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POPULATION STATUS AND HABITAT ASSOCIATION OF KLIPSPRINGER (*Oreotragus oreotragus* Zimmermann) FROM YETEFET WOYENAT FOREST, EAST GOJJAM, ETHIOPIA

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ABSTRACT: Klipspringers (*Oreotragus oreotragus* Zimmermann) are small ungulates with wide geographical range in Africa. The present study deals with the population status and habitat association of klipspringer from Yetefet Woyenat Forest. The study was conducted from September, 2018 to August, 2019 covering both dry and wet seasons. Total count method was used to collect data on current population status of klipspringer by classifying the area in to different blocks. Habitat types where klipspringers mostly spent were also recorded. Data were analyzed using descriptive statistics and chi-square test. On average of 36 individuals of klipspringers were recorded in the study area. Of these, 32 individuals were recorded during the dry season and 40 individuals during the wet season. There was no significant difference in the population size between dry and wet season ($\chi^2 = 0.89$, df = 1, $p > 0.05$). The sex ratio of adult males to adult females was 1.00: 1.23. Klipspringers were mostly observed as solitary or in pairs. Occasionally they form small groups, a male and one or more females with their offspring. The group size varied with food abundance and quality. Mean group size was 2.28±0.7 and 3.07±0.91 during dry and wet seasons, respectively. The population of klipspringer can increase in due time as a result of higher number of adult females than adult males. Habitat encroachment and overgrazing should be minimized. Therefore, the regional government should work with the local people to conserve the animal and other wildlife of the area.

Key words/phrases: Group size, habitat preference, population status, sex ratio, Yetefet Woyenat Forest

INTRODUCTION

Klipspringers (*Oreotragus oreotragus* Zimmermann) are small ungulates and adult females (13 kg) slightly larger than males (10 kg) (Skinner and Chimimba, 2005). Often, males and females form long term pair bonds, and both exhibit territorial behaviour (Norton, 1997). However, small, temporary groups of up to six individuals may assemble in favorable feeding sites (Skinner and Smithers, 1990).

Klipspringers have wide geographical ranges in Africa, occurring from the mountain of the South Cape northward to the highlands of Ethiopia (Wilson and Reeder, 1993). However, in spite of this range, it has received very little attention by researchers. This is largely because of its preference for inaccessible rocky mountain habitats which makes difficult to study. They are restricted to rocky habitats including rocky hills and gorges as high as 4000 m a.s.l (Burger *et al.*, 1997). Males spend more time in anti-predator vigilance behavior, compared to females, which enable females to concentrate a greater proportion of their energy on reproduction. When disturbed, the vigilant adult produces a warning alarm call to allow the other adults and young ones time to retreat a short distance to the safety of rocky, sheltered habitats, before turning to face the source of threat (Norton, 1997).

Klipspringers are vulnerable to both hunting and competition from livestock. These threats have resulted in populations being eliminated in some areas and rare in others (Kingdon, 1997). Klipspringers commonly occur in Yetefet Woyenat Forest. However, so far ecological studies were not carried out. Therefore, the present study focused on population status and habitat association of klipspringer from Yetefet Woyenat Forest, East Gojjam, Ethiopia.

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MATERIALS AND METHODS

Study area description

The study was carried out in Yetefet Woyenat Forest, which is located in Amhara Regional State, East Gojjam Zone, Enebsie Sar Midir Woreda at a distance of 365 km northwest of Addis Ababa and (Fig. 1). It is located at 10˚52′-10˚60′ North latitude and 38˚ 17′-38˚ 25′ East longitude (ESWFEO, 2014). The Forest covers an area of 102 ha. The area is generally characterized by rough topography, deeply incised valleys, escarpments and plateaux (Agriservice Ethiopia, 2004). The annual pattern of rainfall in the area is unimodal ranging from June to September. The maximum rainfall is recorded in August while the minimum is in January and February. The mean annual rainfall is 1053 mm, ranging from 941 to 1203 mm. The temperature ranges from 9.5°C to 27.5°C (Agriservice Ethiopia, 2004).

