
CHAPTER TWO

MATERIAL AND METHODS

Kolhapur is a city of great antiquity which has been able to maintain its ancient celebrity and distinction almost uninterruptedly. It is also one of the oldest cities of Western India. The city has a long historical background dating back to 200 B.C. The ruins of Brahamapuri is famous archaeological site on the banks of the river Panchganga in the Western extremity of the city. Brahampuri's origin is attributed to the Creator, Brahma himself in mythology. As a religious centre, Kolhapur is known as "Dakshin Kashi" or "Kashi of the South". It was also the capital of former Kolhapur State, a premier state of residency for Deccan States.

The city of Kolhapur is located in South Western Maharashtra at an altitude of about 550 meters above mean sea level and lies to the east of the Western Ghats in the transitional zone. It is situated at latitude $16^{\circ}41'$ North and longitude $74^{\circ}17'$ East. Kolhapur Municipal Corporation has an area of 66.84 sq.km. and it is at a distance of 395 km from Bombay and 793 km from Bangalore in opposite directions on the National Highway No.4.

The city is bounded on the east by the boundries of Uchgaon village, on the south by the boundries of Kalamba and Panchgaon village and on the west and north by Panchganga river (Fig.1) a major tributary of River Krishna. The city represents a typical example of dominance of the physical features. A number of small hills and high ground are found in the city itself. The low alluvial land along the bank of the Panchganga river to the north and the hilly aspect to the

