

Diversity, Composition, and Abundance of Avian Species in and around SemienMecha District Wetlands North Western, Ethiopia

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Abstract

The objective of the present study was assessing the species composition, relative abundance and species diversity of avifauna found in wetlands of Semin Mecha District. The diversity, relative abundance and distribution of the avian species were investigated from January 2019 to August 2019 both wet and dry seasons. Both point count and line transect methods were employed to identify birds from the three wetlands. A total of 39 species, 28 genera 14 families and 8 orders were identified. The order Charadriiformes dominated the list (4 families with 14 species) followed by Pelecaniformes (2 families with 9 species), Gruiformes (2 families with 4 species), suliformes 2 families with 3 species), psittaciformes (1 family with 6 species), the rest Accipitriformes, phoenicopteriformes and podicipediformes (1 family with 1 species) each. Out of total 39 species, one species (Black billed gull) was endangered, two species (wattled crane and Black crowned crane) were vulnerable, one species (Rouget's rail) was near threatened, and thirty five bird species recorded were under the Least Concern category. Species abundance and diversity varied between the three habitats. Weirner Simpson index showed significant diversity of birds in Koga reservoir had higher species diversity ($H' = 5.9$) followed by Kurt Bahir dembar ($H' = 4.15$) and lower species diversity Kurt Bahir ($H' = 2.53$). The study shows that habitat destruction due to anthropogenic activities: - over-grazing, sedimentation, poor management of catchment, recession farming, over-utilization of resources, lack of awareness, Lack of sense of ownership, giving less attention to conservation were the main threats to the survival of wetland birds in the study area. The current management of wetlands is poor because of misuse of wetlands as the result birds are endangered. Thus urgent conservation measures are recommended to conserve the bird species.

Keywords: abundance, birds, diversity, reservoir, wetland

1. Introduction

1.1 Back Ground of the Study

Wetlands were defined in different ways in different parts of the world and more than 50 definitions exist. However, the most recent and acceptance definition provided by the Ramsar Convention under Article 1.1 defines wetlands as: “areas of marsh, fen, peat land, or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters (Tsigereda, 2011).

In Ethiopia, 73 hot spots have been identified as Important Bird Areas (IBAs) and grouped into three conservation categories: nineteen critical sites, twenty three urgent sites and thirty one highly sited areas (Redman *et al.*, 2009). Among 2100 bird species so far recorded in Africa [21. According to Stevenson & Fanshawe, (2002)] Ethiopia harbors 926 species (Mengistu&Getahun, 2004) of which twenty one species are endemic and nineteen species are globally threatened (Sivaperuman & Jayson, 2000). Out of the threatened bird species from the country, two species are critically endangered, five species endangered, and twenty species are vulnerable (Collar, *et al.*, (1994).

Birds are an important component of biotic community from the study areas. Thus, the diversity birds in the study area are good indicators of the wetland habitat quality, productivity, stability and the best indications of a healthy environment similarly (Bibby *et al.*, (1992). Birds are often used as a biological model because they are good ecological indicators and they are easily observable (Bibby *et al.*, (1992). Birds can also be used as indicators of sites of high biodiversity.

Similar to Karr & Roth, (1971) birds use wetlands for breeding, nesting and teaching young, as a source of drinking water, for feeding, resting, shelter and for social interactions. In addition the wetlands in Semien Mecha District consist of plant species like, gicha, filla, sedges and others. Wetlands serves the surrounding communities for animal grazing, irrigation, water sources for animal and human consumption, fishing, harvesting place for green grasses-‘Chefe’ for holiday, shelter for wild lives and sources of sedges that serve the local community to prepare rain protective material-‘Gessa’ during the rainy season.

Birds play a significant role in many food webs of aquatic system nutrient cycles, but wetlands from the study areas are facing tremendous anthropogenic pressure caused by an increase of human disturbances which can greatly influence the population structure and diversity of the bird community.

