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(RESEARCH ARTICLE)

Avifauna of the Kani satellite gold deposit mining area (Worodougou region, northwest, Côte d'Ivoire)

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Abstract

The Kani gold mining perimeter in the Seguela department of Côte d'Ivoire underwent an avifaunal assessment to establish a baseline of its bird population prior to project implementation. In woodland areas, the listening point method coupled with point indices of abundance was used to inventory birds. In open areas, however, the main method used was a slow-moving itinerant route on foot, with stops to observe and count birds.

A total of 104 bird species belonging to 41 families from 14 orders were inventoried. Among these bird species, two (02) are endemic to West Africa; seven (07) are characteristic of the Guinean-Congolese forest biome and eight (08) others are recognized as being confined to the Sudano-Guinean savannah biome. Although the study area does not host any bird species whose protection is of worldwide interest, the significant number of birds in terms of species richness and abundance, despite the numerous anthropogenic pressures encountered in the area, makes this site an area of interest for avifauna conservation.

From the perspective of environmental protection and sustainable biodiversity management, this study is of vital interest. In fact, it enabled us to take stock of the birds in the area, which in turn will enable us to plan appropriate conservation measures for avifauna in the biodiversity management plan proposed at the end of the environmental and social impact study for the project.

Keywords: Avifauna; Gold Mining; Environmental Protection; Biodiversity

1. Introduction

Since the fall in world prices for the agricultural raw materials (in the 1980s and 1990s) on which the Ivorian economy was based, Côte d'Ivoire has undertaken to increase the exploitation of its mining resources, making this sector its second economic pillar, with a view to diversifying and growing its economy in order to sustainably support its development [1]. Since then, mining, particularly gold mining, has expanded to cover almost the whole of Côte d'Ivoire. Indeed, thanks to an incentive policy and the establishment of an appropriate institutional and legal framework, Côte d'Ivoire has been able to attract significant investment in the mining sector through the installation of several mining companies throughout the country [2]. While this mining dynamic brings undeniable socio-economic benefits, it also has a negative impact on natural ecosystems, potentially leading to the erosion of biodiversity. Anthropogenic activities, particularly mining, are known to lead to the fragmentation of ecosystems and the disappearance of habitats and ecological niches for animal species, thereby threatening biodiversity.

In addition, the northern part of Côte d'Ivoire, to which the proposed site belongs, has few protected areas and is in an advanced state of degradation due to intense human activity (farming, livestock breeding, land and water pollution from

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agricultural inputs) [3]. Since the 1992 Rio Earth Summit, climate and biodiversity have been at the center of the world's concerns [4]. Thus, the challenges of sustainable development oblige States to reconcile economic, ecological and social considerations for the well-being of current and future generations. Although measures to mitigate and compensate for these negative impacts (destruction of natural habitats, soil degradation, pollution, loss of certain species of wild flora and fauna, etc.) on the environment are taken in most cases, the fact remains that mining seriously undermines efforts to protect ecosystems and conserve biodiversity [5]. For this reason, it seems necessary to reconcile mining and biodiversity conservation.

It is with this in mind that birds, one of the essential components of biodiversity, best known with a significant fringe of vertebrate species [6], playing important ecological roles, notably in the regeneration of forest ecosystems through seed dispersal and also in indicating the ecological state of ecosystems [7], were the subject of an inventory in the Kani gold mining perimeter, with a view to assessing their stand prior to project implementation. The aim of this study is to take stock of the avifauna in the gold mining area, with a view to establishing a reliable database that can be taken into account for the sustainable management of natural resources.

2. Materials and methods

2.1 Study environment

The study area is located in the northwest of Côte d'Ivoire. It is located in the Worodougou region, precisely in the Kani department, between latitude $8^0$29'00''N and longitude 6°36'00'' W (Figure 1). The region is subject to a Sudano-Guinean climate characterized by two main seasons: the dry season and the rainy season. Annual rainfall varies between 900 and 1200 mm, with an average annual temperature of 27°C [8]. The region's vegetation is entirely within the Sudanese domain. Intact forest formations, dense dry forest or dry open forest, only exist in fragmented patches, generally in the valleys of major rivers. Most of the area is therefore covered by savannah with trees or shrubs [9].

2.2 Technical equipment

A pair of binoculars was used to observe and identify distant birds. A digital camera was used to take photos of the birds, and a GPS was used to locate and geolocate the listening and observation stations. A Dictaphone was used to record the unknown vocalizations of certain birds.

