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Avifauna in the Niger Delta University (NDU) Environment, Wilberforce Island, Bayelsa State, Nigeria

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A B S T R A C T

The avifauna in the Niger Delta University environment was studied from January to December 2023 to provide baseline data for further scientific studies. The study was carried out using random trail and non-trail surveys by direct sighting, binoculars with 8 x 40 pair magnification, and a Nikon D500 DSLR camera and a 70-200mm optical zoom lens. Avifauna was identified using field officers and keys. Biodiversity indices and abundance scores were used for analysis. Sixty-six (66) avian species from twenty-nine (29) families were present. Fifty-eight avian species were residents. These were granivores, carnivores, insectivores, piscivores, omnivores, and frugivores. Their habitats were vegetation, shallow waters, grasslands, wetlands, and marshes. Some species were endangered or vulnerable and dominant or rare. Species biodiversity was significant.

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INTRODUCTION

"Avifauna" commonly refers to the birds of a particular region, habitat, or geological period (Ali and Ripley 1983). "Aves" is a Latin name for birds. singular is Avis, which is also their scientific name (Class Aves). Birds are warm-blooded vertebrates distinguished by their feathers, toothless beaks, the ability to lay hard-shelled eggs, a rapid metabolic rate, a four-chambered heart, and a lightweight yet sturdy skeletal framework (Tews et al., 2004). They are bipedal animals whose evolutionary roots trace back to reptiles. Every extant bird species possesses wings, modified forelimbs that enable flight in most species, although some, such as ostriches, emus, penguins, and a few island-dwelling birds, are flightless (Ali, 1999). Their specialized respiratory and digestive systems are highly adapted for aerial locomotion. Furthermore, certain groups like crows and parrots rank among the most intelligent animals, capable of tool-making and problem-solving. Many social bird species also demonstrate cultural transmission, passing learned behaviors and skills from one generation to the next (Grimmett et al., 2011).

Many bird species engage in extensive annual migrations, covering vast distances, while others move shorter or irregular routes depending on environmental conditions. Birds are generally social creatures that communicate through vocalizations, songs, and visual cues, often displaying cooperative behaviors such as group breeding, coordinated hunting, flock formation, and collective defense against predators (Wilcove, 1985). The majority of bird species exhibit social monogamy typically lasting for a single breeding season, though some pairs may remain together for several years or even life. In contrast, a few species practice polygynous or, less commonly, polyandrous mating systems. Birds typically lay eggs in nests, which are incubated and later cared for by one or both parents. Beyond their ecological roles, birds hold significant economic and cultural value, serving as food sources, pets, and producers of guano fertilizer, while also influencing art, religion, and music worldwide (Şekercioğlu et al., 2004).

Birds have been a vital part of Earth's biodiversity for millions of years (Hedenström & Johansson, 2024). Their characteristic features—such as feathers, lightweight bones, and specialized air sacs—evolved gradually, beginning with early dinosaurs over 230 million years ago (Grimmett et al., 1999). Modern birds trace their ancestry to theropod dinosaurs, a group that included Tyrannosaurus and Velociraptor. During the Late Jurassic period, about 150 million years ago, Archaeopteryx emerged as a transitional species linking dinosaurs and modern birds, marking the dawn of avian flight (Steadman, 1996). This evolutionary breakthrough paved the way for diversification, leading to the approximately 10,000 bird species known today (Borrow & Demey, 2004). However, birds now confront growing environmental challenges, particularly from human-induced climate change. Scientists warn that rising global temperatures could threaten over half of North America's avian species (Scharlemann et al., 2004). Beyond their ecological roles as pollinators, seed dispersers, and pest regulators, birds also hold economic and cultural importance—serving in food production, sport, art, communication, and even aviation safety through bird-strike monitoring.

Geographically Amassoma (Latitude: 4.96917, Longitude: 6.10972, Altitude: 79, Geonames – ID: 2350172) is situated in Southern Ijaw, Bayelsa State, in the core Niger Delta region of Nigeria. The Niger Delta, located along the Gulf of Guinea on Nigeria's Atlantic coast, represents the vast deltaic region of the Niger River (National Council for Science and Environment, 2013). It forms part of the Equatorial Guinea rainforest zone, recognized as one of the world's key biodiversity hotspots, ranked 12th globally for its rich concentration of endemic vertebrate species (Mikusiński & Angelstam, 2004). This area is also known for its abundant petroleum and natural gas resources, making it a major hub for oil exploration and production. However, the intensive industrial activities of multinational corporations have led to significant environmental degradation, pollution, and social unrest, threatening the ecological balance and the well-being of local communities within the Niger Delta (Luiselli & Akani, 2003).

The Niger Delta University is a state-owned institution established by the Bayelsa State Government of Nigeria. Its main campus is situated in Amassoma, positioned at approximately 4°58′13″ N and 6°6′35″ E, on Wilberforce Island. The university lies adjacent to the Nun River Forest Reserve (NRFR), a 97.15 km² expanse of humid tropical rainforest characterized by heavy rainfall, seasonal flooding, and dense, multi-layered vegetation. The upper canopy consists mainly of mature trees, while areas near rivers and human settlements show signs of disturbance, forming fragmented forest edges that extend roughly half a kilometer inward (Akani et al., 2014). Investigating the diversity and composition of bird species within the Niger Delta University environment at Amassoma would generate essential baseline data for future ecological studies and conservation planning, benefiting not only avian fauna but broader wildlife management in the region.

