Wildlife Species Diversity and Relative Abundance at PHIA: Insights into Avian, Mammalian, and Reptilian Communities

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Abstract: Understanding wildlife diversity and relative abundance is essential for effective biodiversity conservation and ecological management. This study investigated the species diversity and relative abundance of birds, mammals, and reptiles at the Port Harcourt International Airport (PHIA). Direct observation, transect sampling, acoustic, and point count method were used for the survey. Ten transects of 200m each, at an independent distance of 50 m apart were surveyed over five days between 0600hrs and 1200hrs; 1400hrs and 1600hrs and opportunistically at night. All wildlife species sighted or heard were recorded and identified to species. A total of 52 bird species from 24 families, 13 mammal species from 10 families, and 11 reptile species from 9 families were recorded. Western Cattle Egret (10.01%), White Fulani Cattle (22.58%) and Rainbow Agama (27.78%) were the most abundant bird, mammals and reptile respectively. Diversity indices revealed that birds had the highest diversity (D = 0.95; H' = 3.37), followed by mammals (D = 0.86; H' = 2.16) and reptiles exhibited the lowest diversity index (D = 0.80; H' = 1.79).
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Introduction

Biodiversity serves as the cornerstone of ecosystem health and functionality, supporting a wide range of ecological services, including nutrient cycling, pollination, and climate regulation (Oguh *et al.*, 2021; Efenakpo *et al.*, 2025). However, urbanization and human activities pose significant threats to wildlife diversity, particularly in rapidly expanding urban areas such as Port Harcourt, Nigeria (Marzluff *et al.*, 2016; Efenakpo *et al.*, 2019; Efenakpo *et al.*, 2025). Airports, while critical for human mobility and economic development, often lead to habitat alteration, which can significantly impact local wildlife communities (Radomska *et al.*, 2021). More so, wildlife communities in Airports if not properly managed could cause major hazards and loss to human lives and properties.

The Port Harcourt International Airport (PHIA) and its environs represent a unique ecological landscape characterized by a mosaic of natural and modified habitats. Despite its ecological significance, limited studies have been conducted to assess the diversity and relative abundance of wildlife in this area. Understanding these patterns is vital for informing conservation strategies and mitigating human-wildlife conflicts, particularly in areas of infrastructural development. This study aims to evaluate the species diversity and relative abundance of avian, mammalian, and reptilian taxa at PHIA. Specifically, it seeks to: document the species richness and relative abundance of wildlife in the study area, analyze patterns of diversity across taxa, and provide baseline data to inform conservation and management strategies in the region.

Methodology

Study Area

The study was conducted at the Port Harcourt International Airport, Rivers State, Nigeria which is located in Omagwa, a suburb community of Port Harcourt and lies on Latitude 05° 015' 94" to 05° 00' 55" N and Longitude 6.94 95 94 to 06 56' 58.54"E with an elevation 27 meters above sea level (Ogobiri *et al.*, 2013). PHIA is one of the largest airports in terms of the landmass in Nigeria covering a total land area of 28,000m² (2687.98 Hectares) and has only one runway known as the 03/21 (PHIA-WHMP, 2023).

The area is characterized by a tropical rainforest ecosystem interspersed with grasslands, wetlands, and human-modified landscapes. with the average highest and lowest temperatures range from approximately 27.4 °C in February to 24.6 °C in July respectively and the average annual precipitation is 2708mm, and relative humidity is 80% (PHIA-WHMP, 2023). Agriculture is the predominant land use type around the airport. Local and migratory wildlife populations, local wildlife habitat conditions, weather, soils and vegetation type are some of the contributing factors to the influx of birds/wildlife at PHIA.

Sampling Techniques

The area sampled surveyed included the airside and landing side of the airport and the sampled sites were identified and chosen for the survey based on their unique features. Field observation, were used to collect data for the survey. Ten transects of 200m each, at an independent distance of 50 m apart were surveyed over 16 field days between 0600hrs and 1200hrs; 1400hrs and 1600hrs and opportunistically at night. All wildlife species and attractants sighted or heard were recorded and identified to species with the aid of Helms field guide to birds of Western Africa by Borrow and Demey (2000) and a collection of African bird calls. Bird and other wildlife species' abundance, richness, and diversity were also recorded.

Methods of Data Collection

The study obtained data through three complementary methods depending on the objective.

