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FEEDING ECOLOGY OF SWAYNE'S HARTEBEEST (*ALCELAPHUS BUSELAPHUS SWAYNEI*, SCLATER, 1892) IN MAZE NATIONAL PARK

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Abstract

Swayne's Hartebeest is an endemic but threatened species in Ethiopia. However, data were scarce on its feeding ecology and preferred plant species. Therefore, a study was carried out on feeding habit of Swayne's Hartebeest (*Alcelaphus buselaphus swaynei*) in the Maze National Park, Ethiopia. The objective of this study was determining the preferable plant species available in the park and plant parts consumed by the study animal. Data were collected by direct observation in the field and analyzed using descriptive statistics, Chi-square test, SPSS (version 20) and one way ANOVA. A total of 648 observations were made on feeding habit of Swayne's hartebeest throughout the study period. Of these, 284 (43.82%) were made in the wet season and 364 (56.18%) were made in the dry season. *Sporobolus panicoides* was mostly consumed grass in the wet season (24.3%) followed by *Andropogon gayanus* (19.36%) whereas *Andropogon gayanus* was the most preferred grass in the dry season (21.97%) followed by *Heteropogon contortus* (18.4%). The result revealed that Swayne's Hartebeests fed on nine grass species of Poaceae during the wet season, while they were observed feeding on those grasses and two tree species of Balanitaceae and Fabaceae in the dry season with a varied amount of consumption. The proportion of food items consumed by the animals in wet and dry seasons differed significantly ($\chi^2 = 376.5$, $df = 10$, $p < 0.05$). Swayne's Hartebeest preferred mainly young leaves

followed by shoot and matured ones. They were frequently observed feeding during early morning and late afternoon. Based on the findings of this study, it was recommended that giving high emphasis for habitat quality would be highly appreciable to keep commonly preferred plant species as well as the endemic and endangered species of Swayne's Hartebeest in the Park.

Keywords/phrases: Feeding preference, plant species, Maze National Park, Swayne's hartebeest

Introduction

Swayne's hartebeest is a large antelope restricted to the southern Rift Valley of Ethiopia (East, 1999). It was formerly occurred throughout the Rift Valley of the country and its range extended eastward into northwestern Somalia (IUCN, 2013). Today, even in Ethiopia its distribution and population size has been declining substantially and the two largest populations remaining in the country are in Senkelle Swayne's Hartebeest Sanctuary and Maze National Park (Abiot, 2013). Because of its limited extent of occurrence (estimated about 400 km²) and its small area of occupancy (only 259 km²); the subspecies of Swayne's hartebeest listed as endangered, currently occurring only at two locations (IUCN, 2017).

The population of Swayne's hartebeest is increasing in Maze National Park and Senkelle Swayne's Hartebeest Sanctuary; whereas it is at the verge of extinction in Nech Sar National Park due to habitat degradation, expansion of agriculture, human settlement and livestock grazing (Befekadu, 2005; IUCN, 2013; Simon, 2016). Species survive, grow and reproduce by using the resources available at certain habitat (Aarts *et al.*, 2008) are under question. Most species could migrate to different habitats with lower resources if faced with great interspecific and intraspecific competition. Animals can use habitats as a means of survival strategy which prevent them from predation (Turner, 1997). However, habitats are also important drivers for prey selection made by predators. This is due to the different features that habitats possess (Hayward and Kerley, 2005). Animals may change habitats which are used, based upon seasons. Thus, a species may use a certain habitat during the summer period and will change into a different habitat in the winter as a result of the variation in resource availability (Morrison *et al.*, 1985). Most of the time, Swayne's hartebeests are grazers; but very rarely browse low shrubs and herbs (Tewodros, 2006; Hoberg *et al.*, 2009).

Despite Swayne's hartebeest is charismatic and flagship species of Ethiopia, lack of scientific documentation on its feeding ecology was mainly problems through the country in general and Maze National Park in particular. Therefore, the present study aims on investigating feeding habit of Swayne's hartebeest in the study area. Thus, it was crucial having knowledge of its feeding habit of the Swayne's hartebeest for effective conservation approach and monitoring in the Maze National Park.

