the Jane Goodall Institute

Gombe Stream Research Centre
2005 Annual Report

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Cover photo: Fanni, daughter of Fifi. 19 September 2005. MlW

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1. Introduction

2005 was a productive and eventful year for the Gombe Stream Research Centre. At least 14 publications based on Gombe research appeared in 2005, including 9 journal articles, 3 PhD theses, and 2 reports (Appendix I). Gombe researchers maintained a strong presence at international conferences, presenting 17 papers at conferences in 5 countries: the United States, Canada, Cameroon, the Democratic Republic of Congo, and Tanzania. These studies ranged over such varied topics as genetics, virology, endocrinology, parasitology, cognition, health, tool use, meat sharing, vocal behavior, growth, reproduction, aggression, play, and conservation. While research continued to focus on chimpanzees, this year's studies also included baboons, red-tailed monkeys, and blue monkeys.

The chimpanzee population experienced net population growth for the second year in a row, reaching approximately 97 individuals by the end of the year. This represents an increase from about 94 chimpanzees at the end of 2004 and 92 at the end of 2003. These estimates are higher than last year, due both to a real net increase in the population, and to further improvements in our estimates of the number of chimpanzees in the Kalande community.

This report covers six major topics. First, we provide an overview of ongoing research on chimpanzees, baboons, and other topics at Gombe. Second, we present findings from the long-term monitoring of the chimpanzees, including the demography, male dominance relations, mating, hunting, intergroup aggression and disease. Third, we present findings from the baboon study, including group composition, female and male reproductive strategies, disease, and interactions with other species. The Fourth section focuses on other notable events relating to the park's ecology and other wildlife. Fifth, we discuss issues relating to conservation planning. In the final section, we discuss administrative issues, including developments in infrastructure and personnel.

1.1 Research projects – Overview

GSRC supports long-term studies of chimpanzees and baboons, and also hosts studies of other primates, as well as related topics, including botany, habitat change, and conservation.

1.2 Chimpanzee projects

Three chimpanzee communities live in Gombe, from south to north: Kalande, Kasekela, and Mitumba. Most research focuses on the central Kasekela community, which Dr. Jane Goodall began studying in 1960. The smaller Mitumba community in the north of the park has been studied systematically since the mid 1990s, and the Kalande community in the south of the park has been monitored since 1999.

Current studies include the following:

1.2.1 Health monitoring

Disease is the main cause of death of Gombe chimpanzees, and we suspect that at least some of the diseases chimpanzees suffer come from human sources. Improving the health of Gombe chimpanzees is thus critical for conserving them. Moreover, since humans and chimpanzees are so closely related, study of chimpanzee health can yield important findings for human health. We

have implemented a project for monitoring the health of Gombe chimpanzees in regard to the following: general health and parasites; virology and genetics. Monitoring efforts focus on non-invasive collection of fecal and urine samples. This project involves collaboration with scientists at universities in Tanzania and abroad (Universities of Dar es Salaam, Alabama, and Minnesota), and experts in wildlife health at Tanzania National Parks (TANAPA) and Lincoln Park Zoo, Chicago. Drs. Elizabeth Lonsdorf and Dominic Travis of Lincoln Park Zoo raised funds to implement the project and visit Gombe regularly to provide key guidance and support.

The virology component of the health-monitoring project is part of a multi-site project led by Professor Beatrice Hahn at the University of Alabama. This project focuses on SIVcpz, the immediate precursor of HIV-1, the virus that causes AIDS in people. At least 13% of chimpanzees at Gombe carry this virus (Santiago et al. 2003), but those affected with the virus do not show any obvious AIDS-like symptoms. Chimpanzees carry this virus naturally, and are now thought to be the source of HIV-1, which people probably got from hunting and butchering chimpanzees for meat (Worobey et al. 2004). What we learn about this virus at Gombe will provide important information for improving human health.

Jared Bakuza (University of Dar es Salaam) is studying chimpanzee parasitology for his MSc. Jared has overseen the transformation of an old storage shed into a well-equipped field laboratory, complete with microscope and materials for collecting and storing samples.

As part of the health-monitoring project, we collected over 544 samples, including approximately 370 fecal samples preserved in formalin for parasitological analysis, 174 fecal samples in another preservative, RNAlater, for virology and genetics, and representative tissue samples from the necropsies of Vincent and Ebony. Diagnostic samples were also collected from Faustino during his illness (Section 2.4.2).

1.2.2 Discrimination of paternal kin

In many primates, including chimpanzees, females usually mate with many more than one male each reproductive cycle. Observers can therefore tell who the mothers are, but cannot be sure of who the fathers are without conducting genetic testing. Most researchers have assumed that the fathers themselves don't know who their offspring are, but intriguing observations, including females avoiding mating with their fathers and paternal brothers, suggest that chimpanzees might be able to discriminate paternal kin. Recent studies have found evidence for paternal discrimination in other species, such as baboons (Alberts 1999). To test whether chimpanzees can discriminate paternal kin, Emily Wroblewski (University of Minnesota) is conducting behavioral observations in the field and genetic tests in the lab. Emily began her study by spending 2 months in Gombe (Feb-Mar) collecting pilot data. Over the summer, Emily worked in Beatrice Hahn's laboratory to analyze DNA extracted from fecal samples to determine the fathers of young chimpanzees.

1.2.3 History and demography of the Mitumba community

Efforts to habituate the Mitumba community of chimpanzees began in the 1980s, but this community has received relatively little research attention. For his Master's thesis, Deus Mjungu (University of Minnesota) has worked to improve our understanding of this community by working directly with the field assistants at Gombe (Jun-Aug 2005) and by analyzing years of data on the demography of this community. Deus has been accepted into the PhD program at Minnesota, where he will focus on intercommunity relations.

1.2.4 Intercommunity relations

In addition to serving as Director of Field Research, Dr. Michael Wilson (GSRC) has continued his studies of intercommunity relations at Gombe. Chimpanzees are well known for their hostile intercommunity relations. Studies at Gombe and other sites have greatly influenced the debate on the origins and evolution of human warfare. The ongoing study of chimpanzees at Gombe provides an unparalleled opportunity to gain valuable insights into the causes of intergroup aggression. The project consists of two components: analysis of long-term data from Gombe, housed at the University of Minnesota; and direction of ongoing field studies at Gombe, to ensure that intergroup interactions are adequately documented when they do occur.

1.2.5 Videography

Bill Wallauer (GSRC) continued to document on videotape the life histories and significant events of the chimpanzees within the Kasekela community. Over the course of 2005 Wallauer recorded approximately 70 hours of footage. Highlights during the year included documenting the male politics within the Kasekela community (see Section 2.2.1), detailed documentation of hunting and termite fishing, response by chimpanzees to an earthquake (Section 2.3.3), and the predation of an adult male bushbuck by a python (Section 4.4). Bill also worked closely with the BBC team filming 'Chimp Week' as both a filmmaker and scientific advisor. The filming for this series concluded in July. The show features stories of Flirt on her own, after the death of her mother Fifi, Frodo's return, Gremlin and her twins, and the rise of Kris as alpha. This show aired in Britain as a week long series in January 2006. In the US, the show will air as a two-hour special. In addition to serving as entertainment, this film educates a wide, international public about chimpanzees and conservation, and helps raise worldwide interest in Gombe. Copies of this film have been provided to TANAPA, COSTECH, GONAPA, and TAWIRI. There are plans in the works to make a Swahili version of this film.

1.2.6 Completed Projects

In addition to these ongoing projects, several previous projects have reached completion. Melissa Emery Thompson (Harvard University) completed her PhD thesis on the reproductive ecology of female chimpanzees (Emery Thompson 2005). Elizabeth Greengrass (Bristol University) completed her PhD thesis on play and dominance interactions in chimpanzees (Greengrass 2005). In addition to these completed projects, Carson Murray (University of Minnesota) made rapid progress on her study of female chimpanzee range use and social relations.

1.3 Baboon projects

The Gombe baboon study has continued since 1967, encompassing many aspects of ecology, life history and disease. In addition to ongoing collection of long-term demographic and behavioral data (Section 3), one specific project was completed in 2005, and work continued on two others.

1.3.1 Genetic structure of the baboon population

Amanda Vinson (University of Minnesota) completed work on her PhD thesis, analyzing genetic material obtained from baboon fecal samples collected in previous years at Gombe. Amanda identified paternity for baboons in one well-studied troop, and compared the population genetics of Gombe baboons with baboons from Mikumi National Park, Tanzania

1.3.2 Female baboon hormones and reproduction

Annie Bosacker (University of Minnesota) continued to work on her PhD thesis, which focuses on the relationship between reproduction and hormone levels, as measured through fecal samples previously collected at Gombe. This study focuses on two main topics: the relation between dominance rank and reproduction, and the decline in reproductive competence with increasing age.

1.3.3 Baboon bones and teeth indicating life events

When baboons die, there are numerous signs in their bones and teeth of the events that happened to them during their life, from breakages and injuries down to diseases and periods of stress. Currently Charles Msuya (State University of New York; Muhimbili University College of Health Sciences) and Jacqueline Bowman (University of Philadelphia) have been investigating the skeletons of 40 baboons whose full life histories are known, together with 29 others partially known, and some others for comparison.

1.4 Other primate projects

1.4.1 Natural hybridization of red-tailed and blue monkeys

Guenon monkeys (genus *Cercopithecus*) represent a diverse and recent radiation of primate species, of which three species occur at Gombe: red-tailed, blue, and vervet monkeys. Red-tailed and blue monkeys occur together at many sites across Africa, but at Gombe these two species interbreed to an extent not documented elsewhere (Fig. 1). Kate Detwiler (New York University) and her husband James Gray completed a12-month study of the genetics and natural history of this unusual hybrid zone. With assistance from JGI, Kate was able to maintain efforts to habituate a study troop for close observation by hiring field assistant Mary Nkoranigwa to continue the work.

Figure 1. Parent species and hybrid of Gombe guenon monkeys. On the left is a red-tailed monkey, on the right is a blue monkey. In the center is a hybrid of the two species. The hybrid has the white nose and light-colored cheek fur typical of a red-tail, but the bluish-grey fur on body and tail typical of blue monkeys. (Hybrid photo by James Gray; other photos MLW)

1.5 Conservation and botanical research

1.5.1 Vegetation change

Changes in vegetation in and around Gombe have had a profound effect on the conservation status of chimpanzees living in Gombe. Lilian Pintea (University of Minnesota) neared completion of his study of habitat change in and around Gombe, using aerial photographs, extremely high-resolution satellite images and Geographical Information Systems (GIS) software to analyze how habitat has changed inside and outside the park since the 1940s. Lilian has joined JGI-USA as the Director of Conservation Science.

1.5.2 Bwavi monitoring

Dr. Shadrack Kamenya (GSRC) directed the ongoing efforts to monitor the Kalande chimpanzee population and associated conservation issues near the Bwavi ranger station in the south of Gombe. This project began in 1999 with an effort to estimate the number of chimpanzees in the southern Kalande community (Greengrass 2000). As the project continued, the focus expanded to include other issues relating to ecology and conservation (Grossman 2004).

Figure 2. Traditional healers gathered for workshop at JGI Education Centre, March 2005.

1.5.3 Medicinal plants

Dr. Kamenya and Grace Gobbo (GSRC) worked together to compile information on medicinal plants used by traditional healers in the villages around Gombe. Many of the plants identified as having medicinal value are important chimpanzee foods. By holding workshops (Fig. 2) and otherwise focusing attention on these plants, this project hopes not only to add to our understanding of potentially useful plants, but also to increase awareness in the villages regarding the value of conserving forests.

1.5.4 Chimpanzee and biodiversity survey

In August 2005, JGI staff participated with the Wildlife Conservation Society in a survey of chimpanzees and biodiversity outside protected areas in western Tanzania (Moyer et al. 2006). JGI participants included Dr. Kamenya, Dr. Lilian Pintea, Grace Gobbo, Sood Ndimuligo, and Hamisi Matama. This survey provided valuable information on the status of chimpanzees and other wildlife in the vast tracts of woodland, forest and savanna of western Tanzania. JGI personnel also assisted with the survey within Gombe by monitoring the decay of chimpanzee night-nests to allow the estimation of decay rates. This variable is needed to estimate chimpanzee population size from the number and condition of nests located during surveys. The survey was funded in part by the US Fish & Wildlife Service's Great Ape Conservation Fund, which also funds the Health Monitoring Project (Section 2.4) and contributed to the installation of solar power at Gombe (Section 6.1).

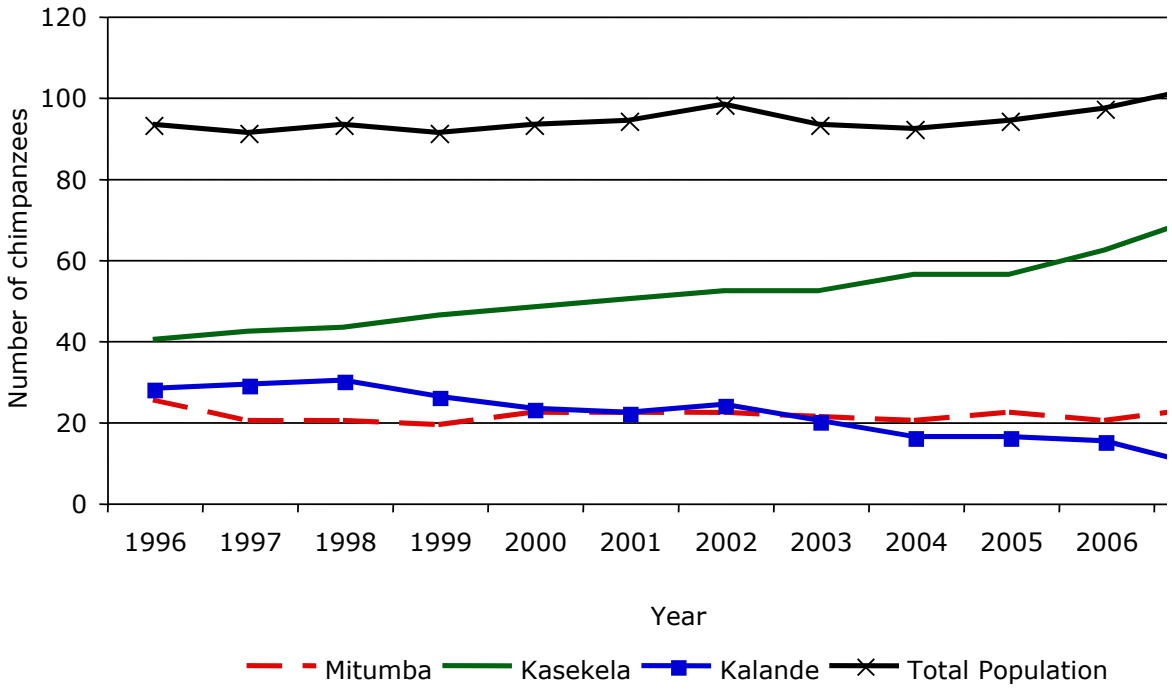
2 Chimpanzee Research

Chimpanzees have remained the focus of research at Gombe since 1960. This study now ranks as one of the longest and most detailed studies of any wild animal.

2.1 Demography

The Gombe chimpanzee study provides a uniquely long-term and detailed dataset for chimpanzee demography (Jones et al., in revision). Analysis of demographic trends – births, deaths, and migrations – provides critical information on the health of the population. Such information is essential for guiding management decisions. Here we discuss the size and trends of the total population plus details for the park's three chimpanzee communities. Of these three communities, detailed demographic data exist for Mitumba since 1996 and for Kasekela since 1966. The Kalande community, which remains unhabituated, has been monitored systematically since 1999, but the exact number of chimpanzees there remains uncertain. As of 31 December 2005, these three communities contained approximately 20, 62, and 15 chimpanzees respectively, giving a total of 97 chimpanzees in the park. This estimated population is larger than the estimate for 2004, both because of actual increase in population, and because of the discovery of additional individuals from Kalande.

Figure 3. Chimpanzee population size, 1996-2006. Separate lines indicate the number of individuals known (Mitumba, Kasekela) or estimated (Kalande) to be in each community on January 1st of each year, as well as the total combined population.



The total number of chimpanzees in the park has remained relatively stable over the past 10 years (Figure 3). On 1 January 1996, an estimated 93 chimpanzees lived in the park. Since then, the population has fluctuated between a low of 91 (1997 and 1999) and a high of 98 (2002).

This overall stability, however, masks a dramatic decline in the Kalande community, which has dropped from at least 28 (and probably over 30) chimpanzees in 1996 to perhaps 15 at the end of 2005. The total Gombe population remained relatively stable because of a concomitant increase in the size of the Kasekela community. However, much of the increase in Kasekela resulted from females emigrating from Kalande. The Mitumba community has remained relatively stable in size since a sharp decline in 1996. However, this community is now extremely vulnerable to intergroup aggression, with only two adult males now surviving to defend the Mitumba community against the 10 adult males of the Kasekela community.

In any case, the current population of 97 chimpanzees represents a substantial decline from the 120-150 estimated to live in the park in 1960 (Pusey et al., 2007).

