8. NESTING

8.1 INTRODUCTION

Nest is an essential prerequisite for reproduction in birds. Nesting in birds is a long and elaborate process. Several factors play important role in various aspects of nesting such as : habitat selection (Hilden, 1965 ; Martin and Roper, 1988), nesting height (Marzluff, 1988 ; Dhindasa *et. al.*, 1989), nest defence (Trives, 1972 ; Dawkins and Carlisle, 1976 ; Curio, 1987) etc. which in turn influence reproductive success (Skutch, 1949 ; Lack, 1968 ; Shagsvold, 1982, 1989 ; Wicklund, 1982 ; Custer *et. al.*, 1983). Nesting requires proper harmony between different environmental factors, various requirements for survival of the species and its life cycle strategy. Coloniality provides many advantages to the birds (Lack, 1968 ; Robertson, 1973 ; Ward and Zahari, 1973 ; Krebs, 1974 ; Emlen and Demong, 1975 ; Robinson, 1985) but it also demands greater co-ordination with other conspecifies and allied species co-inhabiting the colony (Lowe-Meconnel, 1967 ; Martin, 1985; Stauffner and Best, 1986).

Proximate cues for nest-site selection may involve traditional species fidelity (Bongirno, 1970) pressure from conspecifics or other species and environmental factors. Little Cormorants usually perch and nest on trees near waterbodies (Ali and Ripley, 1968) while Night Herons prefer Mongrove trees or bushes standing near waterbodies or grooves of trees on dry land for nesting as well as nesting (Ali and Ripley, 1968 ; Soni, 1992). They were also reported to nest on trees as also in reed beds.

Thus Night Herons appear to enjoy more diverse habitats than Little Cormorants. Nest-site selection in both species is done by both the partners. It appears that experienced early breeders occupy the most preferred nest sites. Structural characteristics of the nest-site such as nest height, distance of nest from the tree center, diameter of the nest branch etc. and

social factors such as : dominance, territoriality population density etc. play important role in nest-site selection of both the species. Nest materials of different sizes and dimensions are used at different phases of nesting. The Little Cormorants and the Night Herons were never found to use artificial materials for nesting. In both the species the male initiates nest building by collecting nesting materials which he transfers to the female who arranged the materials at the nest site. The male partner also collects most nest materials. The energy thus saved by the females is probably channelized towards egg production. Nest repairing acts are observed with the onset of incubation in both the birds. At the present study site the high population pressure seems to limit the distance between adjacent conspecific nests to a bear minimum.

During the early phase of nesting in both the species rampant poaching of nest materials take place mostly by neighbouring conspecifics which gradually decreases with time. Nest defence in Little Cormorants and Night Herons usually involves protection of the egg and brood from arian predators. Nest sanitation of both the birds on the other hand includes keeping the brood and the nest dry to avoid growth of microorganisms. It, however, does not necessitate cleaning of faecal materials as in the Catbirds, Songsparrows and Crows because both the adult Little Cormorants and Night Herons and their hatchlings defecate liquid wastes projected in a jet outside the nest.

8.2 METHODS

Observations were made from a bamboo "machan" suitably built on a tall tree in the island, roof of the Rest House, Watch tower, from some adjacent trees without nests aned also from some suitable sports on the ground.

The experimental nests were inspected daily throughout the season and ecological and behavioural data on nesting were collected. During nest visits, the nests were examined and occasionally photographs were taken.

Nest-site characteristics were measured and recorded after the emergence of first batch of hatchlings, when the nests became stable. Nesting tree height and nest height were measured by a measuring tape. Nests were measured with a 30-centimeter scale. Thickness of canopy cover was indexed by estimating the percent foliage cover which was calculated from the percentage of dark and light areas of the canopy shadow during the sunny midday hours when the sun attained the topmost position.

The experimental nesting trees and all the nests in each tree were individually marked with labeled aluminium plates. Nests that were attended by territorial birds or contained at least one egg was considered as active. To detect predation like Bengal monitors trums of some nesting trees located in innundated areas were covered with a thin uniform coating of mud.

The spatial and behavioural data were recorded instantaneously as far as possible and preference value (PV) of nesting trees was obtained following Altmann (1974).

8.3 RESULTS AND DISCUSSIONS

8.3.1. Nest-site selection

On arrival in the heronry Little Cormorants and Night Herons do not immediately engage themselves in finding a nest-site. At first they settle on some lofty trees which are not their usual nesting trees. During this period they moved from one tree to another in a rather restless condition. Most birds of both the species, however, spent most of their time outside the sanctuary. Gradually they settled on a tree at some particular spot and territoriality is established (Fig. 8.1 and Fig.8.2). So before the final choice they obviously followed a period of appetitive searching for nest-site. During this period birds try to find out the best available site which often determines their ultimate fitness (Walsberg,1981; Findholt, 1988 ; Grieco, 1995).

McCrimmon (1978) suggested that within a heronry, each species may be differentially responding to a number of physical, temporal, spatial and social variables, permitting a number of different species to occupy a colony for nesting. The idea is, however, anything but novel, Robert MacArthur as early as 1957 said almost the same thing in connection with his studies on five species of Warblers in the boreal forests. Essentially he pointed out that two or more species can survive in the same habitat due effective nieche segregation. As Little Cormorant and Night Heron nests in the Raiganj Wildlife Sanctuary along with four other avian species the situation is somewhat similar to that observed by MacArthur in case of Warblers.

