



GLOBAL JOURNAL OF SCIENCE FRONTIER RESEARCH: D
AGRICULTURE AND VETERINARY
Volume 19 Issue 2 Version 1.0 Year 2019
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

Avifauna Species Abundance and Diversity in Modibbo Adama University of Technology Yola, Adamawa State, Nigeria

By Kwaga, B. T., Gawaisa, S. G., Ali A. & Khobe, D.
Adamawa State University

Abstract- The study focused on the abundance and diversity of avifauna species at Modibbo Adama University of Technology (MAUTECH) Yola, in Girei local Government Area, Adamawa State. Information on species abundance and diversity is yet to be ascertained in the study area. Three habitat types (grassland, woodland and riparian) were selected for the study. Three transects of 1km length were established in each of the habitats. Data on avifauna species abundance was obtained through total count method. Diversity was determined using Simpson Diversity Index. Data on the avifauna species abundance was subjected to descriptive statistics (Frequency Tables and Percentages), while data on species diversity was analyzed using Simpson Diversity Index. The results obtained showed a list of 24 different avifauna species with their population distributed across the study sites (157 and 164 for grassland, 200 and 140 for woodland and 272 and 164 for riparian areas) during morning and evening hours respectively.

Keywords: *avifauna, species, abundance, diversity.*

GJSFR-D Classification: FOR Code: 300599



Strictly as per the compliance and regulations of:



Avifauna Species Abundance and Diversity in Modibbo Adama University of Technology Yola, Adamawa State, Nigeria

Kwaga, B. T. ^α, Gawaisa, S. G. ^σ, Ali A. ^ρ & Khobe, D. ^ω

Abstract The study focused on the abundance and diversity of avifauna species at Modibbo Adama University of Technology (MAUTECH) Yola, in Girei local Government Area, Adamawa State. Information on species abundance and diversity is yet to be ascertained in the study area. Three habitat types (grassland, woodland and riparian) were selected for the study. Three transects of 1km length were established in each of the habitats. Data on avifauna species abundance was obtained through total count method. Diversity was determined using Simpson Diversity Index. Data on the avifauna species abundance was subjected to descriptive statistics (Frequency Tables and Percentages), while data on species diversity was analyzed using Simpson Diversity Index. The results obtained showed a list of 24 different avifauna species with their population distributed across the study sites (157 and 164 for grassland, 200 and 140 for woodland and 272 and 164 for riparian areas) during morning and evening hours respectively. The results of avifauna species diversity across the study area during morning session indicated 0.9998, 1.0000 and 0.9999 for grassland, woodland and riparian areas respectively. However, that of evening session indicated 0.9998 across the habitats. Research into other wildlife components (mammals, reptiles, insects and micro fauna) of the study area has been recommended.

Keywords: avifauna, species, abundance, diversity.

I. INTRODUCTION

Birds are very visible and integral part of the ecosystem. They occupy many trophic levels in the food-chain, ranging from consumers to producers. Their occurrences have been helpful as environmental health indicators, plant/crop pollinators and seed dispersal as well as pest control (Ranchandria, 2013; Bideberi, 2013). Diversity is the biological assemblage of species in its entity, which is the complete representation of all possible measures of biological diversity across space and time (Kwaga *et al.* 2017). Species diversity is often measured as an index that incorporates the interplay between species richness and abundance (Lasorte and Boecklen, 2005).

Quantifying the avifauna species abundance and diversity in communities has gained increasing importance in environmental impact assessment especially in conservation planning and ecological research (Mohammed and Mohammed, 2011). Species

Author α σ ρ: Department of Forestry and Wildlife Management, (Mautech), Yola.

Author ω: Department of Animal Production, Adamawa State University (ADSU), Mubi. e-mails: divinetizhe@yahoo.com, zifadi007@gmail.com

inventories not only help in understanding species losses but also help determine the characteristics of species that are vulnerable to habitat perturbations (Koh *et al.*, 2004). Assessment of avifauna species is essential for sustainable development. The lack of it results in weak monitoring of bio-data, vegetation degradation and loss of ecosystem resources (Santhalakshmi *et al.*, 2014). Wrong attitude towards achieving its goal has led to reduced variety of ecosystem potentials which could have negative impact on socio-economic development of varieties of goods and services derived from the ecosystem.

The species richness is simply the total number of species within a habitat or community. Species richness is the most commonly used measure of diversity because it is a straightforward measure and it is intuitive. Species diversity is a measure of both the number of species (species richness) and the relative contribution of each of these species to the total number of individuals in a community (evenness) (Stiling, 2002; Mukund *et al.*, 2012). Birds are warm blooded; they have been able to adapt themselves to living in climates varying from the ice snow of the Antarctic to the fringes of the hottest deserts.

