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Population Status, Feeding Ecology and Habitat Association of the Common Warthog (*Phacochoerus africanus*) in Bale Mountains National Park, Ethiopia

GEBREMESKEL TEKLEHAIMANOT* AND MUNDANTHRA BALAKRISHNAN**

Department of Zoological Sciences, Addis Ababa University, P.O. Box 1176, Addis Ababa, Ethiopia
* Present address: *Department of Biology, Mekelle University, Mekelle, Ethiopia*

Emails: * *gebretekle1224@gmail.com*, ** balak212@yahoo.com

ABSTRACT

Population status, structure, sounder size, feeding ecology and habitat association of the common warthog (*Phacochoerus africanus* Gmelin, 1788) were studied in Bale Mountains National Park, Ethiopia using both total and sample count methods. A total of 195 individuals were counted in the six study sites by total count method, of which 118 (60.5%) were from Dinsho headquarters area with a population density of 43.7 individuals per km^2. Adults constituted 27.7%, sub-adults 16.4% and young 55.9% of the population in Dinsho, with a male to female ratio of adults and sub-adults together 1:1.7. The mean sounder size was 6.5 individuals. Sample count method revealed the presence of 561 individuals in Gaysay/Adelay area, where the population density was 18.1 individuals per km^2. Adults constituted 30.5%, sub-adults 15.9% and young 53.6% of the population in Gaysay/Adelay, with a male to female ratio of adults and sub-adults together 1:1.65. They were mainly grazers and associated with open grassland habitats regardless of seasonal variations. There was more vegetation coverage (64.5%) during the wet season than during the dry season (29.3%). The quality of a given habitat and availability of essential resources have major influence on the distribution and abundance of the common warthogs in the present study area.

Key Words: Abundance; Diet; Distribution; Habitat; Population Ecology

INTRODUCTION

The common warthog (*Phacochoerus africanus* Gmelin, 1788), a member of the damily Suidae, is distributed widely over the sub-Saharan Africa (d'Huart and Grubb 2001). The name 'warthog' refers to their facial wattles, which are more distinct in males. Warthogs have sexually dimorphic tusks, which are larger in males. They live in open and wooded savannas, grass-steppes, open bushlands and in semi-desert habitats (Kingdon 2004, Cumming 2008). Distribution areas of the common warthog are known to be limited by cover, human disturbances and forage (Vercammen and Mason 1993). This species is recorded at elevations of 3,500 m in the Ethiopian highlands like the summit of Mt. Gaysay in the Bale Mountains National Park (BMNP; Yalden et al. 1996). Currently, warthogs are increasingly restricted to protected areas, where they are safer in response to fragmentation of habitats, conflict with agricultural practices and hunting pressure. This species has good population in the open grassland habitats in the Gaysay area of BMNP in Ethiopia (Ermias et al. 2008).

They are social mammals, live in groups called sounders consisting mostly females and their offsprings. A good proportion of adult males live solitarily; or form loose bachelor groups (Vercammen and Mason 1993). This species is predominantly grazer, but also feeds on roots, berries, barks of young trees, sedges, fallen fruits, certain forbs and occasionally their own faeces, and also carcasses left behind by larger predators when food is

scarce (Meijaard et al. 2011). They are seasonal breeders. There are no major threats for warthogs, but the species is susceptible to drought and overhunting in unprotected areas. Predominant predators of common warthogs are lion, leopard, cheetah, wild dog and hyena (Sinclair 1985, Meijaard et al. 2011). Lion, leopard, spotted hyena and common jackal are some of the potential predators of warthogs in BMNP. They are also killed by local people as revenge against raiding crops, and as they are vectors of the African swine fever (Vercammen and Mason 1993).

Due to human population explosion and encroachment into natural habitats for settlements, agricultural activities and livestock grazing, wildlife habitats have been affected in BMNP. Even though warthogs have a wide distribution in Ethiopia, their population ecology is less studied in the Ethiopian highlands. Ermias et al. (2008) gives the data gathered on warthogs during February–December 2000 in BMNP. The present study was planned to find out the population status and trend, and feeding ecology of warthogs in the same area after a gap of over 10 years.