2.1.1 Kasekela community: population increase

The Kasekela community numbered approximately 56 individuals at the start of 2005, and increased to 62 individuals by the end of the year (Table 1). This represents a net increase of 6 individuals over the year, the sum of 5 births (Table 4) and 2 immigrations (Table 5) minus 1 death (Table 6). Females Kipara, Echo, Trezia, Bahati and Dilly gave birth to Keaton, Emela, Zinda, Baroza, and Diaz, respectively (Fig. 4). All of these females are immigrants except Dilly, who was born in Kasekela. Both Dilly and Kipara had lost infants in 2004. The single death recorded from Kasekela was Patti. At an estimated 44 years old, Patti was one of the community's oldest females, but she was in good health until suffering fatal injuries during an attack by Mitumba males, Rudi and Edgar (Section 2.2.4).

Figure 4. Kasekela mothers and infants. Bahati with Baroza (left), and Trezia with Zinda (right). (15 Dec 2005, MLW)

Table 1. Members of the Kasekela community, 2005.

Name	ID	Birth year	Name	ID	Birth year
Mothers			Infants		
BAHATI	**BAH**	1988	*BAROZA*	BAR	2005
CANDY	**CD**	1969	**COCOA**	**COC**	2004
DILLY	**DL**	1986	**DIAZ**	**DIA**	2005
ECHO	**ECO**	1984	**EOWYN**	**EOW**	2001
			EMELA	**EME**	2005
FANNI	**FN**	1981	*FUNDI*	*FND*	2000
			FAMILIA	**FAM**	2004
GREMLIN	**GM**	1970	**GOLDEN**	**GLD**	1998
			GLITTA	**GLI**	1998
			GIMLI	*GIM*	2004
KIPARA	**KP**	1986	**KEATON**	**KEA**	2005
MALAIKA	**MAK**	1990	**MAMBO**	**MAM**	2004
(PATTI)	**(PI)**	1961			
SANDI	**SA**	1973	**SAMWISE**	**SAM**	2001
SHEREHE	**SR**	1991	*SHANGAA*	*SHA*	2004
SPARROW	**SW**	1960	*SINDBAD*	*SDB*	2001
TANGA	**TG**	1989	*TOM*	*TOM*	2001
TREZIA	**TZ**	1978	**ZELLA**	**ZEL**	1999
			ZINDA	**ZIN**	2005
YOLANDA	**YD**	1986	**YAMAHA**	**YAM**	1998
Females without infants			Female adolescents/orphans		
HAIKI	**HAI**	1981	**ELIZA**	**EZA**	1995
HOPE	**HO**	1970	**FLIRT**	**FLI**	1998
IMANI	**IMA**	1994	**GAIA**	**GA**	1993
JIFFY	**JF**	1975	**SCHWEINI**	**SI**	1991
NASA	**NAS**	1988			
NURU	**NUR**	1990			
SIFA	**SIF**	1978			
TITANIA	**TTA**	1984			
VANILLA	**VAN**	1986			
Males			Male adolescents/orphans		
APOLLO	*AO*	1979	*FERDINAND*	*FE*	1992
FAUSTINO	*FO*	1989	*FUDGE*	*FU*	1996
FREUD	*FD*	1971	*SAMPSON*	*SN*	1996
FRODO	*FR*	1976	*TARZAN*	*TZN*	1999
GIMBLE	*GL*	1977	*TITAN*	*TN*	1994
KRIS	*KS*	1982	*ZEUS*	*ZS*	1993
PAX	*PX*	1977			
SHELDON	*SL*	1983			
TUBI	*TB*	1977			
WILKIE	*WL*	1972			

Table 2. Members of the Mitumba community, 2005.

Name	ID	Year of Birth	Name	ID	Year of Birth
Mothers			Infants		
APHRO	**AP**	1973	*APPLE*	*APL*	1998
			(ANDROMEDA)	**(AND)**	2004
EVA	**EVA**	1965	**EDEN**	**EDE**	2004
FLOSSI	**FS**	1985	*FOREST*	*FOR*	1997
			FANSI	*FAN*	2001
			FLOWER	**FLW**	2005
KONYAGI	**KON**	1984	*KOCHA*	*KOC*	2001
LUCY	**LUC**	1987	*LAMBA*	*LAM*	2001
LORETTA	**LOR**	1980	*LONDO*	*LON*	2000
Females without infants			Female adolescents/orphans		
DARBEE	**DB**	1984	**BIMA**	**BIM**	1992
MGANI	**MGA**	1991	**RUMUMBA**	**RUM**	1998
(VANILLA)	**(VAN)**	1988			
Males			Male adolescents		
EDGAR	*EDG*	1989	*(EBONY)*	*(EBO)*	1996
RUDI	*RUD*	1986			

Table 3. Members of the Kalande community, 2005.

Name	ID	Year of Birth (Estimated)	Name	ID	Year of Birth (Estimated)
Mothers			Infants		
PATINA	**PAT**	1976	PAMELA	PAM	2001
POROSA	**POR**	1991	**PAIROTT**	**PAI**	2001
KATI	**KAT**	1986	*KAZI*	**KAZ**	2002
PAULA	**PAU**	1985	**POA**	**POA**	2000
Females without infants			Female adolescents/orphans		
OBENA	**OBE**	1979	**LUTANA**	**LUT**	1991
KLAF6	**KLAF6**	1991	**UWEPO**	**UWE**	1988
			MAKIWA	**MKW**	1996
Males			Male adolescents		
RENADI	*REN*	1978	*OMBA*	*OMB*	1994

Table 4. Chimpanzee births in 2005

ID	Name	Sex	Mother	Birth date	Community
FLW	Flower	F	Flossi	May 2005	Mitumba
KEA	Keaton	F	Kipara	June 2005	Kasekela
EME	Emela	F	Echo	October 2005	Kasekela
ZIN	Zinda	M	Trezia	October 2005	Kasekela
BRZ	Baroza	M	Bahati	November 2005	Kasekela
DIA	Diaz	F	Dilly	December 2005	Kasekela

Table 5. Chimpanzee intergroup transfers in 2005

ID	Name	Sex	Mother	Transfer date	Initial community of residence	Subsequent community of residence
VAN	Vanilla	F	unknown	February 2005	Mitumba	Kasekela
IMA	Imani	F	Echo?	February 2005	Kalande	Kasekela

Table 6. Chimpanzee deaths in 2005

ID	Name	Sex	Death date	Community
EBO	Ebony	M	17-Jan-05	Mitumba
AND	Andromeda	F	13-Aug-05	Mitumba
PI	Patti	F	3-Oct-05	Kasekela

In recent years, many new females have joined the Kasekela community, most of them presumed immigrants from the declining Kalande community. In February 2005, two new females were identified: a young female named Imani, and an older, larger female initially named Ucaho. Imani was often seen traveling with adult female Echo, who immigrated the previous year. Genetic analysis of fecal samples from these females helped clarify their relationships and identity (Wroblewski, unpublished data). Imani is genetically very similar to Echo and may be her daughter. Uchao is genetically identical to Vanilla, a female that disappeared from Mitumba in early 2005. Based on age, overall appearance, and genetic evidence, Uchao is almost certainly Vanilla, and has been renamed accordingly.

2.1.2 Mitumba Community

Over the course of 2005, the Mitumba community declined from 22 to 20 individuals (Table 2). This decline resulted from the single birth (Table 4) being offset by an emigration (Table 5) and two deaths (Table 6). Flossi, the daughter of Kasekela female Fifi, gave birth to a daughter, Flower, in May 2005. Vanilla disappeared from Mitumba early in 2005, and is most likely the female initially called Uchao, who immigrated into Kasekela in February (see above). The two deaths, Ebony and Andromeda, were likely both the result of aggression. Ebony was probably killed by one or more males from his own community (Section 2.3.1). Andromeda was killed

during an intercommunity interaction with Kasekela males (Section 2.2.4). With only two adult males, the Mitumba community faces a precarious future.

2.1.3 Kalande community: revised estimates

The Kalande community, in the south of the park, has been monitored since 1999 (Greengrass 2000). Various efforts have been made over the years to estimate the number of chimpanzees in this community (Greengrass 2000; Grossmann 2004). In 2004, we thought that only 9 individuals remained in Kalande. However, the immigration of 6 individuals into Kasekela in early 2006 forced us to revise this estimate. Consultation with field assistants based in Bwavi and reviewing of existing records indicates that by the end of 2005, the Kalande community consisted of perhaps 15 individuals (Table 3). Due to the difficulty of observing unhabituated chimpanzees, this estimate should still be treated with caution.

Observers saw chimpanzees on 47 occasions in 2005. Most of these sightings occurred in Bwavi valley (32 sightings, 68%) and Nyamagoma valley (8 sightings, 17%). Observers occasionally saw Kalande chimpanzees in Kalande and Nyasanga valleys, which were formerly the heart of the Kalande community's range but which are now frequently used by Kasekela chimpanzees. Observers also found nests outside the park in Mgaraganza village, at Nduruma and Kisenga.

Observers did not report any births or deaths for this community in 2005.

In contrast to previous years, in 2005 researchers did not find any snares in the Kalande community's range, suggesting that increased law enforcement efforts have been successful in reducing poaching in this part of the park.

Figure 5. Male social relations. Alpha male Kris grooming Tubi while former alpha male Frodo sits by neither grooming nor being groomed. (17 Mar, MLW)

2.2 Social behavior

This section focuses on behavioral events recorded by the "B-record" field assistants and other observers of the Kasekela community.

2.2.1 Male dominance relations

Kris, who had taken over as alpha male in mid-2004, remained secure in his position throughout 2005 (Fig. 5). Dominance relations among the other males were unusually ambiguous in 2005. According to Bill Wallauer, "there has never been a time that rank has been more difficult for me to estimate within the Kasekela community males."

Former alpha males Sheldon and Frodo settled into the community, returning from their "exile." It is common for deposed alpha males to spend several months or more in mostly solitary travel, avoiding interactions with the other males, until it appears safe to return. After Frodo fell sick in early 2003 and was overthrown by Sheldon, he kept to himself for nearly a year and a half, before returning in mid-2004. Sheldon was rarely seen during and immediately after Kris's rise to power, but in 2005 he began spending more time with the other males. Frodo's younger

brother Faustino climbed the dominance hierarchy early in the year, but after falling sick in November (Section 2.4.2) dropped back down to low-ranking status.

Table 7. Kasekela male dominance matrix (pant-grunts only)

	KS	FO	TB	FD	GL	SL	AO	WL	FR	FE	PX	TN	ZS	FU	SN	TZN	Sum
KS	X				1				1	3		1					6
FO		X				2	1					1					4
TB			X							1							1
FD				X						1		1					2
GL					X												0
SL						X				1		1					2
AO							X			1							1
WL								X									0
FR									X	1	1	1					3
FE										X							0
PX											X						0
TN												X				1	1
ZS													X				0
FU														X			0
SN															X		0
TZN																X	0
Sum	0	0	0	0	1	2	1	0	1	8	1	5	0	0	0	1	20

Table 8. Kasekela male dominance matrix (dyadic displays, chases etc.)

	KS	FO	TB	FD	GL	SL	AO	WL	FR	FE	PX	TN	ZS	FU	SN	TZN	Sum
KS	X	3	1	4	2	1		2	17	1		1		1			33
FO		X	3		2	3	1	2	2			3	1				17
TB			X	1					5				1				7
FD				X			1	2	3		1	1					8
GL					X	2	1		1			1	1				6
SL						X	1		2			1					4
AO							X	1				1					2
WL								X	2	2		1					5
FR					1				X	1							2
FE										X		2	1				3
PX											X						0
TN												X	1		1		2
ZS													X				0
FU														X		1	1
SN															X		0
TZN																X	0
Sum	0	3	4	5	5	6	4	7	32	4	1	11	5	1	1	1	90

B-record observers recorded approximately 687 dominance interactions (pant-grunts, directed displays, beating, biting, chasing, hitting, and threatening) over the course of the year. Of these, a total of 110 involved dyadic interactions among adult or adolescent males (Tables 7, 8).

Pant-grunts are the best indicator of dominance relations in chimpanzees. Unfortunately, only 20 pant-grunts were recorded among adult and adolescent males, which provides only a very sparse matrix for determining dominance (Table 7). While it is possible that observers failed to record some proportion of pant-grunts, Selemani Yahaya and other field assistants have stated that pant-grunts among males have in fact been very rare. Including other dyadic dominance interactions, including displays, chases, hitting, and so on, allows a more detailed picture to emerge, but must be treated with caution, as these interactions can be more ambiguous than pant-grunts. The dominance order obtained using both pant-grunts and other dyadic interactions shows clearly that Kris was highest ranking throughout the year, and that Faustino rose high in rank before his sickness in November. Tubi, Freud, and Gimble were all high-ranking, while Apollo, Wilkie, Frodo, Ferdinand, and Pax were low-ranking, followed by the adolescent males Titan, Zeus, Fudge, Sindbad and Tarzan (Table 8). Many rank changes appear to have occurred since 2004, but this may simply reflect the difficulty of ordering these males in a linear hierarchy (Fig. 6).

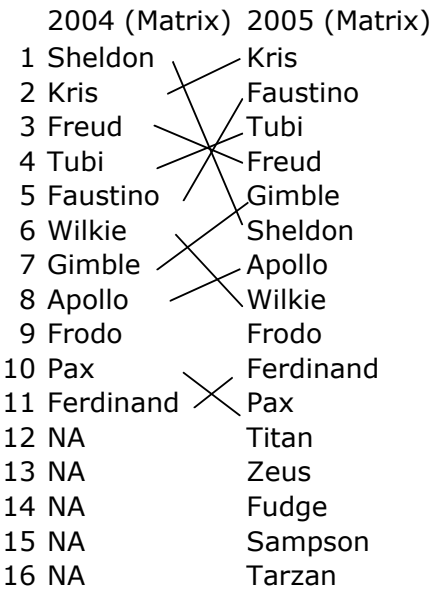


Figure 6. Changes in male dominance rank from 2004 to 2005, based on estimates from dyadic interactions matrixes.

Although Frodo has rejoined the male group and resumed previous activities like vigorous hunting and competing for mates, he appears to remain low-ranking. The dominance matrix ranks Sheldon higher than Frodo, based in part on two charge displays directed by Sheldon towards Frodo (22 Oct and 21 Dec), in which Frodo screamed and begged for help from others. Consistent with this, in mid-November, Bill Wallauer saw Sheldon unnest at 6:24 am and display beneath the night nest of Frodo – behavior typical of higher-ranking males.

Despite appearing to be low-ranking overall, Frodo and Wilkie competed vigorously whenever a popular females was cycling, and appeared to be very high ranking at these times. Apollo likewise sometimes asserted himself despite an overall low rank.

Bill Wallauer estimated ranks based on his overall impression of male behavior at the year's end as follows: Kris as a clear alpha, Tubi as beta, then a cluster of high-ranking males (Frodo/Wilkie/Freud/Sheldon) with the first two appearing to have high rank only when competing for a popular female; followed by Gimble and Apollo as middle-ranking males. When no popular female was in estrous, Frodo and Wilkie appeaed low-ranking, followed by Ferdinand, Pax, and Faustino, who was very high ranking earlier in the year but dropped to the bottom of the hierarchy after falling ill in November.

2.2.2 Mating

Observers recorded a total of 637 matings in 2005 (Table 9). Twenty different females were recorded mating this year, including 10 parous females (Dilly, Echo,

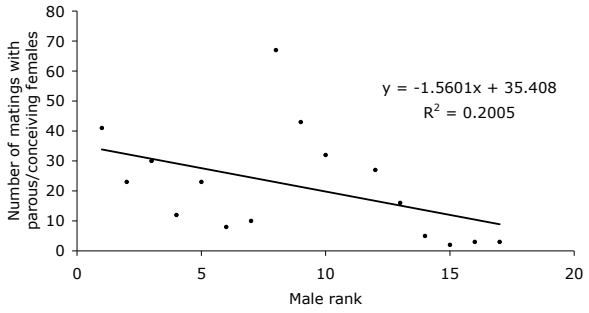


Figure 7. Male rank and mating success.

Hope, Jiffy, Kipara, Patti, Tanga, Titania, Trezia, Yolanda) and 10 females who had not yet given birth (Bahati, Eliza, Gaia, Haiki, Imani, Nasa, Nuru, Schweini, Sifa, Vanilla). Of these, seven females gave birth in 2005 or 2006: Kipara (infant b. Jun 05, and who thus mated while pregnant), Echo (infant b. Oct 05), Trezia (infant b. Oct 05), Bahati (infant b. Nov 05), Dilly (infant b. Dec 05), Gaia (infant b. Apr 2006), and Tanga (infant b. Sep 2006).

As is usually the case, nulliparous females mated more often the parous females. For example, Nuru was observed mating 151 times, and Gaia 89 times. The parous female observed mating most frequently was Patti (81 times), who probably would have conceived in 2005 had she not been killed (see Section 2.2.4). This was the first year in which young female immigrant Eliza was observed mating with adult males. Several females (Sifa, Nasa, and Nuru) have cycled

Table 9. Number of matings observed between males and cycling females. Females known to have conceived or given birth in 2005 are in bold.

