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Habitat Association and Foraging Ecology of Oribi (Ourebia ourebi Zimmermann, 1783) in Maze National Park, Southern Ethiopia

Wondimagegnehu Tekalign*[1] Afework Bekele[2]
1.Department of Biology, College of Natural and Computational Sciences, Wolaita Sodo University, PO Box 138, Wolaita Sodo, Ethiopia
2.Department of Zoological Sciences, Addis Ababa University, Addis Ababa, Ethiopia

Abstract
Habitat association and foraging ecology of oribi (*Ourebia ourebi*) were carried out in the Maze National Park, Ethiopia, during the wet and dry seasons from October 2009 to December 2012. The type of habitat where the animals frequented and the food consumed were recorded for each season. Four habitat types were identified based on the vegetation. Eight variable sized blocks were designed based on the natural and artificial boundaries. Foraging records were carried out during active feeding period of oribi to observe the plant species that were consumed. Focal animals were chosen and observed. The distribution of oribi was high (64.17% and 69.32%) in the grassland with scattered trees and low in bushland (8.37% and 4.46%) habitat types during both wet and dry seasons, respectively. Seasonal distribution of individuals among the habitats was significant ($p<0.05$). Some oribi were observed moving out to nearby villages and farmlands. Oribi were more associated with livestock and Swayne's hartebeests than other animals. They fed on a total of 28 plant species in the Park area. *Andropogon gayanus* and *Themeda triandra* were the most preferred and utilized grass species. It is important to improve both the quality and the quantity of forage availability within the Park by adopting a more effective vegetation management program based on controlled burning.
Keywords: Distribution, Habitat, Feeding, Maze National Park, Oribi

INTRODUCTION

East African savannas are known for large-scale assemblages of grazing ungulates (Voeten *et al.*, 2009). East Africa is noted for its diversity and abundance of large mammalian herbivores. Ethiopia and more generally the Horn of Africa show a great diversity of landscape and environment (Kutilek, 1979). The wide range of habitats in Ethiopia, from arid desert, open grassy steppe, and semi-arid savannas to highland forests and Afro-alpine moorlands, support an exceptionally diverse antelope fauna (Hillman, 1993). The dwarf antelope tribe is very varied in form and habitat (Smithers, 1983). Oribi (*Ourebia ourebi*) is the largest and one of the members of the East African dwarf antelopes in the family Bovidae (Stuart and Stuart, 1997; Cerling *et al*., 2003).

In Ethiopia, oribi occurs mainly within and to the west of the Rift Valley. It survives quite widely in open habitats within its historical range, including some settled areas. East (1999) described the occurrence of oribi in low to moderate numbers in areas such as Senkele Wildlife Sanctuary, Mago, Gambella, Omo and Maze National Parks. It may be more common in Ethiopia and other African countries than is generally realized. Oribi generally occur in open habitats ranging from Guinea savanna, moist savannas, woodland mosaics, flood plains, to montane and coastal grasslands (Smithers, 1983; Kingdon, 1997). Oribi is known to occupy two major habitat types, namely open grasslands and wooded grasslands (Coverdale *et al*., 2006).

Feeding habits of mammals are the centre of interest of population biology and ecology (Matrai *et al*., 1998). Oribi depend on natural grasslands for their survival (Coverdale *et al*., 2006). Skinner and Chimimba (2007) described that based on their morphological features of the digestive system; they were the first African antelopes to become entirely grass feeders. Foraging guild classification categorized *Ourebia ourebi* as concentrate grazers (Boshoff *et al*., 2002). They favour moist grassland on flat to gently undulating terrain with actively growing short grass for food adjacent to long grass which is required to provide cover from the predators, as well as shelter for the young which are left to lie out for the first 8 to 10 weeks (Marchant *et al*., 2007).

Generally, little is known about the feeding ecology of oribi. Knowledge of the diet and plant preference of *Ourebia ourebi* is useful for the Maze National Park management and be used as supportive argument to reduce the domestic stock grazing pressure in the protected area. Oribi can be considered as a flagship species for the conservation of important grassland areas like Maze National Park due to its grassland dependence (Marchant *et al*., 2007). Therefore, the aim of the study was to investigate the feeding preference and habitat association of oribi in Maze National Park that can provide critical for the sound conservation management program of the Park in the future.