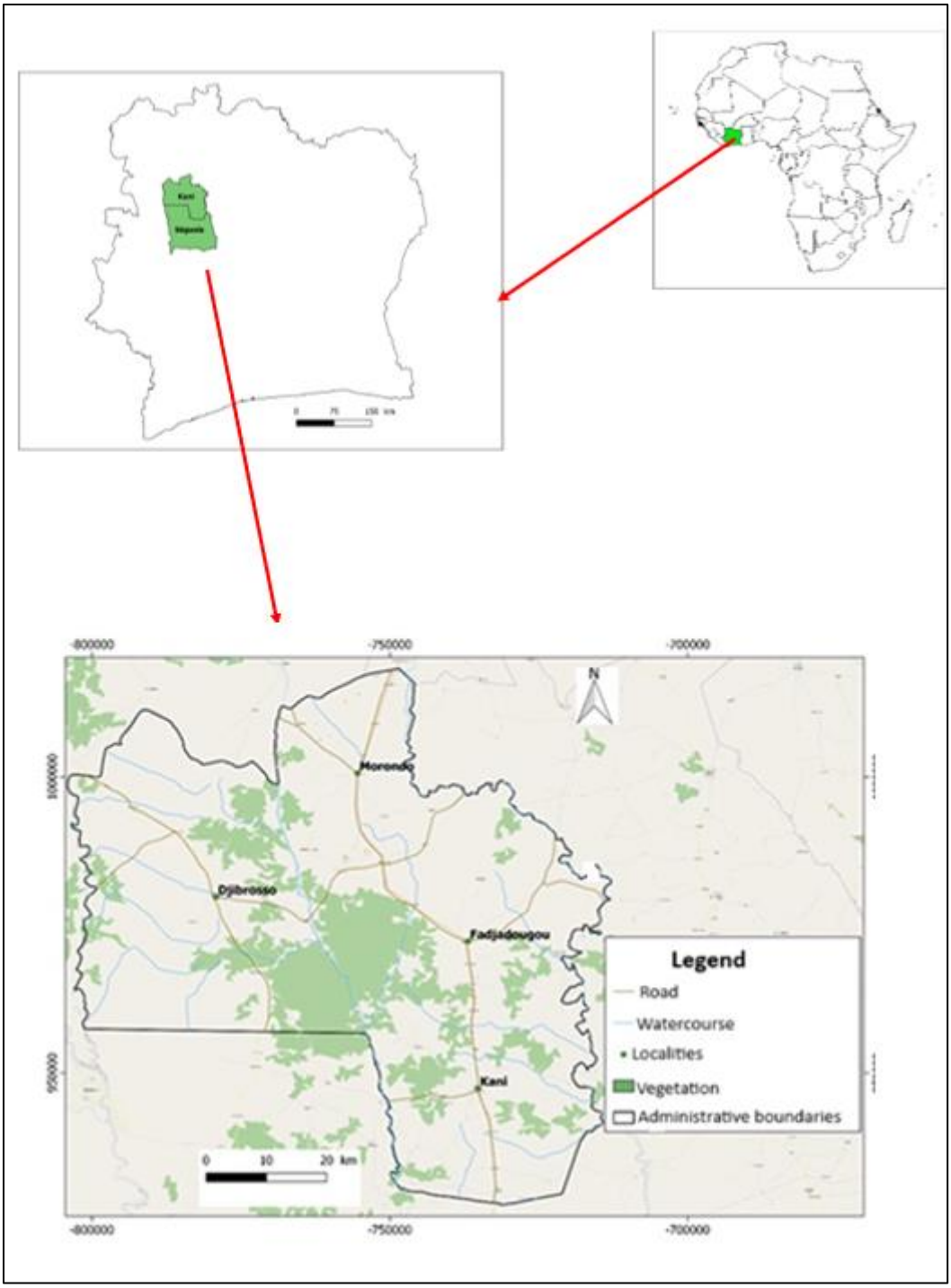

Figure 1 Map showing the location of the site and land use in the study area

The West African Bird Guide [10] and compact discs (CDs) of West African bird songs and calls [11] were used for bird identification. A site location and land use map were used to describe the vegetation in the study area (Figure 1). Habitats were selected on the basis of their ecological characteristics. Three (03) habitat types were selected and sampled within the zone: forests, plantations and fallows, and savannahs (Figure 2).

