



## Diversity of avifauna across habitat types in Lau and Zing local government areas, Taraba State, Nigeria

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### Article Info

**ISSN (online):** 2582-7138

**Volume:** 04

**Issue:** 01

**January-February 2023**

**Received:** 17-01-2023;

**Accepted:** 07-02-2023

**Page No:** 529-534

### Abstract

The aim of study was to determine diversity of avifauna across habitat types in Lau and Zing Local Government Area of Taraba State, Nigeria. The study was conducted between September 2019-February 2020. The habitats were divided in to five (5) habitat types namely: Woodland, Wetland, Riparian forest, Forest and Rocky outcrop. Point count and transect walk method was used to collect data on diversity of avifauna. Shannon Wiener diversity index (H) was used to determine species diversity across the habitat types. 17,408 birds from 57 families and 301 species were recorded in the study area. The highest diversity was recorded in the Riparian Forest (3.645) for the wet season and Forest habitat (3.543) for the dry season. Evenness diversity (E) shows that the highest evenness was recorded in the Riparian forest (0.839) and the lowest in Rocky outcrop (0.507) from September to November 2019 while highest diversity was recorded in the Forest habitat (3.543). Evenness diversity (E) also shows that the highest evenness was recorded in Rocky outcrop (0.830) and the lowest in Riparian forest (0.541) from December, 2019 to February 2020. The findings of this research provide evidence that Riparian Forest and Forest habitats can serve as safety haven for birds, therefore, conservation effort should be focused on Riparian forest, Forest and Wetland habitats.

**Keywords:** Diversity, avifauna, habitat types, Lau and zing LGA

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### Introduction

Birds are warm blooded vertebrates in the scheme of biological classification. They belong to the phylum Chordata because of the presence of backbone and to the class Aves for possessing feathers on their bodies. They can feed on variety of food items and nest on infinite variety of sites. They occupy many trophic levels in the food chain ranging from consumers to predators. They are regarded as the best known class of vertebrate animals that occur worldwide in nearly all habitats (Whelan *et al.*, 2008; Wenny *et al.*, 2011; Sekercioglu, 2012) <sup>[24, 23, 19]</sup>. Their occurrences have been helpful as environmental health indicator, plant pollinators and seed dispersal as well as pest controller (Rachandria, 2013; Bideberi, 2013) <sup>[6]</sup>. Birds play beneficial roles as insectivores, granivores, nectarivores and scavengers. There are over 9,026 species of birds (class Aves), grouped in 27 Orders and 155 families currently inhabiting the earth (Birdlife International, 2017, Nkwabi *et al.*, 2018) <sup>[7, 13]</sup>. Of these, 1,469 species are considered threatened with extinction, 1,017 species are near threatened, 62 species lack the data to determine their status, and 145 species are recorded as extinct. The data from the IUCN shows a total of 2,486 species or just under one quarter of all the world's birds are treated as global conservation priorities. According to Lepage (2017) <sup>[11]</sup> there are 864 bird species in Ethiopia, of which 19 are endemics, 35 are globally threatened and 1 introduced species and a further 13 are shared only with Eritrea.

In Nigeria, the country report published by the Federal Environmental Protection Agency (FEPA) indicates that Nigeria possesses about 1,000 birds and four (4) endemic species which include; the Anambra waxbill (*Estrilda poliopareia*), the Ibadan malimbe, (*Malimbus ibadanensis*), the Jos Plateau indigo-bird (*Vidua maryae*) and the Rock Fire-finch *Lagonostictas anguinodorsalis* (Nigeria's 4th Biodiversity Report, 2010) <sup>[16]</sup>.