Direct Observation: Birds and others wildlife were identified using a pair of binoculars and field guides during the systematic surveys along transects. Mammals and reptiles were identified visually and through Indirect indices and signs such as tracks, droppings, calls, scat, and burrows following standard protocols. Wildlife that were not visibly seen were identified by listening to calls made by the animals and comparing them to the recorded calls.

Transect Sampling: The field survey was done in randomly selected 10 walking trails which were already existing roads which served as the 10 line transects, with each line transect measuring approximately 200 meters (0.02 km) in length and 50 meters (0.005 km) far apart. were established across different habitat types, including grasslands, wetlands, and forest patches. Observations were conducted between 6:00 AM and 10:00 AM and between 4:00 PM and 6:00 PM to coincide with peak wildlife activity. The line transects were randomly selected to cover the entire study area and were visited four times. Point count methods of watching and identifying wildlife species in the field as described by Bibby *et al.* (2000) were also adopted.

Surveys of the birds and animal populations in the study area were conducted over an approximately 16 field day from December 2022 – July 2023 (twice a month) covering both dry and wet seasons to capture seasonal variations in wildlife occurrence.

Ethical Considerations

All fieldwork was conducted in compliance with ethical guidelines for wildlife research, ensuring minimal disturbance to the animals and their habitats. Necessary permits were obtained from relevant authorities, and local communities were engaged to enhance data accuracy and promote conservation awareness.

Methods of Data Analysis

Data from field surveys were statistically analyzed using descriptive statistics on Microsoft Excel 2013 version. Species diversity was analyzed using Shannon-Wiener (H') and Simpson's (D) diversity indices to quantify richness and evenness. Data for population estimates were calculated using Relative abundance which shows the percentage of individuals of a species relative to the total number of individuals recorded for each taxonomic group. Results were presented in tables and figures, showing key trends in species diversity and abundance.

Relative abundance expressed in the formula below;

Species relative abundance = $\frac{\text{Species Abundance} \times 100}{\text{Total Abundance}}$

The diversity of wildlife hazard species was measured using both the Simpson diversity index (Simpson, 1949) and the Shannon-Wiener diversity index (Shannon and Weaver, 1949)

Simpson, given as $D_s = 1 - \frac{\sum ni\,(ni-1)}{N\,(N-1)}$

Where: N = total number of individuals encountered

ni= number of individuals ith species enumerated for i = 1…….a

a = number of different species enumerated.

Shannon-Wiener index of diversity (H):

$H = pi \ln pi$

Where: $pi = n_i/N$

n_i = the population of ith species in a site.

N = total population of all species in a site

Results

Wildlife Species Diversity in the Study Area

The result for diversity and relative abundance of animals in the study area is presented in Tables 1 - 4, Figure 1 and Plate 1. Table 1 shows that the study at PHIA had a total of 52 bird species belonging to 24 families and the Western Cattle Egret (10.01%) was the most abundant bird in the study area while the Palm-nut Vulture (0.10%), Shikra (0.10%), African Pigmy Kingfisher (0.10%), Klaas's Cuckoo (0.10%) and the Red-bellied Firefinch (0.10%) were the least abundant birds. However, combining the result of the study with previously sighted and recorded birds in the study area (Table 5.1) the results show that there are 100 bird species belonging to the families. Table 2 shows that PHIA had a total of 13 species of mammal belonging to 10 families and the White Fulani Cattle (22.58%) was the most abundant mammal in the study area, followed by the African Stripped Ground Squirrel (18.28%), while the Johan's spiny Mouse (1.08%) and Common Dwarf Mongoose (1.08%) had the least occurrences.

Table 3 shows that PHIA had a total of 11 species of reptiles belonging to 9 families and the Rainbow Agama (27.78%) was the most abundant reptile in the study area followed by the Tropical House Gecko (24.44%). In contrast, the Ball Python (1.11%), Black-necked Spitting Cobra (1.11%), West African Carpet Viper (1.11%), and Black-lined Green Snake (1.11%) had the least occurrences. The diversity index provides insight into the variety of species within each group and Table 4 shows that Birds had the highest diversity index (D = 0.95; H' = 3.37), followed by mammals (D = 0.86; H' = 2.16), while reptiles exhibited the lowest diversity index (D = 0.80; H' = 1.79). Figure 1 shows families *Accipitridae, cisticolidae, Columbidae and estrildidae* had the highest number of species representatives.

