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Front Cover: Adult female Roloway monkey (*Cercopithecus diana roloway)* at the Endangered Primate Breeding Centre (EPBC), Accra Zoo & Wildlife Sanctuary, Ghana. Photo by Janette Wallis
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Survey of Threatened Monkeys in the Iladyi River Valley Region, Southeastern Bioko Island, Equatorial Guinea

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Abstract: Bioko Island, Equatorial Guinea, is home to a diverse assemblage of anthropoid primates, making it one of the most important places in Africa for primate conservation. The only threat to the persistence of these primates on Bioko is illegal bushmeat hunting. Since October 1997, the rate of primate carcasses in the central market in the capital, Malabo, has increased significantly, with over 41,000 primates recorded through December 2012. However, the relationship between market dynamics and the status of wild populations is poorly documented and difficult to quantify. This is due, in part, to a lack of island-wide survey data, which detracts from the accuracy of both the population and range estimates of Bioko's monkey species. For instance, the range of the Critically Endangered, endemic Pennant's red colobus (*Procolobus pennantii*) is currently divided into what are believed to be two isolated populations: a core range in the southwest corner of Bioko, and an unconfirmed population in the Iladyi River valley (IRV) to the southeast. This study investigated the presence of *P. pennantii* in the IRV region and assessed the status of remaining monkey populations. We also evaluated temporal changes in the relative abundance and proportional representation of monkey species in the IRV region relative to surveys conducted in the same region in 2007. Although not proving its absence, we found no evidence of *P. pennantii* in the region, suggesting that the Iladyi population may be extirpated. Each of the other five monkey species known to these habitats were encountered, though primate abundance in the IRV region decreased since 2007, concurrent to an increase in hunting in the region. Our results suggest that the primate community may also be undergoing a compensatory shift towards smaller-bodied monkeys (*Cercopithecus* spp.), as larger species like *P. pennantii* are being hunted out. Effective enforcement of existing legislation to achieve a decrease in hunting is critical to the long term future of the primates of Bioko.

Key words: Africa, primate, bushmeat hunting, Bioko Island, Equatorial Guinea, shotgun, conservation

INTRODUCTION

Bioko Island, Equatorial Guinea (Figure 1) is among the highest priority sites in Africa for the conservation of primates (Oates 1996). The island is home to seven species of diurnal primates [drill (*Mandrillus leucophaeus poensis*), black colobus (*Colobus satanas satanas*), Pennant's red colobus (*Procolobus pennantii*), red-eared monkey (*Cercopithecus erythrotis erythrotis*), crowned monkey (*Cercopithecus pogonias pogonias*), putty-nosed monkey (*Cercopithecus nictitans martini*), and Preuss's monkey (*Allochrocebus preussi insularis*)], all of which are threatened with extinction as either species and/or subspecies (IUCN 2012). This diversity notwithstanding, illegal hunting of primates, which represents the primary threat to these species, has increased dramatically over time, with primates comprising approximately 20% of the total bushmeat sold in Malabo, the capital of Equatorial Guinea (Albrechtsen *et al.* 2007; Morra *et al.* 2009; Cronin *et al.* 2010).

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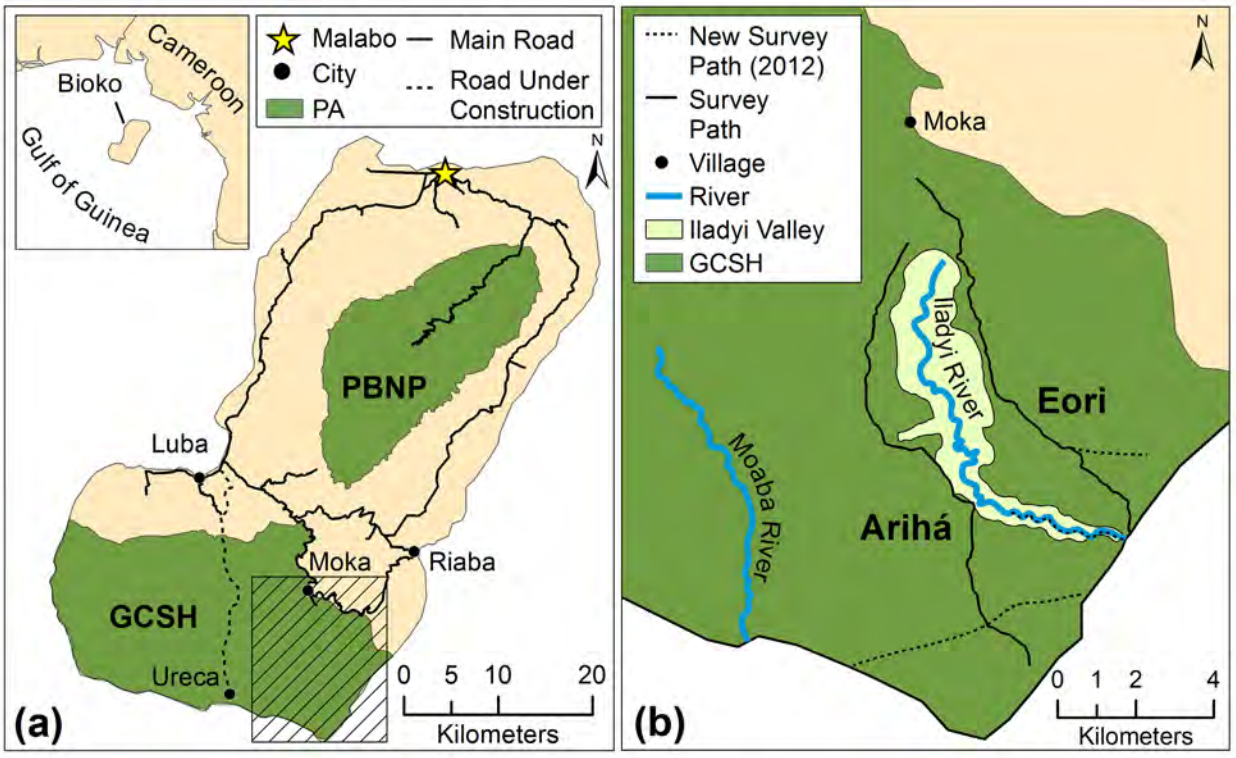

Figure 1: (a) Bioko Island, Equatorial Guinea, showing the major cities and roads on Bioko, as well as both protected areas (PA): Pico Basilé National Park (PBNP), and the Gran Caldera-Southern Highlands Scientific Reserve (GCSH). Ureca, the only village within the GCSH is also shown. The hash marked area depicts the location of the study area in southeastern Bioko. (b) The study area is shown with survey paths used, in both 2007 and 2012, to assess primate abundance and hunting pressure.

The relationship between market data and wild populations on Bioko is poorly documented, as there have been relatively few island-wide primate surveys since Butynski & Koster's (1994) extensive 1986 survey. Much of the work has been restricted to the remote Gran Caldera de Luba in the southwest sector of the island (Figure 1a); consequently, detailed primate distributions, like that of the critically endangered Pennant's red colobus (*Procolobus pennantii*), a species endemic to Bioko, remain approximations (Groves 2007). The core range of *P. pennantii* is estimated to be entirely within the Gran Caldera and Southern Highlands Scientific Reserve (GCSH), with relative abundance highest (up 0.5 groups/km) (Cronin, unpublished data) in the immediate vicinity of the Gran Caldera de Luba to the southwest (Butynski & Koster 1994). A second, unconfirmed, allopatric population is believed to exist within the Iladyi River valley (IRV) in the southeast sector of the GCSH (Figure 1b) (Cronin *et al.* 2010; Oates 2011; IUCN 2012). Despite there being suitable habitat, numerous surveys have not resulted in any evidence of present-day connectivity between the two populations, supporting a hypothesis for allopatry if the second IRV population were to exist (Cronin, unpublished data). Nevertheless, the existence of the second population remains uncertain, as no surveys have been conducted in the immediate area of the IRV to confirm the presence of *P. pennantii*.

To address this dearth of information, in October 2012, we conducted a rapid assessment of primate abundance in the southeast sector of the GCSH (Figure 1b). The main objective of this survey was to confirm the presence of *P. pennantii* in the IRV. In addition, this study also aimed to: (1) document the presence and/or absence of primate species, (2) evaluate the geographic range for the primates, (3) assess the current status of the primates, and (4) quantify temporal changes of primate sighting frequencies by comparing results to surveys conducted in the same region in 2007 (Nowak & Rioso Etingue 2007).

METHODS

Study Area

Bioko Island (2,017 km^2) is a volcanic, continental island in the Gulf of Guinea island chain located 37 km off the coast of Cameroon. The GCSH makes up the entire southern sector of Bioko (510 km^2), encompassing a range of habitat types (monsoon forest, lowland forest, montane forest, Schefflera (Araliaceae) forest, and cultivation) and elevations that rise from sea level to two peaks, the Gran Caldera de Luba (2,261 m) in the west and Pico Biao (2,009 m) in the east, in less than 15 km (Butynski & Koster 1994). Human populations are

concentrated along the northern border of the GCSH (e.g., Moka, Riaba), and, with the exception of Ureca (< 80 individuals), the GCSH holds no permanent human settlement and has been largely protected from exploitation apart from hunting.

Data Collection

During October 2012, surveys of primate populations were conducted in the southeastern sector of the GCSH (Figure 1b). Primate surveys were conducted along established multiuse footpaths first described by Colell *et al.* (1994), the majority of which were comparable to those surveyed by Nowak and Rioso Etingue (2007). Reconnaissance, or "recce", walk methodology was used for all surveys, rather than straight line transects, which typically involve the creation of additional hunting paths. With recces, the researcher follows the path of least resistance through the forest (e.g., footpaths), cutting only what is necessary to maintain a general compass heading (Walsh & White 1999; Linder 2008). In this way, both the surveyed area and number of animals detected can be increased by allowing greater distances to be covered in an equivalent period of time (Walsh & White 1999; Linder 2008). Recce paths were located either on the northern (Eori) or southern (Arihá) ridge above the Iladyi River. We also conducted surveys opportunistically along the Iladyi River valley floor and across Punta Santiago (Figure 1b). A total distance of 36.17 km was surveyed (Eori-11.30 km; Iladyi River-5.00 km; Arihá-19.87 km). Surveys averaged 3.29 km in length (range: 1.03-6.20 km), and were walked between 7:00 and 16:00 h at a rate of 1.06 km/hr. The length of each survey varied relative not only to the difficulty of terrain and the presence and status of preexisting trails, but also to the presence of a useable water source, as the survey team changed camps daily.

All primate survey data were collected according to a methodology established by Schaaf *et al.* (1990). Due to dense vegetation, heavy hunting pressure, and a lack of habituation to human presence, which make detecting individuals exceptionally difficult, group counts are used to estimate primate abundance (Whitesides *et al.* 1988; Butynski & Koster 1994). We collected the following data for each primate encounter: time of encounter, location (GPS coordinates), elevation, species observed, number of individuals sighted, sex of individuals, estimated distance from the observer to the first individual sighted, sighting angle between the transect line and the observer-to-animal line, estimated group height in trees, polyspecific association (if within 50 m of another primate species), vocalization type, method of detection, and response of individuals to human presence. To quantify hunting pressure, all signs of hunting observed along each of the survey transects were recorded. Direct evidence of hunting included spent shotgun shells, discarded batteries, hunting camps, carcasses, and snares (Linder 2008). All survey data were collected via a Cybertracker (v3.248) data collection system developed for use on Bioko (Steventon 2002).

Data Analysis

Survey data for all primates were converted to sighting frequencies, calculated as the number of social groups (including solitary individuals) sighted per kilometer walked (Marshall *et al.* 2008). Sighting frequencies provide a measure of relative density and were used because of problems associated (e.g., violation of key assumptions) with absolute density calculations resulting from difficulties in detecting hunted primates in dense forest (Fashing & Cords 2000; Thomas *et al.* 2010; Linder & Oates 2011). Acoustic primate encounters are reported below, but were excluded from temporal analyses, as accurately identifying primate vocalizations becomes difficult at distances over 50 m or along deep ravines, and call frequency and volume differ between species (Linder & Oates 2011; Cronin, pers. obs.). Additionally, previous surveys conducted in the region did not report any acoustic encounters (Nowak & Rioso Etingue 2007). As a proxy for the relative intensity of hunting pressure along each transect, all observations of hunting signs were converted to a hunting sign encounter rate. Each individual sign was treated as a separate encounter (Linder & Oates 2011).

In addition to reporting the current status of both primate populations and hunting pressure in the southeastern sector of Bioko, we also quantified temporal changes of primate sighting frequencies in the region. We compared sighting frequencies from our study to those conducted in the same areas and along many of the same footpaths in 2007 (Nowak & Rioso Etingue 2007). In order to circumvent problems inherent in a direct comparison (small sample size; lack of replication; non-identical transects), we grouped all surveys conducted north of the Iladyi River as the "Eori" region and all those south of the river as the "Arihá" region. This arrangement follows the general demarcation of Moka area hunting zones, B and C respectively, in Colell *et al.* (1994). Surveys conducted along the Iladyi River itself were not included in the comparison. In order to gauge variability among transects, surveys within each "region" were then portioned into 2 km sections, providing a unit of replication, with each section treated as a "survey transect." A survey length of two kilometers was chosen because we believe this distance represents a length likely to encompass more than local effects, but not so long that it includes the entire surveyed transect. Sighting frequencies for both 2007 and 2012 were then calculated for each region (Eori and Arihá).

Significant differences in sighting frequencies of primates were determined using Wilcoxon-Mann-

Table 1. Overall primate group encounters from all survey regions in the 2012 survey. Sighting Frequency considers only visual identifications, while Encounter Rate includes both visual and acoustic encounters.

Scientific Name	Primate Encounter Data				
	Visual	Acoustic	Total Encounters	Sighting Freq. (grps/km)	Encounter Rate (grps/km)
Eori Region					
Cercopithecus nictitans	4	0	4	0.35	0.35
C. erythrotis	3	2	5	0.27	0.44
C. pogonias	1	6	7	0.09	0.62
Sciurocheirus alleni	1	0	1	0.09	0.09
Region Totals	9	8	17	0.80	1.50
Iladyi River					
C. erythrotis	2	2	4	0.40	0.80
C. pogonias	1	0	1	0.20	0.20
Region Totals	3	2	5	0.60	1.00
Arihá Region					
C. erythrotis	11	4	15	0.55	0.75
C. pogonias	8	7	15	0.40	0.75
Mandrillus leucophaeus	1	2	3	0.05	0.15
Colobus satanas	1	0	1	0.05	0.05
C. nictitans	1	1	2	0.05	0.10
S. alleni	1	0	1	0.05	0.05
Cercopithecus sp.*	1	0	1	0.05	0.05
Region Totals	24	14	38	1.21	1.91
Overall Totals	36	24	60	1.00	1.66

**Cercopithecus* sp. were positively identified to genus, but species identifications were not possible.

Whitney (WMW) tests. Tests were run two ways, using a default WMW test employing a continuity correction, and a permutation-based WMW using the "coin" package; both methods gave similar results (Hothorn *et al.* 2008). We present significance values of the default WMW, as it is slightly more conservative given the small sample size and the high frequency of zero counts. All statistical analyses were conducted using R (v2.14.2; R Core Development Team 2012).

RESULTS

Primate Abundance

Primate groups were encountered a total of 60 times resulting in an overall encounter rate of 1.66 groups/km. Visual identifications were confirmed for 36 encounters, resulting in a sighting frequency of 1.00 groups/km, while 24 groups were identified solely by vocalizations. The most commonly sighted monkey overall was *C. erythrotis* (0.44 groups/km), followed by *C. pogonias* (0.28 groups/km), *C. nictitans* (0.14 groups/km), *M. leucophaeus* (0.03 groups/km), *S. alleni* (0.06 groups/km), and *C. satanas* (0.03 groups/km). We encountered no signs of either *P. pennantii* or *A. preussi* during the survey, though it should be noted that the majority of surveys (95%) took place at lower elevations (< 1,000 m), where *A. preussi* is less likely to be found (Butynski & Koster 1994). Four (11%) visual encounters were with polyspecific associations, however, all polyspecific associations included *C. erythrotis* (11% of all *C. erythrotis encounters*): 3 with *C. pogonias* (30% of all *C. pogonias encounters*); 1 with *C. satanas* (100% of all *C. satanas* encounters).

When both visual and acoustic encounters are considered, *C. erythrotis* and *C. pogonias* represented the majority of encounters in each of the three regions (Table 1). In the Eori region, however, *C. nictitans* were sighted at the highest frequency (0.35 groups/km), while *C. pogonias*, although heard often, were not seen as commonly as in other regions (Table 1). Both the overall

encounter rate (1.91 groups/km) and sighting frequency (1.21 groups/km) were higher for Arihá than for either Eori or the IRV. *C. erythrotis* (0.55 groups/km) and *C. pogonias* (0.40 groups/km) were sighted most often and made up 79% of all sightings (Table 1). The total number of primate species encountered was also higher in the Arihá region, as both *M. leucophaeus* and *C. satanas* were not encountered in Eori or the IRV. The IRV had the lowest encounter rate (1.00 groups/km) and sighting frequency (0.60 groups/km), but this number may be an underestimate due to the breadth of the valley floor (>50 m in parts) and loud ambient sound of the running river, which may have reduced our ability to detect primates. Only *C. erythrotis* and *C. pogonias* were encountered within the IRV.

Temporal Changes in Primate Abundance

There was a significant decrease in the overall primate sighting frequency from 2007 to 2012 in both the Arihá ($W=83.50$, $p<0.02$) and Eori ($W=27.50$, $p<0.03$) regions (Table 2). In Arihá, *C. pogonias* were sighted significantly less frequently ($W=74.00$, $p<0.04$) and represented fewer overall encounters. Sightings of *C. erythrotis* also declined ($W=73.00$, $p<0.05$), but accounted for a higher proportion of primate encounters. Relative to *C. satanas*, which increased in its proportional representation of primate encounters, both *C. nictitans* and *M. leucophaeus* accounted for fewer sightings. In Eori, both *C. erythrotis* ($W=27.00$, $p<0.03$) and *C. pogonias* ($W=25.00$, $p<0.05$) were sighted at significantly lower frequencies between years, accounting for 33% fewer overall primate group encounters; however, this decline was offset by a 27% increase in the proportion of *C. nictitans* encounters.

Hunting Activities

The number of hunting signs increased dramatically in Eori and Arihá since 2007 (Table 3). In Eori, the rate of gun hunting signs more than tripled, while in Arihá it more than doubled. This is largely due to very high numbers of spent shotgun cartridges, but there were also two hunting camps in Eori that were not present for the 2007 surveys. Encounter rates of snare hunting signs also increased in both regions, though not as steeply as signs of gun hunting (Table 3).

DISCUSSION

We encountered five of the seven diurnal primates present on Bioko in the study area; however, we did not encounter any evidence of a population of *P. pennantii*. Although this does not prove its absence, since we could not directly access a 7 km stretch of the Iladyi River (area < 10 km^2), we believe that it is unlikely a viable southeastern population of *P. pennantii* persists. Where they do occur on Bioko, *P. pennantii* are relatively easy to detect, since they move in large, noisy groups, and, in valleys similar to the IRV, can often be heard vocalizing over great distances (Schaaf *et al.* 1990; Butynski & Koster 1994; Struhsaker 2005). As these traits make *P. pennantii* relatively easy to hunt, one would expect a considerable number of carcasses to originate in the region, though Colell *et al.* (1994) only reported one individual taken by Moka hunters during their study. This suggests that by 1992 the southeastern population of *P. pennantii* was already at low density, and given the absence of *P. pennantii* from subsequent surveys in both 2007 and 2012, is now likely extirpated.

In our survey, the Arihá region had the highest primate species richness and relative abundance, likely due to its location south of the IRV, which presents a major barrier to access to the region from the north. There is a history of human habitation to the north and also a network of trails that provide ready access to the Eori forests from Riaba, a major city on the eastern side of Bioko with a direct highway to Malabo. In contrast, there is only a single roadside access to the Arihá region, located in the mountain village of Moka, almost twice the distance by road from Malabo than Riaba. Greater accessibility in the Eori region and higher signs of gun hunting support the conclusion that hunting is a driving factor in the decline in primate abundance in the region.

The declines in primate abundance observed in both Arihá and Eori between the Nowak and Rioso Etingue (2007) surveys and this study (2012) can be linked to hunting as well, as there have been no substantial habitat alterations in the survey areas (Cronin, pers. obs.). Furthermore, since 2007, there has been an increase in the number of carcasses for sale in the Malabo bushmeat market, with an average of over 15 primates/market day, and some months reaching as high as 39 primates/market day (Cronin *et al.* 2010; Cronin, unpublished data). Given the reduction in the abundance of vertebrate fauna in northern Bioko, the majority of bushmeat supplied to the Malabo market now originates in southern Bioko, so much of the increased hunting should be manifested within the GCSH (Fa 2000; Fa *et al.* 2000; Albrechtsen *et al.* 2007).

The absence of *P. pennantii* combined with the low densities of *M. leucophaeus* and *C. satanas*, and the high proportion of *Cercopithecus* spp., also suggest that this region may currently be undergoing an ecological shift in its primate community. P. pennantii and other larger-bodied species are particularly vulnerable to hunting and their loss or population decline is known to dramatically alter their ecosystems (Struhsaker 2005; Wilkie *et al.* 2011). As larger-bodied species were either absent or at low densities in our study, our observed species composition is likely to be reflective of historical hunting pressure, rather than natural distributions (Struhsaker

Table 2. Temporal change in sighting frequency of primate groups between surveys conducted in 2007 (Nowak & Rioso Etingue) and this study (2012). N is the number of group sightings. S.F. is the sighting frequency (groups/km surveyed). % represents the percent contribution of a species' encounters to the overall encounter total. Values in parentheses are standard errors. Values in italics are significant at $p < 0.05$.

Species	**Eori Region**								**Arihá Region**							
	2007			2012					2007			2012				
	N	S.F. (grps/km)	%	N	S.F. (grps/km)	%	W	p	N	S.F. (grps/km)	%	N	S.F. (grps/km)	%	W	p
Cercopithecus erythrotis	13	*1.30 (0.34)*	*56.5*	*3*	*0.25 (0.17)*	*33.3*	*27.00*	*0.03*	26	1.06 (0.15)	39.4	11	0.56 (0.18)	45.8	73.00	0.05
C. pogonias	5	0.50 (0.16)	21.7	1	0.08 (0.08)	11.1	25.00	0.05	26	*1.05 (0.27)*	*39.4*	*8*	*0.35 (0.14)*	*33.3*	*74.00*	*0.04*
C. nictitans	4	0.40 (0.19)	17.4	4	0.33 (0.17)	44.4	16.50	0.84	9	0.33 (0.16)	13.6	1	0.06 (0.06)	4.2	59.00	0.29
Mandrillus leucophaeus	1	0.10 (0.10)	4.3	0	0.00	0.0	18.00	0.36	4	0.16 (0.09)	6.1	1	0.04 (0.04)	4.2	55.50	0.44
*Cercopithecus sp.**	0	0.00	0.0	0	0.00	0.0	n/a	n/a	1	0.04 (0.04)	1.5	1	0.04 (0.04)	4.2	46.50	0.88
Colobus satanas	0	0.00	0.0	0	0.00	0.0	n/a	n/a	0	0.00	0.0	1	0.06 (0.06)	4.2	42.00	0.26
Procolobus pennantii	0	0.00	0.0	0	0.00	0.0	n/a	n/a	0	0.00	0.0	0	0.00	0.0	n/a	n/a
Allochrocebus insularis	0	0.00	0.0	0	0.00	0.0	n/a	n/a	0	0.00	0.0	0	0.00	0.0	n/a	n/a
Sciurocheirus alleni	0	0.00	0.0	1	0.13 (0.13)	11.1	12.50	0.47	0	0.00	0.0	1	0.05 (0.06)	4.2	42.00	0.26
Total	23	*2.30 (0.56)*		9	*0.79 (0.36)*		27.50	*0.025*	66	*2.63 (0.37)*		24	*1.17 (0.42)*		83.50	*0.024*

**Cercopithecus* sp. were positively identified to genus, but species identifications were not possible.

Table 3. Temporal change in hunting sign encounters between surveys conducted in 2007 (Nowak & Rioso Etingue) and this study (2012).

Hunting Sign Type	Survey Region			
	Eori Region		Ariha Region	
	2007	2012	2007	2012
Gun Hunting Signs				
Empty Cartridge	74	269	201	345
Batteries	-	10	-	16
Hunting Camp	-	2	1	1
Gun Shot	1	-	-	1
Carcasses	-	-	-	1
Totals	75	281	202	364
Snare Hunting Signs				
Snares	21	68	25	35
Animal Traps	-	1	-	1
Totals	21	69	25	36
Total Hunting Signs	96	350	227	400
Gun Sign Encounter Rates (km^{-1})	7.59	24.87	8.15	18.32
Snare Sign Encounter Rate (km^{-1})	2.13	6.11	1.01	1.81
Overall Hunting Sign Encounter Rate (km^{-1})	9.72	30.97	9.15	20.13

1999). The increase in the proportional representation of *C. nictitans* in the Eori region relative to decreased encounters of *C. erythrotis* and *C. pogonias* is similar to that in Korup National Park, Cameroon, where a reduction in the abundance of other species led to an increase of *C. nictitans* via competitive release (Linder & Oates 2011). Although larger than both *C. erythrotis* and *C. pogonias* (Butynski *et al.* 2009), *C. nictitans* is often more cryptic and encountered in smaller groups; as well as being more ecologically flexible, allowing for exploitation of a wide range of habitats and diets (Linder & Oates 2011; Cronin, pers. obs.).

These results, though only a microcosm of the situation on Bioko, illustrate an increasingly desperate situation. Conservation strategies, beginning with legitimate enforcement of existing legislation, could greatly improve the current status of Bioko's primates. An island-wide reduction of hunting is necessary, with a focus on government-supported conservation efforts (e.g., training of national staff, sensitization of government, police, and military personnel, and conservation education programs), especially within the GCSH and Pico Basilé National Park. Effective conservation and management of the two protected areas can still secure a future for the biodiversity of Bioko.

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Status of the Critically Endangered Roloway Monkey (*Cercopithecus diana roloway*) in Dadieso Forest Reserve, Ghana

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Abstract: The continuous decline of the Roloway monkey (*Cercopithecus diana roloway*) in many forests of Ghana and Cote d'Ivoire has caused conservationists and primatologists to add the species to the list of the world's 25 most endangered primates in peril. Surveys were conducted in Dadieso Forest Reserve (171 km^2), Ghana, to locate Roloway monkeys at sites where this species was reported to occur in the recent past. A total of 26 transects (131.6 km) were surveyed and 100 interviews were conducted in 2011. No Roloway monkeys or other diurnal primates were encountered during this survey. Indicators of hunting activities encountered were: 1.5 empty cartridges (SD=0.7, N=26) per km per transect and 2.8 wire snares (SD=2.6, N=26) per km per transect. Of the respondents interviewed, 72% had seen primates in the forest and 18% on the farmlands, five years ago. Specifically, 86% of the respondents had seen Roloway monkeys about 20 years ago but not recently, while 10% were not sure about the identity of the species and the remainder, 4%, had seen them less than five years ago. Hunting and farming were identified by 78% and 22% of the respondents, respectively, as the main reasons for not seeing the Roloway monkey recently. The following were the reactions of the respondents if the Roloway monkey were to go extinct: 52% would be sad, 36% would be disappointed, and 12% would not react. None of the respondents said they would be happy. These reactions indicate that the public is not interested in losing this species to extinction. Despite this, the Roloway monkey appears to be on the brink of being extirpated from Dadieso Forest Reserve if, indeed, it still occurs there. Recommendations for conservation action are provided.

