

## Population Status and Diurnal Activity Patterns of the Common Warthog (*Phacochoerus africanus*) in the Bale Mountains National Park, Ethiopia

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### ABSTRACT

The population, age and sex category and diurnal activity patterns of the common warthog (*Phacochoerus africanus*) were studied in the Bale Mountains National Park, Ethiopia during wet and dry seasons. Both total and sample counts were made to study the population size. Focal animal sampling method was used, focussing on one animal, pair or group at a time, to study the activity pattern. Data were analyzed using SPSS computer software package and compared using one-way ANOVA and t-test for independent sample of groups. There were a total of 576 warthogs in the study area. The male: female ratio of adults and sub-adults together was 1.00:1.63. Over 57 % of the population constituted young, showing increasing population trend. Major activities of the species were feeding and resting/lying down. The time spent on each activity by Group I (an adult male) and Group II (one female with her two hoglets) was not significantly different except in feeding. Feeding activity reached its peak in the early morning and late afternoon hours. Resting/lying down was more pronounced during the mid-day. The activity patterns of warthogs were more or less similar to those of the other diurnal ungulates in the Bale Mountains National Park, characterized by morning and evening activity peaks with a period of rest during mid-day.

*Key Words:* Warthog, Population, Behaviour, Bale Mountains National Park, Ecology, Wildlife.

### INTRODUCTION

Warthogs are non-ruminant artiodactyls. They inhabit open wooded savannas, grass-steppe and semi-deserts of Africa from Mauritania and Ethiopia in the north to Namibia and Natal in the south. They are members of the sub-family *Phacochoerinae*. There are two living species of warthogs, the common warthog (*Phacochoerus africanus*) and the desert warthog (*Phacochoerus aethiopicus*) (Grubb 1993). The common warthogs occur over a wide range of altitudes from sea level in Gambia to over 3,000 m asl on the Ethiopian plateau. In the Bale Mountains National Park, they were observed mainly in the Gaysay/Adelay area, and rarely in the Web Valley close to the Adelay Ridge. The continuous expansion of the Sahel-zone has resulted in the depletion of the former northern range of this animal to the extent of extinction in Mali and Niger. There is no recent report on the population status from the southern Central African Republic, most of Zaire and

Angola, but elsewhere they are reported to survive throughout much of their former ranges. Their range has enlarged in Botswana and Transvaal Province as a result of clearing the former wooded savanna and the creation of pasture. Warthogs have been reintroduced in Natal and Eastern Cape Province (Skinner and Smithers 1991, Mason 1992).

Warthogs are diurnal even-toed ungulates, adapted for grasslands and savanna habitats. They usually avoid forests and dense undergrowth. In the dry season, they depend upon the underground rhizomes of perennial grasses, sedges, bulbs and tubers. Even though warthogs are known to be highly diurnal, males are reported to extend activities even after dusk (Estes 1991). Usually, they emerge out of their den later, on cold and rainy days. They seek shade on sunny days and wallow on hot days. Most of the activity peaks are early in the morning and late in the afternoon hours (Estes 1991).

There is lack of authentic information on the

distribution and populations of warthog in Ethiopia. Human persecutions in reprisal for crop raiding, and hunting for meat are important threats to *P. africanus*. As the available data on warthogs are insufficient to assess regional conservation and management priorities, field studies on their distribution, abundance and behavioural ecology are required. In this context, the present investigation was planned to reveal information on this species in the Horn of Africa following the recommendations addressed in the IUCN/SSC pigs, peccaries and hippos Action Plan (Vercammen and Mason 1993).

## THE STUDY AREA

The present investigation was conducted in the Bale Mountains National Park (BMNP) (06° 30' to 07° 00' N and 39°30' to 39° 55' E) in southeastern Ethiopia. The headquarters of the Park is on the northern border of Dinsho, which is 400 km by road from Addis Ababa. The Bale Mountains form the southeastern limits of the eastern Ethiopian highlands, along the eastern edge of the Rift Valley. It covers an area of 2471 km<sup>2</sup>.

