

Research Article

Avifaunal Settlement in a Nickel Mining Project Area in Western Côte d'Ivoire

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Abstract

An ornithological study was carried out in the nickel mining area of Founbesso, Moyango and Viala (Biankouma-Touba) in Côte d'Ivoire, to characterize the initial state of the population of the avifauna prior to the implementation of the said project. In terrestrial environments, the method of listening points coupled with point indices of abundance was used to inventory birds. In aquatic environments, the main method used was a slow-moving itinerant route on foot around bodies of water, with stops to observe and count the birds. A total of 210 bird species belonging to 64 families from 19 orders were inventoried. Of these species, two (02) are recognized as bird species of global conservation concern, eight (08) are endemic to West Africa and two (02) others are species of restricted distribution. Relatively significant samples of species from the biomes characteristic of Côte d'Ivoire have been encountered in the area: 47 of the 185 species from the Guinean-Congolese forest biome and six of the 39 species from the Sudano-Guinean savannahs. From the point of view of the protection and sustainable management of biodiversity for present and future generations, this study is of vital interest. In fact, it enabled an inventory to be made of the birds in the area, which will enable appropriate conservation measures for special-status bird species to be included in the biodiversity management plan proposed at the end of the environmental and social impact study for the project.

Keywords

Birds, Mining, Environmental Impact and Biodiversity

1. Introduction

Natural environments abound in numerous ecosystems that provide the various species that occupy them with the habitats they need to survive. These ecosystems therefore constitute remarkable wildlife habitats [1]. Forest ecosystems play a major role in mitigating the consequences of climate change

worldwide [2].

Since the 1992 Rio Earth Summit, climate and biodiversity have been at the center of the world's concerns [3]. Nowadays, the preservation of natural environments is increasingly being discussed with a view to conserving biodiversity, which is the

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determining factor in sustainable development. However, the erosion of biodiversity in natural environments is becoming increasingly worrying. On a global scale, biodiversity is being eroded by human activities [4] and climate change [5]. Anthropogenic activities lead to the fragmentation of ecosystems and the disappearance of habitats and ecological niches for animal species, thereby threatening biodiversity [6].

Indeed, human population growth and increasing human needs have led to major upheavals in the functioning of natural ecosystems [7]. As a result, more than half the area of tropical forests has been lost to human activities [8]. In West Africa, forest loss represents 70% of total forest cover [9].

In Côte d'Ivoire, forest cover has been considerably reduced because of anthropogenic activities [10]. These activities include mining, which plays a key role in the country's economy, but also disturbs ecosystems by modifying their composition, structure and functioning [11]. They therefore have many negative aspects on ecosystems and their biodiversity [12, 13]. For this reason, it seems necessary to reconcile mining with biodiversity conservation [14].

Birds, the best known of vertebrates [15], represent a significant fringe of vertebrate species and occupy an important place within this biodiversity [13, 16]. Like other vertebrates, birds are highly dependent on habitat factors and variations [17], and their distribution is strongly influenced by the distribution of major vegetation complexes [18]. Indeed, they play undeniable ecological roles, notably in the regulation of certain invertebrate populations and seed dispersal [6]. Some bird species, tied to preferred habitats, play important roles in indicating the ecological status of ecosystems [19]. Their taxonomy and worldwide distribution are relatively well documented compared with other taxa [20], making them easy to identify and enabling rapid analysis of the results of an ornithological study.

With a view to mining, a bird inventory was carried out in the Founbesso, Moyango and Viala area between Biankouma and Touba in western Côte d'Ivoire. The aim of the study was to take stock of the avifauna in the nickel mining zone, with a view to establishing a data base to be considered in the environmental impact study, enabling the authorities to take measures with a view to the sustainable conservation of biodiversity.

2. Materials and Methods

2.1. Study Area

The study area location in western Côte d'Ivoire, between the departments of Touba and Biankouma. It lies between 7°90'0" and 8°00'0" north latitude and 7°65'0" and 7°45'0" west longitude. It is subject to a transitional tropical climate characterized by two rainy and dry seasons, and by the presence of a harmatan period. Annual rainfall is 1,500 mm and the average annual temperature is 26 °C [21].

The hydrographic network is made up of several water-courses that meander through the area, notably the Bafing river and numerous regular rivers.

The vegetation of the area belongs to the Sudanese domain. It is made up of a mosaic of plant formations: grassy savannahs, woodlands and trees, gallery forests and fallow land [22].

2.2. Study Equipment

A pair of binoculars and a telescope or spotting scope were used to observe the birds. A digital camera was used to photograph the birds. A GPS was used to locate and geolocate the listening and observation stations. A voice recorder was used to record the birds' vocalizations. For bird identification, two guides to West African birds [23, 24] and compact discs (CDs) of West African bird songs and calls [25] were used.

2.3. Bird Inventory

A site location and land use map were used to illustrate the vegetation in the study area (Figure 1). Habitats were selected based on their ecological characteristics. Four types of habitats were selected and sampled: fallow land and plantations, savannahs, forests and water bodies (Figure 2). For woodland bird inventories, the method used is that of listening points coupled with point indices of abundance (PIA) [26]. At the water level, the method used is that of a slow-speed itinerant route punctuated by stops for bird observation and counting. Seven fixed listening points were set up in each habitat. The distance between two consecutive listening points is 300 m, to avoid duplication. At each listening point, all bird species seen or heard over a 20-minute period were counted. Unknown vocalizations were recorded either for later identification using the CD Rom of West African bird calls and songs by Chappuis [25], or for playback for species identification purposes on site. Surveys were carried out from 07:00 to 18:00. During the surveys, the number of bird species and their abundance were noted. At the end of the various surveys, the point indices of abundance (PIA) for each species surveyed was obtained by retaining only the highest value for all surveys. Habitat coordinates and characteristics were also recorded.

2.4. Data Analysis

The data collected enabled us to determine various parameters, including species richness (S), which expresses the number of species observed in a stand ($S = \Sigma \text{species}$), relative frequency (Rf), which is the relative importance of each species compared with all those recorded in a given habitat ($Rf = (n_i/N) \times 100$ where n_i = population size of species i and N = sum of the population sizes of the species making up the stand), the Shannon diversity index (H'), which calculates the level of diversity in the environment ($H' = - \Sigma (n_i/N) \ln (n_i/N)$),

and the fairness index (J), which is the ratio between the community's actual diversity and its theoretical maximum diversity, taking into account its theoretical maximum diversity. $J = H' / \ln S$ with H' = Shannon index; $\ln S$ = maximum value of H' (H' max) with S = number of species. These parameters were calculated using R 2.8.0 software.

The conservation status of each species listed was determined according to the categories of the International Union

for Conservation of Nature [27].

Biogeographical status and endemism were also identified for these bird species according to [23]. Biome indications for these species are taken from [19]. Families, genera and scientific names of bird species follow the taxonomic order and nomenclature of IOC World Bird Names, version 13.2, as proposed by [28].

