Chapter 3
Methodology
CHAPTER III

METHODOLOGY

Materials and Methods

Birds were observed with (Zeis 10 x 50) binoculars in the field. While following groups it was usually possible to keep some birds in view at all times, but rarely possible to see all members of the group together. For recording bird behaviour, nearly 4000 hours were spent in the field during this study period. Observation of two successive days are combined; for instance 0630 AM to 1230 PM at a stretch on one day and from 1230 AM to 0630 PM on the next day. This 12 hour observation was considered as one observation day. Such observations were carried out at least once a week or two weeks. While following the groups interactions between members of the same group, different groups of one species and groups of congeneric species were recorded.

Animal sampling

Michael (1984) described the absolute sampling method to collect and record common arthropods of an area. This method involves the use of a 1x1 M wooden quadrat placed on the ground. The frame was pressed into the soil to prevent the animals from running out of the quadrat while the counts are made; Large and conspicuous insects like grasshoppers are counted first, otherwise they
fly or hop about. Data in six points, each point was inside a major quadrat on either side of the line transect of the study area were recorded. Each species was identified and counted and the mean value calculated.

Vegetation sampling

A modified form of quadrate method used by Sykes and Horril (1977) was adopted in this study. The multiple stage quadrat sampling method was used in my study after suitable modifications like reducing the size of the quadrat and reducing the number of quadrats.

In this method major sampling unit is a 20m x 20m quadrat. Two minor sampling units of 5m x 5m and four further subquadrat of 1m x 1m were arranged inside the major quadrat as in Fig. 3.1.

The number of quadrats to be studied was fixed as six. This was based purely on practical considerations.

Quadrats of 20m x 20m size were laid on either side of a transect line of 400m, alternatively; at each end of the transect 40m was left and the interspace between adjacent quadrats was fixed as 40m. In all the quadrats the number of plants are recorded and identified.
FIGURE 3.1. Lay out of the multiple stage quadrat method
The same pattern was followed, particularly the position of the subquadrats within the major quadrat, while recording the vegetation data in all the study sites as in Fig. 3.2.

The plants were arbitrarily grouped into three classes as in the table.

**TABLE 3.1**

<table>
<thead>
<tr>
<th>Class</th>
<th>Measurement</th>
<th>Habit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>&gt; 30 cm GBH</td>
<td>Trees</td>
</tr>
<tr>
<td>Class II</td>
<td>&lt; 30 cm GBH</td>
<td>Shrubs, sapling and other woody plants</td>
</tr>
<tr>
<td></td>
<td>&gt; 100 cm height</td>
<td></td>
</tr>
<tr>
<td>Class III</td>
<td>&lt; 30 cm GBH</td>
<td>Herbs and seedling of trees</td>
</tr>
<tr>
<td></td>
<td>&lt; 100 cm height</td>
<td></td>
</tr>
</tbody>
</table>

GBH – Girth at Breast Height

In each 20 m x 20 m quadrat the following vegetation data were recorded.

- All the trees with > 30 cm GBH were identified and its GBH and Height were measured (Height was measured by visual approximation and in comparison with measured ones).

- In each 5m x 5m quadrat, all the class II plants were identified and counted.

- In each 1m x 1m quadrat all the class III plants were identified and enumerated.
Figure 3.2 – Layout of the transect line and the vegetation study quadrates
Hence, in 20m x 20m major tree quadrat two 5m x 5m quadrats for class II plants and four 1m x 1m quadrats for class III plants were studied. Altogether a total area of 2400m² were sampled for class I plants, 300m² for class II plants and 24m² for class III plants in each study area.

Canopy cover was estimated by visual estimation (Daniels, 1994), percentage of overlap between adjacent tree crowns direct above was estimated visually and grouped into different percentage classes. The mean values of all the percentage score from a study area was considered as the canopy cover of that area.

