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POPULATION SIZE AND STRUCTURE OF GELADA BABOON (*THEROPITHECUS GELADA* –RUPPEL, 1835) IN SIMIEN MOUNTAINS NATIONAL PARK, ETHIOPIA

Habtamu Asfafaw & C. Subramanian
Department of Biology, University of Gondar, Ethiopia

Abstract

Gelada baboon (*Theropithecus gelada gelada*), endemic to Ethiopia, one of the flagship species densely found in Simien Mountains National Park of Ethiopia. Information gathered on population structure of Gelada from eight different sites in the park. A total of 1106 gelada individuals were recorded from the park, among them 97 were adult males; 318 adult females; 519 sub adults and 172 juveniles. The maximum number from 8 groups were recorded in Cheneke site (266) followed by Buit Ras (230) from 6 groups and the minimum numbers of gelada individuals (35) was counted in Ambaras site from a single group. There were 33 groups of gelada recorded from eight different sites with average group size for each sites range from 25 to 37 individuals. The overall group size was recorded as 32.8 ± 3.90 and the mean age and sex class were recorded as follows: adult males 3.13 ±0.8; adult female 8.75±1.2; sub adults 15.75±2.96 and juveniles 5.25± 1.8. The overall ratio (Adult Male : Adult Female : Sub Adults : Juvenile) was 1:2.8:5.04:1.9. This study concludes that the population size of Gelada baboon decline but the population structure remains same in Simien Mountains National Park.

Key Words: *Theropithecus gelada, Population size, Population structure, Simien Mountains National Park.*

Introduction

Ethiopia possesses a wealth of wild life within its political boundaries ranging from alpine moor lands to lowland savannas and arid lands (Yalden, 1983). These are the result of Ethiopia's high mountain ranges from the surrounding regions and ensuring evolutionary diversification of its animals (Yalden *et al*., 1992), have extensive and unique environmental condition resulted in the evolution of excess of endemic animal and plant species, especially those confined to the afro alpine ecosystem and gagged mountains. Endemicity in Ethiopian wildlife is unique in that the coincidence of encompassing one major agro-morphological block within political boundaries has given Ethiopia a long list of unique animals (Yalden and Largen, 1992). Despite the natural and anthropogenic impact on the wildlife, Ethiopia is fortunate to have endemic flora and fauna. Of these endemic fauna, an endemic Cercopithecine genus and species *Theropithecus gelada* is the one (Beehner *et al*., 2008). Geladas, often mistakenly called "baboons" represent the last extant species of a primate genus once found throughout eastern and southern Africa (Jolly, 1972) but in IUCN, (2010) red list it is mentioned as Gelada Baboon as common name. As Dunbar, (1998) stated that the extant gelada is the last remaining member of a genus that, during the later Pleistocene, was one of the most successful and widespread terrestrial primates. As Dunbar, (1998) cited all members of the genus exhibit the same set of ecological characteristics, namely anatomical adaptations to a highly terrestrial way of life and a near total dietary dependence on grasses.

Gelada baboon is physically characterized by large, strong and healthy, covered with dark brown coarse hair, face with pale eyelids, arms and feet are nearly black, tail is shorter than its body with branch of hair at the end, males have a long, heavy cape of hair on their back (Ankel-Simons, 2007; Napier,1981). The gelada has a hairless face that is shorter and higher than in baboons and its snout is more like that of a chimpanzee (Ankel-Simons, 2007). It can also be physically distinguished from a baboon by the bright patch of skin on its chest (Ankel-Simons, 2007; Napier, 1981). This patch is hourglass shaped. On males it is bright red and surrounded by white hair; on females it is far less pronounced. However, when in estrus, the female's patch will brighten, and a "necklace" of fluid-filled blisters forms on the patch. This is thought to be analogous to the swollen buttocks common to most baboons experiencing estrus. In addition, females have pearl-like knobs of skin around their patches. Geladas also have well developed ischial callosities (Ankel-Simons, 2007). There is sexual-dimorphism in this species; the average body mass for an adult male is 18.5 kg while adult females are smaller, averaging 11 kg (Jolly, 2007). The head and body length of this species is 50–75 cm for both sexes. Tail length is 30–50 cm (Ankel-Simons, 2007).

Geladas are found in their present range. In 1970s an aerial survey of the central Ethiopian highlands was carried out and results 440, 000 of Geladas estimated for the total population (IUCN, 2010). But, as a result of the droughts affecting the Horn of Africa in the 1980s, their numbers decreased (Beehner *et al*., 2008). Estimation also carried out based on known ground densities and the total area of gorge face on the plateau yielded a figure of 880,000 considers that these estimates may now be too high, and that a better guesstimate would be approximately 200,000 animals (IUCN, 2010). Surveys in a number of areas give overall densities varying between 15 and 60 animals/km², although densities of animals within home ranges commonly exceed 70/km² (IUCN, 2010). And population trend is decreasing (IUCN, 2010). In recent time here in Simien Mountains National Park 4264 geladas counted (Beehner, *et al*., 2008). Today, geladas are found only in a few areas throughout the northern Ethiopian highlands, and one isolated population south of the Rift

Valley in Arsi province (Mori and Gurja Belay, 1990). It is estimated that only about 50,000–60,000 geladas remain in the wild, and their numbers are thought to be declining (Beehner *et al*., 2008).

