



ASSESSMENT OF RELATIVE ABUNDANCE AND SPECIES DIVERSITY OF AVIFAUNA IN MAYO-SELBE RANGE OF GASHAKA GUMTI NATIONAL PARK, NIGERIA

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ABSTRACT: *The study assessed the relative abundance and species diversity of avifauna in Mayo-Selbe Range of Gashaka-Gumti National Park, Nigeria. Double stage sampling was adopted to obtain the study site. The park has five ranges namely Toungo, Gumti, Filinga, Mayo-selbe and Gangam. At the first stage, Mayo-Selbe range was selected and in the second stage it was divided into three sites; Bodel, Mayo-Jarandi and Mayo-Jankasa based on the habitat characteristics. Data was collected using Timed Species Counts (TSCs) method of bird survey. A total of 145 bird species belonging to 50 families were identified. The result shows that Mayo-Jankasa had the highest relative abundance of 42.07% followed by Bodel (30.34%) and Mayo-Jarandi with 27.59%. Shannon's Diversity Index of bird species among the sites showed that Mayo-Jankasa had $H^1=0.3760$, Bodel ($H^1=0.5180$) and Mayo-Jarandi ($H^1=0.5592$) with a total diversity value of $H^1=1.4532$. It is recommended that the management should intensify efforts to maintain the park's biodiversity by introducing and encouraging Agro forestry practices among the populace of the local communities around the park to reduce pressure on the park resources for fuel wood and subsistence needs. These practices will also reduce habitat loss and habitat fragmentation due to encroachment for farming and will also discourage poaching and illegal mining in the park. The checklist of avifauna should be periodically updated and published on the park's web page.*

Keywords: Avifauna, diversity, Gashaka Gumti, relative abundance National park

1. INTRODUCTION

Many countries in the developing world are experiencing rapid population growth with associated pressure on natural habitat and their native flora and fauna (Soderstrom *et al.* 2003). Habitat loss, destruction and degradation of forests are a major threat to avian species richness and diversity (Birdlife International 2000). Most Nigerians are not aware that many of our birds and other life forms are threatened by intense pressure from various human related activities such as farming, logging and wild fires. According to Classroom Bird Watch (2001), birds are a diverse group of animals with bright colours, distinct songs, calls and showy displays. The beauty of birds has made bird watching a very useful way of spending leisure and generating revenue from both local and international tourists.

Birds are bio-indicators; they are indicators of certain changes occurring in the environment; for example, they have been used extensively as both indicators and

predictors of environmental consequences of using Agro-chemicals and show the effect of pollution of famous environmental pollutants (Hardy *et al.* 1987). They are among the numerous fauna that may be at risk from the use of agricultural pesticides (Mincan *et al.* 1990). From economic view point, the arrivals of Abdim's stork (*Ciconia abdimii*) notify local farmers in the northern region of Nigeria that the rainy season is approaching (Akosim *et al.* 2008). Many bird species are pollinators; sunbird belonging to the family Nectaridae patronizes nectar of most flowering plants and most of them are insectivores that aid in checking insect population explosion that could assume pest status. Typical examples of such species include cattle egret (*Bubulcus ibis*), Abdim's stork (*Ciconia abdimii*) and Abyssinian rollers (*Crociab abyssinica*) (Derek 1992). Some birds transport varieties of things through the environment. Apart from helping in plant seed dispersals, animals can also be dispersed through their activities; for example, some wading birds relocate fish eggs that get stuck on their legs and some such as House finch spread eye diseases called avian conjunctivitis

(*mycoplasmal conjunctivitis*). Factors such as habitat loss and degradation are having great impact on birds and other species. Hence, many migratory birds population are on a decline (Classroom Bird Watch 2001).

Relative abundance of birds is the number of birds of a particular species as a percentage of the total bird population of a given area (Molles and Manuel 2009). Species diversity is the different species that are represented in a given community. Diversity is the number of species present in an area and their spatial distribution (Shimelis and Afework 2008). Species diversity consists of two components, species richness and species evenness. Species richness is simply a count of species whereas species evenness quantifies how equal the abundance of species is there (Shimelis and Afework 2008).

