

Diversity and Relative Abundance of Birds of Alatish National Park, North Gondar, Ethiopia

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ABSTRACT

The diversity and relative abundance of birds were investigated in Alatish during the wet and dry seasons. Based on topographic map, satellite image and preliminary survey, four habitat types were identified comprising 37 blocks in 100 km². Eleven blocks were randomly selected based on the type of vegetation. Transects of 10 km length and width of 0.2 km or less were randomly selected to cover 20% of the area. One hundred forty three species of birds including endangered, rare and vulnerable species were recorded. Sixty five species of birds were residents during both seasons. A total of 122 species of birds was recorded during the wet season and 86 during the dry season. The relative abundance of birds was determined using encounter rates that give ordinal scale. This resulted in 97 species of birds as rare, 20 uncommon, 19 frequent, four common and three abundant. The wet season survey showed highest species diversity in the wooded grassland habitat owing to the presence of resources. The dry season survey showed the highest avian species diversity, evenness and richness in the riverine woodland habitat due to the availability of water. Most species of birds in Alatish were locally rare as a result of habitat degradation. This hindered the establishment of species distribution pattern especially during the dry season. Availability of food, water and cover were the major factors determining the diversity and abundance of birds. Habitat destruction by the nomadic Falata community with their livestock, poaching and forest fire contributed to the deterioration in the diversity and number of birds. Urgent conservation measures are needed to conserve the biological diversity of Alatish.

Key Words: Alatish National Park, Bird diversity, Habitat destruction, Relative abundance.

INTRODUCTION

The diversity of biological resources in Ethiopia is a result of unique geological history, diverse climatic and physical conditions and topographic features. The altitudinal difference between highland and lowland areas has contributed to the diversity of Ethiopia's biological resources (Blower 1969, Hillman 1993, ARCS 1999). There are around 860 species of birds known to occur in Ethiopia (Shimelis and Delelegn 2004). Amhara National Regional State (ANRS) has been designated as one of the Important Bird Areas (IBA) of Ethiopia comprising 75% of the central Ethiopian highland endemic bird areas (EWNHS 1996). Currently, the biodiversity of the ANRS is protected only in the officially protected Simien

Mountains National Park. The lowland areas of the ANRS are also known to contain various species of birds and other forms of life. One such lowland area is Alatish. Alatish is reported to possess a few important species of mammals and birds (BOA/RD/LUPT 1997). Due to lack of systematic studies, the diversity, distribution and relative abundance of the avian fauna of Alatish was little known (Sime et al. 1996). One of the problems in the conservation of biological diversity is lack of information on the relative importance of the area (WCMC 1992)

The natural vegetation in the northwest Ethiopia is undifferentiated Ethiopian and Sudanian type woodland (White 1983, Jensen and Friis 2001). The vegetation in Alatish area is known to act as a "Green Belt" in preventing the expansion of desert from the

Sudan and Sahel Region (Crabtree 1997, ARCS 1999). Therefore, the ecosystem in Alatish is unique acting as an ecotone. Currently, the human population is relatively low in the surrounding area of Alatish. However, there is a high demand to use the area for human settlement, agriculture and grazing land. Recently, Alatish has been established as a Park by the ANRS. Unfortunately, both natural and human activities are threatening the wildlife of Alatish National Park (ANP). Scarcity of water, particularly during the dry season, is a problem in Alatish. During this season, destruction by nomadic Falata community migrating once a year from the Sudan, causes severe damages to the wildlife habitat. Poaching wild animals and cutting trees for various purposes are common in Alatish. The main aim of this paper is to identify the diversity and relative abundance of the avian fauna of Alatish National Park, and to suggest measure for their conservation.