Table 1: Relative Abundance of Birds in the Study Area

S/n	Family	Species Common Names	Scientific Names	R. Abundance
1	Accipitridae	Shikra	*Accipiter badius*	1
2	''	Palm-nut Vulture	*Gypohierax angolensis*	1
3	''	Lizard Buzzard	*Kaupifalco monogrammicus*	4
4	''	Yellow-billed Kite	*Milvus migrans*	42
5	''	African Harrier Hawk	*Polyboroides typus*	18
6	Alcedinidae	African Pigmy Kingfisher	*Ceyx pictus*	1
7	''	Woodland Kingfisher	*Halcyon senegalensis*	3
8	Anatidae	White-faced Whistling Duck	*Dendrocygna viduata*	12
9	Apodidae	Common Swift	*Apus veduta*	12
10	Ardeidae	Grey Heron	*Ardea cinereal*	3
11	''	Black-headed Heron	*Ardea melanocephala*	6
12	''	Western Cattle Egret	*Bubulcus ibis*	98
13	Bucerotidae	Piping Hornbill	*Bycanistes fistulator*	3
14	''	African Pied Hornbill	*Tockus fasciatus*	3
15	Burhinidae	Senegal Thick-knee	*Burhinus senegalensis*	48
16	''	Water Thick-knee	*Burhinus vermiculatus*	12
17	Capitonidae	Yellow-throated Tinkerbird	*Pogoniulus subsulphureus*	8
18	Cisticolidae	Grey-backed Camaroptera	*Camaroptera brachyura*	4
19	''	Chattering Cisticola	*Cisticola anonymus*	28
20	''	Winding Cisticola	*Cisticola galactotis*	25

Table 1 Contd: Relative Abundance of Birds in the Study Area

S/n	Family	Species Common Names	Scientific Names	R. Abundance
21	Cisticolidae	Tawny-flanked Prinia	*Prinia subflava*	3
22	''	Whinchat	*Saxicola rubetra*	3
23	Columbidae	Laughing Dove	*Spilopelia senegalensis*	5
24	''	Red-eyed Dove	*Streptopelia semitorquata*	74
25	''	Vinaceous Dove	*Streptopelia vinacea*	14
26	''	Blue-spotted Wood Dove	*Turtur afer*	13
27	''	Tambourine Dove	*Turtur tympanistria*	6
28	Corvidae	Pied Crow	*Corvus albus*	78
29	Cuculidae	Senegal Coucal	*Centropus senegalensis*	38
30	''	Didric Cuckoo	*Chrysococcyx caprius*	3

31	’’	Klaas's Cuckoo	*Chrysococcyx klaas*	1
32	Estrildidae	Orange-cheeked Waxbill	*Estrilda melpoda*	33
33	’’	Red-bellied firefinch	*Lagonosticta senegala*	1
34	’’	Grey-headed Nigrita	*Nigrita canicapillus*	3
35	’’	Bronze Mannikin	*Spermestes cucullatus*	13
36	’’	Magpie Mannikin	*Spermestes fringilloides*	2
37	Hirundinidae	Common House Martin	*Delichon urbicum*	27
38	’’	Ethiopian Swallow	*Hirundo aethiopica*	23
39	’’	White-throated Blue Swallow	*Hirundo nigrita*	5
40	Laniidae	Southern Common Fiscal	*Lanius collaris*	3

Table 1 Contd: Relative Abundance of Birds in the Study Area

S/n	Family	Species Common Names	Scientific Names	R. Abundance
41	Meropidae	Rosy Bee-eater	*Merops malimbicus*	42
42	’’	Little Bee-eater	*Merops pusillus*	12
43	Motacillidae	Plain-backed Pipit	*Anthus leucophrys*	31
44	’’	Yellow-throated Longclaw	*Macronyx croceus*	5
45	Nectariniidae	Olive Sunbird	*Cyanomitra olivacea*	4
46	Numididae	Helmeted Guineafowl	*Numida Meleagris*	20
47	Passeridae	Northern Grey-headed Sparrow	*Passer griseus*	5
48	Phasianidae	Double-spurred Francolin	*Francolinus bicalcaratus*	18
49	Ploceidae	Yellow-mantled Widowbird	*Euplectes macroura*	27
50	’’	Village Weaver	*Ploceus cucullatus*	68
51	Pycnonotidae	Common Bulbul	*Pycnonotus barbatus*	59
52	Viduidae	Pin-tailed Whydah	*Vidua macroura*	8