Diversity has been referred to as the quantitative measure that reflects how many different species are in existence in a data set. A variety of objective measures have been created in order to measure of diversity. The basic idea is to obtain a quantitative estimate of biological variability that can be used to compare biological entities, composed of direct components, in space or time (Albert, 2012; Santha lakshmi *et al.*, 2014 Magurran, 2004).

Assessment of birds' species richness and abundance of an area makes it possible for any organization to plan for future conservation and sustainable utilization of avifauna resources (Anne and Brian, 2011; Khobe and Kwaga, 2017). Hence, the need for this study which is aimed at assessment of avifauna species richness and diversity in Modibbo Adama University of Technology (MAUTECH), Yola of Adamawa State, Nigeria.

II. METHODOLOGY

a) The Study Area

The study area is Modibbo Adama University of Technology (MAUTECH), Yola. It is located at Sangere in Girei local Government area, Adamawa state in the North-Eastern part of Nigeria. Adamawa State covers a land mass of 39,742.12 sq km. This is about 4.4% of the land area of Nigeria. The study area lies between latitudes 12°30'N to 12°42'N and longitudes 12°30'E to 12°43'E. (Figure1) (Department of Geography, MAUTECH, Yola, 2018). The study area is characterized by two well defined climatic seasons which starts from May and ends in October, while dry season commences from November through April. The average annual rainfall is about 972mm with average of 62 rainy days. The highest occurrence of rain in the study area is in August and September. (Adebayo, 1999). The dominant woody plant species include: *Khaya senegalensis*, *Detarium microcarpum*, *Prosopis africana*, *Combretum species*, *tamarindus indica*, *Terminalia albida*, *Terminalia mantaly*, *Zizipus mauritiana*, *Balanites aegyptiaca* among others. Some of the existing fauna resources are; squirrel, monitor lizard, alligator lizard, hare and several species of birds (Akosim *et al.*, 2007).

b) Study Design and Data collection

The study design followed the method described by Sutherland (1999) and adopted by Kwaga *et al.*, (2017). Reconnaissance survey was carried out in order to ascertain the existing habitats, possible transects for bird identification in the area following Akosim *et al.* (2007) and Kwaga *et al.* (2017) methods. This was followed by the division of the entire area into three (3) basic habitats (A. Grassland/ Area under cultivation, B. Wood land/Partially disturbed area and C. Riparian/along the stream). Survey was carried out between 6.30am and 9.30am (morning hours) and 3.00pm and 6.00pm (afternoon hours). Nine (9) transects of 1km each (i.e. 3 transects per each habitat) were laid and assessed following Sutherland (1999) and adopted by Mukund *et al.*, (2012). The study lasted for a period of six (6) months (June – November, 2018). Each bird species identified and frequency noted with the aid of binoculars and related literatures as outlined by Baker (1993) and adopted by Nik and Ron (2008). The leaders of the community where the study was conducted served as source of information regarding the usage of the area under study as well as identification of the available avifauna species. Information on the micro-climatic factors (rainfall, temperature, relative humidity) was obtained from the Department of Geography of MAUTECH, Yola. The assessment was limited to avifauna species lists and diversity in each of the selected habitats following Rappole *et al.*, (1993), Ali (2015), Khobe and Kwaga (2017) and Kwaga *et al.*, (2017) guides.

c) Statistical Analysis of Data

- i. Data on avifauna species list in the study area were assessed using descriptive statistics (Tables, frequencies, percentages).
- ii. Simpson diversity index as described by Akosim *et al.*, (2007) as well as Kwaga *et al.*, (2017) was employed in the determination of avifauna species diversity in the study area.

The mathematical formula is as follows:

$$D = \sum_{i=1}^p p_i^2$$

Where,

D = Simpson diversity index,

P_i = Proportion of species, that is = $\frac{n_i}{N}$

n_i = individual of species in a sample N

D has a maximum value of 1 in a monoculture and becomes smaller as the community/species becomes more diverse.

