"Effect of environmental factors on the temporal behaviour of the Cattle egret (*Bubulcus Ibis*) around the Laxmangarh, Sikar Rajasthan"

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INTRODUCTION

The word "Roost" is derived from the German meaning; "a sleeping house of fowls" (Campbell and Lack 1885). But, a bird's perching or roosting place is its roost. Aggregations of roosting individuals are common in primates (Anderson 1998), bats (Lewis 1995, Wilkinson 1995), and birds (Eiserer 1984). In birds and in other animals as well, the adaptive value of communal roosting is not clearly understood. Avain communal roosting is thought to confer benefits in term of reduced thermoregulation costs, decreased predation risk, and increased foraging efficiency (Eiserer 1984, Ydenberg and prins 1984) but the results are still controversial (Richner and Hebb 1996). A greater knowledge of the ecological correlates of communat roosting could help unravel issues about the origin and maintenance of the trait in birds.

The roosting behavior of various avian species has been studied all over the world. Some of these investigations include: Study on starling's roosts by Brown (1946); Studies of ecological correlates have focused thus for on simple interspecific comparisons.

In general, factors that promote flock feeding, such as diet typed appear to favor the evolution of communal roosting in ducks and in other species as well (Coombs 1978, Newton1972) studies on the exploitation of certain foraging grounds and its impacts on the population of the birds.

Theroregulation benefits, protection from predation, and foraging efficiency (Eiserer 1984 Ydenberg and Prins 1984),

Although the physical structure of the roost can provide protection from weather, evidence suggests that thermoregulation benefits also accrue from the presence of companions(Francis 1976,Gyllin *et al.*1977,Du-plessis *et al.*1994). Thermoregulation benefits have been argued to be a significant factor in the origin and maintenance of communal roosting in same species (Du-Plessis and Williams 1994, Du-Plessis *et al.* 1994).

Roosting communally may serve to protect birds from predation through the same mechanisms thought to operate in bird flocks (Elgar 1989). For instance, the presence of more eyes in a communal roosts may increase predator detection.The geometric structure of the communal roost is also thought to provide increased predation avoidance. Weatherhead (1983) proposed that increased protection from predation was the main factor that attracts successful foragers to communal roosts.Ward and Zahavi (1973) first proposed that communal roosts act as information centres .

As communal roosts need not be visited on a consistent, it is not clear from the hypothesis why a successful forager should return to the roost unless group benefits are envisaged (Richner and Hebb 1995).

Weatherhead (1983) argued that successful foragers return to the communal roost earlier to the inferior foragers to gain protection from predation by establishing a more central roost location which is surrounded by inferior foragers.Another mechanism proposes that the daily return of foragers to the communal roosts induces a local concentration of foragers in space that allows individuals to more efficiently exploit the food discoveries of nearby companions (Buckley 1996).

Large roosts are expected to be joined to reduce commuting costs from the daily center of activity to supplemental feeding areas (Caccamise *et al.* 1997).

Intra and interspecific interactions at a mixed roost of Ciconiiformes in Mexico have been described by Burger *et al.* (1977). Observations of communal roosts of the Cattle egret focusing on competition for perch site selection was considered to execute during the present study Naugle *et al*. (1996).

As per midwinter Asian waterfowl census conducted by IWRB and AWB with the BNHS and WWF the egrets are reported in the Gujrat and Maharastra states of India. Study on the population of the egret in laxmangarh, sikar Rajasthan could not be conducted by these agencies. Therefore, the same was carried out during present investigations.

To find out the factors inducing the roost site selection, tree preference for roosting, arrival and departure patterns, pre-roosting and roosting behaviours, roosting hours, association with other avian species on roosts, and the occupation of roosts in relation to the population research were studied in the Cattle egret from January 2010 to December 2012 in 100 Km^2 area around Laxmangarh city of arid zone of Rajasthan, India. Therefore the objective of this study was to determine the effect of environmental factors on the temporal behaviour of the Cattle egret at the pre-roost and roost.

Basic patterns in roosting behaviour should provide essential information enabling understanding of the general function of communal roosting of the Cattle egret may help in long term management and conservation of this egret. Therefore, the roosting mechanism was studied in details during present study.

MATERIALS AND METHODS

In the study area, a total of 30 roosts sites were identified and divided into subareas; urban and rural, depending upon the location of roosts, in or at the outskirts of the Laxmangarh city boundary. Further, roosts were classified as temporary or permanent, depending upon seasonal or perpetual presence of the egrets respectively throughout the study period. The proximity of foraging grounds and an aquatic habitat to the roosts were recorded after estimating the availabilities of habitats at temporary and permanent roosts. The Mann-whitney U test was applied to assess the number of foraging

grounds available in 1km radius at temporary and permanent roosts. All the trees in 100 m radius of each roost were counted, identified up to the species level, and measured. This work was performed at the approachable roosts to find out preference for the trees in relation to all characteristics. The diameters at breast height (DBH) of all available trees were measured with the help of a meter tape by measuring the circumference in feet. Heights of all available trees were measured using an ebony level, and recorded in feet. The canopy covers of all available trees were measured from 4 different sides to obtain an average diameter. Trees measuring less than 15 ft high were not taken into account as a roosting tree. Density and distribution of roosts among trees were noted to analyze any preference for the tree with the reference to its availability. Student's t-test was applied on number of trees, and characteristics of available and preferred trees to examine their tendency toward selection. The correlations among tree characteristics were also ascertained to analyze the preference for overall size. Spearman's rank correlation was applied to see the indication towards selection of a tree species with reference to the availability.

Four roosts from the different localities capable of providing roosting sites to at least 08 Cattle egret were selected to study the roosting behaviour. These selected roosts sites were visited once a month for 36 months from January 2010 to December 2012 in the morning from 5.30 AM to 8.30 AM to estimate the peak departure time, and in the evening from 5 PM to 8 PM to estimate the peak arrival time of the egret. The flock size and the relationship of flight path to the location of the microhabitats were determined by recording the number of departing and arriving birds at the interval of every 5-6 minutes. Student's t-test was applied to calculate average arrival and departure timings of the egrets. It is important to make a note on total individuals arrived and departed at the study sites to avoid a bias in making comparison of time required to enter and leave roosts by the same number of birds. Henceforth the student's t-test was applied to confirm the significant equal flock size of the entered and that of departed birds. Sunset and Sunrise timing were collected from the meteorological department to determine relationship between periods of sunlight with the peak arrival as well departure timing of the egret.

As the egret is a communal rooster, it was found to form flocks on feeding grounds or nearby roosts. This flocking behaviour is defined as a pre-roosting. To judge the significance of gathering before entering in to a roost; observations of pre-roosting, various flock sizes, and associated behaviours were registered at the permanent roost named “Bhooth Nath Mahadev” and “Nehru Stadium” Laxmangarh.

The juvenile egrets are apparently less skilled in finding roosts during late evenings after sunset. Therefore; number of birds arriving before and after sunset were recorded at already marked 2 roosts were classified according to adult and juvenile birds to justify the fact whether Juveniles can search roosts after sunset or not. The egret with snow white feather and with yellow beak was considered juvenile. The timings of sleeping and waking calls at roosts were recorded to determine the resting hours during different climatic seasons. Further, the student’s t-test was applied to determine the significance of the variation in resting hours depending upon the length of day during different seasons. To assess the social rituals of mornings, the average time between the first call and sunrise period was compared to the time of first call and the start of departure from the roosts by applying student’s t-test. And the correlation between waking calls and sunrise timings were also analyzed. Other bird species sharing communal roosts of the egrets were recorded to sight an affiliation among avifauna. Individuals present at the roosts were counted to establish the relationship between number of the egret and the occupied roosts in the study area. All the observations were made only on clear weather days to avoid a bias. Observations were made from the distance of about 50m with the help of 10x50 Olympus binocular.

