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CHECKLIST OF AVIFAUNA OF MUBI SOUTH LOCAL GOVERNMENT AREA OF ADAMAWA STATE, NIGERIA

BUBA, Z.M. & ZAINAB BUBA MSHELIA,

Department of Zoology, Adamawa State University, Mubi, Adamawa State, Nigeria.

ABSTRACT

Studies on the bird species diversity and relative abundance between January to October 2017, was carried out to checklist the avifauna of Mubi South Local Government Area of Adamawa State, Nigeria, and to determine the avian diversity and density of Mubi South Local Government Area. Three methods; Breeding Bird Survey-line transect, distance sampling and wandering Point centred quadrant (Wandering PCQ) method along and within the study area were used. Forty Six (46)bird species belonging to twenty three (23) families were recorded at Mubi South Local Government Area. There was a significant difference between the bird species at the different site subjected to student t-test (P<0.05). Whereas in Czekonowski similarity index (Sc) showed no relationship between study sites and bird species. This study revealed that Mubi South is a good area of avifauna diversity.

KEY WORDS: *checklist, avifauna, Mubi South, diversity, density*

Introduction:

The effective management of animal species is greatly improved by the accurate knowledge of population distribution and abundance. The accurate estimation of animal abundance has developed as a necessary requirement of both ecological research projects and wildlife resource management. The monitoring of species is dependent on methods capable of accurately estimating the size of populations in this case birds. The theory of population biology and conservation management explicitly requires accurate estimates of abundance to calculate minimum viable and effective population sizes (McArthur, 2012). According to McArthur, (2012) the establishment of

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Priorities for species recovery depends on estimates of population density. Bird monitoring schemes have an unquestionable interest for the conservation of both the birds and their habitats (Herrando *et al.,* 2008). The priority of inventory calls for accurate estimates of total population size as well as the reliable knowledge of whether populations are increasing or decreasing. Managers and scientists involved in the recovery process need to agree on criteria which incorporate accepted probability of persistence and to then effectively monitor populations through their recovery and management; this will only be known if there is a continuous monitoring and validation (Mark, 2007; Rudra *et al.,* 2013).

Coombes *et al.,* (2006) stated that, in the light of increasing forest destruction and the wide gap in the understanding of tropical bird communities, several researchers have recently applied a rapid assessment approach to maximize data collection with limited funds, time, and personnel Point counts as one of the most common survey methods used in monitoring avian species and are used in varied population at both continental and local scale.

The program DISTANCE (Laake *et al.,*. 1994), in particular, has advanced the science of bird counting considerably (Fancy, 1997). Distance sampling is mostly used because it reduces bias in estimates of avian populations, and has recently become more widely used to assess avian populations. These data are more reliable for conservation planning and assessment, (Michael and Daniel, 1999; Buckland *et al.,*. 2001; Somershoe *et al.,* 2006; Mark, 2007; Claire, 2009). Distance sampling describes a group of methods which estimate the absolute density of a population based on the observer to animal distance (Cassey, 1999).

According to Cassey (1999) Line transect estimators also proved to be a cost effective relative index for the estimated density of species known to violate both the assumptions of no movement in response to the observer prior to initial detection and absolute detection on the transect line. However, line transects created less animal stress and less environmental disturbance, and required significantly less cost in time, effort and man power (Cassey, 1999; Mark, 2007). Other techniques are also used which has a high turn up of bird species per unit effort of survey (Lameed, 2012).

A methodical checklist of avifauna in Mubi South Local Government Area of Adamawa State, Nigeria is lacking, this study is a step to provide a comprehensive checklist of the avifauna in Mubi South Local Government Area of Adamawa State, Nigeria with summary information on their density, diversity and abundance, in a format suitable for use in the field. It should facilitate field identification, especially when used in conjunction with an illustrated field guide in an advent of future study in this area of study. This study was therefore carried out to provide a checklist of the avifauna of Mubi South Local Government Area with the objective of determining the avian density and diversity of Mubi South Local Government Area of Adamawa State, Nigeria.

MATERIALS AND METHOD

Study area: The study was carried out in Mubi South Local Government Area of Adamawa State Nigeria, located at the North-Eastern part of Nigeria between the latitude 10˚30’15’’ N and 10˚15’00’’ N and longitude 13˚15’00’’ E and 13˚45’06’’ E. The area has a tropical climate with an average temperature of 32˚C. The area has an average relative humidity ranging from 28% to 45% and an average rainfall of about 1056mm (Adebayo and Tukur, 2004). It is typically of two vegetation zone; Sudan guinea and northern guinea savannah which spread over Mubi South Local Government Area.