The area is known by the presence of a variety of plant species. The dominant plant species in the area are *Carissa edulis*, *Rosa abyssinica*, *Myrsine africana*, *Acacia species*, *Dodona angustifolia, Albizia schimperi, Syzygium guineense*, *Allophyllus abyssinicus*, *Croton macrostachyus*, *Euclea racemosa, Olea europaea, Maytenus arbutifolia* and others (ESWFEO, 2014). Besides, mammals such as bushbuck (*Tragelaphus scriptus*), Vervet monkey (*Cercopithecus aethiops*), spotted hyaena (*Crocuta crocuta*), aardvark (*Orycteropus afer*), hares and rock hyrax (*Procavia capensis*), and different species of birds including Hardwood francolin reside in the study area (ESWFEO, 2014).

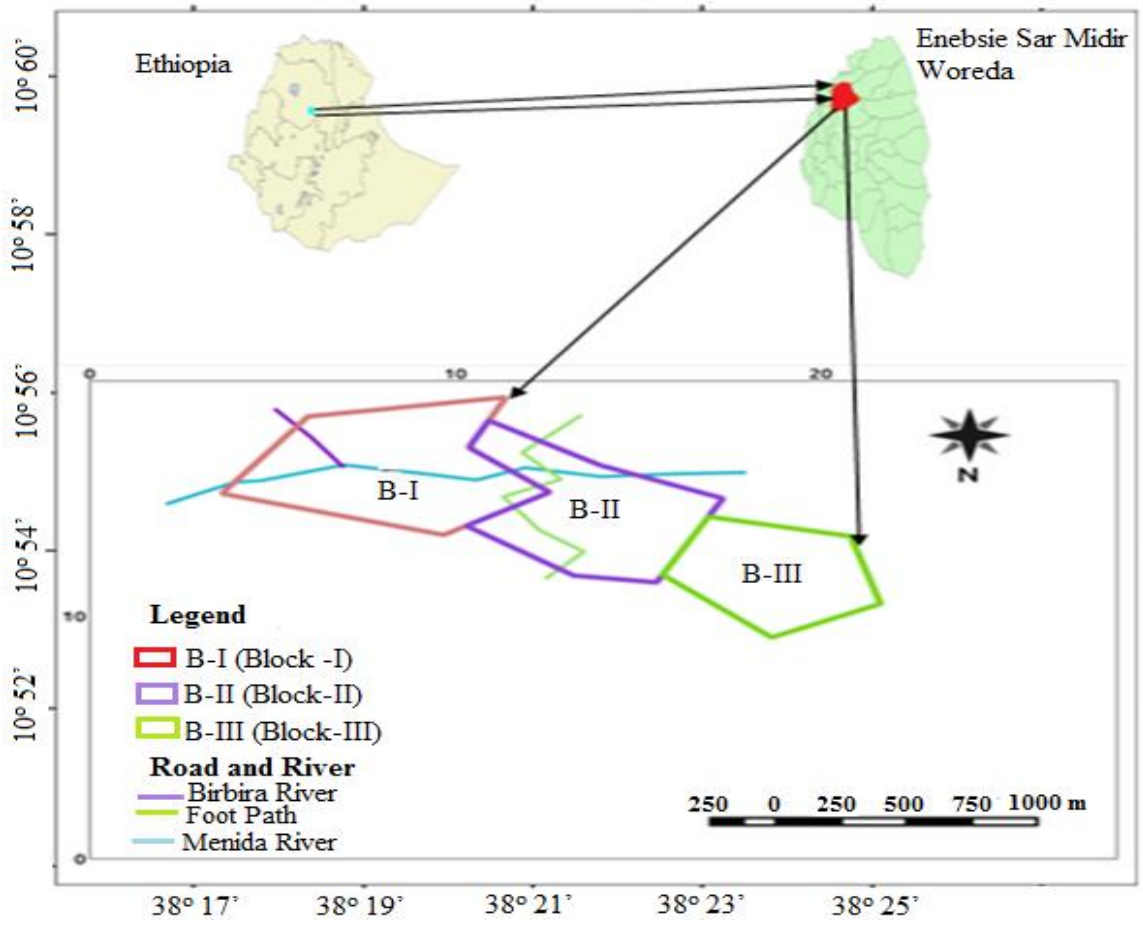

Figure 1. Map of Enebsie Sar Midir Woreda and Yetefet Weynat Forest.

