

Full Length Research Paper

Studies on the community ecology of cattle egrets *Bubulcus ibis coromandus* (Boddaert) in Jammu (Jammu and Kashmir), India

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Some species of birds mirror an association with herbivores like buffaloes, cows, horses and goats to have their sustenance by feeding on insects living either near or on them. This paper attempts to document such associations of cattle egrets with the above mentioned mammals and birds like little egret, pond heron, common myna, cormorants and purple moorhen thereby throwing light on the various foraging parameters of cattle egrets in association with these animals. Cattle egrets are known to obtain more food in the association of herbivores with which they reflect commensalistic association whereas they are neutrally associated with birds. Besides, this piece of work provides information regarding parameters like time spent by cattle egrets in association with herbivore host species, number of hosts and egret steps per minute, location of foraging egret with respect to host (head, front legs or hind legs), number of attempts and items obtained per minute, capture success rate etc. In case of active foraging with cattle, number of strikes per minute was observed to be 10 to 13, average number of steps ranged from 8 to 9 whereas number of prey items captured was 4 to 6. Moreover, number of steps of cattle while foraging with cattle egrets was noted to be 11 to 13.

Key words: Commensalistic Association, Foraging, Herbivore, Capture Success Rate.

INTRODUCTION

In nature, different kinds of organisms grow in association with each other. Community is an assemblage of species living close enough together for potential interaction and community ecology is the study of organization and functioning of communities of organisms. Community structure emerges from an interaction of many environmental variables that permits species to exist in certain places. Cattle egrets, too, can be observed depicting diverse associations with a number of birds and mammals during feeding, breeding and roosting.

The cattle egrets have acquired their name from their accustomed habit of foraging in pasturelands in association with livestock animals whose movements and grazing activities flush out insects and other potential prey items (Heatwole, 1965; Jenni, 1969). Cattle egrets

are social foragers that feed on invertebrates, amphibians and reptiles disturbed by grazing animals (Jenni, 1969; Ruiz, 1985). Possible mechanisms for optimising foraging include maximising net energy intake (benefit minus cost), minimising the cost: benefit ratio and minimising time spent in foraging (Thompson et al., 1982.)

Study area

The study was carried out from December, 2007 to February, 2009 in and around district Jammu. For the sake of convenience, diverse stations were made which aided in carrying out the study. Besides, two water bodies namely, Lake Mansar and River Basantar (falling in Districts Udhampur and Samba respectively) were also selected for scrutinization. The city of Jammu sprawls on a hillock, on both the banks of Picturesque River Tawi in the foothills of Himalayas. Nestled against the backdrop

