Scom**SciencePG**
Science Publishing Group

Avifauna Diversity in Kafa Biosphere Reserve: Knowledge and Perception of Villagers in Southwest Ethiopia

Weldemariam Tesfahunegny[1, *], Tesfu Fekensa[1], Getachew Mulualem[2]

[1]Ethiopian Biodiversity Institute, Animal Biodiversity Directorate, Addis Ababa, Ethiopia

[2]Mekelle Biodiversity Centre, Animal Biodiversity, Wildlife Studies, Tigray, Ethiopia

Email address:

weldea2012@ibc.gov.et (W. Tesfahunegny)

[*]Corresponding author

Abstract: This study was carried out from 2013 to 2014 in Kafa biosphere reserve, southwest Ethiopia. We investigated and documented population status of bird diversity and the existing local community knowledge, attitude and practice associated with ecological significance to conservation of avian diversity. Point observation method was used to collect data on distribution and diversity of birds. Data were analyzed using descriptive Statistics, Chi-square test and one-way ANOVA. Questionnaire surveys were also made to collect qualitative data. A total of 474 birds fit in to 10 orders and 25 families were recorded. There were 398 residents, 56 winter migratory, 15 local migratory and 5 summer migratory birds. Shannon-winner indices of bird diversity for Kafa biosphere reserve, Decha, Chena, Dadiben, Gojeb wetland and Boka were 2.41, 2.71, 2.48, 2.24 and 1.68, while its evenness indices showed that 0.85, 0.94, 0.92, 0.90 and 0.86 respectively. We concluded that species richness, abundance and diversity reach higher values in larger and structurally more heterogeneous forest. Nine (31%) of the locals perceived that, avian conservation has ecological significance, while 20 (68%) were responded, is not essential, being depredators of chickens and crop pests. conservation of birds and its habitat should be integrated with the knowledge and practice of locals to establish participatory avian conservation.

Keywords: Kafa, Anthropogenic Pressure, Perception, Biosphere Reserve, Population Status

1. Introduction

Ethiopia encompasses a broad range of ecosystems with great varieties of habitats that contribute to the occurrence of high faunal diversity. Currently, there are about 926 bird species listed for the country [13], of which 24 are endemic and 19 are globally threatened [12].

The variety of species and great proportion of hot spots, endemic within the groups, particularly in the highlands, is the result of the isolation of Ethiopia's highland areas from other highlands within and outside the country by the surrounding lowlands [27]. To conserve avian genetic resources sustainably, Ethiopia has established about 73 Important Bird Areas (IBAs), 30 of these sites comprise wetlands, while the rest are representatives of other ecosystems [23]. With its dramatic geological history and broad latitudinal and altitudinal ranges.

Ethiopia covers an extraordinary number of the world's broad ecological zones. With a high plateau and a central mountain range divided by Great Rift Valley, the country contains a huge altitudinal range from the depressions in the Afar (115 m.a.s.l) to the mountain tops of Ras Dashen in the north (4,533 m.a.s.l) and the Bale Mountains in the southeast. This range of habitats also supports a rich variety of species, which contributes to the overall biological diversity of the country [27]. These forests can provide connectivity [10], dietary resources, nesting opportunities, and microclimatic refuges [20] too many species in and around the biosphere reserve, and mediate the effects of forest fragmentation.

Avian communities have been found to function as indicators of overall healthy biodiversity and environmental decline or recovery [19, 5]. Presentation of the distribution of birds through graphical methods is a powerful tool to show how these sites are associated with species diversity. Any

natural or anthropogenic disturbance altering the natural forest and distribution of animal communities may seriously affect regional as well as global biodiversity. Among the various causes of species endangerment are agricultural practice, pollution, overgrazing, deforestation and disturbance of breeding habitat [14, 1].

Climate change has been also linked to well-documented changes in physiology, phenology, species distributions, and in some cases, extinction [4, 28]. The biosphere reserve and ornithology of Ethiopia is still in its infancy, because of limited researches but not for lack of qualified environments that support avifauna and serve as biosphere reserve. Currently, 669 Biosphere reserves are registered in 120 countries, including 16 transboundary sites all over the world [26]. 70 of these are located in 28 Africa countries. Sub-Saharan Africa is a home for 64 biosphere reserves in 28 countries [18]. Of which 4 are found in Ethiopia namely, (Kafa, Sheka, Yayu and Lake Tana) that have been successfully included in 2010 and 2014 global Biosphere reserves list. According to Ethiopian wildlife and natural history society [9], investigations on bird fauna in Ethiopia are negligible compared to other neighboring African countries like Kenya, Uganda, and Tanzania. Diversity of birds is assumed to be different across varied ecological zones of the biosphere reserve. Thus, the study was comparing avian diversity along different sites of the reserve. Decha is a site characterized by very steep area, buffering of river inflow with ecological significance of supporting fresh water. The current land use is composed of scattered trees, along stream intense grazing. Furthermore, it is an important site for riparian forest enhancement [7]. Chena is recent forest perforation within core zone, used for cultivation and grazing, rolling topography. The land use is dominated by cultivation 30% (probably maize), remnants of primary forest 40%, shrub/grass land 30%. Moreover, is a site of importance for Rehabilitation of degraded forests [7].

