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Short communication

POPULATION DENSITY, STRUCTURE AND GROUPING PATTERN OF MENELIK'S BUSHBUCK IN THE MENAGESHA-SUBA STATE FOREST, ETHIOPIA

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ABSTRACT: The population density, sex and age ratio and grouping pattern of Menelik's bushbuck (*Traglaphus scriptus meneliki*) was studied in the Menagesha-Suba State Forest (MSF) during August 2009 – April 2010. Data were collected during wet and dry seasons. Total-count method was used in four selected study sites within the forest. A total of 110 and 156 Menelik's bushbucks were recorded during the wet and dry seasons, respectively. The seasonal difference in abundance was statistically significant. Sighting records did not show significant differences between study sites. The overall density of Menelik's bushbucks in MSF was estimated to be 12 km^{-2}. Based on the density estimate, the population of Menelik's bushbuck in the MSF is extrapolated to be 296 individuals. The adult sex ratio was nearly 1:1 while the adult female to young ratio was 9.6:1.0. More than 65% of the sightings were those of single individuals. In comparison to previous studies, the findings of the present study indicate that the population status of Menelik's bushbuck in the MSF is within the expected range and hence there is no need for immediate conservation intervention.

Key words/phrases: Bushbuck, demography, forest, Menagesha, population density

INTRODUCTION

The bushbuck (*Traglaphus scriptus* Pallas, 1766) is a medium sized African Artiodactyle of the family Bovidae, distributed in the southern half of the continent from Senegal to Ethiopia and from the Congo Basin to the Cape Province in South Africa (Alden *et al*., 1995, Stuart and Stuart, 2000). Bushbucks are solitary animals which exhibit momentary male-to-female pairing during the breeding season (Coates and Downs, 2007). Another form of association includes that of a female and its young. Bushbucks are known to be non-territorial. However, Wronski (2005) has revealed that adult males defend core areas as their home grounds, which do not overlap with that of other adult males. Bushbucks are primarily browsers and also known to graze occasionally (Okiria, 1980; Dankwa-Wiredu and Euler, 2002). Grazing is reported to be more frequent during the night than the daytime (Waser, 1975). Woodlands and forests are main habitats of bushbucks.

According to Yalden *et al.* (1984), several races of bushbucks have been described and nine of these were accepted as valid subspecies (Ansell, 1971). Among them, three subspecies are believed to occur in Ethiopia. The common bushbuck, *T. s. decula,* inhabits most of the northern parts of the country including the Simien Mountains and highlands extending as far south as the Awash River Valley. The southern half of the country is mainly inhabited by the endemic subspecies, Menelik's bushbuck (*T. s. meneliki*). This species is found on the highlands of Bale, Arsi, Chercher, western Shoa, Illubabor, Denkoro Forest Proposed National Park (currently Borena Saint National Park) and Menagesha-Suba State Forest (MSF) at altitudes ranging between 2400m and 3440m. The third subspecies, *T. s. fasciatus*, is rare and is restricted to riverine forests of the southeastern parts of Ethiopia along the Wabi Shebelle River (Yalden, *et al.,* 1984). The races differ from each other by their skin colouration and type of habitat (Grubb, 1985).

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According to information leaflets available at the headquarters, a good proportion of the MSF is plantation commissioned by Emperor Zerea Yakob (1434–1468) dominated by the African Pencil Cedar (*Juniperus procera*). This forest was designated as a National Forest Priority Area (NFPA) in 1981 to reinforce its protection (Afework Bekele, 1996). However, during the transition period following the change of government in Ethiopia in 1991, forest habitat and wildlife populations were seriously affected within the area as well as in most of the forest habitats in Ethiopia (Afework Bekele, personal communication). Since the establishment of peace and stability in the country, proper management of the forest has been re-instated. Currently the MSF is owned and administered by the Oromia Forest and Wildlife Enterprise. The present study was undertaken to asses the status of the bushbuck population in the MSF and recommend appropriate conservation interventions. The study examines whether the rare sightings of bushbucks in the MSF are due to a low population size by comparing densities reported elsewhere for similar habitats.