The existing wetlands threatened from overgrazing, sedimentation, poor management of catchment, recession farming, over-utilization of resources, lack of awareness, Lack of sense of ownership, lack of coordination among various stakeholders, giving less attention to

conservation are identified. Thus the aim of this study is to assess the existing status of birds and their threats in the study areas and it serves as a spring board for the preparation of strategic plan for conservation and its sustainable management.

2. Materials and Methods

2.1 Description of the Study Area

Semein Mecha woreda is located between longitude 37° 00' 0.00" E and latitude: 11° 29' 59.99" N. Altitude 2008 m above sea level. It is located 522km North West from Addis Ababa and 35 km South East from Bahir Dar. It is bordered on the South by Debub Mecha and Skela woreda, on the north by Bahir Dar Zuria and Semein Achefer woreda, on the East by Yilmana densa woreda and on the West Debub Achefer and Fageta Lekoma woreda. The administrative center of Semien Mecha is Merawi. The minimum and maximum temperatures are 11.6°C and 23.10°C respectively. The annual mean temperature is 17.8°C, mean annual rainfall 1487mm. The District is crossed by about six permanent rivers (Jema, Koga, Andassa, Denje wonez, Zembolel and Shembudi) which drain into the Abay or Blue Nile; other water features include one manmade Lake, Koga reservoir, Kurt bahir and kurt Bahir dembar marsh areas which are located around 7 km 13 and 17 km respectively. The study was carried out in three wetland habitats namely Koga reservoir, Kutr Bahir and kurt Bahir dembar.

Kurt Bahir is bordering two kebeles Kurt Bahir and Enashenfalen. It is located between latitude 11°22'14.20"N, Longitude 37°15'49.68" E and surface area 131 hectares. Kurt Bahir Dembar wetland is found bordering two kebeles namely Tatak gebere and Midre genet. It is situated between, latitude 11°22'14.20"N longitude 37°15'49.68"E and surface area 410 hectares.

Koga Dam is bordering five kebeles namely:- Abyot fana, Kurt Bahir, Enashenfalen, Enamert and Kudmi. The koga Dam is located at 7 Km, from the main asphalt road Adis ababa to Bahir Dar between latitude 11°21'37.72"N Longitude 37°10'11.66"E. It covers an area of about 1963 hectares and its elevation 1985 to 3200 m above sea level. The Koga catchment is 250 km². Koga River is one of the rivers in the catchment, which is a tributary of Blue Nile River. The source of the river is Wezem, 3200m altitude, and runs 64 km before reaching and filling the reservoir at an altitude 1985m.

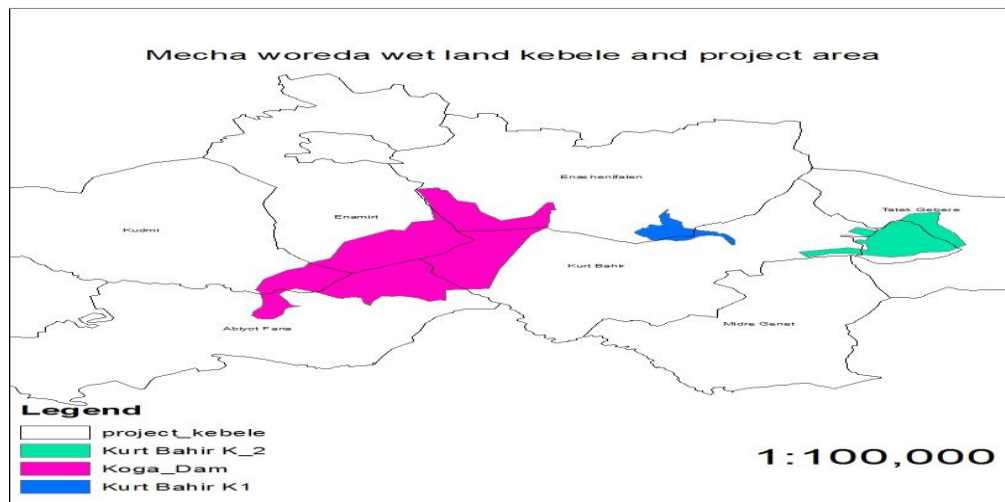


Figure 1: Map of the study area (source from coordinate points)

2.2 Materials

Materials used to accomplish this study efficiently and properly were:-Digital photo camera, 10 x 40 binocular, Geographic Positioning System (GPS), and bird guide books.

