

Figure 1: Subadult male *Colobus vellerosus* resting in a *Ceiba pentandra* tree at BFMS. Photo by T.Saj.



THE POPULATION STATUS OF THE URSINE COLOBUS (*COLOBUS VELLEROSUS*) AT BOABENG-FIEMA, GHANA

Tania L. Saj, Julie A. Teichroeb, Pascale Sicotte
Department of Anthropology, University of Calgary, Calgary, Alberta,

Introduction

The population of Ursine colobus (*Colobus vellerosus*) is thought to be declining throughout most of its range in West Africa. In eastern Côte d'Ivoire and south-western Ghana, sightings of *C. vellerosus* in various reserves and National Parks is reported as rare or few today, in contrast to 'common' sightings in the 1970s [Asibey, 1978; Struhsaker & Oates, 1995; McGraw et al., 1997-1998; Fisher et al., 1999-2000; Oates et al., 2000]. In Togo, there have been no published sightings for over 20 years [Asibey, 1978]. In Bénin, only a few small groups of *C. vellerosus* have been found in a few forest fragments [Inoussa & Nobimé, 1997; Sinsin et al., 2002;] and in south-western Nigeria, the Ursine colobus' eastern-most range, I. Faucher (pers. comm.) reported no sightings of *C. vellerosus* despite searches between 1997 and 2001 and Happold [1987] suggests *C. vellerosus* may be locally extinct in this area.

This decline in population is likely due to the loss of forested habitat and the ubiquitous West African bushmeat trade [Martin & Asibey, 1979 in Struhsaker, 1997; Martin 1991; Oates, 1992, 1996; Oates & Davies, 1994; Oates et al. 2000; Cowlshaw, 1999]. In fact, hunting and the bushmeat trade are probably a more significant impact on the population of West African colobus than moderate habitat disturbance [Oates, 1992]. In East Africa, for example, moderate levels of habitat disturbance are not associated with declines in densities of black-and-white colobus (*Colobus guereza*) [Struhsaker, 1975; Skorupa, 1986]. Rather, moderate levels of logging in Kibale National Park, Uganda, were associated with an increase in black-and-white colobus density [Struhsaker, 1975; Skorupa, 1986]. This may be due to the greater availability of fast-growing, high-protein/lower-fiber colonizing plants preferred by the black-and-white colobus in edge or disturbed habitats [Onderdonk & Chapman, 2000]. The ability of *Colobus guereza* to thrive on such secondary growth may also explain their ability to live in small (approx 1-10 ha) patches around Kibale [Onderdonk & Chapman, 2000]. In West Africa, Martin [1991] also suggests *C. vellerosus* may be able to better adapt to low levels of logging than many other primate species due to its use of secondary forest.

In contrast, the hunting of black-and-white colobus in West Africa has had a devastating effect on the population. Historically, Booth [1979] suggests the Ursine colobus was one of the most preferentially hunted primate species in Ghana. It was sought after for its meat and coat until it was hunted to scarcity in many areas. In the 1890s, an estimated 190,000 *C. vellerosus* skins were exported from Ghana [Grubb

et al., 1998]. In the early 20th century, the trade averaged 17,000 skins per year [Grubb et al., 1998]. Since the 1970s, *C. vellerosus* has been fully protected by law in Ghana and Bénin, and partially protected in Côte d'Ivoire, Togo and Nigeria [de Klemm & Lausche, 1987]. However, poaching still occurs, and the bushmeat trade is thriving in these countries [Asibey, 1972; 1974; Happold, 1987; Ntiamao-Baidu, 1987; 1998; Oates, 1996; Oates et al. 2000; McGraw et al., 1997-1998; Ntiamao-Baidu, 1998; Bowen-Jones, 1997-1998; Fisher et al., 1999-2000; Bakarr et al., 2001]. In Ghana, for example, 93% of the people surveyed in a Wildlife Division bushmeat survey, said they would eat bushmeat if it were available [Ntiamao-Baidu, 1998]. The report estimated that 8,467,255 animals (equivalent to 91,730,915 kg) were killed for the bushmeat trade each year in Ghana [Ntiamao-Baidu, 1998]. In random checks of bushmeat markets across Ghana, Ntiamao-Baidu [1998] reported 6 primate species for sale, including *Colobus vellerosus*.

Against this backdrop, the presence of a relatively large population of Ursine colobus in central Ghana is surprising. This population is located in the Boabeng-Fiema Monkey Sanctuary (BFMS) in the Brong-Ahafo Region of Ghana. The monkeys are a relatively common sight in the forest adjacent to the villages of Boabeng and Fiema, and in the villages themselves. It is not uncommon to see groups of black-and-white colobus traveling through the villages or licking the walls of mud compounds, presumably ingesting trace minerals from the soil. This is the only food item they take from the village. Their presence in the village, although tolerated, is traditionally taken as a sign of an upcoming human death in the village. The site is also inhabited by Campbell's monkeys (*Cercopithecus campbelli*) which travel extensively through the village and actively take food from homes and tourist handouts. Crop-raiding by both species (although relatively rare by the Ursine colobus) is not tolerated, and monkeys are always chased away when they enter the fields.

A recent census by Kankam [1997] found that the Ursine colobus population was increasing at BFMS. Between 1991 and 1997, Kankam [1997] estimated the population of Ursine colobus increased 27% from 128 individuals to 163. This contrasts sharply with the Ursine colobus' decline in other areas of West Africa as described above. It also contrasts with an avifaunal survey conducted by Beier et al. [2000] in which BFMS was found to have the lowest number of forest birds per hectare of the 35 forest fragments surveyed in central Ghana. Fargey [1991, 1992] and Kankam [1997] have suggested the relatively large population of Ursine colobus at Boabeng-Fiema and its increase over time is mainly due to the reduced hunting threat they experience because of a local hunting taboo on the monkeys.

The objective of this study is to determine the current population status of the Ursine colobus at BFMS, in terms of whether or not it is declining, increasing or stable. In October-November 2000, we conducted a third census of the Ursine colobus at BFMS. These results are compared to the two previous and similar censuses done in 1991 [Fargey, 1991] and 1997 [Kankam, 1997]. Our conclusion is that the Ursine colobus population has increased from 1991 to 2000. In light of these results, we discuss two likely reasons for this increase. Firstly, that the population increase

Table 1: The Ursine colobus population at BFMS between years

Census Year	# of Monkeys Counted	# of Groups Counted	Mean Group Size
1991 [Fargey]	128	8	16
1997[Kankam]	163	10	16.3
2000[This study]	200	14	14.3

is mainly due to the intrinsic growth of the population, growth that is due to local villagers' obedience to the hunting ban on monkeys. We present evidence that the hunting ban is working based on the colobus' lack of response to nearby gunshots. We discuss contributing reasons for the obedience to the hunting ban, such as the role of tourism, the presence of the Wildlife Division at BFMS and the positive attitude of the villagers to the monkeys. Secondly, we also suggest some of the population increase may be the result of the emigration of male black-and-white colobus from the surrounding area into BFMS.

