

## SEASONAL DIET COMPOSITION AND FORAGING BEHAVIOUR OF CATTLE EGRET, *BUBULCUS IBIS* IN LUCKNOW, UTTAR PRADESH

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**ABSTRACT :** The cattle egret is globally widespread bird. Egrets are considered as an opportunistic feeder, they feed on easily obtained prey from the feeding habitat. This study reveals an analysis of seasonal diet composition with the diverse foraging behaviour used by cattle egret (*Bubulcus ibis*) in four different sites at Lucknow, Uttar Pradesh. The observations at the study sites results in, that cattle egrets are the highly insectivorous bird. They preferred to consume 18 orders from five phyla of prey items during the study period, which includes twelve orders of insects, three orders of Pisces, an Anura from Amphibia, Opisthoptera order of Annelids and Squamata order of Reptilia.

Moreover, in 13 different common feeding behaviour of herons, the 10 behaviour *i.e.* Walk slowly, stand and wait, walk quickly, standing fly catching, neck swaying, fly scanning and resting were observed in all habitats. Foot stirring and probing were observed in only wetlands, while Search and pecking behaviour was not found in wetlands. Rest of three *i.e.* Leap frog feeding, hopping and canopy feeding behaviour of herons were not present in anyone of the feeding habitats. The descriptive study of diet and feeding behaviour is an important for the study of feeding ecology of the cattle egret.

**Key words :** Cattle egret, foraging behaviour, feeding habitat, prey items.

### INTRODUCTION

Cattle egrets (*Bubulcus ibis*), belonging to the family Ardeidae, this is cosmopolitan bird of heron species. It occupies a big geographic area (Zaccagnini and Beltzer, 1982). In India, it is commonly found in various habitats like wetlands, fresh water sources, marshylands ponds, grassland, roadsides, dumps, parks, sport lawns and agricultural farms etc. (Meyerricks, 1962 and Seedikkoya, 2004) they are terrestrial foragers as they pick the disturbed insects alongside grazing animals, without causing any inconveniences or disturbances to them (Wittenberger and Hunt, 1985). Egrets are gregarious birds feeding in flocks, breeds colonially and form large "roosting places" in permanent and temporary swamps or trees (de laPen a, 1992). Several studies have been reported regarding the habitat and diet selection of egrets, that the both habitat and diet selection get changed with the change in seasons and prey availability (Fogarty and Hetrick, 1973; Ducommun *et al*, 2008). Their prey quality and quantity also changes in different habitats with the time of foraging (Kour *et al*, 2014) they described about cattle egrets diet, that it feed primarily grasshoppers,

crickets, flies, moths, spiders, frogs, crayfish, earthworms (Mckilligan, 2005). Rarely, they also consume fish and snake. At garbage dumps they feed like scavengers.

A wide range of food taken by the egret shows that it consumes whatever could be captured by its primary tactile foraging method (Siegfried, 1971). The good foraging habitat provides an easy availability and accessibility in selecting the prey at a reduced predation risk (Wahungu *et al*, 2003). It play significant roles in a variety of ecosystems, as their foraging habit contributes in controlling the agricultural pests and helpful to public health. Seasonal changes effects the insect prey population, many species of insects prey disappear after the rain. This also effects the cattle egrets feeding and foraging behaviour (Elgood, 1979).

Aim of this study include: Analysis of seasonal diet of egret through food consumed by egret and foraging behaviour observed on the basis of different postures and actions displayed by this bird at respective habitat used. Practically nothing has been revealed on these aspects of cattle Egrets from study areas at Lucknow.

## MATERIALS AND METHODS

The study was carried out weekly between 2016 to 2018 at the different sites in Lucknow district *i.e.* Mawaiya: grassland, Vrindavan: marshyland, Jagatkhed: agriculture land and kallipaschim: wetland. The geographic coordinates of Lucknow are 26.8470°N and 80.9470°E (Kannaujiya, 2013) and the temperature ranges between 25-45°C in summers, 2-20°C in winters. The study was assessed through periodical field visits at Grassland (an area which was included of ecosystem where grasses and forbs were in dominant), Marshy land consisting of (wetland associated with pond, swampy) and agriculture land (includes intensively managed or grazed wet meadow or pastures) and wetlands (A deep-water body such as lake and pond surrounded by land) (Grobicki, 2016).