Species diversity is a community attribute that is directly related to ecosystem production and tropic structure. Research has shown that community productivity is directly linked with species composition and diversity as well as pattern of interaction among species (Pringle *et al.*, 2010). Furthermore, studies have shown that vegetation structure is the most proximate factor that determines species diversity; in addition any habitat is mainly determined by vegetation structure which is further enhanced by the plants species composition (Tela *et al.*, 2021) [22]. The diversity of avian species, therefore, in a specific habitat could serve as a useful barometer of the ecological status of that habitat (Manjunath, 2012) [12]. The diversity patterns depend on birds' mobility, food availability, habitat suitability, geo-physiological structure of a habitats and the size of the habitats (Akosim *et al.*, 2008) [4]. The habitats are being destroyed either as a result of farming, building infrastructure, road construction, dam construction and fire wood collection which affect the diversity of avifauna species.

### Materials and Methods

**Description of Study Area:** The study was carried out in Lau and Zing Local Government Area of Taraba State, Nigeria. Taraba State lies between latitude 6°25'N and 9°30'N and between longitude 9°30'E and 11°45'E. It shares boundary in the North with Bauchi State and Gombe State in the North-East, Adamawa State on the East, Plateau State in the North West, Benue State, in the South West while it shares an international boundary with the Republic of Cameroon to the South-East as shown in Figure 1 (Taraba State Diary, 2006)

[20].

Lau Local Government Area shares boundary with Adamawa State to the North, Karim-Lamido Local Government to the West, Jalingo and Yorro to the East and Gassol Local Government Area to the South. It lies between latitude 8°56'N to 9°20'N and longitude 11°15'E to 11°40'E (Taraba State Diary, 2006) [20]. The Local Government covers an area of 3,525 km<sup>2</sup> (NPC, 2006) [15].

Zing local government area is situated in the North-Eastern part of the state capital. The Local Government Area lies between latitude 8°45'N and 9°10'N and longitude 11°35'E and 11°50'E. (Taraba State Diary, 2006) [20]. It has a total land area of about 1030 km<sup>2</sup> (NPC, 2006) [15]. (Figure 2).

The study area is characterized by tropical continental climate and sudan savanna type vegetation which consists of grasses and scattered tall trees such as *Acacia*, *Borassus aethiopum*, *Ptericarpus* spp, *Vitex doniana* and *Ficus* spp (Aboki *et al.*, 2020) [2]. In terms of occupation, quite a reasonable number of the inhabitants in Lau and Zing are civil servants, while agriculture appears to be their major occupation because almost all the tribes practice agriculture. Generally in the area, the dry season is usually the period of high temperatures of about 40°C. Temperatures are however observed to drop during rainfall to 18°C in July when the relative humidity is generally high and also during December and January under the influence of the harmattan. The mean annual rainfall of Lau Local Government Area is 1,000mm. and mean annual rainfall of Zing is 1,063mm (Taraba State Diary, 2006) [20].

