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Birds species composition and abundance of a relativelly undisturbed vegetation at Mount Pati, Lokoja, Kogi State

Dauda Tanko* and Rita Chinweuba

Department of Biological Sciences, Federal University Lokoja, Kogi State. *Email: tyankwa2007@yahoo.com.

Abstract. Avifauna of a relatively undisturbed vegetation at Mount Patti of Lokoja was surveyed from January to June, 2018. Line transect and point count techniques were used for data collection. This was done by weekly visits to the site between 6:00 h and 10:00 h of the day. Bird identification was done with the aid of a pair of binoculars, Field Guide of birds of western Africa and recorded bird calls. Monthly variation and season variation in bird composition and abundance were compared using Shannon-Wiener diversity index and equitability index. There were 39 species in 21 families encountered during the survey. The Family Nectarinidae had the highest number of 5 species, followed by Columbidae and Estrildidae with 4 species each. A total of 1,148 individuals were encountered during the six months survey with village weaver having the highest encountered rate of 107 while yellow-throated Long-claw had the least encountered rate of 4 individuals. Fluctuation was observed in the monthly encountered rate of the birds. Diversity and equitability indices had their highest values of 5.24 and 1.51 in January. More birds (696) were encountered in the wet season than the dry season (452). Four species were seen only in the wet season. Species effort curve showed that there are more species to be discover. The number of species encountered in this study revealed that the mountain is rich composition of bird species, even though the site seems to favour species that show preference to disturbed areas. The on-going anthropogenic activities probably paved way to these species to move in. Monthly and seasonal fluctuation of bird species diversity and abundance may be due to a combination of physical and biological factors. The physical and biological factors observed at the site which we speculate could be reasons for the observed fluctuations include slash and burnt system of farming, fuel-wood harvesting, intensive sporting activities creation of foot paths etc. High encountered rate indicate abundance and high activity level of the species. The village weaver was the most encountered species probably because they are known to be lousy, move in flocks and breed in colonies. In view of the rich composition and abundance of bird species on Mount Patti and the site being a suitable breeding site for the weavers. We recommend further study of the place as there are yet more

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ORCID
0000-0001-6745-2333
Dauda Tanko
0000-0001-5343-7140
Rita Chinweuba

species to be discovered as indicated by the species effort curve. There is need for conservation procedures to be initiated at the place and this study should serve as a baseline to initiate such programme by the state government.

Keywords: Avifauna; Undisturbed vegetation; Mount Patti; Composition; Abundance.

Introduction

Birds forms a very important group of organisms, inhabiting almost everywhere on earth and serving the role of indicators of environmental health and conditions. Therefore, an environment that is healthy will witness a very abundant bird species as well as other organisms (Adang et al., 2015). Birds serve as pointers to universal biodiversity and one of the reasons is their ability to occupy almost every terrestrial, aquatic and mountainous zones (Birdlife International, 2000). Bibby et al. (2000) pointed out that birds are very easy to notice, serving various important functions, mostly as biological tools for education. The dispersal of seed is among the vital roles birds play in the ecosystem. Because birds are always on the move, seed dispersal by them is geographically widespread, thus, both the birds and the plants are taxonomically diverse. Bascompte and Jordano (2007) are of the opinion that plant and their avian dispersers form part of a complex mutuality network that is fundamental to maintaining biodiversity and community structure. Plants benefits in several ways like gene flow (Godoy and Jordano, 2001), escape from areas of high mortality (Harms et al., 2000), colonization of new sites (Shanahan et al., 2001), and direct dispersal to sites (Wenny and Levey, 1998). These and some other importance of avian seed dispersal contributes to the restoration and recovery of degraded lands (Lozada et al., 2007). Another important role bird species play in the ecosystem is cleaning of the ecosystem as scavengers. For instance, birds like the pied crow *Corvus albus*, through their scavenging activities contributes to the biomass recycling and to a large extent reduce the level of disposable wastes within the ecosystem (Judd et al., 2008). Studies have shown that the removal of carcass by scavengers is faster as compared to other means (DeVault et al., 2004). This was evident in the increased presence of rats and feral frogs in India when the Indian white-backed vulture *Gyps bengalensis*, long-billed vulture *Gyps indicus*, and slender-billed vulture *G. tenuirostris* reduced in population, leading to the accumulation of putrefying carcasses (Pain et al., 2003).

