African Journal of Environmental Science and Technology Vol. 7(1), pp. 49-55, January 2013
Available online at http://www.academicjournals.org/AJEST
DOI: 10.5897/AJEST12.204
ISSN 1996-0786 ©2013 Academic Journals

Full Length Research Paper

Population status, feeding ecology and activity pattern of helmeted guinea fowl (*Numidia meleagris*) in Abijata-Shalla Lakes National Park

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Accepted 7 January, 2013

This study documents the population status, feeding ecology and activity pattern of helmeted guinea fowl (*Numida meleagris*) in Abijata-Shalla Lakes National Park. Data were collected in 2011 during the dry and wet seasons. Direct observation including focal observation and scan sampling methods were used to collect data to study the feeding ecology and activity patterns. Total count method was used to study the population status. Data were analyzed using descriptive statistics, and results compared with Chi-square test and one way ANOVA. The mean number of helmeted guinea fowl in the study area was 225 during the dry season and 208 during the wet season. Helmeted guinea fowls were omnivores during both seasons. The species prefers insects during wet season (71.6%) and largely consumes nodes and seeds of grasses during the dry season (75.2%). Feeding was the most important diurnal activity, followed by scanning, flying, resting and preening. There was a strong relationship between time allocated to each activity and time of the day. Group size ranged from 2 to 21 individuals. These birds were affected primarily by the loss of foraging and nesting habitat and by human disturbance. Different conservation measures should be taken to enhance the number of helmeted guinea fowl by creating suitable habitat.

Key words: Diurnal activity pattern, foraging ecology, helmeted guinea fowl, population.

INTRODUCTION

Understanding the population status of the helmeted guinea fowl is necessary for developing effective management strategies to ensure healthy population and to wisely manage human helmeted guinea fowl interactions. There are six guinea fowl species that occur only in Africa and Arabia (Urban et al., 1986). These include black guinea fowl, white-breasted guinea fowl, helmeted guinea fowl, plumed guinea fowl, crested guinea fowl and vulturine guinea fowl. Crowe (2000), used a simple classification of *Numida meleagris* involve-ing nine well-marked subspecies, which fall into three groupings: West African *N. m. galeata* and *sabyi,* East African *N. m. meleagris* and *somaliensis,* and Central-South African *N. m. reichenowi, mitrata, marungensis, papillosa* and *coronate* (Crowe, 1978).

The conspicuous horny "helmet" on top of their naked heads distinguishes helmeted guinea fowl from others. The helmeted guinea fowls are a species of terrestrial which preferred warm, fairly dry and open habitats with scattered shrubs and trees and farmland (Grafton, 1970). On their feeding habit they are omnivorous consuming a variety of animal and plant food items (Mentis et al., 1975).

Helmeted guinea fowl is a sub-Saharan species but recent information shows there is significant decline in parts of the range in relation to due to habitat destruction and hunting for their meat (Church and Taylor, 1992). Helmeted guinea fowl *N. meleagris* occur in different