LITERATURE REVIEW

Looking into biblical history when the whole earth was destroyed with water (flood), those that survived it used birds (raven and dove) as indicator species to know when the water receded (Gen. 6:9-17). Humans have developed numerous tools and techniques to assess the condition of natural ecosystems. For instance, when evaluating the quality of wetland water, environmental scientists might use instruments to record dissolved oxygen levels or conduct laboratory analyses to detect the presence of heavy metals in the soil. Nonetheless, not all environmental changes require complex equipment; sometimes, observing the abundance, distribution, and behavior of bird species can reveal valuable insights into ecosystem health and transformation (Baillie, 1991). Organisms used in this way to reflect environmental changes are known as indicator species (Owens & Bennett, 2000). Essentially, an indicator serves as a substitute measure for environmental parameters that are otherwise too unstable, complex, or impractical to directly assess or quantify (Ormerod & Watkinson, 2000). Birds are one of the best and, in most cases, the only best to monitor the short (ephemeral) and long-term environmental changes (Newton, 1995). Birds play a crucial ecological role by helping regulate insect populations, acting as scavengers and predators, dispersing seeds, and facilitating pollination. Because of their

sensitivity to environmental variations, they often respond quickly to large-scale landscape disturbances such as habitat loss and fragmentation (Mayura Khot, 2016). Shifts in their breeding success, population size, and survival rates can therefore serve as reliable indicators of broader environmental changes and ecosystem health (Mayura Khot, 2016).

Various animal species can serve as indicators of environmental quality, and birds are among the most widely utilized for this purpose. They are abundant, highly visible, and relatively easy to identify, with extensive scientific knowledge available on their biology and life cycles. Beyond their ecological importance, birds are also admired for their beauty, vocalizations, and dynamic behavior. Although ecosystems are highly intricate and cannot be represented by a single organism, birds often provide valuable clues about overall ecosystem health. Monitoring bird populations and diversity helps researchers assess ecological balance and habitat condition. A rich and varied avian community typically reflects a stable and healthy environment, whereas a decline in species richness or abundance suggests reduced ecological diversity and possible environmental degradation (MacArthur & MacArthur, 1961).

Biodiversity refers to the variety of all living organisms found across terrestrial, marine, and other aquatic environments, including the ecological systems they form part of. It encompasses diversity within species, among species, and across ecosystems (Betts et al., 2024). The word itself combines "bio," meaning life, and "diversity," meaning variation, and represents the total collection of living organisms within a specific geographic area. Essentially, it reflects both the richness of species present and the range of habitats they occupy. Biodiversity is vital to human well-being and sustainable development, as it supports the ecological functions essential for life. These natural systems provide materials, energy, and services critical for survival. Moreover, beyond their tangible benefits, biodiversity contributes to cultural, aesthetic, and ecological balance in both rural and urban environments. Therefore, conserving biodiversity is crucial for sustaining livelihoods and ensuring a stable future for humanity (Opigo, 2021; Mehmet et al., 2010).

Human survival is deeply linked to the plants and animals that share the environment. However, rapid population growth and the unsustainable exploitation of natural resources for food, shelter, medicine, and industrial use have placed immense pressure on ecosystems. This overdependence has become one of the major threats to biodiversity conservation, leading to habitat loss, resource depletion, and the decline of many species. The biological endowments of nature had been taken for granted until the reality of the loss of various materials and services and its attendant negative effects on the environment became overwhelming (Gregory et al., 2004). Although nature has in-built mechanisms by which genetic recombination and biological adaptation to the dynamic environment offer a means of continuous renewal of biodiversity, the persistent exploitative tendency of mankind outweighs the input of nature. In many regions, the rate at which humans exploit natural resources far exceeds the pace at which these biological resources can regenerate. This unsustainable use has heightened global awareness and led to the rise of international conservation

initiatives such as the International Union for Conservation of Nature (IUCN), the Convention on Biological Diversity (CBD), and other organizations, including the World Wildlife Fund (WWF), BirdLife International, Conservation International (CI), the African Wildlife Fund (AWF), and the Nigerian Conservation Foundation (NCF). Around the world, areas rich in oil and gas often overlap with zones of high biodiversity, creating significant ecological risks. As global energy demands continue to rise, extraction activities increasingly threaten fragile ecosystems. The key challenge lies in balancing industrial growth and energy needs with environmental stewardship, ensuring responsible resource management and biodiversity protection through sustainable practices (McEwan, 1978).

There are roughly 10,000 known bird species across the globe, inhabiting nearly every environment from polar regions to tropical rainforests, arid deserts to open oceans, and even urban centers. Birds are among the most visible and diverse forms of wildlife on Earth. Throughout human history, they have played significant roles in nutrition, communication, plant pollination, and aesthetics. Ecologically, birds also contribute to natural pest control, such as regulating rodent populations, and help maintain ecosystem balance through their roles in food chains and nutrient cycling. However, over the past three centuries, industrial expansion and human activities have severely altered natural habitats, disrupting ecological equilibrium. These disturbances have directly or indirectly endangered around 200 bird species worldwide, underscoring the urgent need for habitat conservation and environmental protection (Kati & Şekercioğlu, 2006).