RESULTS

Out of 30 roost sites, 18 (60%) were found temporary whereas 12 (40%) were permanent (Table : 1). Further, it was recorded that out of total 18 temporary roosts, 8 (44.44%) were located in rural area and 10 (55.55%) in the urban area. Among permanent roosts it was found that out of 12 roosts, 7 (58.33%) were located in rural area and 5 (41.66%) in the urban areas. There were total (Temporary + Permanent) 15 (50%) roosts located in the rural area, and 15(50%) in the urban areas. The ratio of temporary and permanent roosts was 50:50 in rural areas. Among 15 urban roosts, 8 (53.33%) were temporary in nature while 7 (46.66%) were of permanent nature. Roosting trees were also used for nesting by the egret. In rural area 80% roosts were selected for breeding, where as in urban areas 86.3% roosts were selected for the same purpose.

Factors inducing the selection of roosts

Distance of foraging grounds and availability of aquatic habitat were the important factors in the site selection of roosts Table 2 and 3 show immediate location of the 7 classified microhabitats around temporary and permanent roosts within 1 km radius. There were an average 3.22 SD± 1.52 foraging grounds located nearby temporary roosts, and 4.66 SD± 2.10 nearby permanent roost of the 18 temporary roosts, 10 (55.55%) were located nearby feeding habitats, 5 (27.77%) within 1000-2000m and 3 (16.66%) beyond 2000m from foraging grounds (Table 4). Among 18 temporary roosts, 11(61.11%) roosts were located near the aquatic habitat, 4(22.22%) within 1000-2000m and 3(16.66%) beyond 2000m from the habitat. Among the 12 permanent roosts, 09(75%) were located near the feeding habitats, 2(16.66%) within 1000-2000m and 1(8.33%) beyond the 2000m from this habitat . Two roosts were having an availability of 2 foraging grounds . Among these 12 permanent roosts, 8(66.66%) roosts were located near an aquatic habitat and 2(16.66%) within 1000-2000 and 2(16.66%) beyond 2000m from aquatic habitat .Temporary roosts sites were preferably near the and occasionally near the animal dead bodies dumping stations and grazing fields.Similarly permanent roost sites were also selected near the sand dunes. They were less preferred near the forest area and grazing fields .

Roost Trees

Total 490 trees belonging 15 species were recorded as roosting trees Khejari *prosopis cineraria* (19.38%), Neem *Azadiracta indica* (21.83%), Peepal *Ficus religiosa* (10.61%), Saresh *Albizzia lebbek* (8.16%) and vilayati babool *Acacia nilotica* (23.46%) were the principal roosting trees comprising 83.44% . Only 16.53% roost trees belonged to 09 species.

Seventy eight (15.92%) trees belonging to 4 species were more preferred for roosting by the egret. Distribution and preference of 15 tree species at the 30 roost sites may be seen in the fig 1. Name and average height of the available and preferred trees are graphically presented in fig 2 and tabulated in the table 5. Average number of available tree species in each plot was 32.66 SD± 38.93 and the average of most preferred trees was 5.2 SD± 5.36 species. This shows a statistically significant difference between the number of trees available and preferred. Table 6 represents the available trees at various roost sites, preferred trees for roosting and tree heights. One roost was found on the Neem tree located near “Bhooth Nath Mahadev Mandir’’ while roosting trees belonging to 9 species were found near Shradha Nath Ashram, Modi Institute Education and Technology Research Centre, Near Bagaria Bal Vidaya Niketan, Bagari road and Nehru Stadium;

Factors influencing the selection of roost trees

The egret selected live and unbroken canopies of the tall trees to roost. Though height was one of the considerations for roosting but only tall trees of Neem, Peepal and Bargad with good canopy selected for roosting. Thus a combination of height, canopy and DBH influenced the roosting of the Cattle egret on trees (Table: 8).

Arrival-departure

Arrival and departure timings at roosts did not remain constant throughout the year and changed with the seasonal photo period. Peak arrival time of the egret at roost was just before or with the sunset and that of Peak departure time from the roosts was just after the sunrise. The arrival time and departure time of the Cattle egret to the nest or away from the nest varies as the sunrise and sunset timings varied from season to season. As such the egret returned to nest late in the summer and the rainy season, while early in winter. The

reverse to this bird was found to leave the nest early in the summer and rainy season while late in the winter. On the average the egret took 89.08 SD± 13.89 min (n=24) to enter the roosts and 69.41 SD± 12.46 min (n=24) to leave (Table: 9). Student's t-test revealed mean arrival time of the Cattle egret was significantly longer than the mean departure time (t = 6.17 df=34, P< 0.001). Even though the numbers of birds recorded during the evening were not exactly same as the number of birds recorded during the morning (Table: 9). An average flock size of arrived and departed birds was not statistically different (t = 3.85, df = 34, P< .001). The number of birds that arrived per minute was lower than the number of birds that departed. The lowest rate of egret arrived per minute was 0.55 and maximum was 1.30. While the lowest rate of egret departed per minute was 0.80 and maximum were 2.38.

The pattern of arrival and dispersion was inconsistent with relation to geographical directions. That means random direction of a flight in North, South, East and West in an equal flock size did not occur. The majority of the egret at the Nehru Stadium site arrived from the south during 2010 and departed mainly towards east (fig. 3,& 5). During 2011 the birds were seen to arrive from the north (fig: 4) and departed to the west at this site (fig: 6). Similar observations were recorded at Bhooth Nath Mahadev site in the urban area during 2010-2011. Majority of the Cattle egret roosted at Bhooth Nath Mahadev during 2010 departed towards east (fig: 7). Similar behavior of this bird was also noted during 2011 at this site (fig: 8). During 2010 and 2011, these birds were observed to arrive from the east in majority (Fig: 9, &10). Flight formation of the arriving and departing birds was typically V-shaped with an occasionally random pattern. At the study sites, a higher percentage of juveniles were noticed to arrive earlier than the adults to the roost site (Table: 10). It was observed that the juvenile birds followed the adults at the time of departure from the roosts in the morning at Nehru Stadium roost, the early arrival of juveniles was found to be 70% while it was 62.28% at Bhooth Nath Mahadev site. But early arrival of adults was found greater at Bhooth Nath Mahadev (60%) than Nehru Stadium (66.60%) roost site.

