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## POPULATION DENSITY AND ASSOCIATION OF CATTLE EGRET (*Bubulcus ibis* L. 1758) WITH CATTLE OF JOSEPH SARWUAN TARKA UNIVERSITY MAKURDI, NIGERIA

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**ABSTRACT:** Cattle egret is a true cosmopolitan bird with a facultative commensalism relationship between human and both domestic and wild herbivores. The population trend of cattle egret is decreasing globally in numbers but is not sufficiently rapid to be classified as vulnerable species. Population density and association of cattle egret with cattle of Joseph Sarwuan Tarka University Makurdi, Nigeria were investigated through direct field observation aided with a binocular (Trekka 10 x 42) from November 2022 to February 2023. Data were analysed using descriptive, distance package, T-tests, Cochran–Mantel–Haenszel test and correlation matrix. Population of cattle egret were estimated to be 14, 460 birds, density of 10.63 egrets ha<sup>-1</sup>, average number of detections of 122 and with mean encounter rate (ER) of 17.98. The association pattern of cattle egret was more with feeding within the cattle than other categories. However, there was no significant association between period of the day and regions of sampling across categories of association ( $P > 0.53$ ). Foraging success was related to insect abundance especially grasshopper (18.6%). Feeding (33.61%) was the highest activity cattle egret spend time on. A positive correlation relationship value of 0.346, 0.138 and 0.048 was obtained between the feeding rate of solitary egrets with within herd of cattle, at hindlimbs, forelimbs and back-top with forelimbs, respectively, while a negative correlation relationship value of -0.393 was obtained between the feeding rate at back-top of the cattle.

**Key Words:** Cattle egret, population, association, feeding

### 1. INTRODUCTION

The cattle egret (*Bubulcus ibis*) is a medium sized, white heron bird species from the family of Ardeidea with a wide spread distribution (Patankar *et al.*, 2017; Elizabeth, 2019). The cattle egret dispersing from Ethiopia to other continent was evident at the start of the 20<sup>th</sup> century

(Palomar, 2001), believing to have spread/travelled across the continents without human assistance (Elizabeth, 2019). However, their global migration and habitat use is attributed to an increase in anthropogenic habitat changes and other environmental parameters (Metallaoui *et al.*, 2020).

The cattle egret derives its name from its feeding ethology of speeding time alongside livestock and wild animals like elephants, wild water buffalo and rhinoceros among other (Bindya, 2019). They usually nest in large colonies associating more towards water body and feed mostly in dry field, grassland and farmlands (Birdlife International, 2014). They are diurnal feeders, commonly feeding on insects (Halidu *et al.* 2020). Due to its predominately insectivorous habit, the cattle egret is considered a good bio-indicator species and are wading birds of noticeable ecological importance (Frederick and Green, 2019), and a known biological pest control agent in an agro-ecosystem (Patankar *et al.*, 2017).

The cattle egrets are always seen together in large numbers (a gregarious bird); thus, it is often difficult to determine its population as a singular rural or urbanized population (Elizabeth, 2019). They make their flight in S-shape with their neck folded, and run or walk with a swinging motion while foraging. The cattle egret forages near the feet of grazing animals, with its head moving as each step is being taken, or rides on the animal back to pick on ticks on the animal body. During breeding season, the male is larger and longer than the female, while the juvenile ones possess a black bill and there is lack of coloured plumes (Krebs *et al.*, 2004).

There is paucity of information on cattle egret in Joseph Sarwan Tarka University Makurdi, as compared to other birds. Hence, the need for scientific information on the population and feeding association between the cattle egrets and the cattle on the campus.

## 2. MATERIAL AND METHODS

### 2.1. Location of the Study Area

Joseph Sarwan Tarka (JOSTUM) (formally University of Agriculture, Makurdi), is situated in the Northern part of Makurdi town within Benue State. It is located within the Guinea Savannah zone between latitudes 8°35'E and 8°41'E and longitudes 7°45'N and 7°52'N; it is on the Southern bank of river Benue, close to River Guma in the East and to the West of the (Route A3) Makurdi to Lafia and is about 16.5 kilometers to the North of the Makurdi city (Ikyaagba *et al.*, 2015; Yager *et al.*, 2016). Rainfall distribution is bimodal in the area occurring in June and September. Mean annual rainfall is between 1000 mm – 15000 mm. Mean annual temperatures is 29°C - 30°C, relative humidity is between 60% and 80% but decreases in the early months of the dry season (Ikyaagba *et al.*,