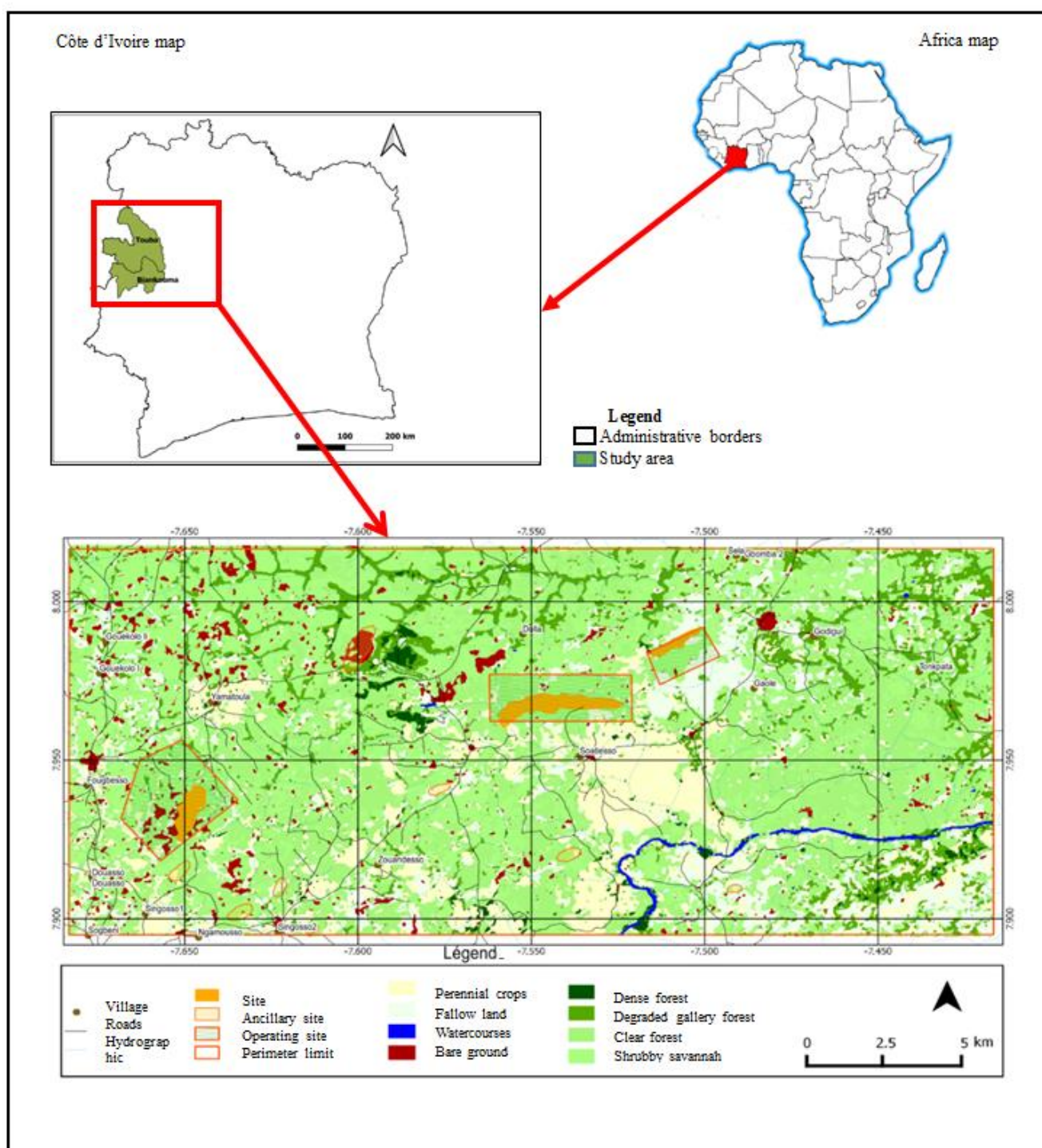
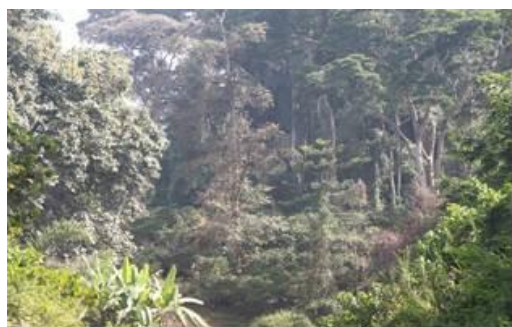


Figure 1. Site Location and Land Use Map of the Study Area.



A. Young Cocoa farm



B. Sacred forest



C. Fallow Land



D. Partial View of the Bafing river

Figure 2. Partial View of the Ecological Facies of the Surveyed Habitats.

3. Results

3.1. Overall Species Composition

Across all habitats, 210 bird species were inventoried, with

a total of 2,322 individuals belonging to 64 families and 19 orders (Figure 3 and Table 1).

Analysis of the results shows that the Cisticolidae family is the most representative, with 12 species in terms of species richness. It is closely followed by the Pycnonotidae family with 11 species. Next come the Nectariniidae (10 species), Cuculidae and Muscicapidae families, each with nine species. These five main families account for almost a quarter, or 24.76%, of the number of bird species in the study area (Table 1).

In terms of species abundance, *Egretta garzetta* (Little Egret) and *Passer griseus* (Grey Sparrow), with relative frequencies of 03.27% and 02.89% respectively, are the two dominant species.

Among the species inventoried, the *Limosa limosa* (Black-tailed Godwit), the *Hylopsar cupreocauda* (Copper-tailed Starling) and the *Ciconia microscelis* (African Woollyneck) are recognized as bird species of worldwide protection interest. They are classified as Near Threatened (NT), while the other species are classified as Least Concern (LC) [27]. Two of the 14 restricted species were inventoried. These are *Apalis sharpii* (Sharpe's Apalis) and the *Hylopsar cupreocauda* (Copper-tailed Starling). Eight (08) species inventoried are endemic to West Africa. These include *Apalis sharpii* (Sharpe's Apalis), *Batis senegalensis* (Senegal Pririt), *Illadopsis cleaveri* (Black-capped Illadopsis), *Lybius dubius* (Bearded Barbet), *Tauraco violaceus* (Violet Turaco), *Poicephalus senegalus* (Youyou Parrot), *Pternistis achantensis* (Ahanta Spurfowl) and *Hylopsar cupreocauda* (Copper-tailed Starling). In terms of biomes, 47 of the 185 bird species in the Guinean-Congolese forest biome were observed (25.41%). Similarly, six (06) of the 39 bird species from the Sudano-Guinean savannah biome known in Côte d'Ivoire were inventoried, i.e. (15.38%).

The bird population of the study area is characterized by 36% common species, 32% uncommon species, 24% common species and 8% rare species (Figure 4). The migratory status of the various species shows that 16% of the species recorded are totally migratory, including 09% palearctic migratory species and 07% intra-African migratory species, while 06% of the species recorded are partially migratory (Figure 5).

A. White-throated Bee-eater *Merops albicollis*



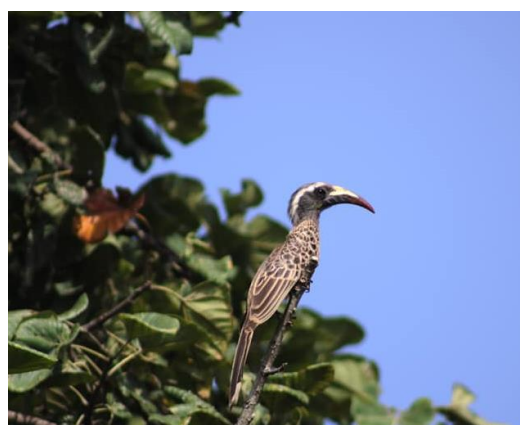
B. Bearded barbet *Lybius dubius*



F. Broad-billed roller *Eurystomus glaucurus*



C. Senegal coucal *Centropus senegalensis*



G. African grey hornbill *Lophoceros nasutus*



D. African green-pigeon *Treron calvus*



H. African jacana *Actophilornis africanus*



E. Violet Turaco *Tauraco violaceus*

Figure 3. Photographs of some of the Species Inventoried in the Study Area.

Table 1. Summary List of Bird Species Observed in the Study Area.