THE STUDY AREA

Bale Mountains National Park is located between 6º29'–7º10'N and 39º28'–39º57'E in the southeastern part of Ethiopia, with an extent of 2200 km^2 (Figure 1). This Park was designated in 1974 primarily for conservation of the endemic mountain nyala and the Ethiopian wolf and also to conserve the largest tract of Afro-alpine habitats in Africa (Hillman 1993). Its headquarters is located at Dinsho, 400 km by road from Addis Ababa, the capital city of Ethiopia. Rainfall in the Park is bimodal, characterized by an eight months rainy season (March to October), followed by four months dry season (November to February) (Daniel 1977). Annual rainfall in the area ranges from 1000 to 1400 mm. The minimum and the maximum temperatures in the Park vary from 1.4ºC (in January) to 18.4ºC (in February), respectively. There are the following five ecological zones in BMNP: the northern grassland, northern woodland and heath moorlands forming a mosaic between 3100–3400 m a.s.l., the treeless Afro-alpine and moorland habitats above 3400 m, and the southern Harenna forest between

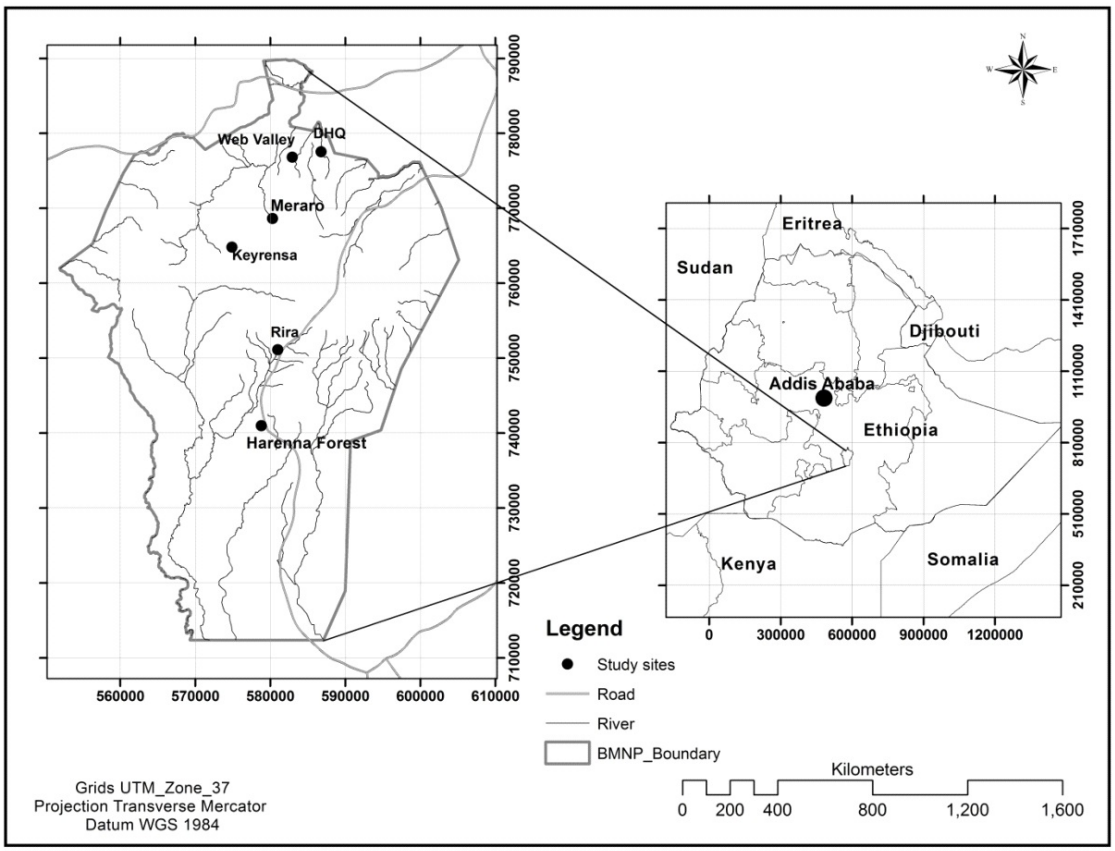

Figure 1. Map of Bale Mountains National Park showing location of the six study sites, where warthogs were subjected to total counts. DHQ = Dinsho Headquarters area)

1500–3200 m (Miehe and Miehe 1994). Each of these vegetation zones has its own characteristic flora and fauna. The vegetation is largely of the Afro-alpine and sub-alpine types (Malcolm and Sillero-Zubiri 1997). There are 1321 flowering plants in BMNP of which more than 163 (12%) are endemic to the nation, and 23 (14%) are endemic to BMNP (Anteneh et al. 2013).