III. RESULTS AND DISCUSSION

The results of avifauna species composition in the study area for morning hours are presented in Tables 1, 2 and 3. A check-list of 24 different avifauna species was encountered. A total of 157, 200 and 272 bird species were encountered. *Treron calvus* had the highest frequency (99.55%), while *Alethe peliocephala* had the least (0.64%) in grassland. *Ploceus vitellinus* (8.00%) and *Tockus nasutus* (1.00%), while *Treron calvus* (8.82%) and *Oena capensis* (1.83%) had the highest and lowest frequencies in woodland and riparian habitats respectively. Tables 4, 5 and 6 showed the result of avifauna species identified during evening session in the study area. From the results obtained, 164, 140 and 164 individuals were identified during evening session in grassland, woodland and riparian respectively. The results also indicated that *Chacomitra rubescens* (11.58%) and *Centropus senegalensis* (0.61%), *Tockus camerus* (11.42) and *Alethe castanea* (0.71) and *Pochycoccyx audeberti* (9.75%) and *Hyltiota australis* (0.70%) had the highest and lowest avifauna frequencies in grassland, woodland and riparian respectively. From the findings of this study, it indicated that many of the species (*Hyltiota australis*, *Hyltiota australis*, *Treron calvus*, *Bubulcus ibis*, *Oena capensis*, *Dicrurus adsimilis*, *Pterodes senegallus*, *Ciconia nigra* and *Urotriorchis macrourus*) were available in all the transects across the study area. The finding of this study in relation to avifauna species distribution is not unconnected with the observation of Khobe and Kwaga (2016) who observed that decreased or degraded forest area could lead not only to loss of biodiversity but also individuals of the ecosystem. Abubakar and Abubakar (2013) made similar observation during their study of Nguru Lake.

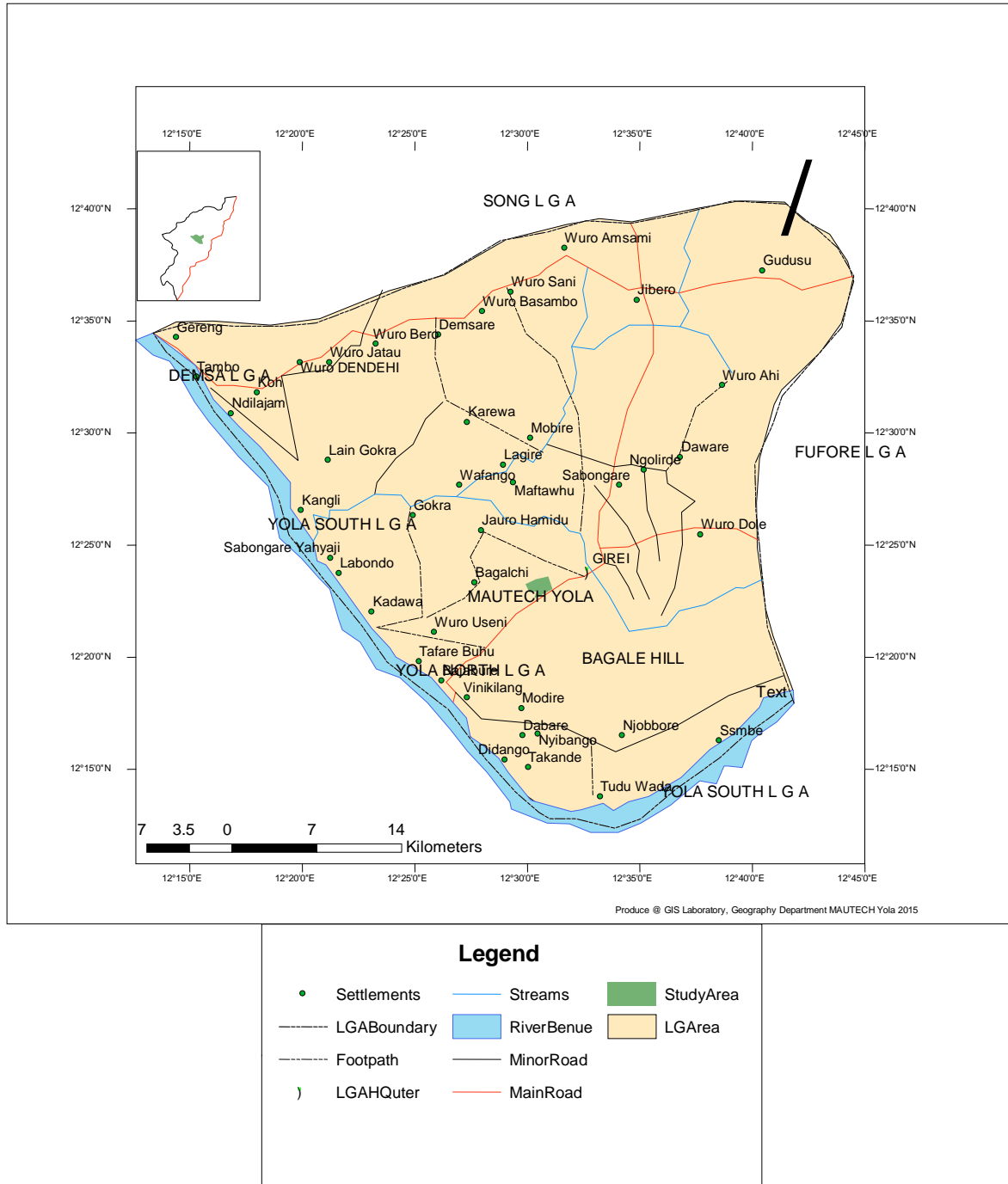
The abundance of avifauna species in the wood land and riparian areas might have been influenced by its micro-climate for optimum performance of the ecosystem. This finding is in agreement with Akosim *et al.*, (2007) who observed that plants do not only provide food for animals/birds including insects but also influences micro-environment for the optimum performance of other fauna species. The finding of this study is also in strong agreement with Santhalashmi *et al.*, (2014) who reported that species composition, abundance and distribution is a function of its rich habitat with ecological requirements of the species in question