Orders	Families	N°	Scientific Names	English Names	Sav	Wb	For est	FP	Tw	Rf (%)	Ac	Cs	Bs
ANSERIFORMES	ANATIDAE	1	<i>Dendrocygna viduata</i> (Linnaeus, 1766)	White-faced Whistling-duck	-	23	-	-	23	0,99	Ra	LC	S/M
GALLIFORMES	NUMIDIDAE	2	<i>Numida meleagris</i> (Linnaeus, 1758)	Helmeted Guinea-fowl	8	-	-	-	8	0,34	Ra	LC	S

Orders	Families	Nº	Scientific Names	English Names	Sav	Wb	For est	FP	Tw	Rf (%)	Ac	Cs	Bs
COLUM- BIFORMES	ONDONTO- PHORIDAE	3	<i>Ptilopachus petrosus</i> (Gmelin, 1789)	Stone Partridge	5	-	-	-	5	0,22	Ra	LC	S
	PHASIANIDAE	4	<i>Synoicus adansonii</i> (Verreaux & Verreaux, 1851)	African Blue Quail	-	-	-	5	5	0,22	Ra	LC	S/M
		5	<i>Pternistis achantensis</i> (Temminck, 1854)	Ahanta Spurfowl	-	-	6	-	6	0,26	Ra	LC	S GC
		6	<i>Pternistis bicalcaratus</i> (Linnaeus, 1766)	Double-spurred Spurfowl	7	-	-	8	15	0,65	Ra	LC	S
	COLUMBIDAE	7	<i>Treron calvus</i> (Temminck, 1811)	African Green-pigeon	-	-	12	17	29	1,25	Re	LC	S
		8	<i>Turtur tympanistria</i> (Temminck, 1809)	Tambourine Dove	-	-	13	2	15	0,65	Ra	LC	S
		9	<i>Turtur afer</i> (Linnaeus, 1766)	Blue-spotted Wood-dove	5	-	2	28	35	1,51	Re	LC	S
		10	<i>Streptopelia semitorquata</i> (Rüppell, 1837)	Laughing Dove	5	-	10	13	28	1,21	Re	LC	S
		11	<i>Streptopelia vinacea</i> Bonaparte, 1855	Vinaceous Dove	42	-	-	-	42	1,81	Re	LC	S
	CAPRIM- ULGI- FORMES	12	<i>Caprimulgus climacurus</i> Vieillot, 1824	Long-tailed Nightjar	-	-	-	5	5	0,22	Ra	LC	S/M
	APODIDAE	13	<i>Telacanthura ussheri</i> (Sharpe, 1870)	Mottled Spinetail	27	-	-	-	27	1,16	Re	LC	S
CUCULI- FORMES		14	<i>Cypsiurus parvus</i> (Lichtenstein, 1823)	African Palm Swift	-	-	-	21	21	0,90	Ra	LC	S
		15	<i>Apus pallidus</i> (Shelley, 1870)	Pallid Swift	-	-	-	17	17	0,73	Ra	LC	P
		16	<i>Apus apus</i> (Linnaeus, 1758)	Common Swift	15	-	-	-	15	0,65	Ra	LC	P
		17	<i>Apus affinis</i> (Gray, 1830)	Little Swift	-	-	-	51	51	2,20	Re	LC	S
		18	<i>Tachymarptis melba</i> (Linnaeus, 1758)	Alpine Swift	12	-	-	-	12	0,52	Ra	LC	P
	CUCULIDAE	19	<i>Clamator levaillantii</i> (Swainson, 1829)	Levaillant's Cuckoo	-	-	5	-	5	0,22	Ra	LC	M
		20	<i>Cuculus solitarius</i> Stephens, 1815	Red-chested Cuckoo	-	-	4	-	4	0,17	Ac	LC	M
		21	<i>Cuculus canorus</i> Linnaeus, 1758	Common Cuckoo	-	-	-	2	2	0,09	Ac	LC	P
		22	<i>Chrysococcyx cupreus</i> (Shaw, 1792)	African Emerald Cuckoo	-	-	6	-	6	0,26	Ra	LC	S
		23	<i>Chrysococcyx klaas</i> (Stephens, 1815)	Klaas's Cuckoo	-	-	-	4	4	0,17	Ac	LC	S/M
		24	<i>Chrysococcyx caprius</i> (Boddaert, 1783)	Diederik Cockcoo	-	-	-	3	3	0,13	Ac	LC	S/M
		25	<i>Ceuthmochares aereus</i>	Chattering Yel-	-	-	-	8	8	0,34	Ra	LC	S

Orders	Families	Nº	Scientific Names	English Names	Sav	Wb	For est	FP	Tw	Rf (%)	Ac	Cs	Bs
GRUI- FORMES	RALLIDAE		(Vieillot, 1817)	lowbill									
		26	<i>Centropus leucogaster</i> (Leach, 1814)	Black-throated coucal	-	-	2	-	2	0,09	Ac	LC	S GC
		27	<i>Centropus senegalensis</i> (Linnaeus, 1766)	Senegal coucal	2	-	-	5	7	0,30	Ra	LC	S
		28	<i>Himantornis haematopus</i> Hartlaub, 1855	Nkulengu Rail	-	-	2	-	2	0,09	Ac	LC	S GC
		29	<i>Crex egregia</i> (Peters, 1854)	African Crake	3	-	-	3	6	0,26	Ra	LC	M
		30	<i>Zapornia flavirostra</i> (Swainson, 1837)	Black Crake	-	3	-	-	3	0,13	Ac	LC	S
MUSOPHAGI FORMES	SAROTHRU- RIDAE	31	<i>Gallinula chloropus</i> (Linnaeus, 1758)	Common Moorhen	-	7	-	-	7	0,30	Ra	LC	S
		32	<i>Sarothrura pulchra</i> (Gray, 1829)	White-spotted Flufftail	-	-	2	3	5	0,22	Ra	LC	S GC
		33	<i>Tauraco persa</i> (Linnaeus, 1758)	Green Turaco	-	-	7	-	7	0,30	Ra	LC	S GC
		34	<i>Tauraco violaceus</i> Isert, 1788	Violet Turaco	6	-	-	-	6	0,26	Ra	LC	S SG
		35	<i>Crinifer piscator</i> (Boddaert, 1783)	Western Plain-eater	6	-	2	10	18	0,78	Ra	LC	S
		36	<i>Ciconia abdimii</i> Lichtenstein, 1823	Abdim's Stork	-	-	-	2	2	0,09	Ac	LC	M
CICONI- IFORMES	CICONIIDAE	37	<i>Ciconia microscelis</i> (Boddaert, 1783)	African Woollyneck	3	-	-	-	3	0,13	Ac	NT	S
		38	<i>Nycticorax nycticorax</i> (Linnaeus, 1758)	Black-crowned Night Heron	-	2	-	-	2	0,09	Ac	LC	S
		39	<i>Ardeola ralloides</i> (Scopoli, 1769)	Squacco Heron	-	3	-	-	3	0,13	Ac	LC	S/P
		40	<i>Bubulcus ibis</i> (Linnaeus, 1758)	Cattle Egret	31	-	-	14	45	1,94	Re	LC	S/M
		41	<i>Butorides striata</i> (Linnaeus, 1758)	Green-backed Heron	-	5	-	-	5	0,22	Ra	LC	S
		42	<i>Egretta garzetta</i> (Linnaeus, 1766)	Little Egret	-	76	-	-	76	3,27	Re	LC	S
PELECANI- FORMES	ARDEIDAE	43	<i>Ardea purpurea</i> Linnaeus, 1766	Purple Heron	-	2	-	-	2	0,09	Ac	LC	S/P
		44	<i>Ardea cinerea</i> Linnaeus, 1758	Grey Heron	-	2	-	-	2	0,09	Ac	LC	S/P
		45	<i>Ardea melanocephala</i> Vigors & Children, 1826	Black-headed Heron	8	-	-	-	8	0,34	Ra	LC	S
		46	<i>Bostrychia hagedash</i> (Latham, 1790)	Hadada Ibis	-	6	-	-	6	0,26	Ra	LC	S
		47	<i>Microcarbo africanus</i> (Gmelin, 1789)	Long-tailed Cormorant	-	5	-	-	5	0,22	Ra	LC	S
SULIFORMES	PHA- LACROCORA CIDAE												