The gelada is restricted to high grassland escarpments in the deep gorges of the central Ethiopian plateau, in the Tigre, Begemdir, Wolle, and Shoa Provinces between 1,800 and 4,400 m asl. The Blue-nile gorge and the upper shabelle river valley (east of the Bale massif) mark the western and southeastern boundaries of the range, respectively (Gippoliti and Hunter, 2008). This species is associated with rocky gorges, precipices and moorland and feeds mainly on the flat margins of high grass plateaus, known locally as high Wurch or Puna grassland steppe (Gippoliti and Hunter, 2008). Geladas use cliffs for roosting and montane grasslands for foraging. These grassland have greatly spaced trees and also contain bushes and dense thickets (Napier, 1981; Lwamoto and Dunbar, 1983). The highland areas were geladas live tend to be cooler and less arid than lowlands areas (Lwamoto and Dunbar, 1983). Thus the gelada does not usually experience the negative effects the dry season has on food availability. Nevertheless, in some areas, gelada do experience frost in the dry season as well as hailstorm in the wet season (Lwamoto and Dunbar, 1983). As the IUCN reported in 2008 the gelada assessed as Least Concern and Appendix II of CITES (Gippoliti and Hunter, 2008). Major threats to the gelada are a reduction of their range as a result of agricultural expansion, however, threats that once existed but no longer do are trapping for use as laboratory animals and shooting to obtain their capes to make items of clothing (Gippoliti and Hunter, 2008). In addition to this the way tourists approach to gelada is also a threat that affect wilderness of the gelada and should be assessed.

Gelada baboon (*Theropithecus gelada gelada)* is a graminivourous primate whose ecology is usually sensitive to ambient temperature. It is primarily feed on the leaves grasses (Dunbar, 1998). There are possibly three subspecies of gelada: *Theropithecus gelada gelada* and *Theropithecus gelada obscurus* occur in the Begemdir, Tigre, and Wollo and Shoa provinces, west of the Rift Valley, while an undescribed subspecies is found along the Wabi-Shebeli River in the Arsi province, east of the Rift Valley. *Theropithecus gelada gelada* is found north of Lake Tana and west of the Takkazzé River, while *Theropithecus gelada obscurus* is found south of Lake Tana and east of Takkazzé River (Mori and Gurja Belay, 1990). A few Gelada bands range in the tiny Simien Mountains National Park. The overall decline of any population would affect the genetic variation, demography and social life (Paulraj and Subramanian, 2000). Despite concern over the species decline, we currently do not have an accurate count of the number of geladas living in the SMNP, and we have even less knowledge about total numbers of geladas throughout Ethiopia. Our primary objective in this study is to provide a population size and structure of gelada individuals living in the Simien Mountains National Park.

Study Area

The Simien Mountains National Park is located (Fig.1) in the northern parts of Ethiopia, North Gondar zone of the Amhara National Regional State (ANRS). The geographic location extends from 13°9’57’’ to 13°19’58’’ north latitude and from 37°54’48’’ to 38°24’43’’ east longitude. The park is situated within three districts of north Gondar administrative zone, namely Debark, Janamora and Adarkay. It is 120 Kms north-east of Gondar, which is about 741 kms away from Addis Ababa. The elevation of this park ranges from 1900 to 4543m a.s.l. The park covers a total area of 23200 ha. The temperature varies from 2^0C to 18^0C and annual rainfall around 2000 mm.

Fig 1. Map shows the Simien Mountains National Park (source - SMNP office, Debark (2010).

Methodology

A preliminary survey was carried out for two days in the study site in January 2011 to get familiar with study area. The population estimation was made by using the most common method of censusing nonhuman primate populations uses line transects (Burnham *et al*., 1980). Adult males were defined as males with visible manes and overall size about twice that of adult females. Sub adult males were defined as males similar in size to adult females with the beginnings of a mane. Adult and sub adult females were estimated based on body size and the rest juveniles were very smaller of all in size (Beehner, *et al*., 2008). The existing eight blocks of the park area was used as sites for the count. Eight teams and the enumerations were made in a single day on 22nd October, 2011. A 48 kilometer road connects all these sites was used as transect.

Results

Gelada Population

A total of 1106 gelada were recorded from 33 groups inside the park during this survey. The highest number of gelada individuals from 8 groups were observed in Cheneke site (266) followed by Buit Ras (230) in 6 groups, and the least number (35) was from Ambaras site in a single group (Table 1). Out of the total number 97 were adult males; 318 adult females; 519 sub adults and 172 juveniles.

Table 1Gelada groups recorded with number of individuals from different sites of the park area.