Pre-roosting and roosting behavior

At the Nehru Stadium roost site, birds were observed to pre-roost on the Khejari tree near to roosting Neem tree , on the top perch of building and on the highest available perch, like TV-antenna, microwave tower etc. out of 100% roosted egrets only 80.55% egrets followed pre-roosting. The percentage of roosting at Bhooth nath mahadev roost was only 27.97% (Table: 11). The average span of pre-roosting was about 38.83 minutes with each individual bird spending an average 8.15 minute. The egret was mainly involved in preening and calling loudly while pre-roosting interactions among individuals were seldom. It was noticed that the Cattle egret were observed to share their roosting sites with a number of other birds on the trees, they showed roosting association with House Crow (*Corvus Splenderd),* Indian Myna (*Acridotheres tristis*) white ibis, Black ibis(*Pseudibis papillosa*), Little egret (*Egretta garzitta garzetta*) Red wattled lapwing (*Vanellus indicus indicus*) Black Drongo (*Dicrures adsimilis albirictus*) etc. (Novel kour and D.N. Sahi 2012). Whereas on the ground they rested with a number of water birds. It was noticed that the roosting bird apparently change its position after arrival of all members on the roosting tree. Juvenile birds were seen in the lower canopy of the roosting trees, whereas adult were seen throughout all available perch sites at different height. After entering the roosts some individuals shifted from one perch to the other made circular flight while re-entrees. The circular flight was generally clock wise in almost all observation. Number of such reshuffling events significantly increased with roosting population. Most of the reshuffling movement occurred without any obvious interactions. Sometimes aggressive encounters were observed during reshuffling event following threat posture and calls.

Once setting on the roost trees, the majority of individuals moved toward the inner canopies. The accumulation of fecal matter on the branches below the perched branches indicated the same perches were used repeatedly over several nights and possible by the same individual. The egret preened its shoulders, wings, belly, back and tail before persisting rest. Adults were noticed to preen often and over longer intervals than the young ones.

Scratching neck and belly by feet was conventional. Other maintenance and social behaviors like stretching body fluffing up feathers, twig shaking and various calls were also noticed. Some time bird flew away from one roosting to another roosting tree of nearby surrounding area.

During breeding season, the female occupy the perch near to its future nesting site at the roosting tree and male bird occupies the top branch of that roosting tree. During rainy season the Cattle egret preferred roosting outskirt of rural and urban area due to availability of feeding material in grazing fields and agriculture farm houses. But in winter season, they shifted themselves to roosting sites close to human habitation and their number also increased per roosting tree due to aggregation as the bird had communal roosting. At the time of an abrupt loud noise of heavy vehicle or the appearance of raptors and cats on roosting tree the bird made circle, and left the site for a shorter duration or for the whole night.

Waking and Sleeping Calls

The waking calls were normally recorded during dawn and the sleeping calls during dusks. In the summer, average waking calls were made at 06.12 hr SD± 0.59 hr (N=12) and average sleeping calls were recorded at 19.30 hr SD± 0.47 hr. During the monsoon season, average waking calls were made at 0614 hr SD± 0.40 hr (N=12) and average sleeping calls at 18.52 hr SD± 0.49 hr (N=12). And during winter season, average waking calls were made at 06.38 hr SD± 0.20 hr (N=12), and average last calls during the late evenings were recorded at 19.38 hr SD± 0.37 hr.

The difference between timing of calls made during summer and monsoon seasons were non-significant. While there was a significant difference between the timings of calls made in monsoon and winter seasons. The difference in the timing of calls made in the summer and winter seasons were also significant. (Table: 12).

A different of time durations between waking calls and sun rising was found significantly longer than that of waking calls and roost departing time.

Although timing of the waking calls was found highly correlated with the period of sun rising in all seasons during study period.

While sleeping during nights the Cattle egret's head was kept and the same brought to the normal position in the morning. The waking calls made by the egret by stretching the neck. Juvenile birds were found more gregarious and vociferous in nature than the adult birds. Intensity of noise was found higher at the roosting holding larger number of the egret. First call in the morning was trumpet like "rick-ric..k" with the slow pitch but call notes made just before leaving the sites were "kink-kink" with the lower pitch. During flight they followed a V shape pattern and during flight in sky they also produced voice like "rick-rick" (Kaieteur news 2012) but with longer interval. During summer in mid day the egrets flew at high altitude along with its colonies and showed association with other birds like circular motion and random motion.

Communal roosting

The Cattle egret is a very social bird. They tend to settle in large colonies often with other species of birds and they also migrate with other similar birds. They also have a great association with grazing animal and can be seen hanging around and on them and disturbed grassy area by the cattle's feet and tractor. The egret was a communal and heterogeneous rooster. The bird occasionally roosts solitary. A total of species of birds were recorded roosting with the egrets in mixed roosts (Table:13) Pariah kite, White ibis, House crow, Little egret, Rose ringed parakeet, Common peafowl, Common Myna, White chicken bulbul, Redvented bulbul, House sparrow were found to roost with the Cattle egret showing communal roosting of Cattle egret with crows, white ibis etc. on Peepal trees total (76.47%) Neem (41.17%) and on Burgad (64.70%) species were found to roost along with the Cattle egret. Theses roosting birds were also breeds on Peepal, Neem, Burgad and Vilayati babool tree and it was found in the ratio of 29.41%, 17.64%, 29.41% and 32.41% respectively. In one nest at Peepal tree House sparrow and Lapwing was found to breed in the nest of the Cattle egret.

Factor affecting communal roosting

The communal roosting of Cattle egret inhabiting arid zone of Rajasthan was mainly affected by the photo period. The birds roost early in the winter and late in summer and rainy season when the span of the day is longer than the winter. Weather conditions majored as ambient temperature, wind speed and cumulative daily precipitation had no effect on arrival times at the preen-roost and the roost likewise, moon light did not affect roosting time.

DISCUSSION

Our result showed that the Cattle egret roosted almost equally in good number in rural areas as well as in urban areas of the arid zone of Rajasthan. Cattle egret is one of the common birds. Seen around human settlement, in rural as well in urban set up and seem to be not much bothered by human activities. The reasons of roosting equally in rural as well as urban areas of arid zone of Rajasthan are the feeding grounds availability both in the rural area viz. sand dunes, grazing fields, forest reservoir and agriculture farm house and the urban areas viz. Waste water bodies, municipal garbage dumping stations and animal dead bodies' carcasses centers near human habitations. While Cattle egret in wetland the Cattle egrets mainly feed on the prey rich available at Gujrat, Maharashtra & Uttaranchal aquatic habitats & agriculture fields confined to rural area. (Subramanya, 1996).

Religious faith of Rajasthani in planting Neem and Peepal trees in front of their houses and temples is another reason which facilitated this egret to select and roost on these trees near human habitation. These trees are full of canopy which provides proper shelter during roosting. Egrets mainly feed in aquatic habitats all over world and their permanent roosts are located near these habitats (Kushlan 1978, Hancok *et al.* 1992 Naik,1989). But the Cattle egrets adapted to forage in the terrestrial habitat available in the arid zone of Rajasthan. Therefore, even permanent roosts of this bird were found on the trees away from aquatic habitats (Grubb 1976, Hafner & Fasola, 1972). Some observations are shows there is no compulsion of aquatic habitat for the egret

to roost, but the foraging ground whether it is aquatic or terrestrial is the guiding factor (Meyerricks, 1962).