MATERIALS AND METHODS

The Study Area

The study was carried out in Maze National Park (MNP), which is located in Southern Nations Nationalities and Peoples Regional State, Ethiopia. The name of the Park is derived after the largest river called Maze River, which rises from the southern parts of the surrounding highlands and passes through the Park in the north direction, and finally drains to Omo River. The Park was established by the regional state in 2005. It is about 485 km southwest of the capital Addis Ababa via Wolaita Sodo-Sawla road. It is situated between x=286484.25 and y=671467.31 latitude and x=300963.36 and 696852.69 longitude. The Park is surrounded by chains of mountains. The altitude ranges from 998 to 1200 m above sea level and covers an area of 220 km^2 (Fig. 1). Rainfall at Maze (Morka area), although continuous has a moderately bimodal pattern, typical of semi-arid agro-ecological zone of Ethiopia. The annual rainfall varies between 843.8 mm and 1375.3 mm. Maze area experiences a long rainy season that extends from April to October with the highest peak towards the end. The dry season is from November to February (ENMA 1995-2009 Meteorological data). The lowest temperature recorded during the wet season was 17.6°C in June and the highest during the dry season 33.9°C in February.

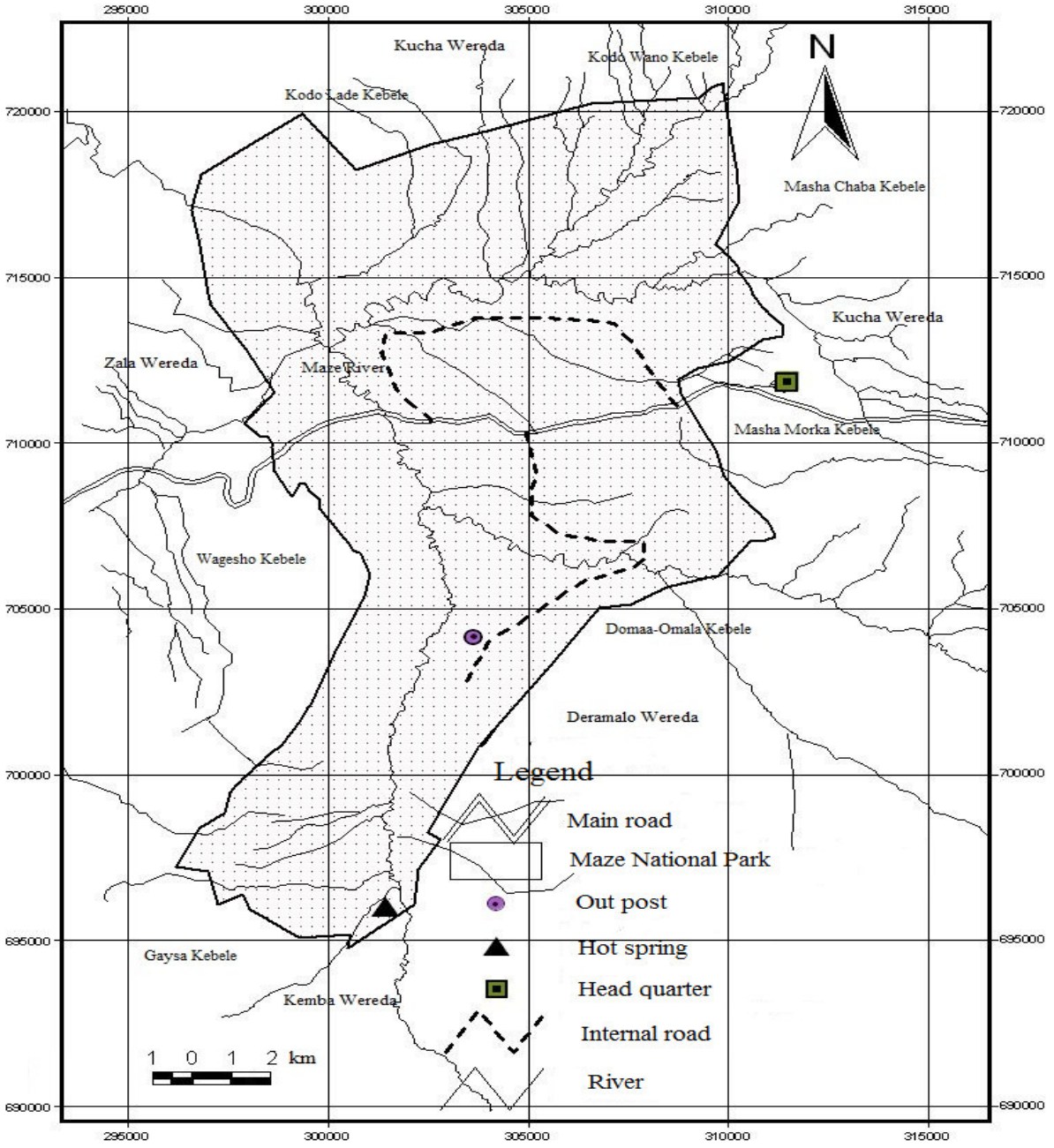

Fig 1 Map of Maze National Park

Methods

The type of vegetation or habitat where the animals frequent and the food taken were recorded for each season following the methods of Martinka (1969), Campton *et al.* (1988) and Reilly *et al*. (1990). The location of each herd and the vegetation or habitat type at each location was recorded. Whenever oribi were observed, the presence of other large mammal species including livestock in the vicinity was also recorded to compare their percentage of association during wet and dry seasons. The methods of Larson *et al*. (1978) and Norton-Griffiths (1978) were used to describe the dry and wet season distribution and utilization of the vegetation type. These data were noted only to determine the use of certain plants and no attempt was made to determine the bulk intake of plant material.

There are four vegetation (habitat) types in the Park area, such as savanna grassland (SGL), grassland with scattered trees (GST), bushland (BL) and riverine forest (RF). Eight blocks were designed based on natural boundaries such as, hills, small mountains, rivers and gorges and, artificial boundaries like main roads crossing the Park and small roads constructed inside the Park. The size of each of the eight blocks was variable. Foraging records were carried out during active feeding time of oribi to observe the plant species that were consumed following the work of Jarman and Jarman (1973), and Wronski (2002). Habitats where oribi usually feed were selected carefully for hide observation. For this, a focal animal was chosen and observed with the help of binoculars