

Short communication

POPULATION ESTIMATE FOR GELADAS (*THEROPITHECUS GELADA*) LIVING IN AND AROUND THE SIMIEN MOUNTAINS NATIONAL PARK, ETHIOPIA

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ABSTRACT: Geladas (*Theropithecus gelada*), endemic to Ethiopia, are listed as "rare" by the IUCN and have an Appendix II listing in CITES. The highest density of geladas, and the only place where they are officially protected, is found in the Simien Mountains National Park (SMNP). However, to date, no comprehensive census of geladas in the area has been carried out. Here, we use a direct count to census geladas living in and around the SMNP. We also examine the age and sex structure of the gelada groups surveyed. A total of 4264 geladas were counted in the area. From these results, we estimate that approximately 2460 geladas live within the current boundary of the SMNP. With respect to age-sex categories, we counted approximately 3 adult females to each adult male, and when bachelor groups were excluded, there were 4.2 females per adult male. The ratio of immatures and subadults to adults was 1.2 immatures per 1.0 adult. The actual size of the SMNP gelada population is significantly lower than expected from previous unpublished estimates. However, gelada populations appear to be healthy in the SMNP, despite a high amount of competition with grazing livestock.

Key words/phrases: Census, gelada, population estimate, Simien Mountains National Park, *Theropithecus*

INTRODUCTION

Very few countries can claim endemic primate species. Ethiopia is fortunate to have an endemic Cercopithecine genus and species, the gelada (*Theropithecus gelada*). Geladas, often mistakenly called "baboons", represent the last extant species of a primate genus once found throughout eastern and southern Africa (Jolly, 1972). 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. Increasingly, geladas are coming into contact with humans as local farmers expand their cultivation and livestock grazing to steep hillsides once inhabited only by wildlife. Additionally, due to their specialized diet, geladas are severely affected by soil erosion, drought, and possibly even global warming (Dunbar, 1998). At

present, the gelada's restricted range and continued human encroachment has resulted in a "rare" status by the World Conservation Union (IUCN) and an Appendix II listing in the Convention of the International Trade in Endangered Species (CITES).

One of the largest populations of geladas lives in the Simien Mountains National Park (SMNP) in the northern Ethiopian highlands (Fig. 1). The SMNP was established in 1969 with the primary aim of protecting the Walia ibex (*Capra ibex walie*), whose world population at the time was less than 130 individuals found only in the Simien Mountains. The park was drawn out over an area of 136 km², with roughly equal coverage of lowlands (1700-2800 m) and highlands (2800-4070 m), separated by a dramatic escarpment. The population of geladas in the SMNP represents the only officially protected gelada habitat. Despite the protected status, the park is heavily populated by humans with widespread barley cultivation up to an altitude of 3600 m and heavy grazing of livestock

to 4000 m. Domestic animals are prevalent throughout the park and represent the main competition for food resources (Hunter, 2001), which for geladas is mainly grass (Dunbar, 1977; Iwamoto, 1993).

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. Accurate population estimates of geladas, as well as all of Ethiopia's endemic species, are important for several reasons. First, population estimates across time will determine whether numbers of a particular species are being maintained, in decline, or in recovery. Second, establishing accurate numbers for each species is a critical first step for conservation and wildlife management policies. Third, as there have been increasingly more reports of human-gelada conflict in the SMNP area, particularly with respect to crop-raiding, it is important to determine whether or not the gelada population in the SMNP may be increasing beyond what the park can support. To date, no comprehensive gelada census of the area has been carried out. Our primary

objective in this study is to provide a current and accurate count of gelada individuals living in and around the SMNP. Additionally, we provide the age and sex structure of the gelada groups surveyed.