Research methodology

Study area: The Maze National Park is located at 460 km southwest of Addis Ababa on the way of Wolaita Sodo- Sawla road in the Southern Nations, Nationalities People's Region. The Maze National Park lies between $06^{\circ} 3'$ to $06^{\circ} 30'$ N latitude and $37^{\circ}25'$ to $37^{\circ}40'E$ longitude. Its altitude ranges between 900 to 1200masl and covers total area of 202Km² (Befekadu and Afework, 2006). Bilbo Hot Spring, which is situated at the southern part of the park, is a natural beauty of hot water gushes out of the ground forming a fountain; and locally and culturally used as a source of cure by different groups of people. The park is surrounded by five districts of Gamo and Goffa zones, namely; Daramalo in the south and southeast, Qucha in the northern part, Qucha Alfa in the northwest, Zala in the Southwest and Kamba in the South (Fig. 2).

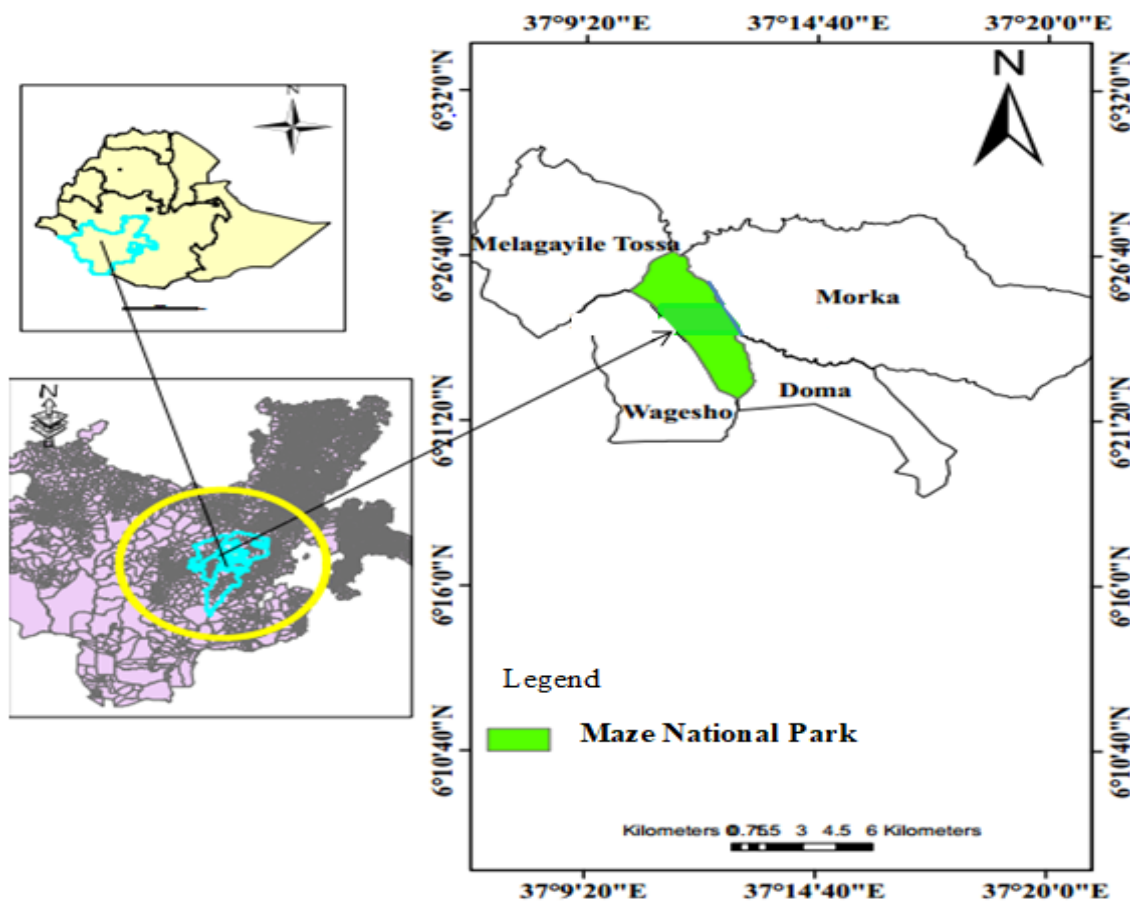


Figure 1: Map of Maze National Park (the study area)

