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Content list available at: www.benthamopen.com/TOOENIJ/

DOI: 10.2174/1874453201710010031

RESEARCH ARTICLE

Bird Survey of the Abobo-Etetak Hill (Yaounde, Cameroon) and a Glance on the Avifaunistic Diversity of this Hill (Abobo-Etetak)

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Received: October 25, 2016 Revised: December 29, 2016 Accepted: January 09, 2017

Abstract:

Introduction:

We conducted a preliminary bird survey in the Abobo-Etetak hill (Yaounde, Cameroon).

Methods:

To carry out this survey, we used the mist-netting method and we captured birds over a period of six months. To study the distribution of this avifauna in their life environment, we performed several analyses to obtain various diversity indexes such as implemented in softwares SAS/STAT and PAST.

Results:

Three hundred and eleven individuals were captured belonging to 21 passerine and non-passerine families distributed into 39 genera and 51 species. We recorded new species for the area: *Anthus brachyurus*, *Cinnyris reichenowi*, *Euplectes gierowii*, *Hirundo fuligula*, *Nicator vireo*, *Pogoniulus atroflavus* and *Pogoniulus subsulphureus,* and *Terpsiphone rufocinerea*. Species documented were from the families Lybiidae, Motacillidae, Nectariniidae, Hirundinidae, Nicatoridae, Ploceidae and Monarchidae. Species from two new genera were recorded, *Cinnyris* (Sunbirds) and *Terpsiphone* (Monarchs). Estimated diversity index values show that the Abobo-Etetak hill exhibits high avifaunistic diversity.

Conclusion:

Our results found an absence of the supremacy of one species (*H'*=3.34) and the value of the Equitability index (*J'*=0.85) suggests an equal distribution of the individuals across species. With the obtained value of the index of Simpson diversity of 0.95, our result suggests high diversity within the Abobo-Etetak avifauna, which could be explained by luxuriant vegetation that is present all year round. Human activities have had an impact on the diversity of this avifauna with the presence of some genera sampled (*Ploceus*, *Passer*, *Estrilda*, *Pycnonotus* and *Spermophaga*) but the relic Centre Region of Cameroon which preserves its originality offers on the whole favourable conditions to birds.

Keywords: Bird survey, Abobo-Etetak hill, Mist-netting method, SAS/STAT software, PAST software, Passerine, Non-passerine, Shannon index, Simpson index, Equitability index.

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INTRODUCTION

Cameroon is a country in West Africa in the great Congo Basin. It covers an area of approximately 475 440 sq. km with a latitudinal widespread of the Equatorial forest in the South to Sahelian areas of the Lake Chad in the Extreme North which shows several major habitats for birds.

However, in its diversity, Cameroon is subdivided into several vegetation regions from the coast to the Lake Chad the Mangrove and the Beach, the Equatorial forest, the Forest-savanna mosaic, the Adamawa Plateau, the Benue Plain, Mandara mountains, Sahel, Inundation area and the Montane district which often represent food areas for many birds.

Due to this diversity which provides habitats for different wildlife, Cameroon abounds in more than ten National Parks (for instance Korup National Park, Lobeke National Park, *etc.*) and eight nature reserve (for instance Dja faunal Reserve, Lake Ossa Reserve, *etc.*) which serve to protect and conserve the wealth of the Nature in the second world reserve of the biodiversity. These reserves and parks are distributed in the ten administrative regions among them the Centre Region in which is located the Yaounde city with its remarkable Zoo of Mvog-Betsi. The Yaounde city is established on a network of several mounts and shows a particularity with a mix of vegetation between the Equatorial forest and the Montane district in low altitude [1]. Thus, the general wildlife of the Yaounde city arouses a great attention as well as a large scientific interest since several years [2].