In the tropical regions, the mountains have been found to have very high composition of bird species and in association with other species within the habitat (Jankowski et al., 2009). The mountains notably support about 75% of birds' species and 45% of adapted habitat that have been modified by human activities (Birdlife International, 2008). Even though mountains have been found to have a high diversity of species, anthropogenic activities like lumbering, farming, etc., have been negatively affecting the natural habitat of birds' species, influencing their variety and variability (Benes et al., 2003). Though human activities have allowed the expansion of a few species of birds such as the barn swallows and the European starling, they have in no small way contributed to the decline or extinction of some other species (Fuller, 2000). The disturbances or total destruction of bird's habitat have been observed to be on the increase in recent times (Manhães and Ribeiro, 2005).

Most bird species are particular about their choice of habitat, and are influenced by various ecological

characteristics when it comes to chosen their habitat. They make preferential selection of vegetation, environmental characteristics and ecosystems. Therefore, any form of alteration on their chosen habitat may leads to their disappearance (Birdlife International, 2000). Composition, diversity and distribution of birds vary along the landscape because they are greatly influenced by variety of factors which may include habitat, topography, anthropogenic activities, climate, etc. (Jankowski et al., 2009). Tanko (2012) observed that continued reduction of habitat can lead to the disappearance of some local species mostly because their source of food has been disrupted. Some bird species feeds primarily on insects and hence are found inhabiting the ground especially during nesting, some other species feeds on aquatic organisms and so are often seen around water bodies. Therefore, these habitat factors limit their distribution and abundance. Tewes et al. (2004) observed that the arrangement of plant communities especially the vertical distribution of foliage influence the distribution and composition of birds more than the composition of plant species. Seasons also play a major role in the composition and abundance of birds as they have great effect on the foods and cover availability of birds, their breeding and finally their survival (Mengesha and Bakele, 2008). Also, the seasonal differences in the amount and duration of rainfall and temperature have effects on these birds and these may result in the alteration in the diversity, abundance and distribution of birds of an area. Though some birds are generalists and may utilize several habitats, Buckley and Freckleton (2010) noted that the differences in requirements among birds have led to specificity on habitat needs. For instance, the mountain plover *Charadrius mountainus* that feeds primarily on insects usually utilize the ground for nesting and have a preference for short grass while the Mongolian sand plover *Charadrius atrifrons* that feeds on invertebrates like worms, molluscs and insects like to use the tree for nesting and have preference for shore of the lake.

The pattern in the composition and abundance of bird species is vital to preservation and conservation of nature and therefore the need for studying birds as well as factors that affects their composition and abundance (Bibby et al., 1992). To many, mountains and inselbergs are seen as waste lands and as result are often neglected in terms of research. However, Tanko (2012) opined that they could serve as either source or sink to the threatened species. This aspect of source-sink importance have not been investigated at Mount Patti. To the best of our ability the only existing literatures in avifauna of the Lokoja area is the work of Tanko et al. (2017) and Adang et al. (20018) where they recommended an extensive study of the Mount Patti.

It is on this background that this study was designed to document species of the study area. This study will create the medium for understanding the composition and abundance of birds' species; and provide the baseline data for future referencing and serve as guide in the event of designing conservation and management strategies of the place.

Materials and methods

The study area

The study was carried out at mount Patti in Kogi State located in the Northern Central Nigeria. It is a flat-topped rocky terrain of about fifteen square kilometres and about 1,500 feet above the sea level (403 meters high). The mountain is located on latitude 7° 49'16.5" N and Longitude 6° 4' 10.0" E. The vegetation is mostly teak *Tectona grandis*, gmelina *Gmelina arborea*, *Daniella oliveri* the famous baobab tree *Adansonia digitata* and secondary forest of indigenous plants species. Figure 1 is the map of the study area.