Orders	Families	Nº	Scientific Names	English Names	Sav	Wb	For est	FP	Tw	Rf (%)	Ac	Cs	Bs
CHARADRI- IFORMES	BURHINIDAE	48	<i>Burhinus senegalensis</i> (Swainson, 1837)	Senegal Thick-knee	-	4	-	-	4	0,17	Ac	LC	S
	CHARADRI- IDAE	49	<i>Vanellus senegallus</i> (Linnaeus, 1766)	Wattled Lapwing	-	8	-	-	8	0,34	Ra	LC	S
		50	<i>Vanellus albiceps</i> Gould, 1834	White-crowned Lapwing	6	-	-	-	6	0,26	Ra	LC	S
		51	<i>Vanellus spinosus</i> (Linnaeus, 1758)	Spur-winged Lapwing	-	10	-	-	10	0,43	Ra	LC	M
	ROSTRATULIDAE	52	<i>Rostratula benghalensis</i> (Linnaeus, 1758)	Greater Painted-snipe	-	2	-	-	2	0,09	Ac	LC	S
	JACANIDAE	53	<i>Actophilornis africanus</i> (Gmelin, 1789)	African Jacana	-	10	-	-	10	0,43	Ra	LC	S
		54	<i>Microparra capensis</i> (Smith, 1839)	Lesser Jacana	-	6	-	-	6	0,26	Ra	LC	M
	SCOLOPACIDAE	55	<i>Limosa limosa</i> (Linnaeus, 1758)	Black-tailed Godwit	-	2	-	-	2	0,09	Ac	NT	P
ACCIPITRI- FORMES	PANDIONIDAE	56	<i>Actitis hypoleucos</i> Linnaeus, 1758	Common Sandpiper	-	6	-	-	6	0,26	Ra	LC	P
		57	<i>Pandion haliaetus</i> (Linnaeus, 1758)	Osprey	-	3	-	-	3	0,13	Ac	LC	P
	ACCIPITRIDAE	58	<i>Elanus caeruleus</i> (Desfontaines, 1789)	Black-winged Kite	-	-	2	4	6	0,26	Ra	LC	S
		59	<i>Milvus aegyptius</i> (Boddaert, 1783)	Yellow-billed kite	14	4	2	8	28	1,21	Re	LC	M
		60	<i>Gypohierax angolensis</i> (Gmelin, 1788)	Palm-nut Vulture	-	3	-	-	3	0,13	Ac	LC	S
		61	<i>Polyboroides typus</i> Smith, 1829	African Harrier-hawk	3	-	3	2	8	0,34	Ra	LC	S
		62	<i>Tachyspiza badia</i> (Gmelin, 1788)	Shikra	4	-	2	-	6	0,26	Ra	LC	S
		63	<i>Accipiter ovampensis</i> Gurney, 1875	Ovambo Sparrowhawk	2	-	-	-	2	0,09	Ac	LC	M
		64	<i>Butastur rufipennis</i> (Sundevall, 1851)	Grasshopper Buzzard	5	-	-	-	5	0,22	Ra	LC	M
		65	<i>Kaupifalco monogrammicus</i> (Temminck, 1824)	Lizard Buzzard	6	-	3	6	15	0,65	Ra	LC	S
		66	<i>Buteo auguralis</i> Salvadori, 1865	Red-necked Buzzard	-	-	2	-	2	0,09	Ac	LC	S/M
STRIGI- FORMES	TYTONIDAE	67	<i>Tyto alba</i> (Scopoli, 1769)	Common Barn-owl	-	-	3	-	3	0,13	Ac	LC	S
	STRIGIDAE	68	<i>Otus senegalensis</i> (Swainson, 1837)	African Scops-owl	-	-	2	-	2	0,09	Ac	LC	S
		69	<i>Ptilopsis leucotis</i> (Temminck, 1820)	Northern white-faced owl	2	-	-	-	2	0,09	Ac	LC	S
TROGON- IFORMES	TROGONIDAE	70	<i>Apaloderma narina</i> (Stephens, 1815)	Narina Trogon	-	-	2	-	2	0,09	Ac	LC	S

Orders	Families	Nº	Scientific Names	English Names	Sav	Wb	For est	FP	Tw	Rf (%)	Ac	Cs	Bs
PICIFORMES	BU-CEROTIDAE	71	<i>Horizocerus albocristatus</i> (Cassin, 1848)	Western Long-tailed Hornbill	-	-	5	-	5	0,22	Ra	LC	S GC
		72	<i>Lophoceros semifasciatus</i> (Hartlaub, 1855)	West African Pied Hornbill	-	-	15	4	19	0,82	Ra	LC	S GC
		73	<i>Lophoceros nasutus</i> (Linnaeus, 1766)	African Grey Hornbill	29	-	-	-	29	1,25	Re	LC	S
		74	<i>Bycanistes fistulator</i> (Cassin, 1852)	Western Piping Hornbill	-	-	8	-	8	0,34	Ra	LC	S GC
	UPUPIDAE	75	<i>Upupa epops</i> Linnaeus, 1758	Common Hoopee	3	-	-	-	3	0,13	Ac	LC	M/P
	PHOENICULIDAE	76	<i>Phoeniculus purpureus</i> (Miller, 1784)	Green Woodhoopoe	8	-	-	-	8	0,34	Ra	LC	S
	INDICATORIDAE	77	<i>Indicator indicator</i> (Sparman, 1777)	Greater Honeyguide	5	-	-	-	5	0,22	Ra	LC	S
		78	<i>Indicator minor</i> Stephens, 1815	Lesser Honeyguide	3	-	-	-	3	0,13	Ac	LC	S
	PICIDAE	79	<i>Jynx torquilla</i> Linnaeus, 1758	Eurasian Wryneck	4	-	-	-	4	0,17	Ac	LC	P
		80	<i>Pardipicus nivosus</i> (Swainson, 1837)	Buff-spotted Woodpecker	-	-	5	-	5	0,22	Ra	LC	S GC
		81	<i>Campethera punctuligera</i> (Wagler, 1827)	Fine-spotted Woodpecker	8	-	-	-	8	0,34	Ra	LC	S
		82	<i>Dendropicos fuscescens</i> (Vieillot, 1818)	Cardinal Woodpecker	4	-	-	-	4	0,17	Ac	LC	S
	LYBIIDAE	83	<i>Dendropicos gabonensis</i> (Verreaux & Verreaux, 1851)	Gabon Woodpecker	-	-	3	-	3	0,13	Ac	LC	S GC
		84	<i>Chloropicus pyrrhogaster</i> (Malherbe, 1845)	Fire-bellied Woodpecker	-	-	7	-	7	0,30	Ra	LC	S GC
		85	<i>Gymnobucco peli</i> Hartlaub, 1857	Bristle-nosed Barbet	-	-	9	-	9	0,39	Ra	LC	S GC
		86	<i>Gymnobucco calvus</i> (Lafresnaye, 1841)	Naked-faced Barbet	-	-	4	5	9	0,39	Ra	LC	S GC
		87	<i>Pogoniulus scolopaceus</i> (Bonaparte, 1850)	Speckled Tinkerbird	-	-	11	-	11	0,47	Ra	LC	S GC
		88	<i>Pogoniulus bilineatus</i> (Sundevall, 1850)	Yellow-rumped Tinkerbird	-	-	6	9	15	0,65	Ra	LC	S
		89	<i>Pogoniulus chrysoconus</i> (Temminck, 1832)	Yellow-fronted Tinkerbird	4	-	-	-	4	0,17	Ac	LC	S
		90	<i>Tricholaema hirsuta</i> (Swainson, 1821)	Hairy-breasted Barbet	-	-	3	-	3	0,13	Ac	LC	S GC
		91	<i>Lybius vieilloti</i> (Leach, 1815)	Vieillot's Barbet	6	-	-	2	8	0,34	Ra	LC	S
		92	<i>Lybius dubius</i> (Gmelin, 1788)	Bearded Barbet	7	-	-	-	7	0,30	Ra	LC	S SG