METHODOLOGY

Sample Collection

Avifauna observations and counting (data collection) were done by random trail and non-trail survey, either by direct sighting with the naked eye or using binoculars with 8 x 40 pair magnification. Also, photography of avifauna was taken with a Nikon D500 DSLR camera and a 70-200mm optical zoom lens. Avifauna identifications were done using field officers and keys: Helm Field Guides, Birds of Western Africa (Mik Borrow and Ron Demey, 2013, Karmierczak, 2000), and A Field Guide to the Birds of West Africa (Serle et al., 1990). The avifauna and associated vegetation were surveyed from November to December 2024 and January to October 2025, during the early hours of morning from 6am to 9am and 4pm to 6pm (which was compatible with avian movements with respect to their feeding pattern). Bird species were counted at each encounter during every survey of the three stations (Station One: CHS, Station Two: Main Campus, Station Three: New Site), and the indices were used as indicators of population abundance or species richness in the study area.

Avifauna statuses were classified as Resident (R) or Visitor (V), and their ecological groups came under Granivores, Insectivores, Omnivores, Frugivores, and Carnivores. Based on species abundance from the number of encounters, the percentage composition of each species was calculated, and the different species were grouped into their taxonomical families to show abundance distribution within the species of a taxonomical family and between species of the different

taxonomical families (Manakadan and Pittie, 2001). Also calculated was the abundance in population between the three study stations and the percentage composition of avifauna in each of the study stations. The bird species identified in this research were categorized based on the International Union for Conservation of Nature (IUCN) Red List criteria, which assess global species conservation status. These classifications include Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Data Deficient (DD), and Not Evaluated (NE).

Statistical analysis

Species Evenness and Richness: The diversity of species within an ecosystem generally increases with greater habitat complexity. This diversity takes into account both *species richness* (the total number of species present) and *species evenness* (the relative abundance of individuals among those species). Evenness reflects how uniformly individuals are distributed across species in a community and serves as a key component in diversity assessments (Leinster & Cobbold, 2012). A high level of evenness indicates a balanced ecosystem where no single species dominates.

Shannon-Weiner Index: To assess bird species diversity, several indices, such as the Shannon–Wiener Index (Shannon & Wiener, 1949) and the Simpson Index (Simpson, 1949), were employed. The Shannon–Wiener Index operates under the assumption that individuals are randomly drawn from a large, independent population and that all species within the community are represented in the sample. It is one of the most widely used indices for comparing biodiversity across different habitats (Clarke & Warwick, 2001). This index measures species diversity based on their abundance and distribution within habitats, providing insight into ecological balance (Hutchison, 1970). It is computed using the following formula:

$H' = - [\sum Pi \ln Pi]$ ……. (1)

Where H′ represents the Diversity Index,

Pi denotes the proportion of individuals belonging to a particular species within the total sample, and **lnPi** is the natural logarithm of that proportion. The detection of a single individual of a species in a sample does not necessarily suggest that the species exists in high numbers within the area. Typically, values of the Shannon-Wiener Diversity Index range between 1.5 and 3.5 and rarely exceed 4.5. An index value approaching 4.6 signifies a highly balanced community, where individuals are distributed almost equally among all recorded species.

Simpson Index (D): The Simpson Index estimates the likelihood that two individuals randomly chosen from a given sample will belong to the same species. It reflects the degree of dominance within a community, where higher values indicate lower diversity. Simpson described this probability for large populations to represent the chance that two randomly selected individuals

originate from different species. The index is calculated using the following formula:

$D = 1- \{\sum n (n-1)/N (N-1)\}$ …… (2)

Where **n=** represents the total number of individuals belonging to a specific bird species, and **N=** denotes the total number of birds recorded across all species. The relationship between bird species composition and time (in years) was analyzed using a simple linear regression model. In this analysis, bird population density served as the dependent variable, while the months were treated as the independent variable to assess temporal trends in species abundance.

Local Occurrence Status: To determine the frequency of occurrence and relative abundance of bird species, the classification system outlined by BirdLife International (2004) was adopted. The percentage composition of each avian species was computed to assess their distribution within the study area. Abundance categories were then derived by summing the minimum and maximum percentage composition values and dividing the result by five (5) to establish the classification range: 0.1 - 4.0 = Rare = 1; 4.1 - 8.0 = Few = 2; 8.1 - 12.0 = Common = 3; 12.1 - 16.0 = Abundant = 4; 16.1 - 20.0 = Dominant = 5. Simple percentages were used to show differences in the total number of avian species in the different sampling stations.

RESEARCH RESULT

The common names, scientific names, families, preferred habitats, status ecological groups, IUCN status, number of species, percentage composition, and abundance scores of avian species in the study area are presented in Table 1. Table 2 shows the distribution of avian species in the sampling stations. The results show that sixty-six (66) avian species from twenty-nine (29) families were present (Table 2). A total of fifty-eight avian species were residents, while only eight were visitors.

The ecological groups ranged from granivores, carnivores, insectivores, piscivores, and omnivores to frugivores, while the preferred habitats ranged from water with vegetation, shallow waters, grasslands, and wetlands to marshes. The grey parrot (*Psittacus erithacus*) is endangered (EN), the hooded vulture (*Neophron monachus*) is critically endangered (CR), and the Anambra waxbill (*Estrilda poliopareia*) is vulnerable (VU). The rest were of least concern (LC). There was none for Extinct (EX), Extinct in the Wild (EW), Near Threatened (NT), Least Concern (LC), Data Deficient (DD), and Not Evaluated (NE). The abundant scores revealed that European swallows (*Hirundo rustica*) and orange-cheeked waxbills (*Estrilda melpoda)* were dominant (5). The pin-tailed whydah (*Vidua macroura*), grey-headed sparrow (*Passer griseus*), village weaver bird (*Ploceus cucullatus*), cattle egret (*Ardeola ibis*), black & white mannikin (*Lonchura bicolor*), and magpie mannikin (*Lonchura fringilloides*) were few, while the rest were rare (1). There was neither common nor abundant in the study area (Table 1). There was a larger avian population (57.88%) in station three (new site) than

in stations one (College of Health Sciences) and two (Main Campus), which recorded 27.00% and 15.12%, respectively (Table 2).

