Behavioral patterns in a population of Samango monkeys

(Cercopithecus albogularis erythrarcus)

Cecilia Tegner

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Supervisor: Professor Matthias Laska, Linköpings universitet
Examiner: Professor Matthias Laska, Linköpings universitet
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Author
Cecilia Tegner

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Abstract

The understanding of behavioral patterns in different species is an important part of the proper management and conservation of wild populations of animals. This study aims to contribute to the understanding of behavioral patterns in the samango monkey (*Cercopithecus albogularis erythrarcus*) of northern South Africa. Using the scan-sampling procedure, the behaviors of an isolated population of free-ranging samango monkeys in the Soutpansberg, Limpopo Province, were recorded during 16 days in the summer of 2010. The day was divided into the intervals: morning, midday and afternoon, and the behaviors social, resting, movement, and feeding were recorded and analyzed. The results showed a behavioral pattern in which the relative frequency of occurrence of social behaviors and movement were significantly different depending of the time of day, whereas the behaviors resting and feeding were not. During midday, social behaviors increased, while movement decreased. The groups’ degree of arboreality was also recorded and analyzed. The group spent significantly more time on the ground during midday compared to morning and afternoon. The amount of time this group spent on the ground is not entirely consistent with what has been described in the literature, where the samango has been described as strictly arboreal. A longer study including more environmental parameters, and using focal animal sampling together with the scan sampling method would be valuable for the further understanding of the behavior of the samango monkey.
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1. Abstract
The understanding of behavioral patterns in different species is an important part of the proper management and conservation of wild populations of animals. This study aims to contribute to the understanding of behavioral patterns in the samango monkey (Cercopithecus albogularis erythrarcus) of northern South Africa. Using the scan-sampling procedure, the behaviors of an isolated population of free-ranging samango monkeys in the Soutpansberg, Limpopo Province, were recorded during 16 days in the summer of 2010. The day was divided into the intervals: morning, midday and afternoon, and the behaviors social, resting, movement, and feeding were recorded and analyzed. The results showed a behavioral pattern in which the relative frequency of occurrence of social behaviors and movement were significantly different depending of the time of day, whereas the behaviors resting and feeding were not. During midday, social behaviors increased, while movement decreased. The groups’ degree of arboreality was also recorded and analyzed. The group spent significantly more time on the ground during midday compared to morning and afternoon. The amount of time this group spent on the ground is not entirely consistent with what has been described in the literature, where the samango has been described as strictly arboreal. A longer study including more environmental parameters, and using focal animal sampling together with the scan sampling method would be valuable for the further understanding of the behavior of the samango monkey.

Keywords: Arboreality, behavioral patterns, C. albogularis, samango monkey, scan-sampling

2. Introduction
The genus Cercopithecus is a large and diverse branch of the primate order. The species Cercopithecus albogularis is distributed from Ethiopia to South Africa. The taxonomy of the Cercopithecus genus is disputed and by some C. albogularis is considered to be conspecific with the C. mitis or blue monkey of eastern central Africa, while others consider them to be different species (separated by Dandelot in 1974). Both C. mitis and C. albogularis are, however, in the C. mitis group of the genus (Wilson and Reeder, 2005). Several subspecies are classified within the species C. albogularis, one of which is C. albogularis erythrarcus (Peters 1852), the subspecies that in South Africa is locally referred to as the samango monkey.

The samango has been described as diurnal and highly arboreal. Being the only true forest dweller in southern Africa it might forage in open areas, but proximity to forest is necessary. Compared to the vervet monkey, for example, which is very adaptable, the samango has a more limited habitat selection. This may lead to a long-term threat to the species survival in the area, especially considering the isolation of the southern African populations. As of now, the samango is not considered threatened or endangered. Most troops consist of up to 30 individuals, although up to 70 individuals have been observed in a single troop. Each group is considered to be composed of one resident male together with multiple females and young (Branch, Stuart, Stuart, Tarboton, 2007; Stuart and Stuart, 2007).