Parous?	N	Y	Y	N	N	N	Y	N	Y	Y	N	N	Y	N	N	Y	Y	Y	N	Y	
Male	**BAH**	**DL**	**ECO**	EZA	**GA**	HAI	HO	IMA	JF	**KP**	NAS	NUR	PI	SI	SIF	**TG**	TTA	**TZ**	VAN	YD	Sum
WL	3	1	5	0	11	0	3	0	1	1	17	20	30	2	0	4	0	1	0	7	106
FR	3	3	5	0	8	0	4	0	0	0	9	15	13	1	1	0	1	1	0	5	69
KS	4	0	5	0	6	0	2	1	1	1	8	11	17	1	4	1	0	1	2	3	68
TN	0	0	1	0	9	0	4	0	0	1	8	19	0	9	1	4	3	3	0	2	64
FE	4	0	0	1	15	0	3	1	1	0	3	12	4	3	1	1	0	3	0	1	53
TB	3	1	0	1	12	0	5	0	1	0	5	14	5	1	0	0	0	0	1	3	52
FO	1	1	0	0	13	0	2	0	0	0	6	16	0	3	0	1	2	2	0	1	48
GL	1	0	0	0	0	0	0	0	3	0	4	6	4	1	1	8	0	1	0	6	35
AO	2	0	0	0	1	0	2	1	1	0	5	17	2	0	0	2	0	0	0	0	33
FD	0	0	0	0	1	0	2	0	1	0	5	13	5	0	1	0	0	1	0	2	31
ZS	1	1	0	0	3	0	1	3	1	0	1	2	1	2	0	6	1	0	0	1	24
SL	0	0	0	0	2	1	1	0	1	0	2	2	0	0	6	4	0	0	3	0	22
FU	0	0	0	0	3	0	0	1	0	0	3	0	0	0	4	2	0	0	0	0	13
TZN	1	0	0	0	2	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0	11
FND	0	0	0	1	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	5
SN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	3
Sum	23	7	16	3	89	1	29	7	11	3	76	151	81	27	21	35	7	13	6	31	637

Table 10. Matings between males and females that were either parous or conceiving.

Male	Male rank	**BAH**	**DL**	**ECO**	**GA**	HO	JF	**KP**	PI	**TG**	TTA	TZ	YD	Sum
WL	8	3	1	5	11	3	1	1	30	4	0	1	7	67
FR	9	3	3	5	8	4	0	0	13	0	1	1	5	43
KS	1	4	0	5	6	2	1	1	17	1	0	1	3	41
FE	10	4	0	0	15	3	1	0	4	1	0	3	1	32
TB	3	3	1	0	12	5	1	0	5	0	0	0	3	30
TN	12	0	0	1	9	4	0	1	0	4	3	3	2	27
FO	2	1	1	0	13	2	0	0	0	1	2	2	1	23
GL	5	1	0	0	0	0	3	0	4	8	0	1	6	23
ZS	13	1	1	0	3	1	1	0	1	6	1	0	1	16
FD	4	0	0	0	1	2	1	0	5	0	0	1	2	12
AO	7	2	0	0	1	2	1	0	2	2	0	0	0	10
SL	6	0	0	0	2	1	1	0	0	4	0	0	0	8
FU	14	0	0	0	3	0	0	0	0	2	0	0	0	5
FND	17	0	0	0	3	0	0	0	0	0	0	0	0	3
TZN	16	1	0	0	2	0	0	0	0	0	0	0	0	3
SN	15	0	0	0	0	0	0	0	0	2	0	0	0	2
Sum		23	7	16	89	29	11	3	81	33	7	13	31	343

for years without producing offspring, and several others were new immigrants (Eliza, Haiki, Imani, Vanilla).

Considering only females that were most likely to be fertile – those that had already given birth, or that gave birth in 2005 or 2006 and were thus experiencing conception cycles – 343 matings were recorded (Table 10). Two females (Echo and Trezia) had resumed cycling in 2004 after the weaning of their previous infant, and four additional females (Patti, Tanga, Titania, Yolanda) resumed cycling in 2005. Two other females (Kipara and Dilly) had resumed cycling in 2004 after losing their infants. The remaining two have cycled for many years without giving birth. Jiffy hasn't given birth since 1989, and Hope hasn't given birth since 1998. Neither has surviving offspring.

Male mating success generally correlated with male dominance rank (Fig. 8), with two striking exceptions. Although Kris, the alpha male, obtained 68 matings with parous and conceiving females, both Frodo (rank = 9), and Wilkie (rank = 8) obtained more matings with these females (69 and 106, respectively).

2.2.3 Hunting

Observers recorded Kasekela chimpanzees killing and eating at least 59 mammals, including 3 baboons, 2 bushbuck, 4 bushpigs, and approximately 50 red colobus monkeys. The baboons, bushbuck and bushpigs were all infants, while the red colobus monkeys included individuals of all ages. The total number of kills (59) was similar to that of the previous year (53).

2.2.4 Intergroup aggression

In 2005, an unprecedented number of intercommunity interactions occurred between the Kasekela and Mitumba communities, including at least 22 patrols by Kasekela males and 53 days on which observers following either Kasekela or Mitumba chimpanzees reported an intergroup encounter (Fig. 8). This represents a dramatic increase over 2004, when 4 patrols by Kasekela and 17 intergroup encounters were recorded. Most encounters were auditory, in which

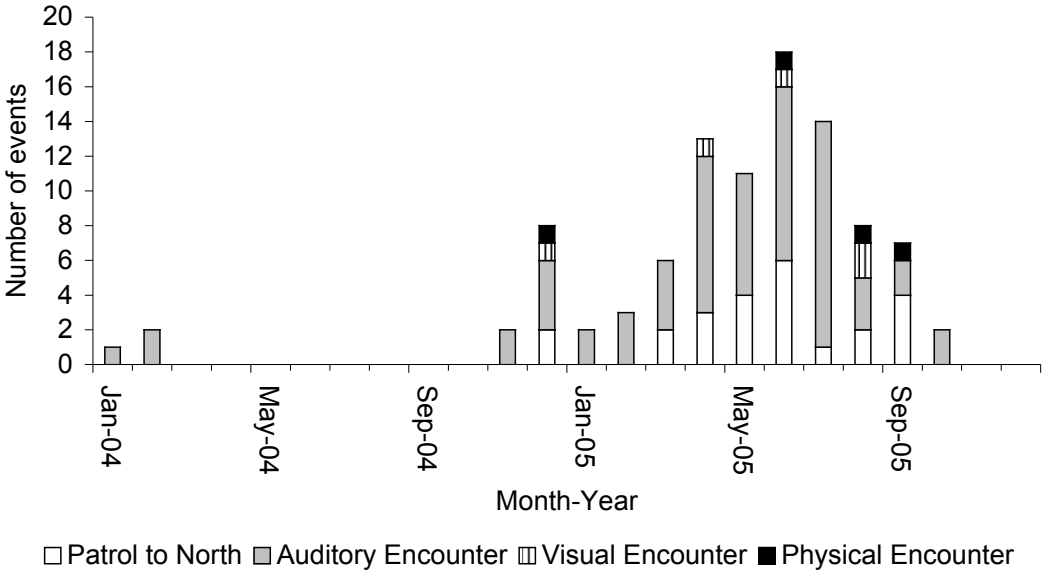


Figure 8. Intergroup events, 2004-2005.

chimpanzees heard and/or exchanged calls with foreign chimpanzees. In only 7 cases did Mitumba and Kasekela chimpanzees come within visual contact, of which 3 involved physical contact. Two intergroup killings occurred as a result of these encounters (Fig. 9). On 13 Aug, Kasekela males killed a female infant of the Mitumba community, Andromeda. On 19 Sep, Mitumba males brutally attacked Patti, who died on 03 Oct. Patti had wounds on her head, above her left ear and eye, but presumably suffered mainly internal damage. Patti's carcass was frozen to allow post-mortem at a later day (10 Feb 2006). Necropsy revealed hemorrhaging of internal organs including esophagus, stomach, liver and kidneys.

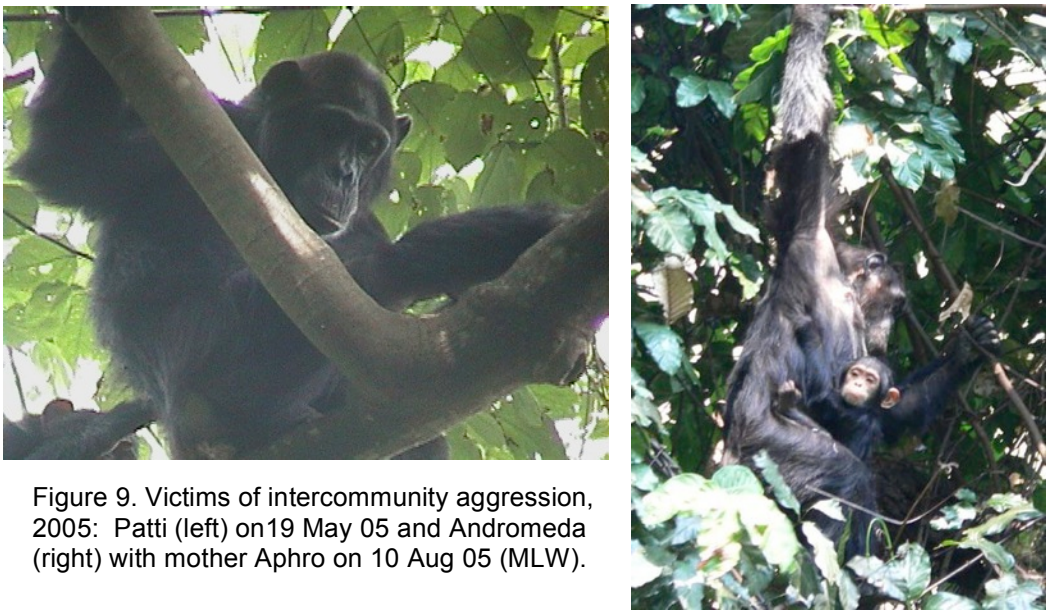


Figure 9. Victims of intercommunity aggression, 2005: Patti (left) on19 May 05 and Andromeda (right) with mother Aphro on 10 Aug 05 (MLW).

The number of incursions into Mitumba territory by Kasekela chimpanzees, and resulting intergroup encounters, increased greatly after Mitumba males killed their own alpha male, Vincent, in Dec 2004. The number of encounters decreased again after Mitumba males killed Kasekela female Patti.

The killing of Patti occurred in the far north. For much of 2004, before Fifi disappeared, Fifi and Patti frequently ranged in Rutanga, the northernmost valley of the Kasekela range. The killing of Patti in the far north provides circumstantial evidence in support of the possibility that Fifi was also attacked and killed by Mitumba males.

The Mitumba chimpanzees spent much time in 2005 ranging outside the park, perhaps to avoid encounters with the Kasekela chimpanzees.

2.3 Other notable occurrences

2.3.1 Death of Ebony

Ebony, an 8-year old male of the Mitumba community, died the evening of 17 January 2005. The timing of the death and the numerous wounds on the body indicate that Ebony was killed by one or more chimpanzees of his own community, the second such killing to occur in Mitumba in a month's time. Ramba Hilali and other researchers saw Ebony alive and in good health on 17 January at 16:50. The next morning at 10:00, trail cutters working in the area found Ebony's body along the trail at MT11. Based on the condition of the body researchers estimated that

Ebony had died the previous evening. The wounds on the body were typical of known and suspected chimpanzee attacks: numerous bruises, cuts, and puncture (canine) wounds, chewing of fingers and toes, and damage to the genitalia. The only other animal likely to kill a chimpanzee in Gombe is the leopard, which could potentially inflict open wounds such as those seen on and near Ebony's neck. A leopard attack seems unlikely, however, because the body was not eaten and no muscle tissue was cut or taken, even though the body lay undisturbed overnight. Moreover, the pattern of wounding – with many bruises and small wounds, including chewing of fingers, toes, and lips, is much more consistent with chimpanzee than leopard attack. In the area around Ebony's death site, there was trampled vegetation, typical of chimpanzee attack sites. In view of this evidence, it is likely that Ebony was attacked and killed by chimpanzees.

Given the high frequency of intergroup encounters between Mitumba and Kasekela chimpanzees in 2005, an intergroup attack might seem likely. However, circumstantial evidence argues against an intergroup attack. On the night Ebony was killed, Kasekela researchers nested a large party containing most of the community's chimpanzees – including all but one of the adult males – in the northern part of the community's current territory, LK6 (Linda Valley), approximately 2.5 km from Ebony's death site. The Kasekela chimpanzees did head into the Mitumba community's territory on 18 January, but only after 14:00, by which time the Ebony's body had already been found. The only Kasekela male not seen on the evening of 17 January was Sheldon, the recently deposed alpha male who has been avoiding the main group of chimpanzees for weeks. It is highly unlikely that Sheldon would invade Mitumba on his own.

Of the Mitumba chimpanzees, the individual most likely to have killed Ebony is Rudi, one of the community's only two remaining adult males. Rudi, approximately 19 years old, appears to be the alpha male of Mitumba, after he and Edgar killed Vincent, the former alpha male, less than a month before (22 December 2004). The other male, 15 year-old Edgar, is Ebony's brother, and hence unlikely to have killed Ebony, though without direct observation this possibility cannot be ruled out entirely. Female chimpanzees sometimes attack and kill infants of other females, and sometimes brutally attack foreign females, but have not been observed to brutally attack or kill older males such as Ebony.

If Rudi did kill Ebony, why did he do so? The Mitumba community faces a grave threat of attack by the much larger Kasekela community. Studies of intergroup aggression indicate that communities with more males are more likely to win intergroup fights. So why would a male facing such intense intergroup threat eliminate his own male allies? Mitumba researcher Lamba Hilali suggested that Rudi killed Ebony to ensure his own dominance in the community. Rudi is an orphan, his mother Rafiki having died in 1996. Without any known male relatives in the community, Rudi lacks natural allies. Ebony was the younger brother of Rudi's only potential challenger, Edgar. These brothers might have eventually teamed up to elminate or overthrow Rudi. In this view, Rudi may have killed Ebony as a preemptive measure to ensure his own position as alpha male. Mitumba researchers saw both Edgar and Rudi on the afternoon of 17 January. When researchers last saw Ebony alive at 16:50 that day, Ebony was away from these males, in the company of his mother Eva and infant sister Eden.

2.3.2 Orphans

The death of Fifi in 2004 and Patti in 2005 left behind two orphans: Fifi's daughter Flirt, born in 1998, and Patti's son Tarzan, born in 1999 (Fig. 10). Both orphans benefited from the help of siblings and other kin. Flirt traveled frequently with some or all of her four brothers (Freud, Frodo, Faustino and Ferdinand) and remarkably was even groomed by Frodo, who rarely grooms

anyone else. Flirt also traveled with her older sister Fanni, who has two sons near Flirt's age (Fudge, aged 8, and Fundi, aged 5). Flirt's nephews sometimes harassed her, but at other times played and traveled amicably with her. Eventually, though, Flirt ended up spending much of her time with adult female Candy, who is not closely related to her. Tarzan traveled frequently with older brother Titan.

Figure 10. Orphans seeking comfort from kin. (Left) Flirt sits next to big brother Frodo (12 May 05); (Right) Tarzan sits on a termite mound while traveling with big brother Titan (17 Nov 05; MLW)

2.3.3 Chimpanzees react to earthquake

On December 5, 2005 at 3:22 pm, a major earthquake shook east-central Africa. The earthquake registered 6.8 on the Richter scale, with the epicenter located approximately 160 kilometers south of Gombe, near Mahale National Park. There were reports of injuries and property damage in some areas along the steep rift escarpment in Tanzania and the Democratic Republic of Congo. The effects of the earthquake were felt as far as 1000 km away. Videographer Bill Wallauer produced the following report:

Figure 11. Gimble responding to the earthquake (05 Dec 05; photo by W. Wallauer)

At the time of the earthquake, I was shooting video footage of a Mountain Wagtail (*Motacilla clara*) foraging in Kakombe Stream, about 1km from the lakeshore. There were several chimpanzees in the valley within 200m of my location.

When the earthquake hit, I was not sure what was happening. The effect I felt was more akin to having a rug pulled slowly from under me, one way, then the other, then back again. It was not the rapid shaking motion usually associated with earthquakes, and I had no difficulty keeping my balance. In fact, having heard a large tree fall earlier in the day, I thought that the tree I was standing under was falling and I was feeling the roots being pulled out from beneath me. I ran about 10 meters, well out of reach of the tree and continued to shoot footage of the wagtail which had flown about 10 meters as well. I thought nothing more of it until Gimble started issuing numerous alarm wraa's a minute or so later. Not far away I heard another male (Freud) wraa

several times, as did Gremlin from across the valley. The vocalizations were similar to snake wraas or the calls that unhabituated chimpanzees' issue when humans approach them.

Gimble called five or six times in the first minutes after the earthquake, then clung to a tree without moving for the next 20 minutes. He peered down at the ground, apparently looking for who or what shook his tree. My guess is that the affect of the earthquake was exacerbated by the fact that Gimble was 25 feet up a relatively thin tree, and it felt as if something was trying to shake him out of it. He looked all around beneath him, with an expression of fear and confusion on his face (Fig. 11). He stared at me as well, and I wondered if he thought that I might have been the cause because I was the only creature moving below him. He started down several times, then lost his nerve and maintained his perch, continuing to look below him in all directions.

Kristin Mosher was nearby watching Gremlin's reaction to the quake. Gremlin too was in a tree, and she issued similar wraa vocalizations. Gremlin climbed down after only about ten minutes. She was exhibiting extremely cautious and nervous behavior, pausing often, and looking in all directions tentatively. Once she was on the ground, she moved quickly away from the area and disappeared in the thick vegetation. Kristin guesses that Gremlin was searching for her twins, who were not with her when the earthquake hit.

