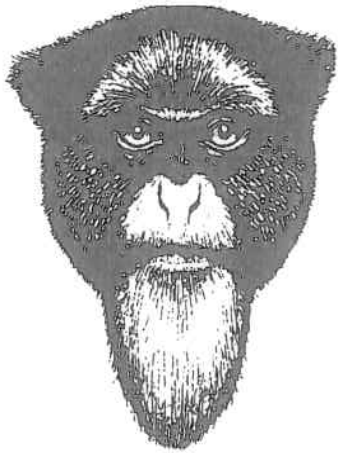


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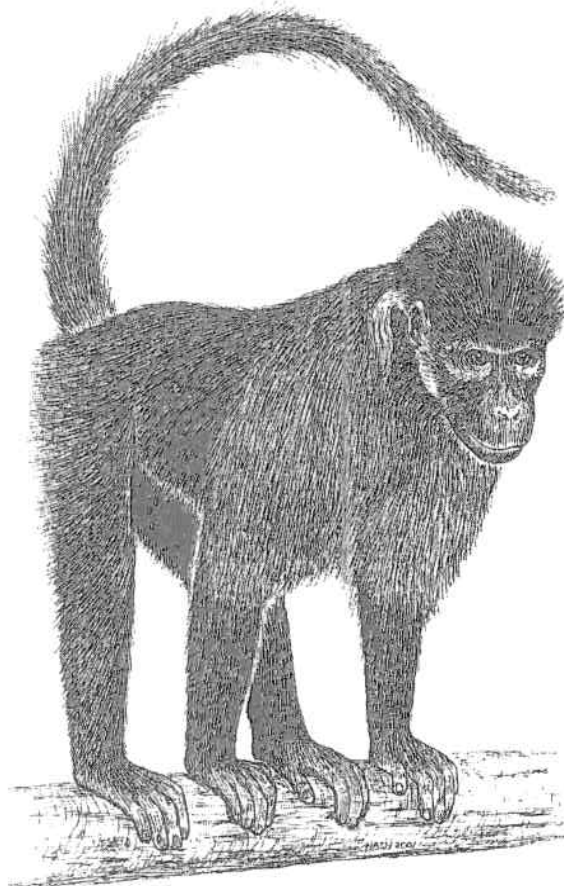
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EDITORIAL**LETTER FROM THE EDITOR**

On the afternoon of 2nd February 2000, the city of Atlanta, Georgia lost an icon. Forty-one year old silverback western lowland gorilla, Willie B., died in his sleep after a 7 week struggle with respiratory and heart disease. Two days earlier, I finished the draft of an article on the commercial bushmeat trade for Zoo Atlanta's members' magazine. A day later, I opened my *National Geographic* magazine to find an article on the reintroduction of gorillas orphaned by the bushmeat trade. The juxtaposition of these events led to contemplation of the pathos and ironies of our chosen field—wildlife conservation.

Dr. Deets Pickett, who was one of the first animal collectors to use non-lethal dart guns, captured Willie B. in Cameroon in the late 1950s. Willie arrived at Zoo Atlanta in 1961 at an estimated age of 2.5 years.

For the next 27 years, Willie B. lived in solitary confinement in an indoor, blue-tiled cage. A television was placed outside his cage for him to watch. Even under those degrading conditions, Willie B. was the undisputed star of the zoo, an animal whose personable nature made him an instant favorite with virtually all who knew him. His primary caretaker, L. Charles Horton, began to work with Willie when the gorilla was a feisty 15 year old silverback. The bond they formed lasted throughout Willie B.'s life.

In 1988, through the efforts of forward-thinking community leaders and the new zoo director, Dr. Terry Maple, himself a comparative psychologist at the Georgia Institute of Technology, Willie B. was given a greater degree of freedom. He stepped from the confines of a building into the fresh air and sunlight of a new exhibit. Contrary to expectation, he was not frightened or bewildered by his sudden change of circumstance. In 1989, Willie was introduced for the first time in his adult life to female gorillas. Later, from the vantage point in his first exhibit, Willie B. served as best man at Charles' wedding. Five years after being introduced to females, Willie's first offspring, a female named Kudzoo, was born. When he died on that Wednesday, Willie B. had five healthy offspring, four females and one male, Kidogo, now to be known as Willie B., Jr.

Since the first press releases of his illness, get-well cards flooded into Zoo Atlanta from school children around the state. As soon as news of his illness was picked up by the national wire services, I began to receive e-mails from friends as far away as California inquiring after him. Within hours of his peaceful death, I could look out my office window and see trucks from all the local television stations, ready to broadcast the

final chapter. The broadcasts reported that Willie B. would be cremated and that a portion of his ashes would be returned to Cameroon. Visitors to the zoo left messages stuck to benches and railings around his exhibit in the Ford African Rainforest.

On Saturday, 5th February, nearly 8,000 people poured into the zoo to pay their last respects to Willie B. Virtually overnight, a memorial service on a grand scale was planned. A standing-room-only crowd filled the zoo's special events tent. Eulogies were given both by those closest to him, like Charles, Dr. Rita McManamon and Dr. Maple, and by those who had played significant roles in helping him become the symbol of the zoo's renewal, such as former Mayor and United Nations Ambassador, Reverend Andrew Young. Amid the lights, cameras and television screens, an over-sized urn and a wreath decorated with lilies, roses and bunches of bananas were prominently displayed.

Everyone who spoke of Willie B. described an animal possessed of many of the traits we hold most in esteem among people. They described their memories of a gentle, but firm leader of his family. His playfulness with his tiny first offspring was recalled. Willie liked people, especially women. All of these facts are somewhat astonishing in the context of the trauma and deprivation he endured when he was young. We know well that primates, and great apes in particular, are almost as sensitive as are humans to early social deprivation. The effects of an abnormal upbringing can result in permanent deficiencies in social behavior. Willie, no doubt due in part to the care he received from Charles and others, but also due to his own personality, rose above the tragedy he experienced as an infant to become a larger-than-life symbol of hope.

But is hope enough? In the past several years, over 150 of Willie B.'s wild relatives have been killed in Kahuzi-Biega National Park in the war-torn Democratic Republic of Congo (formerly Zaire). This is just one park. And, as we learned in the last issue of *African Primates*, the situation in West Africa is, if possible, even more alarming. The global logging industry, fueled by population growth and the attendant demand for building materials, has helped to create the commercial enterprise known as "the bushmeat trade." Logging concessions have attracted workers and created roads in enormous tracts of previously inaccessible forest. This combination of immigration and improved transportation has fostered hunting of large mammals at unsustainable rates.

All mammals are affected, but some of the largest and most sought-after animals are great apes. As if in grim flashback to the dark days of zoological collecting, entire groups may be wiped out in a period of moments. Now, however, the adults are swiftly butchered and packed for transport while any surviving infants are kept locally as pets or sold illegally to naïve buyers.

The problem would be serious enough if the meat were being used only to feed the large camps of loggers and their families. But what has led those closest to the problem to call it the "bushmeat crisis" is the fact that the meat is transported long distances—even internationally—to satisfy a dangerous demand that has made the eating of primates fashionable.

At the same time that gorilla and chimpanzee meat is appearing on the menus of upscale restaurants in capital cities, epidemiologists have discovered that the AIDS pandemic originated some 50 years or so ago when SIV crossed from a chimpanzee to a human (probably during butchering). Clearly, consumption of primates is a health risk. It is possible that education on this point will serve as a significant factor in reducing the practice. Whether or not it can be implemented swiftly enough to save certain populations remains to be seen.

In view of the catastrophic magnitude of the bushmeat trade, the attention attracted by Willie B. during his illness and after his death may seem disproportionate. Should one gorilla receive the benefit of so many resources, while hundreds of others die unknown? Willie was cared for by a team of medical experts, not just veterinarians, but medical doctors throughout the community. Those of us who knew him well do not begrudge him a penny or a second of the care he received. We believe he was worth it.

Yet, what of the many bushmeat orphans? What will be their fate? Obviously, many will die. But many others will be confiscated and will require care. Already, range-country zoos, orphanages and sanctuaries are being flooded with traumatized young apes. Many of these are injured, malnourished or ill. There are insufficient facilities and funds to care for all of them properly. They are living the horror that was Willie B.'s young life. How will the remainder of their years contrast with the life that Willie B. lived subsequently as a zoo gorilla in the United States? It is hard to say what lies in store for these magnificent and intelligent animals, so like us. Perhaps some will be exported from their range countries to live in zoos in Europe and North America. Certainly there are many zoos that still would like to have such animals. But making them go away will not reach the root of the problem. The range country governments will not change easily. How can such change be encouraged?

The only way for this to happen is for the leaders of these countries, like some of our more visionary leaders, to *reconceptualize* great apes. They must somehow acquire the ability to perceive them not as food, but as national and global treasures of biodiversity. Who better to accomplish this attitudinal transformation than the animals themselves? There are certainly Willie B.s now living among the population of bushmeat orphans confined to range country facilities. Would it not be appropriate for them to become ambassadors in

their own countries, as Willie B. was here? This cannot occur without a commitment to develop range country sanctuaries and zoos that are on a par with facilities in our own countries. The Entebbe Zoo has undergone such a transformation. Surely, with the assistance of wealthy zoo owners and benefactors such as the late John Aspinall, similar programs could be carried out successfully in West Africa. It is not enough to care for the animals and attempt to rehabilitate them, or even reintroduce them to protected areas. Education of the populations who hunt these animals is what is needed. Not only do they need to know that eating primates is unsafe, they must be convinced that eating primates is immoral. Such a change in attitude can only occur if a profound and personal connection is made with the organism in question. As has been demonstrated by animals such as Willie B., who was beloved by an entire community, that connection can be made.

It is therefore incumbent upon each of us, as primatologists and conservationists, to keep education at the forefront of our consciousness. But by saying education, I don't mean the dry facts that constitute the bulk of science. At the risk of uttering more heresy, I suggest that all of our educational efforts must rest on an effective foundation. While there is certainly a place for utilitarian concepts of nature and wildlife, as long as those are the primary focus, nature and wildlife will never be accorded the reverence they deserve. The cerebral pursuit of science can give us the tools to conserve our resources. But it is the old structures of our brain, the ones we share with so many other species, which hold the key that will unlock the will to do so.

Debra Forthman

ARTICLES

A SURVEY OF NOCTURNAL PROSIMIANS AT MOCA ON BIKO ISLAND, EQUATORIAL GUINEA

Abstract: *A survey of prosimians conducted at Moca, Bioko Island, Equatorial Guinea, resulted in the identification of four species of galagos: Allen's galago Galago alleni, pale needle-clawed galago Euoticus pallidus, Demidoff's galago Galagoides demidoff, and Thomas's galago Galagoides thomasi. This is the first record of Thomas's galago on Bioko Island. The vocal profile of Allen's galago is identical to that of populations in south-west Cameroon, but distinct from populations south of the Sanaga river in Cameroon and Gabon. The two species of dwarf galago are similar in*

terms of vocalisations and behaviour to other populations surveyed in West and Central Africa. Allen's galago was the only species found to be abundant, but the other galago species are not considered threatened as long as their habitat remains intact.

Résumé: Une étude de terrain sur les prosimiens de Moca sur l'Île de Bioko en Guinée Équatoriale a permis d'identifier quatre espèces de galagos : le galago d'Allen *Galago alleni*, le galago aux ongles allongés *Eooticus pallidus*, le galago de Demidoff *Galagoides demidoff* de même que le galago de Thomas *Galagoides thomasi*. C'est la première fois que le galago de Thomas est identifié sur l'Île de Bioko. Le profil vocal du galago d'Allen est identique à celui des populations au sud-ouest du Cameroun mais diffère de celles au sud de la rivière Sanaga au Cameroun et au Gabon. Les deux espèces de galagos nains sont similaires sur le plan des vocalisations et du comportement aux autres populations étudiées en Afrique de l'Ouest et en Afrique Centrale. Le galago d'Allen est la seule espèce abondante dans la région mais les autres espèces de galagos ne sont pas considérées comme menacées tant et aussi longtemps que leur habitat demeure intact.

Introduction

Background and Aims of the Study

Previous primate surveys conducted on Bioko Island have concentrated on the diurnal species (Butynski & Koster, 1994; Hearn & Berghaier, 1996). Little information is available on the nocturnal prosimians. Research by Oates in 1964 and 1965 (Jewell & Oates, 1969) identified Allen's galago *Galago alleni* and Demidoff's galago *Galagoides demidoff* at Moca. Butynski and Koster (1994) subsequently conducted a short survey at this location in 1986 and found *G. alleni* to be abundant. In addition, they identified this species at five other locations, including Pico Basile in the north of the island. A study in the Gran Caldera de Luba in 1990 by Butynski and Schaaf (pers. comm.) again revealed *G. alleni* and *G. demidoff*. The pale needle-clawed galago *Eooticus pallidus* was identified near Concepcion on the east coast by Eisentraut (1973). Small numbers of this species have also been reported in bushmeat markets (González-Kirchner & Sainz de la Maza, 1993).

Bioko is an important location for primate conservation. The island was connected to mainland Cameroon during the last glaciation (Jones, 1994). The period of isolation is only 11,000 years (Eisentraut, 1973), apparently insufficient time for full speciation among the primate fauna to have taken place. Of the previously recorded 10 species of primates found on

the island, up to eight may be represented by endemic sub-species (Butynski & Koster, 1994), including *Galago alleni alleni* and *Galagoides demidoff poensis*.

The principal aim of this survey was to establish which galago species were present and to go some way towards identifying their taxonomic and conservation status. The emphasis of the research has been to use the loud call repertoires as a guide to species boundaries based on the Recognition Concept of Species (Paterson, 1985). Intra-specific recognition in galagos is principally by sound and scent. Galagos possess a repertoire of calls relating to contact and alarm which provides a species-specific vocal profile (Bearder *et al.*, 1995).

The Study Site

The study was carried out at Moca (3°19'N; 8°40'E) in the southern part of Bioko. The site is situated above a gorge at 1100 m where ancient pathways run from Moca to the coast at Riaba. The montane forest here (Juste & Fa, 1994) is frequently cloud covered, cool and damp with a predominance of tree ferns (*Cyathea* spp.). Other tree species increased in frequency south and eastwards from Moca and formed an open canopy approximately 15–25 m above the ground. There was an abundance of moss and epiphytes.

Methods

The study took place between 26 February and 8 March 1997. Surveys were conducted along three paths which run from Moca south and then east towards the coast. A total of 60.5 h of night surveys was conducted. Surveys commenced at dusk with a mean of 5.5 h of walking each night. Only 4 h of surveys were conducted in moonlit conditions. The vegetation was searched using Petzl zoom 4.5 volt headlamps to pick out galago eyeshine. Identification was made by both observation and by means of the unique vocal profile of each galago species. Tape recordings were made whenever possible using Marantz (CP 130) and Genexxa (VSC 2002) tape recorders, and Sennheiser (MKE 300) directional microphones. Behavioural observations were made relating to the context of the call, height in the forest strata, use of supports, and relationship to other species.

A trapping programme was conducted by placing four Chaddonneret traps (Charles-Dominique & Bearder, 1979) at two different locations (two at each trap site). The traps were positioned 0–2.0 m above the ground and baited with palm wine and bananas. Animals were weighed and measured, and hair samples taken for DNA analysis.

Vocalisations were analysed using an Avisoft Pro 2 for MS Windows 3.1. sonogram programme (Raimund Specht, Berlin). Morphometric data were subjected to statistical analysis using a Mann-Whitney U test.

Results

Four species of galago were identified: *G. alleni*, *E. pallidus*, *G. demidoff* and Thomas's dwarf galago *G. thomasi*. In addition, two other species of nocturnal, arboreal mammals were encountered: western tree hyrax *Dendrohyrax arboreus* and Lord Derby's anomalure *Anomalurus derbianus fraseri*.

Galago alleni alleni

Allen's galago was the most abundant species with an encounter rate of 1.8 animals/h. The majority of observations were made below 5 m (table 1) where they were seen hunting for insects on, or close to, the ground. They were also observed feeding on bananas at two locations. This species characteristically moves rapidly through open under-story by making leaps of several metres between vertical supports.

These galagos are highly vocal, their calls being the dominant sounds of the night (table 2). Low frequency croaks are employed for long distance contact between familiar conspecifics. Mew whistles are used for closer range contact and in situations of mild alarm. These whistles can form long sequences and are either given as single units, or arranged in phrases of up to six units in a descending sequence (figure 1). Kwok yaps and two-tone whistles were heard in the context of high alarm. These whistles rise and fall in frequency and are interspersed with yaps. Two-tone whistles are a comparatively rare call type. Growls are given in the context of unease or threat.

Six females and one male were trapped. One female was pregnant, another lactating, and a third was juvenile. The mean body weight, excluding the pregnant

and juvenile individuals, was 432 g ($n = 5$). This is one-third heavier than those in south-west Cameroon (287.5 g, $n = 4$) (Ambrose & Perkin, 1997). This represents a significant difference ($p < 0.05$).

Euoticus pallidus

The pale needle-clawed galago was rarely encountered (0.25 animals/h.). This species mostly remained in the canopy in dense foliage. The majority of observations were above 10 m (table 1). These galagos moved actively along and down broad supports head first by means of their claw-like nails. Occasionally individuals made horizontal leaps or dropped for several metres with outstretched limbs.

This species called infrequently. Only one call type was identified (table 2). Shrill yaps are high pitched single units that are used for contact and in situations of alarm (figure 1).

Galagoides demidoff poensis

Demidoff's dwarf galago was encountered at a rate of 0.36 animals/h. and was more often heard than seen. These galagos were usually located below 5 m (table 1), preferring fine supports in tangles of dense vegetation. This species made very rapid movements and was occasionally observed catching insects while hanging bipedally from a branch.

Two loud calls were recorded (table 2). Single crescendos are used for contact between familiar conspecifics, usually at dusk and at intervals throughout the night (figure 1). Intermittent yaps or chips (unit-yaps) were heard in the context of mild alarm.

Table 1. Heights in the forest strata where each species of galago was observed during the total sampling period at Moca, Bioko Island, Equatorial Guinea.

Height	<i>G. alleni</i> n=34	<i>E. pallidus</i> n=12	<i>G. demidoff</i> n=10	<i>G. thomasi</i> n=9
0-2 m	47%	0%	30%	0%
>2-5 m	29%	0%	30%	0%
>5-10 m	24%	17%	30%	33%
>10 m	0%	83%	10%	67%

Table 2. Number of times each galago call type was heard per hour during the total sampling period at Moca, Bioko Island.

<i>G. alleni</i> n=144	Calls/hr	<i>E. pallidus</i> n=10	Calls/hr	<i>G. demidoff</i> n=2	Calls/hr	<i>G. thomasi</i> n=16	Calls/hr
Croak	0.83	Shrill yap	0.16	Single crescendo Unit-yap	0.03 0.31	Multiple crescendo Rapid yap Grunt yap Wail yap	0.12 0.08 0.04 0.02
Mew whistle	0.30						
Phrased whistle	1.07						
Kwok yap & 2 tone whistle	0.05						
Growl	0.13						

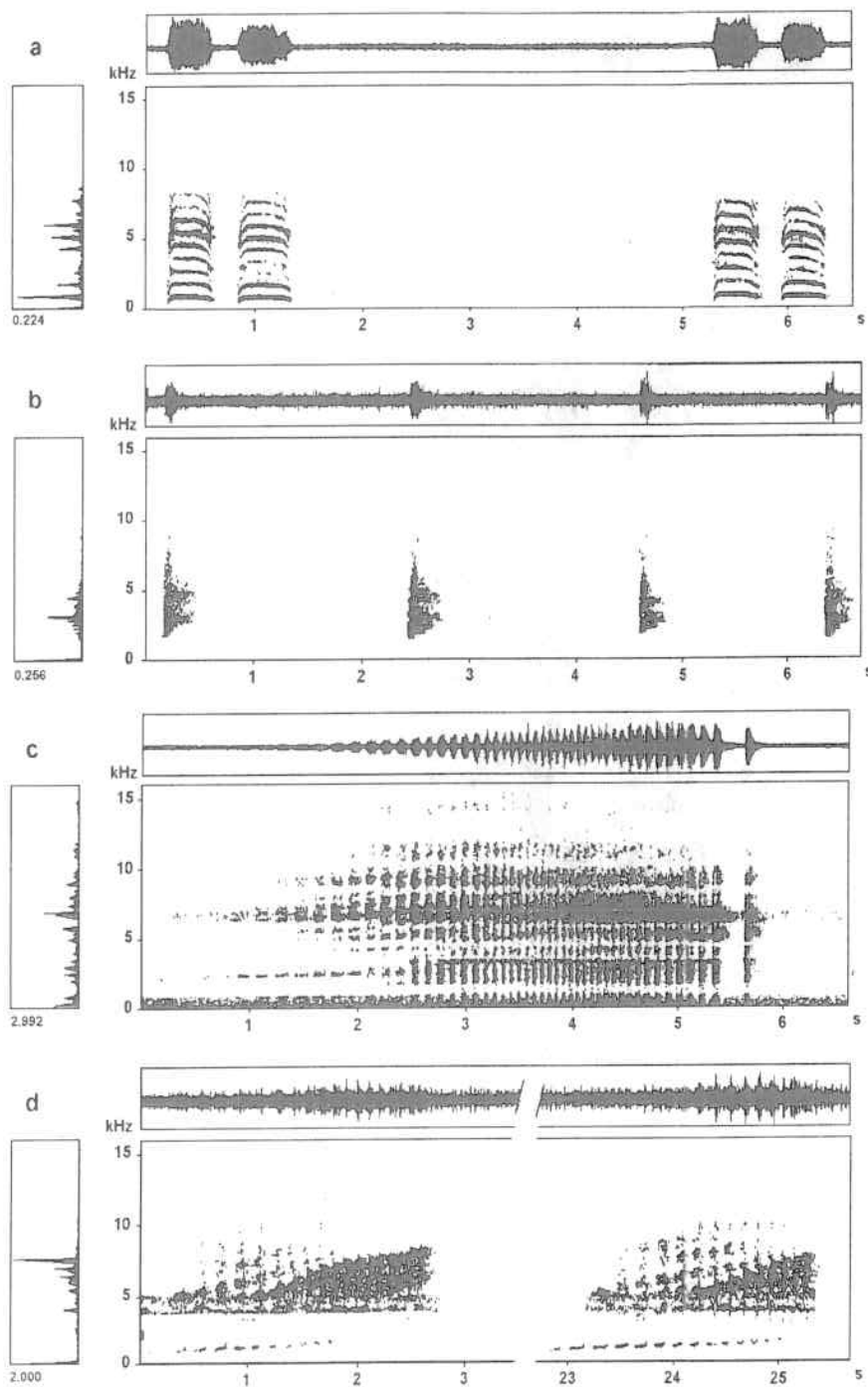


Figure 1. The contact calls of each species of galago; all recorded at Moca, Bioko Island, with the exception of *G. demidoff* where an identical call to that heard at Moca is illustrated from Gabon: a) *G. alleni*, phrased mew whistle; b) *E. pallidus*, shrill yaps; c) *G. demidoff*, single crescendo; d) *G. thomasi*, multiple crescendos.

Galagoides thomasi

Thomas's dwarf galago is slightly larger than Demidoff's galago (Wickings *et al.*, 1998). It was a difficult species to observe, mostly remaining in the forest canopy above 10 m (table 1). The encounter rate was 0.21 animals/h. Two or more individuals were often found in the same location.

eyes were orange and the snout blunt. The short tail was bushier at the distal end and the same colour as the dorsum. One individual was located on the ground but when disturbed ascended the trunk of a tree fern to a height of 4 m. Two other individuals were located in the canopy and one of these was observed gliding to the ground.

Four loud calls were identified (table 2). The contact call consists of short, high pitched crescendos which are given in multiples of three or more (figure 1). Counter-calling was heard on several occasions. There are a number of calls given in situations of alarm. Rapid yaps consist of yaps or chips in long sequences with irregular intervals. These lasted up to 30 min. Yaps may be interspersed with grunts caused by the rapid inhalation by the vocalising animal. Wail yaps were heard on one occasion. This call is used in situations of high alarm. The yaps become rapid and rhythmical, and are given in a double pattern (Ambrose & Bearder, in prep.).

Dendrohyrax arboreus

The western tree hyrax was a highly vocal species that called throughout the night. Lacking eye-shine, it was not observed at this location. The frequency of calling was 1.3 calls/h during night surveys. Each call could last for a minute or more and was frequently answered by another individual. These animals were also heard to call at intervals throughout the day.

Anomalurus derbianus fraseri

Fraser's anomalure had dense glossy black or very dark brown pelage. The

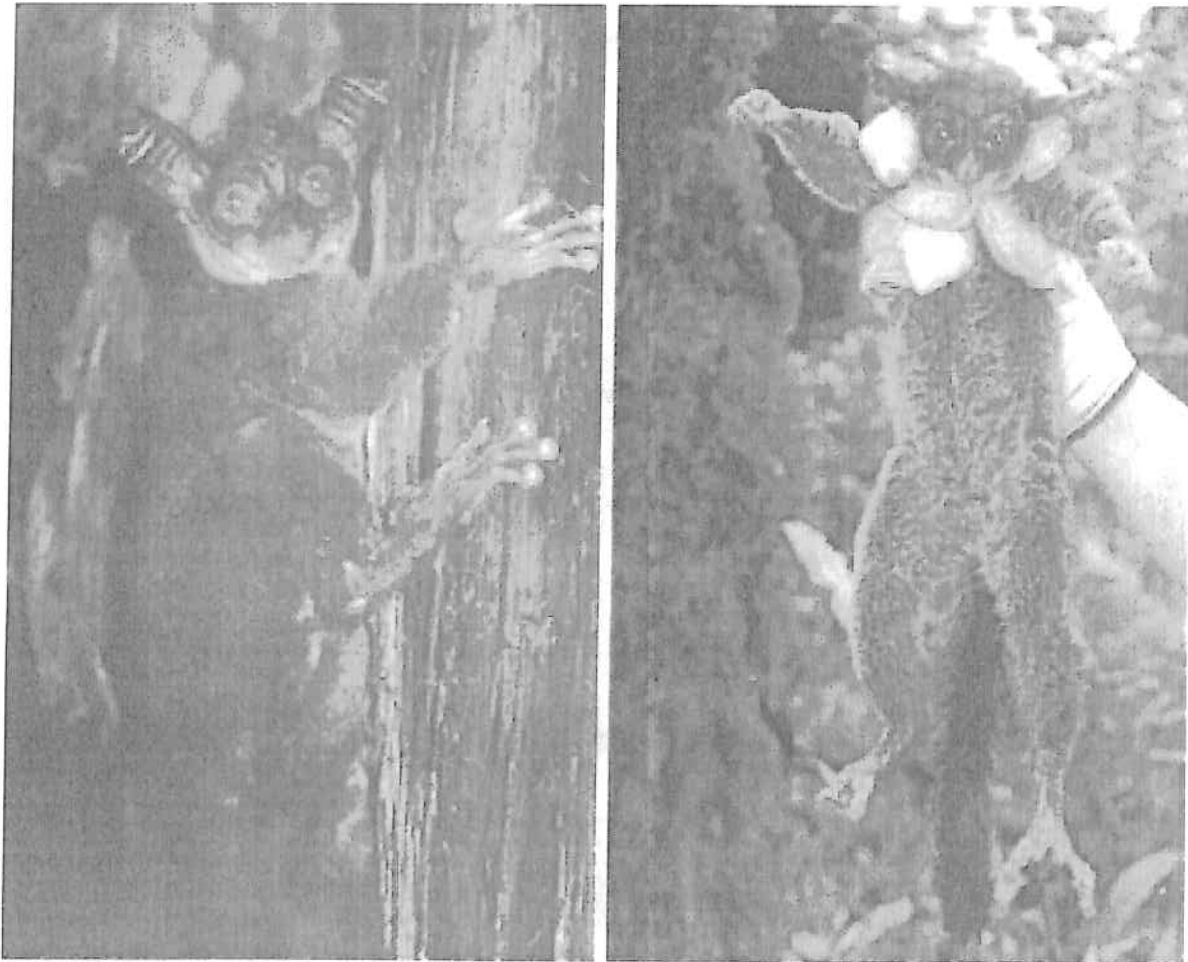


Figure 2. Allen's galago *Galago alleni* at Moca, Bioko Island. Photo by Andrew Perkin.

Discussion

Species Characteristics

Data were collected on all four species of galago. This enabled qualitative comparisons with other populations in terms of their vocal profiles and behaviour. Allen's galago was the most conspicuous nocturnal species at Moca and was both seen and heard frequently. It occurs at high relative densities which is consistent with the montane populations of south-west Cameroon.

The vocal profile of this species is identical to the populations in south-west Cameroon, but there was some regional variation in call use. The organisation of the mew whistle into phrases was only rarely heard on the mainland but was common at this location. The loud calls are quite distinct from those in Cameroon south of the Sanaga river and in Gabon where populations use sequential whistles and unit whistles.

The Allen's galagos at Moca were also found to be significantly heavier than those in south-west Cameroon. This conforms to the findings of Eisentraut (1973). Body size may be influenced by a number of ecological factors. There are no large mammalian predators (Schaaf, 1994) and few competitors, there

being a noticeable absence of the nocturnal species usually encountered in the course of night surveys.

The discovery of identical vocal repertoires with some regional variation, plus differences in body size, lead to the conclusion that the Allen's galagos at Moca are the same species as those in south-west Cameroon and are represented in Bioko by the endemic sub-species *G. alleni alleni*. They are, however, distinct from populations south of the Sanaga river in Cameroon and Gabon.

The needle-clawed galago was only rarely encountered. It was difficult to observe and called infrequently. A major component of the diet of this species is gum. Suitable tree species are, therefore, important to the distribution of this galago and may be a factor in the apparent low densities in this forest. The observed behaviour is consistent with other populations studied and the one call type identified is identical to the mainland form.

Demidoff's galago was also found to occur at low relative densities, but this is again consistent with findings from south-west Cameroon where this species has been found to be rare at elevations above 1000 m. It is represented on Bioko by the endemic sub-species

G. d. poensis, but in terms of its vocal profile and behaviour no differences were found between this population and others studied.

The identification of Thomas's galago adds a new species to the list for the island. This galago is often overlooked because of its similarity to Demidoff's galago. These two dwarf galagos are often sympatric in both West and Central Africa. They co-exist by partitioning their habitat vertically. The vocal profile of Thomas's galago at Moca is identical to the populations in Cameroon, Gabon, Uganda and the Ivory Coast.

Conservation status of nocturnal mammals at Moca
Bioko Island is the largest and most biologically diverse of the Gulf of Guinea Islands, and is a critical area for the conservation of African biodiversity (Juste & Fa, 1994). As a result of the identification of Thomas's galago the number of primate species for Bioko is brought to 11. The three galago species previously identified are not considered threatened (Oates, 1996). Hunting surveys on Bioko have not reported any significant hunting pressure on these animals (Fa *et al.*, 1995; Colell *et al.*, 1994), although González-Kirchner and Sainz de la Maza (1993) reported small numbers of both the needle-clawed and Allen's galagos in the local markets. Severe hunting pressure certainly does exist on the larger mammal species at Moca, however, and hunters were encountered on the footpath on three occasions at night. Few of the nocturnal mammal species normally encountered during surveys were identified at this location. Duiker, rodents, civets and genets were not seen, the conclusion being that the area was largely 'hunted out'.

G. alleni was found to be abundant and evidence from previous surveys (Jewell & Oates, 1969; Butynski & Koster, 1994) suggests little change to their population status over time. *G. demidoff* is unlikely to be under threat as they favour secondary growth and are well able to co-exist with human activity. *E. pallidus* is probably not common anywhere on the island, possibly being restricted by its specialised habitat requirements. This species, like the southern needle-clawed galago *Euoticus elegantulus*, almost certainly relies on a diet of gum from a small number of tree and liane species (Charles-Dominique, 1977). *E. pallidus*, like *G. thomasi*, mostly occupies the canopy strata of the forest and is therefore relatively free from disturbance, and not under threat as long as the forest remains intact. Elsewhere, *E. pallidus* is restricted to south-west Cameroon and southern Nigeria (Nash *et al.*, 1989) where its habitat is fragmented and threatened by local clearance for farms, collection of forest products, and large scale logging. Bioko Island, therefore, represents an important population of this species. The continued existence of large areas of undisturbed habitat is essential for the survival of

galagos and other species of primates on Bioko Island.

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References

- Ambrose, L. & S.K. Bearder. In prep. Vocalizations and biogeography of dwarf galagos (*Galagoides thomasi*, Elliot 1907; *Galagoides demidoff*, Fischer 1806) in West and Central Africa.
- Ambrose, L. & A.W. Perkin. 1997. A survey of prosimians at Moca on Bioko Island, Equatorial Guinea. Unpublished report to the Government of Equatorial Guinea.
- Bearder, S.K., P.E. Honess & L. Ambrose. 1995. Species diversity among galagos, with special reference to mate recognition. In *Creatures of the Dark: The Nocturnal Prosimians*. L. Alterman, M.K. Izard, & G.A. Doyle, eds. Plenum Press, New York. Pp. 331–352.
- Butynski, T. M. & S.H. Koster. 1994. Distribution and conservation status of primates in Bioko Island, Equatorial Guinea. *Biodiversity and Conservation* 3: 939–950.
- Charles-Dominique, P. 1977. *Ecology and Behaviour of Nocturnal Prosimians*. Duckworth, London.
- Charles-Dominique, P. & S.K. Bearder. 1979. Field studies of loridid behaviour: Methodological aspects. In *Prosimian Behaviour*. G.A. Doyle & R.D. Martin, eds. Academic Press, London. Pp. 567–629.
- Colell, M., C. Maté & J.E. Fa. 1994. Hunting among Moka Bubi in Bioko: Dynamics of faunal exploitation at the village level. *Biodiversity and Conservation* 3: 939c950.
- Eisenraut, M. 1973. Die Wirbeltierfauna von Fernando Poo und Westkamerun. *Bonner Zoologisches Monographien* 3: 1–428.
- Fa, J.E., B.J. Juste, J. Pérez del Val & J. Castroviejo. 1995. Impact of market hunting on mammal species in Equatorial Guinea. *Conservation Biology* 9: 1107–1115.
- González-Kirchner, J.P. & M. Sainz de la Maza. 1993.

- Primates as a food source for the native human population of the Republic of Equatorial Guinea, West Africa. *Tropical Biodiversity* 1: 163–168.
- Hearn, G.W. & R.W. Berghaier. 1996. Census of diurnal Primates in the Gran Caldera de Luba, Bioko Island, Equatorial Guinea. *African Primates* 2: 61–65.
- Jewell, P.A. & J. Oates. 1969. Ecological observations on the Lorisid primates of African lowland forests. *Zoologica Africa* 4: 231–248.
- Jones, P.J. 1994. Biodiversity in the Gulf of Guinea: An overview. *Biodiversity and Conservation* 3: 772–784.
- Juste, B.J. & J.E. Fa. 1994. Biodiversity conservation in the Gulf of Guinea Islands: Taking stock and preparing action. *Biodiversity and Conservation* 3: 759–771.
- Nash, L.T., S.K. Bearder & T. Olson. 1989. Synopsis of galago species characteristics. *International Journal of Primatology* 10: 57–80.
- Oates, J.F. 1996. *African Primates: Status Survey and Conservation Action Plan*, Revised Edition. IUCN/SSC Primate Specialist Group, Gland, Switzerland.
- Paterson, H.E.H. 1985. The recognition concept of species. In *Species and Speciation*. E.S. Vrba, ed. Transvaal Museum Monograph No. 4. Transvaal Museum, Pretoria. Pp. 21–29.
- Schaaf, C.D. 1994. The role of zoological parks in biodiversity conservation in the Gulf of Guinea Islands. *Biodiversity and Conservation* 3: 962–968.
- Wickings, E. J., L. Ambrose & S.K. Bearder. 1998. Sympatric populations of *Galagoideus demidoff* and *Galagoideus thomasi* in the Haut-Ogooué region of Gabon. *Folia Primatologica* 69: 389–393.