2.3 Methods

2.3.1. Preliminary survey

Preliminary survey was carried out in June 2019. During the time, the study site and the wetlands were identified. During this preliminary survey, consultation was carried out with the district experts and local communities to locate sampling sites. The study sites identified during the survey were Kurt Bahir, kurt Bahir dembar and Koga reservoir. Line transects and point transects were selected (**Shannon & Weaver, (1949); Bibby *et al.*, (1992).**

2.3.2 Field data collection

After the preliminary survey data collection was carried out from January 2019 to August 2019 both wet and dry seasons were considered (Amare, (2005). Bird counting was carried out using naked eyes, digital camera, and binocular and bird identification, African bird guide books (*Mengistu & Getahun, (2004); James, et al., (2001) ; Redman et al., (2009); Smith, (1992).*

Data were collected by observations using line transects walk, point transects. Line transects sampling method were used for a large and relatively uniform areas of wetlands (Bibby *et al.*, 1992) to assess the avifauna species and abundance. A total of 12 transects were placed at existing paths, (Bibby *et al.*, 2000). The length of each transect varied and ranged from 400 m-500 m depending on the situation in the area.

The abundance of birds was also studied using point count method following. 9 point counting sites were selected. The bird count was done at each point for 5-15minutes. The distance between point counts is 300 m at minimum. All bird species were recorded with in 25 meter radius.

Direct observation method was used to identify and record the individuals of bird species by using binoculars, photographed using Camera and using a bird’s guide book. Data collection was carried out twice daily early in the morning from 6:00 to 10:00am and late afternoon from 4:00 to 6:30 pm when the activity of birds becomes active (Tsigereda, 2011). Binocular and Digital camera were used to aid in the identification of birds. Birds recorded were categorized to species, genera, family and order with the aid of field guide book on West African Birds by (Bibby *et al.*, 2000).

2.3.3 Data analysis

The species diversity of each habitat in the two seasons was analyzed using Shannon diversity Index (H’) Sivaperuman & Jayson, (2000) by the formula $H' = -\sum (pi \ln pi)$. Species evenness was evaluated using Shannon-Wiener evenness Index ($E = H'/H \text{ Max}$) [24]. The Richness Index (RI) of each species was calculated using the formula ($RI = S-1/\ln I$) The relative abundance of avian species was determined using encounter rates that give crude ordinal scales of abundance as common, present, and absent (Bibby, 1998).

3. Results

3.1 Diversity of wetland birds

Table 1: Bird order, family and status of birds

Order	Family	Common name	Scientific name	IUN Status
Passeriformes	Anatidae	Egyptian goose	<i>Alopochen aegyptiacus</i>	LC
		Red-billed duck	<i>Anas erythrorhyncha</i>	LC
		Yellow-billed duck	<i>Anas undulata</i>	LC
		Hottentot teal duck	<i>Spatula hottentota</i>	LC
		spotted whistling duck	<i>Dendrocy gnaguttata</i>	LC
		Spur-winged goose	<i>Plectropterus gambensis</i>	LC
Gruiformes	Gruidae	Demoiselle crane	<i>Grus virgo</i>	LC
		wattled crane	<i>Grus carunculata</i>	VU
		Black-crowned crane	<i>Balearic apavonina</i>	VU
	Rallidae	Rouget's rail	<i>Rougetius rougetii</i>	NT
Pelecaniformes	Ardeidae	Black-headed heron	<i>Ardea melanocephala</i>	LC
Passeriformes	Anatidae	Egyptian goose	<i>Alopochen aegyptiacus</i>	LC
		Grey heron	<i>Ardeac inerea</i>	LC
		Cattle egret	<i>Bubulcus ibis</i>	LC
		Great egret	<i>Ardea alba</i>	LC