THE STUDY AREA AND METHODS

Study area

MSF is located 40 km west of Addis Ababa and lies within longitude and latitude coordinates of 38°31′–39′E and 08°54′N–09°04′N, respectively, and the altitude ranges between 2330 and 3300 masl. The mean annual minimum and maximum temperatures are 9.5°C and 22.5°C, respectively. The annual rainfall is 1,100 mm, the period June to September being the main rainy season (Ethiopian Meteorology Agency unpublished data). The structural diversity of the forest is minimal, and is described as undifferentiated evergreen montane forest (Breitenbach and Koukal, 1962; Gilbert, 1970). Recently, Abate Zewdie (2007) classified the vegetation in MSF into the following six clusters: *Cuprussus lusitanica*, *Myrsine africana-Erica arborea*, *Myrsine africana-Olea europea*, *Olea europea-Sideroxylon gillettii*, *Dovyalis abyssinica-Allophyllus abyssinicus* and *Lantana trifolia-Juniperus procera*. Afework Bekele (1996) documented 12 rodent and 1 insectivore species in this area.

MSF is divided into four areas namely Tona Road, Haileselassie Camping Site, Mulugeta Ber and Kirkira. Two broader sampling plots, which were in turn divided into three sampling blocks were selected from three of the above areas, while Kirkira was represented by a single such broader plot (Fig. 1). Thus, a total of 21 sampling blocks were used in the study. Each sampling block had an area of 0.5 km² (0.1 km width x 5 km length). Accordingly, the total area sampled was 10.5 km², equivalent to 42.6% of the 24.66 km² MSF. Data were collected once during the wet season (September 2009) and twice during the dry season (February and March 2010).

Total count method was used. Counting was carried out during the morning hours (06:00–10:00 h) when bushbucks were active. During counting, the researchers and two field assistants walked along a transect line at a steady pace. One group surveyed on the right and another on the left covering a viewing distance of 50 m each. Binoculars were used to aid detection of bushbucks at a distance. Fresh pellets, horn marks and clear hoof prints were used to ascertain doubtful sightings. Data on sex, group size and approximate age were recorded upon sighting. Sex was differentiated based on presence or absence of horns and body colour. Males are horned and dark-brown while females are hornless and light brown in colour (Nowak, 1991). Individuals which were small in size were recorded as young. Each block was sampled once during each sampling session (one session in the wet season and two in the dry season).

Mean values of the two dry season counts were taken for comparative analysis with the wet season. Sighting records of the four study sites were compared using one-way ANOVA. Since Kirkira site had smaller number of sampling blocks, it was not included in the analysis. LSD post-hoc test was used when ANOVA showed significant difference. Independent-samples *t*-test was used to compare overall sighting records between wet and dry seasons, adult sex ratio and adult female to young ratio. Density of bushbucks was calculated for each sampling site by dividing total sighting records by the total area of the sampling site. Overall density for the forest was estimated by calculating the mean density of all the sampling sites. Percentage proportion of grouping patterns between wet and dry seasons were compared using paired-samples *t*-test. Significance level was set at 0.05%. Data were analyzed using SPSS windows version 17.