The Bale Mountains National Park has three main zones: the northern Gaysay/Adelay grassland and woodland area between 3000-3500 m above sea level, the Central Sanetti Plateau between 3500-4400 m above sea level and the Southern Harenna Forest between 1600-3500 m above sea level (Hillman 1993). The present investigation was carried out in Gaysay/Adelay grassland and woodland areas (Figure 1). This area has broad valleys and high ridges. It comprises *Juniper/Hagenia* woodlands, broad grassy valleys and swamp areas, where a good population of warthogs, mountain nyala, bushbuck and reedbuck were observed. A pack of Ethiopian wolves was also observed as resident in Gaysay.

The rainfall patterns of Dinsho are characterized by a continuous eight months rainy season followed by a four months dry season (Daniel 1977). However, the rainfall was comparatively more in December than in March during the present investigation period. The range of daily temperature was more during the long dry season compared to the long wet season (Miehe and Miehe 1994). The highest and the lowest temperatures occur during the dry season. Frost is regularly experienced in Dinsho during night. During the present study, the maximum temperature was recorded in February. The mean monthly minimum and maximum temperatures recorded were 0.7°C, and 18.3°C, respectively.

## METHODS

Reconnaissance surveys on warthogs were made in the study area in June and September 1999. Data collection for the present report was made during February-December 2000, covering both dry and wet seasons. The population of warthogs in Gaysay Valley was conducted by sample counts using line transect method (Anderson et al. 1978, Burnham et al. 1980). Five transects with a total of 5 km length were located randomly in the study area using GPS. These transects were delineated by poles and/or natural signposts. Censuses were made during the daytime with the assistance of two trained scouts. Information on the number of individuals in the group, sex and age category (Laws and Clough 1966, 1969), the sighting distance and perpendicular distance of the animal from the observer were recorded. Hayne's estimator of density was used to estimate the population density. The population of warthogs in Dinsho hill was studied by total direct count method as the extent of the area

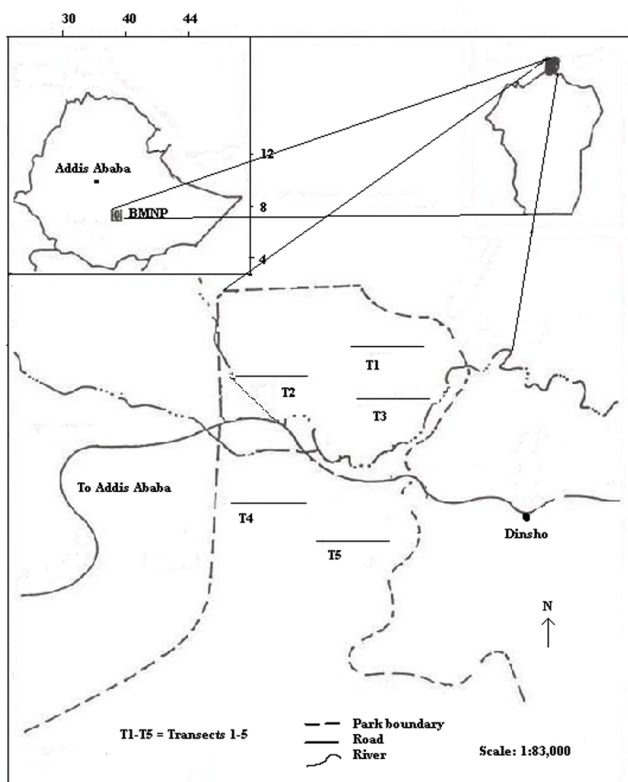


Figure 1. The study area in the Bale Mountains National Park (BMNP). Ethiopia is shown in inset.

was only 2.7 km<sup>2</sup> (Wilson et al. 1996). All observations were made on foot.

Focal animal sampling method was used to study the diurnal activity patterns of warthogs, focusing observations at one individual (pair, group) during a particular sample period (Altmann 1974). Using this method, several activities of four easily recognizable and approachable warthogs were recorded every 5 minutes from 06:00 h to 18:00 h (Clough and Hassam 1970, Lehner 1996). A single adult male (Group I) and a female with her two hoglets (Group II) formed the subjects of observation at a time. They were observed for at least three consecutive days per week (total of 1008 hours of observation), either by unaided eyes or by using a pair of binoculars. Observation was facilitated by the animals' preference for short grassy areas and by selecting strategic observation points on the hilly terrain. Activities were recorded as feeding, walking/running, resting/lying down, and others (standing, wallowing, defaecating, urinating scratching, drinking, digging, fighting and grooming) (Clough and Hassam 1970, Cumming 1975). Duration of time spent in each of these major activities was recorded both during the dry and wet seasons.