PRIMATES OF THE COMOÉ NATIONAL PARK, IVORY COAST

Abstract: *Comoé National Park, Republic of Ivory Coast, is the largest national park in West Africa. It is home to at least 14 primate species, including the western chimpanzee *Pan troglodytes verus*. The majority of the larger mammal species, including almost all species of primates, are threatened. This is due to an almost complete lack of management and heavy poaching pressure for over a decade. Immediate action is needed to halt this degradation.*

Résumé: *Le Parc National de Comoé en République de Côte d'Ivoire est le plus grand parc national de toute l'Afrique de l'Ouest. Le Parc habrite plus d'une douzaine d'espèces de primates, incluant le chimpanzé de l'ouest, *Pan troglodytes verus*. La plupart des espèces de grands mammifères, incluant presque toutes les*

espèces de primates, sont menacées. Ceci est dû principalement à un manque au niveau de l'aménagement du territoire de même qu'à une pression intense de braconnage datant de plus d'une décennie. Une action immédiate est nécessaire afin de cesser cette dégradation.

Introduction

The Comoé National Park (CNP) is one of Africa's largest protected areas (11,500 km²), at least on paper (figure 1). CNP is located in the north of the Republic of Ivory Coast between 9°6'N–8°5'N and 3°1'W–4°4'W. Due to a mosaic of different habitats (*e.g.*, open and dense savanna, gallery forest, forest islands of a few hectares to several square kilometers in size, rivers, streams, waterholes), the park supports a wide variety of species of large mammals. So far, more than 150 species of mammals have been identified (Mess & Krell, 1999; Fischer *et al.*, in press; Fahr, unpubl. data). The finding of additional species is most likely because rodents and insectivores have not been studied comprehensively. At least 14 species of primates are present. This includes rare species and sub-species like the western chimpanzee *Pan troglodytes verus* and the white-thighed black-and-white colobus *Colobus vellerosus*.

Due to an almost complete lack of management for about 15 years, the large mammal community of the park, including almost all primate species, is seriously threatened (Fischer, 1996; Fischer, 1998). Park rangers are poorly equipped, unmotivated, and lack sufficient training to perform their tasks efficiently. There are reports of these officials allowing hunting and fishing within the park. Bushmeat is sold openly in several markets and along the major roads throughout the country, even though hunting is illegal. Hunting in the Comoé National Park is a daily event performed by local villagers as well as foreigners. Poachers either hunt alone or in groups of up to 40 people. Large, village-like hunting camps are installed in the park and used for several weeks at a time. Poachers disperse from these sites for their daily hunts, bringing the carcasses back to the camp, where they are butchered and smoked. The meat is then transported by foot, bicycle or boat to the surrounding villages, where it is sold locally or to merchants. The meat is further transported by daily bush taxis to towns and cities in Ivory Coast and neighboring countries. Although some people still obey taboos that prohibit the hunting or consumption of certain species, others hunt these species. No vertebrate is safe in the park. A project funded by the European Union and carried out between 1998 and 2001 improved the situation somewhat. The project ended in May 2001 and future financial support for this or an equivalent conservation measure is not yet ensured.

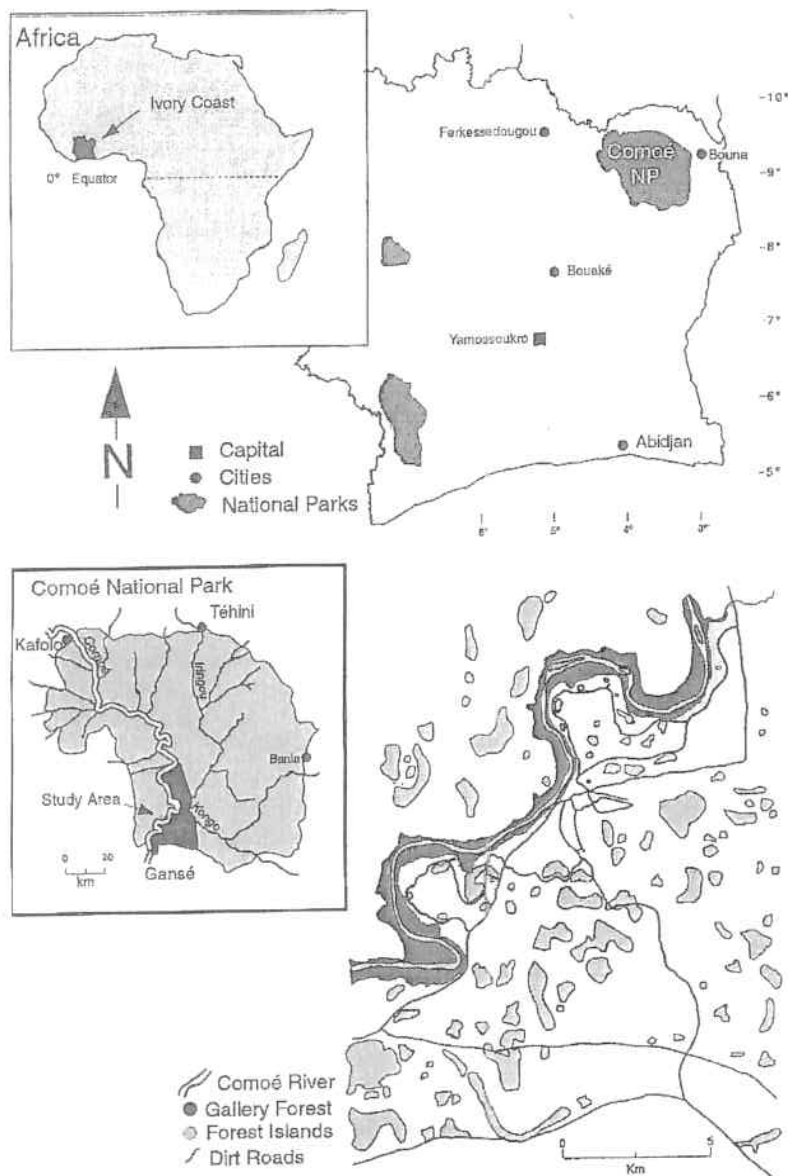


Figure 1. Maps of Africa, Côte d'Ivoire, Comoé National Park, and the study area.

This article provides a list of the primates found in the CNP and gives further information on each species where it is available (table 1). The article also compares our findings in terms of animal abundance with data obtained in the 1970s (Poilecot, 1991).

Methods

Data provided in this article were collected by the authors during their daily work studying kob antelope *Kobus kob kob* (FF, 1993–2001), leopards *Panthera pardus* (MG, 1995–2000), and baboons *Papio anubis* (BK, 1997–2000). We did not follow standardised methods (except for baboon observations) but collected data *ad libitum* whenever sightings of primates were made. Natural primate predators in the park are leopard,

lion *Panthera leo*, hyena *Crocuta crocuta*, rock python *Python sebae*, and probably also larger birds of prey like the martial eagle *Polemaetus bellicosus*.

Results and Discussion

Senegal galago *Galago senegalensis*

The Senegal galago is common in the savanna, where it is easily spotted at night due to the reflection of its eyes. Most observations were of animals at heights of 2–12 m. This species was observed on the ground only during flight. Senegal galagos were encountered in dense *Combretum/Detarium* stands as well as on large single *Daniellia oliveri* trees in more open savanna.

Table 1. Primates of the Comoé National Park, Côte d'Ivoire

Family/Species	Seen	Heard	Tracks/ Traces	Habitat	Status (population trend)	Party size
Galagonidae						
<i>Galago senegalensis</i>	***			Dense savanna	common (stable)	1-3
<i>Galagoides demidoff</i>	Poilecot (1991)				?	
<i>Galagoides</i> sp.	** (2)			Gallery forest	?	1
Lorisidae						
<i>Perodicticus potto</i>	* 1			Gallery forest	?	1
Colobidae						
<i>Procolobus verus</i>	** (6)			Gallery forest	rare (?)	3-7
<i>Colobus vellerosus</i>	***	***		Gallery forest, forest patches	rare (declining)	3-15
Cercopithecidae						
<i>Papio anubis</i>	***	***	***	Savanna	common (declining?)	3-44
<i>Cercocebus torquatus</i>	***	**		Gallery forest, forest patches	less common (declining)	5-23
<i>Erythrocebus patas</i>	**	*		Savanna	less common (declining)	3-17
<i>Cercopithecus aethiops</i>	**			Forest, savanna	less common (declining)	5-15
<i>Cercopithecus mona</i>	**			Gallery forest, savanna	less common (declining)	1-10
<i>Cercopithecus nictitans</i>	**			Gallery forest	extinct? (?)	
<i>Cercopithecus petaurista</i>	**	***		Gallery forest	common (declining)	1-15
<i>Cercopithecus diana</i>	** (3)			Gallery forest	extinct? (?)	
Pongidae						
<i>Pan troglodytes</i>	** (2)	***	**	Gallery forest	less common (?)	

*Encountered once; ** several times; ***regularly.

Numbers in parenthesis give the exact number of observations for those species observed more than once but less than 10 times.

Thomas' dwarf galago *Galagoides thomasi* and *Demidoff's dwarf galago* *Galagoides demidoff*

In the case of the genus *Galagoides*, we were not able to distinguish between *G. demidoff* and *G. thomasi*. One or both of these species might occur since the CNP appears to contain suitable habitat for both species. *G. demidoff* has been reported for the park by Poilecot (1991) who might not have been aware of the difficulties in differentiating the two species.

Potto *Perodicticus potto*

One sighting of potto from the southern part of the CNP was reported to us. The animal was observed for more than an hour in the gallery forest at the research camp of the University of Würzburg.

Olive colobus *Procolobus verus*

At least two species of colobine monkeys are present in the park. Olive colobus have been observed in the gallery forest in the south of the CNP. In two-thirds of the observations two to four of these monkeys were associated with lesser spot-nosed monkeys *Cercopithecus*

petaurista petaurista. The colobus were feeding close to each other 2-4 m above ground on the west bank of the Comoé river. All observations were made in April 1999 when an infant was seen moving within a couple of meters of its mother. One observation of a mixed group of olive colobus, lesser spot-nosed monkeys and mona monkey *Cercopithecus mona lowei*, was made in July 1999. All animals fed close to each other at 2-10 m above the ground.

White-thighed black-and-white colobus *Colobus vellerosus*

White-thighed black-and-white colobus were frequently encountered up to 1996 when groups of 10-15 individuals were often seen in gallery forest. The loud calls of males were heard almost every morning. When large trees fruited, groups were also seen in forest islands close to the river. One white infant was seen in April 1996 at the beginning of the rainy season (March-May). Probably due to over-hunting, this species became rare after 1997 and only a few small groups of 3-5 individuals were encountered in 1999. No calling

males were heard in 1999, 2000 and 2001.

Miss Waldron's red colobus *Procolobus badius waldroni*

There is a slight chance that the red colobus *Procolobus badius waldroni* also occurs in the CNP. Red colobus have never been observed in CNP but its hairs might have been present in two leopard scats one of us (MG) analyzed.

Olive baboon *Papio anubis*

The most common monkey of the CNP is the olive baboon, although its population is also declining. Poilecot (1991) estimated a total of 66,125 baboons for the entire CNP. We believe that the number of baboons in CNP is now much lower, since remains of baboons were frequently found in poacher camps. Baboon groups encountered contained 1–5 adult males. We frequently observed baboons feeding on termites, and once saw them plucking village weaver *Ploceus cucullatus* nests from a bush to eat the eggs and nestlings. While analyzing baboon faeces, one of us (BK) found remains of small mammals and frogs in seven of more than 500 scats sampled (unpubl. data). Past and ongoing studies have so far identified 77 food plants consumed by baboons in the southern CNP and revealed that they play an important role in seed dispersal (Refisch, 1996; Hovestadt, 1997; Kunz & Linsenmair, 2000). Because we encountered baboons close to the village of Gansé, we assume that they are not hunted there. This assumption is supported by the fact that baboons encountered at fruiting trees did not always retreat if an observer approached them, but threatened the intruder instead.

Red-capped mangabey *Cercocebus torquatus lunulatus*

Red-capped mangabeys were encountered in savanna, as well as forest islands and gallery forest. A semi-terrestrial monkey, the red-capped mangabey is highly vulnerable to cable snares and other traps commonly used in the CNP. However, groups of up to 23 animals (including six infants observed in May 1998) were encountered. The loud calls of the males were frequently heard at the beginning of the rainy season (March–May).

Patas monkey *Erythrocebus patas*

Small groups of patas monkeys were occasionally observed in the savanna. Most groups contained one adult male and one or two adult females. Most of the groups encountered outside the park consisted of 10 or more individuals, whereas only two groups of this size were observed inside the park (17 and 15 animals). Patas monkeys are probably more common at the park's edge where they seem to be regular crop raiders. Whereas adult patas monkeys found in fields are killed, their young are commonly kept as

pets. Poilecot (1991) estimated the total patas population within CNP to be about 1,150 individuals. We are not able to give an update for this estimate, but believe numbers to be lower than that.

Vervet monkey *Cercopithecus aethiops sabaeus*

Poilecot (1991) estimated a total of 1,380 vervet monkeys for the entire park. We observed them in the gallery forest, as well as in forest patches and in dense savanna formations. One group was encountered 2 km west of the town of Bania. An individual was seen 20 km south of CNP. The species can cope, at least partially, with human disturbance. The absolute numbers of vervet monkeys still present in the park is unknown, but is probably lower than Poilecot's estimates.

Mona monkey *Cercopithecus mona lowei*

Between January 1998 and July 2000, 23 groups of mona monkeys were observed (20 in the gallery forest, three in the savanna). They contained 1–10 individuals (median three). We encountered mona monkeys only well within the boundaries of CNP.

Putty-nosed monkey *Cercopithecus nictitans martini*

The putty-nosed monkey was observed by several scientists in the past, but has not been seen within the last 9 years. This species might now be extinct in the park.

Lesser spot-nosed monkey *Cercopithecus petaurista petaurista*

The lesser spot-nosed monkey was often seen in the gallery forest. At least one group entered the research camp frequently.

Diana monkey *Cercopithecus diana roloway*

The diana monkey has not been observed by us in the last 5 years, but was documented for the park in earlier studies (GTZ/FGU, 1979; Poilecot, 1991). As for the putty-nosed monkey, this might be due to a decline in numbers (with possible extinction), or to special habitat preferences that limit its range in the reserve. Its occurrence would be most likely in the very moist gallery forest of the Iringou river or the west bank of the Comoé river, both of which are difficult to access.

P. b. waldroni and *C. d. roloway* are both rare monkeys and face extinction in some of their last refuges in the south-east of the country (McGraw *et al.*, 1997–1998).

Western chimpanzee *Pan troglodytes verus*

The western chimpanzee has been studied comprehensively in Côte d'Ivoire's Tai National Park (Boesch & Boesch 1989; Boesch & Boesch-Achermann, 1991). The total chimpanzee population in the Côte d'Ivoire is believed to be fewer than 750 individuals (Bowen-Jones, 1999). Comoé National Park is not listed on the IUCN map that shows the distribution of chimpanzees in West Africa (Oates, 1996). Chimpanzees

were, however, heard frequently on the west bank of the Comoé river. Here their nests were common. We believe that chimpanzees in CNP are fairly undisturbed by hunters. We have been told by people from the village of Gorowi that chimpanzees are not hunted by them due to their resemblance to man. In addition, we never found any chimpanzee remains in poacher camps or local markets. We are not able to give an estimate of chimpanzee density for the CNP, but believe that they are restricted to the gallery forest and some of the larger forest islands west of the Comoé River. That is, they probably occur only in the south of the CNP. We observed chimps only twice in the last 7 years, but frequently heard them calling and drumming close to the research station in all years.

Management Implications

The Comoé National Park contains a rich variety of primates and other large mammals, some of which are not found elsewhere in the Ivory Coast (Fischer *et al.*, in press). For most savanna species the park is the last refuge in the country. Other "protected" sites, like the Marahoué National Park, suffered more from poaching because of their accessibility to people. The cessation of almost all management activities has led to tremendous declines in the large ungulate populations (Fischer, 1996; Fischer, 1998; Fischer & Linsenmair, 2001) and probably also in populations of primates. At least five species of large mammals are believed to have become extinct in CNP within the last 20 years. These are African wild dog *Lycaon pictus*, cheetah *Acinonyx jubatus*, bohor reedbuck *Redunca redunca*, and probably diana monkey and putty-nosed monkey. Others are about to follow. Immediate action against poaching and other support for the park is urgently needed to protect this Biosphere Reserve and World Heritage Site. We hope that European Union and World Bank funding will lead to the implementation of an effective management program for the CNP. This should involve the local people, and offer them alternatives to their destructive use of this unique area.

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References

- Boesch, C. & H. Boesch. 1989. Hunting behavior of wild chimpanzees in the Tai National Park. *American Journal of Physiological Anthropology* 78: 547-573.
- Boesch, C. & H. Boesch-Achermann. 1991. Dim forest, bright chimps. *Natural History Magazine*: 50-56.
- Bowen-Jones, E. 1999. A review of the commercial bush meat trade with emphasis on Central/West Africa and the great apes. *African Primates* 3: S1-S33
- Fischer, F. 1996. Ivory Coast: Comoé National Park. *Antelope Survey Update No. 2*: 9-12; East, R. (Compiler). IUCN/SSC Antelope Specialist Group Publication.
- Fischer, F. 1998. Ökoethologische Grundlagen der nachhaltigen Nutzung von Kobantilopen (*Kobus kob kob*). Ph. D. Thesis, University of Würzburg, Würzburg.
- Fischer, F. & K. E. Linsenmair. 2001. Decreases in ungulate population densities. Examples from the Comoé National Park, Ivory Coast. *Biological Conservation* 101: 131-135.
- Fischer, F., M. Gross & K. E. Linsenmair. In press. Updated list of the larger mammals of the Comoé National Park, Ivory Coast. *Mammalia*.
- GTZ/FGU. 1979. Gegenwärtiger Status der Comoé- und Tai-Nationalparks sowie des Azagny-Reservats und Vorschläge zu deren Erhaltung und Entwicklung zur Förderung des Tourismus. Project Number 73.2085.6 Band II Teil 1 & 2. GTZ Verlag, Eschborn.
- Hovestadt, Th. 1997. *Fruchtmerkmale, endozoochore Samenausbreitung und ihre Bedeutung für die Zusammensetzung der Pflanzengemeinschaft*. Wissenschaft & Technik Verlag, Berlin.
- Kunz, B. & K. E. Linsenmair. 2000. Seed dispersal and seed predation by olive baboons in the Comoé National Park, Ivory Coast. *Folia Primatologia* 71: 233.
- McGraw, W. S., I. T. Monah & M. Abedi-Lartey. 1997-1998. Survey of endangered primates in the forest reserves of eastern Côte d'Ivoire. *African Primates* 3: 22-25.
- Mess, A. & F. T. Krell. 1999. Liste préliminaire des Rongeurs et des Musaraignes du Parc National de la Comoé en Côte d'Ivoire (Mammalia: Rodentia, Insectivora: Soricidae). *Stuttgarter Beiträge zur Naturkunde. Serie A* 586: 1-11
- Oates, J. F. 1996 *African Primates: Status Survey and Conservation Action Plan*. Revised edition. IUCN/

SSC Primate Specialist Group, Gland, Switzerland Pp78–79.

Poilecot, P. 1991. *Un écosystème de savanne soudanienne: Le Parc National de la Comoé. Côte d'Ivoire*. UNESCO / PNUD n° IVC/87/007 Note Technique 2.

Refisch, J. 1996. Samenverbreitung durch Paviane im Parc National de la Comoé. M.Sc. thesis University of Bayreuth, Germany.

THE ENDEMIC PRIMATES OF THE UDZUNGWA MOUNTAINS, TANZANIA

Abstract: *The Udzungwa Mountains of Tanzania, the largest and southern-most of the Eastern Arc "archipelago" of mountains, contain forests that are characterized by high species richness, diversity, and endemism. These fragmented forests are also the most important in Tanzania for primate conservation, with six species of diurnal monkeys (including the endemic Udzungwa red colobus Procolobus (badius) gordonorum and the endangered, endemic Sanje mangabey Cercocebus (galeritus) sanjei) and three to five species of galagos. The intent of this report is to provide a basic background and overview of the Udzungwas and the primates found there. Additionally, limited data are presented on the diurnal primates based upon pilot surveys conducted in the Udzungwa forests in 1994, including distribution information, preliminary counts of group sizes, and polyspecific associations. Conservation threats noted during the survey, such as habitat destruction and poaching, are discussed, emphasizing the need to raise the level of protection in the forest reserves that are adjacent to the recently established Udzungwa Mountains National Park. These preliminary observations clearly indicated the need for extensive research and led to a collaborative, long-term project on the Udzungwa primates by the author, T.M. Butynski, and T.T. Struhsaker. Results from the ongoing collaborative project are forthcoming.*

Résumé: *Les Montagnes d'Udzungwa de la Tanzanie, le plus grand "archipel" de montagnes au sein de l'Arc Oriental, abritent des forêts d'une grande richesse, d'une grande diversité et de taux élevés d'endémisme. Ces forêts fragmentées sont les plus importantes en Tanzanie en terme de conservation des primates avec six espèces de singes diurnes (dont le colobe rouge d'Udzungwa Procolobus (badius) gordonorum qui est endémique et le mangabé Sanje Cercocebus (galeritus) sanjei qui lui est endémique et en danger) et de trois à cinq espèces de galagos. L'objectif du présent rapport est de fournir une vue d'ensemble des forêts d'Udzungwa*

et des primates qui y vivent. De plus, des résultats préliminaires sur les primates diurnes sont présentés suite à des travaux effectués dans les forêts d'Udzungwa en 1994 sur la distribution, la taille des groupes et les associations polyspécifiques. Les menaces liées à la conservation comme la destruction de l'habitat et le braconnage ont été prises en compte, amplifiant le besoin d'augmenter le niveau de protection dans ces réserves forestières adjacentes au nouvellement établi Parc National des Montagnes d'Udzungwas. Ces résultats préliminaires démontrent clairement le besoin d'étendre les recherches et ont amené les chercheurs T.M. Butynski et T.T. Struhsaker à mettre en commun un projet à long-terme. Les résultats qui découlent de cette collaboration seront annoncés bientôt.

Introduction

This report presents an overview of information and pilot study data collected during preliminary survey work conducted by the author during the period August–December 1994 in the Udzungwa Mountains of Tanzania. This work was to assess the feasibility of research on the endemic primates of the fragmented forests of this unique and critically important conservation area in south-central Tanzania. Subsequent to this pilot study, a team composed of myself, Thomas M. Butynski (Zoo Atlanta's Africa Biodiversity Conservation Program), and Thomas T. Struhsaker (Duke University) has worked in the Udzungwa Mountains, conducting primate surveys, obtaining distribution and abundance data, assessing habitat, and establishing a long-term monitoring program in the Udzungwa Mountains National Park (Ehardt *et al.*, 1999). This collaborative project, funded by the Margot Marsh Biodiversity Fund, with supplemental funding from WWF-Tanzania, is ongoing and publications of our findings are forthcoming. To date, we have published information concerning the dwarf galagos found in these forests (Butynski *et al.*, 1998).

The following is predominantly an overview of the biogeography of the Udzungwa Mountains and a description of the primates found in the forests of this important montane region. Also presented are a summary of the preliminary diurnal primate observations made during the 1994 pilot study, and a brief overview of some of the conservation concerns originally noted.

Biogeographic Overview

The Afromontane Region (White, 1976, 1978, 1981) stretches across the African continent from the Loma Mountains of Sierra Leone eastward to Somalia, and from the Red Sea Hills southward to the Cape Peninsula

of South Africa. The disjunct forested mountain ranges of this extensive region have been likened to an "archipelago", characterized by diverse flora and fauna and high rates of endemism within the isolated montane "islands". Unlike other forested areas of Africa, the eastern African forest islands of the Afromontane region have experienced a prolonged period of stability due to Indian Ocean currents which bring moisture to these more eastern regions (Griffiths, 1993; Lovett 1993). Stable Indian Ocean temperatures and the associated high rainfall shielded these forests from the droughts which led to the Pleistocene loss of extensive regions of forest elsewhere in Africa. These tropical forests are therefore of great age, having been in existence since approximately 30 million years ago, and separated from western Africa since the Miocene uplift of the central African plateau. The age, isolation, and fragmented nature of these forests have made them an area well known to biogeographers and ecologists for their richness, diversity, and endemism of plants and animals.

The complex biogeographical history of this region has also produced patchy allopatric distributions of primates across tropical Africa, including the various forms of colobus monkeys (Struhsaker, 1981a,b) and the mangabeys (Rodgers *et al.*, 1982). The endemic taxa of primates found in these ecological island communities are rare, endangered, and living in small, unique forest communities. This, combined with the ecological importance (*e.g.*, as watersheds), historical significance, and vulnerability of the forests, makes these isolated African montane forests high priority areas for conservation. The unique primate populations living in these areas also require special conservation attention, given their limited geographical distribution and consequent small population size.

The Taita Hills of Kenya, and the Pare, Usambara, Uluguru, Nguru, Rubeho (Usagara), Udzungwa, and Mahenge mountains of Tanzania

are the main north-south blocks that comprise what are referred to as the Eastern Arc Mountains (figure 1). The forests of these ancient crystalline mountains are found primarily on the east/southeast-facing scarps where rainfall exceeds 1000–1500 mm per year. An altitudinal range of 300 m to over 2000 m, coupled with topographic and latitudinal variations in rainfall, have produced complex and variable floral and faunal communities characterized by very high degrees of species and generic endemism (Lovett, 1985, 1988, 1990; Beentje, 1988). For example, Lovett (1988, 1993) documented that nearly one-third of the more than 2000 moist forest plant species are endemic. Others cite the great diversity in arthropods (Hoffman, 1993), reptiles, amphibians (Howell, 1993), and montane forest birds (Stuart *et al.*, 1993; Butynski & Ehardt, in press). These Eastern Arc montane forests, coupled with the coastal forests of Tanzania and Kenya, have recently been designated a critically important global biodiversity hotspot (Mittermeier *et al.*, 2000; Myers *et al.*, 2000).

The Udzungwa Mountains of Tanzania and their Primate Fauna

Of the various blocks within the Eastern Arc, the Udzungwa Mountains are the southern-most and largest. The montane forests of the Udzungwas are unique in that the eastern scarp is the only area in East Africa where there is continuous forest cover from 300 m to

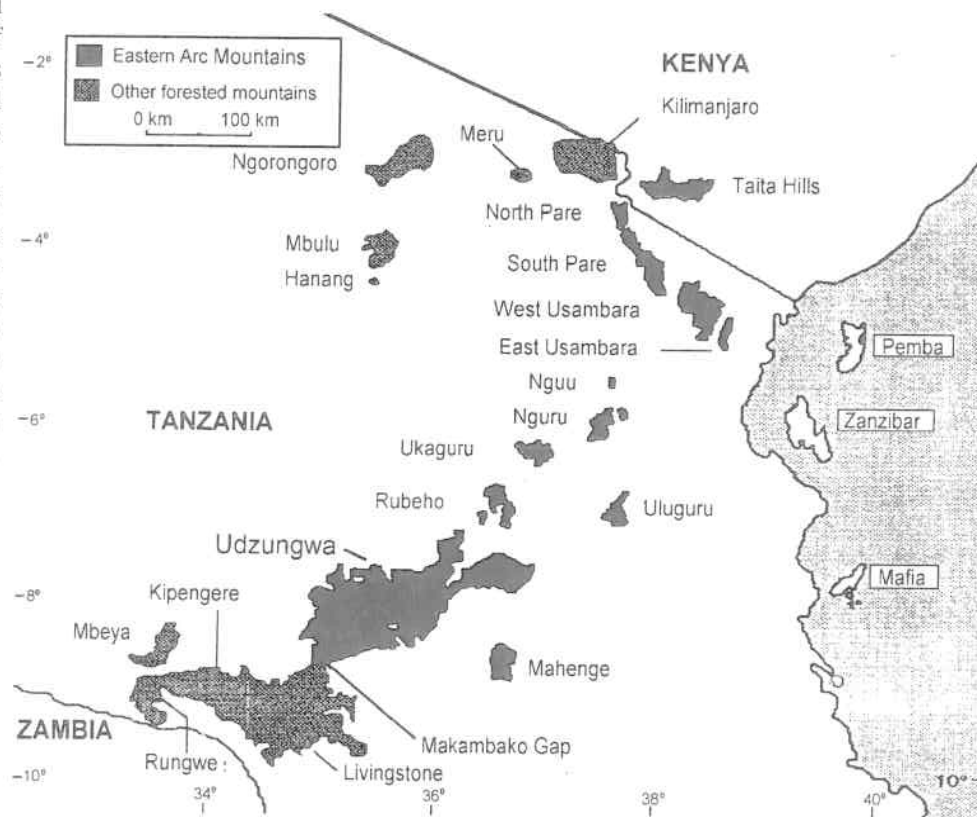


Figure 1. Map illustrating the montane areas comprising the Eastern Arc Mountains.

2600 m. This vertical zonation sequence of 2300 m begins in the lowland forests in the valley of the Great Ruaha River, extends through intermediate *Parinari* rain forest, to montane *Podocarpus* forest and bamboo in the highest elevations (Rodgers & Homewood, 1982). These forests remain largely unexplored. What evidence exists on levels of endemism and species rarity and richness suggests that these may well be the most important forests in East Africa for the conservation of biodiversity (Rodgers & Homewood, 1982; Jensen & Brogger-Jensen, 1992; Butynski *et al.*, 1998; Dinesen *et al.*, 2001).

The Udzungwas are clearly Tanzania's most important area for primate conservation. There are six species of monkeys present in the Udzungwa forests: Syke's monkeys *Cercopithecus mitis* subsp. (possibly *moloneyi* or *monoides*), vervets *Cercopithecus aethiops rufoviridis*, yellow baboons *Papio cynocephalus cynocephalus*, Tanzanian black-and-white colobus *Colobus angolensis palliatus*, and two endemic taxa,



Figure 3. Sanje mangabeys *Cerrocebus galeritus sanjei*. Photo by Carolyn L. Ehardt.

the Udzungwa (or Uhehe, Gordon's, or Iringa) red colobus *Procolobus (badius) gordonorum* (figure 2) and the Sanje mangabey *Cerrocebus (galeritus) sanjei* (figure 3) (Rodgers & Homewood, 1982; Wasser, 1993; Groves 1996, 2001). There are also three to five species of galagos, including one recently discovered species, the mountain (or Amani) dwarf galago *Galagoides orinus* (see Butynski *et al.*, 1998).

The endemic subspecies of mangabey and red colobus are both threatened. The red colobus is classified in the IUCN/SSC Primate Specialist Group Action Plan for African Primate Conservation (Oates, 1986, 1996) as having the highest conservation priority rating, is listed as Vulnerable in the IUCN Red List of Threatened Species (Hilton-Taylor, 2000), and has been described as one of the world's most endangered primates (Mittermeier *et al.*, 1986).¹ The Sanje mangabey is also given high priority, due to its uniqueness, limited distribution,



Figure 2. Udzungwa red colobus *Procolobus gordonorum*. Photo by Carolyn L. Ehardt

and probable small population size (Oates, 1986, 1996). It is classified as Endangered in the IUCN Red List of Threatened Species (Hilton-Taylor, 2000) and has been recognized as one of the world's top 25 most endangered primates (Conservation International & IUCN/SSC Primate Specialist Group, 2000).¹ Both the red colobus and the mangabey are CITES Appendix I taxa.

In addition to their endangered status, the mangabey and red colobus are also of research interest from the perspective of evolution and taxonomy. For African primates in general, there is no firmly established taxonomy, and many of the taxonomic uncertainties involve some of the forms considered to be the most endangered (Oates, 1996). For example, the red colobus group is one of the least resolved taxonomically (Oates, 1994) and yet several forms of the red colobus are among the most endangered of all African primates. Most classifications of the Udzungwa red colobus designate it as *Procolobus badius gordonorum*, with its presumed closest taxonomic affiliate being the Zanzibar red colobus (*Procolobus badius kirkii*), although there is substantial disagreement and recent classifications have given it species status (*Procolobus gordonorum*).

For the mangabeys, Groves (1978) suggested over 20 years ago that they are taxonomically diphyletic and should be divided into two distinct genera, *Cercocebus* and *Lophocebus*, a classification supported by research on genetic and biochemical differences (e.g., Barnicot & Hewett-Emmett, 1972; Cronin & Sarich, 1976). Recent evidence suggests that the *Cercocebus* group may be more closely related to the drill *Mandrillus leucophaeus* and mandrill *Mandrillus sphinx* than to either *Lophocebus* or to the savanna baboons *Papio* spp. and geladas *Theropithecus gelada* (Goodman *et al.*, 1998; Harris & Disotell, 1998; Disotell, 2000), whereas *Lophocebus* is considered to be closely related to *Papio*. This classification raises questions about behavioral and socioecological differentiation in these taxa.

Available data suggest that the two major taxa of mangabeys are distinct ecologically, and perhaps behaviorally, although adequate comparative data are yet to be obtained. There are ecological data for mangabeys, but these are limited (see, for example, Chalmers, 1968a; Homewood, 1975, 1978; Waser, 1975, 1977, 1980, 1982; Gautier-Hion, 1978; Freeland, 1979; Marsh, 1986; Kinnaird, 1990, 1992a,b; Olupot *et al.*, 1994, 1997, 1998; Olupot, 1998) and detailed studies of social behavior focus nearly entirely on *L. albigena* (Chalmers 1968b; Chalmers & Rowell 1971; Wallis 1981, 1983). The exceptions include studies of captive sooty mangabeys *Cercocebus torquatus atys* (Bernstein, 1976; Busse & Gordon, 1983, 1984; Ehardt, 1988a,b; Gust, 1991, 1994; Gust & Gordon, 1990, 1993, 1994), and preliminary work with

captive golden-bellied mangabeys *C. galeritus chrysogaster* (Mitchell *et al.*, 1988).

The Sanje mangabey has been presumed to be a subspecies of *Cercocebus galeritus* (Homewood & Rodgers, 1981). Morphological characteristics of a juvenile Sanje mangabey housed at the Mount Meru Game Sanctuary, Arusha, Tanzania, suggested a preliminary taxonomic designation of *Cercocebus galeritus sanjei*, with a presumed close affinity of this form to the Tana River crested mangabey (*Cercocebus galeritus galeritus*). As will be described by Ehardt *et al.* (in prep.), however, the actual appearance of the Sanje mangabey is quite different from that of the captive animal in Arusha. The latter is depicted in Kingdon (1997) and perhaps contributed to some degree of taxonomic confusion. Most recently, Groves (1996, 2001) suggests that separate species status (*C. sanjei*) may be warranted.

The distribution of the various primates within the Udzungwa forests is not yet well known, although Rodgers and Homewood (1982) made very preliminary surveys in some of the forests. They presented substantial information on the status of the red colobus in the area, but the distribution and density of the mangabey remain poorly known. Mangabeys were reported to be present in the areas designated as the Udzungwa Scarp and Mwanihana Forest, and possibly present in the West Kilombero Scarp (Homewood & Rodgers, 1981; Rodgers & Homewood, 1982; Rodgers *et al.*, 1982). The red colobus, black-and-white colobus, and Sykes monkeys were reported to be present in all three of these areas. These assessments are largely based on interviews with local people, and on brief, limited, and non-systematic surveys conducted during the early 1980s. It should be noted that surveys of primates in these forests are difficult due to the rugged terrain, and the fact that some primates have been hunted by the non-Muslim peoples in the area. The only subsequent information is a report by Wasser (1993) on the Mwanihana Forest within the Udzungwa Mountains National Park, observations made by researchers in several forest reserves as part of a more general biodiversity investigation in conjunction with avifauna research (Dinesen *et al.*, 2001), the pilot work conducted by myself in several of the forests in late 1994, and the current research by myself and collaborators Tom Struhsaker and Tom Butynski.

The 1994 Pilot Work in the Udzungwa Mountains

Much of the original work by the author in 1994 was intended to establish collaboration with Tanzania National Parks (Arusha), the University of Dar es Salaam, Wildlife Conservation Society of Tanzania,

Serengeti Wildlife Research Institute, and the headquarters for the Udzungwa Mountains National Park (UMNP; established 1992). Research focusing on the flora and fauna of Tanzania's forests is recent (see, for example, Hamilton, 1989), and the information and expertise required for management and protection of Tanzania's forests is described as generally insufficient (*e.g.*, Mgeni & Malimbwi, 1990). Rodgers (1993) points out that the objectives of collecting scientific information and stimulating research on forest ecosystems designed to increase knowledge relevant to biodiversity conservation in Tanzania's forests is constrained by insufficient funds and a shortage of qualified personnel. It was a primary intention of the preliminary work, therefore, to establish ties that could be expanded into field-based training and collaborative research. In the current project that we

are carrying out in the Udzungwas, these goals are being met.