The result of avifauna species diversity in the study area is presented in Table 7. The diversity ranged from 0.2926 to 0.3885, 0.2642 to 0.3850 and 0.2757 to 0.3823 in grassland, woodland and riparian habitats respectively. The findings of avifauna species diversity and abundance did not vary very much between transects as well as amongst the habitats. This could be probable due to similar distribution of habitat variables. The value of 1.0000 and 0.9999 obtained in woodland as well as riparian reached maximum, indicating high species of avifauna in the study area. This may not be unconnected with the available ecological requirements of the habitats. This finding is in agreement with the report of Bideberi (2013) and Kwaga *et al.*, (2017) who reported that, diversity, distribution and abundance of avifauna species is related to their habitat types.

IV. CONCLUSIONS

The study focused on the abundance and diversity of avifauna species in Modibbo Adama University of Technology Yola, Adamawa State, Nigeria. From the results obtained, it can be concluded that there was a great similarity in the bird species composition in the study area. Avifauna species richness and diversity were compared in related habitats. Considering the importance of the fragments, the grassland served as a corridor within which farming activities and source of livelihood (fuel wood, herbs, food, grazing animals etc.) were confined. Inventory should be carried on other fauna, insects and reptiles to ascertain the wild animal resources of the area.





Source: Department of Geography, Mautech. Yola (2015)

Figure 1: Map of Girei Local Government Showing the study Area

Table 1: Avifauna Species Abundance in Grassland of the Study Area (Morning session 6.30-9.30am)

S/N Species common name Scientific name Percentage	Frequency per Transect			Total	
	I	II	III		
1. African grey hornbill <i>Tockus nasutus</i>	2	--	--	2	1.27
2. African mourning dove <i>Streptopelia rosegrisea</i>	3	1	2	6	3.82
3. Grey-rumped swallow <i>Pseudhirundo griseopyga</i>	2	5	--	7	4.45
4. Southern hyliota <i>Hyliota australis</i>	1	--	3	4	2.54
5. African mustached wabler <i>Melocichla mentalis</i>	--	2	--	2	1.27
6. Black bee-eater <i>Merops Muelleri</i>	--	1	4	5	3.18
7. African green pigeon <i>Treron calvus</i>	4	5	6	15	9.55
8. Red-bill dwarf hornbill <i>Tockus camurus</i>	6	1	--	7	4.45
9. Thich-billed cuckoo <i>Pachycoccyx audeberti</i>	1	--	4	5	3.18
10. Abyssinian roller <i>Coracias abyssinicus</i>	3	2	2	7	4.45
11. Cattle egret <i>Bubulcus ibis</i>	6	--	1	7	4.45
12. Red-checked cordon bleu <i>Uraeginthus bengalus</i>	4	--	1	5	3.18
13. Green-throated sunbird <i>Chalcomitra rubescens</i>	4	4	3	11	7.00
14. Masked weaver <i>Ploceus vitellinus</i>	6	3	1	10	6.36
15. Senegal coucal <i>Centopus senegalensis</i>	3	--	4	7	4.45
16. Namaqua dove <i>Oena capensis</i>	1	2	6	9	5.73
17. Nimbia flycatcher <i>Melaenormis annamarulae</i>	2	6	1	9	5.73
18. Forked tailed drongo <i>Dicrurus adsimilis</i>	5	1	--	6	3.82
19. Yellow billed expecker <i>Buphagus africanus</i>	1	5	1	7	4.45
20. Brown-chested alethe <i>Alethe peliocephala</i>	--	1	--	1	.64
21. Fine-chested alethe <i>Alethe castanea</i>	--	5	2	7	4.45
22. Spotted-sand grouse <i>Pterodes senegallus</i>	--	3	--	3	1.91
23. Black stork <i>Ciconia nigra</i>	3	--	6	9	5.73
24. Long-tailed hawk <i>Urotriorchis macrourus</i>	4	1	1	6	3.82
Total	61	50	46	157	99.88

Field Survey, 2018

Table 2: Avifauna Species Abundance in Woodland of the Study Area (Morning session 6.30-9.30am)