From then onwards, first surveys signalling this Region date back to the beginning of the twentieth century with [3 - 5] and recently [1, 6, 7]. These studies performed in the Centre Region of Cameroon permitted to identify several passerines families including Pittidae, Motacillidae, Timaliidae, Pycnonotidae, Muscicapidae, Hirundinidae, Campephagidae, Dicruridae, Laniidae, Corvidae, Sturnidae, Picathartidae, Nectariniidae, Fringillidae, Emberizidae, Ploceidae, *etc.* as well as several non-passerine families including Alcedinidae, Columbidae, Cuculidae, Meropidae, Coliidae, *etc* [2, 6 - 10]. Some studies had thus permitted to describe several new specimens from the Yaounde city in its mountains always well conserved even with the urbanization [3 - 5]. We only noted that these studies did not focus on diverse districts of the Yaounde city among which the Abobo-Etetak hill is included.

The Abobo-Etetak hill, in which we did our survey, is a hillside of the Mount Messa which is lengthened on diverse districts of the Yaounde city. The Abobo-Etetak hill is situated in a part of the Oyomabang district. It is limited in North by Carriere district, in West by Afeme Nord district, in East by Abobo district and South by Oyomabang district. Geographically, the Abobo-Etetak hill is situated in the Southeastern Plateau in the forest belt. As the rest of the Centre Region, the climate is characterized by elevated average monthly temperatures as well as a high level of the precipitations during the year [11, 12]. Located in the Equatorial forest, the Abobo-Etetak hill shows different kinds of vegetation as sub-mountane forest, secondary forest intermixed with scrub land and riverine vegetation [11]. Otherwise, human activities have also degraded this area.

More generally until now, avifaunistic studies performed in the Yaounde city did not particularly investigate the avifaunistic diversity of the sites in which birds have been caught and yet, there is a correlation between the food areas and the presence or absence of birds [13]. Thus, expressed through a diversity index, a quantitative measure could reflect for instance how many different taxa (families, genera, species, *etc.*) are in a dataset, and simultaneously takes into account how evenly the basic entities (individuals) are distributed among those taxa [14, 15].

In this study, which was realized in the Abobo-Etetak hill during eight months, we mainly followed two aims: firstly, we thoroughly investigated the avifauna of this hill from base to tip and secondly, we tried to understand the distribution of this avifauna in their life environment.

METHODS

Investigation of the Abobo-Etetak Avifauna

In order to investigate the avifauna, we used an appropriate method: the mist-netting method. According to this method, an inconspicuous mesh net is erected vertically on poles and deployed in areas of high activity to intercept birds as they go about their normal daily routines (Fig. **1**).

We used dark-coloured nylon nets and smaller mesh for smaller species. Our mist nets were fixed with the mounting poles which were chosen carefully and the choice of an appropriate mist-netting site was important for the capture success (Fig. **1**). To ensure the capture success, we mainly identified their preferred flight paths, feeding areas, roosting and shaded sites and that along the hill from the base to tip.

We began our capture very early in the morning (5: 00 AM) and we finished very late in the evening (sometimes 6: 30 PM). We used the same eight mist nets in our different field study and we did nine field studies during eight months.

Fig. (1). Basic set-up of a mist net placed on a side of the Abobo-Etetak hill.

Method for the Calculation of the Relative Abundance of the Abobo-Etetak Avifauna

In order to calculate the relative Abundance, we considered to use the Statistical Analysis System [16]. Otherwise, we used a software program Excel to obtain our histograms and curves [17].

Method for the Calculation of the Occurrence of the Abobo-Etetak Avifauna

In order to calculate the occurrence, we used the same software, the Statistical Analysis System [16]. The obtained results are frequencies as well as graphics.

Method for the Measure of the Distribution of the Abobo-Etetak Avifauna in Keeping with their Environment

Shannon Index (H')

The Shannon's diversity index represents the measure of the sum of degree of the uncertainty when it suggests predicting to which species would belong to an individual taken by chance in a collection of S species and N individuals. *H'* = 0 if the community has only one species; *H'* takes the maximal value $\log_2 S$ only when all species are represented by the same number of individuals. This index is determined by the relationship:

$$H' = -\sum_{i=1}^{S}(p_i \times \log_2 p_i) \qquad \text{Avec} \quad p_i = n_i/n$$

Where *p*i = proportion of the individuals of the species "i"; S = total number of species of environment.

