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## Temporal fluctuation of gorilla social behavior de grauer: Gorilla beringei graueri (primate, hominidae) at national park of Kahuzi-Biega, democratic republic of Congo

Innocent Masiala Mabilia<sup>1</sup>, Séraphyn Ifuta Ndey<sup>2,\*</sup> and Julien Punga Kumanenge<sup>3</sup>

<sup>1</sup> Department of Biology of the Faculty of Sciences of the University of Kinsahsa XI, democratic republic of Congo.

<sup>2</sup> Department of Environment Sciences, Faculty of Sciences, University of Kinshasa, B.P. 190, Kinshasa XI. Congo.

<sup>3</sup> Department of Biology Faculty of Sciences, University of Kinshasa XI, Congo.

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### Abstract

The objective of this study was to assess the temporal and seasonal fluctuation of the daily activities of the Chimanuka family gorillas at high altitude in the Tshivanga station in the Kahuzi-Biega National Park and their implications for the success of tourist visits. We used the methods of reconnaissance walks, direct observation, scanning and focal animal. The activities studied are: feeding on the ground, feeding at height, moving for food research, changing habitats, family rest and agonistic interactions resulting in fights between two dominant males from different families. These appear in both seasons. Comparing the two seasons (rainy and dry), ground feeding is more frequent in the rainy season than in the dry season. Feeding at height is observed especially in the dry season. Travel for food research is more noticeable in the dry season and family rest is observed more in the rainy season. Habitat change and agonistic interactions are more frequent in the dry season. Consideration of temporal and seasonal fluctuations in gorilla social behavior is recommended to guide visitors through the park with the seasons in mind.

**Keywords:** Ground feeding; Family rest; Foraging; Habitat change; Agonistic interactions

### 1. Introduction

Kahuzi-Biega National Park (PNKB) is home to Grauer's Gorillas: Gorilla beringei graueri (Matschie, 2005). Contact between the populations of high altitude gorillas and those of the low altitude forest (which was not yet part of the park) was achieved in 1975 by extending the area of the PNKB to 600,000 ha by Ordinance no. 975/238 of July 22, 1975 (Butynski, 2001). It is an endemic subspecies in the Democratic Republic of Congo (Tango, 2003).

In order to satisfy the curiosity of visitors and provide the park with significant foreign currency income for its conservation, the Belgian curator, Andrien Deschriver, one of the pioneers in the organization of visits to gorillas in the wild, began gorilla habituation at the Tshivanga station of the PNKB (Williamson and Fleistner, 2003). He had been able to take paying visitors from the end of 1973.

This successful habituation and the organization of vision tourism have enabled the monitoring and research program of the PNKB to plan field trips by rotating teams for regular monitoring of the gorillas only at high altitude. Regular observation trips to the different families of Grauer's gorilla have made it possible to know the subspecies, ensure survival and improve surveillance and protection of the park. This has accumulated over time so much experience of Grauer's gorilla sightseeing that much less is known about the temporal fluctuation of social behavior in comparison to the abundant data of mountain and western lowland gorillas (Weghe, 2004).

\* Corresponding author: Séraphyn Ifuta Ndey

Department of Environment Sciences, Faculty of Sciences, University of Kinshasa, B.P. 190, Kinshasa XI, Congo.

We chose the Chimanuka family of gorillas to better study the temporal and seasonal fluctuation of the daily activities of gorillas. The daily activities are the different aspects of the behavior of the gorillas during their movements in the park.

The general objective of this study is the rational use of the data of the temporal and seasonal fluctuations of the different daily activities of the gorillas of the Chimanuka family at PNKB in the success of successful tourist visits.

### 1.1 Study environment

The Kahuzi-Biega National Park (PNKB) is located in the east of the DR Congo in the South Kivu Province between 1°36' and 2°37' of southern latitude and that between 27°33' and 28°46' East longitude. (Muhlenberg et al., 1994). The extreme geographical coordinates are: to the west at the Ezeza river (21°33'E), to the east at Lemera (28°46'E), to the south at Lubimbe (2°37'S) and to the north at Mount Matebo or Mount Kamengele (1°36'S). The altitude varies between 600 and 3308m. The park extends over two zones of different altitudes.