Method: Three different methods was used in data collection; Breeding Bird Survey-line transect, distance sampling and wandering Point centred quadrant (Wandering PCQ) method along and within the study area. Wandering PCQ was used because some part of the study area and data collection was carried out in the urban part of Mubi South Local Government, rugged terrain or in the advent opportunistic data collection of avian species. First, line transect at stratified random location of at least 500m away from the next transect was used.

Line transect survey: The method that was used was the BBS(British Bird Survey)- Line transect, chosen for this sample unit over the point count due to the open nature of much of the area as described by (Bibby *et al.,* 2000; Bibby *et al.,* 1998; Buckland *et al.,* 2001, Risely *et al.,* 2010) Point counting was not applied as survey technique because birds in open area readily fly away on approach on site and some of the birds did not return during the period of the survey; the BBS is a line-transect survey based on randomly located 1sqkm, squares are located through stratified random sampling.

Using the BBS- line transect ensures two early-morning visits to their square from August- October as the survey period, recording all birds encountered while walking through the 1km transects across their square. Each transect was spaced from the next by at least 500m to prevent double count of birds along the respective transect and also for ease of recording. Birds were recorded in five distance categories, or as 'in flight', in order to assess detect ability and work out species density.

However, wandering point centred quadrant PCQ (opportunistic data collection for bird species as well as sample area count) was used for areas of unfavourable terrain, hence, for practical reasons there is often substantial deviation from the ideal route (Harris *et al.,* 2014), and for this reason data was collected periodically from both ideal route (deviation; wandering PCQ) and actual transect to allow correction of observer bias.

The survey area consists of mosaic of habitat transition from open savannah, wetland to mountainous habitat and different field type, in order to limit as much as possible habitat survey per line, the line was restricted to 1km in length and to avoid cross-transects. A distance of 500m was maintained as in Mark, (2007). To ensure consistency, compass reading was taken and followed using a GPS unit to the end. The data collection season was rainy season typical of any tropical zone; randomly placed line transect, grid line transect and wandering PCQ; opportunistic data collection as seen in Andrew *et al.,* (2002) and McArthur *et al.,* (2012).

The grid line transect was the second phase of the data collection as it enabled more efficient coverage and effort whilst retaining statistical robustness. The programme GPS Utility 5.20 was used to place transect within each site as to prevent crossing of transects following (Mark, 2007; Lameed, 2012).

Conducting transect

For a field work survey two visit is ideal; first reconnaissance visit and bird record visit (Risely *et al.,* 2008; Risely *et al.,* 2010). An ideal transect was 1km to utilize unit time and unit count it was maintained at 1km; a distance 500m away from the subsequent line transect as in (Risely *et al.,* 2008; Risely *et al.,* 2010 and Harris *et al.,* 2014) was used.

An observer walked slowly on the route, marking a start point using a GPS unit looking left to right as the crow fly collecting all available data. Transects was conducted with consistency to ensure the whole number of transects are completed in the same season to afford consistency of data collected as in Harris *et al.,* (2014). Whereas, in mountainous habitat transects was not feasible, hence, wandering PCQ was employed; it was independent of any statistical procedure.

A two day visit to each transect was carried out to utilize the time and number of transects to be visited coinciding to the stipulated study period following

(Harris *et al.,* 2014). Data collection zone was defined by probability using single sites of high avian activities to represent the region in avifauna distribution and abundance (Watson, 2004; Risely *et al.,* 2008). Standardized search was used while collecting the data which uses a quantitative result-based stopping rule to determine when sampling is complete, patches of varied size have varied sampling period to fulfil the rule, but all resultant surveys are of comparable completeness. Thus, the actual time taken to complete the survey of a particular patch is immaterial.

Site selection: Since there is no detailed map of area, the site of study or data collection was based on visual determination of avifauna availability. Avian species are abundant in areas of less interference and seen at river banks, artificial lakes, earthed ponds in relation to the study area and open grass and woodland and possibly other habitat type as described by (Ikpa *et al.,* 2009).

Transect method: Transects was conducted between 6:00A.M.-12:00 noon depending on site location as in (Newson *et al.,* 2003; Coombes *et al.,* 2006; Mark, 2007). Transects was walked and completed between 7-10 minutes, this depends on the terrain and number of birds identified and sexed if possible. Birds of the same species within 10m of each other were counted in the same group and to avoid inflation of estimating density distance was sectioned as; 0 -10m, 10 -20m, 20 -30m, 30 - 40m and 40 - 50m.

