

Full Length Research Paper

The diversity, abundance and habitat association of medium and large-sized mammals of Dati Wole National Park, Western Ethiopia

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Knowledge of the faunal diversity, abundance and habitat preference are basics for the status determination and proposing appropriate conservation measures. A survey was conducted to assess the diversity, relative abundance and habitat association of medium and large-sized mammals of the Dati Wole National Park, Western Ethiopia from September 2012 to April 2013. It was hypothesized that the area is rich in mammalian species that prefer to live in grassland and woodland close to water source. Four habitat types were assessed during the study (wetland, woodland, riverine forest and grassland). Line transect survey method was used to collect data in the four sampled habitats. A total of 28 mammalian species were recorded. Woodland was the habitat with the most diversity of mammals ($H' = 2.643$) followed by riverine forest ($H' = 1.60677$), and the wetland was considered the habitat with the least diversity of species ($H' = 1.04086$). *Hippopotamus amphibius* (hippopotamus; 43.92%) and *Syncerus caffer* (African buffalo; 33.3%) were the most abundant species, while *Mellivora capensis* (honey badger) and *Ichneumia albicauda* (black backed jackal) were the least observed (0.099%, each). The greatest species similarity was recorded between woodland and grassland ($SI = 0.76$) and the lowest was between woodland and wetland ($SI = 0.4$). Thorough inventory for faunal diversity, involving multiple seasons and all vertebrates, strengthening the now loose park management by involving the local people will ensure the sustainability of the ecosystem in supporting the rich biodiversity components.

Key words: Diversity indices, evenness, habitat preference, mammals, species richness, transect lines.

INTRODUCTION

The mammalian fauna of Ethiopia is under study (Bekele and Yalden, 2014). Yet, with about 320 species currently recorded, the country is one of Africa's most diverse nations for mammals (Vreugdenhil et al., 2012). Among these, 36 species are endemic, about a quarter of which

are large mammals (Tefera, 2011). Endemism even occurs at the level of genera with six endemic genera of mammals recorded so far of which four are monotypic (Mega-dendromys, Muriculus, Nilopegamys, and Theropithecus) and the other endemic genera are