NB: R. = Relative

Table 2: Relative Abundance of Mammals in the Study Area

S/n	Family	Species Common Names	Scientific Names	Abundance
1	Bovidae	Grimm's duiker	*Sylvicapra grimmia*	2
2	Bovidae	Bushbuck	*Tragelaphus scriptus*	5
3	Bovidae	White Fulani Cattle	*Bos tuarus*	21
4	Cercopithecidae	Mona monkey	*Cercopithecus mona*	13
5	Herpestidae	Common Dwarf Mongoose	*Helogale parvula*	1
6	Muridae	Rat	*Rattus Rattus*	15
7	Muridae	Johan's spiny Mouse	*Acomys johannis*	1
8	Nesomyidae	African Giant Rat	*Cricetomys gambiabus*	7
9	Nycteridae	Hairy slit-faced	*Nycteris hispida*	4
10	Sciuridae	African stripped Ground Squirrel	*Xerus erythropus*	17

11	Soricidae	Shrew	*Crocidura nigeriae*	2
12	Thryonomyidae	Cane rat	*Thryonomys swinderianus*	2
13	Viverridae	African civet	*Civettictis civetta*	3

Table 3: Relative Abundance of Reptiles in the Study Area

S/n	Family	Species Common Names	Scientific Names	R. Abundance
1	Agamidae	Rainbow Agama	*Agama cavetti*	25
2	Colubridae	Variable Green Snake	*Philothamnus semivariegatus*	2
3	Colubridae	Black-lined Green Snake	*Philothamnus irregularis*	1
4	Elapidae	Black-necked Spitting Cobra	*Naja nigricollis*	1
5	Gekkonidae	Tropical House Gecko	*Hemidactylus mabouia*	22
6	Lamprophiidae	Lined African House Snake	*Boaedon lineatus*	3
7	Psammophiidae	Mozambique Sand Snake	*Psammophis mossambicus*	2
8	Pythonidae	Ball Python	*Python regius*	1
9	Scincidae	Mabuya	*Trachylepis afinis*	18
10	Scincidae	Fernandi Skink	*Mochlus fernandi*	14
11	Viperidae	West African Carpet Viper	*Echis ocellatus*	1