Analysis of line transect data

Diversity index: Simpson's diversity index was used to calculate diversity for each site.

$$D = \frac{1}{\sum_{i=1}^{s} P_i^2}$$

S= Total number of species with distance records

P_i= Proportion for the *i-th* species of individuals (individual contribution)

i = number of species individuals

In cases where there is no observation, diversity was not calculated. Simpsons diversity is chosen over Shannon-Weiner diversity index, this is because Simpsons diversity index does not include a natural logarithm, which in Shannon-Weiner diversity index results in transect with only one species having a value of zero.

Distance analysis: To derive variables accurately representing the actual abundance of birds observed on transect the method of (Cassey, 1999; Buckland *et al.,* 2001), distance sampling was used to account for the detection function, the drop-off in the proportion of birds present that are detected as distance from the observer increases. Density estimates of species by transect was calculated using Distance programme version 6.2 as in (Cassey, 1999; Somershoe *et al.,* 2006; Buckland *et al.,* 2001). Most birds observed on transects was treated as clusters of objects, with each group of birds seen having a mean perpendicular distance to transects and the number of the group included in the analysis. Distance estimates was calculated for each transect, taking into account the value of the covariate on the individual transects, the distance to the bird viewed, the number of cluster and the cluster size. Species records were truncated at the distance to which 95% of the individuals are observed.

Indices: Similarity index was used to measure the degree to which the species and their relative abundance are shared between different bird communities. Completely similar communities have an index of 1; while completely dissimilar communities have an index of 0.

Czekonowski similarity index was used;

$$\text{Similarity index Sc} = \frac{[2\sum(xi, yi)]}{[\sum xi + \sum yi]}$$

Where; xi and yi are the abundance of the species i in habitat X and Y.

$[2\sum(xi, yi)]$ Is the sum of the lowest abundance where species i occurs in both habitat X and habitat Y.

Student t-test: Student t-test was used to check the significant difference between the species observed at the individual site patches distributed throughout the study area; that is individual survey patches within Mubi South Local Government Area was tested against the other. The significant difference was set at a probability level of 95%.

Student t-test was used;

$$\text{t-test} = \frac{\overline{x_i} - \overline{x_{ii}}}{\sqrt{\frac{sd_i^2}{n_i} + \frac{sd_{ii}^2}{n_{ii}}}}$$

Where $\overline{x_i}$ is the initial mean value of site *i,* and $\overline{x_{ii}}$, the final mean value of site *ii*, *Sd* is the standard deviation of the species observed at the respective survey sites, *n* is the number of species observed at individual survey site.

RESULT

Indices, t-test and standard deviation

Bird species at the study area was distributed among the three study sites in Mubi South Local Government Area, (Table 1). There was a significant difference (P<0.05) from the standard deviation (St. Dev.). Dirbishi had the highest diversity (D) of species compared to the other sites in Mubi South Local Government Area; D=18.35 and obviously had the highest frequency of birds observed where *f*=149 as presented in table 1.

Table 1: Diversity index and standard deviation of Mubi South Local Government Area

S/no.	Site	*f*	Spp. No.	Mean	St. dev.	D
1	Dirbishi	149	29	5.14	4.31	18.35
2	Mujara	30	16	1.88	1.31	10.59
3	Fed.P-Gada	77	19	4.05	3.94	10.08

P<0.05

There was a significant difference between the bird species at the different site subjected to student t-test. Czekonowski similarity index (Sc) showed no relationship between study sites. Table 2 represents the test relationship of the individual site in terms of species present; site 1-2 topped the list with 3.45 when subjected to student t-test. The similarity index test showed no similarity between the individual sites in relation to one another as Sc< 0.50.

Table 2: T-test and similarity index Mubi South Local Government Area

S/No.	Site range	t-test	Sc
1	1-2	3.45	0.44
2	2-3	-2.28	0.17
3	1-3	0.89	0.25

Sc< 0.50

Density and abundance: Table 3 represent the estimation summary of density and abundance of bird species present at Mubi South Local Government Area at a 95% confidence interval. The encounter rate for all data collected was combined; the probability of detection of all collected data was combined. Likewise, expected cluster size and density of the study site collected data was combined.