The Shannon index (*H'*) increases when the number of the species of the community grows and, theoretically, it can reach elevated values. The value of *H'* varies from 1 to $\log_2 S$. In our study, the Shannon index was calculated with the Software PAST [18].

Simpson Index (λ)

The Simpson index represents the proportion of abundance of the species "i" [18]. This index measures the degree of concentration when individuals are classified into types. It is determined by the relationship:

$$\lambda = \sum_{i=1}^{S} \frac{n_i(n_i - 1)}{n(n-1)}$$

Where *n*i = number of individuals of the species "i"; *n* = total number of the individuals of the sample.

Nevertheless, the most popular of such indexes have been the inverse Simpson index (1/λ) and the Gini-Simpson index (1 – λ) and both have also been called the Simpson index in the ecological literature. In our study, the Simpson index was calculated with the Software PAST [18].

Equitability Index

The Equitability index measures the distribution of the individuals within species independently to the specific richness. Its value varies from 0 (supremacy of one species) to 1 (equal distribution of the individuals in species).

Thus, the Equitability index of Pielou (*J'*) is determinated by the formula:

$J' = H'/H' max$

H' = Shannon index

$H' max = \log_2 S$ (S = the total number of the species).

In our study, the Equitability index was calculated with the Software PAST [18].

All these indexes have been obtained with a confidence threshold of 95%.

RESULTS

Abundance and Occurrence of the Abobo-Etetak Avifauna

Familial Abundance of the Abobo-Etetak Avifauna

We caught 311 individuals belonging to 21 birds' families (Table **1**). The most representative family is the Ploceidae family with 119 of the 311 individuals (38.26%) with the Pycnonotidae family being second most abundant (14.79%; Table **4** and Fig. (**2**)). We found that 84.55% of the captures were from Passerine families and 15.45% from Non-Passerine families (Table **1**). The Ploceidae family was represented by four genera and eight species whereas the Pycnonotidae family was represented in the Abobo-Etetak avifauna by four genera and six species.

Table 1. Avifaunal abundance of the families on the Abobo-Etetak hill.

Familles	Abondance absolue	Abondance relative
Alcedinidae	6	1.93
Lybidae	9	2.89
Coliidae	20	6.43
Columbidae	5	1.61
Cuculidae	2	0.64
Estrildidae	21	6.75
Fringillidae	10	3.22
Hirundinidae	4	1.29
Malaconotidae	6	1.93
Meropidae	3	0.96
Monarchidae	3	0.96
Motacillidae	1	0.32
Nectariniidae	22	7.07
Nicatoridae	1	0.32
Passeridae	3	0.96
Picidae	2	0.64
Platysteiridae	9	2.89
Ploceidae	119	38.26
Pycnonotidae	46	14.79
Sylviidae	8	2.57
Turdidae	11	3.54
Total	311	100