Gojeb wetland is spatially the most dominant wetland of the several smaller ones. The land use is characterized by steep slopes, forested and dominated by agriculture. Moreover, it is regarded as an ephemeral wetland depending on seasonal and occasional inundations of the Gojeb River crossing the wetland from west to east, dividing the wetland in to a northern and southern part [8]. Boka forest is found within Kafa Biosphere Reserve along riverside vegetation composed of shrubs trees none of which are higher than 5m. As well, Dadiben forest is found in the core areas of Kafa Biosphere Reserve [15].

Survey on knowledge and perception are integral components of participatory avian conservation. Moreover, the biosphere reserve is regarded as a site of Avifauna importance bounded by villagers. Therefore, the study was investigating ornithological perception and knowledge of adjacent villagers in Kafa Biosphere Reserve. In this study, we investigated and documented population status of bird diversity at Kafa biosphere reserve and the existing local community knowledge, attitude and practice (KAP) associated with ecological significance and conservation of

avian diversity. Studying the Avifauna in the Kafa biosphere reserve helps to establish baseline information about the reserve for avian conservation in the future.

2. Materials and Methods

2.1. Description of Study Area

Table 1. Gps location of the study sites.

No	Sites	Altitude	N	E
1	Decha forest	1934 m	06°58'55.4"	36°14'05.4"
2	Chena forest	1825 m	07°16'50.55"	35°56'38.3"
3	Dadiben forest	1395 m	07°28'25.3"	36°10'49.6"
4	Gojeb wetland	1420 m	20°96'95"	81°83'22"
5	Boka forest	1597 m	79°17'45.7"	36°22'28.2"

The Kafa Biosphere reserve was designated by UNESCO in June 2010. It is located about 460 km south of Addis Ababa in Ethiopia [25]. It *is* one of Ethiopia's first biosphere reserves and the first coffee biosphere reserve in the world. It is located at 36° 15.00' East and 7° 17.00' North with 1,000 - 3,400 m.a.s.l in Kafa Zone. It covers a total area of 760,144 hectares of which 5.5% are demarcated as a core zone, 28.9% as candidate core zone, 21.2% as buffer zone, and 44.4% as transition zone. The area's altitude ranges from 500 m.a.s.l in the south to the highest elevation of 3,300 m.a.s.l in the northeast. Maximum temperatures range between 11 and 15°C [24]. The region typically receives more than 1,500mm (up to 2,000 mm) of rainfall a year. The biosphere reserve falls within the Omo-Gibe river basin, one of five basins that drain their water in the Great East African Rift-Valley. The primary river systems within Kafa Biosphere reserve include the Gojeb, the Sherma, the Guma and the Omo River system [24].

2.2. Data Collection

Data was collected for a period of two consecutive years (2013 to 2014) with monthly survey. The sites were selected based on heterogeneity of the habitat and its integration as principal components of the biosphere reserve. Pre-determined transect route was walked throughout the study sites characterized by less forest including all field boundaries within the sites.

Point count technique where employed from a fixed location within a fixed time interval (~ 5 to 10 minutes) to identify and enumerate the birds in the early morning from 07:00-10:00 AM and 04:00-06:00PM in the late afternoon for a total of five hours in a day following [23] in each block. In this method, a suitable vantage point was selected and all visible birds were counted.

Percentage of the coverage was marked and block counts were applied to count the birds. Each site was divided into many sections and each section was counted. To minimize disturbance during enumeration, a waiting period of 3 to 5 minutes prior to counting was applied following [3, 8, 23]. Direct observation (with 8x40 binoculars) was made on the type of habitat and local conservation status for each species following [3, 20]. Birds were identified based on physical features with the help of

colored field guides and reference books [17].

Additional information was obtained from interview of structured questionnaires to local people with the help of one field assistant conversant with the local language acting as a translator. Questionnaire survey was administered from 18th February to 1th March 2014.