Roost is not a simple assemblage of individuals, but rather evolved as a predator avoidance and information centre (Ward and Zahavi 1973). Selection of roost sites and roost tree is therefore, largely based on the availability of the roosts with reference to predator avoidance and acting as information centers. Characteristics and availability of the tree species are also the reasons of selecting a particular tree. Trees like Gulmohar (*Delonix regia*), Khejari (*Prosopis Cineraria*). Sisham (*Dalbergia Sissoo*), Khajoor (*Phoenix dectyllfera*), and Ardoo (*Ailanthus excelsa*) lack a dense canopy pattern. They cannot provide protection against climate and potential predators, henceforth not preferred for roost. Whereas the trees with denser canopy such as Vilayati bobool (*Akshia nilotica)*, Neem (*Azadiracta indica*), Peepal (*Ficus religiosa*) and Burgad (*Ficus benghalensis*) were preferred as they provide shades and cover hence minimizing predation and energy loss. Neem is preferred more in comparison to peepal because of slightly short height and characteristics pattern of leaves. Moreover, canopy of Neem tree is denser than the Peepal tree. Some species, such as Sapheda (*Eucalyptus alba*) is fairly tall but its architecturally inappropriate for the egret to perch. Preferences of the Cattle egret to the Neem, Peepal and Vilayati babool trees with dense foliage and fair tallness seems reasonable as the foliage minimize radiation heat loss to clear skies. Exposer of Plower birds to low temperature and high wind speed resulted in weight loss. Some time the Cattle egret roost at the top of the tree at greater height which appears as a compromise between plausible anti-predation advantage and energetic disadvantages as reported in other birds also (Draulans and Vessem 1986). The majority of Cattle egret favors tallest tree to roost in the night, but diurnal roosting is preferred at roosts of moderate height but not on the ground as reported in other egrets.

The Cattle egret usually started to arrive 50-60 minutes before sunset. Most of the bird species usually arrive one or two hour before sunset with some exceptions like Blue jay (*Coracius benghalensis*) which sometimes arrive at roost as much as five hours before sunset (Turner 1965). Arrival time

for roosting varies with species, season, light condition wind velocity and weather. Intensity of light, at the time of dusk also known to influence roosting time, (Krantz and Gauthreaux 1975). Pre- roosting gathering often occurs in Cattle egret on ground and trees near roost site especially with early arrival to roost site. Probably more intensity of light often prevents their roosting and so they follow pre-roosting gathering Duration of arrival in the Cattle egret was shortest in winter while it was longest in summer. Similar observations were made by Soni, K.C. (2008) in Black ibis.

Duration of departure time was shorter Cattle egret compared to that of arrived time at roost. Synchronous or clumped departure in birds is often interpreted as an important mechanism of information transfer about food patch which accomplished by following the successful individuals (Krebs 1974b, Pratt 1980).

Morning dispersion of the Cattle egret from the roost was mainly biased towards predominantly exploiting foraging ground, which resulted in a clump of birds leaving the roosting site in a particular direction in a shorter time period whereas, during the evening the arrival of the egrets in smaller numbers at different intervals happened to take a longer period of time to fill the roost by almost in an equal number of birds. Reebs (1987) also recorded a similar observation on the black billed magpie (*Pica pica*). Dispersion of the Cattle egret in a clump not only depends on patchy distribution but also on socially induced flights, when one flies from the colony others are induced to do likewise.

Young Cattle egret was found to follow adults during dispersion from the roost. Our findings lend support from Draulans and Vessam (1985). Who reported that one year young Herons are less skilled in finding suitable foraging sites than adults and hence follow the later at the time of dispersion. Communal roosters usually feed in flocks (Gadgil and Ali 1975). The Cattle egret, also feed in flocks and hence leave the roost together. Empty digestive tracts of the birds in the morning may also be one of the reasons to form larger flocks and result in quicker dispersion from the roost (Seibert 1951).

Stereotypic directions of arrival and dispersion flights recorded at Nehru Stadium roost were due to rhythmic exploitation of the selected microhabitats by the egrets. It was noted that at the east of Nehru Stadium roost MGDS and ADBDS were located in proximity which were exploited throughout the year 2011. That is why the birds from Nehru Stadium roost took flight towards east. Whereas arrivals in majority from the south in 2011 and from north in 2012 were due to exploitation of available water resources nearby Nehru Stadium roost. Sykes (1983) have recorded similar observations on the Snail Kite. During 2012 birds were found to leave towards west where WWB, AFH and SD were located. Whereas, arrival in majority from the north was due to presence of aquatic habitat (Water digee). At the urban roost of Bhooth nath Mahadev the departing direction were the same in 2011 and 2012 because Bagri road farm house (a foraging site) was located east to Bhooth nath mahadev. It is the largest WWB of the Laxmangarh city.

A V-Shape flight pattern of the egret demonstrates aeronautical skill and a tendency of a flock to scan for a better feeding spot the incidence of early arrival of the juveniles to roosts could be relevant to a poor sense of finding the same site during the dusk period. Also an early arrival would also be beneficiary for the juveniles in spotting the perch in the absence of a whole flock. Whereas experienced adults were capable of utilizing full day length to consume maximum amount of food before returning to their roosts in the dark. Adults also arrived later than juveniles due to more involvement in gaining sufficient energy and sparing some time in social activities.

Pre-roosting gathering has been seen particularly among the species that feed together and roost communally (Ward and Zahavi 1973). It serves as a roosting advertisement and acts as an information centre conveying information about the potential food sources. Soni and Sharma (2006) observed various numbers of bird in flocks gathered either at the feeding grounds or near their roosts. They also suggested that the quality of such gathering may differ with the change in environmental conditions such as food and water. If the availability of food and water is poor than flock sizes will be

larger to exploit limited resources. Our observations on the pre-roosting support this concept as the flock size was greater at pre-roosting during drought. Their behaviors such as preening calls and fluffing of feather during pre-roosting develop learning in young ones. Pre-roosting of flock may help in pair formation as well influencing strength of bonding for the next breeding season. Pre-roosting facilitates late roosting and avoids detection of birds at roost by the predator.

As the egrets are a communal rooster, agonistic behaviour for the better perch was unexceptional and supplanting of an individual by the other individual was moderate. Crowding and group size are known to influence rate of aggregation among vertebrates by increasing both the number of encounters and number of interactions per individual (Wilson 1975, Burger *et al.* 1977). In some vertebrates, the number of aggressive counters per individual increase with group size regardless of availability of space (Wilson, 1975). The egret showed supplanting behaviour only when the new bird arrived to the occupied perch. Any incidence of a heterospecific interaction was rare among the egrets. However, House crow (*Corvus Splendes*) may compete the Cattle egret to leave the perch which is contrary to the theory of Burger (1977) who postulated that bigger bird replace small bird at roost. A true flight ensues in the roosted egret only when an individual displaced or supplanted another simply by attempting to land nearby. In such interactions the bird landing often threatened its nearest neighbor who then flew off (Burger 1977, Gladstone 1977). In an actual interaction fight was brief with vigorous wing beathing and stabbing. Such observations were also recorded Mock (1974) on Boat billed heron (*Cochleavius cochleavius*). Some times the displaced bird returns to its original perch to displace the intruder. These phenomenons seem fairly relevant to the number of birds aggregating at the same and apparently limited space. Hence, entering into the roost during dark by the experienced individuals could also be explained as avoidance by being supplanted or due to their ability of supplanting any occupant. Apparently, there was no conflict for space except for competition for the better perch. Because, the Cattle egret is habitual of sharing roost with other members as

well as other species of the birds. Therefore epideictic displays in some birds to communicate limit of space for roosting observed by Wyhne -Edward (1986) could not be observed in the Cattle egret. The communal roosting of the egret has proclaimed to be a significant aggregation which may minimize potential danger from predator. Selection of the same perch by the egret is based on the experience of the bird for safety preference of the egret for roosting in lower and the inner of a canopy help in hiding and lesser exposure to the wind. Avoidance of overcrowding of the Cattle egret at roost was also evident the fact that most of the movements were directed from high density to low density per tree regardless the height of roost tree. Maximum 10 egrets were observed roosting on Neem or Peepal trees. It implies that the Cattle egret required spacing between two birds. Thus the Cattle egret avoids overcrowding at the roost site as much as possible. The bird allows incoming individuals to roost according to the roosting space available.