METHODS

Study Site

The Boabeng-Fiema Monkey Sanctuary is a 1.92 km² dry semi-deciduous forest fragment (UNDP/ GEF Map Sheet # 0702A4) located in central Ghana [Hall and Swaine, 1981]. The BFMS lies adjacent to the villages of Boabeng and Fiema (7% 43% N and 1% 42% W) in the Nkoranza district of the Brong-Ahafo administrative region. BFMS is connected to several small forests in the surrounding area by a narrow, riparian forest; however, it is otherwise mostly surrounded by farmland and 50 km away from a large forest (1,000 ha or larger) [Beier et. al, 2000]. This area is characterized by a marked dry season from November to February/ March. The long rains last from approximately March to July, the short rains fall in September. During this study, rainfall was collected daily with a rain gauge in a clearing at the Boabeng-Fiema Guesthouse, less than 500 meters away from the forest edge. Between August 2000 - July 2001, the annual rainfall at Boabeng-Fiema was 1049.5 mm. The mean annual rainfall from 1985 to 1990 was 1250 mm (SD \pm 21.1; taken in Nkoranza, 20 km from BFMS) [Fargey, 1991].

The vegetation of BFMS is a mosaic of primary forest (unlogged forest), regenerating farmland, and disturbed forest along the edges. Throughout much of the forest, the sanctuary shows evidence of long-term human influence. Exotic trees are present (e.g. oil palms, teaks, mangos, cocoa) and local people use the forest for firewood collection, bushmeat hunting, medicinal and edible plant collection (Appendix 1) and sheep, chicken and pig foraging. An ecological survey was conducted in the study area: 433 trees of 69 species were counted in a 2.25 ha area (9 randomly placed



Figure 2: Two adult black and white colobus feeding on flower buds in a *Ceiba pentandra* tree at BFMS. . Photo by T.Saj

Figure 3: Entrance to BFMS. Standing is the Senior Wildlife Officer at BFMS, Mr Anthony N'Dassah. . Photo by T.Saj.



quadrats of 50m x 50m). The five most common tree species in this area are *Cola gigantea*, *Angeissus leiocarpus*, *Monodora myristica*, *Myrianthus arboreus* and *Holarrhena floribunda*. They account for 42.3% of the trees surveyed; none are black-and-white colobus food trees. The top 5 food trees of the black-and-white colobus accounted for only 8.3% of the trees surveyed (*Albizia coriaria*, *Piptadeniastrum africanum*, *Antiaris toxicaria*, *Aubrevillea kerstingii* and *Trilepisium madagascariense*). The forest along the edges of BFMS show signs of the most disturbance, including the smallest average tree DBH per quadrat (28.1 cm) and the highest proportion of *Grewia mollis* (n=22% of the trees surveyed in this area), a tree characteristic of disturbed forests [Hawthorne, 1990]. The regenerating farmland contains the highest proportion of large trees ($\geq 40\text{cm DBH} = 46\%$) but the smallest number of trees overall (average 13.5 trees per quadrat). This is likely due to the selective removal of smaller, more easily felled trees to clear the land for farming. The primary or unlogged area of the forest had the most tree species per quadrat (20.8) of the three types of forests, and ranked intermediate in terms of the average number of trees per quadrat (50.4) and average tree DBH per quadrat (31.6 cm). All of these areas are used by the Ursine colobus.

The Study Species

The Ursine colobus is the least known species of black-and-white colobus. Based on our work at BFMS, we characterize this species as primarily folivorous. The annual diet is made up of mature and young leaves (34% and 40% respectively), seeds and seedpods (8%), unripe fruits (8%) and flowers and buds (6%). The main tree species fed upon are from the Moraceae, Leguminosae and Bombacaceae families, representing 27%, 23% and 19% of the diet. This species is characterized by uni-male and multi-male group composition. We have observed an all-male group and female transfer (n=1; Saj & Sicotte, 2002).

The Hunting Taboo & Government Protection

The monkeys at BFMS have historically been protected by a hunting taboo. The hunting taboo can be traced back to local legends about the origin of the villages of Boabeng and Fiema [Fargey, 1991]. According to the elders of Boabeng, the hunting taboo dates back to the 1830s when the first Brong inhabitants came to this site and were told by the god Daworoh to protect the monkeys because they brought good fortune. According to the Fiema elders [Fargey, 1991], the monkeys came to the villages after the establishment of the Fiema township because of the influence of the god Abodwo. Despite the differences, both legends ultimately have the two gods falling in love, and the villages protecting the monkeys from being killed or eaten.

This taboo was breached in the early 1970s when a Christian sect moved into the area [Fargey, 1991]. The sect, named the Saviour Church of Ghana, encouraged members to hunt the monkeys. The church leaders expected new members to hunt the monkeys as a way to show their disassociation from traditional belief in the local gods [Fargey, 1991; Kankam, 1997]. This hunting had a devastating effect on the monkey

population which decreased from hundreds to dozens (A. N' Dassah, pers. comm.).

In response to this crisis, the elders of the villages approached the Wildlife Division in 1974 to ask for help in protecting the monkeys [Fargey, 1991]. The Wildlife Division responded by sending Wildlife Officers to be stationed at Boabeng-Fiema and establish the site as a 'Monkey Sanctuary', a designation that means this area is managed by the government to ensure the 'perpetuation' of the two monkey species at Boabeng-Fiema [World Bank, 1993]. This protection continues to this day, with the Wildlife Division actively involved in preventing poaching and timber extraction within the sanctuary's boundaries. This national designation supersedes an earlier bylaw that was passed in 1974 by the Nkoranza District Assembly during the same hunting crisis. In this bylaw, the communities of Boabeng and Fiema established regulations governing hunting and burning in the area surrounding the Monkey Sanctuary. According to the bylaw, which is still in effect on paper, villagers are not allowed to burn vegetation without permission from the Nkoranza District Assembly and they are not allowed to hunt monkeys within a 4.8km² radius of the boundary of the Monkey Sanctuary.

