ECOLOGY AND BREEDING BIOLOGY OF THE CATTLE EGRET *BUBULCUS IBIS* IN AN INDUSTRIAL AREA AT VADODARA, GUJARAT

Pratyush Patankar [1], Isha Desai [1], Kavita Shinde [1] and B. Suresh [2]

[1,2] Division of Biodiversity, Department of Zoology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat 390002, India
Email: [2] ishakrishnan@yahoo.co.uk (corresponding author)

plust web supplement of 2 pages

ABSTRACT

In the present age of industrialization and urbanization certain species of birds have started adapting to the rapid changes brought by us. Looking into the adaptability of some of these birds, a study was conducted on the ecology and breeding biology of Cattle Egret (*Bubulcus ibis*). The species has been breeding in an industrial area for the past many years. The campus of a multinational company (Asian Brown Boveri - ABB) having huge production plant located in an industrial area at Maneja village, towards southwest part of Vadodara city was chosen for the study. The campus of the company is spread over an area of 105 acres and has good amount of cultivated vegetation or green belt. The present study was carried out for two consecutive years (2004 & 2005) during the months of April to July, *i.e.*, during the breeding season of Cattle Egrets. The trees selected for nesting were *Mimusops ellengi* and *Lagerstroemia* sp. The colony was monospecific with 159 nests. All these nests were simple platform nests. Of all the nests, 13 nests were accessible, for which various parameters like nest size, nest thickness, its distance from the main trunk and distance from the ground were measured. Placement of the nest was observed for almost all the nests. The egg length, egg breadth, fresh egg weight, egg volume and the species specific egg weight constant *Kw* were noted down. Role of parents during weaning period was observed. Dropped food pellets were analyzed and predation pressure was noted down.

KEYWORDS

Breeding biology, *Bubulcus ibis*, Cattle Egret, industrial area

The Cattle Egret *Bubulcus ibis* has a wide spread distribution around the globe. It is a native of the old world, common from Africa to the humid Asian tropics, from India to Japan and northern Australia (Brown *et al*., 1982). It was first reported to occur in British Guiana in the new world in 1877 (Godfrey, 1966). From there it expanded its range, to Florida by 1942 (Godfrey, 1966). Since then the egret population has been exploding throughout the central and south eastern United States. This happened probably due to the lack of natural enemies and relatively less competition from native animals as well as other Ardeidae members of the new world (Snoddy, 1969). It is a widespread resident throughout India and occurs in the major part of the Indian subcontinent (Abdulali, 1962; Ali & Ripley, 1968; Datta, 1996; Mahabal, 1990; Subramanya, 1996). However, the species is not recorded from certain parts of northwestern India which includes the desert region of Rajasthan and Pakistan, extreme parts of northeastern India and greater Himalaya (Grimmett *et al*., 2000). It is a gregarious bird, seen in small parties around grazing cattle, stalking energetically alongside the animals, running in and out between their legs or riding upon their backs and lunging out to seize insects disturbed by their movements amongst the grass (Ali, 1941). Cattle Egret can also be seen in large flocks picking insects from the freshly ploughed fields (Thomas *et al*., 2004). Due to its predominantly insectivorous habit, Cattle Egret is considered as a biological pest control agent and hence is an important bird in an agro-ecosystem (Rao, 2004; Thomas *et al*., 2004). In a study conducted in Georgia the gut content of five birds predominate the presence of insects, the percentage composition was 59% horse flies, 28% grasshoppers and crickets, 5% tree frogs, 4% spiders, 2% dragon flies, 0.8% stable flies, 0.1% ticks and 0.1% undetermined organisms (Snoddy, 1969). Ali (1941) has also reported about insectivorous diet of these birds which mainly comprises of grasshoppers, bluebottle flies, cicadas and other insects. Occasionally, small frogs, lizards and fish are also consumed. The reproductive ecology of the Cattle Egret has been well documented in its traditional range (Siegfried, 1971; Skead, 1956), as well as in its extended range in United States (McConnell, 1967). Certain aspects of breeding biology of Cattle Egret have been studied in detail at Foxs' Bay, in Montserrat, West Indies (Arendt *et al*., 1988). Nesting behaviour of Cattle Egret was recorded for the first time in the Indian subcontinent by Ali in 1941. Thereafter, very scattered studies were conducted on the breeding biology of this species in India, till the last decade when the role of Cattle Egret as a potential biological pest control agent was highlighted. Cattle Egret is known to nest in the mixed colonies with cormorants, ibises and other members of family Ardeidae (Ali & Ripley, 1968; Maccarone *et al*., 1988), it is also known to nest in a monospecific colony with no other Ardeidae member nesting in the neighborhood (Arendt & Arendt, 1988). Such monospecific colonies of Cattle Egrets may not necessarily be located near a water body. Amongst the six species of egrets distributed in India, Cattle Egret seems to be most adaptive of all, probably due to its versatile feeding habit and non specificity for the nesting environment. Cattle Egrets have been reported to nest in agro-ecosystems, in rural as well as urban set up, that depends upon the availability of food, safe nesting places, nesting material and other environmental factors of the area (Gopal *et al*., 2004; Mathew & Gadvi, 2004; Rao, 2004).