Key words: Roloway monkey, Dadieso Forest Reserve, unlogged forest, hunting, Ghana, primates

INTRODUCTION

Primate conservation in Ghana has not been addressed, despite the presence of several restricted-range and Critically Endangered primates (Oates 2006). It has been suggested that one of these primates, Miss Waldron's red colobus monkey (*Procolobus badius waldroni*) might already be extinct (Oates *et al*. 2000) and that the extinction of other animals in the region will likely occur if more resources are not devoted to the rigorous protection of wildlife. Hunting and habitat destruction have been identified as the two major causes of primate loss in all their range states (Cowlishaw & Dunbar 2000; Drechner & Kpelle 2003; Gatti 2010) as forest fragmentation can lead to increased subsistence and commercial hunting (Fa *et al*. 1995). Whereas hunting kills the targeted animal directly (Cowlishaw & Dunbar 2000), habitat destruction does so indirectly (Ganzhorn *et al*. 1997).

The Roloway monkey (*Cercopithecus diana roloway*) inhabits the upper Guinea forests of West Africa and is now more seriously threatened with extinction. It was listed as among the world's 25 most endangered primates (2008-2010) (Mittermeier *et al*. 2009). Oates *et al.* (1996) reported that the Roloway monkey is one of the three endangered monkeys of the upper Guinea forest block and a target species of the bushmeat trade. Many primatologists have documented the continuous

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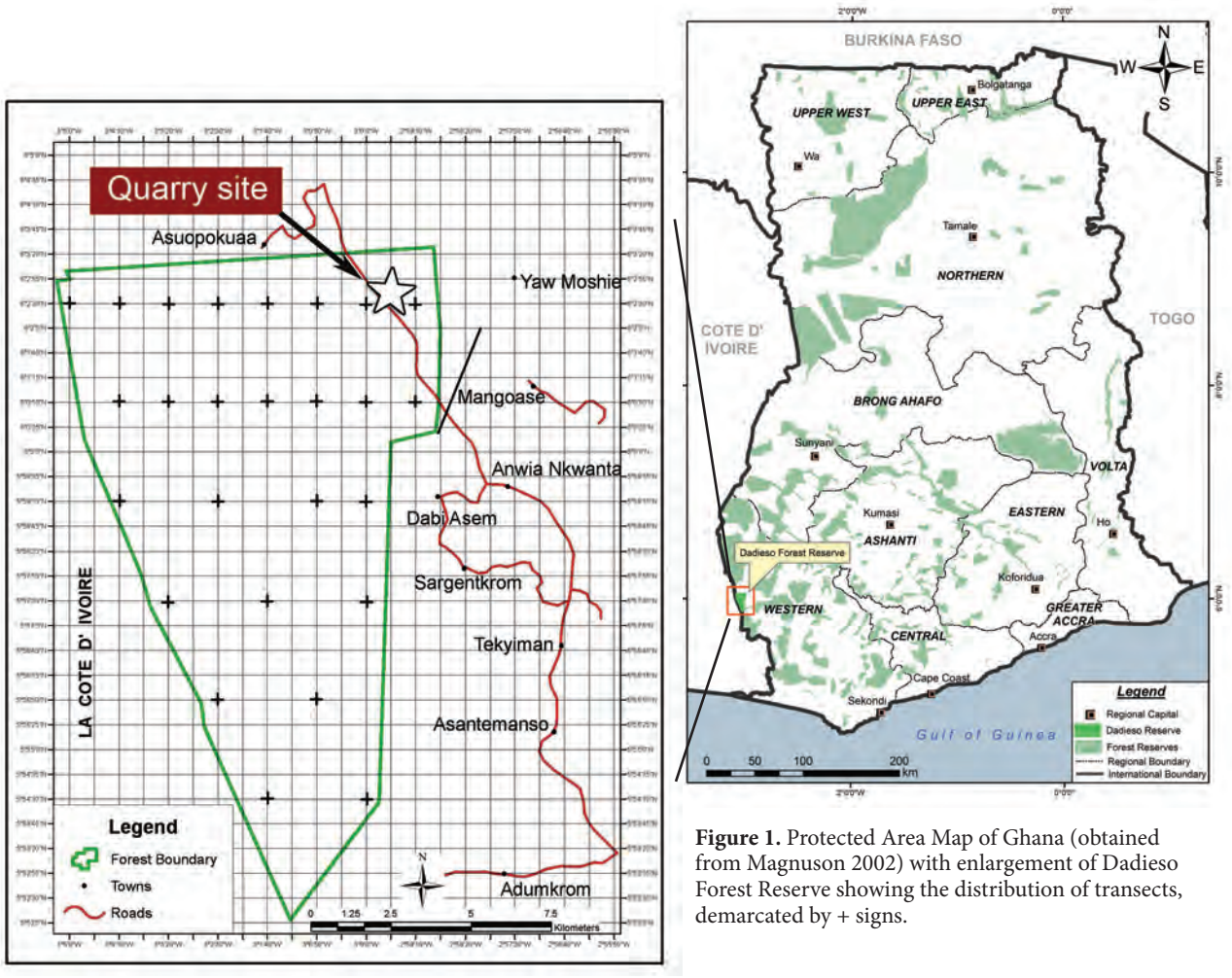

Figure 1. Protected Area Map of Ghana (obtained from Magnuson 2002) with enlargement of Dadieso Forest Reserve showing the distribution of transects, demarcated by + signs.

decline of the Roloway monkey in the forests of Ghana and Cote d'Ivoire (Struhsaker & Oates 1995; Oates *et al.* 1996; Abedi-Lartey 1998, 1999; Oates 2006). Magnuson (2002) also reported on the distribution and habitat use of the Roloway monkey and estimated the density at 0.04 groups/km^2 (non-transect survey) and 1.53 group/km^2 (on transect survey) in southwestern Ghana, after a survey conducted in 2001. Gatti (2010) recently expressed the fear of the Roloway monkey being faced with extinction as no confirmed sightings were made during his two-year primate survey in Ghana between 2008 and 2009. The species has been listed as Critically Endangered as the population is believed to have declined by more than 30% in the course of three generations mainly as a result of habitat loss and hunting (McGraw 1998; Oates *et al.* 2008).

Mittermeier *et al.* (2009) reported that the monkey had recently been found in the Dadieso Forest Reserve in the Enchi forest district of western Ghana. As a contribution to that report, a survey of the Roloway monkey was planned and carried out in Dadieso Forest Reserve. In particular, the survey was intended: to determine the abundance and distribution of the Roloway monkey, investigate activities that are likely to kill or capture Roloway monkeys and other primates, and examine ethno-biological knowledge about the status of Roloway monkeys in the Dadieso Forest Reserve.

MATERIALS AND METHODS

Study Area

The Dadieso Forest Reserve, designated as Dadieso Globally Significant Biodiversity Area (GSBA), is located in the Aowin-Suaman District of the Western Region of Ghana between 5°50' and 6°05' N, 3° 05' and 2° 55' W (Figure 1). The Dadieso Forest Reserve has a common point at its southern tip which coincides with the Ghana - La Cote d'Ivoire international boundary pillar 44 and Forest Reserve Boundary Pillar (FRBP 1) of Disue and Boin River Forest Reserves. It covers an area of 171 km^2 with a total perimeter of 77 km (Forestry Services Division 1999). This pristine forest was designated a forest reserve in 1977 and it is one of the least disturbed forests in Ghana today. From a total of 30 GSBAs and Important Bird Areas (IBA) in Ghana, the Dadieso Forest Reserve is

one of twelve reserves that have been designated as whole coverage GSBA/IBA (Forestry Services Division 1999) within the Moist-Wet Evergreen Forest vegetation zone of Ghana (Hall & Swaine 1981).

Originally, the reserve was designated for timber exploitation for 50 years but, following its reclassification as a GSBA, it has been placed under strict protection. Currently, there are no Timber Utilization Contract Areas (TUCAs) in the reserve but the collection of Non-Timber Forest Products (NTFPs) is allowed. The communities fringing the Dadieso GSBA possess the right to collect NTFPs such as rattan, bamboo, raffia palm, snails, chew-sticks and pestles for domestic use. A portion of the forest has been allocated recently for stone quarry operations (pers. obs.). The forest is stocked with economically important tree species such as Iroko (*Milicia excelsa*), Obeche (*Triplochito scleroxylon*), and Mahogany (*Khaya ivorensis*) and is botanically very unique in terms of floral richness and diversity. A 2001 study confirmed the presence of Roloway monkeys and white-naped mangabeys (*Cercocebus lunulatus*) in the reserve (Magnuson 2002).

Transect Survey

Line transects were established systematically throughout the study area. Grid squares of 0.75 km were super-imposed on the forest map and transects were set at every 1.5 km interval at intersects of the grid lines (Danquah 2007). A total of 26 transects of approximately 2 km each were set systematically throughout the study area (Figure 1). Some transects were longer than 2 km when a particular transect coincided with a hunter's path. Survey walks were conducted two times for each transect during the course of the study to search for Roloway monkeys and other monkey species. The first survey took place between August and September 2011 while the second survey was done in November and December, 2011. Transects were walked between 6:00 - 10:00 GMT and 15:00 - 18:00 GMT to represent morning and evening hours, respectively. To minimize bias, transects that were surveyed in the morning during the first survey were surveyed in the evening hours during the second survey. The team walked slowly at a speed of 0.5 to 1km/hr and at every 100m on the transect they stopped and scanned through the canopy layer of the vegetation for 15-20 minutes to search for primate species with the use of binoculars (Peres 1999). Information such as species name, the number of individuals in a group, location, habitat type, time and other associated animals were collected. All evidence of killing or capture of Roloway monkeys and other wildlife were recorded. To ascertain the general protection of the forest reserve, information such as the number of staff and general activities that can cause destruction to the forest and its components were investigated through observations and interviews.

Interviews

Semi-structured interviews were conducted on 100 adults who had stayed in the area for more than five years and were found in the farming and hunting business. The respondents were purposely selected from the communities fringing the forest reserve, i.e., located at 5 km away from the forest boundary. When the survey team entered a community, they met with leaders who assembled the inhabitants to inform them about their mission. The inhabitants then unanimously selected the hunters and others who have been associated with wild animals for interview. The aim was to investigate their perspective about the population of Roloway monkeys in the area. I gathered information on the following: the period of staying in the area, the last time of seeing monkeys in general and specifically Roloway monkeys, the specific area in which the monkeys were seen, reasons given for not seeing the species now, and what they would feel if the species is established to be extinct. Interviewees were also asked to freely name all the primates they knew, then all the primates they knew to occur in the area. They were then presented with photographs and pictures of primates and asked to name those they recognized, if they had seen them directly, and when was the last time. Some pictures of species not occurring in Ghana were also included as controls.

Data Analysis

The Kilometric Index of Abundance (KIA), which is the ratio of animal groups encountered to the distance covered (Peres 1999; Gatti 2010) could not be used to estimate the relative density of Roloway monkeys, since I did not encounter any. Instead, it was used to estimate the abundance of spent cartridges and snares encountered during the survey. The total number of indicators of hunting activities recorded during the two transect walks was divided by the total combined distance walked per transect for the two surveys to obtain the KIA for each transect. Thus, the total distance covered by each transect for the two surveys was used to estimate the severity of hunting based on the number of cartridges and snares encountered.

The software SPSS 16.0 version was used to analyze the statistical differences of views expressed by the respondents and the influence of certain factors in the presence or absence of the species.

RESULTS AND DISCUSSIONS

Census Efforts

In all, 26 transects were established and surveyed two times each, amounting to a total distance of 131.6 km and the mean distance of 5.1 (SD=1.6) km/transect surveyed. A total of 1236 scans (searches) were made in

Table 1. Distances covered, number of scans and observation hours used on each transect.

Transect No.	Distance	No. of Scans	Obs. Hours	Observation Hours/km
1	4.0	20	1.3	0.3
2	5.8	27	2.6	0.5
3	4.8	24	1.9	0.4
4	3.2	32	1.7	0.5
5	9.0	90	13.5	1.5
6	4.0	40	2.7	0.7
7	4.0	40	2.7	0.7
8	4.0	40	2.7	0.7
9	4.0	40	2.7	0.7
10	4.0	40	2.7	0.7
11	4.0	40	2.7	0.7
12	7.8	78	10.2	1.3
13	5.8	57	5.5	1.0
14	5.3	52	4.6	0.9
15	4.8	48	3.9	0.8
16	4.4	44	3.2	0.7
17	4.8	48	3.9	0.8
18	4.4	44	3.2	0.7
19	4.4	44	3.2	0.7
20	7.3	72	8.7	1.2
21	9.0	90	13.5	1.5
22	4.8	48	3.9	0.8
23	4.0	40	2.7	0.7
24	4.0	40	2.7	0.7
25	3.6	36	2.2	0.6
26	6.3	62	6.5	1.0
Total	131.6	1236	114.9	

the range of 15 to 20 minutes per scan search. Therefore, a total of 114.9 hrs (6892 minutes) were used to search for the Roloway monkeys at a mean rate of 0.8 (SD=0.3) hrs per km (48 minutes/km). Table 1 shows details of the time spent on individual transects.

Roloway Monkey Population

No diurnal primates were sighted nor calls heard during the census or in areas outside the transects, despite the fact that the Dadieso Forest Reserve has suffered little from logging. Since the transect survey failed to record a single Roloway individual or any other diurnal primate, it is likely that the situation of the Roloway monkey is worse than thought. On a few reconnaissance walks in the night, it was noted that nocturnal prosimians were present and relatively abundant in all sites. The crescendo calls of the galagos were heard regularly at night in all locations. The continued presence of nocturnal primates suggests that human diurnal activities are responsible for the decline of the Roloway monkey.

Among the 100 people interviewed from the communities fringing the forest reserve, 14% were female and 86% were male. The mean age of the respondents was 46.2 (SD = 14.6) years. They had stayed in the area for an average of 34.3 (SD = 12.8; range 13 to 60 years). The majority of the respondents (42%) were hunters who farm only for subsistence. Another 34% were farmers who did not hunt, and 18% of the respondents combine hunting and farming as their occupation. The remaining 6% were bushmeat dealers.

In general, 94% of the respondents confirmed that they had seen some primates while 6% denied seeing any primates in the area for the past five years. On picture identification, 73% of the interviewees identified the Roloway monkey correctly, 18% identified it as either black and white colobus (*Colobus vellerosus*), Lowe's monkey (*Cercopithecus campbelli lowei*), or spot-nosed monkey (*Cercopithecus petaurista petaurista*), 5% identified it as white-naped mangabey, and 4% identified it as another of the monkey species that does not occur in Ghana.

For the past five years, out of the 94% that had seen primates in the area, 72% had seen them in the forest and 18% on the farmlands. Regarding quantity, 66% of the respondents said they used to see many but now just a few while 34% stated that they used to see few about five years ago but now they do not see them anymore. The species of monkeys that the interviewees mentioned to have seen in the area are listed in Table 2.

Specifically concerning Roloway monkeys, 86% stated that about 20 years ago they used to see them with other monkey species but they do not see them anymore, while 10% were not sure about the identity of the monkey. Only 4% stated that they had seen the Roloway recently (about five years ago) and added that the number had reduced drastically. This suggests that they either no longer occur in the area or their numbers have been reduced to a very small population size.

When questioned about their likely reasons for not seeing the Roloway monkey recently, 78% of the respondents thought that hunting was the main cause and 22% attributed it to farming and its related activities. When asked about the probable existence of the Roloway monkeys in Dadieso Forest Reserve, 80% of the respondents did not think that they still occur there

Table 2. Number of respondents who have seen one or more the primates in and around the Dadieso Forest reserve.

Primate Species	Scientific Names	% of Respondents Who Reported Sighting
Lowe's monkey	*Cercopithecus campbelli lowei*	32.0
Roloway monkey	*Cercopithecus diana roloway*	14.0
Olive colobus monkey	*Procolobus verus*	6.0
Black and white colobus monkey	*Colobus vellerosus*	12.0
Eastern Spot-nosed monkey	*Cercopithecus petaurista petaurista*	24.0
Western Chimpanzee	*Pan troglodytes verus*	4.0
White-Naped Mangabey	*Cercocebus lunulatus*	4.0
All		4.0
Total		100.0

while 20% think that they still exist but are difficult to see. If the Roloway monkey becomes extinct, 52% of the respondents said they would be sad, 36% said they would be disappointed, 12% said they would not react. None of the respondents said they would be happy. The major reasons assigned by the respondents who would be sad and disappointed include the following: 1. We cannot show them to our children; 2. I have seen some before and cannot see them again; 3. My contribution as a hunter to their eradication; 4. Because I have not seen one before but want to see one; 5. Because I was depending on it for hunting; 6. Other people need to study it; 7. It is a reflection of our wickedness as humans.

For the 12% who did not register any reaction, the common reasons given were: 1. Though I like them, they were crop destroyers; 2. Their existence does not affect my life; 3. Believe the monkeys would come back.

Indicators of Hunting Activities

The mean KIA of human activities that were capable of killing or capturing any primate observed included 1.5 (SD = 0.7, N = 26) empty cartridges per km per transect and 2.8 (SD = 2.6, N = 26) wire snares per km per transect. The details of the KIAs of the various transects are as shown in Figure 2. Wire snares (Figure 3) and empty cartridges (Figure 4) were found on almost all transects.

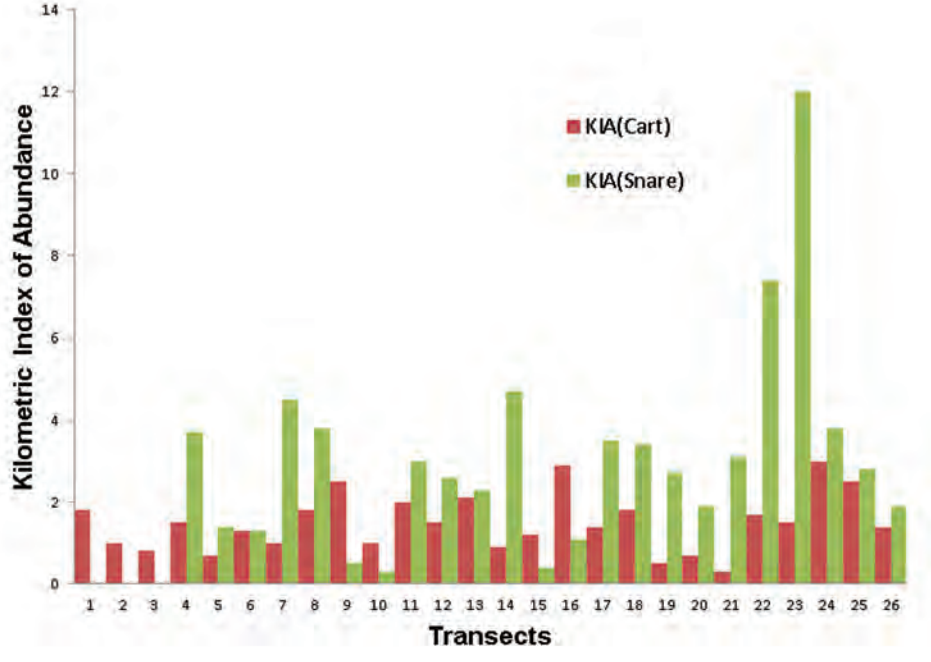

Figure 2. KIA of spent cartridges (Cart) and wire snares (Snares) encountered at the various transects during the survey.

Figure 3. Wire snares encountered during the survey.

Figure 4. Spent cartridges found on the floor of DadiesoForest Reserve.

A total of 12 hunters were met and five hunting camps were discovered during the survey. One of the hunters who had just killed a snake was coming out of the reserve with his bounty. During the interview, he stated that the populations of most mammals in the reserve have been reduced drastically, hence resulting in the hunting of reptiles (Figure 5). Harvesting of non-timber forest products was also observed to be on the rise, including products such as poles of *Celtis* spp., pestles, bamboo stems, and Raphia palm fronds.

The Dadieso Forest Reserve was managed by a range supervisor who receives reports of work done by forest guards and reports to the District Forest Manager, plus two forest guards whose main duty is to maintain the external boundary of the reserve. It was observed that after cleaning the boundary according to the schedule, the forest guards reappear on the boundary line in the following month. Since the area has been declared a GSBA, some members of the fringe communities assist in the maintenance of the boundary. Despite this cooperative activity, there was no signpost to indicate that the place is a reserved area where hunting must be prohibited. It was also observed that part of the reserve has been given out to a Chinese road construction company for stone quarrying and milling. At the time of the survey, the company was engaged in clearing portions of the reserve for stone quarrying (Figure 6). Though this study could not link the activities of the stone quarry to excessive hunting activities, the clearing of tall trees necessarily contributes to habitat loss of the monkeys.

Recommendations

The study should be extended to the neighboring adjoining forests of Boin River, Yoyo and Disue Forest Reserves, to further search for Roloway monkeys and determine their status in those areas. Long-term monitoring for all wildlife species in the Dadieso Forest Reserve must be initiated immediately as all species are at risk of local extinction. The status of the GSBA should be changed to either a National Park or Resource

Figure 5. A hunter with a Gaboon viper (*Bitis gabonica*) met in DadiesoForest Reserve during the survey.

Figure 6. Stone quarry operation in Dadieso Forest Reserve. Photographs by E.D. Wiafe.

Reserve and brought under the management of the Wildlife Division of the Forestry Commission. This may increase the necessary resources, labor, and skills for the protection of wildlife resources. Furthermore, awareness campaigns and community conservation education must be instituted. Natural resource institutions, as part of their outreach programs, must incorporate species decline awareness campaigns and involve students as well as the general public. The hunting situation in Dadieso Forest Reserve calls for strict law enforcement without compromise, both within and outside the reserve.

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Links Between Local Folklore and the Conservation of Sclater's Monkey (*Cercopithecus sclateri*) in Nigeria

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Abstract: Animals feature prominently in African folklore, often in folktales as heroes, tricksters, or their accomplices. Depending on an animal's role or character, it may receive local protection through social taboos or other informal institutions. Folklore can thus provide a basis for culturally relevant conservation and help generate community support for conservation. Sclater's monkey (*Cercopithecus sclateri*) is a threatened primate endemic to southeastern Nigeria, where deforestation and bushmeat hunting are acute problems. The species does not occur in any officially protected areas. In two Igbo-speaking communities in the region (Lagwa and Akpugoeze), Sclater's monkey is intimately linked to traditional religious beliefs and local folklore and effectively protected by associated taboos. Many monkey groups range near people's homes and are commonly regarded as crop-raiding pests. During 2005–2010, I recorded folktales and other information from residents regarding monkey-human interactions, monkey behaviors, and the origins of the monkeys' sacred status. For some, this folklore contributes to their continual observance of the taboos against harming monkeys, particularly in Lagwa where monkeys occupy a totemic position. However, support for the taboos is weakened by the monkeys' crop- and garden-raiding activities and, due to widespread adoption of Christianity by residents, their association with traditional religious beliefs. "Positive" monkey folklore may help offset these negative feelings. Conservation efforts that integrate such folklore and highlight the primates' cultural values will better contribute to the long-term protection of these two important populations of Sclater's monkey.

Key words: Culture, folklore, folktale, human-wildlife relationships, Igbo, sacred, taboo

INTRODUCTION

In many societies worldwide, animals are important figures in literature, belief systems, and folklore. There are numerous cultural representations of primates as religious symbols and characters in literature, film, and folklore (Carter & Carter 1999). Folklore encompasses many things and so is not easily defined (Sims & Stephens 2005). Simply, it is "artistic communication in small groups" (Ben-Amos 1971: 13) and is expressed in various forms, which hold cultural symbolic significance. Among other things, folklore includes folktales, legends, myths, proverbs, jokes, games, art, song, dance, and medicine (Dundes 1965).

In African folklore, animals often appear as central or supporting characters, such as heroes or tricksters (Peek & Yankah 2004). Depending on an animal's role or character, it may be culturally tolerated or protected by a society through informal institutions such as social taboos. Taboos that prevent human harassment or killing of wild species may prove critical in their conservation (Colding & Folke 1997, 2001; Lingard *et al.* 2003; Jones *et al*. 2008; Kideghesho 2008).

Globally, several primates receive some form of protection due to their folkloric or religious associations (reviewed in Cormier 2006; Baker *et al*. 2009; reviewed in Riley *et al.* 2011). Folklore may result in limited take of a species, as in Manu National Park, Peru, where howling monkeys (*Alouatta seniculus*) are regarded as shamans by the Matsigenka and hunted much less frequently than expected given their large size and abundance (Shepard 2002). Other primate populations may receive

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near-complete or complete cultural protection, such as the Tonkean macaque (*Macaca tonkeana*) in Lore Lindu National Park, Sulawesi, Indonesia (Riley 2010); chimpanzee (*Pan troglodytes*) in the Tomboronkoto region of southeastern Sénégal (Clavette 2003) and other parts of West Africa (Kormos *et al.* 2003: Table 21.2); ring-tailed lemur (*Lemur catta*) and Verreaux's sifaka (*Propithecus verreauxi*) at Beza Mahafaly Special Reserve, Madagascar (Loudon *et al.* 2006); mona monkey (*Cercopithecus mona*) at Tafi Atome Monkey Sanctuary, southeastern Ghana (Ormsby 2012); and white-thighed colobus (*Colobus vellerosus*) and Lowe's monkey (*Cercopithecus lowei*) at Boabeng-Fiema Monkey Sanctuary, central Ghana (Fargey 1991; Saj *et al.* 2006).

Folklore can also have the opposite effect (Ceríaco *et al.* 2011). Negative folklore may result in the persecution of some primates, such as aye ayes (*Daubentonia madagascariensis*) in Madagascar (Simons & Meyers 2001) and mantled howlers (*Alouatta palliata*) in Costa Rica (Gonzalez-Kirchner & Sainz de la Maza 1998), both of which are considered evil omens or bringers of bad luck. The use of primates in folk medicine may also contribute to population declines. High demand for lorises (*Nycticebus* spp.) for use in traditional medicine in Cambodia has led to their pervasiveness in the wildlife trade (Nekaris *et al.* 2010). In a global review, Alves and colleagues (2010) found that 56% of all primates used in traditional medicine or magic-religious practices were classified as threatened by the IUCN. Africa was second to Asia in terms of percentage of species used. In northeastern Nigeria, folklore regarding the human-like qualities and behavior of chimpanzees contributes both to their protection and killing, the latter partially for medicinal use of body parts (Nyanganji *et al.* 2011).

In southeastern Nigeria, some primate populations are protected through informal institutions, including Nigeria's only endemic primate species, Sclater's monkey (*Cercopithecus sclateri*) (Oates *et al.* 1992; Baker *et al.* 2009). This species is listed as Vulnerable by the IUCN (Oates *et al.* 2008) and does not occur in any officially protected areas, such as national parks. In parts of three states (Imo, Enugu, and Akwa Ibom), Sclater's monkey is not killed or eaten owing to social taboos (Baker *et al.* 2009). The species' sacred status in these sites is its only known form of full protection across its range. Due to the monkeys' garden- and crop-raiding activities, however, at least two of these populations (Imo and Enugu States) are considered nuisances and are often in conflict with their human neighbors (Oates *et al.* 1992; Tooze 1994; Baker 2009).