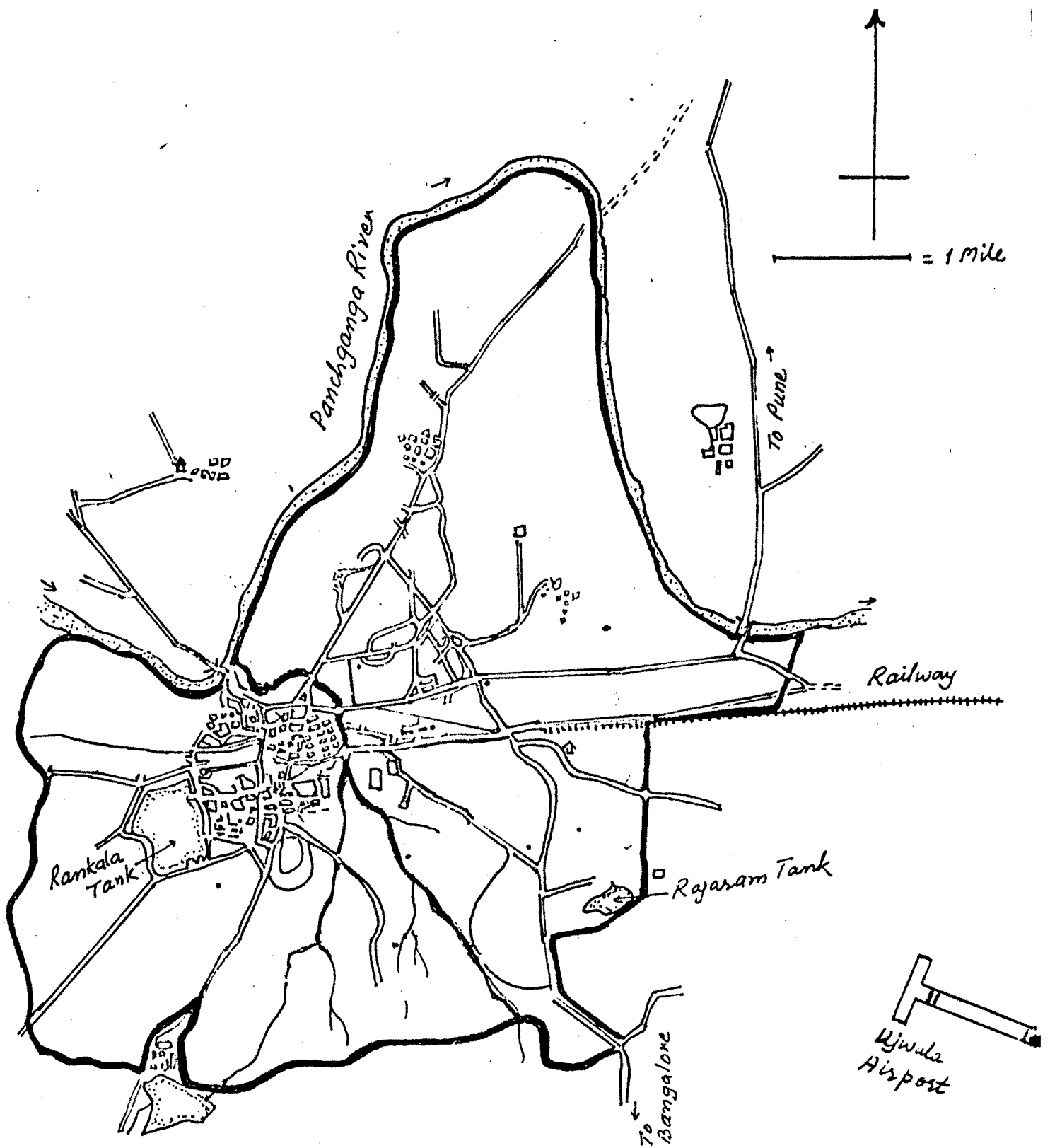


Fig 1: Map of Kolhapur City giving the major physical features.

south are the two striking features of the city.

The old township of Kolhapur, in the past, had a large number of tanks and pools in and around it. Even today there are many small and large water bodies scattered in the city. The prominent being Rankala tank (100 ha) on the west of the city (Fig.1). Rajaram tank (40 ha) is on the east and Kalamba tank (20 ha) on the South West of the city. The medium and small water bodies are Kotitirth, Takala, Bavda Tank etc. The water bodies like Ravaneshwar, Padmala, Phirangai, Varuntirth etc. have been reclaimed and are now converted into play-grounds.

The Jayanti Nala is the biggest stream of the city that receives the tributary Gomati Nala and others and all of them drain an extensive fan shaped hilly area lying to the south of the city. Near the Brahmapuri mound the Jayanti nala meets river Panchganga. The river drains an extensive hill area on the eastern slopes of the Western Ghats about 45 km on the west of the city. Due to the heavy rainfall in the Ghats, around 6000 mm per year, the river carries huge quantity of water during the south west monsoon. The upstream dams regulate the perennial water supply in the river which is one of the important physical features of the Kolhapur city (Fig.1).

Agriculture is practiced within the municipal corporation limits of the city and it is primarily restricted to the peripheries. Due to the extensive lift irrigation facility and the low alluvial tract sugarcane is cultivated along the river. The main inhabited area of the city is triangular in shape.

Due to the suitable climatic conditions and soil depth there are many patches of good vegetation in the city. These are either trees on the banks of waterways and fields, avenue trees or in public parks. There are around 40 old and new gardens in the city. The oldest garden is perhaps the townhall which is about a century old and has excellent, old endemic and exotic trees. There are around 11 new gardens in the city. Apart from this vegetation the horizontal growth of residential areas in the city has a large number of exotic trees planted in the housing society and own lands.

According to the 1981 census, the population of the city is 3,40,306 this excludes many new settlements immediately outside the city limits. The population of the township is increasing rapidly since 1948 and now it is a prominent industrial centre in South Maharashtra.

Kolhapur city derives its importance from trade, commerce, industries and educational centre. Kolhapur is known for the famous "Kolhapuri Chhapals" and Chhapal industry. There are number of small cottage factories which are engaged in leather trade such as leather processing tanning, finishing, drying of hides and skins etc. This industry is concentrated near Jawaharnagar and Subhashnagar i.e. a colony of tanners (Dhows) along the Gomati nala. The major carcass dump is near Ramanandnagar which attracts a large population of scavenger birds.

There are two slaughter houses in the city to cater the growing meat requirements of the residents. Apart from the

slaughter houses goats and sheep are also killed on market day at some other places. At the heart of the city there is a large mutton and fish market at Bindu chowk.

The garbage is collected every day from different points in the city and dumped in many places. These days there are 5 main garbage dumping sites near More colony, Devane colony, Takala, Kasba bavada and Kadamwadi. These places too attract a large populations of scavenger birds particularly Pariah kites.