Looking into the fact that Cattle Egrets are known to nest in an urban set up, the current study was carried out on a nesting colony of Cattle Egret in an industrial area in Vadodara city. In urban areas the bird is so far reported to nest on the trees present in parks and gardens (Iyer, 2004), however, there is no record of nesting of this bird in any industrial area of a city. Selection of nesting site by the birds itself raised a question as to why these birds have selected an area with much anthropogenic activities in its surrounding.

Manuscript 1566; © ZOO; Date of publication 21 October 2007
Received 16 May 2006; Revised received 01 December 2006;
Finally accepted 05 September 2007

Study Area

The current study was carried out at Asian Brown Boveri (ABB) campus, a multinational company having its production unit in the Maneja area situated in the southwestern part of Vadodara. ABB is one of the oldest companies present in the industrial area of the city. The campus covers an area of 105ac. The campus is having a very good green belt developed and maintained. The office buildings are surrounded by beautiful, well maintained gardens. The nesting colony of egrets is located in the garden in front of the main office building. Most of the vegetation around the main office is cultivated. The lawn in front of the office building has more of herbs and shrubs. A row of trees of *Mimusops ellengi* commonly known as 'Bakul' or 'Borsali' and *Lagerstroemia sp.* in front of the main office building harbour the nesting a colony of Cattle Egrets. This nesting colony covers an area of 144m^2 only. Out of the seven trees planted in a row, four were selected by the egrets for nesting.

Methodology

The area was surveyed for three days per week from April to July during 2004 and 2005, which is the breeding season of the birds. Two visits of three hours each were made in a day, 0800-1100hr and 1600-1900hr. Observations were made using 10x50 Optima Zenith Binoculars. All measurements such as nest height, distance of nest from trunk, nest dimensions were noted down using a calibrated measuring tape. Eggs were measured using digital calipers with a least count of 0.01mm. The mass of eggs was determined with a *Sartorious* analytical balance. Egg volume and species specific egg weight constant was calculated using formulae evaluated by Hoyt (1979). To understand the food composition of these birds, droppings of the chicks, regurgitated food pellets from the mouth of adults and gut content of chicks that died due to the fall from nest were examined. Mean and Standard Deviation were calculated for each parameter.