2.3 Bird inventory

2.3.1 Sampling methods

In woodland environments, the method used for bird inventories is the listening point method coupled with point indices of abundance (PAI) [12]. 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 for 20 minutes were recorded. In open areas, the method used is that of a slow-moving itinerant route punctuated by stops for bird observation and counting. Unknown vocalizations were recorded either for later identification using the CD Rom of West African bird calls and songs by Chappuis (2000), or for replay for on-the-spot species identification. Surveys were carried out from 06:00 to 17:00. During the surveys, the number of bird species and their abundance were noted.

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 = ∑ species), relative frequency (Fr), which is the relative importance of each species compared with all those recorded in a given habitat (Fr = (ni/N) x100 where ni = 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' = - Σ (ni/N) ln (ni/N)), and the fairness

A. Partial view of Cashew plantation

B. Partial view of Tree savannah

C. Partial view of the forest undergrowth

D. Partial view of a forest island

E. Partial view of the forest gallery

F. Partial view of the Fallow Land

Figure 2 Partial view of the ecological features of the habitats surveyed

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' / lnS with H' = Shannon index; lnS = 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 was determined according to the categories of the International Union for Conservation of Nature [13]. It should be noted that, in order to standardize the names of the birds recorded in the table, reference has been made to the nomenclature, taxonomy and order of [14]. The names of some species have been corrected according to IOC nomenclature as proposed by [15].

3. Results

3.1 Overall species composition

Across all habitats, 104 bird species were inventoried, with a total of 975 individuals belonging to 41 families and 14 orders (Table I). Figure 3 shows photographs of some of the bird species observed in the study area. According to [13], there are no endangered species in the area, all species being in the category of Least Concern (LC) (Table I). Analysis of the results shows that the Accipitridae family (12 species) is the most representative in terms of species richness. It is followed by the Cuculidae with eight (08) species. Next come the Cisticolidae, Columbidae and Nectariniidae families, each with six (06) species. As for species abundance, the White-throated Bee-eater *Merops albicollis* and the Cattle Egret *Bibulus ibis*, with relative frequencies of 08% and 07.07% respectively, are the two dominant species (Table I). The Shannon diversity index (H') and equitability index (J) are high throughout the area, with values of 3.99 and 0.86 respectively. In terms of West African endemism, one species was reported. This is the violet turaco *Tauraco violaceus*. Of the 182 endemic species of the Guinean-Congolese (GC) forest biome reported in Côte d'Ivoire, seven (07) were observed in the study area.

Table 1 Abundance and status of bird species observed in different habitats in the study area

N°	Orders/Families/ Species	English Names	Forest	Savannahs	plantations and Fallow	Workforce	Fr (%)	Ac	Cs	Ms	Biome	Endem
	GALLIFORMES											
	NUMIDIDAE (1)											
1	*Numida meleagris* (Linnaeus, 1758)	Helmeted Guineafowl	-	7	6	13	1,33	Ra	LC	R		
	PHASIANIDAE (2)											
2	*Pternistis ahantensis* (Temminck, 1854)	Ahanta Spurfowl	-	1	1	2	0,2	Ra	LC	R	GC	
3	*Pternistis bicalcaratus* (Linnaeus, 1766)	Double-spurred Spurfowl	-	3	5	8	0,82	U	LC	R		
	COLUMBIFORMES											
	COLUMBIDAE (6)											
4	*Treron calvus* (Temminck, 1811)	African Green-pigeon	8	-	3	11	1,13	U	LC	R		
5	*Turtur tympanistria* (Temminck, 1809)	Tambourine Dove	5	3	7	15	1,54	F	LC	R		
6	*Turtur afer* (Linnaeus, 1766)	Blue-spotted Wood-dove	2	-	2	4	0,41	U	LC	R		
7	*Streptopelia semitorquata* (Rüppell, 1837)	Red-eyed Dove	10	9	5	24	2,46	F	LC	R		
8	*Streptopelia vinacea* (Bonaparte, 1855)	Vinaceous Dove	-	10	3	13	1,33	U	LC	R		
9	*Spilopelia senegalensis* (Linnaeus, 1766)	Laughing Dove	-	4	5	9	0,92	U	LC	R		
	CAPRIMULGIFORMES											
	APODIDAE (2)											