Vocalisation of birds is the consequential gesture in their social development. Because birds are the only animals other than human beings that can make sounds they were not born to make (Heinroth and Heinroth 1958). Birds in the plains and forests are very regular in their roosting timings. A longer time difference between the first call and sunrise period shows their chronological sense to call before an actual binging of the day. Shorter time difference between the first call and the departure of the Cattle egret from the roost shows its ability to save day duration for the diurnal activities.

Calls of the birds made during dawn and dusk, are considered as vocal information exchanges. But sometimes they are not made in the dawn and dusk and hence make the vocal information exchanges controversial (Cramp and Simmons 1977). However, louder vocalisation noticed at the larger aggregation of the birds could apparently be seen as a technique to attract other individuals to share the roost (Reebs 1987).

Gadgil (1972) reported that the passerine birds normally aggregate in a centralized area of the roost to conserve heat contrary to dissipation of heat at

scattered roosting or perching. But shifting of birds near to each other may increase intra-specific interactions. But, roosting together in a limited space save energy of an individual incurred on watching, predator. This would allow an individual to spend more time in self care such as preening and scratching (Draulan and Veseem 1986). Hence, the egret prefers mixed communal roost with many noisy birds such as the House crow, which not only warn but also actively drive away predators (Gadgil 1972, Gadgil and Ali 1975).

The Cattle egret feeds in the flocks in unevenly distributed habitats of the arid zone and roost communally on the trees near to these habitats. According to Ward and Zahavi (1973), species feeding in flocks on an unevenly distributed food supply tend to roost communally. The adaptive significance of communal roosting includes better anti-predation response of the bird and easy food finding (Ward 1962, Ward and Zahavi 1973). The social attraction among the members of a flock also increases at the communal roosts (Gadgil & Ali 1975).

Some species use the roost as the scan for remarkable displays like mass movants swirling around in tight columns above the roost. Such type of behaviour could not be observed in the Cattle egret at roosts. The egret does not require display as roosts are quite visible like that of Herons and Egrets (Burger *et al.* 1977). The number of communal roosts of the Cattle egret was less in winter as the number of the bird decline due to shortage of food in the arid zone, while the number of these roosts increases in summer and rainy season because the bird gather for breeding and prey availability also increases. According to Gurr (1968), a communal display prior to roosting is an integral part of the roost behaviour. Similar communal display prior to roosting was also observed in the Cattle egret inhabiting arid zone of Rajasthan.

Our results indicate that arrival of communally roosting Cattle egret at the pre-roost and the roost were exclusively determined by day length and cloud cover. This is in agreement with the general view on circadian rhythms in birds, assumed to be primarily governed by photoperiod and light intensity (Aschoff 1960, Janicke and Chakarov 2007). Moonlight does not provide

additional illumination to delay roosting times of the Cattle egret. Our observations are similar to the responses of the ravens to the moonlight (Janick and Chakarvo 2007) and differ from the observations of Alonso *et al.* (1985) on communal roosting in Cranes (*Grus Grus*).

Table: 1 Location of temporary and permanent roosts at urban and rural areas. And record of those sites used for breeding as well (Percentage in Parenthesis)

Roost Site	Rural area	Urban area	Total roost
Temporary	8 (44.44%)	10 (55.55%)	18 (60.00%)
Permanent	7 (58.33%)	5 (41.66%)	12 (40.00%)
Total roosts	15 (50%)	15 (50%)	30 (100%)
Roosts selected for breeding	12 (80%)	13 (86.66%)	25 (83.33%)

Table: 2 Feeding habitats recorded around 1 km radius of temporary roost of the Cattle egret. Asterisk (*) indicate number of available feeding habitats X indicates average number of available feeding habitats SD± indicates standard deviation

Roost Side		WWB	MGDS	ADBDS	AFH	SD	FA	GF	Total
Todi College Camps	Laxmangarh	X			X		X		03
Shradhanath Ashram	Laxmangarh				X	X			02
Krishna Vatika Temple	Laxmangarh						X		01
Nehru Stadium	Laxmangarh	X	X	X	X		X	X	06
Bhooth nath mahadev	Laxmangarh	x	x	X			x	x	05
Bagri road farm house	Bagri		x	X	x	x	x	x	06
Forest campus	Laxmangarh - Fathepur		x			x			02
Front of MITS	Laxmangarh		x				x		02
Sheep breeding station	Fathepur				x	x	x	x	04
Bagaria School	Laxmangarh		x			x			02
Goenka public school campus	Ghassu				x	x		x	03
S.R. Sr. Sec. School	Laxmangarh	X	X	X					03
Sarswat Sr. School	Jajod	X	X		X				03
Gurukul	Harswa				X	X	X		03
Shree Shyam Mandir	Chudi Miyan				X	X			02
Panchayat Samiti	Fathepur	X	X	X					03
Krishna Goshala	Laxmangarh				X		X	X	03
Guawaria Mohala	Laxmangarh	X	X	X	X	X			05
Total		07	10	06	11	09	09	06	58

$\acute{X}$ = 3.22, SD± 1.52, Range: 1-6

WWB = Waste Water Bodies
MGDS = Municipal Garbage Dumping Station
ADBDS = Animal Dead Bodies Dumping Station
AFH = Agriculture Farm House
SD = Sand Dunes
FA = Forest Area
GF = Grazing Field

Table: 3 Feeding habitats recorded around 1 km radius of permanent roost of the Cattle egret. Asterisk (*) indicate number of available feeding habitats X indicates average number of available feeding habitats SD± indicates standard deviation.

Roost Side	Location	WWB	MGDS	ADBDS	AFH	SD	FA	GF	Total
Badka Bajaji	Laxmangarh	X	X		X	X	X		05
Todi Kui mandir	Laxmangarh	X	X	X		X		X	05
Nehru Stadium	Laxmangarh	X	X	X	X	X	X	X	07
Nehru Stadium	Laxmangarh	X	X	X	X	X	X	X	07
Nehru Stadium	Laxmangarh	X	X	X	X	X	X	X	07
Nehru Stadium	Laxmangarh	X	X	X	X	X	X	X	07
Char Chowk ki Haveli	Laxmangarh		X						01
Bhooth nath mahadev	Laxmangarh	X	X	X		X		X	05
Budhgiri ji Mandi	Fathepur				X	X	X	X	04
Power House	Manasi				X	X	X		03
Shiv Mandir	Balara					X			01
Kabristan Bhumi	Laxmangarh		X	X		X	X		04
Total		07	09	07	07	11	08	07	56 $\acute{X}$ =4.66 SD±2.10, Range: 1-7

WWB = Waste Water Bodies

MGDS = Municipal Garbage Dumping Station

ADBDS = Animal Dead Bodies Dumping Station

AFH = Agriculture Farm House
SD = Sand Dunes
FA = Forest Area
GF = Grazing Field

Table: 4 Location of temporary and permanent roosts from feeding and aquatic habitats. Distance of the sites presented in meter (m)