Figure 1. Map of the study area. Source: GIS Lab, KSU (2007).

Method of sampling

The work was done during the dry (January to March) and rainy seasons (April to June) 2018. Point count and line transact methods described by Gibbons (1996) and Tanko (2012) were used to determine the diversity and abundance of the birds. Fifteen sampling points were predetermined at a distance of 100 m interval. These points were visited once in a week for sampling. The visits were carried out between 6:30 h and 10:00 h in the morning because birds are active during the early hours. On getting to each predetermined point, 2-3 min waiting period were given in order for the birds to settle in case of any disturbance in the cause of entering the place. Then about 5 min were used to count and record all birds seen or heard within 50 m radius. The identification of birds were done using field guide of birds of Tropical Western Africa, by Borrow and Demey (2004). The unidentified birds or their calls were recorded using a tape recorder for further identification by experts or by comparing with recorded bird calls.

The anthropogenic activities that could affect bird abundance and distribution

The anthropogenic activities were assessed using visual observation. In each of the visits, human related activities such as farming, fuel wood harvesting, debarking, bush burning, hunting, habitat modification and habitat fragmentation were observed. Representative photographs of these activities were taken.

Data analysis

Shannon Wiener Diversity Index and equitability index were used to compare the birds' abundance between the wet and dry seasons and between the months sampled.

$$Diversity\ index\ H' = -\sum_{i=1}^{R} Pi\ LnPi$$

and

$$\text{Equitability } E = {}^{H'}/_{LnS}$$

Where:
H = Maximum diversity
Pi = proportion of total sample represented by species *i.*
S = the number of species.
E = the evenness.

Results

The study revealed thirty-nine (39) bird species belonging to twenty-one (21) families and encounter rate of 1148 individuals. The Family Nectariniidae had the highest number of species of 5, followed by the families Columbidae and Estrildidae with 4 species each. Two of the 21 families had 3 species each, four others had 2 species each and the remaining 12 families had 1 species each (Table 1). Out of the 39 species encountered, *Ploceus melanocephalus* (village weaver) had the highest total number of individuals encountered (107) while *Macronyx croceus* (yellow-throated long-claw) with only 4 individuals encountered was the least (Table 2).

Table 2 is the monthly distribution of the bird species during the study months. The month of April had the highest number of individuals (252), and was followed by the month of June (234), while the month of January had the least number of individuals (137).

Figure 2 is the graphical representation of the seasonal distribution of bird species during the study while Figure 3 is the species effort curve showing the new species recovery per visit. More birds were encountered in the wet season than in the dry season with the wet season having 696 encountered rate while the dry season had 452 encountered rate. *Ploceus melanocephalus*, *Ploceus cucullatus*, *Macronyx croceus* and *Chlorocichla flavicolis* were present in the wet season but absent in the dry season (Table 3). The month of January recorded the highest diversity of 5.24 while the Month of April had the least diversity of 2.95. The dry and wet seasons diversities were the same (3.36 and 3.32, respectively).

The Equitability was highest in the month of January (1.51), followed by March with equitability of 0.95 while April with equitability of 0.81was the least. The seasonal equitabilities were the same with values of 0.94 and 0.91 for the dry and wet season respectively. Three species were seen to be stenotopic to that typical habitat. These were the Stone Partridge (associated with rocky habitats) Green Turaco and Veiolet Turaco (associated with the gallery forest).

Some of the anthropogenic activities at the site include: fuel wood harvest, lumbering, debarking of ethno-medicinal purposes; slash-and-burn system of farming and tourist activities. Figures 3-6 are photographical evidences of some of these activities.

Table 1. A checklist of bird species composition and abundance of Mount Patti.