S/n Species common name Scientific name	Frequency per Transect			Total	Percentage
	I	II	III		
1. African grey hornbill <i>Tockus nasutus</i>	2	--	--	2	1.00
2. African mourning dove <i>Streptopelia rosegrisea</i>	--	2	2	4	2.00
3. Grey-rumped swallow <i>Pseudhirundo griseopyga</i>	3	--	2	5	2.50
4. Southern hyliota <i>Hyliota australis</i>	10	--	4	14	7.00
5. African mustached wabler <i>Melocichla mentalis</i>	4	10	--	14	7.00
6. Black bee-eater <i>Merops muelleri</i>	4	--	6	10	5.00
7. African green pigeon <i>Treron calvus</i>	2	6	--	8	4.00
8. Red-bill dwarf hornbill <i>Tockus camurus</i>	--	4	2	6	3.00
9. Thich-billed cuckoo <i>Pachycoccyx audeberti</i>	--	6	2	8	4.00
10. Abyssinian roller <i>Coracias abyssinicus</i>	2	2	6	10	5.00
11. Cattle egret <i>Bubulcus ibis</i>	2	4	2	8	4.00
12. Red-checked cordon bleu <i>Uraeginthus bengalus</i>	4	2	1	7	3.50

Field Survey, 2018

13. Green-throated sunbird	<i>Chalcomitra rubescens</i>	6	2	4	12	6.00
14. Masked weaver	<i>Ploceus vitellinus</i>	2	6	8	16	8.00
15. Senegal coucal	<i>Centopus senegalensis</i>	1	3	2	6	3.00
16. Namaqua dove	<i>Oena capensis</i>	3	1	2	6	3.00
17. Nimbia flycatcher	<i>Melaenormis annamarulae</i>	--	6	1	7	3.50
18. Forked tailed drongo	<i>Dicrurus adsimilis</i>	1	2	--	3	1.50
19. Yellow billed expecker	<i>Buphagus africanus</i>	4	6	1	11	5.50
20. Brown-chested alethe	<i>Alethe peliocephala</i>	1	4	--	5	2.50
21. Fine-chested alethe	<i>Alethe castanea</i>	5	2	3	10	5.00
22. Spotted-sand grouse	<i>Pterodes senegallus</i>	2	8	5	15	7.50
23. Black stork	<i>Ciconia nigra</i>	2	--	1	3	1.50
24. Long-tailed hawk	<i>Urotriorchis macrourus</i>	1	1	8	10	5.00
Total		61	77	62	200	100.00

Field Survey, 2018

Table 3: Avifauna Species Abundance in the Riparian of the Study Area (Morning session 6.30 9.30am)

S/n	Species common name	Scientific name	Frequency per Transect			Total	Percentage
			I	II	III		
1.	African grey hornbill	<i>Tockus nasutus</i>	--	--	8	8	2.94
2.	African mourning dove	<i>Streptopelia rosegrisea</i>	5	2	5	12	4.41
3.	Grey-rumped swallow	<i>Pseudhirundo griseopyga</i>	2	--	6	8	2.94
4.	Southern hyliota	<i>Hyliota australis</i>	2	5	--	7	2.57
5.	African mustached wabler	<i>Melocichla mentalis</i>	5	--	10	15	5.51
6.	Black bee-eater	<i>Merops muelleri</i>	5	6	--	11	4.04
7.	African green pigeon	<i>Treron calvus</i>	7	10	7	24	8.82
8.	Red-bill dwarf hornbill	<i>Tockus camurus</i>	5	6	--	11	4.04
9.	Thich-billed cuckoo	<i>Pachycoccyx audeberti</i>	--	2	9	11	4.04
10.	Abyssinian roller	<i>Coracias abyssinicus</i>	2	5	1	8	2.94
11.	Cattle egret	<i>Bubulcus ibis</i>	--	7	4	11	4.04
12.	Red-checked cordon bleu	<i>Uraeginthus bengalus</i>	8	4	2	14	5.14
13.	Green-throated sunbird	<i>Chalcomitra rubescens</i>	--	4	6	10	3.67
14.	Masked weaver	<i>Ploceus vitellinus</i>	3	--	3	6	2.20
15.	Senegal coucal	<i>Centopus senegalensis</i>	10	3	--	13	4.77
16.	Namaqua dove	<i>Oena capensis</i>	--	4	1	5	1.83
17.	Nimbia flycatcher	<i>Melaenormis annamarulae</i>	5	--	8	13	4.77
18.	Forked tailed drongo	<i>Dicrurus adsimilis</i>	8	8	1	17	6.25
19.	Yellow billed expecker	<i>Buphagus africanus</i>	8	--	9	17	6.25
20.	Brown-chested alethe	<i>Alethe peliocephala</i>	1	2	7	10	3.65
21.	Fine-chested alethe	<i>Alethe castanea</i>	1	2	6	9	3.30
22.	Spotted-sand grouse	<i>Pterodes senegallus</i>	2	3	1	6	2.20
23.	Black stork	<i>Ciconia nigra</i>	3	1	2	6	2.20
24.	Long-tailed hawk	<i>Urotriorchis macrourus</i>	1	1	8	10	3.67
Total			9375104	272	96.21		