The analysis was based on exact distance collected at study site to the bird species (perpendicular distance) with the width specification at 20meters, that is, the observation distance was truncated at 20meters (any distance above 20meters was not used in the analysis to increase precision).

Cluster size analysis was based on the exact size; expected value of cluster size was computed by regression of log *(S (i))* on *g(X (i)).* Where *S (i)* is cluster size of *i-th* observation and *X (i)* is the distance *to i-th* observation. The estimators key: Uniform; $K(y) = 1/w$. adjustments- function as simple polynomial, the estimator function was not constrained to be monotone, term selection mode adjustment was sequential, the term selection criterion adjustment was Akaike Information Criterion (AIC); estimate selection was chosen by estimator with minimum AIC. Distance estimation was scaled by right truncation at 20meters. The measurement unit of density was number per square kilometre and the effective strip width or detection radius was measured in meters.

Table 3: Mubi South Local Government Area Density and Abundance estimates

Parameter	Point estimates	Standard error	% coeff. of variation	95% confidence Interval	
				Lower bound	Upper bound
Ds	105.82	14.504	13.70	80.383	139.34
E (s)	2.8179	0.28289	10.04	2.3078	3.4408
D	298.23	50.661	16.99	213.28	417.02

The parameters used are described as; D: density/abundance, Ds: density of clusters, E(s): estimate of expected value of cluster size.

Table 4 Common English names, Scientific names and classification of family where presented following Collins Field Guide 'Birds of West Africa'(Serle *et al.*,1995). However, at Mubi South Local Government Area 256 observations were made in which 46 bird species belonging to Twenty Three (23) Family were recorded at Mubi South Local Government Area. The class or relative abundance checklist of birds observed during the period of this study, the number of individuals observed per site, number of individuals per 213 minutes of observation is represented in Table 4.

Checklist and Relative abundance of the Avian Species

Table 4: Checklist of Avian Species and their relative abundance at Mubi South Local Government Area

S/No.	Species Common Name	Species Code	Species Binomial Name	Species Relative Abundance
FAMILY: ARDEIDAE				
1	Cattle Egret	CAEG	*Ardeola ibis*	*Common*
2	Little Egret	LTEG	*Egretta garzetta*	*Frequent*
FAMILY: CICONIIDAE				
3	Black Stork	BLST	*Ciconia nigra*	*Abundant*
FAMILY: ACCIPITRIDAE				
4	Palmnut Vulture	PNVT	*Gypoheirax angolensis*	*Frequent*
5	Harrier Hawk	HRHK	*Polyboroides radiates*	*Frequent*
6	Brown Harrier Eagle	BRHE	*Circaetus cinereus*	*Frequent*
7	Chanting Goshawk	CHGH	*Melierax metabates*	*Frequent*
FAMILY: PHASIANIDAE				
8	Stone-Partridge	STPT	*Ptilopachus petrosus*	*Common*
9	African Blue Quail	AFBQ	*Coturnix chinensis*	*Common*
10	Clapperton's Francolin	CLFR	*Francolinus clappertoni*	*Frequent*
FAMILY: CHARADRIIDAE				
11	Spur-Winged Plover	SPWP	*Vanellus spinosus*	*Frequent*
FAMILY: COLUMBIDAE				
12	Red Eye Dove	RDED	*Streptopelia semitorquata*	*Frequent*
13	Laughing Dove	LADV	*Streptopelia senegalensis*	*Common*
FAMILY: MUSOPHAGIDAE				

14	Western Grey Plantain-Eater	WGPE	*Crinifer piscator*	*Abundant*
FAMILY: CUCULIDAE				
15	Senegal Coucal	SNCL	*Centropus senegalensis*	*Abundant*
FAMILY: BUCEROTIDAE				
16	Red-Beaked Hornbill	RBHB	*Tockus erythrorhychus*	*Frequent*
FAMILY: CAPITONIDAE				
17	Bearded Barbet	BBBT	*Lybius dubius*	*Common*
FAMILY: HIRUNDINIDAE				
18	African Sand Martin	AFSM	*Riparia paludicola*	*Frequent*
FAMILY: STURNIDAE				
19	Purple Glossy Starling	PPGS	*Lamprotornis purpureus*	*Common*
20	Blue-Eared Glossy Starling	BEGS	*Lamprotornis chalybaeus*	*Frequent*
21	Long-Tailed Glossy Starling	LTGS	*Lamprotornis caudatus*	*Common*
FAMILY: CORVIDAE				
22	Black Magpie	BLMG	*Ptilostomus afer*	*Common*
23	Pied Crow	PDCW	*Corvus albus*	*Common*
FAMILY: PYCNONOTIDAE				
24	Slender Billed Bulbul	SBBB	*Andropadus gracilirostris*	*Frequent*
FAMILY: TURDIDAE				
25	White Crowned Cliff-Chat	WCCC	*Myrmecocichla cinnamomeiventris*	*Frequent*
26	West African Thrush	WATH	*Tardus pelios*	*Frequent*
27	Snowy-Crowned Robin-Chat	SCRC	*Cossypha niveicapilla*	*Frequent*
28	Nightingale	NTGL	*Luscinia megarhynchos*	*Common*