Results and Discussion

Colony site

The colony is located in the garden in front of the main office building of ABB (Image 1[w]). As nesting trees were in garden all were cultivated species and hence planted in a single row. In all, four trees were selected by the birds for nesting of which three are *Mimusops ellengi* and one *Lagerstroemia* sp. There was a vast difference in the size as well as morphology of both species of nesting trees. The average height of *Mimusops* is 8.6m and that of *Lagerstroemia* is 3.7m. *Mimusops* has a dense canopy cover whereas *Lagerstroemia* has sparse or relatively open canopy cover. As a general rule birds nesting in heronries prefer trees with dense canopy cover (Pande & Mestri 2002; Iyer, 2004; Bhatnagar *et al.*, 2004). Not surprisingly out of the 159 nests of Cattle Egrets observed in the present study only seven nests were found on *Lagerstroemia*, a tree with sparse canopy cover. The shortage of space on the canopy of all three *Mimusops* trees and the resultant biotic pressure by way of intra-specific competition might have prompted a few pairs to move onto the neighbouring *Lagerstroemia* tree. The pairs located on *Lagerstroemia* were observed to have started nest building a little later than the other birds who occupied the entire canopy of all three *Mimusops* trees.

[w] See Images 1-8[w] in the web supplement at www.zoosprint.org

Nest type, nest size and placement

Nest type: The heronry studied here has been classified according to Singh and Sodhi (1985) and is described as under:
1. Small sized heronry - as it is located over a small area.
2. Associated type of heronry - as it is located within an industrial area with much anthropogenic activities around.
3. 'Tree' type heronry - as all nests were constructed on trees.
4. 'Monospecific' type - as only a single species was nesting in the heronry.

All the nests were of simple platform type (Image 2[w]). The materials used for nest building were dry and naked twigs. Any other vegetative material was not found to be used in any of the nest studied, other than twigs. Generally, amongst the colonial nesting birds, egrets use only dry and naked twigs for nest building (Iyer, 2004) but Gopal *et al.* (2004) had reported grasses being used in the nests by Cattle Egrets. Egrets were observed collecting twigs from adjoining open areas with plenty of fallen dry branches. Egrets were also seen breaking the dry twigs of certain trees namely the Copper Pod Tree (*Peltoforum pterocarpus*), Nilgiri (*Eucalyptus aromatica*), Neem (*Azhadiracta indica*) and Gulmohar (*Delonix regia*). Egrets were also seen stealing nesting material from other nests that were within pecking distance, and collecting twigs fallen down from other egret nests; simiar to observation reported by Iyer (2004). Nest building activity was carried out in the morning hours until noon. As the day proceeded the birds were found flying to open grounds of the campus or in the adjoining areas foraging for insects. Birds returned by 1630hr and by 1830hr almost all the birds were back to their respective nesting sites (Image 3[w]).

Nest size: The average outer and inner diameter of thirteen Cattle Egret nests was 25.52 ± 1.92cm and 20.09 ± 4.04cm respectively, which is much larger than the average diameter reported by Arendt & Arendt (1988). However, these average diameters are much smaller than those reported by Siegfried (1971) and Burger (1978). The average nest thickness was found to be 11.97 ± 1.97cm.

Nest placement: All the nests located on *Mimusops ellengi* were found to be peripheral in position occupying the entire canopy (Image 4[w]). However, Cattle Egret nests have been reported to occupy peripheral and lower strata of a canopy in a mixed species heronry (Vyas, 2006). The nests on *Lagerstroemia* can be considered as core nests as they were more close to the main trunk. None of these nests were observed in the core region of the canopy. As stated elsewhere *Lagerstroemia* is a tree with sparse or relatively open canopy cover; therefore it is more or less difficult to distinguish between the core and peripheral region. If we consider the seven nests located on *Lagerstroemia* as core nests then only 4% of the total nests were core nests, while the remaining 96% of the nests were peripheral nests. This is in contradiction to Arendt & Arendt (1988) who have reported nearly 53% of Cattle Egret nests to be core nests. Egrets preferring the core region of canopy for nesting

have been reported by Iyer (2004), however, in the present study not a single nest of Cattle Egret was seen in the core region of the canopy of *Mimusops*. The possible reason could be the type of canopy of the tree. *Mimusops* is a tree with a dense canopy cover, wherein it is difficult for a bird of the size of Cattle Egret or larger to easily maneuver through the canopy.