The most common method of censusing non-human primate populations uses line transects (Green, 1978; Defler and Pintor, 1985; Brockelman and Ali, 1987; van Schaik *et al.*, 1995; Varman and Sukumar, 1995; Fashing and Cords, 2000). However, because gelada individuals (and groups) are highly mobile and have a high degree of overlap with other geladas, calculating a species-specific mean group spread is not possible. A more accurate, though time-intensive, means of assessing primate population estimates is through long-term monitoring of home range size and overlap in a population (Struhsaker, 1975; Brockelman and Ali, 1987; Chapman *et al.*, 1988; Whitesides *et al.*, 1988; Fashing and Cords, 2000). While we have begun daily monitoring of all the gelada groups between the Waterfall (just south of Gidir Got) and Buyit Ras (see Fig. 1), we have not been able to extend our population monitoring to the entire SMNP population.

Simien Mountains
National Park

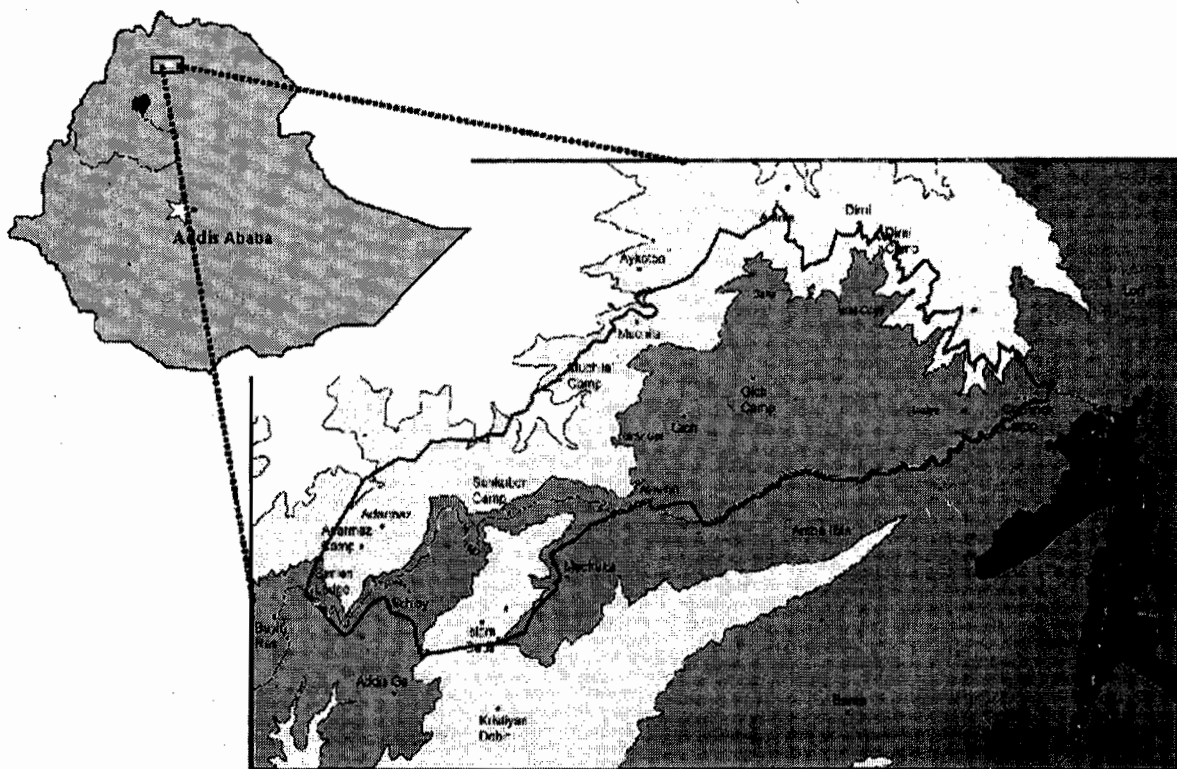


Fig. 1. Location of Simien Mountains National Park in northern Ethiopia.

