Population Census of White-thighed Colobus Monkey *(Colobus vellerosus)* at the Boabeng Fiema Monkey Sanctuary

MBZ Project title and Number; Local Community Actions to Safeguard Critically Endangered White- thighed Colobus Monkey at the Boabeng Fiema Monkey Sanctuary (**202516022)**

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Summary

In Boabeng-Fiema Monkey Sanctuary (BFMS) and surrounding communities, the critically endangered *Colobus vellerosus* population has increased over the years. This survey assessed 1) the current colobus population and the habitat use, 2) the possibility of enhancing the capacity of field guards to conduct independent systematic surveys to monitor the population trend, and 3) mapping of the vegetation occupied by *C. vellerosus* in the surrounding fragments. A complete count was used to census the colobus population. Results show that colobus population in BFMS (the core forest) have increased by 78 individuals from the previous census in 2007 (from 275 to 353 individuals). The colobus population in the surrounding communities also increased by 5 individuals (from 91 to 96 individuals), a reduction by 5 from the 2007 census. The total population of colobus in BFMS and surrounding communities (smaller fragments) was 449 individuals. There were 25 colobus groups in BFMS and 8 groups in surrounding communities totaling 33 groups. The colobus population densities for BFMS and small fragments were approximately 236 ind/ km^2 and 43 ind/ km^2 respectively.

Research Assistants were trained to further train others (Training of Trainers) to assist in conducting independent systematic surveys to monitor and document *C. vellerosus* populations and movement within the catchment area. The boundaries of the forest fragments followed those defined and proposed by the elders and chiefs of the communities. In conclusion, the population of *C. vellerosus* in BFMS and surrounding communities has the potential to increase even further if the protection of the monkeys are sustained and habitat destruction well managed with the primate conservation in mind.

1.0 Introduction

The Boabeng-Fiema Monkey Sanctuary is located in the Nkoranza North Region (formally Brong-Ahafo Region). The Monkey Sanctuary is a habitat for two monkey species, the critically endangered White-thighed colobus (*Colobus vellerosus*) and a Vulnerable Lowe's monkeys (*Cercopithecus campbelli lowei*). These monkeys are protected and revered as "children of the gods" by historic cultural beliefs. Over many generations, a harmonious relationship has existed between the indigenous people and the monkeys such that dead monkeys are buried with elaborate rituals akin to those of humans. Current evidence suggests, monkeys within this area traverse the forests of seven other communities in addition to the Boabeng and Fiema communities.

The population of *Colobus vellerosus* at Boabeng-Fiema Monkey Sanctuary (BFMS) is possibly the only growing population in its range from Côte D'Ivoire, Ghana, Togo, Bénin and Nigeria in West Africa (Saj and Sicotte, 2012). The monkey population live in fragmented habitats (Kankam, 1997; Saj et al*.,* 2005) and has increased over the years (Kankam et al., 2010) from 127 individuals in 1990 (Fargey, 1992) to 163 individuals in 1997 (Kankam, 1997). Furthermore, it increased from 200 individuals in 2005 (Saj *et al.,* 2005) to 275 individuals in 2010 (Kankam and Sicotte, 2013). However, the population trend in the surrounding communities have not been stable (Kankam and Sicotte, 2013). Monitoring the colobus population is critical to understand the population dynamics of *C. vellerosus* at the Boabeng-Fiema Monkey Sanctuary and surrounding forest fragments.

1.1 Aim and Objectives

The aim of the research was to examine if the population of *C. vellerosus* has increased, decreased or remained stable in Boabeng-Fiema Monkey Sanctuary and surrounding forest fragments.

Specific objectives were: 1) assess and document the extent of habitat use by *Colobus vellerosus* in BFMS, 2) enhance the capacity of field guards to conduct independent systematic surveys to monitor and document *C. vellerosus* populations and movement within the catchment area, and 3) map the vegetation occupied by *Colobus vellerosus* in the surrounding fragments.