During the present investigation a detail survey was made, for a period of one month, of the city to locate the roosting sites of scavenger birds. Initially four roosting sites of P.kite and one of whitebacked Vulture was discovered. Subsequently five more roosting sites of P.kites were discovered (Fig. 2). A brief discription of the roosting sites studied is as follows :

Roost site No.1 (R-I) :

This was the largest kite roost in Kolhapur city. It was situated at Tararani Vidyapith Highschool Campus in Rajarampuri in the eastern side of the city. The area of 3 acres had around 169 trees belonging to Eucalyptus (Eucalyptus cambuldensis), Palm trees (Phoenix sylvestnis), Casia (Cassia siamea), Raintree (Samania saman), Ashok (Polyalthia longifolia) etc. (Plate 3, a). This plantation is about 20 years old and a new plantation of about 26 coconut trees has been added to it five years back. The entire school campus is protected by a compound wall. The school is located in a vast residential area

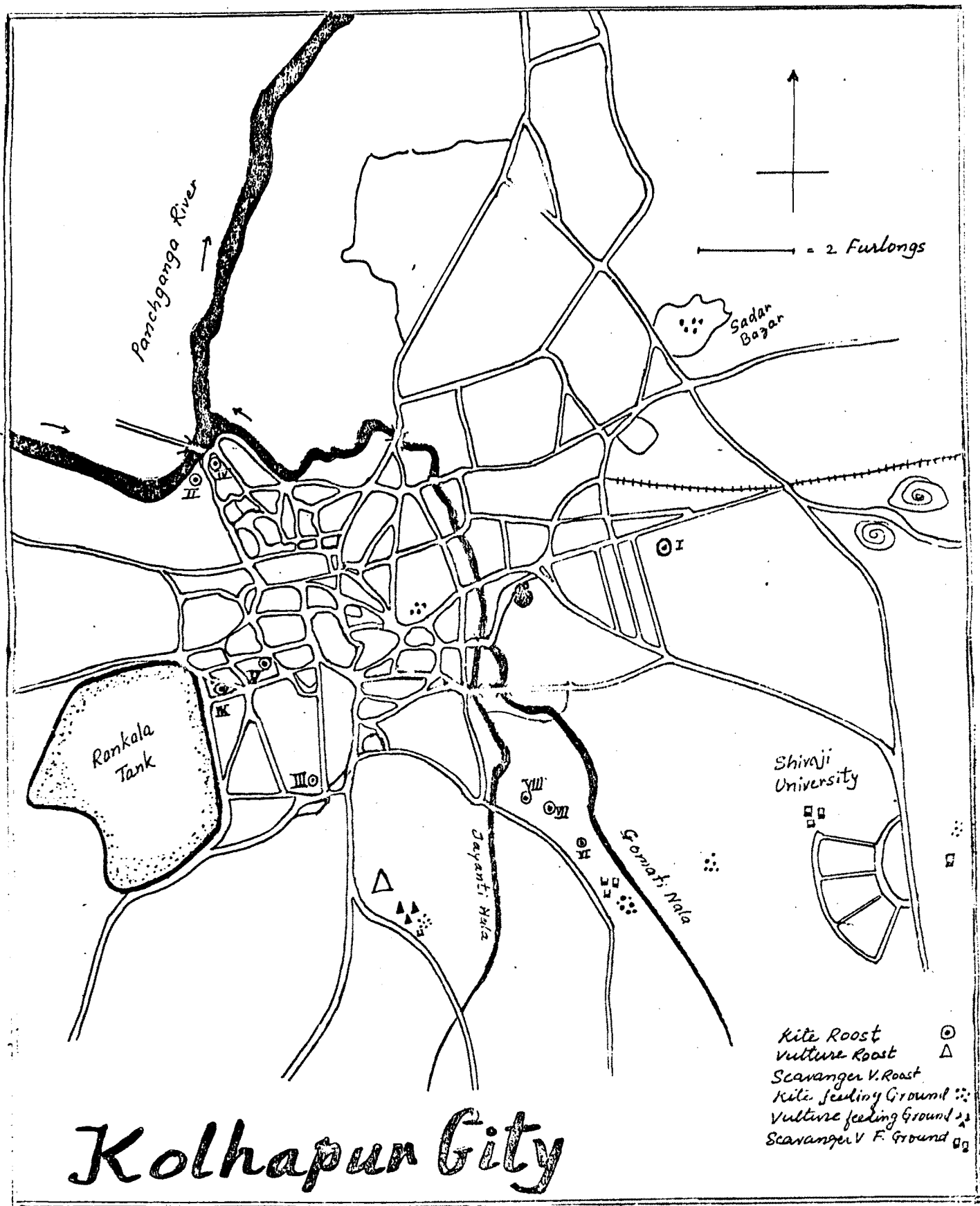


Fig 2: Locations of the Pariah kite roosts
white backed vulture roost and
feeding site of Scavenger Vultures.

**Plate 3 : a) Roost R-I at Tararani Vidyapeeth Campus,
see the eucalyptus roost trees at the
background.**

**Plate 3 : b) Roost R-II, The solitary Peepal tree
at the banks of River Panchganga.**



and there is no other big plantation in the near vicinity.