Data were analyzed using SPSS program. The differences in the time spent in different activities were analyzed using one-way ANOVA (p=0.05). T-test for independent sample of groups (p=0.05) was used to test the differences of each activity during the dry and wet seasons. Activities of the two groups were compared using t-test for independent sample of groups (p=0.05).

**RESULTS**

**Population Estimate**

Data on sample counts in Gaysay Valley is given in Table 1. The maximum population in this area was on transect 2 and the minimum on transect 3. The total for all transects was 445. The highest population was recorded during December and the lowest in August. There were differences in the populations on transect 2, 4 and 5 during wet and dry seasons (Table 2). Data on the total count in Dinsho hill is given in Table 3. Total counts revealed the presence of 108 warthogs in this area. In addition to these, there were 17 warthogs in Web Valley and six in Harrena forest. No warthog was recorded in Sanetti plateau during the present investigation. Altogether, the present study revealed

the presence of 576 warthogs in the study area. The total wet season count was 616 and that of the dry season was 536 with a significant seasonal difference (p<0.05) in their population size.

**Sex Ratio and Age Distribution**

The data on sex and age distribution of warthog are given in Table 4. The sex of 247 individuals was determined. There were more females than males (t=5, p<0.05). The adult and sub-adult female to male ratio was 1.00:1.6. On the average, 42.9% of all warthogs constituted adults and sub-adults and 57.1% young.

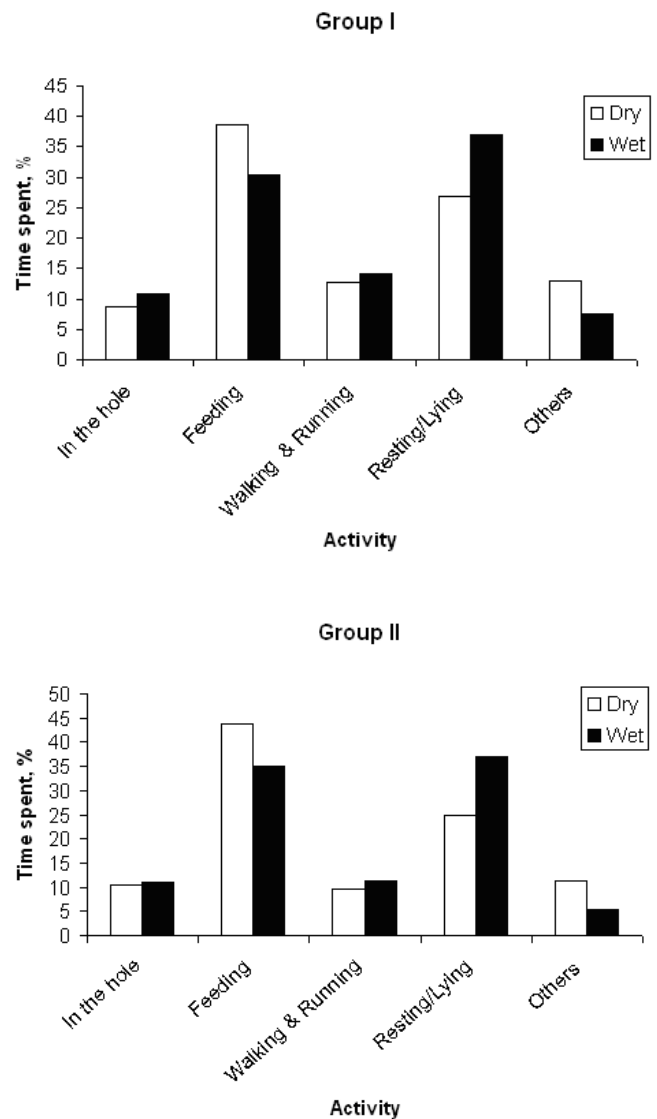


Figure 2. Major activities of the two study groups of warthogs during the dry and wet seasons.

