Population Status, Feeding Behaviour and Habitat Preference of Helmeted Guinea Fowl (*Numida meleagris*) in Surrounding Vegetation of Cross River University Technology, Obubra Campus

ABSTRACT

The population status, feeding behaviour and habitat preference of the helmeted guinea fowl (*Numida meleagris*) were investigated in this research. The period of carrying out the research comprised from january to october, of 2021. The line transect method was used to collect data on the population status of the species. The quadrate vegetation sampling method was used to investigate the preferred habitat. Data generated from the research were analyzed using descriptive statistics, while results were compared using chi-square (X^2) test, one way Analysis of Variance and t-test. The average number *Numida meleagris* in the study area was 434 and 293 during the wet and dry seasons, respectively. The most important daytime activities of the species were feeding, resting, scanning and running. The observed population differ significantly across sectors during the wet and dry seasons (X^2 = 8.00, p = 0.03). The relationship between allocated time to each activity and time of the day was greatly significant (X^2= 4.04, p = .001). The number of individuals was 3.0±4.0 and 5.0±0.2 individuals/km^2 during the dry and wet seasons, respectively. The importance value index (IVI) for *Gmelina arborea, Tectona grandis* and *Elaeis guineensis were* 24.41, 20.39, and 18.17, representing the dominant plant species in the study area. Human disturbance was responsible for loss of habitat, nesting and foraging sites. Protection of the habitat against exploitation will reduce poaching habitat destruction, and restore its nesting sites, thereby increasing its population.

Keywords: Population size, density, dynamics, habitat, characteristics.

1. INTRODUCTION

The helmeted guinea fowl (*Numida meleagris*) is a bird species of the *Numididae* family. They are terrestrial birds capable of strong flight, but prefer to run often than fly. The species are highly polygamous and form breeding pairs [1]. The species eat mostly grubs, roots, tubers, small reptiles, crawling insects, and occasionally vegetables and fruits. The species is found in many African countries such as Senegal, Gambia, Guinea, Sierra Leone, Mali, Burkina Faso, Ghana, and Nigeria, as well as in sub-tropical and tropical Savannahs, grasslands, and shrub land [1].

Though the species is classified by the International Union for Conservation of Nature (IUCN) [2] as least concerned (LC), because of their abundance and extensive range. The increase of the human population, conversion of land for agriculture, burning and environmental degradation have resulted to the decline in the population of the species [3]. The helmeted guinea fowl is also found within the vegetation area in Obubra campus of Cross River University of Technology (CRUTECH), located in Nigeria. This supposedly protected area is exposed to anthropogenic activities by the locals.

Though the species is wide spread and sparingly distributed in areas where it occurs, the current status of its population, feeding behaviour and habitat preference, as well as its management problems as it relate to human interference are still poorly reported [4]. This is necessary to prevent the decimation of the species population, emigration to other unsafe areas, and possible extermination. For effective conservation strategies to be adopted, understanding the status of the population as well as the habitat preference of the helmeted guinea fowl is desirable. This study is therefore designed to estimate the population density, feeding behaviour, and habitat preference of the helmeted guinea fowl in the study area [16].

Birds generally are good indicators of the quality and health of ecosystems. The helmeted guinea fowl is an important component of the ecosystem. The demand for agricultural land couple with visible anthropogenic activities like hunting of animal for bush meat, decimation of habitats for agricultural and other land development purposes, as well as its use as fuel wood is alarming [4].

These constitutes the major factors threatening the survival of the helmeted guinea fowl within its range, thereby mounting pressure on the species population and its habitat. There is yet no study on any species of guinea fowl in the study area, but its population in other parts of Africa, Asia and Europe is reported to be declining [1].

This study can provide useful information for effective planning, monitoring and evaluation, while guiding experts on which conservation measures to adopt. This can reduce emigration of species

to unsafe areas, maintain a balance in its population if not increase it numbers, and ensure the protection of the species and its habitat [13].