S/no	Taxonomic group	Family	English Name	Scientific Name
1	Kites	Accipitridae	Yellow-billed kite	*Milvus aegyptius*
2	Partridges	Phasianidae	Stone partridge	*Ptilopachus petrosus*
3	Doves	Columbidae	Red-eyed dove	*Streptopelia semitorquata*
4	Doves	Columbidae	Black-bill wood dove	*Turtur abyssinicus*
5	Doves	Columbidae	Mourning dove	*Streptopelia decipiens*
6	Doves	Columbidae	Laughing dove	*Streptopelia senegalensis*
7	Coucals	Cuculidae	Senegal coucal	*Centropus senegalensis*
8	Hornbills	Bucerotidae	African grey hornbill	*Tockus nasutus*
9	Barbets	Bucerotidae	Yellow-fronted tinkerbird	*Pogoniulus chrysoconus*
10	Barbets	Bucerotidae	Yellow-rumped tinkerbird	*Pogoniulus subsulphureus*
11	Bulbuls	Pycnonotidae	Common bulbul	*Pycnonotus barbatus*
12	Bulbuls	Pycnonotidae	Yellow-throated leaflove	*Chlorocichla flavicolis*
13	Thrushes	Turdidae	African thrush	*Turdus pelios*
14	Monarchs	Muscicapidae	African paradise flycatcher	*Terpsiphone viridis*
15	Sunbirds	Nectariniidae	Scarlet-chested sunbird	*Chalcomitra senegalensis*
16	Sunbirds	Nectariniidae	Copper sunbird	*Cinnyris cupreus*
17	Sunbirds	Nectariniidae	Splendid sunbird	*Cinnyris coccinigastrus*
18	Sunbirds	Nectariniidae	Grey-headed sunbird	*Deleornis axillaris*
19	Sunbirds	Nectariniidae	Variable sunbird	*Cinnyris venustus*
20	Orioles	Oriolidae	African golden oriole	*Oriolus auratus*
21	Weavers	Ploceidae	Village weavers	*Ploceus melanocephalus*
22	Weavers	Ploceidae	Little weaver	*Ploceus cucullatus*
23	Warblers	Sylviidae	Grey-backed camaroptera	*Camaroptera brachyuran*
24	Bush shrikes	Malaconotidae	Black crowned tchagra	*Tchagra senegalus*
25	Crows	Corvidae	Pied crow	*Corvus albus*
26	Crows	Corvidae	Piapiac	*Ptilostomus*
27	Swallows	Hirundinidae	Black saw-wing	*Psalidoprocne pristoptera*
28	Turacos	Musophagidae	Green turaco	*Tauraco persa*
29	Turacos	Musophagidae	Violet turaco	*Musophaga violacea*
30	Turacos	Musophagidae	Western grey plantain-eater	*Crinifer piscator*
31	White-eyes	Zosteropidae	African yellow white eye	*Zosterops senegalensis*
32	Estridid finches	Estrildidae	Bronze mannikin	*Spermestes cucullata*
33	Estridid finches	Estrildidae	Black-and-white mannikin	*Spermestes bicolor*
34	Estridid finches	Estrildidae	Bare-breasted firefinch	*Lagonosticta rufopicta*
35	Estridid finches	Estrildidae	Red-cheeked cordon-blue	*Uraeginthus bengalus*
36	Wagtails	Motacillidae	Yellow wagtail	*Motacilla flava*
37	Longclaws	Motacillidae	Yellow-throated long-claw	*Macronyx croceus*
38	Sparrows	Passeridae	Northern grey-headed sparrow	*Passer griseus*
39	Indigo birds	Viduidae	Village indigo bird	*Vidua chalybeata*

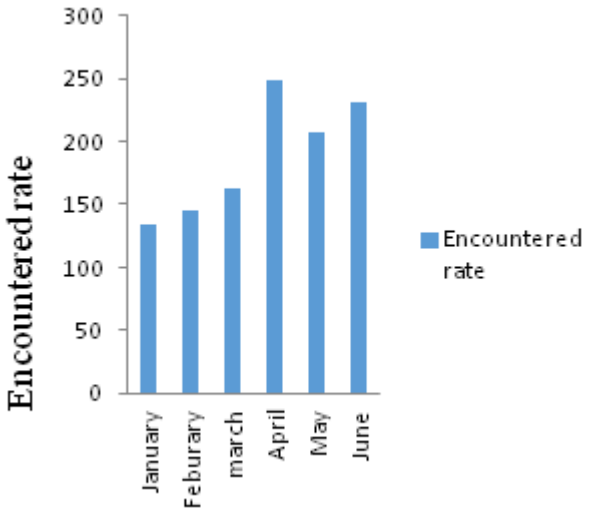

Figure 2. Bird Encountered rate from the months of January to June.