Since the mid-1970s, only a few incidents of people killing the monkeys have been reported, mostly the Campbell's monkey [Fargey, 1991; Kankam, 1997]. The Campbell's monkey is suggested to be at greater risk of being killed than the Ursine colobus due to its lesser esteem by the local population and crop-raiding behavior [Kankam, 1997]. In 1993, two Boabeng citizens were alleged to be selling Campbell's monkeys' meat to a restaurant in the nearby village of Tankor. The villagers moved out of Boabeng when confronted by Wildlife Officers at BFMS [Kankam, 1997].

Population census

We conducted a 'complete' count [Jarman et al., 1996] of the Ursine colobus population at BFMS from October 10 to November 5, 2000 (n=26 days). The census was conducted in the BFMS area along two fixed, nonlinear routes of 5.5 km and 2.2 km that covered the length and breadth of the forest. Systematic census walks alternated daily between the two routes and followed existing trails in the BFMS. Census walks began at 14:00 and lasted between 170 – 227 minutes for the 5.5 km route, and 61 – 98 minutes for the 2.2 km route. All routes were walked by one observer (research assistant Sarah Wong). For one week prior to the study, SW familiarized herself with the forest, trails and colobus detection cues. She then walked the same routes in a systematic manner and was able to identify the home range area of individual groups. This information was used to distinguish between groups, along with a combination of other characteristics such as, group size, behaviors associated with a specific group and the presence of certain individuals [Oates, 1977].

When a colobus was spotted, the group was identified and the number of individuals were counted and identified as to their age-sex class. This was done within 10 minutes of the first sighting to avoid double counting individuals that may have moved. We determined whether individuals were adults (which included subadults, and were defined as large [estimated to weigh approximately 4-9 kg] individuals that

appeared to be sexually mature or close to sexual maturity) or immatures (which included both infants clinging to their mothers and independently moving juveniles, and were defined as small individuals [estimated to weigh < 3 kg]). We determined the adults' sex based on sex-specific coloration of the perineum region. We did not distinguish the sex of immatures. One sighting of a solitary individual was excluded from the final tally because we could not be sure it was not part of a group. We are confident this method of census is suitable for BFMS because of the small size of the forest, our ability to cover its area on existing trails, the good visibility of the monkeys, and the high level of habituation of most groups. We are also confident all of the bisexual groups in this area were counted, as the 5.5 km route was walked monthly for 7 months after this period and we did not locate any new groups in this area. This method, however, may miss counting all-male groups in an area. All-male groups usually have larger home ranges than bisexual groups, which are also less fixed [Hrdy 1977; Rajpurohit & Mohnot 1988; Watts 1994; Steenbeek, 1999]. Thus they could temporarily be out of the study area during the census and may be underrepresented using such a method. In our case, one all-male group (n=7-9 males) that was observed 10 months after the study started was not counted during the census and has since disappeared from the study area.

From this data, a complete count range was calculated from the 'good' counts of the 14 groups SW identified during the census. A group size range was established for each group based on the highest and lowest good count for that group. A count was considered good when visibility was unobstructed and the group was stationary. The group size ranges were totaled to provide the population size.

Our census methodology is comparable to two previous censuses done by Fargey [1991] and Kankam [1997]. These censuses were also completed by one observer, used complete counts of individual groups to calculate population size, surveyed the same area using the same trail system, and used approximately the same number of census days ([Fargey, 1991]: data collected May 1-19, 1990); [Kankam, 1997]: data collected January 27 – February 9, 1997; April 25-30, 1997). There was, however, a slight difference in the season in which censuses were conducted by the authors and Kankam. Part of Kankam's census was done during the middle of the dry season (January – February), which might have increased the visibility of the monkeys in the forest, and may have allowed for more precise counting and sexing of the monkeys.

Gunshot Data Collection

At BFMS, several animals are hunted with shotguns; grasscutters (*Thryonomys swinderianus*), mongoose (*Crossarchus sp.*), and the occasional Royal antelope (*Neotragus pygmaeus*) and duiker (*Cephalophus sp.*). Several species of birds and squirrels (*Epixerus sp.*) are also hunted with slingshots. Most hunting is done opportunistically while people are farming (many farmers carry shotguns with them to their fields) or walking to their farms through the forest.

We collected data on the responses of two Ursine colobus study groups to nearby gunshots as a way to measure whether hunters target the black-and-white colobus or

not. We predicted that if the ban was observed, the black-and-white colobus should not flee or show vigilance (defined as a prolonged look [>5 seconds] in the gunshot direction). If the ban was not being observed, the black-and-white should flee or show vigilance in response to the gunshots. From June to August 2001 ($n=48$ days), all observations of individual responses to nearby gunshots were recorded during bi-monthly 4-day dawn to dusk follows of the two study groups by TLS (WW=30-32 individuals; B1=8 individuals). Only responses to gunshots that were categorized as 'close' were included. Close versus distant gunshots were determined by their loudness. Close gunshots were presumed to correspond with hunting in the same part of forest or adjacent croplands as the study group and therefore represented a more immediate potential threat to the monkeys.

Table 2: Summary of Ursine colobus groups counted at BFMS

Group	Group Size Range	Group Size (mean)	# of Adults (mean)	# of Adult Males (mean)	# of Adult Females (mean)	# of Unsexed Adults (mean)	# of Immatures (mean)	# of Individuals of Unknown Age-Sex (mean)
F1	15-18	16.5	9.5	2	3	5	3.5	3.5
F2	14-16	15	11	2.5	5	3	4	0
F3	11-15	13	9	3.5	4	1	4	0
F4	4	4	2	0	0	2	0	2
F5	8	8	7	1	0	6	1	0
B6	13	13	9	2.5	4.5	1	3	1
B7	14-15	14.5	10.5	3	3	5	3	1
B8	8	8	6	1	3	3	1	1
B9	8	8	4	1	3	0	4	0
B10	30-32	31	16	5	11	0	15	0
B11	14	14	8.5	2.5	4	2	4.5	1
B12	19-23	21	11.5	3.5	5	3	6	3.5
B13	9-14	11.5	7.5	2.5	4	1	3	1
B14	22-23	22.5	15.5	2.5	4	9	5.5	1.5

Results

(1) Population Size & Comparison

In 2000, the population of black-and-white colobus at Boabeng-Fiema was 189-211 individuals (mean=200). In comparison, the number of black-and-white colobus at BFMS in 1991 was 128 [Fargey, 1991; Kankam, 1997]. The observed rate of increase (r) between 1991 and 2000 was 0.56 over 9 years (Table 1).

(2) Number of Groups and Group Size

Between 1991 and 2000, the number of black-and-white colobus groups increased from 8 groups to 14 (Table 1). During this time, the average group size decreased from 16 to 14.3. In 2000, we observed the smallest (n=4) and largest groups (n=30-32) reported at BFMS (Table 2). In comparison in 1991, the smallest group observed was 8 individuals and the largest group was 24 individuals.