Over several years in these two sites, I recorded folktales from residents regarding monkey-human interactions, monkey behaviors, and the origins of the taboos protecting monkeys. I discuss the folklore of these communities and its potential role in the conservation of the Sclater's monkey populations that occur there.

METHODS

Study sites

Research was conducted in the Igbo-speaking region of southeastern Nigeria in two communities: Akpugoeze (Enugu State) and Lagwa (Imo State) (Figure 1). Igbo communities (or village-groups) are autonomous political units having a number of contiguous villages, which are in turn comprised of kindreds or lineages (Meek 1970). Until a few years ago, Akpugoeze was a single community; it has since divided into three autonomous communities that include seven villages (herein, "Akpugoeze" refers to all three communities). Lagwa consists of seven villages, although it formerly contained eight, one of which (Umunokwu) is now an independent community (herein, Lagwa and Umunokwu are referred to as "Lagwa"). The villages of each community share a geographic territory, schools, and a centrally located market. Residents of both communities overwhelmingly claim to be Christian (Baker 2009).

Lagwa and Akpugoeze occur in states that have relatively high average human densities – 424 (Enugu) and 774 (Imo) individuals/km^2 (Geomatics International Inc. *et al.* 1998; NPC 2007) – and are extensively cultivated. Remaining natural forest is primarily found within small patches protected as sacred groves. In Lagwa, these tree groves are degraded and just 0.49ha on average (n = 15), or about ¼ the size of those measured in Akpugoeze (n = 10) (Baker *et al.* 2009). Sacred groves are usually associated with a shrine dedicated to a deity. In Lagwa, shrines are often small buildings or altars that may reside within or near a sacred grove, although many have been demolished or abandoned. Few shrine forests contain physical structures in Akpugoeze; instead, the shrine is simply part of a tree grove, which is maintained free of vegetative undergrowth and debris by one or more shrine priests. In addition to sacred groves, other patches of secondary forest occur in the more-expansive Akpugoeze.

In both sites today, only Sclater's monkey is common, although several primate species historically would have been present. Mona monkeys (*Cercopithecus mona*) occur on the periphery of Akpugoeze, and in Lagwa, a single tantalus monkey (*Chlorocebus tantalus*) has been observed in association with a Sclater's monkey group. Censuses conducted in 2010 estimated 206 monkeys (density: 24.2 individuals/km^2) in Lagwa and 249 (density: 36–38 individuals/km^2) within a core area of Akpugoeze (Baker *et al.* in press).

Data collection

During October–November 2005 and April–June 2006, as part of a broader study on human attitudes toward monkeys, 431 interviews were conducted, including: 1) structured interviews with 410 randomly sampled residents who were ≥ 12 years old (n = 208,

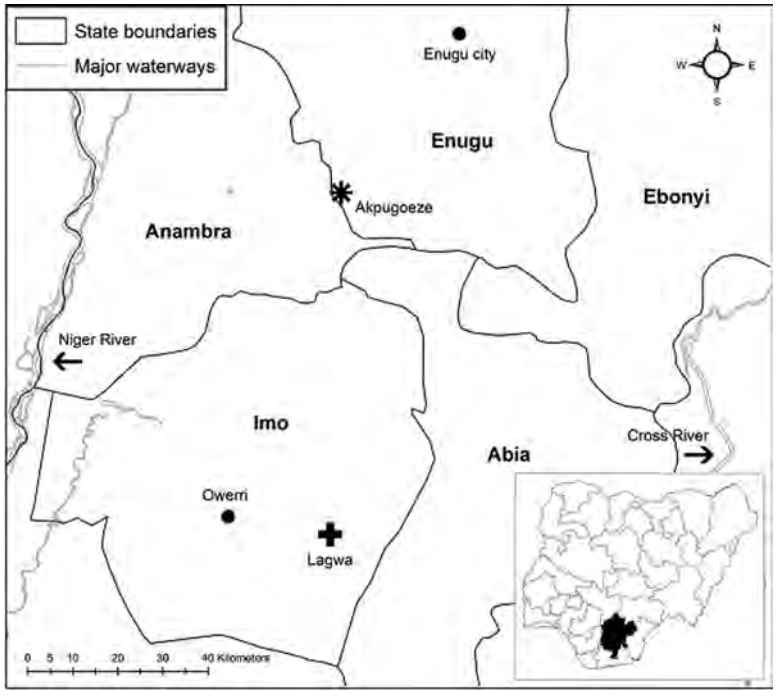

Figure 1. Location of study sites (Akpugoeze ✱ and Lagwa ✚) in southeastern Nigeria. Inset shows the main states of Igboland: Abia, Anambra, Ebonyi, Enugu, and Imo.

Lagwa; *n* = 202, Akpugoeze, in two villages that strictly protect monkeys) and 2) semi-structured interviews with 14 community leaders and elders and seven shrine priests (Baker 2009). During these interviews, informants were asked to share folklore, general stories, or other information about monkeys. Not all informants provided such data. Interviews were usually held at informants' homes. Because English is widely spoken in the region, most interviews were conducted in English, but always with a local Igbo translator.

In June–July 2010, as part of an oral-history project to document the history of the monkeys and religious change in the communities, I recorded folklore during 19 in-depth, semi-structured interviews with four traditional rulers, four shrine priests, five chiefs, and seven others (usually elders) (*n* = 10, Lagwa; *n* = 9, Akpugoeze; one interview involved two people) (Baker, unpublished data). Ten individuals were previously interviewed in the 2005–2006 study, thus some folktales were repeated or further explained. These oral histories were recorded on tape with permission and transcribed, and a printed and bound copy of each memoir was later given to each informant.

RESULTS

Folklore and the origins of the taboos

In Akpugoeze, monkeys are not harmed because they are considered the property of two shrines (deities). At the time monkeys were dedicated to the deities, a dispute between the community's two major clans over this decree resulted in support from just two villages. Today, consequently, only two of Akpugoeze's seven villages strictly protect monkeys. A summary of this story told by one traditional ruler:

> *There are two major clans in Akpugoeze: Ihite and Ezi. Long ago, during the time of the forefathers, the Ezi clan said that the gods declared monkeys should never again be harmed or eaten, as monkeys belonged to the gods. However, one man did not agree, and he was supported by the entire Ihite clan and one Ezi village. The remaining two Ezi villages declared monkeys as the property of two shrines, located in Umuokpasialum and Amagu villages. Over time, monkeys learned that they were safe within the borders of these villages and took refuge there. Residents of other villages in Akpugoeze did not kill monkeys in Umuokpasialum or Amagu out of respect for their kindred.*

Residents also reported that monkeys were formerly used by herbalists and native doctors in rituals. The use of monkey bones in preparing certain medicines was thought to help the people of Akpugoeze bear more children. Nonetheless, the taboo protecting monkeys in Akpugoeze is directly linked to local deities; most residents acknowledge this relationship as the reason monkeys are not harmed (Baker 2009).

In Lagwa, there are two primary sources of the taboo protecting monkeys. First, monkeys are said to be owned by a deity (Arukwu-Lagwa), although many people are reluctant to acknowledge this association (Baker 2009). According to a Lagwa chief, if people protected the

monkeys only for religion, then they would have killed the monkeys by now:

> *[People still protect the monkeys because we see them] as part of us. We are not looking at the deity ... we don't believe in the deity again; we are only seeing the monkey as part of us.... We are not worshipping the monkey. There is nowhere a religion for the monkey. ...Just as somebody would have a dog in his house, a cat in his house, so also we are seeing the monkey.... That's why we are leaving it.*

The second source stems from a folktale regarding the founder of Lagwa. Very few young people were aware of this story, indicating weak cultural transmission across generations. A common variation of this folktale:

> *Before any person lived in Lagwa, there were monkeys. One day a man called Agwa arrived and brought his pregnant wife. Each morning Agwa left his home to tend his farms and hunt animals. One day he was delayed in the bush, and his wife became weak from hunger. While she was waiting for her husband, monkeys came to their compound and began picking fruits from trees. The monkeys dropped these fruits for the woman, who was then able to eat and nourish herself and the baby growing inside her. When Agwa returned, his wife told him what had happened. He was so grateful to the monkeys that he proclaimed from that day forward, any animal capable of such behavior should not be killed or harmed by anyone in his family or village.*

Some Lagwa residents also praised monkeys for the way they care for children and related this to why monkeys are unharmed in the community:

> *When people go to farm and leave behind their young children, monkeys will gather around the children and watch over them until the parents return. If any danger is detected, such as a dangerous animal, monkeys will carry the child to safety or sound an alarm to signal the parents that there is danger.*

In Lagwa and Akpugoeze, residents relayed stories of how monkeys alerted the community to danger during the slave trade or wartime, such as inter-village warfare. I was told that long ago, when forests served as a buffer among neighboring villages, monkeys stayed in the forests. When they sighted a stranger or any non-indigene carrying guns or other weapons, the monkeys would alert the people. One Lagwa resident said the people "would then go out and defend themselves. By so doing, the monkeys became so endeared to the hearts of our ancestors."

General folklore and stories

Some people conveyed negative monkey folklore, although it was relatively uncommon. For example, only two people in the random sample of 410 mentioned that monkey urine and feces were poisonous and could cause a person's foot to swell if stepped on. In Lagwa, positive folklore and even expressions of affection and kinship toward monkeys were recurrent; such expressions were comparatively scarce in Akpugoeze. One Lagwa story explained that a person's cough could be cured by eating fruits partially consumed and discarded by monkeys.

Some Lagwa residents referred to monkeys as sisters and brothers, although they were most commonly called "daughters of the land" (by 7% of the random sample of 208), which I was told means they are "part and parcel of the community." Female indigenes who marry into other communities are referred to as "Lagwa daughters." One common folktale links Lagwa daughters to the protection of monkeys, while another links monkeys to the protection of Lagwa daughters. A variation of the former:

> *A monkey once crossed the boundary and entered a neighboring village. The inhabitants of that village pursued the monkey and tried to kill it. The monkey ran into the house of a Lagwa daughter who married in that village. The woman saw the monkey, locked her house, and told everyone to go away. Once nightfall came and the others finally left, she opened her house and let the monkey go free.*

According to one chief, the monkeys "know the boundaries as if they were cautioned by nature not to cross to [other] places; for if they do, those people kill them." Residents explained how monkeys do not venture out of Lagwa, unless by accident. If they go astray, they know to locate the home of a Lagwa daughter or any Lagwa indigene residing outside the community for protection. The second folktale, which was told to me by a shrine priest, relays the story of a Lagwa daughter who had many problems with her husband's "wicked" family. He explained how the people of Lagwa worried and consulted the shrine. A summary of this story:

> *[Before they could help her], a large group of monkeys from Lagwa went to the home of that woman, covered the roof, and entered the kitchen. Nobody knows how they got there. When the people there saw the monkeys, they were shocked. Some ran inside the bush. When the woman's husband saw this, he apologized to his in-laws, and there was peace between the families. And that daughter of Lagwa was never harmed again.*

Several residents expressed pride with regard to the monkeys, which have a totemic affiliation with the community (Baker 2009). For example, the throne chair of the current traditional ruler of Lagwa is carved with the images of monkeys, and one shrine priest likened eliminating the monkeys to removing one of his body parts. Other Lagwa residents noted:

The monkeys are identified with this place, and we do boast of them. People do come to watch them from other villages and towns.

Lagwa is known with the monkey. It is exemplary. In all of Mbaise, Lagwa is the only [place] that has the monkey. People do come from all over, even on motorcycles and in motos to come and look at the monkeys.

[Monkeys are] the pride of this community, and we are identified with them.

[Monkeys] bring out the uniqueness of our culture. They help to spread the culture of our people beyond the borders of this community.

Other folklore was related to the meanings behind particular monkey behaviors. In both Lagwa and Akpugoeze, when monkeys wrestle on the ground, residents reported that this means something bad will happen, usually that a prominent or elderly person in the community will die. Some folktales highlight the human-like behavior of monkeys and may be told to children to illustrate good behavior, such as morality and compassion, or bad behavior. One example from Lagwa:

Monkeys deserted my kindred's compound because of an incident that took place [many years ago]. One of our brothers killed his younger brother. The monkeys saw this and started crying. They stayed for many days at the back of the compound and left after the burial [and never returned].

The below summarizes a story told in Akpugoeze to illustrate need for caution in certain situations:

A hunter used to kill monkeys in a forest. A little monkey discovered the track being used by the hunter and explained to others. From that day on, the monkeys could not be killed again. The hunter devised a plan in which he lay down and pretended to be dead, but left his weapons around him. The other monkeys saw him and started to rejoice that their enemy was dead. They moved around the hunter, even though the little monkey warned them. Suddenly the man arose and killed many monkeys. The little monkey, however, escaped unhurt.

DISCUSSION

Social taboos currently represent the only full protection afforded Sclater's monkey across its range. Taboos are part of informal cultural institutions that may change over time, however. The way in which people value or perceive primates is tied to their beliefs and attitudes, which are not static and are affected by changing conditions and experiences (Hill 2002). Taboos related to traditional beliefs, for instance, may be rejected with the adoption of new religions. Whittaker (2006) noted how Kloss's gibbon (*Hylobates klossii*) was considered sacred in the Mentawai religion, but with the arrival of Christianity, the local religion and its associated hunting taboos were largely abandoned. Crop raiding by primates may also affect attitudes. In India, damage to crops and gardens by rhesus macaques (*Macaca mulatta*) has caused growing resentment toward these culturally revered monkeys (Southwick & Siddiqi 1985; Srivastava & Begum 2005).

Figure 2. A Sclater's monkey in Lagwa feeding on oil palm (*Elaeis guineensis*), an important cash crop among the Igbo.

The informal institutions protecting Sclater's monkey in Lagwa and Akpugoeze are weakened by the monkeys' crop- and garden-raiding behavior and their association with local deities and the traditional religion (Tooze 1994; Baker 2009). Nearly all residents in both sites believe that crop destruction and its associated economic losses are the major disadvantages to living with monkeys (Baker 2009; Figure 2). Residents are also overwhelmingly Christian, and some have reported that because monkeys belong to the deities and people have been educated about Christianity, monkeys can now be killed (Baker 2009).

In Lagwa, the monkeys' connection to the deity was reported more often than the folktale about Agwa, his wife, and the monkeys; the latter was relayed by only 1.4% of residents interviewed (Baker 2009). This tale is tied to their forefathers' directive and strongly influences their respect for the taboo against harming monkeys. Consequently, such folklore may promote the conservation of these populations. Although the use of folklore cannot stand alone, it can supplement other essential conservation measures, such as those that address crop raiding and environmental degradation. Folklore can encourage community support by highlighting and reinforcing cultural values. Using the popular Monkey King character from the epic Chinese novel *Journey to the West* as an example, Burton (2002: 138) suggested that "folktales may provide the effectual

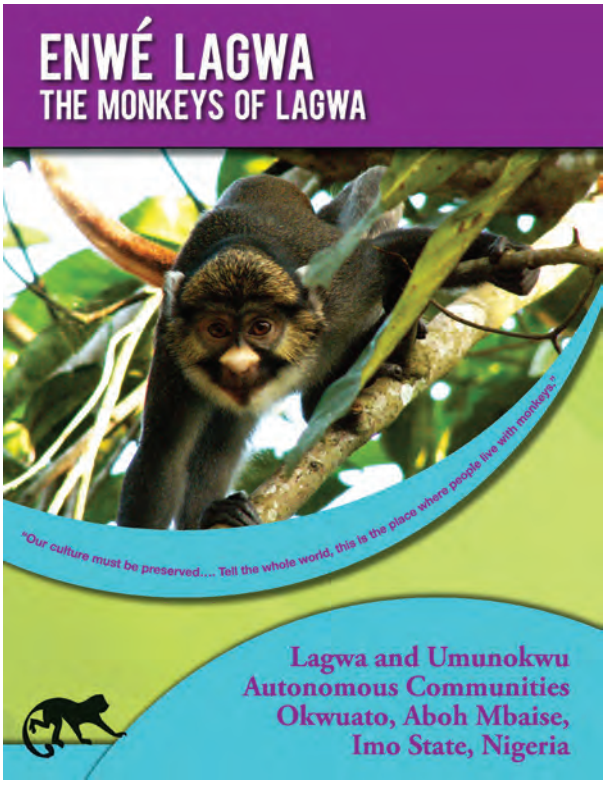

Figure 3. Cover of *Enwé Lagwa* brochure. Educational brochures documenting monkey folklore and the origins of monkey sacredness were distributed in local communities in 2012. Two versions were printed for Lagwa (1,000 copies in English language; 250 copies in Igbo); one bilingual version (1,000 copies) was printed for Akpugoeze. Electronic and hard copies may be requested by contacting the author.

basis for the development of conservation policy by profoundly residing in a people's cultural essence."

As part of a public-awareness campaign for the Siberian crane and wetland conservation in Russia, indigenous and Russian folklore is being compiled and published in two volumes entitled *Migratory Birds in Russian Arctic Folklore* (SCWP n.d.). Conservation efforts for the critically endangered subpopulation of Irrawaddy dolphins in the Mekong River have been assisted by local dolphin folklore, which has contributed to the very positive attitudes held by local communities toward the dolphins (Beasley *et al.* 2009). As a tool for orangutan (*Pongo pygmaeus*) conservation in Indonesia, organizations have developed awareness programs based on local customs and folklore of the indigenous Iban Dayak (Maiden 2011). Similarly, folklore related to Sclater's monkey has been documented and published as educational brochures and distributed in local communities (Figure 3).

For Sclater's monkey, the use of folklore may serve several purposes: 1) increase awareness both within and outside the communities about local culture and the species; 2) instill or reinforce a sense of pride; and 3) provide a non-religious basis for maintaining the taboo protecting monkeys (i.e., promote cultural values). I previously found that nearly all residents in Lagwa and Akpugoeze were unaware of the uniqueness of Sclater's monkey, both within Nigeria and globally, and some were surprised and expressed pride when made aware of this information (Baker 2009). This was especially true in Akpugoeze, which has received comparatively few visitors interested in seeing monkeys. Folklore could also be integrated into educational programs for adults and children. Environmental education programs for primary and secondary schoolchildren were held in both communities in 2011; although these programs emphasized ecological values of monkeys (e.g., seed dispersal), discussion of cultural values would make a valuable addition in future educational efforts.

Finally, the shrines and deities of Lagwa and Akpugoeze have remained influential, yet people are generally wary about acknowledging any association with the traditional religion, and some are adamant that these beliefs are primitive and no longer followed (Baker 2009). As such, "positive" folktales, such as those about monkeys guarding over children and alerting the community to danger, may offer an alternative rationale for monkey conservation. Such folklore may also reinforce or extend the monkeys' totemic position in Lagwa and possibly help develop a similar affiliation in Akpugoeze.

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African Primate Diversity Threatened by "New Wave" of Industrial Oil Palm Expansion

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Abstract: Privately owned, foreign agribusinesses are increasingly acquiring and converting large tracts of arable land in the tropics to grow crops for food. Of particular concern is the rapid expansion of industrially produced palm oil, derived from the African oil palm (*Elaeis guineensis*) and the most widely produced vegetable oil in the world. Although most of the world's palm oil is produced in Southeast Asia, strong economic incentives are encouraging agribusinesses to lease land in the African tropical forest zone to develop oil palm plantations. Such large-scale clearance of forest to plantation agriculture may have wide-ranging implications for forest-dependent species, including and especially the primates. I review the known environmental impacts of industrially produced palm oil and its expected consequences for African primates and their habitat. I highlight the challenges primatologists and conservation practitioners will face in this new wave of industrial oil palm expansion by describing a development in Cameroon by the American agribusiness company Herakles Farms and non-profit organization All for Africa. Through the use of tactics commonplace in the oil palm industry, including the spread of misinformation, Herakles Farms has garnered the support of private donors and investors to build a 73,086 ha oil palm plantation in a forest area characterized by exceptional levels of species diversity and endemism. Agro-industrial developments will soon emerge as a top threat to biodiversity in the African tropical forest zone. If proactive strategies to mitigate the effects of large-scale habitat conversion are not soon implemented, we can expect a rapid decline in African primate diversity.

Key words: palm oil, industrial oil palm plantations, Cameroon, African primate conservation

INTRODUCTION

Palm oil, derived from the African oil palm (*Elaeis guineensis*), has become the world's most produced vegetable oil (Sheil *et al.* 2009; Figure 1). Its uses are varied, ranging from cooking oil to ingredients in soaps, cosmetics, detergents, lubricants, and biodiesel. Driven by increasing consumption and the use of palm oil based products, the global production of this vegetable oil has increased exponentially over the past 50 years (Fitzherbert *et al.* 2008). Between 1961 and 2009, the average annual growth rate of the world's palm oil production was 7.3%, with production more than doubling every 10 years (FAO 2012). At the same time, the land converted to oil palm plantations quadrupled from 3.6 million ha in 1961 to 15.4 million ha in 2007, mostly in Southeast Asia where over 80% of the world's palm oil is produced (FAO 2012).

The relatively recent rise of palm oil as one of the world's most popular vegetable oils coincides with a global shift in the proximate drivers of tropical deforestation. Historically, smallholder farmers clearing land for agricultural production has been the primary cause of tropical forest loss (Rudel *et al.* 2009). However, increasing urbanization, global trade, and demand for food have led to an increase in the relative contribution of private agricultural enterprises to tropical deforestation (Butler & Laurance 2008; Rudel *et al.* 2009; DeFries *et al.* 2010). Consequently, the land area devoted to rice, maize, soybeans, and oil palm has dramatically increased over the last few decades, at the direct expense of intact tropical forest (Gibbs *et al.* 2010). This shift towards private-enterprise-driven tropical deforestation from

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Figure 1. (a) African oil palms and (b) fresh fruit bunches, from which palm oil is derived. Photographs by J. Linder.

agriculture has been most evident and studied in the Amazon Basin and, especially, Southeast Asia.

Unlike the Neotropics and Southeast Asia, forest loss in the African forest zone is still primarily caused by the expansion of subsistence and smallholder farming (Fisher 2010; Rudel 2013). However, Africa has recently begun to experience a shift in drivers of deforestation, as indicated by recent and predicted expansion of large-scale, industrial oil palm plantations through land leases or purchases by multinational agribusiness corporations (Boyfield & Ali 2011; Hawkins & Chen 2011; Feintrenie 2012; Greenpeace International 2012). Human rights groups have labeled the rapid increase in acquisition of land in Africa by foreign investors as "land grabs" to highlight the potential negative consequences for local land owners and users (Friis & Reenberg 2010; Karsenty 2012). Environmental groups have similarly alleged that these land deals in Africa may result in widespread deforestation and an increased rate of local extinctions (World Rainforest Movement 2008; The Rainforest Foundation UK 2013). Certainly, if large tracts of African tropical forest are converted to monocultures, as they have elsewhere in the tropics, this will have a disproportionate impact on forest-dependent species, including and especially, the primates (Koh & Wilcove 2008a; Nantha & Tisdell 2009).

There are very few peer-reviewed articles that have focused on the development and potential environmental and socioeconomic impact of industrially produced palm oil in Africa (but see, Huddleston & Tonts 2007). Yet, primatologists and conservationists who work in African lowland, tropical forests either in protected areas or forests that are relatively accessible and have limited or undefined legal status are likely to be confronted with this oil palm boom in the very near future (e.g., Gonedelé Bi *et al.* 2008). As this appears to be a rapidly emerging threat to African forest biodiversity and local livelihoods, it is critical that biological and social scientists examine, discuss, and debate its advantages, disadvantages, impacts, challenges, and solutions.

The objective of this paper is to inform readers about this emerging ecological threat to African tropical biodiversity and inspire further research and engagement. I discuss the known environmental impacts of industrially produced palm oil and its expected consequences for African tropical forests. The conservation challenges created by this "new wave" of industrial oil palm expansion in Africa is understood through a case study of a highly publicized and contentious oil palm project led by American agribusiness corporation Herakles Farms, in collaboration with the non-profit organization All for Africa.

IMPACTS OF INDUSTRIAL OIL PALM DEVELOPMENT ON PRIMATES AND THEIR HABITATS

Although oil palms require less land to produce the same amount of oil as other vegetable crops, and despite claims by some authors that the environmental damage from oil palm development has been exaggerated (e.g., Tan *et al.* 2009; Boyfield & Ali 2011), evidence shows that the impact of industrial oil palm expansion on primate habitats can be extensive. Results from longitudinal studies clearly indicate that oil palm expansion is a major driver of tropical deforestation in Malaysia and Indonesia, leading to substantial losses of primary and selectively logged forests and peatlands (Koh & Wilcove 2008a; Gaveau *et al.* 2009; Koh *et al.* 2011; Carlson *et al.* 2012). Similar impacts of industrial oil palm expansion have been reported for the Neotropics. In the Peruvian Amazon, for example, the development of industrial oil palm plantations is more likely to occur at the expense of forests, especially old-growth forest, than that of smallholder oil palm expansion (Gutiérrez-Vélez *et al.* 2011). In Columbia, the world's fourth largest palm oil producing country, oil palm expansion has become one of the principle drivers of deforestation and forest fragmentation, especially of gallery forests (Oslender 2008; Carretero-Pinzón *et al.* 2009). Forest loss from oil

palm development in the Neotropics is likely to increase in the coming decades, with nearly half of the Amazon Basin potentially suitable for oil palm cultivation (Butler & Laurance 2009).

Compared with intact primary or selectively logged forest, industrial oil palm plantations are species-poor and/or exhibit substantially lower diversity in communities of plants (Foster *et al.* 2011), mammals (Danielsen & Heegaard 1995; Maddox *et al.* 2007; Bernard *et al.* 2009; Nantha & Tisdell 2009; Struebig *et al.* 2011), birds (Danielsen & Heegaard 1995; Waltert *et al.* 2005; Aratrakorn *et al.* 2006; Koh & Wilcove 2008a; Edwards *et al.* 2010; Azhar *et al.* 2011), lizards (Glor *et al.* 2001), amphibians (Iskandar & Erdelen 2006), ants (Room 1975; Brühl & Eltz 2010; Lucey & Hill 2012), beetles (Chung *et al.* 2000; Davis & Philips 2005), and butterflies (Koh & Wilcove 2008a; Lucey & Hill 2012). Meta-analyses of the impact of industrial oil palm plantations on animal species diversity and abundance suggest that total vertebrate species richness of oil palm plantations is 38% that of natural forest (Danielsen *et al.* 2008). Oil palm plantations are dominated by generalist, invasive, non-forest species and species lost due to forest conversion are typically specialists and/or of highest conservation concern (Fitzherbert *et al.* 2008; Foster *et al.* 2011).