		Yellow-billed egret	<i>Ardea intermedia</i>	LC
	Threskiornithidae	African sacred ibis	<i>Threskiornis aethiopicus</i>	LC
		Hadada ibis	<i>Bostrychia hagedash</i>	LC
		Watt led ibis	<i>Bostrychia carunculata</i>	NT
		Glossy ibis	<i>Plegadis falcinellus</i>	LC
Charadriiformes	Laridae	Black-headed gull	<i>Chroicocephalus ridibundus s</i>	LC
		Great black-backed gull	<i>Larus marinus</i>	LC
		Black-billed gull	<i>Chroicocephalus bulleri</i>	EN
		Crowned lapwing	<i>Vanellus coronatus</i>	LC
		African wattled lapwing	<i>Vanellus senegallus</i>	LC
		Spur-winged lapwing	<i>Vanellus spinosus</i>	LC
	Recurvirostridae	Black-winged stilt	<i>Himantopus himantopus</i>	LC
		Pied avocet	<i>Recurvirostra avosetta</i>	LC
	Scolopacidae	Spotted redshank	<i>Tringa erythropus</i>	LC
		Marsh sandpiper	<i>Tringa stagnatilis</i>	LC
		Little stint	<i>Calidris minuta</i>	LC
		Common snipe	<i>Gallinago gallinago</i>	LC
	Burhinidae	Senegal thick-knee	<i>Burhinus senegalensis</i>	LC
		Water thick- knee	<i>Burhinus vermiculatus</i>	LC
Suliformes	Phalacrocoracidae	Great cormorant	<i>Phalacrocorax carbo</i>	LC
	Anhingidae	Reedcormorant	<i>Microcarbo africanus</i>	LC
		African darter	<i>Anhinga rufa</i>	LC
Accipitriformes	Accipitridae	African fish eagle	<i>Haliaeetus vocifer</i>	LC
Phoenicopteriformes	Phoenicopteridae	greater flamingo	<i>Phoenicopterus roseus</i>	LC
Podicipediformes	Podicipedidae	little grebe	<i>Tachybaptus ruficollis</i>	LC

From the present study the total of wetland bird species, genera, families & orders were identified & common names, scientific names and conservation status of the birds were presented.

The order Charadriiformes dominated the list (4 families with 14 species) followed by Pelecaniformes (2 families with 9 species), Gruiformes (2 families with 4 species), suliformes 2 families with 3 species), psseriformes (1 family with 6 species), Accipitriformes(1 family with 1 species),phoenicopteriformes(1 family with 1 species) and podicipediformes(1 family each with 1 species) each (Table. 1).

The families Anatidae and Laridae dominated by the representation of six species (15.38%)

followed by Ardeidae with five species (12.82%), Threskiornithiade and Scolopacidae with 4 species (10.2650, Gruidae with three species (7.69%), and the least were Recuvirostridae, Burhinidae and Phalacrocoracidae with two species each (5.13%) (Table 1).

Similar to IUCN Red List (IUCN Mengesha & Bekele, (2008) 35 species recorded from the study areas categorized under the Least Concern (LC) which account for 89.74%) and 4 species (10.26%) were Near Threatened (NT). Among four threatened birds, 1(25%) is endangered (Black-billed gull), 2(50%) are vulnerable (wattled crane and Black-crowned crane) 1(25%) near threatened (Rouget's rail) (Table 1).