Little Cormorants and Night Herons generally nest predominantly in the upper canopy layer and scarcely at the periphery. Little Cormorants use mainly top canopy layer. At the present study site, Little Cormorants selectively nest on only five tree species and Night Herons on eight tree species out of thirty available in the nesting area. Table 8.1 and 8.2 shows percent nests (PN), percent abundance (PA) and preference values (PV) of different plant species selected by Little Cormorants and Night Herons respectively for nesting. It may, however, be mentioned that prior to the devasting storm and flood in 1995 Night Herons used to nest extensively on *Eucalyptus* sp. trees in the nesting area of the sanctuary (Datta & Pal, 1990). Most of those trees fell victim to the storm. Subsequently, it was observed that Night Herons adopted other ttees in the same area for nesting. Presently Little Cormorants and Night Herons nest mainly on Jarul acquiring 85.02% and 84.21% respectively.

The high percentage of nests on Jarul indicate its characteristic branching pattern which provides stability at the same time exposure to sun, rain and winds. Soni (1992) reported similar observations in Night Heron at Keoladeo National Park, Bharatpur, Rajasthan. Most nests in Little Cormorants were at a node from which a cluster of branches originated (single, bi-

forked, tri-formed and multiple forked).

On the other hand, selected nesting sports of Night Heron varied from a simple nook formed by two horizontal branches to a node from which a cluster of branches originated (Single, biforked, tri-forked and multiple forked).

8.3.2. Nests at unusal site

In Little Cormorant : Sometimes nests were also observed on a saucer-shaped curve of a single branch. However, only 3 nest were observed in this kind of untoward spots.

In Night Heron : Some nests were soptted at unusal sites such as : at the points where (a) two close, horizontal and parallelly (within 12-15 cm.) growing branches diverge and (b) at the upper form of the point of intersection of two separate branches from the same tree.

8.3.3 Nest Height

At the Kulik Little Cormorants and Night Herons were found to nest on mainly five and eight trees respectively but predominantly on Jarul trees (85.20% in Little Cormorant and 84.29% in Night Heron). Table 8.3 and 8.4 shows the average length of the tree, distance of the nest from peak canopy, distance of nest from canopy bottom line, height range of nests in the canopy, vertical expanse of the canopy with standard errors.

8.3.4. Role of sexes

At Kulik the males always choose the nest-sites. Such male biased behaviour is common to most species of the Cormorants species (Grieco,1995) and in Night Herons (Gross,1923). This is also common in storks. Firstly, the male choose an open vantage position for mate attraction and after that they finally choose the nesting site with proper basal support

irrespective of its overhead cover. In the early stage the distance between the partners ranged from 0.5 to 1 meter after copulation and after final settlement they start nesting in the suitable position of the branches near the display spot. In Little Cormorants on the other hand the males display from a suitable spot which is selected only if the females respond appropriately. In 17.8% cases the spot was deserted by the male in absence of female response. Thus females appear to have a say in the final selection of the nest-spot.

Little Cormorants and Night Herons start nests about 3 to 4 days and 2 to 3 days repectively prior to egg laying. Most often the males collect the nest materials and transfer those to the partner who place the same in the desired position. The male gather materials by picking up dry branches, twigs from the ground as also by cutting parts from trees and uprooting green saplings. On occasions in Night Herons naive-first time breeders take considerable time in placing comparatively longer unsuitable sticks to lay the foundation. On the whole the Little Cormorants 46-50 hrs. and the Night Herons took 42-45 hrs. to construct the nest foundation. There is a clear division of labour between the sexes as the males are predominantly involved in nest material collection and the females in arranging the same and constructing the nest. However, at times both sexes were observed to perform any nest building activity. The division of labour might help the females in conserving energy which may be channelled for more egg production. Similar observations are reported in the Cranes (Johnsgard, 1983).

During incubation the female adds new materials and packs the old materials by small readjustments. On hatching one of the parents stay at the nest for attending the hatchlings while the other feeds itself and collects a man of food for the hatchlings. During their journey back to the nest they usually pick up nest materials. At this stage the parents take turns in feeding and collection of food and nest materials. The incubating bird periodically stood up and rolled the eggs and routinely carried out repair activities.

8.3.5. Nest Material

Little Cormorants and Night Herons strictly use plant materials for nest construction. None of the 988 nests observed (494 of Little Cormorant and 494 of Night Heron) in connection with various aspects of the present investication contained any artificial materials such as : metal wires, cloth, plastic, paper or nylon fibers as found in many species such as Eagles and House Crows (Pal, 1983). Open-bill storks that live in the sanctuary and Sarus Crane (Mukherjee *et. al.*, 2000) also never used any artificial materi also.

In Little Cormorants materials belonging to 18 to 22 different plant species were used to build a nest. Eleven entire nests were analysed for this purpose. Out of the species that were used as nest material, only 16 sere identified. It was observed that the bulk of the nest materials were from eight species viz. Jarul, *Casia*, Jigni, Hijal, Sisso, Akashmani, *Eucalyptus* and Pitali. The contribution of the remaining species were marginal. On the other hand nest materials used by Night Herons belonged to 16 to 19 different plant species. Twelve entire nests were analysed for this purpose. Out of the species that were used as nest material, only 14 have were identified. It was observed that the bulk of the nest materials were from six species viz. Jarul, Kadam, Eucalyptus, Shegun, Akashmoni and Gokul. The contribution of the remaining species were marginal.