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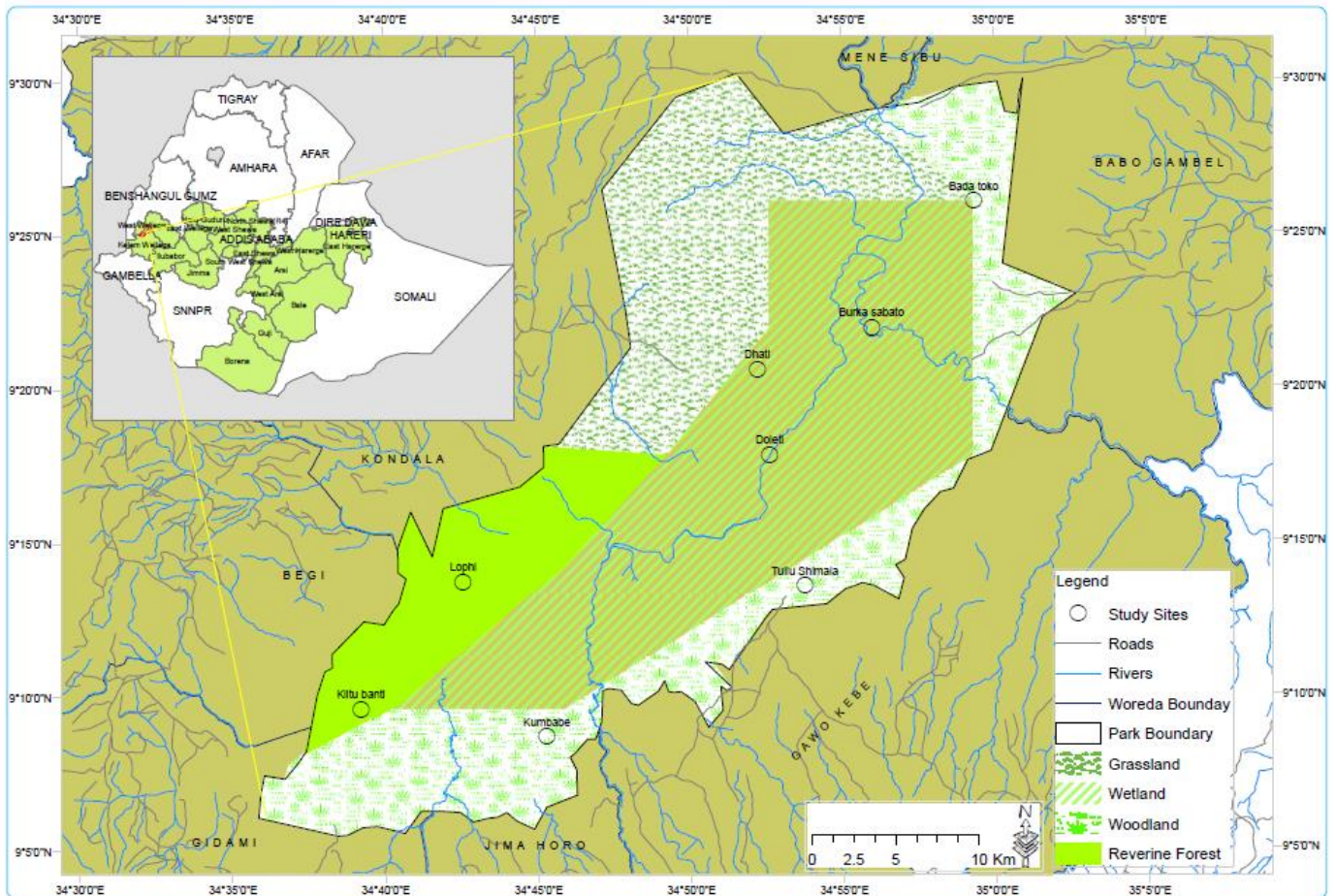


Figure 1. Map of the study area.

Desmomys and *Stenocephalemys* (Vreugdenhil et al., 2012).

The under estimated faunal records of the country are only from the protected areas, where they are relatively well preserved (Young, 2012), but the records and conservation status are still poorly known outside these areas (Bekele and Yalden, 2014). In addition, ranges of natural ecosystems of the country are continually collapsing mainly for the anthropogenic reasons (Yosef et al., 2010). Hence, more than ever, the survival of wildlife species outside the protected areas is at high risk (Largen, 2001; Bekele and Yalden, 2014).

Despite the protection guaranteed to national parks in the most recent Wildlife Proclamation, most parts of the oldest and legally gazetted Ethiopia's protected areas are increasingly degraded and the boundaries are being reviewed. The illegally encroached parts are being converted for subsistence and commercial agriculture, timber used for fuel wood and construction, protected grasslands used for livestock grazing that severely threatening the existing wildlife (Young, 2010). As a result of these, most populations of the medium and large sized mammals are severely depleted and difficult to see

almost everywhere in the country, including most protected areas. These issues are crucial when it comes to the young wildlife protected areas.

Dati Wolei is among the few youngest protected areas in the western tropical forest belt of the country with unique ecosystem and diversified faunal resources (Vreugdenhil et al., 2012). More than half of the area of the park is covered by wetland and followed by the woodland, and the riverine forest covers the least (Figure 1). The park is reputed for harboring the highest population of Hippos and African Buffalos in the country (Bekele and Yalden, 2014). The park was initially designated as a controlled hunting area. However, as there was no well-established regulation for such activity associated with poor enforcement of the existing legislation, the mammalian resources were severely threatened (Young, 2010). To correct these problems, the area was upgraded to the regional park level in 2008 and to the national park status with all the logistics in 2010 (Vreugdenhil et al., 2012; Young, 2010). However, beyond the observational records, no attempts were made to assess the faunal diversity of the area, particularly of the most vulnerable larger and medium sized mammals.

