



## AVIAN DIVERSITY AND ABUNDANCE IN FINIMA NATURE PARK, BONNY ISLAND, RIVERS STATE, NIGERIA

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### ABSTRACT

Bird species indices for monitoring population trends and bird species habitat association in the Finima Nature Park (FNP) were assessed using line transect method. Nine transects of 2 km each, at an independent distance of 0.02 km were used for the study. Transects were surveyed over five days between 0600hrs and 1200hrs; 1400hrs and 1600hrs and opportunistically at night. All birds sighted or heard were recorded and identified to species with the aid of Helms field guide to birds of western Africa and collection of African bird calls. Bird species abundance, richness, diversity, evenness, and Sorenson's index of similarity were deduced. A total of 1479 individuals belonging to 93 species and classified into 35 families were recorded. *Pluvialis squatarola* (20.89%) and *Sternula balaenarum* (13.52%) were the highest occurring birds. Ardeidae (9) and Scolopacidae (8) had the highest numbers of species represented at FNP. Among the birds sighted in the study, *Necrosyrtes monachus* is found to be Critically Endangered (CR); *Sternula balaenarum* to be Vulnerable (VU); and *Numenius arquata* is Near Threatened (NT). A periodic appraisal and protections for the migrant, resident birds, and their habitats is recommended.

**Keywords:** Birds; Diversity; Conservation; FNP

### INTRODUCTION

Birds are among the most numerically successful classes of tetrapods with approximately 10,000 species in the world of which 894 species are found in Nigeria

(Barrowclough *et al.*, 2016). They play a major role in ecosystem function and form an integral part of food chains and food webs (Clergeau *et al.*, 2001). Birds are also an indicator of habitat quality and are important to man and the environment (Sauberer *et al.*, 2004; Lameed, 2011; Thomson *et al.*, 2017). Protected areas offer safe haven to birds and other biodiversity when adequately managed. In Nigeria, there are approximately 1,000 protected areas for the conservation of wildlife (Hassan *et al.*, 2015; Protected Planet, 2020).

However, the paucity of research data on bird diversity in most of Nigeria's protected areas could be detrimental to biodiversity conservation. The Finima Nature Park (FNP) is a privately protected site in the southern part of Nigeria and its home to many wildlife species classified by International Union for Conservation of Nature (IUCN) as vulnerable or critically endangered such as the African Grey Parrot (*Psittacus erithacus*), Hooded Vulture (*Necrosyrtes monachus*), Red Iron Wood (*Lophira alata*) and West African Mahogany (*Mitragyna stipulosa*) (Agorye *et al.*, 2016; FNPBA, 2019). Inventory and monitoring are important to bird conservation and management and the dearth of data on bird diversity in online research databases for the FNP has motivated this assessment. Research data on Avifauna population in the study area which forms a core part of the Niger Delta region that is prone to oil and gas exploration is of paramount importance for the FNP management objectives in protecting the region's biodiversity. The study, therefore, assessed bird species indices for monitoring population trends and bird species association in FNP.

## MATERIALS AND METHODS

### Study Area

The study was carried out in Finima Nature Park, Bonny Island, Rivers State, Nigeria (Figure 1). The Park covers a total land area of 1,000 hectares (10 km<sup>2</sup>) of freshwater swamp forest, mangrove and the coastal area which is divided into two major regions; the Eastern (700 hectares) and Western (300 hectares) block and the park lies on latitude 4° 22' 49" N to 4° 23' 53" N and longitude 7° 8' 40" E to 7° 12' 17" E (Agorye *et al.*, 2016; FNPBA, 2019). The area is characterized by an equatorial climate having the wet season with an annual average rainfall of 3200 mm which occurs from May to October and the dry season which occurs between November and April (Barbour *et al.*, 1982; Akani and Luiselli, 2010).