The low altitude (5400 km<sup>2</sup>) is located in the Congolese basin near Itebero-Utu and the high altitude (600 km<sup>2</sup>) is located at the western border of the Congolese basin, northwest of Bukavu (Mangambu et al., 2010). Our study was carried out in the high altitude area managed by the Tshivanga station which is located at 2058 m (Nixon et al., 2005). This area is made up of two mountains. Mount Kahuzi reaches a height of 3308 m.

Mount Biega rises to an altitude of only 2790 m (Casimir, 1975a and 1975b). The mountain zone of PNKB is characterized by an Afro-Alpine climate with night frost (Hedberg, 1975). The heights of the relief prevent moist air masses from crossing the mountains, causing abundant cloudiness and heavy rains, often in the afternoon and evening (Vandenplas, 1948).

In the mountainous part of the park (region of the Kahuzi and Biega mountains), the vegetation belts at altitudes ranging from 900 to 3300 m have been well studied. There are six different forms of primary vegetation: Mountain rainforests (900 to 2300 m altitude); High mountain rainforests (1600 to 2700 m); Swamp forests; Bamboo forests (2,300 to 2,600 m); Subalpine heaths (above 2600 m) and bog marshes (not beyond 2400 m) (Masumbuku, 2011).

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## 2. Material and method

### 2.1 Biological material and data collection

#### 2.1.1 Biological material

The tracked gorillas are found only at high altitudes. They are divided into Eleven families including the Chimanuka family. Our study relates to the family of Chimanuka gorillas accustomed to human presence and whose tourist activity is organized. The composition of the family was verified with data from the Monitoring and Research Program of the Tshivanga station. It is made up of 33 individuals including 1 dominant male called Sylver Back (29 years old), 9 Adult Females (15 to 23 years old), 5 Black Backs (10 to 11 years old), 3 Subadults (7 to 9 years old), 6 Juveniles (3 to 6 years old) and 9 babies (1 month to 2 years old).

#### 2.1.2 Collection of data

Observations were made over three years from 2012-2014 in the rainy and dry seasons. The rainy season occurs from February to mid-June and September to December. The dry season is from mid-June to August for a harvest year.

As part of the normal activities of the park, a field team responsible for regularly monitoring the animals is made up of five people including a head tourist guide, two trackers and two locators. We joined this team in 2012 to carefully examine and discover the nature of the different aspects of the social behavior of the Chimanuka family gorillas. The entry into the forest began at the place where the field team left the previous day and then we took the geographical positions using a MAP 60 CSX model GPS. We started reconnaissance walks to where the gorillas had been left the previous day. From there, we followed the new traces (droppings, food debris, urine, nests and tracks) until the discovery of the group.

Once the gorillas of the Chimanuka family joined and before any study, we spotted by direct observation, first the dominant male called Chimanuka to ensure that he accepted our presence. We then observed the rest of the group at a minimum distance of 7 m, the recommended regulatory distance for monitoring habituated gorillas (Macfie and

Williamson, 2010). We identified the following social behavior activities: ground feeding, height feeding, foraging movement, habitat change, family resting and agonistic interactions.

The scanning of each aspect of social behavior constitutes a sampling taken in a timed interval of time. The timed time is taken as the minimum time space of 15' in which the activities of social behavior are carried out with regard to an alternation improvised by the individuals of the gorillas (White and Edwards, 2001). The gorillas were tracked on a continuous early morning and afternoon diet only for the purpose of authorized research. The data was collected 21 days per month for 168 days during the rainy season and 126 days during the dry season.

## 2.2 Data analysis

We obtained for each behavior the data in minutes per day due to a 15-minute observation interval. The calculated daily values of each behavior were summed over 21 days of the month. For each behavior, we added the values of 168 days for the rainy season and 126 days for the dry season, or 294 days. From these values, we first have two tables for the two seasons showing the total duration of the activities in minutes during the number of days of data collection, the average duration of the activity per day, the percentages of duration of each activity. We aligned in the Excel software, the data of each behavior for the rainy and dry season expressed in percentage to obtain a graph interpreting the difference and the temporal and seasonal fluctuation.