In addition to causing forest loss, large-scale oil palm expansion also fragments a forested landscape, isolating forest patches, limiting dispersal of non-volant mammals, and increasing edge effects in adjacent forests (Fitzherbert *et al.* 2008; Bernard *et al.* 2009; Laurance *et al.* 2011). In some cases, relatively small forest fragments can remain within the larger oil palm matrix. Koh and Wilcove (2008a), Hill *et al.* (2011), and Struebig *et al.* (2011) suggest that for insects, bats, butterflies, and birds, such forest fragments may be of conservation value. However, a study of forest fragments within oil palm plantations in Borneo found that bird species richness and abundance were significantly lower and more similar to that of the oil palm matrix compared with contiguous forest (Edwards *et al.* 2010). Wilcove and Koh (2010) are careful to point out that protecting forests along waterways or preserving forest fragments within oil palm plantations lead to only minor improvements in biodiversity within the plantation and, in fact, do little to conserve regional biodiversity.

The forest zone of west and central Africa is significantly different from that of Southeast Asia and the Neotropics in its prevalence and intensity of bushmeat hunting (Abernathy *et al.* 2013). Bushmeat hunting can be expected to increase with the expansion of large-scale oil palm development in the African forest zone. Industrial oil palm developments lead to a local increase in human population density, primarily due to the migration of laborers into the project area (Butynski & McCullough 2007; Rist *et al.* 2010; Cramb & Curry 2012). Just as the growth of urban centers in west and central Africa has spurred increased bushmeat trading, these migrant workers will bring with them a preference for bushmeat, thereby increasing demand and off-take. As forest is cleared to plant oil palms, hunters will increasingly harvest meat from the surrounding forests, including protected areas. Expanding industrial oil palm plantations and other forms of deforestation will further isolate intact forest blocks. Coupled with intense bushmeat hunting, local extinction rates of large-bodied mammals in isolated forest blocks can be expected to increase dramatically (Brashares *et al.* 2001; Benchimol & Peres 2013). As a result, perhaps predictive of what might occur with the expansion of industrial palm oil production in the African forest zone, a study of 23 forest protected area fragments in Côte d'Ivoire, varying in size and degree of isolation (due primarily to small- and large-scale farming), indicated that all surveyed forests except one lost between 25%-100% of the primate taxa expected to occur in those areas (Gonedelé Bi *et al.* 2012).

It follows that, not only will industrial oil palm development directly lead to the loss of large areas of primate habitat, but we can also expect that African primates found in protected areas will be at exceptionally high risk of extirpation if those forests are adjacent to industrial oil palm plantations. In a longitudinal study of 60 tropical protected areas, habitat loss and degradation surrounding protected areas were found to significantly threaten plant and animal community structure and erode ecological processes inside the protected area (Laurance *et al.* 2012). In the Pasoh Forest Reserve in Peninsular Malaysia, for example, densities of native wild pigs (*Sus scrofa*) have increased dramatically compared with historical levels due to the disappearance of natural predators and a year-round food supply in the oil palm plantations surrounding the reserve (Ickes *et al.* 2005). Increased levels of tree sapling mortality in the reserve, caused by higher pig densities, are expected to alter the reserve's tree community composition and have cascading effects throughout the ecosystem.

THE ANATOMY OF AN INDUSTRIAL OIL PALM DEVELOPMENT IN AFRICA: THE CASE OF HERAKLES FARMS

Background

With recent moratoriums on deforestation and land shortages in Malaysia and Indonesia, the African tropical forest zone has become a target of multinational agribusiness corporations looking to produce palm oil, fueling a "new wave" of African oil palm development (Hawkins & Chen 2011; Feintrenie 2012). Many African countries are offering attractive terms for agribusiness corporations. Oil palm plantations require high labor input and African nations can offer lower wage labor

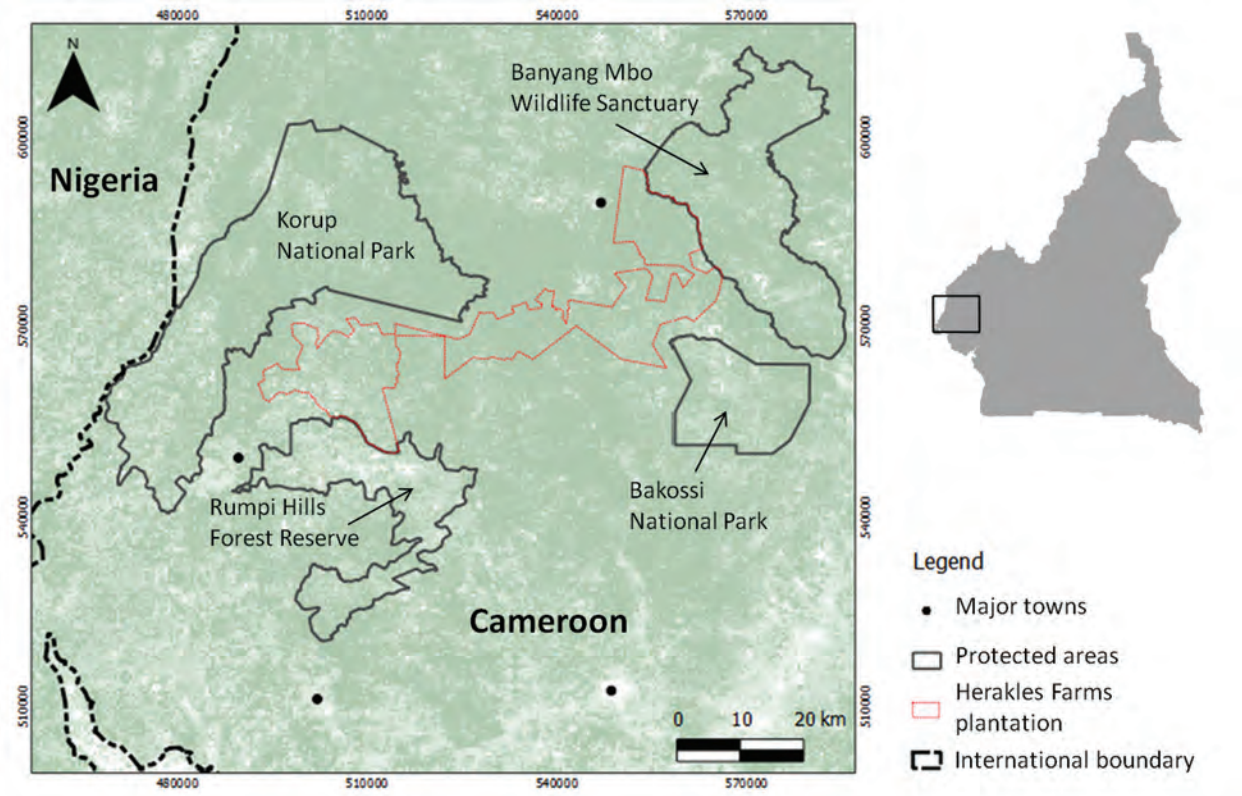

Figure 2. Location of Herakles Farms/All for Africa oil palm plantation in South West Region, Cameroon relative to surrounding protected areas. Boundary of plantation based on the SG Sustainable Oils Summary Report of Planning and Management submitted to the RSPO. Forest cover based on analysis of the MODIS Vegetation Continuous Fields collection (http://glcf.umd.edu/data/vcf/).

than that found in Indonesia and Malaysia, thereby increasing competitiveness (Corley & Tinker 2003). African governments are also offering attractive land acquisition terms, including low rental fees, taxation and duties and rights to water, minerals, and/or timber in the oil palm concession area (Hawkins & Chen 2011; Nguiffo & Schwartz 2012). These factors are contributing to the industrial palm oil boom in the African tropical forest zone, with an estimated 2.6 million ha of land, the majority of which is forested, having already been allocated or suspected to be allocated in west and central Africa (Greenpeace International 2012).

Leading this new wave of industrial oil palm development is New York-based and Delaware-registered agribusiness corporation Herakles Farms (HF) and the non-profit organization All for Africa, which are planning a large-scale plantation in Cameroon's South West Region (Figure 2). Bruce Wrobel, the chairman and CEO of HF, reportedly had interest in producing palm oil in Africa for the biodiesel market and, through his energy company Sithe Global, considered developing plantations in Liberia, Tanzania, and Madagascar (Anonymous 2007; Görgen *et al.* 2009; Carrere 2010; Friis & Reenberg 2010). However, by late 2008, as the price for crude oil sharply declined from its peak of nearly $140/barrel, Wrobel decided that palm oil would have more value as a food crop than as a component in biofuel. HF then acquired all of Sithe Global's assets in the palm oil industry, including the company Sithe Global Sustainable Oils (SGSO), which was incorporated in Ghana and Cameroon in 2008. In 2009, Sithe Global Sustainable Oils in Cameroon (SGSOC) signed an Establishment Convention with the government of Cameroon, which detailed the terms of a 99-year lease of 73,086 ha of land.

All for Africa, also based in New York and registered in Delaware, was co-founded by Wrobel (who also serves as the Chairman and Executive Director) in 2008, and aims to work with the private sector to support projects that generate socioeconomic benefits to communities throughout Africa. In 2008, All for Africa launched its "Palm Out Poverty" campaign, committed to reducing poverty, preventing illness, and promoting education across the African continent (see www.allforafrica.org). All for Africa will plant 1 million oil palm trees, primarily in Cameroon, and use the profits from the sales of palm oil to fund community-based projects in Africa. HF supports the Palm Out Poverty campaign by providing All for Africa with subsidized land and oil palm seeds and assistance with marketing and sales.

In Cameroon, "national land" (on which the HF plantation is situated) is leased through a process that requires the leasee to produce or obtain several

documents prior to developing the land. Of particular relevance here is an Environmental and Social Impact Assessment (ESIA), a Certificate of Environmental Conformity and, for leases of land more than 50 ha, a presidential decree (Cameroonian Decree No 76/166 of 24 April, 1976). HF submitted an ESIA to the Cameroon government in August 2011 and soon after was issued a Certificate of Environmental Conformity. Without a land lease signed by Cameroon's president (which HF has yet to receive as of this writing), HF has already cleared ~300 ha of forest for oil palm nurseries and roads and has been negotiating with villages for additional land outside the planned concession limit outlined in its ESIA (DuPuy & Bakia 2013).

SGSOC became a member of the Roundtable on Sustainable Palm Oil (RSPO) in March 2008 and extended its membership to HF in October 2011. The RSPO was formally established in 2004 with the primary objective of promoting and certifying "sustainable" palm oil (Schouten & Glasbergen 2011; RSPO 2012). The RSPO has defined "sustainability" as being comprised of, "legal, economically viable, environmentally appropriate and socially beneficial management and operations" and guided by a set of principles and criteria focused on issues related to transparency, compliance with local laws, use of appropriate best practices for growing oil palms, limiting environmental impacts and protecting biodiversity, and responsible consideration of affected communities (RSPO 2013). At the heart of the biodiversity components of RSPO sustainability is the protection of high conservation value (HCV), which is defined according to conditions related to ecosystem services and the presence of rare, endemic, flagship, or threatened ecosystems or species (Jennings *et al.* 2003). SGSOC submitted its HCV assessment of the planned plantation area to the RSPO in February 2012 (Asamoah 2011).

Problems with the development first arose in 2009 when the Cameroon Ministry of Forestry and Wildlife informed HF that their plantation area overlapped with existing forest titles (MINFOF 2009). The Program for the Sustainable Management of Natural Resources in South West Region, a sustainable development program of the Cameroon government co-financed by the German Development Bank, wrote to HF in 2010 raising similar issues, and suggested that a majority of the plantation area was covered with dense, HCV forest. The failure of HF to appropriately respond to the Cameroon government and the managers of the joint sustainable development program led to the emergence of an organized local and international campaign to stop the HF development. Critics have argued that the HF development has serious environmental, social, and legal problems and have called on the government of Cameroon to terminate the contract and prohibit HF from clearing forest (Nguiffo & Schwartz 2012; The Oakland Institute 2012; Greenpeace USA 2013; Nelson & Lomax 2013; The Oakland Institute 2013). Here, I will focus on some of the environmental concerns that may be highly relevant to other African forest areas in which agribusinesses are planning plantations.

Environmental claims made by Herakles Farms and the counter evidence

HF has claimed that the land targeted for its plantation, "…consists primarily of fragmented and degraded landscape devoid of any large tracts of the original moist evergreen lowland forest with its characteristic dense and continuous closed canopy" (Asamoah 2011: 3), "has been heavily exploited and now remains as secondary forest…and of low biodiversity value" (Herakles Farms 2012: 12), and is a "biodiversity cold spot" (Herakles Farms 2013). To support its claims, HF cites letters from Cameroon government ministries which state (without accompanied evidence) that the plantation area has been heavily logged and is covered by "secondary forest" (MINRESI 2009; MINFOF 2010). Additionally, HF cites its ESIA and HCV assessment as evidence that extensive human use and commercial logging have seriously degraded the habitat in the plantation area. A map provided by HF of their planned plantation area identified only small (mostly < 25 ha), isolated patches of HCV forest primarily restricted to hilltops and steep-sided ridges (Asamoah 2011).

Is the plantation area "degraded habitat"? This question is at the center of the environmental debate between HF and its detractors, as active members of the RSPO must seek to develop oil palm plantations on "previously cleared and/or degraded land" (RSPO Principles and Criteria 7.3). Despite the claims made by HF, satellite (Maschler 2012) and aerial (Greenpeace International 2012; Figure 3) surveys indicate that dense, intact, high canopy forest covers the majority of the plantation area. Furthermore, the HCV Resource Network, an organization composed of representatives from NGOs and the private sector that conducts peer reviews of HCV assessments, concluded that the survey effort and methods used by HF to assess HCV were inadequate and the HCV assessment would not comply with RSPO principles (HCV Resource Network 2012). Similarly, in letters written to the Cameroon government, Cameroonian and international organizations and scientists strongly criticized the HF environmental assessment for its poor survey design and implementation and misrepresentation of the quality of the forest. Despite these criticisms, the Cameroon government approved the HF environmental assessment. In September 2011, critics of the plantation filed a formal grievance with the RSPO, citing inadequate environmental assessments and unsupported claims made by HF. In August 2012,

Figure 3. Aerial views of two of the three Herakles Farms oil palm nurseries, surrounded by dense, high canopy forest. Photographs © Greenpeace International.

HF/SGSOC withdrew its membership from the RSPO, arguing that the grievance process was preventing the company from moving forward with its activities.

The descriptions provided by HF and the Cameroon government of the forest's condition in the planned plantation area fail to differentiate between types of secondary forest, as forest recovery from selective logging differs substantially from forest regeneration on previously cleared land (Corlett 1994). Data provided by HF in its ESIA indicate that logging has occurred in large portions of the plantation area between 15 and 34 years ago. Although commercial logging has historically occurred in parts of the HF plantation area, HF fails to indicate that its intensity varied from light to heavy selective logging (Waltert *et al.* 2006; Lien 2007). In a study of forest regeneration after selective logging in south Cameroon, van Gemerden *et al.* (2003) reported that logged areas were floristically similar to the surrounding forest pool after 14 years and strongly resembled old growth forests after 27 years. Furthermore, more recent studies are revealing that the negative effects of selective logging on biodiversity may have been exaggerated and that selectively logged forests often retain relatively high levels of biodiversity (Berry *et al.* 2010; Didham 2011; Edwards *et al.* 2011; Gibson *et al.* 2011; Putz *et al.* 2012; Edwards & Laurance 2013; Ramage *et al.* 2013). In fact, studies of forests around the HF plantation area indicate that logged and unlogged forests do not significantly differ in tree abundance, species richness, or tree species composition and logged forests retain important populations of primate and hornbill species (Lien 2007).

Indeed, systematic line transect surveys of the HF plantation area conducted by Cameroonian and German university researchers in 2013 found evidence for the presence of all eight diurnal primate species that are also found in the adjacent Korup National Park (Waltert 2013). Of those, six are listed as threatened by the IUCN Red List of Threatened Species and include the Endangered chimpanzee (*Pan troglodytes ellioti*), drill (*Mandrillus leucophaeus*), and Critically Endangered Preuss's red colobus monkey (*Procolobus preussi*). A fish survey also conducted in 2013 in the plantation area's rivers found high levels of endemism and diversity and concluded that the rivers of the plantation area are of extreme aquatic conservation value both regionally and continentally (Schliewen & Arnold 2013). In other words, although relatively degraded compared with unlogged forest, selectively logged forest can have significant conservation and ecological value and may warrant protection from large-scale, agricultural development (Wilcove *et al.* 2013). This is not to argue that logging and its secondary effects do not have significant negative impacts on forest structure and species composition. Rather, automatically classifying selectively logged forest as degraded and suitable for conversion to a monoculture risks losing a tremendous amount of biodiversity (Koh & Wilcove 2008a).

Despite the RSPO guidelines and claims made by both critics and supporters of the HF plantation, there is no consensus on what constitutes "degraded" land (Gingold 2010; Putz & Redford 2010; Wicke *et al.* 2011) and the RSPO does not provide an operational definition of the concept. Without an internationally accepted definition of and method to identify degraded habitat in tropical forest zones, the rapid expansion of large-scale, industrial oil palm plantations in Africa can be expected to destroy potentially critical primate habitat as the oil palm industry takes advantage of this ambiguity.

Both the World Conservation Union (IUCN)[1] and the World Resources Institute (WRI) have set out to develop methods, in accordance with the RSPO Principles and Criteria, to define and identify degraded areas that could be suitable for oil palm development. The WRI concluded that, due, in part, to high carbon stocks and the likely presence of high conservation values, both primary and secondary (logged) forests should not be included in definitions of "degraded forests" and were, therefore, unsuitable land for oil palm development (Gingold *et al.* 2012). Putz and Redford (2010), in their discussion of defining "forest", argue that secondary and degraded forests are distinct because of substantial differences in structure, composition, and dynamics.

An understanding of the current condition of the forest in the planned plantation area is critical because the plantation is located between four protected areas that serve to protect important populations of threatened primate and non-primate species. The habitat between these protected areas consists of a mosaic of farms, agroforestry, fallow land, regrowth from selectively logged forest, and primary forest. The fate of biodiversity inside these protected areas is, in large part, determined by their degree of isolation from and connectivity to each other and to other forests, the condition of the surrounding matrix, and the intensity of bushmeat hunting (Brashares *et al.* 2001; Laurance *et al.* 2002; Hanson & DeFries 2007; Newmark 2008; Struebig *et al.* 2011; Laurance *et al.* 2012; Benchimol & Peres 2013). In fact, declining forest cover and other environmental changes that occur immediately outside protected areas determine to a large extent the fate of biodiversity inside the protected area (Franklin & Lindenmayer 2009; Laurance *et al.* 2012). Therefore, the HF plantation will not only lead to the elimination of animal populations of conservation concern within the plantation, but will seriously degrade the integrity of

[1]As of this writing, the IUCN is in the process of examining the concept of "degradation" as it pertains to environmental policy and decision making. A brief description of this project can be found at: http://www.iucn.org/about/work/programmes/business/bbp_work/by_sector/energy/biofuels/defining_degraded_lands___for_sustainable_biofuels_and_beyond/

the four protected areas by dramatically reducing habitat connectivity and increasing edge effects and bushmeat hunting (Laurance *et al.* 2012).

CONCLUSIONS AND A WAY FORWARD

The expansion of industrial oil palm plantations in Africa will lead to rapid losses of biodiversity through forest habitat loss and fragmentation and increased hunting off-take in the remaining forest areas (Abernathy *et al.* 2013). This is especially worrisome for African primates, most of which live in lowland forests and are among the most commonly hunted taxonomic groups (Linder *et al.* 2013). The synergistic effects of commercial bushmeat hunting with large-scale clearing of forest for palm oil production may overwhelm conservation efforts to forestall primate extinctions in the African forest zone in the coming decades. Large-scale, industrial oil palm development may pose the biggest threat to primate diversity in areas of exceptionally high species endemism and where bushmeat hunting is already pervasive and intense. This includes the largest remaining intact block of contiguous forest in West Africa, the Nigeria-Cameroon border region, where HF and other agribusiness corporations are prospecting for land.

Following the tactics of the broader oil palm industry, HF has misinformed the government of Cameroon, its investors, and the general public and this, in turn, will help to boost the global demand for "unsustainable" palm oil. The oil palm industry promotes public acceptance of its destructive activities in tropical forests and dismisses concerns of critics by engaging in aggressive public relations campaigns that spread "disinformation" (Koh & Wilcove 2008b). HF exemplifies this behavior by misrepresenting the condition of the forest (and the social impacts of its development) and targeting attacks against its most vocal critics (The Oakland Institute 2013). All for Africa's "Palm Out Poverty" campaign is, perhaps, at the center of this HF public relations blitz. Enlisting the support of former U.S. President William J. Clinton and Hollywood actors, All for Africa attempted to fund its "Palm Out Poverty" campaign by raising $20 million through annual sponsorships and public donations (All for Africa 2010a). In its media, All for Africa informed its supporters that its project would improve the livelihoods of local Africans and benefit the environment (All for Africa 2010b).

Concerned citizens and NGOs have reacted to this spread of disinformation by initiating their own investigations and campaigns, which have revealed the environmental, social, economic, and legal problems associated with the HF plantation. Pressure from other similar kinds of campaigns have led palm oil producers in Indonesia and Malaysia to join the RSPO, consumers to change buying habits and policies, and governments to rein in rampant deforestation from the rapid expansion of oil palm plantations (Khor 2011). Similarly, an informed, evidence-based campaign spearheaded by Cameroonian and international NGOs and scientists, representing environmental, socioeconomic, legal and human rights concerns significantly slowed and altered the development of the HF plantation in Cameroon. By helping to give a voice to local opposition and revealing the environmental problems of the project, the campaign forced HF to withdraw from the RSPO and led the government of Cameroon to suspend HF activities in April 2013. However, by May 2013, the government of Cameroon reversed its decision and lifted the suspension without providing any reason. As of this writing, HF remains active in Cameroon, although reportedly in renegotiation with the government of Cameroon regarding the ultimate size and location of the concession.

The governments of Cameroon and other African countries can take proactive steps to limit the negative biological and social impacts of industrial oil palm expansion (Hoyle & Levang 2012). First, the allocation of new industrial oil palm concessions should be halted until environmentally and socially responsible policies are put in place. All new concessions should be required to follow or exceed the internationally accepted standards for sustainable palm oil development set by the RSPO. Although the RSPO has been widely criticized for various shortfalls (Laurance *et al.* 2010; McCarthy & Zen 2010; Edwards *et al.* 2012), it nonetheless represents minimum standards for producing palm oil. Second, degraded lands within each country should be identified using updated definitions and methods and with the participation of relevant stakeholders. Third, means of improving the productivity and yield of existing industrial and smallholder oil palm plantations should be investigated and implemented before new land leases are allocated. Fourth, governments should work with palm oil producers and conservation organizations to maintain connectivity between forest blocks, facilitating wildlife movement between suitable habitats.

There is also an urgent need to clarify the concept of "degraded land", including its definition and accepted methods of identification. Importantly, any definition should consider different "degrees" and "types" of degradation, as simply describing land as either degraded or not degraded may fail to recognize its biological (and socioeconomic) importance (Gingold *et al.* 2012). Until this is accomplished, there can be no certainty that palm oil certified as sustainable by the RSPO, or any other organization that heavily relies on the concept, safeguards high conservation values.

Finally, field primatologists can and should play an important role in helping to forestall the loss of African biodiversity (especially primate diversity) in the face of habitat loss and increasing bushmeat hunting (Oates 2013). Specifically, with regard to the impending threat

of agro-industrial development, primatologists can help influence changes towards more environmentally and socially responsible palm oil production. Just as applied anthropologists have integrated scientific knowledge with advocacy and improving community welfare (Ryklo-Bauer *et al.* 2008) primatologists can link behavioral ecological research and effective engagement with biodiversity conservation. Located in often remote, poorly studied forests, primatologists can contribute to the understanding and identification of high conservation value habitats targeted for oil palm development. Additionally, the strong relationships primatologists often maintain with local communities can be used to initiate conversations about the advantages and disadvantages of, and alternatives to, industrial oil palm development. Primatologists should also consider being more active in matters of policy (advocacy) and in contributing to campaigns (activism) that aim to protect high-value ecosystems and promote transparency in land acquisition processes. Effective campaigns, such as the one targeting HF, are based on evidence collected by biological and social scientists, which is then shared with organizations that can strategically disseminate the information. Carefully researched, evidence-based campaigns avoid the pitfall of "blackwashing", exaggerating claims and accusations against corporations (Koh *et al.* 2010). Primatologists can also help to initiate and support research on the biological and socioeconomic impacts of large-scale, agro-industrial (especially oil palm) development in tropical Africa, as there is a lack of such peer-reviewed studies (Turner *et al*. 2008).

Oil palm and other agro-industrial developments will soon emerge as a top threat to biodiversity in the African tropical forest zone. If produced correctly, palm oil can be a win-win for the environment and economic development (Koh & Wilcove 2007). However, if the Herakles Farms/All for Africa project is the model for the future of oil palm development, African biodiversity conservation will face serious and, possibly, insurmountable, challenges. If recent trends continue unchecked, the combined effects of commercial bushmeat hunting with large-scale and rapid habitat conversion could be catastrophic for Africa's forest-dependent large mammal species, including and especially, the primates.

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Population Survey of Nigerian-Cameroon Chimpanzees (*Pan troglodytes ellioti*) in Southwestern Nigerian Priority Sites: Idanre Forest Cluster and Ise Forest Reserve

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Abstract: The Regional Action Plan for the Conservation of the Nigerian-Cameroon Chimpanzee (*Pan troglodytes ellioti*) identified four areas in southwestern Nigeria as priority sites for chimpanzee conservation. Our survey was conducted in two of these sites: the Idanre Forest Cluster and Ise Forest Reserve. The overall aim of the survey was to determine the population status and spatial distribution of chimpanzees and understand the dimensions of anthropogenic influences to provide a basis for effective conservation and periodic monitoring. Chimpanzee observations and related evidence of their presence were encountered 0.03 times per kilometer walked in Ise and 0.12/km in the Idanre Forest Cluster. Although data from the survey were insufficient to make conclusions about the species' population numbers or density, results from field observations and reliable local reports are used to hypothesize that chimpanzee population in the survey areas fall within the range of 0 – 115 individuals (≤ 20 in Ise and ≥ 55 in the Idanre Forest Cluster) distributed within an area of about 400km^2 of forests, 18% of the cumulative size of forest reserves surveyed. Survey results also show that populations in these sites are at high risk of extinction due to targeted killings and accelerated habitat loss corresponding to a 34.5% loss of natural forest since the year 2000, which makes habitat loss the most significant threat facing chimpanzee survival in these forest reserves. Although the chimpanzee populations remaining in the survey areas are relatively small and the degree of threats they face is enormous, these are regionally significant populations and deserve assertive conservation efforts.

Key words: chimpanzee, population, forest reserves, habitat, deforestation, hunting, Nigeria

INTRODUCTION

All chimpanzees are endangered (Oates *et al.* 2008a, 2008b), and the Nigerian-Cameroon chimpanzee (*Pan troglodytes ellioti*) is considered the most endangered of all currently known chimpanzee subspecies (Morgan *et al.* 2011), as well as being the most range-restricted. The subspecies survives only in forested habitats in southern Nigeria to western Cameroon, north of the Sanaga River. It is also the most recently recognized subspecies of the common chimpanzee and it has been estimated that there may be as few as 3,500 individuals living in the wild (Morgan *et al.* 2011).