Due to a broad range of habitats between 1500 and 4377 m above sea level, BMNP harbours a variety of fauna. Out of the 67 species of mammals and 256 species of birds recorded in BMNP, five species of mammals and six species of birds are endemic to the Park (Stephens et al. 2001).

METHODS

The present research was conducted during September-October, 2011 (wet season) and January- February, 2012 (dry season). A reconnaissance survey was carried out in the study area in August 2011 to document base-line information on the distribution, habitat and abundance of the common warthogs and vegetation types.

To determine the population size of the common warthogs, the Park area was divided into seven study sites based on the distribution, habitat and abundance of common warthogs. These sites were Dinsho head-quarters area (northern woodlands) (2.7 km^2), Web Valley (a broad valley with swampy area and large caves) (3.5 km^2), Meraro (open plains with swampy area) (2.4 km^2), Keyrensa (treeless Afro-alpine habitats and heather moorlands) (3.5 km^2), Rira (Heathland and scattered trees downwards) (2.9 km^2), Harenna forest (southern Harenna forest area) (6.5 km^2) and Gaysay/ Adelay area (northern grassland, northern woodlands and heather moorlands) (31 km^2) (Figure 2). Dinsho head-quarters area, Web Valley, Meraro, Keyrensa, Rira and the Harenna forest are far apart, and the extents of the areas where warthogs present are relatively narrow. Hence, total count method was used to conduct the census in these sites (Wilson et al. 1996). However, the Gaysay/Adelay area had good population of warthogs in a relatively wider area and hence sample count was carried out in this site. All observations were made on foot.

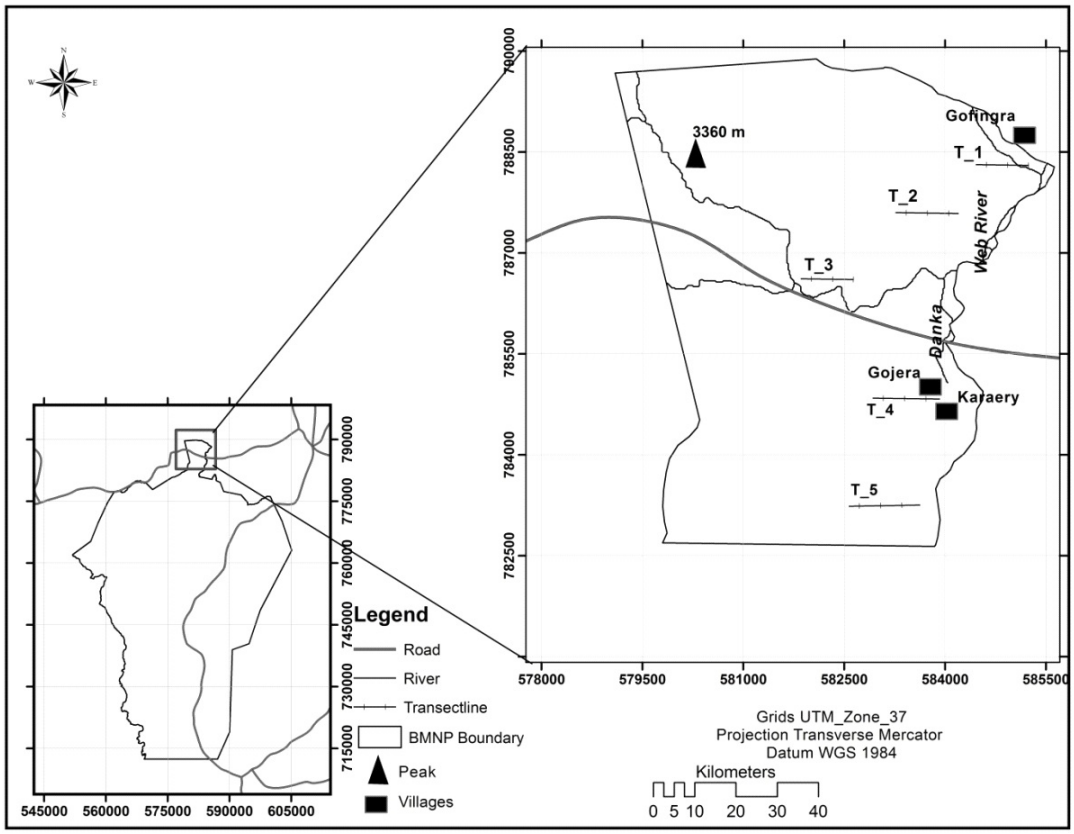

Figure 2. Location of the transect lines in Gaysay/Adelay area (T-1, T-2, T-3, T-4 and T-5 mark the Transects 1 to 5 respectively.

