# SPATIAL AND TEMPORAL DISTRIBUTION OF NESTS IN A HERONRY

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***web supplement***

**Abstract**

*This study is a result of three years of observations on the heronry at Tabela House in Kota, Rajasthan. Small Cormorant, Pond Heron, Night Heron, Cattle Egret, Little Egret, Median Egret and Large Egret have been breeding in this heronry, which is situated in the heart of the city. A pattern in their spatial and temporal distribution in the heronry was noted and different species followed that pattern year after year. Availability of suitable nesting trees, nesting material, safety and foraging success has resulted in site fidelity.*

**Keywords**

*Foraging success, heronry, Kota, reproductive performance, site fidelity, spatial and temporal distribution*

The study of spatial and temporal distribution of a species provides data on its whereabouts at a certain time and the factors responsible for the phenological events in its life. A study of spatial and temporal distribution helps a scientist to study abundance, demography, predation, parasitism and effects of climatic change. Researchers have used these parameters to study the risk of predation (Part & Wretenberg, 2002; Kristan & Boarman, 2003), abundance and demography (Nicholas *et al.*, 2003), brood parasitism (Strausberger, 2001), effects of climate change (Steffan & Part, 2004), nest site selection (Gokula, 2001), nest site fidelity and predation (Newton & Wyllie, 1992). The composition and diversity of trees have a great impact on the occurrence of birds (Jayson & Mathew, 2002).

The researchers have found that the birds are more prone to move out of their home range due to climatic and environmental changes. The mobile avian life style as compared to more sedentary groups of species accounts for the frequent changes quickly seen in the birds. The factors mentioned above also contribute to changes in phonological events in the life of a bird. With the suppression of natural disturbance and addition of human disturbance such as agriculture and development, a decline in abundance of species and their spatial distribution is observed.

The heronries play an important role in the life cycle of the birds of family Ardeidae, Ciconiidae, Threskiornithidae and Phalacrocoracidae. In mixed heronries, such diverse groups congregate in large numbers to breed and raise their progeny. Different species occupy certain space in the heronry at certain times. Strong site fidelity has been observed among birds as this is advantageous to them. As the birds become familiar with the area, it enhances their foraging success, predator avoidance, defense and other behaviours, which contribute to reproduction performance (Newton & Wyllie, 1992). The present study was conducted with a view to study the nest site selection, placement of the nest on a tree, nest predation and the time each species occupied the space in the heronry.

## Study Area

The Tabela House heronry is situated in the middle of Kota city in southeastern Rajasthan ($25^0$10'N & $75^0$52'E). The building has a large courtyard (approx. 70m x 70m) surrounded by rooms and single entrance gate. It was used as a stable for horses in erstwhile Kota state. Presently, a number of government offices and godowns occupy the building and the ground leaving the trees for the birds. The trees in the courtyard are Neem *Azadirachta indica*, Bargad *Ficus benghalensis,* Peepal *F. religiosa*, Gular *F. glomerata*, Gulmohar *Delonix regia*, Ber *Ziziphus mauritiana,* Imali *Tamarindus indica* and Eucalyptus. Three Vilayati Babool *Prosopis juliflora* trees outside the building and two Imali trees in the adjacent temple compound also form a part of the heronry. The height of the trees ranges between 4 to 12m. The present study is based on the data collected during 2002-2004. The observations were taken every fortnight with the help of 8 x 40 Minolta™ binocular and the activities were recorded through a Sony™ camcorder. The arrival and departure dates of each species were noted to ascertain the period of stay in the heronry.

## Observation and Discussion

The observations were taken at Tabela House heronry between April and October for three years (2002-2004). The dates of arrival and final departure for each species were noted (Table 2). The choice of trees and the placement of the nest on the tree were noted for each species. Although situated in the old city of Kota, Tabela House is a remote place with little disturbance. Whatever activity is confined to the office hours between 1000hr and 1700hr. It is during the breeding season that the place buzzes with activity. The Cattle Egret *Bubulcus ibis* and Pond Heron *Ardeola grayii* are the first arrivals at the heronry. By the first week of April, the heronry is established and the rush is on for nesting material. The birds begin to arrive in their breeding plumage, which is golden red wash of fine plumes on head, neck and back for Cattle Egret and maroon back with yellowish-brown head and neck for Pond Heron (Table 3). The dirty black legs and yellow bill of the Cattle Egret also turn bright red. The Cattle Egrets are first to occupy the *Prosopis* trees outside the courtyard and the lower and peripheral branches of Gulmohar, Neem and Ber trees (Fig. 1: ABC,c,d). The Pond Herons occupy the lower and inner branches of the trees (Fig. 1: I,c). The activity at ground level is as intense as it is at tree level. The competition for twigs of