Therefore, the method we employ for determining gelada numbers is a direct count. The direct count method requires the involvement of a large number of people to simultaneously cover all areas of interest. Furthermore, while a direct count avoids double-counting (because all animals are counted simultaneously), the results from a direct count nearly always represent an underestimate of the total population. Therefore, independent counts or estimates are necessary to determine the counting error. Despite these drawbacks, the direct count may be the most effective method for determining population estimates of a species that (1) lives in wide open habitat facilitating visibility, (2) is easily detected by audible cues, (3) is highly mobile, and (4) has variable group sizes across time. All of the above characteristics are true for geladas. Furthermore, geladas are reliably found along cliff edges early in the morning, creating almost a "transect" where observers can find all individuals in a given area. For areas where we

have additional data on population sizes, we compare the direct count from this census to our additional population estimates.

METHODS

Two people were deployed to each of 11 areas (Fig. 2) to count all geladas they observed. A total of 22 people were involved in the direct count, including 1 expert from Bahir Dar (author B.G.), 3 experts from Debarq, 2 American gelada researchers (authors T.J.B. and J.C.B), 1 park guide, and 15 park scouts (see Acknowledgements for names of participants). Counting areas included known gelada habitat from both the highland and lowland sides of the SMNP (Table 1, Fig. 1). All gelada counts were conducted on the same day (11 May 2006) during morning hours (7:00-11:00) to avoid double counting. One day of training was given to scouts on the methodology of counting geladas.