## 3. Result and Discussion

The social behavior activities studied are: feeding on the ground, feeding at height, moving for food research, changing habitats, family rest and agonistic interactions resulting in fights between two dominant males of different families (confrontation).

### 3.1 Rainy season

During the rainy season, the family of Chimanka gorillas was followed for 168 days with a total duration of 31,784 minutes taken for all social behavior activities for a daily average of 189.1 minutes. The percentages of each social behavior activity are: ground feeding (40), family resting (26), high feeding (16); movement for food research (10), change of habitats (4) and characterized agonistic interactions (4) (table 1).

**Table 1** Evaluation of social behavior activities of gorillas in the rainy season

Social behavior of gorillas	Total duration of activities in minutes for 168 days	Average duration of activity per day in minutes (N=168)	Percentage of duration of activities
Ground feeding	12,800	75 ± 32.17	40
Family rest	8.184	48 ± 7.75	26
Feeding at height	5.200	31 ± 13.84	16
Travel for food research	3.200	19 ± 3.32	10
Change of habitats	1.288	8 ± 3.32	4
Agonistic interactions	1.112	6 ± 2.37	4
Total	31.784	187 ± 37.04	100

During the rainy season, ground feeding is the most time-consuming social behavior of the Chimanka family gorillas. It is followed by family rest.

### 3.2 Dry season

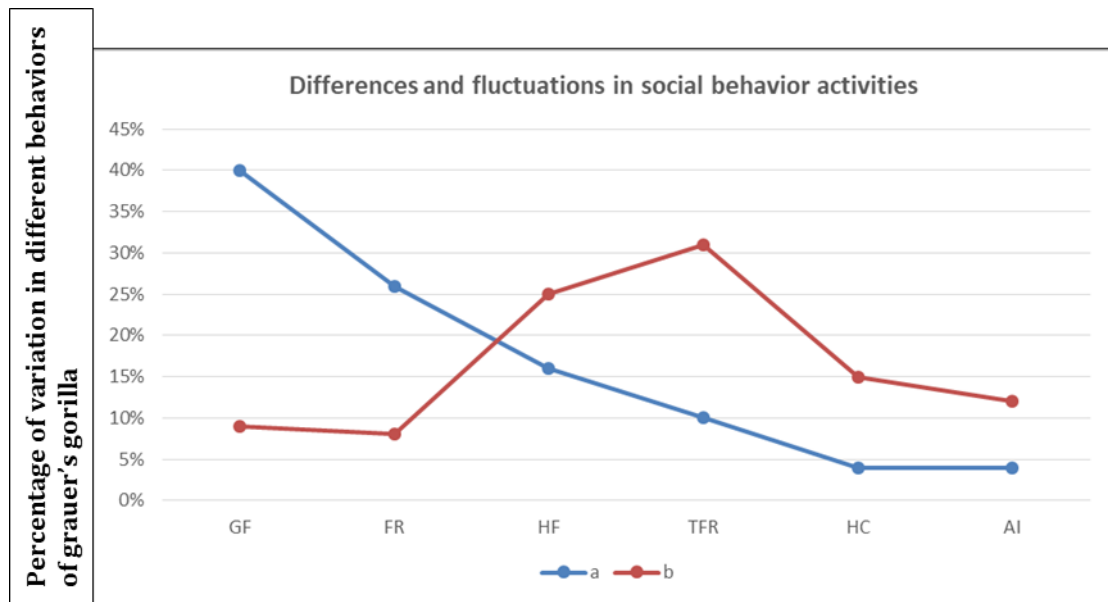
During the dry season, the family of Chimanka gorillas was observed for 126 days for a total duration of 49,098 minutes with a daily average of 389 minutes. The seasonal logarithmic values of the social behaviors are: movement for food search (31), feeding at height (25), change of habitats (15), agonistic interactions (12), feeding on the ground (9) and family rest (8) (Table 2).