Knowledge of the faunal diversity records, their abundance and the preferred habitats are basics for the status determination and to propose appropriate conservation measures (Galetti et al., 2009). In particular, medium and large sized mammals are intolerant for human interference, and remain the best indicators for most isolated healthy habitats (Costa et al., 2005; Galetti et al., 2009; Tabarelli et al., 2010; Mohammed and Bekele, 2014). Hence, we hypothesized that the area is rich in mammalian fauna that prefer to live in grassland and woodland close to water source.

Therefore, the present study was aimed to document the mammalian diversity of the area as base line information for better management of the resources.

MATERIALS AND METHODS

Study area

This study was conducted in the Dati-Wole National Park, Oromia National Regional State, Western Ethiopia. The area is located between 67° 55' 49" and 72° 45' 03" E longitude and between 10° 05' 25" and 10° 51' 01" N latitude (Figure 1). The altitude within the park ranges between 1390 and 1500 masl and covers an area of 1035 km² (Vreugdenhil et al., 2012). The study area was classified into four habitat types: the wetland, woodland, riverine forest and savanna grassland. The national park shares the northwestern portion of the southwestern tropical forest part of the country and receives over 1350 mm average annual rainfall. The area is relatively hot, with mean maximum and minimum temperature ranging between 27 and 29°C and between 15 and 17°C, respectively (EMA, 2013).

Methods

The data to study the diversity, relative abundance and habitat association of medium and large sized mammals in the Dati-wole National park were collected through direct observation from the established transect lines in each habitat type. In total, seven study centers were selected (Burkasabato, Doleti, Lophi, Kumbabe, Kiltubanti, Badatoko and Garaarba) (Figure 1). Forty transect lines were established, being 18 for wetland, 12 for woodland, 7 for the riverine and 6 for grassland habitats depending on the area cover of each habitat. In the woodland, transect length of 1.5 km and width of 100 m, in Wetland transect length of 3.5 km and width of 200 m, in Riverine forest transect length of 3 km and width of 50 m and in Grassland transect length of 2 km and width of 200 m were used.

Each transect in each habitat was surveyed once every two months for eight months (from September/2012 through April/2013). Transects were visited two times during every survey. Two individuals were assigned per transect and all transects in each habitat were surveyed at the same time (between 06:00 and 10:00 am in the morning and between 16:00 and 18:00 in late afternoon). The identity of the observed species, group size, sex and age of individuals were recorded. For the species identification of the mammals, field guides (Kingdon, 1997; Yirga, 2008) and local people were consulted. Body size, pelage coloration, horn and dominant behavior were used to categorize sex and age of the observed mammal. In addition, indirect evidences observed within the transect lines (pug marks, hooves, foot marks, scats/pellets, calls, quills and burrows) were also used according to Sutherland (2007). During this study, body weight was a parameter used to categorize mammals into medium and large sized. Accordingly,

mammals weighing between 2 and 7 kg were considered medium and all above this were categorized large sized (Emmons and Feer, 1997). The numbers of individuals of each species observed, time and habitat type were recorded during the survey. Observations were made with naked eye or aided by binocular (7 x 50 mm).

The identified mammals were grouped as common (if probability of seeing was 100% in every time of the fieldwork), uncommon (if probability of seeing was more than 50%), and rare (if probability of seeing was less than 50%) according to Hillman (1993). Shannon-Wiener Index (H') ($H' = -\sum [(\frac{n_i}{N}) \times \ln(\frac{n_i}{N})]$) and Simpson similarity index ($S_i = \frac{nc}{a+b+c}$) were used to compare mammalian diversity and their similarity among habitats, respectively ((Krebs, 1978). The evenness (J) of mammalian species was calculated as $J = \frac{H'}{H_{max}}$; where $H_{max} = \ln(S)$ and S is the number of species (Krebs, 1978). The abundance of mammalian species in each habitat was computed using the formula (Negussie, 2009):