STUDY SITES

The study area is located in the southwestern part of Quara Woreda in ANRS, northwest Ethiopia (Figure 1). It has an area of 2,579.85 km² lying between 11°48' - 12°26' N latitude and 35° 16'50" - 35° 46'E longitude. The altitude of the area ranges from 534-635 m above

sea level. To the north, Alatish is bounded by Bermal Valley, to the northeast Mahadid borders Alatish. Hayma (Dinder) River makes the southern boundary. Almatani, Amdog and Abunine Mountains of the Sudan, border the study area to the west. Zobator and Nigilla Mountain forms the eastern boundary of Alatish. Out of the two major rivers, Alatish is seasonal. Hayma River, which is perennial, provides water for wildlife of the area. Records of climatic data are lacking in ANP, but the weather record of nearby Metema-Quara Woreda which is similar to the ANP is classified as "Kola" (hot) agro-ecological zone. The region has a rainy season extending from May to September and a dry season from October to August (Gemachu 1977, BOA/RD/LUPT 1997). The mean annual rainfall for the past seven years was 941.3 mm and the mean monthly minimum and maximum temperature of the nearby station at Shedi (Metema) are 17.6°C and 37.0°C, respectively (NMSA 2004).

According to BOA/RD/LUPT (1997), the study area is predominantly bounded by sediments including alluvium-colluvium (Pleistocene-Holocene) undifferentiated as well as alkaline basalts. The soil in ANP is not yet studied but the soil in Quara Woreda is known to consist of eutric vertisols, lithic leptosols, eutric regosols and eutric fluvisols. The vegetation of ANP is mostly undifferentiated Sudanain and Ethiopian woodland type (White 1983, Jensen and Friis 2001).

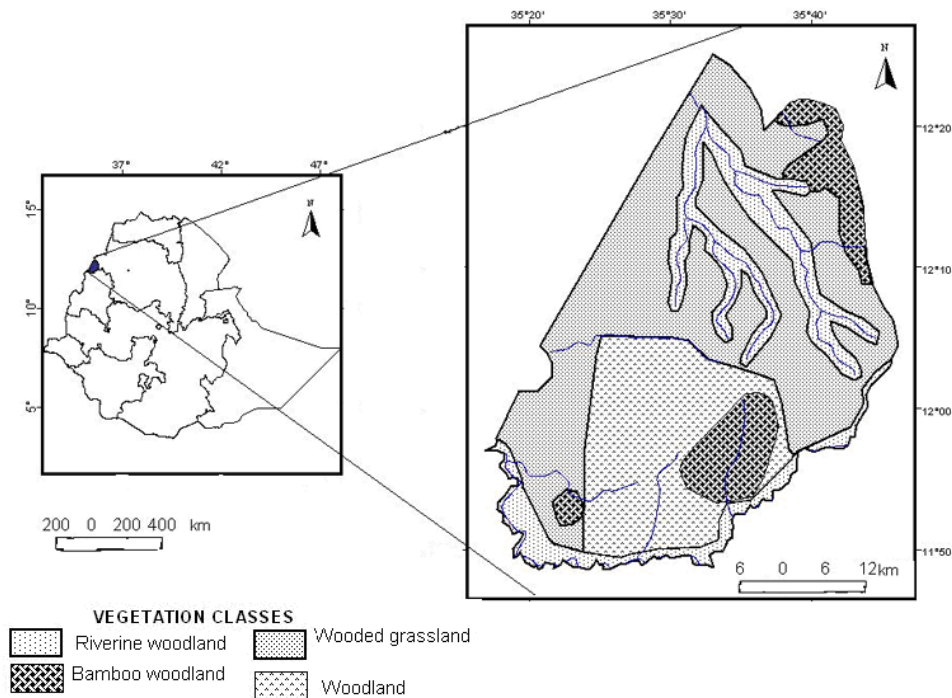


Figure 1. Map of Ethiopia and Alatish National Park with vegetation categories

METHODS

Sampling units (grids) were established in each of the vegetation types as described elsewhere (Norton-Griffiths 1978, Balakrishnan and Ndhivu 1991, Krebs, 1999). The number of grids was determined according to the size and type of vegetation cover in the Park. Based on topographic map of 1:250,000 and satellite image received in 2004, 37 grids were identified. Some of the grids (blocks) were 10 x 10 km covering 100 km². The grids at the periphery of the Park area were less than 100 km². The 37 grids were broadly divided into four vegetation types of the area, riverine woodland, wooded grassland, woodland and bamboo woodland based on descriptive memoir (Grimsdel 1978, White 1983, Jensen and Friis 2001) that describes the vegetation of northwest Ethiopia as Sudanian type. Based on the size of the vegetation types, 20% of the habitats were sampled. The length of each transect line was determined based on bird type and openness of habitat. This was 150–200 m in closed habitat and 250–500 m in open habitats (Bibby et al. 1992, Pomeroy 1992, Bullock 1996, Gibbons et al. 1996, Sutherland 1996). For identification of birds, Mackworth–Praed and Grant (1952, 1995), Bull (1978), Williams and Arlott (1992), Perlo (1995) and Richard