The 1994 preliminary primate survey was concentrated in Mwanihana Forest of UMNP, the intended principal research site, and in three areas designated as catchment forest reserves (FR): Matundu FR, Udzungwa Scarp FR, and the Ndundulu portion of the West Kilombero FR (see figure 4). It was clear from conversations with Tanzanians familiar with the Udzungwa Mountains and from preliminary visits that: 1) there was a critical need for extensive surveys to document distribution and relative abundance of the primates, especially the endemic taxa, 2) the forested areas, though fragmented, covered an extensive area, 3) there were significant conservation problems in the area, especially in the forest reserves to the south and west of the national park, and 4) the difficult terrain

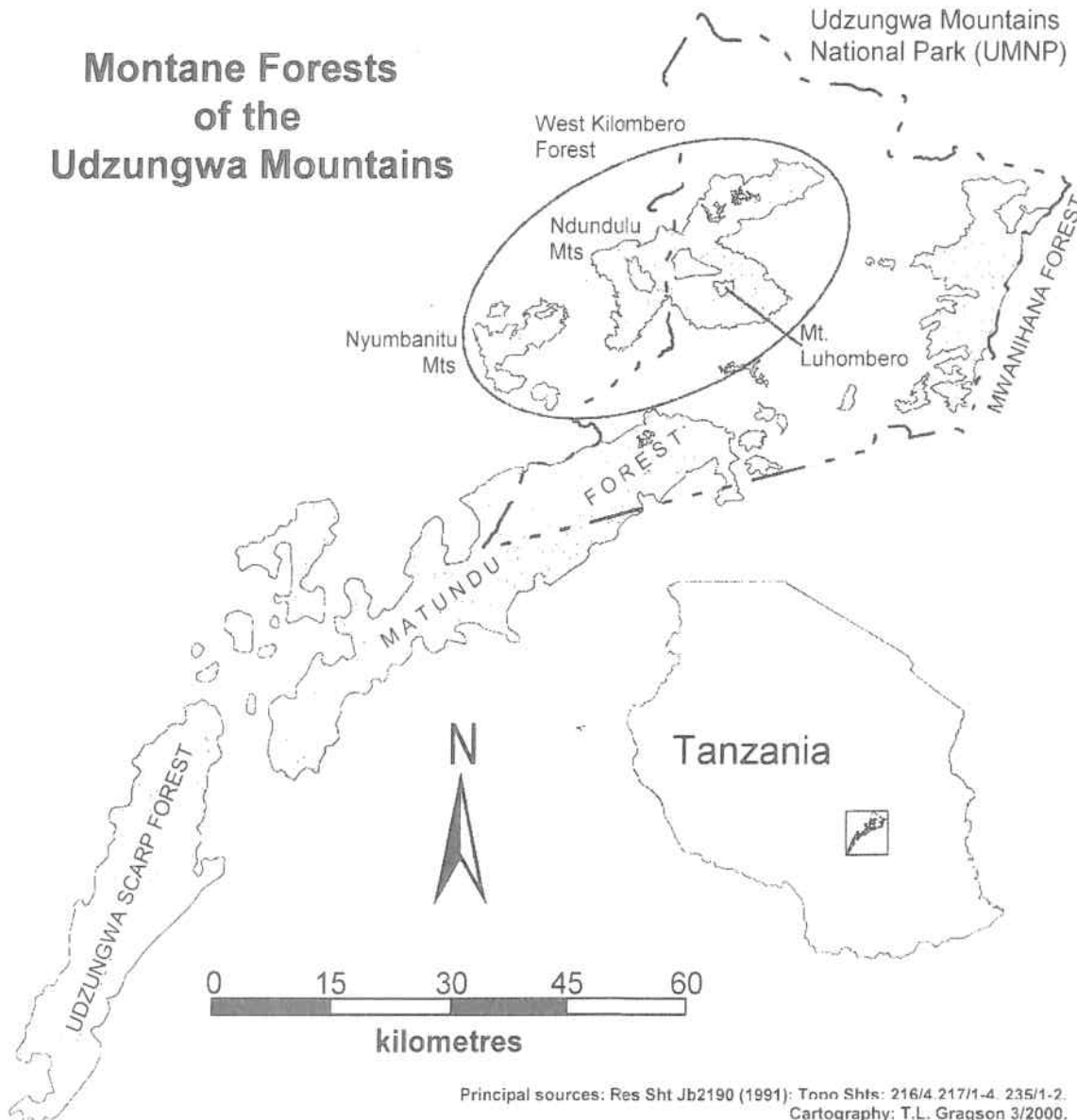


Figure 4. Map of the principal forest blocks of the Udzungwa Mountains. The Udzungwa Mountains National Park is outlined to illustrate the forests that are within the Park versus those that are forest reserves.

and sparse distribution of the mangabeys in particular would necessitate a team approach to future work.

The Diurnal Primates

The observations reported here are based on non-systematic, preliminary surveys by the author with the assistance of Mr. Ayoub Njalale of the Wildlife Conservation Society of Tanzania, who also worked with Wasser in 1984 and 1986 in Mwanihana Forest. Tanzania National Parks personnel also assisted inside the national park, including Mr. Agricola Lihuru (who also worked with Wasser's group) and Mr. Daneri Amandusi. Information was collected in Mwanihana Forest within UMNP, and in the Ndundulu Forest outside the Park's western boundary. Surveys were along existing trails, including firewood-collecting, poacher, and old logging trails, and trails being developed by UMNP personnel. Data collected included all sightings of diurnal primates, the approximate size of some groups, and notation of all polyspecific associations. For Matundu FR and Udzungwa Scarp FR, interviews were conducted with local villagers living along the boundaries.

Matundu FR is the western extension of the much larger portion of this forest now contained within the UMNP boundaries, lying between the Ruipa and Idete rivers. This forest is overall lower in elevation than much of the other forest in the area (300–500 m a.s.l.). It consists largely of miombo woodland and dry forest in the southern portion and lowland forest with taller canopy in the northern half, and was extensively logged (especially *Khaya anthotheca* and *Milicia excelsa*). Interviews with local villagers, including individuals who worked extensively with forestry personnel over the years, indicated that baboons, Sykes monkeys, and both colobines were present in Matundu. Mangabeys, however, were not reported to be seen by anyone familiar with this forest.

Udzungwa Scarp FR covers a steep east-facing portion of the southern escarpment of the Udzungwas and extends over an upland, undulating plateau, with elevations ranging from 300 to 2068 m. The forest shows extensive evidence of human disturbance, from both past cultivation and, in the lower elevations, from logging. Primary forest remains only along the steepest portions of the escarpment, which is drained by numerous fast-flowing streams. We confirmed presence, originally reported by Rodgers and Homewood (1982), of the red colobus, black-and-white colobus, Sykes monkeys, and mangabeys. Villagers also reported that the mangabey was "always seen" when they went into the forest, sometimes in large groups ("as many as 60 animals"). They also reported, however, that hunting is common in the area. This area was originally proposed by Rodgers & Homewood (1982) to be included within the UMNP, although this was not accomplished due to logistical concerns. The

Udzungwa Scarp FR is a substantial distance from Mwanihana Forest, where the headquarters was to be located when the national park was gazetted. In the absence of the more effective protection provided to national parks, human use of the resources in Udzungwa Scarp FR remains high and is a potential threat to isolated populations of mangabeys and red colobus.

I refer to the western forests of West Kilombero FR which cover the Ndundulu Mountains as Ndundulu Forest. This portion of West Kilombero is outside the UMNP and is the highest of the forests visited, ranging from about 1350 to 2400 m. The vegetation differs substantially from the other forests (described by Dinesen *et al.*, 2001) and is dominated by *Hygenia*, *Ocotea*, *Cassipourea*, *Neoboutonia*, and *Podocarpus* spp. at varying elevations, with a greater overall canopy height and less understory. This is another isolated fragment, separated from Udzungwa Scarp FR and the other forested portions of West Kilombero FR (such as that on the nearby Nyumbanitu Mountains) by grassland.

Although mangabeys were confirmed to be present in Ndundulu, they may be rare in this particular portion of West Kilombero. Groups of Sykes monkeys, red colobus and black-and-white colobus were most frequently encountered. During the 9 days in this area, Sykes monkeys were encountered eight times, red colobus five times, and black-and-white colobus 11 times. Our guide, Mr. J. Mudanga, had lived in the area and utilized the forest for more than 50 years. Based on his experiences, and the difficulty of locating mangabeys during this trip, he indicated a strong perception that the mangabey population has decreased. There was evidence of continued logging and hunting in these forests, and the local people indicated that these activities have had a noticeable impact on the mammalian fauna in the Ndundulu forest. Other researchers also have sighted mangabeys in Ndundulu, although on only four occasions (Dinesen *et al.*, 2001).

As is to be expected during preliminary surveys and under the conditions in these forests, it was extremely difficult to obtain information on group sizes. Red colobus groups appeared to be around 14–20 animals. Black-and-white colobus were in smaller groups of approximately 2–6 animals. No counts were attempted for Sykes monkeys. These figures compare favorably with those reported by Dinesen *et al.* (2001), the only other investigators to observe primates in the Ndundulu forest. They report sighting red colobus in groups averaging 18.2 individuals (range 1–50), and black-and-white colobus in groups averaging 8.4 animals (range 1–20).

The majority of field time (22 days) was spent in Mwanihana Forest, the major forest block within UMNP. This forest is approximately 179 km² and ranges in elevation from 300 m (adjacent to the Mikumi-Ifakara road on the southeastern boundary of UMNP) to

approximately 2030 m. Most of the forest covers the steep east-facing Udzungwa escarpment south of the Great Ruaha River and north of the Kiberege River. Mwanihana is characterized by numerous steeply-angled valleys and abundant water courses. The flora is rich in species of restricted distribution, is highly diverse (including more than 40 new species of plants), and holds a large number of endemics (Lovett *et al.*, 1988). Previous to formation of the national park, however, substantial extraction of timber occurred, and there are extensive areas of secondary growth, especially at the lower elevations along the populated eastern boundary. This forest was the first location from which the Sanje mangabey was documented (Homewood & Rodgers, 1981).

Movement through Mwanihana Forest was restricted largely to the Sanje River area where Wasser and his collaborators worked in the 1980s. Based on all observations to date by researchers visiting this forest, this may be the most important forest for the conservation of the Sanje mangabey. Although this endemic monkey was sighted 13 times, and its “whoop-gobble” long call and other vocalizations were heard daily, the animals were extremely shy, alarm calling immediately upon sighting humans and then fleeing through the trees. Groups sighted were multimale; crude counts averaged at least 15 individuals, comprising all age-sex classes, including clinging infants. Homewood and Rodgers (1981) reported “at least 20 individuals” in the groups they observed (including a minimum of three adult males), and Wasser (1993) reported a mean group size of 10.2 (range 1–40). On one occasion, two male mangabeys were sighted in the absence of any other individuals (table 1).

As also observed by Homewood and Rodgers (1981) and by Wasser (1993), mangabeys were sighted foraging on the ground and in the canopy. These observations occurred at the end of the dry season when ripe fruits were scarce. Ripe fruit is reported to be the predominant plant material in the mangabey diet (Wasser, 1993). Mangabeys were observed feeding in *Tabernaemontana pachysiphon* and in *Bequaertiodendron natalense* trees, both of which contained fruit. Wasser (1993) reported that *T. pachysiphon* was the species most preferred by the

mangabeys, comprising 25% of their diet (based on 48 observations). These mangabeys also have been reported to feed on insects and on crabs found in the streams (Homewood & Rodgers, 1981; Wasser, 1993).

Presented as table 1 are the sightings and group sizes for the four primary diurnal species, with comparative figures from Wasser’s 1993 data. The relative numbers of sightings for the four taxa are virtually identical, although there is some variation in minimum group size estimates between the two sets of observations. In the case of the red colobus, if the four smallest counts (out of 15) for this species are eliminated, the mean group size compares very favorably with that of Wasser (21.4, range 8–62). Of the species encountered, the Sykes monkeys were the most difficult to count; crude estimates of minimum group size for this species are based on only three attempts to count individuals.

Polyspecific Associations Among the Primates.

The following observations are also presented for comparison to Wasser’s (1993) data for Mwanihana Forest. It must be recognized, however, that as is true for counts of individuals in groups, some error is to be expected in determining to what extent encounters are polyspecific. This error will include incorrect designations due to observational conditions, as well as potential bias toward sightings of polyspecific as opposed to monospecific groups (important in determination of percentages of each type), and differences between researchers in operational definition of what actually constitutes a polyspecific association (especially problematic when making comparisons between data sets).

As stated previously, in terms of overall sightings in Mwanihana Forest, the 1994 data are in agreement with Wasser’s (1993) data for relative frequency of sightings for each species, with the red colobus and black-and-white colobus seen most frequently. Of all sightings, 32.9% were mixed species. Most often seen in interspecific association were the red colobus and black-and-white colobus (32% of 26 encounters with red colobus; see table 2). This finding is in agreement with Wasser’s (1993) observations, which indicated that red colobus and black-and-white colobus were in

Table 1. Sightings and group sizes for the diurnal primates in Mwanihana Forest.

	Red colobus	Mangabey	Black-and-white colobus	Sykes
Relative percentage of sightings				
in 1994 (n)	32.9(26)	16.5(13)	31.7(25)	18.9(15)
Wasser (1993)	32.9	16.5	31.6	19.0
1994 Mean Minimum Group Size				
Estimates(range)	16.7(2-62)	15.0(1-21)	04.5(2-8)	06.5 (5-8)
Wasser (1993)	23.3(1-75)	10.2(1-40)	04.0(1-20)	03.4(1-15)

Table 2. Associations between red colobus and black-and-white colobus in Udzungwa Mountains.

	Number of encounters with red colobus	% encounters with red colobus in association with black-and-white colobus
Mwanihana Forest (this study, 1994)	26	32
Magombera Forest:		
Decker (1996)	30	50
Struhsaker & Leland (1980)	(Not reported)	77
Rodgers <i>et al.</i> (1979)	20	50

association with one another more often than with either Sykes monkeys or mangabeys, and the latter two species were most often encountered as non-associated, single species. Others have also reported high rates of interspecific association between these colobines in the Magombera Forest in the Kilombero valley adjacent to the Udzungwa (table 2).

One difference in the 1994 data may be the association between the mangabeys and Sykes monkeys. Of 13 encounters with mangabeys in Mwanihana, 23% were in association with Sykes groups, whereas Wasser (1993) recorded less than 2% of sightings in which these two species were associated. This may be due to the limited and more restricted seasonal nature of the 1994 data in that the associations between the mangabey and Sykes were typically in the vicinity of the limited number of fruiting trees present at the end of the dry season.

Conservation Concerns in the Udzungwa Mountains

As clearly noted in 1994 and by others who have worked in or visited this important area of Tanzania, these relict forests are fragmented, poorly known, very diverse in composition, and substantially unprotected (with the exception of the quite recently established UMNP). It is therefore vital that research such as that currently being conducted with the primates, birds, and other fauna and flora be continued, recording distribution, abundance, and habitat quality. It was clear in 1994 that national park personnel lacked the requisite data to state with any certainty what the extent of biodiversity was in UMNP, much less the conservation status of specific important or unique fauna or flora present within the boundaries of this protected area. Of even more concern was the observation that the forest reserves outside of the Park boundary were not well-protected and subject to illegal logging and hunting. Given that these forests represent the remaining refuges for endangered, endemic primates such as the Udzungwa red colobus and the Sanje mangabey, the

conservation status of these primates needs to be fully ascertained. Data are needed on population size, distribution, degree of fragmentation, and population viability.

During the survey work in Mwanihana Forest, gunshots were heard on two occasions. In addition, one of the UMNP rangers with our group had recently encountered several individuals poaching within the park (they were arrested and tried). These incidents made it clear that law enforcement activities were necessary and being implemented in the newly established park. The situation had clearly improved since 1982, however, when Rodgers and Homewood reported that recently used pathways and active logging camps were encountered throughout Mwanihana Forest. This was not the case in 1994. Facilities were lacking to position park personnel in regions of the park other than at the headquarters at Mang'ula, especially in the more remote northern and western portions of the park (UMNP is 1990 km²). Given this lack of enforcement coverage of the park, the resistance to inclusion of fairly distant forest areas such as Udzungwa Scarp FR into the original park boundaries was not surprising. The most recent survey work by myself and colleagues has indicated that poaching does not appear to be a significant problem in Mwanihana Forest or other areas in the southern portion of the park. Although there still is no ranger station placed in the northern or western portions of the park, where they are certainly needed, this is currently being addressed.

The human population along the Mikumi-Ifakara road running parallel to the southeastern boundary of UMNP was substantial in 1994 and growing. The view across the Kilombero valley from the Udzungwa escarpment consisted of numerous farm plots and the massive Kilombero Sugar Estate. Only extremely small pieces of forest remained in the lowland plain, with Magombera Forest being the only clearly visible exception (although the portion of the forest west of the TAZARA railway is now completely destroyed). Rodgers and Homewood (1982) reviewed available aerial photographs from 1951 and 1975 and reported that they showed presence of much more continuous

forest in the Mwanihana-Magombera area only a few years before their survey work in the Udzungwas, indicating that as recently as 1980 human disturbance had dramatically altered the landscape below and adjacent to the escarpment. The road was in extremely poor condition in 1994, restricting to some degree population influx and development in the area adjacent to the UMNP. It is now tarmac for most of the distance from Mikumi to Mang'ula and is very passable dirt road for the remainder of the distance to Ifakara. What was only nascent population growth and concentration in 1994 has burgeoned into ever-increasing density and concomitant development. WWF began a tree nursery project in the area of the park in the early 1990s, and it continues today, although firewood collection is still permitted in UMNP, with restrictions set on when and where this activity is supposed to take place. With continued population growth in the area, the potential pressure on the park increases and has contributed to growth and expansion of park personnel activities related to "community conservation" and law enforcement.

Of greatest conservation concern in 1994 were the activities noted in the catchment forest reserves visited, especially Udzungwa Scarp FR and Ndundulu Forest. Interviews conducted near Chita along the base of the Udzungwa Scarp revealed that hunting of primates was common, as also noted by Rodgers and Homewood (1982). The degree of population concentration and landscape alteration was not as great in this area of the Udzungwas, although with continued road improvement and other developments (such as the extensive internationally-funded hydropower project at Kihansi in the southern-most extension of Udzungwa Scarp) this is changing. Survey work in the Udzungwa Scarp forest is therefore of high priority, especially given that it may represent one of the few remaining refuges for the red colobus and mangabey, and, as Rodgers and Homewood (1982) suggested, primate densities may be low. A survey of the Udzungwa Scarp Forest is part of our current project.

The walk from the closest village (Udekwa) to Ndundulu Forest took approximately 6 hours and passed through numerous traditionally cultivated fields in a wet but virtually treeless landscape dominated by grasses. There was evidence of extensive burning to clear land for planting. Discussions with the villagers and field assistants (Wahehe people) revealed that periodically individuals other than Forestry personnel arrived with trucks and removed timber (often camphor *Ocotea usambarensis*) from the remaining forested areas, sometimes leaving behind "gifts" of beer as compensation for local "cooperation." Limited evidence of pitsawing was also present in Ndundulu Forest. Hunting was not freely discussed by the local people, although they acknowledged that it was occurring. In the time spent in Ndundulu Forest, no large mammals

were encountered, with the exception of occasional hyrax *Dendrohyrax validus*. Dinesen *et al.* (2001) have also suggested that hunting occurs in this area but noted that a number of forest antelopes were present, though likely in low densities.

The designation of Forest Reserve in Tanzania prohibits settlement but permits officially sanctioned consumption of resources. It was clear in 1994 that violations related to illegal resource extraction were occurring in the forest reserves visited, as has also been noted by other researchers in the area and as is known to continue at present. Given the extreme value of these forests for water catchment, soil conservation, and potential attraction for limited-impact tourism, they merit strong conservation measures. This is in addition to the presence of endangered, legally protected species such as the mangabey and red colobus. If our current work in UMNP continues to support our growing concern for the conservation status of the Sanje mangabey, the populations of this endemic residing in these forest reserves *outside* the better protected confines of the national park become especially critical for the future viability of this mangabey. With increasing human population pressure and development in the area, these primate populations, already being impacted in 1994 and earlier, will face increasing threat. Once again, the value of continued research and effective management in protected areas of the Udzungwas cannot be over-emphasized, including renewed consideration of augmented levels of protective status for the very important forest reserves.

Notes

¹A recently held IUCN/SSC Primate Specialist Group workshop has amended the taxonomy and conservation status of a number of primates, including the red colobus and mangabey. The results are to be published in the very near future and will likely amend or alter some of the designations reported in this manuscript.

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References

- Barnicot, N.A. & D. Hewett-Emmet. 1972. Red cell and serum proteins of *Cercocebus*, *Presbytis*, *Colobus* and certain other species. *Folia Primatologica* 17: 442-447.
- Beentje, H.J. 1988. An ecological and floristic study of the forests of the Taita Hills, Kenya. *Utafiti* 1: 23-66.
- Bernstein, I.S. 1976. Activity patterns in a sooty mangabey group. *Folia Primatologica* 26: 185-206.
- Busse, C.D. & T.P. Gordon. 1983. Attacks on neonates by a male mangabey (*Cercocebus atys*). *American Journal of Primatology* 5: 345-356.
- Busse, C.D. & T.P. Gordon. 1984. Infant carrying by adult male mangabeys (*Cercocebus atys*). *American Journal of Primatology* 6: 133-141.
- Butynski, T.M. & C.L. Ehardt. In press. Notes on ten restricted-range birds in the Udzungwa Mountains, Tanzania. *Scopus*.
- Butynski, T.M., C.L. Ehardt & T.T. Struhsaker. 1998. Notes on two dwarf galagos (*Galagoides udzungwensis* and *Galagoides orinus*) in the Udzungwa Mountains, Tanzania. *Primate Conservation* 18: 66-72.
- Chalmers, N.R. 1968a. Group composition, ecology, and daily activities of free living mangabeys in Uganda. *Folia Primatologica* 8: 247-262.
- Chalmers, N.R. 1968b. The social behavior of free-living mangabeys in Uganda. *Folia Primatologica* 8: 263-281.
- Chalmers, N.R. & T.E. Rowell. 1971. Behavior and female reproductive cycle in a captive group of mangabeys. *Folia Primatologica* 14: 1-14.
- Conservation International & IUCN/SSC Primate Specialist Group. 2000. *Primates in Peril: The Top 25 Most Endangered*. Report, January 2000. Conservation International, Washington, D.C.
- Cronin, J.E. & V.M. Sarich. 1976. Molecular evidence for the dual origin of mangabeys among Old World monkeys. *Nature* 260: 700-702.
- Decker, B.S. 1996. Notes on the behavioural ecology of the Iringa red colobus *Procolobus badius gordonorum*. *African Primates* 2: 15-18.
- Dinesen, L., T. Lehmberg, M.C. Rahner & J. Fjeldsa. 2001. Conservation priorities for the forests of the Udzungwa Mountains, Tanzania, based on primates, duikers and birds. *Biological Conservation* 99: 223-236.
- Disotell, T. 2000. Molecular systematics of the Cercopithecoidea. In *Old World Monkeys*. P.F. Whitehead & C.J. Jolly, eds. Cambridge University Press, Cambridge. Pp. 29-56.
- Ehardt, C.L. 1988a. Affiliative behavior of adult female sooty mangabeys (*Cercocebus atys*). *American Journal of Primatology* 15: 115-127.
- Ehardt, C.L. 1988b. Absence of strongly kin-preferential behavior by adult sooty mangabeys (*Cercocebus atys*). *American Journal of Physical Anthropology* 76: 233-243.
- Ehardt, C.L., T.T. Struhsaker & T.M. Butynski. 1999. Conservation of the endangered endemic primates of the Udzungwa Mountains, Tanzania: Surveys, habitat assessment, and long-term monitoring. Report for the Margot Marsh Biodiversity Foundation (Conservation International) and the World Wide Fund for Nature - Tanzania.
- Ehardt, C.L., T.T. Struhsaker & T.M. Butynski. In prep. The physical appearance of the Sanje mangabey (*Cercocebus sanjei*): An historical and corrective note.
- Freeland, W.J. 1979. Mangabey (*Cercocebus albigena*) social organization and population density in relation to food use and availability. *Folia Primatologica* 32: 108-124.
- Gautier-Hion, A. 1978. Food niches and coexistence in sympatric primates in Gabon. In *Recent Advances in Primatology, Volume I*. D.J. Chivers & J. Herbert, eds. Cambridge University Press, Cambridge. Pp. 269-286.
- Goodman, M., C.A. Porter, J. Czelusniak, S.L. Page, H. Schneider, J. Shoshani, G. Gunnell & C.P. Groves. 1998. Toward a phylogenetic classification of Primates based on DNA evidence complemented by fossil evidence. *Molecular Phylogenetics and Evolution* 9: 585-598.
- Griffiths, C.J. 1993. The geological evolution of East Africa. In *Biogeography and Ecology of the Rainforests of East Africa*. J.C. Lovett & S.K. Wasser, eds. Cambridge University Press, Cambridge. Pp. 9-21.
- Groves, C.P. 1978. Phylogenetic and population systematics of the mangabeys (Primates: Cercopithecoidea). *Primates* 19: 1-34.
- Groves, C.P. 1996. The nomenclature of the Tanzanian mangabey and the Siberut macaque. *Australian*

- Primate Taxonomy*. Smithsonian Institution Press, Washington, DC.
- Gust, D.A. 1991. Male age and reproductive behavior in sooty mangabeys, *Cercocebus torquatus atys*. *Animal Behaviour* 46: 277–283.
- Gust, D.A. 1994. Alpha-male sooty mangabeys differentiate between females' fertile and their post-conception maximal swellings. *International Journal of Primatology* 15: 289–301.
- Gust, D.A. & T.P. Gordon. 1990. Female rank instability in newly formed groups of familiar sooty mangabeys (*Cercocebus torquatus atys*). *Primates* 32: 465–471.
- Gust, D.A. & T.P. Gordon. 1993. Conflict resolution in sooty mangabeys. *Animal Behaviour* 46: 685–694.
- Gust, D.A. & T.P. Gordon. 1994. The absence of matrilineally based dominance system in sooty mangabeys, *Cercocebus torquatus atys*. *Animal Behaviour* 47: 589–594.
- Hamilton, A.C. 1989. African forests. In *Tropical Rain Forest Ecosystems. Ecosystems of the World, Vol. 14B*. H. Lieth & M.J.A. Werger, eds. Elsevier, New York. Pp. 155–182.
- Harris, E.E. & T.R. Disotell. 1998. Nuclear gene trees and the phylogenetic relationships of the mangabeys (Primates: Papionini). *Molecular Biology and Evolution* 15: 892–900.
- Hilton-Taylor, C. (compiler). 2000. *2000 IUCN Red List of Threatened Species*. IUCN, Gland, Switzerland.
- Hoffman, R.L. 1993. Biogeography of East African montane forest millipedes. In *Biogeography and Ecology of the Rainforests of East Africa*. J.C. Lovett & S.K. Wasser, eds. Cambridge University Press, Cambridge. Pp. 103–114.
- Homewood, K.M. 1975. Monkey on a riverbank. *Natural History* 84: 68–73.
- Homewood, K.M. 1978. Feeding strategy of the Tana mangabey *Cercocebus galeritus galeritus* (Mammalia: Primates). *Journal of Zoology* (London) 186: 375–391.
- Homewood, K.M. & W.A. Rodgers. 1981. A previously undescribed mangabey from southern Tanzania. *International Journal of Primatology* 2: 47–55.
- Howell, K. 1993. Herpetofauna of the eastern African forests. In *Biogeography and Ecology of the Rainforests of Eastern Africa*. J.C. Lovett & S.K. Wasser, eds. Cambridge University Press, Cambridge. Pp. 173–201.
- Jensen, F.P. & S. Brogger-Jensen. 1992. The forest avifauna of the Udzungwa Mountains, Tanzania. *Scopus* 15: 65–83.
- Kingdon, J. 1997. *The Kingdon Field Guide to African Mammals*. Academic Press, New York.
- Kinnaird, M.F. 1990. Pregnancy, gestation, and parturition in free-ranging Tana River crested mangabeys (*Cercocebus galeritus galeritus*). *American Journal of Primatology* 22: 285–289.
- Kinnaird, M.F. 1992a. Variable resource defense by the Tana River crested mangabey. *Behavioral Ecology and Sociobiology* 31: 115–122.
- Kinnaird, M.F. 1992b. Competition for a forest palm: Use of *Phoenix reclinata* by human and nonhuman primates. *Conservation Biology* 6: 101–107.
- Lovett, J.C. 1985. An overview of the moist forests of Tanzania. Research monograph, *Utafiti*. Tanzania National Scientific Research Council, Dar es Salaam.
- Lovett, J.C. 1988. Endemism and affinities of the Tanzanian montane forest flora. *Monographs in Systematic Botany from the Missouri Botanical Garden* 25: 591–598.
- Lovett, J.C. 1990. Classification and status of the Tanzanian forests. *Mitteilungen aus dem Institut für Allgemeine Botanik in Hamburg* 23A: 287–300.
- Lovett, J.C. 1993. Eastern Arc moist forest flora. In *Biogeography and Ecology of the Rainforest of Eastern Africa*. J.C. Lovett & S.K. Wasser, eds. Cambridge University Press, Cambridge. Pp. 33–55.
- Marsh, C.W. 1986. A resurvey of the Tana River primates and their habitat. *Primate Conservation* 7: 72–82.
- Mgeni, A.S.M. & R.E. Malimbwi. 1990. Natural forest resources of Tanzania and their management needs. In *Proceedings of a Joint Seminar/Workshop on "Management of Natural Forests of Tanzania" under Sokoine University of Agriculture and Agricultural University of Norway Cooperation, Olmotonyi, Arusha, Tanzania 5–10 December 1988*. A.S.M. Mgeni, W.S. Abeli, S.A.O. Chamshama, & G.S. Kowero, eds. *Sokoine University of Agriculture, Morogoro, Tanzania, Faculty of Forestry Records* 43: 67–76.
- Mitchell, G., S. Towers, S. Soterious, C. Schumer, L. Kenney, K. Guse, & L. Dillin. 1988. Sex differences in behavior of endangered mangabeys (*Cercocebus galeritus chrysogaster*). *Primates* 29: 129–134.
- Mittermeier, R.A., N. Myers, & C.G. Mittermeier. 2000. *Hotspots. Earth's Biologically Richest and Most Endangered Terrestrial Ecosystems*. CEMEX, Mexico City.
- Mittermeier, R.A., J.F. Oates, A.E. Eudey, & J. Thornback. 1986. Primate conservation. In: *Comparative Primate Biology, Volume 2: Behavior, Conservation, and Ecology*. G. Mitchell & J. Erwin, eds. Alan R. Liss, Inc.,

- New York. Pp. 3-72.
- Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca, & J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403: 853-858.
- Oates, J.F. 1986. *Action Plan for African Primate Conservation: 1986-90*. IUCN/SSC Primate Specialist Group, Stony Brook, NY.
- Oates, J.F. 1994. The natural history of the African colobines. In *Colobine Monkeys: Their Ecology, Behaviour, and Evolution*. A.G. Davies & J.F. Oates, eds. Cambridge University Press, Cambridge. Pp. 75-128.
- Oates, J.F. 1996. *African Primates: Status Survey and Conservation Action Plan*. Revised Edition. IUCN/SSC Primate Specialist Group, Gland, Switzerland.
- Olupot, W. 1998. Long-term variation in mangabey (*Cercocebus albigena johnstoni* Lydekker) feeding in Kibale National Park, Uganda. *African Journal of Ecology* 36: 96-101.
- Olupot, W., C.A. Chapman, C.H. Brown, & P.M. Waser. 1994. Mangabey (*Cercocebus albigena*) population density, group size and ranging: A twenty-year comparison. *American Journal of Primatology* 32: 194-205.
- Olupot, W., C.A. Chapman, P.M. Waser & G. Isabirye-Basuta. 1997. Mangabey (*Cercocebus albigena*) ranging patterns in relation to fruit availability and the risk of parasite infection in Kibale National Park, Uganda. *American Journal of Primatology* 43: 65-78.
- Olupot, W., P.M. Waser, & C.A. Chapman. 1998. Fruit finding by mangabeys (*Lophocebus albigena*). Are monitoring of fig trees and use of sympatric frugivore calls possible strategies? *International Journal of Primatology* 10: 339-353.
- Rodgers, W.A. 1993. The conservation of the forest resources of eastern Africa: Past influences, present practices and future needs. In *Biogeography and Ecology of the Rainforests of Eastern Africa*. J.C. Lovett & S.K. Wasser, eds. Cambridge University Press, Cambridge. Pp. 283-331.
- Rodgers, W.A. & K.M. Homewood. 1982. Biological values and conservation prospects for the forests and primate populations of the Udzungwa Mountains, Tanzania. *Biological Conservation* 24: 285-304.
- Rodgers, W.A., K.M. Homewood & J.B. Hall. 1979. Magombera Forest Reserve and the Iringa Red Colobus. Unpublished report to the Ministry of Natural Resources, Dar es Salaam, Tanzania.
- Rodgers, W.A., C.F. Owen & K.M. Homewood. 1982. Biogeography of East African forest mammals. *Journal of Biogeography* 9: 41-54.
- Struhsaker, T.T. 1981a. Forest and primate conservation in East Africa. *African Journal of Ecology* 19: 99-144.
- Struhsaker, T.T. 1981b. Vocalizations, phylogeny and paleogeography of red colobus (*Colobus badius*). *African Journal of Ecology* 19: 265-283.
- Struhsaker, T.T. & L. Leland. 1980. Observations on two rare and endangered populations of red colobus monkeys in East Africa: *Colobus badius gordonorum* and *Colobus badius kirkii*. *African Journal of Ecology* 18: 191-216.
- Stuart, S.N., F.P. Jensen, S. Brogger-Jensen & R.I. Miller. 1993. The zoogeography of the montane forest avifauna of eastern Tanzania. In *Biogeography and Ecology of the Rainforests of Eastern Africa*. J.C. Lovett & S.K. Wasser, eds. Cambridge University Press, Cambridge. Pp. 203-228.
- Wallis, S.J. 1981. The behavioural repertoire of the grey-cheeked mangabey *Cercocebus albigena johnstoni*. *Primates* 22: 523-532.
- Wallis, S.J. 1983. Sexual behavior and reproduction of *Cercocebus albigena johnstonii* in Kibale Forest, western Uganda. *International Journal of Primatology* 4: 153-166.
- Waser, P.M. 1975. Monthly variations in feeding and activity patterns of the mangabey *Cercocebus albigena*. *East African Wildlife Journal* 13: 249-263.
- Waser, P.M. 1977. Feeding, ranging, and group size in the mangabey *Cercocebus albigena*. In *Primate Ecology*. T.H. Clutton-Brock, ed. Academic Press, London.
- Waser, P.M. 1980. Polyspecific associations of *Cercocebus albigena*: Geographic variation and ecological correlates. *Folia Primatologica* 33: 57-76.
- Waser, P.M. 1982. Primate polyspecific associations: Do they occur by chance? *Animal Behaviour* 30: 1-8.
- Wasser, S.K. 1993. The socio-ecology of interspecific associations among the monkeys of the Mwanihana rain forest, Tanzania: A biogeographic perspective. In *Biogeography and Ecology of the Rainforests of East Africa*. J.C. Lovett & S.K. Wasser, eds. Cambridge University Press, Cambridge. Pp. 267-280.
- White, F. 1976. The vegetation map of Africa: The history of the completed project. *Boissiera* 24: 659-666.
- White, F. 1978. The Afromontane region. In: *Biogeography and Ecology of Southern Africa*. M.J.A. Werger, ed. Junk, The Hague. Pp. 463-513.
- White, F. 1981. The history of the Afromontane archipelago and the scientific need for its conservation. *African Journal of Ecology* 19: 33-54.

**CONSERVATION OF THOLLON'S RED
COLOBUS *PILIOCOLOBUS THOLLONI*,
DEMOCRATIC REPUBLIC OF CONGO**

Abstract: *Thollon's red colobus* *Piliocolobus tholloni* is a little known, unique monkey type. Field measurements from specimens within the Zone Dekese, D.R. Congo, are presented. Survival of Thollon's red colobus is threatened by hunting. No action is being taken to reduce this threat. This paper aims to bring attention to Thollon's red colobus, encouraging the process toward estimating population numbers and initiating a conservation effort to slow rate of decline.