(3) Age-Sex Composition of the Population in 2000

In Table 2, we present the group composition data for all of the black-and-white colobus groups counted in 2000. In 9 of the groups we do not have full information on the number of adult females. We have restricted our analysis of age-sex composition of the population to the 5 groups we have the most complete age-sex class information. To be included in this analysis, the groups had to have 1 or fewer adults of unknown sex (Table 3).

In 2000, adults constituted 58.7% of the population; immatures 38.7%, and 2.6% of the individuals could not be placed in either category (Table 3). In terms of the sex

Table 3: Age-sex composition of the population in 2000

Group Name	# of Adult Males (mean)	# of Adult Females (mean)	# of Unsexed Adults (mean)	# of Immatures (mean)	# of Unknown Individuals (mean)	AM:AF Ratio	AF:IM Ratio
F3	3.5	4	1	4	0	1:1.14	1:1
B7	2.5	4.5	1	3	1	1:1.8	1:0.67
B10	1	3	0	4	0	1:3	1:1.33
B11	5	11	0	15	0	1:2.2	1:1.36
B14	2.5	4	1	3	1	1:1.6	1:0.75
Total	14.5	26.5	3	29	2		
% of the Population	58.7%	38.7%	2.6%				

Table 4: Age-sex comparison between years

	% of the Population = Adult / Subadult	% of Adult / Subadult Population = Male	% of the Adult / Subadult Population = Female	Average ratio of AM:AF	% of the Population =Immature	Average ratio of AF:IM
1991	67	—	—	—	32	—
1997	64	22	78	1: 3.54	35	1: 0.69
2000	58.7	33	60.2	1: 1.95	38.7	1: 1.02

ratio, the adult sex ratio is biased towards females in 4 of the 5 groups and is even in one group (Table 3). The ratio of adult females to immatures ranges from 1 AF : 0.67 IM to 1 AF : 1:36 IM (Table 3).

(4) Age-Sex Composition Comparison Between Years

The adult age composition of the BFMS population is relatively similar over time (Table 4). In 1991, Fargey found that 67% of the population was made up of adults and subadults and in 1997 Kankam found 64% were adults and subadults. Our results indicate that 58.7% of the population was adult/ subadult in 2000. Our adult sex ratios are different from Kankam, however. In 1997, 22% of the adult/ subadult population was male and 78% was female, whereas our results show 33% and 60.2% of the population were male and female respectively in 2000 (6.8% of the adult population could not be sexed in 2000). Fargey does not identify the sexes.

The proportion of the population that is immature (juveniles and infants) is similar over time. In 1991, 32% of the population was immature vs. 35% in 1997 and 38.7% in 2000.

The Response to Gunshots

Twenty-five gunshots were heard on 19 out of 48 observation days (n=40% of days). In only 24 shots was the study group visible. Of these 24 shots, the only reactions were 2 brief glances (\approx 3 seconds) in the direction of the gunshots. Both cases were in the smaller study group (B1) on different days by two different adult females. In both cases no other group members responded to the gunshots. In the one case where the study group was not visible during the gunshot, the Campbells' monkeys that were visible responded to the gunshot with loud alarm calls.

DISCUSSION

The Population Increase of the Ursine Colobus

Between 1991 and 2000, the population of Ursine colobus at the BFMS increased 56%. There has been an increase in the total number of individuals (128 to 200) and the number of groups at BFMS (8 to 14). We suggest this increase has oc-

curred mainly due to the intrinsic growth of the population at BFMS, as well as to the emigration of male black-and-white colobus from the surrounding area into BFMS.

We suggest that there has been intrinsic growth at BFMS due to the high proportion of immatures in the population in 1991, 1997 and 2000. In all of these censuses, the immature population has consistently been 1/3 or greater of the population. A large proportion of immatures in the population is an indicator that the population overall is reproductively healthy [Richard, 1985]. Between 1997 and 2000, the ratio of immatures to females has also increased suggesting a healthy fertility rate.

It is also likely that limited movement of individuals from the surrounding forest fragments into BFMS may be occurring. We describe these fragments below and give more information about the status of their populations of black-and-white colobus. The increase in the proportion of adult males in the BFMS adult population between 1997 and 2000 may represent such age-sex specific migration to BFMS. From 1997 to 2000 the average sex ratio of adult males to females has increased, as has the proportion of adult males in the population. It is possible that males are immigrating from outside BFMS due to its greater number of females, increased food supply, and greater protection. This phenomenon has been observed among capuchin monkeys in Santa Rosa National Park, Costa Rica (Fedigan et al. 1996; Fedigan & Jack, 2001). Fedigan and colleagues suggest protected areas may differentially attract the dispers-



Figure 4: At Boabeng-Fiema humans, goats and monkeys (*Cercopithecus campbelli* in this instance) are often in close proximity. Photo by S. Marteinson.

ing sex—predominantly males in the case of the black-and-white colobus. Male emigration from the surrounding forests may explain the presence of an all-male group in the study area 10 months after the start of the study—they were not noticed before this time in the census or daily observations suggesting they may have emigrated from or at least ranged in the surrounding forests. Thus a proportion of the population increase we observed between years may be due to male immigration.

Overall, however, we suggest it is unlikely that the majority of the population increase at BFMS is due to emigration from monkeys from these forest fragments or from further away: (1) because of bushmeat hunting in areas outside of the sanctuary and the surrounding forest fragments and (2) because of the isolation of BFMS. Firstly, local villagers in the forests surrounding BFMS admit that until recently, monkeys that would have trespassed into the 5 surrounding villages would have been killed as bushmeat [Kankam, 1997; A. N' Dassah, pers. comm.]. Since the early 1990s, the villagers in these 5 communities, all of which lie within a 7 km radius of BFMS, have sought to expand the current 2 village sanctuary management committee (consisting of Boabeng and Fiema) to include their villages. Their motivation is the success of the tourism program at BFMS and their desire to also benefit from tourism revenue. The villagers are of the opinion that the recent populations of monkeys in their villages have dispersed from BFMS [Kankam, 1997; A. N' Dassah, pers. comm.]. Outside of this 7 km area there have been no reports of black-and-white colobus. In 1997, Kankam surveyed these areas and found populations of black-and-white colobus in 4 of the 5 villages. In three villages, Akrudwa Kuma, Akrudwa Panyin, and Bonte, the first black-and-white colobus to be seen in these villages in many years appeared around 1993 and 1994 [Kankam, 1997]. In the fourth village, Busunya, the villagers report the return of colobus in 1983, the first time the monkeys had been seen since the 1940s [Kankam, 1997]. TLS and PS also confirmed the presence of colobus groups in Busunya and Bonte in 2001 during a reconnaissance survey. The groups observed were adjacent to the villages and seemed habituated. Our guide indicated that the black-and-white colobus were no longer hunted in these areas, unlike the Campbells' monkeys that were conspicuously absent. In Busunya, a new hunting taboo seems to have developed against killing the black-and-white colobus. Several years ago a farmer from Busunya had shot a black-and-white colobus while it was crop-raiding. Forty days after the shooting, he was said to have had a vision of the monkey. In Akan culture, the 40th day after death is significant as a customary day of mourning [Sarpong, 1974; Opuku, 1978]. Reportedly, the vision was so disturbing to the farmer it caused the man to shoot himself. We were told the man's death was responsible for the new local taboo against killing the monkeys. In a visit to Akrudwa Kuma, our guide also told us the black-and-white colobus were not hunted in the hopes of one day turning the small forest into a tourist site. We plan to survey this area more thoroughly for black-and-white colobus in the near future.