2. MATERIALS AND METHODS

2.1. Study area

The study was conducted in the surrounding vegetation of Obubra campus of Cross River University of Technology. The area comprehends 1115km^2 [5], and is located between latitude 5^0 45$^'$ and 6^0 15$^'$ North of the equator and longitude 8^0 12$^'$ East. The climate is characterized by distinct wet and dry seasons, with an annual rainfall distribution of between 2500mm to 3000mm, and an annual temperature ranging from 25 - 27^{0}C [6].

2.2. Sampling techniques and experimental procedure

Preliminary survey was conducted to determine the potential location of the species using the line transect method. This method involves walking and recording species on both sides of a predetermined route. In transect distance estimation is perpendicular to the line transect, rather than the distance from the bird to the observer following the method proposed by Hosteler & Main [7]. The area was divided into four (4) sectors; Northern (N), Western (W), Eastern (E) and Southern (S).

Three (3) transects each measuring 3km and 10m in width were laid following the method of Blendinger [7]. in upland agricultural field (UAF), lowland swamp field (LSF) and secondary forested area (SFA) in each of the sectors respectively. Each transect (1.5km) in a 10,000km^2 area was walked simultaneous with trained assistants for sixty minutes to avoid double counting [14].

Data was collected periodically, between morning (6:30am), afternoon and evening (6:30pm), being three months each in the rainy season and dry season. The species abundance was recorded using the visual and call method [20]. Silent movement followed by five minutes waiting was allowed before the commencement of the survey to avoid habitat disturbance [8]. The

materials used include binoculars, field note books, pencils, biros, stopwatches, identification guides, data recording sheets, protective clothing, and measuring tape.

2.3. Estimating population

Data was collected consecutively for three days every month for ten (10) months, between morning (6:30am), afternoon and evening (6:30pm). The direct method, involving the transect method and indirect methods, approaching calls and visual observation were employed in population estimation. The population density was determined using the formula (equation 1) proposed by Asokan et al. [8].

$$D = N / 2 \times L \times W \qquad \text{(Equation 1)}$$

Where: D = estimated density of the species, N = number of the species detected, L = total transect W= width of transect

2.4. Feeding behaviour

Time spent and activity carried out during foraging, time of day, length and site of perching, preening, resting, and flying will be recorded using field observations approaching the methodology proposed by Shimelis and Afework [9]. The focal sampling method was used repeatedly to watch and follow the species for ten minutes, early in the morning and late in the evening. Additionally, type of food items consumed were recorded.

2.5. Habitat preference

Major plant species were collected and identified using the quadrate method as described by Schemnitz [10], and with the support of a plant taxonomist. Three quadrates measuring 10m x 10m for the secondary forested area, 4m x 4m for upland agriculture field and 2m x 2m for lowland swam field were used [11]. Relative density (RD), relative frequency (RF) and relative dominance (RDO) for plants was determined by the equations 2, 3 and 4, respectively;

Relative density (RD) = Density of a species / total density of all species * 100 (Equation 2)

Relative frequency (RF) = frequency of a species / total frequency of all species * 100 (Equation 3)

Relative dominance (RDO) = dominance of a species / total dominance of all species * 100 (Equation 4)

2.6. Data analysis

The one-way analysis of variance test (one-way ANOVA) was used to analysis and interpret the data from different habitats, and population, while the Chi square (X^2) and t-test using was used for comparison of population densities across sectors, seasons and habitats at a significant level 95% significant level. The importance value index (IVI) for tree species in each transect was calculated using the equation 5 [12];

IVI = RD+ RF+ RDO (Equation 5)

Where: IVI: importance value index; relative density (RD); relative frequency (RF); relative dominance (RDO)

3. RESULTS

3.1. Population Size of Helmeted Guinea Fowl in the study area

For the wet and dry seasons, a total of 727 helmeted guinea fowls were recorded. The Eastern sector had the least number of birds, while the highest number was recorded in the Southern sector, followed by the Northern sector (Table 1). The total number of guinea fowls in the study area was significantly different (X^2 = 8.00, p = .03**)** in both the wet and dry seasons (Figure 1).