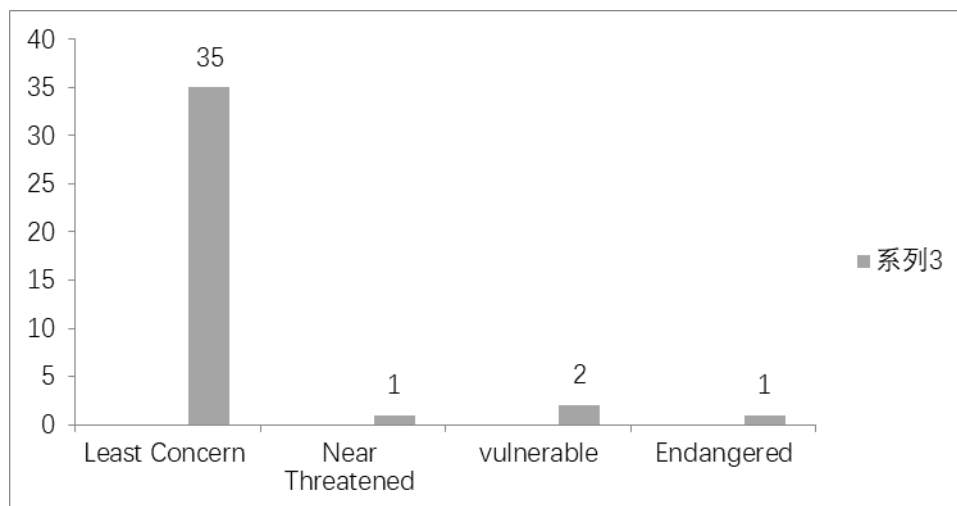


Figure. 2 The status of birds from the study area

Table 2. Abundance and distribution of birds from the three wetlands

Common name	Scientific name	sites		
		Kurt Bahir	KurtBahir dembar	Koga Reservoir
Egyptian goose	<i>Alopochen aegyptiacus</i>	xx	xx	xx
Red-billed duck	<i>Anas erythrorhyncha</i>	-	-	xx
Yellow-billed duck	<i>Anas undulata</i>	x	xx	xx
spotted whistling duck	<i>Spatula hottentota</i>	-	x	xx
Hottentot teal duck	<i>Dendrocy gnaguttata</i>	--	-	x
Spur-winged goose	<i>Plectropterus gambensis</i>	x	xx	xx
Demoiselle crane	<i>Grus virgo</i>	--	x	x
wattled crane	<i>Grus carunculata</i>	xx	x	--
Black-crowned crane	<i>Balearic apavonina</i>	--	xx	x
Rouget's rail	<i>Rougetius rougetii</i>	-	x	-
Black-headed heron	<i>Ardea melanocephala</i>	xx	xx	x

Grey heron	<i>Ardeac inerea</i>	-	xx	x
Cattle egret	<i>Bubulcus ibis</i>	xx	x	--
Great egret	<i>Ardea alba</i>	xx	xx	-
Yellow-billed egret	<i>Ardea intermedia</i>	--	--	x
Glossy ibis	<i>Threskiornis aethiopicus</i>	-	--	x
African sacred ibis	<i>Bostrychia hagedash</i>	xx	xx	xx
Hadada ibis	<i>Bostrychia carunculata</i>	x	xx	x
Watt led ibis	<i>Plegadis falcinellus</i>	xx	x	xx
Black- headed gull	<i>Chroicocephalus ridibundus s</i>	--	--	xx
Great black-backed gull	<i>Larus marinus</i>	--	--	xx
Black- billed gull	<i>Chroicocephalus bulleri</i>	--	--	x
Crowned lapwing	<i>Vanellus coronatus</i>	x	-	xx
African wattled lapwing	<i>Vanellus senegallus</i>		xx	
Spur-winged lapwing	<i>Vanellus spinosus</i>			x
Black- winged stilt	<i>Himantopus himantopus</i>	--	--	xx
Pied avocet	<i>Recurvirostra avosetta</i>	--	-	xx
Spotted redshank	<i>Tringa erythropus</i>	--	x	xx
Marsh sandpiper	<i>Tringa stagnatilis</i>	--	--	xx
Little stint	<i>Calidris minuta</i>	--	--	x
Common snipe	<i>Gallinago gallinago</i>	--	--	x
Water thick-knee	<i>Burhinus senegalensis</i>	--	x	-
spotted thick- knee	<i>Burhinus vermiculatus</i>	--	--	x
Great cormorant	<i>Phalacrocorax carbo</i>	-	x	--
Long tail cormorant	<i>Microcarbo africanus</i>	x	-	--
African darter	<i>Anhinga rufa</i>	x	xx	x
African fish eagle	<i>Haliaeetus vocifer</i>	-	x	xx
Greater flamingo	<i>Phoenicopterus roseus</i>	--	---	xx
Little grebe	<i>Tachybaptus ruficollis</i>	--	x	xx