Field Survey, 2018

Table 4: Avifauna Species Abundance in the Grassland of the Study Area (Evening session 3.00-6.00pm)

S/n	Species common name	Scientific name	Frequency per Transect			Total	Percentage
			I	II	III		
1.	African grey hornbill	<i>Tockus nasutus</i>	2	--	1	3	1.82
2.	African mourning dove	<i>Streptopelia rosegrisea</i>	3	--	1	4	2.43
3.	Grey-rumped swallow	<i>Pseudhirundo griseopyga</i>	1	1	5	7	4.26
4.	Southern hyliota	<i>Hyliota australis</i>	1	5	--	6	3.65
5.	African mustached wabler	<i>Melocichla mentalis</i>	--	2	4	6	3.65
6.	Black bee-eater	<i>Merops muelleri</i>	--	3	1	4	2.43
7.	African green pigeon	<i>Treron calvus</i>	--	6	--	6	3.65
8.	Red-bill dwarf hornbill	<i>Tockus camurus</i>	4	--	2	6	3.65
9.	Thich-billed cuckoo	<i>Pachycoccyx audeberti</i>	6	--	5	11	6.71
10.	Abyssinian roller	<i>Coracias abyssinicus</i>	1	2	1	4	2.43
11.	.Cattle egret	<i>Bubulcus ibis</i>	4	--	5	9	5.48
12.	Red-checked cordon bleu	<i>Uraeginthus bengalus</i>	3	5	--	8	4.87
13.	Green-throated sunbird	<i>Chalcomitra rubescens</i>	8	10	1	19	11.58
14.	Masked weaver	<i>Ploceus vitellinus</i>	--	1	10	11	6.71
15.	Senegal coucal	<i>Centopus senegalensis</i>	--	1	--	1	0.61
16.	Namaqua dove	<i>Oena capensis</i>	1	--	2	3	1.82
17.	Nimbia flycatcher	<i>Melaenormis annamarulae</i>	2	4	6	12	7.32
18.	Forked tailed drongo	<i>Dicrurus adsimilis</i>	4	1	2	7	4.26
19.	Yellow billed expecker	<i>Buphagus africanus</i>	--	4	1	5	3.05
20.	Brown-chested alethe	<i>Alethe peliocephala</i>	--	2	1	3	1.82
21.	Fine-chested alethe	<i>Alethe castanea</i>	1	1	4	6	3.65
22.	Spotted-sand grouse	<i>Pterodes senegallus</i>	2	5	1	8	4.87
23.	Black stork	<i>Ciconia nigra</i>	5	1	5	11	6.71
24.	Long-tailed hawk	<i>Urotriorchis macrourus</i>	1	1	1	3	1.82
Total			48	57	59	164	99.85

Field Survey, 2018

Table 5: Avifauna Species Abundance in the Woodland of the Study Area (Evening session 3.00-6.00pm)

S/n	Species common name	Scientific name	Frequency per Transect			Total	Percentage
			I	II	III		
1.	African grey hornbill	<i>Tockus nasst</i>	2	--	1	3	2.14
2.	African mourning dove	<i>Streptopelia rosegrisea</i>	2	4	4	10	7.14
3.	Grey-rumped swallow	<i>Pseudhirundo griseopyga</i>	2	--	8	10	7.14
4.	Southern hyliota	<i>Hyliota australis</i>	--	3	4	7	5.00
5.	African mustached wabler	<i>Melocichla mentalis</i>	1	5	2	8	5.71
6.	Black bee-eater	<i>Merops muelleri</i>	--	2	--	2	1.42
7.	African green pigeon	<i>Treron calvus</i>	2	3	--	5	3.57
8.	Red-bill dwarf hornbill	<i>Tockus camurus</i>	5	--	11	16	11.42
9.	Thich-billed cuckoo	<i>Pachycoccyx audeberti</i>	--	1	3	4	2.85
10.	Abyssinian roller	<i>Coracias abyssinicus</i>	2	2	2	6	4.28