METHOD

Population estimate

Preliminary survey was conducted to gather information such as accessibility, climatic conditions, vegetation types, fauna and topography of the study area. Key informants were also employed to identify the location of klipspringers population in the study area.

The actual data collection was carried out from September, 2018 to August, 2019 to cover both wet and dry seasons. To estimate the population size of klipspringers, total count method was employed in different blocks. Direct observation technique is the most appropriate method for relatively open habitats and on fairly flat terrain (Andanje and Ottichilo, 1999). To identify ranges of klipspringers, the study area was classified into three different blocks based on artificial and natural boundaries, and vegetation types. Block-I mainly contained mixed grassland, Block-II consisted of forest and, Block-III had grass. Counting was carried out once a month for three consecutive days during each season. To avoid double counting, trained assistants were assigned in each counting site. Census was conducted from 07:00 to 10:00 hours in the morning and 16:00-18:00 hours in the late afternoon simultaneously in each block when animals were most active and visibility was good (Wronski *et al.*, 2006). The movement of the observer was against the direction of the wind in order to minimize detection by the animals, and noise was minimized to reduce disturbance of individuals.

During the census period, detailed observation of the entire herd was carried out and categorized as adult male, adult female, sub adult male and female, and Juvenile. The size of each herd (group) of klipspringers was recorded. The respective sex and age categories were determined based on body size, presence or absence of horns and size of horns (Brashares and Arcese, 2002).

Data analysis

Data were analyzed using SPSS software version 20 and Microsoft Excel. Chi-square test was used to compare population sizes across habitat types and used to see significant differences in populations between the wet and dry seasons.

RESULTS AND DISCUSSION

Population estimate

On average, 36 individuals were recorded in the study area. Of these, 32 and 40 individuals of klipspringer were recorded during the dry and wet seasons, respectively (Table 1). However, there was no significant difference between dry and wet seasons counting (χ^2 = 0.89, df = 1, p > 0.05). Among blocks, the highest average number was 16 in B-I and the lowest counted was 6 in B- II while B-III had 14. There was a significant difference (χ^2 = 4.67, df = 2, p< 0.05) in the number of individuals among blocks.

Table 1. Count of klipspringers during wet and dry seasons.

Season Total	B-I	B- II	B- III
Dry 32 (100%)	14 (43.75%)	6 (18.75%)	12 (37.5%)
Wet 40 (100%)	18 (45%)	6 (15%)	16 (40%)
Mean 36 (100)	16 (44.4)	6 (16.66)	14 (38.88)

The total number of klipspringer in all blocks was 32 during the dry season. These were 14(43.8%), 6 (18.8%) and 12 (37.5%) in B-I, B-II and B-III, respectively. The highest number of klipspringer was observed in B-I (14) and the lowest was recorded in B- II (6) during the study period during the dry season. There was a significant difference (χ^2 = 3.25, df = 2, p < 0.05) in the number of klipspringer among blocks of the study area during the dry season (Fig. 2). On the other hand, the total number of klipspringer in all blocks was 40 during the wet season. These were 18(45%), 6(15%) and 16 (40%) in B-I, B-II and B-III, respectively. The highest number of klipspringer was observed in B-I during the wet season (18) and the lowest was recorded in B-II (6) during the study period. There was a significant statistical difference (χ^2 = 6.2, df = 2, p < 0.05) in the number of klipspringers among blocks of the study area during the wet season (Fig. 2).

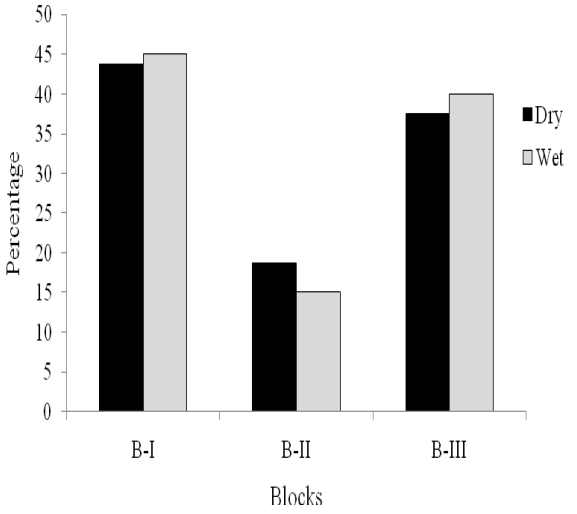

Figure 2. Relative abundance of klipspringer during the dry and wet seasons in three blocks of Yetefet Woyenat Forest