The average height of the nests was 4.64 ± 1.01m and the average distance of the nests from the main trunk was 1.50 ± 0.70m. The values reported here are much greater than those of Arendt & Arendt (1988). The difference in the values is evident from the fact that there is a vast difference in the study area. Arendt & Arendt (1988) carried out their studies in a mangrove ecosystem where the maximum height of the nesting trees seldom exceeds 5m whereas the average height of the nesting trees in the current study area is observed to be 8.6 m.

Egg characteristics

Eggs were oval in shape and possessed skim milk blue colour. Mean clutch size as observed in the nests of Cattle Egret was 2.46 ± 0.52 (range 2-3 eggs). Maximum clutch size earlier reported is five eggs (Arendt & Arendt, 1988; Gopal *et al*., 2004; Iyer, 2004). However, in the present study none of these nests were observed with the clutch size greater than three eggs. The mean length and breadth of egg was observed to be 43.21 ± 0.2mm and 32.13 ± 0.15mm respectively, this is almost similar to that reported by Arendt & Arendt (1988). The average egg weight was recorded to be 21.63 ± 0.32g, which is quite similar to the earlier reported values (Arendt & Arendt 1988). The fresh egg weight was 23.2g. With the help of fresh egg weight and the average length and breadth of the egg, the egg volume calculated was 22,744.71mm^3. The species specific egg weight constant Kw, which was 0.521 was also calculated. The obtained value is in the range reported by Hoyt (1979). The incubation period was around of 23-24 days followed by the weaning period of 21-28 days. Gopal *et al*. (2004) have recorded the incubation period having a wide range of 20-26 days and observed that 70% of the chicks fledging after 21 days. In the current study no chicks were observed to fledge from the nest before 21 days. The incubation started with the laying of first egg itself and second egg was laid roughly after an interval of 24 hours; this was evident from the fact that chicks of different age group were seen in the same nest (Image 5^w).

Weaning period

Good parental care was seen in Cattle Egrets. Both the parents took equal part in the weaning of chicks (Image 6^w). The chicks were continuously fed throughout the day from morning till late afternoon. Analysis of chicks' droppings and the regurgitated pulp fallen from the mouth of the adults revealed that the chicks were fed chiefly on insect diet. The gut content of some dead chicks fallen from the nests included the body parts of grasshoppers and crickets, beetles, flies, moths, dragonflies, some larvae probably belonging to order Lepidoptera; ticks and other undetermined organisms. Occasionally, the adult birds were also seen catching small fish from the garden pond in front of the nest colony. The percentage composition of the food given to the chicks included:

Grasshoppers and Crickets	: 66%
Dipteran flies	: 17%
Beetles	: 13%
Lepidopteran insects	: 1%
Dragonflies	: 0.8%
Ticks	: 1.2%
Other organisms	: 1%

By the end of their weaning period, chicks started venturing out of the nest on the neighboring branches (Images 7^w & 8^w). Inexperience led them to accidental falls from the nest which resulted in death due to some serious injury or due to starvation because the chicks fallen from the nest were not taken care of by the parents.

Predation pressure

The only natural predator observed in the study area was House Crow (*Corvus splendens*). House Crows were opportunistic in plundering the eggs from the nest or carry away the newly hatched chicks when both the parents were away. Although irrespective of nest all the egrets took equal part in defending their colony against crow attacks. Black Kites (*Milvus migrans*) were also seen flying over the nesting colony, but they were never observed predating on the chicks. The chicks that survived the accidental falls from the nest were probably taken up for food by domestic cats and stray dogs during the night. Partially consumed carcasses or bones of the chicks were often observed in the morning in the vicinity of the nesting colony. As the nesting colony was located in front of the main office building with continuous human activities throughout the day, stray dogs or cats seldom visited this area. Other than these predators Cattle Egrets had no other enemy in their surroundings.