Finally, BFMS is quite isolated. The sanctuary is isolated from other large forests (> 50 km [Beier et al., 2000] and smaller ones outside of the 7 km radius described above. This makes travel for a preferentially hunted species like the Ursine colobus

difficult, and we suggest that bridging the gap between forests outside the protected area and BFMS is unlikely. In agreement with Kankam [1997], we argue that black-and-white colobus from BFMS are mainly dispersing into the surrounding forests where they are newly protected, and are not migrating in from other areas, although this remains to be confirmed.

Obedience to the Hunting Ban at BFMS

In the literature, there is a pervasive assumption that local obedience to the hunting ban at BFMS has protected the colobus population [Dorm-Adzobu et al., 1991; Fargey, 1991, 1992; Colding & Folke, 1997; Ntiamoa-Baidu, 1987, 1995, 2001]. The evidence for this hunting restraint has mainly come from interviews with the local population and oral histories. For example, Fargey [1991] reported that 99.4% of the 320 villagers interviewed responded that they did not kill monkeys at BFMS. Of the villagers that said ‘no’, 90% said the taboo on the monkeys stopped them, tellingly only 8% said the law against killing the monkeys stopped them. Fargey [1991] also asked the villagers, “Would you kill and eat the monkeys if there was no taboo?”—75% said ‘yes’. Of those people that said ‘yes’, 99% said they would kill the monkeys for bushmeat. These results suggest the desire to for bushmeat is present among the villages; however the hunting taboo seems to make them reluctant to kill the monkeys.

These results, however, do need to be taken with caution as some villagers would not likely admit to hunting that they know is illegal. Our approach was to collect data on the black-and-white colobus’ responses to gunshots as a way to assess the hunting threat on the monkeys. The results of this study suggest the black-and-white colobus are rarely hunted at BFMS. Their lack of response to close gunshots suggests the monkeys are not wary of the gunshots because they are not hunted. At Tai National Park in Côte d’Ivoire, Diana monkeys (*Cercopithecus diana*) that are hunted by humans respond by becoming temporarily cryptic [Zuberbuhler et al., 1997; Bshary, 2001] and adjust their behavior to different human hunting strategies [Bshary, 2001]. Playback experiments of Diana monkeys at Tai, found that groups living in poached areas responded to human imitations of eagle and duiker distress calls (which hunters use to detect the monkeys) with ‘human predator reactions’ (i.e. behaving cryptically) whereas Diana monkeys that did not live in poached areas responded by giving the ‘correct’ responses—the typical alarm calls and male approaches given to calls from actual eagles and duikers [Bshary, 2001]. Bshary [2001] suggests the high selective pressures in the poached areas have forced the monkeys to properly discriminate within a very short period of time (the past two decades) whereas monkeys in the non-poached areas have not learnt to do so because it has not been necessary. We suggest a similar situation might be occurring at BFMS—the black-and-white colobus do not respond warily to gunshots because they do not associate gunshots with human hunting. The Campbell’s monkeys, on the other hand, may still be wary of hunters, as indicated by the alarm call response we observed to one gunshot. Their wary response, although not the cryptic response given by the Diana monkeys at Tai,

may be indicative of the higher hunting threat they face in this area. Anecdotal information from the Wildlife Office at Boabeng-Fiema suggests the Campbell's monkeys are more frequently hunted than the black-and-white colobus and it is known they were hunted for the local bushmeat trade in the early 1990s [Fargey, 1991; Kankam, 1997].

It is possible that some hunting of black-and-white colobus is occurring at BFMS, especially at the more peripheral areas of the sanctuary. Of our two study groups, one ranged mainly in the forest next to the village, the second ranged further away from the village, about half way between the village and the sanctuary boundary. Perhaps these groups were more habituated to humans than groups further away or were under reduced hunting threat. The only way to get a really comprehensive assessment of the hunting threat at BFMS would have been to compare our study groups' responses to more peripheral groups at BFMS, and to other populations that are known to be hunted in Ghana. This was outside the scope of this project, but it remains a future research interest.

Reasons for the Current Success of the Hunting Ban

We suggest adherence to the hunting ban at Boabeng-Fiema is in part motivated by the increase in monkey-based tourism to the site. Over the last decade, yearly tourism to Boabeng-Fiema has been steadily increasing, from 100 - 150 tourists in early 1990s [Fargey, 1992] to 5000 in 2001 (Boabeng-Fiema Wildlife Division Office). The money generated from entrance fees and accommodation at the guesthouse run by sanctuary's management goes to community projects and the elders of both villages. In 2001, money from tourism was spent on several student scholarships, the purchase of electricity poles, road grating, bore hole repairs, the performance of traditional ceremonies and the construction of pit latrines, as reported in a July 2001, Boabeng-Fiema Management Committee newsletter. Local businesses, such as kiosk owners, taxi drivers, and local craftspeople benefit from increased revenue generated by tourists; as well local people are hired by grove management for positions of tour guide, guesthouse caretaker, night watchman, and as occasional day laborers.

The presence of the Wildlife Division is also instrumental to the monkeys' protection. Although we can only report anecdotally on their importance, there seems to be a general consensus among the villagers that the Wildlife Officers are necessary to mediate Management Committee decisions about the sanctuary and act as a necessary outside check on illegal activities. TLS was frequently told that the presence of the Wildlife Division was an effective check on poaching and timber extraction that would be difficult to regulate if left to the villages alone. Several villagers said they would find it difficult to report law-breakers to authorities because of family and community ties.