The conservation planning workshop for West African Chimpanzees held in Ivory Coast in 2002 identified the forests of southwestern Nigeria of highest priority for surveys to assess their little-known chimpanzee populations (Kormos *et al.* 2003). Chimpanzee populations in these forests (and the Niger Delta) are perhaps the least known biologically and demographically. This recommendation led to a wide ranging chimpanzee survey conducted in 2006 covering 17 forest sites or reserves in 5 states in southwestern Nigeria (Greengrass 2006, 2009). The 2006 survey found that chimpanzees were either extinct or at the verge of extinction in 5 of the forest sites (Ala, Akure, Oba Hills, Ogbesse and Oni Forest Reserves). Seven sites definitely contain chimpanzees (Idanre, Ifon, Omo, Oluwa, Okomu, Ologbo and Ise Forest Reserves) and, though their abundance could not be ascertained due to the rapid nature of the survey, the populations were perceived as being generally small and isolated (Figure

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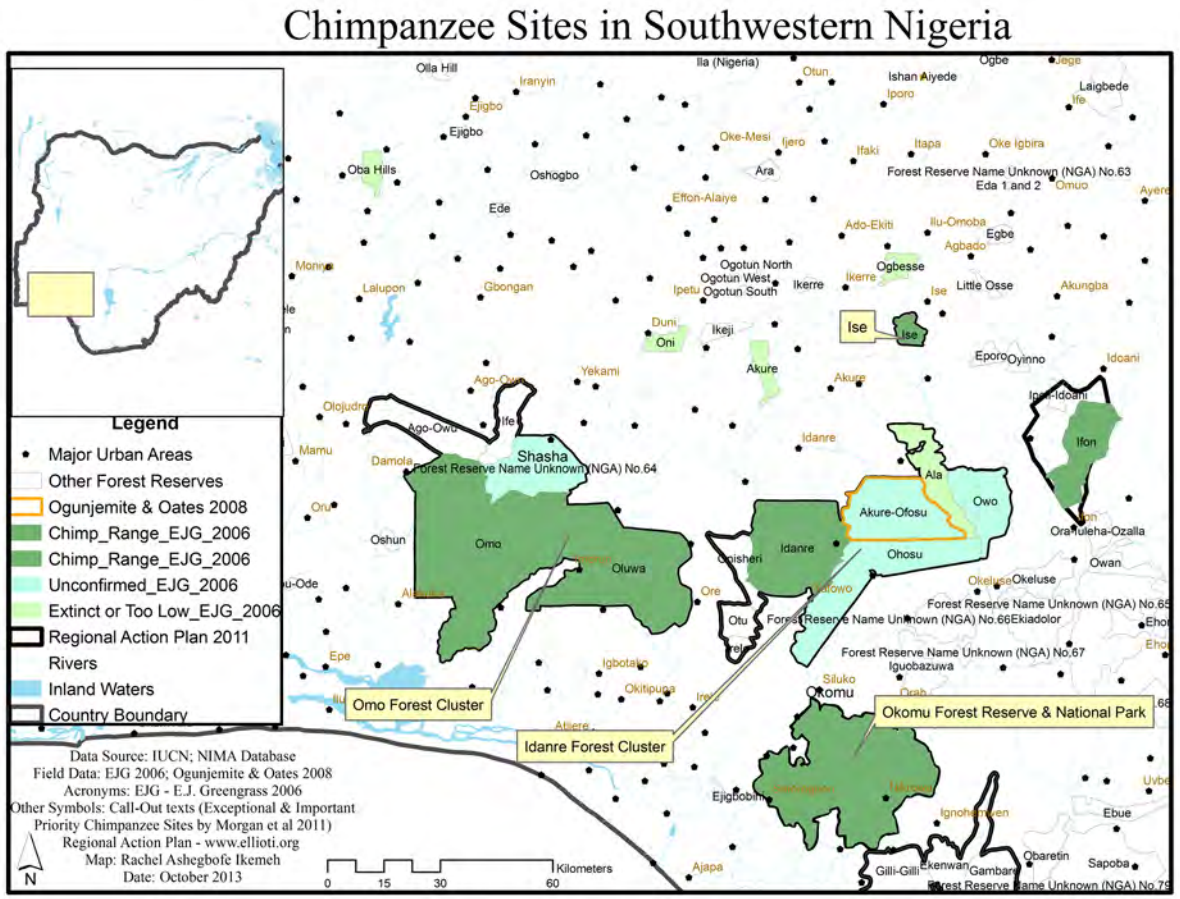


Figure 1. Southwestern Chimpanzee Sites. Forest sites (reserves) where chimpanzees have been previously reported in 2006, 2008, and 2011 and their associated status.

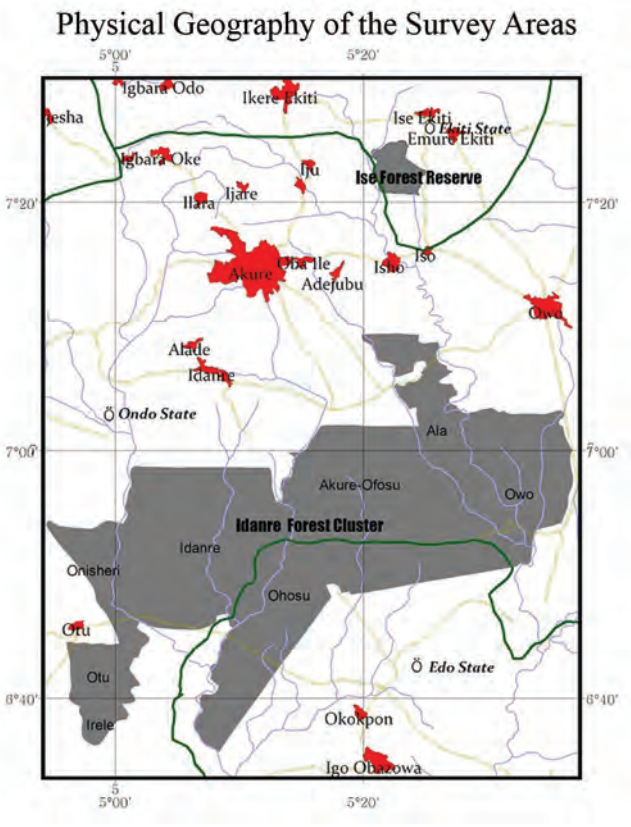
1). However, chimpanzee presence was not confirmed in five forest reserves: Owo, Shasha, Ishan-Aiyede, Ohosu and Akure-Ofosu (Greengrass 2009). Ogunjemite and Oates (2008) further surveyed Ishan-Aiyede, Akure-Ofosu and Ifon Forest Reserves in intervals from December 2006 through January 2008. The survey found that chimpanzees are probably extinct in Ishan-Aiyede and noted the population in Ifon Forest Reserve is not viable for long-term conservation. Akure-Ofosu Forest Reserve was identified as having a significant population of chimpanzees with potential for conservation, and their report recommended further study for formulating practical conservation strategy (Ogunjemite & Oates 2008). Similarly, in 2008 the Nigerian Conservation Foundation (NCF) embarked on a biodiversity survey in the Omo Forest Cluster (Oates *et al.* 2008c) where chimpanzees were confirmed to persist in Omo (Ikemeh 2009a) and Oluwa Forest Reserves (Ogunjemite 2010; Ogunjemite & Olaniyi in press).

During a series of workshops held in Cameroon and Nigeria in 2009 and 2010, researchers, government officials and international experts deliberated the plight of *P. t. ellioti* in a first ever attempt to formulate strategic actions to conserve the Nigerian-Cameroon chimpanzee since it was first identified as a distinct subspecies in 1997 (Gonder *et al.* 1997). Priority sites were identified and actions were determined that highlighted the Okomu National Park/Forest Reserve, the Omo Forest Cluster, and the Idanre Forest Cluster as Exceptional Priority Sites, and the Ise Forest Reserve was recognized as an Important Priority Site in southwestern Nigeria. As a result, this survey was initiated based on the recommendations of the resultant Nigerian-Cameroon Chimpanzee Regional Action Plan Document (Morgan *et al.* 2011).

STUDY AREAS

Our surveys were carried out at two sites: (1) the Idanre Forest Cluster*, which comprises Idanre, Akure-Ofosu, Ala and Owo Forest Reserves in Ondo State, and Ohosu Forest Reserve in Edo State; and (2) the Ise Forest Reserve in Ekiti State. The other sites identified as "Exceptional Priority Sites" (the Omo Forest Cluster and Okomu National Park and Forest Reserve) are already

* "Forest Cluster" refers to a number of administratively separate forest reserves with shared boundaries.



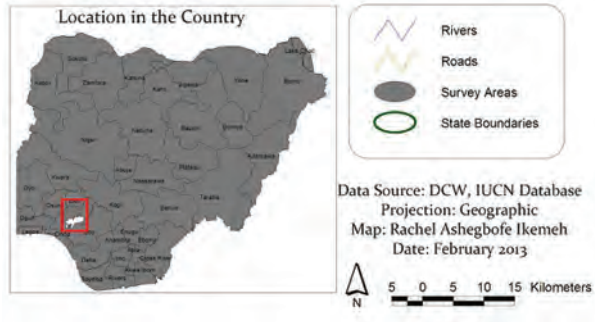


Figure 2. Geographic Location of the Survey Areas. Map showing the locations of the survey sites within the country with accompanied information on the roads, rivers and major urban areas around the sites. The Idanre forest cluster is made up of five forest reserves namely Idanre, Akure-Ofosu, Ala, Owo, Onisheri, Otu, Irele forest reserves in Ondo State including Ohosu forest reserve in Edo State.

receiving some form of conservation attention and, although these efforts are not focused on chimpanzee conservation, they afford some protection to chimpanzee habitat.

The survey areas cover a cumulative Geographical Information Systems (GIS) estimated land area of 2205.8km^2. The Idanre Forest Cluster covers 2159.2km^2, and the Ise Forest Reserve is 46.6km^2. The Idanre Forest Cluster is located within coordinates 07°15'N at the northern edge, 04°89'E at the western edge, 06°58'N at the southern edge, and 05°62'E at its eastern edge. The Ise Forest Reserve is the northerly site, which can be accessed from Ise-Ekiti town located at 05°42'E 07°47'N, which is about 6km straight line distance to the northern edge of the reserve at 05°39'E 07°43'N (Figure 2).

The natural vegetation of the survey region is mixed deciduous forest (Isichei 1995, Mengistu & Salami 2007). The sites are located within the Nigerian lowland forest ecoregion that extends from the eastern margin of the Dahomey Gap in Benin to the Niger River in the west (Werre 2001) and are situated within the Congolian subdivision of the Guinea–Congolian belt (Oates *et al.* 2008b). Where intact natural forest vegetation still persists, some relatively dominant plant species include *Cola* spp., *Mansonia altissima*, *Nesogordonia papaverifera*, *Pterygota* spp., *Sterculia* spp., *Triplochitonscleroxylon*, *Antiaris africana*, *Ficus* spp., *Milicia excelsa*, *Brachystegia* spp., *Cylicodiscus gabunensis*, and P*iptadeniastrum africanum* (Werre 2001). However, the natural vegetation has been greatly modified by excessive logging and deforestation. The forests are now severely fragmented with pockets of monocultures of exotic tree plantations including farmlands of cocoa, plantain, and other food crops. Throughout the survey region, the forests are mostly low-lying at altitudes ranging between 10–400 meters above sea level; average altitude for the Idanre Forest cluster is 177m while the altitude average is 349m in Ise Forest Reserve. Mean annual temperature is between 25°C – 26°C, with a minimum temperature of 19°C and a maximum temperature of 33°C. Annual precipitation is between 1200mm–1800mm. Specifically, Ise forest reserve receives 1380mm of rain annually while the Idanre cluster receives 1654mm of rain annually (DIVA-GIS World Climate Database 1950-2000). The region experiences 3 months of dry season from December to February with intermittent rain showers in March, whereas the rest of the year is the rainy season with peak periods from May to October.

METHODS

Field surveys were conducted from the 1 November 2012 – 25 January 2013 covering a distance of 332.9km in a combination of systematic reconnaissance and direct search methodologies within and around the 2205.8km^2 area covered by both Ise Forest Reserve (46.6km^2) and Idanre Forest Cluster (2159.2km^2). Of the cumulative distance covered by the survey within and around the survey areas, 120.6km distance was covered in Ise forest reserve and 212.3km in the Idanre forest cluster; primarily, survey methods were developed based on suggestions in Kühl *et al.* (2008). In the first instance, the survey area(s) was divided into two strata, remnant forested areas and non-forest areas based on spectral response from public domain satellite images. Within the delineated forest patches, automated sampling lines were

designed using the computer program DISTANCE™ version 6.0 (Thomas *et al.* 2006). These sampling lines were used to guide the direction of our survey routes using a compass bearing on an approximate straight line direction along paths of least resistance. However, this approach was only partially achieved in parts of Ise Forest Reserve and was not implemented in Idanre Forest Cluster because of the activities of armed gangs (some with automatic weapons) operating marijuana (*Cannabis sativa*) plantations within the forest reserves in the region. This information became known only after commencement of the field surveys. Attempting to follow a straight line led us into contact with these gangs, and after one particularly dangerous encounter we decided the risk to life was too great to continue this method. Afterwards, we took only the routes well-known to our local guides. Throughout the area, we either made daily night camps as we traveled or used hunter camps. In order to maximize survey efforts, we did not visit areas where only very patchy forests exist (as depicted from satellite imagery) or areas where reliable information gathered from local people and forest guards suggested that chimpanzees no longer occur. For example, satellite imagery indicated there is some forest left in Otu and Irele Forest Reserves, but reports by government forest guards working in the area suggested that what may appear to be forests are actually exotic tree plantations and that chimpanzees have not been observed or reported in these areas in the last ten years. This provided credible information that prevented surveys in those areas.

All available evidence of chimpanzee presence (e.g., direct sighting, vocalization, feces, nests, foot or handprints, and feeding signs) was recorded including associated data on other wildlife species and habitat status (i.e., whether habitat is unspoiled, regenerating or has been cleared, otherwise degraded or converted). A systematic method of observing and recording data during sampling followed recommendations in White and Edwards (2000). Face-to-face interviews with resource users, researchers and government officials were also conducted including investigations (also through interviews) into wildlife trade in the major bushmeat market destinations in the region. Secondarily, efforts were made to gather information from published and unpublished literature related to the species in the survey area or region to determine previously observed locations related to chimpanzee presence (or absence) and distribution. A Geographical Information Systems (GIS) database was developed for the project with integrated information on elevation, climate, human population, land use/cover and the areas' boundaries. Data were collected on human activities in five major categories: poaching/hunting (including snares, hunters seen, gun shots, used cartridges and animal kills); logging (workers seen, chainsaws heard, timber stock piles, felled logs and timber trucks); farming (land clearing, bush burning, standing crops, harvest, farmers seen); collection of Non-Timber Forest Products (NTFPs) such as fishing, firewood gathering, including collection of *Carpolobia* spp. (stem supplied mostly to cattle herdsmen), *Thaumatococus danielli* (leaves used mostly to wrap food), *Irvingia gabonensis* (also known as bushmango, the seed of which is an important soup ingredient); and settlements (such as houses/huts, old camps, camps in use, villages). Public-domain USGS satellite data from 2000–2013 were used to understand habitat status and assess the changes in land cover over the 13 year period and to measure the rate of change in the Idanre Forest Cluster.

RESULTS AND DISCUSSION

Chimpanzees and related evidence of their presence (e.g., nests, foot or knuckle prints, feeding sign and vocalizations) were observed a total of 22 times during the survey. Only one direct observation of two individuals was made in Akure-Ofosu forest reserve. Foot or knuckle prints were seen twice, 10 nest sites were observed; loud vocalizations (screams and grunts) were heard on one occasion and feeding signs were seen three times. Other evidence includes carcasses and body parts. Only three observations were made in Ise forest reserve, while 17 observations were made in the Idanre Forest Cluster. In general, the encounter rate of chimpanzee evidence was 0.03 per kilometer walked in Ise and 0.12/km in the Idanre Forest Cluster (Table 1). Several factors may have contributed to this low encounter rate which may have limited overall survey data. For example, high hunting pressure may have inhibited animals from vocalizing, large-scale felling of trees would have prevented some nest observations and the resultant effect of avoiding armed gangs and deviating from vast areas of dense fallow bush had significant impact on the straight-line sampling method used to assess the target species. Thus, the sampling methods employed may not have been well-suited for quantitatively assessing chimpanzee numbers in this area.

Nonetheless, the cumulative data from field observations confirmed the presence of chimpanzees within the areas surveyed and was useful in identifying group size (see Table 1) but too low to provide any useful information on abundance or density and as such is insufficient to make accurate suggestions about the population size of chimpanzee in these sites. However, an attempt is made to hypothesize about approximate chimpanzee numbers using these field data, reliable local reports (observations made ≤ 1 year prior to the report) and habitat conditions. Survey observations in Ise Forest Reserve indicated the presence of 3 – 6 individuals while accompanying information gathered from local people

Table 1. Summary of Chimpanzee Observations.

Area	Type of Obs.	Estimated age of sign	No. of items	Associated Notes	Survey Type	Date/Time of Obs.	Habitat
Ise	Nests (Cluster)	Very Old (Over 8 weeks)	3	appeared to have been more nests in this cluster because area was only recently cleared	reccet	02-NOV-12 7:36:34	Secondary forests but highly degraded form
Ise	Footprint	Recent (2 days)	1	local hunter saw 2 individuals (male & female)	recce	04-NOV-12 8:39:41	Area of dense vegetation of lianes, stranglers and thorn bushes
Ise	Body parts	Very Old (Over 1 year)		A traditional native doctor/hunter shows off his remains from chimpanzee killed over a year ago	Inter-view	10-NOV-12 17:45:08	
Ise	Feeding Sign	Old	-	Frayed tips from leafstalk of a young palm tree.	recce	14-JAN-13 15:27:52	Gallery forests along the Ogbesse river. Seasonally inundated areas surround-ed by farmlands
Akure-Ofosu	Body parts	Recent (About 2 weeks)	-	A hunter encountered shows off his chimpanzee bones (from upper arm) which he distributed to his associates and traditional doctors. A kill he claimed he made (confirmed by others) only 2 weeks before.	Inter-view	15-NOV-12 11:12:17	
Akure-Ofosu	Nests (Cluster)	Fresh	4	There might have been more individuals in the group than the nests observed because some vegetation on the rocky areas were suppressed but could have been done by a buffalo whose feces was observed some distance away	recce	20-NOV-12 14:20:59	Relatively undisturbed forests with rocky outcrops
Akure -Ofosu	Nests (Cluster)	Fresh	7	The vegetation used for the nests was still green	recce	21-NOV-12 9:46:58	Relatively undisturbed forests with rocky outcrops
Akure -Ofosu	Nests (Single)	Fresh	1	Only one nest was observed close to a rocky cliff.	recce	24-NOV-12 9:26:46	Secondary forests surrounding hills/ rocky outcrops
Akure -Ofosu	Nests (Cluster)	Fresh	4	Nests were located on different trees	recce	27-NOV-12 11:11:49	Secondary forests surrounding hills/ rocky outcrops

Table 1. Summary of Chimpanzee Observations (continued).

Area	Type of Obs.	Estimated age of sign	No. of items	Associated Notes	Survey Type	Date/Time of Obs.	Habitat
Akure -Ofosu	Feeding Sign	Fresh (Early morning)	-	Fresh signs apparently made just before arrival at the spot. Chimpanzee knuckle prints were also visible at the site. The amount of feeding remains suggests it may have been a reasonably large group of up to 10 individuals.	recce	27-NOV-12 11:19:33	Forest patches along a water source.
Akure-Ofosu	Nests (Cluster)	Recent	2	Nests were observed on ropes and stranglers.	recce	27-NOV-12 11:37:05	Relatively undisturbed forests with rocky outcrops
Akure-Ofosu	Nests (Cluster)	Fresh	2	New nests believed may have been constructed the previous night.	recce	27-NOV-12 9:27:05	Relatively undisturbed forests with rocky outcrops
Akure-Ofosu	Trail/ Footpath	Fresh (few hours before sighting)	1-2	We believe that this individual (couldn't have been more than two individuals) might have heard us approaching because the footpath was very fresh and trail appeared to have been flattened during walk. Footprint of an adult was visible.	recce	28-NOV-12 11:49:40	Secondary regrowth with thorn bushes
Akure-Ofosu	Direct Sighting	Real time	2	We were startled by two individuals (or perhaps they had been startled by us). Sighting was for a few seconds before scurrying off.	recce	19-JAN-13 7:58:55	Relatively undisturbed forests with rocky outcrops
Idanre	Carcass	Recent (Still decompos-ing)	1	Skull, hands and feet in possession of hunter.	Inter-view	30-NOV-12 15:08:43	Idanre area
Idanre	Feeding Sign	Old	-	Hunter guide had observed chimpanzee eating at the spot a week ago and the feeding remains bits of fibrous vegetation eaten and discarded were still visible.	recce	24-JAN-13 10:57:53	New clearing for farmland. Some rocky outcrops can be found in this area
Idanre	Nests (Single)	Very Old	1	Vegetation already almost completely disintegrated	recce	24-JAN-13 11:37:04	Area of rocky outcrops and open understorey
Idanre	Nests (Cluster)	Very Old	2	Nests observed were located on large cotton tree (Ceiba pentandra).	recce	24-JAN-13 13:40:00	Recently burned forest presently over-taken by the Chromolaena odorata weed.
Idanre	Vocaliza-tion	Real time	3 - 4	Loud grunts were heard accompanied by a sharp scream supposedly from an infant.	recce	24-JAN-13 6:53:35	Inselberg surrounded by over-logged forests and new farm clearings
Idanre	Nests (Single)	Fresh	1	It seemed likely that there were more nests besides this single nest observed because we observed a nest-like structure on felled trees around this area.	recce	25-JAN-13 9:38:29	Highly disturbed forest patch mixed with old farmlands

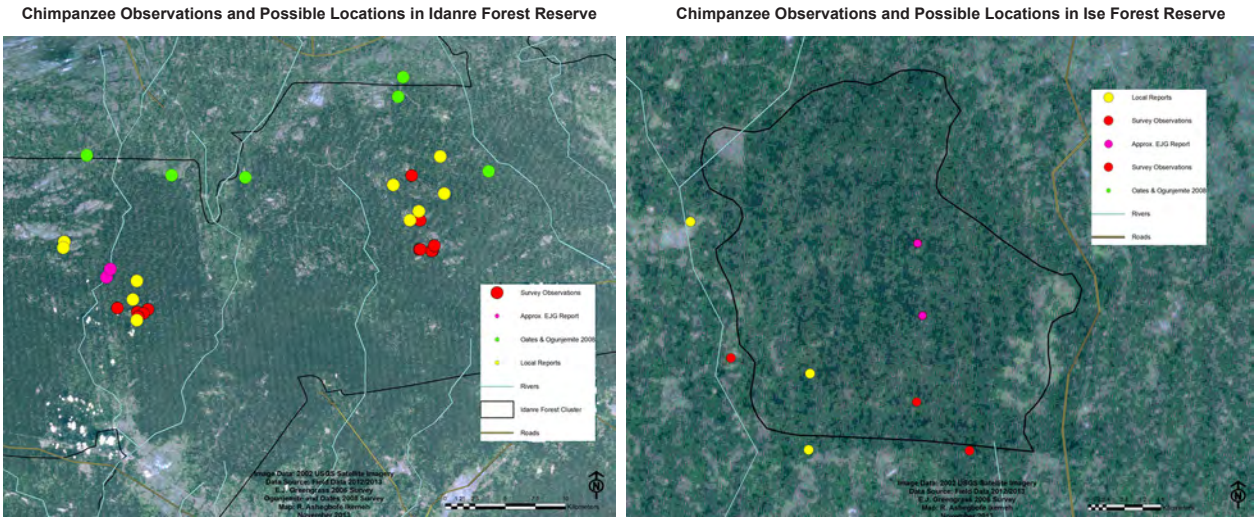


Figure 3. Chimpanzee observations in the survey areas, Idanre (above) and Ise (right) Forest Reserves. Maps show chimpanzee observations from this survey, reliable local reports and previous systematic surveys conducted on the species.

suggest there may be up to 15 individuals there. In Akure-Ofosu a total of 20 fresh or recent nests were seen in six clusters; the largest cluster, 7 nests, sets a minimum boundary on the number of individuals present. Because some clusters were within 3km of each other and seen on different days, there may have been overlap in party membership so the total number of individuals is likely to be less than 20 (see Plumptre & Reynolds 1997, Kühl *et al.* 2008). Observations in Akure-Ofosu also included one direct sighting of two adult individuals (male and female), the trail of no more than two individuals, and feeding signs from a reasonably large group. Taken together, these observations suggest there may be 16 – 38 chimpanzees especially if reliable local hunters' reports are taken under consideration as well. One hunter who killed an adult male two weeks prior to the survey (evidence provided), claimed he counted 13 individuals in the group that day, and another account of 9 weaned individuals was reported separately. Field data collected in Idanre Forest Reserve indicated there may be a group of about 5 individuals from which vocalizations were heard, 4 individuals from nest observations, while additional information from accounts of recent encounters by some locals suggest that chimpanzees surviving in the Idanre Forest Reserve are between 8 – 13 individuals. Within this Forest Cluster, Owo Forest Reserve was completely avoided because of reports of the presence notorious marijuana armed gangs in the reserve (although, some parts of Ala and Akure-Ofosu have also been occupied by these illegal marijuana growers). There were credible reports of chimpanzee presence in Onisheri Forest Reserve along its boundary with Idanre, although direct field assessment was not made in this forest patch. In Ohosu Forest Reserve, our survey assumed that with the high-level of human activities observed, chimpanzees are unlikely to inhabit this area. Although, some local hunters believe that chimpanzees occur in this reserve, it may be the same populations from Akure-Ofosu.

Generally, these observations and reports suggest a population size within the range of 7 – 115 individuals (≤ 20 in Ise F.R. and ≥ 51 in the Idanre forest cluster) that may be present in the survey areas. Thus, even at the high end of the gross estimates of 115, populations are small and can be considered highly vulnerable to extinction owing to the level of anthropogenic threats discussed in succeeding sections. Figure 3 shows the locations of chimpanzee observations during this survey, reported locations indicated by recent observations (less than 1 year of sighting) made by local people, GPS locations reported in Ogunjemite and Oates 2008, and observations reported in Greengrass 2006 (as indicated by the same local guides utilized by Greengrass during her survey). Only a few previous surveys can make reliable suggestions on population numbers from which to estimate the species' population trends or make comparisons about population numbers over time. However, Ogunjemite *et al.* (2006) reported 13 nest clusters in Akure-Ofosu Forest Reserve and 22 nest clusters in Ise Forest Reserve, Ogunjemite and Oates (2008) reported observing 7 nest clusters made up of 33 individual nests in Akure-Ofosu Forest Reserve, while Ogunjemite (2011) estimated a density of 0.22 km^{-2} in Akure-Ofosu Forest Reserve and 0.31 – 0.40 chimpanzees km^{-2} in Ise Forest Reserve with about 12 -17 chimpanzees estimated to occur in Ise (Ogunjemite 2004). Overall, there were no substantial differences in the frequency of chimpanzee observations over time.