Vidua macroura, Ploceus nigerrimus, Passer griseus, Halcyon senegalensis, and *Gypohierax angolensis* were present in all sampling stations. *Ploceus cucullatus and Streptopelia senegalensis* were found only in station one. *Halcyon malimbica, Tringa glareola, Centropus senegalensis, Psittacus erithacus, Egretta grazetta, and Limnocorax flavirostra* were found only in station two, while *Dendrocyna viduata, Vidua camerunensis, Ploceus melanocephala, Quelea erythrop, Ceryle rudis, Vanellis spinosus, Tringa ochropus, Charadrius tricollaris, Vanellus albiceps, and Gypohierax angolensis were found only in station one. Accipiter toussenelii, Kaupifalco monogrammicus, Circus neruginosus, Tringa hypoleucos, Microcarbo africanus, Treron calvus, Turtur rehmeri, Treron australis, Chrysococcyx klaas, Tropicranus albocristatus cassini, Bycanistes fistulator, Tockus fasciatus, Andropadus virens, Motacilla aguimp, Macronyx croceus, Galerida crisstata. Ardeola ralloides, Egretta alba, Mycteria ibis, Estrilda melpoda,* and *Carythaela cristata* were present in only station 3. The diversity of avian fauna of Niger Delta University in Amassoma is presented in Table 3. The indices for the Shannon Weiner Index (H) were 3.36, the Simpson Index (D) was 0.93, the Simpson Index (D) was 0.93, the Species Evenness (E) was 0.31, the Census Index (birds per hectare) (C.I.) was 5.81, and the Species Richness (r).

TABLE 1: AVIFAUNA CHECKLIST OF NIGER DELTA UNIVERSITY (NDU) WILBERFORCE ISLAND, AMASSOMA. BAYELSA STATE

S/N	COMMON NAMES	SCIENTIFIC NAMES	FAMILY	Preferred Habitat	STATUS	ECOLOGICAL GROUP	IUCN Status	NO OF SPP	% com.	Abundant score
1	White-faced whistling duck	*Dendro cygnaviduata*	Anatidae	Water with vegetation	R	Granivores	LC	29	1.52	1
2	Hammer Kop	*Scopus umbretta*	Scopidae	Shallow water	R	Carnivores	LC	15	0.78	1
3	Pin-tailed whydah	*Vidua macroura*	Viduidae	Grassland/forest edges	R	Granivores	LC	147	7.69	2
4	Yellow-crowned bishop	*Euplectes after*	Ploceidae	Shrubs/Grassland	V	Insectivores/granivores	LC	24	1.26	1
5	Grey headed sparrow	*Passer griseus*	Passeridae	Human habitations	R	Insectivores/granivores	LC	115	6.02	2
6	Senegal Kingfisher	*Halcyon senegalensis*	Alcedinide	Swamp	R	Piscivores	LC	13	0.68	1
7	White-throated bee-eater	*Merops albicollis*	Meropidae	Sandy grassland	V	Insectivores	LC	14	0.73	1
8	Grey Partincole	*Glareola cinerea*	Glareolidae	Muddy area	V	Insectivores	LC	12	0.63	1
9	Black headed weaver	*Ploceus melanocephala*	Ploceidae	Forest edges	R	Granivores/insectivores	LC	52	2.72	1
10	Palm-nut vulture	*Gypohierax angolensis*	Accipitridae	Forest edges	R	Omnivores	LC	1	0.05	1
11	Common Sand piper	*Tringa hupoleucos*	Scolopacidae	Sandy shores	V	Insectivores/carnivores	LC	7	0.37	1
12	Buff-throated sunbird	*Chalcomitra adelberti*	Nectariniidae	Forest edges	R	Insectivores	LC	6	0.31	1
13	Fork-tailed Drongo	*Dicrurus adsimilis*	Dicruridae	Shrubs/grassland	R	Insects	LC	5	0.26	1
14	Red-headed Guelea	*Quelea erythrops*	Ploceidae	Grassland	R	granivores	LC	11	0.58	1
15	Vieillot's black weaver	*Ploceus nigerrimus*	Ploceidae	Forest	R	Insects	LC	23	1.20	1
16	Village weaver bird	*Ploceus cucullatus*	Phoceidae	Human habitation	R	Granivores	LC	143	7.48	2
17	Long-tailed cormorant	*Microcarbo africanus*	Phalacrocoraci	Forest/wetlands	R	Piscivores	LC	2	0.10	1
18	African Green Pigeon	*Treron calvus*	Columbidae	Forest	R	Frugivores	LC	1	0.05	1
19	Grey Parrot	*Psittacus erithacus*	Psittacidae	Forest edges	R	Granivores/frugivores	EN	2	0.10	1
20	Klaa's cuckoo	*Chrysococcyx klaas*	Cuculidae	Forest edges	R	granivores	LC	3	0.16	1
21	White crested hornbill	*Tropicranus albocristatuscassini*	Bucerotinae	Forest	R	Insectivores/granivores	LC	2	0.10	1
22	Piping Hornbill	*Bycanistes fistulator*	Bucerotidae	Forest	R	Frugivores	LC	3	0.16	1
23	European swallow	*Hirundo rustica*	Hirundinidae	Human habitations	R	Insectivores/granivores	LC	379	19.83	5
24	African Pied Hornbill	*Tockus fasciatus*	Bucerotidae	Forest	R	Frugivores/insectivores	LC	4	0.21	1