The adherence to the hunting ban is also likely motivated by the generally positive attitude the villagers have to the monkeys. In his 1991 interviews, Fargey [1991] found that 71.9% of the respondents felt that the monkeys were an important part of their cultural heritage. Over 90% of the people interviewed said they found the mon-

keys 'enjoyable to watch', and 80.9% said they would feel 'sad' if they monkeys were to leave [Fargey, 1991]. It is important to note that these interviews were done before tourism at the site had generated revenue for the communities, and would seem to indicate a genuine appreciation for the monkeys. A supportive public attitude towards protected areas is an important, if little understood, component of their success [e.g. Mehta and Kellert, 1998; Gillingham & Lee, 1999; Struhsaker, 2002]. At BFMS, the tolerated close proximity of humans and monkeys also alludes to this supportive attitude. The colobus at BFMS are frequently seen in the village, and move around unharrassed. Many times local adults and children can be seen watching the monkeys play and travel. This contrasts to most other areas of Ghana where black-and-white colobus would be more valued as bushmeat.

The (Lack of) Protected Status of the Forest at BFMS

Unfortunately, the same level of protection given to the monkeys at Boabeng-Fiema is not given to the surrounding forest. Only trees within the 1.92 km² sanctuary are protected at the local level—the Management Committee prohibits the cutting of large trees within this area (the cutting of 'dead' trees is allowed), but this ban is not enforced by district or national law. Therefore trees outside the 1.92 km² area are not protected at any level. This lack of protection allowed for a swath of forest 3 km in length and 10 m in width, adjacent to the core grove, to be felled in May 2001 to make way for the installation of electricity poles to the villages of Boabeng and Fiema. The decision to cut the trees by the youth and elders of the two villages was done in response to a proposal by the Wildlife Division to seek outside funding for an underground electricity system that would have minimized tree cutting and electrocution risks for the monkeys. The communities were concerned, however, that this proposal might have delayed or prevented the villages from receiving electricity [Densu, 2001]. In an effort to prevent the proposal from being pursued, the communities cut a swath of trees in the area proposed for the overhead electricity system, thus ending the debate.

The forest is also not adequately protected from bush fires [Kankam, 1997; TLS, pers. obs.]. Bush fires are deliberately set by farmers and hunters during the dry season to clear farmland and hunt grasscutters. This is despite a prohibition against unsanctioned fires outlined in the 1974 bylaw. During the 2001 dry season, TLS observed two large fires burning adjacent to the grove and one that burned in the grove at Fiema. The fire at Fiema required the efforts of the Ghana Fire Service to extinguish it.

In general, Fargey [1991] suggests the people of Boabeng and Fiema attach more importance to the protection of the monkeys than the protection of the forest. It is not that the villagers do not value the forest—in fact, they list many benefits associated with the forest, such as supplying spring water, beekeeping, fuelwood, increasing the probability of an early rain, preventing bushfire, gathering medicinal plants, hunting bushmeat and providing a windbreak [Fargey, 1991]. However, they also think that the forest is big enough, especially when the land is needed for other uses. When



Figure 5: A large *Bombax buonopozense* tree (left) and a *Ficus ottonifolia* (right) along one of the trails in the sanctuary. Both species are important food sources for the black and white colobus. . Photos by T.Saj



Figure 6: Seasonality contrasts at Boabeng-Fiema. July 2002 wet season and January 2001 dry season. . Photos by T.Saj.

Fargey [1991] asked if the protected forest at Boabeng-Fiema should be increased, 58.4% of the people said 'no'. Most people who said 'no', said so because they felt that the land bordering the sacred grove was needed for farming. We observed a glimpse of this land use conflict during the course of the study when a small reforestation project was returned to farmland. The BFMS Management Committee started the project on an unused piece of farmland adjacent to the sacred grove; however, during the course of the planting, the land was reallocated to the family of a fetish priest and is now a yam farm.

This lack of forest protection is likely to become a significant problem for the monkeys as their population continues to expand into an area of increasing human density. In 1990, Fargey noted the degradation of the forest by the haphazard way the village of Fiema had expanded between 1968 and 1990, as well as the addition of garbage pits and latrines in the core area of the grove [Fargey, 1991]. Both villages have doubled in size in terms of number of households between 1968 and 1990. The sanctuary is also surrounded by farmland at many of its boundaries. Other studies have shown that the greater the proximity between farm and forest, the greater the likelihood of crop-raiding [Naughton-Treves, 1998; Hill, 2000; Saj et al., 2001]. From our records, we know that crop-raiding in these adjacent farms occur, mainly by *Cercoptes campbelli* and to a lesser extent by the black-and-white colobus. From May to August 2001, we observed the black-and-white colobus feeding on yam leaves at least 3 times on adjacent farms. It is well known from other studies that crop-raiding monkeys quickly become pests that are hard to eradicate, which escalates the conflict between humans and primates [e.g. Strum, 1987; Else, 1991].

SUMMARY

The increase in the population size of the Ursine colobus at Boabeng-Fiema is a reflection of the protection strides made since the 1970s. A population that was once threatened by over-hunting less than 30 years ago is now expanding. Unfortunately, the same protection given to the monkeys is not given to the forest. The two most important habitat-related threats at Boabeng-Fiema are the small size of the grove that is being encroached upon by farmland, bushfires and timber extraction, and the high human population density in the area. These human pressures will likely be a direct threat to the long-term sustainability of the colobus population in this area. Hunting seems to be less of a threat to the monkeys in this area, however, as was seen in the 1970s, if hunting was to resume again, the monkey population would be in danger of local extirpation.

Protection efforts need to be refocused on ensuring the long-term health of the forest. This is a difficult issue: the villagers are appreciative of the financial benefits generated from monkey-based tourism, but they are also eager for more farmland. However, if the unused farmland in this area is not used for reforestation, or the major extractive uses of the forest are not better managed, the forest at BFMS is at risk of becoming completely isolated or even disappearing. Although black-and-white colobus are known to survive in very small forest fragments, their success in these

fragments is somewhat deceptive as such fragments are usually at greater risk of disappearing due to their unprotected status [Chapman et al., 2002]. The upper limits of *C. vellerosus*' behavioral and dietary flexibility are unknown; however, such pressures will undoubtedly put more strain on an already vulnerable species [IUCN, 2003] and put at risk the progress made in protecting these monkeys up to this point.