2015). The area is characterized by undulating rolling plain with irregular river valleys and ridges with steep slope. The drainage pattern is dendritic. The surrounding of the area is open savannah woodland which is relatively rich with high diversity of species comprising of a wide variety of woody trees, predominately fewer trees, more shrubs, and a collection of herbs, palms, climbers and predominately tall grasses up to 2 m tall. Forest formations are found in low-land areas and river banks and a riparian forest along tributaries close to the College of Forestry and Fisheries. Some of the species found in the area include: *Daniellia oliverri*, *Vitellaria paradoxa*, *Vitex doniana*, *Hymenocordia acida*, *Burkia africana*, *Khaya senegalensis* and *Parkia biglobosa* (Ikyaagba *et al.*, 2015).

### 2.2. Data Collection and Sampling Method

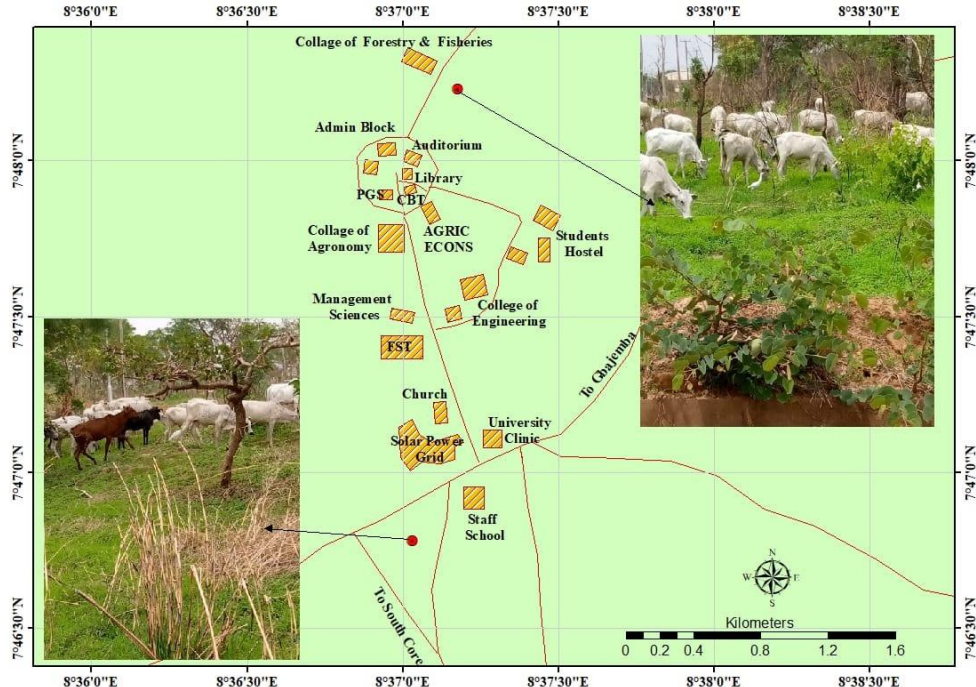
Data collection lasted between 9:00hrs – 12noon and 15.00 hrs am to 17.00hrs (evening) each study day during November, 2022 to February, 2023. These hours were chosen so as to synchronise with the period that livestock guide bring out their cattle for grazing. Visitation to the selected habitats was done randomly to influence the time cattle herds are grazing in the habitat.

Based on the survey method where the distance between the observer and the cattle herd is 20 to 50 m, a model was designed such that the highest distance was used to obtain the transect as shown above. Similarly, the distance between cattle and birds was recorded as 0 – 5m for those associated and those unassociated were those that were sighted >5m from the cattle herd. The cattle herd is represented by the circle and the imaginary centre of the herd was used as base point for the measurements. Hence a right-angled triangle is created with two known lengths of 50m each. Using the Pythagoras theorem:

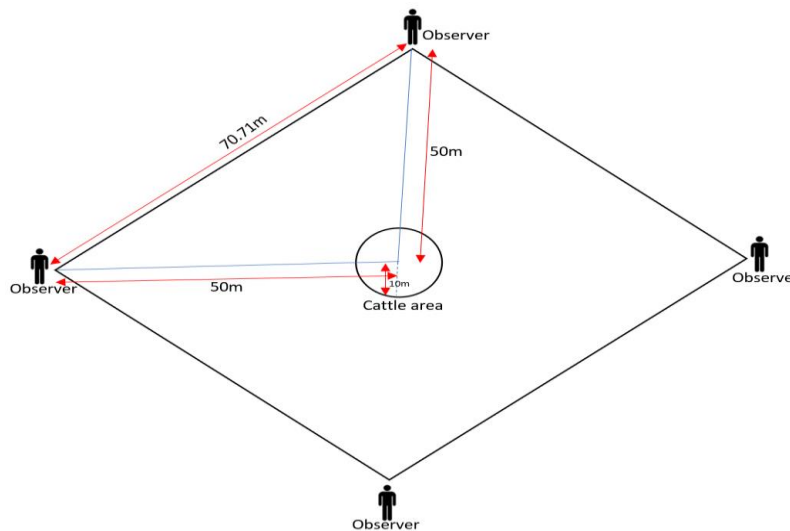
$$\begin{aligned}c^2 &= a^2 + b^2 \\c^2 &= 50^2 + 50^2 \\c^2 &= 2500 + 2500 \\c^2 &= 5000 \\c &= \sqrt{5000} \\c &= 70.71m\end{aligned}$$

#### 2.2.1. Measures of cattle egret association

Associated Cattle egrets with cattle was determined by counting birds that are within 1meter to cattle and unassociated ones were those more than 1meter away from the cattle.



**Figure 1.** Geo-mapping of the Cattle Egret association with grazing cattle in JOSTUM



**Figure 2.** Typical Survey approach of cattle egret in JOSTUM

2.2.2. Cattle egret feeding behaviour

Cattle egrets were studied under two feeding conditions as explained below:

- i. Feeding within cattle: this denotes feeding activities carried out by individual cattle egrets within cattle or up to a distance of 5 m from cattle.
- ii. Solitary feeding: this was considered when cattle egrets fed on their own without the presence of

grazing animals around them. In each case, individual cattle egrets were sampled at random and observed using a pair of binoculars (Trekka 10 x 42 field of view). Any target individual was observed over a period of 5 min. (due to fast foraging movements by most individuals). Feeding rates and time interval between successive prey captures were quantified for each individual; feeding rate was defined as the number of times an egret captured a prey while time interval between prey

captures is the time between successive prey captures.

### 2.3. Data Analysis

The distance package (Miller *et al.*, 2019) in R version 4.2.1 (R Core Team, 2022) was used to estimate egret population based on the counts. The original data comprised weekly, daily and association as factors. In order to create a flat data for input into distance package, the week factor was removed and means of population sampled daily (morning and evening) for the two association types were calculated and rounded up to the nearest whole number. Subsequently the distances of birds from cattle were generated using randomization in R based on observation of the least and farthest distance from cattle: 0 - 5m for associated egrets and >5m for unassociated cattle. In order to create a closure for the distance of unassociated egrets, 10m was chosen as appropriate since the least distance between the observer and the cattle is 20m. This effectively gives 10m gap between the observer and the birds.

Effort was estimated using the length of observation transect multiplied by the number of times observations were made. In this case, observations lasted 12 weeks with four observations per week (2 in the morning and 2 in the evening). Therefore, with a length of 70.71m, effort was estimated as:

$$\begin{aligned} \text{Effort} &= \text{Transect length} \times \text{No. of weeks} \\ &\quad \times \text{No. of observations per week} \\ \text{Effort} &= 70.71\text{m} \times 12 \times 4 = 3394.08\text{m} \\ \text{Effort} &\approx 3394\text{m} \end{aligned}$$

However, the effort input from data fed into R was half of this effort since all other factors that contributed to the effort except the morning and evening factors were not included in the data. Therefore, the distance package was given the raw data material to finish off the estimation of effort with the removal of 2 from the number of observations per week. This implies that effort fed in was:

$$\begin{aligned} \text{Effort}_{\text{fed in}} &= 70.71\text{m} \times 12 \times 2 = 1697.04\text{m} \\ \text{Effort}_{\text{fed in}} &\approx 1697\text{m} \end{aligned}$$

The T-tests were conducted using the ggpubr package (Kassambara, 2020) in R version 4.2.2 (R Core team, 2022). To determine the association of cattle egrets with

the cattle in the locations studied and the periods of observation, the Cochran–Mantel–Haenszel test was carried out after the Woolf test for homogeneity of odds ratios across strata was carried out. The correlation between variables was determined using the Hmisc package (Harell and Dupont, 2021).