Abundance = Total number of individuals of species/sampled habitat

RESULTS

Species composition

During this survey, we recorded 3021 individuals of 28 mammalian species distributed in seven orders and 14 families (Table 1). Of these, about 15% (4 species): crested porcupine (*Hystrix cristata*), stark's hare (*Lepus starcki*), bush hyrax (*Hetrohyrax brucei*) and rock hyrax (*Procavia capensis*) were medium-sized mammals while the remaining 85% (24 species) were large-sized mammals. Carnivora was represented by the largest number of families (six) and species (11). More mammalian species was recorded for the families Bovidea (five specie), followed by Felidae and Cercopithecii (each with four species). The families Procaviidae, Suidae and Hyaenidae contained 2 species each. The remaining families were represented by single species (Table 1).

Relative abundance

Among the 28 species of mammals, *Hippopotamus amphibius* (hippopotamus) was the most abundant, comprising 43.92% of the recorded individuals, followed by *Syncerus caffer* (African buffalo), with 33.3%. *Icheumia albicauda* (black-backed jackal) and *Mellivora capensis* (honey badger) contributed only 0.099% each of the total recorded individuals (Table 2).

Diversity indices of mammals in the four habitat types

Among the four habitat types, woodland supports the greatest diversity of mammalian species ($H' = 2.643$), wetland being with the lowest ($H' = 1.04086$). The species

Table 1. Mammalian species identified in the Dati Wolel National Park, Ethiopia.

Order	Family	Common name	Scientific name	Local name
Carnivora	Felidae	Lion	<i>Pantheraleo</i>	Lencha
		Leopard	<i>Pantherapardus</i>	Qeransa
		Africa wild cat	<i>Felisservestris</i>	Adala
		Serval cat	<i>Felisserval</i>	Dero
	Hyaenidae	Spotted Hyaena	<i>Crocutacrocuta</i>	Worabessa
		Striped hyena	<i>Hynaehyanae</i>	Worabessa
	Canidae	Common jackal	<i>Canisaureus</i>	Jedala
		Black-backed jackal	<i>Canismesamolas</i>	Jadala
	Hyrpestidae	White-tailed mongoose	<i>Icheumiaalbicauda</i>	Fochi
	Mustelidae	Honey badger	<i>Mellivoracapensis</i>	Hama
Viverridae	African civet	<i>Civettictiscivetta</i>	Xirinyi	
Artidactyla	Bovidae	African buffalo	<i>Synceruscaffer</i>	Gafarsa
		Common bushbuck	<i>Traglyphusscriptus</i>	Bosonu
		Klipspringer	<i>Oreotagusoreotagus</i>	Borte
		Tora hartebeest	<i>Alcelaphusbuselaphus</i>	Korke
	Hippopotamidae	Common reedbuck	<i>Reduncaarundinum</i>	Worabo
		Hippopotamus	<i>Hippopothamusamphibus</i>	Robi
	Suidae	Bush pig	<i>Potamochoeruslarvatus</i>	Boye
		Warthog	<i>Phacochoerus africanus</i>	Karkaro
Primate	Cercopithecii	Vervet monkey	<i>Chlorocebusaethiops</i>	Qamale
		Colobus monkey	<i>Colobusabyssinicus</i>	Weni
		Debraza monkey	<i>Cercopithecusneglectus</i>	----
		Olive baboon	<i>Papioanubis</i>	Jaldesa
Hyracoidea	Procaviidae	Bush hyrax	<i>Hetrohyraxbrucei</i>	Osoleholka
		Rock hyrax	<i>Procaviacapensis</i>	Osoledaga
Tubulidentata	Oryctestidae	Aardvark	<i>Orycteropusaffer</i>	Waldigesa
Lagomorpha	Leporidae	Stark's hare	<i>Lepusstarcki</i>	Hileti
Rodentia	Hystricidae	Crested porcupine	<i>Hystrixcristata</i>	Xade

evenness was highest in woodland ($J=0.936$), and lowest in Grassland habitat (Table 3).