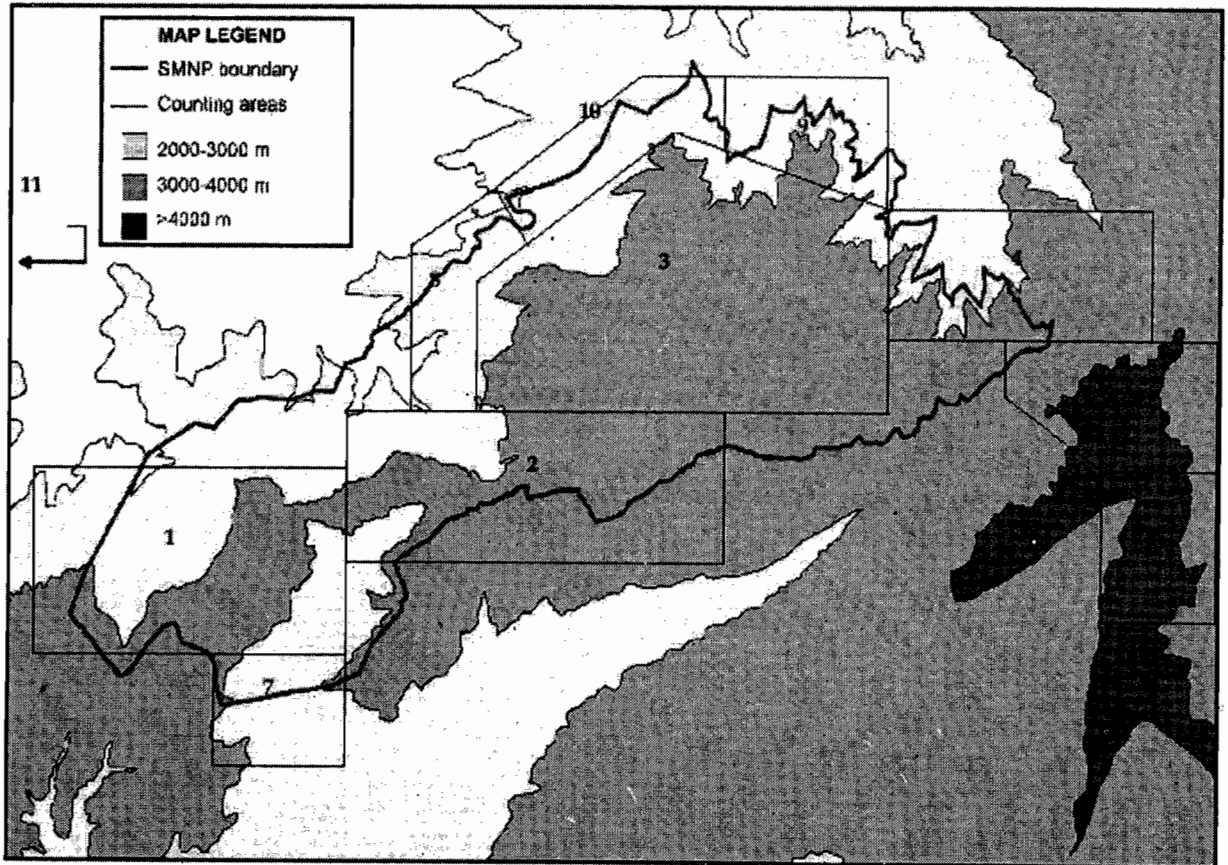


Fig. 2. Contour map of the Simien Mountains National Park indicating the counting blocks for the gelada census.

Observers were asked to separate geladas into the following age-sex categories: adult males, adult females, subadult males, subadult females, and immatures (listed in Table 2). Adult males were defined as males with visible manes and overall size about twice that of adult females. Subadult males were defined as males similar in size to adult females with the beginnings of a mane. Adult and subadult females were estimated based on body size. All other individuals were considered immatures. In two cases (counting blocks 1 and 2), counts were unable to distinguish subadults from immatures (due to high densities of individuals), and therefore the subadults for these two categories were estimated from the ratios derived from the other nine counts. To determine the number of geladas inside the gazetted national park, we added all of the results from the counting blocks that fall completely within the park and half the results from the counting blocks that fall both inside and outside the national park (counting block locations with respect to the park boundary are listed in Table 1).

Table 1. Counting blocks, elevation, and location relative to the SMNP for Gelada census.

Map Area	Area Name	High/Low	Inside/Outside SMNP
1	Buyit Ras-Sankaber	highland	inside
2	Sankaber-Amba Ras	highland	inside
3	Gider Got-imet Gogo	highland	inside
4	Lori-Duhara	highland	half inside
5	Chennek-Bwahit	highland	inside
6	Chelada Metacha-Kechemoch Bwahit	highland	outside
7	Debir-Abrana	lowland	outside
8	Muchila area	lowland	half inside
9	Aykotba area	lowland	half inside
10	Dirni area	lowland	half inside
11	Talakmeda-Shihazan (Off map)	lowland	outside

We compare both the counts and the age and sex data obtained from this census to (1) additional current population estimates obtained across 8 months of monitoring of several other gelada groups (Bergman and Beehner, unpublished data) and (2) published reports of population estimates from the 1970s (Dunbar and Dunbar, 1975; Ohsawa, 1979).

RESULTS AND DISCUSSION

The results from the gelada count across different age and sex groups from the 11 areas are listed in Table 2. A total of 4264 geladas were counted in the entire area (both inside and outside the SMNP). Because portions of some counting blocks are outside the park boundary, we estimate that approximately 2460 geladas live within the current boundary of the SMNP (see Table 1 for each counting block location).

Based on longer-term census data generated over the previous 8 months from a subset of the censused area, 1593 geladas are known to live in the Buyit Ras, Michiby, Sankaber, Gidir Got, Saha, and Imet Gogo gelada groups. This count is based on multiple counts in each area using individual identification in many cases. Summing the number of geladas counted in the current census for these areas (*i.e.* map areas 1, 2, and 3, Table 2), we find that 1481 geladas were counted. This suggests that the current count found 93% of the geladas in these areas. In other words, the current census probably represents an under-count of about 7%. Therefore, our estimate of the population for the SMNP ranges from 2450–2650 geladas. Using the same error rate, the population for the entire area ranges from 4260–4560 geladas.

Table 2. Number of Geladas Counted in Each Counting Block for Different Age and Sex Groups.