## 3. RESULT AND DISCUSSION

### 3.1. Population Estimate, Density and Number of Detection

Cattle egrets population estimate and density of terrestrial egrets in JOSTUM are presented in (Table 1 and 2). The total population estimate of cattle egrets encountered was 14460.21 comprising of 11076.76 at Animal farm region and staff quarters – middle core with 3383.47. The overall population density estimate was 10.63 egrets ha<sup>-1</sup>, Animal farm region had the highest density 11.08 egrets ha<sup>-1</sup> and Staff quarters – middle core had 9.40 egrets ha<sup>-1</sup>. The cattle egret's population was dependent on the presence of the cattle and their benefits to feed on disturbed insects and vigilance by predators during grazing. This was supported by the study of Hockey *et al.* (2005) in Kereala, India; John and Kagembe (2022) in Tanzania.

The total average number of cattle egrets detection recorded was 122 across the two regions, animal farm had (n =66) and staff quarters (n = 56). The total area covered was 13.58 ha, with mean encounter rate (ER) of 17.98 (ER = 19.45 at animal farm and ER = 16.50 at staff quarters), with the effort of 6.78 (Table .3). Although, its population determinant is quite difficult both in rural or urbanized areas. Observation between the interaction of cattle egrets and cattle in JOSTUM suggest a facultative commensalism relationship. This is in line with the study of Seedikkoya *et al.* (2005). Observer distances from target birds ranged between 20-50 m to avoid distracting avian behaviour. The distance between cattle and cattle egrets was 0 – 5m for those associated and those unassociated was >5m. Results of cattle egrets count (simulated distance), detection function and distance sampling Cramer-von Mises (CvM) test is given in (Figure 3, 4 and 5). The half-normal detection function fits the cattle egret data very well, because majority points of the q-q plot fall on the diagonal line and the p-value associated with the CvM test statistic is very large (> 0.05) indicating a good fit of the model to the data. The Test statistic = 0.240184 p-value = 0.201456 was obtained (Figure 3).

**Table 1.** Population Estimates of cattle Egrets in JOSTUM

S/No.	Region	Estimate	Se	Cv	Lcl	ucl	df
1	Animal Farm	11076.761	1055.38	0.095	9158.08	13397.41	59.14
2	Staff_Qrt	3383.447	389.64	0.115	2570.91	4452.79	6.62
3	Total	14460.208	1370.13	0.095	11981.30	17449.09	87.74

se = standard error, cv = coefficient of variation, lcl = lower confidence limit, ucl = upper confidence limit, df = degree of freedom

**Table 2.** Population Density (No./ha) of cattle Egrets in JOSTUM

S/No.	Region	Density	Se	Cv	Lcl	Ucl	Df
1	Animal Farm	11.08	1.06	0.095	9.16	13.40	59.14
2	Staff_Qrt	9.40	1.08	0.115	7.14	12.37	6.62
3	Total	10.63	1.01	0.095	8.81	12.83	87.74

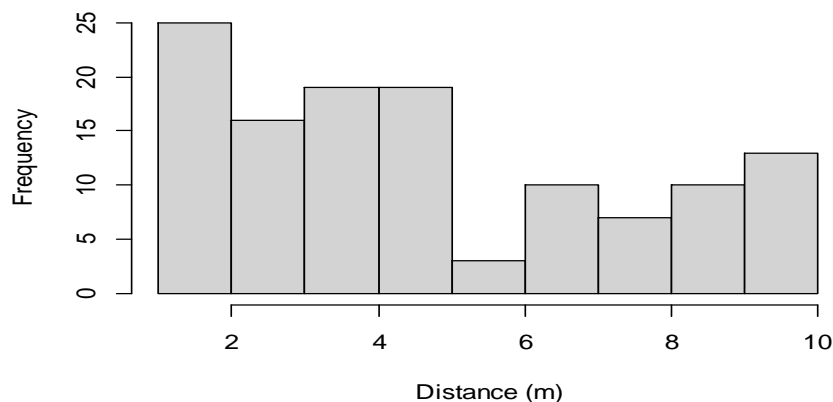
se = standard error, cv = coefficient of variation, lcl = lower confidence limit, ucl = upper confidence limit, df = degree of freedom