Figure 3. A Farmer and his farmland.

Figure 5. Saw dust, an indication of timber lumbering.

Figure 4. Debarked tree.

Figure 6. A dead tree caused by slash-and burn farming system.

Table 2. Monthly encountered Rate of Bird Species from January to June 2018.

Bird species	Jan	Feb	Mar	Dry season	Apr	May	Jun	Wet Season	Grant Total
Yellow-billed kite	11	14	10	**35**	8	13	9	**30**	**65**
Stone partridge	4	4	5	**13**	3	3	4	**10**	**23**
Red-eyed dove	2	3	2	**7**	5	3	3	**11**	**18**
Mourning dove	5	4	3	**12**	4	2	6	**12**	**24**
Laughing dove	8	7	10	**25**	13	6	8	**27**	**52**
Black-billed wood dove	3	5	2	**10**	4	4	4	**12**	**22**
Senegal coucal	6	3	1	**10**	4	5	4	**13**	**23**
African grey hornbill	-	4	2	**6**	1	4	6	**11**	**17**
Yellow-fronted tinkerbird	4	3	4	**11**	6	5	6	**17**	**28**
Yellow-rumped tinkerbird	2	2	6	**10**	7	4	8	**19**	**29**
Common bulbul	8	5	6	**19**	7	5	7	**19**	**38**
Yellow-throated leaflove	-	-	-	**0**	5	2	1	**8**	**8**
African thrush	3	6	4	**13**	6	8	10	**24**	**37**
African paradise flycatcher	2	1	5	**8**	3	4	4	**11**	**19**
Scarlet-chested sunbird	3	6	4	**13**	5	8	6	**19**	**32**
Splendid sunbird	5	6	8	**19**	6	4	6	**16**	**35**
Variable sunbird	3	4	2	**9**	7	4	6	**17**	**26**
Copper sunbird	3	4	4	**11**	7	3	4	**14**	**25**
Grey-headed sunbird	2	2	6	**10**	4	3	4	**11**	**21**
African golden oriole	4	2	6	**12**	3	2	3	**8**	**20**
Village weavers	-	-	-	**0**	40	30	37	**107**	**107**
Little weaver	-	-	-	**0**	8	6	10	**24**	**24**
Grey-backed camaroptera	3	2	4	**9**	5	6	10	**21**	**30**
Black-crowned tchagra	3	1	2	**6**	5	1	4	**10**	**16**
Pied crow	5	7	4	**16**	3	5	3	**11**	**27**
Piapiac	2	4	3	**9**	2	2	4	**8**	**17**
Red-cheeked cordon-blue	3	6	7	**16**	4	7	5	**16**	**32**
Bronze mannikin	5	7	10	**22**	15	11	13	**39**	**61**
Black-and-white mannikin	5	4	6	**15**	13	9	9	**31**	**46**
Bare-breasted firefinch	6	5	8	**19**	9	13	8	**30**	**49**
Swallows	13	10	8	**31**	14	8	5	**27**	**58**
Green turaco	1	3	1	**5**	3	2	-	**5**	**10**
Violet turaco	5	4	3	**12**	4	3	3	**10**	**22**
African yellow white eye	-	-	2	**2**	3	2	4	**9**	**11**
Yellow wagtail	-	-	4	**4**	2	2	-	**4**	**8**
Western grey plantain-eater	3	4	5	**12**	2	3	2	**7**	**19**
Yellow-throated long-claw	-	-	-	**0**	4	-	-	**4**	**4**
Northern grey-headed sparrow	2	3	4	**9**	2	5	3	**10**	**19**
Village indigo bird	3	4	5	**12**	6	3	5	**14**	**26**
Total	**137**	**149**	**166**	**452**	**252**	**210**	**234**	**696**	**1,148**
Shannon-Weiner Diversity	**5.24**	**3.28**	**3.39**		**2.95**	**3.29**	**3.28**		**3.41**
Equitability	**1.51**	**0.93**	**0.95**		**0.81**	**0.91**	**0.92**		**0.93**