Map area	Area name	Adult males	Adult females	Subadult males	Subadult females	Immatures	Total count
1	Buyit Ras-Sankaber	64	30	175	63	178	510
2	Sankaber-Amba Ras	63	35	190	90	266	644
3	Gidir Got-Imet Gogo	33	15	153	42	84	327
4	Lori-Duhara	19	10	84	58	48	219
5	Chennek-Bwahit	34	11	87	23	95	250
6	Chelada Metacha-Kechemoch Bwahit	31	22	115	39	70	277
7	Debir-Abrana	28	20	92	36	74	250
8	Muchila area	40	28	150	80	137	435
9	Aykotba area	15	7	80	40	70	212
10	Dirni area	70	50	195	90	188	593
11	Talakmeda-Shihazan	95	60	159	76	157	547
	Total count for area	492	288	1480	637	1367	4264

With respect to the age-sex categories, we counted a total of 492 adult males (not including subadults but including bachelor males) and 1480 adult females (not including subadults) in the area. Thus, we found a male to female ratio of 1:3, or 3 adult females for each adult male in the population. However, when bachelor males were excluded from the analyses, there were 4.2 females per adult male. The ratio of immatures (including subadults) to adults was 1.2 immatures per 1.0 adult.

A single census during a single year cannot track the trajectory of a population (*i.e.*, whether numbers are increasing, decreasing, or remaining stable). Future counts using the same method should be carried out in subsequent years to determine the population trend for geladas in the area. However, the results of the current census suggest that the actual size of this gelada population is significantly lower than expected (less than half) based on previous unpublished reports. For example, some local guides and residents report that there are anywhere from 7,000 to 10,000 geladas in the SMNP. Although it is not known how this estimate was obtained, this (now incorrect) estimate has been published by at least 2 tourist guidebooks (Bradt: Ethiopia, 4th Edition, pp. 238; Lonely Planet: Ethiopia and Eritrea, 2nd Edition, p. 151). Nevertheless, despite the unexpectedly low number of geladas in the SMNP, the overall health of the current population does not appear to be in jeopardy; based on our 8 months of observation, gelada coats were vibrant and intact, missing teeth were observed only in older males, and most reproductive females had infants. Furthermore, several previous counts of gelada groups in the area were conducted in the 1970s (Dunbar and Dunbar, 1975; Ohsawa, 1979) and their estimates approximate counts from the current census. For example, in 1979, Ohsawa counted 325 geladas on the Gich plateau using a direct count. This is almost identical to the 327 geladas counted in the current census (counting block 3, Table 2). Dunbar and Dunbar's estimate is more difficult to compare to the current census because their census area (the Sankaber and Michibi areas) comprises a sub-section of 2 different counting blocks (blocks 1 and 2). However, when we compare the current estimates for the Sankaber and Michibi bands obtained from our long-term study, we get the exact same number as Dunbar and Dunbar estimated for this area (698 individuals). Thus, a broad comparison between

the counts from over 30 years ago and the current one suggest that the gelada population has not significantly increased or decreased across three decades.

The gelada is a charismatic mammal that not only brings much-needed tourism to the area but also, as an Ethiopian endemic genus, represents a national treasure. Monitoring this species should be an important component to any wildlife management plan for the SMNP. As human populations in the area grow, the conflicts between humans and wildlife such as geladas are sure to grow as well. The SMNP receives international attention as a World Heritage Site due to its biodiversity, its high number of endemic species, and its outstanding physical features. However, this international attention is being threatened by the spread of farming and grazing in the area. The extensive impact of humans and their livestock on this afroalpine ecosystem needs to be reduced to preserve the SMNP as a sanctuary for endemics like geladas. While geladas appear to be able to compete in the face of extensive competition, this is less true for other endemics such as the Walia ibex and the Ethiopian wolf. In the long run, preserving this relatively small area for wildlife and subsequent tourism will reap benefits that far outweigh the economic value of the crops and livestock that are utilizing this area

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