The proportion of key villagers included in the ornithological perception study was determined by their day to day interference in the biosphere reserve. This was further assured by kebele and Wereda administration. Accordingly, a total of 29 villagers living adjacent to Kafa biosphere reserve were included. A total of 29 local people, each representing a different household were interviewed. Questionnaires are particularly suitable tools for approaching studies of local knowledge, attitude and practice of ecological processes and conservation of avian diversity [3, 10]. Current village registers of the study site formed the sampling pool and households were randomly selected. Household heads or other permanently resident adults (≥18 years) were targeted as the respondents and took part in the interviews in each respondent's residence. The local villagers living adjacent the biosphere reserve were asked about the perceived socioeconomic damage caused by birds, extent of endemic and migratory bird poaching, threatening factor of avian habitat and their overall ecology. Likewise, the link between avian conservation and traditional tribal cultural implication were surveyed.

2.3. Data Analysis

After the data collection, all data were entered into SPSS software package version 20 for analysis. Data were analyzed using descriptive Statistics, Chi-square test and one-way ANOVA. Chi-square analyses were used to determine the relationship between site and the number of bird species recorded at each point count. T-tests were used to compare the mean bird species diversity of the selected five sites from the biosphere reserve. P-values of less than 0.05 were considered to be statistically significant. Diversity was also measured by species number and Shannon index (H) were used [22]. This was in an assumption that, all species are represented in a sample and they are randomly sampled. This takes into account evenness as well as number of species. It was estimated as $H' = -\sum (P_i * \ln (P_i))$ where P_i = is a proportion of the total number of birds belonging to species i and summation is over all species. Equitability (Evenness) index is calculated using the formula:

$E = H'/ \ln(S) = H'/Hmax$

Where, E = Shannon-Wiener Evenness Index

H' = Shannon-Wiener Diversity Index

S = total number of species in the sample

ln = natural logarithm [21].

Species observed for 25% more of the study periods were considered as residential species [11] and only those birds were considered for analysis. Bird species observed once in one of the sites were considered as accidental visitors and removed from analysis.

3. Results

3.1. Diversity of Birds

A total of 474 individual birds of 42 Species belonging to 10 Orders and 25 Families were recorded during the study period (Table 2). The best represented orders were Passeriformes with (47.6%), From the total recorded 6 bird species, namely Black Headed Forest Oriole *Oriolus larvatus,* Ruppell's Robin Chat, *Cossypha semirufa,* Abyssinian Oriole, *Oriolus monacha* Banded Barbet *Lybius undatus,* Thick Billed Raven *Corvus crassirostris,* White-cheeked Turaco *Tauraco leucotis* were nearly endemic to Ethiopia. Forty of them are forest dependent, while 2 species, Hadada Ibis *Bostrychia hagedash and* Woolly Necked Stork *Ciconia episcopus* are wetland dependent.

The biosphere reserve together holds 10 orders namely; Passeriformes contributing (46%) while Columbiformes (14%). Coraciiformes and Piciformes represented by (7%) each. Falconiformes (5%), Cuculiformes (5%) while the remaining Pelecaniformes, Apodiformes, Ciconiiformes, Coliiformes are represented by (4%) each (Figure 2). Statistically significant difference in diversity of birds in Kafa biosphere reserve particularly, between Decha and Chena (t=7.707, n=5, p<0.05), Dadiben and Gojeb wetland (t=3.492, n=5, p<0.05) and Gojeb wetland and Boka (t=7.405, n=5, p<0.05) were observed while statistically significant difference in diversity of birds within the selected sites of the biosphere reserve (t=-0.361, n=5, p=0.05).

***Table 2.** Birds list recorded from Kafa Biosphere Reserve (Decha (De), Chena (Ch), Dadiben (Da), Gojeb wetland (Go) and Boka (B).*

Common Name	Scientific name	Family	Order	Study sites				
				De	Ch	Da	Go	B
Abyssinian Ground Horn Bill	*Bucouryus abyssinicus*	Bucerotidae	Coraciiformes	*	*	-	-	-
Abyssinian Ground Thrush	*Zoothera piaggiae*	Turdidae	Passeriformes	*	*	-	-	-
Abyssinian Oriole	*Oriolus monacha*	Oriolidae	Passeriformes	*	-	-	-	-
Abyssinian Slaty Fly Catcher	*Melaenornis chocolatinus*	Muscicapidae	Passeriformes	*	*	*	-	-
African Pied Wagtail	*Motacilla aguimp*	Motacillidae	Passeriformes	-	-	-	*	-
Augur Buzzard	*Buteo rufofuscus*	Accipitridae	Falconiformes	-	-	-	-	*
Banded Martin	*Riparia cincta*	Hirundinidae	Passeriformes	-	-	-	*	*
Banded Barbet	*Lybius undatus*	Lybiidae	Piciformes	-	-	*	-	-
Black Headed Bulbul	*Pycnonotus atriceps*	Pycnonotidae	Passeriformes	*	*	*	*	-
Black Headed Forest Oriole	*Oriolus larvatus*	Oriolidae	Passeriformes	-	-	*	-	-
Black Headed Weaver	*Ploceus melanocephalus*	Ploceidae	Passeriformes	-	*	*	-	-