25	Little green bulbul	*Andropadus virens*	Pycnonotidae	Forest fringes	R	Frugivores/insectivores	LC	9	0.47	1
26	Common garden bulbul	*Pycnonotus barbatus*	Pycnonotidae	Shrubs/grassland	R	Granivores	LC	57	2.98	1
27	Yellow wagtail	*Motacilla* flava	Motacillidae	Forest edges	V	Insectivores	LC	15	0.78	1
28	Plain backed pipit	*Anthus leucophrys*	Motacillidae	Open grassland	R	Insectivores	LC	15	0.78	1
29	African pied wagtail	*Motacilla aguimp*	Motacillidae	Fresh water marshes	R	Omnivores	LC	5	0.26	1
30	Yellow throated longclaw	*Macronyx croceus*	Motacillidae	Grassland	R	Insectivores	LC	12	0.63	1
31	Senegal Coucal	*Centropus senegalensis*	Cuculidae	Grassland	R	Insectivores	LC	2	0.10	1
32	Crested lark	*Galerida crisstata*	Aluadidae	Sandy land	R	granivores	LC	3	0.16	1
33	Cattle egret	*Ardeola ibis*	Ardeidae	Open grassland	R	Insectivores	LC	81	4.24	2
34	Little egret	*Egretta grazetta*	Ardeidae	Large wetland	R	Piscivores	LC	5	0.26	1
35	Squacco heron	*Ardeolar alloides*	Ardeidae	Forest edge	R	Carnivores	LC	1	0.05	1
36	Great white egret	*Egretta alba*	Ardeidae	Wetland/swamp	R	Carnivores	LC	5	0.26	1
37	Pied kingfisher	*Ceryle rudis*	Alcedinidae	Wetland	R	Piscivores	LC	2	0.10	1
38	Yellow billed stork	*Mycteria ibis*	Ciconiidae	Wetland	R	Piscivores	LC	1	0.05	1
39	Pied crow	*Corvus albus*	Corvidae	human habitations	R	Scavenger	LC	14	0.73	1
40	Black kite	*Milvus migrans*	Accipitridae	Human habitations/ forest edges	V	Scavenger	LC	12	0.63	1
41	Red eyed dove	*Streptopeliase mitorquata*	Columbidae	Forest	R	Grass seeds grains	LC	7	0.37	1
42	Laughing dove	*Streptopelia senegalensis*	Columbidae	Farmland	R	Granivores/frugivores	LC	3	0.16	1
43	Great blue turaco	*Carythae olacristata*	Misophagidae	Forest	R	Fruits	LC	7	0.37	1
44	Long-tailed hawk	*Urotriorchis macrourus*	Accipitridae	Rain forest	R	Small mammals	LC	3	0.16	1
45	Hooded vulture	*Neophron monachus*	Accipitridae	Forest edge	R	Scavenger	CR	2	0.10	1
46	Orange-cheeked waxbill	*Estrilda melpoda*	Estrildidae	Grassland/Shrubs	R	Granivores/insectivores	LC	321	16.80	5
47	Grey-crowned negro-finch	*Nigrita canicapilla*	Estrildidae	Forest edges roads, streams	R	Insectivores/frugivores	LC	38	0.42	1
48	Bronze manikin	*Lonchura cucullata*	Estrildidae	Grassland/forest edges	R	Granivores	LC	58	3.04	1
49	Green sandpiper	*Tringa ochropus*	Charadriidae	Sandy grassland	R	Insectivores	LC	2	0.10	1
50	Wood sandpiper	*Tringa glareola*	Charadriidae	Swamp	R	insectivores	LC	1	0.05	1
51	Three-banded plover	*Charadrius tricollaris*	Charadriidae	Wet Sandy grassland	R	Insectivores	LC	1	0.05	1

52	White-headed plover	*Vanellus albiceps*	Charadriidae	Sandy shores	V	Carnivores/insectivores	LC	6	0.31	1
53	Black crake	*Limnocorax flavirostra*	Rallidae	Forest edges/marshes	R	Carnivores/granivores	LC	1	0.05	1
54	African jacana	*Actophilonis africanus*	Jacanidae	Swamp wetland	R	Insectivores	LC	5	0.26	1
55	Lizard buzzard	*Kaupifalco monogrammicus*	Accipitridae	Forest clearings	R	Carnivores	LC	2	0.10	1
56	West African Goshawk	*Accipiter toussenelii*	Accpitriidae	Forest	R	Carnivores	LC	3	0.16	1
57	Anambra waxbill	*Estrilda poliopareia*	Estrildidae	Forest edges	R	Granivores	VU	3	0.16	1
58	Black & white mannikin	*Lonchura bicolor*	Estrildidae	Tall grassland	R	Granivores	LC	93	4.87	2
59	Cameroon indigobird	*Viduaca merunensis*	Viduidae	Shrubby river edges	R	Granivores	LC	1	0.05	1
60	Green-backed heron	*Butorides striatus*	Ardeidae	Marshes	R	Carnivores	LC	7	0.37	1
61	Magpie mannikin	*Lonchura fringilloides*	Estrildidae	Tall grasses	R	Granivores	LC	86	4.50	2
62	Blue-breasted kingfisher	*Halcyon malimbica*	Alcedinidae	Forest fringes	R	Insectivores/carnivores	LC	1	0.05	1
63	Spur-winged laping	*Vanellus spinosus*	Charadriidae	Sandy grassland with pockets of water	R	Insectivores	LC	4	0.21	1
64	Green fruit pigeon	*Treron australis*	Columbidae	Forest	R	Frugivores	LC	2	0.10	1
65	Blue-headed dove	*Turturb renmeri*	Columbidae	Forest	R	Granivores/insectivores	LC	1	0.05	1
66	Marsh harrier	*Circus neruginosus*	Accipitridae	Marshy forest edge	V	Carnivores	LC	1	0.05	1
	TOTAL							1911		