Population Assessment

Population assessment of warthogs was carried out by direct observations by unaided eyes and/or with a 10 x 42 binoculars. Census was conducted in the morning (07:00–09:00 h) and late afternoon (16:00–18:00 h) for five consecutive days in each of the study sites during each of the census sessions, following the methods of Norton-Griffiths (1978) and Caughley and Sinclair (1994).

Three experienced scouts participated in the census in each of the study sites. To avoid double counting, census was done simultaneously in all sites and transects. Five transect lines (T-1: grassland with scattered trees, T-2: bush grassland, T-3: swamp grassland, T-4: open grassland and T-5: woodland and heather moorlands (see Fig. 2), each of 1.5 km long were laid randomly in different habitats in the Gaysay/Adelay area using natural sign-posts and poles. A GPS was used to follow straight lines by sighting signposts on the line of travel. Data on the number of warthogs in a sounder, approximate age, sex categories and perpendicular distance of sightings from the observer were recorded (Burnham et al. 1980). Data gathered were also plotted habitat-wise.

Age and Sex Structure

Adults, sub-adults and young (including hoglets and yearlings) were distinguished in the field by their relative body size and approximate length of tusks (Mason 1982). Adult males were distinguished from adult females by their two pairs of warts, larger tusks, mane and scrotal sack and adult females by their relatively smaller tusks, a pair of warts and mammary glands (Randi et al. 2002). Sex of young individuals was indeterminate.

Sounder Size

Individuals sighted within less than 20 m of each other in spatial association with relatively synchronous behavior, moving in the same direction maintaining the sounder cohesion were considered as of the same sounder (White et al. 2010). Single animals were considered as 'sounder' for the purposes of analysis (Arcese et al. 1995).

Feeding Ecology

Food items of warthogs were determined by direct observations on selected focal animals during their feeding in Gaysay/Adelay area (Field 1972, Henley et al. 2001). Instantaneous focal animal sampling (Altmann 1974) was employed to observe food items consumed by warthogs by silent detection. The time taken for feeding a particular food item was recorded at five minute intervals throughout the feeding period. When the focal animal was observed feeding, its feeding location was identified using nearby landmarks. When it moved away from the feeding site, fresh bites were identified as old bites turn brown quickly (Arsenault and Owen-Smith 2008). Parts of the plant species consumed were classified as young leaves/blades, mature leaves/blades, stem, root and rhizome. Using line intercept method, data on availability of vegetation were obtained from 75 sample sites (Sutherland 1996, Cummings and Smith 2001). All plant species intercepted by transect lines were identified, counted and recorded. The following formula was used to find out the mean percentage coverage of each species (MPCSp):

$$MPCSp = [TCSp/L] \times 100$$

where, TCSp is the total cover of the species and L is length of the line.

To find the mean percent vegetation cover of the site (MPCS):

$$MPCS = [TCS/L] \times 100$$

where, TCS is total cover of the site, L is length of the line.

Food items were identified in the field with the help of field guides and ecologists of the Park. Those plants, which could not be identified in the field were taken to the National Herbarium, Addis Ababa University and identified using the herbarium collections.

Habitat Association

The Gaysay/Adelay area was categorized into open grassland, swamp grassland, bush grassland and woodland and heather moorlands (Okello 2005, White et al. 2010). Data on the distribution and habitat association of warthogs were collected based on their sightings and preferential use of the habitats (Garshelis 2000), and by recording the number of warthogs/sounders sighted in a given habitat type (Campton et al. 1988). Vegetation types and the location of each warthog/sounder sighting were recorded in order to examine seasonal vegetation

utilization and habitat association of the species (Dankewa-Wiredu and Euler 2002).