Gashaka-Gumti National Park (GGNP) is one of the Important Bird Areas (IBAs) in Nigeria. On the list of 30 IBAs in Nigeria, GGNP with the IBA code NG002 have more than 500 bird species, being the most ornithological diverse site in the country. Much attention is given to studies on the primates in the park with scanty information on the relative abundance and diversity of avifauna. Hence, the design of the study to assess the relative abundance and species diversity of avifauna in Mayo-Selbe Range of Gashaka Gumti National Park, Nigeria.

2. MATERIALS AND METHOD

2.1 Study Area

It is located in the east of the country against the Cameroon border (Fig. 1). Part of it is situated on the mountainous Mambila Plateau and is therefore, part of a westward extension of the Cameroun Mountains; the site is contiguous with Tchabel Mbebo in Cameroun (Ezealor 2002). The landscape is undulating and rugged, with some escarpments rising up to 2,400m, which makes the park largely inaccessible except on foot (Dunn 1999). The park covers an area of approximately 6,731sqkm and has the highest biodiversity of the seven National parks in Nigeria (Ezealor 2002). An extensive system of pristine streams and rivers drain the park and join to form the Taraba River, which in turn, discharges into the Benue.

The annual temperature range is 21°.00°C-32°.50°C (Physical Geography of Global Park, 2012). Annual rainfall is in the range of 1,000-1,750mm and the length of the dry season varies between 5 months in the drier, lower parts to 2 months in the wetter montane areas but generally from December to March it is dry everywhere with a wide range of relative humidity from 26-78%

(Ezealor 2002; PGGP 2012). The park is a heterogeneous mix of habitats comprising montane forests and grasslands, derived savanna with lowland forests, riparian forest and Sudan-Guinea Savanna woodlands. Plants commonly found include *Terminalia superba*, *Khaya grandifolia* and *Milicia excelsa* in lowland forest areas; *Syzygium guineense*, *Prunus africana* and *Rex mitis* in montane forests; *Daniellia oliveri*, *Lophira lanceolata*, *Azelia africana*, *Isobertia doka* and *Burkea africana* in the Sudan-Guinea savanna woodlands (Ezealor 2002). Grasses include *Loudetia simplex*, *Andropogon* spp. and *Hyparrhenia* spp. among others. Fauna resources of the park is very diverse with about 366 species of birds so far recorded and 103 species of mammals with a population of about 2000 chimpanzees (*Pan troglodytes*) and a large number of antelopes (Ezealor 2002). Ethnic groups in the area according to Dunn, (1999) is considered to be diverse and dominated by Jibu, Dakka, Tiv, Panso, and Fulani. Others are Chamba, Kutim, Nyamnyam and Kona. The occupations of the people are farming, fishing, pastoralism and trading (Dunn 1999).

2.2 Study design and data collection

A preliminary survey was conducted in July 2015 to identify the terrain, vegetation, size of the range and accessibility to and within the range for data collection. The park has five ranges namely: Toungo, Gumti, Filinga, Mayo-Selbe and Gangam ranges. Multi-stage sampling (Double-stage) was used in selecting the study site. Mayo-Selbe range was selected, and was divided into three sites: Bodel, Mayo-Jarandi and Mayo-Jankasa. Timed Species Counts (TSCs) method developed by Sethy *et al.* (2015) was used for data collection.

Two vantage positions in areas where bird activities were observed to be highest during preliminary survey were used for the observation of birds, as outlined by Sethy *et al.* (2015), TSC data were recorded in six columns corresponding to six 10-minutes intervals during a survey that lasted for one hour. Birding was carried out at a slow pace at about 1-2km/h between 7:00-8:00am and 5:30-6:30pm when bird's activities were relatively high. For the first 10-minutes all species encountered were recorded in the first column. Only the name of the species and not the number of individuals were recorded on the data form. For the second 10-minutes period, any species not already recorded were recorded in the second column. The remainder of the hour was also divided into 10-minutes periods and any species recorded for the first time during any 10-minutes period was recorded in the appropriate column, such that any species recorded during the hour was written down only once in the column representing the

10-minutes period during which it was first seen. Distant birds were identified with the aid of 8x30mm binocular. Identification and nomenclature of birds followed Borrow and Demey (2007). Additionally, the number of times a species was encountered during the TSCs or incidentally after the TSCs was recorded on a separate sheet.