Sex structure

There was a significant difference (χ^2 = 25.3df = 2, p < 0.05) in the number among the different sex groups both during wet and dry seasons in all blocks of the study area. Among the populations sighted in Yetefet Woyenat Forest during both dry and wet seasons at different blocks, females on average constituted 32 (44.5%), males 36 (50%) and undefined juveniles were 4 (5.6%). There was no difference in the number between females and males in all blocks of the study sites during both wet and dry seasons. The difference was not statistically significant (χ^2 = 0.23, df = 1, p > 0.05) (Table 2).

Table 2. Sex structure of klipspringer during wet and dry seasons

	Sex			
Season	Male	Female	Juvenile	Total
Dry	15(20.8%)	15 (20.8%)	2 (2.7%)	32 (44.4%)
Wet	17 (23.6%)	21 (29%)	2 (2.7%)	40 (55.5%)
Total	32 (44.4%)	36 (5.5%)	4 (5.5%)	72 (100%)

The sex ratio of klipspringers during wet and dry seasons in all blocks was represented in Table 3. The ratio of males to females was 1:1 and 1:1.23 during the dry and wet seasons, respectively. There was no significant statistical difference between male and female sex ratio during the dry (χ^2 = 2.3, df = 1, p > 0.05) and wet seasons (χ^2 = 0.42, df = 1, p > 0.05). In addition, the sex ratio of adult male to adult female was 1:1.2 and 1:1.23 and sub adult male to sub adult female was 1:0.6 and 1:1.25 during the wet and dry seasons, respectively. There was no statistical significant difference in adult male to adult female sex ratio during dry (χ^2 = 0.182, df = 1, p > 0.05) and wet seasons (χ^2 = 0.31, df = 1, p > 0.05).

Table 3. Sex ratio of klipspringer during the wet season in three blocks of Yetefet Woyenat Forest

	Sex ratio		
Season	M:F	AM:AF	SAM:SAF
Dry	1:1	1:1.2	1:0.6
Wet	1:1.23	1:1.23	1:1.25
Mean	1:1.125	1:1.2	1:0.88

Group size

During the dry season, a total of 14 groups were observed with the mean group size of 2.28±0.70. However, during the wet season, the groups observed were 13 with a mean group size of 3.07±0.91. The number of groups recorded in the study area across seasons was statistically insignificant (χ^2 = 0.04, df =1, p > 0.05). The group size differed within the wet and dry seasons. The highest range of group size was recorded during the wet season from 1 up to 4 individuals, whereas the minimum group size was recorded during the dry season 1up to 3 individuals. The mean range of groups of klipspringers was from 1 up to 3.5. Large group sizes of klipspringers were aggregated during the wet season while during the dry season, they split further in smaller groups spreading in a wider area (Table 4).

Table 4. Group size of klipspringers during the wet and dry seasons

Season	Number	Group number	Mean group size	Range of group size
Wet	40	13	1-4	3.07
Dry	32	14	1-3	2.28
Mean	36	13.5	1-3.5	2.67

Habitat association

Klipspringers were distributed in three different habitat types of the study area. Habitat association varied according to seasons. There was a significant difference in the number of klipspringer among the three habitats during the dry (χ^2 = 7.4, df = 2, p < 0.05) and wet seasons (χ^2 = 6.66, df = 2, p < 0.05) based on the number of individuals sighted. However, seasonal distribution was not statistically significant

between wet and dry seasons among the three habitat types ($F_{1\ 70}$ = 0.22, p > 0.05). The highest number was observed in mixed grassland during the wet (18) and dry (14) seasons. On the other hand, the lowest number of individual was recorded in the forest habitat equally during both the wet (6) and dry (6) seasons (Fig. 3).