Table 1. Population size (n) of helmeted guinea fowl in the different sectors of the Obubra campus of Cross River University of Technology, Nigeria. N, W, E, and S = Northern, Western, Eastern and Southern sectors.

	Sector				
Season	N	W	E	S	**Total**
Wet	136	65	72	161	434
Dry	93	77	47	76	293
Total	229	142	119	237	727

Mean	114.5±21.5	71.0±6.0	59.5±12.5	118.5±42.5	363.5±70.5

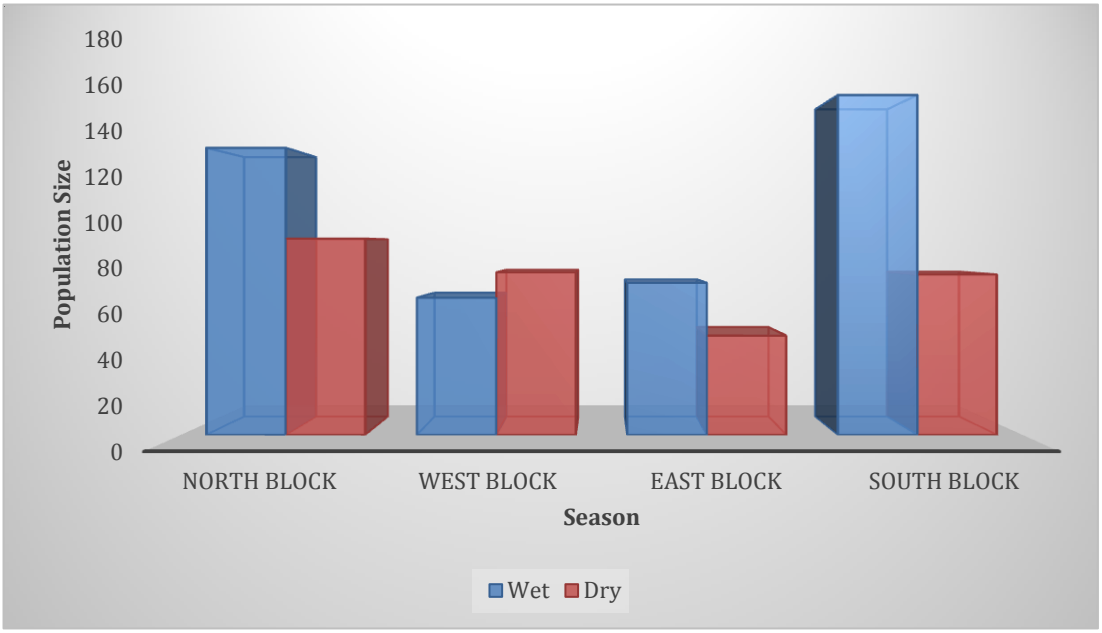

Figure 1: Population of *Numida meleagris* comparison with wet and dry season and location of transects in the Obubra campus of Cross River university of Technology, Nigeria.

3.2. Feeding/behavior pattern of helmeted guinea fowl in the study area

The species feeds mostly on insects, worms, and fresh grasses especially. During wet and dry seasons the activities observed were flying, resting, scanning, feeding, and running, with feeding being the most important activity (Figure 2). There was a significant difference in the feeding and behavioral pattern of the helmeted guinea fowls in both seasons (t = 4.04, p = .001**)** (Table 2).