According to Richard (1985, cited by Lawes and Piper, 1992), a change in activity patterns is the most readily measured response to environmental changes. The present study aims to contribute to the understanding of the samango monkey’s general behavioral patterns by evaluating the time spent on the activities resting, feeding, moving and social, throughout the day. Additionally, a comparison was made of the time spent in trees and on the ground throughout the course of the day, to evaluate the group’s degree of arboreality.
3. Materials and method

3.1 Location
The study was conducted at Lajuma Research Centre (23°02’S, 29°26’E) in the Soutpansberg Mountains in Limpopo Province, South Africa from early June through early August of 2010. Lajuma – named after Mount Lajuma (1747 m) – is a world heritage site and is a private area within the Vhembe Biosphere Reserve. The area hosts an isolated population of samango monkeys together with the other four South African primates: vervet monkeys (Chlorocebus pygerythrus), chacma baboons (Papio ursinus), thick-tailed bushbabies (Otolemur crassicaudatus) and southern lesser bushbabies (Galago moholi). The area is also home to leopards and eagles that are known to prey on primates.

The area consists of different habitat types, which include rare and endangered plant species, many of which are endemic to the area. Woodland, thicket, grassland and mistbelt forest are some of the habitat types that the samangos inhabit. The areas where the monkeys mainly forage are, however, mostly tall, evergreen forest and medium and short semi-deciduous woodland. The forests are characterized by flame acacia (Acacia ataxacantha), broom cluster fig (Ficus sur), buffalo thorn (Ziziphus mucronata), lavender tree (Heteropyxis natalensis), red milkwood (Mimusops zeyheri), pock ironwood (Chionanthus foveolatus), olive tree (Olea europaea), forest bushwillow (Combretum kraussi) and Eugenia species.

3.2 Study group
At Lajuma, two troops of samango monkeys are present. According to previous observations the two troops were one in the past, but after increasing in size, it has divided into two separate troops (personal communication, I. Gaigher). The groups’ ranges overlap in certain areas, but physical conflicts are rare, even though the two troops encounter each other on a weekly basis (personal communication, B. Coleman).
The studied group consisted of between 45 and 60 individuals, but an exact number has never been established, since the group members are often scattered during their daily foraging. This group was observed to have two resident males and at least one satellite male together with adult females, subadults and infants.

The group had a few sleeping sites which they repeatedly used. All sleeping sites were located in areas with tall trees and/or rock. The group mainly foraged in areas away from the sleeping sites. Because of this, the group needed to travel some distance to get to and from their preferred foraging areas everyday. Some of the sleeping sites were shared with troops of chacma baboons. Baboons are known to prey on vervet monkeys, but during the study period only peaceful encounters between samangos and baboons were observed. According to anecdotal evidence, no violent encounters between members of the samango populations and the baboon populations have occurred in the past, though several such encounters have been observed with the vervet groups with lethal outcome for vervet infants. A few encounters between the study group and the other resident samango group were observed during the present study, all of which were non-violent.

3.3 Data collection
Due to the fact that samango monkeys are notoriously hard to identify individually and observation time was limited, focal animal sampling could not be used. Instead, the scan-sampling procedure (Altmann, 1974) was used without individual identification. Data was collected in five-minute scans with 30 min intervals, where all visible individuals were scanned. Each individual was observed until a behavior was performed for a minimum of three seconds, after which the behavior was recorded and a new individual was selected. No individual was scanned more than once in each scan session, and the group was browsed systematically to avoid double scans. The scan sampling method has been widely used to assess and determine activity budgets in different primates, for example: Cercopithecus mitis erythrarcus, Cercocebus albigena and Cercopithecus sabaes (Lawes and Piper 1992; Waser, 1975; Harrison, 1985).

The day was divided into three periods: morning: sunrise-9.59 am; midday: 10.00 am- 1.59 pm; afternoon: 2 pm- sunset.