Climate: Maze experiences a bimodal rainfall pattern (Befekadu, 2005). Being continuous and moderate, it is typical of semi-arid agro-ecological zone of Ethiopia. The annual rainfall ranges between 843 and 1321mm (Befekadu, 2005). Rainy season in Maze extends from March to October (Yosef *et al.*, 2012) while the dry season is from November to February (Befekadu, 2005). The lowest temperature in the wet season is 15.3°C in June and the highest (33.5°C) is in February for the dry season (Wondimagegnehu and Afework, 2011; Yosef *et al.*, 2012).

Faunal Composition of the Park: There are 39 species of large and medium mammals and 196 bird species are found in the Park (EWCA, 2012). The Park is also known for its good population of the critically endangered endemic Swayne's hartebeest. The existence of these types of resources provides high opportunity for Maze National Park to develop ecotourism. Wild animals are the major natural attractions for ecotourism development (Bahmanpour *et al.*, 2012). Wild animals like Anubus baboon, Vervet monkey, Lion, Leopard, Wild cats, and Serval

cats Swayne's heartbeats (*Alcelaphus buselaphus swaynei*), Klipspringer (*Oreotragus oreotragus*) Waterbuck (*Kobus ellipsiprymnus*), Oribi (*Ourebia ourebi*), Warthogs (*Phacochoerus aethiopicus*), Bush pig (*Potamochoerus porcus*), Reedbuck (*Redunca redunca*), Bush duiker (*Sylvicapra grimmia*), African buffalo (*Synceros caffer*), Lesser kudu (*Tragelaphus imberbis*), Bushbuck (*Tragelaphus scriptus*) are among common species in Maze National Park (EWCA, 2012).

Vegetation: Most of the plains of the Park are covered by open *Combretum-Terminalia* wooded grasslands (Matewos, 2003; Siraj, 2016). An occasional variant of woodland vegetation is usually associated with riverine habitats. Combretum dominated wooded grasslands occupy well-drained sites on the upland. This includes the higher ridges and side slopes. It is fire-induced type that replaced a true Combretum woodland or evergreen bush land forest. There are at least 146 plant species in the Park (Siraj, 2016). Woody plant species like *Combretum adenogonium*, *Acacia drepanolobium*, *Maytenus arbutifolia*, *Harrisonia abyssinica*, *Acacia seyal*, *Grewia bicolor*, *Ziziphus spina-cristi*, *Bridelia scleroneura*, *Combretum molle*, *Pilostigma thonningii* are some of common woody plant species in the Park (Wegene and Feleke, 2015) whereas, *Andropogon gayanus*, *Chrysopogon aucheri*, *Cyndon dactylon*, *Dichrostachys cinerea*, *Digitaria abyssinica*, *Eragrostis cylindriflora*, *Glycine wightii*, *Hetropogon contortus*, *Hyparrhenia hirta*, *Hyparrhenia rufa*, *Ischaemum afrum*, *Loudetia arundinacea*, *Panicum maximum*, *Pennisetum thunbergii*, *Sporobolus panicoides* and *Sporobolus* species, *Themeda triandra*, *Solanum incanum* are some of grasses and herb species are commonly found in the plain area of the Park (Wondimagegnehu and Afework, 2016).

Data collection: Data on feeding habit of Swayne's hartebeest were collected from October 2018 to April 2019. The wet season data were collected from October 2018 and March to April 2019, while the dry season data were collected from November to December 2018 and January 2019. The study site was classified based on topography and habitat type. Data were taken from each habitat type to increase sampling effort. During data collection, animals were observed using unaided eye and/or Binocular.