In comparison to other members of the family Ardeidae, Cattle Egrets are much more adaptive and can be seen in wilderness as well as in an urban set up. Due to their predominantly insectivorous habit, Cattle Egrets can sustain in any ecosystem. Cattle Egrets are one of those common birds seen around human settlement, in rural as well as in urban set up and seem to be not much bothered by human activities. Availability of food, relatively safe nesting place and availability of nesting material seem to be the only requirements of the species. An undisturbed environment is nowhere a conditional requirement for Cattle Egrets to breed. Due to their potential role as biological pest control agents, Cattle Egrets have been identified as agriculturally beneficial birds. Breeding records of the species hence need to maintained throughout the globe so as to know the population status. If at all a dramatic decline in the population of Cattle Egrets is observed, then a preliminary or base line data of such kind will be helpful in investigating the factors attributed to the decline in the population. By enhancing such agriculturally beneficial organisms in the field we can definitely look forward to minimizing the use of chemical pesticides which have toxic effects on the biota.

References

Abdulali, H. (1962). An ornithological trip to the Gulf of Kutch. *Journal of the Bambay Natural History Society*. 59: 655-658.

Ali, S. (1941). *The Book of Indian Birds*. Bombay Natural History Society, Oxford University Press, Mumbai. 12th revised edition, 72pp.

Ali, S. & S.D. Ripley (1968). *Handbook of The Birds of India and Pakistan* - Vol 1. Oxford University Press, Bombay, 66-68pp.

Arendt, W.J. & A.I. Arendt (1988). Aspects of the breeding biology of the Cattle Egret (*Bubulcus ibis*) in Montserrat, West Indies, and its impact on nest vegetation. *Colonial Water Birds* 11(1): 72-84.

Bhatnagar, S.P., S.K. Shukla & M.S. Bhaum (2004). Studies on the distribution of the heronries in and around Ajmer city ecosystem. *Newsletter for Birdwatchers* 44(3): 46-47.

Brown, L.H., E.K. Urban & K. Newman (1982). *The Birds of Africa* Volume I. Academic Press, London, 145-149pp.

Burger, J. (1978). Competition between Cattle Egrets and native North American herons, egrets, and ibises. *Condor* 80: 15-23.

Datta, S. (1996). Bird watching at Dibru-Saikhowa Wildlife Sanctuary. *Newsletter for Birdwatchers* 36: 51-53.

Godfrey, W.E. (1966). *The Birds of Canada* - National Museum of Canada, Bulletin No. 203, Biological Series No. 73, Ottawa, 38-39pp.

Gopal, G., A.K. Mathur & H.R. Choudhary (2004). Study on breeding performance of Cattle Egret, *Bubulcus ibis* in Kota division of Rajasthan. International Conference on Bird and Environment. Haridwar, India (Unpublished).

Grimmett, R., C. Inskipp & T. Inskipp (2000). *Pocket Guide to The Birds of The Indian Subcontinent*. Oxford University Press, Mumbai.

Hoyt, D.F. (1979). Practical methods of estimating volume and fresh egg weight of bird eggs. *Auk* 96: 73-77.

Iyer, M.K. (2004). Nesting of Phalacrocoracidae, Threskiornithidae and Ardeidae at Ahmedabad Zoo. *Newsletter for Birdwatchers* 44(3): 43-44.

Lowe-McConnell, R.K. (1967). Biology of the immigrant Cattle Egret *Ardeola ibis* in Guyana, South America. *Ibis* 109: 168-179.

Maccarone, A.D. & K.C. Parsons (1988). Differences in flight patterns among nesting ibises and egrets. *Colonial Water Birds* 11(1): 67-71.

Mahabal, A. (1990). Heronries in Raigad district, Maharashtra - a preliminary survey. *Journal of the Bombay Natural History Society* 87: 137-138.

Mathew, K.L. & I.R. Gadvi (2004). Distribution pattern and the size of Cattle Egret *Bubulcus ibis* heronries in Saurashtra region of Gujarat, India. International Conference on Bird and Environment. Haridwar, India (Unpublished).