Individual behavior was classified into four categories:

- **Resting**
  - Sitting or lying without feeding or interacting with other individuals
  - Auto-grooming

- **Feeding**
  - Searching for, processing or ingesting food
  - Processing or ingesting food from cheek pouches

- **Movement**
  - Locomotion without picking up or consuming food item
  - Climbing, jumping, running and walking

- **Social**
  - Social activity with another individual
  - Playing, sex, allo-grooming

Degree of arboreality was evaluated by recording the individuals’ location during scans:

- **Tree**
  - Performing activities in a tree or bush with no ground contact
• Ground
  o Performing activity on ground or rock
  o Foraging on small bushes, if individual is not sitting in the bush

3.4 Data processing
Since the time intervals between scans were 25 minutes, the behaviors and locations were considered to be independent between scans. Relative frequencies of observed behaviors for each time period were used to balance for uneven sample sizes between days and times. The data was analyzed with Chi-square tests on the time distribution of all behaviors, as well as degree of arboreal activity. All expected frequencies of behaviors in the Chi-square tests were approximated with consideration to uneven sample sizes between days and times.

4. Results
A total of 2169 observations of general behavior were made during the 16 days of following the troop from dawn to dusk. Out of these observations, 600 observations were recorded during morning, 842 during midday, and 727 in the afternoon, with a mean of 135±21 observations per day. Arboreal activity was recorded during 15 out of 16 days, resulting in 2052 observations. Out of these, 569 observations were recorded during morning, 782 during midday, and 701 in the afternoon with a mean of 136±22 observations per day.

Each day, a varying number of scans were performed that, in turn, each included a varying number of observations. Since visibility varied between scans, times and days, the amount of observations per scan varied from two to twelve. This led to a range in the total number of observations between days from 24 to 52 in the morning, from 20 to 69 during midday, and from 26 to 60 in the afternoon.

![Figure 2. Distribution of relative frequencies of the behaviors: movement, social, resting and feeding during the whole day](image)

Figure 2 shows the distribution of the relative frequencies of observed behaviors during the day. Feeding accounted for of 41% of all observed activities; movement 28%; resting 17%, and social 14%. This shows that the group divided its time unequally between the different activities (p<0.001, Chi-square test).
Figures 3 and 4 show the distribution of the relative frequencies of the behaviors: movement, social, resting and feeding throughout the day, grouped in behaviors (fig. 3), and time interval (fig. 4). Feeding was the most frequent activity and movement the second most frequent, in all three time intervals. Movement decreased during midday, while social behavior had a peak during the same interval. These two behaviors were significantly different depending on the time of day (p<0.001, Chi-square test, for both behaviors). The frequencies of the activities resting and feeding did not differ significantly depending on the time of day. In neither of the intervals morning, midday and afternoon were the relative frequencies of behaviors evenly distributed (p=0.001, Chi-square test).
Figure 5 shows the group’s relative frequency of arboreal activity throughout the day, grouped in morning, midday and afternoon.

Figure 5. Comparison of the group’s relative frequency of arboreal activity throughout the day, grouped in morning, midday and afternoon

5. Discussion
The present study found that the observed group of samango monkeys has an activity pattern in which most of the group’s time is spent foraging and moving, and less time is spent on resting and social activities. A difference was observed between the activity patterns during midday, compared to morning and afternoon. More time is spent on social interactions during the middle of the day, and more time is spent on the ground during midday. Also, more time is spent on moving during morning and afternoon, compared to midday.