Availability of prey items was recorded by the help of two sweeps of a long handled net from the foraging area, with in 5m<sup>2</sup> range. While fishes were collected with help of local fisherman, all was done by following the similar method as of Fasola (1986). Besides it, regurgitated food items were collected and preserved in a 70% ethanol for identification of taxa (Chapman, 2013). Food consumed and different foraging behaviour was recorded at every 15 minute interval from dawn to dusk and was noted carefully from a distance of 30-40 meters with a help of binocular. The nomenclature of foraging behaviour was used as Mayerricks (1962) and Kushlan (1978).

The sampling had been done between 0600 h - 1800 h, the observation carried out visually during the feeding time of cattle egrets with the help of digital video camera and binocular (Celestron up close G2, 6.8°/35FT/118M 10x50X). Non-invasive method was avoided. The whole study period was divided in to three seasons, summer (March to June), monsoon (July to October) and winter (November to February). The food consumed success was identified by the characteristic of *i.e.* Head-jerk, swallowing behaviour (Dinsmore, 1973 and Scott, 1984). "Shapiro wilk test" method was used for Normality test of the data where ( $P > 0.05$ ), therefore, prey items consumed and availability of prey items were analyzed through Kruskal Wallis-H analysis (SPSS version 21). ( $P > 0.05$ ).

## RESULTS

In the present study, the total number of 1,443 cattle egrets were observed at different foraging sites, the percentage in agriculture land (34.21%) followed by grassland (26.57%), marshy land (21.70%) and wetland (17.49%). Most of cattle egrets showed a little seasonal variations at foraging sites *i.e.* in rainy season they feeds

in large number as compared to summer and winter. It was observed that the bird has a highest frequency of feeding in early morning and late in the evening (Aboushiba, 2015).

A total of 18 orders from five phyla of prey items consumed during the study period including twelve orders of Insects, three orders of Pisces, Anura of Amphibia, Opisthoptera order of Annelida and Squamata order of Reptilia. We observed that the prey items of cattle egret were found varied according to the seasons. The maximum prey fed were insects among the phylum included twelve orders alone. Odonata was maximum fed by cattle egret in all the seasons, whereas the result was, a maximum fed in monsoon ( $16.5 \pm 5.80$ ) and minimum in winter ( $4.5 \pm 3.69$ ). Kruskal Wallis H test also showed significant difference in all season ( $H=6.031$ ,  $P=0.049$ ) (Table 1). While secondly maximum consumed prey item were Coleoptera in every season *i.e.* in monsoon ( $14.25 \pm 5.57$ ), summer ( $8.75 \pm 3.30$ ) and in winter ( $3.75 \pm 3.30$ ). Statistically a significant variation among the season was observed ( $H=6.89$ ,  $P=0.032$ ) (Table 1). It was seen that, when food availability was limited, the Pisces was the main food item of cattle egret. As in winter the channa ( $8.25 \pm 2.87$ ) was maximum consumed by cattle egret, while minimum in summer ( $0.75 \pm 0.95$ ). Whereas Kruskal Wallis H test showed significant difference among the seasons ( $H=6.026$ ,  $P=0.049$ ) (Table 1). Furthermore, other prey items including Amphibian, Annelids and Reptilia were consumed in less quantity in all three seasons (Table 1).

A total prey items availability was observed among 18 orders of five phyla at foraging sites during the study period. In the whole study, the maximum orders of prey items were found *i.e.* Odonata, Coleoptera and Opisthoptera in monsoon, while presence of Coleoptera was also seen maximum in summer and Cypriniformes, Siluridea and Channa in monsoon and winter (Table 2).