Feeding habits: Data on feeding habit were collected by direct observation (focal sampling method) from appropriate visible points. This includes watching an individual or group of

animals for 10 minutes within an interval of 5 minutes (Sutherland *et al.*, 2005). Animals were observed in the early morning (06:30 to 10:30) and in the late afternoon (14:00 to 18:00) when the animals are active (Fashing, 2001; Mesele and Afework, 2012; Reta and Solomon, 2013; Tahani and Ibrahim, 2014; Wubie and Mesele, 2018). Recordings were ceased when the animal moved out of the sight.

Data on feeding habit were collected two times per month for each habitat type for both seasons over a total of 12 observation days. When the animal was observed during foraging, foraging types (grazing/browsing/chewing/biting), the plant habit (tree/shrub/herb/grass), plant species and part of the plant consumed (leaf/shoot/stem/fruit) were recorded (Dereje *et al.*, 2011; Wubie and Mesele, 2018). Each record was counted when individual Swayne's hartebeest were observed feeding continuously from a single plant species or plant group (Smits, 1986). Soon after the animal moved away from the site, freshly eaten plant species and plant parts were carefully examined following Brnesh *et al.* (2015). From the plant species consumed by the SHB, samples were collected and taken with careful plant press to Arba Minch University for further identification with a support from expert.

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Data Analysis: Before conducting the actual data analysis, data were checked for some errors (e.g. recording and consistencies). Data were analyzed using statistical package for social science (SPSS) version 20 software ($\alpha = 95\%$ level of significance, $p < 0.05$), descriptive statistics and Excel spreadsheet. The preference of plant species and parts of plant between seasons were analyzed by Chi-square test.

Results

Feeding habit: A total of 648 observations were made on feeding habit of Swayne's hartebeest in the Maze National Park. Of these, 284 (43.82%) were made in the wet season and 364 (56.18%) were made in the dry season. Among total observation conducted on grassland habitat, 142 (43.82%) were in wet and 182 (58.18%) were in dry season period, on scattered tree habitat 57 (43.84%) were in wet and 73 (56.16%) were in dry season period, on riverine forest 57 (44.18%) were in wet season and 72 (55.82%) were in dry season and on bush land habitat 28 (43%) in wet and 37 (57%) observation were conducted in dry season and in bush land habitat neither of the animal nor feeding activity was recorded during the study period. Swayne's hartebeest were observed feeding on nine grass species (Family Poaceae) in the wet season and on 11 plant species of the three families (Balanitaceae, Febaceae and Poaceae) in the dry season in the park. Poaceae family constituted the major forage of the Swayne's Hartebeest in the park. Almost all of the plant species recorded during the study period of both seasons were grasses. Only few tree species were recorded as feed upon the studied animal in the dry season. All feed plants identified for wet season were also eaten in the dry season with differed consumption rate (Table 1 and 2).

Table 1: Plant species mostly preferred by Swayne's hartebeest during the wet season

No.	Scientific name	Local name	Parts of plants consumed	Total No. of sighting	Percentage
1	<i>Sporobolus panicoides</i>	Wosho	YL, Sh	69	24.3
2	<i>Andropogon gayanus</i>	Hargaza	YL, ML	55	19.36
3	<i>Heteropogon contortus</i>	Alba	YL, ML	42	14.78
4	<i>Hyparrhenia rufa</i>	Tinka	YL, Sh	34	11.97
5	<i>Hyparrhenia hirta</i>	Matuse	YL	27	9.5
6	<i>Digitaria abyssinica</i>	Zare goyna	YL, YSt	22	7.74
7	<i>Cyndon dactylon</i>	Bergada	YL, ML, St	17	5.98
8	<i>Themeda triandra</i>	Senbelet	YL, ML	12	4.22
9	<i>Pennisetum thunbergii</i>	Myrolle	YL	7	2.46
Total		9		284	100

YL= Young leaf, ML= Matured leaf, Sh= Shoot, St= Stem, Note: All belong to poaceae

Table 2: Plant species mostly consumed by Swayne's hartebeest during the dry season