Table 1. Population estimate of warthogs in Gaysay Valley in Bale Mountains National Park.

Month	Transects 1-5					Total	Mean/Transect
	T1	T2	T3	T4	T5		
February	228	606	264	438	558	2094	419
August	264	828	240	492	594	2418	484
October	240	720	180	564	612	2316	463
December	252	612	228	450	540	2082	416
Total	984	2766	912	1944	2304	8910	1782
Mean	246	691	228	486	576	2228	445

Table 2. Comparison of warthog counts between wet and dry seasons using t-test for independent sample of groups.

Transects	t-value	p-value
1	-0.70	0.497
2	-4.78	0.005
3	1.62	0.120
4	-3.01	0.007
5	-2.68	0.011

Table 3. Total count of population of warthogs at Dinsho Hill.

Month	Male	Female	Unidentified	Total
February	21	37	50	108
August	20	32	68	120
October	15	30	74	119
December	9	26	50	85
Total	65	125	242	432
Mean	16	31	52	108

Table 4. Sex and age distribution of warthogs counted during the wet and dry seasons.

Season	Adult		Sub-adult		Young*	Total
	Male	Female	Male	Female		
Wet	54	81	42	72	367	616
Dry	56	84	36	69	291	536
Mean	55	83	39	71	329	576

\*Hoglets plus yearlings

### Diurnal Activity Pattern

There were differences in the time spent on each activity ( $t=53.5$ ,  $p<0.05$ ). In general, the feeding activity of both the male and female was frequent and reached its peak during morning and late afternoon hours. Resting/lying down was highly pronounced during the mid-day. The percentage of time spent by warthogs in different activities during the dry and wet seasons is summarized in Table 5.

Table 5. Comparison of the activities between Group I and II during the wet and dry seasons, using t-test for independent sample of groups.

Activity	Group I vs. II		Wet vs. dry season	
	t-value	p-value	t-value	p-value
In the hole	0.55	0.59	1.97	0.06
Feeding	2.74	0.05	2.47	0.02
Walking/running	0.83	0.42	0.6	0.55
Resting/lying	0.20	0.84	-2.7	0.01
Others	-2.07	0.05	0.01	0.17

### Activities of the Male (Group i)

A total of 34.6 % of the daytime activity of the adult male was spent in feeding (Figure 2). Feeding activity reached its peak in the early morning (08:00-10:00 h) and late afternoon hours (16:00-18:00 h) (Figure 3). Resting/lying down was the second prominent activity, which was more frequent during the noon hours, when they remained in the bush. Walking/running from the nest hole to the grazing field and from the grazing field back to the hole was the third major activity of the

male. During the breeding season, the male frequently walks/runs following the female. Other major activities included standing, wallowing, defaecating, urinating, scratching, drinking, digging, fighting and grooming. Wallowing occurred during the noon hours. Even though the general activity patterns remained more or less the same in both the dry and wet seasons, the time spent in feeding was more during the dry season than the wet season. The male warthog comes out of the nest before 07:00h and starts feeding, which continued until 13:00-14:00h.

was the initiator of any change in activities. Major activity in this group was feeding, which occupied over 39.4% of the time. Even though there was no major difference in the activity patterns during different seasons, the time taken for feeding was less during the wet season, compared to the dry season. The feeding activity was initiated during 06:00-07:00 h, and continued until 13:00-14:00 h.

There were no major variations between the activities of groups I and II, although individuals in group II tended to spend more time in feeding than did group I. Once they come out from the nest in the morning, they continued to be in the field during the whole of the daytime. The second most common activity was resting/lying down. They were engaged in resting during the hottest part of the day. Resting was mainly interspersed with other activities such as feeding, and walking. Warthogs were also observed wallowing during the noon hours.

The time spent in each activity by group I and II was not significantly different except for feeding. Warthogs in group II spent significantly more time in feeding ( $t=2.74, p<0.05$ ) than the one in group I. The differences in time spent in each activity under the dry and wet seasons were not significantly different, except in feeding and in resting/lying down. The time spent in feeding during the dry season was significantly greater ( $t=2.47, p <0.05$ ) than during the wet season. Conversely, the time spent in lying down during the dry season was significantly less ( $t=-2.7, p<0.05$ ) than during the wet season. Warthogs were engaged in resting for an extended period of time during the wet than the dry season.