FNP has two distinct vegetation storeys; the emergent layer which includes plants such as *Symphonia globulifera*, *Cleistopholis patens*, *Uapaca* sp., *Musanga cecropioides*, *Hallea ledermannii*, *Terminalia* sp., *Anthostema aubryanum*, *Gmelina arborea*, *Tectona grandis*, and *Elaeis guineensis* and the understory layer which comprised of *Calamus deeratus*, *Alchornea cordifolia*, *Monodora tenuifolia*, *Harungana madagascariensis*, *Strophanthus preussii*, *Rauvolfia vomitoria*, and *Raphia* sp (Akani and Luiselli, 2010; FNPBA, 2019). The interior of the forest is very shady, and as a result, a wide variety of shade-tolerant forbs (*Nephrolepis biserrata*, *Culcasia scandens*, *Laportea* sp., *Chromolaena odorata*, *Aframomum melegueta* and *Costus afer*) and various sedges form thickets on the forest floor (Akani and Luiselli, 2010). FNP is home to numerous wildlife species of high conservation value which includes mammals, birds, fishes, amphibians, reptiles, and invertebrates.

## Avian diversity and abundance in Finima Nature Park

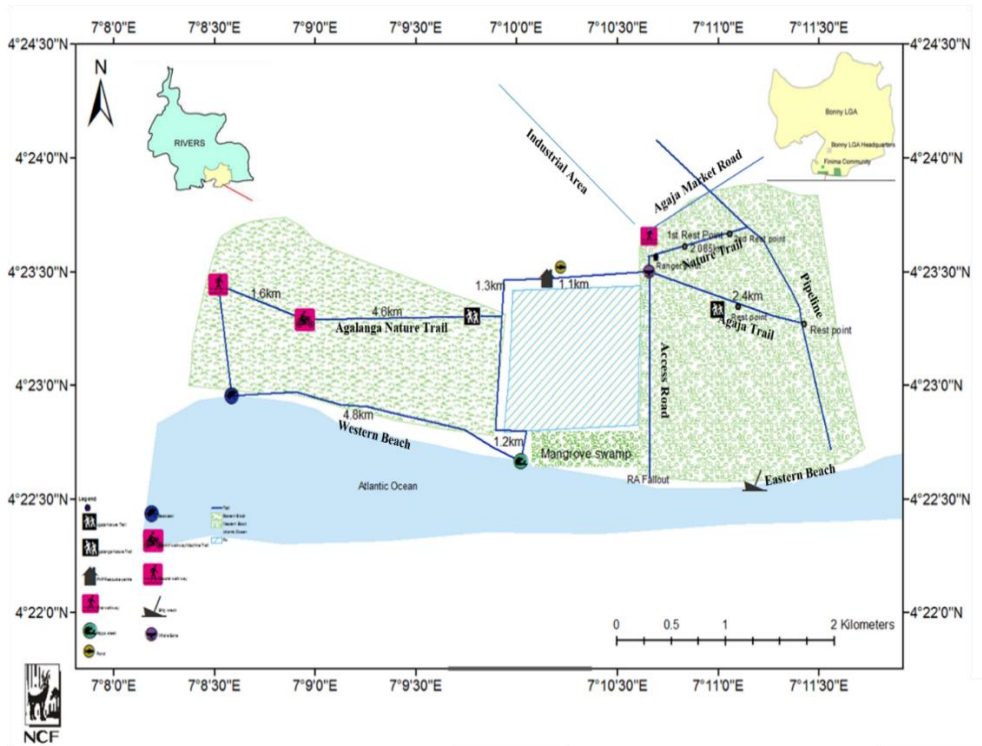


Figure 1: Map of Finima Nature Park

Source: FNP, 2019

### Sampling and Data Collection

Line transects method was used because it's the most efficient in terms of data collection per unit area (Yallop *et al.*, 2003; FNPBA, 2019). The survey involved walking a total of nine (9) purposively selected pre-existing trails with each transects measuring 2 km. A pair of Celestron 8 X 42 Binoculars, Bird Lasser App, Birds of Western Africa (Borrow and Demey 2013), Nikon digital camera and a QUP mobile sound recorder were used in the course of data collection. The line transects represent 5 major habitat types; mangrove forest, freshwater swamp, coastal area, industrial layout, and residential area. All birds sighted and heard were recorded to species. The sampling covered a period of 5 days in the wet season (September 2-6, 2019).