Orders	Families	Nº	Scientific Names	English Names	Sav	Wb	For est	FP	Tw	Rf (%)	Ac	Cs	Bs
CORACII-FORMES	MEROPIDAE	93	<i>Merops pusillus</i> Müller, 1776	Little Bee-eater	12	-	-	20	32	1,38	Re	LC	S
		94	<i>Merops albicollis</i> Vieillot, 1817	White-throated Bee-eater	15	-	-	30	45	1,94	Re	LC	M
	CORACIIDAE	95	<i>Eurystomus glaucurus</i> (Müller, 1776)	Broad-billed Roller	2	-	2	3	7	0,30	Ra	LC	S/M
	ALCEDINIDAE	96	<i>Ispidina pictus</i> (Boddaert, 1783)	African Pygmy-kingfisher	-	-	5	-	5	0,22	Ra	LC	S
		97	<i>Corythornis cristatus</i> (Pallas, 1764)	Malachite Kingfisher	-	3	-	-	3	0,13	Ac	LC	S
		98	<i>Alcedo quadribrachys</i> Bonaparte, 1850	Shining-blue Kingfisher	-	5	-	-	5	0,22	Ra	LC	S
		99	<i>Ceryle rudis</i> (Linnaeus, 1758)	Pied Kingfisher	-	3	-	-	3	0,13	Ac	LC	S
		100	<i>Halcyon leucocephala</i> (Müller, 1776)	Grey-headed Kingfisher	-	-	4	2	6	0,26	Ra	LC	M
		101	<i>Halcyon senegalensis</i> (Linnaeus, 1766)	Woodland Kingfisher	3	-	6	5	14	0,60	Ra	LC	S
FALCONI-FORMES	FALCONIDAE	102	<i>Falco tinnunculus</i> Linnaeus, 1758	Common Kestrel	3	-	-	2	5	0,22	Ra	LC	S/P
		103	<i>Falco ardosiaceus</i> Vieillot, 1823	Grey Kestrel	-	-	-	3	3	0,13	Ac	LC	S
		104	<i>Falco cuvierii</i> Smith, 1830	African Hobby	2	-	-	4	6	0,26	Ra	LC	S
		105	<i>Falco biarmicus</i> Temminck, 1825	Lanner Falcon	2	-	-	2	4	0,17	Ac	LC	S
PSITTACI-FORMES	PSITTACIDAE	106	<i>Poicephalus senegalus</i> (Linnaeus, 1766)	Senegal Parrot	5	-	-	-	5	0,22	Ra	LC	S SG
		107	<i>Psittacula krameri</i> (Scopoli, 1769)	Rose-ringed Parakeet	3	-	-	-	3	0,13	Ac	LC	S
PASSERIFORMES	ORIOOLIDAE	108	<i>Oriolus brachyrhynchus</i> Swainson, 1837	Western Black-headed Oriole	-	-	5	-	5	0,22	Ra	LC	S GC
		109	<i>Oriolus auratus</i> Vieillot, 1817	African Golden Oriole	11	-	-	-	11	0,47	Ra	LC	M
	PLAT-YSTEIRIDAE	110	<i>Batis senegalensis</i> (Linnaeus, 1766)	Senegal Batis	-	-	10	-	10	0,43	Ra	LC	S GC
		111	<i>Platysteira castanea</i> Fraser, 1843	Chestnut Wattle-eye	-	-	11	-	11	0,47	Ra	LC	S GC
		112	<i>Platysteira cyanea</i> (Müller, 1776)	Brown-throated Wattle-eye	-	-	-	5	5	0,22	Ra	LC	S
	VANGIDAE	113	<i>Prionops plumatus</i> (Shaw, 1809)	White-crested Helmetshrike	11	-	-	-	11	0,47	Ra	LC	S
	MALACONOTIDAE	114	<i>Tchagra australis</i> (Smith, 1836)	Brown-crowned Tchagra	-	-	-	4	4	0,17	Ac	LC	S
		115	<i>Tchagra senegalus</i> (Linnaeus, 1766)	Black-crowned Tchagra	-	-	-	11	11	0,47	Ra	LC	S

Orders	Families	Nº	Scientific Names	English Names	Sav	Wb	For est	FP	Tw	Rf (%)	Ac	Cs	Bs
		116	<i>Dryoscopus gambensis</i> (Lichtenstein, 1823)	Northern Puffback	-	-	-	5	5	0,22	Ra	LC	S
		117	<i>Laniarius aethiopicus</i> (Gmelin, 1788)	Tropical Boubou	3	-	-	-	3	0,13	Ac	LC	S
	DICRURIDAE	118	<i>Dicrurus adsimilis</i> (Bechstein, 1794)	Fork-tailed Drongo	11	-	-	-	11	0,47	Ra	LC	S
	LANIIDAE	119	<i>Lanius collaris</i> Linnaeus, 1766	Common Fiscal	-	-	-	8	8	0,34	Ra	LC	S
	CORVIDAE	120	<i>Corvus albus</i> Müller, 1776	Pied Crow	25	15	-	18	58	2,50	Re	LC	S
	MONARCHIDAE	121	<i>Terpsiphone rufiventer</i> (Swainson, 1837)	Red-bellied Paradise-Flycatcher	-	-	5	-	5	0,22	Ra	LC	S GC
		122	<i>Terpsiphone viridis</i> (Müller, 1776)	African Paradise-flycatcher	8	-	-	-	8	0,34	Ra	LC	S/M
	NECTARINIDAE	123	<i>Deleornis fraseri</i> (Jardine & Selby, 1843)	Fraser's Sunbird	-	-	5	-	5	0,22	Ra	LC	S GC
		124	<i>Anthreptes longuemarei</i> (Lesson, 1831)	Western Violet-backed Sunbird	13	-	-	-	13	0,56	Ra	LC	S
		125	<i>Anthreptes rectirostris</i> (Shaw, 1811)	Yellow-chinned Sunbird	-	-	4	-	4	0,17	Ac	LC	S GC
		126	<i>Hedydipna collaris</i> (Vieillot, 1819)	Collared Sunbird	-	-	3	5	8	0,34	Ra	LC	S
		127	<i>Cyanomitra verticalis</i> (Latham, 1790)	Green-headed Sunbird	-	-	-	3	3	0,13	Ac	LC	S
		128	<i>Cyanomitra olivacea</i> (Smith, 1840)	Olive Sunbird	-	-	3	4	7	0,30	Ra	LC	S
		129	<i>Cinnyris minullus</i> Reichenow, 1899	Tiny Sunbird	-	-	5	-	5	0,22	Ra	LC	S GC
		130	<i>Cinnyris cupreus</i> (Shaw, 1811)	Copper Sunbird	-	-	4	-	4	0,17	Ac	LC	S
		131	<i>Cinnyris coccinigastrus</i> (Latham, 1801)	Splendid Sunbird	6	-	-	-	6	0,26	Ra	LC	S SG
		132	<i>Cinnyris superbus</i> (Shaw, 1811)	Superb Sunbird	-	-	5	-	5	0,22	Ra	LC	S GC
	PLOCEIDAE	133	<i>Euplectes hordeaceus</i> (Linnaeus, 1758)	Black-winged Bishop	24	-	-	20	44	1,89	Re	LC	S
		134	<i>Euplectes macroura</i> (Gmelin, 1789)	Yellow-mantled Widowbird	-	-	-	24	24	1,03	Re	LC	S
		135	<i>Euplectes ardens</i> (Boddaert, 1783)	Red-collared Widowbird	-	-	-	11	11	0,47	Ra	LC	S
		136	<i>Ploceus nigricollis</i> (Vieillot, 1805)	Black-necked Weaver	-	6	-	6	12	0,52	Ra	LC	S
		137	<i>Ploceus heuglini</i> Reichenow, 1886	Heuglin's Masked Weaver	6	-	-	-	6	0,26	Ra	LC	S SG
		138	<i>Ploceus cucullatus</i> (Müller, 1776)	Village Weaver	45	-	-	30	75	3,23	Re	LC	S