Résumé: *Le colobe rouge de Thollon* *Piliocolobus tholloni* est une espèce de singe unique et peu connue. Sont présentées des mesures prises sur des spécimens sauvages en provenance de la Zone Dekese en République Démocratique du Congo. La survie du colobe rouge de Thollon est menacée à cause de la chasse. Aucune mesure pour le moment n'a été prise afin de réduire ce risque. L'objectif de cet article est d'attirer l'attention sur le colobe rouge de Thollon dans le but d'encourager une étude où la taille de la population y serait évaluée et aussi afin d'initier un programme de conservation pouvant réduire son déclin.

Introduction

The goal of the Lukuru Wildlife Research Project is to promote scientific research, conservation, and

education, primarily on the bonobo *Pan paniscus* within an area corresponding to the administrative Zone Dekese, Province Kasai Occidental, Democratic Republic of Congo (DRC) (former Zaire). Between June 1994 and June 1998, opportunistic data were collected on Thollon's red colobus *Piliocolobus tholloni* during encounters with groups and from freshly killed specimens carried by hunters returning from the forest within the Lukuru study area. The forested basin south of the Congo River supports a major distinct regional center of primate diversity, including several unique endemic species such as *P. paniscus*, Thollon's red colobus, black mangabey *Lophocebus aterrimus*, diad or Salonga guenon *Cercopithecus dryas*, Wolf's mona monkey *Cercopithecus wolfi*, golden-bellied mangabey *Cercocebus chrysogaster*, and subspecies such as redtail monkey *Cercopithecus ascanius whitesidei* (Oates, 1996).

Thollon's red colobus has a patchy distribution throughout the forested area south of the Congo River. The population size is unknown and no estimates exist. Colyn (in prep.) recognizes [*Colobus*] *tholloni* within the forest block defined by the Congo/Kasai/Lomami Rivers. Thollon's red colobus is known to occur in only one protected area, North Block (Maisels *et al.*, 1994) and South Block (Thompson, in prep.) of the Salonga National Park. Thollon's red colobus are not found south of the Sankuru River. The Lukuru study area, therefore, represents this species' southern-most distribution (Myers Thompson, 1997).

On 9 October, 1969 the DRC formally agreed to follow the rules of the African Convention on the Conservation of Nature and Natural Resources. As a participant in the treaty, the country committed to

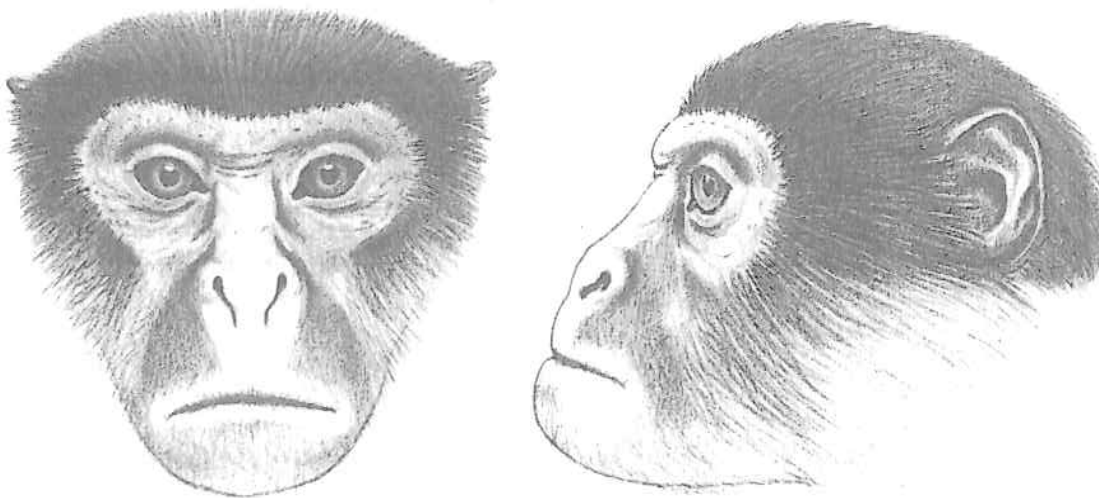


Figure 1. Composite illustration produced by Stephen Nash from photographs of three adult female specimen profiles from the Lukuru, DRC. The nose and mouth are flesh coloured, the facial pigment is dark blue, and the skullcap is bright red.

domestically manage their natural resources at the highest possible level, including a goal towards the long-term conservation of threatened fauna and their habitat. Thollon's red colobus are listed under Class B of the Convention which, according to Article VIII, permits hunting, killing, capturing or collecting with local authorization. This international agreement is important to the survival of Thollon's red colobus because it deals with the nation's internal domestic protection of the species and habitat.

Nomenclature

Thollon's red colobus is characterized by an elongated jaw (figure 1), prominent facial mass, cranium morphology, and uniform and stable pelage. When considering distribution patterns of red colobus within the Congo Basin, Colyn (in prep.) remarked that, "scientific publications have only indicated at the extreme intra-specific variability of the Zairean red colobus, who, with the exception of the *Colobus tholloni*, reveal a wide variation of pigmentation." The classification by Colin Groves in Wilson and Reeder (1993) is currently considered the definitive authority by the American Association for Zoological Nomenclature (D.G. Smith, AAZN, pers. comm., 1998). Unfortunately, this broad classification structure does not sufficiently represent the distinct red colobus type found south of the Congo River. By lumping Thollon's red colobus under *Procolobus pennantii*, the southern type had essentially been overlooked. Subsequently, Kingdon (1997) and Groves (2001) recognised Thollon's red colobus as a distinct species *Piliocolobus tholloni*. Clearly, an extensive reanalysis of the taxonomy of the red colobus is required. Genetic analysis of the red colobus would help elucidate this taxonomy (Oates, 1996).

Background

The first description of *P. tholloni* was published by Riviere (1886) applying the manuscript name given by Milne-Edwards for the assemblage of specimens in the Paris Museum including this "new species" collected by M. Thollon during the Brazza expedition of 1886 (D.E. Wilson, Smithsonian Institution, pers. comm., 1998). The type specimen, a female skull and a very bright orange skin, is recorded as originating from the left (south) bank of the Congo River, but no definite collection locality is indicated.

Only one systematic study of Thollon's red colobus has ever been conducted. It occurred at the Botsima study site (along the north-eastern limit of the Salonga National Park-North Block, near the Lomela River) between September 1990 and September 1991. This

was a study of feeding behavior between two sympatric colobines (Maisels *et al.*, 1994). This study found that Thollon's red colobus feed mostly on young leaves (61%) and seeds (33%) from legumes with seasonal variation. Perhaps due to habitat, the food species consumed by Thollon's red colobus were more diverse than recorded for other red colobus types. They also included more Caesalpinioideae in their diet than reported for other red colobus types (Maisels *et al.*, 1994).

Table 1 summarizes the occurrence of diurnal monkeys at eight research sites in the Congo Basin. The absence of Thollon's red colobus at the Lilungu, Lomako, and Yalosidi sites (figure 2) cannot be understood by considering the predominant vegetation types at these locations or local human hunting pressures. The Wamba and Lilungu sites may have the highest relative percent of secondary forest cover and high human population density. Across sites listed in table 1, the Lomako forest has the lowest human density, is the only site exposed to timber company supported commercial bushmeat hunting, and has the greatest percent of undisturbed old growth forest cover. Studies at the Yalosidi site were limited to observations focused around an open marsh grassland surrounded by waterlogged forest on the shoulders of the Djali River system. Thus, there was sampling bias against the observed presence of Thollon's red colobus at Yalosidi.

Results

Although my primary species of study is *P. paniscus*, during field work within the Lukuru area I collected opportunistic measurements from dead Thollon's red colobus that hunters made available to me (table 2). I was also able to opportunistically observe the monkey in the field. Thollon's red colobus, called "Nkulungu" in the Lingala trade language, is similar to other red colobus types that have a small head, but may be unique in its greater degree of prognathism compared to the rounded cranium of the red colobus across the tropical forest belt north of the Congo River (figure 1).

Within the Lukuru area several groups of Thollon's red colobus have been observed. Between 1994 and 1998, Thollon's red colobus were always observed in mixed-species, seasonally dry, old-growth forest where they occupied the middle strata. During extended periods of rest, groups were easily observed clustered in one or two trees. Their location was monitored by sounds (belching) and their bright orange pelage.

Table 2 identifies preliminary findings based on measurements from freshly killed individuals. Although this is a small sample, the average adult weight for Thollon's red colobus males is 7.9 kg (N=2) and females is 6.2 kg (N=4). The average adult torso length for males is 45 cm (N=2) and females is 42 cm (N=4).

Table 1. Diurnal primates reported at eight study sites in the Congo Basin¹ (Myers Thompson, 1997). See figure 2.

	A	B	C	D	E	F	G	H
Thollon's red colobus								
<i>Piliocolobus tholloni</i>			X	X	X		X	X
Bonobo								
<i>Pan paniscus</i>	X	X	X	X	X	X	X	X
Allen's swamp monkey								
<i>Allenopithecus nigroviridis</i>		X		X	X		X	
Black mangabey								
<i>Lophocebus aterrimus</i>	X	X	X	X	X	X	X	X
Golden-bellied mangabey								
<i>Cercocebus chrysogaster</i>								X
Redtail monkey								
<i>Cercopithecus ascanius whitesidei</i>	X	X	X	X	X	X	X	X
Wolf's mona monkey								
<i>Cercopithecus wolffi</i>	X	X	X	X	X	X	X	X
DeBrazza monkey								
<i>Cercopithecus neglectus</i>	X	X	X	X	X		X	?
Salonga guenon								
<i>Cercopithecus dryas</i>					X			
Black-and-white colobus								
<i>Colobus angolensis angolensis</i>	X	X	X	X	X	X	X	X
Talapoin monkey								
<i>Miopithecus talapoin</i>								X

¹Site and source: A. Lilungu 1°07' S, 23°31' E (Sabater-Pi & Vea, 1990); B. Lomako 0°50' N, 21°05' E (Thompson-Handler, 1990; White, 1988); C. Lukuru 3°45' S, 21°21' E (Myers Thompson, 1997); D. Lake Tumba 0°53' S, 17°58' E (Horn, 1980); E. Wamba 0°10' N, 22°30' E (Kano, 1992); F. Yalosidi 2°00' S, 23°14' E (Kano, 1983; Uehara, 1990); G. Salonga National Park-North Block 1°15' S, 22°00' E (Maisels *et al.*, 1994); H. Mimia 2°29' S, 20°00' E (Myers Thompson, 1997).

? = presence reported by local hunters but not confirmed by researchers.

¹Local hunters of Wamba report the presence of the blue monkey *Cercopithecus mitis*, which has not been confirmed by researchers. The greater spot-nosed monkey *Cercopithecus nictitans* is reported from Mimia. Local hunters of Lomako report the presence of the talapoin monkey *Miopithecus talapoin*. Some taxonomic confusion and misidentification may result from individual variations in coloration, specifically the polytypic age-related pelage patterns of the DeBrazza monkey and the visual similarity between the blue monkey and the greater spot-nosed guenon. The presence of the greater spot-nosed guenon at Mimia and the proposed presence of the blue monkey at Wamba may be the continued distribution of the same species, the DeBrazza monkey. Although the DeBrazza monkey was not confirmed at Mimia, its presence is most certain. In some instances, particularly during short-term studies limited to a specific habitat type, some sampling bias may result rather than species absence. The presence of the southern talapoin at Mimia (see Thompson, p. 69, this issue) may represent the species' northeastern distribution limit following the ancient low elevation Congo Sea floodplain and swamp forest vegetation. White (1988) reported that native guides confirmed the presence of talapoin in the N'dele swamp forest but, perhaps due to the difficult terrain for human locomotion, researchers have yet to corroborate the accounts.

Conservation Problems

When moving through the forest, the presence of Thollon's red colobus was relatively easily detected by their conspicuous body odour. Within the Lukuru area, Thollon's red colobus are known to feed on the young leaves of two unidentified tree species (known in the local language as *Tombenga* and *Beape*; however, see Maisels *et al.*, 1994 for identified food species) which have a strong odor of garlic. The local people believe that Thollon's red colobus is seasoned (flavored) specifically to make them more palatable for human consumption and, influenced by long-term missionary teachings, it is Gods' intention that they seek out and

eat this monkey. Therefore, Thollon's red colobus is locally a preferred source of bushmeat. Further, because it is the second largest monkey of the Lukuru, it is a favoured target of hunters. The smoked carcass of Thollon's red colobus is easily transported long distances to commercial bushmeat markets. Among the eight primate species observed, Dupain and Van Elsacker (1999) reported that 36% of the 229 carcasses counted across 29 days in the commercial market of Basankusu were Thollon's red colobus.

On occasion, Thollon's red colobus are found in mixed-species groups. When alarmed, Thollon's group members reduce their inter-individual space and maintain a relatively immobile position, darting and

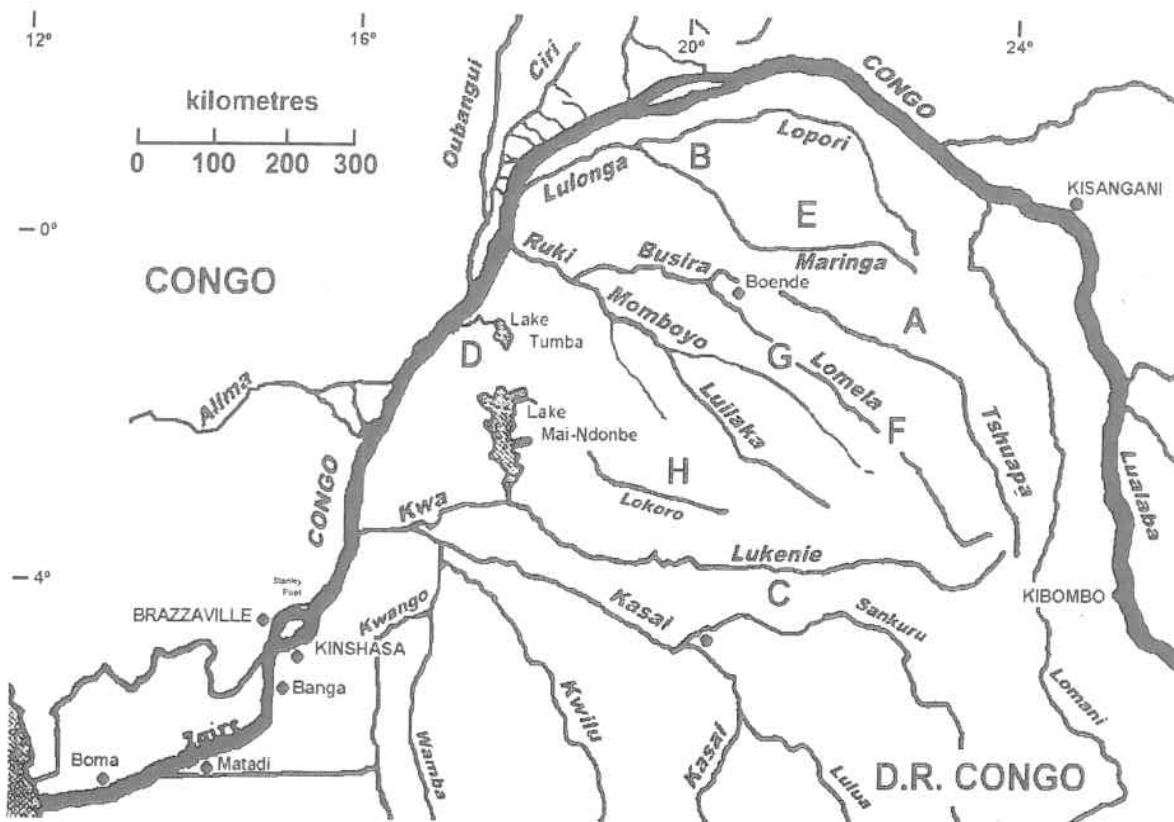


Figure 2. Map of Democratic Republic of Congo showing locations referred to in table 1.

leaping between a few trees and vocalizing loudly. These large and noisy aggregations make relatively easy targets, permitting human hunters to take several individuals at a time (figure 3). Occasionally, whole groups are exterminated during one hunt.

In 1937 a colonial decree prohibited hunting throughout the national territory. This was repealed in 1985 by national legislation which strove to be less restrictive in order to incorporate the needs of indigenous people. At that time hunting "seasons",

determined at the discretion of the local authorities, were adopted and rules for the distribution of meat from identified species were established as the method of protection in lieu of permits by local authorities as stipulated in the African Convention. Prior to the national political changes during 1997, locally the Thollon's red colobus had been "protected" under this practice. The new administration determined that in recent years Thollon's red colobus has become so rare that the species is now inconsequential to village affairs,

Table 2. Fresh weight and torso length of Thollon's red colobus specimens (1994-1998) from the Lukuru area, DRC.

Sex	Age ¹	Weight (kg)	Torso length ² (cm)
male	M	7.5	43
male	M	8.25	47
male	I	4	36
female	M	6	41
female ³	M	6.75	38
female	M	6.25	45
female ⁴	M	5.6	45
female	I	3	32

¹ The age classification was determined as sexually mature (M) or immature (I) based on the development of the genitalia.

² Only the torso length was recorded. This was determined by measuring from the shoulder blade, along the back, to the outer edge of the ischial callosity. This measure does not include head length and is considered unconventional.

³ Cycling with maximum engorged perineal skin.

⁴ Traveling alone.



Figure 3. One hunter's take of Thollon's red colobus. Photograph by Jo A. M. Thompson.

does not merit continued protection, and that hunting can continue unrestricted.

Discussion

Studies are recommended that will assess the distribution, density, and status of this species across its range. Education of local authorities is critical. Because a definitive taxonomy is often times decisive in conservation (Butynski, 1996), efforts towards collecting genetic material for DNA analysis must ensue. Compilation of photographic documents, genetic samples, and field reports (including opportunistic data) may all be used to clarify the conservation problems. Prior to the outbreak of civil war in June 1998, the absence of commercial logging throughout the remote and largely inaccessible interior of DRC has provided some small safeguard to Thollon's red colobus. However, with the activities of civil war, the increased presence of human occupiers, and availability of weapons and ammunition, hunting has increased throughout the range. The problem of habitat modification is predominantly a result of the increasing human population and the demand for agricultural land and domestic forest products.

For readers interested in further conservation illustrations or photographs, a collection of detailed images taken from the Lukuru area are currently held on repository with Stephen Nash (Conservation International and SUNY Stony Brook, NY) in the hopes that they will be of use towards disseminating information about this little-known species. Some of these photographs illustrate the female external genitalia (including individuals with engorged sexual swellings)

and the perineal organ of the male, attributes sometimes used to determine taxonomic status.

It is the intent of providing these initial findings that conservation actions will be taken in an effort to safeguard the survival of the Thollon's red colobus.

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References

- Butynski, T.M. 1996. International trade in CITES Appendix II African primates. *African Primates* 2: 5–9.
- Colyn, M.M. (in prep.) Primates of the Lomami/Lualaba Forests (Zaire): inventory, distribution and exploitation by the local population.
- Dupain, J. & L. Van Elsacker. 1999. *Bonobo In Situ: Iyema*. Unpublished update.
- Groves, C.P. 2001. *Primate Taxonomy*. Smithsonian Institution, Washington, D.C.
- Horn, A.D. 1980. Some observations on the ecology of the bonobo chimpanzee (*Pan paniscus*, Schwarz 1929) near Lake Tumba, Zaire. *Folia Primatologica* 34: 145–169.
- Kano, T. 1983. An ecological study of the pygmy

- chimpanzees (*Pan paniscus*) of Yalosidi, Republic of Zaire. *International Journal of Primatology* 4: 1–31.
- Kano, T. 1992 (translated into English). *The Last Ape: Pygmy Chimpanzee Behaviour and Ecology*. Stanford University Press, Stanford (first published in 1986 in Japanese).
- Kingdon, J. 1997. *The Kingdon Field Guide to African Mammals*. Academic Press, London.
- Maisels, F., A. Gautier-Hion & J.-P. Gautier. 1994. Diets of two sympatric colobines in Zaire: More evidence on seed-eating in forests on poor soils. *International Journal of Primatology* 15: 681–701.
- Myers Thompson, J.A. 1997. The history, taxonomy and ecology of the bonobo (*Pan paniscus* Schwarz, 1929) with a first description of a wild population living in a forest/savanna mosaic habitat. Ph.D. dissertation. University of Oxford.
- Oates, J.F. 1996. *African Primates: Status Survey and Conservation Action Plan*. Revised Edition. IUCN/SSC Primate Specialist Group, Gland, Switzerland.
- Riviere, E. 1886. Exposition de la mission Brazza au Museum. *Révue Scientifique*, Paris, Serie 3e, 23e année, 2e semestre, No. 1, 3 Juillet: 13–23.
- Sabater Pi, J. & J.J. Veà. 1990. Nest-building and population estimates of the bonobo from the Lokofe-Lilungu-Ikomaloki Region of Zaire. *Primate Conservation* 11: 43–48.
- Thompson, J.A.M. 1999–2000. New distribution record for the southern talapoin. *African Primates* 4: 69–70.
- Thompson-Handler, N.E. 1990. The pygmy chimpanzee: Sociosexual behavior, reproductive biology and life history patterns. Ph.D. dissertation. Yale University, New Haven.
- Uehara, S. 1990. Utilization patterns of a marsh grassland within the tropical rain forest by the bonobos (*Pan paniscus*) of Yalosidi, Republic of Zaire. *Primates* 31: 311–322.
- White, F.J. 1988. Party composition and dynamics in *Pan paniscus*. *International Journal of Primatology* 9: 179–193.
- Wilson, D.E. & D.M. Reeder (eds.). 1993. *Mammal Species of the World*. Smithsonian Institution Press, Washington, D.C.

degradation since 1994, the time of the last complete primate census. Forests have been lost and degraded by clearance for farmland and product use. This degradation and loss has had detrimental impacts on the two endemic, critically endangered primates found in these forests: the Tana River red colobus *Procolobus rufomitratus*, Africa's only critically endangered species of primate, and the Tana River crested mangabey *Cercocebus galeritus galeritus*. We report on forest habitat degradation and loss, on changes in primate group numbers and sizes, on possible reasons for the escalation in forest destruction, and on steps that now need to be taken to conserve what remains of this ecosystem.

Résumé: Les forêts en aval de la Rivière Tana, incluant celles au sein de la Réserve Nationale Primate de la Rivière Tana, ont subi de grandes pertes et ont été dégradées depuis 1994, soit au moment elles ont été l'objet pour la dernière fois d'un recensement complet des primates. Des forêts ont été coupées et dégradées à des fins agricoles ou autres utilisations. Cette dégradation et perte ont eu des impacts néfastes sur les deux espèces de primates en danger de cette forêt: le colobe rouge de la Rivière Tana *Procolobus rufomitratus*, le seul primate en danger critique de l'Afrique, et le mangabé à crête de la Rivière Tana *Cercocebus galeritus galeritus*. Nous présentons nos observations sur la perte et la dégradation des habitats forestiers, les changements dans le nombre et la taille des groupes de primates, les raisons possibles de l'accroissement de la destruction de la forêt et les moyens à prendre maintenant pour conserver ce qui reste de cet écosystème.

Introduction

The Tana River floodplain in Southeastern Kenya supports about 26 km² of riparian forest patches between latitudes 2°15'S and 1°40'S in an otherwise arid thorn scrub environment (Butynski & Mwangi, 1994). The forests support a diverse array of plants and animals, including more than 260 species of birds, 57 species of mammals, and 175 species of trees (Andrews *et al.*, 1975; Medley, 1992).

The forests are inhabited by eight species of non-human primates: the Tana River red colobus *Procolobus rufomitratus*, the Tana River crested mangabey *Cercocebus galeritus galeritus*, Sykes monkey *Cercopithecus mitis albotorquatus*, vervet monkey *Cercopithecus aethiops*, yellow baboon *Papio cynocephalus*, Zanzibar galago *Galago zanzibaricus*, Senegal galago *Galago senegalensis*, and Garnett's galago *Otolemur garnettii* (Andrews *et al.*, 1975; Butynski & Mwangi, 1994). The Tana River red colobus and the crested mangabey are both endemic to a 60 km

INCREASING THREATS TO THE CONSERVATION OF ENDEMIC ENDANGERED PRIMATES AND FORESTS OF THE LOWER TANA RIVER, KENYA

Abstract: The forests of the lower Tana River, including those in the Tana River Primate National Reserve, have suffered a high level of loss and

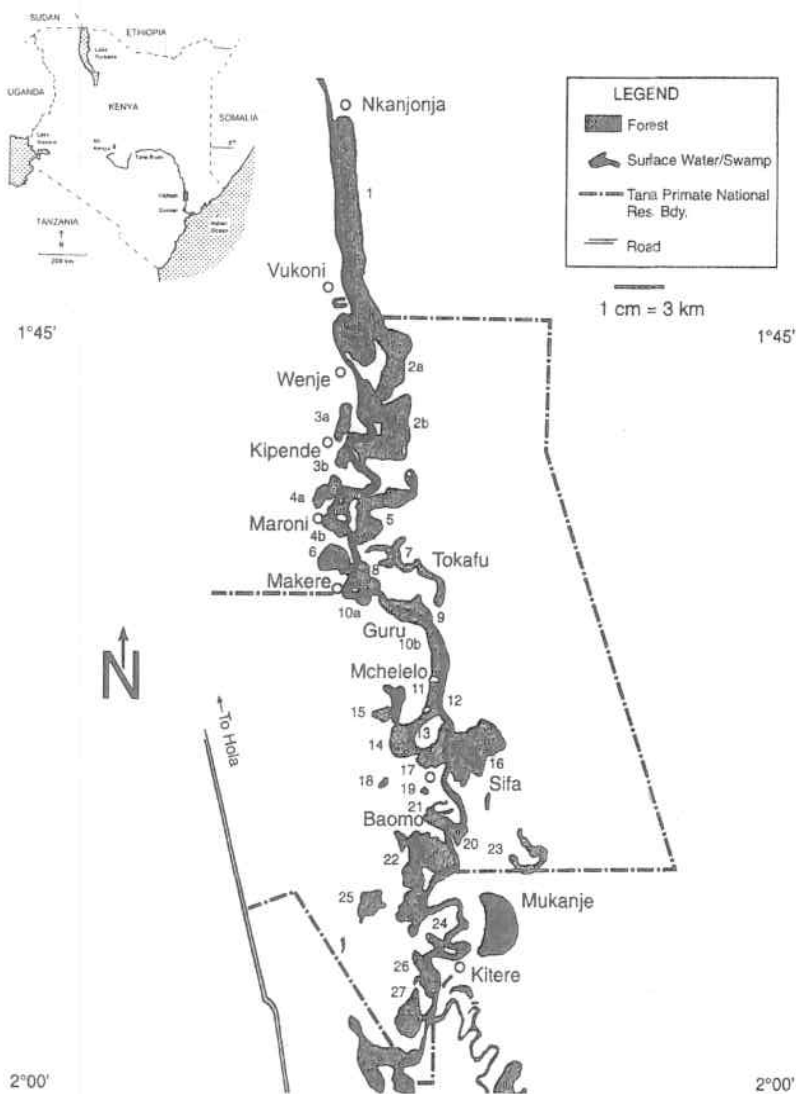


Figure 1. Location of the Tana River Primate National Reserve (TRPNR) and the study area in detail. The range of the Tana River red colobus and the Tana River crested mangabey is from ~1 km upstream of TRPNR to ~1 km downstream of Garsen. Numbered forest patches are named as follows: (1) Nkanjonja, (2) Wenje East, (5) Maroni East, (8) Makere East, (9) Guru East, (10a) Guru North, (11) Mchelelo West, (12) Mchelelo East, (17) Sifa West, (21) Baomo North, (22) Baomo South, (26) Mnazini North, and (27) Mnazini South. Inset map adapted from Kinnaid (1990). Map of study area by David Mbora.

stretch on both sides of the river (figure 1). The Tana River red colobus is currently classified as Africa's only "Critically Endangered" primate species, whereas the Tana River crested mangabey is a "Critically Endangered" subspecies (IUCN, 2000). The lower Tana River, with its rich, endemic, and endangered primate diversity, is the most important primate conservation area in Kenya, if not in East Africa.

The colobus and mangabey are confined to the lower Tana River, from Nkanjonja (figure 1) to Mitapani. The forests of this area are a unique combination of coastal, West and Central African, pan-African, and

northeastern species (Medley, 1990).

There are two main threats to the extent of forest cover along the lower Tana River. Forest clearing for farmland and extracting products reduce the forest cover and alter forest structure on a short time scale (this study). River course changes, causing forest senescence and establishment of new forests, are a natural part of the Tana River system dynamics (Hughes, 1984). However, this is now being interfered with by development (forest clearing and dam construction) upstream, constituting a long-term threat.

Local communities along the lower Tana River rely on forest products for a variety of purposes: food, construction material, food procurement (traps and beehives), household uses (rope, brooms, etc.), medicines, commerce, and other (e.g., firewood, ritual, scents) (Medley, 1993a). Specific examples of forest product use are felling of canopy trees to construct canoes and to collect wild honey, cutting of sub-canopy trees to use as building poles, and topping of *Phoenix reclinata* to collect palm wine.

In 1976, the Kenya government gazetted 169 km² of floodplain as the Tana River Primate National Reserve (TRPNR), under the management of the Tana River County Council, to protect the

colobus, the mangabey, and their riverine forest habitat (Homewood & Mkunga, 1977; figure 1). The Kenya Wildlife Service (KWS) has the institutional mandate for the conservation and management of the Reserve.

In the late 1980's, the Tana Delta Irrigation Project (TDIP) was begun at the southern limit of the primates' range (Medley *et al.*, 1989; figure 1). The land, including the forests, is now under the management of the Tana-Athi Rivers Development Authority (TARDA).

The remaining forests within the primates' range, but outside the TRPNR and TDIP areas, are under the

authority of the Forest Department. Currently, there is a nationwide moratorium on the cutting of all indigenous forests. This moratorium has not been effectively enforced, however, and the cutting of indigenous trees remains widespread in Kenya.

Since 1996, the Tana River Primate National Reserve GEF Project, a US\$6.5 million World Bank funded Global Environment Facility (GEF) project for the conservation of the TRPNR, has been in progress. The project is under implementation by KWS over a period of 5 years. The project has three components: Research and Monitoring, Reserve Management, and Community Conservation and Development.

The Research and Monitoring component has two main objectives. First, it is expected to define and quantify the factors that threaten the integrity of the reserve and its flora and fauna, and to identify possible solutions through interventions, including improved management, ecological restoration and rehabilitation, community awareness-building, and benefit sharing and development. Close monitoring of trends in ecological indicators and species population dynamics was expected to be an essential element of the program, feeding into a flexible reserve management approach designed to take corrective action when problems are identified. Five priority areas were identified for research and monitoring: "monitoring of primate populations, genetics, and habitat parameters; flora and fauna (with the aim of establishing sustainable use levels); and prospects and methods for promoting and facilitating community-based conservation of remaining forest patches outside the Reserve boundaries" (World Bank, 1996, pp. 3-4).

Through GEF support, the Reserve Management component was expected to "protect and manage the reserve in a traditional sense (border demarcation, mobility, infrastructure, etc.), and also promote greater involvement of local communities in conservation and management of an area, which represents an important, but deteriorating resource for them" (World Bank, 1996, p.3).

The Community Conservation and Development component would focus on helping "community groups develop alternative sources of income and materials to decrease their dependence on (and over-exploitation of) the Reserve's resources and would provide funds to encourage and assist those willing to leave the Reserve" (*i.e.*, voluntary resettlement of those dependent on TRPNR) (World Bank, 1996, p.5).

In this paper, we present data on forest product use and forest clearance, and demographic and behavioral changes in the two critically endangered primates. Damage has occurred despite the good intentions of the GEF Project, and it threatens the entire ecosystem. We offer possible reasons for the forest destruction, and suggestions for conservation action.

Methods

Forest Degradation and Loss

Definition of forest: Forest is strictly defined as an area composed of trees with greater than 50% canopy cover and over 10m in height. This is the quality of forest needed for the long-term survival of the endemic and endangered primates as clearly demonstrated by various researchers in Tana (*e.g.*, Medley, 1993b).

Forest area: Baseline forest areas in 1994 are taken from Butynski and Mwangi's (1994) primate census along the lower Tana River (funded by the KWS/GEF preparatory fund). Forest areas were estimated visually: width was measured by pairs of observers 100 metres apart from one another, and length was estimated as the pairs walked the length of the forest. We used the same visual estimation procedure in 1999-2000, using the 1994 estimates as a basis. We include forests where the clearing is drastic and easily seen. Most of the forests are small enough to make visual estimation easy.

Forest product use: The amount of forest product use was determined by two methods. The first one, also undertaken by Butynski and Mwangi (1994), is a descriptive classification of the level of human activity observed in each forest (*e.g.*, light, heavy, extreme). The subjective classifications of the current study were then supplemented by objective measurements, with data collected in belt transects (Brower *et al.*, 1998). We present data on two types of forest product use: cutting and topping of *Phoenix reclinata*, and cutting of canopy trees. *P. reclinata* individuals with obvious trunks were counted, and an individual was recorded as cut if it was topped or if more than 50% of its fronds were removed. We focused on this species because *P. reclinata* is the mangabey's top food source (Homewood, 1976; Kinnaird, 1990). Eighty-four per cent of reproductive individuals have obvious trunks, and topping of the palm and removing more than half of its fronds impacts reproduction (Kinnaird, 1990). The diameter of canopy trees, not cut (at breast height) and cut (where cut), were measured when greater than 10 cm, and converted to basal area.

Primate Populations

Our data on primate groups were collected by systematically searching forests for primate groups. We walked through each forest systematically, looking and listening for primates. This was repeated over several days in order to obtain an accurate count. Because the mangabeys can move between forests, we censused adjacent forests in succession to reduce the likelihood of missing or double-counting a group that had moved. Due to the small size of the majority of the Tana River forests, we worked with only a small team of four field assistants.

Once a group of either colobus or mangabeys was found, we attempted to count all individuals, age and

sex them (following the criteria in Marsh, 1978 and Homewood, 1976, respectively). Colobus are less mobile, and generally clumped on a few trees when feeding or resting. This made it easy to maintain group contact for long hours and determine group composition by thoroughly searching trees within the vicinity of a group's location. A thorough search was necessary as colobus often freeze for hours on noticing humans and it was, therefore, possible to overlook some individuals. Counting mangabeys involved following the group as closely as they allowed throughout the day. Mangabey groups have a large spread, move over long distances, and generally flee when approached by humans. Counts were best obtained after several days or weeks of contact with them (to attain partial habituation), and when the animals were moving in an orderly progression in clear view.

Results

Forest Loss and Degradation

Table 1 is a list of eight forests that have suffered extensive reduction in area since 1994 due to the clearing of forest for farmland. These forests have lost an estimated 54% of their area since 1994. The loss suffered by these forests (769 ha) represents 30% of the minimum total area of forest in the lower Tana River in 1994 (2,616 ha) (Butynski & Mwangi, 1994). The loss suffered by the five forests within TRPNR (250 ha) represents 20% of the minimum total area of forest present within TRPNR in 1994 (1,349 ha) (Butynski & Mwangi, 1994). Nkanjonja forest (figure 2) is an especially alarming situation, having lost 99% of its area since 1994. These estimates of forest loss

are highly conservative as there are forests that we did not work in and there are forests where clearing is present but less dramatic.

The following forests demonstrate the kind and level of forest product use that the Tana River forests have suffered: Guru East, where the majority of the *Phoenix reclinata* palm population has been topped for palm wine; Mnazini South, where the collection of firewood and building poles has degraded the forest; Mnazini North, where many canopy trees are felled for the construction of canoes and the collection of small amounts of wild honey; Sifa West, where fires on the edge continue to shrink the forest and the collection of building poles continues to degrade the forest; and Baomo North, where the *P. reclinata* population has been completely decimated for palm wine (figure 3). All of these forests are within the TRPNR.

Mature canopy trees in Sifa East are felled for the collection of wild honey. This activity is wasteful because it provides only a small amount of honey, less than 1 kg, but results in the death of a mature tree. It is also wasteful, because nearby trees may be broken during the felling of the honey trees.

Table 2 presents comparisons between the 1994 and 2000 classifications for level of human activity in selected forest patches. In 1994, seven of the 12 forests were classified as having light human activity. In 2000, nine of the 12 were classified as having very heavy or extreme human activity, and none were classified with less than heavy human activity. Table 3 presents objective data on forest product use in forests selected to illustrate the range of subjective classifications for level of human activity. In these forests, the objective data support the subjective classifications.