Species similarity index

Among the four habitat types, more similarity of mammalian species was observed between woodland and grassland ($SI=0.76$) followed by woodland and riverine forest ($SI = 0.59$). The similarity was lower in woodland and wetland species ($SI = 0.4$) and wetland and riverine forest ($SI = 0.48$) (Table 4).

DISCUSSION

Dati Wolel National Park has unique ecosystem, being at north western edge of the southwestern tropical forest of

the country. The large extent of woodland savanna grassland, the Reverine forest associated with wetland form ideal habitats for medium and large sized mammals. However, the total number mammalian species (28) recorded during the present study was relatively low when compared with other relatively younger national parks in Ethiopia. For instance, Woldegeorgis (2010) reviewed 37 species for Nechisar, 38 for Mago and 40 for Omo National Parks. The mammalian diversity seems less probably because the list does not include all mammalian species especially medium sized mammals as they can be overlooked and no special method is employed for them separately.

Several scholars (Tews et al., 2004; Matias et al., 2011) showed the positive correlation between habitat heterogeneity and animal species diversity. Among the four habitats in the study area, the heterogeneous plant species

Table 2. Number of each mammalian species recorded and their relative abundance in the Dati Wole National Park, Ethiopia.

Species	Habitat				Total	Abundance (%)
	WTL	WL	GL	RF		
<i>H. cristata</i> (Crested porcupine)	-	5	1	-	6	0.198
<i>L. starcki</i> (Stark's hare)	-	7	4	5	16	0.529
<i>H. brucei</i> (Bush hyrax)	-	-	7	9	16	0.529
<i>P. capensis</i> (Rock hyrax)	-	35	-	-	35	1.155
<i>O. afer</i> (Aardvark)	-	5	2	-	7	0.23
<i>C. aethiops</i> (Vervet monkey)	18	20	32	16	94	3.1
<i>C. abyssinicus</i> (Colobus monkey)	-	-	-	32	32	1.056
<i>C. neglectus</i> (Debraza monkey)	-	-	-	16	16	0.52
<i>P. panubis</i> (Leopard)	27	20	14	15	76	2.5
<i>S. caffer</i> (African buffalo)	701	46	65	194	1006	33.3
<i>T. scriptus</i> (Common bushbuck)	-	3	4	4	11	0.36
<i>O. oreotagus</i> (Klipspringer)	-	3	2	-	5	0.165
<i>A. buselaphus</i> (Tora hartebeest)	25	-	13	-	38	1.25
<i>R. arundinum</i> (Common reedbuck)	58	-	28	-	86	2.84
<i>H. amphibus</i> (Hippopotamus)	727	-	600	-	1327	43.92
<i>P. larvatus</i> (Bush pig)	-	4	9	-	13	0.42
<i>P. africanus</i> (Warthog)	18	16	15	3	52	1.7
<i>P. leo</i> (lion)	10	5	-	7	22	0.72
<i>P. pardus</i> (leopard)	-	14	-	6	20	0.66
<i>C. crocuta</i> (Spotted hyaena)	-	47	22	4	73	2.4
<i>H. hynae</i> (Stripped hyaena)	-	18	5	-	23	0.75
<i>F. servestris</i> (Africa wild cat)	-	4	2	-	6	0.198
<i>I. albicauda</i> (White-tailed mongoose)	-	1	4	2	7	0.23
<i>C. aureus</i> (Common jackal)	5	3	2	2	12	0.39
<i>C. mesamolas</i> (Black-backed jackal)	-	-	3	-	3	0.099
<i>M. capensis</i> (Rock hyrax)	-	-	-	3	3	0.099
<i>C. civetta</i> (African civet)	-	7	2	-	9	0.297
<i>F. serval</i> (African wild cat)	-	6	-	1	7	0.23
Total (28)	1559	279	834	319	3021	100

Table 3. The mammalian species diversity (H') and evenness (J) in different habitat types in the Dati Wole National Park, Ethiopia.