2.4 Chimpanzee health

Overall, chimpanzee health remained good in 2005. The three deaths that occurred in 2005 were all the result of intraspecific violence, rather than disease. The one serious case of disease involved 16 year-old male Faustino (see below).

As part of the health-monitoring project, we hired a veterinary officer, Jane Raphael, in August 2005. In September, Jane went to Uganda for training at the Ngamba Island Chimpanzee Sanctuary and Kibale National Park.

2.4.1 Necropsies of Ebony and Vincent

On 12 February 2005, a team of experts assembled at Gombe to conduct necropsies of two chimpanzees from the Mitumba community: Ebony and Vincent. The team included Prof. Ephata Kaaya (Head of Pathology at Muhimbili University College of Health Sciences), Dr. Titus Mlengeya (Chief Veterinary Officer, TANAPA), Julia Lyimo (Warden of Ecology, GONAPA), Dr. Mike Kinsel (Director, Zoological Pathology Program, University of Illinois), Dr. Dominic Travis (Veterinary Epidemiologist, Lincoln Park Zoo), Prof. Anne Pusey (University of Minnesota), Mr. Jared Bakuza (Research Assistant, GSRC), Mr. Bill Wallauer (Videographer, GSRC), and Dr. Michael Wilson (Director of Field Research, GSRC).

Necropsy of Ebony made clear that he died of traumatic injuries. Ebony exhibited massive hematoma on the back of his neck and dislocated cervical vertebrae. Though Ebony was generally in good health, he did suffer from mild infection by a nematode worm, presumably a strongyle.

Vincent was also clearly the victim of traumatic injuries, including numerous severe lacerations and puncture wounds. Vincent also suffered from infection with nematode worms, probably strongyles, with a more severe level of infection than that seen in Ebony. The most striking finding from the necropsy of Vincent was that despite his heavy infection with SIVcpz, he showed no evidence of immune system dysfunction. Lymphoid tissues appeared normal, and no lesions such as those seen in laboratory primates with SIV-induced AIDS were observed. This is consistent with other evidence that chimpanzees do not suffer AIDS-like symptoms from SIV infection, but this necropsy provided the first direct evidence from a wild chimpanzee naturally infected with the virus.

2.4.2 Veterinary intervention for Faustino

On 24 Nov, Faustino was found resting near the site of Kakombe bridge, thin and weak, barely able to sit up. His legs appeared to be paralyzed, and he moved only by rolling or dragging himself along the ground. Because of concerns that Faustino may have been suffering from a disease that could spread to other chimpanzees, TANAPA and GSRC authorities agreed that it was critical that Faustino be sedated and treated. Dr. Richard Ssuna, a veterinarian from the Ngamba Island chimpanzee sanctuary, flew in from Uganda for this intervention. By the time Dr. Ssuna arrived, Faustino was weak, immobile, and apparently very close to death. Dr. Ssuna injected Faustino with anesthetic by hand, after which he collected samples for diagnosis, injected antibiotics and put Faustino on an IV drip (Fig. 12).

Figure 12. Team working on Faustino: Richard Ssuna, Michael Wilson, Jared Bakuza, and John MacLachlan. (01 Dec 05; photo by W. Wallauer)

Within days, Faustino's condition improved dramatically, and by 8 Dec Faustino was walking again (Fig. 13). Faustino soon achieved a full recovery. Preliminary diagnosis indicated that Faustino suffered from an intestinal protozoan infection, such as Giardia or an amoeba. Samples were sent to laboratories in Tanzania and abroad for further testing.

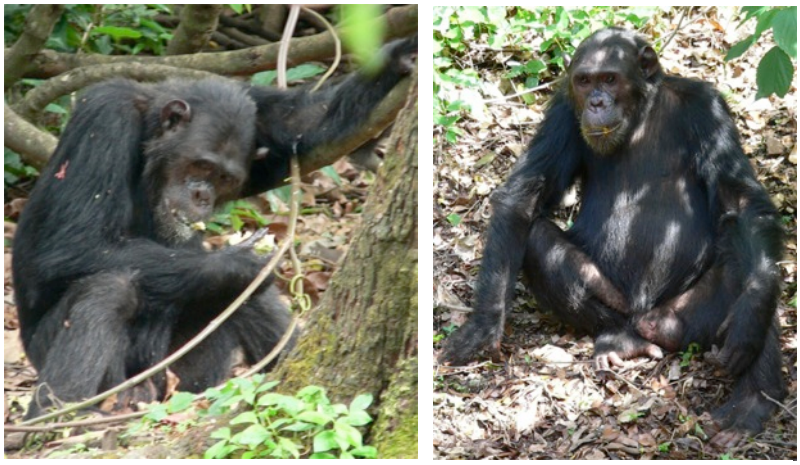


Figure 14. Faustino before (left) and after (right) veterinary treatment. (24 Nov 05 and 08 Dec 05; MLW)

3. Baboon studies: Long-term monitoring

The field staff has continued through 2005 under the leadership of Marini P. Bwenda. and Sood Athumani. We continued studying nine groups. Five of these groups were monitored every day, the other four were sampled twice a week.

3.1 Composition of baboon groups

By the end of the year the largest group comprised 45 baboons, while the smallest had only 17 (compare 42 and 13 last year). A typical group of 35 members would be composed of 5 adult males, 14 adult females, and 16 immature offspring. Group-compositions at the end of the year (Dec 31st), in order of group-size, are shown in Table 11. The high priority groups, sampled every day, are asterisked *.

Table 11. Composition of baboon study groups, 31 Dec 2005

Group name	**Female adults**	**Immatures**	**Male adults**	TOTALS
BB *	6	6	5	17
AC *	6	14	3	23
AB *	10	16	4	30
C	14	13	4	31
BA *	14	12	9	35
DA *	14	17	5	36
AA	14	20	4	38
DB	12	22	5	39
DC	15	20	10	45
TOTALS	**105**	**140**	**49**	**294**

Over the year, the number of baboons in the study population increased by 21, from 273 in January to 294 in December. This increase was widespread, since seven groups increased, but only two decreased. The number of breeding adult females remained steady at 105, one died, one adolescent matured to become adult; so the increase was entirely in immatures and adult males. Among immatures, 36 were born and survived to the end of the year, whereas eight others died and 15 adolescent and subadult males emigrated, leaving a net increase of 13. As for adult males, three died and five emigrated outside the study groups, yet ten others joined from elsewhere and six were recruited as breeding males by transferring from their mothers' groups in the study population, a net increase of 8 adult males.

The size-range of between 6 and 15 adult females per group, and 6 to 22 immatures, gives an average of 1.33 extant offspring per female (cf. 1.26 last year). However there are three groups which still have no more than one offspring per female: as last year, these are C Group (0.93 per female), BA Group (0.85) and BB Group (1.0, an improvement over 0.67 last year). The number of adult males in a group ranges from 3 to 10, though one group briefly had 13. The number of males might be expected to follow the number of breeding females, but they do not coincide closely except in the case of group DC, though that may be because adult males are attracted to their favourable range area near the village.

Most deaths were among infants. Their causes were not easy to determine: in most cases a mother is seen carrying her dead baby, or a body is found too late to determine the cause, or an infant simply disappears. However one newborn infant was taken by chimps in November; and two older infants Pari and Hanang, and one juvenile Shikoku, died with wounds, the latter two from cuts in the lower back which might have been from bites.

Adult mortalities were few, and in all cases, there were signs of illness. Adult female Ugalla, who had ranked 7th of 11 females in AC Group, fell ill and died during July. Adult male Fogo was badly ill in DC Group on 21st March, and missing by the 23rd, presumed dead. Male Fidell, after a four month absence from DA Group, joined DC Group very ill and blind in one eye in October, but left again after one week, and was found dead four weeks later. Male Sandarusi of DC Group, died in December under close observation, and the post mortem revealed adhesions in the lungs as a possible cause: samples are still being analysed.

3.2 Female baboon reproduction

During the year, 41 infants were born, of whom five died or disappeared. The number of births varied in different months, from none up to seven, but there was no clear birth season as the peak birth-months were distributed evenly through the year. Of the 38 infants whose sex was identified (others disappeared), 22 were male and 16 female, suggesting an overall tendency toward males (58 %) though this was only evident in four groups, notably DB group in which all five born were male.

Figure 14. Baboon consort pair (29 Nov 05; MLW)

There were also at least seven miscarriages and abortions, though early abortions are hard to detect and may have been missed. Previously we have reported a tendency for high-rankers to suffer more miscarriages, but this year it was not evident, the mothers' ranks being 2, 3, 3, 5, 8, 14, and 14; these ranks were in hierarchies of 14 females, (except one was ranked 3rd of 6, one was 14th of 15). One miscarriage was from a female who had been wounded the week before, another was a female's first pregnancy which was lost at ¾ term.

Some females were seen with unusually extended periods of swelling suggesting abnormalities of the oestrus cycle. In one case this was associated with wounding and infection but in other cases the cause was not evident. Many times during the year, particular females were seen drinking milk from their own nipples. In most cases a female who does this is one whose infant has just died while she is still lactating, but two females in AC group suckled themselves during the first month of pregnancy.

The five newborn infants who died during the year reached ages ranging from one to eight months. The causes were not determined but infants are very vulnerable especially when they first start to move away from the mother after three months of age. One of the dangers they can encounter, is being kidnapped:

1. In DA Group, a subadult male (Alizeti), took a 3 week-old infant Alexandra and dragged it along the ground, while the mother (Aroma) followed behind. He prevented the infant returning to the mother for 30 minutes.
2. Again in DA group, the two-day old infant of adult female Arancini (rank 6) was stolen by another female of much lower rank (Altoid, rank 10). In her attempts to retrieve her infant, Arancini was repeatedly blocked, chased and even attacked by Altoid's juvenile brother Asyut and a larger adolescent, Ayari, and two other juveniles who joined-in. Ultimately, Altoid presented to adult male Alli while holding the baby, and rather than acknowledge her greeting Alli instead attacked her, so she dropped the baby and fled, and Arancini grabbed her baby, who thus resumed suckling 1 hour and 28 minutes after the kidnap was first seen.
Ten days later, Altoid made several approaches to Arancini trying to contact the infant again, but Arancini held him close protectively and the incident did not recur.

3.3 Adult female baboon dominance ranks

Female dominance-ranks are much more constant than male ranks and are family-based. Daughters generally acquire ranks just below their mothers', so that each section of the female hierarchy is taken by a particular family, within which the mother and daughters also have their own rank-order. In other terms, the hierarchy is a rank-order of families, such that we can recognize the highest-ranking family, then the second-ranking family, and so on right down to the lowest-ranking family.

In five of the nine study groups, the female hierarchy is family-based in this way. Thus in AA Group, the hierarchy runs down through the H-family, then the females of the families D > S > Y > B. Likewise two nearby groups have fewer families but the same system: AB Group has the family-order H > U > A, while AC Group has two families, U > Y. Similar patterning holds within DB Group, while BB group's six females are all from one family.

However in the other four Study-Groups, this pattern has been disrupted. DA Group has two families, broken into subsets ranking A > S > A > S > A; in the related DC Group there are two families but even more broken, with the sequence S > H > S > H > S > H > S > H > S. BA Group has four families but the first-ranking W-family has outlying members in the middle and at the bottom of the hierarchy, and the third-ranking family (A-) also has members near the bottom. Finally C Group has five families, but some of their representatives are separated in the different sections of the hierarchy.

These patterns may come about in different ways. Sometimes when a group divides into two, the families don't always reconstitute themselves in the same order in the daughter groups. Alternatively, females may overcome an established family-based hierarchy by improving their rank by their own endeavours. Such a case happened in BA Group this year. Between August and December, the trio of Alectra (10), Amara (12), and Ajuga (9) gained better rank positions (## 6, 7 & 8 respectively) whereas Whiterose and Webbia had fallen below them (from #3 to #9, and from #7 to 10 respectively).

There is a curious footnote to this discussion of female rank. When imposing dominance on subordinates, high-ranking females often give disciplinary bites on the scalp and on the tail. Therefore low-rankers often have cuts on the arch of the tail, but generally these heal fairly quickly. However in three members of BA Group the wounds have been so bad that the distal half of the tail has dropped-off. What is curious is that these are all middle-ranking members of

the same family, the W-family. It is not clear whether this represents intractable insubordinance by this family, or simply a genetic weakness in their tails.

3.4 Male baboon reproductive strategies

In contrast to chimpanzees, all male baboons leave their mother's group when they approach adulthood, and transfer to another group where they strive to attain high dominance rank among the resident males, and they compete for access to mate with fertile females.

This year nine subadult males left their mother's group and disappeared, and we have to assume that most of these eventually joined one of the neighbouring groups outside the study population. It is possible, however, that some may have died in the process, as two of them were not quite full-grown, and there are risks involved in joining a new group.

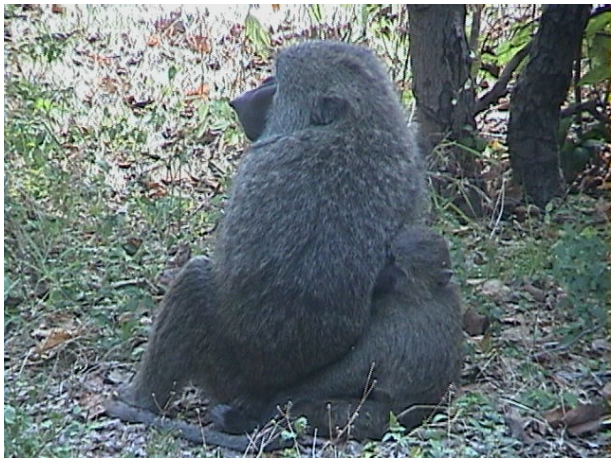


Figure 15. Male baboon with infant. (09 Jun 05; MLW)

Another six of these moved from their mother's group to other groups within the study population, and so we are still able to trace their life-histories. One example was a subadult called Save, in DA Group. In mid-August he was seen very close to DC Group, and interacted with several of them, and then in October he finally left his mothers' group. However it was not until three weeks later that he finally took-up residence in DC, ranking ninth among the twelve adult males. This illustrates that transferring may be a difficult process, as during the interim he was not seen and he was probably moving furtively near the group but not daring to join them. In contrast, another subadult named Agar moved back and forth four times between his mother's and a neighbouring group, before finally settling there at rank five.

Sometimes two or more subadult males leave their mothers' group at the same time, thus Honolulu and Uzungwa both left AB group within the same week, though we can't say whether they joined the same group as they went outside our study population. However Amadu and Alizeti (DA group) clearly went separate ways.

Once a male has transferred, he generally stays in his new group for some time before moving on to another, but we have a number of cases of older males who maintain membership of two groups simultaneously, moving back and forth quite frequently. Males Applejack and Mink both made at least four moves this year, and male Maha transferred at least twelve times. Once he moved into DA Group, consorted with an oestrus female, then left the next day: it appears he is maximising his reproductive options! However there are other cases of dual-membership involving very old males, for whom it appears more that they are economising on travel-distance. For example Hamadan, who was declining with age, ended-up as a low-ranker in both BA and DA groups till the end of the year.

The alpha male in a baboon group does not have the pre-eminent status accorded to an alpha male chimpanzee, he is simply one step higher than number two, and he must behave

assertively to maintain this position against any younger males who join the group after him, and to pre-empt challenge from any more experienced rivals from within the group.

In five groups, the alpha position remained constant through most of the year (we do not have full data for every month): these being, Artemis in DA, Kitebo in DB, Ugogo in C, Ngozi in AB, and Pingo in AC. This is not to say their situation was stable, since these males can be challenged at any time, and Pingo for one was deposed by the second-ranking male Hooch during July, though by August he had regained his position.

Other groups experienced more change during the year. In AA Group, male Sumei was deposed in October by Mapua, who had been his subordinate all the year. In BB Group the alpha male was Poe during January and February, but during March he lost his position to Algipan who had just joined the group, and he left, becoming a low-ranker in DA Group.

The major success-stories of the year both start in DA Group during the first week in February. Two subadults, Amadu and Alizeti, left almost at the same time. Amadu managed to join the neighbouring DC Group, and by August he had attained alpha-rank over eleven other males. Alizeti moved into BA Group: the alpha male there had been A.Saba, with Amstell and Ntengazi in the second and third ranks. However by March Alizeti was able to supplant all of them, and they fell into ranks 2,3 and 4 respectively.

During their adult lives, these males compete to monopolise fertile females at the peak of oestrus. Since females spend only a minority of their lives in monthly oestrus cycles, there is always an excess of males to compete for each cycling female (1.36 males per cycling female (Table 12). Also, because it is for only a proportion of each cycle that females are fertile, the competition can be intense, and there are frequent fights and injuries in which the higher rankers often, but not always, have the greater success.

Table 12. Number of males per cycling female in each baboon group, 2005

Group name	**Adult Females**	**Cycling females**	**Male adults**	Males: Cyc Fem
BB	6	4	5	1.25
AC	6	1	3	3.00
AB	10	1	4	4.00
C	14	4	4	1.00
BA	14	8	9	1.13
DA	14	5	5	1.00
AA	14	3	4	1.33
DB	12	3	5	1.67
DC	15	7	10	1.43
TOTALS	**105**	**36**	**49**	**1.36**

Once old age begins, males generally withdraw from competition and avoid confrontation, accepting low-ranks and lowered risk of injury. For example Hamadan, who had been second-ranker in DA Group in February, began to weaken and lose weight, left the group and took up residence as a low-ranker in BA, and part-time in DA, till the end of the year. Other cases this year have been Sandarusi, who died in DC Group in December, and Fidell, who started the year as fifth-ranker in DA, but left in June, and by October was a low-ranker in DC, where he died in November.