The species absent (-), species present (+) and the species common (++)

3.2 Species distribution among different habitats

During the present study, bird species were distributed differently from the three wetlands. Out of the total bird species 76.92% of them were found in Koga reservoir, 53.85% of the listed bird species were found to be in kurt bahir dembar and the remaining 33.33 % of bird were registered in kurt bahir wetland [Tble 2].

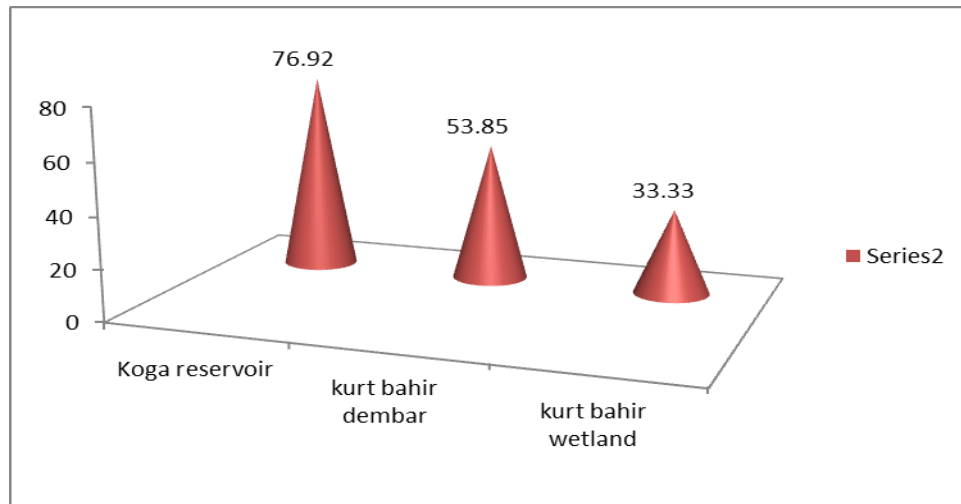


Figure 3. Species distribution among the three habitats

The avian community characteristics such as, Diversity (H'), Evenness ($H'E$), Richness (RI) were calculated for the comparison of habitats with reference to overall and seasonal variations (Table 4).

Table 3. Species diversity of birds both dry & wet seasons

wetlands	seasons	No of species	abundance	D	H'	H'/H_{max}
` Kurt Bahir	Dry season	8	84	0.23	0.23	1.59
	wet season	5	53	0.14r	0.14r	0.10
Kurt Bahir Dembar	Dry season	12	128	0.33	0.33	2.34
	wet season	9	94	0.25	0.25	1.74
Koga Reservior	Dry season	18	169	0.42	0.42	3.14
	wet season	!2	127	0.32	0.32	2.39

Species Diversity

Variations were observed in Species diversity among the different habitats during the dry and wet seasons. The maximum avian species were recorded during the dry season and the minimum during the wet season. The highest Shannon’s index diversity of bird species was recorded in the koga reservoir ($H'=3.14$) followed by kurt Bahir dembar ($H'=2.34$) and the lowest diversity of species was found in the kurt Bahir ($H'=1.59$) during dry season.