NB: *This is a component under the main MBZ study "Local Community Actions to Safeguard Critically Endangered White- thighed Colobus Monkey at the Boabeng Fiema Monkey Sanctuary* (**202516022**)"

1.2 Study Site

The Boabeng-Fiema Monkey Sanctuary (BMFS) (7º 43' N, 1º 42' W) is a 192-ha area within a 4.5 km sqaure sacred grove, situated around the twin villages Boabeng and Fiema in the Nkoranza North District (Wong & Sicotte, 2007) (Figure 1). The area lies within southern rain forest-dry northern grassland transition zone with mean annual temperature and rainfall of 26 degree Celsius and 1,250 mm, respectively (Fargey, 1991). The sanctuary is home to the endangered White-thighed colobus (*Colobus vellerosus*), which is endemic to Upper Guinean Forest and Lowe's monkeys (*Cercopithecus campbelli lowei*) (Figure 2a & 2b), some 375 butterfly species (Larsen et al., 2009). The vegetation comprises a mosaic of original forest, degraded forest, woodland and savannah. Majority of inhabitants are Christians but there are also sizeable populations of traditionalists and Muslims. Ownership and management of the Sanctuary are vested in the traditional authorities with the Wildlife Division playing supervisory and advisory roles, making the BFMS a model blend of novel traditional African wildlife conservation with classical in situ conservation (Fargey, 1991). The sanctuary is surrounded by nine communities that have pockets of forests which contain small populations of *C. vellerosus* (e.g., Konkrompe, Bonte, Bomini, Busunya, Akrudwa Kuma, Akrudwa Panyin, Senya, Kwaase, Tankor; *see* Figure 1) (Kankam, 1997; Wong and Sicotte, 2006; Kankam and Sicotte, 2013).