3.5 Baboon health

As mentioned, the deaths of female Ugalla and of adult males Fogo and Fidel were caused by illnesses, but these could not be diagnosed. There is hope that some diagnosis of male Sandarusi may follow from his port-mortem on December 30th, but preliminary findings were of lung disorder.

Despite the treatment for genital disease (probably *Treponema*) given to AA Group in 2004, yet during February and June two adult females still showed signs of the disease. However there was no major resurgence there or in any other of the study groups during 2005. But observers have noted the disease widespread in the baboon groups at Mitumba, (about three group-ranges' distance north of our study groups). Fortunately until now no case of this illness has been seen among the chimpanzees, although the disease has been recurrent among baboons since first detected at Gombe 18 years ago.

3.6 Interactions between baboons and other species

In 2005 there were 99 reported encounters between baboons and other species. The most frequent encounters described (42), were with monkeys, variously red colobus (20), and Cercopithecus (22: redtail monkeys, blue monkeys and their hybrids, and once with vervet). Most of these involved simply resting nearby or intermingled, or feeding amicably in the same trees. However there were nine feeding-disputes, seven of which the baboons won, over *Croton*, *Pericopsis* shoots, *Maesopsis eminii, Pterocarpus* flowers, and *Elaeis* palm nuts. There were also occasional social interactions, juvenile Makari groomed a blue monkey, juvenile Asyut groomed a redtail until it was chased away protectively by another redtail, and one colobus presented to a subadult male baboon on the beach, he responded by placing his finger in its anus! One group of juveniles was seen trying to catch a redtail by its red tail!

There were also many encounters with chimpanzees (21), though in fortunate contrast to last year, only one baboon infant from the study groups was killed and eaten. However when chimpanzees passed near, baboon mothers were normally attentive to retrieve their infants and sit alert. There was some feeding competition, chimpanzees chasing baboons out of feeding trees (*Parinari*, and Oil-palm): and once three juvenile chimpanzees brandished sticks and hit the ground to chivvy baboons away from *Parinari* fruit which they were gathering from the ground. On other occasions, however, they can feed at the same place without interference, as seen in abundant fruit crops of *Uapaca*, *Parinari*, and *Pseudospondias*. There were also reports of play between juvenile chimpanzees and baboons. There was one striking case when an adult male baboon of DA Group was chasing-away an intruding subadult male from AC Group, but the chase ended abruptly when both were startled as they ran-into a male chimpanzee at close quarters, the chimpanzee threatened them, and the subadult made his escape!

Bushbuck (*Tragelaphus scriptus*) are commonly seen near baboons, especially at the forest-edge and woodland. Sometimes they feed on the same things, such as grasses and *mpelele* shoots, and their relations are relaxed, although twice baboons were seen avoiding large adult bushbuck. Baboons also respond to bushbuck alarm calls, by giving their own alarm calls and climbing into trees. Indeed once they did so even though it was the baboons (with a rough-and-tumble playgroup) who had alarmed the bushbuck in the first place!

However baboons do also try to catch and kill young bushbuck for food. In AB Group three attempts were seen, all unsuccessful. It was striking that of the six baboons involved, three of them took part twice, suggesting that they have greater interest or skill in obtaining meat.

There was one successful hunt in BB Group, in which fourth-ranking adult male Biak caught a bushbuck and managed to retain it although the other four males all tried to get it from him. Also, in BA Group, all adult males were involved in trying to take a young bushbuck from its mother.

Bushpigs (*Potamochoerus porcus*) are one of the commonest large mammals at Gombe, and although they sleep most of the day, baboons sometimes encounter them below palm trees where the pigs are cracking palm-nuts. There can be a division of spoils, with the baboons feeding on fresh nuts in the tree, the pigs cracking dried nuts below, but when the baboons are also on the ground foraging for nuts the pigs tend to supplant them especially if the pig is a mother with piglets. However once a pig threatened baboons away from the palm nuts, the baboons responded with pantgrunts and threats and the pig withdrew, so it is possible for the baboons to win, their numbers compensating for their smaller size.

Baboons encountered pythons on four occasions: generally the baboons gave alarm calls, moved to a safe position from which to observe the snake, studied it for a while, then moved away. The one encountered at the Dell in mid-December was very large, the baboons very nervous.

Baboons' relations with birds depend rather on the nature of the bird. In February one juvenile attempted to catch a small bird, the African Pied Wagtail or *kacheche*, and in August the alpha male of AC ate a small bird, which a juvenile tried to take from him. Large birds of prey, however, are treated with caution and alarm: In March a palm-nut vulture (*mombo, kunguru*) was flying in the trees above AB Group and the baboons gave alarm calls, mothers holding closely their infants, and the group remained on alert for over half an hour. AC group responded with full alarm to a Crowned Eagle (*mwewe, kibombo*) overhead in August, females and young hiding in the thickets, but they gave threat barks as he flew off a few minutes later. This is in contrast to AA Group's actions when they encountered one Crowned Eagle apparently ill which could not fly: six juveniles gathered and threatened him, but the bird raised its wings and they fled. However after five minutes an adult male (Mapua) arrived, and sniffed at the bird, while also threatening-away the juveniles, but he also left without interfering.

3.7 Baboon group ranges and interactions

Each baboon group has its own core area and sleeping sites, but the group's travel is largely directed by the availability of food, especially fruits which ripen in different areas at different times. At some seasons the group can find enough food in a small area, at others they may have to travel far and spread-out to find enough.

For example, DA Group normally occupies an area between Kakombe and Mkenke valleys, including the lower slopes above the lake. However in May, at the end of the rainy season, they suddenly extended their range uphill and even started to use a new sleeping-site in Chihagga valley; this was all to feed on the abundant fruit of Mswankala (*Uvaria angolensis*) and Mtaturana (*Croton macrostachyss*) on the middle-slopes. But in August they spent rather less time uphill, and by October were again frequenting their normal wet-season range nearer the lake. A number of different fruits caused baboon groups to shift uphill in this way during the

year, Bulindankwavu (*Sabicea orientalis*) in January, Mpapa (*Vitex fischeri*) in March, *Uvaria*, *Croton*, and *Pterocarpus tinctorius* (Msiloti) flowers March-April, then in the dry-season, fruits of Mbula (*Parinari*), Mugusu (*Uapaca*), and Mshindwi (*Anisophyllea*) from May till September.

Because each group has a favoured range, to some extent they restrict each others' movements, such that two of our study groups (BB and C) are now confined to the middle slopes and never come to the lake-shore. However the changes in the availability of food described above often caused groups to move far into their neighbours' areas, especially if food was in short supply. When different groups met, they sometimes ignored each other, or even mingled peacefully: but at other times, they would avoid each other, or one group would avoid the other, or one would move assertively and displace the other.

On 66 occasions when groups met, the larger one displaced the smaller in 46 cases, (or 70 %). In pairs of groups which met repeatedly, it was clear that the larger was usually dominant, in 12 of the 18 pairs in which this could be determined. However, there were still a fair number of cases where the smaller group displaced the larger, and these were partly cases when the larger group was far into the home range of the smaller one. For example, on 17th April DC Group was moving furtively well within the range of the smaller DA Group, searching for *Croton* and *Uvaria*, when a male recently arrived in the group, Amadu, attacked an adult female. She screamed, and so inevitably revealed their presence to DC Group nearby, with the result that DA had to make a rapid retreat from the smaller group, back to their own range. However, the need for food sometimes takes precedence over territorial respect. In October, AC Group baboons were well inside the range of DC Group but they still chased DC baboons from a mango tree so they could feed. Eventually however enough DC adult males rallied round that AC had to retreat, but not before they had gained the food!

It was clear that during April and May, AC Group (22 baboons) were forced to shift their ranging to the north and east due to pressure from the larger DB Group (37): during the year AC Group were seen to withdraw from DB 13 times, while DB never withdrew. Even C Group, in the same general area, was pressured by DB Group to move uphill where they would repeatedly have to avoid unhabituated groups from Upper Linda and Chihagga valleys. In this way, although Gombe is a very productive habitat for most of the year and can support a high population of baboons, yet in months when food is scarce there can be considerable competition between the groups for access to the best areas.

4. Ecology and other notable events

4.1 Food abundance

Overall, 2005 was a year in which abundant food supported large chimpanzee parties through many months: Mabungo Makubwa and Mabungwa Madogo in January-February, Mpapa in March, Budyankende and Mbula from May through August.

Figure 16. Fruits of *Vitex fischeri* (MLW)

4.2 Medicinal plants

One of these fruits, Mpapa (*Vitex fischeri*; Fig. 16), appears likely to affect female reproductive cycles. Analysis of reproductive hormones extracted from fecal samples found that females had unusually high levels of estrogens when feeding on this fruit (Emery Thompson 2005). The fruit of a related tree, *Vitex agnus-castus*, is called "chasteberry" and is a recognized herbal remedy for menstrual irregularities (Emery Thompson 2005).

4.3 New Year's Storm

In the pre-dawn hours of January 2nd, a violent storm brought heavy waves that badly damaged almost all the boats in the park. The same storm brought a violent flood down Kakombe stream, destroying the bridge near the mouth of the river. A torrent of debris tore vine tangles and other vegetation from the streambed and left behind a remarkable expanse of white stones (Fig. 18). When Freud came to the reshaped streambed, he spent nearly an hour sitting among the rocks, contemplating the new lay of the land (Fig. 17). The trails alongside Kakombe stream were

Figure 17. Aftermath of the New Year's Flood. (Left) field assistant Kadaha John walking along the bed of Kakombe stream on 6 Jan, shortly after the New Year's Flood deposited a massive load of gravel. (Right) Freud sits amid the rubble, contemplating the radically changed streambed. (MLW)

covered in a layer of fine gray ash-like particles. It seems likely that the torrent of rocks and ashy

soil resulted from heavy rains hitting steep slopes denuded of vegetation by the major fire of August 2004.

4.4 Python consumes bushbuck

Figure 18. Python consuming bushbuck (10 Apr 05. Photos by W. Wallauer)

On April 10th, a python killed and ate a fully-grown male bushbuck near Park Headquarters in Mitumba. Videographer Bill Wallauer recorded video and still images as the snake, estimated to be about 4 m (13 feet) long, swallowed the antelope, horns and all (Fig 19). It was fascinating to watch, over a six-hour period, as the large serpent stretched and pulled its mouth, inch by inch, over the shoulders, body, and finally hindquarters of the bushbuck. This illustrates that pythons are formidable predators, potentially dangerous even to adult baboons or chimpanzees.

4.5 Waterbird survey

In January 2005, Julie Lyimo (Warden of Ecology, GONAPA) and Bill Wallauer (Videographer, GSRC) participated in the National Waterbird Count for Tanzania. Two transects were performed by traveling along the park's entire 15 km lakeshore from South to North (18 Jan) and from North to South (19 Jan). The first transect was conducted in two parts to avoid collecting data during the heat of the day. The second transect was started at 7:01 a.m. and completed at 11:13 a.m. In addition to these transects, *ad libitum* observations were made daily during the two week period (8-23 Jan). Also, bird observations were recorded in the Kigoma port area on two separate visits during this time.

A total of 11 water bird species were seen during the study period within Gombe National Park: Grey Heron (*Ardea cinerea*), Knob-billed Duck (*Sarkidiornis melanotos)*, Common Sandpiper (*Tringa hypoleucos*), Palm-nut Vulture (*Gypohierax angolensis*), Pied Kingfisher (*Cerle rudis*), Giant Kingfisher (*Megaceryle maxima*), African Pied Wagtail (*Motacilla aguimp*), Blue-breasted Kingfisher (*Halcyon malimbica*), Mountain Wagtail (*Motacilla clara*), White-winged Black Tern (*Chlidonias leucopterus*), Gull-Billed Tern (*Sterna nilotica*), and Hadada Ibis (*Bostrychia hagedash*).

Five additional species were observed in the Kigoma port area during the study period: Grey-headed Gull (*Larus cirrocephalus*), Common Black-headed Gull (*Larus ridibundus*), Long-tailed Cormorant (*Phalacrocorax africanus*), Little Egret (*Egretta garzetta*), and Intermediate Egret (*Mesophoyx intermedia*).

4.6 Effects of fire

Like many seasonally dry landscapes, Gombe experiences fires in the dry season. Many of the plants in Gombe are adapted to survive fire, and some may even depend on fire for their reproduction and regeneration. Woodland trees have deep roots and thick bark, and the extensive root systems of grasses allow them to regenerate quickly after their dry leaves have burnt. Because fire is important to many ecological processes, conservation managers in many parts of the world conduct controlled burns of grasslands, woodlands and forests. However, fires that are too intense, too widespread, or too frequent can kill trees, destroy fruit crops, and slow the succession of disturbed areas into forest and woodland. At Gombe, managers take steps to limit the destructive effect of fire. To reduce the risk of fires crossing into the park from village lands, park rangers conduct controlled burns around the park perimeter in the early dry season. Even with this precaution, fire sometimes enters the park. When this happens, park and research employees work together to extinguish fires.

About half the park is covered by grasslands and woodlands, which have a grassy understory (Fig. 20). These areas burn quickly and frequently; some areas burn almost every year. The remaining half of the park is more heavily forested, and it is this forested land that provides most of the ripe fruit on which chimpanzees depend. The mass of tangled green vegetation slows fires that enter the forest areas, and in this habitat fire can usually be stopped before it spreads far. Many forested areas haven't burnt at all since the introduction of fire suppression policy in the 1970s.

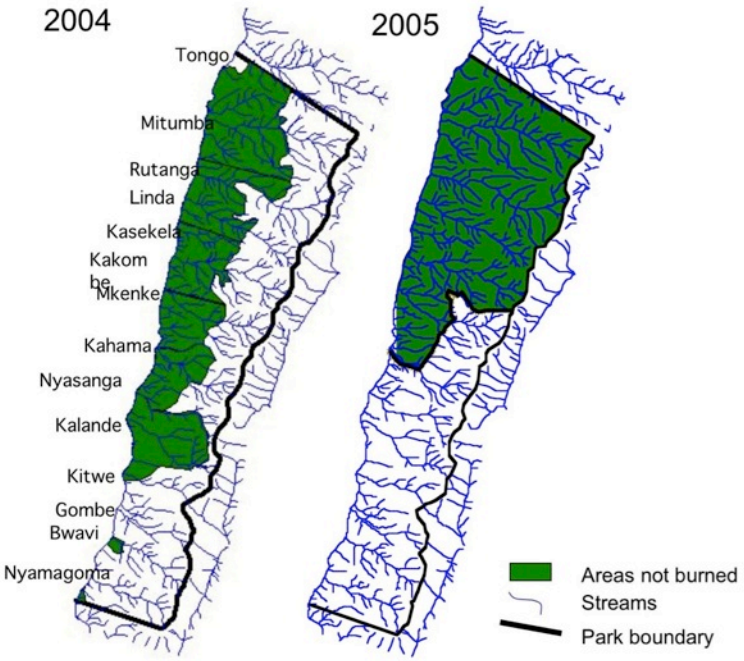


Figure 19. Extent of fire damage in 2004 and 2005. Green areas indicate the areas of the park not burned each year. Though extensive, these fires affected mainly the grassland and woodland in the south and east of the park, rather than the forested areas of the north and west.

In August 2004, a major wildfire swept through the park, burning nearly all the woodland and grassland areas (Fig 20). Intensive efforts prevented the fire from crossing into Kalande and Nyasanga valleys. In 2005, fires again burned through much of the park. Fire fighting successfully prevented the fire from crossing north into Kakombe valley, but in the south, the fire burned right to the lake (Fig. 19).

To assess the fire damage in the southern part of the park, three transects were conducted 2005 (31 Oct, 08 Nov, 09 Nov), covering a total of 5600 m. On these three transects, observers counted a total of 227 trees killed by fire. The species killed were mainly *Brachystegia* spp., but also included some species important for providing for food for chimpanzees, including *Pterocarpus*, *Uapaka*, and *Parinari*.

5. Conservation planning

5.1 General Management Plan

JGI staff participated in the development of General Management Plans (GMP) for both Gombe and Mahale Mountains National Parks. In January (26-27), Prof. Anne Pusey and Michael Wilson participated in the Ecology Working Group workshop for the Mahale GMP. For the final stages of the Gombe GMP, JGI staff visited TANAPA Headquarters in Arusha (July 4-6), followed by an intensive workshop in Kigoma (15-22 August) to complete the plan. The TANAPA Board of Trustees approved the resulting plan in September. This marked the conclusion of a 2-year process, in which participants from TANAPA, JGI, the Institute of Resource Assessment, and other institutions worked together to ensure a bright future for Gombe.

5.2 Greater Gombe Ecosystem Project

As a National Park, the wildlife and vegetation within Gombe enjoy strong legal protection. However, the park is small, only 35 km^2 in area (about 14 square miles), and is located in an area with a dense and rapidly growing human population. Deforestation outside the park has isolated Gombe from other forests and has created problems for the human population, including erosion, landslides, degraded water quality, and decreased availability of wood for fuel and construction. Because the long-term viability of the park depends on ecological processes operating outside the park, as well as the good will of the people living in the area, JGI has worked for over 10 years to help improve livelihoods and promote sustainable agricultural and forestry practices in the region surrounding Gombe. In 2005, JGI was awarded major funding from the United States Agency for International Aid (USAID) and the Annenberg Foundation to further advance this work with the project "Landscape-Scale Community-Centered Ecosystem Conservation in Western Tanzania." The goal of this project – known informally as the "Greater Gombe Ecosystem Project," is to protect the globally important biodiversity in and around Gombe while promoting the sustainable use of natural resources at a landscape scale through a community-centered conservation approach.