**Table 2** Assessment of gorilla social behavior activities in the dry season

Social behavior of gorillas	Total duration of activities in minutes for 126 days	Average total duration per day in minutes, N= 126 days	Percentage of duration of activities
Travel for food research	15.204	117 ± 48.01	31
Feeding at height	12.474	96 ± 15.47	25
Change of habitats	7.560	58 ± 34.78	15
Agonistic interactions	5.670	44 ± 9.68	12
Ground feeding	4.410	34 ± 19.15	9
Family rest	3.780	29 ± 18.46	8
Total	49.098	378 ± 112.07	100

During the dry season, the search for food absorbs more the gorillas of the Chimanku family. It is followed by feeding at height.

Figure 1 shows the difference and daily temporal fluctuation in the duration of gorilla social behavior activities between the rainy season and the dry season.



Legend 1: Ground Feeding (G.F), Height Feeding (H.F), Travel for Food Search (T.F.S), Family Rest (F.R), Habitat Change (H.C) and Agonistic Interactions (A.I); a: rainy season and b: dry season

**Figure 1** Differences and fluctuations in social behavior activities (rainy and dry season)

Ground feeding dominates during the rainy season because the gorillas consume a lot of leaves present on the ground, in particular those with *Urera hypselodendron*. (Yamagiwa et al., 2005) studied the diet of Grauer's gorillas in the mountain forest of Kahuzi-Biega and attested that the gorillas consumed 98% of the leaves of *Urera hypselodendron* among 106 species of local plants.

The herbaceous vegetation of the gorillas during the rainy season constitutes the major part of the food ration in order to fill its belly and maintain its weight (Yamagiwa et al., 2003). Of all the great apes, the gorilla exhibits the most stable group behavior (IRSNB, 2005). In the dry season, feeding on the ground is less intense and is characterized above all by the consumption in the marshy areas of the bulbs of *Cyperus latifolia*, the green leaves which are still present on *Urera hypselodendron*, *Taccazea apiculata* and *Basella alba*.

In the rainy season, feeding at height leads gorillas to seek food by climbing trees. This is the case for the species *Taccaea apiculata*: It is a vine which is also a favorite food of the gorillas studied. Then, the *Ficus* sp. colonize certain trees including *Macaranga kilmandscharia* and *Maessa lanceolata* to consume the fruits.

Feeding at height becomes systematic during the month of May when there is fruiting of the tree species *Afrocania volkensis*. (RBINS, 2005) observed that several types of fruits are eaten seasonally by Eastern Lowland Gorillas at the upper elevations of PNKB. In the dry season, feeding at height is very characteristic during this season. This is the period of fruiting. During this period, the gorillas climb a lot to take the yellow fruits of *Myrianthus holstii*.

(Gauthier – Hion et al., 1999) show that gorillas climb trees mainly to pick fruit. Given their weight, adult males are seen there less often than females and young. (IRSNB, 2005) mention that Grauer's gorillas consume more fruits than Bwindi's but not as much as western lowland gorillas.

Family rest is observed more during the rainy season and depends on the amount of food consumed by the gorillas since their morning awakening. During this period, the different categories of individuals of the gorillas meet. In the dry season, family rest occurs less and often late because the gorillas have to travel certain distances before finding food. Rest time is irregular. There are few individuals associated.

Travel for food search is less frequent during the rainy season and starts at 7 am (Barhakaziga, 2010). They mainly occupy the morning in search of food. When food is abundant, foraging is done by short trips. During this period, gorillas average 1 km (Mühlenberg et al., 1994). (Gauthier – Hion, 2006) show that feeding on a dense plant cover requires little movement and does not force the animals to distance themselves from each other. Travel in search of food dominates more during the dry season. The morning awakening of the gorillas is around 5:30 a.m. (Barhakaziga, 2010). Gorillas travel long distances to search for the scattered feet of *Myrianthus holstii*. It is the main food during this period. The feet of *Myrianthus holstii* are the sites sought by the gorillas and become the meeting places of several groups.