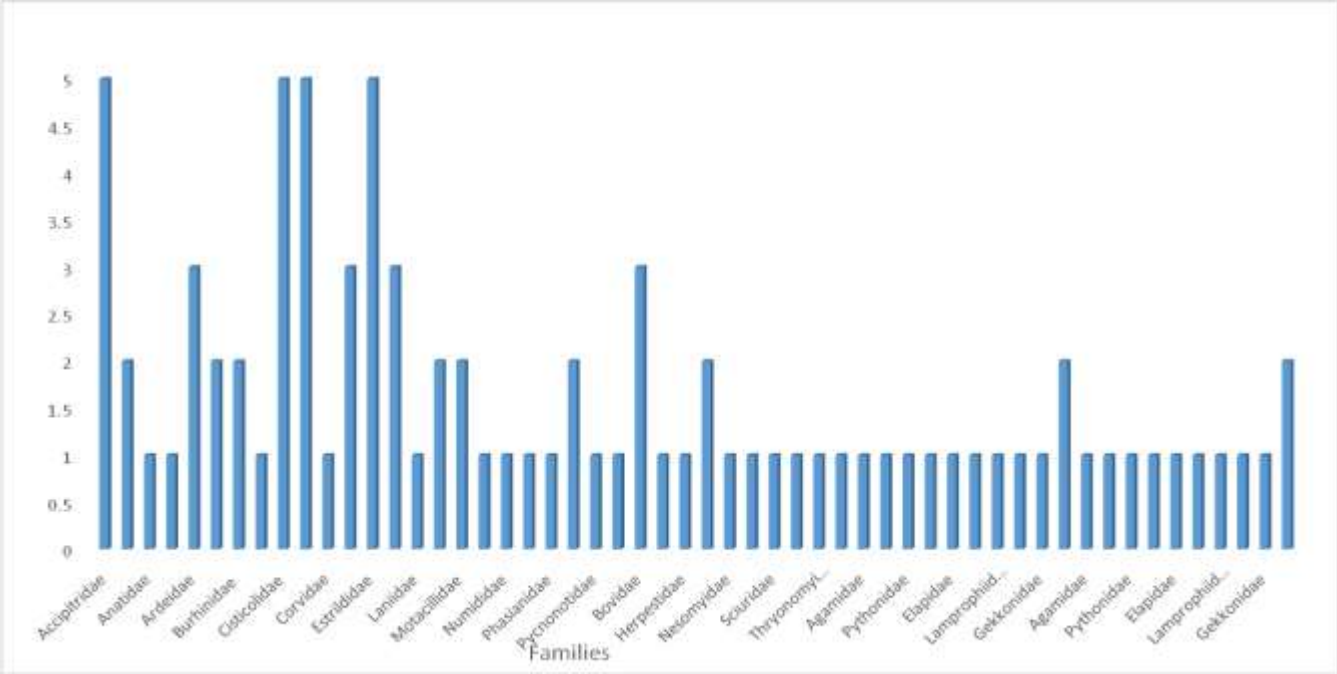

Figure 2: Wildlife Family Abundance in PHIA

Table 4: Diversity Index of Animals in the Study Area

Parameter	Birds	Mammals	Reptiles
Species **S**	52	13	11
Individuals	979	93	90
Simpson 1-D	0.95	0.86	0.80
Shannon H'	3.37	2.16	1.79

Discussions

Wildlife Species Diversity in the Study Area

The result of diversity and relative abundance of animals at the PHIA had the majority of animals as birds belonging to 52 species and 24 families and the Western Cattle Egret was the most abundant bird species while this was followed by the mammal which had 13 species of belonging to 10 families with the White Fulani Cattle despite not been a resident as the most abundant mammal and the least animal diversity was in the reptiles which had 11 species of reptiles belonging to 9 families with the Rainbow Agamas the most abundance in the study area. This result suggests a complex interaction between wildlife and the airport environment, potentially due to factors like habitat availability and food resources. These results demonstrate the varying degrees of abundance and diversity of animals within different taxonomic groups in the study area and emphasize the importance of considering multiple taxa in wildlife hazard management.

This result of animal diversity is dissimilar to Oduntan *et al.* (2012) survey at the Murtala Muhammed International Airport, Lagos with a total of 36 species belonging to 22 families and Egummah *et al.*, (2018) which had a total of 33 bird species belonging to 18 families and 1 mammal species record at the Makurdi Airport (Naf Base) Makurdi, Benue State. The variation in results may be connected to the difference in ecological region, scope of study and time frame of the study. Nevertheless, on the most abundant bird species which was the Cattle Egret, the result is similar to Oduntan *et al.* (2012) and this result may not be unconnected to the fact that the Cattle Egret has successfully adapted its habit to fit in with that of human as noted by Nason, (1992) and Efenakpo *et al.* (2019).

The result of this survey also suggests that certain taxonomic groups, such as birds and mammals, are more common and potentially more relevant to wildlife hazard management which aligns with international practices, while others, like the least abundant reptiles, have lower occurrences. The result is essential for wildlife conservation efforts and for developing strategies to mitigate wildlife hazards in the study area. Many airports prioritize managing these groups because of their potential to collide with aircraft. Hence the need for airport authorities to consider implementing measures to deter or manage the presence of high-risk species, like the Western Cattle Egret, to reduce the likelihood of bird strikes.

Conclusion/ Recommendations

The study on wildlife hazards and mitigation measures at the PHIA, Rivers State, Nigeria, provides valuable insights into the dynamics of wildlife interactions with aviation operations. The study highlighted the diverse wildlife species present in the area, their abundance, and the associated risks to aviation safety. The findings reflects the need for context-specific strategies to manage wildlife and its potential hazards at PHIA. Hence, the study recommends an establishment of a robust system for continuous monitoring of wildlife species at the airport. Regular surveys and data collection are crucial for understanding changes in wildlife patterns, allowing for timely adjustments in mitigation strategies. As the successful implementation of these recommendations will contribute to a safer aviation environment at PHIA, ensuring the coexistence of air travel and local biodiversity while minimizing economic and safety risks associated with wildlife hazards.

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