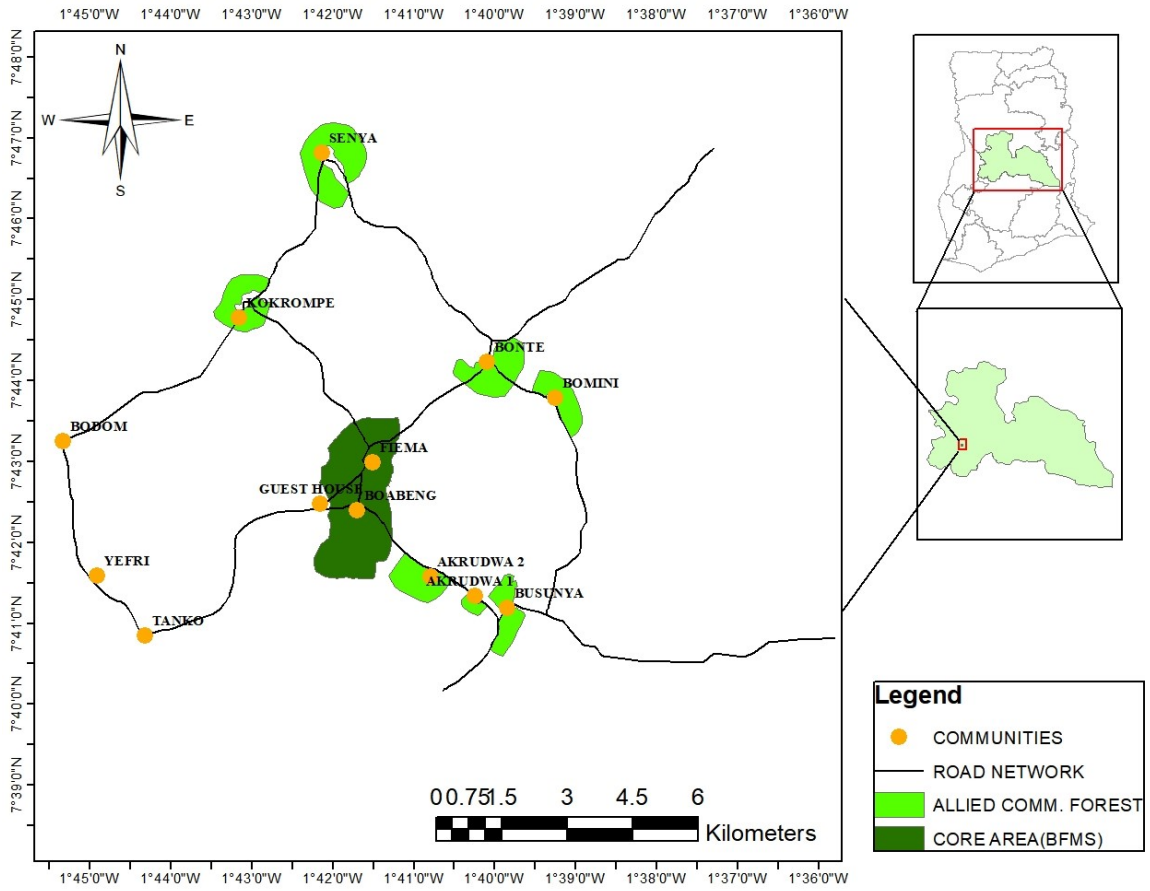

Figure 1. Map of Boabeng-Fiema and surrounding communities.

Figure 2a. White-thighed colobus (*Colobus vellerosus*)

Figure 2b. Lowe's monkeys (*Cercopithecus campbelli lowei*)

1.3 Protocol

Firstly, permission was sought from nine chiefs and two traditional priests in the study area to work in their locality (as tradition demands in Ghana). At the meeting with the chiefs, the purpose of the census was explained to them after which two bottles of schnapps and cash donations presented (equivalent US$ 200) for each community.

2.0 Methodology

2.1.1 Survey and Census

The research assistants have knowledge of the groups and the home ranges of the monkeys within the communities where they are present. A complete count (Jarman, 1996; Kankam and Sicotte, 2013) was used to census the *Colobus vellerosus* at the BFMS. Prior to the counting of monkeys in each community, the group(s) of monkeys and the distribution in the associated fragments were identified by the trained research assistants. This exercise was very important to identify all groups and where they could possibly be found. Transects (number of transects: Boabeng=30; Fiema=10; Konkrompe=10; Bonte=5; Bomini=5; Busunya=10; Akrudwa Kuma=7; Akrudwa Panyin=5) of variable lengths were then placed in all fragments depending on the size of the fragments, the number of colobus groups present in each fragment and how dense the vegetation was in order to gain access to various parts of the fragments (Kankam, 1997). Two transects each were placed in Kwaase, Tankor, and Senya communities. The length of transects was averaged 50 m (range: 20-100 m); transects were placed in such that it avoided intersecting any other transect. Distance between any two transects were at least 20 m. Existing trails, footpaths and roads were also walked on to count the monkeys (Kankam, 1997; Kankam et al., 2010). Some of the transects were straight, others were in a loop form (Kankam, 1997). The census was conducted in three days.

The census period was from 07:00 to 11:00 because the monkeys were active at this time. The census team remain with a group for 4 hours to find as many individuals as possible to record (Kankam and Sicotte, 2013) for 3 days. All monkeys in the different fragments were censured at the same day and at the same time (from 07:00 to 11:00 hrs) to avoid counting twice any migratory/dispersal individuals or groups. In addition to these two people also scout each fragment during the same period to look for individuals and any other group that were not identified due to monkeys inactive or failing to spot them.

For each census, the number of individuals in the group (Table 1), sex and age class and group locations were recorded. The presence or absence of colobus groups in the fragments was recorded. Age class was categorized according to Wong and Sicotte (2006).

2.1.2 Training

Twelve research assistants from the communities were trained to be involved in counting of the monkeys to enhance the capacity of field guards to conduct independent systematic surveys to monitor and document *C. vellerosus* populations and movement within the catchment area. The research assistants (RAs) were taught how to use the binoculars, classify and census *Colobus vellerosus* in fragment forests. They were also taught how to tally counts against the different age class categories (i.e., adults which includes sub-adults, immature and infants). Furthermore, they were trained on how to avoid repeated counts or a rush in conducting the census. The training was important for consistency and accuracy in conducting the census.

2.1.3 Communities Boundaries and Satellite Image Information

Each community has a forest associated with it. The boundaries of the forest fragments were mapped with Global Positioning System (GPS: Garmin 60SC). The elders and chiefs of the selected communities elected community members who had knowledge of the proposed boundaries to accompany tracker to take the GPS points of the areas. The GPS waypoints were downloaded with a Garmin MapSoure software, and the data points were used to generate satellite data on land cover and fragment connectivity.