Data Analyses

Data were analyzed using SPSS software version 17 and Microsoft Excel. Hayne's estimator of density (Krebs 1998) was used to estimate the population size on transects. Population counted in the study area, sounder size, vegetation cover and feeding during wet and dry seasons were compared by independent sample t-test and by One-way ANOVA. Age and sex structure as well as population estimate among transects and habitat association of warthogs in different habitats were compared by Chi-square test.

RESULTS

Population Assessment

Data on the population size of warthogs in the six study sites are shown in Table 1. There were 224 individuals during the wet and 165 during the dry season counts (average: 195 ±12.4) with a significant seasonal difference ($t = 0.031$, $P<0.05$).

Out of the total warthogs counted, 60.5% (n = 118) was in Dinsho headquarters area with a mean population density of 43.7 individuals per km^2, followed by the Harenna forest habitat, which constituted 15.9% (n = 31) of the population. The least was 3.1% (n = 6) in Keyrensa. There were 14, 10 and 16 warthogs in Web Valley, Meraro and Rira, respectively.

Sample count in Gaysay/Adelay area revealed the presence of 561 warthogs in the five transects with a mean population density of 18.1 individuals per km^2. The wet season estimate (n= 598) was significantly more ($t= 0.21$, $P<0.05$) than the dry season estimate (n= 524). The mean population estimates in the five transects during the wet and dry seasons are given in Figure 3. During the study period, the mean number of warthogs recorded in T-1, T-2, T-3, T-4 and T-5 were 466±24.1, 667±38.9, 532±28.7, 782±45.3 and 359±17.5, respectively. The maximum recorded was in transect 4, followed by transect 2 and the least was in transect 5. There were variations in population estimates among transects. Number of the warthogs estimated in transect 4 was significantly more than the number estimated in transect 1 ($\chi^2 = 43.6$, df = 4, $P<0.01$), transect 3 ($\chi^2 = 37.4$, df = 4, $p<0.01$) and transect 5 ($\chi^2 = 47.2$, df = 4, $P<0.01$).

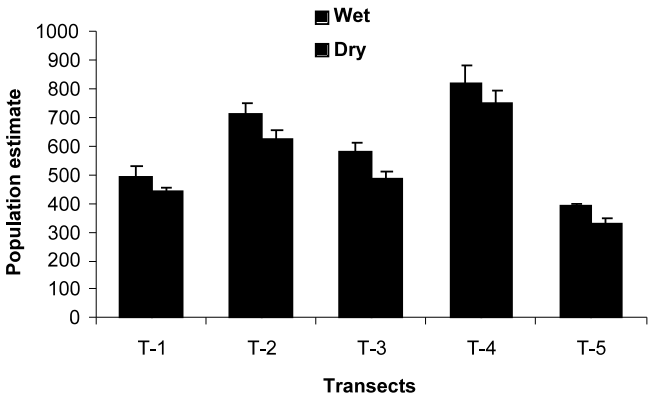

Figure 3. Population estimate of the common warthogs in the five transects (T-1 to T-5) in Gaysay/Adelay area during wet and dry seasons (Mean ± SE)

Population Structure

Out of the warthogs enumerated in the study sites, 27.7% (n = 54) were adults; 16.4% (n = 32) sub-adults and 55.9% (n=109) were young individuals. Adults were significantly more than sub-adults ($\chi^2 = 11.2$, df =2, $P<0.01$) and less than young individuals ($\chi^2=6.1$, df = 2, $P<0.01$). The ratio of adults to young, and sub-adults to

Table 1. Season-wise population of common warthogs (Mean±SE) in the six study sites
DH= Dinsho headquarters area, WV= Web Valley, MR= Meraro, KR= Keyrensa, RI= Rira, HF= Harenna forest

Season	Population at each site						Total
	DH	WV	MR	KR	RI	HF	
Wet	130±18.3	16±2.5	11±1.6	7±0.7	21±2.2	39±13.3	224
Dry	106±11.8	11±3.0	9±1.3	5±0.3	12±2.0	22±8.9	165
Mean	118	14	10	6	16	31	195
%	60.5	7.2	5.1	3.1	8.2	15.9	100

young were 1:2 and 1:3.4, respectively. Among the populations of the sexed warthogs (n= 86), males constituted 37.2% and females 62.8%. Among the 561 warthogs estimated in the Gaysay/Adelay area, 30.5% (n=171) was adults, 15.9% (n= 89) was sub-adults and 53.6% (n= 301) was young. In the Gaysay/Adelay area also adults were significantly more than sub-adults (χ^2 = 5.3, df= 2, P< 0.01), and less than young individuals (χ^2 =2.1, df = 2, P<0.01). The ratio of sub-adults to adults was 1:1.9, whereas those of adults to young, and sub-adults to young were 1:1.8 and 1:3.4, respectively. Among the sexed warthogs in Gaysay/Adelay area (n= 260), males constituted 37.7% and females 62.3%.