(2000) were used. A tape recorder (Walkman) was used to record the voice of birds. Along the randomly selected transects, the diversity and relative abundance of birds were studied for 38 days each during the wet and dry seasons. The observation was made using naked eyes aided by binoculars. Location of observed species was recorded using GPS. The record was carried out between 06:00-10:00 h and 15:00 – 19:00 h. Then, bird species were counted in the method used by randomly selected transects following Bibby et al. (1998) to measure the relative abundance of birds (Simpson 1949). These were grouped under rare, uncommon, common, frequent and abundant. The diversity of birds was determined using FORTRAN computer program (Krebs 1999). Relative abundance of the bird species was determined using encounter rates that gives ordinal scale of abundance (Bibby et al. 1998).

RESULTS

One hundred and forty three species of birds grouped into 45 families were recorded during the present study period (Table 1). Sixty five species of birds were residents during both seasons. A total of 122 species of birds was recorded during the wet season and 86 during

Table 1. Recorded bird species of Alatish and their abundance score (♠ Species recorded only during the wet season, * species recorded only during the dry season).

Common Name and Scientific Name	Number/ 100 field hr	Abundance score	Common Name and Scientific Name	Number/ 100 field hr	Abundance score
♠ Abdim's stork, <i>Ciconia abdimii</i>	0.49	1	♠ Bar breasted fire finch, <i>Lagonosticta rufopicta</i>	0.56	1
Abyssinian ground hornbill, <i>Bucorvus abyssinicus</i>	0.43	1	♠ Bare eyed thrush, <i>Turdus tephronotus</i>	0.43	1
Abyssinian roller, <i>Coracias abyssinica</i>	13.70	3	*Barn owl, <i>Tyto alba</i>	0.08	1
♠ Abyssinian white eye, <i>Zosterops abyssinica</i>	0.82	1	Bateleur, <i>Terathopius ecaudatus</i>	1.40	1
♠ Acacia paradise whydah, <i>Vidua paradisaea</i>	0.57	1	♠ Bimaculated lark, <i>Melanocorypha bimaculata</i>	0.06	1
African drongo, <i>Dicrurus adsimilis</i>	3.70	2	*Black billed wood dove, <i>Turtur abyssinicus</i>	7.36	3
African firefinch, <i>Lagonosticta rubricata</i>	6.60	1	♠ Black crowned crane, <i>Balearica pavonina</i>	0.01	1
African fish eagle, <i>Haliaeetus vocifer</i>	0.94	1	♠ Black faced firefinch, <i>Lagonosticta vinacea</i>	0.28	1
African grey hornbill, <i>Tockus nasutus</i>	7.08	3	Black headed bush shrike, <i>Laniarius erythrogaster</i>	28.00	3
♠ African Hawk-eagle, <i>Hieraaetus spilogaster</i>	0.65	1	♠ Black headed weaver, <i>Ploceus cucullatus</i>	256.00	5
African Hoopoe, <i>Upupa epops</i>	3.41	2	Black kite, <i>Milvus migrans</i>	34.01	4
African mourning dove <i>Streptopelia decipiens</i>	10.65	3	♠ Black stork, <i>Ciconia nigra</i>	0.43	1
*African open billed stork, <i>Anastomus lamelligerus</i>	0.41	1	♠ Black winged red bishop, <i>Eupectes hordodeaceus</i>	0.69	1
♠ African paradise monarch, <i>Terpsiphone viridis</i>	0.58	1	♠ Black winged stilt, <i>Himantopus himantopus</i>	0.17	1
♠ African pied wagtail, <i>Motacilla aguimp</i>	0.85	1	Blue capped cordon bleu, <i>Uraeginthus cyanocephalus</i>	4.56	2
♠ African singing bushlark, <i>Mirafra cantillans</i>	2.01	1	♠ Bronze tailed glossy starling, <i>Lamprotornis chalcurus</i>	1.40	1
♠ African Thrush, <i>Turdus pelios</i>	3.40	2	♠ Brown rumped serin, <i>Serinus trisriatus</i>	0.43	1
*African wood owl, <i>Strix woodfordii</i>	0.04	1	Brown snake eagle <i>Circaetus cinereus</i>	11.78	3
*Augur Buzzard, <i>Buteo rufofuscus</i>	0.29	1	♠ Brown-tailed chat, <i>Cercomella scotoclerca</i>	0.11	1