### Method of Data Analysis

Avian species diversity was calculated using the Simpson index (1-D), Shannon Weiner index ( $H'$ ), abundance was deduced as relative abundance, evenness, and Sorensen's coefficient index was used to deduce line transect degree of similarity.

Species richness (S) were counts of species number.

Calculation of Relative abundance

$$\text{Species Relative Abundance} = \frac{\text{Species abundance} \times 100}{\text{Total abundance}} \dots\dots\dots(i)$$

Calculation of Shannon Weiner index (H') (Shannon and Weaver, 1949)

$$H' = - \sum pi \ln(pi) \dots\dots\dots(ii)$$

$$Pi = \frac{\text{Number of individual of ith species}}{\text{Total abundance of species}}$$

ln = natural log

Calculation of Simpson Index (1-D)

$$D = 1 - \frac{\sum n(n-1)}{N(N-1)} \dots\dots\dots(iii)$$

D = Dominance index

N = total number of entities in the dataset

Evenness Index (E) refers to how close in numbers each species is in an environment. It describes the level of uniformity in the population sizes of different species in a biotic community is and calculated as:

$$\frac{H}{H_{max}} \dots\dots\dots (iv)$$

E = Evenness index

H' = Shannon Weiner index

H<sub>max</sub> = the highest value of Shannon Weiner index

Sorensen's coefficient index calculates community similarity

$$\text{Sorensen's Coefficient (CC)} = \frac{2C}{S1+S2} \dots\dots\dots (v)$$

Where: C = the number of species of two communities have in common

S1 = the total number of species found in community 1.

S2 = the total number of species found in community 2.

## RESULTS

### Checklist, Conservation Status and Family Relative Abundance in the Study Area

Bird species checklist, conservation status, species, and family relative abundance in the study area is presented in Table 1 and Figure 2. A total of 1479 wild individuals were recorded, belonging to 93 species and classified into 35 families. However, compared with the results of the previous sighting (FNPBA, 2019), a total of 125 species of birds belonging to 44 families were found in the FNP. *Pluvialis squatarola* (20.89%) and *Sternula balaenarum* (13.52%) were the most abundant bird species in the park. Ardeidae (9) and Scolopacidae (8) had the highest numbers of species represented at FNP. Among the birds sighted in the study *Necrosyrtes monachus* are Critically Endangered (CR), *Sternula balaenarum* is Vulnerable (VU) while *Numenius arquata* is Near Threatened (NT).