The Soutpansberg of northern South Africa – where the present study was conducted – is an area where seasonal changes affect temperatures and day length considerably. During winter, the morning and evening hours are much colder than the middle of the day, when the climate can be quite mild. In addition, days are considerably shorter during the winter season. These two factors might be part of an explanation behind a difference in midday behavior compared to morning and afternoon. The shorter winter days might constrain and alter behavior, since the daily activities need to be performed during a shorter period of time. Fluctuating temperatures might also be a part of the explanation behind a different behavioral pattern during midday, both in winter and in summer. In summer, the midday rest takes place in the shade, providing protection from intense sun and heat (Branch, et al, 2007; Stuart and Stuart, 2007). In winter, the midday hours are instead the milder hours of the day compared to the chilly mornings and evenings.

Lawes and Piper (1992) hypothesized that when inhabiting an area with seasonal changes, such as the southern range limit of the C. mitis species, samango monkeys of Cape Vidal, South Africa were more affected by fluctuations in day length, food availability and thermoregulation, than equatorial C. mitis populations. Closer to the equator, climate and day length is more stable throughout the year, which would then also make behavioral patterns
more consistent throughout the year. Their study found that the fluctuating day length indeed affected the observed samango monkeys’ feeding behavior. According to the authors, varying day length is an environmental factor that needs to be considered when observing population that inhabit areas far from the equator, especially when comparing the findings with findings on equatorial populations’ (Lawes and Piper, 1992).

The influence of day length and latitude on behavior has also been investigated in the chacma baboon. In a four-year study of a group of baboons at the De Hoop Nature Reserve, South Africa, a variation in behavioral patterns depending on the season was found. The results imply that the amount of daylight depending on the time of year is a factor that affects behavior. The patterns of the behaviors moving, feeding, resting and grooming were investigated. During the winter months of June-August the observed group displayed a pattern in which feeding was the most common activity, followed by moving. The behaviors grooming and resting were less common, with resting making a dip during the winter months. During summer, resting instead increased dramatically. In fact, resting was almost as frequent as moving during Dec-Jan. According to the authors this is largely due to the fact that longer summer days allow for more leisure activities, when individuals are no longer as restricted by the necessary time spent on foraging. Essentially, a higher proportion of total time is spent on foraging when available day light time is limited during winter (Hill et al, 2003).

In a study investigating the social and ecological factors affecting behavior in the vervet monkey, Isbell and Young (1993) compared six groups inhabiting different areas of Amboseli National Park, Kenya. They found that the most common activity – feeding – fluctuated seasonally for all study groups, with no variation between groups or habitats. The pattern of feeding being the most common behavior and resting and grooming being the least common behaviors was also independent of group. For all groups, about twice as much time was spent feeding during the winter months (June-September) compared to the other months. This was shown to coincide with specific diet choice during the same time period, which was thought to be the main reason behind the fluctuation. As the relative time spent on feeding increased, all other behaviors decreased accordingly. When analyzing the behaviors feeding, moving and resting, the authors found no difference between males and females. Differences between and within groups were, however, found in the behaviors of grooming, scanning and moving. The study showed that behavioral patterns displayed in one group of a species, is not readily generalizable to another group, since several environmental and social factors, such as habitat and group size need to be taken into account when analyzing a group’s behavior. Therefore, in order to fully understand a species’ behavior, longer studies of several groups, in several different habitats, are necessary to find a species’ “characteristic behavior” (Isbell and Young, 1993).

In the present study, the troop of samango monkeys rarely foraged near or at the sleeping site. Instead, the morning hours were often spent moving to areas where most of the foraging took place. However, most of the daily range was almost always covered during morning and afternoon. The properties of a good sleeping site are, of course, different from the properties of the foraging area. Good sleeping sites – from what was observed – are locations with tall trees or high rock, rather than sites with more open areas and short trees. Hypothetically, tall trees and high rocks provide protection from ground predation. Sleeping in less open areas also provides protection from predation from eagles, since bigger trees provide for more leafy coverage. In order to cover the distance between the preferred sleeping sites and the preferred foraging areas without losing valuable day time, especially during winter, the group needs to
keep moving during the morning hours. During the afternoon, they once again need to cover longer distances to reach a proper sleeping site before dusk.