During the feeding of cattle egret, the series of foraging behaviour were observed. Each behaviour had a different postures and actions. According to habitats some differences were also noticed in the number of displayed foraging behaviours. From 13 different common feeding behaviour of herons, 10 behaviours were seen in cattle egret. From these only seven *i.e.* Walk slowly, stand and wait, walk quickly, standing fly catching, neck swaying, resting and fly scanning were seen at all habitats. While foot stirring and probing were observed in only wetlands. Search and pecking behaviour was not found in wetlands. Leap frog feeding, hopping and canopy feeding behaviour were also not found in any habitats.

**Table 1** : The seasonal variation in consumption of prey items by cattle egret is given as mean  $\pm$  SD of three distinct seasons. The Kruskal Wallis H test is Significant at the 0.05 level.

Taxa	Summer	Monsoon	Winter	Statically value	
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	H	P
<b>Insect</b>					
Hymenoptera	4.5 $\pm$ 4.50	3.75 $\pm$ 4.11	2.5 $\pm$ 3.78	1.09	0.58
Hemiptera	-	1.75 $\pm$ 1.70	-	7.157	<b>0.028</b>
Odonata	9.5 $\pm$ 6.60	16.5 $\pm$ 5.80	4.5 $\pm$ 3.69	6.031	<b>0.049</b>
Lepidoptera	-	3.75 $\pm$ 3.30	-	7.031	<b>0.239</b>
Orthoptera	4.25 $\pm$ 3.5	10.5 $\pm$ 2.38	2.5 $\pm$ 2.64	6.934	<b>0.031</b>
Diptera	4.25 $\pm$ 2.06	7.75 $\pm$ 8.38	2.75 $\pm$ 3.09	1.012	0.603
Dermapetra	-	2.5 $\pm$ 1.91	-	10.507	<b>0.005</b>
Areanea	1.5 $\pm$ 1.29	2.5 $\pm$ 3	3.75 $\pm$ 0.95	0.792	0.673
Ixodida	2.2 $\pm$ 1.70	2.5 $\pm$ 1.91	2.5 $\pm$ 1.91	0.396	0.82
Coleoptera	8.75 $\pm$ 3.30	14.25 $\pm$ 5.56	3.75 $\pm$ 3.30	6.89	<b>0.032</b>
Diplopoda	-	12.75 $\pm$ 4.99	1.25 $\pm$ 1.5	9.116	<b>0.01</b>
Chilopoda	-	13.5 $\pm$ 4.43	2.75 $\pm$ 1.89	9.116	<b>0.009</b>
<b>Pisces</b>					
Cypriniformes	1.25 $\pm$ 0.95	4.75 $\pm$ 3.09	7.75 $\pm$ 3.30	7.372	<b>0.025</b>
Siluridae	1.75 $\pm$ 2.06	3.25 $\pm$ 1.5	7.25 $\pm$ 1.70	7.577	<b>0.023</b>
Channa-punctatus	0.75 $\pm$ 0.95	3.75 $\pm$ 3.86	8.25 $\pm$ 2.87	6.026	<b>0.049</b>
<b>Amphibia</b>					
Anura	-	9.25 $\pm$ 2.06	-	6.715	<b>0.035</b>
<b>Annelida</b>					
Opisthopora	-	8.75 $\pm$ 4.11	-	6.958	<b>0.031</b>
<b>Reptilia</b>					
Squamata	1.25 $\pm$ 1.25	1.75 $\pm$ 1.25	2.25 $\pm$ 1.5	1.131	0.568

## DISCUSSION

This study discusses about the diet selection, diet composition and foraging behaviour of cattle egret. Cattle egret obtains their food items usually from the grasslands, marshylands, agriculture lands and wetlands. Terrestrial food items are present such as insects, damsel fly, beetles, grasshopper etc. Although, aquatic organisms were also seen in their diet. Cattle egret were found with less dependency on vertebrate prey items as pisces and reptilians in comparison to invertebrates prey items, those belongs to Arthropoda, Annelida. However, the differences in the diet selection and composition were observed in cattle egret. For example among insects, the cattle egret consumed more dominantly Odonata, Orthoptera and Coleoptera (Table 1). Weber (1972) and Kaufman (1996) also considered that the diet of egret was mainly insectivorous, it can be assumed that, the Cattle Egret is also having some impact on particular prey species and it shall be classified as a beneficial addition to the native fauna.