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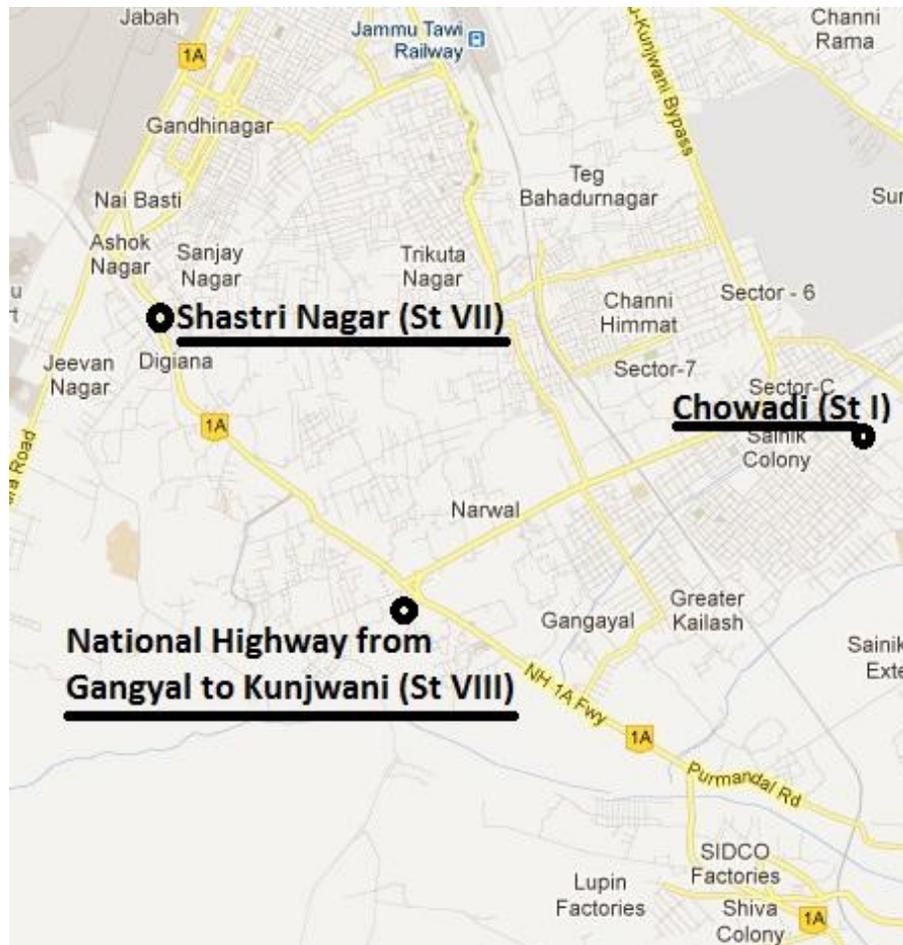


Figure 1. Map of the study area highlighting Stations I, VII and VIII (Courtesy: Google Earth).

of the Snow-capped Pir- Panjal mountains, the region of Jammu constitutes the southernmost unit of the state of Jammu and Kashmir. It forms part of the transition between the Himalayan range in the north and dusty plains of Punjab in the south. Between these two extremities, lie a series of scrub-covered hills, forested mountain ranges and river valleys, encompassing several microclimatic regions that extend from Kishatwar in the north-east to Akhnoor in the southwest, and the historic town of Poonch in the northwest to the borders of Kangra (H.P.) in the south-east. The geographical area of the district is 3097 sq.km. Geographically, it lies between $32^{\circ} 27'$ and $33^{\circ} 50''$ North latitudes and $74^{\circ} 19''$ and $75^{\circ} 20''$ east longitudes. Altitudinally, it extends from 250 to 410 m above the mean sea level.

The study was conducted at Station - I (Chowadi, Sainik Colony; $32^{\circ} 40' 33.59''$ N and $74^{\circ} 54' 16.20''$ E; 360 masl) (Figure 1), Station -II (Gharana Wetland, R.S. Pura; $32^{\circ} 36' 51.52''$ N and $74^{\circ} 38' 58.15''$ E; 251 masl (Figure 2)), Station - III (Mokhein, R.S. Pura ; $32^{\circ} 30' 31.36''$ N and $74^{\circ} 42' 51.75''$ E; 261 masl) (Figure 2),

Station IV(Lake Mansar, $32^{\circ} 41' 48.36''$ N and $75^{\circ} 08' 44.70''$ E; 664 masl) (Figure 3), Station V (Lake Surinsar, $32^{\circ} 46' 07.90''$ N and $75^{\circ} 02' 28.48''$ E; 603 masl) (Figure 3); Station VI (Army Cantonment, Nagrota, $32^{\circ} 46' 33.86''$ N and $74^{\circ} 54' 16.20''$ E; 351 masl) (Figure 3), Station- VII (Shastri Nagar, $32^{\circ} 41' 27.25''$ N and $74^{\circ} 51' 30.88''$ E; 29 masl) (Figure 1) and Station- VIII (Highway from Gangyal to Kunjwani; $32^{\circ} 40' 19.74''$ N and $74^{\circ} 52' 01.50''$ E, 298 masl) (Figure 1).