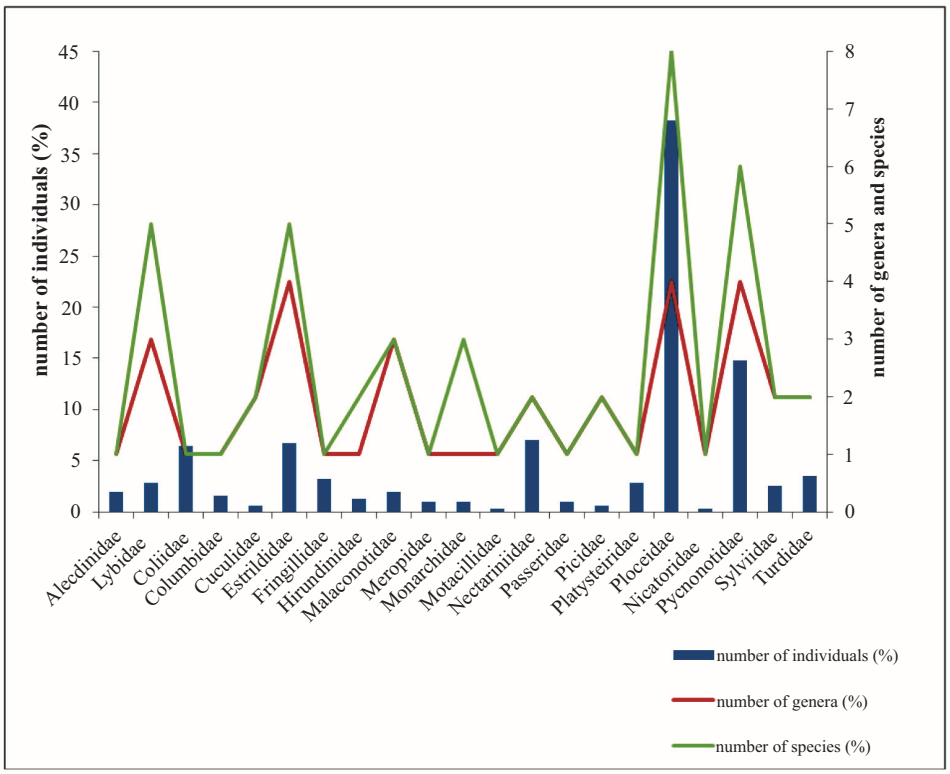

Fig. (2). Histogram of the relative abundances of the families captured in the Abobo-Etetak hill and species and genera number curves.

Generic Abundance and Occurrence of the Abobo-Etetak Avifauna

311 individuals were captured which belong to 39 genera (Table **2**). Within the Abobo-Etetak avifauna, the representative genera are *Ploceus* (16.72%), *Euplectes* (10.29%) and *Quelea* (9.32%) which are members of the Ploceidae family (Table **2** and Fig. (**3**)). These genera are followed by *Cyanomitra* (6.43%) (Nectariniidae family), *Colius* (6.43%) (Coliidae family) and *Eurillas* (4.82%) (Pycnonotidae family) (Table **2** and Fig. (**3**)). The less represented genera (relative abundance < 0.50%) are mainly the non-passerine members (*Centropus*, *Chrysococcyx*, *Campethera*, *Sasia*) (Table **2**).

Table 2. Avifaunal abundance of the genera on the Abobo-Etetak hill.

Familles	Genres	Abondance absolue	Abondance relative (%)
Alcedinidae	*Ceyx*	6	1.93
Coliidae	*Colius*	20	6.43
Columbidae	*Turtur*	5	1.61
Cuculidae	*Centropus*	1	0.32
	Chrysococcyx	1	0.32
Estrildidae	*Estrilda*	5	1.61
	Lonchura	8	2.57
	Nigrita	2	0.64
	Spermophaga	6	1.93
Fringillidae	*Ochrospiza*	10	3.22
Hirundinidae	*Hirundo*	4	1.29
Lybidae	*Gymnobucco*	3	0.96
	Lybius	2	0.64
	Pogoniulus	4	1.29
Malaconotidae	*Dryoscopus*	3	0.96
	Laniarius	1	0.32
	Tchagra	2	0.64

(Table 2) contd.....

Familles	Genres	Abondance absolue	Abondance relative (%)
Meropidae	*Merops*	3	0.96
Monarchidae	*Terpsiphone*	3	0.96
Motacillidae	*Anthus*	1	0.32
Nectariniidae	*Cinnyris*	2	0.64
	Cyanomitra	20	6.43
Nicatoridae	*Nicator*	1	0.32
Passeridae	*Passer*	3	0.96
Picidae	*Campethera*	1	0.32
	Sasia	1	0.32
Platysteiridae	*Platysteira*	9	2.89
Ploceidae	*Amblyospiza*	6	1.93
	Euplectes	32	10.29
	Ploceus	52	16.72
	Quelea	29	9.32
Pycnonotidae	*Atimastillas*	9	2.89
	Chlorocichla	11	3.54
	Eurillas	15	4.82
	Pycnonotus	11	3.54
Sylviidae	*Camaroptera*	4	1.29
	Cisticola	4	1.29
Turdidae	*Cossypha*	6	1.93
	Turdus	5	1.61
	Total	311	100

The majority of the genera (52.63%) captured on the Abobo-Etetak hill were rare (25% > FO ≥ 10%) (Table **3**). However within the most representative family, the Ploceidae family, the genus *Ploceus* appeared very frequent on the Abobo-Etetak hill with a frequency of occurrence of 100% (Table **3**). According to our results, except the genus *Ploceus*, two other genera have been frequent on the Abobo-Etetak hill, *Cyanomitra* (FO = 100%) and *Colius* (FO = 88.89) (Table **3**).