Occurrence, Range and Distribution of Chimpanzees

The current distribution of chimpanzees in the Akure-

Ofosu forest reserve is very patchy. The remnant habitat where they occur is severely fragmented and is faced with an onslaught of human encroachment. It appears that chimpanzees are restricted to the remnant tract of forest patch at the center of the reserve – an area characterized by vast expanse of inselbergs (rocky outcrop vegetation). It is difficult to tell at this stage how the chimpanzees in Idanre forest reserve are distributed, but based on our observations and local reports, chimpanzees occur mostly within the gallery forest patches along the three major rivers that traverse and border the Idanre forest reserve. In Ise forest reserve, we were able to observe chimpanzees only at the southern edge of the reserve, and only one observation was made inside the reserve itself while another observation was made outside the boundaries of the reserve along the gallery forests of River Ogbesse. Field observations and most local reports consistently associate current chimpanzee occurrence with forested patches within the survey areas. However, despite habitat analysis on satellite imageries indicating that an area of 669km^2 (31%) of forests remain in the Idanre Forest Cluster much of which is within Akure-Ofosu and Idanre Forest Reserves, study results (both from field data and local accounts) suggest that chimpanzees are present in an estimated area of only about 487km^2 within the Idanre forest landscape and an area of 32km^2 in Ise Forest Reserve, which is about 68% of the total land area covered by the reserve.

Anthropogenic Influence

Encounter rates of human activities suggest that logging in both sites is a major part of income generating activities for people in the region. Logging was the most predominant activity in Ise Forest Reserve and Idanre Forest Cluster, making up about 40% of an estimated 181 (57 in Ise and 124 in Idanre) total human activities recorded during the survey. However, hunting, farming, and settlements are relatively more intense in the Idanre Forest Cluster than in Ise as they were observed 0.21, 0.20, and 0.11 per kilometer walked, respectively, compared to the 0.07, 0.10, and 0.04 per kilometer recorded in the Ise Forest Reserve. Survey results indicate that a combination of excessive logging activities and land cultivation preceded by clearing must have had a profound impact on chimpanzee abundance and distribution inside the forest reserves. Land cultivation also contributes significantly to overall forest loss in the survey areas. Two forms of farming were observed during the survey: the cultivation of cash/food crops and the cultivation of marijuana. The Idanre Forest Reserve is almost completely taken over by illegal farm encroachment, and areas that were previously relatively intact during a 2009 survey (Ikemeh 2009b) have become farmland with permanent settlements. The level of new clearing observed during this survey suggests that the remaining forest patches within the Idanre forest reserve would have all become farmland by the end of 2013 if no decisive action had been taken to stop it. Fortunately, the Ondo State Government reacted quickly to the report of this survey, submitted to the State Governor in April 2013, and in the week following the report presentation the government arrested hundreds of illegal encroachers in the reserve. Similarly, marijuana farms are spreading throughout the survey areas. The Cannabis sativa leaves supply a growing local illicit drug market and this has become an important income-generating activity for many locals. By its very nature, the Cannabis plant requires fertile areas of rich habitats and its vegetative growth phase requires more than 12 – 13 hours of light per day. As a result, the forest canopy is removed completely, speeding up deforestation and biodiversity loss. It is unclear at this stage (and difficult to estimate) how many hectares of forest cover have been lost to marijuana plantations in the survey areas, but survey findings indicate that vast areas of forest land within the reserves have been affected by the cultivation of this plant. GIS analysis (Figure 4) indicates that 744,488ha of forest (34.5% of the total land area) was converted from 2000 to 2013. This further suggests that an average of 7.7% (57, 268ha) of forest is cleared each year within the Idanre Forest Cluster, and land cover classification analysis for the 13 year period indicates that 85.1% of forest conversion is driven by farming activities. In Ise forest reserve, our observations were not consistent with the reflection (indications of forests/non-forests) from the satellite imagery. We found that much of what appeared to be forest were actually large areas of fallow land with no large trees but with dense understory characterized by thorn bushes.

Other human disturbances such as hunting also have an impact on chimpanzee populations as their body parts (particularly hands, feet, and head) provide relatively huge profits when sold to traditional native doctors who produce charms believed to enhance physical strength and protection (Figure 5). Although many local people claim they would not eat chimpanzee meat because of its resemblance to humans, a few individuals admit they would eat the meat if available. Overall, the interviews conducted suggest that an average of 5 chimpanzees have been hunted annually since 2005. Ninety-four percent of these involved killing for sale to traditional native doctors and 6% during the 9-year period were to capture an infant for sale as a pet. There were no claims that chimpanzees have been hunted for meat and the chairman of the Hunters' Association insists that there is a law within the Association that prohibits the hunting of chimpanzees in Ondo State because the ape is revered in traditional Yoruba culture. He admits, however, that even though some hunters regularly break this law, the meat must not be seen in the open market where other bushmeat is sold. Hunting of wildlife is generally very

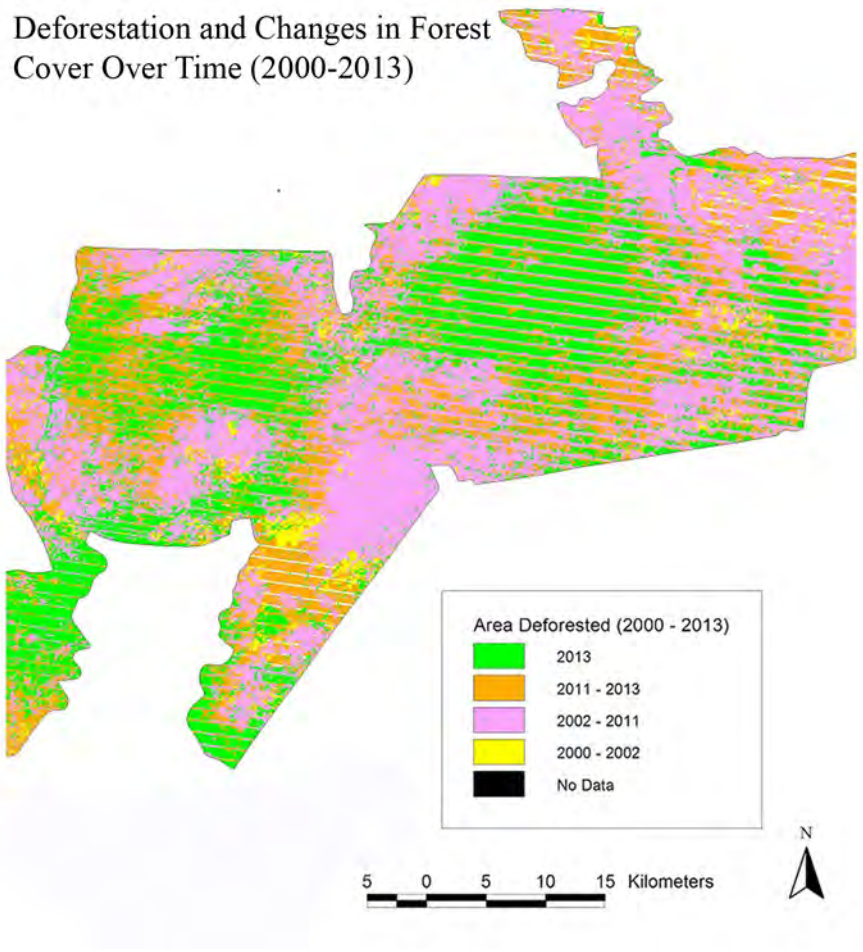


Figure 4. Deforestation Rate in the Idanre Forest Cluster. Rate of loss of natural forest/tree cover in the Idanre forest cluster over a period of 13 years. Current areas covered by forests and other tree cover types such as exotic tree plantations is about 34.5% of the total land area. Data source: USGS Imagery 2000-2013. Groundtruthing: R. Ashegbofe Ikemeh, December 2012/January 2013. Map: R. Ashegbofe Ikemeh, April 2013.

high in these forests, according to one of the Hunters' Association executives; there are about 400 registered members of the Association in Ondo State. Even in a case where some animals are legally protected in the State, such as the case for forest elephants (*Loxodonta africana cyclotis*), evidence of poaching continues. For example, in 2012 alone, there were three independent reports of elephant killings within the Idanre –Akure Ofosu forest landscape and we found that only one of these cases was prosecuted by officers of the Ministry of Natural Resources.

CONCLUSION AND RECOMMENDATIONS

Very small and severely fragmented natural forest remains in the survey area but a great deal of biodiversity is already lost. This current situation can be attributed to several causes (based on observed human activities), but there are underlying factors that must be identified and addressed before these threats can be ameliorated. One of the major resultant effects of the high level of human activities in the survey areas, especially logging

Figure 5. Fresh chimpanzee parts with traditional native doctor/hunter. Our survey found that chimpanzees are mostly hunted for their body parts supplied for use by traditional native doctors. This photo is taken in Idanre during the survey. Photo © Rachel Ashegbofe Ikemeh 2013.

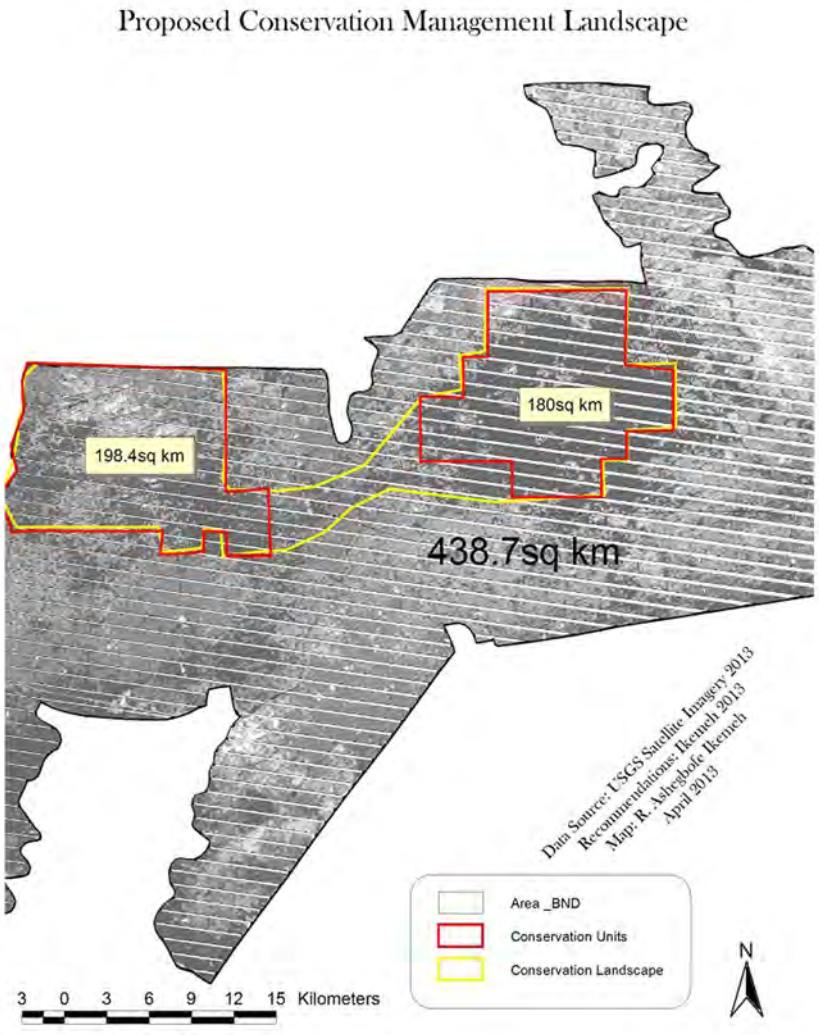


Figure 6. Recommended Areas in Idanre Forest Cluster for Chimpanzee Management and Monitoring.

and farming, is habitat loss and degradation. Hunting is equally devastating to wildlife populations in general; forest elephants are being poached in record numbers. It is therefore recommended that clearly defined management objectives targeted at the establishment of conservation areas should form the basis for any further efforts. It is imperative that these objectives are defined based on available information gathered so far, in this regard, emphasis should be placed on species conservation or the conservation of a range of species within this threatened landscape. Correspondingly, connecting chimpanzee and other wildlife populations via a series of protected habitat corridors is also very important, e.g., Ikemeh (2009b, 2009c) found that elephants were using areas east of Idanre Forest Reserve to travel to the Akure-Ofosu Forest Reserve. Chimpanzees and other large mammal species require relatively large forest tracts to forage and thrive; otherwise wildlife will continue to come into conflict with humans. For example, of the three reported killings of elephants in 2012, one was an occasion of elephants raiding crops. The farmer had reportedly targeted the elephant as he claimed the animal always trampled his crops (cultivated illegally in a forest reserve).

Chimpanzee populations, like other wildlife species in the Idanre Forest Cluster and Ise Forest Reserve, are heavily threatened and are on the verge of extinction. If no further action is taken in the near future, populations will not have a chance of recovery. Yet, the taxonomic status of chimpanzees in southwestern Nigeria still remain unresolved (Gonder *et al.* 2006), and this survey was unable to find faecal remains needed for genetic sampling. There are indications suggesting there are differences between chimpanzee populations in western

and eastern Nigeria (Gonder *et al.* 1997, Gonder 2000), and if this difference is confirmed it will further increase the importance of the western Nigerian chimpanzees. The loss of this population will represent the loss of biological and cultural heritage of this great ape. With existing survey data, a conservation management landscape of about 438.7km^2 in the Idanre Forest Cluster (180km^2 in Akure-Ofosu Forest Reserve, 198.4km2 in Idanre Forest Reserve, and 60.3km^2 as Community Conservation Area, or CCA) is recommended to ensure a habitat corridor that may connect isolated populations (Figure 6). A 30km^2 chimpanzee reserve is recommended in Ise Forest Reserve, but in both sites government needs to address insecurities and habitat devastation resulting from marijuana cultivation before any conservation-related activities can be successful.

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Sightings and Habitat Use of the Northern Lesser Galago (*Galago senegalensis senegalensis*) in Niumi National Park, The Gambia

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Abstract: *Galago senegalensis* have the widest distribution of any nocturnal primate in Africa, extending from Senegal through to East Africa, a distance of over 7000 km. Yet few field studies of this species are published. Here we present the first field study from The Gambia, in the westernmost part of their geographical range. The study was conducted in Niumi National Park from 28 April to 12 May 2012. We aimed to determine whether there are any differences in the habitat use and characteristics of *G. senegalensis* in The Gambia compared to elsewhere, and to assess possible conservation threats. We took systematic measures of heights used by galagos during their activity, their grouping tendencies, sleeping site use and *ad libitum* observations of behaviour and pelage colour. We collected 703 data points related to habitat use and inter-individual distances. Galagos used all vegetation strata from the ground to 15 m with a modal height of 4-6 m. Animals slept alone on 30% of the observations and in groups on 70%. Twenty-four calls were recorded. Calls were similar to those recorded for other populations of *G. senegalensis* but pelage coloration differed from other populations. In The Gambia, *G. s. senegalensis* was more social during their active period compared to *G. s. braccatus*. Individuals of *G. s. senegalensis* were observed solitary in 40% of the encounters and in groups of ≥3 individuals in 23%. The galagos in Niumi NP were observed near human settlements, and were not reported to be hunted. However, there is concern that the natural vegetation is being undermined by high levels of anthropogenic disturbance, specifically trampling of the undergrowth by cattle, thus decreasing the preferred habitat for galagos. Niumi NP provides an ideal location for long term studies of *G. s. senegalensis*.

Key words: behaviour, biogeography, bushbabies, conservation, grouping tendences, Strepsirrhini

Résumé: *Galago senegalensis* est le primate nocturne africain avec la distribution géographique la plus large, s'étendant du Sénégal au l'Afrique de l'Est, une distance de plus de 7000 km. Pourtant, peu d'études de cette espèce ont été publiées. Nous présentons ici le premier étude de Gambie, dans la partie occidentale de son aire de répartition géographique. L'étude a été menée dans le parc national Niumi du 28 Avril au 12 mai 2012. Nous avons voulu déterminer s'il existe des différences dans l'utilisation de l'habitat et les caractéristiques de *G. senegalensis* en Gambie par rapport à d'autres sites d'étude et évaluer les menaces possibles pour la conservation de l'espèce. Pendant cette étude, nous avons pris des mesures systématiques des hauteurs utilisées par les galagos au cours de leur activité, leurs tendances de regroupement, leur utilisation des sites pour dormir, et des observations ad libitum de comportement ainsi que leur vocalisation et la couleur du pelage. Nous avons recueilli 703 points de données liés à l'utilisation de l'habitat et les distances inter-individuelles. Les galagos utilisent toutes les couches de la végétation à partir du sol jusqu'à 15 m, avec une hauteur modale de 6,4 m. La hauteur moyenne des arbres et l'espacement étaient 5,4 m et 3,8 m respectivement. Les animaux dormaient seuls de 30 % des observations et en groupe de 70 %. Vingt-quatre appels ont été enregistrés. Les appels étaient similaires à ceux enregistrés pour *G. senegalensis* ailleurs en Afrique, mais la coloration du pelage était différente des autres *G. senegalensis*. En Gambie, *G. s. senegalensis* était plus sociable au cours de la période d'activité par rapport

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à *G. s. braccatus*. *G. s. senegalensis* n'a été observé solitaire que dans 40 % des rencontres et en groupes de ≥ 3 individus dans 23 % des rencontres. Les galagos dans le parc national Niumi ont été observé à proximité des villages, et n'ont pas été indiqué à être chassées. Cependant, il est à craindre que la végétation naturelle soit diminuée par des niveaux élevés de coupe sélective, le surpâturage et le défrichement des terres pour les cultures. Une préoccupation est le piétinement des sous-bois par les vaches, réduisant ainsi l'habitat de prédilection des galagos. Le Parc National Niumi offre un emplacement idéal pour les études à long terme de *G. s. senegalensis*.

INTRODUCTION

Galagos (bushbabies) are nocturnal primates distributed throughout sub-Saharan Africa from Senegal to South Africa, and are found in forest, woodland, and savannah habitats. Some 24 species are currently recognised (Bearder *et al.* 2008; Nekaris & Bearder 2011; Nekaris 2013), an increase from the previous six acknowledged species in the genus (Osman Hill 1953). The species with the widest distribution, *Galago senegalensis*, extends from western Senegal (*G. s. senegalensis*) through to Kenya, Tanzania, and Ethiopia in the east (*G. s. sotikae, G. s. braccatus* and *G. s. dunni*), a distance of over 7000 km (Nash *et al*. 2013). Yet field studies of this species cover only a small number of populations in the eastern part of their geographical range (e.g., Haddow & Ellice 1964; Butler 1967; Nash & Whitten 1989; Ambrose 2002; Off *et al.* 2008; Butynski & de Jong 2012). Data are also available from museum specimens (Jenkins 1987; Masters & Bragg 2000; Masters & Brothers 2002) and from individuals kept in captive colonies (Izard & Nash 1988; Zimmermann 1989).

Here we present the first field study of *G. senegalensis* in The Gambia, at the westernmost part of their geographical range. During this study we aimed to: 1) determine whether there are any differences in the habitat use and characteristics of *G. senegalensis* in The Gambia compared to elsewhere, and 2) assess possible conservation threats to the population of *G. senegalensis* under study.

The Gambia has progressive wildlife laws whereby all wildlife species, regardless of their conservation status, are protected. All activities not compatible with protected area status are prohibited under the Biodiversity/ Wildlife Act 2003, including illegal hunting and felling of trees within national parks (Nije *et al.* 2011). There are currently eight protected areas in The Gambia, covering 4.27 % of the country's land area (Camara 2012). Understanding the habitat use of *G. s. senegalensis* and identifying the conservation threats they might face in The Gambia is crucial for planning effective conservation management strategies.

METHODS

Study area

The study was conducted in Niumi National Park on Jinack Island, on the shores of the Atlantic Ocean (13° 33' N 16° 31' W), about six kilometres north of the capital Banjul (Figure 1). Niumi NP is one of only two national parks on the northern shore of the Gambia River. Jinack Island is separated from the mainland only by the narrow river Niji Bolon and Niumi NP encompasses almost the whole island. The Niumi NP was gazetted in 1986 and is contiguous with the Delta du Saloum National Park and Biosphere Reserve in Senegal. The terrestrial part of this Gambian national park covers an area of 49.4 km^2 (Nije *et al.* 2011). The vegetation is mainly open woodland-savannah adjacent to the coast, dominated by tree species such as baobabs (*Adansonia digitata*), bembé (*Lannea acida*), gingerbread plum (*Neocarya macrophylla*), African locust bean tree (*Parkia biglobosa*) and West African copal (*Daniellia oliveri*), as well as shrubs such as acacias (*Acacia albida*), red spike thorn (*Maytenus senegalensis*), Senegal prickly-ash (*Zanthoxylum zanthoxyloides*), Combretum nigricans and sicklebush (*Dichrostachys glomerata*). The last two shrubs tend to be dominant in areas where there has been clearance for agriculture in the past. The natural vegetation has been increasingly degraded by human activities. In previous generations, before the declaration of Niumi NP, the human population living within the park cleared land for rice cultivation, watering collecting points, and grazing of their animals. Since then, these activities have expanded every year (Nije *et al*. 2011). Uncontrolled grazing by cattle and donkeys is still occurring within the National Park, as well as selective cutting, fruit collection and the planting of exotic trees, including the neem tree (*Azadirachta indica*), cashew trees (*Anacardium occidentale*), mangoes (*Mangifera indica*) and blue gum (*Eucalyptus globulus*). Onions, maize, rice, and cannabis are cultivated and irrigated from deep wells dug into the sand. These wells indicate that the water table has dropped in recent years, as the wells are drying up.

Data Collection

The study was conducted from 28 April to 12 May 2012, at the end of the dry season, which extends from November to May. We used Petzl Zoom head torches with red filters to observe the galagos, aided by the galago's yellow/orange eye reflections. The use of red light allowed us to observe the animals without disturbing them, as red light is invisible to them. It also allows the observer to develop better night vision (Charles-Dominique & Bearder 1979; Nekaris 2003). Pilot surveys

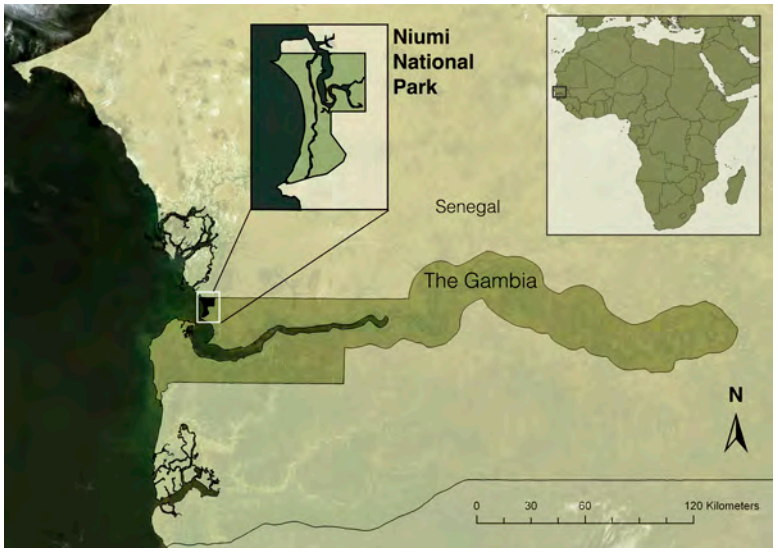

Figure 1. Map of The Gambia showing the location of the Niumi National Park.

were conducted in cashew plantations near one of the two villages within the National Park, but the broad leaves of cashews made observations difficult so we moved to an area of natural vegetation further south. The grazing activities of domestic animals in the area produced many pathways, giving us easy access when following the galagos. We followed individuals away from their sleeping sites each evening and back again at dawn. Most observations were within three hours after dusk and three hours before dawn, but one all-night session was conducted on the night of the full moon (5 May 2012). The total survey effort accounted for 70 hours.

We approached the animals slowly and carefully until they ignored our presence, usually after about 45 min. It was then possible to follow them for up to two hours at a time. If the animal was lost, it was nearly always possible to find another within a few minutes. We recorded the estimated height of each individual at first sighting, and then at five minutes intervals for as long as possible. At each interval we noted whether the animal was travelling alone or with others, and whether there was any physical contact with other individuals. We recorded travelling "with others" when two or more individuals were travelling at a distance of ≤ 20 from each other. We also recorded data on sleeping site use, including numbers of individuals and time of entry and exit.

We noted behaviours ad libitum, including foraging, feeding, locomotion, social interactions, and mating (Bearder & Doyle 1974; Nash 2003). Animals were photographed extensively, enabling us to examine their pelage characteristics and proportions for comparisons. When we heard vocalising, we noted time, call type, the vocalization context and associated behaviour. Calls were recorded with a Marantz PMD222 cassette recorder and Sennheiser K6 microphone with an ME67 directional extension.

For the vegetation survey we employed the method of point-quadrat sampling (Ganzhorn 2003). We established sampling points randomly 50 m apart along compass bearings within the study area. As galagos use a wide range of strata, we included all trees and shrubs. We measured the distance from the sampling point to the nearest tree or shrub in each quadrat, together with tree height and the diameter at breast height (DBH).

RESULTS

Out of the 70 hours of surveying we followed galagos for a total of 58 hours, during which we collected 703 5-minute interval-samples relating to habitat use and inter-individual distances. All animals we observed appeared to be adults, based on body proportions (Oates 2011; Nash *et al.* 2013), and one female appeared to be pregnant. The pelage of the galagos was pale grey, with the tail noticeably darker than the body. Circum-occular markings were circular and the ears were relatively small in comparison to other populations of *G. senegalensis* (Nash *et al.* 2013). The galagos used all available strata from ground level to 15 m. The mean height use observed was 4.1 ± SD 2.5 m (Figure 2). One galago was observed to leap six meters between trees. On 10 occasions we observed an individual crossing on the ground for up to 25 m by means of bipedal hopping.

The galagos left their sleeping sites on average 17 minutes after sunset (n = 11) and returned again on average 41 minutes before sunrise (n = 9). We observed individuals using two different sleeping sites: one 5 m up in a dense tangle of the climber *Zanthoxylum zanthoxyloides* surrounding a dead tree, the other in a

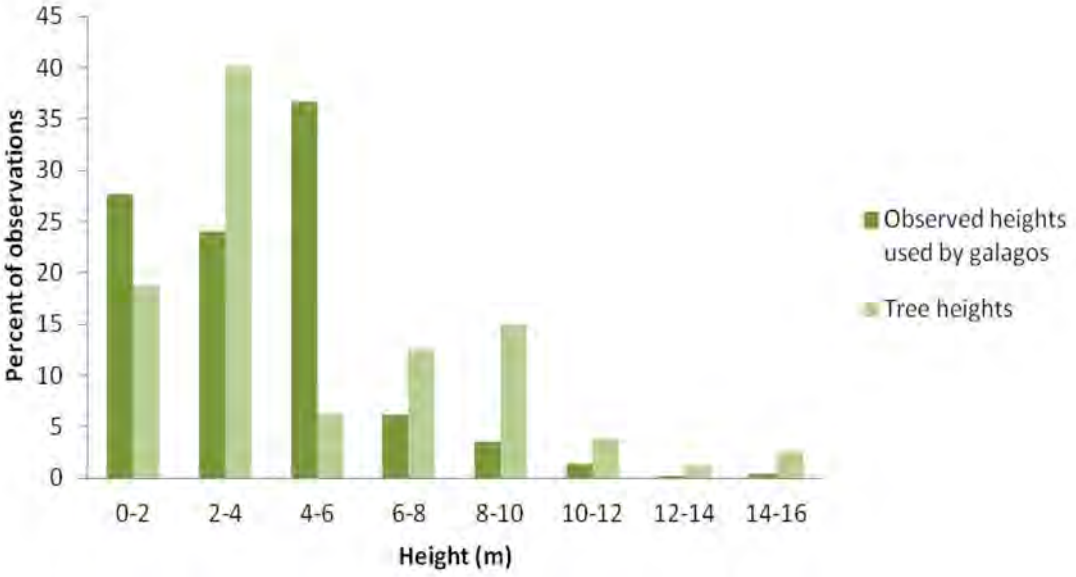

Figure 2. Height use of *G. s. senegalensis* and tree heights based on vegetation survey.

hole at 1.5 m in a dead stump. A further two potential sleeping sites were indicated by an individual that investigated the known sleeping hole during the night and then entered two new tree holes within a 30 minute period; one 2 m up on a tree trunk and the other at 1.5 m in a hollow stump.