Figure 20. Dr. Jane Goodall on the David boat (03 Aug 05; MLW)

6 Administrative issues

6.1 Infrastructure

We made a number of improvements to the Research Centre's infrastructure in 2005.

After the severe damage to boats incurred in the New Year's Day storm, we installed boat moorings offshore to provide more secure anchorage for our boats.

One of the boats damaged by the storm, Fifi, was later found to have severe structural problems resulting from old, rotting timbers. We estimated that the cost

of replacing all the necessary timbers would be too high to justify the repairs, so Fifi was taken apart and her wood used for other purposes around camp, including the installation of sinks. It is poignant that the boat Fifi lasted only a few months after the disappearance of her namesake chimpanzee in September 2004. We were fortunate to have a new boat already in use, "David" (Fig. 21). This boat was named in memory of the son of JGI-UK board members Richard and Victoria Pleydell-Bouverie, who generously donated funds for building the boat and providing its engine.

We also began making regular use of an inflatable Zodiac boat donated in previous years to JGI (Figure 21). The Zodiac is fast and light, capable of making the trip from Kigoma to Gombe in under one hour (compared to 1.5 to 2 hours for larger boats), using less than 10 liters of fuel (compared to 30 liters for larger boats). Though the boat carries few passengers, and due to its age requires care and frequent patching to remain seaworthy, it has greatly added to the flexibility of travel for GSRC managers.

Figure 21. The Gombe Zodiac. (02 Dec 05; photo by John MacLachlan)

The housing for staff is badly in need of renovation. As an interim measure, we made repairs: houses were repainted on the inside and outside, new corrugated iron sheets were added where roofs were leaking, new roof beams were added when necessary, and solid wooden doors were provided for each house (Fig 22). Sinks were also provided for each house to improve cooking and cleaning facilities. We also continued to make improvements to garbage pits and latrines to reduce risk of disease transmission to chimpanzees and other wildlife.

Figure 22. Staff quarters in Kasekela: new paint, doors, sinks, and roofing. (23 Nov 05; MLW)

Funding from the Solar Electric Light Fund and the US Fish & Wildlife Service made possible the installation of an extensive solar power system at Gombe (Fig. 24). The system, designed by John MacLachlan, provides electrical lighting for all staff housing, and sufficient power for laptop computers, freezer, charging batteries for radios and flashlights, and other equipment. The

system also made possible the installation of an Internet system, with a satellite dish mounted on the newly renovated field lab (Fig. 23). These are both major improvements for the Research Centre.

Figure 23. Installation of the new solar panels (left) and satellite dish (right) (25 May 05 and 08 Dec 05; MLW)

6.2 Celebrity visitors

Over the years, Jane Goodall's books and lectures and the many films made at Gombe have made chimpanzees such as Frodo, Gremlin, and her twins Golden and Glitter into global celebrities. In February, these chimpanzees received a visit from another set of celebrities: Cameron Diaz (*There's Something About Mary, Charlie's Angels, Shrek*), Justin Timberlake ('*N Sync*), Jimmy Fallon (*Saturday Night Live*), and hip-hop artist Talib Kweli, who came to film the season finale for the MTV series *Trippin'*. Gombe was one of a select number of globally significant conservation areas highlighted by the series, along with the Serengeti and Yellowstone National Parks.

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Figure 24. Nile monitor lizard hunting for termites (29Nov 05; MLW)

Appendix 1. Publications based on Gombe research

Journal Articles

1. Detwiler, K.M., Burrell, A.S., and Jolly, C.J. (2005). Conservation implications of hybridization in African primates. *International Journal of Primatology*, 26(3): 661-684.
2. Emery Thompson, M. (2005). Reproductive endocrinology of wild chimpanzees (*Pan troglodytes schweinfurthii*): methodological considerations and the role of hormones in sex and conception. *American Journal of Primatology*, 67:137-158.
3. Lonsdorf, E. V. (2005). What is the role of the mother in the acquisition of tool-use skills in wild chimpanzees? *Animal Cognition*, 9:36-46.
4. Lonsdorf, E. V. (2005). Sex differences in the development of termite-fishing skills in the wild chimpanzees (*Pan troglodytes schweinfurthii*) of Gombe National Park, Tanzania. *Animal Behaviour*, 70:673-683.
5. Lonsdorf, E. V. & Hopkins, W. D. (2005). Wild chimpanzees show population-level handedness for tool use. *Proceedings of the National Academy of Sciences*, 102:12634-12638.
6. Lonsdorf, E. V., Travis, D., Pusey, A. E. & Goodall, J. (2005). Using retrospective health data from the Gombe chimpanzee study to inform future monitoring efforts. *American Journal of Primatology: Special Topics Issue on Disease Risk Analysis*. 68:897-908.
7. Pusey, A. E., Oehlert, G. W., Williams, J. M. & Goodall, J. (2005). The influence of ecological and social factors on body mass of wild chimpanzees. *International Journal of Primatology*, **26,** 3-31.
8. Sharp, P. M., Shaw, G. M. & Hahn, B. H. (2005). Simian immunodeficiency virus infection of chimpanzees. *Journal of Virology*, **79,** 3891-3902.
9. Tosi, A.J., Detwiler, K.M., and Disotell, T.R. (2005). Y-chromosomal markers suitable for non-invasive studies of guenon hybridization. *International Journal of Primatology*, 26(3):685-696.

Theses

1. Emery Thompson, M. 2005. Endocrinology and ecology of wild female chimpanzee reproduction. Ph.D. Thesis, Anthropology Department, Harvard University, Cambridge, MA..
2. Greengrass, E. 2005. Aggression and play in wild chimpanzees. Ph.D. Thesis, Bristol University, Bristol, UK.
3. Vinson, A. 2005. The impact of sociality and demography on the distribution of genetic variation within and among 2 populations of savannah baboons, *Papio hamadryas anubis* at Gombe National Park and *Papio hamadryas cynocephalus* at Mikumi National Park, Tanzania. Ph.D. Thesis, Department of Ecology, Evolution and Behavior, University of Minnesota, St. Paul, MN.

Books

1. Caldecott, J. & Miles, L. 2005. *World Atlas of Great Apes and their Conservation*. pp. 456. Berkeley, CA: University of California Press, in assocation with UNEP-WCMC, Cambridge, UK.

Reports

1. Wilson, M. L. (2005). Chimpanzee health at Gombe National Park. In: *TANAPA Veterinary Unit Report July 2002 - December 2004* (Ed. by Mlengeya, M.), pp. 39-42. Arusha, Tanzania: Tanzania National Parks.
2. Wilson, M. L., Kamenya, S., Collins, D. A. & Wallauer, W. R. 2005. Gombe Stream Research Centre 2004 Annual Report. pp. 58. Kigoma, Tanzania: The Jane Goodall Institute.

Presentations and Abstracts

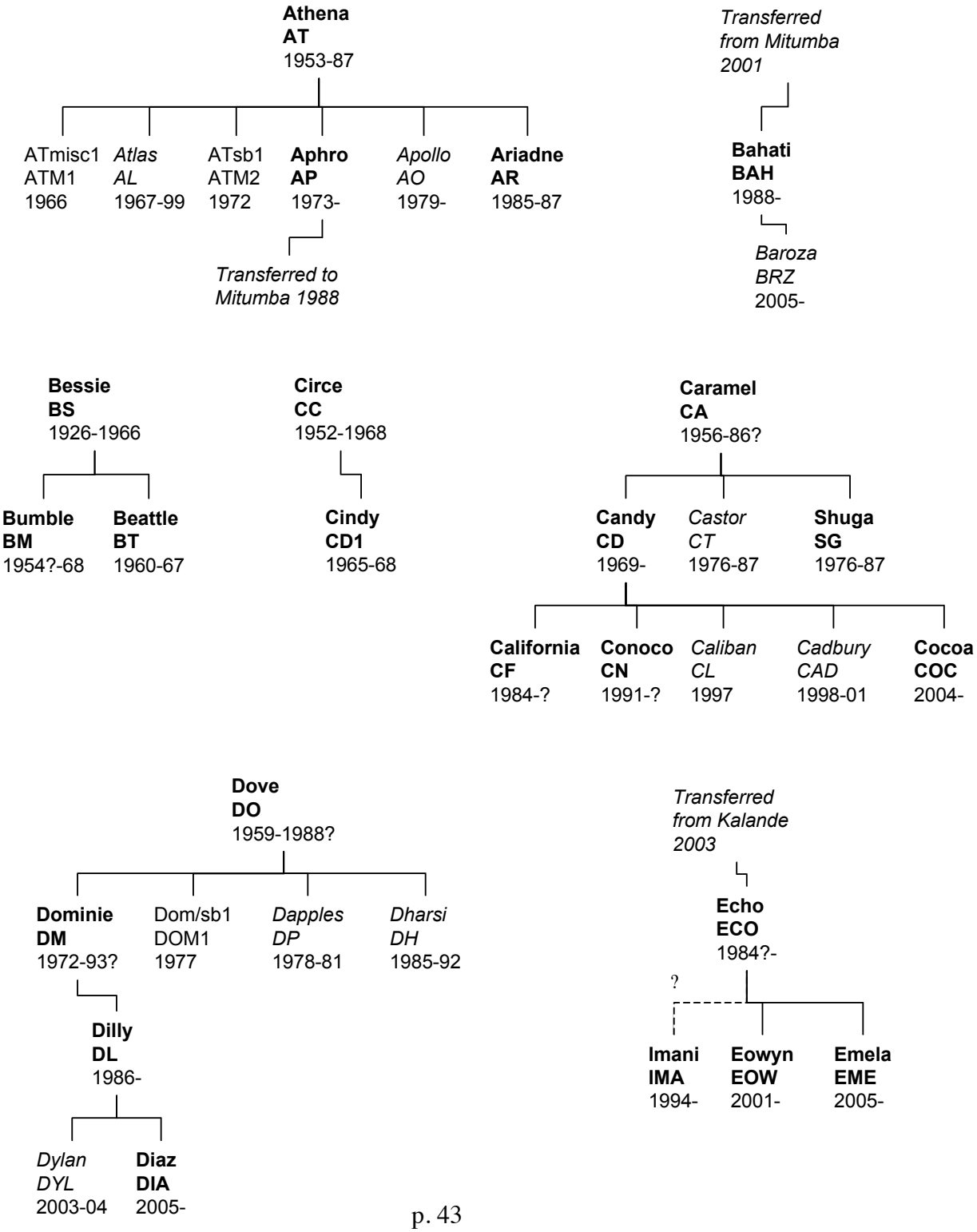
1. Emery Thompson, M. (2005). Ovarian hormones and reproductive development in wild female chimpanzees (*Pan troglodytes schweinfurthii*) . *American Journal of Physical Anthropology*, 126 Suppl, 99.
2. Gilby, I. C. 2005. Why do wild chimpanzees share meat? At Gombe, persistent beggars prevail. 42nd Annual Meeting of the Animal Behaviour Society.
3. Keele, B. F., Santiago, M. L., Li, Y., Wilson, M. L., Chen, Y., Kamenya, S., Collins, D. A., Pusey, A. E., Brookfield, J. F. & Hahn, B. H. (2005). SIVcpz Prevalence Determination in Nonhabituated Chimpanzee Communities. Keystone Meeting X7 (HIV pathogenesis*)*, Banff, Alberta, Canada.
4. Liu, W., Santiago, M. L., Keele, B. F., Li, Y., Chen, Y., Goepfert, P. A., Switzer, W. M., Mpoudi, E., Sanz, C., Wilson, M. L., Bailes, E., Sharp, P. M., Peeters, M., Shaw, G. M. & Hahn, B. H. (2005). Simian foamy virus infection in wild chimpanzees. Keystone Meeting X7 (HIV pathogenesis*)*. Banff, Alberta, Canada.
5. McGrew, W. C. (2005). Mahale and Gombe compared: patterns of research on wild chimpanzees over four decades. Annual Meetings of the American Association of Physical Anthropology, April 9, 2005, Milwaukee, WI.
6. Pintea, L. 2005. Remote Sensing and GIS Applications for Chimpanzee Research and Conservation in JGI. 1st meeting of the Section on Great Apes of the IUCN/SSC Primate Specialist Group, April 17-19 2005, Chicago.
7. Pintea, L. 2005. International ESRI Users Conference Dr. Jane Goodall's keynote address: Gombe GIS demo. July 15-29, 2005, San Diego, California.
8. Pintea, L., A. Pusey., P. Bolstad., M. Bauer. 2005. Chimpanzees of Gombe: Spatial Analysis of Vegetation and Feeding Patterns. 25th International ESRI Users Conference, July 15-29, 2005, San Diego, California.
9. Pintea, L., M. Leighton., and C. Boesch. 2005. A Collaborative Geodatabase and MapServer for Monitoring Great Apes. Intergovernmental Meeting on Great Apes and First GRASP Council Meeting, 5-9 September 2005, Grand Hotel, Kinshasa, DRC.
10. Pusey, A. E., Bebus, S., Muller, M. N., Schumacher-Stankey, J., Wallauer, W. & Wilson, M. L. (2005). Parturition in wild chimpanzees. Annual Meetings of the American Association of Physical Anthropology, April 9, 2005, Milwaukee, WI.
11. Travis, D., Lonsdorf, E.V., Lonsdorf, E.V., Mlengeya, T., Pusey, A.E. (2005) Great ape health monitoring in small populations. Wildlife Conservation Society and Mountain Gorilla Veterinary Project Gorilla Health Workshop, Limbe, Cameroon.
12. Travis, D., Hungerford, L., Lonsdorf, E.V., Lonsdorf, E.V. (2005) Health risk analysis in great apes. Pan African Sanctuary Alliance Veterinary Health Workshop, Limbe, Cameroon.

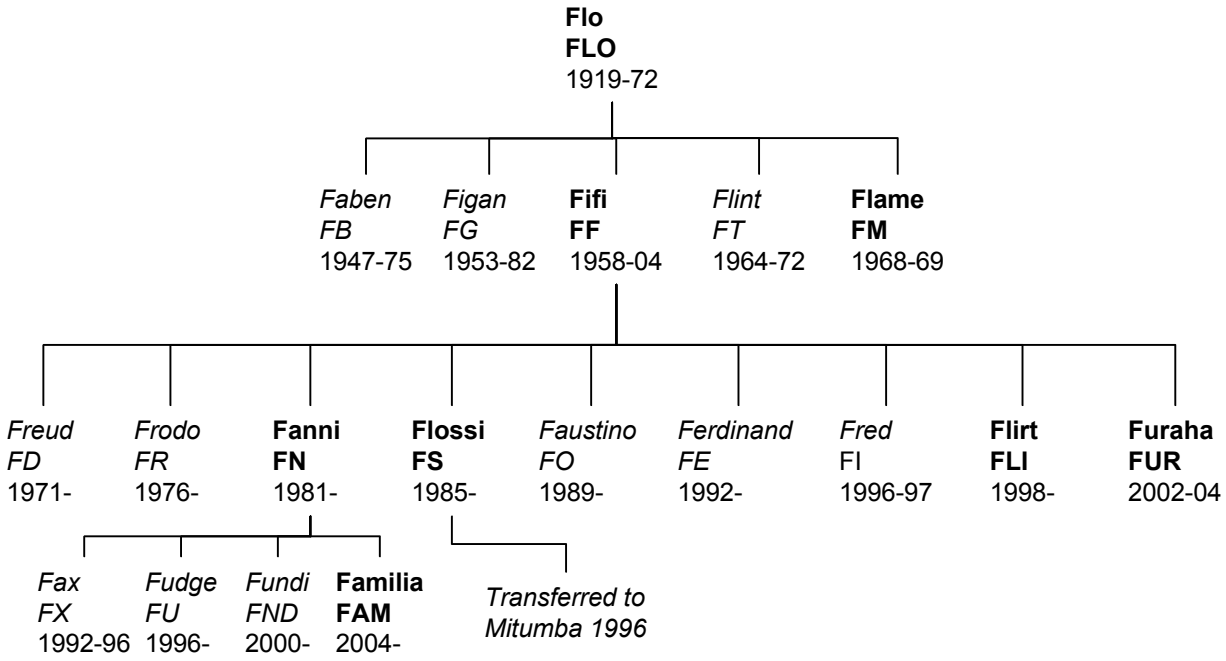
13. Travis, D., Lonsdorf, E.V., Pusey, A.E. (2005) Ecosystem health in Gombe National Park, Tanzania. Annual Meeting of the American Association of Zoo Veterinarians, Omaha, Nebraska.
14. Vinson, A., Packer, C., and Rogers, J. (2005) Patterns of relatedness and the population genetic effects of male-biased dispersal in savannah baboons at Gombe National Park and Mikumi National Park, Tanzania. Annual Meetings of the American Association of Physical Anthropology, April 9, 2005, Milwaukee, WI.
15. Vinson, A. 2005. Theory and methods for accurate data collection from forensic quality samples and results describing genetic structure in savannah baboons at Gombe and Mikumi National Parks, Tanzania. Presented at the American Association of Anthropological Genetics workshop, Southwest Foundation for Biomedical Research, San Antonio, Texas.
16. Wilson, M. L., Hauser, M. D. & Wrangham, R. W. (2005). Vocal behavior and risk assessment in wild chimpanzees. Annual Meetings of the Acoustical Society of America. Minneapolis, MN.
17. Wilson, M. L., Pusey, A. E., Earnhardt, J. M., Lonsdorf, E. V., Travis, D., Pintea, L., Kamenya, S., Mtiti, E., Bakuza, J. S., Collins, D. A. & Goodall, J. (2005). Chimpanzee conservation in the Greater Gombe Ecosystem. 5th TAWIRI Annual Scientific Conference and Silver Jubille*e*. Arusha, Tanzania.