Table 2. AVIFAUNA distribution in the different sampling stations

s/n	Family/ Species	SS1	SS2	SS3	Total
1	**ANATIDAE**				
	1. *Dendrocyna viduata*	-	-	29	29
2	**SCOPIDAE**				
	2. Scopus umbretta	-	1	14	15
3	**VIDUIDAE**				
	3. Vidua macroura	35	41	71	147
	4. Vidua camerunensis	-	-	1	1
4	**PLOCEIDAE**				
	5. Euplectes afer	-	7	17	24
	6. Ploceus melanocephala	-	-	52	52
	7. Quelea erythrop	-	-	11	11
	8. Ploceus nigerrimus	13	5	5	23
	9. Ploceus cucullatus	143	-	-	143
5	**PASSERIDAE**				
	10. Passer griseus	30	35	50	115
6	**ALCEDINIDEA**				
	11. Halcyon senegalensis	4	3	6	13
	12. Ceryle rudis	-	-	2	2
	13. Halcyon malimbica	-	1	-	1
7	**CHARADRIIDAE**				
	14. Vanellis spinosus	-	-	4	4
	15. Tringa ochropus	-	-	2	2
	16. Tringa glareola	-	1	-	1
	17. Charadrius tricollaris	-	-	1	1
	18. Vanellus albiceps	-	-	6	1
8	**GLAREOLIDAE**				
	19. Glareola cinerea	-	-	12	12
9	**ACCIPITRIDAE**				
	20. Gypohierax angolensis	-	-	1	1
	21. Milvus migrans	7	2	3	12
	22. Urotriorchis macrourus	1	-	2	3
	23. Neophron monachus	1	1	-	2
	24. Accipiter toussenelii	-	-	3	3
	25. Kaupifalco monogrammicus	-	-	2	2
	26. Circus neruginosus	-	-	1	1
10	**SCOLOPACIDAE**				
	27. Tringa hupoleucos	-	-	7	7
11	**NECTARINIDAE**				
	28. Chalcomitra adelberti	4	2	-	6
12	**DICRURIDAE**				
	29. Dicrurus adsimitis	-	2	3	5
13	**PHALACROCORACI**				
	30. Microcarbo africanus	-	-	2	2
14	**COLUMBIDAE**				
	31. Treron calvus	-	-	1	1
	32. Streptopelia semitorquata	2	2	3	7
	33. Stretopelia senegalensis	3	-	-	3
	34. Turturb rehmeri	-	-	1	1
	35. Treron australis	-	-	2	2
15	**CUCULIDAE**				
	36. Chrysococcyx klaas	-	-	3	3
	37. Centropus senegalensis	-	2	-	2

16	**PSITTACIDAE**				
	38. Psittacus erithacus	-	2	-	2
17	**BUCEROTIDAE**				
	39. Tropicranus albocristatus cassini	-	-	2	2
	40. Bycanistes fistulator	-	-	3	3
	41. Tockus fasciatus	-	-	4	4
18	**THRUNDINIDAE**				
	42. Hirundo rustica	159	63	157	379
19	**PYCNONOTIDAE**				
	43. Andropadus virens	-	-	9	9
	44. Pycnonotus barbatus	15	10	32	57
20	**MOTACILLIDAE**				
	45. Anthus leucophrys	3	7	5	15
	46. Motacilla flava	7	-	8	15
	47. Motacilla aguimp	-	2	3	5
	48. Macronyx croceus	-	3	9	12
21	**ALUADIDAE**				
	49. Galerida crisstata	-	-	3	3
22	**ARDEIDAE**				
	50. Ardeila ibis	13	17	51	81
	51. Egretta grazetta	-	5	-	5
	52. Ardeola ralloides	-	-	1	1
	53. Egretta alba	-	-	5	5
	54. Butorides striatus	-	2	5	7
23	**CICONIIDAE**				
	55. Mycteria ibis	-	-	1	1
24	**CORVIDAE**				
	56. Corvus albus	8	4	2	14
25	**ESTRILDIDAE**				
	57. Estrilda melpoda	-	-	321	321
	58. Nigrita canicapilla	13	12	13	38
	59. Lonchura cucullata	17	14	27	58
	60. Estrilda poliopareia	-	-	3	3
	61. Lonchura bicolor	15	20	58	93
	62. Lonchura fringilloides	19	17	50	86
26	**JACANIDAE**				
	63. Actophilonis africanus	-	2	3	5
27	**MEROPIDAE**				
	64. *Merops albicolli*	3	4	7	14
28	**MISOPHAGIDAE**				
	65. Carythaela cristata	-	-	7	7
29	**RALLIDAE**				
	66. *Limnocorax flavirostra*	-	1	-	1
Total		515	290	1106	1911
% comp		27.00	15.12	57.88	100

Key: SS1=College of Health Sciences; SS2=main campus; SS3=New site

Table 3: Diversity of avian fauna of Niger Delta University

	Diversity	Indices
1	Shannon Weiner Index (H)	3.36
2	Simpson Index (D)	0.93
3	Species evenness (E)	0.31
4	Census Index (birds per hectare) (C.I)	5.81

5	Species richness (r)	183.00

Note: H´= Shannon-weiner diversity Index; D= Simpson Diversity Index; E= Evenness; C.I = Census Index; r = Species richness.