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***Table 1. Number and percentage of nests of each species in the heronry***

| Year | Total | Pond Heron | | Night Heron | | Cattle Egret | | Little Egret | | Median Egret | | Small Cormorant | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Tree- Gulmohar (*Delonix regia*) | | | | | | | |
| 2002 | 107 | 8 | 7.47% | - | 0% | 56 | 52.33% | 10 | 9.34% | 2 | 1.87% | 31 | 29% |
| 2003 | 132 | 9 | 6.8 % | - | 0% | 77 | 58.33% | 8 | 6.00% | 1 | 0.75% | 37 | 28% |
| 2004 | 124 | 2 | 1.60% | 5 | 4% | 72 | 58.00% | 14 | 11.3% | 5 | 4.00% | 26 | 21% |
| | | | | | | Tree- Neem (*Azadirachta indica*) | | | | | | | |
| | | Large Egret | | Night Heron | | Cattle Egret | | Little Egret | | Median Egret | | Small Cormorant | |
| 2002 | 153 | 13 | 8.50% | - | 0% | 92 | 60.10% | 23 | 15.0% | 20 | 13.00% | 5 | 3.20% |
| 2003 | 171 | 11 | 6.40% | - | 0% | 88 | 51.40% | 27 | 15.8% | 23 | 13.45% | 22 | 12.9% |
| 2004 | 238 | 12 | 5.00% | 28 | 11.3% | 103 | 43.3% | 28 | 11.8% | 32 | 13.44% | 35 | 14.7% |

***Table 2. Period of stay of each species in the heronry***

| Bird Species | April | May | June | July | August | September | October |
|---|---|---|---|---|---|---|---|
| Cattle Egret | ├ | ─ | ─ | ─ | ─ | ┤ | |
| Pond Heron | ├ | ─ | ─ | ─ | ┤ | | |
| Night Heron | | ├ | ─ | ─ | ─ | ─ | ┤ |
| Small Cormorant | | ├ | ─ | ─ | ─ | ┤ | |
| Small Egret | | ├ | ─ | ─ | ─ | ┤ | |
| Median Egret | | ├ | ─ | ─ | ─ | ┤ | |
| Large Egret | | ├ | ─ | ─ | ─ | ─ | ┤ |