**TABLE 3.2**

<table>
<thead>
<tr>
<th>Type</th>
<th>Canopy</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Open</td>
<td>0 - 20%</td>
</tr>
<tr>
<td>2</td>
<td>Adjacent crowns just meet</td>
<td>21 - 40%</td>
</tr>
<tr>
<td>3</td>
<td>Crowns overlap still allows sunlight to penetrate</td>
<td>41 - 80%</td>
</tr>
<tr>
<td>4</td>
<td>Sky not visible</td>
<td>81 - 100%</td>
</tr>
</tbody>
</table>

Foliage density was estimated for class II plants using the plumbline method (Mac Arthur, 1962). A plumbline 5 m long was suspended at ten random points over a grid of two sq. m and the number of leaves touching the line at each
point (ni) was counted, the percentage density was then calculated from the formula

\[ C = \frac{n}{10} \times 100\% \]

where \( n = \) total number of leaves touching the line.

This method was impractical for high canopy density which was estimated by using the measurements on the class II plants as standard for comparison. The percentage of foliage cover was estimated for 1 m, 5 m, 10 m, 15 m, 20 m, 25 m and 30 m height in all the major quadrats.

**TABLE 3.3**

**Categories of Plants based on Crown Position**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Type</th>
<th>Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Emergent trees</td>
<td>No lateral contact between trees</td>
</tr>
<tr>
<td>2</td>
<td>Canopy trees</td>
<td>Interconnected lateral overlapping branches from all the sides</td>
</tr>
<tr>
<td>3</td>
<td>Under story trees</td>
<td>Trees just below the canopy but not integrated into the canopy</td>
</tr>
<tr>
<td>4</td>
<td>Shrub layer</td>
<td>Saplings of trees, woody plants and true shrubs</td>
</tr>
<tr>
<td>5</td>
<td>Herb layer</td>
<td>True herbs, and seedlings of species</td>
</tr>
</tbody>
</table>

The density and relative density of a plant species in the study sites were calculated by using the equation
Density = \frac{\text{Total number of individuals of the species}}{\text{Total number of quadrats used in sampling}}

Relative density = \frac{\text{Total individuals of species A}}{\text{Total individuals of all species}} \times 100

To determine the mean number of a population the following formula was used,

\[
\text{A.M.}; \ X = \frac{\sum X}{n}
\]

where \( \sum X \) was the total number of individuals of a species observed in the quadrats and \( n \), the number of quadrats of observation.

In the case of vegetation sampling the number of quadrats were six for class I plants and 12 for class II plants and 24 for class III plants.

To observe the difference in group size in relation to vegetation structure 10 visits to each study site were conducted during this study period and the birds were observed on either side of 400 m transect line. Birds which could be seen up to a distance of about 50 m from the transect line on either side alone were taken into account. Observation of two successive days were combined; 0630 AM to 1230 PM at a stretch on one day and from 1230 to 0630 PM on the next day. This 12 hour observation was considered as one observation day. The number of groups and number of birds in each group were recorded. Printed data sheets were used in the field to record the data.
To gather data on the seasonal variations in diet diversity, gut content analysis was conducted in birds from areas outside the main study area. The Babblers were shot with an air gun. In total 38 Jungle Babblers and 37 Whiteheaded Babblers were collected. The gut of these birds were taken out immediately after shooting and the contents were dried on blotting papers for 15 to 20 minutes at room temperature. Animal and plant matter was sorted and weighed on an electric balance true to 0.001 gm. After weighing the plant matter was preserved dry, while animal matter was preserved in 70% alcohol for further identification.

In addition to the gut content analysis, data on the food habits of Babblers was collected from the field by direct observation periodically at different times of the day. Behaviour patterns such as the sentinel system, allopreening, vocalization, waking, roosting and bathing were also recorded.

For recording allopreening interactions the body was divided into four areas as in Fig. 3.3. An allopreening interaction was considered complete when the involving birds separated. If one bird moved to another perch and was followed by the other and resumed allopreening, the resumption was treated as a new interaction, even though less than one minute had elapsed between the cessation and resumption of allopreening. Each area of the body preened was scored only once in each interaction.
Figure 3.3 – Parts of a Jungle Babbler scored separately in recording allopreening behaviour.
For studying the ecological isolation, measurements of bill, tarsus, wing and tail of *T. affinis*, *T. striatus* and *T. subrufens* were taken for comparison and to find out character displacement if any. Specimens in the collection of the Bombay Natural History Society were taken for measurements.