Common Name	Scientific name	Family	Order	Study sites				
				De	Ch	Da	Go	B
Black Kite	*Milvus migrans*	Accipitridae	Falconiformes	-	-	*	-	*
Brown Parisoma	*Sylvia lugens*	Sylviidae	Passeriformes	-	-	*	-	-
Grass Hopper Buzzard	*Butastur rufipennis*	Accipitridae	Falconiformes	*	*	-	-	-

Table 2. *Continued.*

Common Name	Scientific name	Family	Order	Study sites				
				De	Ch	Da	Go	B
Hadada Ibis	*Bostrychia hagedash*	Threskiornithidae	Pelecaniformes	*	*	*	*	*
Laughing Dove	*Spilopelia senegalensis*	Columbidae	Columbiformes	-	-	-	*	-
Little Swift	*Apus affinis*	Apodidae	Apodiformes	-	-	-	-	*
Malindi Pipit	*Anthus melindae*	Motacillidae	Passeriformes	-	-	-	*	-
Morning Dove	*Zenaida macroura*	Columbidae	Columbiformes	-	*	-	-	-
Brown-rumped Seed eater	*Serinus tristriatus*	Fringillidae	Passeriformes	-	-	-	*	-
Moustached GreenTinker Bird	*Pogoniulus leucomystax*	Lybiidae	Piciformes	*	*	-	-	-
Olive Thrush	*Turdus olivaceus*	Turdidae	Passeriformes	*	*	-	-	-
Pale Prinia	*Prinia somalica*	Cisticolidae	Passeriformes	*	*	-	-	-
Streaky Seed eater	Serinus striolatus	Fringillidae	Passeriformes	*	-	-	-	-
Red- Billed Oxpecker	*Buphagus rythrorhynchus*	Sturnidae	Passeriformes	*	-	-	-	-
Ruppell's Robin Chat	*Cossypha semirufa*	Muscicapidae	Passeriformes	*	-	*	-	-
Shellel's Starling	*Lamprotornis shelleyi*	Sturnidae	Passeriformes	-	*	*	-	-
Silvery-cheeked Hornbill	*Bycanistes brevis*	Bucerotidae	Coraciiformes	*	*	-	-	-

Table 2. *Continued.*

Common Name	Scientific name	Family	Order	Study sites				
				De	Ch	Da	Go	B
Speckled Mouse Bird	*Colius striatus*	Coliidae	Coliiformes	*	-	-	*	*
Speckled Pegion	*Columba guinea*	Columbidea	Columbiformes	-	*	-	-	-
Steel Blue Whydah	*Vidua hypocherina*	Viduidae	Passeriformes	-	-	-	*	-
Tambourine Dove	*Turtur tympanistria*	Columbidae	Columbiformes	-	-	*	-	-
Tawny Flanked Prinia	*Prinia subflava*	Cisticolidae	Passeriformes	-	-	*	-	-
Thick Billed Raven	*Corvus crassirostris*	Corvidae	Passeriformes	-	*	-	-	-
Tinker Bird	*Pogoniulus chrysoconus*	Lybiidae	Piciformes	-	-	-	*	-
Vinaceous Dove	*Streptopelia vinacea*	Columbidae	Columbiformes	-	-	-	*	-
White Browed Coucal	*Centropus superciliosus*	Cuculidae	Cuculiformes	-	-	*	-	-
White-cheeked Turaco	*Tauraco leucotis*	Musophagidae	Cuculiformes	-	*	-	-	-
White -Thighed Horn Bill	*Bycanistes albotibialis*	Bucerotidae	Coraciiformes	-	-	*	-	-
White Throated Bee- Eater	*Merops albicollis*	Meropidae	Coraciiformes	*	*	*	-	-
Woolly Necked Stork	Ciconia episcopus	Ciconiidae	Ciconiiformes	-	-	-	*	*
Zenker's Honey Guide	Melignomon zenkeri	Indicatoridae	Piciformes	*	*	-	-	-

NB: * =Present, - = Not recorded

Table 3. *Total number of encountered avian species diversity across the study sites.*