S#	Name of the Site	No. of Groups	No. of Gelada
1	Buiteras	6	230
2	Chiluanie	5	185
3	Mechibegn	4	140
4	Tyia	3	80
5	Onion field	4	100
6	Engedhimeda	2	70
7	Ambras	1	35
8	Cheneke	8	266
Total		33	1106

Group size and composition of Geladas

The mean group size of Gelada was calculated as 32.88 ± 3.9, and the mean age and sex classes also derived. The result shows that, the adult males number was lesser than other classes (3.13 ± 0.8), the adult female individuals were greater than males and juveniles *i.e*. 8.75 ± 1.2 but less than sub adults (15.75 ± 2.96). The mean number of juveniles per group was 5.25 ± 1.8 (Table 2)

Table 2. Shows the mean age and sex classes of Geladas from different sites.

S#	Site	Mean group size of Gelada				
		AM	AF	SA	JU	Total
1	Buiteras	3	6	19	7	35
2	Chiluanie	4	9	17	7	37
3	Mechibegn	3	11	15	5	34
4	Tyia	2	9	12	4	27
5	Onion field	2	9	11	3	25
6	Engedhimeda	4	8	17	8	37
7	Ambras	4	8	19	4	35
8	Cheneke	3	10	16	4	33
Mean with SD		3.13 ± 0.8	8.75 ± 1.2	15.75 ± 2.96	5.25 ± 1.8	32.88 ± 3.9

Note: AM – Adult males; AF – Adult females; SA – Sub adults; JU – Juvenile; SD – Standard deviation

Age and sex ratios

The age and sex ratio of geladas were calculated from the data gathered and it shows the difference among the sites. The overall average ratio of adult males to adult females was 1:2.8, adult to sub adults was 1:5, and adult male to juvenile was 1:1.7. The overall ratio between adult females and sub adults was 1:1.8 and adult female to juvenile was 1.7:1. The maximum sex ratio (1:4.5) among the adult males and adult females was recorded from two sites namely Tyia and Onion field and the minimum (1:2) was recorded at Buiteras, Engedhimeda and Ambaras. The site-wise age and sex class ratios were given in table 3.

Table 3.Shows the average age and sex ratios of Geladas from different sites.

S#	Site	Age and sex ratio of Gelada				
		AM:AF	AM:SA	AM:JU	AF:SA	AF:JU
1	Buiteras	1:2	1:6.3	1:2.3	1:3.1	1:1.1
2	Chiluanie	1:2.3	1:4.3	1:1.8	1:1.8	1:0.7
3	Mechibegn	1:3.7	1:3	1:1.7	1:1.4	2.2:1
4	Tyia	1:4.5	1:6	1:2	1:1.2	2.3:1
5	Onion field	1:4.5	1:5.5	1:1.5	1:1.2	3:1
6	Engedhimeda	1:2	1:4.3	1:2	1:2.1	1:1

7	Ambras	1:2	1:4.8	1:1	1:2.4	2:1
8	Cheneke	1:3.3	1:5.3	1:1.3	1:1.6	2.5:1
Mean		1:2.8	1:5	1:1.7	1:1.8	1.7:1

Note: AM – Adult males; AF – Adult females; SA – Sub adults; JU – Juvenile

Discussion

The present study results reveal that the population size of the Gelada declines. Research carried out by Beehner *et al*., (2008) on population estimation on gelada baboon inside and outside the park results 4,264 geladas, Ohsawa, (1979) 325 individuals in Gicha plateau using direct count, Dunbar and Dunbar (1975) 696 gelada individuals in both Sankaber and Michibi. Thus, these can be some of the evidence of the declining of its population even though a single census during a single year cannot indicate whether numbers are increasing, decreasing or stable. The maximum gelada were counted at Cheneke followed by Buite Ras, which were similar results reported by Beehaner et al., 2008. The gorges and sharp cliffs these sites might be the reason, that provide place for roosting during the night time as well as less agricultural activities, human disturbance and domestic animal pressure. On the other hand, Ambaras was one of the sites we counted less number of geladas because of high human pressure along with their livestock and agricultural activities. In addition to this there is also a direct relationship between population size and elevation. As elevation increases, from 1300 m.a.s.l. to 3650 m.a.s.l., their size increases even though less number were recorded at Ambars site. This because of intense agricultural activity and its sensitivity to ambient temperature that means, " a 7^{o}c raise in temperature would be sufficient to result in the species being confined to a small number of isolated mountain peaks" (Dunbar, 1998). As reported by Crook,1996; Dunbar, 1986 and Gruter,2004 the reproductive unit made up of 1-4 males and 1-12 females which were similar to the current results. During foraging time more than one or more groups were unit together (near each other with no mixing) and consists a band for many reasons to defend enemies. Adult male to adult female ratio was matching with report of Beehner *et.al*., (2008) that one male to three females in the population. This is because of females live remaining in their reproductive units due to environmental control of conception and other social factor (Dunbar, 1980). The ratio of immature to adults was 5:1, *i.e*. 5 immature per one adults.

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