The change of habitats is not observed much during the rainy season. The gorillas of the Chimanuka family stay in the clearings to eat the leaves of *Urera hypselodendron* and sometimes visit the *Cyperus latifolia* swamps and the stands of *Macaranga kilmandscharia* and *Maessa lanceolata* to eat the *Ficus* sp. Around the month of May is added the typical research of the fruits of *Afrocania volkensis*.

The change of habitats mainly takes place during the dry season. The gorillas run and they range from dense, isolated secondary forests of *Myrianthus holstii* to swampy areas of *Cyperus latifolia*. They spend little time in the rich clearings of *Urera hypselodendron*, *Taccaea apiculata* and *Basella alba* where the leaves dry up and disappear. This causes them to travel long distances to find available food to fill the belly and maintain its weight. This change of habitat is often done in single file and often the gorillas take the paths that men take in the high altitude. (RBINS, 2005) mention that the habitats consist of dense primary forests interspersed with stands of bamboo, moderately humid undergrowth, marshy *Cyperus* areas and bogs, with higher elevations; patches of vegetation can be observed at low altitude. (Gauthier – Hion, 2006) studying western lowland gorillas, reports that encounters between groups are favored by the fact that gorillas are not territorial animals and that groups use widely overlapping domains.

In the Chimanuka family, agonistic interactions are less frequent during the rainy season than in the dry season. In the rainy season, the plant food resource is abundant. Gorillas don't have to fight for food. (Yamagiwa et al., 2005) report that the majority of food (70.2%) consumed by gorillas consists of leaves and sometimes bark and marrow. They wander about 1 km daily during the rainy season under the guidance of the dominant silverback (Mühlenberg et al., 1994). This behavior can often manifest itself during the search for a typical food such as in May, during the consumption of the fruits of *Afrocania volkensis*. (Mühlenberg et al., 1994) report that the food of eastern lowland gorillas is fairly evenly distributed over their territory. We observed gorillas of the Chimanuka family consuming the bark of *Ecalyptus* sp. towards the end of March.

In the dry season, meetings of different families are favored by the search for fruits, especially *Myrianthus holstii*. The agonistic interactions then between dominant males of different groups.

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#### 4. Conclusion

The study of the social behavior of the family of Chimanuka gorillas in Kahuzi-Biega National Park revealed 6 social behaviors. These are: feeding on the ground, feeding at height, movement for food research, family rest, change of habitats and agonistic interactions. These appear over the course of two seasons. Ground feeding dominates more in the rainy season than in the dry season. Feeding at height is observed more in the dry season, travel for food search is

more noticeable in the dry season and family rest is more observed in the rainy season. The change of habitats and the agonistic interactions manifest themselves more in the dry season. The rainy season seems better suited for viewing tourism of the Chimanuka family gorillas at the Tshivanga station of the Kahuzi-Biega National Park. Knowledge of the seasonal temporal fluctuation of the social behavior of the Chimanuka family gorillas makes it possible to define favorable periods to bring visitors to the park at appropriate times and not interfere with the behavior of the gorillas.

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## Compliance with ethical standards

### *Acknowledgments*

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### *Disclosure of conflict of interest*

I am Innocent MASIALA MABIALA author of the manuscript. Professors Séraphyn Ifuta Ndey and Julien Punga Kumanenge are thesis supervisors. I declare that there is no conflict of interest.

### *Statement of ethical approval*

This study is carried out on the endemic subspecies of the Democratic Republic of Congo at Kahuzi – Biega National Park. I declare that *Gorilla beringei graueri* belongs to the Kingdom animalia, phylum Chordata, Class of mammalia, Order of Primates, suborder Haplorrhini, Infra-order Simiiformes, micro-order Catarrhini, Super family Hominoidea, family Hominidae, Species *Gorilla beringei* and subspecies *Gorilla beringei graueri*.