Orders	Families	Nº	Scientific Names	English Names	Sav	Wb	For est	FP	Tw	Rf (%)	Ac	Cs	Bs
		139	<i>Ploceus nigerrimus</i> Vieillot, 1819	Vieillot's Black Weaver	-	10	15	-	25	1,08	Re	LC	S GC
		140	<i>Malimbus rubricollis</i> (Swainson, 1838)	Red-headed Malimbe	-	-	5	-	5	0,22	Ra	LC	S GC
	ESTRILDIDAE	141	<i>Lagonosticta senegala</i> (Linnaeus, 1766)	Red-billed Fire-finch	-	-	-	19	19	0,82	Ra	LC	S
		142	<i>Estrilda melpoda</i> (Vieillot, 1817)	Orange-cheeked Waxbill	-	-	-	15	15	0,65	Ra	LC	S
		143	<i>Nigrita bicolor</i> (Hartlaub, 1844)	Chestnut-breasted Nigrita	-	-	-	8	8	0,34	Ra	LC	S GC
		144	<i>Nigrita canicapillus</i> (Strickland, 1841)	Grey-headed Nigrita	-	-	5	-	5	0,22	Ra	LC	S
		145	<i>Spermestes cucullatus</i> Swainson, 1837	Bronze Mannikin	-	-	-	21	21	0,90	Ra	LC	S
		146	<i>Spermestes bicolor</i> (Fraser, 1843)	Black-and-white Mannikin	-	-	-	17	17	0,73	Ra	LC	S
		147	<i>Spermestes fringilloides</i> (Lafresnaye, 1835)	Magpie Mannikin	-	-	-	11	11	0,47	Ra	LC	S
	VIDUIDAE	148	<i>Vidua chalybeata</i> (Müller, 1776)	Village Indigobird	15	-	-	7	22	0,95	Ra	LC	S
		149	<i>Vidua macroura</i> (Pallas, 1764)	Pin-tailed Whydah	-	-	-	10	10	0,43	Ra	LC	S
	PASSERIDAE	150	<i>Passer griseus</i> (Vieillot, 1817)	Northern Grey-headed Sparrow	32	10	-	25	67	2,89	Re	LC	S
	MOTACILLIDAE	151	<i>Anthus leucophrys</i> Vieillot, 1818	Plain-backed Pipit	10	-	-	8	18	0,78	Ra	LC	S
		152	<i>Anthus trivialis</i> (Linnaeus, 1758)	Tree Pipit	-	-	-	10	10	0,43	Ra	LC	P
		153	<i>Macronyx croceus</i> (Vieillot, 1816)	Yellow-throated Longclaw	15	-	-	10	25	1,08	Re	LC	S
		154	<i>Motacilla aguimp</i> Dumont, 1821	African Pied Wagtail	-	6	-	-	6	0,26	Ra	LC	S
		155	<i>Motacilla flava</i> Linnaeus, 1758	Western Yellow Wagtail	-	-	-	5	5	0,22	Ra	LC	P
	PARIDAE	156	<i>Melaniparus guineensis</i> (Shelley, 1900)	Pale-eyed Black Tit	-	-	-	4	4	0,17	Ac	LC	S
	NICATORIDAE	157	<i>Nicator chloris</i> (Valenciennes, 1826)	Western Nicator	-	-	3	-	3	0,13	Ac	LC	S GC
	MACROSPHENIDAE	158	<i>Sylvietta virens</i> Cassin, 1859	Green Crombec	-	-	-	8	8	0,34	Ra	LC	S GC
		159	<i>Sylvietta brachyura</i> Lafresnaye, 1839	Northern Crombec	10	-	-	-	10	0,43	Ra	LC	S
		160	<i>Melocichla mentalis</i> (Fraser, 1843)	Moustached Grass-warbler	5	-	-	-	5	0,22	Ra	LC	S
	CISTI-	161	<i>Eremomela pusilla</i>	Senegal Ere-	14	-	-	-	14	0,60	Ra	LC	S

Orders	Families	Nº	Scientific Names	English Names	Sav	Wb	For est	FP	Tw	Rf (%)	Ac	Cs	Bs
	COLIDAE		Hartlaub, 1857	momela									
		162	<i>Apalis sharpii</i> Shelley, 1884	Sharpe's Apalis	-	-	5	-	5	0,22	Ra	LC	S GC
		163	<i>Camaropectera brachyura</i> (Vieillot, 1820)	Bleating Camaropectera	12	-	-	-	12	0,52	Ra	LC	S
		164	<i>Camaropectera superciliaris</i> (Fraser, 1843)	Yellow-browed Camaropectera	-	-	7	-	7	0,30	Ra	LC	S GC
		165	<i>Camaropectera chloronota</i> Reichenow, 1895	Olive-green Camaropectera	-	-	8	-	8	0,34	Ra	LC	S GC
		166	<i>Cisticola erythropus</i> (Hartlaub, 1857)	Red-faced Cisticola	-	-	-	21	21	0,90	Ra	LC	S
		167	<i>Cisticola cantans</i> (Heuglin, 1869)	Singing Cisticola	-	-	-	8	8	0,34	Ra	LC	S
		168	<i>Cisticola lateralis</i> (Fraser, 1843)	Whistling Cisticola	-	-	-	12	12	0,52	Ra	LC	S
		169	<i>Cisticola galactotes</i> (Temminck, 1821)	Rufous-winged Cisticola	-	-	-	7	7	0,30	Ra	LC	S
		170	<i>Cisticola natalensis</i> (Smith, 1843)	Croaking Cisticola	-	-	-	9	9	0,39	Ra	LC	S
		171	<i>Cisticola brachypterus</i> (Sharpe, 1870)	Short-winged Cisticola	-	-	-	11	11	0,47	Ra	LC	S
		172	<i>Prinia subflava</i> (Gmelin, 1789)	Tawny-flanked Prinia	-	-	-	15	15	0,65	Ra	LC	S
	ACROCEPHALIDAE	173	<i>Hippolais polyglotta</i> (Vieillot, 1817)	Melodious Warbler	-	-	-	32	32	1,38	Re	LC	P
		174	<i>Acrocephalus schoenobaenus</i> (Linnaeus, 1758)	Sedge Warbler	-	-	-	19	19	0,82	Ra	LC	P
		175	<i>Acrocephalus scirpaceus</i> (Hermann, 1804)	Common Reed-warbler	-	-	-	22	22	0,95	Ra	LC	P
		176	<i>Acrocephalus arundinaceus</i> (Temminck & Schlegel, 1847)	Great Reed-warbler	-	-	-	33	33	1,42	Re	LC	P
	HIRUNDINIDAE	177	<i>Delichon urbicum</i> (Linnaeus, 1758)	Northern House Martin	20	-	-	-	20	0,86	Ra	LC	P
		178	<i>Hirundo lucida</i> Hartlaub, 1858	Red-chested Swallow	15	-	-	-	15	0,65	Ra	LC	S
		179	<i>Riparia riparia</i> (Linnaeus, 1758)	Collared Sand Martin	14	-	-	-	14	0,60	Ra	LC	P
	PYCNONOTIDAE	180	<i>Stelgidillas gracilirostris</i> (Strickland, 1844)	Slender-billed Greenbul	-	-	4	-	4	0,17	Ac	LC	S
		181	<i>Bleda canicapillus</i> (Hartlaub, 1854)	Grey-headed Bristlebill	-	-	5	-	5	0,22	Ra	LC	S GC
		182	<i>Thescelocichla leucopleura</i> (Cassin, 1856)	Swamp Palm Bulbul	-	-	6	-	6	0,26	Ra	LC	S GC
		183	<i>Baeopogon indicator</i> (Verreaux & Verreaux,	Honeyguide Greenbul	-	-	4	-	4	0,17	Ac	LC	S GC