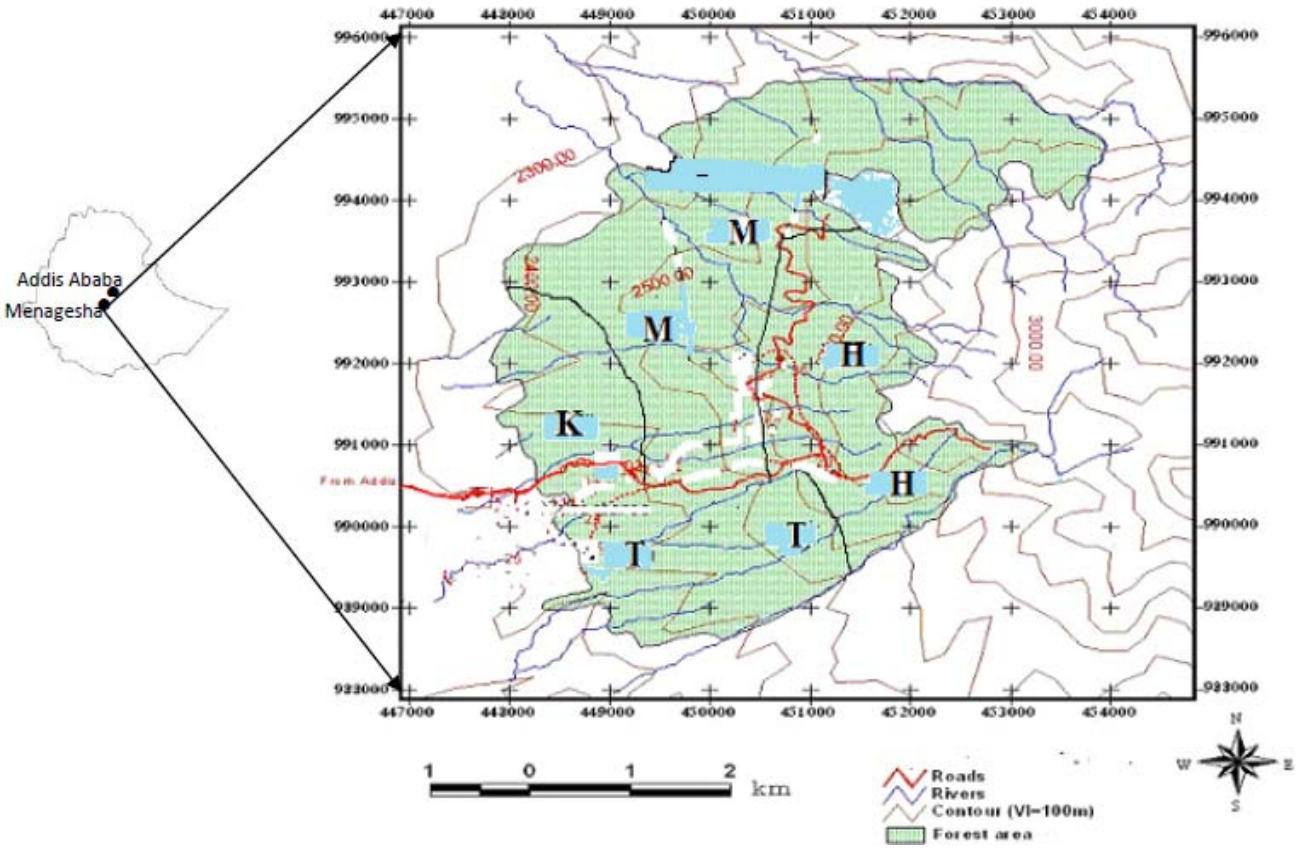

Fig. 1. Map of the study area with the study areas indicated (M=Mulugeta Ber; K=Kirkira; T=Tona Road; H=Haileselassie Camping Site). (Adopted from Bekele Tsegaye *et al.*, 2008).

RESULTS

A total of 110 and 156 bushbucks were recorded during the wet and dry seasons, respectively (Table 1). Statistical comparison between the wet and dry season records showed significant difference (df= 40; p=0.00). Sighting records among the three sites (excluding Kirkira) using ANOVA did not show significant difference in both wet (df = 17; F = 2.534; p = 0.113) and dry (df = 17; F = 1.76; p = 0.206) seasons.