Habitat	Location of 18 temporary roosts (m)			Location of 12 permanent roosts (m)		
	<1000	**1000-2000**	**>2000**	**<1000**	**1000-2000**	**>2000**
Feeding	10 (55.55)	5 (27.77)	3 (16.66)	9 (75)	2 (16.66)	01 (8.33)
Aquatic	11 (61.11)	4 (22.22)	3 (16.66)	8 (66.66)	2 (16.66)	2 (16.66)

Table: 5 Record of available and preferred roosting trees and average height of each species. Observation were recorded in feet (ft) and presented as mean (x) and range (R)

Common name of tree	Number of tree available	Number of tree preferred	Average height of available tree (ft)	Average height of preferred tree (ft)
Peepal	52	08	$\acute{X}$ =21.05 R:15.65-30.60	$\acute{X}$ =24.35 R:17.46-33.03
Neem	107	15	$\acute{X}$ =22.32 R:14.60-24.32	$\acute{X}$ =21.85 R:15.73-26.02
Khejari/Jantee	95	0	$\acute{X}$ =19.45 R:14.56-24.63	
Sirash/Saresh	40	0	$\acute{X}$ =20.11 R:17.76-25.59	
Talle/Sisham	13	0	$\acute{X}$ =17.39 R:14.08-22.70	
Bargad	09	0	$\acute{X}$ =20.95 R:15.83-23.25	
Imali	07	0	$\acute{X}$ =24.19 R:16.70-29.67	
Khajoor	03	0	$\acute{X}$ =17.98	
Fransh	01	0	$\acute{X}$ =23.16	
Vilayati babool	115	07	$\acute{X}$ =26.95 R:19.25-30.50	$\acute{X}$ =29.07 R:16.50-29.75
Shapheda	14	0	$\acute{X}$ =15.96	
Jamun	05	0	$\acute{X}$ =24.98	
Gulmohar	04	0	$\acute{X}$ =19.46 R:19.42-19.48	
Ardoo	10	0	$\acute{X}$ =30.19	
Rohida	15	0	$\acute{X}$ =24.27	
Total		30		

Table: 6 Record of available and preferred roosting trees at different roosting sites. Roost site in italics indicate permanent roost site. P=Peepal, N=Neem, K=Khejari, S=Sirash, T=Talle, B=Babool, I=Imali, Kh=Kahjoor, F=Fransh, Vb=Vilayati babool, Sh=Shapheda, G=Gulmohar, R=Rohida, J=Jamun

S. No.	Roost Side	Location	Available Tree	Preferred tree for roosting	Tree heighe r
1	Todi College Camps	Laxmangarh	P,N,S,T,A	P	17.46
2	Shradhanath Ashram	Laxmangarh	P,N,S,T,A	N	17.50
3	Krishna Vatika Temple	Laxmangarh	P,N,T	N	32.35
4	Nehru Stadium	Laxmangarh	Vb,P,N,T	Vb	25.40
5	Bhooth nath mahadev	Laxmangarh	P,N,K,B	N	23.56
6	Bagri road farm house	Laxmangarh	Vb,N,Kh	Vb	22.73
7	Forest campus	Laxmangarh	N,Kh,Vb,B	Vb	22.50
8	Front of MITS	Laxmangarh	Vb,G,A,N	N	18.76
9	Sheep breeding station	Fatehpur	N,Kh,A,Vb	N	22.87
10	Bagari School	Laxmangarh	N,G,F,K	N	26.50
11	Goenka public school campus	Ghassu	N,Kh,G,A	N	21.50
12	S.R. Sr. Sec. School	Laxmangarh	P,N,K	P	19.65
13	Sarswati Sr. School	Jajod	N,Kh	N	24.30
14	Gurukul School	Harswa	N,G,S	N	27.40
15	Shree Shyam Mandir	Chudi miyan	J,Kh,K,N,B	B	25.35
16	Panchayat Samiti	Fatehpur	N,B,P,Vb	N	22.40
17	Guawarian Mohala	Laxmangarh	Vb,N,Rh	Vb	22.40
18	Badka Balaji	Laxmangarh	B,P,N,A	B	18.25
19	Todi Kui Mandir	Laxmangarh	P,N,B	N	24.15
20	Nehru Stadium	Laxmangarh	P,N,Vb,K	Vb	22.23
21	Nehru Stadium	Laxmangarh	P,N,Vb,K	Vb	19.78
22	Nehru Stadium	Laxmangarh	P,N,Vb,K	N	17.94
23	Nehru Stadium	Laxmangarh	P,N,Vb,K	N	25.90
24	Char Chowk Haveli	Laxmangarh	P,N	P	27.40
25	Bhooth nath mahadev	Laxmangarh	P,N,K,B	P	26.63
26	Budh giri mandi	Fatehpur	N,P,B,J,Vb	N	23.65
27	Power house area	Manasi	N,Vb,K	N	16.84
28	Shiv mandir	Balara	B,P,N,A	P	23.60
29	Kabristan Bhumi	Laxmangarh	A,K,N	N	25.40
30	Krishna Goshala	Laxmangarh	N,P,B	P	19.46

Table: 7 Recorded of number of available and preferred roosting trees at different roosting sites. Roost site in italics indicate permanent roost site.

Roost Side	Location	Number of tree available	Number of tree preferred for roosting
Todi College Camps	Laxmangarh	55	1
Shradhanath Ashram	Laxmangarh	34	1
Krishna Vatika Temple	Laxmangarh	10	1
Nehru Stadium	Laxmangarh	27	1
Nehru Stadium	Laxmangarh	27	1
Nehru Stadium	Laxmangarh	27	1
Nehru Stadium	Laxmangarh	27	1
Nehru Stadium	Laxmangarh	27	1
Bhooth nath mahadev	Laxmangarh	21	1
Bhooth nath mahadev	Laxmangarh	21	1
Bagri road farm house	Laxmangarh	12	1
Forest campus	Laxmangarh	44	1
Front of MITS	Laxmangarh	03	1
Sheep breeding station	Fatehpur	10	1
Bagari School campus	Laxmangarh	09	1
Goenka public school campus	Ghassu	08	1
S.R. Sr. Sec. School	Laxmangarh	10	1
Sarswat Sr. School	Jajod	17	1
Gurukul School	Harswa	09	1
Shree Shyam Mandir	Chudi miyan	06	1
Panchayat Samiti	Fatehpur	15	1
Guawarian Mohala	Laxmangarh	18	1
Badka Balaji	Laxmangarh	06	1
Todi Kui Mandir	Laxmangarh	04	1
Char Chowk Haveli	Laxmangarh	02	1
Budh giri mandi	Fatehpur	10	1
Powar house area	Manasi	07	1
Shiv mandir	Balara	03	1
Kabristan Bhumi	Laxmangarh	08	1
Krishna Goshala	Laxmangarh	13	1
		490	

Table: 8 Average values of height, canopy cover, and diameter at breast height (DBH) of the available and preferred roost trees. Measurements were recorded in feet(ft) and represented as mean ±SD Two tailed student's t-test performed to compare the mean characteristics between available and preffered trees. N=Number of trees.