Orders	Families	Nº	Scientific Names	English Names	Sav	Wb	For est	FP	Tw	Rf (%)	Ac	Cs	Bs
			1855)										
		184	<i>Chlorocichla simplex</i> (Hartlaub, 1855)	Simple Greenbul	-	-	3	-	3	0,13	Ac	LC	S GC
		185	<i>Eurillas latirostris</i> (Strickland, 1844)	Yellow-whiskered Greenbul	-	-	3	-	3	0,13	Ac	LC	S
		186	<i>Eurillas virens</i> (Cassin, 1858)	Little Grenbul	-	-	7	20	27	1,16	Re	LC	S
		187	<i>Phyllastrephus icterinus</i> (Bonaparte, 1850)	Icterine Greenbul	-	-	5	-	5	0,22	Ra	LC	S GC
		188	<i>Phyllastrephus albigularis</i> (Grote, 1919)	White-throated Greenbul	-	-	7	-	7	0,30	Ra	LC	S GC
		189	<i>Pyrrhurus scandens</i> Swainson, 1837	Leaf-love	-	-	3	-	3	0,13	Ac	LC	S GC
		190	<i>Pycnonotus barbatus</i> (Desfontaine, 1789)	Common Bulbul	12	4	-	24	40	1,72	Re	LC	S
	PHYL- LOSCOPIDAE	191	<i>Phylloscopus trochilus</i> (Linnaeus, 1758)	Willow Warbler	4	-	-	-	4	0,17	Ac	LC	M
	SCOTOCER- CIDAE	192	<i>Hylia prasina</i> (Cassin, 1855)	Green Hylia	-	-	10	-	10	0,43	Ra	LC	S GC
	SYLVIIDAE	193	<i>Sylvia atricapilla</i> (Linnaeus, 1758)	Eurasian Blackcap	-	-	-	6	6	0,26	Ra	LC	P
		194	<i>Sylvia borin</i> (Boddaert, 1783)	Garden Warbler	-	-	-	5	5	0,22	Ra	LC	P
	PELLOR- NEIDAE	195	<i>Illadopsis fulvescens</i> (Cassin, 1859)	Brown Illadopsis	-	-	4	*	4	0,17	Ac	LC	S GC
		196	<i>Illadopsis cleaveri</i> (Shelley, 1874)	Black-capped Illadopsis	-	-	8	-	8	0,34	Ra	LC	S GC
	STURNIDAE	197	<i>Lamprolornis splendidus</i> (Vieillot, 1822)	Splendid Starling	-	-	17	8	25	1,08	Re	LC	S
		198	<i>Cinnyricinclus leucogaster</i> (Boddaert, 1783)	Violet-backed Starling	-	-	-	11	11	0,47	Ra	LC	M
		199	<i>Hylopsar cupreocauda</i> (Hartlaub, 1857)	Copper-tailed Starling	-	-	5	-	5	0,22	Ra	NT	S GC
	MUSCICAPI- DAE	200	<i>Alethe diademata</i> (Bonaparte, 1850)	White-tailed Alethe	-	-	4	-	4	0,17	Ac	LC	S GC
		201	<i>Muscicapa comitata</i> (Cassin, 1857)	Dusky Blue Flycatcher	-	-	11	-	11	0,47	Ra	LC	S GC
		202	<i>Muscicapa cassini</i> Heine, 1859	Cassin's Flycatcher	-	7	-	-	7	0,30	Ra	LC	S GC
		203	<i>Melaenornis Pallidus</i>	Pale Flycatcher	-	-	8	-	8	0,34	Ra	LC	
		204	<i>Fraseria ocreata</i> (Strickland, 1844)	African Forest-flycatcher	-	-	-	6	6	0,26	Ra	LC	S GC
		205	<i>Cossypha niveicapilla</i> (Lafresnaye, 1838)	Snowy-crowned Robin-chat	4	-	2	-	6	0,26	Ra	LC	S
		206	<i>Chamaetylas poliocephala</i> (Bonaparte, 1850)	Brown-chested Alethe	-	-	3	-	3	0,13	Ac	LC	S

Orders	Families	Nº	Scientific Names	English Names	Sav	Wb	For est	FP	Tw	Rf (%)	Ac	Cs	Bs	
		207	<i>Luscinia megarhynchos</i> (Brehm, 1831)	Common Night- ingale	-	-	-	5	5	0,22	Ra	LC	P	
		208	<i>Saxicola rubetra</i> (Linnaeus, 1758)	Whinchat	3	-	-	-	3	0,13	Ac	LC	P	
	TURDIDAE	209	<i>Neocossyphus poensis</i> (Strickland, 1844)	White-tailed Ant-thrush	-	-	4	-	4	0,17	Ac	LC	S	GC
		210	<i>Turdus pelios</i> Bonaparte, 1850	African Thrush	-	-	2	-	2	0,09	Ac	LC	S	
Orders 19	Families 64		Specific richness (Sr)		70	32	77	85	210	100,00				
			Number of individuals (NI)		703	261	420	938	2322					
			Shannon diversity index (H')		3,91	2,87	4,17	4,15	4,84					
			Fairness index (J)		0,92	0,83	0,96	0,93	0,92					

Sav = savannahs FP = Fallow and Plantations TW = Total workforce Rf = relative frequency

Conservation status: NT = Near Threatened; LC = Least Concern

Biogéographic status: S = resident; M = Intra-african migrant; P = Palearctic migrant

Biome: GC = confined to the Guineo-Congolese forest biome; SG = confined to the Sudano-Guinean savannah biome

Abundance characterization (Ac): D = dominant species; Ra = rare: rarely observed, one or two sightings of solitary individuals; Re = a regular species; Ac = accidental species

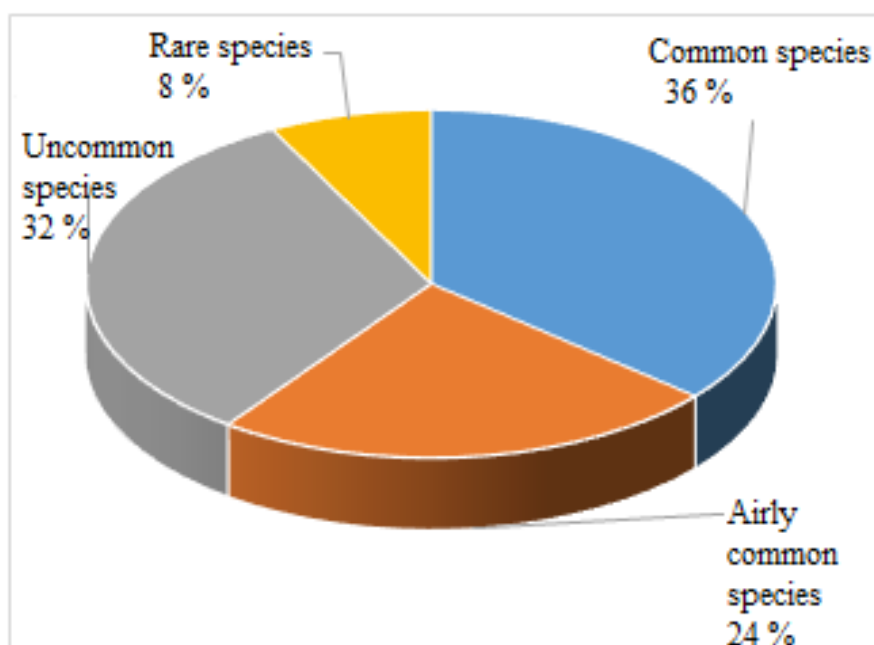


Figure 4. Characterization of the Avifauna Population.