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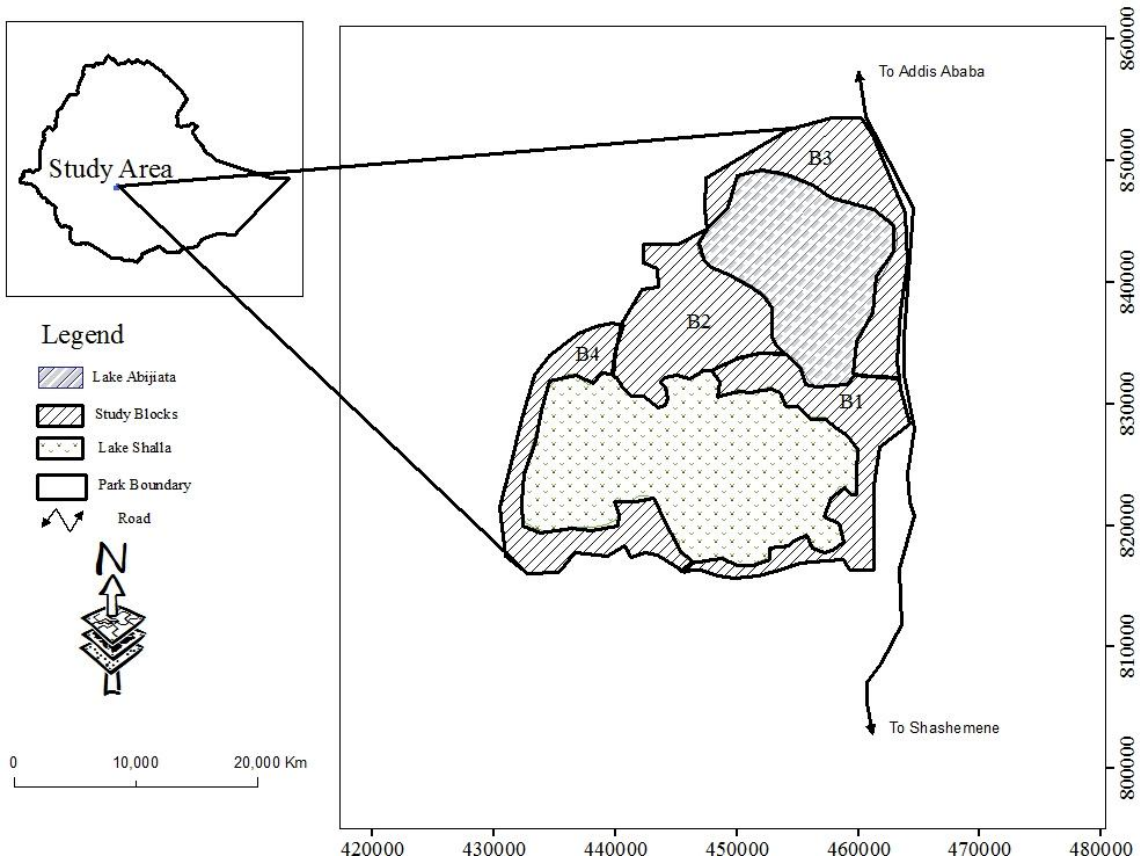

Figure 1. Map of Abijata-Shalla Lakes National Park and the study area.

parts of the Ethiopia. However, the current population structure, feeding ecology and activity pattern of the birds and its conservation problems in relation to human impacts are still poorly known for this species. As a result, this paper aims to analyses the population, feeding and activity of these birds.

Study area

The specific site lies between the coordinates of 7° 15'45' and 38° 30' to 38° 45'E; at about 207 km south of Addis Ababa. Abijata-Shalla Lakes National Park (ASLNP) comprises two types of ecosystems, namely the water part (482 km^2) and land (405 km^2) together covering a total area of 887 km^2 (Figure 1) (Senbeta and Tefera, 2001). The vegetation zone of the study site is generally classified as savannah grassland. The habitat surrounding the lakes in the park is largely dominated by Acacia and Fiscus savannah, Acacia-Ephorbia wood lands and open scrub on the rocky slopes (Mohammed, 1993). The climate of ASLNP is favorable for visitors and residents. Rainfalls period is between June and September, averaging 500 mm (Gebre-Mariam et al., 2002). Average annual temperature is 20.10°C; with a mean maximum of 26.60°C and mean minimum of 13.50°C (EWNHS, 1996). The Park possesses high bird species diversity, endemic and abundant wetland birds and large concentration of birds in Lake Abijata (Urban et al., 1986). It consisted of 200 000 water birds including globally threatened species (Gobena, 2008). A total of 436 bird species was recorded from the Park (Wako, 2009). Of these, 144 bird species were wetland and 292 were terrestrial species. In addition to bird's fauna, the savannah habitat provides homage to 76 mammal species (Debushe and Itana, 2010). And it has six endemic mammals' species including Scott's Hairy Rat, white toothed shrew, Mahomet's Mouse, Ethiopian Grass Rat and Harrigton's Scrub Rat (Tefera and Almaw, 2002). The Park also harbors human settlement as well. As a result, an extensive area of the Park was disturbed for expansion of agricultural land and livestock grazing.

METHODS

Data collection was conducted during the dry (March to May, 2011) and wet (June to August, 2011) season. The Park area was divided into four counting blocks (Figure 1) based on the vegetation struc-

Table 1. Counted population size of helmeted guinea fowl.