MATERIALS AND METHODS

The present study was carried out from December, 2007 to December, 2009. Recurrent surveys of the stations were performed from 0630 to 1200 h in the morning and 1300 to 1900 h in evening during summer and 0730 to 1200 h in morning and 1400 to 1830 h in evening during winter. Besides, several erratic excursions were also conducted during different hours of the day, before sunrise to sunset. The birds were observed with naked eye and through binoculars (Bushnell 7 X 50 U. S. A. made) whenever found necessary to record the data from quite a long distance in order to avoid any interference to birds due to the presence of observers.

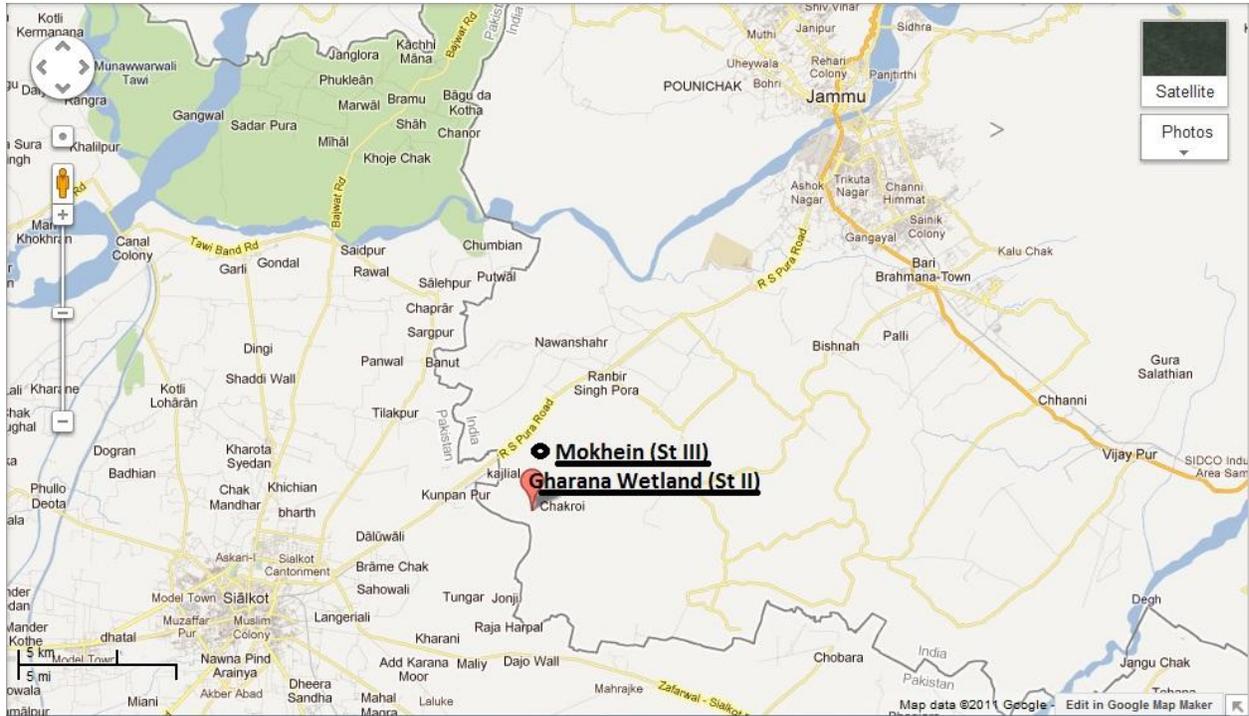


Figure 2. Map of the study area depicting Stations II and III (Courtesy: Google Earth).