Discussion

The number of species encountered in this study revealed that the mountain is rich composition of bird species, even though the site seems to favour species that show preference to disturbed areas. The on-going anthropogenic activities probably paved way to these species to move in. Tanko (2012) reported how some species benefits from disturbance of a forest ecosystem, especially to opportunistic species. The encountered rate was high and is in agreement with the findings of (Burgess et al., 2002) that the tropical mountains serve as important bird area due to the high diversity of bird species including endemic species.

Monthly and seasonal fluctuation of bird species diversity and abundance may be due to a combination of physical and biological factors. Tanko et al. (2011) made a similar observation in their study. In attempting to advance reasons for the fluctuations, they assumed it could be due to accumulative effects of physical and biological factors of the habitat. The physical and biological factors observed at the site which we speculate could be reasons for the observed fluctuations include slash and burnt system of farming, fuel-wood harvesting, intensive sporting activities creation of foot paths etc. Creation of foot path alongside the farming activities brings about habitat fragmentation which may lead to decrease in patch colonization and increase in local extinction (Tanko et al., 2011). These factors have a combined effect of increase in human influx into the site. Human activities may interfere with breeding birds, disrupt mating individuals, and expose incubating birds to predators and also the destruction of nests and nestlings. Other possible factors that could be responsible for the fluctuations of the avifauna include seasonal nature of food sources where an increase in the abundance of macro-invertebrates and their larvae as well as fruits, seeds and nectar from plants in the wet season may lead to influx of insectivorous and fruigivorous birds (Tanko et al., 2011).

High encountered rate indicate abundance and high activity level of the species. However, Tanko et al. (2011) opined that there is a tendency to encounter more vocal and prominent species than the skulking and shy species. The village weaver was the most encountered species. This was probably because they are known to be lousy, move in flocks and breed in colonies. The vegetation and the interspersion of farmlands at the site also provided suitable nesting sites, nesting materials and foraging sites for the species.

The species effort curve indicated there are still more species to be discovered at the site. Tanko et al. (2012) recorded 107 species in a similar study in an inselberg in Zaria, Nigeria. The wet season had a higher abundance of encountered rate than the dry season. This supports the reports by Mengesha *et al.,* (2008), in which they inferred that seasons and climate affect the composition and abundance of birds' species. The study also revealed three stenotopic species and goes to support the work of Tanko (2012) in which he reported that mountains may serve as source or sink for threatened, endemic and or stenotopic species.

It has been reported that in mountain ecosystems altitude affects birds' species composition, abundance and diversity (Hobson et al., 2003; Waterhouse et al., 2002). That was not observed in this study probably because the mountain is not high enough to bring about climatic and vegetational variations with altitude. As you go up a mountains there tends to be a decline in vegetation and elevation creates microclimate that in turn determines temperature, vegetation and soil characteristics. According to Rahbek (2005) these changes in altitude as you go up the mountain have effect on the distribution and diversity of bird species

directly or indirectly through limiting the availability of their various needs and energy that flows into the ecosystem. This study however seemed to disagree with these findings as the study site revealed a uniform distribution of vegetation and hence had a uniform composition and abundance of birds both at lower and higher altitude.

Tanko (2012) in his work on Dumbi inselberg discovered more encountered rate in the dry season than the wet season and this he attributed to the presence of rock pools that serve as water source to the birds. However, this work is contrary to his findings and this is because the site is the only site with dense and thick vegetation that could serve as habitat for the birds and also provide fruits during the wet season.

Conclusions

The results showed rich composition and abundance of bird species on Mount Patti. The place is also home to stenotopic species as well as suitable breeding site for the weavers**.** We recommend further study of the sites as there are yet more species to be discovered. There is need for conservation procedures to be initiated at the place and this study should serve as a baseline to initiate such programme by the State Government.

Conflict of interest

Authors declare that they have no conflict of interests.

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