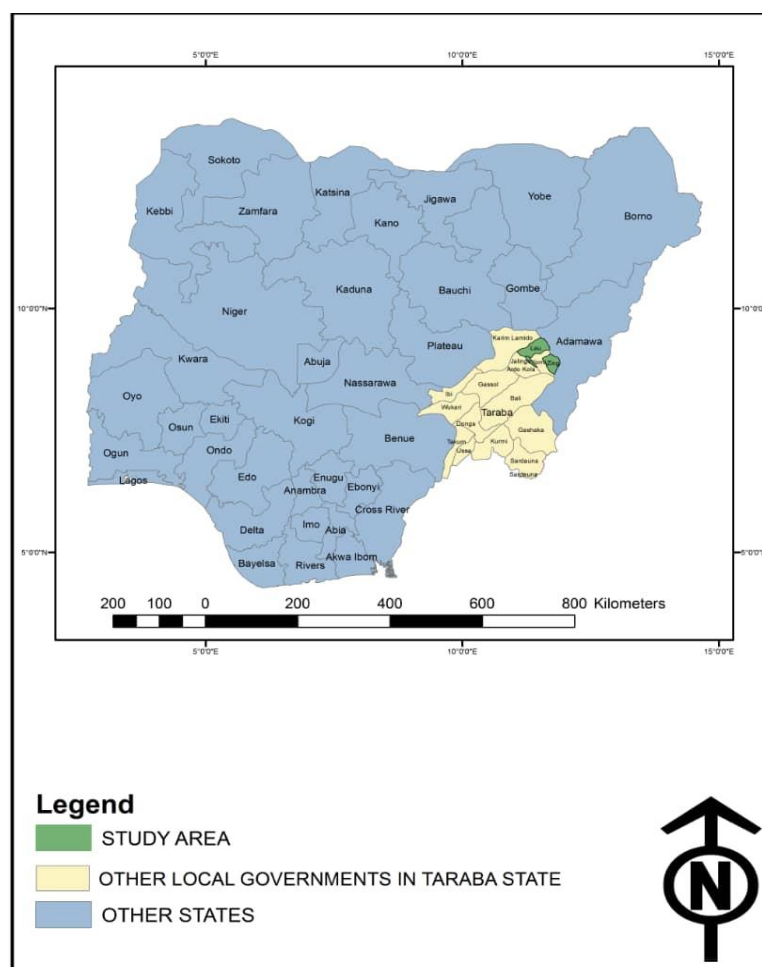
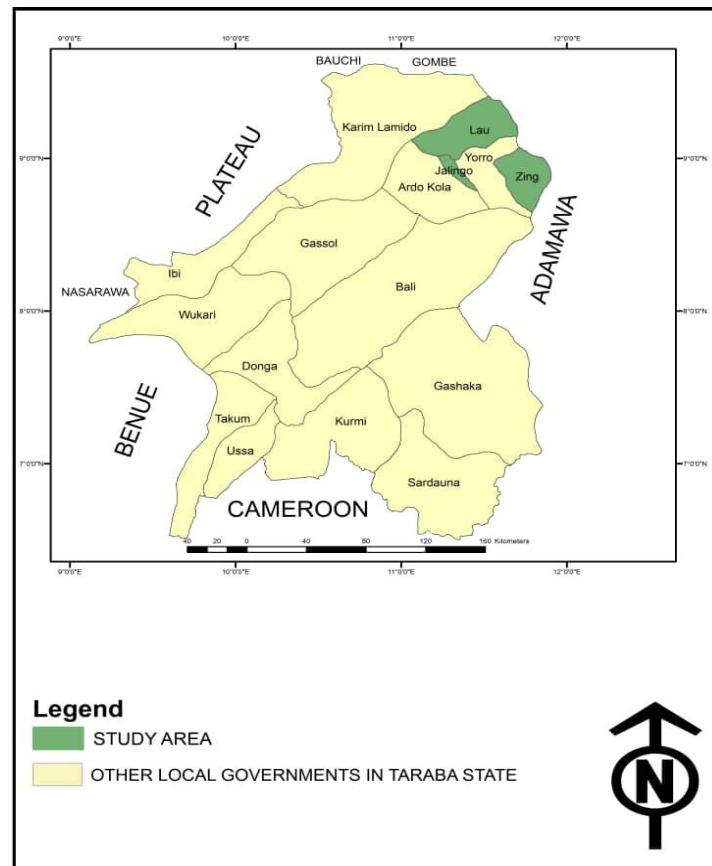


Fig 1: Nigeria Showing the Study Area



**Fig 2:** Taraba State showing the study area

### Experimental Design

The study was conducted in Lau and Zing Local Government Area. The survey was divided into five (5) habitat types namely: Riparian forest, Woodland, Forest, Rocky outcrop and Wetland habitats. The Stratified Random Sampling Technique was used to collect data. The survey took place between September, 2019 to November, 2019 for the wet season data collection and from December, 2019 to February, 2020 for the dry season data collection. Five (5) points of 120m in length covering a distance of 2.2km were surveyed. Point count method as outlined by Bibby *et al.* (1992) [5] was adopted for the collection of data. Points are usually laid out on a random transect, every 50 m. One walks from one point to the other, stops at the point for a predetermined amount of time (5-10 minutes) to count all birds present (individuals and species) and then walks to the next point to repeat this and so forth; a total of 36 minutes was spent at each site. The data was collected in the morning and evening to determine diversity of birds in the study area. Data collection was carried out between 6:30 am - 9:30 am and between 3:30 pm -6:30 pm for twelve (12) weeks in each habitat for the wet and dry season. Garmin GPS device was used to record the coordinates, a pair of binoculars was used to confirm the identification of birds located by eye and bird's call or song was recorded and identified. Photograph of birds was taken using a Nikon DSLR camera with 300 and 500 type of camera. A field guide of "Birds of West Africa" by Borrow and Demey (2004) [8] was used for the identification of birds and a print out from the internet of birds of West Africa was also used for confirmation.