2.3 Data analysis

The relative abundance of species was obtained by dividing the number of species observed in each site by the total number of species from all the sites based on the assumption that the frequently seen species is more

abundant (Bibby *et al.* 1992; Sethy *et al.* 2015). Bird diversity was calculated using Shannon-Wiener Diversity Index (H^1) as used by Lameed (2011) stated as follows:

$$H^1 = -\sum_{i=1}^R P_i \ln P_i$$

Where P_i = Proportion of individual species

R = Total number of species of the community (number seen and heard).

Descriptive statistics using tables, frequency and percentage were used in presenting the results.



Source: Maps and Safari (2014)

Figure 1: Map of Nigeria showing Gashaka-Gumti National Park and other Reserved areas in Nigeria

3. RESULTS

3.1 Checklist of Bird Species Identified in Mayo-Selbe Range of Gashaka-Gumti National Park

The result of bird species inventory is presented in Tables 1 and 2. There were 145 species of birds belonging to 50 families. Bird families with the highest number of species were the Estrildidae (10), Ploceidae and Columbidae with 9 and 8 species respectively.

Seven species equally were identified for Hirundinidae and Saxicolinae families. Cuculidae, Musophagidae and Nectariidae had 6 species equally. Seventeen (17) families were represented by one (1) species each. Globally threatened species such as Pied crow (near threatened), Osprey (vulnerable) and Black-headed heron (near threatened) were also identified in the area. The Helmeted guinea fowl (*Numida meleagris*) and Double-spurred francolin (*Pternistis bicalcaratus*) were the most abundant species and occurred throughout the

sites. Migrants among the birds were Cattle egret (*Bubulcus ibis*), Black headed heron (*Ardea melanacephola*) and Palm nut vulture (*Gypoheitax angolensis*), while all the other species were residents.

Table 1: Checklist of Bird Species Identified in Mayo-Selbe Range of GGNP

Family	Scientific Name	Common Name
Accipitridae	<i>Buteo angularis</i>	Red-necked buzzard
	<i>Elanus caeruleus</i>	Black-shouldered kite
	<i>Aquila rapax</i>	Tawny eagle
	<i>Polyboroides typus</i>	African harrier hawk
	<i>Macheiramphus aleinu</i>	Bat hawk
Acrocephalidae	<i>Acocephalus rufescens</i>	Grater swamp warbler
	<i>Locustella naevia</i>	Grasshopper warbler
Podidae	<i>Capsiurus parvus</i>	African palm swift
	<i>Apus cafer</i>	White-rumped swift
	<i>A.apus</i>	Common swift
	<i>Tachymarptis melba</i>	Alpine swift
Ardeidae	<i>Bubulcus ibis</i>	Cattle egret
	<i>Ardea melanocephala</i>	Black-headed heron
	<i>A.purpurea</i>	Purple heron
Bucerotidae	<i>Tokus nasatus</i>	African grey hornbill
Burhinidae	<i>Burhinus senegalensis</i>	Senegal thick-knee
Campephagidae	<i>Campephaga phoenicea</i>	Red-shouldered cockooshrike
	<i>Coracina pectoralis</i>	White-breasted cockooshrike
Campromulgidae	<i>Camprimulgus longipennis</i>	Standar-winged nightjar
	<i>C.vexillanus</i>	Pennant-winged nightjar
	<i>C.climacurus</i>	Long-tailed nightjar
	<i>Prinia subflava</i>	Tawny-flanked prinia
Cisticolidae	<i>Cisticola brachypterus</i>	Short-winged cisticola
	<i>C.guinea</i>	Dorst's cisticola
	<i>Cametoptera brachyura</i>	Grey-backed cametoptera
Coliidae	<i>Colius stratus</i>	Speckled mousebird
Columbidae	<i>Streptopalia decipiens</i>	African mourning dove
	<i>S.vinacea</i>	Vinaceous dove
	<i>S.semitorquata</i>	Red-eyed dove
	<i>S.hypopyrrha</i>	Adamawa turtle dove
	<i>S.senegalensis</i>	Laughing dove
	<i>Columba guinea</i>	Speckled pigeon
	<i>Treron calvus</i>	African green pigeon
	<i>Oena capensis</i>	Namaqua dove
	<i>Coracias cynogaster</i>	Abyssinian roller
	<i>Corvus albus</i>	Pied crow
Cuculidae	<i>Centropus senegalensis</i>	Senegal coucal
	<i>Cuculus clamosus</i>	Black cuckoo
	<i>Centhmocharis aureus</i>	Yellow bill
	<i>Clamator jacobinus</i>	Jacobin cuckoo
	<i>C.glandanus</i>	Great-spotted cuckoo
	<i>C.levillantii</i>	Levaillant's cuckoo
Discruvidae	<i>Discrurus adsimillis</i>	Fork-tailed drongo
	<i>D.modestus</i>	Velvet-mantled drongo