and/or naked eye depending on the distance of observation. Species of plants consumed were examined for 120 hrs. Observations were carried out from a distance of 10–50 m. The place where the animal was feeding was spotted, immediately after the animal moved away from the position, freshly cut plants were carefully examined. Samples of plant species that could not be identified in the field were collected, and brought to the Ethiopian National Herbarium for identification.

Further information on the identification of foraging plants was named by local language and seasonal distribution of oribi were also gathered from experienced local elders, Park scouts, wildlife experts and interviews of the local community. Food preferences of oribi were also categorized after Reilly *et al*. (1990) as follows: Preference a= more than 11% utilization of plant species; preference b= 5-11% utilization of plant species and preference c= <5% utilization of plant species. The distribution of oribi among different blocks in various habitat types were compared through percentage frequency, one-way ANOVA test, applying one-sample t-test, paired samples correlation test and multiple comparisons of Tukey-test. The mean difference of the association of oribi with other ungulates of the area during different seasons was analyzed through the application of one-sample t-test. The vegetation preference and sighting frequency of oribi in different seasons was compared using descriptive statistics, one-sample t-test and Chi-Square tests.

RESULT AND DISCUSSIONS

Oribi were observed during the study period distributed in all of the four vegetation types: savanna grassland (SGL), grassland with scattered trees (GST), bushland (BL) and riverine forest (RF). Blocks 1 and 2 are dominated by SGL and GST vegetation types which are repeatedly burned by local community while Blocks 6, 7 and 8 are covered primarily with BL and RF. However, the remaining Blocks are with the mixture of all vegetation types but dominated by GST. During all census periods, oribi individuals were observed in all vegetation types of all counting blocks during both wet and dry seasons but with variation in number among blocks based on the existing vegetation types. Generally, 3993 oribi distributed in different habitats were recorded during the study period.

The percentage distribution of oribi was high in the GST during the wet (64.17%, n=1096) and the dry (69.32%, n=1584) seasons, and low in BL. It was also the same during both wet (8.37%, n=143) and dry (4.46%, n=102) seasons, compared to the distribution in the other vegetation communities. The result showed that the distribution tendency of oribi towards GST was greater and there was lower in BL vegetation types during both wet and dry seasons (Fig. 2). Insignificant number of oribi individuals occasionally was also observed during the study period moving out of the study area into the nearby villages and farmlands during both seasons.