Animals slept alone on 6 occasions (30%) and with one or more others on 14 occasions (70%). During their active period individuals were observed alone in 40% of the encounters, in pairs in 37%, and in groups of ≥ 3 individuals in 23% of the encounters (Figure 3).

On four nights we observed a male maintaining close contact with a female, associated with copulations lasting three to seven minutes. These included pelvic thrusting and grasping. No vocalisations were heard and the pair was only once joined briefly by another individual. We observed feeding on insects in the trees and on the ground, where animals searched the leaf litter. Fruit eating and gum licking were both photographed (Figure 4). Urine washing was not observed.

Twenty-four bouts of calling were recorded. Calls were typically brief, lasting a few seconds, with only one bout of calling lasting 30 minutes (n = 38). Based on the call types described by Zimmermann *et al.* (1988), six call types were heard: yaps (Fwa), honks (Woo1), explosive coughs (Tjong), buzzing coughs (no equivalent),

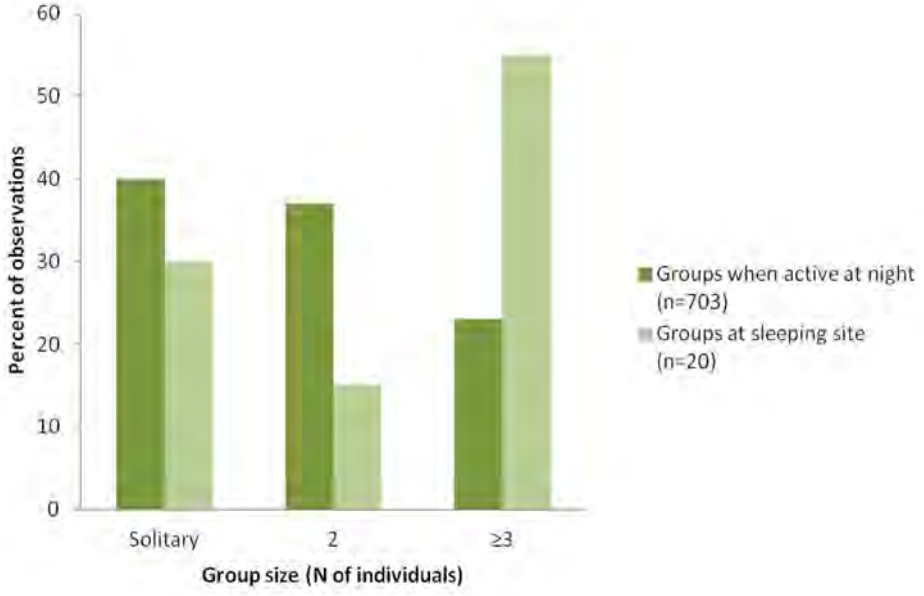

Figure 3. Number of *G. s. senegalensis* involved in grouping whilst active at night and at sleeping sites.

Figure 4. *Galago. s. senegalensis* eating fruits of *Lannea acica* and consuming gum.

sneeze (Ft) and gewit (Fwa variant). Calling was most frequently associated with antagonism and chasing, with the calling individual fleeing and descending towards the ground. Calls used in this context were yaps, gewits, and explosive coughs. Honking calls were given in the context of reassembly at dawn and also soon after leaving the sleeping site at dusk. The buzzing coughs were heard in association with yaps and explosive coughs, whilst sniffs were made when attempting to jump close to the observer.

We surveyed 20 randomly distributed point quadrat sampling plots, measuring a total of 80 trees, including shrubs. The mean vegetation height was 5.4 ± SD 3.4 m (range 1 - 16 m; Figure 2). The mean DBH of trees was 11.23 ± SD 4.54 cm (range 3.74 – 19.26 cm). The mean distance between trees was 3.8 ± SD 2.6 m (range 0.2 – 11.2 m), indicating an average tree and shrub density of 1,912 trees/ha.

DISCUSSION

Figure 5 compares the facial markings and body pelage of the study animals to *G. moholi* (once considered a subspecies of *G. senegalensis*; Nash *et al.* 2013) and Kenyan *G. s. braccatus* and *G. s. sotikae*. *Galago moholi* has diamond-shaped, as opposed to the round circum-occular markings of *G. s. braccatus, G. s. sotikae* and *G. s. senegalensis*. The light grey pelage of *G. s. senegalensis* is the least colourful within the species, lacking the yellow/russet colouring on the limbs of *G. s. sotikae* and *G. s. braccatus*. The tail of *G. s. senegalensis* is grey-brown in colour and noticeably darker than the body, as in the other three galagos. Our impression was that the study animals were similar in size to *G. moholi* (average weight ~200 g) and smaller than *G. s. braccatus* (average weight 315 g in males and 250 g in females) (Izard & Nash 1988; Pullen 2000).

The animals were seen relatively low down at our study site with a mean height of 4.1 m compared to 7.4 m for *G. s. braccatus* in Kenya (Off *et al.* 2008), and to *G. s. senegalensis* in Uganda, which was observed mainly at 10-12 m (Ambrose 2002). Our findings resemble those of Nekaris and Bearder (2011) with proposed heights of 1-4 m as the most used strata in *G. senegalensis*. In our study, *G. s. senegalensis* used substrates below 10 m almost exclusively (96.5%), whilst Off *et al.* (2008) found that *G. s. braccatus* occurred below 10 m in 59% of the observations (Off *et al.* 2008). Both *G. s. braccatus* and *G. s. senegalensis* were observed on the ground for less than 3% of all observations. The use of lower strata at Niumi NP might be related to the area being highly affected by human activities and the low occurrence of taller trees (mean vegetation height was 5.4m).

Galago senegalensis are known to use both tree hollows and dense tangles of vegetation as sleeping sites, as well as building nests (Haddow & Ellice 1964; Bearder *et al.* 2003; Butynski & de Jong 2012). Although tree hollows were observed as sleeping sites in this study, *G. s. senegalensis* slept mostly in a dense tangle of vegetation, which is consistent with other subspecies of *G. senegalensis* (Bearder *et al.* 2003; Off *et al.* 2008; Nekaris & Bearder 2011). This choice of a densely shaded sleeping site may provide protection from the sun and easy escape routes from diurnal predators (Bearder *et al.* 2003).

In The Gambia, *G. s. senegalensis* was more gregarious during the night compared to studies by Off *et al.* (2008) on *G. s. braccatus* and by Haddow and Ellice (1964) on *G. s. senegalensis* in Uganda. In our study, *G. s. senegalensis* was observed alone in only 40% of the encounters, whereas *G. s. braccatus* was solitary on 81% of encounters (Off *et al.* 2008), and the Ugandan *G. s. senegalensis* on 56% (Ambrose 2002). Furthermore, *G. s. senegalensis* in The Gambia was observed in groups of ≥ 3 individuals

Figure 5. (a) *G. s. senegalensis* in The Gambia, (b) *G. s. sotikae* in Kenya, (c) *G. s. braccatus* in Kenya, (d) *G. moholi* in South Africa (5a & d by S.K. Bearder, 5b & c by Y. de Jong and T. Butynski).

on 23% of the encounters, whilst *G. s. braccatus* only 3% (Off *et al.* 2008) (Figure 3). The difference in sociality compared to the eastern *G. senegalensis* populations may have been influenced by the timing of the study, as this study was conducted during the mating season.

We observed chasing and mating at the beginning of May, and a female appeared in a late stage of pregnancy. Previous studies of *G. senegalensis* in Sudan (Butler 1967) point to seasonal breeding, and this is probably also the case in The Gambia. The gestation length for *G. s. braccatus* is recorded as 141-142 days with 92% single births (Izard & Nash 1988). Given a similar gestation for *G. s. senegalensis*, a birth period around mid-June (based on the pregnant female) to mid-September (based on observed mating) is indicated. Further observations are required to confirm the timing of births, particularly towards the end of June and around mid-September. The apparent absence of urine washing during this survey is unusual and deserves further study. Urine washing is normally common in galagos and is thought to enhance grip when moving in dry habitats (Harcourt 1981; Nash *et al.* 2013). Most calls were similar to those recorded for *G. senegalensis* elsewhere in Africa, although the buzzing coughs have never been recorded in any *G. senegalensis* previous to this.

In this study, galagos were seen searching for and eating insects and gum and the fruits of *Lannea acida*, but the relative proportions of each are not known. *Galago senegalensis* is known to eat insects, fruits and gums, but few detailed studies have been conducted on their diet (Nekaris & Bearder 2011; Oates 2011; Nash *et al.* 2013). Fruit eating is rare in the closely related *G. moholi* and is infrequently reported in the diet of *G. senegalensis*, although Kingdon (1971) and Nekaris (2013) note feeding on fruits of *Tamarindus* (Fabaceae), *Sclerocarya* (Anacardiaceae) and *Balanites aegyptiaca* (Zygophyllaceae).

The people in and around Niumi NP seemed to have limited knowledge about the galagos and were often unaware of their existence. A few people had seen their eye-shine when using torches at night, but they had not associated this with a primate. The galagos occur in Niumi NP despite high anthropogenic disturbance. There is concern that the natural vegetation is being increasingly depleted by high levels of selective cutting, over-grazing and land clearance for crops. Of specific concern is the uncontrolled activity of cattle and donkeys. This inhibits the normal regeneration of vegetation and protection of the sand dunes bordering the coast. With progressive wildlife laws under the Biodiversity/Wildlife Act 2003 already in force in The Gambia, the problem is evidently one of enforcement.

This brief study provides a starting point towards understanding similarities and differences between populations of *Galago senegalensis*, and we hope that the data presented here will provide baseline information for longer-term studies. We consider Niumi NP as an ideal location for long term studies to investigate galago ecology, behavior, and conservation status in more detail.

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Brief Communication:

Predation on an Endemic and Endangered Tana River Mangabey (*Cercocebus galeritus*) by a Sympatric Yellow Baboon (*Papio cynocephalus*) in Tana River National Primate Reserve, Kenya

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INTRODUCTION

Predation plays a significant evolutionary role in shaping primate behavior as a crucial selective force (Isbell 1994; Stanford 2002; Hart 2007; Mitani *et al.* 2012). Besides humans, carnivorous mammals, reptiles, and raptors are the major predators to most nonhuman primates (Sherman 1991; Tsukahara 1993; Vasquez & Heymann 2001; Gursky 2002; Hart 2007; Oliveira & Dietz 2011; Fichtel 2012). Systematic and consistent predation by other nonhuman primates has rarely been observed with exception of well documented cases of chimpanzees (*Pan troglodytes*) hunting of red colobus monkeys, with baboons, blue monkeys and redtailed monkeys killed at lower rates (Wrangham & Riss 1990; Stanford *et al.* 1994).

Baboons (*Papio* spp.) on several occasions have been reported to include meat in their diet (Hausfater 1976; Whiten *et al.* 1991; Fichtel 2012; Altmann *et al.* 2013; Palombit 2013). Their common prey species include hares and young antelopes (Whiten *et al.* 1991). Though they rarely prey on other nonhuman primate species, some cases of baboon predation on vervet monkeys and related guenons (*Chlorocebus* spp.) have been reported (Struhsaker 1967; Hausfater 1976; Seyfarth *et al.* 1980). Baboon predation on the endangered Tana River mangabey (*Cercocebus galeritus*) has never been previously reported making the incident reported here of special interest.

Predation in wild nonhuman primates remains difficult to study since it is rare and unpredictable in occurrence (Oliveira & Dietz 2011). Consequently, there are very few cases reported in Tana River National Primate Reserve (TRNPR) despite continuous research over the last four decades. Condit and Smith (1994) reported lion (*Panthera leo*) predation on yellow baboons (*Papio cynocephalus*) while Wieczkowski *et al.* (2012) attribute possible predation of Tana River mangabeys to African crowned eagles (*Stephanoaetus coronatus*). Other potential predators for the Tana primates include leopards (P*anthera pardus*), spotted hyenas (*Crocuta crocuta*), crocodiles (*Crocodylus niloticus*), and pythons (*Python sebae*) (Condit & Smith 1994; Malonza *et al.* 2006; Wieczkowski *et al.* 2012).

Primates have diverse anti-predation strategies which include polyspecific associations (Gautier-Hion *et al.* 1983). There are five diurnal nonhuman primate species inhabiting the Tana riverine forests (Butynski & Mwangi 1994), yet there have been no documented cases of nonhuman primate predation on other primates there. Here I report the first incidence of a wild male yellow baboon killing and eating a Tana River mangabey in the Mchelelo riverine forest fragment in TRNPR.

METHODS

Study area

The incidence reported here took place in the Mchelelo west forest fragment in TRNPR in Kenya. The reserve is 171 km^2 and it lies between 1°40' to 2°15´S and 40° 07´ - 40° 10´ E, in southeastern Kenya. The forest stretch utilized by the observed yellow baboons and the mangabey groups in Mchelelo west is about 63 ha (Bentley-Condit 2009). Beside baboons and mangabeys, three other diurnal primates are found in TRNPR, which include Sykes' monkeys (*Cercopithecus albogularis albotorquatus*), vervets (*Chlorocebus pygerythrus*) and Tana River red colobus (*Piliocolobus rufomitratus*) (Butynski & Mwangi 1994; de Jong & Butynski 2012; Butynski *et al.* 2013). The area receives a mean annual rainfall of about 400 mm and daily temperature ranges between 30-38°C (Hughes 1990).

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Study subjects

The primary subjects of this report are yellow baboons and Tana River mangabeys. The two species have been studied in TRNPR over the last three decades. The major focus has been on niche overlap between the two species, dietary ecology, ranging patterns, habitat use, threats, conflict with humans, food resource dynamics and population trends (Butynski & Mwangi 1994; Wahungu 1998a, 1998b; Wieczkowski 2004; Moinde-Fockler *et al.* 2007; Bentley-Condit 2009; Kivai 2010). The Tana River mangabey is considered endangered while the yellow baboon is of least concern (Butynski *et al.* 2008; IUCN 2013).

Observation approach

The observation reported here was made during group follows of Tana River mangabeys. The focal group had been habituated and followed by different researchers in the Mchelelo forest over the past. The yellow baboon troop encountered during the mangabey monitoring was also the subject of previous behavioral studies and was seemingly semi-habituated. Two observers followed the mangabeys while doing focal sampling to understand their feeding behavior and its linkages with crop raiding. The mangabeys were approachable to a distance of approximately five meters, while the baboons were approachable to a distance of about ten meters. Even though visibility was not measured, at least about 50% of the members of the mangabey group were visible during the predation event. The mangabey group consisted of approximately thirty individuals while the yellow baboon troop had fifty individuals. The mangabey follows started at 07:00h and continued for four hours before they were joined by yellow baboons at 11:00h and shortly thereafter by a group of Sykes' monkeys. Observation involving the co-occurrence of the mangabey and baboons lasted for about 105 minutes before the attack took place.

RESULTS

The predation incident was observed on January 31, 2010, while following a group of Tana River mangabeys in the Mchelelo forest fragment. One mature male yellow baboon attacked, killed and consumed a sub-adult mangabey individual whose sex could not be established as the baboon tore apart and consume it. Prior to the predation event, mangabeys emitted alarm calls accompanied by a change of their travel direction. The mangabey group had spread widely by then so that the two observers were not at a close range to determine what was happening. However, the baboons appeared to continue moving and foraging in the same direction with the mangabey group.

The two primate species involved in the incident moved and foraged together on the ground for over 200 m following their merger and from the point of predation. During the attack the mangabey individuals being followed started resting and engaging in terrestrial grooming activity. Within a distance of 10-15m from the observer, there were two adult male yellow baboons but they had not attracted the observers' attention. At that time, many individuals of the mangabey group had aggregated and were not far away from each other. At around 12:45 h loud alarm calls were heard from the mangabeys followed by a commotion as they escaped into the trees. Immediately, the mangabeys were observed retreating and emitting distress calls while moving away and gazing at the bushes behind the observers. One of the observers approached to see what was happening and spotted the two adult male yellow baboons which had then moved behind a bush. One was eating some meat while the other sat about 2 m away observing the other feeding baboon. Moving closer, the male ran away carrying something. Moving to the spot which the baboon just left, the observer noticed that it had fed on a sub-adult mangabey based on the bone and paw remains shown in Figure 1. The second baboon male moved to the spot where the male that had killed the mangabey had been consuming it and proceeded to consume the remains that had been left behind. It is likely that the baboon that dominated the carcasses killed the mangabey and perhaps was high ranking since cooperative hunting of prey is rare in baboons (Hill 1982).

DISCUSSION

This report documents a rare observation of predation involving two sympatric African cercopithecines, yellow baboons and Tana River mangabeys. These two primate species have large overlap in their diets and utilize the same habitat in TRNPR, especially when food resources are scarce (Wahungu 1998a). Baboon predatory behavior targeting other nonhuman primates is known but uncommon, and has not previously been reported from the TRNPR despite long term behavioral studies on mangabeys and baboons in the area.

This predation event brings up two pertinent research questions: (1) What are the factors driving the observed predatory behavior, and (2) What are the possible conservation implications on the endemic and endangered Tana River mangabey? The predation incident reported here occurred following the long drought experience in Kenya and the region in 2009. Consequently, the baboons foraged more in the forest where food resources were relatively more abundant compared to the dry woodland habitats where they predominantly forage (Bentley-Condit 2009). Since the food resources in the forests had also declined following the drought, it was likely that food competition was high between the two species given their high dietary overlap (Wahungu 1998a). Even though baboons are opportunistic feeders (Altmann *et al.* 2013), this predation behavior might

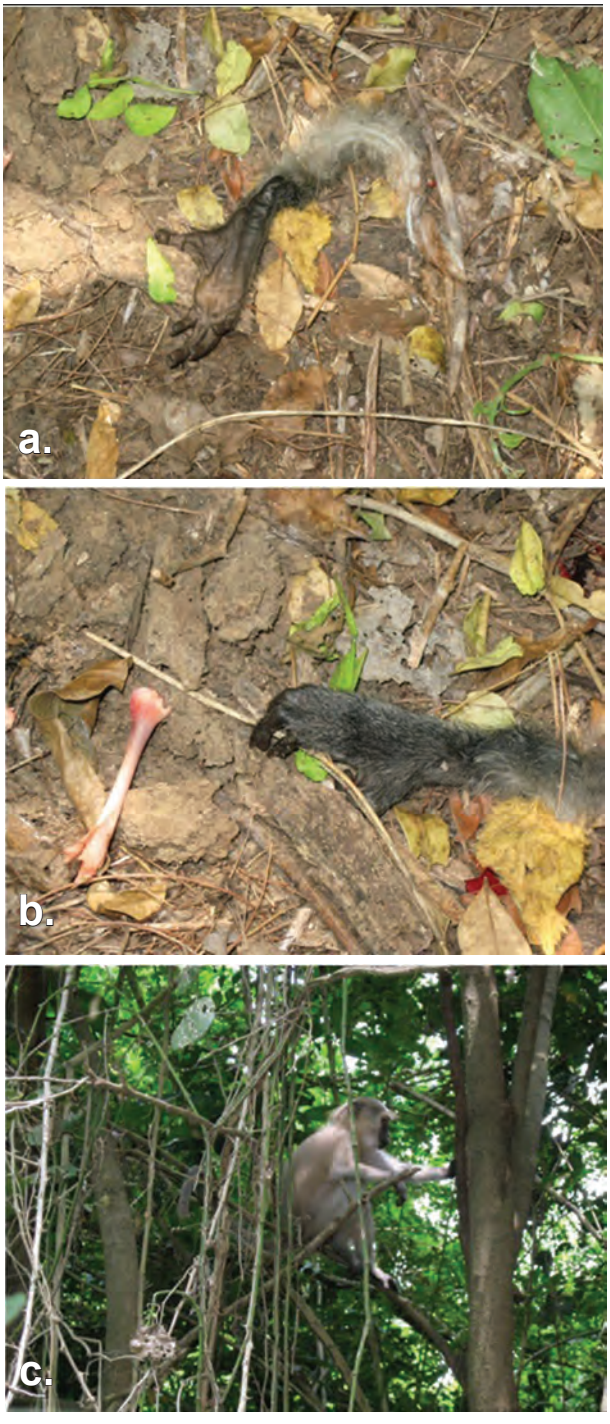

Figure 1. Remains of sub-adult Tana River mangabey preyed upon by an adult yellow baboon male (a, b,) and another sub-adult mangabey taking cover after the incidence (c).

have been triggered by possible nutritional deficiencies. This could partly be supported by observation that olive baboon predation on small invertebrate species increases with decline in food resources, especially during the dry period (Whiten *et al.* 1991).

Previous studies have indicated that Tana River mangabeys avoid areas occupied by baboons while foraging (Wahungu 1998b; Bentley-Condit 2009). In addition, mangabeys are more adapted to feeding on a mechanically challenging diet and utilize hard food items with high fracture toughness, compared to the yellow baboons and other sympatric primates (Wahungu 1998a; McGraw *et al.* 2011). As a result, food competition between the two species might be minimal given the reported mangabey foraging adaptations. Hence, foraging avoidance could possibly be attributed to the observed predatory behavior. This incident suggests that baboon predatory behavior acting cumulatively with habitat destruction and the killing of mangabeys as crop pests and for bush meat (Moinde-Fockler *et al.* 2007; Kivai 2010) might exacerbate the threat to the long term survival of the Tana River mangabeys. Although these other threats are more frequent and well documented with respect to Tana mangabey conservation, predation by yellow baboons and its threat severity remains poorly understood and warrants further monitoring to understand its causes, magnitude, and conservation consequences.

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Brief Communication:

Sightings of Thick-tailed Greater Galago *Otolemur crassicaudatus monteiri* (Bartlett in Gray, 1863) Near Lake Mburo National Park, South Uganda

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INTRODUCTION

Although East African primates are generally well-studied (e.g., Chapman *et al.* 2010; de Jong & Butynski 2011, 2012), the taxonomy of several taxa remains debated (Campbell *et al.* 2011; de Jong & Butynski 2012). This lack of clarity is particularly true for nocturnal primates, including populations that are threatened with extinction (Mittermeier *et al.* 2012; Nekaris & Nijman 2013). At several established field sites in East Africa, such as Bwindi Impenetrable National Park (Uganda) and Gombe National Park (Tanzania), with scientific research mainly focused on diurnal monkeys and apes, little is known of the resident nocturnal primate species (Nekaris & Nijman 2013). Populations of nocturnal primates are easily misidentified (e.g., Weisenseel *et al.* 1993; cf. Perkin 2003) and distribution patterns thereby rendered uncertain.

Twenty-three species of primates are known to be present in Uganda, excluding nocturnal species requiring further verification, such as the greater galagos (*Otolemur crassicaudatus*) (de Jong & Butynski 2012). The only recorded sighting of *O. crassicaudatus* in Uganda comes from Kingdon (1971), whose observation was made in the 1960s at Kigagati, on the Kagera River just near the Tanzanian border (Figure 1). Due to the lack of any further records, it seems likely that the majority of authors listing *Otolemur* sp. as present in Uganda refer to the sighting made by Kingdon (1971). de Jong & Butynski (2012) list *O. crassicaudatus* as likely present in Uganda but highlight the necessity of evidence such as specimens, photographs, or authoritative sightings. Here, we aim to provide a confirmation of the presence of *O. crassicaudatus* in southern Uganda. We describe and discuss our sightings of *O. crassicaudatus* in Uganda and highlight the importance of the Lake Mburo National Park (LMNP) area as a possible site for further studies on this species.

METHODS

Study species

Otolemur crassicaudatus is a large sized galago found in groups of up to six individuals (Doyle & Bearder 1977). *Otolemur c. monteiri* displays little sexual dimorphism: the average weight is 1220 g (940-1640 g) in adult males and 1130 g (990-1460 g) in adult females (Smithers & Wilson 1979). *Otolemur crassicaudatus* ranges from eastern South Africa northwards to Tanzania and southwestern Kenya, with a linear distance of over 3400 km (Bearder 2008, Figure 1). *Otolemur c. monteiri* extends from Angola in the west, through Zambia, Zimbabwe, Malawi, Tanzania, Rwanda, Burundi and the southern parts of Democratic Republic of Congo (DRC) (Bearder 2008). The northernmost part of its range extends into southwestern Kenya in the east, and towards the west the range reaches just above the southern Ugandan boarder before crossing into DRC (Bearder 2008). In the south, the subspecies' range extends as far as the northern parts of Mozambique, although these southerly limits are poorly documented (Olson 1979; Bearder & Svoboda 2013).

Much ambiguity surrounds the taxonomy of *Otolemur* spp. Prior to 1979, large galagos (>800 g) were normally classified as *Galago crassicaudatus* (Osman Hill 1953; Napier & Napier 1967; Groves 1974; Petter & Petter-Rousseaux 1979). Their taxonomy was then revised by Olson (1979), who recognised *Otolemur* as a genus distinct from *Galago*, comprising two species: *O. crassicaudatus* and *O. garnettii*. Olson (1979) placed *monteiri*, *crassicaudatus,* and *argentatus* as subspecies of *O. crassicaudatus*. In contrast, Groves (2001) recognised *O. monteiri* as a distinct species, and this classification was followed by Grubb *et al.* (2003), with the subspecies *O. m. monteiri* and *O. m. argentatus*.

Given the history of taxonomical uncertainty, it is not surprising that the species thought to occur in

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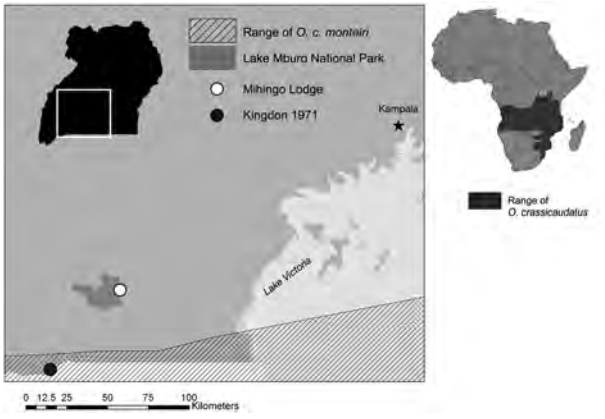

Figure 1. Map with location of Lake Mburo National Park and sightings of *Otolemur crassicaudatus monteiri.*

Uganda has been referred to by several scientific names (Table 1). We follow Olson (1979), hereafter referring to the Ugandan thick-tailed greater galago as *Otolemur crassicaudatus monteiri*.