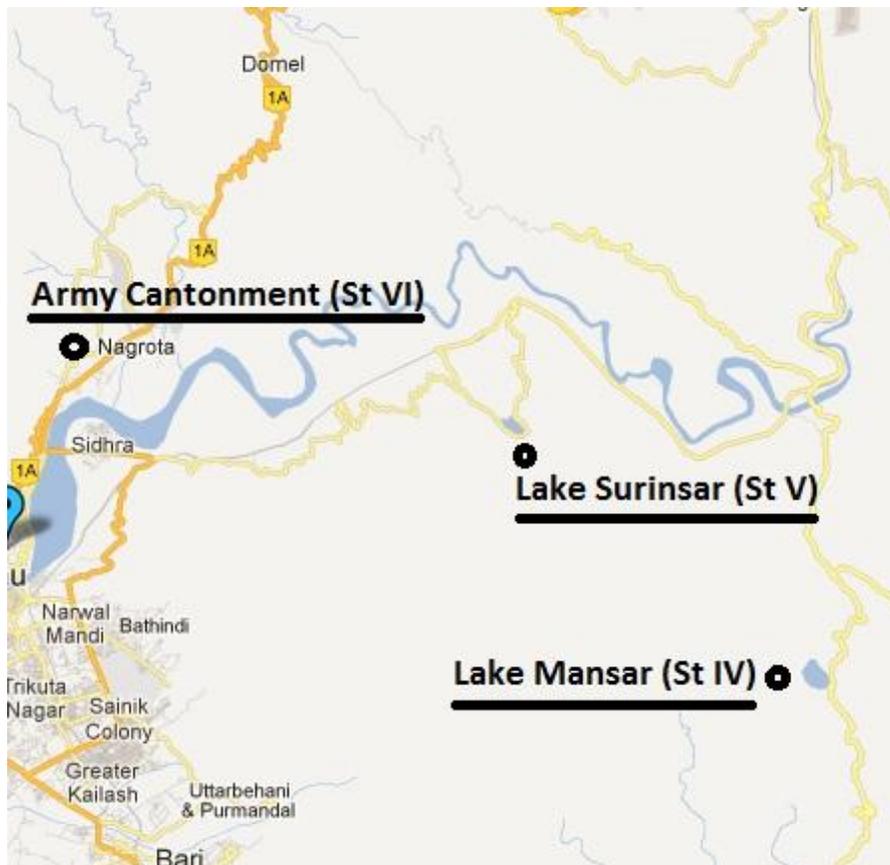


Figure 3. Map of the study area reflecting Stations IV, V and VI (Courtesy: Google Earth).

Table 1. Host selection by adult cattle egrets at different stations observed during the study period from December, 2007 to February, 2009.

Number	Stations								Total
	St-I	St-II	St-III	St-IV	St-V	St-VI	St-VII	St-VIII	
Buffaloes	25	30	12	06	04	16	08	10	111
Cattle egrets attending buffaloes	12	28	20	12	06	28	09	08	123
Cows	10	12	03	05	03	04	00	04	41
Cattle egrets attending cows	03	07	02	02	01	01	00	02	18
Horses	04	03	04	01	03	04	01	04	24
Cattle egrets attending horses	05	04	03	01	01	02	01	03	20
Goats	04	06	00	01	03	04	00	15	33
Cattle egrets attending goats	02	01	00	01	01	01	00	02	08

Photographs were taken with the aid of Canon EOS camera fitted with 300 mm zoom lens, digital camera and video camera.

Cattle egrets were considered to be associated with cattle if the former were within 2 to 3 m of foraging cattle and no other species was within the immediate vicinity of cattle. When cattle egrets foraged solitarily but in the presence of hosts, their feeding activity was also noted. Focal observations were carried on randomly selected foraging cattle egrets, during which number of strikes, successful captures (identified by the characteristic head-jerk swallowing behaviour: Heatwole, 1965; Dinsmore 1973; Grubb, 1976; Scott, 1984) and number of steps in a two minute period were recorded. The information in relevance to the number of steps taken per minute by adult and juvenile cattle egrets in relation to that of cattle was also acquired with the information on average attempts/minute and items obtained per minute by adult and juvenile cattle egrets both in association with cattle and alone. Roosting association of cattle egrets was also noted down. Karl Pearson correlation coefficient (Gupta, 2002) was used to examine relationship between two foraging variables of adults and juveniles to examine the significance of the results.