10	*Apus apus* (Linnaeus, 1758)	Common Swift	-	4	4	8	0,82	U	LC	P		
11	*Apus affinis* (Gray, 1830)	Little Swift	-	6	-	6	0,61	Ra	LC	R		
	CUCULIFORMES											
	CUCULIDAE (8)											
12	*Clamator levaillantii* (Swainson, 1829)	Levaillant's Cuckoo	-	1	--	1	0,1	Ra	LC	M		
13	*Cuculus solitarius* (Stephens, 1815)	Red-chested Cuckoo	2	-	-	2	0,2	Ra	LC	M		
14	*Cuculus clamosus* (Latham, 1802)	Black Cuckoo	1	-	1	2	0,2	Ra	LC	M		
15	*Chrysococcyx cupreus* (Shaw, 1792)	African Emerald Cuckoo	1	-	-	1	0,1	Ra	LC	R		
16	*Chrysococcyx klaas* (Stephens, 1815)	Klaas's Cuckoo	4	-	2	6	0,61	U	LC	R/M		
17	*Chrysococcyx caprius* (Boddaert, 1783)	Diederik Cockoo	1	-	2	3	0,31	Ra	LC	R/M		
18	*Centropus grillii* (Hartlaub, 1861)	Black Coucal	4	-	2	6	0,61	U	LC	M/R		
19	*Centropus senegalensis* (Linnaeus, 1766)	Senegal coucal	-	10	3	13	1,33	U	LC	R		
	MUSOPHAGIFORMES											
	MUSOPHAGIDAE (4)											
20	*Corythaeola cristata* (Vieillot, 1816)	Great Blue turaco	2	-	-	2	0,2	Ra	LC	R		
21	*Tauraco persa* (Linnaeus, 1758)	Green Tauraco	7	-	-	7	0,72	F	LC	R	GC	
22	*Tauraco violaceus* (Isert, 1788)	Tauraco violaceus	5	12	2	19	1,94	C	LC	R	SG	AO

23	*Crinifer piscator* (Boddaert, 1783)	Western Plantain-eater	-	4	8	12	1,33	C	LC	R		
	PELECANIFORMES											
	ARDEIDAE (1)											
24	*Bubulcus ibis* (Linnaeus, 1758)	Cattle Egret	-	50	19	69	7,07	C	LC	R/M		
	SCOPIDAE (1)											
25	*Scopus umbretta* (Gmelin, 1789)	Hamerkop	-	26	-	26	2,66	U	LC	R		
	STRIGIFORMES											
	TYTONIDAE (1)											
26	*Tyto alba* (Scopoli, 1769)	Common Barn-owl	-	-	1	1	0,1	Ra	LC	R		
	STRIGIDAE (1)											
27	*Strix woodfordii* (Smith, 1834)	African Wood-owl	-	-	1	1	0,1	Ra	LC	R		
	ACCIPITRIFORMES											
	ACCIPITRIDAE (12)											
28	*Pernis apivorus* (Linnaeus, 1758)	European Honey-buzzard	-	2	-	2	0,2	Ra	LC	P		
29	*Elanus caeruleus* (Desfontaines, 1789)	Black-winged Kite	-	1	-	1	0,1	Ra	LC	R		
30	*Milvus migrans* (Boddaert, 1783)	Yellow-billed kite	-	6	5	11	1,28	C	LC	M		
31	*Gypohierax angolensis* (Gmelin, 1788)	Palm-nut Vulture	-	2	-	2	0,2	Ra	LC	R		
32	*Polyboroides typus* (Smith, 1829)	African Harrier-hawk	2	-	-	2	0,2	Ra	LC	R		

33	*Micronisus gabar* (Daudin, 1800)	Gabar Goshawk	-	1	-	1	0,1	Ra	LC	R		
34	*Melierax metabates* (Heuglin, 1861)	Dark Chanting-goshawk	-	-	1	1	0,1	Ra	LC	R		
35	*Accipiter tachiro* (Daudin, 1800)	African Goshawk	-	1	-	1	0,1	Ra	LC	R		
36	*Tachyspiza badia* (Gmelin, 1788)	Shikra	-	1	1	2	0,2	U	LC	R		
37	*Butastur rufipennis* (Sundevall, 1851)	Grasshopper Buzzard	-	2	-	2	0,2	Ra	LC	M		
38	*Kaupifalco monogrammicus* (Temminck, 1824)	Lizard Buzzard	-	3	4	7	0,72	F	LC	R		
39	*Buteo auguralis* (Salvadori, 1865)	Red-necked Buzzard	-	2	-	2	0,2	U	LC	R/M		
	BUCEROTIFORMES											
	BUCEROTIDAE (3)											
40	*Lophoceros semifasciatus* (Hartlaub, 1855)	West African Pied Hornbill	1	9	16	26	2,46	F	LC	R	GC	
41	*Lophoceros nasutus* (Linnaeus, 1766)	African Grey Hornbill	-	25	22	47	4,82	C	LC	R		
42	Bycanistes fistulator (Cassin, 1852)	Western Piping Hornbill	6	-	-	6	0,61	U	LC	R	GC	
	PHOENICULIDAE (1)											
43	*Phoeniculus purpureus* (Miller, 1784)	Green Woodhoopoe	-	3	1	4	0,41	U	LC	R		
	CORACIIFORMES											
	MEROPIDAE (1)											