DISCUSSION

The Niger Delta University region in Amassoma hosts a diverse assemblage of avian species, comprising waterfowl, raptors, and forest, mountain, and savanna-inhabiting birds. A total of sixty-six (66) avian species from twenty-nine (29) families were recorded in this study; fifty-eight were resident, while only eight were visitors. This result differs from the findings of Bibi and Ali (2013), who documented a total of 58,598 individual birds representing 171 species distributed across 53 families at the Wildlife Sanctuary located in Taunsa Barrage, Pakistan. The reason is that it could be that the wildlife sanctuary in Tunsa Barrage is a conserved area. A total of sixty-six (66) species were recorded from the three campuses (stations) of Niger Delta University, with a recorded total population abundance of one thousand nine hundred and eleven birds in the wild belonging to twenty-nine taxonomical families. Sixty-three (63) species were of least concern (LC) according to the International Union of Conservation of Nature (IUCN) status. One species was of the critically endangered (CR) status: the hooded vulture *(Neophron monachus)*. One other species was of vulnerable status (VU): the Anambra waxbill (*Estrilda paliopareia*). And the grey parrot (*Psittacus erithacus*) was of endangered status (EN). Nine species in the recorded avifauna checklist were visitors, while the rest were residents.

The European swallow was the most abundant in population (379), followed by the orange-cheeked waxbill (321), pin-tailed whydah (147), village weaver bird (143), and grey-headed sparrow (115). Others were the White and Black Mannikin (93), Magpie Mannikin (86), Cattle Egret (81), Bronze Mannikin (58), Common Garden Bulbul (57), and Black-Headed Weaver (52). The new site station (that is, station three) had the highest number of population abundance both in species level and taxonomical families. The actual count of species recorded in the wild was one thousand, one hundred and five, belonging to fifty-six (56) species of twenty-six (26) taxonomical families. On the contrary. Even though station one (CHS) had a higher number in population abundance of encountered individual species in the wild of five hundred and fifteen (515) than station two, its total number of taxonomical species of twenty-three (23) and families of fourteen (14) is less than that of station two (Main campus). Main campus had a total of two hundred and ninety (290) encountered individual species in the wild belonging to thirty-one (31) species of fifteen (15) taxonomical families.

Hirundo rustica (European swallow) and *Ploceus cucullatus* (village weaver bird) were the two species responsible for the high population abundance of encountered species in station one. This was made possible by their habitat requirement in station one. Station one is surrounded by village settlements. Like the *Hirundo rustica* species, whose preferred habitat is always around human habitation, the *Ploceus cucullatus* nest in large trees around human habitation for

protection from predators. In contrast with the comparatively high number of population abundance in station one, station two shares very similar habitat characteristics with station three. It is the transitory point (boundary) between stations one and three. On the other hand, the high population abundance recorded in station three compared to stations one and two can be linked to the shorter duration of human activities and presence. Unlike stations one and two, station three still possesses more or less undisturbed natural habitats surrounding it, less infrastructure compared to its open land space, reduced duration of human stay, and more land space. As a result, if European swallows and village weaver birds are eliminated from the checklist, there will be a gradual increase in avifauna population abundance from stations one to two to three.

The population distribution pattern between the three stations is a display of the impact of anthropogenic activities on avifauna population abundance. Some birds, like the European swallow and village weaver, are closely attached to human habitations; therefore, their high abundance in an area is an indicator of human settlements. Birds are highly susceptible to human activities in the environment; as a result, they are excellent indicators of the environment. Saying it differently, birds are strongly attached to biotic and abiotic environmental factors, which make them depend highly on the environment. As a result, their activities reveal environmental changes. For example, the black kite, yellow wagtail, and white-throated bee-eater were migratory birds (visitors) encountered in the study area. According to some local inhabitants in the study, these birds migrate in such an unnoticed manner that they cannot be found from July to September. The Black kite will be seen from late September, and the White-throated bee-eater and yellow wagtail from November, and their return is a sign of the water receding until February, when they will start noticing increasing water in the rivers, streams, etc. (personal communication).

The avifauna species Spur-winged lapwing was seen to be resident at station three (new site), but contrary to available literature, this species was not supposed to be found in the south-south region of the Niger Delta, and it is also among the species covered under the **Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA),** which promotes the protection and sustainable management of migratory waterbird populations across their range.