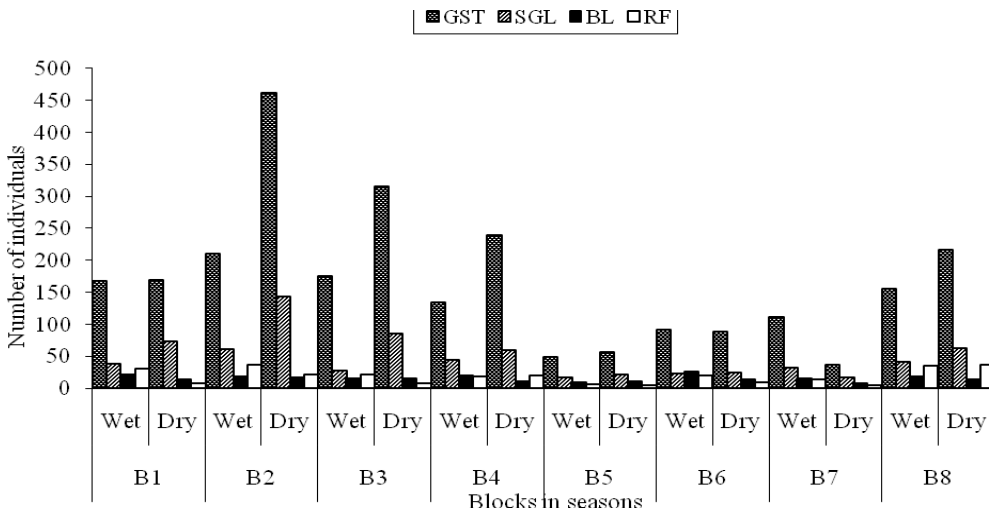

Fig 2 Distribution of oribi in different blocks during the wet and dry seasons (GST= Grassland with scattered tree, SGL= Savanna grassland, BL= Bushland and RF= Riverine forest, B=block)

The distribution of oribi among blocks in all vegetation types, such as GST (137.00 ± 18.23) (t=7.516, df=7, p<0.05), SGL (35.88 ± 4.98) (t=7.204, df=7, p<0.05), BL (17.88 ± 1.75) (t=10.233, df=7, p<0.05) and RF (22.75 ± 3.72) (t=6.113, df=7, p<0.05) was significantly different during the wet season. During the dry season, there was also a significant difference in the distribution of oribi population among blocks in all vegetation types, such as GST (198.00 ± 50.77) (t=3.900, df=7, p<0.05), SGL (61.00 ± 14.97) (t=4.076, df=7, p<0.05), BL (12.75 ± 1.01) (t=12.583, df=7, p<0.05) and RF (13.88 ± 4.01) (t=3.463, df=7, p<0.05). There was a significant different in the distribution of individuals among the habitat types based on seasons ($F_{3\ 3989} = 28.371$, p<0.05). In addition, there was a statistically significant difference in the distribution of oribi among the habitats in blocks ($F_{3\ 3989} = 11.731$, p<0.05). Also, there was a significant seasonal difference in the distribution among blocks ($F_{7\ 3985} = 23.668$, p<0.05). Applying the paired samples correlations test, individuals in blocks were positively correlated with the various habitat types in the area (r=0.081, p<0.05). The investigation by the way of multiple comparisons of Tukey-test signifies that there was a significant seasonal difference between GST with BL (p<0.05) and RF (p<0.05), and SGL with BL (p<0.05) and RF (p<0.05), but the difference was not significant between GST with SGL (p>0.05), and BL with RF (p>0.05).

Oribi showed a tendency to associate with non-domestic ungulate species such as Swayne's hartebeest (*Alcelaphus buselaphus swaynei*), waterbuck (*Kobus ellipsiprymnus*), bushbuck (*Tragelaphus scriptus*), bohor (*Redunca redunca*), warthog (*Phacochoerus aethiopicus*), greater kudu (*Tragelaphus strepsiceros*) and domestic ungulates (livestock) that ranged in their habitats. During the two year study, the total number of associated animals recorded was 987 and 1942 during wet and dry seasons, respectively. The percentage frequency of such association was greater with livestock, 39.21% (n=387) and 52.94% (n=1028), and smaller with lesser kudu, 2.43% (n=24) and 1.18% (n=23) both during wet and dry seasons, respectively. Swayne's hartebeests associated as the second percentage frequency during both wet (33.74%, n=333) and dry (25.03%, n=486) seasons. The percentage association of oribi with livestock was greater during the dry season than the wet season, whereas for the Swayne's hartebeests, it was greater during the wet season than to the dry season (Fig. 3). The mean difference of association among the ungulates during the wet season was 141.00 ± 57.34 and there was no statistically significant difference among the association (t=2.459, df=6, p>0.05). The mean difference of association among ungulates during the dry season was 277.43 ± 138.37. There was a significant difference among the associations (t=2.005, df=6, p<0.05).