Common Name and Scientific Name	Number/ 100 field hr	Abundance score	Common Name and Scientific Name	Number/ 100 field hr	Abundance score
♣Bruce's green pigeon, <i>Treron waalia</i>	0.36	1	Northern black flycatcher, <i>Melaenornis edolioides</i>	2.20	1
♣Buff-Belled warbler, <i>Phyllolais pulchella</i>	1.31	1	♣Nubian shrike, <i>Lanius nubicus</i>	0.25	1
*Bush petronia, <i>Petronia dentata</i>	9.37	3	Nubian woodpecker, <i>Campethera nubica</i>	1.70	1
*Carmine bee eater, <i>Merops nubicus</i>	2.73	1	*Olive thrush, <i>Turdus olivaceus</i>	0.11	1
Caspina plover, <i>Charadrius asiaticus</i>	0.71	1	Osprey, <i>Pandion haliaetus</i>	0.68	1
Clapperton's francolin, <i>Francolinus clappertoni</i>	9.50	3	Pallid flycatcher, <i>Bradornis pallidus</i>	0.44	1
♣Common Button Quail, <i>Turnix sylvatica</i>	0.19	1	*Pearl spotted wood owl, <i>Glaucidium perlatum</i>	6.54	3
Common Bulbul, <i>Pycnonotus barbatus</i>	3.68	2	Pied kingfisher, <i>Ceryle rudis</i>	0.70	1
♣Common scops owl, <i>Otus scops</i>	0.11	1	♣Pied wagtail, <i>Monticella alba</i>	3.77	2
Crowned lapwing, <i>Vanellus coronatus</i>	1.01	1	♣Plain backed Pipit, <i>Anthus leucophrys</i>	0.50	1
*Curlew sandpiper, <i>Calidris ferruginea</i>	0.33	1	Red billed hornbill, <i>Tockus erythrorhynchus</i>	2.22	1
Dark chanting Goshawk, <i>Melierax metabates</i>	0.70	1	Red cheeked cordon bleu, <i>Uraeginthus bengalus</i>	17.55	3
Egyptian goose, <i>Alopochen aegyptiacus</i>	0.57	1	Red eyed dove, <i>Streptopelia semitorquata</i>	145.00	5
Egyptian plover, <i>Pluvianus aegyptius</i>	1.02	1	♣Red throated bee eater, <i>Merops bullocki</i>	0.69	1
Emerald spotted wood dove, <i>Turtur chalcospilos</i>	10.87	3	♣Red-pate cisticola, <i>Cisticola njombe</i>	0.21	1
Familiar chat, <i>Cercomela familiaris</i>	3.05	2	Ring necked Dove, <i>Streptopelia capicola</i>	0.67	1
Gabar Goshawk, <i>Micronisus gabar</i>	0.44	1	Rose-ringed parakeet, <i>Psittacula krameri</i>	4.30	2
Gaint kingfisher, <i>Megaceryle maxima</i>	44.70	4	Rueppell's long tailed starling, <i>Lamprotornis purpuropterus</i>	34.00	4
♣Grasshopper buzzard, <i>Butastur rufipennis</i>	4.33	2	*Sacred Ibis, <i>Threskiornis aethiopica</i>	0.36	1
Greater blue-eared glossy starling, <i>Lamprotornis chalybeus</i>	10.48	3	*Saddle-billed stork, <i>Ephippiorhynchus senegalensis</i>	0.16	1
♣Greater honey guide, <i>Indicator indicator</i>	4.32	2	♣Sand partridge, <i>Ammoperdix heyi</i>	0.38	1
*Greater sand plover, <i>Charadrius leschenaultii</i>	0.66	1	Scaly Francolin, <i>Francolinus squamatus</i>	4.11	2
Greater short toad lark, <i>Clandrella brachydactyla</i>	0.10	1	Senegal coucal, <i>Centropus senegalensis</i>	3.88	2
*Greater white egret, <i>Egretta alba</i>	0.52	1	Speckled pigeon, <i>Columba guinea</i>	7.21	2
Green wood hoopoe, <i>Phoeniculus purpureus</i>	2.60	1	♣Splendid glossy starling, <i>Lamprotonis splendidus</i>	0.50	1
Grey heron, <i>Ardea cinerea</i>	29.90	3	*Spotted eagle owl, <i>Bubo africanus</i>	0.46	1