Season	Block				
	B_1	B_2	B_3	B_4	Total
Dry	120	30	49	26	225
Wet	87	23	58	40	208
Mean	103.5±7.34	26.5±2.61	33±3.78	53.5±4.2	216.5±5.43

ture, artificial and natural boundaries (small gorges). Block 1 (B_1) consisted of open grassland while Block 2 (B_2) had wooded grassland. Block 3 (B_3) possessed large well branched tree and dense bush. Block 4 (B_4) include open Acacia woodland dominated Acacia tortilis and farmlands. Both transect line walk and point count methods, as appropriate, were used on the study blocks based on the habitat types. The length and width of the transect lines were determined based on the size of blocks (Pomeroy, 1992; Sutherland, 1996; Aynalem and Bekele, 2008). Point count method was conducted standing at a particular point for a fixed time using direct observation through binoculars (Bibby et al., 1998). To avoid double counting, routes were spaced (Niemuth et al., 2006). To minimize disturbance during counting, silent movement followed by 3 to 5 min of waiting period was allowed to settle down from any disturbance (Hosteler and Main, 2001). Video recordings and pictures were taken for further confirmation. Census data were collected twice a day, morning (6:30 to 10:00 a.m.) and late afternoon (4:30 to 6:00 p.m.). These were the periods where most of the avian species were most active (Sutherland, 2000).

To collect data about the foraging behavior of the helmeted guinea fowl, repeated standard observations were used (Johnsgard, 1986). Time spent on foraging was recorded using focal sampling following Bhatt and Kumar (2001). Focal sampling method was used repeatedly for different individuals. Focal sampling consists of watching an individual for 10 min. Using this method, data on the type of food items consumed were designated as plant food, worm, insects, frogs, lizards and other invertebrates. Time spent for foraging, activity carried out during foraging time of the day and lengths of perching site were recorded. Individual bird was followed at a distance of 5 to 15 m. The foraging behavior of individual birds was followed for longer time following Bonkoungou (2005). Data were collected early in the morning from 6:30 to 10:00 a.m. and late in the afternoon from 2:00 to 6:00 p.m. when most of the avian species were active during the dry and wet seasons (Williams and Arlott, 1980; Buskirk and McDonald, 1995). The activities were divided into five major categories:

i. Scanning: perched in an upright position and scanning the surroundings actively,
ii. Flying: in flight, often in pursuit of prey,
iii. Feeding: capturing prey and swallowing into the buccal chamber,
iv. Preening: comfort movements including feather shaking, wing flapping, bill cleaning, bill scratching, and body shaking and tail shaking, and
v. Resting: perched sleeping or dozing with head retracted and eyes closed.

Data collected were analyzed using SPSS version 16 computer software programme. Data were analyzed using descriptive statistics and responses compared using chi-square test and one-way ANOVA. Kruskal-Wallis test was performed to compare activities between time blocks, seasons and habitats. Significance of all tests were assessed at $\alpha = 0.05$.

RESULTS

Seven total counts were undertaken during the study period. A total of 216 helmeted guinea fowls were observed during both seasons. The number of birds in B_1 was the highest, followed by B_3 and least in B_2 (Table 1). There was a marked difference in the total number of helmeted guinea fowl counted during the dry and wet seasons (x^2=6.31, p=0.010) (Figure 2). The density of helmeted guinea fowl in the area is 7 to 11 birds/km^2. But this large area comprised of very small population of helmeted guinea fowl was due to human impact on their habitat and on the bird itself. Direct observation, video and film images revealed that helmeted guinea fowl were omnivores on their feeding habit during both seasons. The species prefers insects during the wet season (71.6%) and largely consumes nodes of grasses during the dry season (75.2%). There is a significant difference on their feeding strategy on the two seasons (x^2=33.54, df=1, P=0.004). Their feeding habitat is shown in Figures 3a and b. Data on the various activities recorded throughout the study period have been condensed into 6 major activities (Figures 3 and 4). Data from 20 days (wet and dry seasons) continuous contact provide 240 h of quantified observations. Feeding comprised 63.15% of the activity budget over the study period. It comprised 70.25 and 56% of the time during the dry and wet seasons, respectively (Figures 4 and 5). There was a significant difference between the two seasons in feeding (x^2=11, df=1, p = 0.044). The times spent on resting (x^2= 16.3. df= 1, P=0.025, scanning (x^2=2.34, df= 1, P=0.032) and preening (x^2= 5.13, df=1, P= 0.014) also showed significant differences during the dry and wet seasons (Figures 4 and 5). Helmeted guinea fowls fed least during the wet season (56 %) and most during the dry season (71 %). Flying and running (X^2=3.51 df=1, p=0.41) usually was higher during the wet season but statistically not significant.