The difference in density between study sites was not statistically significant during the wet season (df=20; F=3.08; p=0.055), but significant in the dry season (df=20; F=3.801; p=0.03). LSD Post-hoc test showed that Tona and Haileselassie Camping Site have significantly higher density than Kirkira; p= 0.006 and 0.017, respectively (Fig. 2). The overall mean density of Menelik's bushbuck in the study area was 12 km^{-2} and the total number of bushbuck in the MSF (24.66 km^2) was estimated at 296 individuals.

Table 1. Number of Menelik's bushbuck sighted in each study site.

Study Sites	Number of bushbucks sighted		
	Wet season	Dry season [a]	Mean ± SD
Tona Road	36	52.5	44.25±11.67
Haileselassie Camping Site	29	49	39.00±14.14
Mulugeta Ber	32	40.5	36.25±6.01
Kirkira[b]	13	14	13.5±0.71
Total	110	156	

[a]= mean values are given for the two dry season counts
[b]= only three sample blocks were used

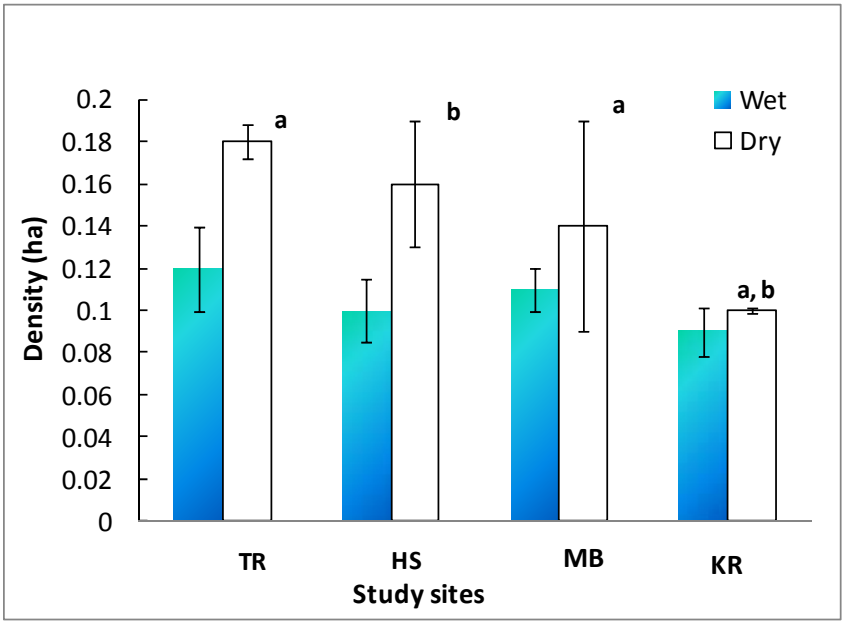

Fig. 2. Density of Menelik's bushbuck in the four study sites during the wet and dry seasons (TR= Tona Road; HS= Haileselassie Camping Site; MB= Mulugeta Ber; KR= Kirkira) (Values sharing a common letter are significantly different – LSD Post Hoc test).

The number of male, female and young bushbucks is given in Table 2. The adult male to adult female ratio was 1.0:1.09 (df = 40; p = 0.227) in the wet season and 1.12:1.00 (df = 40; p = 0.274) in the dry sesaon. On the other hand, the ratio of young to adult female was 1.0:18.67(df = 40; p = 0.00) in the wet season and 1.0:6.9 (df = 40; p = 0.00) in the dry season.

Single female and single male sightings constituted the the highest percentage (65%) followed by male-female pairs. All male, all female and male-female-young groups were rare (Fig. 3).