RESULTS

The different stations had dominant plant species like *Acacia nilotica* (Babul), *Acacia modesta* (Kramishatrav), *Dalbergia sissoo* (Sheesham), *Morus alba* (Shahtoot), *Eucalyptus tereticornis* (Safeda), *Mangifera indica* (Aam), *Zizyphus spp.*(Ber), *Zizyphus mauritiana*, *Butea monosperma* (Pallash), *Adhatoda vasica*, *Grewia optiva* (Dhamin), *Embllica officinalis* (Amla), *Cannabis sativa* (Bhang), *Ficus bengalensis*, *Ficus religiosa* (Peepal), *Calotropis procera* (Akvan) etc. Agriculture included predominantly of *Oryza sativa* (Rice), *Triticum aestivum* (Wheat), *Zea mays* (Maize), vegetables and fruit trees.

Association during feeding

(1) With cattle: Egrets's association with cattle provided them food in three different ways:

(a) By the disturbance caused by the movement of cattle.

(b) Insects exposed when the vegetation was uprooted by the cattle.

(c) Ticks present on the body of cattle.

It was concluded that among cattle, the association of adult cattle egrets was maximum with buffaloes and minimum with goats (Table 1). Cattle egrets were observed maximally associated with cattle from 0900 to 1200 h and 1400 to 1600 h and the minimum association was noticed in the early morning, late in the evening and during the middle of the day.

(2) With birds: Cattle egrets were seen to feed with birds of different families. The different birds with which the cattle egrets were found to feed in different stations during the study period are depicted in Table 3. We observed that for same relative energy expenditure, adult cattle egrets had a higher capture success than juveniles indicating that fewer items were located by juveniles and among those also, all the located items were not captured as proposed by Burger and Gochfeld (1989).

Association during breeding

During the course of study, the cattle egrets were not discerned to share their breeding or nesting sites with any other bird. The colonies of the birds were found to be purely monospecific.

Association during roosting

Cattle egrets were observed to share their roosting sites with a number of other birds. On the trees, they showed roosting associations with Indian Pond Heron (*Ardeola grayii grayii*) House Crow (*Corvus splendens*) and Indian Myna (*Acridotheres tristis tristis*) whereas on the ground, they rested with a number of water birds as shown in Table 4.

Table 2. Attempts per minute and capture success of cattle egrets in different stations in the study area in the absence of cattle.

Stations	Average steps taken by cattle egrets/minute		Average attempts taken by cattle egrets/minute		Items captured by cattle egrets/minute	
	Adults	Juveniles	Adults	Juveniles	Adults	Juveniles
St - I	12	11	09	06	06	02
St - II	11	11	08	04	05	02
St - III	12	10	10	06	07	04
St - IV	14	14	12	07	05	03
St - V	15	15	13	06	06	01
St - VI	13	12	10	07	07	03
St - VII	11	09	08	03	05	04
St - VIII	12	10	10	06	06	03
Mean \pm SD	12.5 \pm 1.32	11.5 \pm 1.94	10 \pm 1.66	5.63 \pm 1.32	5.88 \pm 0.78	2.75 \pm 0.97

Table 3. List of birds sharing the feeding sites with cattle egrets in the study area.

S/N	Name	Order	Family
1.	Little Cormorant (<i>Phalacrocorax niger</i>)	Ciconiiformes	Phalacrocoracidae
2.	Indian Pond Heron (<i>Ardeola grayii grayii</i>)	Ciconiiformes	Ardeidae
3.	Little Egret (<i>Egretta garzetta garzetta</i>)	Ciconiiformes	Ardeidae
4.	Red Wattled Lapwing (<i>Vanellus indicus indicus</i>)	Ciconiiformes	Charadriidae
5.	Purple Moorhen (<i>Porphyrio porphyrio</i>)	Gruiformes	Rallidae.
6.	Indian Myna (<i>Acridotheres tristis tristis</i>)	Passeriformes	Sturnidae
7.	Bank Myna (<i>Acridotheres ginginianus</i>)	Passeriformes	Sturnidae
8.	House Crow (<i>Corvus splendens</i>)	Passeriformes	Corvidae
9.	Black Drongo (<i>Dicrurus adsimilis albirictus</i>)	Passeriformes	Dicruridae

Table 4. List of birds sharing the resting sites with cattle egrets in the Gharana Wetland Reserve.