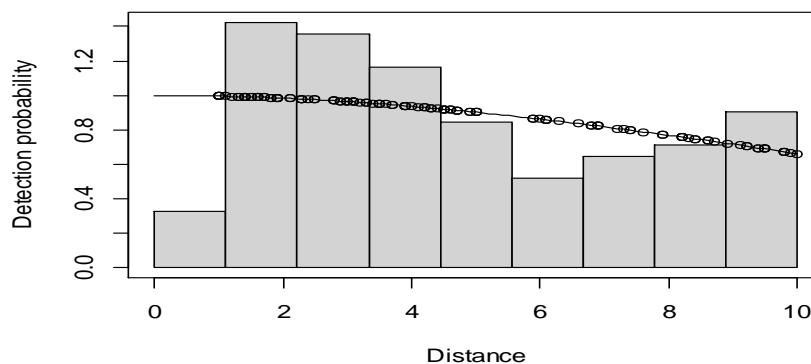
**Table 3.** Station summary of cattle egrets counts in the study area

Region	Area	Covered Area	Effort	N	K	ER	se.ER	cv.ER
1 Animal Farm	1000	6.788	3.394	66	2	19.45	0.59	0.030
2 Staff_Qrt	360	6.788	3.394	56	2	16.50	1.18	0.071
3 Total	1360	13.576	6.788	122	4	17.98	1.01	0.056

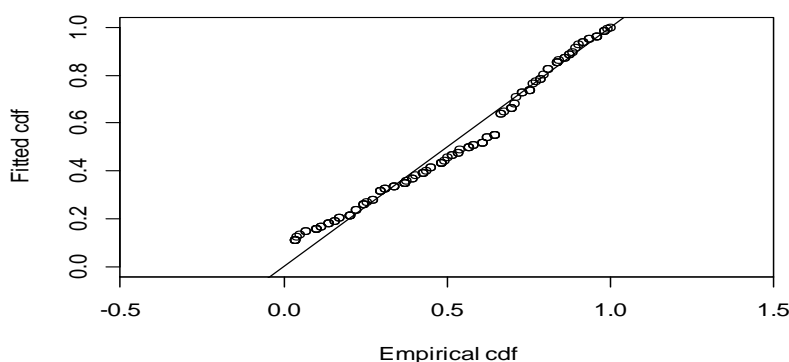
Area = size of study area (Ha), Covered Area = area covered by sampling effort (Ha), Effort = length of all transects (km), n = Average number of detections, k = number of times survey was conducted daily, ER =

encounter rate i.e. number of detections per unit transect length and its associated variability, se = standard error, cv = coefficient of variation

**Figure 3.** Histogram of bird count and simulated distances from cattle in JOSTUM



**Figure 4.** Histogram of detection function for cattle egrets in JOSTUM



**Figure 5.** Distance sampling Cramer-von Mises (CvM) test (unweighted) cdf = cumulative distribution function, Test statistic = 0.240184 p-value = 0.201456

### 3.2. Mean count of cattle Egret and association with cattle in JOSTUM

The percentage association pattern of cattle egret with cattle was more with feeding within the cattle (herd) during morning 30.92% and evening 32.08%, followed by feeding solitary between evening 21.67% and morning 24.17%, while the least was egrets associating at the back top of the cattle (morning = 8.08% and evening = 9.12%) (Figure 6). The result of Mantel-Haenszel mean count of cattle egrets showing association with cattle is presented in Table 4. The population of cattle egrets associated with cattle herd was 31 between morning hours and 33 for evening hours. At solitary, population of cattle egrets was 25 and 22 for morning and evening. The association with fore limbs, hind limbs and back – top revealed a population of 25, 18, 21 and 9, respectively for morning hours and 22, 16, 22 and 10, respectively for evening hours. The Mantel-Haenszel test showed that  $\chi^2 = 0.3857$ ,  $df = 1$ ,  $p\text{-value} = 0.5346$  was obtained, this indicate that there is no significant association between period of the day and regions of sampling across categories of association of cattle egrets with cattle (Table 4). The egrets were seen to prey upon cattle ectoparasites, although a list of such parasites was

not made. This is probably one reason behind their name and why they follow the cattle for surety of getting their highly delicious food.