No.	Scientific name	Local name	Consumed parts	Total sighting frequency		Percentage (%)	
No.	Species	Local Name	Consumed parts	Dry	Wet	Dry	Wet
1	<i>Andropogon gayanus</i>	Hargaza	YL, ML, St	80	55	21.97	19.36
2	<i>Heteropogon contortus</i>	Alba	YL, ML	67	42	18.4	14.78
3	<i>Hyparrhenia rufa</i>	Tinka	YL, YSh	54	34	14.83	11.97
4	<i>Sporobolus panicoides</i>	Wosho	YL	46	69	12.63	24.3
5	<i>Hyparrhenia hirta</i>	Matuse	YL	39	27	10.71	9.5
6	<i>Cyndon dactylon</i>	Bergada	YL, ML, St	30	17	8.24	5.98
7	<i>Digitaria abyssinica</i>	Zaregoyna	YL, St	23	22	6.31	7.74
8	<i>Themeda triandra</i>	Senbelet	YL, St	15	12	4.12	4.22
9	<i>Pennisetum thunbergii</i>	Myrolle	YL	4	7	1.09	2.46
10	<i>Piliostigma thonnigii</i>	Qalqalo	RF	4	-	1.09	-
11	<i>Balanites aegyptiaca</i>	Domayee	RF	2	-	0.54	-
Total		11		364		100	

YL=Young leaf, ML=Matured leaf, Sh=Young shoot, St=Stem, RF= ripen fruit

Note: Except *Piliostigma thonningii* (Fabaceae) and *Balanites aegyptiaca* (Balanitaceae) all species belong to Poaceae

A significant differences were observed in preference of plants ($\chi^2= 376.5$, $df = 10$, $p < 0.05$) and consumption between seasons ($\chi^2 = 9.2$, $df = 1$, $p < 0.05$) among plant species identified for Swayne's hartebeest feed through the study period in the Park (fig.)