Table 8.5 and 8.6 shows the relative importance of various plant species used by Little Cormorants and Night Herons respectively as nesting materials. Plant materials of varried length, shapes and nature i.e. soft-hard stem, dry-wet twigs with leaves, inflorescence, fruits etc. were used to construct different parts of the nest at different phases.

8.3.6. Nest Construction

At the initial stages of nest construction Little Cormorants and Night

Herons males brought most of the nest materials from the nesting tree or other adjacent trees in the sanctuary. This is also found in Greater Adjutant Stork (Singha *et. al.*, 2003) and in the Sarus Crane (Ramchandra and Vijayan, 1994). At this phase males of both species colected nest materials within a radius of 25-50m. of the nest.

In Little Cormorant

At the beginning the pair placed dry long sticks 20 to 40 cm. in length and 0.8 to 1.2 cm. in diameter at the nest-site with a lot of caqre. Occassionaly they took rather long time (50-90m.) in placing the single stick. These sticks are meant to care the weight of the evolving nest and the developing brood. Thus, they must be strong and are usualy from hardwood trees.

Once the foundation is made the next job is to lay the floor of the nest. Here they use slender sticks of 10-15 cm. length. This twigs are often with dry or green leaves which are used as packing materials. Then sticks of even smaller dimensions (6-15 cm. length) are used to form the wal of the nest. It was observed that most of the sticks were curved and or semi-dry so that they are plastic enough to be curved as per required. Finally bed of the nest is made of small sticks (2-10 cm.), green-leaves and gren or dry saplings. Thus a nest, i.e. cup-shaped, untidy structure of sticks and twigs takes shape.

In Night Heron

At the very outset the mating pair placed rather long dry sticks (45-72 cm. in length and 1.2 to 1.6 cm. in diameter) at the nesting spot with lot of care and attention, spending 40-120 minutes in placing a single stick. Occasionally sticks as long as 110 cm. were used. Sometimes it takes more than 3 hours to place a single stick in the right position. It is probable that first time, novice breeders are involved in these exceptional cases. They set and reset the sticks with lot of care. These stick function as foundation and

are meant to bear the weight of the evolving nest and the developing brood.

Subsequently, dry sticks ranging from 30 to 46 cm. in length and 0.8 to 0.4 cm. in diameter are suitably arranged on the weight bearing sticks towards the formation of the nest floor. Dry as wel as wet twigs with leaves of 8 to 16 cm. length are then used as a sort of packing material. Finally sticks of even smaller length along with green leaves are set to form the bed of the nest. Thus a nest, " a rough untidy platform of twigs, sometimes quite flimsy" (Ali and Ripley, 1968) i.e. a more or less shalow sancer-shaped structure takes shape.

In most instances egglaying occurs long before (7 to 10 days) the construction of the nest bed. However, laying was never observed before at least 25-30 sticks are suitably placed on the weight bearing foundation structure. The pattern of placement of the stick roughly simulates weaving of buskets.

In construction of the wall of the saucer-shaped nest often small dry and curved stick, 15-30 cm. long and 0.4 to 0.2 cm. in diameter, green twigs with inflorescence and fruits, and long saplings with soft stems were used.

Apparently the Little Cormorants and the Night Herons do not seem to require a full fledged nest to start egg laying. Mukherjee *et. al.*, (2000) reported similar observations.

Poaching of nest materials by other conspecifics goes on predominantly during the early nesting phase in both Little Cormorants and Night Herons. During poaching the poacher usualy reaches the host-nest by stealthy movements and departs with a stick as quickly as possible. Usualy unattended nests fall victim to poaching. This practice sometimes necessitates urgent repair of the host nest. Poaching, however, diminishes progressively with the breeding season. Singha *et. al.* (2003) reported loss of nest materials even in presence of the owner in Greater Adjutant Storks. No such activity was observed in

Little Cormorants and Nitght Herons.

In both the species addition - alteration-extention and repair activity of nests continues throughout the breeding season until all the chicks are fledged. Due to these activities the nest volume and weight increases considerably. Fig. 8.3 & Fig. 8.4 shows the regression line of nest volume in cubic cm. at egg stage, hatchling stage and fledgling stage in Little Cormorants and Night Herons. It also shows that the overall regression line for nest volume over the entire period of nesting activity is statistically significant at 0.001% level in Little Cormorant ($r = 0.97$, $t = 12.51$, $df = 10$) and in Night Heron ($r = 0.92$, $t = 7.26$, $df = 10$). The regression lines for nest volume at various stages of chick development are even more significant. The dots under egg laying phase present nest volume at two, three, four and five egg stages in Little Cormorant and at one, two, three and four egg stages in Night Herons. Each dot shows the average volume of four different nests. Similarly the dots under hatching and fledging phases indicate nest volume with one, two, three and four hatching and fledging phases respectively. It is observed that the first eggs are laid after 3 days of the onset of nest construction in both the species. In Little Cormorants hatching of the first egg and fledging of the first hatchling occurs on the 25th and 55th day of nesting while the same for Night Herons occurs on the 26th and 56th day nesting.