♣Grey wagtail, <i>Motacilla cinerea</i>	0.66	1	Spur winged lapwing, <i>Vanellus spinosus</i>	7.30	2
Hadada ibis, <i>Bostrychia hagedash</i>	1.40	1	♣Square tailed drongo, <i>Dicrurus ludwingii</i>	0.51	1
Hamerkop, <i>Scopus umbretta</i>	4.20	2	Standardwinged nightjar, <i>Macrodipteryx longipennis</i>	0.31	1
*Hartlabu's Bustard, <i>Eupodotis hartlaubii</i>	0.30	1	♣ Stone curlew, <i>Burhinus oedicnemus</i>	2.02	1
Helmeted Guineafowl, <i>Numida meleagris</i>	195.00	5	Stone partridge, <i>Ptilopachus petrosus</i>	0.74	1
♣Lappet faced vulture, <i>Aegyptius tracheliotus</i>	1.00	1	♣Tawny eagle, <i>Aquila rapax</i>	1.22	1
♣Laughing dove, <i>Streptopelia senagelensis</i>	4.60	2	♣Tawny-Flanked Prinia, <i>Prinia subflava</i>	0.23	1
Lesser blue eared glossy starling, <i>Lamprotornis chloropterus</i>	21.00	3	♣Tiny cisticola, <i>Cisticola nana</i>	3.06	2
Lesser honey guide, <i>Indicator minor</i>	4.33	2	♣Tree pipit, <i>Anthus trivialis</i>	3.01	2
♣Levaillant's cuckoo, <i>Oxylophus levaillantii</i>	0.66	1	Tropical Boubou, <i>Laniarius ferrugineus</i>	0.57	1
♣Liechtenstein's sand grouse, <i>Pterocles lichtensteinii</i>	3.00	1	*Verreaux's eagle owl, <i>Bubo lacteus</i>	0.16	1
Little bee eater, <i>Merops pusillus</i>	5.10	2	♣Water thicknee, <i>Burhinus vermiculatus</i>	0.22	1
Little green bee eater, <i>Merops orientalis</i>	1.10	1	*West Nile bishop, <i>Euplectes capensis</i>	0.31	1
*Little ringed plover, <i>Charadrius dubius</i>	0.28	1	*White backed duck, <i>Thalassornis leuconotus</i>	0.08	1
Little rush warbler, <i>Bradypterus baboecala</i>	0.22	1	White Bellied Go-away bird, <i>Corythaixoides leucogaster</i>	0.31	1
♣Little weaver, <i>Ploceus luteolus</i>	1.10	1	White fronted bee eater, <i>Merops bullockoides</i>	0.60	1
♣Long billed pipit, <i>Anthus similis</i>	0.24	1	White headed vulture, <i>Aegyptius occipitalis</i>	0.23	1
♣Long crested eagle, <i>Laphaetus occipitalis</i>	0.84	1	White-rumped helmet shrike, <i>Eurocephalus rueppelli</i>	1.10	1
♣Long legged buzzard, <i>Buteo rufinus</i>	2.30	1	♣White rumped serin, <i>Serinus leucopygius</i>	0.55	1
♣Marabou stork, <i>Leptoptilos crumeniferus</i>	13.50	3	White Stork, <i>Ciconia ciconia</i>	21.30	3
Malachite kingfisher, <i>Corythornis cristata</i>	0.08	1	♣White throated bee eater, <i>Merops albicollis</i>	0.40	1
Martial eagle, <i>Polemaetus bellicosus</i>	0.08	1	*Winding cisticola, <i>Cisticola galactotes</i>	31.50	4
Mountain wagtail, <i>Motacilla clara</i>	0.08	1	♣Yellow billed oxpecker, <i>Buphagus africanus</i>	0.28	1
Moustached warbler, <i>Melocichla mentalis</i>	1.80	1	♣Yellow crowned bishop, <i>Euplectes afer</i>	0.19	1
Namaqua dove, <i>Oena capensis</i>	10.40	3	♣Yellow wagtail, <i>Motacilla flava</i>	0.28	1
♣Nighthangle, <i>Luscinia megarhynchos</i>	3.07	2	Yellow white eye, <i>Zosterops senegalensis</i>	0.49	1
			♣Zitting cisticola, <i>Cisticola juncidis</i>	3.68	2