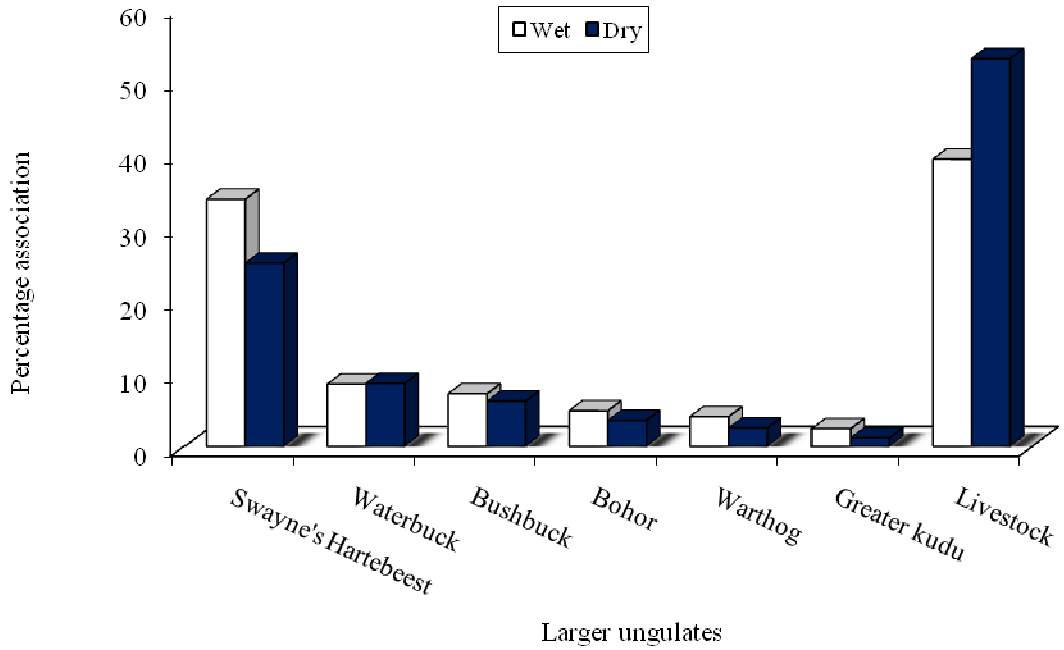

Fig 3 Percentage frequency association of oribi with other ungulates in the Park

Oribi were observed to consume grasses, herbs and woody plants during the study periods. Overall, annual grasses accounted for the highest percentage of oribi food across all study blocks in either of the study periods. During the study of vegetation utilization of oribi, they were observed to feed on 15 grasses and herbs, and 11 trees and shrub plant species, from five identified families during the dry season, and 17 grasses and herbs, and one tree and shrub plant species from three identified families during the wet season. Generally, during the study period of both seasons, oribi fed on a total of 28 plant species in the Maze National Park. Based on the criteria of preference category *Andropogon gayanus* (Local name 'Argeza') (12.48%, n=78) was the highest followed by *Themeda triandra* (12.32%, n=77) during the wet season (Table 1).

Table 1 Types of plant species utilized by oribi during the wet season

Scientific name (Grasses and herbs)	Local name	Family name	Sighting frequency	Percentage	Preference category	Rank
Andropogon gayanus	Argeza	Poaceae	78	12.48	a	1
Chrysopogon aucheri	Xiniqiyaa	Poaceae	15	2.40	c	14
Cyndon dactylon	Bergeda	Poaceae	29	4.64	c	10
Dichrostachys cinerea	Gargaroo	Fabaceae	15	2.40	c	14
Digitaria abyssinica	Zaragoyna	Poaceae	31	4.96	c	8
Eragrostis cylindrifora	____	Poaceae	11	1.76	c	16
Glycine wightii	Tura	Fabaceae	22	3.52	c	12
Hetropogon contortus	Alba	Poaceae	50	8.00	b	5
Hyparrhenia hirta	Matusa	Poaceae	63	10.08	b	3
Hyparrhenia rufa	Tinka	Poaceae	41	6.56	b	7
Ischaemum afrum	Bargadaa	Poaceae	23	3.68	c	11
Loudetia arundinacea	Washoo	Poaceae	43	6.88	b	6
Panicum maximum	____	Poaceae	31	4.96	c	8
Pennisetum thunbergii	Mayrole	Poaceae	60	9.60	b	4
Sporobolus panicoides	Wosho	Poaceae	20	3.20	c	13
Sporobolus spp.	____	Poaceae	9	1.44	c	17
Themeda triandra	____	Poaceae	77	12.32	a	2
*Solanum incanum**	Buloo	Solanaceae	7	1.12	c	18
Total			625	100.00		

(* =trees and shrubs/leaves, pods and fruit parts of the plants)

During the dry season, the forage preference result showed that *Themeda triandra* (12.54%, n=132) and *Andropogon gayanus* (11.59%, n=122) were preferred more by the oribi (Table 2).