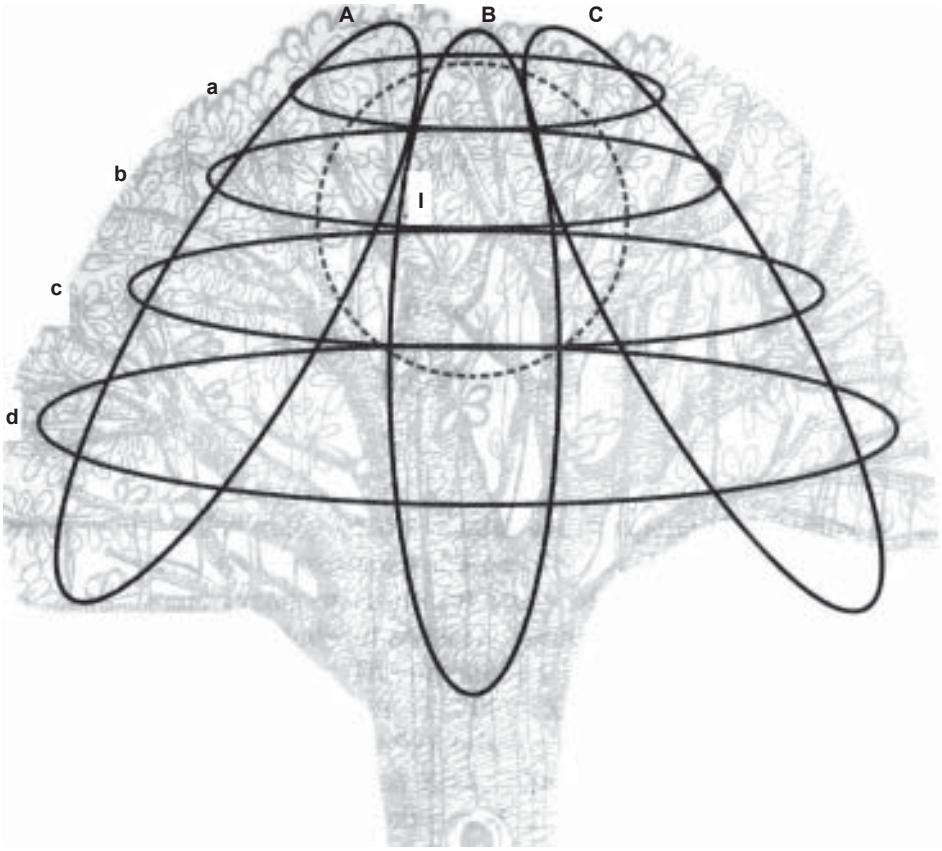


***Figure 1. Spatial distribution of nests of different species on a tree***
***A,B,C - Placement of nest on vertical plane; a,b,c,d - Placement of nest on horizontal plane; I - Inner Branches; Cattle Egret - A,B,C,c,d; Little Egret - A,B,C,c; Median Egret - A,B,C,b,c; Large Egret - A,B,C,a,b; Pond Heron - I,d; Night Heron - B,a,b,I; Small Cormorant - B,a,b,I***

the right size and curvature is fierce and theft is not uncommon. The midrib of the compound leaf of Gulmohar and Neem is preferred by both the species and it is available in plenty.

By the last week of April, the heronry begins to receive new arrivals. The Small Cormorant *Phalacrocorax niger* swarm the upper, middle and inner branches of loftier trees including Eucalyptus, Bargad, Peepal and Gular. It is noteworthy that the latex producing Ficus trees are avoided by egrets and herons. The cormorants do not show any such reservation and also place their nests on Eucalyptus trees, which are not inhabited by any other species. Their choice of nesting material is also different. In a crotch made up of a few twigs and dried Eucalyptus leaf, lot of soft refuge is collected. Little and Median Egrets *Egretta garzetta* and *E. intermedia* arrive between last week of April and first week of May. Little Egrets have a crest of thread like feathers and filamentous plumes on their back. The iris is red and yellow in different individuals and the lores is dark pink or yellowish-green. The red and yellow iris colour has been seen in the mates therefore it may be inferred that it is a sexual characterstic. The feet are pink or yellowish-green matching the lores of the same colour. I have not come across any Indian reference in which different iris colours have been mentioned. In the book Roberts' Birds of Southern Africa I have found a mention of this phenomenon in Great White and Little Egret. Since I have observed this in all the three species of egrets with photographic records (see Images in the web supplement), this may be the first report of this phenomenon for Indian egrets. Median Egrets have long thread like plumes on their breast and back, which are spread to show off from time to time. The lores is lemon yellow or yellowish-green (Table 3). Little and Median Egrets share the middle (Fig. 1 c,b) and peripheral branches for nesting. The nests are bigger and made up of thicker twigs and midribs. Dry as well as green twigs are used in nest building. Reinforcement of the nest continues throughout the breeding period.

Large Egrets *Egretta alba* arrive in the last week of May and choose the loftier sites for placing their nests. They show a preference for Neem and Imali trees in the heronry. Large Egrets also have long filamentous plumes on their neck and back. The colour of the iris is red and yellow. The lores is red or blue to bluish-green and tibia is pink (Table 3). The latest addition to the heronry is the Night Heron *Nycticorax nycticorax*. In 2004, their arrival was noted in the first week of June. They placed their nests among cormorants on inner branches of upper and middle tier (Fig. 1: I,a,b). The nest is made up of twigs and soft leaf refuge.

The available literature is mute about distribution of nests of different species in a mixed breeding colony. I found certain non specific references like "nests here are scattered amongst those of other species without any suggestion of segregation", "nests are often close together, even touching others of the same or different species" (Ali & Ripley, 1983) but the present study showed clear preference of each species for a certain