## Avian diversity and abundance in Finima Nature Park

Table 1: Bird species in Finima Nature Park, Rivers State

Family	Species	Scientific names	A	R. Ab%	CS	DS
Phalacrocoracidae	Reed Cormorant	<i>Phalacrocorax africanus</i>	5	0.34	LC	cR
Anhingidae	African Darter*	<i>Anhinga rufa</i>	*	*	LC	rR
Ardeidae	Black Heron	<i>Egretta ardesiaca</i>	2	0.14	LC	uR
	Black-headed Heron	<i>Ardea melanocephala</i>	12	0.81	LC	cR
	Great Egret	<i>Ardea alba</i>	3	0.20	LC	uR
	Green-backed Heron*	<i>Butorides virescens</i>	*	*	LC	rR
	Grey Heron	<i>Ardea cinerea</i>	2	0.14	LC	uR
	Intermediate Egret	<i>Egretta intermedia</i>	9	0.61	LC	cR
	Little Egret	<i>Egretta garzetta</i>	4	0.27	LC	uR
	Striated Heron	<i>Butorides striata</i>	4	0.27	LC	uR
	Western Cattle Egret	<i>Bubulcus ibis</i>	14	9.47	LC	cR
			0			
	Western Reef Heron	<i>Egretta gularis</i>	11	0.74	LC	cR
	Purple Heron*	<i>Ardea purpurea</i>	*	*	LC	rR
Scopidae	Hamerkop	<i>Scopus umbretta</i>	3	0.20	LC	uR
Ciconiidae	Woolly-necked Stork	<i>Ciconia episcopus</i>	8	0.54	LC	cR
	Africa Openbill Stork*	<i>Anastomus lamelligeris</i>	*	*	LC	rR
Threskiornithidae	Sacred Ibis*	<i>Threskiornis aethiopia</i>	*	*	LC	rR
Anatidae	White-faced Whistling Duck	<i>Dendrocygna viduata</i>	3	0.20	LC	uR
	African Pygmy-Goose*	<i>Nettapus auritus</i>	*	*	LC	rR
	Geese +	<i>Branta Canadensis</i>	4	+	LC	i
Pandionidae	Osprey*	<i>Pandion haliaetus</i>	*	*	LC	rR
Accipitridae	African Fish Eagle	<i>Haliaeetus vocifer</i>	3	0.20	LC	uR
	African Goshawk	<i>Accipiter tachiro</i>	1	0.07	LC	uR
	Hooded Vulture	<i>Necrosyrtes monachus</i>	2	0.14	CR	uR
	Palm-nut Vulture	<i>Gypohierax angolensis</i>	8	0.54	LC	cR
	Yellow-billed Kite	<i>Milvus migrans</i>	22	1.49	LC	cR
	Shikra*	<i>Accipiter badius</i>	*	*	LC	rR
Falconidae	Common Kestrel	<i>Falco tinnunculus</i>	2	0.14	LC	uR
Phasianidae	Peafowl +	<i>Pavo cristatus</i>	2	+	LC	i
Rallidae	African Crane*	<i>Crex egregia</i>	*	*	LC	rR
	Black Crane*	<i>Amaurornis flavirostra</i>	*	*	LC	cR
	White-spotted Flufftail	<i>Sarothrura pulchra</i>	5	0.34	LC	cR
Heliornithidae	African Finfoot*	<i>Podica senegalensis</i>	*	*	LC	rR
Jacaniidae	African Jacana	<i>Actophilornis africanus</i>	7	0.47	LC	cR
Burhinidae	Senegal Thick-knee	<i>Burhinus senegalensis</i>	8	0.54	LC	cR
	Water Thick-knee	<i>Burhinus vermiculatus</i>	4	0.27	LC	uR
Glareolidae	Collared Pratincole*	<i>Glareola pratincola</i>	*	*	LC	rR
Charadriidae	Grey Plover	<i>Pluvialis squatarola</i>	30	20.8	LC	cR
			9	9		
	Spur-winged Lapwing	<i>Vanellus spinosus</i>	15	1.01	LC	cR
	White Fronted Plover*	<i>Charadrius marginatus</i>	*	*	LC	rR
	Kittlitz's Plover*	<i>Charadrius pecuarius</i>	*	*	LC	rR
Scolopaciidae	Common Sandpiper	<i>Actitis hypoleucos</i>	6	0.41	LC	cR
	Eurasian Curlew	<i>Numenius arquata</i>	47	3.18	NT	cR
	Little Stint	<i>Calidris minuta</i>	3	0.20	LC	uR
	Marsh Sandpiper	<i>Tringa stagnatilis</i>	1	0.07	LC	uR
	Pectoral Sandpiper	<i>Calidris melanotos</i>	1	0.07	LC	uR
	Sanderling	<i>Calidris alba</i>	3	0.20	LC	uR
	Bar-tailed Godwit	<i>Limosa lapponica</i>	53	3.58	LC	cR
	Whimbrel	<i>Numenius phaeopus</i>	1	0.07	LC	uR
	Common Greenshank*	<i>Tringa nebularia</i>	*	*	LC	rR
Laridae	Common Tern	<i>Sterna hirundo</i>	1	0.07	LC	uR