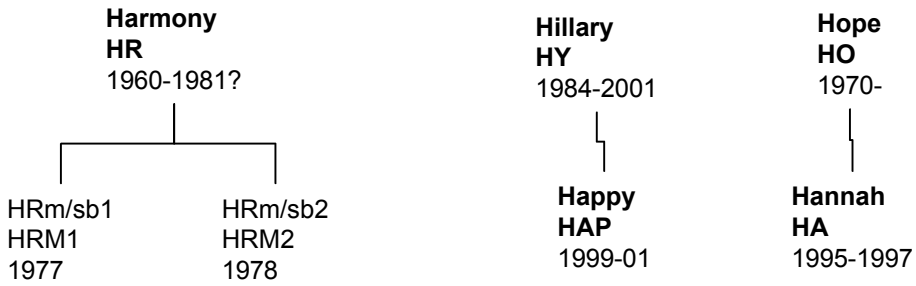
Figure 25. Forest crab. Lake Tanganyika boasts amazing biodiversity, including many endemic crab species. This forest crab lives in streams when young but spends its adult life on land, eating leaf litter. This particular specimen was found halfway up Jane's Peak. Baboons, otters and other animals eat these crabs. (22 Dec 05; MLW).

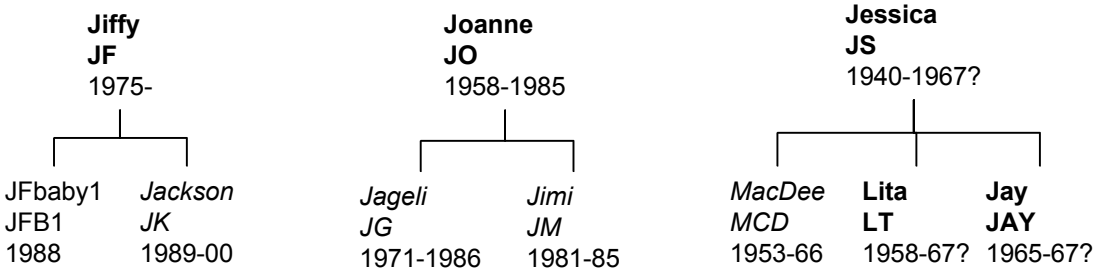
Appendix II. Kasekela community family trees

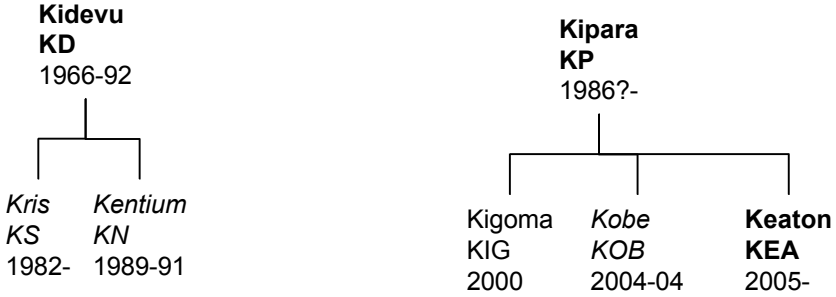
These trees illustrate the maternal relations of Gombe chimpanzees. Information for each individual includes name and ID code (females in bold, males in italics, and individuals of unknown sex in plain text) and year of birth (known or estimated). Names of individuals that died before being named consist of the mother's ID code followed by a code ("m" = miscarriage, "sb" = stillbirth, "baby" = unnamed live birth).

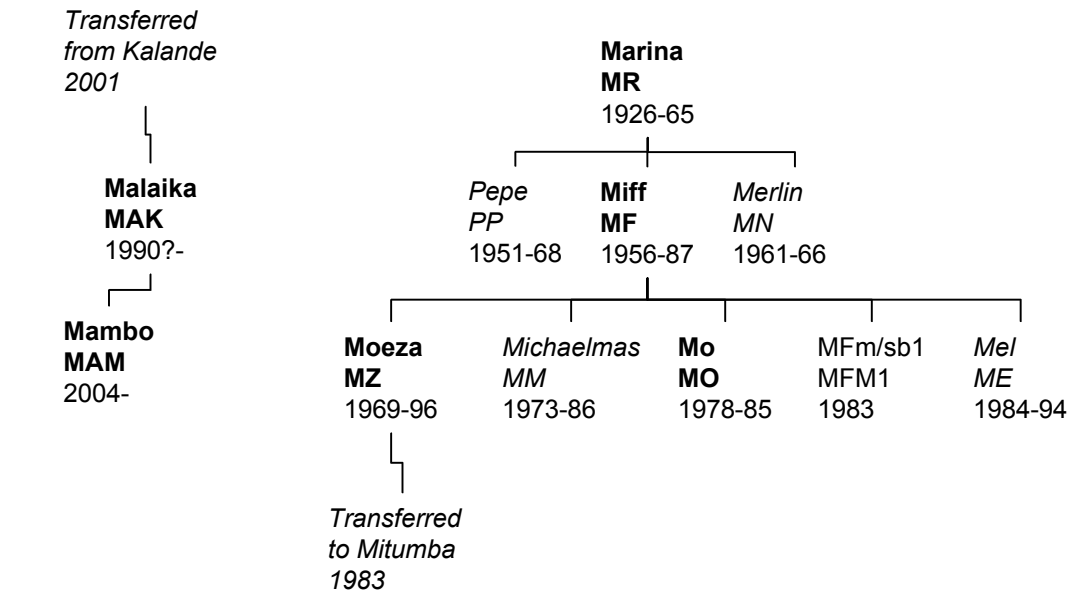


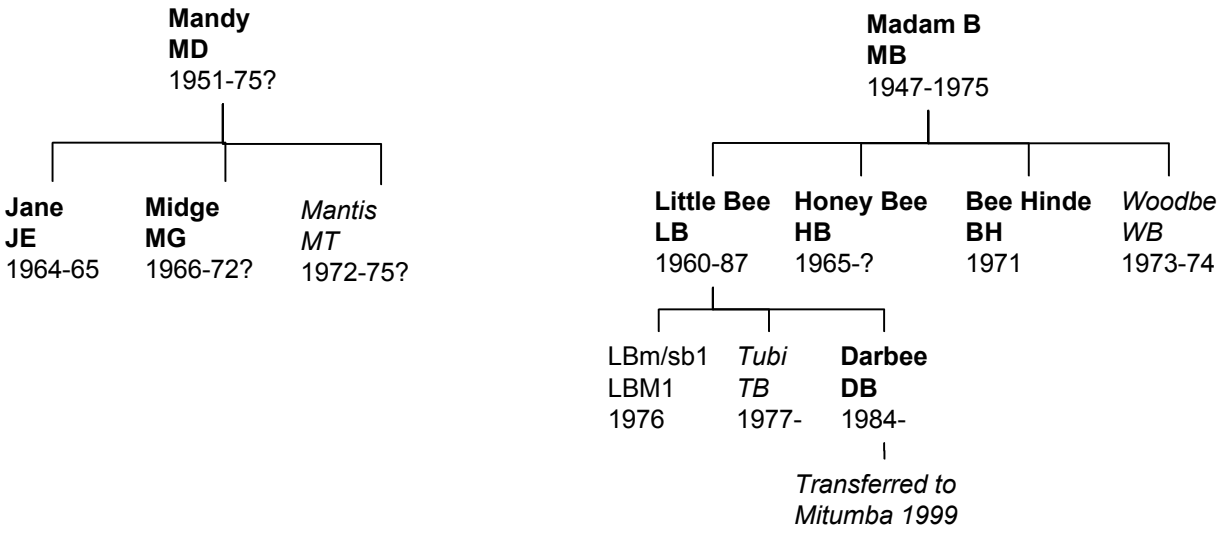

Flo
FLO
1919-72
Faben
FB
1947-75
Figan
FG
1953-82
Fifi
FF
1958-04
Flint
FT
1964-72
Flame
FM
1968-69
Freud
FD
1971-
Frodo
FR
1976-
Fanni
FN
1981-
Flossi
FS
1985-
Faustino
FO
1989-
Ferdinand
FE
1992-
Fred
FI
1996-97
Flirt
FLI
1998-
Furaha
FUR
2002-04
Fax
FX
1992-96
Fudge
FU
1996-
Fundi
FND
2000-
Familia
FAM
2004-
Transferred to
Mitumba 1996

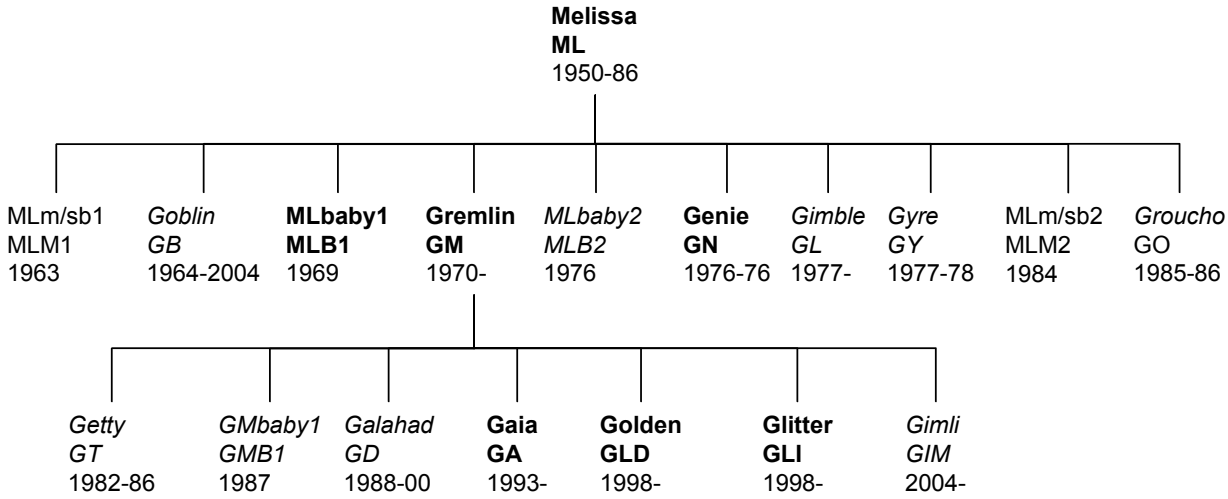

Harmony
HR
1960-1981?
HRm/sb1
HRM1
1977
HRm/sb2
HRM2
1978
Hillary
HY
1984-2001
Happy
HAP
1999-01
Hope
HO
1970-
Hannah
HA
1995-1997

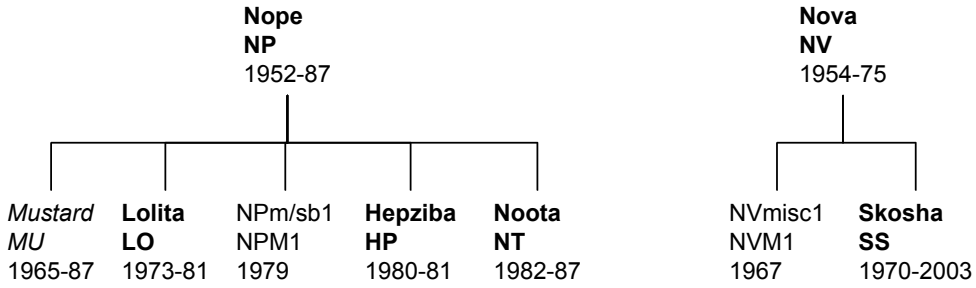

Jiffy
JF
1975-
JFbaby1
JFB1
1988
Jackson
JK
1989-00
Joanne
JO
1958-1985
Jageli
JG
1971-1986
Jimi
JM
1981-85
Jessica
JS
1940-1967?
MacDee
MCD
1953-66
Lita
LT
1958-67?
Jay
JAY
1965-67?

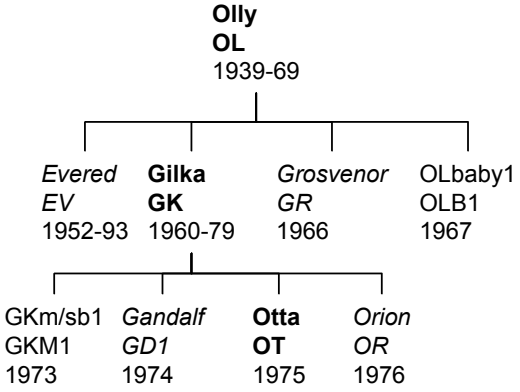

Kidevu
KD
1966-92
Kris
KS
1982-
Kentium
KN
1989-91
Kipara
KP
1986?-
Kigoma
KIG
2000
Kobe
KOB
2004-04
Keaton
KEA
2005-

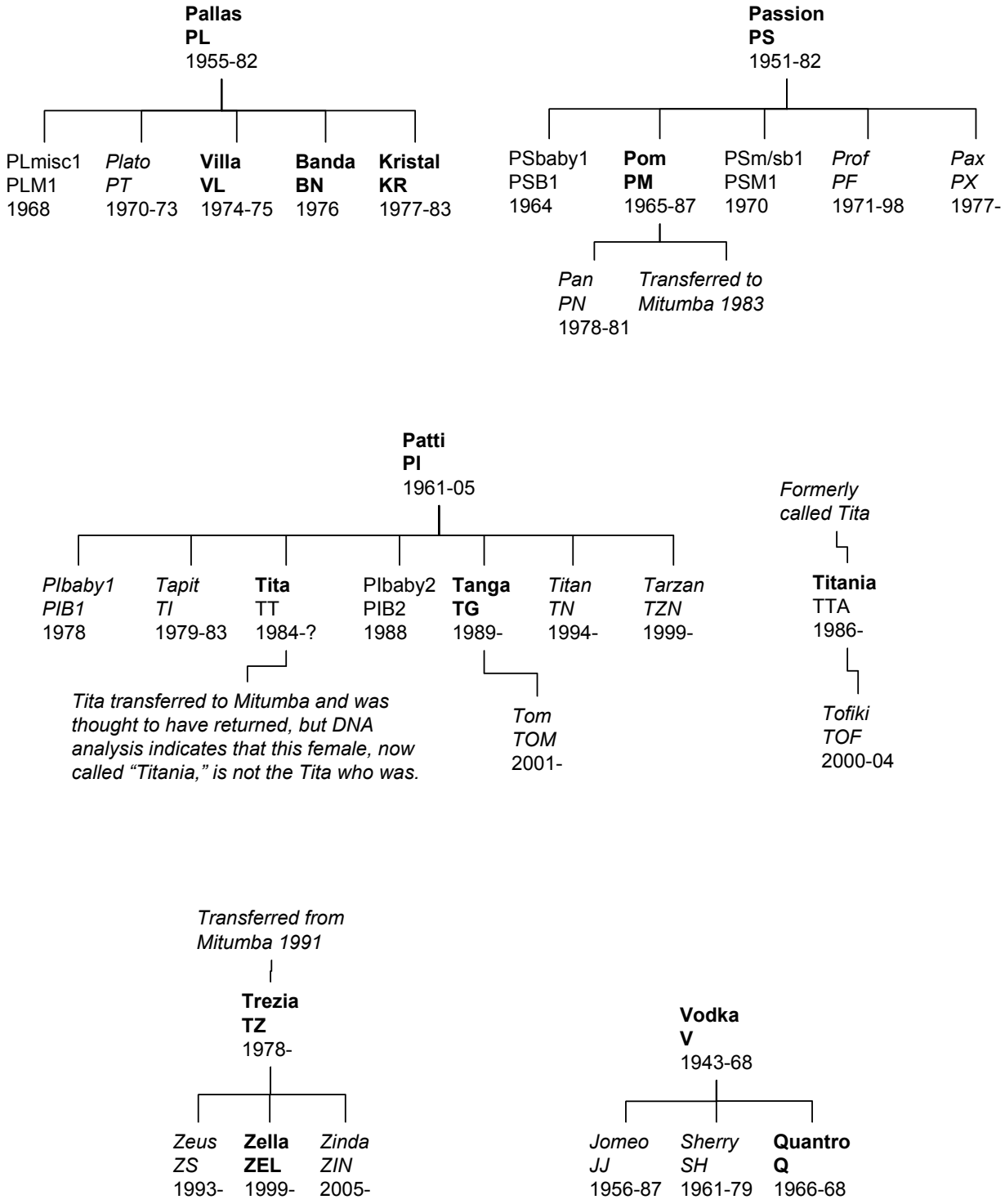

Transferred from Kalande 2001
Malaika MAK 1990?-
Mambo MAM 2004-
Marina MR 1926-65
Pepe PP 1951-68
Miff MF 1956-87
Merlin MN 1961-66
Moeza MZ 1969-96
Michaelmas MM 1973-86
Mo MO 1978-85
MFm/sb1 MFM1 1983
Mel ME 1984-94
Transferred to Mitumba 1983