***Table 3. Breeding plumage of the heronry birds in literature and present observations***

| Bird Species | Compact Handbook of the Birds of India and Pakistan (Ali & Ripley, 1983) | Field Guide to the Waterbirds of Asia (Sonobe & Shunji, 1993) | Tabela House observations [w] |
|---|---|---|---|
| Cattle Egret | June – August<br>Golden buff on head, neck, back | -<br>Orange yellow plumes on nape, neck<br>And lower backBill and legs - vermilion red | April – June<br>Golden buff on head, neck, back<br>Bill and leg - deep red |
| Little Egret | July – September<br>Drooping nuchal crest, filamentous<br>Feathers on back and breast<br>Feet - pink and orange yellow | -<br>Slender crest on rear crown, breast plumes<br>Lores - dark pink<br>Feet - red | May – Early September<br>Crest of filamentous plumes<br>Lores - greenish yellow<br>Feet - orange yellow, Iris- yellow<br>Iris - yellow and red |
| Median Egret | July – September<br>Filamentous plumes on back, breast<br>Iris - lemon yellow<br>Lores - Yellowish green<br>Legs/tibia - rose pink | -<br>Plumes on upper breast<br>-<br>Lores - yellow green<br>- | May – September<br>Plumes on back and breast<br>Iris - yellow and red<br>Lores - lemon yellow, yellowish green<br>Leg/tibia - pink |
| Large Egret | July – September<br>Diaphanous lance like plumes on back<br>Iris - bright orange yellow<br>Lores - verdigris green<br>Legs/Tibia - bright rose pink | -<br>Plumes on lower back<br>Lores - yellow green<br>Tibia - dark pink | June – Late September<br>Plumes on back and lower neck<br>Iris - yellow and red<br>Lores - Blue to blue green, dark pink<br>Tibia - pink |
| Pond Heron | May – September<br>Head and neck light yellow brown<br>Back - deep maroon<br>Occipital crest | Head and neck buff with yellow<br>wash, back rich maroon | April – July<br>Head and neck yellow brown<br>Back - rich maroon<br>Lores - pale blue |
| Small Cormorant | July – September<br>Gular skin - purple, legs and feet tinged with<br>flesh colour | Forehead, sides of head, neck<br>has narrow white feathers | June – Late September<br>Gular skin - purple, legs and feet feet |
| Night Heron | June – September<br>Legs and feet- lemon yellow to orange yellow | - | June – Early October |

[w] See Images in the web supplement at www.zoosprint.org

location on a tree for nest placement (Fig. 1). The dictum 'safety in numbers' also holds true in a heronry and is a good enough reason for sharing a space at the same time every year by different species.

I have generally collected data for the heronry but intensive data was kept for one Gulmohar and two Neem trees (Table 1). The Gulmohar tree is of medium size (approx. 7m tall) and is favoured by Cattle Egret and Small Cormorant and 79% (2004) to 86% (2003) nests were of these two species. The number of Pond Heron nests have gradually declined from 7.47% to 1.6% from 2002-2004. New addition in 2004 was the Night Heron and they had made five nests on this tree. Little and Median Egrets have a very small presence on this tree (7% to 15%). Large Egrets find it too small a tree for their liking. Two Neem trees stand side by side close to the terrace. The trees are about 9-10m in height and most preferred by all the bird species. The egrets capture most of the space as 148 of 153 nests in 2002 were made by Cattle, Little, Median and Large Egrets. In 2004 they had made 175 nests out of a total of 238 nests. In terms of percentage we see a fall but the actual number has increased by 18%. Small Cormorant and Night Heron made 35 and 28 nests respectively in 2004. Pond heron did not nest on Neem trees. Small Cormorant and Night Heron had greater affinity to nest on Imali and Gular trees and even built few nests on Peepal and Bargad trees in case of heavy rush late in the season. Large Egret showed distinct preference for lofty Imali trees, which are over 12m tall. Therefore more nests were built on Imali trees in the temple compound adjacent to Tabela House (average 11 nests per tree).

The present study is based on data collected during 2002-2004, but Tabela House heronry was under observation for over 10 years. This is a pertinent case study for site fidelity. Site fidelity is advantageous to the birds as it becomes familiar with the area; this enhances foraging success, predator avoidance, defense and other behaviours which contribute to reproductive performance (Newton & Wyllie, 1992). In the beginning it was a breeding colony of Cattle Egrets with a few nests of Pond Herons. It is the suitability of the habitat in terms of protection, extremely low raptor population and availability of nesting material and nesting sites and food. As reported by Kristan and Boarman (2003) in their study on Desert Tortoise, the predation is higher near landfills and roads where predator population is higher. It is also low where parents are defending the territory. The breeding territories of nest predators may affect the breeding habitat selection of prey species (Staffan & Part, 2004). In this study I did not find any raptor in the close vicinity of the heronry except for Shikra *Accipiter badius*, which did not pose any threat to these birds. The presence of House Crow *Corvus splendens* was observed but there was no active predation. They were there just for fallen eggs and eggshells. On rare occasions non-alate juveniles fell from the nests and were attacked by dogs. These juveniles seldom survived their injuries particularly broken legs and wings.

The foraging success is yet another reason why this heronry has supported so many birds for so long. The right main canal and Kishor Sagar tank are in close vicinity of the heronry. The breeding pairs make frequent trips to fetch food from these shallow waterbodies. The shallow pools of water during summer are rich hunting ground for egrets and herons as there are plenty of fishes, amphibians and crustaceans.

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