Feeding was the most important diurnal activity, followed by scanning, flying and running, resting and preening. There was a strong relationship between time allocated to each activity and time of day. Feeding activity varied among daylight hours and was higher in the morning (72 ± 3.21 %) and afternoon (70 ± 3.64 %) than that of mid-day (8 ± 0.66 %) (Table 2). The peaks in flying were similar to the peaks in feeding in all the time blocks

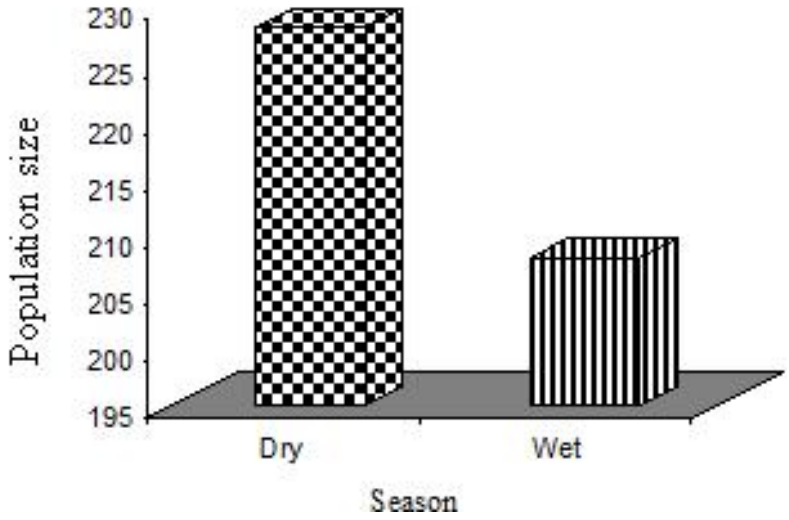

Figure 2. Comparison of helmeted guinea fowl counted during both seasons.

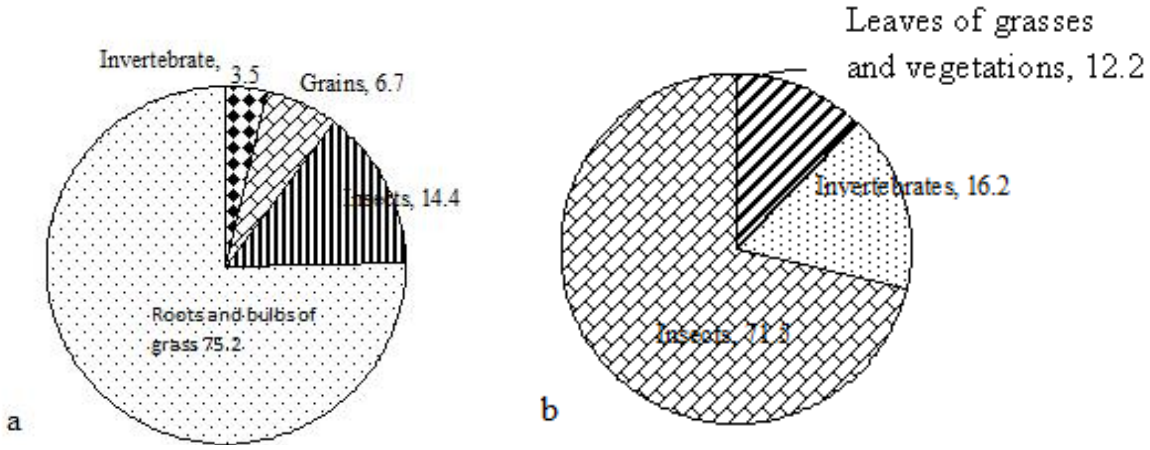

Figure 3. (a) Diet of helmeted guinea fowl during the dry; (b) wet season.