The Gbaran-Ubie IOGP Biodiversity Action Plan, 2014, recorded 25 avian species belonging to 22 genera and 14 families in TCFR. TCFR birds are dominated by members of the families Ploceidae (weavers), Apopidae (swifts), Columbidae (pigeons and doves), and Bucerotidae (hornbills). Of great economic importance in the area are the weavers, which roost often on oil palm trees and devour a lot of maize in the farmlands, leading to disappointing harvests. Over 88% of the birds are resident breeders, while a few (about 5-10%) are Palearctic and local migrants. The bulk of them are resident breeders, while a few are palearctic migrants. Among the species frequently sighted in TCFR airspace are the passerines, diurnal birds of prey, scavengers, and seed-eaters—swifts, weavers, kingfishers, common bulbuls, sunbirds, egrets, allied hornbills, pied crows, hawks, kites, lizard buzzards, doves, pigeons, hooded vultures, Senegal

coucals, and blue plantain eaters. Birds sighted occasionally, which are threatened, are the Fawn-breasted Anambra waxbill, Palm-nut vulture, Fish Eagle, Grey Parrot, woodpeckers, Hammerkop, stork, whistling ducks, and Damara tern. There are also nocturnal forms like the owl and nightjar, whose conservation status is not known because of their strict crepuscular and nocturnal habits. These birds are uncomfortable with the high intensity of light in the day. Most birds of TCFR are conserved, as there are traditions against killing and eating them (Clay, 2004).

Based on local occurrence status, a total of 12 bird species were identified as *very abundant*, 19 as *abundant*, 62 as *very common*, 16 as *common*, and 41 as *fairly common*. In addition, seven species each were classified as *uncommon*, *rare*, and *very rare*. Analysis of seasonal distribution revealed that 42% of the species were *year-round residents*, 7% were *summer breeders*, 38% were *winter migrants*, and 13% were *passage migrants*. The most dominant species recorded included *Fulica atra* (13.3%), *Bubulcus ibis* (12.28%), *Egretta garzetta* (11.46%), *Aythya ferina* (8.9%), and *Corvus splendens* (5.8%). Regression analysis indicated a declining population trend in 14 bird species. Major threats to avian populations were found to include habitat loss, pesticide contamination, and illegal hunting. Given that species composition and richness are essential for ecosystem stability and functionality, conservation measures to protect natural habitats are urgently required.

The diversity indices calculated in this study showed a Shannon–Weiner Index (H′) value of 3.36, a Simpson's Index (D) of 0.93, a Species Evenness (E) of 0.31, and a Census Index (C.I.) of 5.81 birds per hectare, while overall bird density was 6.9 birds per hectare. The findings closely align with those reported by Bibi and Ali (2013), who recorded a Shannon–Weiner Index (H′) of 3.39, a Simpson's Diversity Index (D) of 0.93, and a bird density of 6.9 birds per hectare. These results indicate a stable avian community structure with moderate species evenness and high diversity. However, continuous anthropogenic pressures such as habitat degradation, pesticide application, and poaching pose significant risks to the sustainability of bird populations. Protecting and restoring natural habitats are therefore essential strategies to maintain avian diversity and ecological balance in the study area.

CONCLUSION AND RECOMMENDATIONS

A significant reduction in bird populations has been observed within the study area. The primary factors contributing to this decline include habitat destruction, lack of environmental awareness, and widespread poverty among local residents. Since species richness and composition play crucial roles in maintaining the balance and proper functioning of ecosystems, the conservation of avian diversity is of utmost importance. Therefore, immediate measures should be taken to preserve and restore the natural habitats within the protected area to ensure the survival and sustainability of bird species. This could be achieved through notes on some critical biodiversity criteria observed in the HBVAS around GBARAN-UBIE IOGP area of influence, making it exceptionally rich in biodiversity. The impacts of the challenges to biodiversity conservation in the area could be minimized and probably reversed by:

- Regularly updating the biodiversity information base.

- Prompt implementation of research findings.
- Embracing emerging biotechnologies.
- Undertaking periodic natural resource accounting.
- Implementing appropriate policy, legal, and administrative measures; and.
- Providing institutional support

ADVANCE RESEARCH

Apart from insecurity in the study area and financial constraints, threats to biodiversity conservation are visible and have been going on for years. Loss of biodiversity is traced to unsustainable exploitation that has taken place in the area. The status and integrity of the area are largely compromised. Although it still retains its major ecosystems—freshwater swamp forest and riparian forest—the character and structure have been largely disturbed by human activities. The major threats are anthropogenic. They include logging, farming, swamp fishing, unbridled hunting, snail gathering, fuelwood gathering, and bush mango and rattan cane collection. Whereas poaching is driven by interest in wildlife/pet and bush-meat trade. Habitat degradation is promoted by excessive agriculture and land use, unsustainable natural resource exploitation, government development projects, and oil and gas exploration (Jiang and Harris, 2021). Pollution caused by oil theft, pipeline vandalism, and oil spillage also constitutes significant threats to biodiversity (Anne, 1992). The proposed site of the Yar'Adua Airport, at the Nyambiri Zarama end of the forest, has been relocated, but the vegetation has now changed to residual grassland. The Pipeline Right-of-Way (ROW) from East-West Road to Adibawa oilfield is now invaded by grass and sedges and has not only become grazing ground but also a route through which natives access and exploit forests that hitherto were inaccessible (The IUCN Red List of Threatened Species, 2016). Among the multiple pressures observed to be threatening biodiversity conservation in the area are non-enforcement of existing laws, use of chemicals for fishing, human population growth, Overharvesting of the rich bioresources, uncontrolled bush burning, slash-and-burn method of farming, and conversion of forest patches to agricultural plots. unbridled hunting and fishing methods, logging, flooding, sand mining, fragmentation of natural habitats, and climate change. habitat destruction, hunting and fishing, poverty, unawareness, and grazing.

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