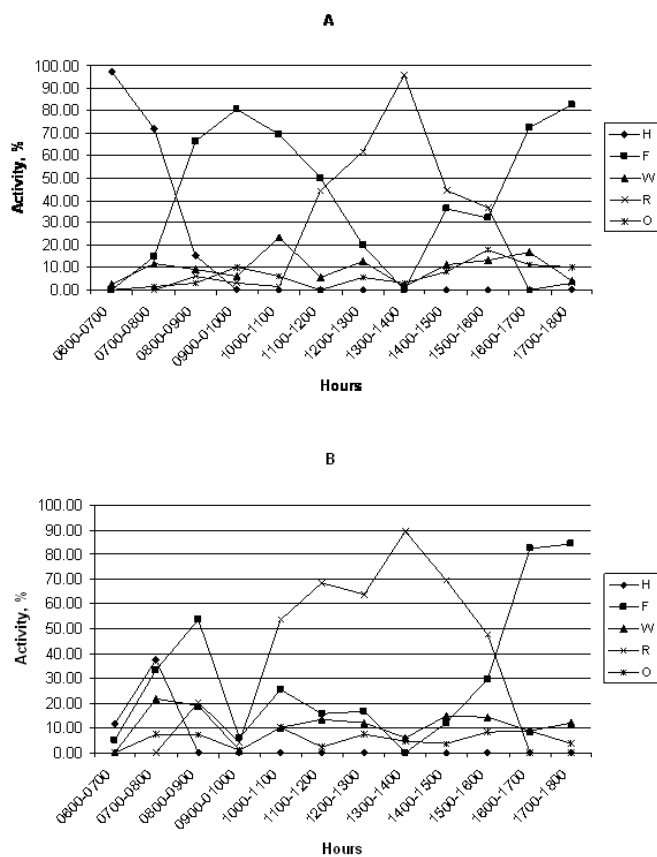


Figure 3. Diurnal activity patterns of a male warthog during wet (A) and dry (B) seasons. H = in the hole, F = feeding, W = walking & running, R = resting & lying, O = other activities.

**Activities of the Female and Hoglets (Group II)**

The two hoglets remained with their mother always. When accompanying each other, all the three individuals had similar activity patterns. The mother

**DISCUSSION**

Warthogs are the only pigs adapted to grasslands and savanna habitats. They are known to have differences in their activity patterns based on seasons; graze during the wet season and dig out underground rhizomes of perennial grasses, sedges, bulbs and tubers during the dry season with the tough snout (Cumming 1975). In the Bale Mountains National Park, it was possible to approach warthogs within a distance of 20 to 40 m, without causing disturbance to their regular activities. This has helped us to follow them at a close range.

Separation of the study period into wet and dry seasons was important in order to observe the influence of the seasons on the vegetation cover and thus on the distribution and activities of the animals. More wart-

hogs were encountered during the wet season than during the dry season. Young were born at the end of the dry season and at the beginning of the wet season as reported earlier elsewhere (Child et al. 1968, Boshe 1984). Hence a population build up could be expected during the wet season as confirmed by the present investigation. There might also be high rate of mortality during the dry season due to physiological stresses in connection with shortage of food and water.

Counts of warthogs among the five transects were significantly different. This might be due to a number of ecological factors including resources such as food, breeding site and protection from predators. Out of all habitat types, they frequented more in transect 2, which is an open grassland supporting Cumming (1975). Transects 1 and 3 showed lowest warthog counts. These transects are mostly of bushes of *Artemisia* sp., *Helichrysum* sp. and of *Hypericum* sp.

Total count in Dinsho revealed the density of about 40/km<sup>2</sup>. As this area is the most protected in the whole of the park with fencing along the park headquarters, the above warthog density is reasonable. However, due to this high density, some disturbance in the vegetation is also observed.

Eventhough, warthogs do not prefer forests, they were found on the clearings between the forests (Lavrenchenko 2000). Only six warthogs were found in the *Harrena* forest. As expected, warthogs are absent in the Sanetti plateau. Although few were recorded in the Web Valley, such a habitat of cold weather is unsuitable for warthogs.

