CHAPTER EIGHT

DISCUSSION AND CONCLUSIONS

Birds have been extensively used by the Scientists world over to study various impacts of physical variables and their impacts on the life cycles, distribution, migration etc. Roosting is a very characteristic behaviour in several birds species about which we know very little. Particularly in Scavanger birds like kites, Vultures, Gulls, Crows, who play a crucial role in keeping our environment clean, there is an additional importance to the roosting behaviour.

In India Pariah kite Milvus migrans and whitebacked Vulture Gyps bengalensis are the two most important Scavanger bird species performing a commendable service to mankind. Specially kites are well known for their role in cleaning up refuge in parts of towns and villages where waste disposal in human settlements is not proper. In a country like India where vast population resides in the rural area and where sanitation is poor and hygenic practices are much below the required minimum level, the Scavenger birds have no parallel.

In the recent years, due to unplanned development of industries and particularly their waste disposal and also the municipal wastes from the ever growing cities scavenger birds are attracted to the perennial sources of food. It is also observed during recent years that kite populations from the rural areas have been gradually reduced. Experts attribute this change to two factors. Firstly the roosting habitats i.e. old prominant trees have been cut in the recent years due to various reasons and secondly the earlier trade of drecessing the carcasses in open by Dhor Community is no more practiced. This has resulted in less food supply to the Vultures and kites.

The increased congregations of Scavanger birds around cities have posed new problems like epidemics and still more recent and hazardous airstrikes. These strikes from 1979 to 1982 number 868. In two years alone i.e. 1980-82 6 skilled airforce pilots have lost their lives and 12 defence aircrafts have perished causing a great damage to the nation.

The current study was undertaken to evaluate the present status of Pariah kite in particular and whitebacked Vultures in general in Kolhapur city. The emphesis of the work on identifying the roosting sites, studying the population fluctuations their correlation with the important climatic factors and general observations on feeding and nesting habits of the study birds.

Because of the preposed daily flight of a commercial aircraft (December 1988) from Kolhapur and the low flying airforce crafts this study has tremendous applied significance. Also in the developmental activities like road widening, new constructions and reclaimation processes, vast areas of the natural roosts and habitats are being destroyed.

Interestingly there is extremely scanty information about various vital aspects of the Scavenger bird populations in the country except Ali (1926, Ali & Ripley (1968), Gadgil & Ali (1974) and Mahabal & Bustawde (1985).

Nine kite and one vulture roosts were studied at weekly intervals, following a true census method of direct count of all individuals, during November 1986 to March 1988. A total of 338 visits were made to make detail observations on roosting,

feeding and nesting. Mean and median time of arrival of kites were studied. The important climatic parameters like Average temperature, maximum and minimum temperatures, Rainfall, percentage humidity, radiation, wind speed and hours of sunshine were studied and their monthly averages were correlated with the monthly average populations of kites and Vultures. Some new correlations were established. The data has been generated on scatterplots and graphs.

The Rainy season in the study area was restricted to the four monsoon months of June-September, the highest rainfall being in the month of July every year (223mm). There were 130 rainy days during the study period. There was a clearcut direct and positive correlation with the intensity of rainfall and kite and vulture populations in the city.

The temperatures were moderate and average temperature values had significant correlations with kite populations. But in case of vultures the well correlation was established with minimum temperature. The relation between wind speed and the Scavenger bird numers were tried, in kites it was insignificant where as in vultures it was just moderate.

Percentage of relative humidity had excellent correlation with both the bird species, which was basically related to the annual precipitation. The relationship with the hours of Sunshine was also well established though the values were negative in Vultures and kite. This reveals the fact that during less hours of Sunshine larger populations were observed on the roosts of kite and Vulture. However, radiation values could not be correlated to Vultures but with Kites there was

a positive but very moderate correlation could be established, this fact suggests that radiation has no influence on the roosting behaviour or population fluctuations in the test bird species.

During the study period in monsoon the number of kites roosting in Kolhapur city were found to be maximum. This increase seems to be due to the immegration of Pariah kites into the city. This inference in supported by the views of various authors. Smythies (1953) has reported that Pariah kite a common breeding bird in Burma disappears at the break of rains. Henry (1955) has suspected that Pariah kite migrate from Ceylon to South India with the onset of South West monsoon and return to the island by about August. Ali & Ripley (1968) have indicated that Pariah kite migrate from localities of heavy rainfall to drier areas before commencement of monsoon. Pariah kite leave Calcutta almost entirely for 3-4 months during rains (Dover et al., 1920). Desai and Malhotra (1978) also found that at Delhi Zoological Park during June to August, few Pariah kites were present which increased form September to reach a maximum in December. Aitken (1947) stated that the common Pariah kites go to Poona from Bombay for the monsoon months. Mahabal & Bastawade (1985) also had similar records from Pune. According to them a heavy rainfall in neighbouring areas may be causing scarcity of food, provoking kites to migrate from those high rainfall areas to low rainfall regions like Pune city where they can get sufficient food.