Only the 30-40 feet tall 81 eucalyptus trees were occupied by the roosting birds in the mixed roost shared by Pariah kite Milvus migrans, house crow Corvus macrorhynchos jungle crow Corvus splendens myna Acridotheres tristis and house sparrow Passer domesticus.

Eucalyptus trees, which constituted 47.92 % of the total trees, were mainly used by kites, crows and myna. Palm trees were used as roost only by myna and mainly Ashok and partially lower branches of eucalyptus were used by house sparrows.

Roost Site No. 2 (R-II) :

The roost was located on the bank of river Panchganga on the western side of the city near the famous Panchganga Ghats. This was a solitary 14 meters tall Peepal tree Ficus religiosa (Plate 3, b). On the east of this roost tree there are some large rain trees and on the opposite side in the agriculture field another solitary and equally big peepal tree but none of these trees were used by P.kite or other bird species for roost purpose. The roost was outside of the city and was situated in the country side near the river.

Roost Site No. 3 (R-III) :

The site had three peepal trees of about 12 meters height near each other in a residential area on the west of the city near Rankala tank. Kites used only one of these trees (Plate 4) throughout the period of investigations and the other two were never occupied. Though one of the two trees

Plate 4 : Roost R-III, A peepal tree situated in a
residential area at "Panyacha Khajina".



was used by a nesting pair of kites in 1987. There was partial agriculture and residential area around this roost.

Roost Site No. 4 (R-IV) :

This roost is located near the famous archeological site of Brahmapuri and the newly created Picnic spot on the bank of river Panchganga at an elevation of about 20 meters height. This is said to be the oldest and original nucleus of the township.

There are ten trees like Accacia (Acacia nilotica), Neem (Azadirachta indica), white champa (Plumeria acutifolia), and Tamarind (Tomarindus indica) on the roosting site (Plate 5). All the trees were used by Pariah kite at different times without any preference to a particular tree species. No other bird species roosted on these trees (Plate 5).

Roost Site No. 5(R-V) :

The roost R₅V was located near Kapiltirtha, the main city vegetable market in the thickly populated Shivaji Peth. The solitary roost tree was 15 meter tall eucalyptus which was occupied only by P.kite for roosting (Plate 6, a). There was another eucalyptus tree nearby which was never occupied by kites. An open place used as waste dumping site was observed near the roost tree.

Roost Sites No. 6, 7 and 8 (R-VI, R-VII and R-VIII) :

These three roosts were situated near Subhash nagar on the south side of the city in agriculture fields. The roosts were close to one another. Roost VI consisted of only one

Plate 5 : Roost R-IV at 'Brahamapuri', note other
tall trees in the area.



**Plate 6 : a) Roost R-V near Kapiltirtha Market in the
Old Residential area of Shivaji Peth.**

**Plate 6 : b) Roost R-VIII, at Subhashnagar, Casurina
trees in the agriculture land.**



Plate 7 : Roost VII, Eucalyptus trees in the
agriculture land at Subhashnagar.



eucalyptus tree where as Roost VII had a patch of eight eucalyptus trees (Plate 7). Roost VIII had ten casuria trees (Plate 6,b). The three roosts were exclusively used by Pariah kites. Human habitation was away from the place where the roosts were located.

Roost Site No.9 (R-IX) :

This roost was situated about 1 km from the Roost V, at Sakoli Corner. A solitary eucalyptus tree of about 35' was used by kites in March 1988. This tree was in the crowded locality on a side of a main road. There were other trees like tamarind, palm, coconut etc. around this tree but they were never used as a roosting site by any birds.

Roosting Site of whitebacked Vultures :

There was only one roost site of whitebacked Vultures in Kolhapur city during the present investigations (Plate 10). It was situated near Ramanand nagar Carcas dump. Altogether 11 trees i.e. 7 of Bhoker Cordia myxa and 4 of Ain, Terminalia arjuna were recorded. The trees were located near agriculture fields.

Though Egyptian Vultures were observed at different feeding sites their roost was not located.

METHODS :

The different techniques evolved from time to time by ecologists to assess wildlife populations are based on primarily three methods. They are - 1. The true census, i.e. a direct count of all individuals in the area of investigations, 2. a sampling estimate, derived from counts made in sample area and 3. a numerical way to the animal count, (Davis, 1963).