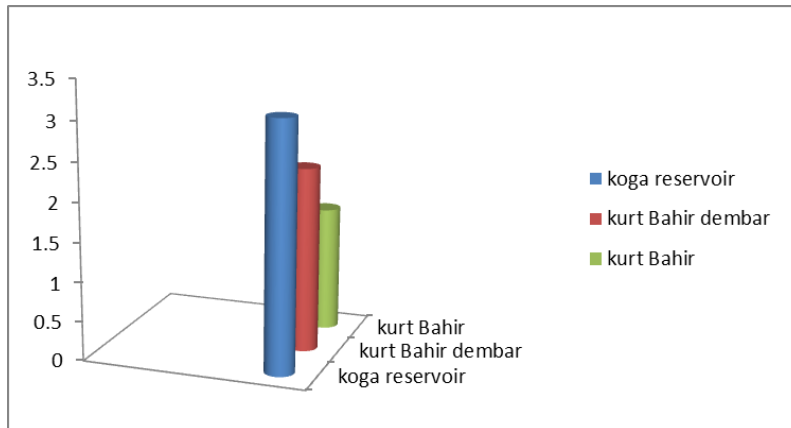


Figure 4. Diversity of Species from the three habitats

During the wet season, the highest Shannon’s diversity index of bird species was recorded in the koga reservoir ($H'=2.39$) followed by kurt Bahir dembar ($H'=1.74$) and the lowest diversity of species was found in the kurt Bahir ($H'=0.1$) (Table 3).

Species evenness

As shown in the above Table 4 the highest species evenness was registered in the Koga Reservoir ($E=3.14$) & ($E=2.3$ both dry and wet seasons respectively).

Species Richness

Variation in the number of species was observed among the three wetlands & d between seasons in the same habitat. The maximum avian species were recorded during the dry season & the minimum during the wet season. The highest richness was registered in in koga reservoir ($RI = 0.072$) followed by Kurt Bahir dembar ($RI=0.069$), but lower in in Kurt Bahir (0.006) during the wet season. The least species number was recorded in Koga Reservoir ($RI =0.068$) followed by kurt Kurt Bahir dembar ($RI =0.063$), and kurt Bahir ($RI =0.061$) during the dry season (Table 3).

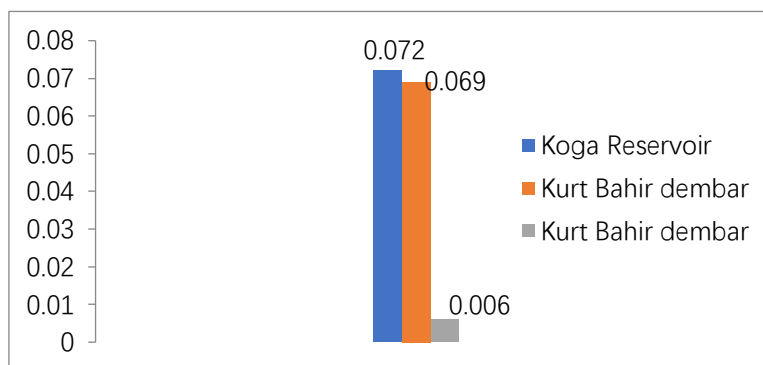


Figure 5. Species richness during wet season

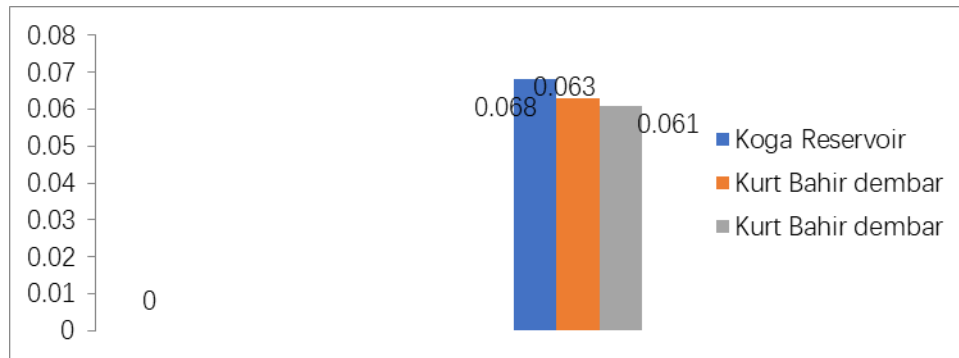


Figure 6. Species richness during dry season

Discussions

In the present study a total of 39 species of birds belonging to 8 orders and 14 families have been recorded. The difference in species diversity, number of species among the three wetlands of the present study could be associated with differences in Geographical variation, Vegetation structure, wetland size and feeding habits of birds similarly (Bibby *et al.*, 2000; Karr& Roth, 1971; smith, 1992).