FAMILY: MUSCICAPIDAE				
29	Paradise Flycatcher	PAFC	*Terpsiphone viridis*	*common*
30	Black Flycatcher	BLFC	*Melacnornis edolioides*	*Frequent*
FAMILY: PARIDAE				
31	White-Shoulder Black Tit	WSBT	*Parus leucomelas*	*Frequent*
FAMILY: NECTARINIDAE				
32	Beautiful Long-Tailed Sunbird	BLTS	*Nectarinia pulchella*	*Frequent*
FAMILY: ZOSTEROPIDAE				
33	Yellow White Eye	YLWE	*Zosterops senegalensis*	*Frequent*
FAMILY: EMBERIZIDAE				
34	Rock Bunting	ROBT	*Emberiza tahapisi*	*Abundant*
FAMILY: FRINGILLIDAE				
35	Grey Canary	GRCA	*Serinus leucopygius*	*Common*
36	Yellow-Fronted Canary	YLFC	*Serinus mozambicus*	*Common*
FAMILY: PLOCEIDAE				
37	Sparrow Weaver	SPWR	*Plocepasser soperciliosus*	*Frequent*
38	Grey Headed Sparrow	GRHS	*Passer griseus*	*Common*
39	Red Bishop	RDBH	*Euplectus orix*	*Common*
40	Fire Crown Bishop	FCBH	*Euplectus hordeaceus*	*Frequent*
41	Blue-Bellied Weaver	BLBW	*Spermophaga haematina*	*Frequent*
42	Pin Tailed Whydah	PNTW	*Vidua macroura*	*Frequent*
43	Bush Sparrow	BHSW	*Petronia dentate*	*Common*
FAMILY: ESTRILDIDAE				
44	Senegal Fire Finch	SNFF	*Lagonosticta senegala*	*Common*

45	Warbling Silverbill	WRSB	*Lonchura malabarica*	*common*
46	Grey Crowned Negro Finch	GCNF	*Nigrita canicapilla*	*Frequent*

DISCUSSION

This result revealed that Mubi South is a suitable area of avifauna diversity as forty six species of birds belonging to twenty three families were recorded during this study. This may be because of the availability of their numerous food items and the weather condition of the area. The species observed were mostly of Savannah habitat, this is in line with Mark, (2007), who reported that birds' species of open habitat are more commonly associated with scrubs and Savannah habitat. During this study, birds were mostly found along mountain edge, edge of seasonal forest and farms. This result also disagrees with that of (Ydenberg and Dill, 1986; Bibby *et al*, 1998), who stated that Savannah birds may be more likely to keep close to the edge habitat in other to escape from predators whilst open-country birds may be more likely to avoid edge habitat where predators may be concealed. Many of the observation during this study was made on the farm, some species particularly of the family Estrildidae and Ploceidae which are widely distributed on farm, bushy grasslands were observed. The result is similar when compared with the one reported by (Keith *et al*, 1992; Borrow and Demey, 2001), that some species mostly of the family Estrildidae were widely distributed in Western Africa where the vegetation is slightly woodland and bushy grassland. This may be because of the small annual grass seeds which they can easily obtain.

CONCLUSION

This study was carried out to provide baseline information on the avian checklist of Mubi South Local Government Area of Adamawa State for a period of ten months January to October 2017. The study revealed the importance of Mubi South as a suitable area of avifauna diversity as forty six species of birds belonging to Thirty five families were recorded during this study.

RECOMMENDATION

The researcher therefore recommend that, Management decisions should be taken by the Ministry of Environment on the control of habitat destruction and over exploitation of the wilderness either through logging, farm clearing, bush burning and so on, Which kills about 30% of any species inhabiting such areas. The use of pesticides and chemicals which is driving our nation towards desert encroachment at an alarming rate should be discouraged.

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