Kolhapur lies on eastern side of high rainfall belt of Western Ghats. It receives an average annual rainfall of 1140 mm compaired to the heavy rainfall in the neighbouring Western Ghats where an annual average rainfall is from 5000-6000 mm. Kites may be migrating from these areas to Kolhapur city. Poor visibility due to heavy rainfall may also be affecting their feeding activity and forcing this hawk to migrate to lower rainfall areas for food. The slow decrease in population of kites from September onwards may be due to return migration of kites to their original habitat.

In pre-breeding season all the birds gathered only at the permanant roost. This phenomenon may be helping the birds in selection of partners as this congregation was observed only in pre-breeding season. Mahabal & Bastawade (1985) have reported large number of birds gathering at one of the permanant roosts only in the pre-breeding season. After the pre-breeding season the birds may be scattering with their partners which decreases the total number of kites in the city.

In breeding season number of temporary roosts were formed and the birds dispersed at these different roosts. Most kites in the breeding season exploit a distributed supply of food. Therefore apparantly the temporary roosts are formed in the breeding season possibly to reduce crowding only at one roost. Increased food requirements during the breeding and post-breeding season may be responsible for this dispersal. The nesting sites of the kites were never the roosting sites. The intense pre-breeding displays were related to pair formation

and communication of information regarding the preparation for return journey to their original localities.

Communal display prior to roosting is an integral part of the behaviour at roosts (Gurr, 1968). The same worker has also recorded the increased intensity of aerial displays in Harriers before breeding season.

Behaviour, in a bird or any other animal, theoretically results from stimuli acting through the sense organs and nervous system on muscles and glands. Behaviour resulting from any stimulus or combination of stimuli depends in part upon the birds hormonal balance; state of nutrition and other physiological variables. The migration of bird may depend on interacting weather and preceding stimuli, including social stimuli.

The decrease in number of kites was seen during winter months. The clear weather and longer hours of Sunshine may act as a triger factor along with social stimuli. In pre-breeding season the Kites gatherings in large numbers and the preroosting displays may have been facilitated by Social stimulus. Miskimen (1955) reported that in ducks migrations during clear weather usually followed periods of cloudiness or wind which increased maneuvering together several times in the evening before taking off. This was mainly through mutual stimulation and synchronized behaviour which helped flock organization buildup and thus migration takes place. In kites also there was strong influence of Social stimuli which could counter act the influence of insignificant or moderate climatic variables.

In the present study variations in the monthly population of Pariah kite at different roosts was observed. Some kites changed their roost periodically. Thus it was noticed that the population was not constant and varied from season to season and roost to roost. It is not clear where the same birds used the same roost as in the case of other species of birds. This may be because of the changing availability of food resource near different feeding sites, making the number of birds to often change the roosting place.

Secondly the use of the kite roost by other species of birds was perhaps also related to the shifting source of food as reported by some authors. Apprerantly there was no conflict for space when the roosts were shared with other species of communal birds like sparrows, crows and mynah.

Ward & Zahavi (1973) and Feare et al. (1974) regard the main function of communal roosting to be for disseminating information about food distribution. Gadgil & Ali (1975) suggest that communication of information about the food resource and reduction of the risk of predation are the two important functions of communal roosting in birds. Also it appears from the findings of the current study that the roosting behaviour in Pariah kite must be providing suitable situation for pair formation. Because during the pre-breeding season there was intense display above the roosts but the birds returned to permanant communal roost R-I. In the breeding season i.e. in the months of October - February the birds dispersed to the temporary roosts. The courtship displays were common and at times the pairs formed during season were

seen isolated on trees all over the city. Only on few occasions the nests were seen in different stages of construction, from the city but never at the nine roosts studied during the investigations.

All the trees used for roosting by Pariah kites were more than 20 years old. Permanent roost R-I was situated on a large educational institution campus with many buildings around it. All other roosts were present with relatively little disturbance. At roost R-II the branches of the roosting trees were cut by the local people during the investigations and the roost was gradually abandoned by kites within next 10 days. Selection of roosting site said to be dependent on the disturbance by man in those particular areas, Sengupta (1978) studied site selection in a communal roost of Myna (Acridotheres tristis) he found that the selection of site was dependent on protection against predators and disturbance by man. Ward & Zahavi (1973) comment that larger birds such as vultures and raptors though do not have predators nevertheless these species choose 'safe sites' as roost implying some danger from predators.

All the trees used for communal roosting by kites in Kolhapur were tall enough to get clear vision of the surrounding area. Though the trees at R-IV were shorter, the roost was original at a higher location. All these trees selected for roosting had no thick foliage. At roost R-IV there were less leaves for all the three trees during the period of investigation. The less foliage of trees may be helping the birds to get the clear vision of the surrounding area during the roosting

time. Also perhaps it was easier for the birds during landing and taking off from the trees.

Considering the nature of the permanant roost R-I it appears that a cluster of large number of tall trees with less foliage, at any place irrespective of its closeness to the feeding grounds and availability of water, is prefered by Pariah kite for the permanant roosting site.

The mean arrival time was studied at six major roosts to study their correlationship with the six climatic variables. However no clearcut relationship could be established between different factors and one factor in all the roosts. This was an important finding as the correlation between median time and the climatic variables was significant. In other wards this means only the median time and not the mean time gives the reliable readings in the roosting behaviour studies.