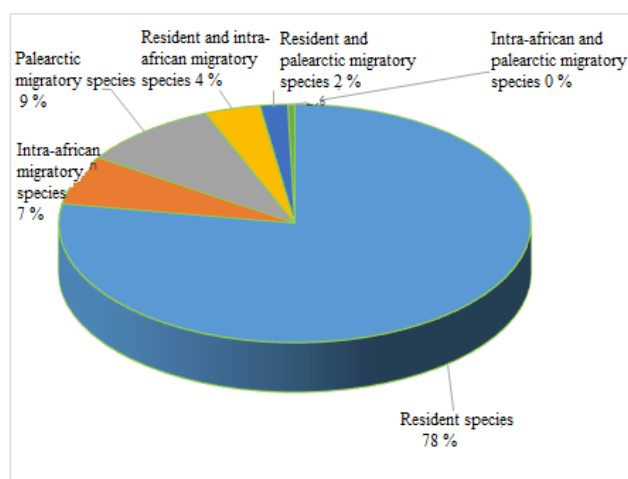


Figure 5. Categorized of migratory species in the inventoried birds on Côte d'Ivoire.

3.2. Specific Composition and Diversity Index by Habitat

3.2.1. Specific Composition and Diversity Index in Savannahs

In the savannahs, 70 bird species were inventoried, with a total of 703 individuals, i.e. 33.33% of the overall species composition. The Shannon diversity index (H') is 3.91, with a fairness index (J) of 0.92. The dominant species in these environments are *Streptopelia vinacea* and *Bubulcus ibis*.

3.2.2. Species Composition and Diversity Index in Fallow Land and Plantations

In these habitats, eighty-five (85) bird species with a total of 938 individuals were observed. The Shannon diversity index (H') is 4.15 with a fairness index (J) of 0.93, and the most dominant species are *Apus affinis*, *Acrocephalus arundinaceus*, *Hippolais polyglotta* and *Merops albicollis*.

3.2.3. Species Composition and Diversity Index in Forests

In the forests, 77 species were observed, with a total of 420 individuals. The Shannon diversity index (H') was 4.17, with a fairness index (J) of 0.96. These habitats are home to a large population of *Lamprotornis splendidus* and *Lophoceros semifasciatus*. *Hylopsar cupreocauda*, a globally protected species, has also been observed in these habitats.

3.2.4. Species Composition and Diversity Index Around Water Bodies

In these habitats, 32 bird species with a total of 261 individuals were observed. In these environments, the Shannon diversity index (H') is 2.87, with a fairness index (J) of 0.83. However, *Egretta garzetta*, with an observation frequency of 29.46%, is the most dominant species. These habitats are also home to the near-threatened Black-tailed Godwit *Limosa limosa* (Figure 6 and Table 2).

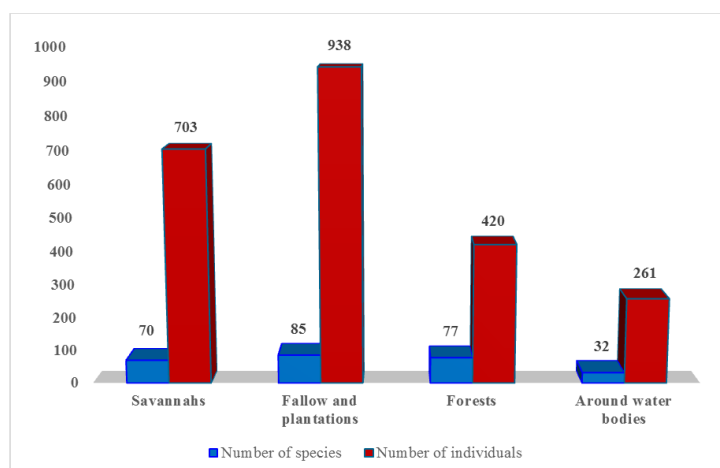


Figure 6. A histogram that depicts bird numbers across different habitats.

Table 2. *Habitat diversity indexes.*

Sites	Diversity index	
	Shannon diversity index (H)	fairness index (J)
Savannahs	3,91	0,92
Water Bodies	2,87	0,83
Forest	4,17	0,96
Fallow and Plantations	4,15	0,93

4. Discussion

A total of 210 bird species were inventoried in the study area, representing more than a quarter of the total 781 bird species recorded in Côte d'Ivoire [29]. This species richness is relatively high in view of the many threats facing birds in terms of deforestation [30]. Similarly, with the scarcity, or even disappearance, of large mammalian fauna, certain bird species, particularly large ones such as raptors, hornbills, turacos etc., are heavily poached for local consumption [31]. Species from certain families, such as Psittacidae, Nectariniidae and Columbidae, are caught for sale. Ploceidae species are poached because of the damage they cause in cereal crop fields [32].

This relative specific richness of the study site can be explained by the fact that the site contains a variety of habitats, since according to [33], the specific richness of an environment is correlated to the variety of habitats it contains and also to its ecological characteristics.

Work has been carried out in areas with similar ecological characteristics. In particular, the work of [34] on the Sucrivoire estates in Borotou-Koro and that of [35] in the Yorodougou area (Sipilou), which recorded 145 and 176 bird species respectively. This difference in species richness with our study area could be explained by the sampling methods used and the presence of preferential habitats for certain species.

Forest diversity indices are higher than those of other habitats. This could be justified by the fact that these forests, most of which are sacred forests, are in a good state of conservation. Although smaller in terms of surface area, the forests in this study area would represent refuge sites for avifauna. Similarly, the presence of near-threatened species in the area can be explained by the fact that the various forest habitats are little modified, and also by the good conservation of the site's wetlands.

Also, the presence of 47 of the 185 bird species confined to the Guineo-Congolese forest biome, recorded in the area, is quite remarkable given the scale of the anthropic activities taking place there. However, the high number of migrants

recorded in the area is due to the coincidence of the study period with the peak of bird migration in Côte d'Ivoire [36].

According to [12], mining is a threat to biodiversity and therefore to sustainable development. There has to be thorough consideration of wide-spread harm that mining activities pose to bird biodiversity.

5. Conclusion

This study is of capital interest, as it has enabled us to assess the state of the area's bird life, revealing that the study area is home to a rich and diverse avifauna. However, the area contains neither migratory routes nor important bird nesting sites that could be disturbed or damaged by mining operations. However, mining will have a considerable impact on the quantitative and qualitative composition of the area's avifauna, which will recover over the long term, even after mining ceases. With a view to protecting and sustainably managing biodiversity, we strongly recommend that the project promoters include appropriate conservation measures for special-status bird species in the biodiversity management plan to be proposed at the end of the project's environmental and social impact assessment. This will make it possible to reconcile development and environmental preservation.

Abbreviations

GPS	Global Positioning System
IOC	International Ornithological Congress
PIA	Point Indices Abundance

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Conflicts of Interest

The authors declare no conflicts of interest.

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