the dry season. Fifty seven species of birds were exclusively recorded during the wet season and 21 during the dry season. There were 97 rare, 20 uncommon, 19 frequent, four common and three abundant species of birds in Alatish (Table 1). During the wet season, highest species diversity was obtained in wooded grassland and riverine woodland habitats followed by the woodland habitat (Table 2). Species richness was the highest in the wooded grassland habitat. However, evenness was highest in bamboo woodland. Highest avian species diversity during the dry season was obtained only in the riverine woodland habitat. Riverine woodland habitat also had highest avian species richness and evenness. The lowest species diversity was obtained in bamboo woodland habitat. Compared to the wet season, bird species diversity was the highest in riverine woodland habitat. Bird species richness was also highest in the wooded grassland habitats during the wet season. However, bird species richness was highest in the riverine woodland habitat during the dry season.

During the wet season, avian faunal diversity showed less similarity in all the four habitat types (Table 3). During the dry season, bird community showed similarity between the wooded grassland and woodland, wooded grassland and bamboo woodland and between woodland and bamboo woodland habitats. But less similarity was indicated between the riverine woodland, woodland and wooded grassland habitats during the dry season.

DISCUSSION

Avian diversity is an indication of habitat heterogeneity (Pomeroy 1992). The number of species and individuals in an area implies the importance of the area. The present study recorded 143 species of birds in Alatish, where most of the species were locally rare. At the time

Table 3. Similarity index of bird species during wet and dry seasons among habitat types.

	Wooded grassland		Woodland		Bamboo woodland	
	Wet	Dry	Wet	Dry	Wet	Dry
Riverine woodland	0.60	0.64	0.49	0.61	0.49	0.63
Wooded grassland			0.57	0.92	0.59	0.82
Woodland					0.59	0.87

of establishment, similar lowland area National Parks in Ethiopia showed the same pattern. Gambella National Park harboured 152 bird species in an area of 5061 km² (Hillman 1993). The present study area is half the size of Gambella National Park, where almost the same number of species was recorded. This shows a high bird species diversity in the Alatish National Park. More species of birds would have been recorded in the area, had the area been free from habitat modification and destruction and if intensity and duration of observation were prolonged.

The diversity of bird species in Alatish could be due to the presence of diverse food resources. Most bird species in Alatish were locally rare and uncommon. Species such as *Psittacula krameri*, *Ephippiorhynchus senegalensis*, *Pluvians aegyptius* and *Burhinus oedicephalus* are also rare in East Africa (Perlo, 1995). Others such as *Bubo africanus* and *Buhnus remiculatus* are uncommon in East Africa. The occurrence of such species makes Alatish an important wildlife conservation area.

Wooded grassland and riverine woodland had the highest bird species diversity during the wet season as these two habitats provide variety of food items. Further, water was adequately available in both these habitats. The presence of sufficient cover during the wet season also contributed to the higher species diversity

Table 2. Avian species diversity and abundance during the wet and dry seasons.