It may be pointed out that nest addition-alteration-repair etc. goes on, even in absence of any damage because it is necessary to prevent loss of chicks due to fall from nests.

8.3.7. Nest Distance

Of the six bird species that live in the sanctuary four i.e. Open-bill Stork (*Anastornus oscitans*), Little Cormorant (*Phalacrocorax nigler*), Night Heron (*Nycticorax nycticorax*) and Little Cormorant (*Egretta garzetta*) are considered to be major species. The total populations of the major species

according to Forest Department, Raiganj Social Forestry Division census ranged from about 43500 to 81300 over the last ten years. The range presented is wide mainly because of large scale mortality of nestlings as wel as adults in years of severe rains-storms and floods. However, despite significant losses in some years eg. 1995, 1999, the population of all the bird species is increasing handsomely particularly for the four major bird species. As stated earlier the six bird species inhabiting the sanctuary utilize roughly about 15.871 ha i.e. 12.2% of a total area of 130.09 ha. Thus there is tremendous intra and interspecific competition with regard to almost all aspects of survival particularly for nesting sites. As a result distances between nests of the same as well as other species is very small inducing lot of conflicts at the early phase. However, once the nests are constructed the birds get summarily busy with reproduction and parental care activities and aggression with neighbours assumes a secondary position.

Table 8.7 and 8.8 shows inter-nest distance of Little Cormorant-Little Cormorant of Little Cormorant- Open-bill Stork, Little Cormorant-Night Heron, Little Cormorant-Little Egret and Night Heron-Night Heron, Night Heron-Open-bill Stork, Night Heron-Little Cormorant and Night Heron-Little Cormorant. It is observed that average distance between Little Cormorant-Little Cormorant with exception to Little Cormorant-Little Egret and Night Heron-Night Heron nests is maximum.

Little Cormorants and Night Herons nested closer to contraspecific nests than to conspecific ones. This was also found in Cattle Egrets, Little Blue Herons and in Louisiana Herons. This, however, was not the case in Great Egrets (McCrimmon, 1978). This observation supports the contention that intraspecific competition is most severe. On the basis of this it may be assumed that inter-nest distance can be used as an index of ecological separation between two species. In otherwords ecological requirements of two species is most different when distance between their nest is least.

8.3.8 Nest defence behaviour

Although predation by mammals (Southern and Southern, 1979 ; Rodgers, 1980), birds (Baker, 1940 ; Dusi and Dusi, 1968 ; Nisbet, 1975 ; Burger, 1982 ; Shield and Parnell, 1986) ande snakes (Dusi and Dusi, 1968) are common to wading bird colonies, in this sanctuary only the house crow was found to be the most dominant predator. Prerdation of egg by crows, however, has been reported for various bird species (Baker, 1940 ; Picozzi, 1975; Verbeek, 1982 ; Salathe, 1987). Actually the crows scavenged nest contents (Eggs and one to three days hatchlings) only when the nests were left unguarded. Thus no special antipredatory behaviour was observed in either species.

8.3.9 Nest Sanitation

Nest sanitation is important, in the over all perspective of nest success in bird life. It protects the young from infectious micro-organisms and insect parasites. It also helps to keep the predators away from the nests. It is established that different predators are attracted to the nests by different cues such as olfactory, auditory and visual. The degree of sanitation is also influenced by the nature of habitat and quantum of predator-pressure. Little Cormorants and Night Herons in the present study at Kulik exhibited several nest sanitation behaviours. It was observed that both the birds remove the empty egg shells from the nest and drop them on the ground beneath the nests within approximately one hour of hatching. The Greater Adjutant Storks also cleaned the nest by disposing egg shels (Singha *et al.*, 2003). Apprantly this could be due to at least three reasons : 1) The inside of egg could attract micro-organisms that could infect the hatchlings. 2) The white inside of the broken egg shell could attract the attention of the airborne predators such as : eagles and crows. Now although eagles are rather rare in the area both jungle and house crows

regularly visit the sanctuary in large number from nearby localities and tend to stay in the sanctuary almost over the whole day. The crows particularly the house crows continuously look for opportunities to predate on eggs and hatchlings. Thus it appears to be beneficial for the Little Cormorants and Night Herons to get rid of the empty egg shells at the earliest. 3) Again the sharp edges of the broken shell is potentially dangerous as it could damage the soft tissue of the hatchlings. Hence, removal of the broken egg shell is beneficial.

It was also observed that adult Little Cormorants and Night Herons excrete liquid defecates along with nitrogenous wastes force-fully in a jet directed outside their nests. Prior to the act they orient the posterior part of their body including the cloaca outside the rim of the nest. Similar observations were made by Maxwell and Putnam (1968) in Black Crowned Night Herons at Western Lake Erie. The older hatchlings also do the same thing at about 2-3 weeks of hatching. However, the younger hatchlings less than 15-20 days do excrete inside the nest in both the bird species.

Again parent birds are in the habit of dropping unhatched eggs and dead youngs to the ground from the nest. This behaviour is possible only if groundborne predators are absent in the area. Infact although there are some ground dwelling predators such as : Bengal monitors, domestic dogs, the Bengal foxes, the Indian grey mongoose, and jungle cats their numbers are low and they were never in need of attacking nests because of abundance of food at the ground level itself. No attempts to climb up to the nests was observed in the course of over 10 years study period by any of the predators.