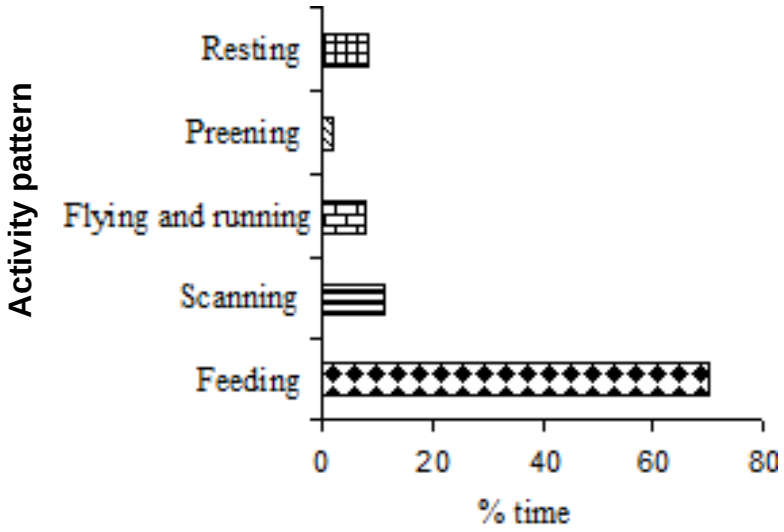

Figure 4. Percentage time spent on different activities during the dry season.

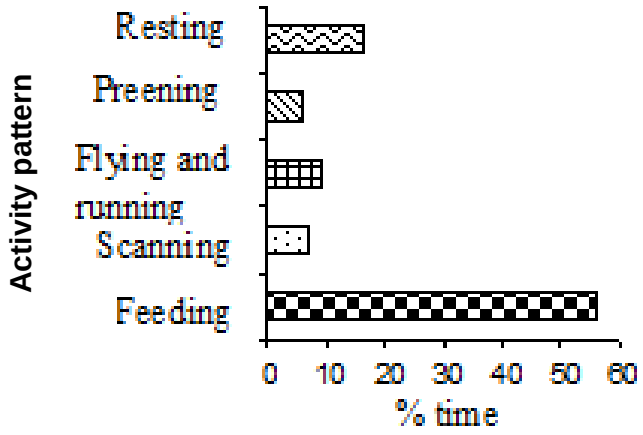

Figure 5. Percentage time spent on different activities during the wet season.

Table 2. Percentage of time spent (mean ± SD) on different activities by time of day**.**

Activity	Time of day (h)					
	6-9	9-12	12-15	15-18	H	P
Feeding	72±3.21	66±3.30	8±0.66	70±3.64	40.11	0.000♦
Scanning	9±4.21	14±1.47	24±1.96	12±2.14	56.63	0.045♦
Flying and running	13±4.40	11±2.66	2±1.05	10±0.54	12.54	0.000♦
Preening	2±1.2	3±2.04	6±0.47	3±1.23	44.63	0.000♦
Resting	4±0.47	6±0.08	58±4.10	5±0.71	61.12	0.000♦

♦, Differ significantly (Kruskal-Wallis test, $p < 0.05$) between time blocks.

of a day and scanning, preening and resting were higher during the mid-day. Scanning was the highest time consuming diurnal activity for helmeted guinea fowl. The bird was observed to spend more time in search of food. Within the time blocks, scanning activity was greater during late morning (9 to 12 h) and mid-day (12 to 15 h) and differed between time blocks. The availability of insect prey was lowest during the above period and they spent additional time in scanning for prey. Feeding was also comparatively less in the above time blocks.

The mean monthly flock size showed variation with month and was high between the months of March and April (24 ± 4.3 birds per group) to a low in August (6 ± 2.1 birds per group). Most vegetation undergoes seasonal changes in habitat structure and food abundance and these changes influence their flock size in the park area. As the wet season begins, the large flocks were split into smaller flocks and were distributed widely in the park area for breeding. Rounded wings make the bird poorly equipped for long flights. The helmeted guinea fowl occasionally flies up into trees if chased by a predator. These birds are affected primarily by the loss of feeding and nesting habitats. The habitats of helmeted guinea fowls are degraded through intensive livestock grazing, settlement or agricultural expansion, or modified through human activities, such as, selective removal of vegetation for firewood and fence. They suffer locally from hunting pressure. They have numerous predators such as dogs, raptors, monkeys and other mammals which take the eggs and the chicks, and sometimes kill the adults.

DISCUSSION

The number of birds counted showed block wise variations with block 1 supporting highest populations followed by block 3. According to Hayes and Krausman (1993), terrestrial animals seek their habitats rather than dispersing randomly and birds are no exception. The greater number of helmeted guinea fowl in block 1 might be due to the relatively rich supply of food due to low disturbance rate, since it is close to the head quarter and also because of the provision of food (for ostrich) and water. This agrees with Brown et al. (2001), that species show a tendency to be confined to the habitat where they get their feeding and nesting sites.