However, considering the man power, time and efforts involved in making the observations on median time at a moderate size roost it was not practical to conduct the studies on R-I leave alone all the roosts at the same time.

Median time of arrival of kites on roost R-III was significantly correlated with wind speed ($r=0.69$, $P=0.00$), and moderatly correlated with average temperature ($r=0.45$, $P=0.05$) day length ($r=0.53$, $P=0.02$) and sunset time ($r=0.47$, $P=0.05$). Percentage of relative humidity values had well but negative correlation with the median time ($r=-0.68$, $P=0.00$) and insignificant correlation with hours of Sunshine ($r=-0.35$, $P=0.11$).

Mean and Median Time has great significance in the bird roost studies. Seibert (1951) showed that the mean time of arrival of herons was correlated with the time of sunset. Bunning (1973) stated that the abrupt changes in the light intensity shortly after sunset are more effective as causes for roosting behaviour than the absolute light intensity during sunset because of the fluctuations caused by the factors such as darkness. Median time of arrival of kites has been correlated with sunset time which also showed a some correlation. Warkentin,(1986) showed a strong correlation of roosting activity with sunset time, in Merlin. Kites were also showed a correlation of arrival time with Sunset.

During the studies on mean arrival time at the permanant roost R-I on 23-9-1987, the day of partial Solar eclipse very interesting observations were made. The total arrival time of birds at the roost was 55 minutes, the largest recorded on the roost. The kites started arriving 26 minutes before Sunset and went on coming for 29 minutes after sunset. This was in contrast to the mean time readings on the same roost on the previous day i.e. 22-9-87. It was confirmed that eclipse does influence the behaviour of the roosting birds. The impact of Solar eclipse in roosting birds from temperate regions is little different.

On the Solar eclipse day, arriving of kites were before Sunset may be premature roosting in Kites. However, premature roosting by Sturnus vulgaris did not occur during a total Solar eclipse in Sweden (Ebrstrom, 1956). Counsilman (1975) stated

that no premature roosting by myna Acridotheres tristis at light intensity 1,500 Lux, at mid-day in the winter and any other day.

Many workers have tried to establish correlation between climatic factors like temperature and mean or median time of arrival of birds on roost. According to workers like, Ravelling et al. (1972), Kessel (1976), Pitts (1976), and Brodsky & Weatherhead (1984), there were early arrivals at roosts due to low air temperatures. Reebs (1985) pointed out that on cold days there are early arrivals of the birds on roost than on mild days. He also stated that they remain on roost for longer time and decrease their general activity on cold days. Jumber (1956) reported low temperatures supported by high wind velocity stimulating roosting at higher intensities than during fine weather days.

Davis (1955) found no statistically significant correlation between the median time of arrivals of starlings at a roost and temperature, wind, cloud cover or light. He, however, strongly felt that light determined the time of arrival of roosting. Counsilman (1975) stated that arrival of common myna moderately correlated with temperature.

Based on a study of wintering Black Ducks (Anas rubripes) Brodsky and Weatherhead (1984) showed that temperature explained a significant proportion of the variation observed in departure and arrival times at the roost. On days colder than -25°C, ducks delayed leaving the roost by 100 min. and returned upto 160 min. sooner. Kites were also showed a moderate correlation of temperature and roosting.

Warkentin (1986) showed that a combination of different factors are responsible for the roosting movements of Merlin. Similarly, roosting in kites may also depend on combination of different climatic factors.

In studies on the feeding habits of Pariah kite, white-backed Vultures and Scavanger Vulture three sites were thoroughly studied. Altogether 55 visits were made to carcass dump, Central mutton and fish market and Subhash nagar municipal garbage dump. These feeding grounds were exclusively used by both the vultures as almost the total whitebacked population observed on the only roost were seen active at the carcass dump.

Scavanger Vultures were found only at Subhash nagar feeding ground. Since there roost was not located. The utilization of the feeding ground by the species could not be confirmed. The kite population were observed on all the three feeding grounds throughout the year. There numbers used to be more at Subhash nagar. However the total number of kites on all the feeding grounds at a time was much less than the total population in all the roosts. This means kites from city used to go out for feeding purpose.

It is revealed from the present studies that P.kite was the single dominant Scavanger bird of the area. Also this can rather be considered as an indicator of hygenic conditions in the city. Presently the food available in the city for kites may be less, as can be seen from kites going out for feeding, and therefore there is a limitation in further drastic increase in its population size. Another limiting factor being

the rapidly reducing number of old tree clusters which could serve as probable roosting sites to attract larger kite populations in the city.

A total of 30 kite nests were seen during studies out of which 21 were studied. The percentage of success in roosting was moderate i.e. 57 %. Human interference in the form of tree cutting was observed. Reuse of the same nest again and again was noticed. This makes it still more important to conserve the old nesting trees in the Scavanger bird species. Also it was found out that the existance of a permanant roost and many temporary roosts is very important for the survival of viable populations of kites because it is inter dependent. For whiteback Vultures a necessity of roost near feeding ground is essential it is more so because Vultures apparantly use the only roost during all seasons.