Parent birds were also observed to drop the parts of food items such as : spines of fish, heavily chitinized parts i.e. carapace, legs and the chela of crustaceans. Again during rains the parents shield the young and the nest with expanded wings in order to keep them dry. This act retard the growth of the microbs which flourish at high moisture / humidity and temperature situation.

Table 8.1 : **Percent nests of Little Cormorant on nesting tree species with percent abundance (PA) and preference values (PV) at Raiganj Wildlife Sanctuary.**

Serial No	Common / Local Name	Scientific Name	Percent Nest (N=494)	PA Nesting Tree species N=78	PV (PV=Percent Nest on a tree sp)
1.	Jarul	*Lagerstroemia flosregnae*	85.2	62.5	1.36
2.	Bamboo	*Bamboosa sp.*	5.66	19.44	0.27
3.	Pithali	*Trewia nudiflora*	5.06	8.33	0.60
4.	Chatim	*Alstonia seholaris*	3.03	5.55	0.54
8.	Jigni	*Lannea coromandetica*	1.21	4.16	.29

Table 8.2 : **Percent nests of Night Heron on nesting tree species with percent abundance (PA) and preference values (PV) at Raiganj Wildlife Sanctuary.**

Serial No	Common / Local Name	Scientific Name	Percent Nest (N=494)	PA Nesting Tree species N=78	PV (PV=Percent Nest on a tree sp)
1.	Jarul	*Lagerstroemia flosregnae*	84.21	57.69	1.46
2.	Bamboo	*Bamboosa sp.*	7.08	17.94	0.39
3.	Pithali	*Trewia nudiflora*	2.02	7.69	0.26
4.	Chatim	*Alstonia seholaris*	1.82	6.41	0.28
5.	Hijal	*Brringtonia acutangnla*	1.01	2.56	0.39
6.	Sisso	*Dalbergia sissoo*	1.61	2.56	0.62
7.	Sheora	*Streblus asper*	1.41	1.28	1.10
8.	Jigni	*Lannea coromandetica*	.81	3.84	0.21

Table 8.3 Spatial Distribution of nests in Little Cormorants in the tree canopy at Raiganj Wildlife Sanctuary

Name of tree	Sl. No.	Peak canopy to nest (m)	Bottom canopy to nest (m)	Height range of nest in canopy (m)	Vertical expanse of Canopy (m)	Length of tree (m)
Jarul ***(Lagerstroemia flosregnae.)***	1	1.47	1.62	1.58	4.67	15.23
	2	0.48	1.80	1.37	3.65	14.62
	3	0.76	1.53	1.40	3.69	7.93
	4	0.83	1.33	0.32	2.48	6.85
	5	0.73	1.44	0.82	2.99	7.00
	6	1.32	1.51	0.67	3.50	7.77
	7	0.76	1.51	0.60	2.87	6.55
	8	0.86	1.10	0.33	2.89	6.35
	9	1.42	2.82	2.13	6.37	11.70
	10	0.96	2.15	0.85	3.97	9.27
	11	0.99	1.20	0.76	2.95	8.13
	12	0.71	1.17	0.45	2.33	6.70
	13	0.91	2.23	0.57	3.71	8.54
	14	1.11	1.91	0.94	3.96	9.09
	15	0.76	1.39	0.85	3.00	7.37
	16	0.56	4.04	1.82	6.42	10.46
	17	1.67	1.03	0.73	3.43	8.08
	18	0.60	1.12	0.97	2.69	8.23
	19	1.11	0.87	0.64	2.62	8.79
	20	0.91	1.11	0.51	2.53	7.00
	$\bar{X}$ + S.E.	0.94 ± 0.07	1.64 ± 0.16	0.91 ± 0.11	3.53 ± 0.79	8.78 ± 0.55

Table 8.4 **Spatial Distribution of nests in Night Herons in the tree canopy at Raiganj Wildlife Sanctuary**

Name of tree	Sl. No.	Peak canopy to nest (m)	Bottom canopy to nest (m)	Height range of nest in canopy (m)	Vertical expanse of Canopy (m)	Length of tree (m)
Jarul ***(Lagerstroemia flosregnae.)***	1	1.88	1.22	1.57	4.67	15.23
	2	0.53	1.65	1.47	3.65	14.62
	3	0.46	0.94	2.29	3.69	07.93
	4	0.76	0.81	0.91	2.48	06.85
	5	0.68	0.86	1.45	2.99	07.00
	6	0.91	0.91	1.68	3.5	07.77
	7	1.68	0.84	0.35	2.87	06.55
	8	1.02	0.81	0.46	2.29	06.35
	9	1.73	0.91	3.73	6.37	11.70
	10	0.89	0.97	1.09	2.95	08.13
	11	1.80	1.08	1.07	3.96	09.27
	12	1.09	0.86	0.38	2.33	06.70
	13	1.22	1.02	1.47	3.71	08.54
	14	2.06	0.99	0.91	3.96	09.09
	15	1.27	0.97	0.76	3.0	07.37
	16	2.89	1.09	2.44	6.42	10.46
	17	1.83	0.94	0.66	3.43	08.08
	18	0.94	0.86	0.89	2.69	08.23
	19	1.32	0.46	0.84	2.62	08.79
	20	0.71	0.53	1.29	2.53	07.00
	$\bar{X}$+S.E.	1.28 ± 0.13	0.93 ± 0.04	1.28 ± 0.17	3.50 ±0.25	8.78 ± 0.55