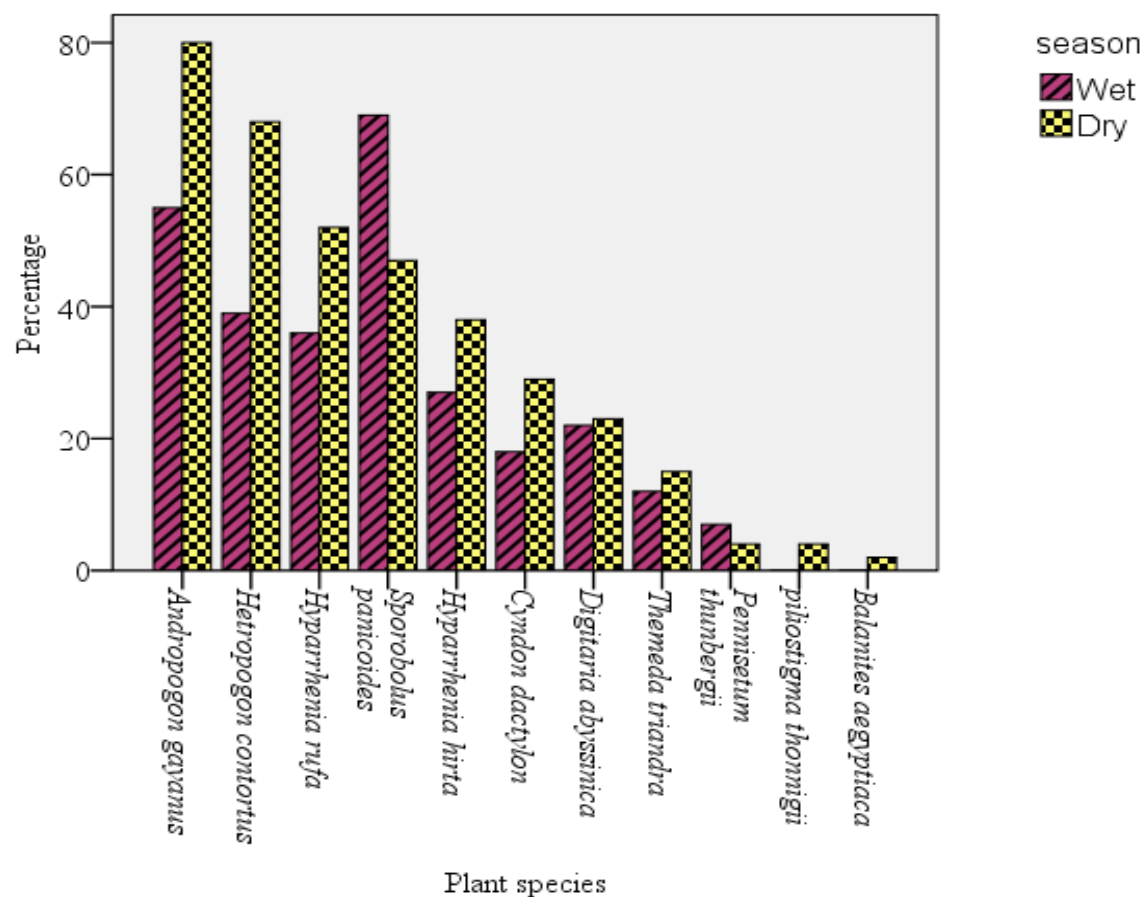


Figure 2: Plant species consumed by Swayne's hartebeest.

The Swayne's hartebeests were also observed feeding on the other parts of the plants i.e. 26.64% on shoots; 18.56% on matured leaves; 14.67% on stem in the wet season and 23.26% on shoots, 23.82% on matured leaves and 15.23% on stem; 3.32% on fruits during the dry season (Fig. 4). There is a significant differences between plant parts consumed by Swayne's hartebeest ($\chi^2= 43.590$, $P < 0.05$ and $\chi^2 = 1.048$, $P < 0.05$) for wet and dry season, respectively.

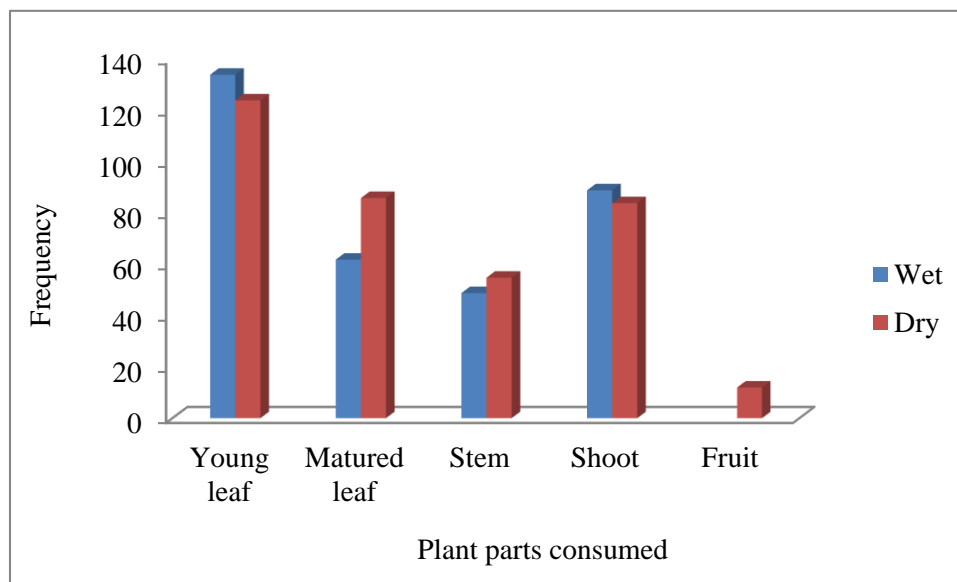


Figure 3: Plant parts consumed by Swayne's hartebeest during wet and dry season

Discussion

Sporobolus panicoides was the most frequently consumed grass in the wet season that accounts for 24.3% followed by *Andropogon gayanus* (19.36%). *A. gayanus* was the most preferred grass in the dry season (21.97%) followed by *H. contortus* (18.4%). This was in line with other studies that *A. gayanus* was highly preferred by roan antelope and other subspecies of hartebeests in Burkina Faso (Schuette *et al.*, 1998). *P. thunbergii* was the least preferred grass in both seasons with frequency of (2.46%) in wet and (1.09%) in the dry seasons. *P. thonnigii* and *B. aegyptiaca* were the least and rarely consumed woody species by Swayne's hartebeest in dry season comprising (1.09%) and (0.54%), respectively. This might be due to low palatability of their nature.