44	*Merops albicollis* (Vieillot, 1817)	White-throated Bee-eater	-	58	20	78	8	F	LC	M		
	CORACIIDAE (2)											
45	*Coracias cyanogaster* (Cuvier, 1817)	Blue-bellied Roller	-	34	16	50	5,12	C	LC	R	SG	
46	*Eurystomus glaucurus* (Müller, 1776)	Broad-billed Roller	-	11	12	23	2,46	F	LC	R/M		
47	*Halcyon chelicuti* (Stanley, 1814)	Striped Kingfisher	-	-	1	1	0,1	Ra	LC	R		
48	*Halcyon senegalensis* (Linnaeus, 1766)	Woodland Kingfisher	-	-	2	2	0,2	Ra	LC	R		
	PICIFORMES											
	LYBIIDAE (2)											
49	*Pogoniulus chrysoconus* (Temminck, 1832)	Yellow-fronted Tinkerbird	-	2	-	2	0,2	Ra	LC	R		
50	*Lybius vieilloti* (Leach, 1815)	Vieillot's Barbet	-	5	3	8	0,82	U	LC	R		
	FALCONIFORMES											
	FALCONIDAE (3)											
51	*Falco tinnunculus* (Linnaeus, 1758)	Common Kestrel	-	2	-	2	0,2	Ra	LC	R/P		
52	*Falco ardosiaceus* (Vieillot, 1823)	Grey Kestrel	-	1	2	3	0,31	U	LC	R		
53	*Falco subbuteo* (Linnaeus, 1758)	Eurasian Hobby	-	1	-	1	0,1	Ra	LC	P		
	PSITTACIFORMES											
	PSITTACIDAE (1)											
54	*Poicephalus senegalus* (Linnaeus, 1766)	Senegal Parrot	-	22	10	32	3,28	C	LC	R	SG	

	PASSERIFORMES											
	ORIOLIDAE (2)											
55	*Oriolus auratus* (Vieillot, 1817)	African Golden Oriole	-	13	4	17	1,74	C	LC	M		
56	*Oriolus oriolus* (Linnaeus, 1758)	Eurasian Golden Oriole	-	5	-	5	0,51	Ra	LC	P		
	CAMPEPHAGIDAE (2)											
57	*Ceblepyris pectoralis* (Temminck, 1824)	White-breasted Cuckooshrike	-	1	1	2	0,2	Ra	LC	R		
58	*Cyanograucalus azureus* (Cassin, 1852)	Blue Cuckooshrike	-	2	-	2	0,2	Ra	LC	R	GC	
	VANGIDAE (1)											
59	*Prionops plumatus* (Shaw, 1809)	White-crested Helmetshikre	-	21	5	26	2,66	F	LC	R		
	PLATYSTEIRIDAE (1)											
60	*Platysteira cyanea* (Müller, 1776)	Brown-throated Wattle-eye	-	2	2	4	0,41	U	LC	R		
	MALACONOTIDAE (3)											
61	*Tchagra senegalus* (Linnaeus, 1766)	Black-crowned Tchagra	-	1	2	3	0,31	U	LC	R		
62	*Dryoscopus gambensis* (Lichtenstein, 1823)	Northern Puffback	-	-	-	1	0,1	Ra	LC	R		
63	*Laniarius aethiopicus* (Gmelin, 1788)	Tropical Boubou	2	-	-	2	0,2	Ra	LC	R		
	DICRURIDAE (3)											
64	*Dicrurus ludwigii* (Smith, 1834)	Square-tailed Drongo	-	3	-	3	0,31	U	LC	R		