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REFERENCES

- Asibey EOA. 1972. Ghana's progress. *Oryx* 11: 470-475.
- Asibey EOA. 1974. Wildlife as a source of protein in Africa south of the Sahara. *Biological Conservation* 6: 32-39.
- Asibey EOA. 1978. Primate conservation in Ghana. In Chivers DJ and Lane-Petter W, editors. *Recent Advances In Primatology. Vol.2: Conservation*. New York: Academic Press. p 55-74
- Bakaar MI, da Fonseca GAB, Mittermeier RA, Rylands AB, Painemilla KW, editors. 2001. *Hunting And Bushmeat Utilization In The African Rainforest: Perspectives Toward A Blueprint For Conservation Action*. Washington, DC: Conservation International, Center for Applied Biodiversity Science.
- Beier P, van Drielen M, Kankam BO. 2002. Avifaunal collapse in West African forest fragments. *Conservation Biology* 16: 1097-1111.
- Booth AH. 1979. The distribution of primates in the Gold Coast. In Sussman R, editor. *Primate Ecology: Problem Oriented Field Studies*. New York: John Wiley & Sons. p 139-153

- Bowen-Jones E. 1997-1998. A review of the commercial bushmeat trade with emphasis on Central/West Africa and the great apes. *African Primates* 3 (1-2): S1-S37.
- Bshary R. 2001. Diana monkeys, *Cercopithecus diana*, adjust their anti-predator response behavior to human hunting strategies. *Behavioral Ecology And Sociobiology* 50(3): 251-256.
- Chapman CA, Lawes MJ, Naughton-Treves L, Gillespie TR. 2002. Primate survival in community-owned forest fragments: Are metapopulation models useful amidst intensive use? In Marsh LK editor. *Primates In Fragments: Ecology And Conservation*. New York: Kluwer Academic/ Plenum Publishers. p
- Colding J, Folke C. 1997. The relations among threatened species, their protection, and taboos. *Conservation Ecology*. www.consecol.org. 1(1): Article 6.
- Cowlishaw G. 1999. Predicting pattern of decline of African primate diversity: an extinction debt from historical deforestation. *Conservation Biology* 13(5): 1183-1193.
- Densu KAK. 2001. Tourism and monkeys can go to hell. *The Dispatch* (Ghana). July 23.
- Dorm-Abzobu C, Ampadu-Agyei, Veit PG. 1991. *Religious Beliefs And Environmental Protection: The Malshegu Sacred Grove In Northern Ghana*. Nairobi and Washington: Acts Press and World Resources Institute.
- Else JG. 1991. Nonhuman primates as pests. In Box HO Editor. *Primate Responses to Environmental Change*. London: Chapman & Hall, pp. 115-165.
- Fargey PJ. 1991. *Assessment Of The Conservation Status Of The Boabeng-Fiema Monkey Sanctuary: Final Report To The Flora And Fauna Preservation Society*. University of Science and Technology, Kumasi, Ghana.
- Fargey PJ. 1992. Boabeng-Fiema monkey sanctuary—an example of traditional conservation in Ghana. *Oryx* 26: 151-56.
- Fedigan LM, Jack K. 2001. Neotropical primates in regenerating Costa Rican dry forest: a comparison of howler and capuchin population patterns. *International Journal Of Primatology* 22(5): 689-713.
- Fedigan LM, Rose LM, Avila RM. 1996. See how they grow: tracking capuchin monkey (*Cebus capucinus*) populations in a regenerating Costa Rican dry forest. In Norconk MA, Rosenberger AL, Garber PA, editors. *Adaptive Radiations Of Neotropical Primates*. New York: Plenum Press. p 289-307
- Fisher F, Gross M, Kunz B. 1999-2000. *Primates of the Comoé National Park, Ivory Coast*. *African Primates* 4: 10-15.
- Gillingham S, Lee PC. 1999. The impact of wildlife-related benefits on the conservation attitudes of local people around the Selous Game Reserve, Tanzania. *Environmental Conservation* 26(3): 218-228.
- Grubb P, Jones TS, Davies AG, Edberg E, Starin ED, Hill JE. 1998. *Mammals Of Ghana, Sierra Leone And The Gambia*. Great Britain: Tendrine Press.

- Hall JB, Swaine MD. 1981. Distribution And Ecology Of Vascular Plants In A Tropical Rain Forest: Forest Vegetation In Ghana. The Hague: Junk.
- Happold DCD. 1987. The Mammals Of Nigeria. Oxford: Clarendon Press.
- Hawthorne W. 1990. Field Guide To The Forest Trees Of Ghana. Natural Resources Institute, Overseas Development Agency.
- Hill CM. 2000. Conflict of interest between people and baboons: crop raiding in Uganda. *International Journal Of Primatology* 21(2): 299-315.
- Hrdy SB. 1977. The Langurs Of Abu: Female And Male Strategies Of Reproduction. Cambridge: Harvard University Press.
- Inoussa TM, Nobimé G. 1997. Genre De Vie Des Colobes Blancs Et Noirs De Kikélé Et Des Primates De La Forêt Classée De Pénessoulou (Sous-Préfecture De Bassila Nord-Bénin), Rapport #1. Unpublished manuscript. Laboratoire d'Ecologie Appliquées, Faculté des Sciences Agronomiques, Université Nationale du Bénin.
- IUCN. 2002. IUCN Red List Of Threatened Species. www.redlist.org. Downloaded on 31, March 2003.
- Jarman P, Smith AP, Southwell C. 1996. Complete Counts. In . Wilson DE, Cole FR, Nichols JD, Rudran R , and Foster MS. editors. *Measuring And Monitoring Biological Diversity*. Washington and London: Smithsonian Institution Press. p 192-193
- Kankam OB. 1997. The Population Of Black-And-White Colobus (*Colobus polykomos*) And The Mona Monkeys (*Cercopithecus mona*) At The Boabeng-Fiema Monkey Sanctuary And Surrounding Villages. BA Thesis: University of Science and Technology, Kumasi, Ghana.
- de Klemm C, Lausche B. 1987. African Wildlife Laws. IUCN Environmental Policy And Law Occasional Paper No.3. Gland-Switzerland: IUCN Environmental Law Centre.
- McGraw WS, Monah IT, Abedi-Lartey M. 1997-1998. Survey of endangered primates in the forest reserves in Côte d'Ivoire. *African Primates* 3: 22-25.
- Martin C. 1991. *The Rainforests Of West Africa*. Basel: Birkhauser Verlag.
- Martin C, Aisbey EOA. 1979. Effect of timber exploitation on primate population densities and distribution in the Bia rainforest of Ghana. Paper Presented At The VIIth Congress Of The International Primatological Society, Bangalore, India.
- Mehta JN, Kellert SR. 1998. Local attitudes toward community-based conservation policy and programmes in Nepal: a case study in the Makalu-Barun Conservation Area. *Environmental Conservation* 25(4): 320-333.
- Naughton-Treves L. 1998. Predicting patterns of crop damage by wildlife around Kibale National Park, Uganda. *Conservation Biology* 12(1): 156-158.
- Ntiamoa-Baidu Y. 1987. West African wildlife: a resource in jeopardy. *Unasylva* 39: 27-35.