Source: Field survey (2015)

Table 1 Cont'd

Family	Scientific Name	Common Name
Estrildidae	<i>Spermestes cucullata</i>	Bronze manikin
	<i>S.bicolour</i>	Black and white manikin
	<i>Estrilda nonnula</i>	Black-headed waxbill
	<i>E.troloodytes</i>	Black-rumped waxbill
	<i>E.astrid</i>	Common waxbill
	<i>E.polioporeia</i>	Anambra waxbill
	<i>Amanadava subflava</i>	Zebra waxbill
	<i>Uraeginthus bengalus</i>	Red-chicked lordon-bleu
	<i>Logonosticta rara</i>	Black-bellied firefinch
	<i>L.senegal</i>	Red-bellied firefinch
	Falconidae	<i>Falco tinnincullus</i>
<i>F.biarnicus</i>		Lanner falcon
<i>F.ardosiaceus</i>		Grey krestrel
Hirundiniidae	<i>Pseudhirundo griscopryga</i>	Grey-rumped swallow
	<i>Hirunda aethiopica</i>	Aethiopian swallow
	<i>H.rustica</i>	Barn swallow
	<i>Delichon urbicum</i>	Common house martin
	<i>Cecropis domicella</i>	West African swallow
	<i>C.semirusa</i>	Rofous-chested swallow

Source: Field survey (2015)

Table 2: Other Bird species identified in the Study Area

Family	Scientific Name	Common Name	
Hirundiniidae (cont'd)	<i>Petrochelidon preussi</i>	Preuss's cliff swallow	
Indicatoridae	<i>Indicator indicator</i>	Greater honey guide	
	<i>I.minor</i>	Lesser honey guide	
Jacanidae	<i>Actophilormis africanus</i>	African jacana	
Laniidae	<i>Lanius collaris</i>	Common fiscal	
	<i>L.nubicus</i>	Masked shrike	
	<i>L.mackinnoni</i>	Mackinnon's fiscal	
	<i>L.meridionalis</i>	Southern grey shrike	
Macrosphenida	<i>Sylvietta virens</i>	Green crombec	
Malaconotiidae	<i>Dryoscopus angolensis</i>	Pink-footed puffback	
	<i>Laniarus aethiopicus</i>	Tropical boubou	
	<i>Tchahra senegalensis</i>	Black-crowned tchagra	
Monarchidae	<i>Terpsiphone viridis</i>	African paradise flycatcher	
	<i>T.rufiventer</i>	Red-bellied flycatcher	
	<i>T.rufocinerea</i>	Rufous-vented flycatcher	
	<i>Erythrocecus mcalli</i>	Chest-nut capped flrcatcher	
Motacillidae	<i>Motacilla aguimp</i>	African pied wagtail	
	<i>Anthus leucophrys</i>	Plain-backed pipit	
Muscicapidae	<i>Myrmecocichla albifrons</i>	White-fronted black chat	
Saxocolinae	<i>Oenanthe familiaris</i>	Familiar chat	
	<i>O.oenanthe</i>	Northern wheatears	
	<i>Luscinia megarhynchos</i>	Common nightingale	
	<i>Myrmecocichla aethiops</i>	Northern anteater chat	
	<i>Myioparus plumbeus</i>	Bead-coloured flycatcher	
	<i>Elminia longicanda</i>	African blue flycatcher	
	Musophagidae	<i>Crinifer piscator</i>	Western-grey plantain eater
		<i>Turaco violaceus</i>	Violet turaco
<i>Cotythacola cristata</i>		Great blue yuraco	
<i>Turaco persa</i>		Green turaco	
<i>Cinnyris capreus</i>		Scarlet-chested sunbird	
	<i>Cyanonutra verticalis</i>	Green-headed sunbird	