Table 3. Frequency of occurrence of the diverse birds' genera captured on the Abobo-Etetak hill from July 2015 to February 2016.

Genera	Frequency of occurrence (%)
Amblyospiza	22.22
Anthus	11.11
Atimastillas	55.56
Camaroptera	22.22
Campethera	11.11
Centropus	11.11
Ceyx	55.56
Chlorocichla	44.44
Chrysococcyx	11.11
Cinnyris	11.11
Cisticola	22.22
Colius	88.89
Cossypha	55.56
Cyanomitra	100.00
Dryoscopus	33.33
Eurillas	44.44
Estrilda	44.44
Euplectes	44.44
Gymnobucco	11.11
Hirundo	33.33
Laniarius	11.11

(Table 3) contd.....

Genera	Frequency of occurrence (%)
Lonchura	22.22
Lybius	11.11
Merops	22.22
Nicator	11.11
Nigrita	22.22
Passer	33.33
Platysteira	44.44
Ploceus	100.00
Pogoniulus	33.33
Pycnonotus	55.56
Quelea	33.33
Sasia	11.11
Ochrospiza	33.33
Spermophaga	22.22
Tchagra	11.11
Terpsiphone	22.22
Turdus	33.33
Turtur	22.22

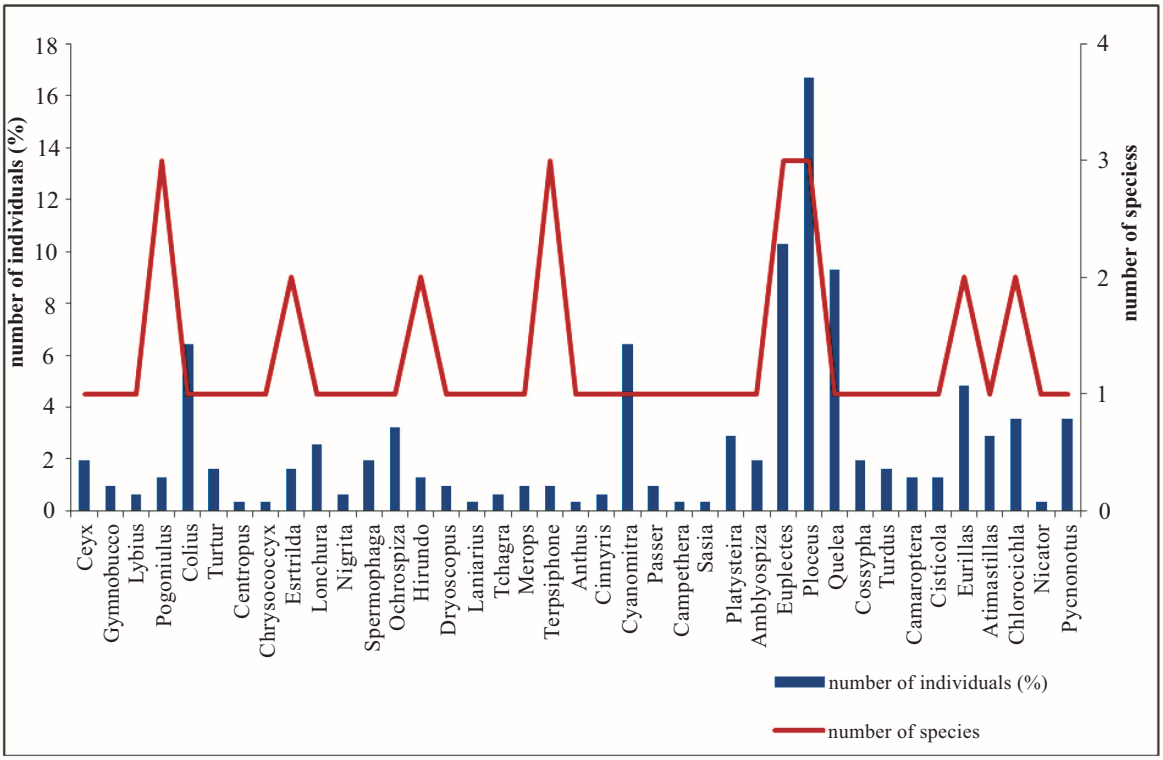

Fig. (3). Histogram of the relative abundances of the genera captured in the Abobo-Etetak hill and species number curve.

Specific Occurrence of the Abobo-Etetak Avifauna

According to our occurrence results, only 5.88% of the birds captured are relatively common on the Abobo-Etetak hill, including the passerine members *Cyanomitra verticalis* (FO = 100%) and *Ploceus nigricollis* (FO = 88.88%), and the non-passerine member *Colius striatus* (FO = 88.88%) (Table **4**). Species (21.57%) less commonly encountered included *Platysteira cyanea* (FO = 44.44%), *Eurillas virens* (FO = 44.44%), *Eurillas latirostris* (FO = 33.33%), *Chlorocichla falkensteini* (FO = 44.44%), *Dryoscopus senegalensis* (FO = 33.33%), *Estrilda nonnula* (FO = 33.33%), *Euplectes ardens* (FO = 33.33%), *Ochrospiza mozambica* (FO = 33.33%), *Passer griseus* (FO = 33.33%), *Quelea erythrops* (FO = 33.33%) and *Turdus pelios* (FO = 33.33%) (Table **4**). In return, our analyses show clearly that the