- Ntiamoa-Baidu Y. 1995. Issues In African Biodiversity, No.1. Indigenous vs. Introduced Biodiversity Conservation Strategies: The Case Of Protected Area Systems In Ghana. African Biodiversity Series.
- Ntiamoa-Baidu Y. 1998. WILDLIFE DEVELOPMENT PLAN VOLUME 6: SUSTAINABLE HARVESTING, PRODUCTION AND USE OF BUSHMEAT. Protected Area Management and Wildlife Conservation Project. Ghana Wildlife Division, Accra.
- Ntiamoa-Baidu Y. 2001. Indigenous versus introduced biodiversity conservation strategies: the case of protected area systems in Ghana. In Weber W, White LJT, Vedder A, and Naughton-Treves L, editors. African Rain Forest Ecology And Conservation. New Haven: Yale University Press. p 385-394
- Oates JF. 1977. The social life of a black-and-white colobus monkey (*Colobus guereza*). *Zeitschrift Für Tierpsychologie* 45: 1-60.
- Oates JF. 1992. Habitat alteration, hunting and the conservation of folivorous primates in African forests. *Australian Journal Of Ecology*. 21(1): 1-9.
- Oates JF. 1999. Myth And Reality In The Rain Forest: How Conservation Strategies Are Failing In West Africa. Berkeley: University of California Press.
- Oates JF, Abedi-Lartey M, McGraw WS, Struhsaker TT, Whitesides GH. 2000. Extinction of a West African red colobus monkey. *Conservation Biology* 14: 1526-1632.
- Oates JF, Davies AG. 1994. Conclusions: the past, present and future of the colobines. In Davies AG and Oates JF, editors. *Colobine Monkeys: Their Ecology, Behaviour And Evolution*. Great Britain: Cambridge University Press. p 347-358
- Onderdonk DA, Chapman CA. 2000. Coping with forest fragmentation: the primates of Kibale National Park, Uganda. *International Journal of Primatology* 21: 587-611.
- Opoku K. 1978. West African Traditional. FEP International Private Ltd: Singapore.
- Rajpurohit LS, Mohnot SM. 1988. Fate of ousted male residents on one-male bisexual troops of Hanuman langurs (*Presbytis entellus*) at Jodhpur, Rajasthan, India. *Human Evolution* 3(4): 309-318.
- Richard A. 1985. *Primates In Nature*. New York: W.H. Freeman and Company.
- Saj TL, Sicotte P. 2002. Male invasion and female transfer in the Geoffroy's pied colobus (*Colobus vellerosus*). [Abstract]. *Caring for Primates*. Abstracts of the XIXth Congress of the International Primatological Society. Beijing: Mammalogical Society of China. p 214
- Saj TL, Sicotte P, Paterson JD. 2001. The conflict between vervet monkeys and farmers at the forest edge in Entebbe, Uganda. *African Journal of Ecology* 39(2): 195-199.
- Sarpong P. 1974. *Ghana in Retrospect*. Ghana Publishing Corporation: Accra-Tema.

- Sinsin B, Assogbadjo A, Van den Akker M, Van den Akker E. 2002. Inventaire et Stratégie de Conservation de la Faune Sauvage dans La Forêt Marécageuse de Lokoli (Sous-Préfecture de Zogbodomey). Unpublished report. Laboratoire d'Ecologie appliquée, Faculté des Sciences Agronomique, Université d'Abomey-Calavi, Bénin.
- Skorupa JP. 1986. Responses of rainforest primates to selective logging in Kibale forest, Uganda: a summary report. In Benirschke K, editor. *Primates: The Road To Self Sustaining Populations*. New York: Springer-Verlag. p 57-70
- Steenbeek R. 1999. Tenure related changes in wild Thomas' langurs I: between-group interactions. *Behaviour* 136(5): 596-625.
- Struhsaker TT. 1997. *Ecology of an African Rain Forest: Logging in Kibale and the Conflict Between Conservation and Exploitation*. Gainesville: University Press of Florida.
- Struhsaker TT. 1975. *The Red Colobus Monkey*. Chicago: University of Chicago Press.
- Struhsaker TT. 2002. Guidelines for Biological Monitoring and Research in Africa's Rain Forest Protected Areas. Unpublished manuscript. A Report to the Centre for Applied Biodiversity Science, Conservation International.
- Struhsaker TT, Oates JF. 1995. The biodiversity crisis in southwestern Ghana. *African Primates* 1(1): 5-6.
- Strum S. 1987. *Almost Human: A Journey into the World of Baboons*. New York: W.W. Norton.
- Watts DP. 1994. The influence of male mating tactics on habitat use in mountain gorillas (*Gorilla gorilla beringei*). *Primates* 35(1): 35-47.
- World Bank, 1993 *Ecologically Sensitive Sites In Africa*. Volume IV: West Africa. Washington, DC: The World Bank.

Tania Saj received her MA in 1999 under the supervision of James Paterson and Pascale Sicotte working on the diet and habitat use of crop-raiding vervets in Entebbe, Uganda. Her Ph.D., under the supervision of Pascale Sicotte, focuses on the socioecology of *C. vellerosus*. She also works on the conservation potential and ecological role of sacred groves in West Africa. Her research has been supported by NSERC and Killam doctoral fellowships.

Julie Teichroeb received her MA in 2002 under the supervision of James Paterson, working on the feeding ecology, ranging behaviour, and activity budget of *Colobus vellerosus* in Ghana. She is currently working on her doctorate degree at the University of Calgary, under the supervision of Pascale Sicotte. Her dissertation will focus

on the roles of infanticide risk and food competition in constraining group sizes in *C. vellerosus*. Her work is supported by an NSERC doctoral fellowship.

Pascale Sicotte received her PhD in 1993 from the Université de Montréal in Canada, under the supervision of Bernard Chapais. Her research focuses on the social dynamics of primates, particularly male reproductive competition and female mate choice. Most of her field work has been at the Karisoke Research Center (Rwanda), and she has published on these research themes out of her work on the mountain gorillas. She was Director of the Karisoke Research Center in 1993-1994 and held a position as Assistant Professor at McMaster University (Canada) in 1995. Since 1996, she has been with the department of Anthropology at the University of Calgary (Canada), where she currently is Associate Professor. She currently conducts research on *Colobus vellerosus* in Ghana.