### Data Analysis

Avifauna species diversity was analyzed using Shannon-

Wiener diversity index ( $H'$ )

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

Where

- P<sub>i</sub> = proportion of individual species,
- S = is the total number of species in the community (Number seen plus number heard)
- ln = natural logarithm
- i = i<sup>th</sup> species and
- D<sub>s</sub> = (ni(ni -1)/N(N-1))

Where

- D<sub>s</sub> = Bias corrected form for Simpson Index
- ni = number of individuals of the ith species
- N = Total number of species in the community

### Results

17,408 birds from 57 bird families and 301 species were recorded in the entire study area out of which 11,662 birds from 219 species in 50 families were recorded in Lau and 5,746 birds from 166 species in 40 families were recorded in Zing. Columbidae (28) was the most dominant family in the study areas representing 14 species each in Lau and Zing, followed by Ploceidae and Nectarinidae recording 19 species each, then Accipitridae and Pycnonotidae recording 17 species each (Table 1). Table 2 shows the Shannon Wiener diversity across habitats in Lau and Zing from September to November 2019. In terms of species diversity across the habitat types, Riparian forest (3.645) took the lead, followed by Wetland (3.442), then Woodland (3.180) all in Lau, while

Forest (3.068) and Rocky Outcrop (2.068) were the least in Zing. Evenness diversity (E) shows that the highest evenness was recorded in Riparian Forest (0.839) and the lowest in Rocky outcrop (0.507). Table 3 shows the Shannon Wiener diversity of all the habitats in Lau and Zing from December 2019 to February 2020. The result shows that Forest (3.543)

had the highest species diversity in Zing, followed by Wetland (3.539) in Lau, then Rocky outcrop (3.401) in Zing while Riparian Forest (3.301) and Woodland (3.038) were the least in Lau. Evenness diversity (E) shows that the highest evenness was recorded in Rocky outcrop (0.830) and the lowest in Riparian Forest (0.741).

**Table 1:** Composition of Birds Families Recorded across habitat types In Lau and Zing from Sept.-Nov. 2019, Dec.2019-Feb.2020