Figure 2. Forest clearance in Nkanjonja, TRPNR. Photograph by J. Wieczkowski.

Primate Populations

A total of 30 groups of colobus were studied in 11 forests. The mean group size is 8.6 animals per group. This is a 32% decrease in the mean group size. Mean group size pre-1994 was about 12.6 animals (Butynski & Mwangi, 1994; $n=50$). The decrease in mean group size is significant (t -test; $8.6:t=2.426$; $df=36$; $p<.02$). The number of groups remains the same, so this is a loss

of individuals (*i.e.*, the groups are not fissioning).

We have not seen a decline in the mangabey population at this time; mean group size is 32.1 ($n=8$), an increase from 20.5 animals per group used in the 1994 census (Butynski & Mwangi, 1994 from Kinnaird & O'Brien, 1991) ($n=7$). In the majority of forests, the same number of mangabey groups that were counted in 1994 were counted in 1999–2000. They are, however, now

living in a much smaller area and are not expected to sustain their current numbers. In the small patches of forest that remain in Nkanjonja, there are three to four mangabey groups. These animals are unlikely to survive in the long-term. Other forests that have suffered a drastic reduction in forest area, and where we expect the mangabey population to decline, are Wenje East, Maroni East (where there already is a loss of one group), and Baomo South.

As a result of forest clearance for farmland, the mangabeys are increasingly raiding crops (observed in Makere East), which intensifies human-wildlife conflict. While working in Guru East, Guru North, Baomo North, and Baomo South, we have witnessed mangabeys being chased by dogs. Because of the proximity of farmland to these forests, it is very likely that mangabeys in those forests are now crop raiding as well. Near the farms in Wenje East, we found traps set to catch crop raiding animals. Whether the mangabeys are actually crop raiding in Wenje East or not, they could easily be caught in the traps. In Guru East, the head of a mangabey that was cleanly cut with a machete, was found in July 1999.

Discussion

Primate and Habitat Relationships

The last published figures for forest area within the lower Tana River (Butynski & Mwangi, 1994) are 76 forests totaling a minimum of 2616 ha (range 1–500 ha). These forests are distributed under various management authorities as shown in table 4. Those forests within the Reserve are under management by KWS. TARDA manages the forests within the TDIP



Figure 3. Topping of *Phoenix reclinata* for the collection of palm wine. Photo by D. Mbora.

area. The Forest Department has authority over all remaining forests. The majority of colobus and mangabeys, and the forests supporting these two species, are outside of the TRPNR (colobus forests: 68%; colobus groups: 63%; mangabey forests: 53%; mangabey groups: 44%) (Butynski & Mwangi, 1994).

Forest degradation and loss can have an extreme and negative impact on the populations of critically endangered primates. Medley (1993b) studied the correlations between primate population characteristics (number of colobus and mangabey groups and individuals) and selected forest attributes (structural, resource, disturbance, and spatial). Numbers of the primates were positively correlated to canopy tree coverage, coverage of primary food resources, and *Phoenix reclinata* density. Canopy tree coverage is reduced when trees are felled for canoes, beehives, collection of honey, *etc.* As the most highly utilized canopy tree species are also important primate food resources, this human use of canopy trees also impacts food resources.

P. reclinata is highly used by humans, who, as a consequence, reduce the density of this palm that is available for the mangabey (the number of mangabey individuals was significantly correlated to *P. reclinata* density (Medley, 1993b)). Numbers of primates were negatively correlated to forest disturbance (basal area of cut and damaged trees) and intraforest heterogeneity, measures which are increased by forest product use. Finally, numbers of primates were positively correlated to forest area and forest area-to-perimeter ratio, measures which are reduced by the clearing of forest (Medley, 1993b).

The loss of 30% of the forest cover along the lower Tana River is a major blow to the survival of the

Table 1. Forest loss along the lower Tana River, Kenya, between 1994 and 2000.

Forest Name	Size in 1994 (ha)	Estimated size 2000 (ha)	Loss (ha)	Loss (%)
Wenje East (TRPNR)	625	525	100	16
Maroni East (TRPNR)	35	10	25	71
Makere East (TRPNR)	7	4	3	43
Guru North (TRPNR)	5	3	2	40
Baomo South (TRPNR)	220	100	120	55
Nkanjonja	500	3	497	99
Wema West 2	14	5	9	64
Hewani West 2	16	3	13	81
Total	1422	653	769	54

1994 data from Butynski and Mwangi (1994).

2000 data from this study.

colobus, mangabey, and all the other species that rely upon these forests for survival (Kenya Section of the IUCN/SSC Primate Specialist Group and Kenya Primate Conservation Group, 2000). Available data do not show that recent forest loss has caused the decline in colobus, but it is certainly the most likely explanation. We have not seen any population decline in the mangabey because of a time lag between forest loss and population response. This delay may be due to the mangabey's greater flexibility in habitat requirements, ranging, grouping, and diet (Homewood, 1976; Kinnaird, 1990). If 30% of the forest cover has been removed, and additional areas are seriously degraded, the remaining populations will find themselves crowded into the remaining habitats. They will be above carrying capacity, and birth rates will decline, incidence of disease will increase, and conflict with humans will increase, among other potential problems.

Reasons for the Forest Destruction

Although the evidence is anecdotal, we have heard that the forest degradation and loss is the community's

response to the GEF project. The feeling of the communities is that if there are no forests and monkeys, the World Bank and KWS (with whom there already was a volatile relationship prior to the GEF Project) will leave them alone, and especially not relocate them (Mborra, 2000a, 2000b).

The focus of the GEF project has been on a voluntary relocation exercise, to the detriment of the area's conservation. According to the Project Document (World Bank, 1996, p. 4), the Community Component's main objective was to "gain local support and cooperation for conservation by maintaining a positive dialogue". One of the focus areas of the Research and Monitoring Component specifically targets communities outside the Reserve boundaries (see Introduction). The improved Reserve infrastructure is non-existent, the management plan is 3 years beyond schedule, and the Research and Monitoring Component (from which the management plan will be developed) has accomplished far less than half the proposed work. There is no ecological monitoring program at all.

The Tana River Primate National Reserve GEF Project was developed with the goal of enhancing the

Table 2. Changes in classification of level of human activity between 1994 and 2000 within forests in the Tana River Primate National Reserve.

Forest	Level of Human Activity	
	1994	2000
Nkanjonja	Light	Extreme
Wenje East	Light	Very heavy
Maroni East	Light	Very heavy
Makere East	Light	Extreme
Guru East	Light	Extreme
Guru North	Light	Very heavy
Sifa West	Very heavy	Very heavy
Baomo North	Moderate	Very heavy
Baomo East	Light	Heavy
Baomo South	Very heavy	Heavy
Mnazini North	Moderate	Heavy
Mnazini South	Moderate	Very heavy

1994 data from Butynski and Mwangi (1994).

2000 data from this study.

Table 3. Data on forest product use in selected forests, collected in belt transects within forests in the Tana River Primate National Reserve in 2000.

Attribute/Forest	Mchelelo West	Mchelelo East	Mnazini North	Guru North	Guru East
Level of human activity	Light	Moderate	Heavy	Very heavy	Extreme
Density of <i>Phoenix reclinata</i> (#/ha)	325	146.15	76	50	114.3
Density of cut <i>P. reclinata</i> (#/ha)	0	46.15	60	62.5	257.1
Percentage of <i>P. reclinata</i> cut	0	24	44.1	55.6	69.2
Basal area of canopy trees (m ² /ha)	67.9	38.1	29.5	32.6	52.8
Basal area of cut canopy trees (m ² /ha)	0	0	0.5	1.2	2.6
Percentage of basal area of canopy trees cut	0	0	1.8	3.4	4.7

conservation of the forests of the lower Tana River. In the end, the main measures that will be used to judge the success of the project are the numbers of colobus and mangabeys present, and the extent of the forest cover. Our research has clearly shown that within the life of the GEF project, forest cover has drastically reduced, with future declines in the primate populations assured. Based on these criteria and our observations, the GEF Project has already failed. Nevertheless, important lessons can be learned from this debacle. To learn these lessons, however, an independent, external, and detailed review must be undertaken.

What Needs To Be Done?

There are several actions that can be taken in order to stop the forest destruction and protect the remaining primate populations.

We have evaluated the forests within the Tana River Primate National Reserve. We have visited the forests within the TDIP area and in between TRPNR and TDIP. The conditions of these forests, however, need a more detailed evaluation. We need to determine the current state and level of human threat to those forests. In addition, the GEF's Research and Monitoring Component must be carefully planned and implemented to gather the most important data in the remaining months of the project (Kenya Section of the IUCN/SSC Primate Specialist Group and Kenya Primate

Conservation Group, 2000).

KWS needs actively to enforce the protected status of the TRPNR. There are several forests within TRPNR that are still in [near] pristine condition; these need to be patrolled to prevent any detrimental human activity from starting. There are also several forests outside, especially immediately south of TRPNR, that are in good condition. KWS needs to assure the people living next to those forests that the forests will not be gazetted into the Reserve. If the local people feel threatened enough, they will respond by cutting down the forest or killing the monkeys, thereby getting rid of what they think is valued or wanted by others (Mborra, 2000b).

The 1994 census found 50 groups of the mangabey throughout its 60-km long range (Butynski & Mwangi, 1994). In the area that used to be Nkanjonja forest, there are at least three, maybe four, groups. These groups represent 8% of the world's population of Tana River crested mangabey, and they will be lost if nothing is done. A detailed assessment needs to be undertaken in Nkanjonja, and other badly degraded forests, to determine the most appropriate and acceptable action to save these primates. The following alternatives should be investigated: (1) forest restoration and provisioning *in situ*, (2) translocation to other forest sites within the lower Tana, and (3) captive breeding (Kenya Section of the IUCN/SSC Primate Specialist Group and Kenya Primate Conservation Group, 2000).

Table 4. Distribution of forests in 1994 under various management authorities within the range of the Tana River red colobus and Tana River crested mangabey.

	No. forests	Total hectares	Proportion of total hectares (%)	Proportion colobus forests (%)	Proportion colobus groups (%)	Proportion mangabey forests (%)	Proportion mangabey groups (%)
TRPNR	25	1349	52	32	37	47	56
TDIP	14	222	9	15	19	6	10
Outside	37	1041	39	53	44	47	34
Total	76	2616	100	100	100	100	100

Data from Butynski and Mwangi (1994).

The survival of the forests and wildlife of the lower Tana River is ultimately in the hands of the local people. Conservation and development organizations should work with local communities to establish conservation education programs and community-based conservation projects. Research should be undertaken to study and revitalize traditional management institutions. The potential for ecotourism, which is ideal in the lower Tana River and would financially benefit the local people, should be seriously pursued.

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References

- Andrews, P., C.P. Groves, & J.F.M. Horne. 1975. Ecology of the lower Tana River floodplain (Kenya). *Journal of East African Natural History Society & National Museums* 151: 1–31.
- Brower, J.E., J.H. Zar, & C.N. von Ende. 1998. *Field and Laboratory Methods for General Ecology*. 4th Edition. WCB McGraw-Hill, Boston.
- Butynski, T.M. & G. Mwangi. 1994. *Conservation Status and Distribution of the Tana River Red Colobus and Crested Mangabey*. Report for: Zoo Atlanta, Kenya Wildlife Service, National Museums of Kenya, Institute of Primate Research, and East African Wildlife Society.
- Homewood, K. 1976. *Ecology and Behaviour of the Tana Mangabey (Cercopithecus galeritus galeritus)*. Ph.D. Dissertation, University of London.
- Homewood, K.M. & J. Mkunga. 1977. Kenya's new primate reserve. *Oryx* 14: 175–177.
- Hughes, F.M.R. 1984. A comment of the impact of development schemes on the floodplain forests of the Tana River of Kenya. *The Geographical Journal* 150(2): 230–244.
- IUCN. 2000. *Taxonomy of African Primates*. Unpublished report from the IUCN/SSC Primate Specialist Group Workshop on Primate Taxonomy, Orlando, Florida.
- Kenya Section of the IUCN/SSC Primate Specialist Group and Kenya Primate Conservation Group. 2000. *Joint Recommendations of the Kenya Section of the IUCN/SSC Primate Specialist Group and of the Kenya Primate Conservation Working Group for Emergency Action to Conserve the Forests, Primates, and Biodiversity of the Lower Tana River, Kenya*. Unpublished report to World Bank and Kenya Wildlife Service.
- Kinnaird, M.F. 1990. *Behavioral and Demographic Responses to Habitat Change by the Tana River Crested Mangabey (Cercopithecus galeritus galeritus)*. Ph.D. dissertation, University of Florida.
- Kinnaird, M.F. & T.G. O'Brien. 1991. Viable populations for an endangered forest primate, the Tana River crested mangabey (*Cercopithecus galeritus galeritus*). *Conservation Biology* 5: 203–213.
- Marsh, C. 1978. *Ecology and Social Organization of the Tana River Red Colobus, Colobus badius rufomitratu*. Ph.D. Dissertation, University of Bristol.
- Mboraa, D.N.M. 2000a. Assault on the lower Tana. *Swara* 23: 19–21.
- Mboraa, D.N.M. 2000b. Saving the Tana. *EcoForum* 24: 33–35.
- Medley, K.E. 1990. *Forest Ecology and Conservation in the Tana River National Primate Reserve, Kenya*. Ph.D. dissertation, Michigan State University.
- Medley, K.E. 1992. Patterns of forest diversity along the Tana River, Kenya. *Journal of Tropical Ecology* 8: 353–371.
- Medley, K.E. 1993a. Extractive forest resources of the Tana River National Primate Reserve, Kenya. *Economic Botany* 47: 171–183.
- Medley, K.E. 1993b. Primate conservation along the Tana River, Kenya: an examination of the forest habitat. *Conservation Biology* 7: 109–121.
- Medley, K.E., M.F. Kinnaird, & B.S. Decker. 1989. A survey of the riverine forests in the Wema/Hewani vicinity, with reference to development and the preservation of endemic primates and human resources. *Utafiti* 2: 1–6.

The World Bank. 1996. *The Republic of Kenya: Tana River Primate National Reserve. Project Document*. The World Bank, Washington, D.C.

possible d'utiliser intensivement la radio-téléométrie avec de l'équipement standard, même dans des conditions de forêts tropicales humides.

DARTING, INDIVIDUAL RECOGNITION, AND RADIO-TRACKING TECHNIQUES IN GREY-CHEEKED MANGABEYS *LOPHOCEBUS ALBIGENA* OF KIBALE NATIONAL PARK, UGANDA

Abstract: *Finding an individual grey-cheeked mangabey Lophocebus albigena in the field can be difficult because mangabeys have relatively large home ranges and individuals are often widely scattered within groups. The problem of finding individuals is compounded by the difficulty in identifying them using natural features. It was therefore necessary to capture and mark individuals to facilitate a study of dispersal. From July 1996-March 1998, 41 male grey-cheeked mangabeys in the Kanyawara study area of Kibale National Park, Uganda, were captured with 1 cc barbless darts and Telazol®. The anesthetized animals were fitted primarily with radio-transmitters, occasionally with collars without transmitters. Findings from this exercise suggest that: 1) provided adequate precautions are taken to minimize mortality risk from falls, capture of mangabeys by darting is feasible, 2) Telazol® is a safe anesthetic for capturing mangabeys in the wild, and 3) it is possible to radio-track intensively with standard equipment, even under humid rainforest conditions.*

Résumé: *Trouver un individu mangabé noir Lophocebus albigena sur le terrain peut être difficile parce que les mangabés ont une aire vitale relativement grande et aussi parce que les individus sont souvent dispersés au sein de leur groupe. Le problème de trouver des individus est accentué par la difficulté de les identifier avec des traits naturels (de leur corps). Il a ainsi été nécessaire de capturer et de marquer certains individus afin de faciliter une étude sur la dispersion. De juillet 1996 à mars 1998, 41 mâles mangabés noirs ont été capturés à Kanyawara au Parc National de Kibale en Ouganda à l'aide de dards 1 cc sans plume et du Telazol®. Des radio-transmetteurs et à l'occasion des colliers sans transmetteur ont été installés sur les animaux anesthésiés. Cette expérience nous permet de conclure les points suivants : 1) compte tenu que des précautions adéquates aient été prises afin de minimaliser la mortalité due aux chutes du haut des arbres, il est possible de capturer des mangabés en les dardant; 2) le Telazol® est un anesthésiant sécuritaire pour capturer des mangabés sauvages; et 3) il est*

Introduction

Recognition of individuals is one of the first prerequisites in many studies of primate behavior (Scott *et al.*, 1976; Glander *et al.*, 1991). In some species, naturally occurring features can be used to distinguish individuals (*e.g.*, Ron & Whitehead, 1993). In other species, distinguishing characteristics may be subtle. Use of subtle features depends on the location of the feature on the animal and on visibility afforded by the habitat (National Research Council, 1981). Where a large sample of individuals has to be observed, total reliance on natural distinguishing features may not be feasible. In such cases workers have resorted to application of artificial marks (*e.g.*, Scott *et al.*, 1976; Jones & Bush, 1988; de Ruiter, 1992; Karesh *et al.*, 1998).

Many studies of primate behavior also require routine location of individual animals for long periods of observation. Large home ranges and poor visibility can preclude finding individual animals reliably or following them continuously. Where difficulties in individual recognition compound difficulties in locating individuals, workers have solved both problems with radio-telemetry (Mech, 1983; Jones & Bush, 1988). In this technique, an individual is fitted with a transmitter that emits radio signals at a preset frequency. The signals are then used to identify and to locate the animal by use of specialized radio receivers (Brander & Cochran, 1969; Mech, 1983). When different individuals are fitted with transmitters that emit signals at different frequencies, individuals can be recognized by use of the signal alone.

In many cases, application of artificial marks necessitates capture of the animal. A variety of capture techniques are available (Taber & Cowan, 1969; National Research Council, 1981; Glander *et al.*, 1991; de Ruiter, 1992), each of which is more or less appropriate for a particular species or individual depending on the species and purpose of capture. For free-ranging, unprovisioned primates, one of the most common capture techniques is chemical immobilization. In this technique, projectile darts, loaded with an anesthetic are propelled at the animal from a launching device, such as a blow-pipe, pistol, or rifle (*e.g.*, Jones & Bush, 1988; Glander *et al.*, 1991; Agoramoorthy & Rudran, 1994; Sapolsky & Share, 1998). Choice of the type of launching device employed depends on the distance and the potential responses of the target, as well as non-target individuals within the area.

Attempts to record natural features used to distinguish individual primates are rarely reported and

reports on efforts at intensive radio-tracking under rainforest conditions are not common (but see Campbell & Sussman, 1994, for an exception). Risk of death from darting is a primary concern for any darting program; however, determinants of mortality risk are not commonly explored in the primate literature. Male grey-cheeked mangabeys *Lophocebus albigena* (figure 1), the subject of this dispersal study, have few natural characteristics that can be used to distinguish individuals. They occupy fairly large home ranges (ca. 250 ha) in their forest habitat. This makes it difficult to locate and follow them on a routine basis (Waser, 1974; Waser & Floody, 1974; Wallis, 1978; Olupot unpub. data). The value of radio-tracking in studying rainforest primates has been explored in detail elsewhere (Campbell & Sussman, 1994). This paper describes my experiences at darting, radio-tracking, and attempts to recognize individual mangabeys for documentation of their dispersal behavior in Kibale National Park, Uganda. I also present quantitative information on four variables related to the darting procedure that may have influenced the success of this darting program.

Study Area and Study Animals

Kibale National Park (0° 13' - 0° 41' N; 30° 19' - 30° 32' E) is a tropical rainforest located in western Uganda, approximately 24 km east of the Rwenzori Mountains (Struhsaker, 1975). The Park, 766 km² in size, is classified as a medium altitude forest. It contains 11

primate species. Seven of these, including mangabeys, are monkeys. The Park receives annual rainfall averaging 1664 mm (Chapman *et al.*, 2000).

Mangabeys are arboreal and live in multi-male groups averaging 13–15 individuals (Waser, 1974; Wallis, 1978; Freeland, 1979; Olupot *et al.*, 1994, this study). Group home ranges vary from 125–410 ha (Waser, 1974; Freeland, 1979; Wallis, 1978; Olupot *et al.*, 1997). These home ranges are much larger than those of other sympatric arboreal monkeys.

Kanyawara study area (0° 34' N, 30° 22' E) is located on the northwestern edge of the Park. It covers a stretch of mature, unlogged forest as well as an area that was selectively logged in the 1960s. The logged (compartments 14, 15 & 31) and unlogged areas (compartment 30) constitute the northern, southwestern, and southern portions of the study area, respectively. Although there has been substantial post-logging regeneration in the lightly logged K14 compartment (Olupot *et al.*, 1994), heavily logged K15 & K31 are still characterized by a relatively open canopy (Struhsaker, 1997). In the open areas of the heavily logged habitat, there is a dense tangle of herbaceous undergrowth. More closed areas of logged forest are characterized by young regenerating trees. The unlogged K30 habitat has a much more closed canopy and a more open understorey (Kasenene, 1987).

The study area, like the rest of Kibale forest, lies on hilly terrain. The hillsides are gentler in the north but steeper in the south of the study area (Oates, 1974). Hilltops are characterized by relatively low stature and

often thick forest, especially those with shallow and rocky soil (Struhsaker, 1997). The tallest forest occurs on the slopes. Lower slopes and valley bottoms are characterized by relatively low vegetation. Substantial parts of these slopes are swampy. Swamp vegetation has a low density of tree species and a high proportion of sedges, grasses, and dense stands of semi-woody species. Details of the study area can be found elsewhere (Struhsaker, 1975; Skorupa, 1988; Struhsaker, 1997).

Methods

Capturing and Marking

For most groups, habituation was achieved within 1 month of frequent daytime contact with groups. Individuals were darted only after a group was habituated to the presence of human observers.

Prior to darting, males were distinguished from females by an ischial

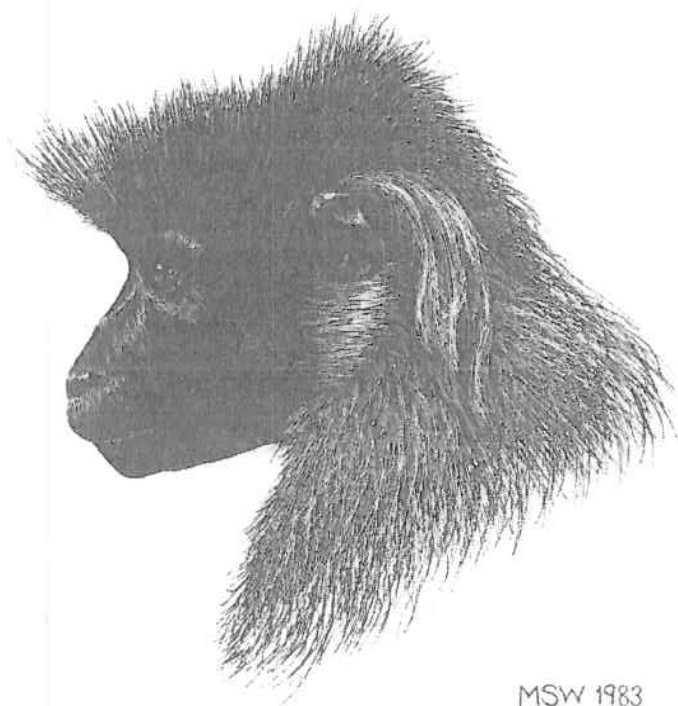


Figure 1. Grey-cheeked mangabey *Lophocebus albigena* by Mary Sue Waser.

Table 1. Location of dart sites on male grey-cheeked mangabeys *Lophocebus albigena* captured in Kibale National Park, Uganda.

Site darted	Number of individuals
Thigh	10
Rump	18
Lower leg	4
Arm	3
Foot	1
Callosity	2
Tail	3
Total	41

callosity, which is continuous, and by the penis, which was normally visible even in juveniles. They were categorized into age classes before capture using the classification of Waser (1974). Males were classified as adult if they were larger than adult females. Sub-adults were classified as males about the size of adult females, and juveniles as males that appeared to be smaller than adult females but were not carried by other individuals.

Having received training from K. E. Glander (Glander *et al.*, 1991) who darted four individuals himself, I captured the rest of the animals with the help of at least two other people. The assistants helped in carrying the equipment, which included a net; locating target males before capture; and processing captured animals. Assistants were also important in locating target males before they fell.

The animals were immobilized with approximately 25mg/kg of Telazol® (Fort Dodge Laboratories, Fort Dodge, IA, USA). This dosage rate was recommended by K.E. Glander, R. Rudran and G. Agoramoorthy (pers. comm.). This dose is much higher than the 2.75mg/kg reported as effective in captive animals (Eads, 1976). The drug was loaded in 1 cc barbless darts and launched from a Pneu-Dart model 176B rifle (Pneu-Dart, Williamsport, PA, USA). This rifle is CO₂ powered and could shoot accurately up to 30 m. Shots were typically delivered from a distance of 10–30m into the muscle blocks of the rump and thigh (table 1) when target animals were clearly visible, and sat facing away from the observer. The time that the animal was darted and when it fell were recorded. The distances traveled by the animals (Dart-drop distance, DDD) were noted.

Captured animals were transferred to a nearby suitable site for processing and laid on clean burlap. Pulse, temperature, and respiration rate were recorded and measurements of weight and linear dimensions of the body recorded following Glander *et al.* (1991). Teeth were examined for wear, and body surface for body condition and distinguishing features. Artificial markers were applied or fitted. Markers applied included radio-collars, collars without radio-transmitters, tail rings and V-shaped ear notches. Collars without radio-transmitters were used when there

were no radio-collars available. Tail rings were applied to animals too young for a collar. This was done by shaving hairs in the tail to form a ring. Ear notches were applied using disinfected notching pliers. Wounds from notching and those sustained by falling animals were disinfected and sutured if necessary. Finally, samples of hair and 1–2 ml of blood were collected. If the animal revived before processing was complete, additional doses of the anesthetic were administered and the time and dose per kg recorded.

Following processing, the animals were allowed to recover in a shaded area. To prevent premature escape, they were then placed in a duffel bag at the first sign of recovery. Animals were judged to be capable of climbing when they became very active in the bag. They were released within their groups by opening and holding the mouth of the bag beside a narrow tree trunk. If the animal had recovered sufficiently, it walked out of the bag and climbed the tree; if not, it was retained in the bag until it recovered enough to climb. Time of release was noted.

The time (in minutes) that elapsed between the firing of the gun and the fall of the animal (induction time), and the time (in hours) that elapsed between the shot and release of the animal (recovery time) were calculated. Dosage rate was calculated as the number of mg of Telazol® in the dart, divided by the weight of the animal in kilograms. Overall dose was calculated as the dose in the dart plus any dose added after the animal fell.

Individual Recognition and Radio-tracking

The radio-collars, supplied by Advanced Telemetry Systems (ATS), Inc., Isanti, MN, USA, had transmitters with timers that allowed transmission on a cycle of 12 hours, and thereby potentially doubled the lifetime of the battery. Radio-tagged animals were identified by the frequency of signals from their transmitters, and by unique color combinations of the transmitter housing and collar. Animals without radio-transmitters were identified by the color of the collar alone, by the number of rings shaved on the tail, and occasionally by natural features. Animals with rings were described as "one ring", "two rings", *etc.*, depending on the number of rings shaved. V-shaped

ear notches (3–4 mm wide and 3–4 mm deep applied to the lower, mid, and upper margins of the right and left ears in unique combinations) were not visible on released individuals. However, they were potentially useful for recognizing recaptured individuals who lost their collars or re-grew their tail hair.

Individuals were radio-tracked approximately three times a week with the help of three assistants, each moving independently. Using AVM LA12 (AVM Instrument Co., Champaign, IL, USA) and ATS R2100 receivers and Yagi antennas, radio-tagged animals were regularly located on foot by a single observer moving in the direction of signals originating from their radios [see Mech (1983) for homing techniques].

Three analog LA12 receivers and a digital ATS receiver were used in the study. The frequency settings at which a transmitter's signal was clearest often drifted when the analog receivers were used. This caused confusion about the source of the transmitted signal. The problem was corrected by contacting the animals using the digital receiver, and re-tuning the frequency in the LA12 receivers. Animals that moved out of the receiving system's tracking range were located from a "Telemetry Station" (TELSTA) located on a high hill that was situated centrally within the study area. From this hill, it was almost always possible to detect signals from all radio-collared animals and to determine their location at any time when the radios were active. In instances where the signal direction suggested that the animal was within the study area's trail system, trail maps helped the observer to home in on the animal. On many occasions, however, study groups and individuals ranged outside the existing trail system. To facilitate radio-tracking of such animals, as well as of animals that were located on distant trails, a series of points were mapped within and outside trails using a GARMIN GPS 38 unit (accuracy of ± 100 m) (Garmin Corp., Olathe, KS, USA). Having done that, a "TELSTA map" was constructed, which indicated the location of each of these points with reference to TELSTA. Then, when the signal suggested that the animal was out of the trail system, the TELSTA map provided the first guide to the possible location of the animal.

Data Analysis

Descriptive statistics were used to present differences in DDDs, induction times, recovery times, doses (in mg) and dosage rates (in mg/kg) among age classes of the individuals captured. The initial dose of Telazol® that was loaded into the dart, and the total dose, were distinguished. The total dose was calculated as initial dose plus any additional doses that were injected into the partially immobilized animal. Required dose was calculated by multiplying the actual weight of the animal and the dosage rate of 25 mg/kg. Significance of these differences was tested with a Kruskal-Wallis statistic.

Pearson's regression coefficient was used to test the relationship between dosage rate and the other three variables. A one sample t-test was used to test the difference between mean dosage administered and the desired dosage of 25 mg/kg of body weight.

Results

Capturing and Marking

The number of marked animals required to conduct the dispersal study was realized, but poor habitat conditions, the wary behavior of certain individuals, and equipment malfunction sometimes slowed the pace of darting. It was easier to dart animals in logged than in unlogged habitats, and from groups that were habituated for long periods than for short periods. Additionally, because adult males were less nervous than young males, they were easier to dart than sub-adult or juvenile males. When the equipment was functioning properly, most males (37 of 41) were immobilized on the first shot.

From eight social groups consisting of 5–24 individuals of different age and sex classes (unpublished data), 41 adult, sub-adult, and juvenile male mangabeys were captured. Of these, 35 were marked with radiocollars, 4 with collars without transmitters, and 2 by shaving rings on tails (table 2). Six animals did not fall. Of these, five moved out of view and were not seen for long periods (hours) following the shot. Three of these individuals (FTF-4, FTF-5, FTF-6) were eventually captured on other days. Examination of previous dart-sites and recovered darts suggest that the drug had been fully injected in at least two of these individuals. The other individual that did not fall following the first shot (FTF-3) stayed partially immobilized and in view 8m from the location at darting. We could not retrieve him by climbing. However, 90 minutes later, he was still at the same spot; another shot was made and he was captured. Examination of both dart sites and fallen darts suggested that the drug fully injected on both occasions.

Following the hit, animals typically ran in an approximately straight course towards other group members or in the direction of group movement, before falling or moving out of sight. In many cases, animals fell in stages through branches and lower vegetation to make a relatively soft landing on the forest floor. Three animals were trapped in tree branches and were retrieved by climbing. Although effort was made to catch falling animals in a net, this was not possible in most cases because vegetation obscured a clear view of the animal. Sometimes, even when the animal was clearly visible, the undergrowth made it difficult to set the net. As a result, only three animals were caught in the net. Nevertheless, most animals were not severely injured by the falls. Thirty seven of the 41 animals had

Table 2. Male grey-cheeked mangabeys darted in the Kanyawara study area of Kibale National Park, Uganda (1996-1998). Body weights, dosage rates, and additional doses are shown. Age classes, dates when darted, and groups at darting are indicated. Measurements on the following three post-darting parameters are also provided: Dart-drop distances (DDD), Induction time (IT), and Recovery time (RT). Abbreviations: Wt = body weight; Dosage = dosage rate of Telazol® at darting; ADD = additional dose of the drug administered to the animal following its fall; * = recaptures; # = re-darted following failure to fall the first time; - = missing data.

No.	Name	Group	Date	Location	Age class	Dosage (mg/kg)	Wt (kg)	DDD (m)	IT (min)	RT (hr)	ADD (mg)
1	Yellow (YM)	Butanzi	7/27/96	U28	Adult (young)	20	7.5	42	4	3.8	0
2	Two Rings (TWR)	Butanzi	7/27/96	U23	Juvenile	51.7	2.9	7	-	6.0	0
3	Blue	Butanzi	7/29/96	A14	Adult	18.3	8.2	-	4	2.8	0
4	Red	Butanzi	7/29/96	A14	Adult	18.5	8.1	-	5	-	25
5	Maroon	Mikana	7/30/96	HJ 1200	Adult	17.2	8.7	10	-	-	25
6	Green	Lower camp	8/2/96	Q13	Adult	17.6	8.5	25	-	2.5	0
7	Dark Blue (DB)	Mikana	8/10/96	F 800-900	Adult (young)	17.9	8.4	16	4	4.2	0
8	Light Grey (LG)	Mikana	8/10/96	DF 900	Sub-adult	19.7	7.6	14	4	2.3	0
9	No Label-1	Southern	8/11/96	B 1000	Sub-adult	20	7.5	35	2	-	-
10	Light Brown (LB)	Upper camp	8/17/96	UU 46	Sub-adult	23.8	6.3	37	2	2.6	0
11	Fail to Fall-1 (FTF-1)	K15	8/19/96	4S/SB	Adult	-	-	-	-	-	-
12	Olive Green (OG)	Mikana	9/12/96	B 800	Adult	18.0	9.7	28	3	4.7	25
13	Light Maroon (LM)	None (Solitary)	9/13/96	9E/6S	Adult (young)	21.6	8.1	70	8	2.7	25
14	Red-Blue (RB)	Lower camp	10/13/96	R11	Sub-adult	20.6	7.6	22	4	3.1	50
15	Fail to Fall-2 (FTF-2)	Mikana	11/21/96	West, WsT	Adult	-	-	-	-	-	-
16	White-Maroon (FTF-2)#	Mikana	11/21/96	West, WsT	Adult	19.4	9.0	8	-	2.3	175
17	Red-Maroon (RM)	Mikana	11/24/96	K Rock	Sub-adult	21.9	8.0	40	7	3.0	62.5
18	Fail to Fall-3 (FTF-3)	K15	11/25/96	5S/5E	Adult	-	-	-	-	-	-
19	Yellow-Maroon (YM)	Mikana	11/28/96	K 400	Adult	22.7	8.8	33	9	3.2	0
20	White-Blue (WB)	Butanzi	11/29/96	M2	Adult	25.6	7.8	4	2	2.6	0
21	Blue-Yellow Green (BYG)	Mikana	5/19/97	K450	Adult	20.1	8.7	53	9	5.0	25
22	Yellow-Blue (YB)	Butanzi	5/20/97	F 24	Adult	20.7	8.5	33	3	3.0	0
23	Maroon-Yellow Green (MYG)(TWR)*	Butanzi	5/26/97	K8	Juvenile	51.5	3.4	22	3	1.5	0
24	Maroon-Yellow Green	Butanzi	5/26/97	K9	Juvenile	51.5	-	-	-	-	-
25	Green-Yellow Green (GYG)	Upper camp	5/29/97	KK 38	Adult	18.7	9.4	29	5	2.5	25
26	Green-Red (GR)	CC	5/31/97	B 200	Adult	18.4	9.5	48	6	1.5	0
27	Green*	Lower camp	6/3/97	O 14	Adult	21.1	8.3	29	4	1.5	0
28	Blue-Green1 (BG-1)	Nyakagera	6/7/97	15/13	Adult	19.4	9.0	37	3	5.0	0
29	No Label-2	CC	6/8/97	CC 600	Adult	15.9	11.0	22	4	-	0
30	Yellow-Red (YR)	CC	6/11/97	10 JG	Adult	19.4	9.0	55	8	2.0	0
31	Fail to Fall-4 (FTF-4)	CC	6/12/97	B-CC 600	Adult	-	-	-	-	-	-
32	Maroon-Red (MR)	Mikana	6/14/97	24 Cens	Adult	19.7	8.9	15	2	2.5	0
33	Fail to Fall-5 (FTF-5)	Nyakagera	6/16/97	NE Sawm	Adult	-	-	-	-	-	-

Table 2. continued

No.	Name	Group	Date	Location	Age class	Dosage (mg/kg)	Wt (Kg)	DDD (m)	IT (min)	RT (hr)	ADD (mg)
34	White-Red (FTF-4)#	CC	6/18/97	CC 400	Adult	23	9.7	235	41	2.5	12.5
35	Green-Green (FTF-5)#	Nyakagera	6/19/97	NE Sawm	Adult	22.5	10.0	40	1	4.5	0
36	Fail to Fall-6 (FTF-6)	CC	6/26/97	B-CC 1000	Adult	-	-	-	-	-	-
37	Yellow-Black (YBK)	Butanzi	7/27/97	B16	Juvenile	35.7	4.9	34	1	2.3	0
38	Red Collar (REC) (FTF-6)#	CC	7/31/97	B/CC 1000	Adult	23.0	7.6	40	2	4.5	50
39	One Ring	Lower camp	8/21/97	K14 SWP	Juvenile	51.7	2.9	15	2	2.9	0
40	Light-Blue Collar (LBC)	Butanzi	8/23/97	U/21	Adult	19.7	7.6	42	4	3.0	0
41	Blue-Green2 (BG-2)	Butanzi	10/25/97	B' 28	Adult	20.3	8.6	34.5	4	2.0	0
42	White-Black (WBK)	MikanaB	10/29/97	1E/6S	Adult	23.0	7.6	50.0	5	2.0	25
43	Light Green-Yellow Green (LGYG)	Lower Camp	11/8/97	U26	Adult	19.2	9.1	11.0	3	1.5	0
44	Maroon-Maroon (MM)	Mikana	11/24/97	G450	Juvenile	44.9	3.9	11	1	2.0	0
45	Red-Red (RR)	Butanzi	2/8/98	H10	Adult	27.1	8.3	20.1	10	3.8	75
46	Blue-Blue (BB)	Butanzi	2/22/98	U23	Adult	25.0	8.0	9	4	2.6	50
47	Yellow Collar (YC)	CC	3/14/98	C/800	Adult	25.0	8.1	29.9	3	6.0	0

no visible injuries. Of the other four, two had slight injuries: one had slight cuts on his gums, and the other had a skin cut above his achilles' tendon. The other two cases (both of which proved fatal) concern individuals who climbed higher before the drug took effect. For these two cases, there was no intervening vegetation to cushion falls. The animals, one of which missed the net by inches, fell directly to the forest floor and died within an hour of falling. No deaths resulted from drug overdose.