This present study also reflects the variation in their food items according to seasonal changes (Tables 1 and 2). It reveals the egrets foraged more extensively in monsoon as compare to summer and winter. As the

number of insects or aquatic organism increases in rainy season in all type of feeding habitats. The wide range of food items in the diet of cattle egret indicates that it consume the suitable prey items, abundantly available at the foraging sites according to season.

It is useful to study about the types of posture and actions, as they could be used in distinguishing of the sitting behaviour and provide sub categories, which were observed in all the habitats mentioned in Table 3. The series of foraging behaviour displayed by the egrets were found to be very immense (Table 3).

Searching of food items on feeding ground and in water bodies from short distancing height was noticed as one of the foraging behaviour. Perhaps it is recorded for the first time in this study. The explanation and nomenclature of feeding behaviour along with total behaviour cataloguing were found to be the most important in foraging studies of the cattle egret.

**Leap frog feeding** : A herons jumps into the air and flies a short distance to a potential prey item and often stabs simultaneously with landing. Siegfried (1971) suggests, that it helps birds to maintain contact in the long grass. In observation, the cattle egret was not found

**Table 2 :** The availability of prey items of cattle egret in three distinct seasons respectively summer, monsoon and winter.

Taxon		Season		
Vernacular name	Order	Summer	Monsoon	Winter
Wasp, Bees, Ants	Hymenoptera	+	++	+
Rice bug, Truebug	Hemiptera	-	+	-
Damselfly, Dragonfly, Nymph	Odonata	+	++++	+
Caterpillar	Lepidoptera	-	+	-
Grasshopper, Cricket	Orthoptera	+	++	+
House fly	Diptera	+	+	-
Earwig	Dermaptera	-	+	-
Spider	Areanea	+	+	+
Ticks	Ixodida	+	+	+
Ladybird beetle, Ground beetle, Blister beetle	Coleoptera	++	+++	+
Millipedes	Diplopoda	-	++	-
Centipedes	Chilopoda	+	+	-
<i>Labeo rohita</i> , Catla	Cypriniformes	+	++	++
<i>Mystus seenghala</i>	Siluridae	+	++	++
Spotted snakehead	Channapunctatus	+	++	++
Frog, Tadpole	Anura	-	++	-
Earthworm	Opisthopora	-	+++	-
Lizard, snake	Squamata	+	+	+

Where, (-) absent, (+) 10 % (++) 20%, (+++) 30-35%, (++++) 40-50% observation.

**Table 3 :** Different foraging behaviour displayed by cattle egrets at different habitats.

Foraging behaviour	Grassland	Marshyland	Agricultureland	Wetland
Leapfrog feeding	-	-	-	-
Search and pecking	+	+	+	-
Walk slowly	+	+	+	+
Stand and wait	+	+	+	+
Walk quickly	+	+	+	+
Foot stirring	-	-	-	+
Probing	-	-	-	+
Standing flying catching	+	+	+	+
Neck swaying	+	+	+	+
Canopy feeding	-	-	-	-
Fly scanning	+	+	+	+
Resting	+	+	+	+
Hopping	-	-	-	-

Where, (-) absent, (+) Present observation.

feeding in dense high grass, therefore this behaviour was not observed in cattle egret.

**Search and pecking :** Cattle egret displayed this behaviour at all feeding habitats except in wetland. There the cattle egret easily picks up the food materials from the substrate or ground, with the help of their bills. It

also reported by Heatwole (1965), Sharma and Soni (2014).

**Walk slowly :** In this behaviour walking becomes slower as the heron examines items or area of interest, just before striking, the heron may walk too slow (Recher *et al*, 1983). This kind of behaviour was observed at all types of feeding habitats. In this behaviour egret does not make extra effort to exhibit.

**Stand and wait :** Cattle egret commonly execute this behaviour at feeding sites. The egret stands for some time to watch the prey item for capturing (Kushlan, 1976). In this behaviour less energy is consumed.