Table 2 Cont'D

Family	Scientific Name	Common Name	
Nectariinidae	<i>Cinniris coccinigastus</i>	Splendid sunbird	
	<i>C.venustus</i>	Variable sunbird	
	<i>C.bifaaciatus</i>	Purple-branded sunbird	
	<i>Chalcometra fuliginosa</i>	Carmelite sunbird	
	<i>C.rubenscens</i>	Copper sunbird	
	<i>Anthreptes rectarostris</i>	Green sunbird	
Numidae	<i>Numida meleagris</i>	Helmetted guineafowl	
Odontophoridae	<i>Ptilopachus petrosus</i>	Stone partridge	
Pandionidae	<i>Gypoheirax angolensis</i>	Palm-nut vulture	
Passeridae	<i>Passer domesticus</i>	House sparrow	
	<i>P'grisens</i>	Northern-grey headed sparrow	
Paridae	<i>Parus funereus</i>	Dusky tit	
	<i>P.guinensis</i>	White-shouldered black tit	
Phasianidae	<i>Ptermistis bicalcaratus</i>	Double-spurred francolin	
	<i>Pelipardix coqui</i>	White-throated francolin	
Phalacrocoracidae	<i>Anhinga rufa</i>	African darter	
Platysteiridae	<i>Platysteira cyanea</i>	Common wattle-eye	
Phylloscopidae	<i>Iduna natalensis</i>	African yellow warbler	
	<i>Hippobus olivetorum</i>	Olive true warbler	
	<i>Phylloscopus herberti</i>	Black-cap woodland warbler	
	<i>Sylvia borin</i>	Garden warbler	
	Ploceidae	<i>Ploceus melanocephalus</i>	Black-headed weaver
		<i>P.cucullatus</i>	Village weaver
		<i>P.loteolus</i>	Little weaver
<i>P.heugliric</i>		Heuglin's masked weaver	
<i>P.vitellinus</i>		Vitalline masked weaver	
<i>P.nigriesillis</i>		Black-necked weaver	
Podicipedidae	<i>P.ocularis</i>	Spectacled weaver	
	<i>Quelea quelea</i>	Red-billed quelea	
	<i>Euplectes gierowii</i>	Black bishop	
Pycnonotidae	<i>Tachybaphus ruficollis</i>	Little grebe	
	<i>Pycnonotus barbatus</i>	Common bulbul	
	<i>Phyllastrephus poensis</i>	Cameroun olive green bulbul	
	<i>Chlorocichla simplex</i>	Simple leaflove	
	<i>Atimastillas flavicollis</i>	Yellow-throated leaflove	
Rallidae	<i>Zapornia flavirostra</i>	Black crane	
	<i>Gallinula chloropus</i>	Common moorhen	
Scopidae	<i>Scopus umbretta</i>	Hamerkop	
Sturnidae	<i>Lamprotormis purpureus</i>	Bronze-tailed glossy starling	
	<i>L.pulcher</i>	Chestnut-bellied starling	
Timaliidae	<i>Creotophora cinerea</i>	Wattled starling	
	<i>Illadopsis rufipennis</i>	Pale-breasted illadopsis	
Turdidae	<i>Turdus pelios</i>	African thrush	
Turnicidae	<i>Podica senegalensis</i>	African finfoot	
Strigidae	<i>Ptilopsis leuocotis</i>	Northern white-faced owl	
	<i>Strix woodfordi</i>	African wood owl	
	<i>Otus senegalensis</i>	African scops owl	
	<i>Bubo cinerascense</i>	Greyish eagle owl	
	<i>Tyto alba</i>	Barn owl	
Tytonidae	<i>Tyto alba</i>	Barn owl	
Viduidae	<i>Vidua macroura</i>	Pin-tailed whydah	
	<i>V.chalybeata</i>	Village indigobird	

Source: Field survey (2015)

Total: Families = 50 Species = 145

3.2 Relative Abundance of Bird Species in the three Sites

The relative abundance of birds in the three sites delineated in the Mayo-Selbe range of the park is presented in Table 3. The result showed that 42.07% of the bird species identified in Mayo-Selbe range of the park occurred in Mayo-Jankasa; 30.34% in Bodel and 27.59% in Mayo-Jarandi. The high relative abundance of birds in Mayo-Jankasa was accounted for by the presence of six (6) genus's of Ploceus of the Ploceidae family, five (5) genus's of Streptopalia of the Collumbidae and four (4) genus's of Estrilda of the Estrildidae families respectively.