Study sites	Number of species detected	Abundance (Individuals No.)	H´	H´/H´max
Decha	17	84	2.41	0.85
Chena	18	136	2.72	0.94
Dadiben	15	148	2.48	0.92
Gojeb wetland	12	52	2.24	0.90
Boka	7	54	1.68	0.86

H´= Shannon-Wiener Index; H´/H´max= Evenness

Table 4. *Population status of birds across the study sites.*

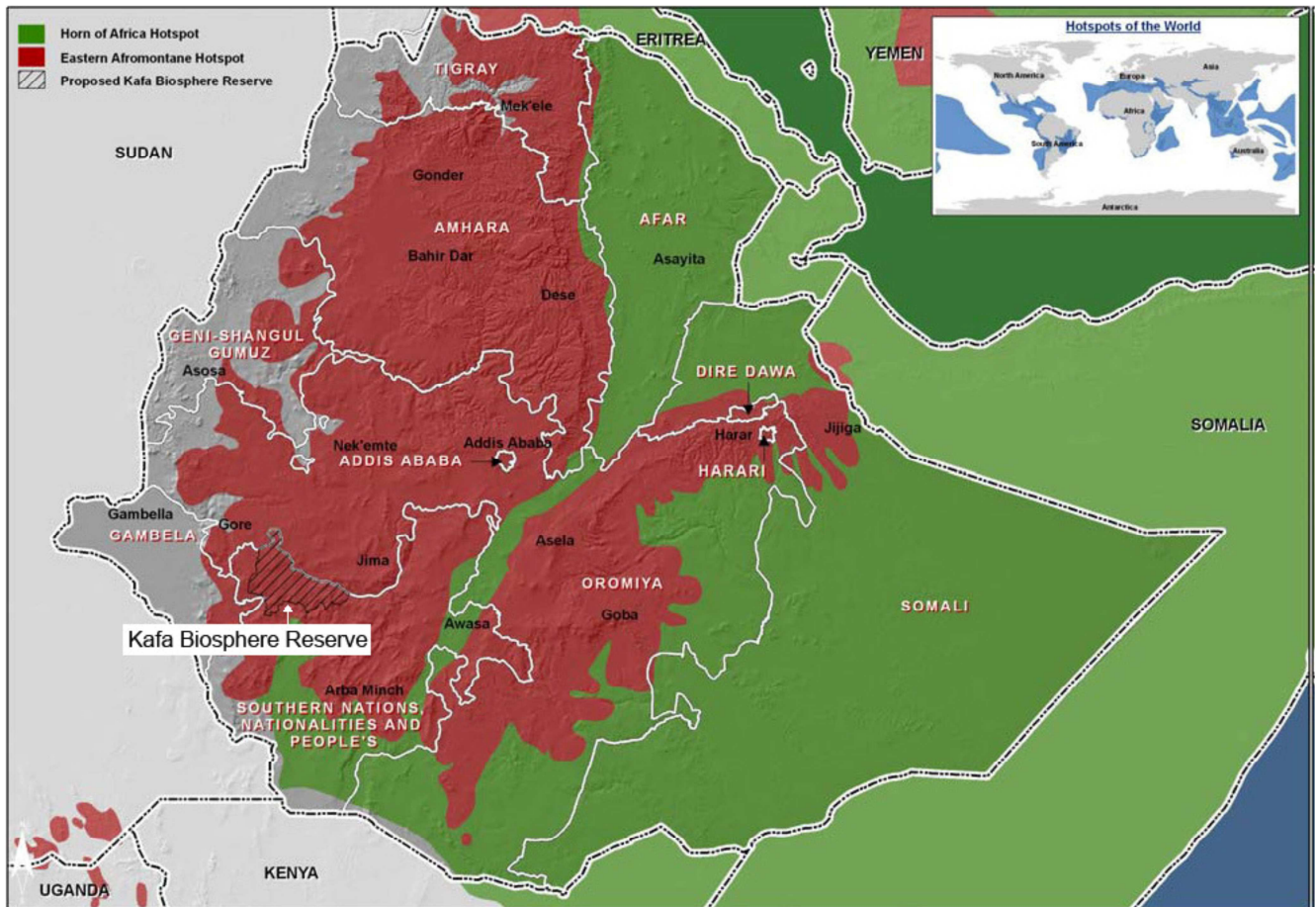| Sites	Population abundance		Crude odd ratio (95% CI)	P- value
	Non- abundant	Abundant		
Decha	13 (56.5%)	10 (43.5%)	5.1 (1.2, 22.2)	.029
Chena	15 (46.9%)	17 (53.1%)	7.6 (1.9, 30.6)	.005
Dadiben	24 (58.5%)	17 (41.5%)	4.7 (1.2, 18.5)	.026
Boka	8 (66.7)	3 (33.3%)	3.3 (0.6, 18.4)	.167
Gojeb wetland	20 (87.0%)	3 (13.0%)	Reference	-