Sounder Size

There were less sounders of warthogs during the wet season (21±7.6) than during the dry season (33±10.4), and the difference was significant (t = 0.093, P<0.05). Sounders mostly constituted one or more adult females, sub-adults and their young. The mean sounder size observed was 8.8±6.2 and 4.2±4.9 during the wet and dry seasons, respectively, with a mean of 6.5±5.5 during the study period. The mean sounder size varied significantly during the wet and dry seasons (t = 0.042, P<0.05). Sounders of 1–13 individuals were encountered during the wet season and of 1–7 during the dry season. In most cases, adult males were seen solitarily.

Feeding

A total of 1538 feeding observations were recorded from scan sampling during the study period. During the wet and dry seasons, 666 (43.3%) and 872 (56.7%) feeding observations, respectively, were recorded. There were more feeding observations and intake of a large number of plant species during the dry season than during the wet season. Plant species such as *Carex steudneri* and

Table 2. List of the plant species consumed by warthogs, mean coverage of the species and percentage of time spent on diet (Life forms: 1= annual non-woody herb, 2= perennial non-woody herb, 3= perennial woody shrub; Habitat types: a= Open grassland, b= Swamp grassland, c= Bush grassland, d= woodland; Parts consumed: yl= young leaves; ml= matured leaves; st= stem; ro= root; rh= rhizome)

Plant species consumed	Family	Mean % cover	Life forms	Habitat type	Parts consumed	* Time spent (%)
Festuca abyssinica Hochst. ex A. Rich	Poaceae	13.2	2	d	yl,st	2.7
Andropogon amethystinus Steud.	Poaceae	6.3	2	a, d	yl,ml,rh	5.3
Carex conferta Hochst. ex A. Rich.	Cyperaceae	5.4	2	b, d	yl,ml,rh	14.2
Brachypodium pectinatus Thunb.	Poaceae	1.9	1	a	yl,st	4.4
Polypogon schimperianus (Hochst. ex Steud.) Cope	Poaceae	3.4	2	d	yl,st,rh	6.1
Cyperus digitatus Roxb.	Cyperaceae	2.7	2	b	yl,rh	3.1
Valpia bromoides (L.) S.F. Gray	Poaceae	0.8	1	a, c	yl,st	1.8
Carex steudneri Böck	Cyperaceae	6.2	2	a, d	yl,ml,rh	5
Festuca simensis Hochst. ex A. Rich.	Poaceae	7.3	2	a, c	yl, ml,rh	21.8
Aeollanthus abyssinicus Hochst. ex Benth.	Lamiaceae	0.8	2	b	yl, ro	0.7
Helictotrichon elongatum (Hochst. ex A. Rich.) C.E. Hubb.	Poaceae	3.7	2	a, d	yl,st	6.4
Conyza nana Sch.Bip.ex Oliv.& Hiern	Asteraceae	0.4	2	a,c	yl	1.6
Calamagrostis epigejos (L.)Roth	Poaceae	5.2	2	a, d	yl,rh	0.6
Carduus schimperi Sch.Bip.	Asteraceae	0.6	2	a, d	ro	1.9
Agrostis gracilifolia C.E. Hubb.	Poaceae	3.1	2	b, d	yl,st	5.5
Hypericum revolutum Vahl	Hypericaceae	4.2	3	b, d	yl,ro	3.1
Helichrysum splendidum (Thunb.)Less.	Asteraceae	5.9	3	b	yl	1.4
Pentaschistis pictigluma (Steud.) Pilger.	Poaceae	1.4	2	d	yl,st	2.8
A Agrostis keniensis Pilger.	Poaceae	8.2	2	c	yl,ml	11.6

* % of time utilized was evaluated only for the most consumed 19 plant species.