To compare the population trend of warthogs in the present study area, the only information available is that of Hillman (1986), who estimated 588 warthogs in the area. This population size is not much different from that of the present estimate. An increase in the human population and expansion of human settlements within and around the park since early 1990s has intensified the competition among the wildlife, livestock and people. However, this did not reveal any significant effect on the warthog population in the present study area.

The knowledge of sex and age distribution of individual mammals is vital for evaluating the viability of a species. Sex and age structure of a population at any given point of time is also an indication of the viability of the population (Woolf and Harder 1979) in addition to the structure and dynamics of the population (Wilson et al. 1996). The result of the present study showed that more than 50% of the warthog population is of young ones. This shows a

healthy, increasing trend of warthog population in the study area as revealed earlier by Boshe (1981) in the Eastern Salous Game Reserve, Tanzania.

As it was difficult to sex the young warthogs in the field, only the sub-adult and adult ones were sexed during the present investigation. The presence of more females in the population was also expected (Cumming 1975). The sexual disparity was observed only after one year of age in the case of Tanzanian populations of warthog, leading to female favoured status (Boshe 1981). This shows that the males are subjected to high levels of mortality probably due to their wandering habits and getting exposed to predators as they move away from the hide outs, in addition to isolation from the group by the time they mature. The male preferred hunting by local people might also contribute further to this effect.

There were significant differences in the time spent by warthogs in different activities ( $t=53.5$ ,  $p<0.05$ ). They spent more than 50% of their daytime in feeding and resting/lying down. The general activity pattern of warthogs was characterized by morning and late afternoon peaks with a period of rest in the middle of the day. This pattern is comparable to the earlier reported feeding pattern of warthogs (Clough and Hassam 1970). Feeding was intense in the late afternoon before the animals retire to their holes after dusk. Warthogs were active in feeding during 06:00-10:00 h. This comprised more than 60 % of the overall activity of that time. However, during noon hours, they rest under shade to escape the intense heat of the day. After 15:00 h, the feeding activity increased steadily and reached up to 80% of the activity level by 18:00 h. Wallowing was associated with ambient temperature. There is a correlation between frequency of wallowing and ambient air temperature of the day as described earlier (Cumming 1975). In the study area, the wallowing activity of warthogs during the mid-day would also point out this factor. Apart from a thermoregulatory function, the wallowing activity might have an effect on ecto-parasites (Cumming 1975), but it was difficult to draw any conclusion from the present study.

Basically, similar activity patterns were observed for all individuals during the present study, except for minor differences associated with sex and age. Comparing the observations of group I with those of group II, the significant difference was only in the case of feeding. The amount of time spent in feeding by the adult male was less than the adult female and her two hoglets. Clough and Hassam (1970) have reported differences in feeding efficiency based on the size of

mouth and molars. Bradley (1968, cited in Cumming 1975) has also found similar differences in the percentage of time spent in feeding by males compared to females among the warthog populations in Nairobi National Park. The female warthog in the present observation also had the responsibility to feed the hoglets, which may also have contributed to the additional time spent in feeding.

The differences in the time spent in each activity under different seasons were not significantly different except that of feeding and resting/lying down (Table 1). Time spent in the feeding activity was comparatively less during the wet season. The decrease in feeding time was associated with the availability of more food during the wet season. Even though they are predominantly grazers, they feed upon grass, roots, berries, bark of young trees and occasionally on carrions (Kingdon 1997, Nowak 1999). During the dry season and during drought conditions, they may be able to sustain with succulent rhizomes and bulbs. More time was required in digging out food resources during the dry season, which is reflected in the seasonal differences in time spent in feeding. This is also correlated to the comparatively less time spent in resting/lying down during the dry season. There was more time to rest/lying down during the wet season, when feeding took comparatively less time.

The animals also appeared from their holes earlier and returned late during the dry season than during the wet season. Thus, the time spent outside the nest hole was more during the dry season when compared to the wet season in association with the seasonal changes during the day length.

#### ACKNOWLEDGEMENTS

We are indebted to the Oromia Agriculture Bureau for permission, and the staff members of the Bale Mountains National Park for field assistance. The School of Graduate Studies and the Department of Biology, Addis Ababa University are thanked for financial support and facilities.

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