Figure 1. *Location of Kafa Biosphere Reserve in Southwest Ethiopia (Source: Sigrun and Michael, 2011, Figure 1, Page 6).*
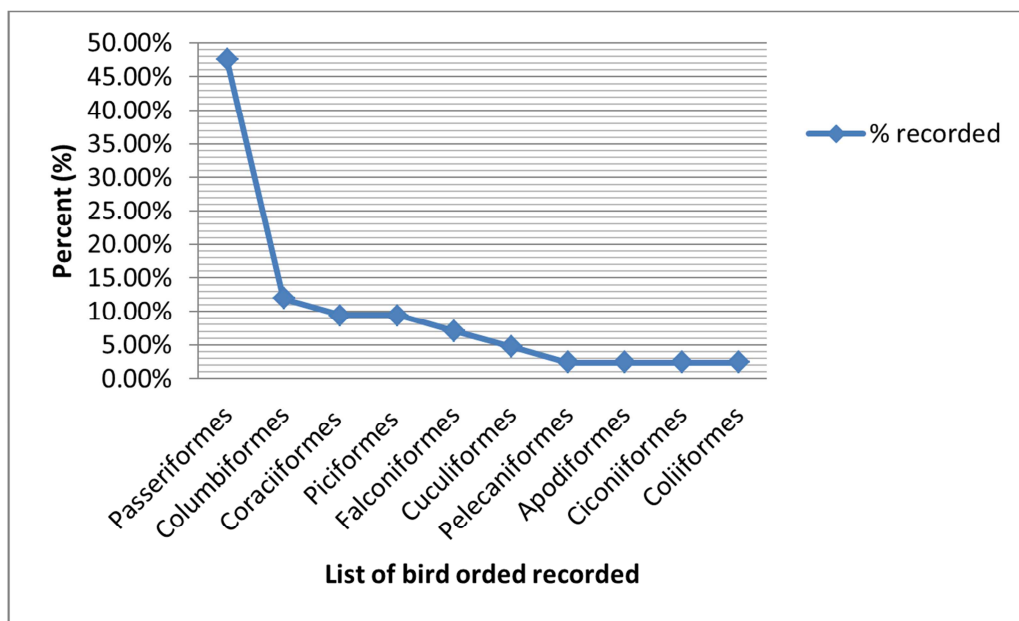

Figure 2. *Percentage contribution of bird order at Kafa Biosphere Reserve.*

3.2. Knowledge and Perception of Adjacent Villager of the Biosphere Reserve on Avian Conservation

A questionnaire survey was carried out to assess perceived ecological value of birds and their associated conservation problems. Twenty-nine local villagers (13 females and 16 males) were contacted for the surveys. Among the respondents, 22 (75.7%) reported that, birds were harming paddy cultivation, whereas 4 (13.8%) felt no crop damage due to the birds. 26 (89.7%) of local villagers

were not aware of avian conservation problems while 3 (10.3%) were aware. A majority 24 (82.8%) of the respondents suggested that, wildlife poaching was not a serious problem in the biosphere reserve. Two (6.9%) of local villagers reported that, low level of killing of birds and only two (6.9%) high and one (3.4%) respondent very high level of poaching. Some of the respondents 11 (37.9%) knew that, burning of grass would destroy the eggs and nests of resident birds; however, they were not aware about this. The main reason for burning the grass was for fertilizers 14 (48.3%), but 15 (51.7%) people's opinion that burning was carried out purposefully to stop the growth of weeds. Only some 2 (6.9%) were aware that certain species of birds are extinct, whereas 27 (93.1%) respondents have no idea about this fact. 9 (31%) of the local community replies the significance of conserving birds, while 20 (69%) were responded that conservation of birds is not essential, they reason out as they are considered as depredator of chickens and crop pests. Few 8 (27.6%) of the local community knew about the presence of endemic birds and migratory nature of birds coming to Kafa biosphere and many 21 (72.4%) were ignorant of this fact. Most of the local people 19 (65.5%) were aware about the harmful effect of poaching on endemic and migratory birds and other wildlife. Many of the respondents reported that, the best way to stop poaching in wildlife is by enforcing the laws strictly 23 (79.3%), whereas 6 (20.7%) reported that, community scale education will reduce the problem. Poaching of birds was primarily for food 20 (68.9%) and medicine 6 (20.6) but 3 (10.3) did not give answer. The bird species used for food includes Hardwood francolin and Guinea fowls 20 (68%); however, Ragouts Rail used for medicine by killing and drying the heart part then drinking with water to cure for pneumonia 19 (65.5). Six (20.7%) of the respondents reported that, there was no change in the pattern of crop damage by birds when compared with the earlier periods. However, 23 (79.3%) were of the opinion that the damage by birds is drastically reduced presently; instead there is an increase in the incidences of crop damage with *Guereza colobus*. Majority 16 (55.2%) have no suggestion about the reasons for change in the bird numbers, but 13 (44.8%) reported that there is a reduction in the number of birds coming to the Kafa biosphere reserve compared with the previous years. Some of the local people 10 (34.5%) perceived that, the food availability of birds was reduced due to agricultural expansion, crop damage incidences also reduced. Majority of the respondents 16 (55.2%) inspection that manure and insect control are the main benefit derived from birds, while in traditional beliefs and superstitions as sign of bad omens 16 (55.2%) and good luck 13 (44.8%). Bird species such as Owls are used as sign of bad omen like death and loss of money from pocket. If somebody breaks the egg of super wing plover his/her childe could be dead, since the birds' sound to the lord. Another belief with this species is if this bird crosses frequently on your way you face a bad station.