Similar study conducted by *Mengesha & Bekele, (2008)* season affects food and availability of bird population, which in turn affects the breeding success and finally survival of the bird species. From the present study bird diversity was significantly higher in the dry season than in the wet season. During the wet season many small patches of water were created as a result birds were foraging, nesting and breeding out of the wetlands that are why the diversity of birds decreased in the wetland. During the dry season higher diversity of birds were observed in the wetlands because patches of water were dried up no, opportunity for birds to get their access could only be limited in and around the wetlands.

The highest species diversity was observed in koga reservoir ($H=5.90$), followed by Kurt Bahir dembar ($H=4.15$) and Kurt Bahir had the least species diversity ($H=2.53$) during the dry season. The reason for high diversity of bird species in koga reservoir could be the availability of a variety of food sources for the bird. The difference in species diversity in Kurt Bahir was very small due to less availability of resources and small wetland size. Similar to *Adeyemo& Ayodele, (2005)* that the increase and decrease of species diversity at the three wetlands and seasons might be due to local migration of birds from one habitat to the other in search of food.

The poor management of koga dam has led to the extinction of many aquatic species (birds) losses of vegetation, wetland, and others. Consequently, habitat loss and alteration cause the degradation of breeding sites, decrease water level, sedimentation, similarly (Davidson & Rothwell, 1993). The vegetation along the banks of the dam provides food, nesting place and hide out for some bird species but, the part of the reservoir modified by planting Eucalyptus trees which are not recommended for birding ecology as the result the number of birds declined.

The large size of Koga reservoir, as compared to the other wetlands might contribute to the highest bird species diversity. This is because of the availability of multiple and variety of alternatives which is a favorable condition for breeding, feeding, and nesting sites.

The implementation of unmanaged construction of Dam can lead to degradation due to poor management of catchment. Similar study conducted to Krüger *et al.*, (1996) alterations in the river flow create great disturbances of the Dam ecosystem, resulting in sediment accumulation in the mouth of the Dam. Koga River entering the Dam runoff from its catchment brings different substances resulted from anthropogenic activities which, contributed to the deterioration in the diversity and abundance of bird species in the area.



Plate 1



Plate 2



Plate 3

Photo credit (Desalegn Taye) shows sedimentation in Koga reservoir



Plate 4



Plate 5



Plate 6

Photo credit (Desalegn Taye) shows recession farming in Koga reservoir



Plate 7



Plate 8



Plate 9

Photo credit (Desalegn Taye) shows free-grazing in Koga reservoir



Plate Plate 7



Plate 8



Plate 9

Photo credit (Desalegn Taye) shows free- grazing in Kurt Bahir wetland



Plate 10



Plate 11



Plate 12

Photo credit (Desalegn Taye) shows and over collection of grasses in Kurt Bahir wetland.



Plate 10



Plate 11



Plate 12



Photo credit (Desalegn Taye) shows degradation around Kurt Bahir dembar wetland

Conclusions and Recommendations

The study concluded that the study area is very important to the bird communities. The present study 39 species of birds belonging to 28 genera, 14 families and 8 orders were recorded. The study area is severely threatened by the following anthropogenic factors:- overgrazing, sedimentation, poor management of catchment, recession farming, over-utilization of resources, lack of awareness, Lack of sense of ownership, lack of coordination among various stakeholders, giving less attention to conservation are identified. Develop sense of ownership within community; improve poor management of catchment; develop collaborative approach among stakeholders; giving better attention to conservation and reduction of free- grazing. The need for further research should be carried out to get detailed information on the challenges of wetland bird species. Therefore, a proper avian conservation management program me & appropriate

community based conservation measures should be designed to minimize the problems.

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