Table 2 Types of plant species utilized by oribi during the dry season

Scientific name (Grasses and herbs)	Local name	Family name	Sighting frequency	Percentage	Preference category+	Rank
Andropogon gayanus	Argeza	Poaceae	122	11.59	a	2
Chrysopogon aucheri	Xiniqiyaa	Poaceae	28	2.66	c	12
Cyndon dactylon	Bergeda	Poaceae	53	5.03	b	8
Dichrostachys cinerea	Gargaroo	Fabaceae	25	2.37	c	13
Digitaria abyssinica	Zaragoyna	Poaceae	49	4.65	c	9
Eragrostis cylindrifora	_____	Poaceae	11	1.04	c	19
Glycine wightii	Tura	Fabaceae	34	3.23	c	10
Hetropogon contortus	Alba	Poaceae	87	8.26	b	5
Hyparrhenia hirta	Matusa	Poaceae	106	10.07	b	3
Hyparrhenia rufa	Tinka/Dinqaa	Poaceae	90	8.55	b	4
Ischaemum afrum	Bargadaa	Poaceae	33	3.13	c	11
Loudetia arundinacea	Washoo	Poaceae	69	6.55	b	7
Panicum maximum	Qolishomboo	Poaceae	23	2.18	c	15
Pennisetum thunbergii	Mayrole	Poaceae	82	7.79	b	6
Themeda triandra	_____	Poaceae	132	12.54	a	1
*Acacia abyssinica**	Odoruwa	Fabaceae	15	1.42	c	17
*Acacia albida**	Keretor/Dorqaa	Fabaceae	17	1.61	c	16
*Acacia nilotica**	Palo/Cheba	Fabaceae	4	0.38	c	24
*Acacia Senegal**	Tundukiae	Fabaceae	11	1.05	c	19
*Acacia seyal**	Fundukia	Fabaceae	12	1.14	c	18
*Acacia tortilis**	Shera	Fabaceae	5	0.48	c	23
*Albizia lophontha**	Gelchecha	Fabaceae	9	0.86	c	21
*Balanites aegyptiaca**	Domayee	Balanitaceae	4	0.38	c	24
*Dichrostachys cinerea**	Gargaroo	Fabaceae	6	0.57	c	22
*Euphorbia tirucalli**	Maxoo/Matua	Euphorbiaceae	2	0.19	c	26
*Solanum incanum**	Buloo	Solanaceae	24	2.28	c	14
Total			1053	100.00		

(* =Trees and shrubs/ leaves, pods and fruit parts of the plants)

A total of 126 oribi individuals were followed for 7200 minutes, during both wet and dry seasons of the study period. Oribi favoured typically more grass and herb species during the whole time of the year than trees and shrubs. Very rarely through the year when grasses were scarce especially during the dry season, they were observed utilizing trees and shrub plants, most of the time *Acacia* trees. Out of the 1053 feeding observations recorded during the dry season, 89.65% (n=944) were foraging on grass species and the rest 10.35% (n=109) were foraging on trees and shrubs. During both wet and dry seasons, a total of 1678 feeding observations were recorded during the study periods. The sighting frequency of grasses and herbs during both the wet (36.35 ± 5.41) ($t=6.714$, $df=16$, $p<0.05$) and dry (62.93 ± 9.95) ($t=6.323$, $df=14$, $p<0.05$) seasons was significantly different. Besides, the sighting frequency of trees and shrubs during the dry season (9.91 ± 2.03) ($t=4.883$, $df=10$, $p<0.05$) was also significantly different. The dry season sighting frequency of foraged plant species was significantly different compared to the wet season ($\chi 2=109.168$, $df=1$, $p<0.05$). With the exception of the two species such as *Sporobolus panicoides* and *Sporobolus species* of the family Poaceae that were recorded only during the wet season, all the other grasses and herbaceous plant species were recorded as foraged by oribi during both wet and dry seasons.

Carbone *et al*. (2005) stated that understanding the relationship between the distribution of animals and that of food resources is fundamental to ecology. Knowledge of the relationship of an animal with its habitat is essential for making and designing strategies for management. Early research in Africa focused on the distribution of animal species in relation to vegetation species composition and structure. The research emphasized on the balance among trees, shrubs, and grasses as factors both influencing and influenced by large mammals (McNaughton and Georgiadis, 1986; McNaughton *et al*., 1988). During the present study period, oribi were distributed in all vegetation types of all counting blocks in the Park but with variation in number among the blocks throughout the years. During the present study, few numbers of oribi were observed in tall and closed vegetation cover compared to the other habitats. This might be due to the inconvenience of the habitats to watch predators and other intruders from the distant, and a reduction of palatable green grass. Caughly and Sinclair (1994) suggested that the availability of food resources affects the population dynamics and distribution of animal species. Consequently, spatial distribution, local density, and grouping patterns, all are influenced by habitat heterogeneity.