4. Discussion

During the study period, 42 species of birds belonging to 10 Orders and 25 Families were recorded within the selected sites. The recorded highest avian diversity can be successfully combined with high yields in afro montane forest of Kafa biosphere reserve. An increasing amount of evidence suggests that landscape texture is correlated with the distribution of bird species. Diverse, low-input agro-ecosystems include traditional shade coffee plantations and a number of other wetland ecosystem types. This implies that, such ecosystem with some native cover maintain a significantly larger proportion of important wildlife or avian guilds such as frugivores and nectarivores, and their respective services. Enhanced arthropod species richness in agricultural systems adjacent to biosphere reserve, particularly of pollinators and predators, can ultimately result in increased crop yields thereby crop damaging avian species [16]. Shannon diversity index of avian community (3.11) for the whole wetland also indicates the high diversity of birds. Highest diversity index (H') was recorded from Chena (2.72) followed by Dadiben (2.48), Decha (2.41), Gojeb wetland (2.24) and Boka (1.68). The difference in avian diversity across varied sites might be associated with the availability of food, disturbance and predation pressure. But, in terms of species evenness, Chena (0.94) holds first, then Dadiben (0.92), Gojeb wetland (0.90), Boka (0.86) and Decha (0.80). This might be due to the ecological stability of the regional ecosystem. The evenness measures of the bird community also showed higher values, this can be due to species is uniformly represented by individuals. This is explained through habitat heterogeneity.

The finding of the survey carried out to assess the ecological significance of avian conservation and their associated problems shown that, birds were harming paddy cultivation. Besides, some of the adjacent local villagers did not know anything about avian sustainable conservation. Majority (68%) of the local people responded that, conservation of birds is not essential; this is due to depredation of low income livelihood chickens and crop pests. This problem could be related to lack of through mass awareness and poor local people participation in biodiversity conservation systems. The current species richness of Kafa biosphere reserve showed lower values, which is comparable to pervious study [9], among the species of birds recorded, 44 were migrants. Higher diversity indices even during the monsoon months showed the conservation value of the wetlands. Many migrants make extensive use of habitats with intermediate disturbance, such as shade coffee and other agricultural landscapes around the Biosphere reserve.

5. Conservation Perspective

A Literature survey by [6] on biological data and research carried out in Bonga area, Kafa, Ethiopia shown that, the areas is inhabited by 100 bird species. Fifteen of the bird species are reported to comprise the "Highland Biome

Species", thus accounting for 31% of the Restricted Highland Biome Assemblages in Ethiopia" [2]. Nevertheless, in our study 42 bird species belonging to 10 orders and 25 families were recorded. The decline in avian species could be associated with a range of threatening practices halting the conservation of high biological value sites which supports Avifauna. Moreover, to our understanding conservation efforts of avifauna along the livelihood of the adjacent local community is poorly prioritized. Therefore, participatory approach of avian conservation is decisive. Besides, further intensive study of avian community over different season of the year could help to notice conservation action of Avifauna of the biosphere reserve.

References

[1] Aerts R, Lerouge F, November E, Lens L, Hermy M, Muys B. 2008. Land rehabilitation and the conservation of birds in a degraded Afromontane landscape in northern Ethiopia. *Biodiv. Conserv.* 17: 53-69.

[2] Bekele T. 2003. The potential of Bonga forest for certification - A case study. National Stakeholders Workshop on Forest Certification. pp. 2-23.

[3] Bibby J, Burgess N, Hill A. 2000. Bird Census Techniques. 2nd edition. Academic Press, London. pp. 698-701.