	Damara Tern	<i>Sternula balaenarum</i>	20	13.5	V	cM
			0	2	U	
	Kelp Gull	<i>Larus dominicanus</i>	1	0.07	LC	u
						M
	Royal Tern	<i>Sterna maxima</i>	2	0.14	LC	u
						M
Columbidae	African Green Pigeon	<i>Treron calvus</i>	2	0.14	LC	uR
	Blue-spotted Wood Dove	<i>Turtur afer</i>	3	0.20	LC	uR
	Laughing Dove	<i>Spilopelia senegalensis</i>	6	0.41	LC	cR
	Red-eyed Dove	<i>Streptopelia semitorquata</i>	4	0.27	LC	uR
	Tambourine Dove	<i>Turtur tympanistria</i>	1	0.07	LC	uR
	Feral pigeons+	<i>Columba livia</i>	18	+	LC	ic
						R
Psittacidae	African Grey Parrot*	<i>Psittacus erithacus</i>	*	*	CR	rR
Cuculidae	Blue Malkoha	<i>Ceuthmochares aereus</i>	1	0.07	LC	uR
	Diederik Cuckoo	<i>Chrysococcyx caprius</i>	1	0.07	LC	uR
	Senegal Coucal	<i>Centropus senegalensis</i>	2	0.14	LC	uR
Strigidae	African Wood Owl	<i>Strix woodfordii</i>	5	0.34	LC	cR
Apodidae	African Palm Swift	<i>Cypsiurus parvus</i>	3	0.20	LC	uR
	Little Swift	<i>Apus affinis</i>	20	1.35	LC	cR
Alcedinidae	Blue-breasted Kingfisher	<i>Halcyon malimbica</i>	21	1.42	LC	cR
	Giant Kingfisher	<i>Megaceryle maxima</i>	3	0.20	LC	uR
	Pied Kingfisher	<i>Ceryle rudis</i>	1	0.07	LC	uR
	Malachite Kingfisher*	<i>Alcedo cristata</i>	*	*	LC	rR
	Woodland Kingfisher	<i>Halcyon senegalensis</i>	11	0.74	LC	cR
Meropidae	White-throated Bee-eater*	<i>Merops albicollis</i>	*	*	LC	rR
Coraciidae	Broad-billed Roller*	<i>Eurystomus glaucurus</i>	*	*	LC	rR
Bucerotidae	African Pied Hornbill	<i>Tockus fasciatus</i>	2	0.14	LC	uR
	Piping Hornbill	<i>Bycanistes fistulator</i>	22	1.49	LC	cR
Capitonidae	Red-rumped Tinkerbird	<i>Pogoniulus atroflavus</i>	2	0.14	LC	uR
	Yellow-fronted Tinkerbird	<i>Pogoniulus chrysoconus</i>	1	0.07	LC	uR
	Yellow-rumped Tinkerbird	<i>Pogoniulus bilineatus</i>	1	0.07	LC	uR
	Yellow-throated Tinkerbird	<i>Pogoniulus subsulphureus</i>	14	0.95	LC	cR
Picidae	Buff-spotted Woodpecker	<i>Campethera nivosa</i>	1	0.07	LC	uR
Hirundinidae	Common House Martin	<i>Delichon urbicum</i>	65	4.39	LC	cR
	Ethiopian Swallow	<i>Hirundo aethiopica</i>	33	2.23	LC	cR
	Pied-winged Swallow	<i>Hirundo leucosoma</i>	7	0.47	LC	cR
	White-bibbed Swallow	<i>Hirundo nigrita</i>	4	0.27	LC	uR
Motacillidae	Plain-backed Pipit	<i>Anthus leucophrys</i>	8	0.54	LC	cR
	Yellow-throated Longclaw	<i>Macronyx croceus</i>	1	0.07	LC	uR
Pycnonotidae	Common Bulbul	<i>Pycnonotus barbatus</i>	43	2.91	LC	cR
	Little Greenbul	<i>Andropadus virens</i>	13	0.88	LC	cR
	Little Grey Greenbul	<i>Andropadus gracilis</i>	2	0.14	LC	uR
	Red-tailed Greenbul	<i>Criniger calurus</i>	1	0.07	LC	uR
	Swamp Palm Bulbul	<i>Thescelocichla leucopleura</i>	1	0.07	LC	uR
	Yellow-whiskered Greenbul	<i>Andropadus latirostris</i>	8	0.54	LC	cR
Sylviidae	Chattering Cisticola	<i>Cisticola anonymus</i>	22	1.49	LC	cR
	Rattling Cisticola	<i>Cisticola chiniana</i>	18	1.22	LC	cR
	Grey-backed Camaroptera*	<i>Camaroptera brevicaudata</i>	*	*	LC	rR
	Green Crombec	<i>Sylvietta virens</i>	1	0.07	LC	uR
	Green Hylia*	<i>Hylia prasina</i>	*	*	LC	rR
Monarchidae	Red-bellied Paradise	<i>Terpsiphone rufiventer</i>	*	*	LC	rR
	Flycatcher*					
Remizidae	Tit Hylia*	<i>Pholidornis rushiae</i>	*	*	LC	rR
Nectariniidae	Collared Sunbird	<i>Hedydipna collaris</i>	4	0.27	LC	uR
	Little Green Sunbird*	<i>Anthreptes seimundi</i>	*	*	LC	rR