11. Cattle egret	<i>Bubulcus ibis</i>	1	--	1	2	1.42
12. Red-checked cordon bleu	<i>Uraeginthus bengalus</i>	1	3	--	4	2.85
13. Green-throated sunbird	<i>Chalcomitra rubescens</i>	4	2	--	6	4.28
14. Masked weaver	<i>Ploceus vitellinus</i>	--	5	5	10	7.14
15. Senegal coucal	<i>Centopus senegalensis</i>	2	--	--	2	1.42
16. Namaqua dove	<i>Oena capensis</i>	--	5	2	7	5.00
17. Nimbia flycatcher	<i>Melaenormis annamarulae</i>	2	--	1	3	2.14
18. Forked tailed drongo	<i>Dicrurus adsimilis</i>	--	2	3	5	3.57
19. Yellow billed expecker	<i>Buphagus africanus</i>	1	--	4	5	3.57
20. Brown-chested alethe	<i>Alethe peliocephala</i>	4	--	2	6	4.28
21. Fine-chested alethe	<i>Alethe castanea</i>	1	--	--	1	0.71
22. Spotted-sand grouse	<i>Pterodes senegallus</i>	--	4	--	4	2.85
23. Black stork	<i>Ciconia nigra</i>	--	5	--	5	3.57
24. Long-tailed hawk	<i>Urotriorchis macrourus</i>	5	4	--	9	6.42
Total		37	50	53	140	99.70

Field Survey, 2018

Table 6: Avifauna Species Abundance in the Riparian of the Study Area (Evening session 3.00-6.00pm)

S/n	Species common name	Scientific name	Frequency per Transect			Total	Percentage
			I	II	III		
1.	African grey hornbill	<i>Tockus nasutus</i>	2	1	2	5	3.04
2.	African mourning dove	<i>Streptopelia rosegrisea</i>	--	2	1	3	1.82
3.	Grey-rumped swallow	<i>Pseudhirundo griseopyga</i>	4	3	2	9	5.48
4.	Southern hyliota	<i>Hyliota australis</i>	--	1	--	1	0.70
5.	African mustached wabler	<i>Melocichla mentalis</i>	--	1	5	6	3.65
6.	Black bee-eater	<i>Merops muelleri</i>	6	4	2	12	7.31
7.	African green pigeon	<i>Treron calvus</i>	1	--	1	2	1.21
8.	Red-bill dwarf hornbill	<i>Tockus camurus</i>	2	5	--	7	4.26
9.	Thich-billed cuckoo	<i>Pachycoccyx audeberti</i>	--	6	10	16	9.75
10.	Abyssinian roller	<i>Coracias abyssinicus</i>	3	1	2	6	3.65
11.	Cattle egret	<i>Bubulcus ibis</i>	--	2	1	3	1.82
12.	Red-checked cordon bleu	<i>Uraeginthus bengalus</i>	5	--	6	11	6.70
13.	Green-throated sunbird	<i>Chalcomitra rubescens</i>	1	10	--	11	6.70
14.	Masked weaver	<i>Ploceus vitellinus</i>	2	--	5	7	4.26
15.	Senegal coucal	<i>Centopus senegalensis</i>	--	1	4	5	3.04
16.	Namaqua dove	<i>Oena capensis</i>	--	1	1	2	1.21
17.	Nimbia flycatcher	<i>Melaenormis annamarulae</i>	7	--	1	8	4.87
18.	Forked tailed drongo	<i>Dicrurus adsimilis</i>	1	2	--	3	1.82
19.	Yellow billed expecker	<i>Buphagus africanus</i>	3	--	1	4	2.43
20.	Brown-chested alethe	<i>Alethe peliocephala</i>	--	5	--	5	3.04
21.	Fine-chested alethe	<i>Alethe castanea</i>	--	1	3	4	2.43
22.	Spotted-sand grouse	<i>Pterodes senegallus</i>	2	--	--	2	1.21
23.	Black stork	<i>Ciconia nigra</i>	--	2	1	3	1.82
24.	Long-tailed hawk	<i>Urotriorchis macrourus</i>	4	1	1	6	3.65
Total			48	57	59	164	85.16

Field Survey, 2018

Table 7: Avifauna Species Diversity in the study Area

Habitat Type	Transects	Morning session	Evening session
Grassland	I	0.3885	0.2926
	II	0.3184	0.3475
	III	0.2929	0.3597
Simpson Diversity Index		0.9998	0.9998
Woodland	I	0.3050	0.2642
	II	0.3850	0.3571
	III	0.3100	0.3785
Simpson Diversity Index		1.0000	0.9998
Riparian	I	0.3419	0.2926
	II	0.2757	0.3472
	III	0.3823	0.3475
Simpson Diversity Index		0.9999	0.9998