Festa-Bianchet (1988) stated that forage quality, quantity and predator avoidance influence the

movement of certain mammals from habitat to habitats. According to Pulliam and Danielson (1991), one solution offered to explain how animals deal with conflicting needs to forage efficiently and avoid predation is selection of habitats that minimize the ratio of predation risk to available forage. Conversely, such animals would tend to avoid other habitats in which predation risk is high and value of food low. Began *et al*. (1986) described that different species of animals that make seasonal movements between habitats. In areas where food resources change with seasons, individuals are known to move from one type of habitat to another depending upon the season. Mduma and Sinclair (2008) elaborated that oribi preferred habitats with rocky outcrops and *Combretum-Terminalia* woodland. These habitats supported preferred food plant species. However, oribi occurred close to rocks during the dry season, and in areas with long grass during the wet season, both of which are used for cover against predators. They further discussed the functions and strategy of habitat selection in antelopes, to minimize the cost of obtaining resources, from niche partitioning due to interspecific competition, or to avoid predation by using escape terrain and by associating with other species for protection. Roberts and Dunbar (1991) explained that grass cover preference in herbivores is correlated with predator avoidance and dependence on cover as a principal part of avoidance strategy. In addition to food and cover, Afolayan and Ajayi (1980) stated that mineral requirements and burning practice are found to be the main factors influencing the movements and distribution of wildlife, particularly during the dry seasons. During the present study, a shift of large number of oribi from unburnt to burnt habitats in addition to mineral licking habitats was observed.

The study indicated that oribi reside with other few wild ungulates and livestock. They were observed associating more frequently with livestock and Swayne's hartebeests compared to other wild herbivores dwelling in the area. From these associations with other larger ungulates, oribi may get dilution effect to be alert and escape from intruders. Coverdale *et al*. (2006) described oribi seldom tend to mix with other ungulates as a form of anti-predator behavior. They stated that, oribi were noticed to significantly prefer Springbuck (*Antidorcas marsupialis*) as their nearest neighbour, simply because they tend to associate with prey of similar size thereby reducing the risk of being chosen by a predator. Mduma and Sinclair (2008) also documented similar findings about oribi within the Serengeti National Park. Although, the above researchers state in their findings oribi prefer to associate with similar sized herbivores, the present study shows that oribi also mix with other larger ungulates that exist in the range. Adamczak and Dunbar (2008) stated that their small size and open habitat preference make them unusually susceptible to predation risk. According to Clauss *et al*. (2003), large body sized animals provide an organism with the ability to avoid predation.

Besides, the association probably explains that the two herbivore species are not ecologically competitors as revealed in different feeding strategies. Bell (1971) hypothesized that larger herbivores graze tall grass and facilitate the grazing of smaller herbivores by increasing access to green leaves. Larger herbivores, such as hartebeests are better able to tolerate the poorer quality forage provided by taller grasses (Bell, 1971; Geist, 1974; Jarman 1974; Arsenault and Owen-Smith, 2002). Hence, larger species require longer grass in order to meet their quantitative food requirements, while small grazers can still achieve an adequate rate of food intake on very short swards (Arsenault and Owen-Smith, 2002). Clauss *et al*. (2003) explained that larger animals use forage of lower quality due to potentially longer passage rates and consequently more thorough digestion. According to Murray and Illius (2000), observations of free-ranging wildebeest and topi in Serengeti show a distinctive niche divergence with wildebeest utilizing short grasslands and topi utilizing mid-length grasslands with high leaf biomass. Topi are well known to be selective feeders acquiring up to seven times the green leaf content of the sward in their bites, whilst the broad muzzle of wildebeest has long been recognized as an adaptation to feeding on short swards. Gordon and Illius (1996), and Arsenault and Owen-Smith (2002) point out that selection for grass height is influenced additionally by the effective mouth width relative to body size. The above mentioned typical selective feeding strategy of oribi might also be due to their sharp, narrow head and muzzle, because oribi are highly selective feeders compared to other bovids. So, the result of this study revealed that oribi were often associated with non-domestic ungulates that existed in the Park area and fed among domestic livestock for protection and preferable food facilitation strategies. Gordon and Illius (1994) elaborated that body mass, feeding facilitation, competitive exclusion and predation have been hypothesized as the primary ecological pressures shaping the community structure of African ruminants. In the present study, the association of oribi with domestic ungulates was high during the dry season compared to the wet season. This might be due to the increasing number of livestock in the Park area to get access to the grass.