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	Olive Sunbird	<i>Cyanomitra olivacea</i>	2	0.14	LC	uR
	Olive-bellied Sunbird	<i>Cinnyris chloropygius</i>	2	0.14	LC	uR
	Reichenbach's Sunbird	<i>Anabathmis reichenbachii</i>	9	0.61	LC	cR
	Western Olive Sunbird*	<i>Cyanomitra olivacea</i>	*	*	LC	rR
Laniidae	Southern Fiscal	<i>Lanius collaris</i>	2	0.14	LC	uR
Corvidae	Pied Crow	<i>Corvus albus</i>	53	3.58	LC	cR
Sturnidae	Purple Starling	<i>Lamprotornis purpureus</i>	1	0.07	LC	uR
	Splendid Starling	<i>Lamprotornis splendidus</i>	36	2.43	LC	cR
Passeridae	Northern Grey-headed Sparrow	<i>Passer griseus</i>	5	0.34	LC	cR
Ploceidae	Black-necked Weaver*	<i>Ploceus nigricollis</i>	*	*	LC	rR
	Blue-billed Malimbe*	<i>Malimbus nitens</i>	*	*	LC	rR
	Orange Weaver	<i>Ploceus aurantius</i>	1	0.07	LC	uR
	Slender-billed Weaver	<i>Ploceus pelzelni</i>	1	0.07	LC	uR
	Village Weaver	<i>Ploceus cucullatus</i>	48	3.25	LC	cR
	Vieillot's Weaver*	<i>Ploceus nigerrimus</i>	*	*	LC	
Estrildidae	Black-and-white Mannikin	<i>Spermestes bicolor</i>	5	0.34	LC	cR
	Black-bellied Seedcracker *	<i>Pyrenestes ostrinus</i>	*	*	LC	rR
	Bronze Mannikin	<i>Spermestes cucullatus</i>	29	1.96	LC	cR
	Grey-headed Nigrita	<i>Nigrita canicapillus</i>	5	0.34	LC	cR
	Magpie Mannikin	<i>Spermestes fringilloides</i>	2	0.14	LC	uR
	Orange-cheeked Waxbill	<i>Estrilda melpoda</i>	3	0.20	LC	uR
	Pale-fronted Nigrita	<i>Nigrita luteifrons</i>	1	0.07	LC	uR
Viduidae	Pin-tailed Whydah	<i>Vidua macroura</i>	5	0.34	LC	cR

N/B: Species with relative abundance computed were sighted between September 2-6 2019 by this study, those asterisked (\*) were sighted in previous surveys and rangers' documentations (as observed in FNP visitor pamphlet and FNPBA, 2019; birds assessed April 29<sup>th</sup> – 4<sup>th</sup> May 2019) but not in our study. (+) Exotic Bird. Acronyms: LC = Least Concern; NT = Near Threatened; CR = Critically Endangered; (c) common birds, (u) uncommon birds, (r) rare, (i) introduced, (R) Resident; (M) Migrant