65	*Dicrurus adsimilis* (Bechstein, 1794)	Fork-tailed Drongo	7	2	3	12	1,23	F	LC	R		
66	*Dicrurus modestus* (Hartlaub, 1849)	Velvet-mantled Drongo	2	3	11	16	1,64	C	LC	R		
	MONARCHIDAE (1)											
67	*Terpsiphone rufiventer* (Swainson, 1837)	Red- bellied Paradise-Flycather	3	-	3	6	0,61	F	LC	R	GC	
68	*Corvinella corvina* (Shaw, 1809)	Yellow-billed Shrike	-	4	3	7	0,72	U	LC	R	SG	
69	*Corvus albus* (Müller, 1776)	Pied Crow	-	2	-	2	0,2	U	LC	R		
70	*Ptilostomus afer* (Linnaeus, 1766)	Piapiac	-	2	1	3	0,31	U	LC	R	SG	
	MACROSPHENIDAE (2)											
71	*Sylvietta brachyura* (Lafresnaye, 1839	Northern Crombec	-	2	2	4	0,41	Ra	LC	R		
72	*Sylvietta virens* (Cassin, 1859)	Green Crombec	-	3	2	5	0,51	U	LC	R	GC	
	CISTICOLIDAE (6)											
73	*Camaroptera brachyura* (Vieillot, 1820)	Bleating Camaroptera	-	2	-	2	0,2	Ra	LC	R		
74	*Cisticola erythrops* (Hartlaub, 1857)	Red-faced Cisticola	-	1	2	3	0,31	U	LC	R		
75	*Cisticola cantans* (Heuglin, 1869)	Singing Cisticola	-	2	-	2	0,2	Ra	LC	R		
76	*Cisticola lateralis* (Fraser, 1843)	Whistling Cisticola	-	5	2	7	0,71	F	LC	R		
77	*Cisticola brachypterus* (Sharpe, 1870)	Short-winged Cisticola	-	1	-	1	0,1	Ra	LC	R		

78	*Prinia subflava* (Gmelin, 1789)	Tawny-flanked Prinia	-	1	1	2	0,2	Ra	LC	R		
	HIRUNDINIDAE (3)											
79	*Delichon urbicum* (Linnaeus, 1758)	Northern House Martin	-	2	3	5	0,51	U	LC	P		
80	*Cecropis senegalensis* (Linnaeus, 1766)	Mosque Swallow	-	3	-	3	0,31	U	LC	R		
81	*Hirundo smithii* (Leach, 1818)	Wire-tailed Swallow	-	-	5	5	0,51	U	LC	R		
	PYCNONOTIDAE (3)											
82	*Stelgidillas gracilirostris* (Strickland, 1844)	Slender-billed Greenbul	-	5	2	7	0,72	U	LC	R		
83	*Eurillas virens* (Cassin, 1858)	Little Greenbul	8	-	-	8	0,82	F	LC	R		
84	*Pycnonotus barbatus* (Desfontaine, 1789)	Common Bulbul	-	10	14	24	2,46	C	LC	R		
	LEIOTRICHIDAE (1)											
85	*Turdoides plebejus* (Cretzschmar, 1828)	Brown Babbler	10	-	3	13	1,33	C	LC	R		
	STURNIDAE (1)											
86	*Lamprotornis purpureus* (Müller, 1776)	Purple Starling	-	5	-	5	0,51	U	LC	R	SG	
	TURDIDAE (1)											
87	*Turdus pelios* (Bonaparte, 1850)	African Thrush	-	2	-	2	0,2	U	LC	R		
	MUSCICAPIDAE (1)											
88	*Saxicola rubetra* (Linnaeus, 1758)	Whinchat	-	1	2	3	0,31	U	LC	P		
	NECTARINIIDAE (6)											

89	*Hedydipna collaris* (Vieillot, 1819)	Collared Sunbird	-	-	1	1	0,1	Ra	LC	R		
90	*Cyanomitra verticalis* (Latham, 1790)	Green-headed Sunbird	-	2	-	2	0,2	Ra	LC	R		
91	*Cyanomitra olivacea* (Smith, 1840)	Olive Sunbird	-	1	1	2	0,2	U	LC	R		
92	*Cinnyris chloropygius* (Jardine, 1842)	Olive-billed Sunbird	-	2	2	4	0,41	F	LC	R		
93	*Cinnyris coccinigastrus* (Latham, 1801)	Splendid Sunbird	-		2	2	0,2	U	LC	R	SG	
94	*Cinnyris cupreus* (Shaw, 1811)	Copper Sunbird	-	2	3	5	0,51	Ra	LC	R		
95	*Quelea quelea* (Linnaeus, 1758)	Red-billed Quelea	-	6	19	25	2,56	F	LC	O		
96	*Ploceus cucullatus* (Müller, 1776)	Village Weaver	-	2	5	7	0,72	U	LC	R		
	ESTRILDIDAE (5)											
97	*Lagonosticta senegala* (Linnaeus, 1766)	Red-billed Firefinch	-	-	4	4	0,41	Ra	LC	R		
98	*Estrilda melpoda* (Vieillot, 1817)	Orange-cheeked Waxbill	-	-	39	39	4	U	LC	R		
99	*Nigrita canicapillus* (Strickland, 1841)	Grey-headed Nigrita	6	-	-	6	0,61	U	LC	R		
100	*Spermestes cucullatus* (Swainson, 1837)	Bronze Mannikin	-	10	18	28	2,87	U	LC	R		
101	*Spermestes bicolor* (Fraser, 1843)	Black-and-white Mannikin	-	2	2	4	0,41	U	LC	R		
	VIDUIDAE (1)											
102	*Vidua chalybeata* (Müller, 1776)	Village Indigobird	-	-	12	12	1,23	Ra	LC	R		