| Families          | Number Recorded in Lau | Number Recorded in Zing | No. of species recorded in the study area |
|-------------------|------------------------|-------------------------|---|
| Cuculidae         | 2                      | 3                       | 5   |
| Bucerotidae       | 2                      | 1                       | 3   |
| Psittacidae       | 4                      | 1                       | 5   |
| Columbidae        | 14                     | 14                      | 28  |
| Musophagidae      | 2                      | 1                       | 3   |
| Ardeidae          | 14                     | 2                       | 16  |
| Coraciidae        | 2                      | 1                       | 3   |
| Phoeniculidae     | 2                      | 3                       | 5   |
| Accipitridae      | 12                     | 5                       | 17  |
| Zosteropidae      | 1                      | 1                       | 2   |
| Sylviidae         | 10                     | 11                      | 21  |
| Capitonidae       | 2                      | 3                       | 5   |
| Ciconiidae        | 4                      | -                       | 4   |
| Burhinidae        | 4                      | -                       | 4   |
| Charadriidae      | 14                     | -                       | 14  |
| Meropidae         | 2                      | 3                       | 5   |
| Threskiornithidae | 2                      | -                       | 2   |
| Scopidae          | 1                      | -                       | 1   |
| Ploceidae         | 7                      | 12                      | 19  |
| Jacaniidae        | 2                      | -                       | 2   |
| Recurvirostridae  | 1                      | -                       | 1   |
| Glareolidae       | 4                      | -                       | 4   |
| Laniidae          | 3                      | 2                       | 5   |
| Scolopacidae      | 11                     | -                       | 11  |
| Alcedinidae       | 7                      | -                       | 7   |
| Anatidae          | 7                      | -                       | 7   |
| Nectarinidae      | 2                      | 17                      | 19  |
| Indicatoridae     | 1                      | 4                       | 5   |
| Sturnidae         | 11                     | 4                       | 15  |
| Estrildidae       | 9                      | 0                       | 9   |
| Corvidae          | 3                      | 2                       | 5   |
| Hirudinidae       | 3                      | 1                       | 4   |
| Apodidae          | 1                      | 1                       | 2   |
| Viduidae          | 4                      | 3                       | 7   |
| Fringillidae      | 2                      | 2                       | 4   |
| Anhingidae        | 1                      | -                       | 1   |
| Timaliidae        | 2                      | 2                       | 4   |
| Rallidae          | 7                      | -                       | 7   |
| Dicruridae        | 1                      | 1                       | 2   |
| Buphagidae        | 1                      | -                       | 1   |
| Numididae         | 1                      | 2                       | 3   |
| Turdidae          | 4                      | 3                       | 7   |
| Gruidae           | 1                      | -                       | 1   |
| Emberizidae       | 1                      | 2                       | 3   |
| Pycnonotidae      | 4                      | 13                      | 17  |
| Phasianidae       | 1                      | 2                       | 3   |
| Motacillidae      | 2                      | 1                       | 3   |
| Falconidae        | 1                      | 1                       | 2   |
| Otididae          | 1                      | -                       | 1   |
| Malaconotidae     | 1                      | 1                       | 2   |
| Orididae          | -                      | 1                       | 1   |
| Passeridae        | -                      | 1                       | 1   |
| Muscicapidae      | -                      | 2                       | 2   |
| Capephagidae      | -                      | 2                       | 2   |
| Turnicidae        | -                      | 1                       | 1   |
| Prionopidae       | -                      | 2                       | 2   |
| Picidae           | -                      | 1                       | 1   |
| <b>Total</b>      | <b>50</b>              | <b>40</b>               | <b>57</b>                                 |

**Table 2:** Shannon Wiener diversity across the habitat in Lau and Zing L.G.A, Sept-Nov. 2019

|                  | Riparian Forest | Wetland | Woodland | Forest | Rocky outcrop |
|------------------|-----------------|---------|----------|--------|---------------|
| Taxa (S)         | 77              | 86      | 61       | 64     | 59            |
| Species richness | 1,123           | 1,283   | 831      | 1,472  | 1,052         |
| Shannon H'       | 3.645           | 3.442   | 3.180    | 3.068  | 2.068         |
| Evenness $E^H'$  | 0.839           | 0.772   | 0.773    | 0.737  | 0.507         |

**Table 3:** Shannon Wiener diversity across the habitat in Lau and Zing L.G.A, Dec. 2019-Feb. 2020

| Diversity index     | Riparian Forest | Wetland | Woodland | Forest | Rocky outcrop |
|---------------------|-----------------|---------|----------|--------|---------------|
| Taxa (S)            | 86              | 76      | 53       | 85     | 60            |
| Species richness    | 3,953           | 2,475   | 1,997    | 2,448  | 774           |
| Shannon (H')        | 3.301           | 3.539   | 3.038    | 3.543  | 3.401         |
| Evenness ( $E^H'$ ) | 0.741           | 0.817   | 0.765    | 0.797  | 0.830         |