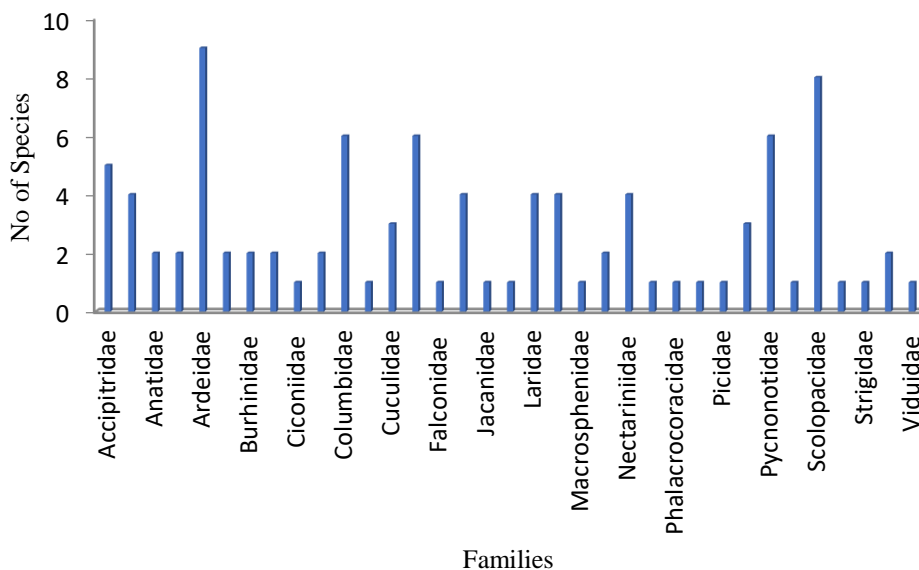


Figure 2: Number of bird species by families' in Finima Nature Park  
Source: Field Survey (2019)

### Species Diversity and Similarity Index of Birds in Finima Nature Park

Bird species richness, abundance, and diversity are presented in Table 2, and Sorenson’s Similarity indices in Table 3. Western Beach had the highest species richness ( $S=37$ ;  $1-D = 0.77$ ;  $H'= 2.04$ ) then Agaja market road ( $S=35$ ;  $1-D=0.84$ ;  $H'=2.63$ ), while Agalanga Nature trail ( $S=28$ ;  $1-D = 0.93$ ,  $H'= 3.00$ ) and Nature trail ( $S=31$ ;  $1-D=0.92$ ,  $H'=2.98$ ) had the highest bird species diversity. Agaja trail ( $S= 14$ ;  $1-D = 0.74$ ,  $H' = 1.91$ ), Eastern Beach ( $S= 15$ ;  $1-D = 0.83$ ,  $H' =2.23$ ) and Pipeline ( $S= 18$ ;  $1-D = 0.87$ ,  $H' = 2.45$ ) were the least in species richness and diversity. Species evenness was highest in Agalanga Nature Trail ( $E = 0.90$ ), and lowest in Western Beach ( $E=0.56$ ). Table 3 shows that similarity or overlap was highest between Nature Trail and Agalanga Nature Trail ( $SI = 0.50$ ) followed by Agalanga Nature Trail and Access Road ( $SI = 0.46$ ) and the overlap was lowest between Eastern Beach and Agaja Trail ( $SI = 0.07$ ) followed by Western Beach and Agaja trail ( $SI = 0.12$ ).