There are excellent records of birds observation, i.e. behaviour and taxonomy, in the country particularly by noted workers like Ali (1941), Ali and Ripley (1968). However very scanty information is available about roost studies. During the current investigations main method of study was visual observations of the study birds at predetermined time at identified sites with the help of 7 x 50, prismatic, central focus binoculars. Photographs were taken by 35 mm SLR camera with a normal lens of 50 mm with 1.5 F.

Gaston (1975) has suggested many methods in estimating bird populations including line transects, tape recordings, mist netting, random nest researching, estimation of breeding populations, roost counting etc. None of these methods could be accepted in toto for the present investigations therefore the methods designed for the study were carefully chosen with the objectives, the nature of the work and characteristics of the study species in mind.

The investigator noted the numbers of birds at different roosts, weather conditions and roosting times. The observations were made from the vantage points outside the roosting area to

avoid any possible disturbance to the birds and to have good view of the entire roost for easy observations. The observations covered the general roosting patterns of the study bird species. However, the bird directions were not recorded at any time on the roosts. During all the roost observations only the arrivals at all roosts were attempted, the departure of the birds was not studied due to practical problems. Birds arriving at roost were recorded as minutes before (-ve values) or after (+ve values) the sunset.

During the present investigations by using the total count method (Odum, 1971) and counting the birds as they came to the roost (Gaston, 1975) Pariah kites were counted at different roosts in Kolhapur City. The study was carried at weekly intervals for a duration of 17 months from November 1986 to March 1988.

Each roost was observed in the evening, spending about 45 minutes before and after the sunset, thus spending about one and half hours for observing the roosts at each time in the field. Counts made on successive days were put together and mean value was used for the calculations of the bird populations.

Records were maintained of the total number of kites arriving at their communal roost in the evening. As the kites arrive slowly in loose parties at the roost, they could be accurately counted and the time of arrival of the first kite and of all the successive arriving birds upto the last one, as well as the total time span of arrival of the birds were noted at each roost.

In the studies on the roosting behaviour of scavenger birds and there correlation with climatic variables various climatic parameters were extensively used. For this purpose the daily readings of the parameter were used for the date of the observation concerned. The relevant data on humidity, windspeed, temperature, hours of sunshine and rainfall was obtained from the field observatory of the Central Meterological Department and Agro-meterological Department both situated in Kolhapur.

The time of arrival of the first and the last kite was used in calculating the meantime and time range for all the roosts. The correlation between some important climatic factors like temperature, percentage humidity, day length, hours of sunshine, rainfall etc. and mean time and arrival time of kite at different roosts were studied. Swingland (1976), Brodsky and Weatherhead (1984) have used median time, i.e. 50 % of the birds gone or arrived, instead of mean time to express times of departure and arrival.

At Roost R-III records were maintained of the number of kites arrived at 5 minutes intervals in the evening. This data was used in the calculations of Median time. In general, for median within a class interval containing tide observations,

$$\text{Median} = \left[\begin{array}{c} \text{lower limit} \\ \text{of interval} \end{array} \right] + \left[\frac{0.5n - \text{Cum.Freq.}}{\text{no. of observations in interval}} \right] \left[\begin{array}{c} \text{interval} \\ \text{size} \end{array} \right]$$

where, 'Cum.freq.' refers to the cumulative frequency of the previous classes and 'n' represents total number (Sokal, 1981; Zar, 1974).

In the present study, mean and median times at roost R-III, were highly correlated with each other for arrival (Pearson's $r = 0.7537$, $n = 13$, $P < 0.001$). The use of median instead of mean time in the calculations of the correlation was attempted and it led to results essentially similar to those reported in other roosts.

Bird census of mixed roost, occupied by crows and myna along with the Pariah kite was carried out twice a month at Roost R-I, from August 1987 to March 1988 and at roost R-III from July 1987 to March 1988. Crows and mynas were counted on their 'flight lines' of roost (these birds tend to fly to roost following the line of roost ways) on the way to the roost. These observations were basically to see the impact of other birds in the mixed roost on the behaviour patterns of roosting Pariah kite.

It was also of significant academic interest to know about population ecology and roosting behaviour of other major scavenger birds operating in the same area. Roosting behaviour of whitebacked vulture, Gyps bengalensis was studied by visiting their roost twice a month from January 1987 to March 1988 by using methods adopted by Grubb (1974).

In order to get an idea about the feeding activity and its relation with the fluctuations in populations of the study bird species, the major feeding sites like caracas dump, slaughter house, mutton market etc. were visited twice a month from January 1987 to March 1988. The observations were made for a period of two hours in the afternoon and all the birds were counted during the visit.