Habitat	Number of spp.	Abundance	Diversity (H')	Evenness (J)
Wetland	9	317.8	1.04086	0.50054
Woodland	21	55.8	2.643	0.936
Riverine forest	16	79.75	1.60677	0.579
Grassland	21	208.5	1.0677	0.350

Table 4. The similarity of mammalian species among the four habitat types in the Dati Wole National Park, Ethiopia.

Habitats	Wet land	Woodland	Riverine forest
Wet land	-	-	-
Wood land	0.4	-	-
Riverine forest	0.48	0.59	-
Grass land	0.533	0.76	0.54054

assemblage available in woodland and riverine forest contributed to the recorded high diversity of mammals in these habitats. Chane (2010) reported a high diversity and evenness of medium and large-sized mammals from Woodland and Riverine forest in Borena-Sayint National Park, South Wollo, Ethiopia. On the contrary, habitat homogeneity was reported for lower diversity (Mekonnin et al., 2011).

The distribution and habitat association of mammals are often correlated mainly with the availability of water, food and cover (Yaba et al., 2011; Girma et al., 2012). The high abundance of mammalian species in Grassland, in this study, might be due to these factors. The highest species similarity record between woodland and grassland might be due to the high similarity of vegetation between the two habitats. Similar result was reported by Mengesha and Bekele (2008) for the Alatish National Park, Ethiopia.

Dati Wolel National Park is unique in harboring the highest number of mega herbivores specially the African buffalo (*S. caffer*) and hippopotamus (*H. amphibious*) relative to any of the parks in the country (Bekele and Yalden, 2014). The extensive grassland surrounding the wetland may contribute to the abundance. Some mammalian species like Warhog (*Phacochoerus africanus*), Vervet monkey (*Chlorocebus aethiops*), Olive baboon (*Papio Anubis*), Common jackal (*Canis aureus*) including the African buffalo (*S. caffer*) were considered more adaptive and recorded from all habitats in the study area. The distribution of these mammals in all habitat types indicates their adaptation to a variety of habitat types. However, some such as hippopotamus (*H. amphibious*) and common reedbuck (*Reduca arundinum*) have highly restricted distribution (around wetland and grassland). In this regards, the ecological preference and evolutionary adaptation of the mammalian species play a role in their distribution in different habitat types (Bailey, 1984).

During this study, some nocturnal and cryptic species such as Honey badger (*Mellivora capensis*) and Black backed jackal (*Canis mesomelas*) were under reported. Particularly, these two carnivores are considered vermin known for raiding goats, sheep and poultry, hence easily targeted for human persecution. Local informants reported that, Honey badger is also in a continuous conflict with farmers for breaking hives. Similar observation was reported by Chane (2010), who recorded the least number of both species from Borena-Sayint National Park, located in the Northern Ethiopian.

The adverse effect of livestock and human settlement on the distribution of wild animals has been reported (Bonnington et al., 2007; Gundogdu, 2011). The high number of mammalian species in woodland might be due to the movement of many species from the peripheral area towards the inner in search of food and cover as this habitat is the most inaccessible for human activities and livestock. Regardless of this minor human encroachment into the park areas and the prevailing poaching activities

by sporadic hunters, Dati Wolel National Park possesses unique habitat with high potential of conserving biodiversity. The park contains diversities of habitats suitable for diversities of flora and the associated fauna. Hence, thorough inventory for faunal diversity, involving multiple seasons and all vertebrates, strengthening the now loose park management will ensure the sustainability of the ecosystem in supporting the riche biodiversity components.

Conflict of interests

The authors did not declare any conflict of interest.

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