Vegetation complexity has been shown to be strongly correlated with the structure of avian communities. In block

3, large well branched trees and dense bush were recorded. Such complex vegetation may aid in protection from predators and provides suitable sites for nesting. The dependence of birds on vegetation and its effect on determining the diversity of feeding, breeding and hiding possibilities have been documented in numerous studies (Asokan et al., 2003). At the same time, there was a significant relationship between the bird and the physical structure of the vegetation in the B_3, it provides a safe breeding and more protection against predators for the guinea fowl. The low density of the bird in the area were related to increments of human population in the park feeding and breeding area of the area, setting wild fires and using natural resources illegally. Estimation of population size can provide a strong foundation for the conservation of bird species. Avian population number can be influenced by the singular or interactive influences of predation, intra- and inter-specific resource competition, parasites, diseases, habitat availability and weather (Asokan et al., 2010). The low number recorded during the wet season was due to the wide range distribution of the bird and the growth of grass which decreases the conspicuous nature of the bird.

Animals exhibiting extreme selectivity in diet may be particularly vulnerable to problems associated with nutritional deficiencies and to environmental stressors and anthropogenic disturbances that impact their specific food requirements (Fielding and Haworth, 1995). In contrast, generalist species like helmeted guinea fowl that are able to exploit a wider range of food components may adapt better by adjusting their diet or shifting their ranging patterns. Helmeted guinea fowls are not migratory but do show some seasonal movement and are omnivorous feeders mainly on plant matter such as leaves of grasses, berries and fruits of bushes and small trees, and also roots and bulbs reached with the strong bill by digging out the underground food items. They largely feed on insects, Arachneda (spiders), Orthoptera (grasshoppers), Hymenoptera (ants), Isoptera (termites), Coleoptera (beetles), Chilopoda (centipedes), Diplopoda (millipedes), Acarina (ticks), Gastropoda (snails) and egg shell by walking along, pecking on the ground and scratching with their feet. They also collect maize and other grains that are available on farm, but the birds are not considered pests because they feed only on fallen or discarded grains.

Activity time budget data are useful in studying the ecological, behavioral and physiological aspects of birds. A bimodal peak in the feeding pattern one during morning (6 to 9 h) and another during late afternoon (15 to 18 h) was observed. During the dry season, because of the mid-day heat, food was mostly available during the early morning. High feeding activity of helmeted guinea fowl during the late evening may reflect their need to obtain energy for overnight energetic requirements. The diurnal time of resting differed significantly between times of day and it always peaked at mid-day. Tamisier (1976), suggested that an increase in resting during midday is a mechanism to minimize the heat load on a bird at high environmental temperatures. Sleeping was the major diurnal resting activity mostly on dense trees. Departing from home base, the flock precedes toward a watering hole for a communal drink. Dominant males act as the leaders of the line and lookouts. After a drink, helmeted guinea fowls sweep the savannah. Walking shoulder to shoulder; they patrol the tall grasses and peck at the ground, randomly picking up food. During the dry season, they scratch the ground to expose highly nutritious tubers, bulbs and roots.

Variation observed in the group size and distribution during the wet and dry seasons was due to the changes of feed source. The group size aggregated more during the wet season than the dry season. The growth of different vegetation and a variety of insects immediately following the rainfall provided more food during the wet season and helmeted guinea fowls were distributed widely in all area in search of food. Their main habitat is grassland area and wooded grassland. There are several ways in which vegetation structure can influence habitat selection for bird species. Vegetation structure may impede the movement of foraging birds both physically and behaviorally and may influence foraging efficiency through its effects on the detectability and accessibility of food items.

The dependence of species habitat relationship on factors ranging from local vegetation structural features suggests that several processes operate simultaneously at different scales of influence. The present study showed the presence of strong interaction between the habitat type and helmeted guinea fowls. This indicates that certain habitat is very important for the survival of birds. During the dry season, farmland along the side of the Park was frequented by a large number of livestock. Helmeted guinea fowls are also observed on the farmland in association with cattle. This was to collect ticks and sown seeds.

ACKNOWLEDGEMENTS

We thank Addis Ababa University for the financial support and the Ethiopian Wildlife Conservation Authority for the permit. We are also grateful to the local people and the staff of the Park for the cooperation and help they have rendered during the period of field work.

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