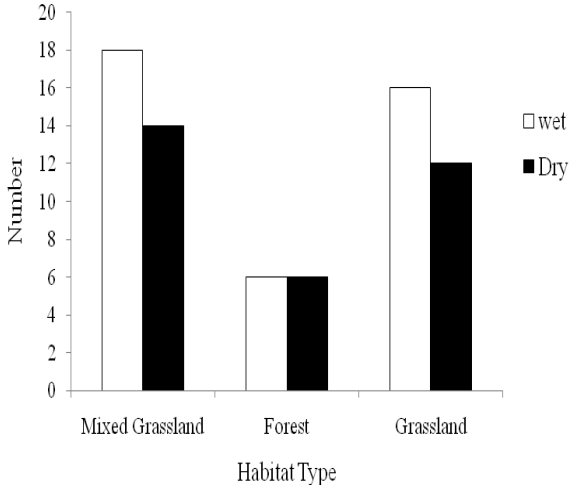

Figure 3. Number of klipspringers observed at different habitat type.

Estimating animal abundance is essential for studying population ecology and devising appropriate conservation strategy and management (Wilson and Delahay, 2001). According to the present study, a total of 32 individuals during the dry season and 40 during the wet season were recorded in the study area. Although, the difference was not statistically significant (χ^2 = 0.89, df=1, p > 0.05), there was a slight increase in the number of individuals counted during wet season. This might be due to the difference in the availability of more food resource during the wet season. During the dry season, when the availability of food item declines, klipspringer may migrate to other localities in search of food. In addition, klipspringers are more vulnerable to predator during the dry season due to grass height. Klipspringer is more vulnerable to predation compared to other African antelopes because they live in an open habitat. Spotted hyaenas, common jackals, wildcat, hamadryas baboons and eagles are the common predators of klipspringer (Norton, 1997).

The study shows that the male to female sex ratio is unequal. The average sex ratio of adult male to female was 1.00:1.26. The possible reasons for an unequal sex ratio may be due to an increased predation pressure on males, due to greater boldness and the emigration of subordinate males to less favourable habitats. The greater female to male sex ratio of klipspringer has its own contribution for increasing population in the study area for the future because of the higher rate of reproduction. The male klipspringer can indirectly assist its young by defending their territory from predators and potential competitors (Dunbar and Dunbar, 1980). The average number of adult female to young and adult male to young ratio was 1.00:0.14 and 1:0.17, respectively. The considerable decline of young population may be due to calves becoming more susceptible to predators, particularly by common jackal. In addition, the grassland habitat may not be suitable for calves due to overgrazing by livestock leading to predator exposure. Calves are vulnerable to eagles and baboons.

One of the advantages of living in groups is that individuals may need to be less vigilant, allowing them more time for other important activities such as feeding (Shorrocks and Cokayne, 2005). In this study, the maximum group size of klipspringer during the wet season was 4 with the mean group size of 3.07±0.91 and during the dry season the maximum group size was 3 with the mean group size of 2.28±0.70. Group size was highest during the wet season probably due to increased availability of food. Based on the result, the aggregation of large group of klipspringer population during the wet season in a limited area and splitting in to smaller groups and dispersal to a wider area may be due to their selective feeding behaviour to get more preferred forage. Frey (2000) described this typical of small bodied antelopes, which are selective feeders in order to disperse widely to get for better food. In the present study, the mean group size of klipspringer during the whole study period was 2.67. Previous studies in South Africa by Tilson and Norton (1981) showed that they are solitary, occurring in monogamous pairs, or as a family group with a male, female, and their offspring with the average group size of 2.6 individuals.

Klipspringer population was distributed into three different habitat types. The highest number was recorded in mixed grassland habitat during both wet and dry seasons. This might be due to the availability of ample food. But the lowest number was recorded in the forest habitat during the wet

and dry seasons. This is associated with the less availability of palatable species. In addition, visibility is also less restricted in the forest habitat due to plant cover.

The results of the present study have several conservation and management implications for the species and their habitat. Yetefet Woyenat Forest was severely threatened by agricultural land expansion. In order to conserve these species and prevent future decline, conservation practice should be implemented involving both the local people and officials.

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