## Discussion

Lau has a rich diversity of birds cutting across water birds, wetland, forest, montane and woodland dwellers. Diversity of birds recorded during the wet season was high in areas with less human activities and more vegetation cover. High species diversity was observed in the Riparian forest and Wetland habitats; this could be attributed to the proximity of the aquatic ecosystem that is River Benue in Lau compared to other habitats. One of the most important factors observed in the field that led to high species diversity in the Riparian Forest and Wetland habitat could be related to the high productive environment, suitable ecosystem, wide variety of food resources, presence of fresh grasses, availability of water, good vegetation cover, good breeding and nesting sites, moderate level of disturbance, moderate level of predation, presence of insects, their caterpillar/maggot stage, seeds, fruits, grasses, leaves, availability of fish and invertebrates which influenced the high diversity for some family of birds like, Columbidae (Speckled pigeon), Ploceidae (Black-winged red bishop) and Accipitridae (Hen harrier). This research agrees with Abie *et al.* (2019) [1] who reported that, Riparian and Wetland habitats inhabited the highest species diversity because of the relation to availability of water, cover and food items in the habitat. This work also agrees with David *et al.* (2015) [9] who explained that good breeding sites at Mayo-Selbe which include a wide variety of resources, high productivity and moderate levels of predation contributed to higher diversity of birds. Kwaga *et al.* (2017) [10] reported that higher diversity of bird in the habitats is influenced by the presence of cover, nesting sites and availability of food resources. Ntongani and Andrew (2013) [14] reported that habitats with low human disturbance had more number of bird species, genera, families and diversity as well as foraging sites favored high diversity of birds.

The low species diversity observed in Rocky outcrop during the wet season, could be attributed to high level of disturbance, hunting, high rate of bush burning, high temperature (heat), changes in weather condition, less vegetation cover, lack of fruiting trees, high number of predators that preyed on the species, high rate of deforestation, insufficient water, lack of seeds and leaves for birds to forage on, lack of breeding and nesting sites, high rate of farming activities, grazing, settlement areas and pesticide application which might be the reason that contributed to low bird species diversity in the habitats. This finding concurs with Adeyanju (2014) [3] who reported that the diversity of niche specific bird species tends to narrow and decline to habitats due to habitat fragmentation and

alteration attributed to human development. A significant increase in species diversity was observed in Forest and Wetland habitat during the dry season; this increase in species diversity could be due to seasonal changes in breeding, foraging behavior of birds that attracted the family Nectarinidae to the Forest zone, weather condition change and the intra African and Palearctic migrants that returned from their residential habitat to roost and breed. Another important factor that led to high species diversity is the vegetation cover, sufficient fruiting trees, absence of predation, abundance of grasses, provision of shelter, water and availability of food resources, because the period of November to December coincided with the cultivation of crops like, rice, maize and guinea corn which were available for the birds to feed on. This research is in line with Shochat *et al.* (2010) [10] who reported that birds adapt to urban ecosystem both physically and behaviorally in foraging behavior extending breeding season; increase in population densities is related to increase in food and probably predation. The low species diversity in Woodland during the dry season could be attributed to the openness in the environment, heat, less vegetation cover, lack of food items, starvation, lack of fresh grasses, seeds, fruits and scarcity of water, bush burning, deforestation, farming, logging and overgrazing probably which might have been the contributing factors to the low species diversity. This result supported the finding of Taleke and Afework (2018) [21] who reported that agricultural expansion and overgrazing contribute to the deterioration in species diversity.

## Conclusion

This study reveals that there are numerous bird species across habitat types in Lau and Zing which attracted many families in the study area. These birds occupied various niches in the many ecological zones in Lau and Zing ranging from insectivores, grain eater to flesh eaters. However, based on the findings of study it can be concluded that Riparian forest and Wetland habitats harbor high species diversity in Lau while Forest harbor high diversity in Zing. High ecological requirements contributed to high species diversity across these habitat types in Lau and Zing. Qualified graduates from local communities should be encouraged by the state government to take up employment such as park rangers, trackers, caterers, drivers, clerks, which should be reserved exclusively for the indigenes.

## Acknowledgements

I am grateful to my sponsor, Mr. B.D. Nubuya who stood by me from the beginning to the end of this project; and to my

statistical analyst Mr. Nsa Ayi Akiba, thanks for your contribution which made this study a successful one.

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