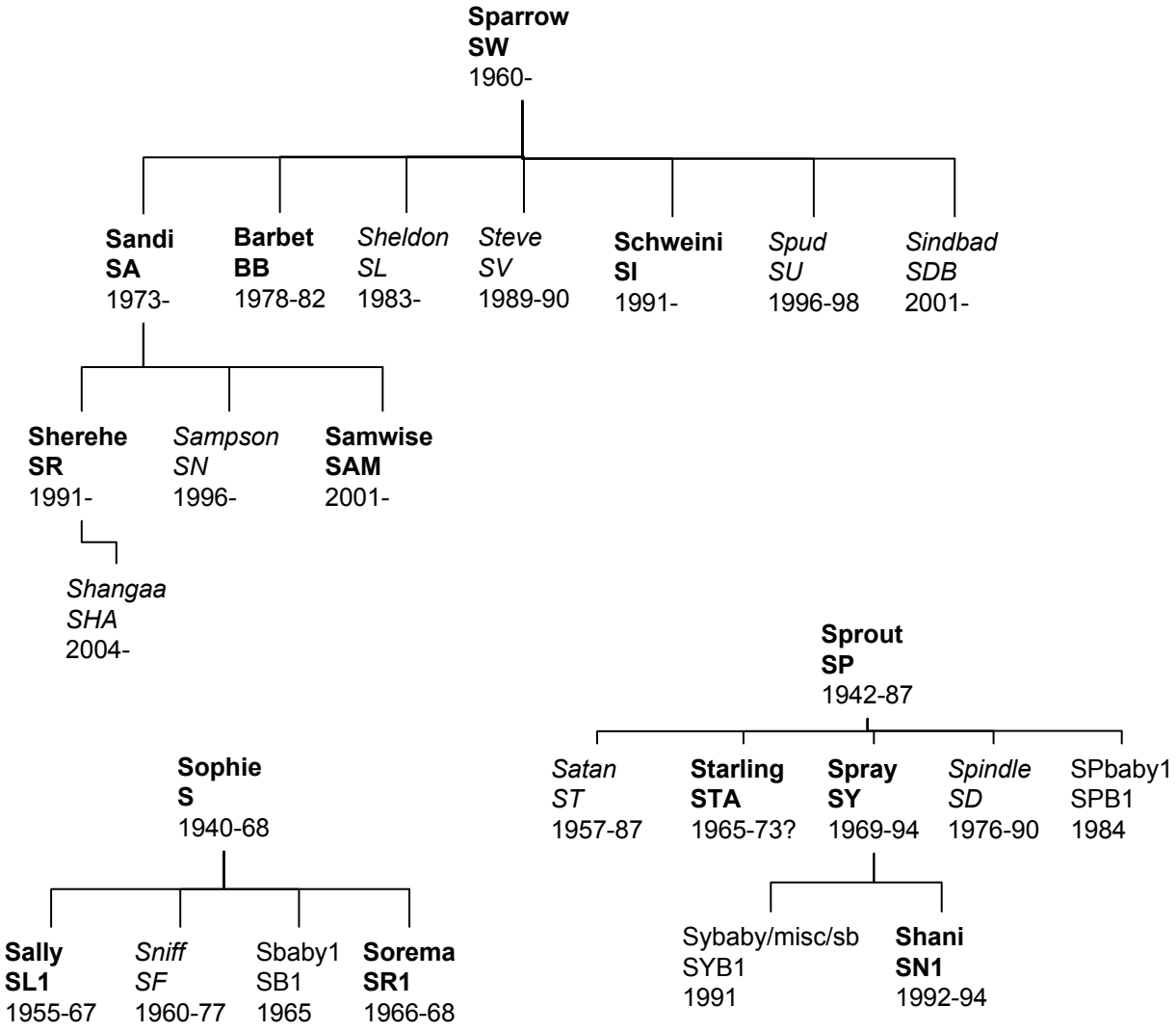

Mandy MD 1951-75?
Jane JE 1964-65
Midge MG 1966-72?
Mantis MT 1972-75?
Madam B MB 1947-1975
Little Bee LB 1960-87
Honey Bee HB 1965-?
Bee Hinde BH 1971
Woodbe WB 1973-74
LBm/sb1 LBM1 1976
Tubi TB 1977-
Darbee DB 1984-
Transferred to Mitumba 1999


Melissa
ML
1950-86
MLm/sb1
MLM1
1963
Goblin
GB
1964-2004
MLbaby1
MLB1
1969
Gremlin
GM
1970-
MLbaby2
MLB2
1976
Genie
GN
1976-76
Gimble
GL
1977-
Gyre
GY
1977-78
MLm/sb2
MLM2
1984
Groucho
GO
1985-86
Getty
GT
1982-86
GMbaby1
GMB1
1987
Galahad
GD
1988-00
Gaia
GA
1993-
Golden
GLD
1998-
Glitter
GLI
1998-
Gimli
GIM
2004-


Nope
NP
1952-87
Mustard
MU
1965-87
Lolita
LO
1973-81
NPm/sb1
NPM1
1979
Hepziba
HP
1980-81
Noota
NT
1982-87
Nova
NV
1954-75
NVmisc1
NVM1
1967
Skosha
SS
1970-2003


Olly
OL
1939-69
Evered
EV
1952-93
Gilka
GK
1960-79
Grosvenor
GR
1966
OLbaby1
OLB1
1967
GKm/sb1
GKM1
1973
Gandalf
GD1
1974
Otta
OT
1975
Orion
OR
1976


Pallas
PL
1955-82
PLmisc1
PLM1
1968
Plato
PT
1970-73
Villa
VL
1974-75
Banda
BN
1976
Kristal
KR
1977-83
Passion
PS
1951-82
PSbaby1
PSB1
1964
Pom
PM
1965-87
PSm/sb1
PSM1
1970
Prof
PF
1971-98
Pax
PX
1977-
Pan
PN
1978-81
Transferred to Mitumba 1983
Patti
PI
1961-05
PIbaby1
PIB1
1978
Tapit
TI
1979-83
Tita
TT
1984-?
PIbaby2
PIB2
1988
Tanga
TG
1989-
Titan
TN
1994-
Tarzan
TZN
1999-
Tita transferred to Mitumba and was thought to have returned, but DNA analysis indicates that this female, now called "Titania," is not the Tita who was.
Tom
TOM
2001-
Formerly called Tita
Titania
TTA
1986-
Tofiki
TOF
2000-04
Transferred from Mitumba 1991
Trezia
TZ
1978-
Zeus
ZS
1993-
Zella
ZEL
1999-
Zinda
ZIN
2005-
Vodka
V
1943-68
Jomeo
JJ
1956-87
Sherry
SH
1961-79
Quantro
Q
1966-68


Sparrow
SW
1960-
Sandi
SA
1973-
Barbet
BB
1978-82
Sheldon
SL
1983-
Steve
SV
1989-90
Schweini
SI
1991-
Spud
SU
1996-98
Sindbad
SDB
2001-
Sherehe
SR
1991-
Sampson
SN
1996-
Samwise
SAM
2001-
Shangaa
SHA
2004-
Sprout
SP
1942-87
Satan
ST
1957-87
Starling
STA
1965-73?
Spray
SY
1969-94
Spindle
SD
1976-90
SPbaby1
SPB1
1984
Sybaby/misc/sb
SYB1
1991
Shani
SN1
1992-94
Sophie
S
1940-68
Sally
SL1
1955-67
Sniff
SF
1960-77
Sbaby1
SB1
1965
Sorema
SR1
1966-68
Winkle
WK
1959-88
Wilkie
WL
1972-
Wunda
WN
1978-?
Wolfi
WF
1984-90?
Wanda
WD
1958-75
Romany
RO
1971-75
Yolanda
YD
1986-
Yamaha
YAM
1998-

Females without offspring

Transferred from Mitumba 2005

Gigi
GG
1954-93

Pooch
P
1955-68

Female X
FMX
1957-69?

Jenny
JN
1966-80

Sifa
SIF
1978?-

Haiki
HAI
1981?-

Nasa
NAS
1988?-

Vanilla
VAN
1988-

Nuru
NUR
1990?-

Eliza
EZA
1995?-

Males without known mothers

Huxley
HX
1926-67

McGregor
GR1
1925-66

William
WM
1930-63

Hugo
HG
1936-75

Leakey
LK
1935-75

JB
JB
1933-66

Rix
RX
1941-68

Goliath
GOL
1937-75

Mike
MK
1938-75

David Greybeard
DV
1936-68

Hugh
HH
1944-73

Worzle
WZ
1944-69

Humphrey
HM
1946-81

Charlie
CH
1951-77

Willy Wally
WW
1949-76

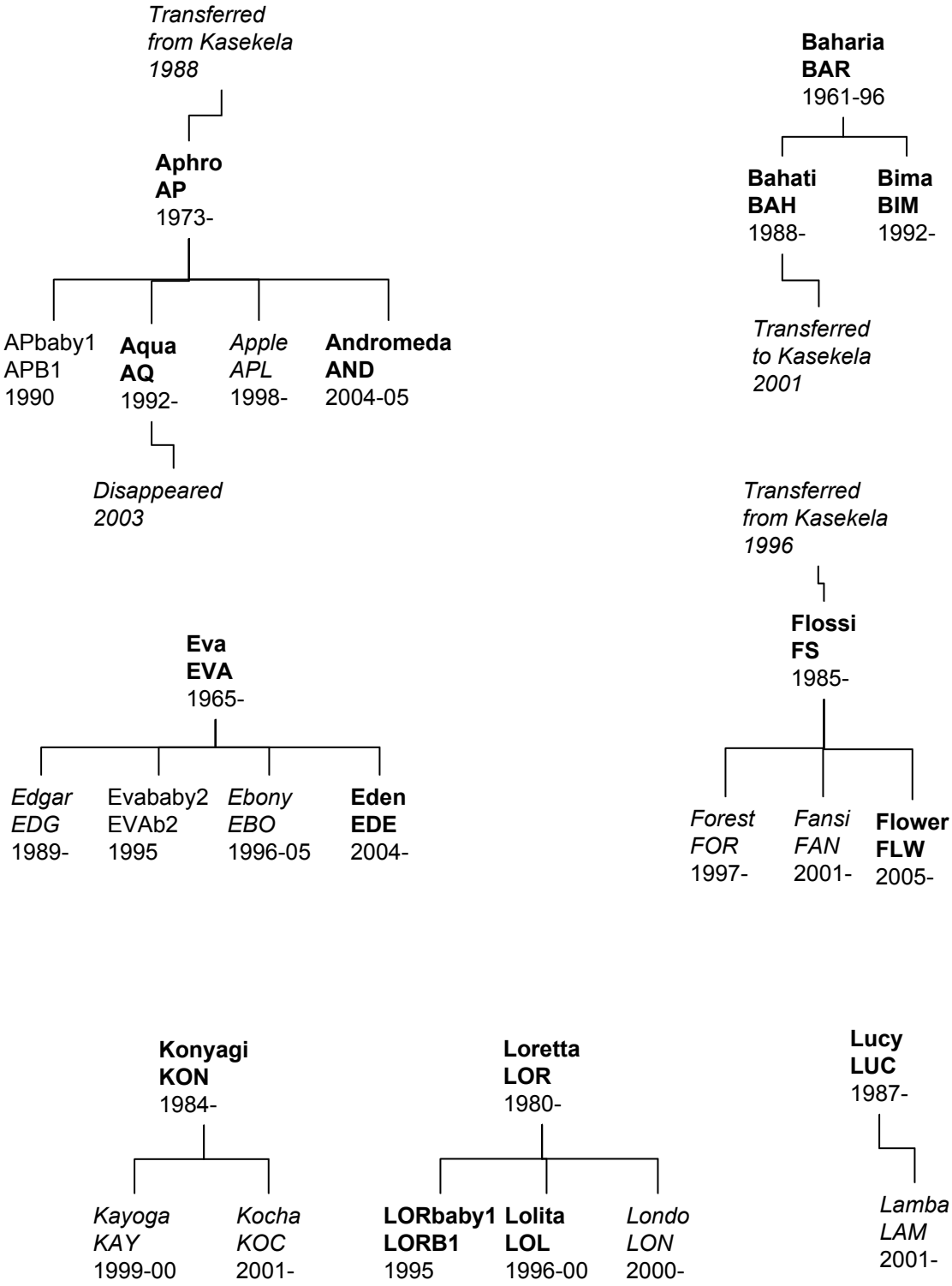
De
DE
1948-74

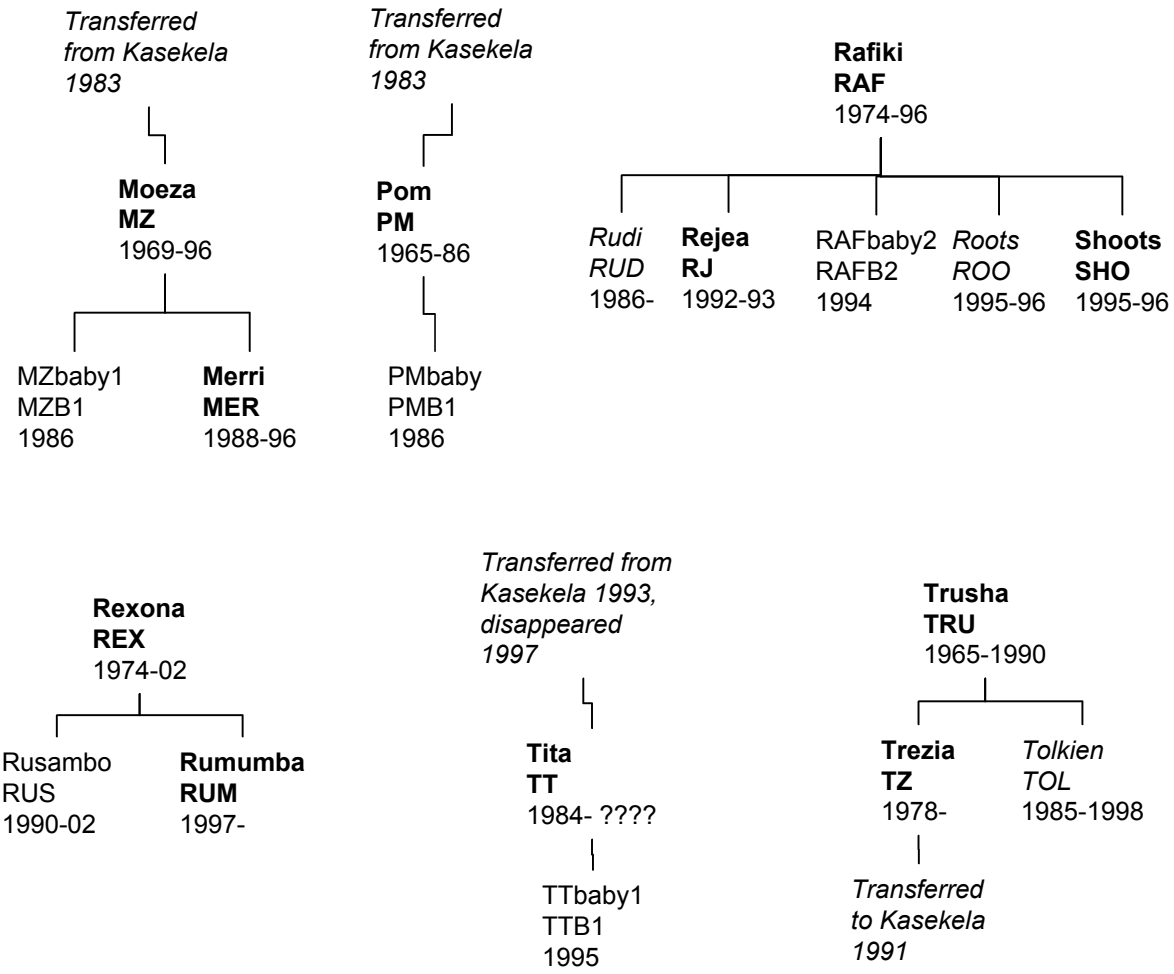
Godi
GI
1953-74

Hornby
HBY
1957-66

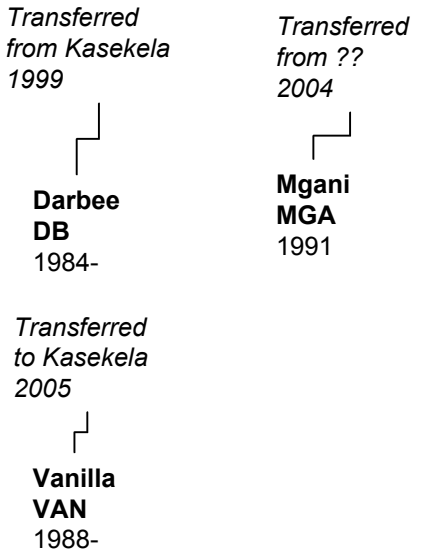
Beethoven
BE
1969-2002

Appendix III. Mitumba community family trees





Females without offspring



Males with unknown mothers

Cusano *CUS* 1956-96	*Gorbachev* *GOR* 1968-96	*Rugongo* *RUG* 1945-88
Sefa *SEF* 1960-98	*Vidole Vitatu* *VID* 1971-01	*Vincent* *VIN* 1976-04