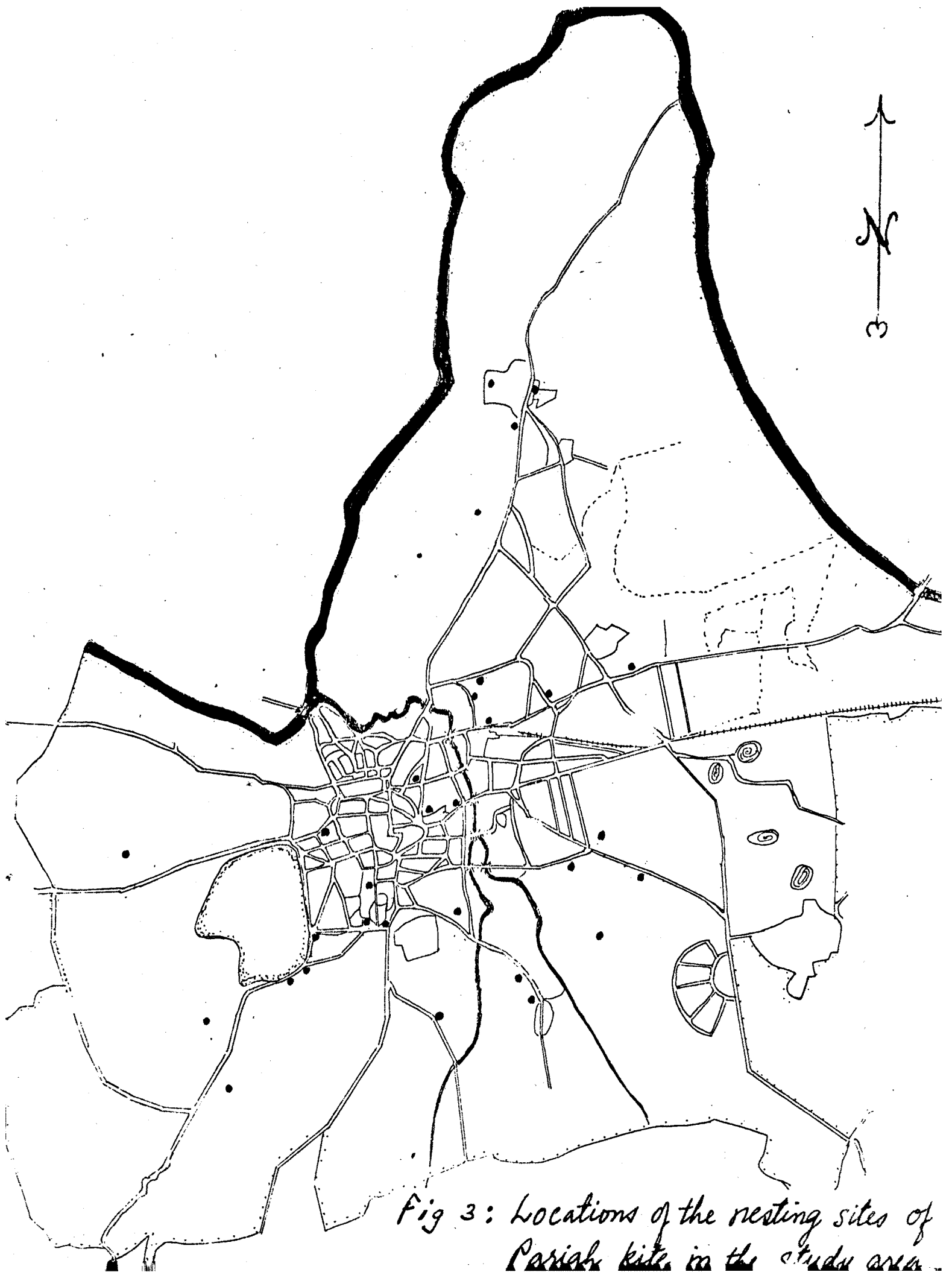


Fig 3: Locations of the resting sites of Pariah kite in the study area.

Attempts were also made to locate the nests of the birds in the study area. Seven to ten hours per week were spent for searching the nests sites and after locating such sites periodic visits were made to record the success and progress of the nests.

A total of 338 visits were made (kite roost-135, vulture roost-26, feeding sites-55 and nesting sites-122) during the field studies involving more than 380 hours of actual field observations.

The data thus generated on various aspects of scavenger birds and particularly roosting behaviour and population ecology of Pariah kite was computer analysed and results are expressed with manual graphs and scatter plots.