Aeollanthus abyssinicus, which were neglected during the wet season, were consumed during the dry season. Out of the 48 plant species identified in the study area, 19 species, belonging to five families, were recorded as food of warthogs (Table 2). Among them, Poaceae (grasses) contributed the major diet (69%), while the least (0.7%) was contributed by Lamiaceae. Plant cover during the wet season was 64.5%, while it was only 29.3% during the dry season ($t= 4.361$, $p<0.05$). The common plant species in the study area were *Festuca abyssinica, Agrostis keniensis, Festuca simensis, Carex steudneri* and *Helichrysum splendidum* in the decreasing order. Among the feeding observations, 490 (73.6%) and 568 (65.1%) were when warthogs were grazing during the wet and dry seasons, respectively ($t = 7.548$, $P<0.05$). *Festuca simensis, Carex conferta, Agrostis keniensis, Helictotrichon elongatum* and *Polypogon schimperianus* were the five most preferred grasses in the decreasing order, which formed the bulk of the warthog diet. There was more consumption of *Festuca simensis* during the wet season (28.1%) than during the dry season (15.5%). The intake of *Carex conferta* was significantly less during the wet season (7.7%) than during the dry season (20.6%). Herbs comprised 151 (22.7%) and 164 (18.8%) of the feeding observations of warthogs during wet and dry seasons, respectively. Shrub consumption comprised 6 (0.9%) and 67 (7.6%) during the wet and dry seasons, respectively. Root consumption comprised 19 (2.8%) and 73 (8.4%) of the feeding observations during wet and dry seasons, respectively ($t= 3.62$, $P<0.05$).

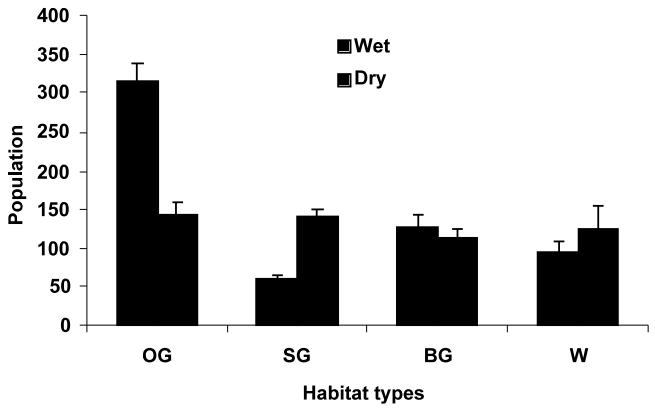

Figure 4. Habitat-wise population of warthogs in Gaysay/Adelay area during wet and dry seasons (Mean ± SE). OG= Open grassland, SG= Swamp grassland, BG= Bush grassland, W= Woodland

Habitat association

Distribution of warthogs in different habitat types varied with season (Figure 4). During the wet season, 52.7% (315±24.3) of the warthogs was observed in open grasslands, when only 10.2% (61±3.3) was observed in the swamp grassland. During the dry season, 27.7% (145±14.1) and 26.9% (141±8.7) of them were recorded in the open grasslands and swamp grasslands, respectively. The percentage of occurrence of warthogs in bush grassland was 21.2 (127±17.4) during the wet season and 21.6 (113±10.3) during the dry season. During the study period, 41% (230±19.9) of the warthogs were observed in the open grassland and 18% (101±7.0) in the swamp grassland habitat ($\chi^2 = 18.6$, df = 1, $P<0.01$). Significantly more warthogs were observed in the swamp grassland habitat during the dry season than during the wet season ($\chi^2 = 24.7$, df = 1, $P<0.01$). Only 19.6% (110±12.4) of them was observed in woodland and heath moorland habitats during the study period.

DISCUSSION

The population size of warthogs in Dinsho headquarters area, Harenna forest and Web Valley was higher than the previous population estimates of 108 in Dinsho headquarters and six in the Harenna forest (Ermias et al. 2008), who used similar census techniques as the present investigation. The common warthogs do not prefer forest areas, but those recorded in the Harenna forest in the present study might be probably due to the presence of open spaces between forests where warthogs can get forage and visibility against predators. Künzel et al. (2000) also noted that in some areas like the Goda Mountains in Djibouti, this species occupies forested areas. They were also reported earlier in clearings between forests in the Harenna forest in Bale Mountains (Lavrenchenko 2000).