[4] BirdLife International. 2004. *State of the world's birds 2004: indicators for our changing world.* Cambridge, UK: BirdLife International. pp. 1-76.

[5] BirdLife International. 2010. *State of the World's Birds.* Birdlife International, Cambridge, UK. 104 (3): 168-701.

[6] Dennis R. 2007. Literature Survey on biological data and research carried out in Bonga area, Kafa, Ethiopia. pp 5-8.

[7] Elisabeth Dresen. 2011. Climate Protection and Preservation of Primary Forests: A Management Model using the Wild Coffee Forests in Ethiopia as an Example. Pp 1-250.

[8] Elisabeth Dresen. 2015. Final Report Mapping and analysis of wetlands and rivers at Kafa Biosphere Reserve. Pp 1-220.

[9] EWNHS. 1996. Important Bird Areas of Ethiopia. A First Inventory. Ethiopian Wildlife & Natural History Society. Addis Ababa. pp. 1-279.

[10] Girma M, Yosef M, Afework B. 2011. A comparison of terrestrial bird community structure in the undisturbed and disturbed areas of the Abijata Shalla lakes national park, Ethiopia. Intern. *J. of Bio. Conserv.* 3 (9): 389-404.

[11] Hockey P, Dean W, Ryan P. 2005. *Roberts - Birds of southern Africa,* VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town. pp. 1-123.

[12] Lepage D. 2006. Avibase - Bird Checklists of the World-Ethiopia. http://www.bsc-eoc.org. Accessed on 2/08/2015.

[13] Lepage D. 2013. Avibase - Bird Checklists of the World-Ethiopia. http://avibase.bsc-eoc.org/checklist.jsp?region=et&list=clements. Accessed on 6/07/2015.

[14] Malcolm J, Liu C, Neilson R, Hansen L, Hannah L. 2006. Global warming and extinctions of endemic species from biodiversity hotspots. *Conserv. Biol.* 20 (2): 538.

[15] NABU. 2013. Manual for youth to youth training raisisng environmental awareness. Training manual. Pp 1-110.

[16] Olschewski R, Tscharntke P, Benı´tez S, Schwarze A, Klein M. 2006. Economic evaluation of pollination services comparing coffee landscapes in Ecuador and Indonesia. *Ecol Soc.* 11 (1): 7.

[17] Perlo B. 2009. *A Field Guide Birds of Eastern Africa.* 2nd edition HarperCollins Publishers Ltd. London. pp. 1-301.

[18] Ruida pool Stanvliet and Miguel clusener godt. 2013. Biosphere reserve in Sub Saharan Africa: showcasing sustainable development. Printed and bound by the Government Printing Works Pretoria, South Africa. Pp 1-352.

[19] Schrag A, Zaccagnini M, Calamari N, Canaveli S. 2009. Climate and land-use influences on avifauna in central Argentina: broad-scale patterns and implications of agricultural conversion for biodiversity. *Agri. Ecosys. Environ.* 132 (1-2): 135-142.

[20] Sekercioglu C. 2007. Bird functional diversity and ecosystem services in tropical forests, agroforests and agricultural areas. *J. Ornithol,* 153: 153-161.

[21] Shannon C, Weaver W. 1949. *Measurement of diversity.* The Mathematical Theory of Communication. University of Illinois Press, Urbana, Illinois. pp. 117.

[22] Shannon C. 1948. A mathematical theory of communications. Bell Systems *Techn. J.* 27: 379–423.

[23] Shimelis A, Afework B. 2008. Species composition, relative abundance and distribution of bird fauna of riverine and wetland habitats of Infranz and Yiganda at southern tip of Lake Tana, Ethiopia. *Trop. Ecol.* 49 (2): 199-209.

[24] Sigrun L, Michael J. 2011. Development of management and business plan for ecotourism in Kafa Biosphere Reserve, Bonga, Ethiopia. pp. 5-6.

[25] Sisay N. 2008. Flora Biodiversity Assessment in Bonga, Boginda and Mankira Forest, Kafa, Ethiopia. Addis Ababa, Submitted to PPP Project. pp. 9-10.

[26] UNESCO. 2016. UNESCO's Man and the Biosphere Programme (MAB). http://www.unesco.org/mab/mabProg.shtml; Accessed 06.24.2016.

[27] USAID. 2008. Ethiopia Biodiversity and tropical forests 118/119 Assessment. pp. 17.

[28] Watson J, Rao A, Kang L, Xie Y. 2012. Climate change adaptation planning for biodiversity conservation: *A review. Adv. Clim. Change Res.* 3 (1). pp. 1-11.