### 3.3. Food items, activity pattern and relationship of cattle egrets with cattle in JOSTUM

The proportion of food items found in the diet of cattle egret and activity pattern of the birds was revealed in Figure 7 and 8. It reveals that grasshopper recorded the highest percentage (18.60%) of insects-pray composition, followed by caterpillars and earthworms (16.53%) each, while the least was recorded amongst the unidentified food items (2.48%). The number of insect-pray capture was a function of the abundance of the insect pray occurrence at the grazing regions of the cattle herd. Feeding (33.61%) were the highest activities that they spend most of their time on, followed by walking (24.59%), while flying (9.02%) was the least activity (Figure 8). Insects -prey represent a large proposition of cattle egrets’ food items sampled in the area. The findings agree with the work of Halidu *et al.* (2020) in Niger State, Nigeria, which reported that cattle egret diet is distinctly carnivorous, being 33% represented by orthoptera. The association was more when cattle egrets foraged within

cattle than when egrets foraged solitarily, prey abundance was observed within cattle and success in capturing prey, shorter time intervals between successive prey captures was more than those that foraged solitarily. This helps the bird to reduce energy ought to spend for prey capture (Chaskda *et al.*, 2018).

The result of correlation analysis to investigate the relationship among different observed parameters in the study area is given in Table 5. A positive correlation exists between the feeding rate of solitary egrets with within herd of cattle (CCo = 0.346), between feeding rate

at hindlimbs and forelimbs with CCo = 0.312 and back-top with forelimbs (CCo = 0.293), while a negative correlation exists between the feeding rate at back-top of the cattle with CCo of -0.393. The grazing movement of the cattle in JOSTUM is sure to flush insects from their niches leading to easy detection by cattle egrets around them. Possibly, this could have been the reason for the non-significant association between period of the day and samples region across categories of association of cattle egrets with cattle. These observations are in agreement with several previous studies such as Mukherjee (2000); Seedikoya *et al.* (2005) and Chaskda *et al.* (2018).

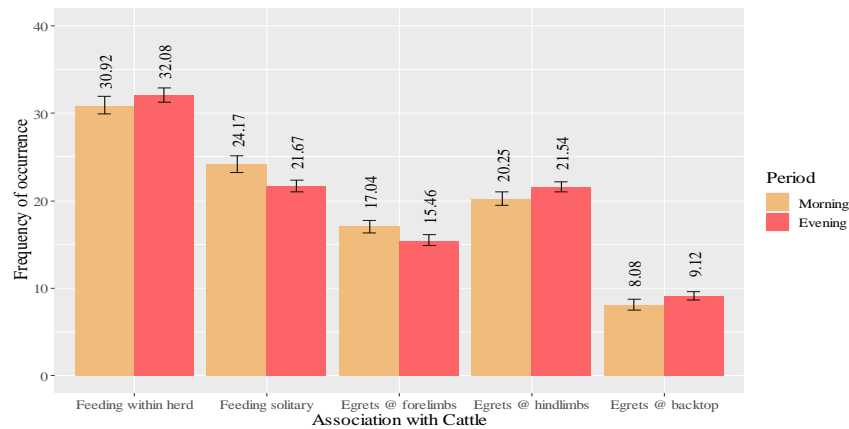
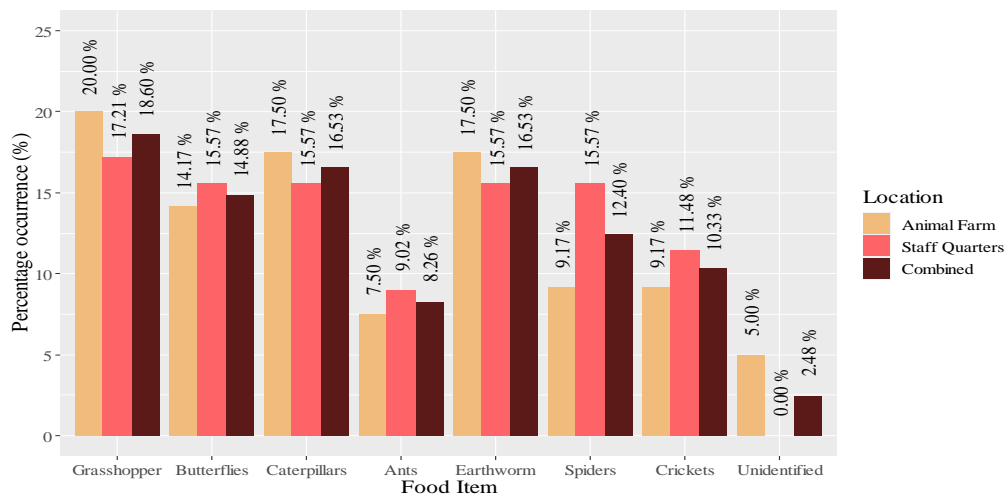