2.2 Data Analyses

The age class of the colobus was categorized into adults (this group includes sub-adults), immature and infants (Wong and Sicotte, 2006; Kankam and Sicotte, 2013). The number of individuals in each fragment, divided by the size of each fragment was used to calculate the colobus population density in each community (Kankam and Sicotte, 2013). The percentage change in colobus population was calculated by the formulae (New population – Old population)/Old population multiplied by 100%.

3.0 Results

3.1 Extent of Habitat Use: Population Status in BFMS and Surrounding Forest Fragments

The population of colobus in Boabeng and Fiema communities (BFMS) was 353, whereas that of the surrounding communities (smaller fragments) was 96 (Table 1). The total population of colobus in BFMS and surrounding communities (smaller fragments) was 449 individuals. There were 25 colobus groups in BFMS and 8 groups in surrounding communities totaling 33 groups (Table 1). The colobus population densities for BFMS and small fragments were approximately 236 ind/ km^2 and 43 ind/ km^2 respectively.

Table 1— The number of *Colobus vellerosus* in BFMS and surrounding fragments in 2020

	Community	Age sex composition				# Monkeys	# Groups
		Adult Female	Adult Male	Immature	Infants		
BFMS	Boabeng	93	30	91	52	266	19
	Fiema	29	8	33	17	87	6
	Total	***122***	***40***	***124***	***69***	***353***	***25***
Surrounding Fragments	Konkrompe	5	1	6	2	14	1
	Bonte	6	2	4	2	14	1
	Bomini	5	1	3	3	12	1
	Busunya	12	3	8	5	28	2
	Akrudwa Kuma	8	2	4	3	17	2
	Akrudwa Panyin	4	1	4	2	11	1
	Total	***40***	***10***	***29***	***17***	***96***	***8***
Total: BFMS & Fragments.		162	50	153	86	449	33

There was a population increase in BFMS by 78 individuals from the previous census in 2007 (from 275) to (353 individuals) in 2020. Similarly, there has been an increase in population in the surrounding communities by 5 individuals (Table 2).

Table 2—Population Trends of *C. vellerosus* in BFMS and surrounding fragments between 1990 and 2020. Numbers of monkey groups are shown in brackets.

Fragment	Total # of Individuals					
	Census: 1990[a]	Census: 1997[b]	Census: 2000[c]	Census: 2003[d]	Census: 2007[e]	Census: 2020*
Akrudwa Kuma	-	6 (1)	-	16 (1)	17 (2)	17 (2)
Bonte	-	15 (1)	-	17 (1)	24 (2)	14 (1)
Akrudwa Panyin	-	0 (0)	-	0 (0)	0 (0)	11 (1)
Busunya	-	45 (2)	-	27 (4)	24 (3)	28 (2)
Konkrompe	-	0 (0)	-	0 (0)	22 (2)	14 (1)
Bomini	-	0 (0)	-	0 (0)	4 (1)	12 (1)
BFMS	127 (8)	163 (10)	200 (14)	220 (15)	275 (19)	353 (25)

Source: Fargey 1992 [a], Kankam 1997 [b], Saj *et al.* 2005 [c], Wong & Sicotte 2006 [d], Kankam et al. 2010 [e], This census*
-: Census was conducted only in BFMS,

The percentage change in colobus population in BFMS from 2007 to 2020 (13 years) is 28%; whereas that of the surrounding communities increased by 5%. However, the percentage change in BFMS (Boabeng and Fiema only) from the first census in 1990 to current survey in 2020 is 178%. Between 1990 and 2020, even a higher percentage change of 254% is recorded when the population of the surrounding communities is added to that of Boabeng and Fiema communities (BFMS). The percentage change in colobus population from 2007 to 2020 in Akrudwa Panyin (>100), Busunya (17%), and Bomini (200%) communities were positive respectively; however, that for Bonte (-42%) and Konkrompe (-36%) were negative (Table 3). The percentage change in colobus population in Akrudwa Kuma was stable and unchanged.