Table 2. Time spent on different activities according to time of day. X^2 = *Chi-Square test*, *P= Prob. value*

Activity	Time of day (% of hours)					
	6:30-9:30	9:30-12:30	12:30-15:30	15:30-18:30	**X^2 = 4.043**	**P = 0.001**

Flying	7	6	3	12
Resting	9	8	61	7
Scanning	8	14	22	10
Feeding	68	65	6	66
Running	8	7	8	5

Source: Field Survey (2021)

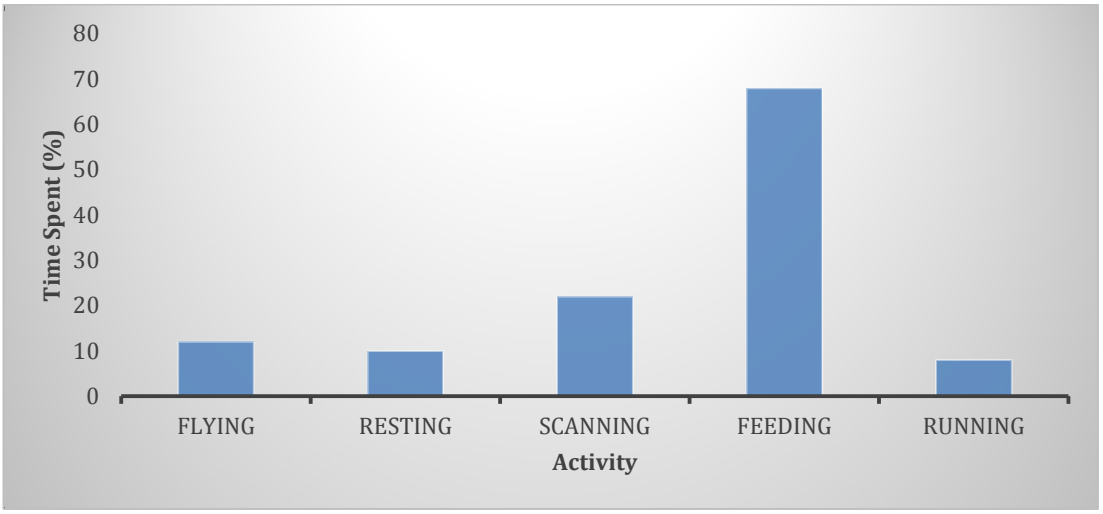

Figure 2: Percentage seasonal activity pattern of *Numida meleagris* in the study area

The population (n) of helmeted guinea fowls were higher during the wet season and in upland agricultural fields compared to the dry season across the habitats (Table 3).

3.2. Habitat Preference/Plant Species Composition of Helmeted Guinea Fowl according to seasons

The helmeted guinea fowls observed showed preference for upland agricultural field, compared to the lowland swamp field and the secondary forested area in both dry and wet seasons (Table 3). There was a significant relationship between the species population across the seasons and habitats.

Table 3. Seasonal variation in number of individuals of helmeted guinea fowl in the different habitats.

Habitat type	**Season**

	Wet	Dry	Mean±SE
UAF	243	176	209.5±33.5
LSF	168	98	133.0±35.0
SFA	23	19	21.0±2.0

Where: UAF= upland agricultural field, LSF = lowland swamp field, SFA = secondary forested area, SE = standard error. Source: Field Survey (2021). Significant relationship existed between seasons and across habitats (X^2 = 12.0, p = 0.02).

Gmelina (*Gmelina arborea*), teak (*Tectona grandis*) and oil palm (*Elaeis guineensis*) were the most dominant plant species observed, across habitats during the study (Table 4).

Table 4. Plant species in the three selected habitats in the study area.