S/N	Name	Order	Family
1.	Little Cormorant (<i>Phalacrocorax niger</i>)	Ciconiiformes	Phalacrocoracidae
2.	Intermediate Egret (<i>Mesophoyx intermedia</i>)	Ciconiiformes	Ardeidae
3.	Little Egret (<i>Egretta garzetta garzetta</i>)	Ciconiiformes	Ardeidae
4.	Great Egret (<i>Casmerodius alba</i>)	Ciconiiformes	Ardeidae
5.	Bar Headed Goose (<i>Anser indicus</i>)	Anseriformes	Anatidae.
6.	Mallard (<i>Anas platyrhynchos</i>)	Anseriformes	Anatidae
7.	Eurasian Wigeon (<i>Anas penelop</i>)	Anseriformes	Anatidae
8.	Northern Shovellar (<i>Anas clypeata</i>)	Anseriformes	Anatidae

Statistical analysis

Karl Pearson correlation coefficients (r) are shown in Table 5. The number of foraging attempts was significantly related to the number of host steps in juveniles ($r = -0.682$, $p < 0.05$) but not in adults. Items collected per minute also were significantly negatively correlated with the number of host steps both in adults ($r = -0.886$, $p < 0.05$) and juveniles ($r = -0.885$, $p < 0.05$). In addition, the capture success (that is, the items collected) was

positively correlated with the number of attempts for both adults and juveniles (Table 5) but adults reflected higher capture success as compared to juveniles as juveniles had lower attempt rate.

DISCUSSION

The foraging strategy of cattle egrets in attendance of grazing cattle is well known. Cattle egret and cattle (*Bos*

Table 5. Karl Pearson's correlation coefficients (r) of foraging variables of two age groups of cattle egrets.

Age groups	Parameter	Egrets steps/min.	Egrets attempts/min.	Items collected/min.
Adults	Host steps/min.	-0.240	-0.568	-0.886*
	Egrets steps/min.		0.901*	0.622*
	Egrets attempts/min.			0.882*
	Items collected/min.			
Juveniles	Host steps/min.	-0.285	-0.682*	-0.885*
	Egrets steps/min.		-0.890*	0.664*
	Egrets attempts/min.			0.932*
	Items collected/min.			

*marked were significant ($p < 0.05$).

taurus) associations are one of the most well known of all bird and mammal associations (Heatwole, 1965). This association of a facultative commensalistic nature as also studied by Rand (1954) and Heatwole (1965), with domestic ungulates like buffaloes, cows, horses and goats was very well documented during the present study. Our observation agreed with that of Burger and Gochfeld (1989) who reported the foraging association with wild ungulates like African Buffalo (*Syncerus caffer*), Burchell's Zebra (*Equus burchelli*), Wildebeest (*Connochaetus taurinus*) and Hartebeest (*Alcelaphus buselaphus*) in Kenya. Moreover, the foraging behavior of cattle egrets feeding with cows has been extensively studied by Heatwole (1965), Dinsmore (1973) and Siegfried (1978).

Cattle egrets were reported to obtain food primarily by the disturbance caused by the head movements and progression of the cattle foraging in herds during the study period. Secondly, they preyed upon insects which were exposed when any vegetation was uprooted by the cattle and thirdly on the ticks present on the body of cattle. This is in consonance with Mc Killigan (2005) who recorded cattle egrets to feed on cattle ticks (*Boophilus microplus*) in addition to former two methods of feeding. The former two observations are in accordance with those given by Dinsmore (1973), and Heatwole (1965) who did not detect cattle egrets preying upon cattle ectoparasites.