Table 3—Population changes between census years in BFM and surrounding communities

Community	Census				% change (1990-2000)	% change (2007-2020)
	1990[a]	2000[b]	2007[c]	2020*		
Boabeng -Fiema	127	200	275	353	254	28
Total	***127***	***200***	***275***	***353***		
Konkrompe	-	-	17	17	-	0
Bonte	-	-	24	14	-	-42
Bomini	-	-	0	11	-	>100
Busunya	-	-	24	28	-	17
Akrudwa Kuma	-	-	22	14	-	-36
Akrudwa Panyin	-	-	4	12	-	200
Total	***-***	***-***	***91***	***96***	-	***5.5***

Source: Fargey 1992 [a], Saj *et al.* 2005 [b], Kankam et al. 2010 [c], This census (2020) *
-: Census was conducted only in BFMS

4.0 Discussion

Current Population Status

Colobus vellerosus in BFMS continues to explore other surrounding communities as their population also continues to increase over the years. The communities are connected together mostly by single canopy tree cover, which is secondary re-growths due to poor agricultural practices. The ability of colobus to survive in small fragments, and use diverse tree as their diet (Kankam and Sicotte, 2013) when food resources become scarce in their habitat could partially explain why *C. vellerosus* population is consistently increasing, especially in BFMS. The gradual increase of colobus population may also be due to increasing protection within the core area of the sanctuary and high reproductive rates (Fernandez-Duque *et al*., 2001). The proportion of the number of immature to adults as well as the number of infants to adult females suggest that reproductive rate is high in both BFMS and surrounding communities. However, the inconsistent population increase and sometimes a decrease in the surrounding communities may partially be due to natural mortality in the population and wildfire (Kankam B. O. *pers. observation*). The low increase in colobus population in the surrounding communities could be due to smaller size of the fragments and continuous loss of forest through anthropogenic activities. It is likely that more colobus groups have relocated to unknown areas outside the sanctuary because species in fragmented habitat may usually break into smaller association group sizes to effectively utilize the food resources available in the habitat (Marsh *et al*., 1987; Tutin, 1999).

Enhancing the Capacity of Field Guards

Two Research Assistants (Robert Koranteng and Charles Kodom) who were trainees were further trained by Dr. Bright Kankam (a primatologist) to become trainers (Training of Trainers). They will intend train other people and build their capacity to assist in conducting independent systematic surveys to monitor and document *C. vellerosus* populations and movement within the catchment area.

Mapping the vegetation occupied by C. vellerosus in the surrounding fragments.

The boundaries of the forest fragments followed that of Kankam (2010) and as proposed by the elders and chiefs of the communities. The defined boundaries of the forest fragments may change as deem necessary by the chiefs and elders of the communities. Only BFMS has some of the boundary pillars in place; most of the pillars are either removed or missing. The BFMS sanctuary is surrounded by at nine communities that have pockets of forests. The communities and the size of the fragments are–Konkrompe [38.9 ha/0.389 Km^2], Bonte [33.5 ha /0.335 Km^2], Bomini [30.6 ha /0.306 Km^2], Busunya [54.1 ha/ 0.541

Km^2], Akrudwa Kuma [34.2 ha /0.342 Km^2], Akrudwa Panyin [3.2 ha/ 0.032 Km^2], Tankor [6.8 ha /0.068 Km^2] (Kankam and Sicotte, 2013). These small surrounding fragments are within the radius of 15 Km from BFMS (Kankam and Sicotte, 2013).

4.1.1 Conclusion and way forward

In conclusion, the population of *Colobus vellerosus* in BFMS and surrounding communities has the potential to increase even further if the protection of the monkeys in continued, and habitat destruction through farming activities and settlement expansion are managed. If the condition of the fragments improves in terms of food diversity and density, the forest composition and forest structure will also be enhanced to sustain the increasing population of the monkeys in future and protection. Future research areas in BFMS and surrounding communities should include –wildfire effect on primates; practice of climate smart agriculture; control of invasive species (e.g., *Leucaena leucocephala*) in the fragments, and monitoring of the primate population trend. As an interim solution to facilitate continuous population monitoring, a basic data management structure has been created through this project. Going forward, the project team is considering employing molecular techniques to monitor population of threatened primates in this landscape. While we believe this can provide accurate estimates over time, the added advantage of using same techniques to monitor primate health especially understanding the epidemiology of parasites in the landscape and present a novel platform to forge partnerships to promote such research, attract long term research and partnerships that may potentially transform income for the sanctuary and rural communities in the landscape.

5.0. References

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