Examination of DDDs, induction times, recovery times, dosage rates, and doses administered reveals high variation across age classes (table 3). Animals that fell ran an average distance of 35m within the first 1 to 2 minutes before dropping, on average, 5 minutes later.

On average, adult and sub-adult males received lower initial doses/kg of Telazol® (adult mean+SD = 20.63+2.74, n = 30; sub-adult mean+SD = 21.1+1.67, n = 5) than the desired 25mg/kg (one sample t-test: adults, t = 8.75, p < 0.0001; sub-adults, t = 5.07, p = 0.007). Juveniles on the other hand received more of the drug at darting (mean+SD = 47.1+7.01, n = 5) than was desired (one sample t-test, t = 7.05, p = 0.0021). Twenty-seven per cent of the adult males and 40% of the sub-adult males required additional doses of 25-50 mg to keep them immobilized throughout the processing period that lasted for approximately 50 min. Juveniles did not require an additional dose. When pooled data for all age classes were used, there was a significant positive relationship between weight and the overall dose ($r^2 = 0.551$, p < 0.001) required to keep an animal anesthetised throughout the processing period. Data from juveniles were too few for within-age class analysis; however, there was not such a relationship for adults ($r^2 = 0.005$, p = 0.70) or sub-adults ($r^2 = 0.346$, p = 0.30).

Overall, there was no relationship between dosage rate and DDD ($r^2 = 0.02$, p = 0.42), and dosage rate and induction time ($r^2 = 0.009$, p = 0.559). Similarly, for the 28 males that did not receive an additional dose, there was no relationship between recovery time and initial dosage rate ($r^2 = 0.002$, p = 0.821). As would be expected, there was a close relationship between induction time and DDD ($r^2 = 0.832$, p = 0.0001). There was no significant difference between initial dose and the desired dosage (t-test for matched samples, t = 0.665, P = 0.510). This underscores the fact that, when comparisons were made across age classes, there were no significant differences between DDDs and recovery time. However, there were differences in comparisons for induction time (table 4).

Although the effect of capture and marking may have persisted 1 or 2 days later, darting had no pronounced long-term effect on habituation. Animals most recently marked did not appear more frightened of people after than before marking. Only four males

Table 3. Descriptive statistics for dart-drop distances, induction time, recovery time, and doses of Telazol® administered, for male grey-cheeked mangabeys captured in the Kanyawara study area of Kibale National Park, Uganda (1996 to 1998).

Variable	Mean	Standard deviation	Median	Range (Min–Max)	n
a) All age classes					
Dart-drop distance (m)	34.6	36.8	29.5	3.5–235.0	38
Induction time (min)	5.0	6.5	4.0	1.0–41.0	37
Recovery time (hr)	5.0	6.5	4.0	1.5–6.0	33
Desired dose (mg)	197.3	46.3	206.3	72.5–275.0	40
Initial dose (mg)	173.1	21.5	175.0	150.0–225.0	40
Dosage rate (mg/kg)	24.0	9.4	20.5	15.9–51.7	30
Final dose (mg)	194.4	48.1	175.0	150.0–350.0	40
b) Adults					
Dart-drop distance (m)	38.1	41.8	31.5	3.5–235.0	28
Induction time (min)	5.7	7.6	4.0	1.0–41.0	25
Recovery time (hr)	3.0	1.1	2.7	1.5–5.0	23
Desired dose (mg)	216.2	20.1	213.8	187.5–275.0	30
Initial dose (mg)	177.5	22.1	175.0	150.0–225.0	30
Dosage rate (mg/kg)	20.7	2.4	20.1	15.9–25.6	22
Final dose (mg)	196.3	43.0	175.0	150.0–350.0	30
c) Sub-adults					
Dart-drop distance (m)	29.6	11.1	35.0	14.0–40.2	5
Induction time (min)	4.0	1.9	4.0	2.0–7.0	5
Recovery time (hr)	2.8	0.4	2.8	2.3–3.1	4
Desired dose (mg)	183.5	15.9	187.5	157.5–20.0	5
Initial dose (mg)	155.0	11.2	150.0	150.0–18.0	5
Dosage rate (mg/kg)	21.2	2.3	20.0	19.8–23.8	3
Final dose (mg)	196.3	43.0	181.3	150.0–350.0	30
d) Juveniles					
Dart-drop distance (m)	18.3	13.6	13.0	7.0–44.0	6
Induction time (min)	1.6	0.9	1.0	1.0–3.0	5
Recovery time (hr)	2.8	1.6	2.1	1.5–6.0	6
Desired dose (mg)	90.0	20.9	85.0	72.5–122.5	5
Initial dose (mg)	165.0	13.7	175.0	150.0–175.0	5
Dosage rate (mg/kg)	47.1	7.0	51.5	35.7–51.7	5
Final dose (mg)	200.0	84.8	175.0	150.0–350.0	5

left the groups shortly after release. Three of these four cases were males that had recently immigrated into the groups, and were probably not fully habituated (see Discussion). The other case was of a juvenile male. In a majority of cases, recovering animals were unable to keep up with the movement by the group on the day of capture. Nevertheless, animals that temporarily stayed out of groups were seen in the van of the group by the end of the following day. Recently released or returning animals were not charged by the other group members.

Individual Recognition and Radio-tracking

Attempts to find naturally occurring features that could be used to distinguish individuals and groups were frustrating. Of the 39 individuals captured and in the seven groups (mean group size = 14.8 individuals) that were intensively monitored, the following features identified individuals fairly reliably: lameness of the

body as identified by a U-shaped deformity of the spine (one adult female), a distinct adult male long distance call (the whoopgobble, two adult males), rhino horn-like outgrowth of tissue above the nose (one sub-adult male), a missing eye (one adult male) or a torn ear, visible at only close range from the immobilized animal (five males). Shaving of rings in the hair on the tail was temporary, but useful, until the hair re-grew within 6 months.

When radio-tagged animals were in sight, the transmitter housing was usually the first part of the radio-collar seen. Animals were most easily identified when the colors of the transmitter housing and the collar represented a unique combination. Color-coded patches sewn on collars were usually covered by hair. It was therefore much more difficult to distinguish individuals on the basis of the color patch.

Overall, there was good success at finding radio-tagged individuals. With the exception of two cases in

Table 4. Results of Kruskal-Wallis tests on age class differences in dart-drop distances, induction time, and recovery time for male grey-cheeked mangabeys captured in the Kanyawara study area of Kibale National Park, Uganda (1996 to 1998).

Variable	H Statistic	P value	n adult	n sub-adult	n juvenile
Dart-drop distance (m)	2.11	0.349	28	5	5
Induction time (min)	6.85	0.033	28	5	4
Recovery time (hr)	1.157	0.5606	23	6	4

which radios failed within 24 hours of release of the animal, and in instances where receivers drifted frequencies, we could locate every male using signals emanating from his radio. The in-built timer that operated the transmitter every 12 hours shifted the “turn-on” and “turn-off” time in two cases, but we were able to locate the animals at other times when the transmitter was emitting signals. Signal direction was most ambiguous when animals were in a valley, or in terrain with steep slopes. Such ambiguity was solved by radio-tracking from high elevation routes, until the direction of signal source became certain. Typically, signals were received 0.3–1.2 km from the individual. However, from TELSTA, we could pick up signals from individuals that were more than 3 km away.

Discussion

Capturing and Marking

The reasons some individuals failed to fall after darting are not clear. Possibilities include differences in vascularity of the injection site and the animal's degree of fat cover (Schobert, 1987), whether or not the drug was fully injected into the animal, and differences in resistance of individual animals to Telazol®. Examination of recovered darts suggested that the drug had been fully expelled in all occasions when the target individuals did not fall. Therefore, partial injection could have resulted from injection of the drug into the air if the dart bounced off the animal prematurely or if the hit was “glancing”. When the animals were recaptured (hours or days later), examination of previous sites of injection suggested that five animals had received solid hits, while one whose tail was lacerated by the dart, had received a glancing hit. One exceptional case that suggested drug resistance was that of adult FTF-4. Having resisted the first dose by holding on to a tree branch until he recovered fully, he took a record time of 41 minutes to fall following a second higher dose delivered 6 days later. During these 41 minutes, he traveled 245m before finally succumbing to the drug.

If the target animal traveled far following the shot, it was more difficult to keep it within view and therefore catch it in the net when judged necessary. The significance in the relationship between induction time and DDD suggests that a low induction time was desirable to keep the animal in view. However,

induction time may be difficult to control since it is likely determined by a variety of factors including dosage rate, site of injection, individual drug resistance, and proximity of observers to the animal. Minimal induction time was achieved when the animal was injected in the muscle blocks of the thigh and rump. DDDs, on the other hand, can be reduced by darting individuals that are not far from the group, by minimizing noise of observers, and by not following the darted individual closely.

There was no relationship between dosage rate and DDD, induction time, and recovery time. It is conceivable that lack of relationships might be because of the poor representation of juveniles and sub-adult males in the sample. However, while there are no concrete data on this, it appeared that factors other than dosage rate might have determined how far animals traveled before falling, how long they took to fall, and how long they remained under anaesthesia. For instance, the distance of the majority of group members from the darted animal, and the behavior of human observers following the animal at the time of darting appeared to determine how far the darted animal traveled. Large differences in variation of induction time across age classes occurred because juveniles fell within a very short time. This is probably because they received a high dose/kg of Telazol®.

One of the advantages suggested for Telazol is dose-related anaesthesia (Eads, 1976). This was not demonstrated here due to lack of correlation between recovery time and dosage rate. Since there was no significant difference between initial dosage and desired dosage, taking into account the actual weight of the animal, such lack of correlation could have been caused by any of the following factors: 1) errors in judgment of when the captured animal was “ready to go”; 2) profound differences in metabolic rate among individuals; and 3) at least some occurrence of partial injection.

Eads (1976) and Schobert (1987) list several advantages of the use of Telazol® as an immobilization/ anesthetic agent in exotic species. Among those suggested are small-volume dose requirements (500 mg can be solubilised in as little as 1 cc of water), ease of preparation of solutions, rapid induction, excellent muscular relaxation at higher doses, a wide safety margin, and an unremarkable recovery. These advantages were all apparent during this exercise. Good

muscle relaxation appears to be a particularly useful quality for arboreal primates. Workers darting other primates (Jones & Bush, 1988; Glander *et al.*, 1991) attribute certain cases of failure to fall by injected animals to the poor muscle relaxation quality when they employed Ketamine HCl as the anesthetic (Glander, Jones, pers. comm.).

It was desirable to load the dart with doses that could be suitable for any of the target males as it was not known which one would present the first darting opportunity. As a result, the first dose administered was frequently higher for smaller animals, lower for the bigger males. This necessitated administration of a top-up dose in adult males, resulting in a significant relationship between dose and weight. Nevertheless, no animals died as a result of suspected drug overdose. Although efforts were made to minimize dosage, some animals received more than the desired dosage of 25mg/kg. For instance, juveniles received an average dose one and a half times higher than the desired dosage, but none of them died as a result. In fact, juveniles slept for a shorter time than adults or sub-adults. This underlines the fact that Telazol® has a wide safety margin.

Recovery time, which partially determines how many animals can be captured in any single day, may have been affected by differences in metabolic rates of individual animals (which were presumably not the same), as well as by errors in judgment by observers as to when the animal was ready for release. I am not aware of any way to reduce recovery time once the drug has been injected because Telazol® has no specific antagonist or reversal agent. Even Doxapram hydrochloride (Dopram), which is regarded as effective for increasing respiratory rates and shortening arousal time, may not lessen the time of recovery to walking or climbing (Schobert, 1987). In view of the fact that animals took a long time to recover, the above advantages should be weighed against this disadvantage before use of the drug is considered.

It has been suggested that a prominent feature of Telazol® anaesthesia is that the patient's eyes are usually open even during profound surgical anaesthesia and that adverse side reactions such as increased salivation, respiratory depression, prolonged recovery, and emesis can arise from use of Telazol® (Eads, 1976). In this exercise, none of the immobilized animals' eyes remained open. Slight salivation was observed in only two out of the 41 cases. Other side effects were not observed.

The two mortalities arising from darting were of animals captured in K30 that died from falls. Unlike the forest areas in compartments 14 and 15 (K14 & 15) of the study area that had a number of low trees and denser ground cover, K30 consisted predominantly of high trees and relatively sparse ground cover. These conditions made darting more hazardous in K30 than in the other two compartments. Whether in K14, 15,

or K30, canopy cover was dense all year round precluding clear sight of the falling animal from directly below and making it difficult to catch falling animals in the net. This is consistent with Jones & Bush (1988) who captured red-tail monkeys *Cercopithecus ascanius* at the same site. These results differ from findings in highly seasonal habitat where shedding of leaves by trees and shrubs during the dry season provides good visibility (Agoramoorthy & Rudran, 1994). In view of the fact that the success of catching falling animals was lowered by habitat conditions, it is recommended that animals are darted in situations that minimize drop height, such as when the group is in low trees, and where the forest and substrate type are likely to help break the fall of the immobilized animals. One of the advantages of presence of intervening vegetation in the path of the falling animal is that the animal falls in gentle stages (Sale & Andau, 1995). This advantage can be augmented by use of large nets, but it should be realized that such nets are more difficult to set up quickly under dense forest conditions.

In general, well-habituated animals were not dishabituated by darting (Phillips-Conroy & Jolly, 1993; but see Karesh *et al.*, 1998 for an exception) despite the fact that some individuals in the group occasionally saw the captured individuals retrieved and transferred to the processing site. The same has been observed in red-tail monkeys (Jones & Bush, 1988) and reinforces the suggestion that risk of dishabituation of the group should not be a major concern, provided the groups are already well habituated. The Pneu-Dart 176B rifle used makes loud pops, and is therefore a potential cause for dishabituation. However, this was minimized when the human observers maintained silence and minimized movement within the first 2 minutes of firing the gun. Captured individuals may, however, become dishabituated if they are not handled properly. For instance, if the animal fails to climb after release and comes down to the forest floor, attempts to catch him and put him back in the bag can dishabituate him. In such cases, animals were best left alone until they regained their strength. It should also be noted that capturing newly immigrated, unhabituated animals can cause them to leave the group.

Individual Recognition and Radio-tracking

This study, like other mangabey studies (Waser, 1974; Wallis, 1978; Freeland, 1979), found that facial features, pelage features, and vocal features can be used only rarely to identify individual mangabeys. Unlike those studies that reported presence of animals with stiff fingers, broken tails and "truncated" tails, I found none of these features in my sample of "41" males, suggesting that even these features may be rare. Another feature used by previous workers for mangabeys is the color and size of nipples in adult females. It was possible to use this feature for only a handful of females.

Availability of a high point suitable for radio-telemetry solved problems of locating individuals most of the time, but not all the time. Success of locating radio-collared individuals would have been lowered by field factors determining the range of telemetric signals. These may include height of the animal above the ground, elevation of the animal above the general terrain, the type of vegetation, and the soil type (Mech, 1983:36) which determine the level of signal degradation and scatter. Sometimes, animals were not found even when the approximate direction of location of the individual was known. In one extreme situation, one of the study groups ranging in the unlogged habitat was not located in a week of intensive searching even when signals from TELSTA suggested a general direction where the monkeys were located. In this case, signals were lost as one descended from TELSTA. However, fainter signals were received from the tops of two lower hills situated along the known direction, but the direction of signals received suggested that the monkeys were in the area that had already been searched intensively. Monkeys were only re-contacted when they returned to the known home range.

Difficulties in finding animals due to signal loss and signal reflection were confounded by drifts and overlaps of frequencies from different transmitters with the LA 12 receivers. In the absence of the digital receivers, frequency drifts resulted in temporary loss of contact with certain animals due to overlap of frequencies emanating from different transmitters. The digital ATS R2100 receiver did not drift frequencies of reception, but is heavier than the analog receivers. Neither type of receiver is, however, designed specifically for use under moist tropical forest conditions. Although we made every effort to ensure that the receivers stayed dry, it was not always possible to keep them completely dry. Despite caution against wetting by receiver manufacturers, I was impressed by the fact that both types of receiver survived some of the wettest El Niño months [up to 300 mm, c.f. monthly mean of < 200 mm (Struhsaker, 1997)] in Kibale, with only a few failures arising from moisture.

Conclusions

1. Mangabeys had few natural distinguishing features, and application of artificial marks appears to be the first pre-requisite to behavioral study of a large sample of individuals in the wild.

2. Darting and radio-tagging are feasible and are valuable capturing and marking techniques. However, darting in tall mature forest, or in the vicinity of tall trees, can be risky.

3. Mortality risk due to overdose with Telazol[®] was

not a problem in this exercise. Mortality risk was mainly a function of drop height and can best be reduced by darting in conditions that minimize drop height and ensure a soft landing on the substrate.

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References

- Agoramoorthy, G. & R. Rudran. 1994. Field application of Telazol (Tiletamine Hydrochloride and Zolazepam Hydrochloride) to immobilize wild red howler monkeys (*Alouatta seniculus*) in Venezuela. *Journal of Wildlife Diseases* 30: 417–420.
- Brander, R.B. & W.W. Cochran. 1969. Radio-location telemetry. In *Wildlife Management Techniques*. R.H. Giles Jr. & L. Toschik, eds. Washington D.C. The Wildlife Society. Pp. 95–103.
- Campbell, A.F. & R.W. Sussman. 1994. The value of Radio tracking in the study of Neotropical rain forest monkeys. *American Journal of Primatology* 32: 291–301.
- Chapman, C.A., S.R. Balcomb, T.R. Gillespie, J.P. Skorupa, & T.T. Struhsaker. 2000. Long-term effects of logging on African primate communities: A 28 year comparison from Kibale National Park, Uganda. *Conservation Biology* 14: 207–217.
- de Ruiter, J.R. 1992. Capturing long-tailed macaques (*Macaca fascicularis*). *Folia Primatologica* 59: 89–104.
- Eads, E.F. 1976. Telazol[™] (CI-744): A new agent for chemical restraint and anesthesia in nonhuman

- primates. *Veterinary Medical/Small Animal Clinician* 71: 648–652.
- Freeland, W. J. 1979. Mangabey (*Cercocebus albigena*) social organization and population density in relation to food use and availability. *Folia Primatologica* 32: 108–124.
- Glander, K.E., L.M. Fedigan, L. Fedigan & C. Chapman. 1991. Field methods for capture and measurement of three monkey species in Costa Rica. *Folia Primatologica* 57: 70–82.
- Jones, W.T. & B.B. Bush. 1988. Darting and marking techniques for an arboreal forest monkey, *Cercopithecus ascanius*. *American Journal of Primatology* 14: 83–89.
- Karesh, W.B., R.B. Wallace, R.L.E. Painter, D. Rumiz, W.E. Braselton, E.S. Dierenfeld & H. Puche. 1998. Immobilization and health assessment of free-ranging black spider monkeys (*Ateles paniscus chamek*). *American Journal of Primatology* 44: 107–123.
- Kasenene, J.M. 1987. The influence of mechanized selective logging, felling intensity and gap-size on the regeneration of a tropical moist forest in the Kibale Forest Reserve, Uganda. Ph.D. Thesis. Michigan State University.
- Mech, D.L. 1983. *Handbook of Animal Radio-tracking*. University of Minnesota Press, Minneapolis.
- National Research Council. 1981. *Techniques for the Study of Primate Population Ecology*. National Academy Press, Washington, DC. Pp. 110–117.
- Oates, J.F. 1974. The ecology and behavior of the black-and-white colobus monkey (*Colobus guereza* Rüpell) in East Africa. Ph.D. Thesis. London, University of London.
- Olupot, W., C.A. Chapman, C.H. Brown & P.M. Waser. 1994. Mangabey (*Cercocebus albigena*) population density, group size and ranging: A twenty-year comparison. *American Journal of Primatology* 32: 194–205.
- Olupot, W., C. A. Chapman, P.M. Waser, & G. Isabirye-Basuta. 1997. Mangabey (*Cercocebus albigena*) ranging patterns in relation to fruit availability and the risk of parasite infection in Kibale National Park, Uganda. *American Journal of Primatology* 43: 65–78.
- Phillips-Conroy, J.E. & C.J. Jolly. 1993. The use of capture in field primatology. *American Journal of Primatology* 16 (Suppl.) 158.
- Ron, T. & S. Whitehead. 1993. A key for identifying individual female baboons under poor visibility conditions. *Folia Primatologica* 60: 176–180.
- Sale, J.B. & P.M. Andau. 1995. The capture and translocation of orang-utans in Sabah, Malaysia. *Re-introduction News* 10: 12–14.
- Sapolsky, R.M & L.J. Share. 1998. Darting terrestrial primates in the wild: A primer. *American Journal of Primatology* 44: 155–167.
- Schobert, E. 1987. Telazol® use in wild and exotic animals. *Veterinary Medicine*: 1080–1088.
- Scott, N.J., A.F. Scott & L.A. Malmgren. 1976. Capturing and marking howler monkeys for field behavioral studies. *Primates* 17: 527–533.
- Skorupa, J.P. 1988. The effect of selective timber harvesting on rain-forest primates in Kibale Forest, Uganda. Ph.D. Thesis. University of California, Davis.
- Struhsaker, T.T. 1975. *The Red Colobus Monkey*. University of Chicago Press, Chicago.
- Struhsaker, T.T. 1997. *Ecology of an African Rainforest*. University Press of Florida, Gainesville. Pp. 16–40.
- Taber, R.D. & McT. Cowan. 1969. Capturing and marking wild animals. In *Wildlife Management Techniques*. R.H. Giles Jr. & L. Toschik, eds., The Wildlife Society, Washington, D.C. Pp 277–318.
- Wallis, S. J. 1978. The Sociology of *Cercocebus albigena johnstoni* (Lydekker): An arboreal, rainforest monkey. Ph.D. Thesis. University of London.
- Waser, P. M. 1974. Intergroup interaction in a forest monkey: The mangabey *Cercocebus albigena*. Unpublished Ph.D. Thesis. The Rockefeller University, New York.
- Waser, P.M & O. Floody, 1974. Ranging patterns of the mangabey *Cercocebus albigena* in the Kibale Forest, Uganda. *Zeitschrift fuer Tierpsychologie* 35: 85–101.

SURVEY OF THE ANGOLAN BLACK-AND-WHITE COLOBUS MONKEY *COLOBUS ANGOLENSIS PALLIATUS* IN THE DIANI FORESTS, KENYA

Abstract: A subspecies of Angolan black-and-white colobus monkey *Colobus angolensis palliatus* inhabits the coastal forests of southern Kenya and the Eastern Arc Forests of Tanzania. A survey was conducted in the Diani forests, Kenya, to determine the distribution and population size of *C. a. palliatus*, and the effects of deforestation on the population. A total of 165 *C. a. palliatus* was counted. Average group size was 6.5 animals. Age and sex ratios were: adult males : adult females = 1:2.2; adult females : young = 1:1.2; adult males : young = 1:2.5. Density was about 14 animals/km² and biomass was 94 kg/km². Sixty-two percent of

the groups inhabited forest patches in hotel or residential compounds. Effective population size (N_e) was calculated to be 68.3 individuals, with an inbreeding coefficient (F) of 0.79%. The implication of these results is that the future of *C. a. palliatus* in Diani is uncertain. With decreasing habitat, continued fragmentation and isolation of forest patches, limited opportunity for immigration among groups, and small effective population size, this population may be subject to genetic and demographic problems intrinsic to its small size. There is an imminent need for the protection at Diani of this colobus subspecies. Reforestation is recommended, as is the creation of corridors among forest patches.

Résumé: Une sous-espèce de colobe angolais noir-et-blanc *Colobus angolensis palliatus* habite les forêts côtières du sud du Kenya et les forêts de l'Arc Oriental de la Tanzanie. Une étude a été menée dans les forêts de Diani afin de déterminer la distribution et la taille des populations de *C. a. palliatus* de même que les effets de la déforestation sur la population. En tout, 165 *C. a. palliatus* ont été dénombrés. La taille moyenne du groupe était de 6.5 individus. L'âge et le ratio mâle/femelle ont été évalués comme suit : mâles adultes : femelles adultes = 1 : 2 ; femelles adultes : enfants = 1 : 1 ; mâles adultes : enfants = 1 : 2. La densité de population s'est élevée approximativement à 14 individus/km² et la biomasse à 94 kg/km². Soixante-deux pour cent des groupes habitaient les îlots forestiers au sein des zones hôtelières et résidentielles. La taille de la population active (N) a été estimée à 68.3 individus pour un coefficient de consanguinité (F) de 0.79%. De tels résultats impliquent que l'avenir de *C. a. palliatus* à Diani est incertain. Avec un habitat qui rétrécit, une fragmentation et une isolation continues des îlots forestiers, une immigration limitée entre les groupes et une petite taille de la population active, cette population pourrait être sujette à des problèmes démographiques et génétiques intrinsèques à leur petite taille. Le besoin de protéger cette sous-espèce de colobe à Diani est imminent.

Introduction

Habitat destruction is ranked as the most severe threat to primate species (Butynski, 1997). The creation of patchy habitats leads to the isolation of populations. Species occupying these fragmented habitats are more at risk from catastrophic events. There are eight subspecies of Angolan black-and-white colobus *Colobus angolensis* (Kingdon, 1997). *C. a. palliatus* is found in the forests of Kenya's south coast, and at many sites in Tanzania, including the Usambara, Uluguru, Udzungwa and Mahale Mountains in Tanzania. In Kenya, most *C. a. palliatus* live in privately owned forest patches. Shimba Hills National Reserve is the only protected area in Kenya where *C. a. palliatus* is present. This Reserve covers an

area of 217 km² of which only 95 km² are forested (Bennun & Njoroge, 1999).

Moreno-Black and Maples (1977) conducted the first study of the Diani colobus population in 1973. Since then, the structure of the forest in Diani has changed dramatically. A growing human population and consequent clearing and degradation of the forest threaten the survival of the colobus and other species in Diani. Over 75% of the forest cover in Diani has been lost along with several mammal species such as leopard *Panthera pardus*, lion *Panthera leo*, and elephant *Loxodonta africana* (Moreno-Black & Maples, 1977; Kahumbu, 1997). Deforestation is not the only threat facing the fauna of Diani forests. In 1971 a 10-km road was constructed through the center of the Diani forests. Numerous primates and other animals have been killed or injured while attempting to cross this busy road (Kahumbu, 1997).

Moreno-Black and Maples (1977) conducted a 6-month study of five groups of *C. a. palliatus* in Diani nearly 30 years ago, counted 26 individuals, and found a density of 93 animals/km². Kahumbu (1997) conducted a 1-month survey, counted 234 individuals in 39 groups, and found a density of 24 animals/km². Apart from these two studies, no other research has been conducted on *C. a. palliatus* in Kenya. Due to the rapid decline in the forested area of Diani, it was important that the remaining forests be surveyed. A census and survey of the forests sustaining this *C. a. palliatus* population are the first steps in preserving and managing this increasingly rare subspecies in Kenya.

This paper documents a total count of *C. a. palliatus* inhabiting the private Diani forests and the demography of some groups. The effective population size (N_e) and inbreeding coefficient (F) for the Diani *C. a. palliatus* as a metapopulation are presented.

Study Site

Diani is located on the south coast of Kenya, approximately 30 km south of Mombasa. *C. a. palliatus* inhabit the coral rag lowland forests of Diani and the surrounding kaya forests (kaya forests are sacred communal forests where the local people perform traditional rituals). The census covered forest patches characterized by open canopy with scrubby undergrowth. There are a total of 19 hotels along this strip of approximately 12 km in Diani. The forest patches here are separated by cleared and developed land. The estimated area of the censused forests is 12 km². The five main tree species in these forests are *Combretum schumannii*, *Sterculia appendiculata*, *Corpidoptera africana*, *Trichilia emetica* and *Commiphora zanzibarica*. Other larger mammals in these forest patches include: Sykes's monkeys *Cercopithecus albogularis*, vervet monkeys *Cercopithecus aethiops*, yellow baboons *Papio*

cynocephalus, greater galagoes *Galago garnetti*, senegal galagoes *Galago senegalensis*, bush pigs *Potamochoerus porcus*, sunis *Neotragus moschatus*, red-bellied coast squirrels *Paraxerus palliatus*, and bush squirrels *Paraxerus ochraceus*.

Rainfall is bimodal, with a range of 76–102 mm per year. Long rains occur from April through June, and the short rains from October through November (Moreno-Black & Maples, 1977). Human disturbance included the construction of water mains and power lines through the forests in 1969–1970, and the construction of a 10 km paved road in 1971–1972 (Moreno-Black & Maples, 1977). Trash dumping sites are common throughout the forests. Hunting of animals is not a major threat in Diani forests.

Methodology

A total count of the *C. a. palliatus* population in Diani forests was conducted over 5 weeks from May to June 1997. More than 152 hours were spent in the field, of which 88.2% were observation hours.

Twenty-eight forests were traversed in search of *C. a. palliatus* groups. Most of the censused area covered forests on privately owned land where hotels, restaurants and homes were located. The forests ranged in size from 0.5–2 ha. No attempt was made to measure the size of each forest. The forests were ranked in terms of continuity of the tree canopy, tree height, and proximity to a hotel or a home. Forests were ranked from 1–3; where rank 1 was given to forests over 1.5 ha., with a continuous canopy, tall trees and healthy undergrowth. Rank 2 forests were less than 1.5 ha. with low trees, and were within a hotel or a residential compound. Rank 3 forests had no canopy, and were comprised of bush with dense entangled undergrowth, and may or may not have been within a hotel or residential compound.

Census walks usually followed roads and trails within the forest. Two observers, following each other at about 10 m apart, traversed the forests systematically in north-south or east-west directions, walking at a speed of about 1 km/h, listening and watching for *C. a. palliatus*. Although groups of primates were often heard before being seen, the presence of a troop was always verified visually. When a group was encountered, the observers stood still and all members of the group were counted, aged, and sexed. Individual primates in each group were categorized as juveniles, sub-adults and adults. Adults were individuals with full body size and fully developed black and white pelage. Sub-adults were smaller in size than adults, with fewer white hairs on the face and were independent of their mothers. Juveniles stayed close to their mothers and were smaller in size and covered by white curly hair (Dorst & Dandelot, 1970). Notes on the specific location, food items collected, general behavior, forest condition, presence of other primates

and mammals were recorded.

Effective population size (N_e) was determined using the equation:

$$N_e = \frac{4N_m N_f}{N_m + N_f}$$

Where N_m = the number of adult males.

N_f = the number of adult females.

This equation assumes a closed population, random mating, discrete generations, and that all adult males and adult females may reproduce (Falconer, 1982).

The rate of inbreeding was determined using the inbreeding coefficient (F) and the equation:

$$F = \frac{1}{2N_e}$$

Where N_e = the effective population size.

This equation assumes random mating, and no mutation, selection, or migration (Falconer, 1982).

Results and Discussion

A total of 165 *C. a. palliatus* was counted in 25 groups. Three lone males were located. Of the 165 individuals, 15% were adult males, 33% were adult females, 20% were sub-adults, 13% were juveniles, 5% were infants, and 14% were unidentified. The ratio of adult males to adult females was 1:2.2; adult females to young was 1:1.2; adult males to young was 1:2.5. Average group size was 6.5 ± 2.8 , with a range of 3–11 individuals (figure 1).

The effective population size (N_e) was 68.3 individuals, which is 41% of the metapopulation of 165. The maximum possible N_e for the Diani metapopulation is 108. Thus, the actual N_e lies in the range of 68–108 individuals. Inbreeding coefficient (F) was 0.73%. The minimum rate of inbreeding possible for the Diani *C. a. palliatus* is 0.46%. Thus, the present inbreeding coefficient lies in the range of 0.46–0.73%.

Of the 28 forests surveyed, 10 were ranked 1, 15 were ranked 2 and three were ranked 3. Thirty-three percent of *C. a. palliatus* inhabited forests in rank 1, 62% were found in forests of rank 2, and 5% inhabited forests in rank 3.

The density of *C. a. palliatus* in Diani was 13.8 animals/km². Biomass estimates are based on an average weight for an adult male of 12 kg, 7.5 kg for an adult female, and 5 kg for a sub-adult (Eley, 1989). A weight of 8.2 kg was assigned to each of the 24 individuals that was not aged. Juveniles and infants were assumed to weigh an average of 2 kg. Based on a censused area of 12 km², biomass is estimated to be 94 kg/km².

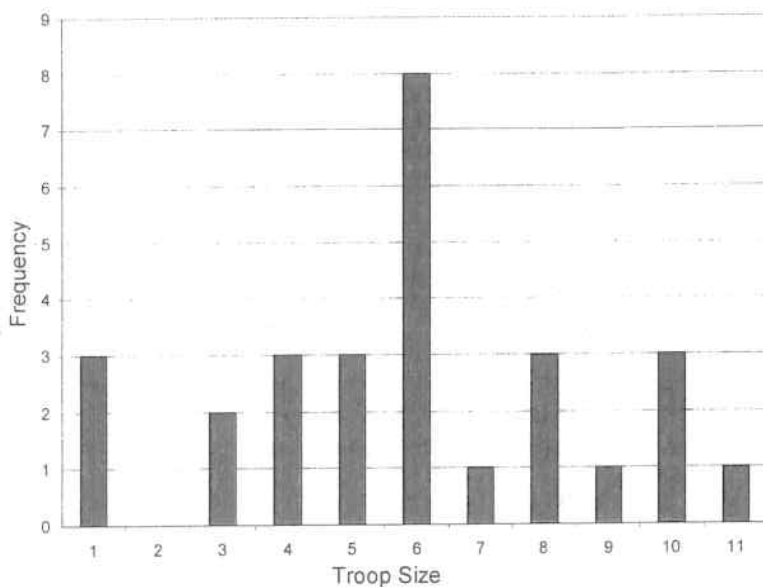


Figure 1. Frequency distribution of *Colobus angolensis palliatus* troop sizes in Diani forests, Kenya (1997) ($n=28$).