Based on the definition of Andere (1981), utilized vegetation type refers to the habitat where most oribi are observed grazing or browsing alone or in groups at a definite time. According to Shrestha and Wegge (2006), knowledge of the food habits of wild and domestic herbivores is a basic requirement for the management of rangeland resources. However, Lewis (1994) explained that reliable determination of ungulate diets is difficult. A widely used procedure in studies of herbivore diet is direct observation of the grazing animal. Several authors have used direct observation to determine feeding preferences of herbivores (Lamprey, 1963; Tinley, 1969) and more specifically to oribi (Reilly *et al*., 1990). Leuthold and Leuthold (1978) and Holechek *et al*. (1982) explained that direct observation requires minimal time (simplicity and ease of use) and minor equipment inputs

but accuracy and precision are a problem particularly, with wild animals. Initially, during this study, it proved difficult to follow oribi foraging in the grass field. However, with practice and help from the experienced Park staffs and local people, it proved feasible to collect reliable data by direct observation technique.

In the present feeding investigation of oribi, *Andropogon gayanus* and *Themeda triandra* were the most preferred grass species. *Themeda triandra* was reported by Mduma and Sinclair (2008) to be favoured by most oribi populations in South Africa and also similar results for oribi were obtained by Tekalign and Bekele (2011) at Senkele Swayne's Hartebeests Sanctuary (SSHS), Ethiopia. Among the grass species, *Cymbopogon commutatus* was commonly known by the local community and also observed during the study period as excluded and not preferred by oribi, livestock and other wild animals in the study area. This might be due to their toxic and bad smell. Oribi feed selectively on high-quality of plants for food. It is known that herbivorous animals decide where to forage, what plants to eat, and how much to consume at any given location. Hodges and Sinclair (2005), and Seccombe-Hett and Turkington (2008) explained that the selection of food in their diet is influenced by energy expenditure, susceptibility to predation, and nutritional quality and energy content. According to Van Soest (1996) concentrate selectors like oribi, are unable to tolerate large amount of fibre in their diet and thus are limited to selective feeding on low fibre portions of plants.

Marchant *et al*. (2007) described that, it is typical to small-bodied antelopes which feed very selectively on highly nutritious food to be widely dispersed as their preferred food is generally not abundant. In the present study, the high preference of oribi foraging on short grasses and their wide distribution throughout the study area might also be related to this strategy. Therefore, selection of particular plant species or plant parts and leaving out when the grasses become long by oribi at Maze National Park might be, due to their requirements to achieve a balance of nutritional components. Furthermore, oribi showed a high preference to foraging green grasses in burnt areas and strongly avoided areas with high amount of dry stem during the dry seasons. Van de Vijver *et al*. (1999) and Klop *et al*. (2007) stated that post-fire re-growth has higher nutrient levels and higher digestibility than un-burnt vegetation. Grazing herbivores are attracted by post-fire re-growth because of the superior forage quality and more favorable sward structure. The positive effects of burning on sward structure were clearly seen in patterns of resource selection as oribi were found to significantly avoid grass swards with high amount of dry stem. Grazing on the burnt areas would provide oribi with an opportunity to ingest the preferred diet without spending much time and energy on selecting the best parts, since most of the grass available is of the desired quality.

Illius and O'Connor (2000) explained that ungulates commonly experience considerable seasonal, climatic and spatial variation in resources, especially in arid and semi-arid tropical environments, where such variation is extreme. Alternating wet and dry seasons impose a cycle of plant growth and phenology that results in a cycle of food abundance and quality. It is known that resource limitation occurs during the dry season, when low quality food causes animals to lose weight; their survival then depends on the adequacy of body fat reserves carried over from the previous season. During both wet and dry seasons, the foraging time of oribi is limited due to high mid-day temperature. During the wet season, a high intake rate compensates for the loss in foraging time, but during the dry season, water and protein become limiting (Owen-Smith and Novellie, 1982). Several woody plants (11 tree and shrub plants) were recorded during the dry seasons, serving as food for oribi in the Maze National Park. This might be due to the shortage of palatable green grasses in the area. Manser and Brotherton (1995) stated that during the dry seasons, dik-diks fed on plant species that they avoided during the wet seasons to meet minimum daily water requirements. They mentioned also higher species selectivity and observed more during the wet season than the dry season. During the dry months, food quantity and quality is at its lowest and it is at this time that there is a marked decline in the crude protein content of grass species (Coverdale *et al*., 2006). Therefore, the digestibility and nutritional value of the food is very low during the dry seasons. Roques *et al*. (2001) and Voeten *et al*. (2009) described that as a result of continuous high grazing pressure during the dry season, a change in forage species composition to less palatable species can be expected, leading to an increase in woody vegetation. Based on the present study and the selective feeding behavior of oribi, it is important to improve both the quality and the quantity of forage availability within the Park. It could be achieved by adopting a more effective vegetation management program based on controlled burning and selective ploughing of the natural grasslands within the Park by effective control and monitoring of the Park management.

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