Pande, S.A. & P.G. Mestri (2002). Heronries of the raigad district, Maharashtra. *Newsletter for Birdwatchers* 42(2): 19-20.

Rao, V.V. (2004). Egrets and their role in environment. International Conference on Bird and Environment. Haridwar, India (Unpublished).

Siegfried, W.R. (1971). The nest of Cattle Egret. *Ostrich* 42: 193-197.

Singh N. & N.S. Sodhi (1985). Heronries and the breeding population density of the cattle egret *Bubulcus ibis coromandus* (Boddaert) during 1985, in tehsil Kharar of the Ropar district (Punjab). *Pavo* 23(1/2): 77-84.

Skead, C.J. (1956). The Cattle Egret in South Africa. *Audubon Magazine* 58: 206-209.

Snoddy, J. (1969). Feeding behaviour of cattle egret *Bubulcus ibis*. *Condor* 70: 137-143.

Subramanya, S. (1996). Distribution, status and conservation of Indian heronries. *Journal of the Bombay Natural History Society* 93: 459-486.

Thomas, J., M. Chellappan & H. Bhaskar (2004). Role of insectivorous birds in rice pest management. International Conference on Bird and Environment. Haridwar, India (Unpublished).

Vyas, R. (2006). Spatial and temporal distribution of nests in a heronry. *Zoos' Print Journal* 21(8): 2339-2342.

Acknowledgements

The authors are thankful to Mr. S. Dhavan (Senior Vice President ABB, Baroda) for granting permission to work in the ABB campus and for financial assistance. We acknowledge Mr. S.N. Shah (Vice President ABB, Baroda) for providing necessary facilities. We are grateful to Prof. Bonny Pilo for critical comments and encouragement. Thanks are also due to Ms. Rushita for photographic assistance.

CASE REPORT **ZOOS' PRINT JOURNAL 22(11): 2888-2890**

DIURNAL RHYTHM AND MOVEMENT PATTERN OF PEREGRINE FALCON *FALCO PEREGRINUS* IN CAPTIVITY IN UNITED ARAB EMIRATES

M. Zubair [1], E.A.A. Shukkur [2], P.A. Azeez [3] and E.A. Jayson [4]

[1] Department of Zoology, University of Calicut, Kerala, India; [2] Department of Zoology, Farook College, Kozhikode, Kerala, India; [3] Salim Ali Centre for Ornithology and Natural History, Anaikatty, Tamil Nadu, India; [4] Division of Forest Ecology and Biodiversity Conservation, Kerala Forest Research Institute, Peechi, Kerala, India
Email: [1] drzubairm@gmail.com

Abstract

Diurnal rhythm and activity pattern of Peregrine Falcon *Falco peregrinus* was studied in UAE from 2001 to 2003 in large enclosures, wherein they showed regular movement and the median distance travelled in a day was 50-75m. They preferred to forage in the morning than in the evening. The daily activity (68%) started from 0530-0630hr and they roosted between 1730-1830hr (47%). The major part of their daily activity involved in foraging followed by resting. The males were parochial about roosting sites and during the breeding season they made a variety of calls, which attracted and stimulated the females for courtship display preceded by mating. The vocalizations also helped them maintain territories.

Keywords

Falco peregrinus, foraging, roosting, United Arab Emirates

According to Ali (1977) the Peregrine Falcon's *Falco peregrinus* body is a marvel of nature's engineering; wings are long and pointed, legs are strong, toes are long and claws are hooked and powerful. The species is extremely accomplished and swift fliers, generally killing their prey on the wings (Ali & Ripley, 1983). They take great delight in bathing and the birds wintering in England took bath daily, despite the chill and choose running water of few inches depth where the stream bottom matched the colour of their plumage (Baker, 1967). The birds have devised various means of energy conservation in every aspect of their life and their metabolism is the highest in the animal kingdom (Remple & Gross, 1993). The Peregrine

Manuscript 1718; © ZOO; Date of publication 21 October 2007
Received 14 February 2007; Finally accepted 02 September 2007