Although the present census surveyed a greater area of forest and encountered groups not included in the 1996 census, fewer *C. a. palliatus* were counted. It is doubtful that the *C. a. palliatus* population decreased dramatically in the 6 months between the two censuses. Both censuses found an average group size of approximately six colobus. The difference in total population count likely arises from double counting of groups by volunteers in the first census (Kahumbu, 1997). There is also the possibility that the present study may have missed one or two groups. Taking these factors into consideration, the estimated current population of the Diani colobus is between 165 and 195 individuals. This figure is arrived at by taking the average of the previous survey (Kahumbu, 1997) and the present survey with some allowance for field technicalities.

Effects of Deforestation

Unlike guereza *Colobus guereza*, *C. angolensis* do not favor areas of secondary and regenerating forests (Groves, 1973; Moreno-Black & Maples, 1977; Dunbar, 1987; Thomas, 1991). Thus, loss of primary forest affects *C. angolensis*. Habitat loss and degradation are the primary threats affecting the *C. a. palliatus* population in Diani, considering that 80% of forest cover was lost within the period 1977–1989 (Kahumbu, 1997). More than half of the censused population (67%) inhabited small forest patches without canopy trees within areas of human activity. These facts have several implications for the future of *C. a. palliatus* in Diani forests.

The effective population size and inbreeding coefficient give indications as to the severity of inbreeding within the Diani metapopulation. Effective population size (N_e) is 68.3 individuals, which is only 27% greater than the minimum of 50 required to avoid a long-term

loss of genetic diversity and negative inbreeding effects (Falconer, 1982). Similarly, the inbreeding coefficient (F) of 0.79% signifies high inbreeding. Inbreeding coefficients greater than 1% indicate a short-term loss of genetic diversity and an increase in inbreeding (Falconer, 1982). The values for both N_e and F in Diani *C. a. palliatus* are close to the minimum required to avoid the negative effects of a decrease in genetic diversity and increase in inbreeding. If deforestation continues at the present rate in Diani, effective population size will decrease and inbreeding will increase. The risks from catastrophic events to the Diani *C. a. palliatus* metapopulation due to low effective population and high

inbreeding will be greatly increased.

Inbreeding depression and lack of resources are not the only threats to *C. a. palliatus* as a result of deforestation in Diani. *C. a. palliatus* and other primates have a high risk of death from vehicles as they attempt to cross the Diani highway. At the beginning of 1997, 17 *C. a. palliatus* were killed by vehicles in less than 3 months. “Colobus bridges” were erected in 1997 to encourage *C. a. palliatus* and other primates to cross over the busy road (Kahumbu, 1997). *C. a. palliatus* occasionally use these bridges while *C. albogularis* and *C. aethiops* frequently use them. Uncoated electrical wires run through the Diani forests. These wires are a threat to all primates in this area. During the study period, one male *C. a. palliatus* was killed by electrocution. One *C. a. palliatus* troop has a female with a clubbed hand because of electrocution, and other primates have physical defects due to the same. Diani forests are not the only areas along Kenya’s south coast where habitat loss is threatening *C. a. palliatus*. Populations in other forests also are threatened by wood poaching, encroachment, clearance for cultivation and subdivision (Robertson & Luke, 1993), and dumping of rubbish.

Conclusion

The establishment of corridors among forest patches is one way to increase immigration opportunities among groups and to reduce inbreeding depression. Trees utilized by *C. a. palliatus* for feeding, traveling, and resting need to be planted in Diani. These would connect the currently isolated forests, allowing for immigration between groups and the expansion of group ranges. Troops in small poor forest patches might be translocated

to better patches or even other forests. Careful monitoring, and active public participation and cooperation are needed to ensure the survival of this black and white colobus subspecies in the private forests of Diani.

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References

- Bennun, L. & P. Njoroge. 1999. *Important Bird Areas in Kenya (IBA)*. East African Natural History Society, Nairobi.
- Butynski, T.M. 1997. African Primate Conservation—The IUCN/SSC Primate Specialist Group Network. *Primate Conservation* 17: 87–100.
- Dunbar, R.I.M. 1987. Habitat quality, population dynamics and group composition in colobus monkeys *Colobus guereza*. *International Journal of Primatology* 8: 299–329.
- Eley, R. 1989. *Know Your Monkeys. A Guide to the Primates of Kenya*. Institute of Primate Research, National Museums of Kenya, Nairobi.
- Falconer, D. 1982. *Introduction to Quantitative Genetics*. (2nd Ed). Longman, London.
- Groves, C.P. 1973. Notes on ecology and behavior of Angolan colobus *Colobus angolensis* in northeast Tanzania. *Folia Primatologia* 20: 12–26.
- Kahumbu, P. 1997. Diani colobus census. Unpublished Report to Wakuluzu Friends of the Colobus Trust, Diani.
- Kingdon, J. 1997. *The Kingdon Field Guide to African Mammals*. Academic Press, London.
- Kingston, T.J. 1971. Notes on the black-and-white colobus monkeys in Kenya. *East African Wildlife Journal* 9: 172–175.
- Moreno-Black, G. & Maples, R.W. 1977. Differential habitat utilization of four Cercopithecidae in a Kenyan forest. *Folia Primatologia* 27: 85–107.
- Oates, J.F. 1977. The guereza and man: How man has affected the distribution and abundance of *C. guereza* and other black-and-white colobus monkeys. In H.S.H. Prince Rainier III of Monaco & G.H. Bourne, eds. *Primate Conservation*. Academic Press, New York. Pp. 420–467.
- Robertson, S.A. & W.R.Q. Luke. 1993. Kenya coastal forests. The report of the NMK/WWF Coastal Forest Survey. WWF Project 3256: Kenya coast forest status, conservation and management.
- Thomas, S.C. 1991. Population densities and patterns of habitat use among anthropoid primates of the Ituri Forest, Zaire. *Biotropica* 23: 68–83.
- Von Hippel, F.A. 1996. Interaction between overlapping multi-male groups of black-and-white colobus monkeys *Colobus guereza* in Kakamega Forest, Kenya. *American Journal of Primatology* 38: 193–209.

ANTI-PREDATOR BEHAVIOR OF MALE HAMADRYAS BABOONS PAPIO HAMADRYAS IN ERITREA

Abstract: During a 5-month survey of hamadryas baboons *Papio hamadryas* in central and eastern Eritrea, we observed several incidents in which baboons interacted with people or dogs. People and dogs represent the main threat to baboons, as most natural predators have been extirpated during past decades, and because people and baboons live in close proximity. Subadult and adult bachelor males engaged in predator defense of the group and that they also were the first to enter into dangerous areas. Our observations are consistent with those on hamadryas baboons in Ethiopia, but are in contrast to those on Ethiopian olive baboons *Papio anubis*.

Résumé : Lors d'une étude de 5 mois sur les babouins hamadryas *Papio hamadryas* au centre et à l'est de l'Érythrée, nous avons observé plusieurs incidents où les babouins ont interagi avec des gens ou des chiens. Les gens et les chiens représentent la principale menace pour les babouins parce que les prédateurs naturels y ont été extirpés depuis plusieurs décennies et aussi parce que les gens et les babouins vivent en étroite proximité.

Les mâles adolescents et adultes solitaires ont adopté un comportement de défense anti-prédateur et ils sont les premiers à pénétrer les zones à risques. Nos observations sont compatibles avec celles faites sur les babouins hamadryas en Éthiopie quoiqu'ils contrastent avec celles faites sur les babouins olives d'Éthiopie, Papio anubis.

Introduction

In central and eastern Eritrea, hamadryas baboons *Papio hamadryas* have lived in close association with humans for centuries. Because most of the natural predators of baboons, like lions *Panthera leo* and leopards *Panthera pardus*, have been eradicated or greatly reduced in number by humans, people and their dogs have become the most frequent threat to, and predators of, hamadryas baboons. During our survey on hamadryas baboons in Eritrea (Zinner *et al.*, 2000, Zinner *et al.*, in press), we had the chance to observe several interactions between people, dogs and baboons. Because these baboons live in a heavily degraded environment, which is strongly influenced by human activities, most cases of anti-predator behavior in this species are directed towards humans and dogs, and provide a good opportunity to study the special role of males during these encounters.

The number and role of males in primate groups have once again become topics of interest to primatologists (Kappeler, 2000). One hypothesis is that in several primate species males play an important role

as defenders of females and their offspring (Anderson, 1986; Cheney *et al.*, 1987; van Schaik & Hörstermann, 1994), but in well-studied species like savannah baboons their role as primary defenders seems to be ambiguous (Stoltz & Saayman, 1970). There is no consensus as to whether males occupy particular protective positions when moving with the group (Altmann, 1979; Rhine & Westlund, 1981). The limited information about the reaction of hamadryas baboons in the presence of predators, however, suggests a protective role for males (Sigg, 1980; Kummer, 1995; Zinner & Peláez, 1999). Because systematic studies of baboon reactions towards predators are difficult to achieve, our knowledge relies mainly on opportunistic observations. Here we report on free-ranging hamadryas baboon males in Eritrea attacking potential predators.

Methods

The main aim of our study was a survey on distribution and abundance of primates in central Eritrea. The following observations were, therefore, not part of a systematic study of anti-predator behavior of hamadryas baboons. We conducted our surveys during October–November 1997, March–April 1998, and October 1998. The survey area covered more than 25,000 km² (figure 1). We interviewed local administrators and people in villages using a questionnaire to gather information about hamadryas baboon sleeping sites, and predator and wildlife presence. The people are normally very well informed about baboons in their

neighborhood, because in most areas, baboons are recognized as a threat to crops. We visited the baboon sleeping sites and recorded their positions by using a GPS. Distances between sleeping sites or records of baboons and the nearest settlement, were calculated from 1:250,000 maps. Distances to the nearest agricultural area bigger than 5 ha were provided by our vegetation classification of Landsat MSS data (Zinner & Torkler, 1996). Results of



Figure 1. Position of hamadryas baboon *Papio hamadryas* sleeping sites and the survey area in central and eastern Eritrea (1997 and 1998).

the survey are given elsewhere (Zinner *et al.*, 2000; Zinner *et al.*, in press).

During the survey we observed several incidents when hamadryas baboons interacted with possible predators or went into potentially dangerous areas. Potential predators of hamadryas baboons in Eritrea are leopards, spotted hyenas *Crocuta crocuta* and striped hyenas *Hyaena hyaena*, ackals *Canis* spp. and Verreaux's eagles *Aquila verreauxii*. People and their dogs, however, represent the greatest danger for baboons. We defined agricultural fields as potentially dangerous areas due to the greater probability of baboons being chased and killed by people and their dogs in open fields. Observations were made from elevated points, so that most of the relevant area was in focus. Observation conditions were good because of the low vegetation and clear sunny weather. We used 8 x 40 and 10 x 24 binoculars, and a 20–60 x Leica Televit 77 spotting scope fixed on a tripod.

Results

The positions of 80 baboon sleeping sites are given in figure 1. We could determine group size at 52 sleeping sites. Mean group size was 186 baboons (range 25–800). The estimated population density in the survey area was 0.6 baboons per km². The average distance between baboon sleeping sites and the nearest settlement was 3,955 m (range 850 to 10,000 m, n = 80). The mean distance to the nearest agricultural area larger than 5 ha was 1,317 m (range 50 to 8,600 m, n = 69). Almost all baboon home ranges included agricultural areas and settlements, which demonstrates the spatial proximity between baboons and people, and the potential for severe conflicts.

Observations

1. In the late afternoons of 15 and 16 October, 1997, from a distance of 400 m, we observed a group of 80 hamadryas baboons walking towards a ripe wheat field on the central plateau of Eritrea (38°59'E, 15°25'N). Similar observations were made on both days. A sub-group of 12–15 subadult and adult males walked in front of the main group. Females, infants, juveniles and other adult males followed 30–40 m behind. A farmer and his large dog immediately started to chase the male sub-group. The main group of baboons then entered the field from the opposite side. The males of the sub-group spread out and encircled the dog. Two of them attacked the dog. The dog escaped and followed the farmer who was chasing the main baboon group, which retreated and fled from the field. The farmer ran again towards the male sub-group, which had by then entered far into the field. The male sub-group retreated a short distance, while the main group reentered the field. The baboons rapidly filled

their cheek pouches and left the field when a second man arrived. On 17 October, the farmer harvested the wheat.

2. On 31 March, 1998, we observed a group of 300 hamadryas baboons all afternoon from a steep escarpment just above their sleeping cliff (38°58'E, 15°22'N). At around 16:00 h the baboons started to move towards the sleeping cliff. Most of them traversed the slope 30 m below us. This situation was potentially dangerous for the baboons because on other days we saw people chasing them by throwing stones from above. One sub-group after another approached slowly to 25 m from us. Here they stayed 2–3 minutes before they moved on rapidly and climbed up to their sleeping cliff. As they passed us at high speed, the adult males stayed between the group and us, while some other adult males passed us very slowly. Fifteen minutes after the first sub-groups had passed, a group of four subadult and adult males approached us to 20 m. Some notified others by presenting and glanced repeatedly between us and the other members of the group. The younger males threatened us by slapping the ground with one hand and by staring with lifted eyebrows. The males also showed intense yawn-threats or bared-teeth yawning. At first, there were four males, but more males joined this group. After 15 minutes, the group consisted of 18 males and one young female with a pronounced sexual swelling. They slowly advanced towards us and frequently glanced at each other. When they were within 10 m, we retreated carefully and the baboons stayed behind.

3. On 8 October, 1998, we located a group of 100 hamadryas baboons on the south-eastern slopes of Mrara Mountain (38°53'E, 15°39'N). At around 06:00 h the next morning, the baboons left their sleeping cliff in a steep gorge 2 km outside Fichey village and walked slowly in a large semi-circle towards the nearest fields. We observed them from above, 300 m away. The fields were small (0.05 ha) and wheat had been sown a few days before. At 06:30 h, the first baboons, five adult males, went into the fields. The rest of the group was at least 50 m behind, most of them under the cover of bushes and trees. The five males immediately started to collect food items from the ground (probably wheat seeds) and moved on to other fields. After 5 minutes, the farmer detected the baboons in his fields and started to shout and gesture. He and his dog (the size of a German shepherd) hurried downhill. The dog immediately ran towards the baboons. The five males joined, rushed towards the dog and attacked. The dog escaped narrowly. In the meantime, the owner of the fields arrived, shouted and threw stones. The five males slowly followed the main group out of the agricultural area. We were able to observe a similar situation the next morning. Again, adult and subadult males were

ahead of the main group and the first to enter the fields. The farmers reported that on other occasions, dogs were severely injured or killed by the male baboons.

On two occasions we saw a group of 25 baboons resting in close proximity (<25 m) to a pair of black-backed jackals *Canis mesomelas*. The baboons did not show any fear or threat behavior. The jackals stayed within 25 m distance for about 1 h and eventually moved away.

Discussion

At almost all hamadryas baboon sites in Eritrea, people and baboons compete for agricultural products and for wild fruits like prickly pears *Opuntia* sp. One result of this competition is the threat to baboons posed by people and their dogs. On the other hand, natural predators of baboons have become rare, so that people and their dogs represent the most frequent "predator" for baboons. As hunting is illegal in Eritrea, people "just" chase the baboons and try to catch some of the young baboons with dogs. Under these circumstances, the baboons are usually able to defend themselves. Jackals and probably dogs of jackal size seem not to be a serious danger for adult hamadryas baboons.

Our observations suggest that in hamadryas baboons, sub-adult and adult males act as defenders of other group members. They take more risks when entering potentially dangerous areas like agricultural fields, and they are the only age/sex classes that attack potential predators. These males are not accompanied directly by females, and do not appear to have acquired females. Females, infants and most juveniles, but also other adult males, stay behind and are not involved in attacks on dogs. Sigg (1980) observed similar reactions of male hamadryas baboons towards potential predators, and Kummer (1995) reported that hamadryas males often position themselves between potential danger and weaker group members, thus forming a protective shield. Adult males also show defense behavior against attacking Verreaux's eagles, and are the preferred individuals when juveniles seek protection (Kummer, 1995; Zinner & Peláez, 1999). In Ethiopia, Jolly and Phillips-Conroy (1998) found taxon-specific differences between olive baboons *Papio anubis* and hamadryas baboons in the manner in which the group reacted to the trapping of a group mate. Among olive baboons, adult males responded most vigorously when an infant was trapped, less for females and juveniles, and minimally for other adult males. Among the hamadryas baboons, all trapped animals are vigorously defended by the whole group, including females and juveniles. Jolly and Phillips-Conroy (1998) explained these differences using the differing degrees of relatedness within groups. Our observations on hamadryas baboons emphasize the role of males, particularly subadult and

adult bachelor males, in defending the group against predators.

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References

- Altmann, S.A. 1979. Baboon progressions: Order or chaos? A study of one-dimensional geometry. *Animal Behaviour* 27: 46-80.
- Anderson, C.M. 1986. Predation and primate evolution. *Primates* 27: 15-39.
- Cheney, D.L. & R.W. Wrangham. 1987. Predation. In *Primate Societies*. B.B. Smuts, D.L. Cheney, R.M. Seyfarth, R.W. Wrangham & T.T. Struhsaker, eds. University of Chicago Press, Chicago. Pp. 227-239.
- Jolly, C.J. & J.E. Phillips-Conroy. 1998. Taxon-specific reactions to trapping among Ethiopian baboons. *American Journal of Physical Anthropology* Supplement 26: 29.
- Kappeler, P.M., ed. 2000. *Primate Males. Causes and Consequences of Variation in Group Composition*. Cambridge University Press, Cambridge.
- Kummer, H. 1968. *Social Organization of Hamadryas Baboons. A Field Study*. University of Chicago Press, Chicago.
- Kummer, H. 1995. *In Quest of the Sacred Baboon*. Princeton University Press, Princeton.

- Rhine, R.J. & B.J. Westlund. 1981. Adult male positioning in baboon progressions: Order or chaos revisited. *Folia Primatologica* 35: 77-116.
- Sigg, H. 1980. Differentiation of female positions in hamadryas one-male-units. *Zeitschrift für Tierpsychologie* 53: 265-302.
- Stoltz, L.P. & G.S. Saayman. 1970. Ecology and behaviour of baboons in the northern Transvaal. *Annals of the Transvaal Museum* 26: 99-143.
- van Schaik, C.P. & M. Hörstermann. 1994. Predation risk and the number of adult males in a primate group: a comparative test. *Behavioral Ecology and Sociobiology* 35: 261-272.
- Zinner, D. & F. Torkler. 1996. GIS and remote sensing techniques as tools for surveying primates. *Ecotropica* 2: 41-47.
- Zinner, D. & F. Peláez. 1999. Verreaux's eagles (*Aquila verreauxii*) as potential predators of hamadryas baboons (*Papio hamadryas hamadryas*) in Eritrea. *American Journal of Primatology* 47: 61-66.
- Zinner, D., F. Torkler & F. Peláez 2000. Primates in Eritrea—distribution and habitat. In *Isolated Vertebrate Communities in the Tropics*. G. Rheinwald, ed. Proceedings of the 4th International Symposium of Zoologisches Forschungsinstitut und Museum A. Koenig, Bonn. *Bonner Zoologische Monographien* 46: 255-264.
- Zinner, D., F. Peláez & F. Torkler. In press. Distribution and habitat associations of baboons (*Papio hamadryas*) in Central Eritrea. *International Journal of Primatology*.

**DEATH OF A CHIMPANZEE
PAN TROGLODYTES SCHWEINFURTHII IN A
TRAP IN KASOKWA FOREST RESERVE,
UGANDA**

Abstract: *Hunting for bush meat is a common practice throughout Uganda. Traps are set regularly in forest undergrowth for pigs and antelope. Although not a target species, chimpanzees Pan troglodytes schweinfurthii are at a high risk of becoming entrapped. An alarming proportion of chimpanzees do get caught and many suffer debilitating injuries. This report details the death of an adult male chimpanzee whose right hand had become caught in the jaws of a large metal trap. This event verifies the concern that wild chimpanzees are dying as a result of illegal hunting practices in Uganda. As chimpanzees are an "Endangered Species", active law enforcement and education programs need to be implemented or increased to minimize deaths and injuries.*

Résumé: *La chasse pour la viande de brousse est une pratique commune partout en Ouganda. Des collets sont installés sous le couvert forestier dans le but d'y attraper des cochons sauvages et des antilopes. Même si elle n'est pas une espèce ciblée comme telle, le chimpanzé Pan troglodytes schweinfurthii court de grands risques de s'y faire prendre. Une proportion alarmante de chimpanzés s'y coincent effectivement et plusieurs souffrent de blessures graves. Ce compte-rendu explique en détail la mort d'un chimpanzé mâle adulte dont la main droite s'est prise dans la mâchoire d'un grand piège en métal. Cet événement confirme que les chimpanzés sauvages meurent suite à des pratiques de chasse illégales en Ouganda. Comme le chimpanzé est une espèce menacée, un renforcement actif des lois et des programmes d'éducation doivent être mis en place ou accrus si l'on veut minimiser les morts et les*

Introduction

An estimated 3,000-4,000 eastern chimpanzees *Pan troglodytes schweinfurthii* remain in the tropical-high forests of Uganda (Edroma *et al.*, 1997). Major threats to these populations include habitat destruction or degradation, poaching (mostly in the form of accidental snaring), transmission of human diseases (Wallis & Lee, 1999), and political instability. Habitat destruction alone could reduce the number of chimpanzees in Ugandan forests by 65 individuals a year¹. Chimpanzees in Uganda are at a risk of population extinction as they tend to occur at low densities (Plumptre *et al.*, 1999) and they have long inter-birth intervals (Nishida *et al.*, 1990; Tutin, 1994; Wallis, 1997). In addition, the population is spread out in approximately 12 isolated forest blocks. Although chimpanzees may visit small forest fragments, there is little opportunity for natural exchange among the main forest areas (Edroma *et al.*, 1997).

The chimpanzee is classified as an "Endangered Species" (IUCN, 1996), and protected under the "Uganda Wildlife Bill, 1996" which states that hunting of a protected species is illegal. All species of vertebrate living within Uganda's forest reserves are given full protection under existing legislation and therefore no hunting is permitted (Howard, 1991). Despite this fact, hunting is common and traps² are regularly set throughout forests, including protected forests, targeting bush pigs *Potamochoerus larvatus*, red duikers *Cephalophus weynsi*, blue duikers *Philantomba monticola*, and bushbuck *Tragelaphus scriptus*. Spring snares and wire nooses are trapping methods commonly used in Uganda. A small length of wire or cord is looped and placed in a strategic position for the purpose of catching terrestrial forest quadrupeds. Steel-jaw traps are less commonly used; the victim places weight on a metal plate that springs two parallel jaws together with

great force firmly trapping the limb.

Chimpanzees are rarely deliberately hunted in Uganda, but they become accidental victims of trapping, resulting in the twisting and paralysis of digits or the loss of hands or feet. At least 20% of chimpanzees at five study sites in Uganda have debilitating injuries (table 1). Recent studies in the Budongo Forest Reserve have focused on the effects these injuries have on wild chimpanzee behaviour (Quiatt & Reynolds, 1994; Reynolds *et al.*, 1996; Stokes, 1999; Munn, in prep.). There are few recorded deaths directly related to entrapment. In Kibale National Park there has been one confirmed death from a trap wound (Wrangham, 2000a). In addition, trap injuries have been the probable cause of death for two chimpanzees in the Budongo Forest Reserve (Reynolds, 1997/1998; H. Notman, pers. comm). Death owing to entrapment directly impacts the survival rates of chimpanzees and in turn the conservation of the species.

Background

Kasokwa Forest Reserve is a small isolated patch of riverine forest in Kinyara District, western Uganda (figure 1). In September, 1999, Richard Kyamanywa, a local resident, alerted the Budongo Forest Project to a small group of chimpanzees that were living in this depleted forest patch. By February, 2000, Kyamanywa had identified a community of 12 chimpanzees. They presently occupy an area of roughly 1.4 km² (Lloyd & Mugume, 2000), although chimpanzees occasionally move between the Kasokwa Forest Reserve and the main block of Budongo Forest Reserve (V. Reynolds, pers.com). The forest patch is bordered on one side by the main road that runs from Masindi to Kinyara, and on the other sides by villages, gardens and sugar cane plantations. Rapid deforestation throughout the area in the last 4 years has caused the formation of small patches of forest such as Kasokwa. These forest islands isolate chimpanzees, making them vulnerable to local extinction through habitat destruction and poaching. Lloyd and Mugume (2000) state that they observed signs of deforestation every day while working in this forest.

They found that 50% of sub-adults and adults had missing hands or feet, or crippled limbs similar in type to the trap related injuries described by Waller and Reynolds (2001).

Description of Death

On 6 June, 2000, locals first observed 'Kigere', the alpha male chimpanzee of the Kasokwa community, dragging a large steel jaw trap (figure 2) on the fingers of his right hand. It was not until 17 June, 2000, however, that Kigere was found by Kyamanywa in the shade of thick bushes just outside of the Kasokwa Forest. He was dead with the trap still on his fingers. His right leg was missing below the knee. This was probably the result of a previous snare injury. Villagers reported seeing other chimpanzees shaking mangoes from a tree enabling Kigere to continue eating up until his death. It was also reported that he was trying to climb trees with the trap on his hand. A recent nest used by Kigere was found less than 4m from the ground.

A post-mortem examination was carried out on 18 June, 2000, by GK. The trap (40 cm in length and weighing 10 kgs) was attached across the distal metacarpals of the right hand. Based on the observations of local villagers it is believed that the trap was attached for 10 days. As a result, the right arm developed extensive gangrene, which led to over-whelming septicaemia and toxemia.³

Discussion

The incident described above indicates that chimpanzees are at risk of death from being caught in traps. In both the major study sites in Uganda (Budongo Forest Reserve and Kibale National Park) chimpanzees (not of an immigrating age or sex) disappear from the community without signs of ageing or illness. It is possible that some of these individuals die as a direct result of entrapment or subsequent infection.

Uganda has a human population growth of 3.2% (United Nations Economic Commission for Africa, 1997) and

Table 1: Percentage of chimpanzees *Pan troglodytes* with injuries known or suspected to be a result of traps, at five study sites in Uganda.

Study Site	Percentage with trap injuries	Source
Budongo (Sonso)	26.3% (Sept, 2000) *	Waller & Reynolds, 2001; J.M., pers.observ.
Kibale (Kanyawara)	27.1% (from 1988-1999) *	Wrangham, 2000a
Kibale (Kanyanchu)	21.7% (Oct, 2000) **	J. Lloyd, pers.comm
Kalinzu	56.2% (1998) #	Hashimoto, 1999
Kasokwa	50% (Feb, 2000) #	Lloyd & Mugume, 2000

* Individuals in community aged 6 years or above, defined as a "snareable" age (Wrangham, 2000a)—whole community is known.

** Individuals in community aged 6 years or above—identified individuals in community only.

Identifiable individuals in community only.

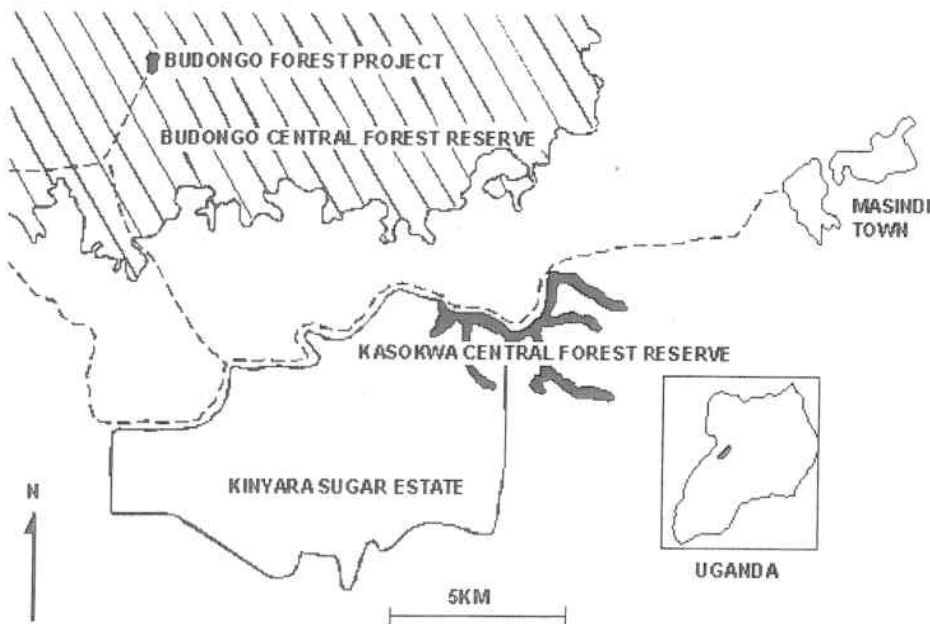


Figure 1. Map of the Kasokwa Forest Reserve, showing its proximity to the Budongo Forest Reserve, Masindi Town, the main road in the area and Kinyara Sugar Estate. The area in between the road and the Budongo Forest Reserve is predominantly agricultural land.

habitat destruction leads to a loss of 590 km² of forest each year (FAO, 1999) of which 8.3% is likely to be chimpanzee habitat (Edroma *et al.*, 1997). Since hunting in Uganda has always been common regardless of the law, both the human population pressure and reduction of habitat are creating an increasing demand for limited forest resources including bush meat (both as a protein source and for financial gain). Accidental snaring of chimpanzees and other terrestrial primates is likely to increase as a result.

While this report focuses on the accidental death of a wild chimpanzee, recent reports tell the alarming story of two arrested bush meat traders carrying chimpanzee carcasses in western Uganda. This is one of the first recorded incidents of deliberate chimpanzee hunting east of the Democratic Republic of Congo (DRC) (Moeller, 2000). While it is considered culturally unacceptable for Ugandans to eat chimpanzee meat, refugees from neighbouring DRC have a cultural acceptance of chimpanzee meat consumption (Wrangham, 2000b). The recent instability in DRC has led to hundreds of refugees crossing the Ugandan border in hope

of security. Chimpanzees, and other forest dwelling primates in Uganda, could now be facing yet another threat to their survival.

Snare removal programs have been initiated at Kibale National Park and Budongo Forest Reserve. In the first 3 months of the program, two exhunters removed 514 snares from the Budongo Forest Reserve (J.M., pers.observ.). Over a 2½ year period an average of 65 snares/month were removed from Kibale National Park by a team of two (Wrangham, 2000a). In addition to these programs there needs to be increasing work with local communities in education programs, active law enforcement, and the provision of hunters with alternatives to setting traps.

The death reported here is evidence that, as a result of hunting practices in Uganda, wild chimpanzees are killed. The time to act in Uganda is now, before more chimpanzees die or are injured as a result of entrapment, and before a bush meat trade in nonhuman primates becomes a serious problem.

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Figure 2. The steel jaw trap. Photo by Julie Munn.

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References

- Chapman, C.A. & L.E. Lambert. 2000. Habitat alteration and the conservation of African primates: a case study of Kibale National Park, Uganda. *American Journal of Primatology* 50: 169–186.
- Edroma, E.L., N. Rosen, & P.S. Miller, eds. 1997. Conserving the chimpanzees of Uganda: population and habitat viability assessment for *Pan troglodytes schweinfurthii*. Unpublished report. IUCN/SSC Conservation Breeding Specialist Group, Apple Valley, Minnesota. Pp. 3–11 & 71.
- FAO. 1999. *State of the World's Forests*. Rome: Food and Agriculture Organisation of the United Nations.
- Hashimoto, C. 1999. Snare injuries of chimpanzees in the Kalinzu Forest, Uganda. *Pan Africa News* 6: 20–22.
- Howard, P. 1991. *Nature Conservation in Uganda's Tropical Forest Reserves*. IUCN Report, Gland, Switzerland.
- IUCN. 1996. *The 1996 Red List of Threatened Animals*. IUCN, Gland, Switzerland.
- Lloyd, J. & S. Mugume. 2000. Investigation into the survival of a small chimpanzee community under immediate threat. Unpublished report by The Jane Goodall Institute, Ugandan Wildlife Education Centre, Uganda.
- Moeller, W. 2000. Chimp meat in western Uganda. Unpublished Report by the Ugandan Wildlife Education Centre, Uganda.
- Nishida, T., H. Takasaki, & Y. Takahata. 1990. Demography and reproductive profiles. In T. Nishida, ed., *The Chimpanzees of the Mahale Mountains: Sexual and Life History Strategies*. Tokyo: University of Tokyo Press. Pp. 63–98.
- Plumptre, A. 1997. Estimating chimpanzee populations. In *Conserving the Chimpanzees of Uganda: Population and Habitat Viability Assessment for Pan troglodytes schweinfurthii*. E.L. Edroma, N. Rosen, & P.S. Miller, eds. Unpublished report IUCN/SSC Conservation Breeding Specialist Group, Apple Valley, Minnesota. Pp.163–166.
- Plumptre, A., S. Mugume, D. Cox, R. Bergl, & L. Rothen. 1999. Chimpanzee and other large mammals survey of Bugoma Forest Reserve and the Kagombe-Matiri Forest Reserve complex. Unpublished report for The Jane Goodall Institute and Wildlife Conservation Society, Ugandan Wildlife Education Centre, Uganda.
- Quiatt, D. & V. Reynolds. 1994. Budongo Forest chimpanzees: Composition of feeding groups during the rainy season, with attention to the social integration of disabled individuals. *Abstract, XVth Congress of the International Primatological Society*.
- Reynolds, V., D. Burch, J. Knight, R. Smith & J. Walter. 1996. The nature, causes and consequences of injuries sustained by wild chimpanzees in the Budongo Forest, Uganda. *Abstract, XVIth Congress of the International Primatological Society*.
- Reynolds, V. 1997/8. Demography of chimpanzees *Pan troglodytes schweinfurthii* in Budongo Forest, Uganda. *African Primates* 3: 25–28.
- Stokes, E.J. 1999. Feeding skills and the effect of injury on wild chimpanzees. Unpublished Ph.D. thesis. University of St. Andrews, Scotland.
- Thomson, W.A.R. 1984. *Blacks Medical Dictionary*. 34th edition. Adams and Charles Black Publishers. London.
- Tutin, C.E.G. 1994. Reproductive success story: Variability among chimpanzees and comparisons with gorillas. In R. Wrangham, W.C. McGrew, F.B.M. deWaal & P. Heltne, eds., *Chimpanzee Cultures*. Harvard University Press, England. Pp. 181–194.
- Waller, J.C. & V. Reynolds. In press. Limb injuries resulting from snares and traps in chimpanzees (*Pan troglodytes schweinfurthii*) of the Budongo Forest, Uganda. *Primates*.
- Wallis, J. & D.R. Lee. 1999. Primate conservation: Prevention of disease transmission. *International Journal of Primatology* 20: 803–826.
- Wallis, J. 1997. A survey of reproductive parameters in the free-ranging chimpanzees of Gombe National Park. *Journal of Reproduction and Fertility* 109: 297–307.
- Wrangham, R. 2000a. Kibale snare removal program 1997–2000: Interim Report. Unpublished report to The Jane Goodall Institute, Ugandan Wildlife Education Centre, Uganda.
- Wrangham, R. 2000b. Moral issues in on-site conservation: A chimpanzee case study. In N. Rosen

& O. Byers, compilers. *Chimpanzee Sanctuary Management Workshop: Briefing Book*. Unpublished report IUCN/SSC Conservation Breeding Specialist Group: Apple Valley, Minnesota. Pp. 31–57.

¹ Habitat loss in Uganda was calculated using data from the period 1990–1995 (FAO, 1999). The area of forest with chimpanzee habitat was calculated using data from Edroma *et al.*, 1997, p. 39. Density of chimpanzees was taken from Plumptre (1997) with the lowest density used (1.3/km²). This method of extrapolating chimpanzee losses from habitat destruction was taken from Chapman & Lambert (2000).

² The term “trap” is used throughout the text to describe all trapping methods including spring snares, wire nooses, and steel jaw traps.

³ Gangrene: in a living animal, death of a part of the body sufficiently large to be seen.

Toxaemia: forms of blood-poisoning due to the absorption of bacterial products (toxins) formed at some local site of infection.

Septicaemia: a serious form of blood-poisoning due to the multiplication in the blood of bacteria.

(Thomson, 1984)

NOTES

MTDNA, PRIMATE PHYLOGENIES, AND POTENTIAL PROBLEMS CAUSED BY NUMTS.

The advances in biomolecular technology and methodology over the last three decades have made DNA sequencing a relatively common and widely practiced procedure, and readily available for primate systematic and evolutionary studies. Because mitochondrial DNA (mtDNA) was the first mammalian DNA genome to be completely sequenced, and its genes and functional regions are well known, it has been widely used for constructing primate phylogenies (Anderson *et al.*, 1981).