Tree characteristics	Available trees N=430	Preferred trees N=30	Student's test
Height (ft)	$\acute{X}$ =22.09 SD ± 3.99	$\acute{X}$ = 21.73 SD ± 0.84	t : 454.75 df = 458 P < 0.001
Canopy cover (ff)	$\acute{X}$ =18.33 SD ± 5.16	$\acute{X}$ = 19.63 SD ± 1.23	t : 2522.8 df = 458 P < 0.001
DBH	$\acute{X}$ =2.87 SD ± 1.67	$\acute{X}$ = 3.15 SD ± 1.90	t : 18495.44 df = 458 P < 0.001

Table: 9 Average times span record of arrival and departure of the egret during 2010-2012. Time was recorded and represented in minutes (min).

x indicates average number of the egret.

SD± indicates standard deviation.

Months	Arrival Period (Min)	Egret Arrival	Departure Period (Min)	Egret Departed	Egret Arrival permin	Egret depaited Perform
January	90	48	56	70	0.58	0.95
February	75	58	84	83	0.70	0.80
March	95	40	70	75	0.55	1.25
April	103	80	63	69	0.74	1.12
May	115	68	72	70	0.60	1.14
June	106	75	68	63	0.69	1.25
July	125	81	80	85	0.85	2.15
August	85	69	90	95	0.80	1.30
September	70	87	85	70	1.30	1.08
October	65	63	65	35	1.05	0.85
November	80	64	60	75	0.75	1.76
December	60	73	40	70	1.19	2.38
Total	1069	806	833	860	9.8	16.03
$\acute{X}$:	89.08	67.16	69.41	71.66	0.816	1.33
SD±	13.89	13.30	12.46	13.83	0.60	0.64

Table: 10 Record on average number of juvenile and adult egrets arrived at selected 2 permanent roosts before sunset.
N=Number of inspectorial month percentage in parenthesis

Egrets at roosts	Nehru Stadium (N = 18)	Bhooth Nath Mahadev (N= 18)
Juveniles	10	14
Juveniles arrived before sunset	7 (70%)	9 (64.28%)
Adults	6	10
Adults arrived before sunset	4 (66.66%)	6 (60%)

Table: 11 Number of time Egrets pre-roosting number of egrets pre-roosting and time spending for pre-roosting at the permanent Nehru Stadium roost. Time was recorded and represented in minutes (min.). Data represented as the mean ±SD.
Percentage in parenthesis.

No of observation (1/Month)	Occurrence of per-roosting	Number of the egrets	Number of the egret per-roosted	Pre-roosted (time/min)
36	29(80.55%)	840 $\acute{X}$ = 23.33 SD± 7.94	235 (27.97%) $\acute{X}$ = 6.52 SD± 2.404	1434 $\acute{X}$ = 39.83 SD± 7.90

Table: 12 Record of average time of waking and sleeping calls at Bhooth nath roost site during summer, winter and rainy seasons N = Number of inspectorial months. Data represented as the mean ±SD S = Summer, M = Monsoon, W = Winter.

Season	Walking call	Sleeping call	Student's t-test		
Summer (N=12)	0615 hr SD± 0.59	1930 hr SD± 0.47	(S-M)	(M-W)	(S-W)
Monsoon	0614 hr	1852 hr	t: 5.03	t: 1.85	t: 1.27
(N=12)	SD± 0.40	SD± 0.49 hr	df = 22	df = 22	df = 22
Winter (N=12)	0638 hr SD=0.20	1938 hr SD± 0.37	P<0.001	P<0.10	P<0.10 (NS)

Table: 13 List of birds roosting with the Egret. Percentage in parenthesis.* indicate the roosting association, B=Breeding on the same tree.

Common Name	Zoological Name	Peepal tree	Neem tree	Burgad
Parih Kite	*Milvus migrans*	* B	* B	
House Crow	*Corvus splendenss*	* B	* B	
Roseringed Parateet	*Psittacula Kramer*	*	* B	* B
Little Browndav	*Streptopelia senegalenis*	*		*
Indian Ringdav	*Streptopelia decaocto*		*	
Red turtledove	*Streptopelia tranquebria*		*	*
Common Peafowl	*Pavo Cristatus*	* B	*	
Little Egret	*Egreta garzelta*			*
Pond heron	*Ardeola grayil*	*		*
Common myna	*Sturnus contra*			*
Black ibis	*Pseudibis papillosa*	* B		* B
Redvented balbul	*Pycnonotus cafer*	*		* B
Whicked chicked bulbul	*Pycnonotus Leucogenys*	*		* B
House sparrow	*Passer domesticus*	* B		* B
Yellow/egged Pigeon	*Treron phoenicoptera*	*		
Grey hornbill	*Tockus birostris*	*		
White ibis		*	*	*
Total roosting species	17	13 (76.47%)	7 (41.17%)	11 (64.70%)
Total breeding species	08	5 (29.41%)	3 (17.64%)	5 29.41%)

Table: 14 Average sunrise and sunset times at Laxmangarh in the arid zone of Rajasthan. Range in parenthesis.

Seasons	Month	Sunrise time	Sunset time	Length of clay
Summer	March	6.25 (6.10-6.45)	6.29 (6.20-6.39)	11h 55m 40s
	April	5.55 (5.40-6.15)	6.45 (6.40-6.59)	13h 55m 20s
	May	5.30 (5.20-5.43)	7.08 (6.50-7.20)	13h 34m 40s
	June	5.20 (5.19-5.24)	7.19 (7.15-7.24)	13h 55m 25s
Monsoon	July	5.30 (5.26-5.40)	7.22 (7.15-7.24)	13h 45m 42s
	August	5.35 (5.40-5.55)	6.55 (6.40-7.14)	13h 10m 41s
	September	6.08 (5.56-6.15)	6.26 (6.10-6.45)	12h 22m 51s
	October	6.20 (6.12-6.50)	5.50 (5.36-6.10)	11h 26m 35s
Winter	November	6.35 (6.30-6.50)	5.26 (5.24-5.34)	10h 40m 35s
	December	7.06 (6.55-7.12)	5.25 (5.20-5.30)	10h 22m 20s
	January	7.14 (7.10-7.14)	5.54 (5.35-5.59)	10h 40m 46s
	February	6.55 (6.48-7.10)	6.10 (6.05-6.20)	11h 10m 38s

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Fig:1.Distribution of available tree species and the preference for roosting by the egret at 30 sites

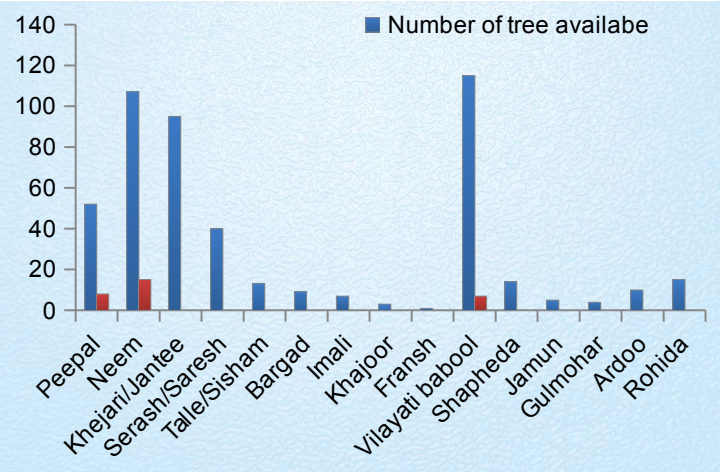
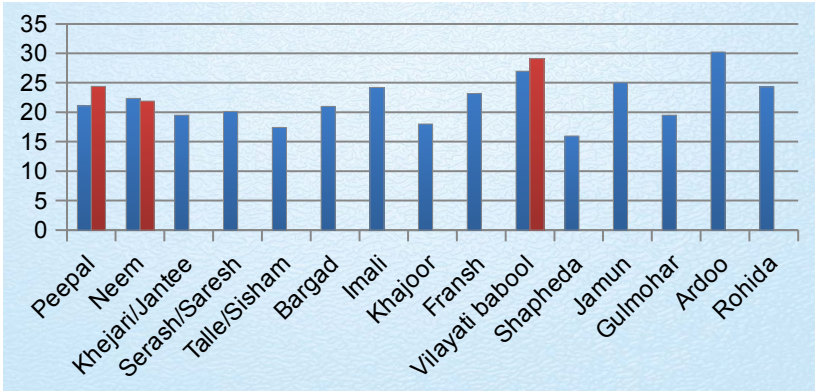