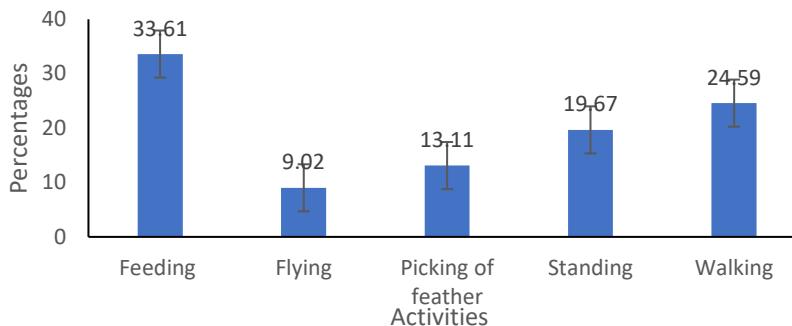
Figure 6. Association of cattle egrets with cattle at both sampling stations

Table 4. Mean count of cattle egrets showing association with cattle in JOSTUM

Period	Region	Association				
		With Herd	Solitary	Fore limbs	Hind limbs	Back-top
Morning	Animal Farm	17	14	9	11	5
	Staff Quarters	14	11	9	10	4
Evening	Animal Farm	17	11	7	11	4
	Staff Quarters	16	11	9	11	6





**Figure 7.** Proportion of food items encountered in the sampling stations**Figure 8.** Activity Pattern of Cattle Egret in JOSTUM**Table 5.** Correlation matrix showing the relationship of cattle egrets feeding rate and association with cattle in the study area

	Feeding rate	Within herd	Solitary	Forelimbs	Hindlimbs	Backtop
Feeding rate		<i>0.2678</i>	<i>0.4685*</i>	<i>0.6669*</i>	<i>0.9294*</i>	<i>0.0000</i>
Within herd	0.114		<i>0.0006</i>	<i>0.1786</i>	<i>0.6449*</i>	<i>0.9000*</i>
Solitary	0.075	<b>0.346</b>		<i>0.7380</i>	<i>0.8753*</i>	<i>0.1819</i>
Forelimbs	-0.044	0.138	0.035		<i>0.0020</i>	<i>0.0038</i>
Hindlimbs	-0.009	0.048	0.016	<b>0.312*</b>		<i>0.6414*</i>
Backtop	<b>-0.393*</b>	-0.013	-0.137	<b>0.293</b>	0.048	

\*Correlation coefficients (CCo) are on the lower diagonal while the probability levels are on the upper diagonal (italics). Significant correlations are shown in bold type.

#### 4. CONCLUSION

The following conclusions can be drawn from this study;

1. The study revealed high population density of cattle egrets in the study area.
2. Cattle egret feed more successfully when foraging within cattle flock than when they fed solitarily. The foraging success was related to insect abundance especially grasshopper.
3. A positive correlation exists between the feeding rate of solitary egrets and those within herd of cattle, the hindlimbs, forelimbs and back-top with forelimbs, while a negative correlation exists between the feeding rate at back-top of the cattle.
4. There is need to develop holistic approach for ecological study of cattle egret and to halt further decline in the population of cattle egrets in order to improve its conservation status.