Field Survey, 2018

REFERENCES RÉFÉRENCES REFERENCIAS

- Abubakar, M. M. and Abubakar, J. Y. (2013). Some aspects of the Limnology of Nguru Lake, North-eastern Nigeria. *International Journal of Basic and Applied Sciences*. 2 (2): 140- 144
- Adebayo A. A. & Tukur A. L. (1999). Climate 1 (Sunshine, temperature, evaporation and relative humidity), *Adamawa State in Maps*. Adebayo, A. A. and Tukur, A. L. (eds.). Pp. 20-26.
- Adesoye, P.O. (2004). *Practical guide to statistical analysis for scientists*. Premier edition, Ibadan-Nigeria. Pp. 1- 189.
- Akosim, C., Kwaga, B. T., Amadi D.C.A and Inah, E.I. (2007). Ecological potentials of Beekeeping in Adamawa State, Nigeria. *Journal of Agricultural Sciences, Environmental Technology (ASSET)* University of Agriculture, Abeokuta, Nigeria PP 67- 76.
- Albert, O. H. (2012). Measurement of Species Diversity in Developing Nations. *Journal of Applied Ecology*. B lack well Publishing. Oxford, U. K. Pp 22- 29.
- Ali, A. (2015). Evaluation of Avian and Flora Diversity in Relation to Some Ecology and Water Quality Parametets in Hadija-Nguru Wetlands, Nigeria. Unpublished PhD Theisis, Department of Forestry and Wildlife Management, MAUTECH, Yola. Pp 1- 199
- Anne, E. M. and Brian, J. M. (2011). *Biological Diversity: Frontiers in Measurement and Assessment*. Oxford University Press, U.K
- Baker, K. (1993). *Identification Guide to European Non-passerine*. British Trust for Ornithology, Thetford, U.K.
- Bideberi, G. (2013). Diversity, Distribution and Abundance of Avifauna in Respect to Habitat types.
- A case study of Kilakala and Bigwa- Morogoro, Tanzania; M.Sc. Thesis, University of Agriculture, Morogoro. Tanzania. p 2.
- B. T. Kwaga, D. Iliya, A. Ali and Khobe, D. (2017). Avifauna abundance and diversity in Jos Wildlife Park, Nigeria (2017). *International Journal of Agricultural science and Technology*. Faculty of Agriculture, Trakia University, Stara Zogara, Bulgaria. Volume 9, Number 3. Pp234-239. ISSN 1313-8820 (print), ISSN 1314-412X (online).
- Department of Geography, Meteorological Unit, Modibbo Adama University of Technology, Yola (2018)
- Khobe, D. and Kwaga, B. T. (2017). Check-list of Birds Species of Jos Wildlife Park, Nigeria. *International Journal of Agriculture, Environment and Bioresearch*. Vol. 2, issue 4. ISSN: 2456-8643. Pp 216-229.
- Koh, L. P., Sodhi, N. S., and Brook, B. W, (2004). Prediction extinction proneness of tropical butterflies. *Conservation Biology*, 18, 1571—1578.
- Larsorte, F.A. and Boecklen, W.D. (2005). Changes in Diversity Structure and Avian Assemblages in North America. *Global Ecology and Biogeography*: 18: 367-378
- Magurran, A. E. (2004). *Measuring Biological Diversity*. Blackwell Publisher: Oxford, U.K. Pp1-256
- Mohammed, N. R. and Mohammed, Z.(2011). Birds species Abudance and their Relationship with Micro-climate and Habitat Variables at Natural Wetland Reserve, Pennisula-Malaysia. *International Journal of Zoology*, Vol.11, Pp2-11

18. Mukund, D., Manik, D., Paresh, L. and Dinesh, D. (2012). Check-list of aquatic microphytes in certain Wetland of Yavatmal District, Maharashtra State, India. *International Journal of Botany and Research*, India Vol.11 (2-11)
19. Nik, B. and Ron, D. (2008). *Helm Field Guide Birds of West Africa*. Black Publishers Ltd. 38 Soho Square, London. WID 3HB; Pp1-509.
20. Ranchandria, A. M. (2013). Diversity and Richness of Bird Species in newly Formed Habitats of Chandoli National Park in Western Ghats, Maharashtra State, India. *Biodiversity Journal 4*: 235-242.
21. Rappole, J. H., Mcshea, W.J. and Vega-River, J. (1993). Evaluation of Two Survey Methods in Upland avian breeding Communities. *Journal of Field Ornithology*. 64: 55-70
22. Santha lakshmi, A. S., Jeyakumaran, T. P. S. and Arunachalam, M. (2014). Species Composition, Relative Abundance and Distribution of Bird Fauna of Riverine and Wetland Habitats in Lower Reaches of Tamiraparani River. *International Journal of Research in Engineering and Biosciences*. Vol. 2 (1) p 14
23. Stiling, P. (2002). *Ecology Theories and Applications 4th edition* Prentice Hall of India private Ltd New Delhi 10001pg 300.
24. Sutherland, W. (1999). *Ecological Census Technique 1st ed. A Handbook*. U.K, Cambridge University Press U. K. Pp 1-335.