that purpose. The roosting trees constituted mainly by *Samanea saman*, *Delonix regia*, *Caesalpania inermis*, *Eucalyptus globossus*, *Bombax ceiba*, *Mangifera indica*, *Bambusa sp.*, *Tamarindus indica*, *Ficus religiosa*, *F. bengalensis*, *F. glomerata*, *Antheroecephalus cadamba*, *Eugenia jambolana*, *Alstonia scholaris*, *Polyalthiya longifolia*, *Terminalia arjuna*, *Shorea robusta*, *Trewia nudiflora* and *Artocarpus heterophyllus*.

Food and feeding habits were studied following the works of Goyal and Sale (1992); and Marshall and McWilliam (1982) so far food in general and food selection in particular.

Food plants, food preference, seasonal feeding patterns, mechanism of food selection and other feeding behaviours were done in and around 10 sq.km areas of three selected day roosting sites of the three districts. All the three selected feeding sites were surveyed for two consecutive years starting from
January 2001 to December 2002 to identify and record the maximum possible food sources used by the *Pteropus giganteus*.

Food items were identified as far as possible on the spot during feeding hours in their feeding ground. Some of the food resources have also been recorded by observing the partially chewed fragments of fruits or flowers that were dropped beneath the feeding plants or sometimes under the day roosting sites while feeding on in-situ or ex-situ condition respectively.

Ten food plant species such as *Areca catechu, Musa balbisiana*, *Ficus glomerata, Bombax ceiba, Mangifera indica, Ziziphus jujuba, Psidium guajava, Anthocephalus cadamba, Eucalyptus globossus* and *Samanea saman* were selected from the study areas upon which feeding habits were specially monitored. An US made Headlamp (PETZL) was used to locate the feeding habits of the bat species. Sometimes theirs presence in a feeding area was determined by hearing their screaming sounds or nasal cries produced during the intra or interspecific struggle for food resources.

Breeding and parental care were studied by following the works of Moghe (1951), Prater (1971), Goyal and Sale (1992), Sinha (1995), Bates and Harrison (1997) and Koilraj et al. (2001). Breeding and parental care relating to courtship, copulation, gestation, parturition, fecundity and nursing of young ones by the mother were studied with their finer details, one after another, mostly during day roosting period through spot observations for three years (Sep 2000–Aug 2003) at two-selected roosting sites such as
Kacharighat of Kamrup district and the Kacharighat of Dhubri district respectively. Male and female individuals of breeding pairs were identified after physical verification of their sex organs (Penis and distended scrotum of adult male; vagina of female). Breeding pairs were also identified depending on their involvement in courtship activities and continued up to parturitions. Juvenile or newborns and sub adults were detected in relation to body sizes, nearness or attachment to their mothers as well as looking at the clear line of demarcation on the mantle and the dark hairs of the dorsum of the babies which has been recognized as the identification mark of *P. giganteus*.

For diurnal behavioural study “Scan Animal Sampling Method” of Altman (1974) was followed. A scan refers to a single recording of the group of activities of ten (10) randomly selected bats starting from 0500 hours to 1700 hours. The study of *P. giganteus* was conducted at the Kacharighat roosting site of Dhubri district for one year starting from September 2001 to August 2002 on the eight (8) different characters such as resting or sleeping, fanning, grooming, vocalisation, aggression, flying, crawling or climbing and other behaviour which includes seasonal mating, defecation and occasional daytime feeding displayed by the species during daytimes (inactive period for bats).

For all kinds of behavioural study, one Russian binocular (Pathiscope, de Luxe) having the field 10×50 was used.
To estimate the population status and present population dimension data were collected once in a month prior fortnight in the early morning hours from the fifteen selected roosting sites of Kamrup, Barpeta and Dhubri districts (five roosting sites in each district) for 36 months starting from March 2000 to February 2003. Approximately 786 sq.km area was surveyed to locate the 15 roosting sites of the three districts. Statistical analysis of variance (ANOVA) was done to assess the comparative distribution of population in different months, years, seasons and sites during the study period. One fourth of the adult male and females were counted separately to find out the sex ratios in all the 15 selected roosting sites.

Threats and conservation related issues were evaluated by observing their plight of behaviours at different roosting sites, feeding areas and also by interviewing the common people, local inhabitants residing nearby the roosting and feeding habitats, forest officials, nature lovers and wildlife activists. Habitat loss due to anthropogenic deforestation, hunting for medicinal use as well as meat, electrocution, natural calamities like cyclones, occasional strong hail storms and predation to some extent were observed to be the threats of P. giganteus population in their habitat in lower Brahmaputra Valley of Assam.

Looking at the role of P. giganteus in forest pollination and seed dispersal to restore and enrich our forest ecosystem and to mitigate the problem of prevailing threats, it is time to launch serious long term awareness and conservation education cum management programme along with
multidimensional scientific research works in the College and Universities
ultimately to save the existing roosting sites and existing population from
further declines in the state of Assam.

Statistical formulae used:

1) Tree height was calculated by using the following formula:

\[ H = (D \times \tan \theta) + h \]

Where, \( h \) = Height of measuring person at the eye level.

\( \theta \) = sighting angle from which the top of the tree canopy was visible,

\( D \) = Perpendicular distance from the stem to the point from which the
top of the tree canopy was visible

2) ANOVA:

Variance \( (S^2) = \sum (x-\bar{x})^2/N \)

Or, \( (S^2) = \sum (x-\bar{x})^2/N-1; \) when \( N \leq 30 \)

\[ F = \frac{\text{Between sample variance}}{\text{Within sample variance}} \]