Table 3: Number of Bird Species Sighted and their Relative Abundances in the three Sites in Mayo-Selbe Range

Site	Number Sighted	Relative Abundance
Bodel	44	30.34
Mayo-Jankasa	61	42.07
Mayo-Jarandi	40	27.59
Total	145	100

Source: Field Survey (2015)

3.3 Species Diversity of Birds in the three Sites in Mayo-Selbe Range of the Park

Result on species diversity of birds in the study area is shown in Table 4. The result shows that Shannon's Diversity Indices (H^1) of Mayo-Jankasa, Bodel and Mayo-Jarandi were 0.3760, 0.5180 and 0.5592 respectively. A total of Shannon's Diversity Index ($H^1=1.4532$) was obtained.

Table 4: Species Diversity of Birds by Site in Mayo-Selbe Range of Gashaka Gumti National Park

Site	Number Sighted	P^1	$\log P^1$
Bodel	44	0.3034	0.5180
Mayo-Jankasa	61	0.4207	0.3760
Mayo-Jarandi	40	0.2759	0.5592
Total	145		1.4532

Source: Field survey (2015)

4. DISCUSSION

Mayo-Selbe Range of Gashaka Gumti National Park is characterized by three vegetation types namely Montane Forest, Derived Savanna and Sudan-Guinea Savanna Woodlands. It is significant for the variety and number of wildlife species it contains (Dunn 1999). Prominent among these are primates, birds and antelopes. Most of the birds are residential while others were migrants. A total of 145 species identified is just 16.04% of the 904

species reported by Ezealor (2002) for Nigeria. The difference might be due to variation in size of the range as the three sites studied in Mayo-Selbe Range of Gashaka Gumti National Park is an insignificant fraction of the entire country. Hence, the result agrees with the observation of Usher (1992) and Akosim *et al.* (2008), that species richness is often affected by the size of the habitat and that diversity is positively correlated with habitat size. The 145 bird species identified in a range of Gashaka Gumti National Park is much higher than the 49 species reported by Akosim *et al.* (2008) for Yankari National Park.

The relative abundance of bird species in the study area might be related to the availability of food, habitat condition and breeding season of some species, for example, the weavers evidenced by band nests in the vicinity. The abundance of bird species is determined by the composition of the vegetation that forms a major element of their habitat (Aynalem and Bekele' 2008). The study of diversity of bird species on three sites of Mayo-Selbe Range sharing similar ecological characteristics showed that about 145 bird species were sighted in them, therefore; the occurrence of 145 bird species on single range is an indication of its rich avifauna diversity. Shannon Index has a minimum value of zero in a monoculture and increases to a maximum value (infinity) where all individuals are in different species. It has therefore a characteristic of becoming larger as a community become more diverse (Usher 1992). Hence, the Shannon index $H^1=1.4532$ obtained from this study is indicative of high bird diversity of Mayo-Selbe Range of Gashaka Gumti National Park. The diversity of bird species in the three sites was not found to be significant ($p < 0.05$). This suggests that habitat requirement of birds (food, cover, nesting, roosting and others) are equally available from the study sites. This also indicates that the study sites are equally important for bird watching and conservation of birds.

5. CONCLUSION AND RECOMMENDATIONS

From this study, the following conclusions can be made:

1. There is a significant number of bird species found in Mayo-Selbe Range of Gashaka-Gumti National Park. A total of 145 bird species belonging to 50 families were identified during the period of this study and the bird species were well distributed within the range.
2. The avifauna in the range has an average relative abundance and of high species diversity.
3. The avifauna checklist of the park should be updated from time to time which will enhance the assessment of the health of the park ecosystem.

4. More effort on surveillance is required to check indiscriminate felling of trees, illegal mining activities and poaching so as to conserve and maintain the avifauna population and diversity.

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