major part of the species (62.74%) sampled on the Abobo-Etetak hill were rare (25% > FO ≥ 10%) (Table **4**).

Table 4. Frequency of occurrence of the different birds' species captured on the Abobo-Etetak hill.

Species	Frequency of occurrence (%)
Amblyospiza albifrons	11,11
Anthus brachyurus	11,11
Atimastillas flavicollis	55,55
Camaroptera brachyura	22,22
Campethera cailliautii	11,11
Centropus monachus	11,11
Ceyx pictus	55,55
Chlorocichla falkensteini	44,44
Chlorocichla simplex	22,22
Chrysococcyx caprius	11,11
Cinnyris reichenowi	11,11
Cisticola erythrops	22,22
Colius striatus	88,88
Cossypha niveicapilla	55,55
Cyanomitra verticalis	100
Dryoscopus senegalensis	33,33
Estrilda melpoda	11,11
Estrilda nonnula	33,33
Eurillas latirostris	33,33
Eurillas virens	44,44
Euplectes afer	11,11
Euplectes ardens	33,33
Euplectes gierowii	11,11
Gymnobucco bonapartei	11,11
Hirundo fuliginosa	11,11
Hirundo fuligula	22,22
Laniarius luhderi	11,11
Lonchura bicolor	22,22
Lybius bidentatus	11,11
Merops pusillus	22,22
Nicator vireo	11,11
Nigrita canicapilla	22,22
Ochrospiza mozambica	33,33
Passer griseus	33,33
Platysteira cyanea	44,44
Ploceus cucullatus	55,55
Ploceus nigerrimus	11,11
Ploceus nigricollis	88,88
Pogoniulus atroflavus	11,11
Pogoniulus bilineatus	11,11
Pogoniulus subsulphureus	11,11
Pycnonotus barbatus	55,55
Quelea erythrops	33,33
Sasia africana	22,22
Spermophaga haematina	22,22
Tchagra australis	11,11
Terpsiphone rufocinerea	11,11
Terpsiphone sp1	11,11
Terpsiphone sp2	11,11
Turdus pelios	33,33

(Table 4) contd.....