Habitat type	Species number		Abundance	H'	H'/H'max			
	Wet	Dry			Wet	Dry	Wet	Dry
Riverine woodland	73	96	5145	32423	3.66	2.28	0.85	0.48
Wooded grassland	77	54	9436	18811	3.66	3.09	0.84	0.70
Woodland	45	44	4246	8742	3.31	3.71	0.87	0.89
Bamboo woodland	40	53	1911	2521	3.56	3.65	0.93	0.92

richness and evenness in the two habitats. Similarly, during the dry season avian species diversity was the highest in the riverine woodland habitat followed by wooded grassland. Water was available only in the riverine woodland area during the dry season. The presence of patches that had grasses provided food for birds in this wooded grassland habitat. This also has contributed to the increase in diversity, richness, and evenness of aves during the dry season in this habitat type.

Each habitat has a specific set of microenvironment that is suitable for a species (Sreekumar and Balakrishnan 2001). Thus, habitat requirement might have determined each species distribution in Alatish Park area. As disturbance was minimal during the wet season, most bird species were distributed in most habitat types in Alatish. However, frequent incidence of fire by the nomads in the natural habitat that provided breeding ground, food and cover, most of the bird species were restricted to certain type of habitats during the dry season. Scarcity of water and food during the dry season could lead them to change their previous ranges. Species such as Rose-ringed parakeet (*Psittacula krameri*) and Green wooded hoopoe (*Phoeniculus purpureus*) were present along Alatish River in the centre and Hayma River in the south during the wet season. However, due to shortage of food along the rivers owing to large number of livestock during the dry season, their range was restricted to the centre. Migratory birds such as Stone curlew (*Burhinus oedipnemus*) also visited the area during the dry season (Urban and Brown 1971).

Vegetation classification based on structural features of habitat is important in the study of birds in open habitats (Bibby et al. 1998). Flowering plants support wide variety of birds as they feed on nectars, berry, fruits and seeds (Brook and Berkead 1991). During the wet season, flowering plants were flourishing and as a result, food was plentiful for birds in almost all the habitats. However, during the dry season, the deciduous trees defoliate and in the absence of food, many species of birds were restricted to riverine woodland habitat where water was available. Thus, during the dry season, the wooded grassland and woodland habitats showed similarity in bird composition. Both these habitats were dry as they were far away from the water sources and relatively undisturbed by nomads. This might have also contributed to the similarity in the composition of birds of the two habitats. During this season, the whole area of ANP was burnt, but patches remain in places where grass was wet during burning. These patches had insects

and large number of rodents which formed important sources of food for birds. Moreover, during this season, the wooded grassland and woodland habitats were comparatively used less by nomads as compared to the riverine woodland habitat contributing further for the nomadic community to forage.

CONCLUSION AND RECOMMENDATIONS

The presence of 143 species of birds revealed the importance of Alatish for wildlife protection. The distribution of birds in different habitats was based on availability of food, water and cover. Accordingly, the wooded grassland habitat had highest avian species diversity and richness during the wet season, while this was true in the riverine woodland habitat during the dry season. This clearly shows the response of birds to climatic changes. The riverine and bamboo woodland habitat were comparatively moist as they occurred near Alatish and Hayma Rivers. High species diversity and richness in the riverine woodland during the dry season revealed the importance of this habitat. Most avian species observed were locally rare and uncommon, although Alatish is identified as a rich biodiversity area. The occurrence of endangered, rare and vulnerable bird species makes Alatish an area of conservation importance. The woody vegetation in Alatish area is also known to protect expansion of desert from the adjoining Sudan region.

Based on the present study, we recommend the following:

- The activities of nomadic Falata community should be regulated to minimize the effect on the wildlife in Alatish.
- Logging trees and setting fire destructs the wildlife habitats and their breeding nests. This should be controlled.
- Artificial ponds should be constructed at certain interval in Alatish to avail water for wildlife.
- Further study especially on smaller and cryptic bird species needs to be conducted to provide more information on the diversity of birds in the area.
- Alatish is also rich in other vertebrate species. Moreover, the vegetation was not systematically studied in Alatish. Therefore, a multidisciplinary approach is needed to fill the gap.

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