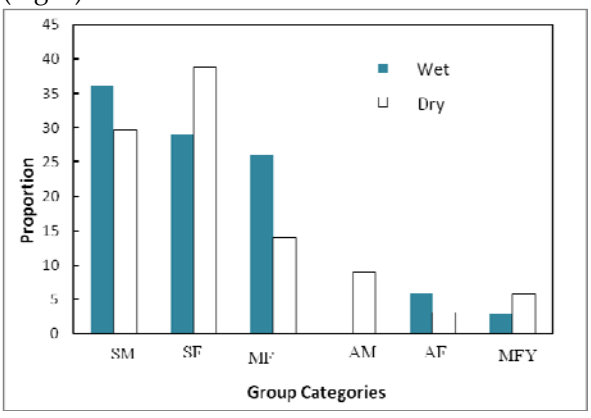

Fig. 3. Proportion of group categories of Menelik's Bushbuck during the wet and dry seasons (SM= - single male; SF= single female; MF= male-female pair; AM= all male; AF= all female; FY= female-young pair; MFY= Male–Female–Young).

Table 2. Age and sex composition of Menelik's bushbuck during wet and dry seasons

Season	Number of Bushbucks observed		
	Male	Female	Young
Wet	51	56	3
Dry	77	69	10
Mean ± SD	64±18.38	62.5±9.19	6.5±4.95

DISCUSSION

The population data obtained in the present study is comparable to that of Dereje Yazezew *et al.* (2011) in the Denkoro Forest Proposed National Park; the authors have reported a density of 11.75/ km², male-to-female ratio 1.0: 1.5 and young-to-adult female ratio 1.0:7.5. On the other hand, the adult sex ratio is in contrast with Waser (1975), who reported a female biased sex ratio for bushbuck in Mweya Peninsula, Uganda. The density of bushbucks was reported to be high in woodlands reaching up to 25 km^{-2}, and low in forests with values of 4 km^{-2} (Nowak, 1991). In comparison to these values, the density of Menelik's bushbuck in the MSF is three times higher than the expected value for a forest habitat.

No spatial variation in the density of Menelik's bushbuck was observed in different habitat types. Lack of habitat diversity and differentiation in the study sites could explain the spatial homogeneity observed in the distribution of Menelik's bushbuck. The overall mean ± SD of the number of Menelik's bushbuck per study site (see Table 1) is calculated to be 39.83 ± 9.36. According to the variance/mean ratio method, distribution patterns that have standard errors less than the mean are said to have even distribution (Banerjee, 1975). Therefore, the distribution of Menelik's bushbuck in the MSF can be considered as even. The high number of bushbuck sightings during the dry season can be explained in terms of better visibility of bushbucks during this season as opposed to the dark and cloudy days of the wet season.

The observed adult sex ratio was nearly 1:1 and it was in accordance with the expected value for most vertebrates (Romano, 1991). With regard to age ratio, common perception is that, large proportion of young indicates an increasing population. However, Romano (1991) argues that this may not be necessarily true. Lower proportion of adults compared to young could indicate low survival of adults, for example, as a result of selective hunting by people. Therefore, populations with such age structure could be declining in actual fact rather than increasing. Accordingly, the high proportion of adult females in the present study could indicate higher degree of survival and absence of selective hunting.

The grouping pattern documented in the present study is confirmatory to previous knowledge about bushbuck, which is known to be solitary (Nowak, 1991; Alden *et al*., 1995; Coates and Downs, 2007; Wronski *et al*., 2009). Sixty five and sixty nine percent of the sighting proportions were those of single individuals during the wet and dry seasons, respectively. High proportions (25%) of male-to-female pair were observed during the wet season. Such pairings were common during the breeding season. Therefore, our data suggest that the main breeding in Menelik's bushbuck occurs during the wet season. The other common form of pairing known in bushbucks is that of mother and its young. The observed proportion of such pairing in the present study was low. It is known that the young of bushbucks and other antelopes are hide to avoid predation risk. Therefore, they tend to have less detection probability by observers and this could partly explain the low proportion of female-to-young pairs (Nowak, 1991).

In conclusion, the present study showed that the population of Menelik's bushbuck in MSF is not unusually low compared to the density recorded elsewhere. Therefore, the population status in the MSF could be taken as normal and hence immediate conservation intervention is not required. It is recommended that ongoing protection efforts and prevention of illegal hunting should be sustained.

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