Species	Frequency of occurrence (%)
Turtur afer	22,22

Diversity Index

The Shannon index was 2.24 at the familial level, 3.11 at the generic level and 3.34 at the specific level (Table **5**).

The Simpson index values were of 0.81 at the familial level, of 0.93 at the generic level and of 0.95 at the specific level (Table **5**). As for the Shannon index, the general tendency is the same as the Simpson index with the obtained values which are also high (Table **5**).

The equitability index values were 0.73 at the familial level, 0.85 at the generic level and 0.85 at the specific level (Table **5**). As for the two first indexes, the obtained values also appear far from 0 (Table **5**).

Table 5. Values of the different indexes of diversity obtained with the software PAST.

Diversity Index	Families	Genera	Species
Specific richness (**S**)	21	39	51
Individuals	311	311	311
Shannon index (H')	2,24	3,11	3,34
Simpson index (**1-D**)	0,81	0,93	0,95
Equitabilityy index (J)	0,73	0,85	0,85

DISCUSSION

Avifauna of the Abobo-Etetak Hill

The survey accomplished on the Abobo-Etetak hill permits to highlight that Passerines birds were the most representative birds in this area with regard to Non-Passerines birds. Our study moves toward several surveys performed in Cameroon [1, 6, 7].

We found that 84,55% of birds captured were passerines and 15,45% of birds were non-passerines (Tables **1** and Fig. (**2**)). Among these non-passerines, some families (Lybiidae, Meropidae, Alcedinidae, Columbidae, Cuculidae, Coliidae and Picidae) have been indicated in the relic Centre Region of Cameroon (Yaounde) but other passerine families (Pycnonotidae, Cisticolidae, Nectariniidae, Estrildidae, Ploceidae, Platysteiridae, Turdidae, Hirundinidae, Malaconotidae and Passeridae) have been already found in this Region [1, 6, 7].

Thus, this study permits to highlight new families in the relic Centre Region of Cameroon and particularly in the Abobo-Etetak hill. Comparatively to previous records, we newly recorded species representatives of the non-passerines families (Lybiidae) as well as the passerines families (Motacillidae, Nectariniidae, Hirundinidae, Nicatoridae, Ploceidae and Monarchidae) in this area (Table **1**). Within the Abobo-Etetak avifauna, the most representative family is the Ploceidae family (Table **1** and Fig. **2**). The Ploceidae family commonly called 'weavers' gets this name because of their meticulously woven nests; these small passerine birds are gregarious, breed colonially and occur in several habitats (woodland, forests, forest edge, lowland forests, wet habitats, gardens, open or semi-open habitats, human habitation, grassland, *etc.*) [19, 20]. Contrary to several other passerine families, their closest relatives still remain unknown and a future study in keeping with their phylogeny is long-awaited.

We found two new genera until now not encountered in this relic Centre Region, *Cinnyris* (the Nectariniidae family) and *Terpsiphone* (the Monarchidae family) (Table **2**). Except for these genera, most genera we found have been already recorded in this Region [1, 6, 7]. Among the genera met in this relic area, the genera *Ploceus* and *Cyanomitra* have obtained an occurrence frequency of 100% (Table **2**). The genus *Ploceus* is a representative of the Ploceidae family (see above) and the genus *Cyanomitra* is a member of the Nectariniidae family; African sunbirds are very small passerine birds which feed on nectar but in their youth feed on insects [19, 21, 22].

Concerning species representatives, our survey brings several new elements compared with the general avifauna known of this relic Centre Region (Table **4**). Thus, seven of the 21 families listed show new representatives at the species' level (Tables **1** and **4**). Before our survey, these species were not mentioned in this relic Region: *Anthus brachyurus* (Motacillidae), *Cinnyris reichenowi* (Nectariniidae), *Euplectes gierowii* (Ploceidae), *Hirundo fuligala* (Hirundinidae), *Nicator vireo* (Nicatoridae), *Pogoniulus atroflavus* and *Pogoniulus subsulphureus* (Lybiidae) and *Terpsiphone rufocinerea* (Monarchidae) (Table **4**). Otherwise, two species (*Chlorocichla simplex* and *Campethera cailliautii*) had been mentioned only in a district of Yaounde (Nsimalen) [7].