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## References

- [1] Barhakaziga S., (2010). Some aspects of the ecology of gorillas undergoing habituation at the Tshivanga station, Kahuzi-Biega National Park in the DRC, unpublished report Garoua, 50p.
- [2] Butynski, T., (2001). Africa's great apes. In: B.B. Beck, T.S.Stoinski, M. Hutchins, T.L.Maple, B. Noron, A. Rowan, E.F. Stephens and A. Arluke (eds).
- [3] Casimir, M.J. (1975a). Some data on the systematic position of the Eastern Gorilla population of the Mont Kahuzi Region (Republique du Zaïre).Z.Morph. Anthropol., 66: 188-201.
- [4] Casimir, M.J. (1975b). Feeding ecology and nutrition of an eastern gorilla group in the Mt. Kahuzi region (République du Zaïre), Folia Primatologica, 24: 1-36.
- [5] Gautier-Hion, A., (1990). Interaction among fruit and vertebrate fruit-eater in an African tropical rain forest. In (K.S. Bawa et M Hadley, eds) Reproductive Ecology of tropical Forest Plant, pp. 219-230. Unesco, Paris.
- [6] Gauthier – Hion, A., M., Collyn et J.P. Gauthier, (1999). Naturel history of Central African primates ECOFAC. Libreville. 95p.
- [7] Gautier-Hion, A., (2006). The Gorillas, Apogée Editions, 63p.
- [8] Hedberg, O., (1957). Afroalpine vascular plants – a taxonomie revision.Symb. Bot. Upsal., 15 1-411.
- [9] Belgian Institute for Research in Naturel Sciences (IRSNB, 2005). World Atlas of Great Apes and their conservations (published in 2005). 34p.
- [10] Macfie et Williamson E.A. , 2010. Best Practice Guidelines for Great Ape Sightseeing, Gland, Switzerland : IUCN / SSC Primate Specialist Group. www.primatesg.org dated access july 22, 120p.
- [11] Mangambu M., Habiyaremye F.M., Lina A. et Ntahobavuka H. (2010). The importance of the *Cyathea manniana* Hook group in the biodiversity of Kahuzi – Biega National Park, DRC.Geo-Eco-Trop 34 (1/2) : 45 – 63.

- [12] Masumbuko N. C. (2011). Ecology of *Sericostachys scandens* and liana in the montane forests of Kahuzi – Biega National Park, Democratic Republic of Congo. College Sciences, Plant and biogeochemistry laboratory, Unpublished doctoral thesis. Free University of Belgium. 176p.
- [13] Matschie, 2005. Mammal species of the World (version 3, 2005) : *Gorilla beringei graueri* Matschie, 1914 (archive) consulted on 06/08/2019.
- [14] Mühlenberg M., Slowik J., Sternhauer-Burkart B., 1994. Kahuzi- Biega National Park. Brochure published by the Zairian-German project IZCN / GIZ, Bukavu, Integrated Nature Conservation, 52p.
- [15] Nixon, S.C., Ngwe E.E., Mufabule K., Nixon F., Bolamba D. et P.T. Mehlman (2005) .Grauer's gorilla and other wildlife in the Maïko South Region. *Gorilla Journal* 31: 4-6.
- [16] Tango, P., 2003. Economic value on ecotourism. Abidjan : National Bureau of technical studies and development.
- [17] Vandenplas, (1948). On the vertical distribution of precipitation in the mountainous region of eastern Belgian Congo. *Bull. Agri., Belgian* 39 : 101 – 118.
- [18] Weghe, J.P., (2004). Central African Forest : Nature and Man. ECOFAC, Libreville / Lannoo, Tielt. Ed. Lannoo.367p.
- [19] Williamson, E.A. and A.T.C Fleistner 2003. Habituating primates: processes techniques, variables and ethics. In *Field and Laboratory Methods in Primatology: A Practical Guide*. Cambridge: Cambridge University Press.
- [20] White, L. et Adwards, A. (2001). Conservation in the African rainforest. *Research methods*, 455p.
- [21] Yamagiwa, J., Basabose K.A., Kaleme K. et Yumoto, T. , 2005. Diet of Grauer's Gorillas in the Montane Forest of Kahuzi, Democratic Republic of Congo. Vol.26
- [22] Yamagiwa, J., K. Basabose, K. Kaleme & Y. Yumoto. (2003). Within-group feeding competition and socioecological factors influencing social organization of gorillas in the Kahuzi-Biega National Park, Democratic Republic of Congo. In A.B. Taylor & M.L.