During our survey, it was noted that adult cattle egrets mostly preferred buffaloes as their hosts whereas juveniles were observed mainly following cows (Table 1). The probable reason of choosing buffaloes as the favourite hosts may be their bulkiness and moderate speed which endows them (cattle egrets) with the capability of seeking more and more insects and other food items thereby, enhancing their (cattle egrets') capture success.

Our results agree with the findings of Seedikkoya et al. (2005) who have recorded the highest frequency of cattle and cattle egret association from 0900 to 1200 h and 1400 to 1600 h and the lowest frequency of association in the morning, late in the evening and during the middle of

the day. The maximum frequency of association at the aforesaid hours reflects the grazing peaks by cattle and the time of minimum frequency of association mirrors the time during which cattle rests during the hottest part of the day.

Regarding the feeding or foraging position of adult and juvenile cattle egrets, it was observed that adults usually fed near the head and front legs of the cattle but sometimes also near the hind legs of the cattle. There may be two plausible explanations for this:

1. The juveniles may have adopted a segregating strategy in order to avoid competition with that of adult cattle egrets; thereby making an attempt to surpass their lower strike or attempt rate and eventually feeding success.
2. The juveniles may be afraid of the flicking movements of head of cattle, so they generally preferred to be near the hind legs of the cattle.

Juveniles compensated the lower strike or attempt rate by feeding for a longer time during the day than adults. Furthermore, juveniles may require a long learning period to forage as efficiently as adults. Food items are more available near the head and front legs because the insects would be first encountered there and this can be an appropriate justification for the feeding of adult Cattle Egrets near the head and front legs of the cattle, thereby leading to the higher strike or attempt rate and searching of more food items (Burger and Gochfeld, 1989).

In case of active foraging with cattle, number of strikes per minute was observed to be 10 to 13. There was no considerable difference in the number of steps per minute taken by adults and juvenile cattle egrets.

In our study, cattle egrets shared their feeding grounds with a number of other birds as depicted in Table 3. Andrews and Mathew (1997) reported the association of cattle egrets with crows (*C. splendens*), mynas (*A. tristis tristis*) and drongos (*Dicrurus adsimilis albirictus*) during feeding. Moreover, cattle egrets colonies were found to be purely mono specific because, probably, such

colonies reduce the chances of interspecific competition for nesting sites in addition to imposing a pressure on predation (Arendt and Arendt, 1988; Si Bachir et al., 2000). However, cattle egrets are known to nest in mixed colonies with cormorants, ibises and other members of Family Ardeidae (Ali and Ripley; 1968; Burger, 1978). Cattle egrets are known to use human activity to their advantage when feeding following plows, tractors etc. (Menon, 1981).

We observed that cattle egrets shared their roosting sites with a number of other birds. On trees, they showed roosting associations with Indian Pond Heron, House Crow and Indian Myna, whereas on the ground, they rested with a number of water birds as shown in Table 4. Communal roosting protects cattle egrets from predators as many birds can better distract predators and get a clue regarding the presence of food in a particular habitat (Gopakumar, 1992 at Rajkot, Gujarat). On ground, they used to rest with waterbirds. Seedikkhoya et al. (2005) however, detected cattle egrets to roost on rubber plantations. A review of the habit of communal roosting in Indian birds showed that a significant proportion of these roost in close association of two or more species. Gadgil (1972) reported mixed communal roosts of House Crow, Jungle Crow and Common Myna and associations of cattle egret, little egret and common myna.

Conclusions

The present work considers the mechanisms by which commensal advantages from mammals can be obtained and the probable extent of the existence of loose commensal associations of cattle egrets among other birds. Cattle egrets were observed to be maximally and minimally associated with buffaloes and goats respectively among mammals. This association included additional inter specific interactions such as provoking resting cattle to move, cleaning, riding and feeding from cattle and communicating with them by warning flights. Besides, the study reflects the comparison of the degree of benefits accrued by cattle egrets in terms of both time and energy by their association with cattle and without cattle. Association with other egrets foraging near cattle were also noticed to result in group benefits such as improved vigilance or reduced probability of attack by predators.

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