Of the total observations of 284 for wet season (40.11%) was made while SHB populations were feeding on young leaves. Likewise (34.43%) of the total observation of 364 for dry season was made while the Swayne's hartebeest was feeding on young leaves in the dry season. The preference of SHB to young leaves could be because of high palatability of the young leaves than the other parts of the plants.

The type of food and plant species preference was differed with seasons for Swayne's hartebeest for most grass species in the plains of Maze National Park were getting matured and dried in the dry season. Some of the wet season preference couldn't be choice in dry season as the development of over-matured grasses can decrease the appearance and palatability for that particular grass. Similar results were reported by Ego *et al.* (2003) for three ungulates in Tanzania. In the present study *Sporobolus panicoides* was highly preferred in wet season but not in dry season. This is because of the natural process, that most of plants especially grass species dried and losing their palatability during the dry season (Voeten *et al.*, 2009). Seasonal variation of food preference depends on change in quality and abundance of grass species in the present study. For instance, Swayne's hartebeests highly consumed *Sporobolus panicoides* in wet season, but it was not preferable in dry season. As mentioned above, this showed that the plant gets old, palatability decline during dry season. Tewodros (2006) and Abiot (2013) reported that a grassland habitat gets poor in Senkele Swayne's Hartebeest Sanctuary in the dry season with limited option for SHB to feed on.

The preference of plant species by Swayne's hartebeest in the study area might be driven by different factors. This can be explained in terms of the distribution and availability of the plants, plant morphology, plant age, herbage density, habitat variability and behavioral aspects of the animal (Hejzmanova *et al.*, 2009). This was supported by the evidence that Swayne's hartebeest was observed mostly feeding on short to medium sized grass species. The crude protein content and digestibility of the plants highly decrease in dry season (Coverdale *et al.*, 2006). The quality of plant species can be affected by grazing and can result in low palatability and preference (Lewis and Wilson, 1979; Gutbrodt and Bettina, 2006; Voeten *et al.*, 2009). Feeding habits of mammals are an important aspect of population biology and ecology (Matrai *et al.*, 1998). Investigating on the abundance and quality of high and low preferred plant species is important to make the bulk of the diet of herbivore Israel *et al.* (2018). The highest selection ratio for the plant parts suggests that a preference for the food items that the plant species provided while low selection ratio indicates not preferred (Fashing *et al.*, 2007; Solomon and Hailemariam, 2016). In the present study, the dietary preference of Swayne's hartebeest consisted of young and matured leaves of nine grass species, stem, shoots and some of the trees/shrubs.

Conclusion

The present study emphasizes on feeding ecology of the Swayne's hartebeest in Maze National Park southern Ethiopia. A total of 11 forage species were identified as food source for the animal and almost all of these species were observed on plain areas of the Park. Swayne's Hartebeest was grazer in wet season and browser in small amount during the dry season when forage availability and quality is getting low. Moreover, the findings of this study would provide useful information for effective conservation of Swayne's hartebeest particularly in the studied area and can also be applied to other protected areas and other large herbivores as the SHB's general behavioral patterns overlap with those of other large herbivores.

Recommendations

Based on the findings and conclusion, the following recommendations were forwarded.

- Continuous monitoring and evaluation of habitat quality (food, water, shelter), long term studies on seasonal variations in forage availability taking with community based mitigation measure on timely basis is highly appreciable.
- Working in collaboration with relevant stakeholders and concerned bodies such as Southern Region Tourism and Cultural Office, Ethiopian Wildlife Conservation Authority and all responsible bodies including local community to implement an integrated plan for better conservation is recommended.
- Mitigation measures of the human and livestock disturbance that are affecting the plant species of the animal should be in place.

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