In the Gaysay/Adelay area, 561 warthogs were recorded during the present study. Stephens et al. (2001) and Ermias et al. (2008) estimated 400 and 445 individuals, respectively, in the same area. The present population estimate is higher than the previous two investigations. This difference might probably be due to the population increase by natality during the last decade and/or by immigration from nearby areas. The relatively higher population density can also be attributed to better protection of these areas from human interference and impacts of livestock, and due to the availability of

enough forage and shelter. However, conflicts for common interest between warthogs and the local community in and around the Park has negative effects on the future existence of this species as warthogs cause damage to various crops, and compete for grazing (Vercammen and Mason 1993).

Abundance of young was more in the population of warthogs. Further, there were more young individuals during the wet season than during the dry season. This difference is mainly due to the birth of young during the wet season and their growth to sub-adults by the following dry season. Physiological stress such as extreme temperature might also contribute to mortality of the young during the dry season (Boshe 1984).

Sex-wise comparison of warthogs during the study period clearly revealed a female-biased population in BMNP. The possible reason for this might be due to dispersal of males from the sounder and their susceptibility to predators (Vercammen and Mason 1993). The presence of more unsexed individuals might also have significant effect on the unbalanced sex ratio. Ermias et al. (2008) also reported adult and sub-adult males to female ratio of 1:1.6 in the same study area. The presence of more adult females and a relatively large number of young individuals in the population might help to further increase warthog populations in BMNP. Discussions made with farmers and herders from three nearby villages (Gofingra, Gojera and Karaery), and scouts also revealed an increasing trend of the warthog population in BMNP.

The larger sounder size recorded during the wet season than during the dry season can be explained in terms of seasonal changes in the availability of resources in different habitats and ambient weather conditions. Fresh grass is abundant and solar radiation is mostly shielded by clouds, and hence warthogs congregate in open grassland habitats during the wet season. But, during the dry season, grass is scarce and solar radiation is high in open habitats, and thus, warthogs have to compete for resources. Hence, during the dry season, they might dissociate into smaller sounders in order to avoid competition for food. Sounder formation also varied with age and sex. Larger sounders were formed by young individuals than sub-adults and adults. This might also be associated with the play behaviour of young individuals. Yearlings form sounders, regardless of their sex and time of the year (White et al. 2010).

Tropical ungulates obtain most of their food by grazing (Field 1972). However, the present findings have recorded increased consumption of herbs, browse and root excavations during the dry season, probably in relation to the decline in the availability of fresh grasses. Skinner and Chimba (2005) also noted that common warthogs have other food items in their diet including underground rhizomes, tubers, bulbs and fruits during the dry season. During the present study period, warthogs mainly depended on grasses as reported earlier (Cumming 2008). Cumming (1975) also reported that common warthogs depend on roots during the dry season to supplement their water demands. More feeding observations witnessed during the dry season as compared to the wet season could be probably to increase their food breadth as forage is scarce during the dry season. This supports the view of the optimal foraging theory that even less favoured food types will be incorporated in the diet to widen diet breadths when food items become scarce (Owen-Smith and Novellie 1982, Stephens and Krebs 1986). The preferred grasses were not abundantly available in the area, and hence it might be possible that they depend upon the more accessible and palatable ones in the habitat.

The preference of warthogs to the open grassland habitat (Transect 4) might be due to the availability of preferred grass, and easy detection of predators. On the other hand, the presence of grasses like *Agrostis keniensis,* which is a food item in the bush grassland (Transect 2), and the use of the bushes for hiding against predators and shade from overheating might contribute for the preference of warthogs to the bush grassland habitats. Warthogs tend to choose open areas for feeding (Radke 1990), while seeking cover under bushes (Treydte et al. 2006). Increased sightings of warthogs in the swamp grassland habitat (Transect 3) during the dry season might be attributed to the lack of fresh grasses in the open grassland habitat (Bezawork et al. 2009). Availability of food and water sources governs the distribution patterns of warthog populations in their natural habitats (Mwangi and Western 1998). The relatively less association of common warthogs in the woodland and heather land habitat (Transect 5) can be viewed in terms of lack of forage under the canopy of big trees and cooler environment as warthogs avoid such environments despite they use trees for shade underneath and protect themselves from high temperature during noon hours. Warthogs mostly avoid highlands as they are intolerant of lower temperatures (Sinclair et al. 2006).

Thus, quality of a given habitat and availability of essential resources greatly influence the distribution, abundance and sounder size of warthogs. Detailed, long-term studies are envisaged for better understanding of their population status, trend and ecology and their effective conservation and management in BMNP.

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