**Walk quickly :** This kind of behaviour indicates about the chase disturb feeding (Kushlan, 1976). They observed that, the running and quick walking activity was used by the birds for capturing the moving prey and spotting the prey in a better way. It was seen that in solitary mode of feeding, cattle egrets feeds in absence of cattle and other disturbing objects *i.e.* Moving vehicle and farmers etc. (Recher and Holmes, 1982).

**Foot stirring :** The special use of feet in this type of foraging seen in cattle egret. It is also comes under category of disturb and chase feeding (Holt, 1961) a heron extends one leg forward and vibrates its leg and foot, or it vibrates its foot while wading forward normally. This motion disturbs the area around its foot, the disturbed prey get captured. Foot stirring can occur in mud, vegetation, mid-water. In present study, it was observed only at wetlands.

**Probing :** This feeding movement noticed when cattle egret placed its bill half and more than half inside the water to pick up a prey items. It was observed

in stagnant water bodies and in the natural wetlands. (Meyerriecks, 1959).

**Standing fly catching :** This feeding behaviour involves catching of flying preys, while the birds are in standing posture (Sharma and Soni, 2014). This behaviour however rarely used and was noticed only in few cattle egret. During the study period this behaviour was seen

in foraging lands and margins of wetlands.

**Neck swaying :** While the egret is in standing or walking posture, it use to move the neck forward and backward, this keeps the egret to remain in parallel position for maintaining a precise estimated distance and location of the object (Kushlan, 1986). Thus, it catches the easily escapable prey in a single strike. Egret used this behaviour at all type of feeding habitats.

**Canopy feeding :** The large wading birds are bringing their both wings forward to form a canopy type structure, the shadow in front of their own body attracts the fish and insects (Delacour, 1946). This type of technique was not observed in cattle egret, as the size of cattle egrets is smaller than other larger heron.

**Fly scanning :** Cattle egret scans the ground or wetland to search their food while flying from a distance between 5-10 meter. This behaviour is used more at wetlands in compare to other habitats. Perhaps this behaviour is reported first time in this investigation.

**Resting :** This behaviour was observed at all type of feeding habitats. Cattle egret displays this activity after the feeding. They usually stand on one leg (Sharma and Soni, 2014) and after 10-15 minute interval they change their leg position.

**Hopping :** The characteristic of this behaviour is that, the herons follow the flying insects for short distance and often stabs the insects simultaneously with landing (Meyerriecks, 1960). In present study this behaviour was absent in cattle egret. In place of hopping, it commonly use the standing fly catching and neck swaying behaviour in capturing the flying insects.

Foraging behaviour helps in understanding the ecology of herons (Murton, 1972 and Kushlan, 1976) the beginning of their study on ecology of herons provides about the role of habitat in determining heron's feeding behaviour. The observations suggest that the variation in availability of prey may also effects the feeding efficiency, diet and habitat selection along with other parameters of the feeding site, *i.e.* Differs from one location to the next. The present study shows the variations in prey type and density, density of cattle egret and other parameters of the feeding site differ from one location to the next. And the feeding efficiency also differs.

## CONCLUSION

According to the study, it is concluded, that cattle egrets in Lucknow area are carnivorous. This study suggests that the diet of cattle egrets is influenced by the habitat where they feed, rather than on specialised food. Cattle egrets showed a dietary flexibility and habitat

adaptability. The food of cattle egrets at the grasslands and agriculture site were mainly restricted to insects, asodonata, orthoptera and coleoptera however, at the aquatic habitat, the cattle egrets fed on a variety of prey including insects and amphibians. Regarding to the type and amount of prey consumed by cattle egrets at grassland and agricultural land. The feeding priority shows that the cattle egrets are playing major role in determining the ecological conditions of the habitats. Clear understanding of the descriptive aspects of each behaviour and knowledge of the occurrence of various behaviours in cattle egrets shall be beneficial to understand more about the foraging ecology of cattle egrets. This present paper may provide a common background and may help in future studies.

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