Fig. 2 Average height of available and preferred roost tree species at 30 sit



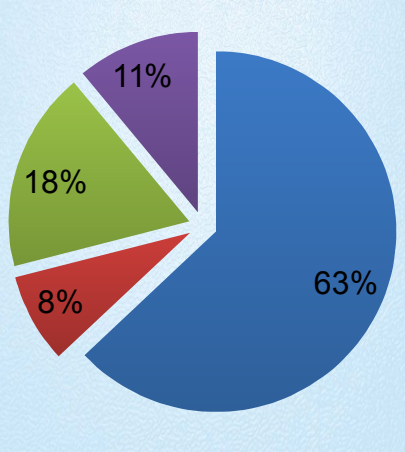


Fig. 3 Number of egret arriving from different directions to the Nehru Stadium roost during 2011

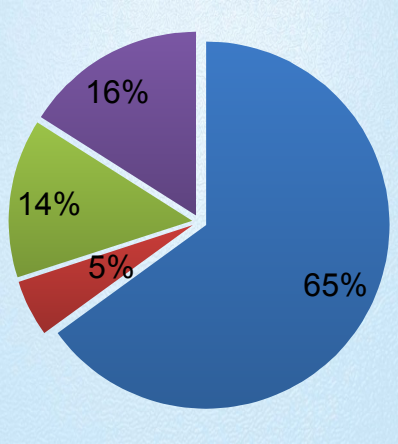


Fig.4 Number of egret arriving from different directions to the Nehru stadium roost during 2012.

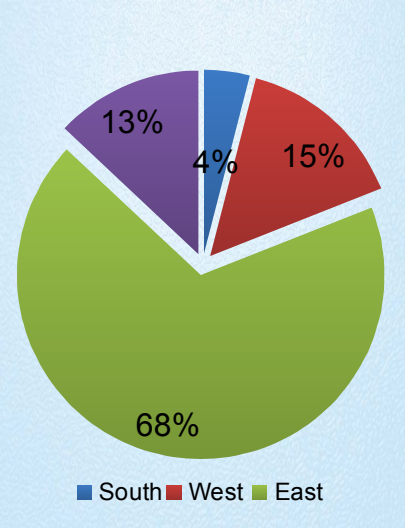


Fig. 5 Number of egret departing in different direction from the Nehru Stadium roost during 2011.

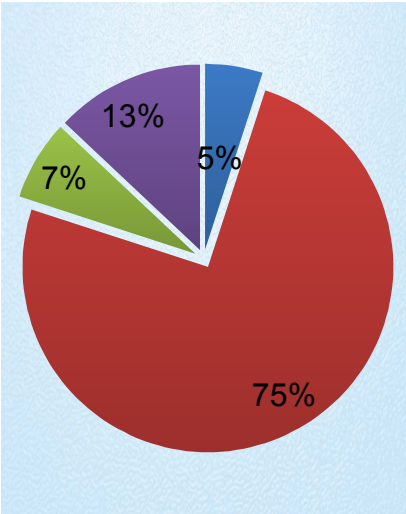


Fig.6 Number of egret departing in different direction from the Nehru Stadium roost During 2012.

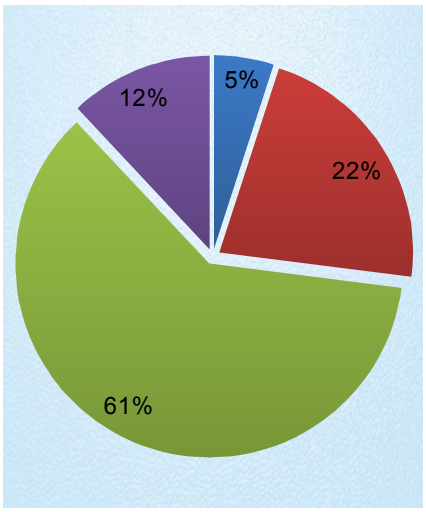


Fig. 7. Number of egret departing in different directions from the Bhooth Nath Mahadev during 2011.

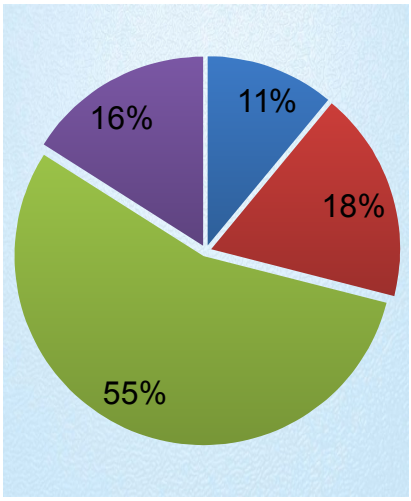


Fig.8 Number of egret departing in different directions from the Bhoot Nath Mahadev during 2012.

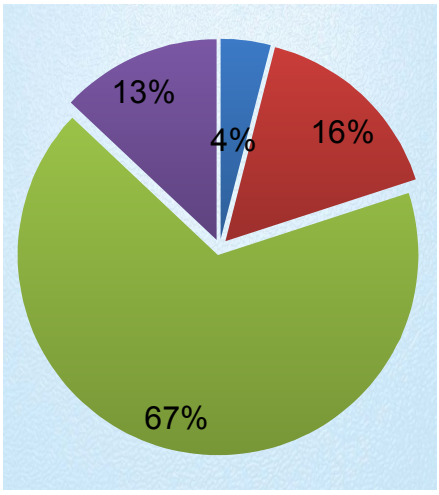


Fig. 9. Number of egret arriving from different directions to the Bhooth Nath Mahadev roost during 2011.

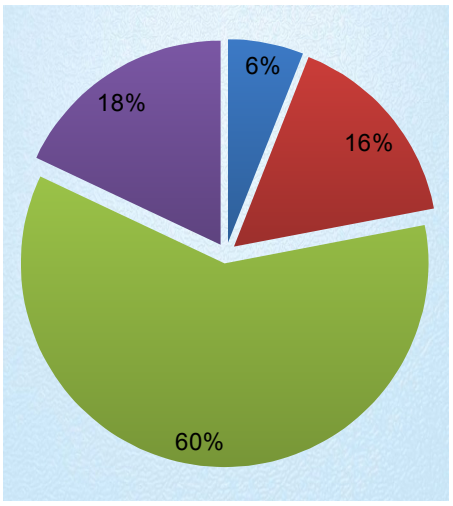


Fig. 9. Number of egret arriving from different directions to the Bhooth Nath Mahadev roost 2012.

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