Table 2: Species diversity index of birds in the different transects of the study area

	A. Road	A.N. Trail	Agaja Mrkt Rd	Agaja Trail	Western Beach	IA	Nature Trail	Pipeline	Eastern Beach	Entire Study Area
S. richness	29	28	35	14	37	17	31	18	15	93
S										
Individuals	117	62	174	58	800	90	90	49	39	1479
Shannon H'	2.83	3.00	2.63	1.91	2.04	1.90	2.98	2.45	2.23	3.26
Simpson (1-D)	0.91	0.93	0.84	0.74	0.77	0.70	0.92	0.87	0.83	0.92
Evenness	0.84	0.90	0.74	0.72	0.56	0.67	0.87	0.85	0.82	0.72

NB: A. Road - Access Road; A. N. Trail. - Agalanga Nature Trail; IA- Industrial Area; S. richness: Species richness; Mrkt Rd –Market Road  
Source: Field Survey (2019)

Table 3: Sorensen’s Similarity Indices of Birds in the Different Transects of the Study Area

	A. Road	AN Trail	Agaja MR	Agaja Trail	Western Beach	IA	Nature Trail	Pipeline	Eastern Beach
A. Road	*	0.46	0.44	0.28	0.39	0.35	0.39	0.34	0.32
ANT		*	0.19	0.25	0.34	0.36	0.50	0.43	0.37
Agaja MR			*	0.16	0.36	0.42	0.33	0.38	0.28
Agaja Trail				*	0.12	0.13	0.39	0.38	0.07
Western Beach					*	0.33	0.29	0.22	0.38
IA						*	0.17	0.34	0.44
Nature Trail							*	0.33	0.26
Pipeline								*	0.24
Eastern Beach									*

NB: A. Road - Access Road; ANT - Agalanga Nature Trail; IA- Industrial Area; MR –Market Road  
Source: Field Survey (2019)



## DISCUSSION

Protected areas are one of the most important tools for biodiversity conservation (Duckworth and Altwegg, 2018). This may not be unconnected with the high relative abundance of species recorded in the study area compared to a similar work conducted by Efenakpo *et al.* (2019) from 2<sup>nd</sup> to 4<sup>th</sup> of August at Choba community of Rivers State who documented a total number of 760 individuals in 36 bird species belonging to 20 families and the survey of Alawa *et al.* (2018) which was conducted in the Rivers State University that recorded 38 species of birds belonging to 24 families.

Although, Choba, Rivers State University, and FNP are in urban areas, the latter boasts a significantly higher bird species richness and abundance which may be attributed to its protected area's status and diversities of habitats all at the same surrounding, thus corroborating the report of Duckworth and Altwegg (2018) that increasing habitat heterogeneity has a positive impact on biodiversity conservation. This study also recorded more bird species and families compared to an earlier survey of FNPBA (2019) which had 80 bird species belonging to 31 families and this variation may be connected to an off migratory season when the earlier survey was carried out. Notably in both surveys, nocturnal species were lacking. Nevertheless, comparing the bird species of FNP to Omo Forest Reserve which had 154 species according to surveys conducted by Olmos and Turshak (2009) and Oluwa Forest Reserve (OFR) which had 135 species belonging to 41 families according to Okosodo *et al.* (2019), both study areas had more bird species than FNP and this could be attributed to landmass and variability of different microhabitats such as farmlands and fallow areas present in the OFR and Omo Forest Reserve.

The availability of vegetation cover, the level of noise, and traffic volume are important features to consider in understanding urban avian diversity (Bunza *et al.*, 2017; Efenakpo *et al.*, 2019). The entire study area has a high species diversity, and this may be connected to the diversity of plants and habitats in the study area. While the Western Beach coastal area boasted the highest bird diversity which may be attributed to its relative remoteness and sand shores (suitable for shorebirds) compared to the Eastern Beach area and other selected transects. Species similarity index of the different transects was highest between Nature Trail and Agalanga Nature Trail and least between western Beach and Agaja Trail index may reflect the proximity that exists and the presence of similar habitat types.

## CONCLUSION

Birds are an important part of every ecosystem and the study revealed that the FNP boasts of a remarkably high diversity of avian species despite the study area located around the gas exploration company, NLNG. The nature park, which is situated on an island, though, not known for its avian composition has the potential of becoming an important avitourism attraction and consequently an avitourism destination center and Important Bird Area (IBA) due to the presence of migrant species in the western coastal area, home to three species of critically endangered birds and other species of conservational interest. The study therefore inevitably recommends a periodic appraisal and protections for the migrant, resident birds, and their habitats.

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