Study site

Lake Mburo National Park (LMNP) is located in the Akagera Ecosystem (Van de Weghe 1990). The park and its surrounding areas are composed of a mosaic of habitats, mainly open and wooded *Acacia* savannah, but also swamps, lakes, bushy thickets, rocky outcrops, forests and dry hillsides (Snelson & Wilson 1994; Kigyagi 2002). The location of our sightings was Mihingo Lodge, which is situated adjacent to LMNP on the edge of the savannah (0°36'S, 31°02'E) (Figure 1). In 2008, staff at the lodge began to habituate a group of *O. c. monteiri* occurring in the nearby area. With the purpose of attracting the animals, small amounts of fruit were placed on a platform located near the guest area. This arrangement allowed guests to view the animals with the staff while informing them about the species' ecology, behaviour, and conservation needs.

RESULTS

Field observations

In April and September 2006 we conducted a study on nocturnal predators, spending 30 nights in the field. During a night survey in September, we came across a single individual of *O. c. monteiri* just outside the LMNP. We observed the animal clearly at a distance of 2 m for approximately three minutes. Morphology and locomotion were consistent with descriptions of *O. c. monteiri* (Nash *et al.* 1989; Nekaris & Bearder 2011; Bearder & Svoboda 2013).

On the 1st of July 2011 we returned to LMNP and Mihingo Lodge to obtain photographic evidence confirming the presence of *O. c. monteiri*. Our observation was made during a series of nocturnal surveys throughout southwestern Uganda (ten nights). We did not conduct further night walk surveys in and around LMNP due to the abundance of large predators and other potentially dangerous wildlife in the area. At Mihingo Lodge, we observed the animals by using Petzl Zoom headlights with red filters (Nekaris 2003) and acquired photographic evidence with a Nikon D90 camera (without flash to avoid disturbance). The night of the sighting was clear with a new moon.

At 18:59, two individual *O. c. monteiri* approached the feeding platform. Both individuals displayed silver pelage, relatively long and thick tails and a body-size comparable to that of a domestic cat. Based on body size, the first individual was identified as an adult (estimated body length 30-35 cm and about 70 cm including the tail), and the second individual as immature (estimated approximately three quarters the size of the adult). We observed them feeding and travelling between the platform and nearby trees at an animal-observer distance of 0.5 - 4 m, for approximately 15 min. Our photograph (Figure 2a) and that provided later by Mihingo Lodge (Figure 2b) confirmed the identity of the subspecies.

According to S. Mugisha (pers. comm.), the group that commonly visits the platform at Mihingo Lodge includes six individuals: two adults, one light grey and

Table 1. Literature records of greater galagos in Uganda.

Author	Species	Reported range
Vincent (1969)	*Galago crassicaudatus*	Throughout, except SW
Kingdon (1971)	*G. c. crassicaudatus*	S
Olsen (1979)	*Otolemur crassicaudatus monteiri*	SW
Petter & Petter-Rousseaux (1979)	*G. crassicaudatus*	E
Groves (2006)	*O. monteiri argentatus*	SW
de Jong & Butynski (2012)	*O. c. monteiri*	Range not reported
Osman Hill (1953)	N/A	Not reported as present
Jenkins (1987)	N/A	Not reported as present
Groves (2001)	N/A	Not reported as present
Bearder & Svoboda (2013)	N/A	Not reported as present

Figure 2. *Otolemur crassicaudatus monteiri* at the Mihingo Lodge. [a] Photograph by E. Bersacola (taken in 2011),[b] Photograph courtesy of Mihingo Lodge (taken in 2008) (http://www.mihingolodge.com/).

one black, and four immatures, two of which have silver pelage and two with melanistic appearance.

DISCUSSION

Otolemur c. monteiri is listed as Least Concern on the 2013 International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, despite a number of populations being considered locally threatened due to deforestation (Bearder 2008). According to Bearder (2008), populations of *O. crassicaudatus* used to occur commonly all around Lake Victoria, but they have now nearly vanished from the area. Our sightings confirm the presence of a population of *O. c. monteiri* west of Lake Victoria that was previously unknown.

The distance between the sighting in 2006 and that of 2011 is approximately 5 km, indicating the presence of at least two distinct groups of *O. c. monteiri* in the area. The morphology of the individuals observed in 2006 and 2011 is consistent with data from the literature (Kingdon 1971, 1997; Nash *et al.* 1989; Bearder & Svoboda 2013). The grouping of the animals described by the staff conforms to that in Doyle & Bearder (1977).

The location of our sightings is some 70 km northeast of the sighting made by Kingdon (1971), and some 40 km north of the northernmost range of the species as mapped by Bearder (2008). Previous studies have highlighted the unexpected absence of *O. c. monteiri* in several suitable habitats in Uganda (Kingdon 1971; L Ambrose, pers. comm.). The prevalent habitats of LMNP are likely to be suitable for *O. c. monteiri* (Skinner & Chimimba 2005; Bearder 2008; Bearder & Svoboda 2013). As these habitats extend further north and towards the west (Snelson & Wilson 1994; Kigyagi 2002) we hypothesize that *O. c. monteiri* occurs in these parts of Uganda as well.

According to Bearder (2008), *O. crassicaudatus* is expanding its range in the southern parts of its geographical distribution. Whether this is also the case in Uganda remains unknown. With the species being cryptic and not homogeneously distributed across its habitat (Nekaris *et al.* 2008), it is also possible that *O. c. monteiri* might simply have been missed in previous field surveys.

We hope that our data contribute to baseline information on *O. c. monteiri* in Uganda. This nocturnal primate is well-known by the staff at Mihingo Lodge (S Mugisha, pers. comm.), making this site favorable for possible long-term studies. By conducting interviews with park staff and local people we may acquire valuable information about this primate inside LMNP. Further research, in addition to comparative studies of populations at different sites, could provide us with the required data to clarify the taxonomy and develop a more accurate conservation assessment of *O. crassicaudatus* across Africa.

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Brief Communication:

A Note on the Effective Use of Social Media to Raise Awareness Against the Illegal Trade in Barbary Macaques

Sian Waters and Ahmed El-Harrad

Barbary Macaque Conservation in the Rif (BMCRif), Tetouan, Morocco

The Barbary macaque (*Macaca sylvanus;* Figure 1) is the only macaque species in Africa, occurring in Morocco and Algeria with an introduced population on Gibraltar. The wild populations in North Africa are separated by large distances and groups are sometimes fragmented and isolated due to habitat degradation and destruction (Fa *et al*. 1984; Waters *et al*. 2007; Menard *et al*. 2013). In the Middle Atlas, in particular, the population has been depleted by the capture of infants destined for the primate pet trade prevalent in Morocco and mainland Europe (Waters 2011; Menard *et al*. 2013). The sale of Barbary macaques is illegal in Morocco and punishable by a fine, the confiscation of the animal(s) and the closure of the vendor's business.

Barbary Macaque Conservation in the Rif (BMCRif), is a interdisciplinary Moroccan conservation NGO using social and natural science research methods to drive conservation action. Our mission is to monitor Barbary macaque populations, engage with forest users around their habitat, and raise awareness amongst both rural and urban populations in Morocco. Moroccans tend to lack awareness of conservation or animal welfare issues, and views of macaques differ between rural and urban populations necessitating different approaches for both. In the urban population, the lack of awareness and knowledge of Moroccan wildlife results in much of the illegal trade going unreported within the country.

The use of social media sites is common amongst conservation and other NGOs to effectively and quickly communicate with the public and, in some cases, to raise awareness against primate pet-keeping. However, social media and related sites can also encourage trade in endangered primates. Such an event occurred on online video sharing site Youtube where an individual posted a video of himself "tickling" his pet slow loris (*Nycticebus* spp.). The video went viral being re-posted many times on Facebook and other social media sites. The widespread exposure may have increased the public's desire to keep a loris as a pet which, in turn, may have contributed substantially to an increase in the illegal trade in the species (Nekaris *et al*. 2013). Loris conservationists have fought back, however, using social media and Youtube to post information concentrating on the negative conservation and welfare aspects of loris pet keeping (Nekaris *et al*. 2013).

The above example demonstrates that care needs to be taken when using a social media site as a medium of communication to ensure that the awareness message is clear, and cannot be taken out of context easily. This is particularly important amongst a human population which does not have a high level of conservation awareness or understanding of conservation or animal welfare issues. BMCRif focuses on raising awareness regarding the illegal macaque trade amongst Morocco's urban middle class because they are the main purchasers of infant Barbary macaques usually while on holiday in cities where Barbary macaque infants are openly for sale. The urban middle class population is literate and has regular access to the internet.

The realization that conservation awareness regarding the macaque was low and that Facebook use is very high in Morocco stimulated us to form a group on Facebook to inform people about the issues facing the macaque in Morocco. On 14th July, 2012, we started a BMCRif page on which we present news about project activities, information about the Barbary macaque, new Barbary macaque research and information about the realities of the illegal trade in Barbary macaques (https://www.facebook.com/BarbaryMacaqueConservationInTheRif.) At the time of writing, the page has 1034 members, over a third of whom is Moroccan (375) with 46% of members aged between 25 - 44 years. These are the people most likely to buy a pet macaque under pressure from their children. The majority of Moroccan members are distributed between the cities and environs of Tetouan, Casablanca, Rabat and Marrakech.

Group members have the facility to interact directly with the group administrators with these communications

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Figure 1. A Barbary macaque (*Macaca sylvanus*) in the Bouhachem Forest, in northern Morocco. (Photograph by BMCRif.)

invisible to group members. Since we began the group 12 months ago, six of the sixteen notifications we have received from Moroccans reporting a total of six illegally held Barbary macaques have been through the medium of our Facebook page. Four of these macaques were confiscated by the authorities when we reported them, one had already been sold and one was returned to its wild group. Thus, Facebook acts as an important medium for communication between the Moroccan public and the authorities, with BMCRif acting as an intermediary. Due to this collaboration, the practice of using Barbary macaques as tourist photo props is no longer tolerated in the region of Tangier-Tetouan and the, formerly open, trade in the species in Tangier has been forced underground. Thus, we have found Facebook to be a very effective tool in engaging with the Moroccan public to raise awareness about an endangered primate whilst they in their turn engage with BMCRif to "anonymously" report the illegal wildlife trade.

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News

Vocal Profiles for the Galagos: A Tool for Identification

The galagos (Family Galagidae) of Africa are nocturnal, small, and often difficult to observe, and most species are phenotypically cryptic. As such, galagos are frequently difficult to identify with confidence, particularly in the field. Being nocturnal, conspecifics mainly identify each other using auditory and olfactory cues...not visual signals. All galagos produce species-specific 'loud calls' (or 'advertisement calls'). Loud calls have several functions, one of which is long-distance species identification. Knowing this, field scientists are now able to identify all currently recognized species of galagos by their loud calls.

Young Kenya coast galago (*Galagoides cocos*) at Mpeketoni, north coast of Kenya. Photograph by Yvonne de Jong & Tom Butynski. For more photographs, visit wildsolutions.nl

The Nocturnal Primate Research Group at Oxford Brookes University maintains a collection of the calls of African wildlife which includes more than 300 hours of recordings. These recordings have been obtained by the Group's 24 members from many field sites over the past 40 years. From this extensive collection, 27 vocal profiles for 24 taxa of galagos have been compiled. These recordings are now freely available at: www.wildsolutions.nl

Each species presented on the website is illustrated by Stephen Nash, and there is an 'audiomap' that depicts the site at which each recording was made.

Additional recordings of galagos and other species will be added to this site as they become available. If you would like to hear further examples of each call type, or if you have good quality recordings of galago vocalizations that you would like to deposit with the Nocturnal Primate Research Group, please contact Simon Bearder at: skbearder@brookes.ac.uk

This product is the result of a joint initiative of the Nocturnal Primate Research Group and the Eastern Africa Primate Diversity and Conservation Program.

Simon K. Bearder
Thomas M. Butynski
Yvonne A. de Jong

Nocturnal Primate Research Group

Eastern Africa Primate Diversity and Conservation Program

Eastern Africa Primate Diversity and Conservation Program - www.wildsolutions.nl -

The Eastern Africa Primate Diversity and Conservation Program is a long-term research program, based in Nanyuki, Kenya, founded by Tom Butynski and Yvonne de Jong. The program focuses mainly on primate biogeography, diversity, taxonomy and conservation in eastern Africa, but also conducts research on other species, particularly desert warthog (*Phacochoerus aethiopicus*), common warthog (*Phacochoerus africanus*), East African springhare (*Pedetes surdaster*), Guenther's dikdik (*Madoqua guentheri*), Kirk's dikdik (*Madoqua kirkii*), African golden cat (*Caracal aurata*) and hyrax (*Hyracoidea*).

Wildsolutions.nl is the website of the research program. At present, the site provides program details, publications, distribution maps, photographic maps, as well as a blog (National Geographic Explorers Blogs by De Jong and Butynski).

News

Great Apes Summit Delegates Issue Statement on Palm Oil

The Great Apes Summit, which brought together scientists, advocates, public policy experts, media professionals, conservation leaders, range state officials and program funders to discuss issues and propose solutions, was co-hosted by the Great Apes Survival Partnership (GRASP), the Arcus Foundation, and the Jackson Hole Wildlife Film Festival.

We, the delegates to the Great Apes Summit, gathered 21-24 September in Jackson Hole, Wyoming, USA, and committed to the conservation of apes and their habitats, are concerned that the rapid and under-regulated expansion of oil palm plantations across Asia and Africa poses a significant danger to the long-term survival of all ape species in the wild. We therefore issue a coordinated response that seeks to protect priority forests and the apes they contain, including chimpanzees, gorillas, bonobos, orangutans and gibbons, and seek to promote the use of sustainably sourced palm oil through the following six action points:

1. Governments to suspend any development of palm oil concessions until areas of High Conservation Value (HCV) and High Carbon Stock (HCS) are identified, including existing protected areas and areas off-limits due to national planning laws.
2. Governments to cease any expansion of plantations into existing protected areas, and commit to expanding protected area size and connectivity of forested areas through a combination of a) enforcement of national laws, b) improved management practices, c) participatory community engagement, and d) public exposure of non-adherent companies.
3. Governments and producers to develop rules for palm oil concessions that a) prevent deforestation and promote use of previously non-forested land, b) improve yields on existing plantations as opposed to expansion of land area, c) discourage use of toxic pesticides, d) promote the human rights of the workforce, and e) implementation of an accessible, transparent system of reporting on these commitments through independent third-party auditing.
4. Purchasers, processors, traders, and retailers to investigate and publicize current supply chains and halt sourcing from companies that a) are involved in current deforestation or new peatland development, b) not identifying and protecting HCV and HCS areas in their concessions, c) involved in developments on peatland, and d) breaking national environmental and conservation laws.
5. The Roundtable on Sustainable Palm Oil (RSPO) to monitor existing Principles and Criteria (RSPO P & C) and strengthen protocols, where necessary, to ensure that standards are enforced in a transparent way and members are accountable for their actions, with special attention to: a) no clearance of protected forests, HCV forests or areas off-limits due to National Spatial Planning regulations, b) no clearance of HCS forest, c) no clearance of peatlands or new planting on previously cleared peatlands, d) consideration of existing ape population ranges prior to development of concessions e) immediate public reporting and reducing greenhouse gas emissions, f) fixed time limits for members to certify plantations and associated smallholders, and g) enforcement of current standards.
6. Consumers (companies and individuals) and financiers to a) immediately shift to sustainably sourced palm oil and palm oil products, b) cease partnerships with, and funding support for, suppliers that do not implement RSPO P&C, c) commit to a clear timelines to transition certified palm oil sourcing to fully segregated physical product, d) direct purchases to suppliers willing to go beyond current RSPO standards, and e) commit to a zero deforestation policy with clear targets and timelines.

We can strengthen the palm oil regulatory processes and act together to halt the illegal or under-regulated expansion of plantations that threatens ape species and their habitats. Experts predict that by 2030 over 90 percent of ape habitat in Africa and Asia will have been disturbed by the expansion of development projects, and the palm oil industry represents a significant portion of that development. Failure to act now will have serious consequences that could hasten the extinction of chimpanzees, gorillas, bonobos, orangutans, and gibbons.

For more information, please visit www.un-grasp.org.

News

Grands Singes se Prononcent sur la Question de L'huile de Palme

Le Sommet sur les Grands Singes, qui a rassemblé scientifiques, militants, experts en politique publique, experts médiatiques, leaders de la conservation, dignitaires des Etats de l'aire de répartition des grands singes et donateurs, pour discuter des défis rencontrés et y apporter des solutions, était co-animé par le Partenariat pour la Survie des Grands Singes (GRASP), la Fondation Arcus et le Festival Jackson Hole du film sur la vie sauvage.

Nous, les délégués du Sommet des Grands Singes, qui nous sommes rassemblés du 21 au 24 septembre à Jackson Hole, Wyoming, Etats-Unis, et nous sommes engagés pour la protection des grands singes et de leur habitat, craignons que l'expansion rapide et peu contrôlée des plantations de palmiers à huile en Afrique et en Asie ne représente une menace importante pour la survie sur le long terme de toutes les espèces de singes présentes dans la nature. Nous avons en conséquence établi une action coordonnée visant à protéger les forêts prioritaires et les grandes singes qui y vivent – parmi lesquels les chimpanzés, les gorilles, les bonobos, les orang-outans et les gibbons – et nous appelons à la mise en œuvre de ces six plans d'action:

1. Aux gouvernements de suspendre l'allocation et le développement de concessions de plantations de palmiers à huile jusqu'à ce que soient identifiés des espaces de Haute Valeur pour la Conservation (HCV) et de Hautes Réserves de Carbone (HRC), y compris au sein des aires protégées déjà existantes et d'espaces dont les lois nationales interdisent l'exploitation.
2. Aux gouvernements de cesser l'expansion des plantations au sein des aires protégées existantes, et s'engager à accroître la taille des aires protégées et la connectivité des aires boisées, en conjuguant a) l'application des lois nationales, b) des pratiques gestionnaires améliorées, c) la participation des communautés, et d) l'exposition publique des entreprises n'adhérant pas aux réglementations.
3. Aux gouvernements et producteurs d'établir des règles pour les concessions de plantations de palmiers à huiles, telles que a) prévenir la déforestation et promouvoir l'usage de terres préalablement non boisés, b) améliorer le rendement sur des plantations existantes au lieu de procéder à l'expansion des plantations, c) décourager l'usage de pesticides toxiques et d) promouvoir les droits des travailleurs. La mise en œuvre de ces règles requiert un système, accessible et transparent, de rapports sur le respect de ces engagements, via des audits qui seront réalisés par un tiers indépendant.
4. Demander aux acheteurs d'huile de palme brute, aux entreprises de transformation industrielle, aux commerçants et aux détaillants d'investiguer et de rendre public leur chaîne logistique actuelle, ainsi que de stopper leurs achats auprès d'entreprises qui a) sont actuellement impliquées dans des chantiers de déforestation ou de développement de nouvelles plantations sur des tourbières, b) ne distinguent ni ne protègent les espaces HCV et HCS au sein de leurs concessions, c) impliquées dans le développement de nouvelles plantations sur des tourbières, et d) enfreignent les lois nationales pour l'environnement et la conservation.
5. A la Table Ronde pour une Huile de Palme Durable (RSPO) de revoir et réviser les Principes et Critères existants (P&C de la RSPO), et de renforcer les protocoles si nécessaire, pour garantir une application transparente des standards et s'assurer que les membres soient redevables de leurs actions, avec une attention particulière donnée à a) l'interdiction de déboiser des forêts protégées, des forêts HCV et des espaces dont l'exploitation est interdite en raison des régulations de la Planification Nationale pour l'Utilisation des Sols, b) l'interdiction de déboiser des forêts HCS, c) l'interdiction de déboiser des tourbières et d'établir de nouvelles plantations sur les tourbières préalablement déboisées, d) une prise en considération des populations existantes de grands singes avant de procéder à l'allocation et au développement de nouvelles concessions, e) fournir immédiatement des rapports publics sur les émissions de gaz à effet de serre et sur la réduction de ces derniers, f) des limites temporelles fixes pour les membres en ce qui concerne la certification de leurs plantations et des petits exploitants qui leur sont associés, et g) l'application des standards actuels.
6. Aux consommateurs (entreprises et individus) et acheteurs a) de se tourner immédiatement vers l'huile de palme exploitée avec des objectifs durables, b) de cesser les partenariats avec les, et le soutien financier aux, fournisseurs qui ne mettent pas en œuvre les P&C de la RSPO, c) de s'engager à respecter un calendrier fixe et clair pour passer de l'huile de palme dont la provenance est certifiée aux produits bruts d) d'acheter directement à des fournisseurs prêts à adopter des standards plus hauts que les standards actuels de la RSPO, et e) de s'engager à une politique de non déforestation, avec des buts et des délais clairs.

Nous pouvons renforcer les processus de régulation de l'huile de palme et agir ensemble pour stopper l'expansion illégale ou peu régulée de plantations qui menacent les espèces de grands singes et leurs habitats. Les experts s'accordent sur le fait que, d'ici 2030, plus de 90% de l'habitat des grands singes aura été mis à mal par l'expansion de nouvelles zones d'activités, et l'industrie productrice d'huile de palme représente une portion significatives de ces activités. Echouer à prendre des mesures dès maintenant aura de sérieuses conséquences et pourrait précipiter la disparition des chimpanzés, gorilles, bonobos, orang-outans et gibbons. Pour plus d'informations, consultez www.un-grasp.org.

News

Gorilla Research/Conservation Grant
The Conservation Working Party will award an annual grant of £750 in memory of Ymke Warren <http://www.4apes.com/ymke/> who was assassinated while working in Cameroon on the conservation of the critically endangered Cross River gorilla. The award is intended for early-career gorilla researchers and conservationists from gorilla range state countries. Anyone fitting these criteria who is interested in this grant can contact Caroline Harcourt, the CWP Convenor (cwp@psgb.org <mailto:cwp@psgb.org>), at any time for more details. Please pass this information on to anyone you know who would be a suitable applicant. Many thanks, Dr C. Harcourt, Convenor, CWP, PSGB.

African Wildlife Foundation Web Site Redesign
After months of careful planning and hard work, the redesigned AWF.org is here. Our new website enables you to learn more about critically endangered African wildlife... and what we can do together to save this continent's iconic animals and landscapes. You can now easily navigate the site from a computer, phone or tablet – and share the importance of conservation with your friends and family.

***Pan Africa News* (PAN) Call for Papers**
We are still calling for short papers for upcoming issues of Pan Africa News (PAN). Also please encourage your students/colleagues to submit their papers. Those who are not familiar with PAN, please visit the following web site. http://mahale.main.jp/PAN/. Dr. Michio NAKAMURA, Deputy Chief Editor, Pan Africa News, pan.editor@gmail.com, http://mahale.main.jp/PAN/.

Nacey Maggioncalda Foundation
The Nacey Maggioncalda Foundation is a private, nonprofit organization established to support primate research and conservation. NMF funds global research projects in the areas of primate evolution, ecology, physiology and behavior. NMF also supports conservation efforts that establish a lasting, positive relationship between primates and their human neighbors, in order to improve the health and welfare of both. The foundation awards James F. Nacey Doctoral Fellowships and supports ongoing research and conservation projects with Goldberg Research and Conservation Grants. Check the web site for next due dates (www.naceymagg.org).

Lawrence Jacobsen Library
If you value the Lawrence Jacobsen Library services, please consider completing this short survey: https://www.surveymonkey.com/s/jacobsen_library_survey. The staff of the Lawrence Jacobsen Library of the Wisconsin National Primate Research Center is evaluating the current usefulness of its digital resources and services to plan a grant application to meet users' needs. Please help us by completing this short but important survey regarding your use of the Lawrence Jacobsen Library services. Your input is vital for sustaining and possible revamping of this aspect of our program. Clicking on the web link will take you directly to our survey. We encourage you to invite your colleagues and co-workers to participate, by simply forwarding this email with the web link below. Thank you for your help. Sincerely, The staff of the Lawrence Jacobsen Library (Wisconsin National Primate Center).

Send us your contributions!

Research Articles and Brief Reports: See the inside back cover for details.

News: *African Primates* lists grant opportunities, conferences, job announcements, etc. However, please keep in mind that the journal is published only once or twice per year. Thus, time-sensitive announcements should be adjusted accordingly.

Recent Publications: Send the details any new papers, books, reports published since the last publication of *African Primates* (see page 73-75).

Connections - E-News, Web Sites, Social Media: In this issue, pages 75-76 list ways you can stay connected with the African primatology community. Have we listed your information? Help keep this list up to date and accurate!

All correspondence should be sent to: wallis@africanprimate.net

Recent Publications

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Connections: E-News, Web Sites, and Social Media

Africa Biodiversity Collaborative Group
- Website: abcg.org
- E-newsletter contact: Kamweti Mutu (kmutu@abcg.org)
- Facebook: www.facebook.com/ABCGconserve
- Twitter: @ABCGconserve

African Primates (for journal and group)
- Website: www.primate-sg.org/african_primates/
- Facebook: www.facebook.com/groups/232900723505713/
- Twitter: @africanprimates

African Wildlife Foundation
- Website: www.awf.org
- Facebook: www.facebook.com/AfricanWildlifeFoundation?ref=stream&hc_location=stream
- Twitter: @AWF_Official

Barbary Macaque Awareness and Conservation
- Newsletter: Contact: sian@barbarymacaque.org
- Facebook: www.facebook.com/BarbaryMacaqueAwarenessandConservation
- Twitter: @BMCRif

The Bioko Biodiversity Protection Program (BBPP)
- Website: bioko.org
- Twitter: @Bioko_BBPP
- Facebook: English - www.facebook.com/pages/Bioko-Biodiversity-Protection-Program/107673299261496; Spanish - www.facebook.com/BiokoBiodiversidad

The Bonobo Conservation Initiative (BCI)
- Website: bonobo.org
- Facebook: www.facebook.com/bonobodotorg
- Twitter: @Bonobodotorg

Budongo Conservation Field Station
- Website: budongo.org
- Facebook: www.facebook.com/pages/Budongo-Conservation-Field-Station/111160629076237

Connections: E-News, Web Sites, and Social Media

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- Facebook: www.facebook.com/CERCOPAN
- E-newsletter contact: webmaster@cercopan.org
- Twitter: @CERCOPANHQ

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- Website: ngambaisland.com/
- E-newsletter Contact: info@ngambaisland.org
- Facebook: www.facebook.com/ngambaisland
- Twitter: @ngambachimps

Colobus Conservation
- Website: colobusconservation.org
- Facebook: www.facebook.com/pages/Colobus-Conservation/137445029669543
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Conservation through Public Health
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- Twitter: @CTPHuganda

Ebo Forest Research Project
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- E-Newletter contact: ekwoge@eboforest.org

Falémé Chimpanzees
- Twitter: @FalemeChimps

Great Ape Survival Partnership (GRASP)
- Website: www.un-grasp.org
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Guenon Conservation Community
- Facebook: www.facebook.com/pages/Guenon-Conservation-Community/203180009723143?ref=stream

International Gorilla Conservation Programme
- Twitter: @IGCP

International Primate Protection League
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International Primatological Society – Conservation
- Website: internationalprimatologicalsociety.org
- Twitter: @ipsconservation

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- Website: kasankababoonproject.com
- Twitter: @KindaCamp

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Samango Monkey Project
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