	PASSERIDAE (2)											
103	*Passer griseus* (Vieillot, 1817)	Northern Grey-headed Sparrow	-	2	3	5	0,51	Ra	LC	R		
104	*Gymnoris dentata* (Sundevall, 1850)	Sahel Bush-sparrow	-	9	5	14	1,43	U	LC	R	SG	
104						Total workforce 975						

Abundance characterization (Ac): C - Common: observed daily, alone or in significant numbers, F - Quite common: observed almost every day, U - Uncommon: irregularly observed and not every day, Ra- Rare: rarely observed, one or two observations of solitary individuals. **Conservation status (Cs)**: LC - Least Concern **Endemism:** AO - endemic to West Africa. **Biome:** GC - confined to the Guineo-Congolese forest, SG - confined to the Sudano-Guinean savanna. **Migratory status** (Ms): R – Resident, M - Intra-african migrant, P - Palearctic migrant O – Occasional species.

A: Common Bulbul *Pycnonotus barbatus*

B: Broad-billed Roller *Eurystomus glaucurus*

C: Striped Kingfisher *Halcyon chelicuti*

D: Common Kestrel *Falco tinnunculus*

E: White-crested Helmetshikre *Prionops plumatus*

F: Western Plantain-eater *Crinifer piscator*

Figure 3 Photographs of some bird species recorded in the study area

The site also hosts eight species of birds from the Sudano-Guinean (SG) savannah biome (Table I). The bird population in the project area is characterized by 38% rare species, 38% uncommon species, 13% fairly common species and 11% common species (Figure 4).

Based on the migratory status of the various species, it can be seen that 80% of the species recorded are totally resident (R). However, 7% of species are intra-African migrants (M) and 6% are Palearctic migrants (P). Mixed-status species (R/M; R/P) account for 6%, compared with 1% for occasional species (O) (Figure 5).

3.2 Species composition and diversity index by habitat

3.2.1 Species composition and diversity index in forests

In forests, 23 species were observed, with a total of 99 individuals (Figure 6). The Shannon diversity index (H') was 2.91, with a fairness index (J) of 0.93 (Figure 7). These habitats are home to large populations of Brown Babbler *Turdoides plebejus* and Collared Dove *Streptopelia semitorquata* (Table I).

3.2.2 Specific composition and diversity index of savannahs

In the savannahs, 76 bird species were inventoried, with a total of 488 individuals (Figure 6). The Shannon diversity index (H') is 3.62, with a fairness index (J) of 0.84 (Figure 7). The dominant species in these habitats are the White-throated Bee-eater *Merops albicollis*, the Cattle Egret *Bubulcus ibis* and the Blue-bellied Roller *Coracias cyanogaster* (Table I).

3.2.3 Specific composition and diversity index of plantations and fallows

In these habitats, 71 bird species with a total of 388 individuals were observed (Figure 6). The Shannon diversity index (H') was 3.75, with a fairness index (J) of 0.88 (Figure 7). These habitats contain high populations of Orange-cheeked *Astrilda melpoda*; Black-billed Hornbill *Lophoceros nasutus*; White-throated Bee-eater *Merops albicollis* and Cattle Egret *Bubulcus ibis* (Table I).