Table. 8.5 : Contribution of different tree species in the construction of various parts of Little Cormorant Nests (N=11)

Tree species	FOUNDATION	FLOOR	WALL	BEDDING
	Range of length & diameter 20 to 72 cm 40 to 1.6 cm	Range of length & diameter 30 to 46 cm .4 to .8 cm	Range of length & diameter 50 to 30 cm .2 to .4 cm	Range of length & diameter 3 to 16 cm .2 to .3 cm
1. Jarul (*Lagerstroemia flosregnae.)*	68 (45.33)	185 (39.36)	773 (54.74)	132 (31.35)
2. Jigni (*Lannea coromandelica*)	42 (28.00)	23 (4.89)	169 (11.96)	22 (5.22)
3. Hijal (*Barringtonia acutangula*)	23 (15.33)	---	147 (10.41)	110 (26.12)
4. Casia (*Casia sophera*)	---	35 (7.44)	68 (4.81)	---
5. Eucalyptus (*Eucalyptus sp.*)	---	77 (16.38)	90 (6.37)	66 (15.67)
6.Akashmani (*Acacia moniliformis*)	---	23 (4.89)	46 (3.25)	13 (3.08)
7. Sisso (*Dalbergia sissoo*)	08 (5.33)	12 (2.55)	20 (1.41)	---
8. Pitali (*Trewia mudiflora*)	09 (6.00)	34 (7.23)	---	---
9. Subabul (*Lencina leucocephala*)	---	20 (4.25)	---	---
10.Durba grass (*Cynodon dactylon*)	---	18 (3.82)	12 (0.84)	25 (5.93)
11.Napea grass(*Pennisetum sp.*)	---	13 (2.76)	32 (2.26)	12 (2.85)
12. Bamboo (*Bamboosa sp.*)	---	14 (2.97)	22 (1.55)	---
13. Kash (*Saccharum spontaneum*)	---	10 (2.12)	13 (0.92)	---
14. Toss Jute (*Corchorus olitorius*)	---	---	---	20 (4.75)
15. Biskatali (*Persicaria sp.*)	---	---	20 (1.41)	10 (2.37)
16. Chatim (*Alstonia scholaris*)	---	6 (1.27)	---	---
Total	150	470	1412	421
Average	13.63	42.72	128.36	38.27

The figure in the parentheses indicate percentage

Table 8.6 : Contribution of different tree species in the construction of various parts of Night Heron Nests (N=12)

Tree species	FOUNDATION		FLOOR		WALL		BEDDING	
	Range of length & diameter 50 to 72 cm	1.2 to 1.6 cm	Range of length & diameter 30 to 46 cm	.4 to .8 cm	Range of length & diameter 50 to 30 cm	.2 to .4 cm	Range of length & diameter 3 to 16 cm	.2 to .3 cm
1. Jarul *(Lagerstroemia flosregnae.)*	108	(64.3)	480	(63.5)	1932	(72.9)	522	(47.5)
2. Kadam *(Acanthocaphalus cadamba.)*	24	(14.3)	60	(7.9)	324	(12.2)	348	(31.7)
3. Eucalyptus *(Eucalyptus globulus.)*	---		120	(15.9)	96	(3.6)	108	(9.8)
4. Shegun *(Tectona grandis.)*	24	(14.3)	24	(3.2)	72	(2.7)	---	
5. Akashmani *(Acacia moniliformis.)*	---		24	(3.2)	48	(1.8)	48	(4.4)
6. Gokul *(Allanthus grandis.)*	12	(7.1)	12	(1.6)	12	(0.5)	---	
7. Bamboo *(Bamboosa sp.)*	---		12	(1.6)	24	(0.9)	---	
8. Napea grass *Pennisetum sp.)*	---		12	(1.6)	36	(1.4)	---	
9. Lichu *(Litchi chinensis.)*	---		12	(1.6)	36	(1.4)	---	
10. Guava *(Pisidum guajava.)*	---		---		48	(1.8)	---	
11. Karanj *(Pongamia pinnata)*	---		---		---		24	(2.2)
12. Bakul *(Mincosops elengi.)*	---		---		---		24	(2.2)
13. Subabul *(Lencina leucocephala.)*	---		---		---		24	(2.2)
14. Bougan vallia *(Bougainvillea sp.)*	---		---		24	(0.9)	---	
Total	168		756		2652		1098	
Average	14		63		221		91.5	

Table 8.7 : Nest distance as an index of ecological closeness in Little Cormorant

Sl No.	Species	Ave (m)	SD	df	t	P
1	LC-LC	1.21	0.94	30	7.16	<0.01
2	LC-OBS	1.13	0.62	30	10.14	<0.01
3	LC-NH	1.18	0.60	30	10.94	<0.01
4	LC-LE	1.30	0.55	30	13.16	<0.01

LC=Little Cormorant, OBS = Open-bill stork, NH = Night Heron LE = Little Egret.