#### REFERENCE

- Bindya, M.C. (2019). Cattle egret and grazer- story of their relationship, Science Reporter. Pp 34-35.
- BirdLife International (2014). (*Egretta garzetta*). IUCN Red List of Threatened species. Found at

<https://en.m.wikipedia.org/wiki/Dorset>. Accessed December 31, 2015

- Chaskda, A.A. Iniunam, I.A. Dami, D.F. and Mwansat, G.S. (2018). Aging Success of the Cattle Egret *Bubulcus Ibis* in Relation to Insect Abundance, Herd and Flock Size, *Journal of Research in Forestry, Wildlife & Environment* 10(1):41-45, <http://www.ajol.info/index.php/jrfwe>
- Elizabeth, M. (2019). An exploration into the relationship between Cattle Egret (*Bubulcus ibis*) behaviour in a desert and urban habitat in Lanzarote. With a focus on Cattle Egret association within a mixed goat and sheep herd. B16110- Dissertation, Uniniversity of Chester pp 3-40.
- Frederick, P. and Green, C. (2019). GoMAMN strategic bird monitoring guidelines: Wading birds. *Strategic Bird Monitoring Guidelines for the Northern Gulf of Mexico*. Starkville, Mississippi: Mississippi State University, 203-228.
- Halidu, S.K., Wahab, M.K.A., Ibrahim, A.O. and Chekezie, J. (2020) Food and Feeding Ecology of Cattle Egret (*Bubulcus Ibis*) in Federal College of Wildlife Management, New-Bussa, Niger State Nigeria, *International Journal of Progressive Sciences and Technologies (IJPSAT)* 22(2):152-156

- Harrell, F. E. and Dupont, C. (2021). Package 'Hmisc': Harrell Miscellaneous. R package version 4.5-0. <https://CRAN.R-project.org/package=Hmisc>
- Hockey, P.A.R., Dean, W.R.J., Ryan, P.G. (2005). *Roberts Birds of Southern Africa*. (7th ed.). Cape Town: John Voelcker Bird Book Fund.
- Krebs, E., Hunte, W., and Green, D. (2004). Plume variation, breeding performance and extra-pair copulations in the cattle egret. *Behaviour*, 141(4), 479-499.
- Ikyaaagba, E.T., Tee, T.N. Dagba, B.I., Ancha, U.P, Ngibo, K.D., Tume, C. Tree composition and distribution in Federal University of Agriculture Makurdi, Nigeria. *Journal of Research in Forestry, Wildlife & Environment*. 2015;147-157.
- John, J.R., and Kagembe, Q. (2022). Avian community changes along an urbanization gradient in Dar es Salaam, Tanzania, with a reversed trend for alien species. *Scopus: Journal of East African Ornithology*, 42(1), 1-20.
- Metallaoui, S., Dziri, H., Bousseheba, A., Heddami, S., and Chenchouni, H. (2020). Breeding ecology of the Cattle Egret (*Bubulcus ibis*) in Guerbes-Sanhadja wetlands of Algeria. *Regional Studies in Marine Science*, 33, 100979.
- Miller DL, Rexstad E, Thomas L, Marshall L, Laake JL (2019). "Distance Sampling in R." *Journal of Statistical Software*, 89(1): 1-28. doi:10.18637/jss.v089.i01
- Mukherjee, A. (2000). Adaptiveness of cattle egret's (*Bubulcus ibis*) foraging. *Zoos' Print Journal* 15(10): 331-333.
- Patankar, P., Desai, I., Shinde, K., Suresh, B. (2017). Ecology and breeding biology of the Cattle Egret *Bubulcus ibis* in an industrial area at Vadodra, Gujarat. - *Zoos' Print Journal* 22(11): 2885-2888.
- Palomar, C. J. P. (2001). Datos sobre la biología reproductora de la garcilla bueyera *Bubulcus ibis* (L.) en Lanzarote, Islas Canarias (Aves, Ardeidae). *Vieraea: Folia scientiarum biologicarum canariensium*, (29), 97-102.
- R Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.
- Seedikkoya, K., Azeez, P.A. and Shukkur, E.A.A. (2005). Cattle Egret *Bubulcus ibis* habitat use and association with cattle. *Forktail*, 21, 174– 176.
- Yager, G.O., Agbidye F.S., Okoh, A.O. (2016). Diversity and abundance of butterfly species (Lepidoptera) fauna in Federal University of Agriculture, Makurdi Forestry Nursery, Benue State, Nigeria. *Journal of Research in Forestry, Wildlife & Environment*. 8(3). Available:<http://www.ajol.info/index.php/jrfwe>