Among species collected in this area, we noted a lot of sedentary birds which are rarely dispersed more than a few kilometres from their natal sites (*Eurillas latirostris*, *Camaroptera brachyura*, *Turdus pelios*, *etc.*), seasonal birds which appear only seasonally in another part (*Anthus brachyurus* and *Chrysococcyx caprius*), intra-African migrant birds which breed in one part of Africa and spend the post-breeding season in a different area (*Ceyx pictus*) and vagrant birds which are outside their normal range (*Hirundo fuligula*) (Table **4**). Among the captured species, we highlighted two species of the Monarchidae family, the genus *Terpsiphone*, which are not found in the Guide [21] and they are probably new species; for this, we will do a molecular study in the future to clarify their situation.

Distribution and Diversity of the Avifauna in the Abobo-Etetak Hill Area

The Abobo-Etetak hill shows high avifaunistic diversity (see Table **5**), with an absence of the supremacy of one species (*H'* = 3.34; Table **5**). According to some authors [2, 23], the montane vegetation grows on hills near Yaounde (at elevations of only 800-900 metres) and these semi-montane biomes offer the same feeding favourable conditions for all birds visiting or living in this relic area. Otherwise, it is documented that the distribution of many tropical bird species is closely related to a particular vegetation type [1] and more generally a correlation between food areas and birds is well established [13]. The Abobo-Etetak hill appears with the same vegetation from base to tip (secondary forest with in some places farmland). The distribution of the Abobo-Etetak avifauna corroborates practically this principle with the obtained value of the Equitability index (*J'*= 0.85; Table **5**) which establishes the equal distribution of the individuals inside species.

The Simpson diversity index of 0.95 (1 – D = 0.95; Table **5**) shows that the diversity within the Abobo-Etetak avifauna is established and this result goes in the same direction that the absence of the supremacy of one species as well as the equal distribution of the individuals of the species. Thus, all obtained values show that the Abobo-Etetak avifauna appears diversified; the diversity of this avifauna could be explained by luxuriant vegetation in this relic area all year round and this would have been favoured by a lesser competition between the individuals living in this hill. Otherwise the transformation of this area by human activities (particularly farmland) would have had an impact on the diversity of this avifauna with some genera captured in this hill (*Ploceus*, *Passer*, *Estrilda*, *Pycnonotus* and *Spermophaga*).

Scientific Interest of the Abobo-Etetak Hill Area

Contrary to several African regions, this relic Centre Region shows the Montane district at very low altitude (an altitude of less of 800 to 900 metres) whereas generally it begins in other African regions at an altitude of 1600 to 1800 metres [1, 2, 24 - 26]. Thus, several new and endemic species have been described [3 - 5] in this relic Region and certainly the two new taxa not found in the Guide [21] could be new species. Otherwise in spite of the urbanization as well as climatic changes, this Region preserves its originality in keeping with the fresh climate in an Equatorial area thus offering favourable conditions to birds all year around and receiving many European migrants' birds during the winter.

LIST OF ABBREVIATIONS

N	=	North
E	=	East
SAS/STAT	=	Statistical Analysis System
PAST	=	Paleontological Statistics
%	=	Percentage
FO	=	Frequency of occurrence

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

ACKNOWLEDGEMENTS

We thank the chief of the Abobo-Etetak village, his majesty ENYEGUE, who permitted us to carry out this study. We wish to thank the guide, Sir Yannick, for all his efforts and his good knowledge of site which facilitated birds capture. We thank the zoology laboratory of the University of Yaounde I, especially the ornithology team for the technical material which has been used for the realization of this scientific work. We also wish to thank all persons,

especially Sir OJONG Gaines who read this paper in order to ameliorate its quality through their scientific critics. Finally, authors are grateful to all the researchers who participated by near or by far to the accomplishment of this work. We also thank two anonymous reviewers for their comments that greatly improved the manuscript.

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