Family	**Species**	**RD**	**RF**	**RDo**	**IVI**
Combretaceae	*Terminalia ivorensis*	5.3	5.3	0.03	10.63
	T. superba	5.3	2.6	0.01	7.91
Makvaceae	*Tripochiton scleroxylon*	5.3	4.3	0.02	9.62
Moraceae	*Milicia excelsa*	5.3	3.9	0.02	9.22
	Treculia africana	5.3	0.7	0.00	6.00
Sterculaceae	*Cola nitida*	5.3	2.9	0.02	8.22
	C. gigantean	5.3	4.9	0.03	10.23
Anacardiaceae	*Magnifera indica*	5.3	3.6	0.02	8.92
Lamiaceae	*Gmelina arborea*	5.3	19.0	0.11	**24.41**
	Tectona grandis	5.3	15.0	0.09	**20.39**
Arecaceae	*Elaeis guineensis*	5.3	12.8	0.07	**18.17**
Fabaceae	*Tetrapleura tetraptere*	5.3	1.9	0.01	7.21
	Parkia biglobosa	5.3	2.3	0.00	7.60
	Afzelia african	5.3	0.9	0.00	6.20
Leguminosae	*Pterocarpus mildbraedii*	5.3	3.9	0.02	9.22
	P. osun	5.3	6.9	0.04	12.24
Burseraceae	*Dacryodes edulis*	5.3	1.9	0.01	7.21
Irvingiaceae	*Irvingia gabonensis*	5.3	5.2	0.03	10.53
Rutaceae	*Citrus sinensis*	5.3	2.6	0.01	7.91
Total	**19**	**100.7**	**100.6**	**0.54**	**201.84**

Where: D = density, F = frequency, RF = relative frequency, RDO = relative dominance, IVI=importance value Index. Results are for D/10m^2, D/4m^2, D/2m^2. Source: Field Survey (2021)

4. DISCUSSION

The study showed that the species was generally abundant in the study area, the number of helmeted guinea fowls observed showed variations across sectors with the southern sector having the highest population, closely followed by the northern sector.

The high population recorded in this sectors may have been due to the availability of food and water in the area as stated by Sajid et al [3]. The highest density of the species was recorded during wet season, between the months of june and september. During this period, there is abundant food and breeding activities of bird species as described by Tewodros and Afework [15]. However, the low densities recorded in eastern and western sectors was majorly due to habitat disturbance, crop cultivation, subsistence hunting and predation [19].

The helmeted guinea fowl feeds largely on invertebrates such as centipedes, ants, termites, spiders, beetles, slugs, snails and worms, most of which are usually in abundant during the wet season. The upland agricultural field was most preferred by the species during both seasons, followed by the lowland swamp field. This can be related to the availability of different species of invertebrates for consumption by the species [17].

The species also utilizes swamp areas for drinking water during evening hours, and for rest when the weather is extremely hot [18].

Low numbers of the species were observed in the secondary forested area. The helmeted guinea fowl usually prefers open space for feeding, shelter, escape from predators and mating. Nevertheless, the selectivity preference of this species was greatly dependent on varied environmental and anthropogenic factors within the surrounding vegetation of the study area as emphasized by [7].

The presence of *Gmelina arborea*, *Tectona grandis* and *Elaeis guineensis* as the dominant plant species in the study area is an indication that the area is highly disturbed [15]. This is because the species are exotic and mostly found areas that are highly degraded [12]. The disappearance of the helmeted guinea fowl habitat was a result of persistent agricultural activities, local poaching and habitat changes resulting from annual bush burning, erosion and other anthropogenic activities.

5. CONCLUSION

The helmeted guinea fowl population is adversely affected by both anthropogenic and environmental factors. The species population is under threat of man's interference in the form agricultural activities and hunting of the species for meat. The low numbers and population density recorded are indicative of depleted and disturbed habitats. The protection of the species habitat through demarcation and fencing can ensure the protection of the species and increase its population, restore its habitat and influence the ecosystem positively.

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COMPETING INTERESTS

Authors hereby declare that they are no competing interests with regards to this study.

AUTHOR'S CONTRIBUTION

This study was carried out by all authors. The study design and etiquette was written by the first author. Data collection, handling and processing was jointly handled by all authors, while the first draft was written by the second author. The third author reviewed all relevant literatures, while the first author handled the data analysis aspect of the study. The final manuscript was read and approved by all authors.

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