The fact that sleeping sites and foraging grounds differ in location and composition might partly explain the difference in the group’s midday behavior. When the foraging areas are reached, more time can be spent on social behaviors instead of movement. The fact that it is warmer during the middle of the day also lessens the need to move to stay warm. During night, when temperatures are the lowest, individuals can keep warm by huddling with other members of the group. This was seen during daytime as well, especially during the coldest days. However, sitting still during daytime is inefficient from a foraging perspective. Moving therefore serves as both a thermoregulating mechanism and a necessary means to get to and from foraging sites, especially during morning and afternoon.

The observed group spent a considerable amount of time on the ground, especially during midday. The increase in activities on the ground during midday also coincided with the increase in social behaviors. The amount of time this group spent on the ground is not consistent with what has been described in the literature, in which the samango has been portrayed as a monkey who only visits the ground occasionally for drinks, but otherwise is seen high up in trees (Branch, et al, 2007; Stuart and Stuart, 2007). The amount of time spent on the ground might also be due to the studied group being more active on the ground in general than other groups. This group is isolated and might display behaviors that are not ‘typical’ when compared to descriptions of the samango monkey in the literature. This might be an adaptation to the specific environmental factors in the area, such as a low predation pressure.

An unusually rainy wet-season which preceded the study period might have increased the amount of available foods on the ground. This includes increased amounts of small bushes, herbs and shoots, which might explain the increase in time the group spent on the ground. However, the rain would also have increased the amount of leaves in trees, which the group also forages on.

A longer comparative study – in which other groups are also observed, and weather conditions and other environmental factors such as predation pressure are closely monitored – would be necessary to draw a conclusion concerning if and why this group spent more time on the ground than what the literature describes. A full-year study with the same group would not only allow for more observations of behavior and seasonal variations in climate, but also provide more data on the age and gender distribution in the group. Along with individual identification this, in turn, would allow focal animal sampling as an additional observational method.

The scan sample method used in the present study might have a bias toward individuals who are more habituated to human observers. In turn, these individuals might not be a representative selection of individuals from all age classes or both sexes. Lawes and Piper (1992) identified the approximate age and gender of all observed animals when using the scan sample method in their study of a South African population of samango monkeys, which made it possible to identify any differences in behavioral patterns between ages and sex within the group.

In the present study, no identification of individual animals was made, nor was the number of females, subadults of either sex, or infants in the group counted or known beforehand.
Therefore, it is not known if the observations represented a random selection of the group. If, for example, older females are more habituated, they might tend to stay closer to a human observer than a relatively unhabituated subadult. This might lead to a bias in the scan sampling, with an overrepresentation of older females compared to their actual occurrence in the group. Several other factors – besides the degree of habituation – may affect the individuals’ proximity to the observer. Proximity to the other samango troop as well as either of the baboon or vervet troops, or predation risk, may affect displayed behaviors. Therefore, including the whereabouts of the other resident troops in the area during a longer study would be valuable.

Getting a completely un-biased sample with the scan sample method is difficult when observing a group as large as the one in the present study (up to 60 individuals), where scanning of all individuals in every scan is practically impossible. However, when offered a limited time for observation with an unknown group of animals, the scan sampling method offers a good means of collecting general information. One might assume that external factors affect the whole group equally at a given time, and when scans are systematically performed, the sample of individuals can be considered random. The risk of the selection being biased is something that must be considered, but the risk must also be compared to the value in obtaining any data at all.

This study aimed at gaining more understanding about the samango monkey in general, and this isolated population of the Soutpansberg Mountains in particular. Some findings suggest that the observed population differs in some of its behaviors from what has been described for the samango monkey in the literature. In order to look into the reasons behind these differences, a longer study, in which more environmental factors are included in the analysis, together with comparative analysis with other populations, would be ideal. In such a study, individual identification would provide more options in the choice of method, which then could be extended to focal animal sampling in addition to scan sampling.
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7. References