Table 8.8 : Nest distance as an index of ecological closeness in Night Heron

Sl No.	Species	Ave (m)	SD	df	t	P
1	NH-NH	1.76	0.90	40	12.51	<0.01
2	NH-OBS	1.31	0.69	30	10.57	<0.01
3	NH- LC	1.18	0.60	30	10.94	<0.01
4	NH-LE	1.68	0.72	26	11.89	<0.01

LC=Little Cormorant, OBS = Open-bill stork, NH = Night Heron LE = Little Egret.

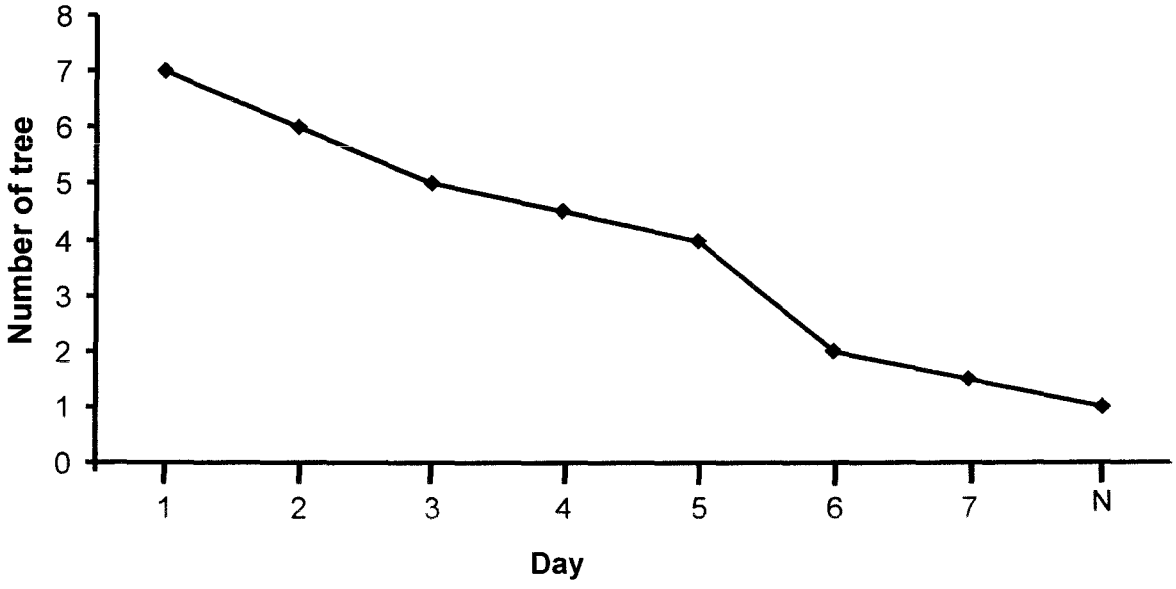

Fig. 8.1 Number of tree used to exhibit nest-site territoriality before the initiation of true nesting ("N") by Little Cormorant

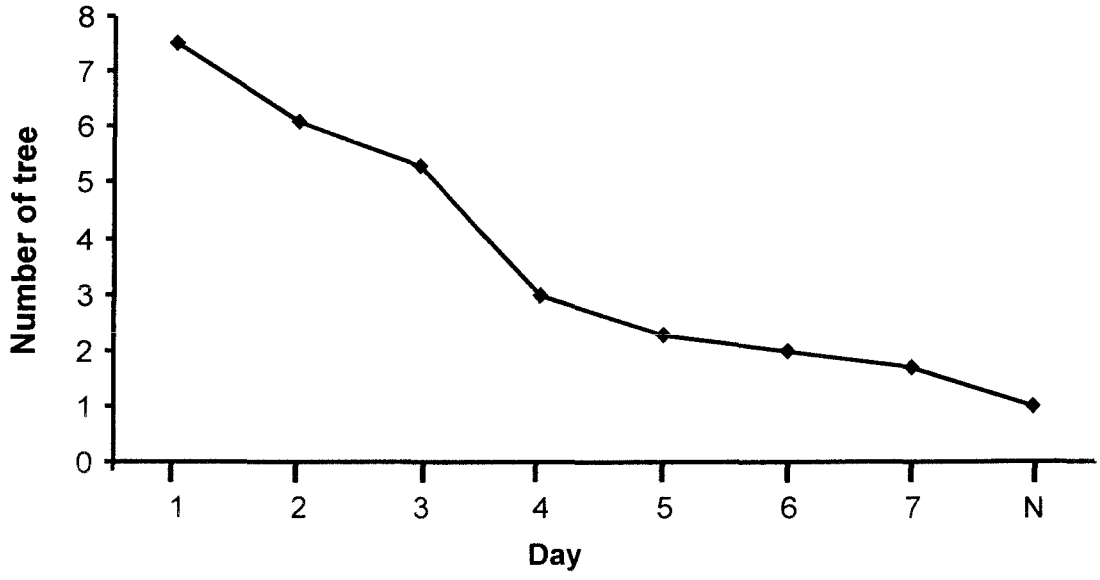

Fig. 8.2 Number of tree used to exhibit nest-site territoriality before the initiation of true nesting ("N") by Night Heron