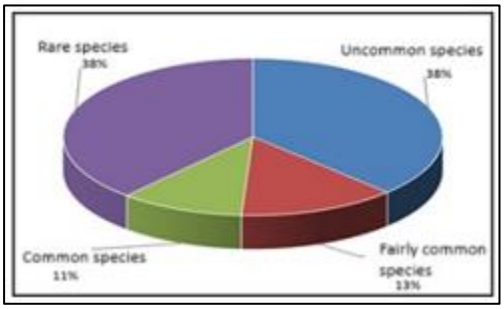

Figure 4 Characteristic of the abundance of the avifauna population

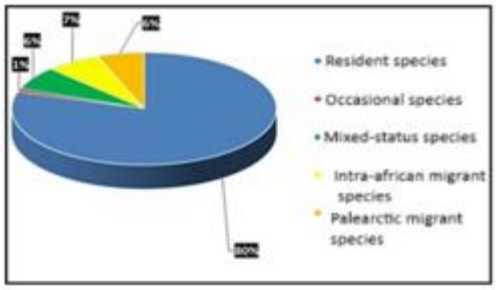

Figure 5 Migratory status of species

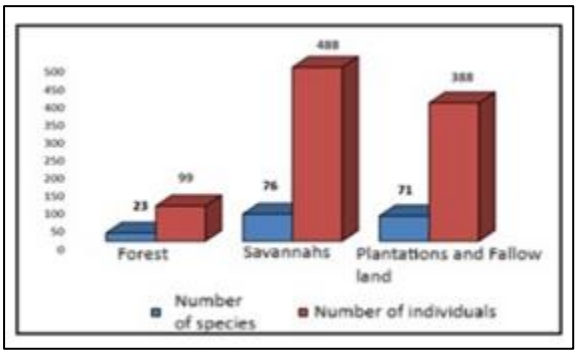

Figure 6 Distribution of bird populations by habitat types surveyed

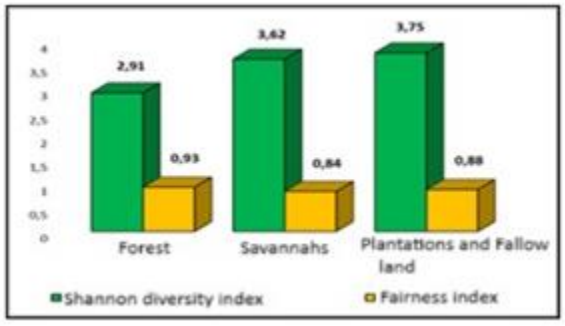

Figure 7 Diversity indices of bird populations in different habitats

4. Discussion

In the study area, 104 bird species were recorded, representing 13.32% of the 781 bird species recorded in Côte d'Ivoire [16]. This species richness is relatively high in view of the numerous anthropogenic activities such as agriculture and mining, which degrade bird habitats and have a considerable impact on their survival [17].

In addition, some bird species are poached by local populations for local consumption [18]. These various threats could explain the absence of certain bird species whose range covers the study area. The high values of the avifaunal diversity index (3.99) and the equitability index (0.86) in the surveyed site suggest that this area offers habitat variability and a good distribution of species. These results could undoubtedly be explained by the availability of sufficient food resources in the study site. Indeed, [19] have indicated that the distribution of bird species in an environment is linked to the satisfaction of their ecological niches in terms of habitat variability and the availability of food resources. In terms of vulnerability, no endangered species on the IUCN Red List have been observed on the site. This can be explained by the advanced degradation of habitats in the study area. It is well known that most of these endangered species require specific habitats with low levels of human disturbance. However, the project area is heavily disturbed by human activities such as extensive and intensive agriculture, land clearing, over-cutting of firewood, pollution by agricultural inputs, over-grazing, etc. These various threats could explain the disappearance or deterioration of these habitats. These various threats could explain the disappearance or departure of certain bird species whose known range in Côte d'Ivoire largely covers the project area.

However, the area deserves special attention in view of the species it contains. Most of the species recorded are sedentary. This sedentary nature is linked to the availability of sufficient trophic resources for their survival and to ideal ecological conditions [20]. Migratory birds present in the area generally prefer wetlands. They are not really attached to these types of habitats in the area, as they only use them for a short period of the year [21].

5. Conclusion

The study site is home to a relatively rich and diverse avifauna. In view of the undeniable role played by birds in regenerating forest ecosystems and maintaining ecological balance, this avifaunal data is necessary and deserves particular attention from the project managers. These data provide a reliable basis on which to base the site management plan, so that appropriate decisions can be taken for the sustainable and rational management of the area's biodiversity. Indeed, mining will have a considerable impact on the composition of the area's avifauna, which will recover slowly over the long term, even after mining ceases. It is important that the promoters of this project take into account appropriate mitigation measures to minimize the environmental impact of the project. This will help to reconcile mining with environmental protection.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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