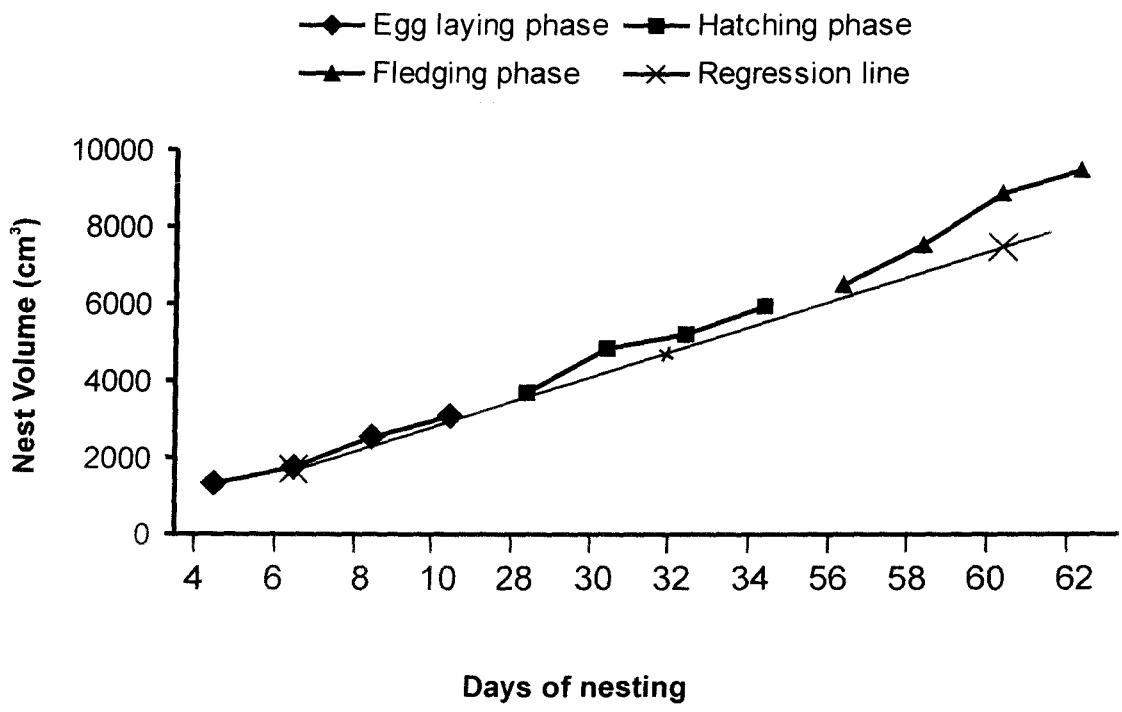

Fig. 8.3 Nest size of Little Cormorants at different developmental stages.

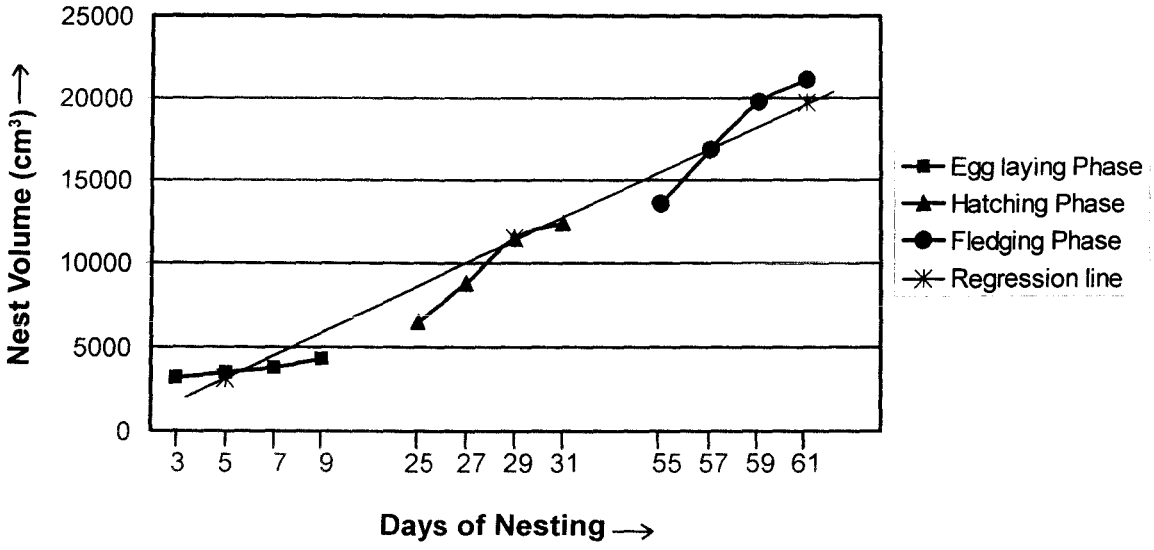

Fig. : 8.4 Nest size of Night Herons at different developmental stages

Plate 8.1 A nest of Little Cormorant in the early stage on a Jarul tree.

Plate 8.2 A clutch of three eggs in a Little Cormorant nest on a Jarul tree.

Plate 8.3 A Night Heron nest at the early nesting phase on Jarul tree.

Plate 8.4 A clutch of four eggs in a Night Heron nest.

Plate 8.5 A damaged nest of Night Heron

Plate 8.6 A nest of Night Heron at an unusual spot.