The tendency for mtDNA to transpose into nuclear DNA forming nuclear mitochondrial inserts (Numts), however, can result in misidentification of mtDNA sequences and misinterpretations of phylogeny (Zhang & Hewitt, 1996). Possessing the replication and evolutionary properties of other non-functional nuclear DNA sequences, Numts evolve independently and may show divergence from their mtDNA homologues. Amplifications of specific mtDNA regions by polymerase chain reaction (PCR) from tissue samples, may inadvertently amplify the homologous Numts, and lead to erroneous characterisation of the Numt sequence

instead of the desired mtDNA sequence. Depending on the degree of differences between the Numt and homologous mtDNA sequences, and the group(s) they are misidentified in, the inadvertent use of Numts in phylogenetic studies may either separate closely related taxa or closely join distally related taxa.

The recent misidentification of a Numt as a mtDNA sequence in two captive western gorillas *Gorilla gorilla* led Garner and Ryder (1996) to postulate a split within western gorillas nearly comparable in magnitude to that separating western gorillas from eastern gorillas *Gorilla beringei*, and greater than that separating the two species of chimpanzees, *Pan troglodytes* and *Pan paniscus* (Groves, 1996; Jensen-Seaman, 2000). Misidentification of Numt sequences has also resulted in an erroneous report of mutation events correlating with Alzheimer's disease, and spurious claims as to the recovery of dinosaur DNA (Hirano *et al.*, 1997; Collura & Stewart, 1995; Zischler *et al.*, 1995). In the latter case, the dinosaur sample had been tainted by human DNA, which included a non-readily identifiable human Numt.

Numts seem to be common in primates and have been identified in all those taxa with extensively sequenced mtDNA, mainly humans, apes and Old World monkeys (table 1). That as of yet Numts are not well known in New World monkeys and lemurs is no doubt a factor of either poor sampling or lack of reporting (for exception see Moreira & Seuánez, 1999; Mundy *et al.*, 2000). When more mtDNA sequence data accumulates for lower primates, it is almost certain that Numts will be found among them. In fact, most organisms that have been extensively sequenced exhibit Numts (Zhang & Hewitt, 1996).

Amplification of DNA sequences from old or degraded tissue with poor quality DNA, or in tissues with high ratios of mtDNA to nuclear DNA as found in hair or avian nucleated red blood cells respectively, may be biased in yielding high proportions of Numts. This increases the likelihood that Numts will be sequenced instead of the mtDNA (Greenwood & Pääbo, 1999).

Because primate studies often rely on potentially problematic tissues such as shed hair or desiccated museum specimens, care must be taken that Numts are not confused for mtDNA sequences. To avoid this problem, overlapping mtDNA fragments should be amplified with non-overlapping primer pairs (figure 1). Use of two non-overlapping primer pairs reduces the chances of isolating and amplifying the same Numt(s) sequence. Sequencing of multiple clones from such PCR products also helps to determine if a mtDNA sequence is uniform or heterogeneous (made up of more than one sequence). Whenever possible, additional tissues from an individual should also be used to test for similar mtDNA sequences. Ultimately, when there is reason to believe that a Numt has been amplified, and fresh tissue is available, characterization of RNA

Table 1. Reports of Numts in primates.

Reported occurrence	Reference
New world monkeys (Callitrichinae)	Moreira & Seuánez, 1999 Mundy <i>et al.</i> , 2000
Old world monkeys and hominoids	Collura & Stewart, 1995
Old world monkeys	van der Kuyl <i>et al.</i> , 1995
Hominoids	Collura <i>et al.</i> , 1996 Zischler <i>et al.</i> , 1998 Zischler, 2000
Humans	Tsusuki <i>et al.</i> , 1983 Nomiyama <i>et al.</i> , 1984 Nomiyama <i>et al.</i> , 1985 Fukada <i>et al.</i> , 1985 Wakasugi <i>et al.</i> , 1985 Kamimura <i>et al.</i> , 1989 Shay & Werbin, 1992 Hu & Thilly, 1994 Hu & Thilly, 1995 Zischler <i>et al.</i> , 1995 Hirano <i>et al.</i> , 1997 Wallace <i>et al.</i> , 1997 Davis & Parker, 1998 Parfait <i>et al.</i> , 1998 Herrnstadt <i>et al.</i> , 1999 Yuan <i>et al.</i> , 1999

(transcribed) copies of the desired mtDNA should be isolated. Unlike mtDNA, Numts are pseudogenes, and are thus not transcribed into RNA (Collura *et al.*, 1996, Greenwood & Pääbo, 1999). Unfortunately, when dealing with the d-loop sequence it may not be possible to isolate complete RNA transcripts to verify the absence of pseudogenes. In addition, RNA degrades much more rapidly than DNA, and is unlikely to be detectable in older tissues. As such, phylogenies based on d-loop sequences have a relatively low level of confidence.

Given these problems, phylogenies based on mtDNA sequences with novel or non-orthodox placements of taxa should be viewed with some skepticism, especially when the necessary procedures to avoid Numts have not been applied. Conversely, phylogenies seemingly orthodox and in line with current systematic dogma should not be interpreted as Numt(s) free. In cases where Numts have not diverged from the homologous mtDNA from which they originated, their inadvertent use in phylogenetic analysis may not change the constructed phylogeny in any appreciable way.

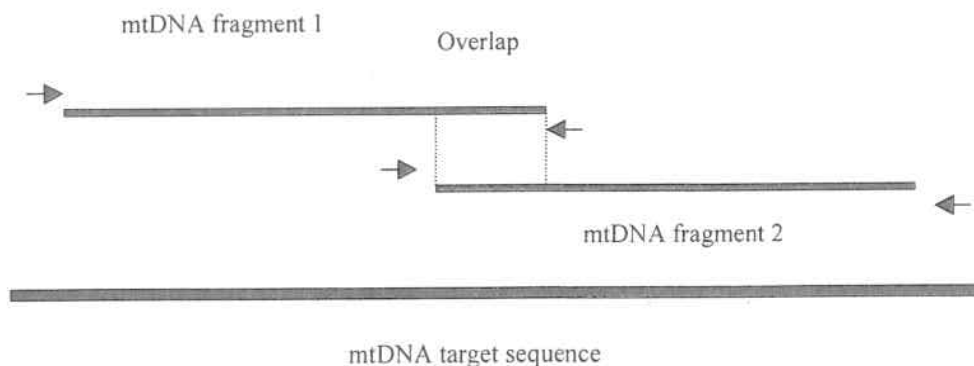


Figure 1. Amplification of overlapping mtDNA fragments. Arrows represent non-overlapping independent PCR primers. The probability that two independent primer pairs amplify the same Numt sequence is miniscule. The region of overlap should contain the same sequence if bona fide mtDNA has been amplified. Alternatively, amplification of a Numt(s) is implied when the region of overlap does not contain the same sequence. Additional amplifications with independent PCR primers pairs may be required to distinguish which of the fragment sequences (if any) are the bona fide mtDNA sequence (Handt *et al.* 1996).

Nevertheless, construction of credible mtDNA based phylogenies should take every precaution necessary to ensure that Numts have not been inadvertently used instead of *bona fide* mtDNA sequences.

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References

- Anderson, S., A.T. Bankier, B.G. Barrell, M.H.L. de Bruijn, A.R. Coulson, J. Drouins, I.C. Eperon, D.P. Nierlich, B.A. Roe, F. Sanger, P.H. Schreier, A.J.H. Smith, R. Staden, & I.G. Young. 1981. Sequence and organization of the human mitochondrial genome. *Nature* 290: 457-465.
- Collura, R.V. & C.B. Stewart. 1995. Insertions and duplications of mtDNA in the nuclear genomes of Old World monkeys and hominoids. *Nature* 378: 485-9.
- Collura, R.V., M.R. Auerbach & C.B. Stewart. 1996. A quick direct method that can differentiate expressed mitochondrial genes from their nuclear pseudogenes. *Current Biology* 6: 1337-1339.
- Davis, J.N. II & W.D. Parker Jr. 1998. Evidence that two reports of mtDNA cytochrome c oxidase "mutations" in Alzheimer's disease are based on nDNA pseudogenes of recent evolutionary origin. *Biochemical and Biophysical Research Communications* 244: 877-83.
- Fukuda, M., S. Wakasugi, T. Tsuzuki, H. Nomiya, K. Shimada & T. Miyata. 1985. Mitochondrial DNA-like sequences in the human nuclear genome. Characterization and implications in the evolution of mitochondrial DNA. *Journal of Molecular Biology* 186: 257-66.
- Garner, K. J. & O.A. Ryder. 1996. Mitochondrial DNA diversity in gorillas. *Molecular Phylogenetics and Evolution* 6: 39-48.
- Greenwood, A.D. & S. Pääbo. 1999. Nuclear insertion sequences of mitochondrial DNA predominate in hair but not blood of elephants. *Molecular Ecology* 8: 133-137.
- Groves, C. 1996. Do we need to update the taxonomy of gorillas? *Gorilla Journal* 12: 3-4.
- Handt, O., M. Krings, R.H. Ward & S. Pääbo. 1996. The retrieval of ancient human DNA sequences. *American Journal of Human Genetics* 59: 368-376.
- Herrnstadt, C., W. Clevenger, S.S. Ghosh, C. Anderson, E. Fahy, S. Miller, N. Howell & R.E. Davis. 1999. A novel mitochondrial DNA-like sequence in the human nuclear genome. *Genomics* 60: 67-77.
- Hirano, M., A. Shtilbans, R. Mayeux, M.M. Davidson, S. DiMauro, J.A. Knowles & E.A. Schon. 1997. Apparent mtDNA heteroplasmy in Alzheimer's disease patients and in normals due to PCR amplification of nucleus-embedded mtDNA pseudogenes. *Proceedings of the National Academy of Sciences U S A* 94:14894-9.
- Hu, G. & W.G. Thilly. 1994. Evolutionary trail of the mitochondrial genome as based on human 16S rDNA pseudogenes. *Gene* 147: 197-204.
- Hu, G. & W.G. Thilly. 1995. Multi-copy nuclear pseudogenes of mitochondrial DNA reveal recent acute genetic changes in the human genome. *Current Genetics* 28: 410-4.
- Jensen-Seaman, M. I. 2000. Evolutionary genetics of gorillas. Ph.D. thesis, Yale University.
- Kamimura, N., S. Ishii, L.D. Ma & J.W. Shay. 1989. Three separate mitochondrial DNA sequences are contiguous in human genomic DNA. *Journal of Molecular Biology* 210: 703-7.
- Moriera, A.M. & H.N. Seuánez. 1999. Mitochondrial pseudogenes and phyletic relationships of *Cebuella* and *Callithrix* (Platyrrhini, Primates). *Primates* 40: 353-364.
- Mundy, N.I., A. Pissinatti & D.S. Woodruff. 2000. Multiple nuclear insertions of mitochondrial cytochrome b sequences in callitrichine primates. *Molecular Biology and Evolution* 17: 1075-1080.
- Nomiya, H., T. Tsuzuki, S. Wakasugi, M. Fukuda & K. Shimada. 1984. Interruption of a human nuclear sequence homologous to mitochondrial DNA by a member of the KpnI 1.8 kb family. *Nucleic Acids Research* 12: 5225-34.
- Nomiya, H., M. Fukuda, S. Wakasugi, T. Tsuzuki & K. Shimada. 1985. Molecular structures of mitochondrial-DNA-like sequences in human nuclear DNA. *Nucleic Acids Research* 13: 1649-58.
- Parfait, B., P. Rustin, A. Munnich & A. Rotig. 1998. Co-amplification of nuclear pseudogenes and assessment of heteroplasmy of mitochondrial DNA mutations. *Biochemical and Biophysical Research Communications* 247: 57-9.
- Shay, J.W. & H. Werbin. 1992. New evidence for the insertion of mitochondrial DNA into the human genome: significance for cancer and aging. *Mutation Research* 275: 227-35.
- Tsuzuki, T., H. Nomiya, C. Setoyama, S. Maeda & K. Shimada. 1983. Presence of mitochondrial-DNA-like sequences in the human nuclear DNA. *Gene* 25: 223-9.
- van der Kuyl, A.C., C.L. Kuiken, J.T. Dekker,

- W.R. Perizonius & J. Goudsmit. 1995. Nuclear counterparts of the cytoplasmic mitochondrial 12S rRNA gene: a problem of ancient DNA and molecular phylogenies. *Journal of Molecular Evolution* 40:652–7.
- Wakasugi, S., H. Nomiya, M. Fukuda, T. Tsuzuki & K. Shimada. 1985. Insertion of a long KpnI family member within a mitochondrial-DNA-like sequence present in the human nuclear genome. *Gene* 36: 281–8.
- Wallace, D.C., C. Stuard, D. Murdock, T. Schurr & M.D. Brown. 1997. Ancient mtDNA sequences in the human nuclear genome: a potential source of errors in identifying pathogenic mutations. *Proceedings of the National Academy of Sciences U S A* 94: 14900–5.
- Yuan, J.D., J.X. Shi, G.X. Meng, L.G. An & G.X. Hu. 1999. Nuclear pseudogenes of mitochondrial DNA as a variable part of the human genome. *Cell Research* 9: 281–90.
- Zhang, D. & G.M. Hewitt. 1996. Nuclear integrations: challenges for mitochondrial DNA markers. *Trends in Ecology and Evolution* 11: 247–251.
- Zischler, H., M. Höss, O. Handt, A. von Haeseler, A.C. van der Kuyl, J. Goudsmit & S. Pääbo. 1995. Detecting dinosaur DNA. *Science* 268: 1192–1193.
- Zischler, H., H. Geisert, A. von Haeseler & S. Pääbo. 1995. A nuclear 'fossil' of the mitochondrial D-loop and the origin of modern humans. *Nature* 378: 489–92.
- Zischler, H., H. Geisert & J. Castresana. 1998. A hominoid-specific nuclear insertion of the mitochondrial D-loop: implications for reconstructing ancestral mitochondrial sequences. *Molecular Biology and Evolution* 15: 463–9.
- Zischler, H. 2000. Nuclear integrations of mitochondrial DNA in primates: inference of associated mutational events. *Electrophoresis* 21: 531–6.

THE TAXONOMIC STATUS OF *CERCOPITHECUS DRYAS* AND *CERCOPITHECUS SALONGO*

The *dryas* guenon *Cercopithecus dryas* was described by Schwarz (1932) on the basis of a photograph of a living juvenile male (erupted M1 and m1 with M2 and m2 in crypts), and the skin and skull it yielded after its death. The monkey was the pet of Mr Guilmot, a Belgian government officer living in Lomela, Democratic Republic of Congo (DRC) (2°20'S; 23°12'E), and was thus thought to have originated from this area. The locality of provenance of *C. dryas*, however, is unclear. Schouteden (1946) notes that

Mr Hendrickx, a government officer familiar with the animal, believed it originated from Watsi, a village on the right bank of the Tshuape River. This locality, however, was never confirmed, and Watsi may be a misspelling of the village Yapatsi (1°33'S; 23°13'E) or the stream Patsi¹ (1°23'–28'S; 23°12'–29'E) (Thys van den Audenaerde, 1977).

About 45 years after Schwarz's description of *C. dryas*, Thys van den Audenaerde (1977) described the Salongo guenon *Cercopithecus salongo* based on an adult (probably male) skin brought to him by T. Kano from an animal collected in Djolu, DRC (0°01'N–0°01'S; 22°31'–33'E) near Wamba (ca. 250–260 km from Lomela and ca. 180 km from Yapatsi). Colyn *et al.* (1991), following an allusion by Kuroda *et al.* (1985) and a suggestion by Lernould (1988), subsumed *C. salongo* into *C. dryas*, claiming *C. salongo* was the adult form of *C. dryas*.

There are considerable problems with subsuming *C. salongo* into *C. dryas*. Principally, *C. dryas* does not have a locality of origin and there are no described or known specimens of *C. salongo* comparable in age to the juvenile *C. dryas*. In spite of matching facial hair patterns (Dandelot, 1971; Colyn *et al.*, 1991), the pelage of the young adult female *C. salongo* described by Colyn *et al.* (1991) differs from that of the juvenile male *C. dryas*. The tail of the juvenile male *C. dryas* is black at the root and rufous-green distally, the dorsum of the hands and feet are dirty grey, and the ventrum is mouse grey (Schwarz, 1932). The ground colour on the dorsum of the body is gold-green with rufous highlights (Schwarz, 1932; Dandelot, 1971). In the young adult female *C. salongo*, the tail is dirty white with a gray mid-dorsal line, showing a characteristic black inverted V at its root (Thys van den Audenaerde, 1977; Kuroda *et al.*, 1985). The dorsum of the hand and foot is black, the ventrum, inside of thighs, and perianal region are creamy to white, and the dorsum of the body is chestnut grey.

While some of the differences in the pelage of *C. dryas* and *C. salongo* are comparable to those seen in juvenile to adult comparisons of other guenon species (*i.e.*, in the perianal area, root of tail and dorsum ground colour highlights), specifically in De Brazza's monkey *Cercopithecus neglectus*², other differences between the two (*i.e.*, tail and ventral colour) are much more marked than characteristically seen in juvenile and adult guenons. In view of the differences in *C. dryas* and *C. salongo*, it is odd that the crown and face hair pattern is similar. This implies that the differences between them may not simply be explained as age related differences. Differences in juvenile and adult pelage among anthropoids, as seen in *C. neglectus*, are most likely to be in the perianal area and crown/face areas, since both are important sites of group and mate recognition.

The possibility that *C. dryas* is a hybrid, as suggested

by Dandelot (1971), cannot be discounted. Considering presumed differences in their provenance, it is also possible that the two represent subspecies of the same species. Unfortunately, without a known distribution, a certain origin, or a range of comparative specimens for *C. dryas*, a subspecies vs. a species distinction to *C. salongo* cannot be shown.

A two-point regression of braincase height vs. length in the juvenile male *C. dryas* and in the adult (probably male) *C. salongo* shows a greater slope than do comparable regressions of 36 juvenile vs. adult combinations of Wolf's guenon *Cercopithecus wolffi* of unknown sex, and of all but two of 156 juvenile to adult combinations of the red-tailed monkey *Cercopithecus ascanius* of unknown sex (Colyn *et al.*, 1991). These regressions suggest that there is too great an increase in braincase length relative to braincase height for juvenile *C. dryas* to belong to the same taxon as adult *C. salongo*. Contrary to what was claimed by Colyn *et al.* (1991), therefore, these regressions do not support placing *C. dryas* and *C. salongo* in the same taxon.

Until specimens of *C. salongo* of a comparable age to specimens of *C. dryas* are available and show otherwise, and/or DNA evidence³ and craniodental morphology can support the two as the same taxon, *C. dryas* and *C. salongo* are best treated as separate species.

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References

- Colyn, M. C. 1988. Distribution of guenons in the Zaire-Lualaba-Lomami river system. In *A Primate Radiation: Evolutionary Biology of the African Guenons*. A. Gautier-Hion, F. Bourliere, J.-P. Gautier, & J. Kingdon, eds. Cambridge University Press, Cambridge. Pp. 104–124.
- Colyn, M. C., A. Gautier-Hion & D.F.E. Thys van den Audenaerde. 1991. *Cercopithecus dryas* Schwarz 1932, and *C. salongo* Thys van den Audenaerde 1977 are the same species with an age-related coat pattern. *Folia Primatologica* 56: 167–170.
- Dandelot, P. 1971. Order Primates Suborder Anthropoidea. Part 3. In *The Mammals of Africa: An Identification Manual*. J. Meester & H.W. Setzer, eds. Smithsonian Institution Press, Washington DC. Pp. 5–45.
- Kuroda, S., T. Kano & K. Muhindo. 1985. Further information on the new monkey species, *Cercopithecus salongo* Thys van den Audenaerde, 1977. *Primates* 26: 325–333.
- Lernould, J.M. 1988. Classification and geographical distribution of guenons: A review. In *A Primate Radiation: Evolutionary Biology of the African Guenon*. A. Gautier-Hion, F. Bourliere, J.-P. Gautier & J. Kingdon, eds. Cambridge University Press, Cambridge. Pp. 54–78.
- Schouteden, H. 1946. De Zoogdieren van Belgisch Congo en van Ruanda-Urundi (Les mammiferes du Congo Belge et du Ruanda-Urundi) I. Primates, Chiroptera, Insectivora, Pholidota. *Annalen van het Museum van Belgisch Congo*. C. Dierkunde. reeks II, deel III, Afl. I. Tervuren. Pp. 1–168.
- Schwarz, E. 1932. Der Vertreter der Diana-Meerkatze in Zentral-Afrika. *Révue Zoologique et Botanique Africaine* 21: 251–254.
- Thys van den Audenaerde, D.F.E. 1977. Description of a monkey skin from east-central Zaire as a probable new monkey species (Mammalia, Cercopithecidae). *Review Zoologique Africaine* 91: 1000–1010.
- Van Krunkelsven, E., I. Bilia-Isia & D. Draulans. 2000. A survey of bonobos and other large mammals in the Salonga National Park, Democratic Republic of Congo. *Oryx* 34: 180–187.

¹ Watsi Kengo is a town on the right bank of the Salonga River in the northern sector of Salonga National Park at approximately 1°00'S; 20°38'E. Watsi Kengo is a 1–2 days walk south from the fork of the Lomela and Tshaupa Rivers. There is some logic in expecting that Mr Guilmo's pet *C. dryas* was collected in the vicinity of a river that also passed through the town of Lomela where he lived. This town is about 240 km southwest of Wamba, the type site of *C. salongo* as calculated from the co-ordinates provided by Thys van den Audenaerde (1977). The co-ordinates given by Kuroda *et al.* (1985) incorrectly place Wamba 1 degree farther east. Notably, "ekele", the Ngando name for *C. salongo* at Wamba (Kuroda *et al.*, 1985; but see Colyn, 1988), is used by hunters in the Salonga National Park for a yet unidentified monkey (Van Krunkelsven *et al.*, 2000).

² Based on the author's examination of 30 adult and 20 immature *C. neglectus*; 20 adult and two immature owl-faced monkeys *Cercopithecus hamlyni*; 10 adult and five immature patas monkeys *Erythrocebus patas*; 10 adult and four immature blue monkeys *Cercopithecus mitis*; 12 adults and four immature Sykes monkeys *Cercopithecus albogularis*; and 10 adults and five immature vervet monkeys *Cercopithecus aethiops*. During maturation, the hairs on the dorsum, base of tail and thigh become progressively lighter in colour in *C. hamlyni*, and the ventral hairs darken and a yellow-beige horizontal stripe appears on the crown above the brow. During maturation, *E. patas* shows marked

changes in facial hair colour (*i.e.*, nose, cheeks, brow), there is bleaching of the limb hairs distally, reddening of the hairs on the dorsum, and the shoulders and arms become interspersed with black hairs. During maturation in *C. mitis* and *C. albogularis*, the ventrum and tail hairs become darker, the perianal hairs redden, and there is a stronger demarcation of the white hairs on the face and/or throat. In *C. aethiops* there is a stronger demarcation of the ventrum and dorsal colours in adults, especially on the rump and base of tail, and the scrotal or perineal hairs may redden. Age related changes in *C. neglectus* coat colour have been preliminarily described by Colyn *et al.* (1991).

³ Although finding a unique genetic marker in both *C. dryas* and *C. salongo* may prove that the two are the same species, if the two differ genetically it will be difficult to determine whether the difference corresponds to differences in populations, subspecies or species. In any case, the burden of proof falls on those wishing to subsume *C. salongo* into *C. dryas*.

USE OF THE NAME "BILIA" FOR PAN PANISCUS

Kano and Nishida (1999) proposed universal usage of the name "bilial", derived from "elia" (singular) and "bilial" (plural), instead of "bonobo" in order to encourage national conservation recognition *in-situ* and global one-word simplicity. Although the name bonobo has been known since 1936 (Heck, 1939) and is the most widely used word internationally, some individuals do not like it. Kortlandt (1997) argued against use of bonobo because the name does not follow the Linnean principle of binomiality, does not recognise the taxonomic ancestor of proto-*Pan*, does not recognise the species' true nature, and is not recognised in Congolese law. Thus, the search for alternatives.

Kano (1984, 1992) reported that during his 1973 survey within bonobo habitat of Tshuapa District, Equateur Province, Democratic Republic of Congo (DRC), people from villages did not know the name "pygmy chimpanzee". This has been supported by my own experience surveying for bonobos within District Mai-Ndombe, Bandundu Province; Tshuapa District, Equateur Province; and District Kasai, Kasai Occidental Province, DRC. Where bonobos occur, the people only know one ape (*Pan paniscus*) and, therefore, do not need to distinguish size.

DRC is extremely varied ethnically, with over 200 rural languages and local dialects. Pervasive tribalism excludes any universal usage of a single indigenous name. Those who argue for the use of an indigenous

name would be hard pressed to single out one authentic vernacular that could be recognised throughout the whole of the bonobo's geographic range. French is the official national language and used in all urban settings. Lingala, also a national language, is the most widely used indigenous vernacular. Officials in urban areas influenced by European trends, particularly the capital city of Kinshasa, use the French names "chimpanzé nain" (translated means "dwarf chimpanzee", inaccurately implying a small size) or "chimpanzé noir" (translated means "black chimpanzee", referring to the black pigmented face of infants). Additionally, live animal traders in urban markets promote the use of "pygmy chimpanzee" to bait potential buyers with the promise of a very small ape. The Lingala words for *Pan* are "mokomboso" (singular) and "bamikomboso" (plural), but are not used to differentiate between the two allopatric species of *Pan* found in DRC.

In my article "Logging the Lukuru" (Thompson, 1999), editorial license was used to insert the name "bilial" after bonobo. The Congolese people of Zone Dekese/Lukuru, descendants of Kuba, do not use the term "bilial." The Lukuru people use the local names "ifuk" (singular) and "tofuku" (plural). The Lukuru Wildlife Research Project uses the name "tofuku" in our site-specific conservation and education propaganda materials.

Kano proposed the ubiquitous use of "bilial" because the local people of Wamba (Mongo ethnic group Gandu) use the terms "elia" or "elya" (singular) and "bilial" or "bilya" (plural). Kano (1984, 1992) points out that the Mongo people of Equateur Province include more than 40 diverse ethnic groups who speak unique dialects. Selecting one name from the numerous alternatives available in local Mongo dialects, including the Mongo terms "eza," "edja," "engombe," "edjambanda," or "elyamana" as reported by Kano (1984, 1992), is biased towards the immediate Wamba area.

The people of Zone Dekese recognise the word "elia" only in Lingala. In the Lingala language, used throughout the bonobo's distribution, the radical or root of the verb "to eat or consume" is "-lia" or "-liya", and "e-" is the associated pronominal prefix which indicates "it" as the subject of the verb. If the local name "elia" were corrupted to a broader practice corresponding with the national use of Lingala, the name "elia" might literally denote "to eat it." In the root "-lia" or "-liya" the essential idea is one of consumption; this is certainly not something to encourage with regard to the bonobo and the prevailing bushmeat crisis that threatens the very existence of this species.

Ethnicity is at the root of all conflicts, wars, and loss of millions of lives across DRC's bloody history. I seriously caution anyone from promoting one faction (whether in language preference or otherwise) over another especially during this time of growing inter-ethnic antagonism, and hope this response will elucidate

the implications of widespread usage of the term "bilias" rather than "bonobo."

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References

- Kano, T. 1984. Distribution of pygmy chimpanzees (*Pan paniscus*) in the Central Zaire Basin. *Folia Primatologica* 43: 36-52.
- Kano, T. 1992. *The Last Ape: Pygmy Chimpanzee Behaviour and Ecology*. Stanford University Press.
- Kano, T. & T. Nishida. 1999. Bilias as an authentic vernacular name for *Pan paniscus*. *Pan Africa News* 6: 1-3.
- Heck, H. 1939. Die bonobos. *Das Tier und Wir* Jan./Feb.: 10-26.
- Kortlandt, A. 1997. Pygmy chimpanzee, bonobo, or gracile chimpanzee: What's in a name. *African Primates* 3: 28-35.
- Thompson, J. 1999. Logging the Lukuru: Update on the conservation of *Pan paniscus*. *Pan Africa News* 6: 13-15.

NEW DISTRIBUTION RECORD FOR THE SOUTHERN TALAPOIN *MIOPITHECUS TALAPOIN*

On 11 August, 1994, I was traveling on foot along "Route d'intérêt local" between Belonge and Lokolama, west of the Salonga National Park-South Sector in Zone Oshwe, District Mai-Ndombe, Bandundu Province, Democratic Republic of Congo. Approximately 6 km northeast of the village of Mimia (2°29' S; 20°00' E from GPS reading), my guide and I encountered a local hunter (see figure 1; also see point H on figure 2, p. 30, this issue). He was carrying a freshly killed aaaaadult male southern (Angolan) talapoin *Miopithecus talapoin*. The monkey was identified by its' small adult-size, large eyes, and large ears. The hunter explained that he had killed this monkey, caught in a snare, during a midday check of his tree snares set for hornbill in dense forest along one of the many tributaries flowing south-west into the Lokoro River.

Mimia is 411 m a.s.l. and is located at the eastern limit of the floodplain of the former Congo Sea. The area is dominated by dense, swamp forest vegetation. This observation of the southern talapoin extends the known range for this species 100 km to the north and 300 km to the east. This is the first record for this species north of the Kasai River. Of note, the swamp monkey

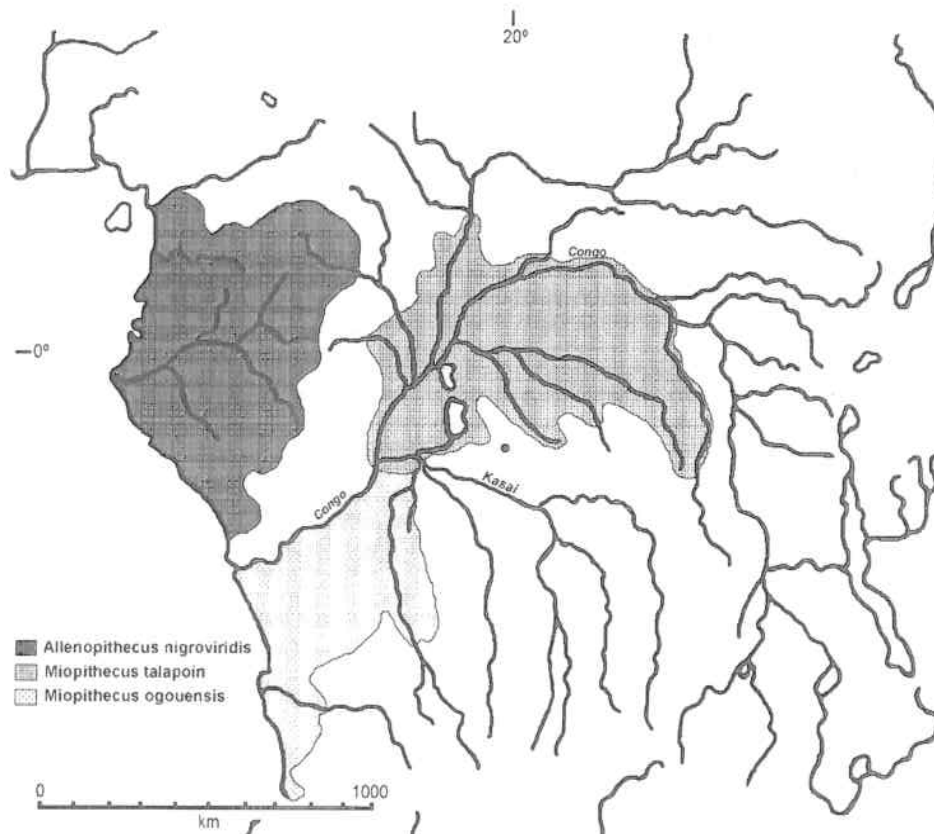


Figure 1. Geographic ranges of *Allenopithecus nigroviridis*, *Miopithecus talapoin*, and *M. ogouensis*. Map adapted from Kingdon (1997). Black dot indicates the new site for *M. talapoin*.

Allenopithecus nigroviridis is absent in this area. Gautier (1985) did not find talapoin 34 km south of Mbandaka (0°19' S; 18°15' E) where the swamp monkey is present.

The local people are quite familiar with this talapoin as it lives near their villages and settlements. In their local Nkundu language, *M. talapoin* is called "Kelo" in recognition of its small size. The local people do not actively hunt talapoin because, with easy access to weapons and munitions from the military camp at Oshwe, they are able to kill larger mammals.

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References

- Gautier, J.-P. 1985. Quelques caractéristiques écologiques du singe des marais, *Allenopithecus nigroviridis*. *Revue d'Ecologie (Terre Vie)* 40(T.3): 331-403.
- Kingdon, J. 1997. *The Kingdon Field Guide to African Mammals*. Academic Press, London.

RÉGRESSION DE LA DISTRIBUTION ET STATUT ACTUEL DU BABOUIN *PAPIO PAPIO* EN LIMITE D'AIRE DE RÉPARTITION AU SENEGAL

Abstract: *Specific data on the distribution of baboons Papio papio in Senegal, at the extreme north west of the geographic range of baboons in Africa, are more than 40 years old. Data collected during IRD's (French Institute of Research for Development) «Perturbations and Large Wild Fauna» scientific research program updates the distribution area of this species. Field surveys associated with local human population inquiries were carried out in 1974-1976 and 1988-2000 (more than 100 villages since 1996). Direct observations and indirect indices of the presence of baboons were recorded, allowing us to present a map of the actual distribution area updating that published by Sarmiento (1998).*

Baboons are still relatively abundant, but increased human population and cultivation have resulted in a decline in their habitat and population. Due to decreased rainfall, the northern limit moved south from Matam and is now near Bakel, along the Falémé and the Senegal rivers, while the western limits are situated

near Tambacounda and Kolda. Some fragmented populations may continue to live in Casamance for some time. Though the density of the baboon did not decrease inside the Niokolo Koba National Park, it has drastically decreased outside the Park. A map of the distribution area of the baboon is presented.

Acknowledgements. National Parks Senegal, Populations of the villages, Dr O. Skovmand. Financial support. ORSTOM, IRD, DDR, FAC.

Introduction

Le babouin *Papio papio* bien qu'encore relativement abondant, est devenu une espèce menacée compte tenu de la rapide disparition de son habitat en Afrique de l'Ouest (LR nt, IUCN, 1996). Sarmiento (1998) présente une carte de la répartition des différentes espèces de babouins en Afrique. Les données acquises dans le cadre de l'opération de recherche scientifique *Perturbations et Grande Faune Sauvage* de l'IRD, l'Institut de recherche pour le développement, permettent de préciser cette carte et de réactualiser son aire de répartition au Sénégal, à l'extrême nord-ouest de son aire de répartition en Afrique.

Méthode

Des prospections sur le terrain, parfois précédées par des enquêtes auprès des villageois, dont une série d'enquêtes récentes dans plus d'une centaine de villages conduite depuis 1996, ont été menées au Sénégal de 1974 à 1976 et de 1988 à 2000. Les observations directes et les indices indirects de la présence du babouin ont été relevés et cartographiés, permettant de présenter la distribution actualisée de cette espèce au Sénégal.

Résultats

Le babouin est rencontré au sud et à l'est du Pays. Son aire de répartition actuelle est reportée dans la figure 1.

Discussion

Accroissement démographique et extension des cultures ont conduit à une régression de l'aire de répartition du Babouin. La fragmentation de la population de Casamance, à l'est de Tambacounda et de Kolda, en est une conséquence directe. Deux des auteurs avaient noté en 1975 (A. Galat-Luong et G. Galat, obs. pers.) que la limite nord de l'aire de répartition des babouins coïncidait avec la raréfaction des arbres feuillus et la dominance de l'*Acacia nilotica*, moins exigeant en précipitation, et se situait non loin de Matam. Le déficit

pluviométrique d'environ 300 mm annuels des vingt dernières années est certainement le facteur majeur du déplacement vers le Sud de la limite nord qui s'est ainsi rapprochée de Bakel, le long de la Falémé et du fleuve Sénégal. De 1965 à 1992, une population de babouins a été réintroduite dans le Saloum, à l'ouest du pays d'où elle avait disparu, dont environ 100 en 1989 et 200 en 1991 et 1992. Cette population s'est acclimatée aux conditions locales et s'est scindée en au moins trois groupes. L'aire occupée par cette population est actuellement en expansion. Si la population de cette espèce n'a pas diminué au sein du Parc National du Niokolo Koba (Verschuren, 1982; Galat *et al.*, 1994; Adie *et al.*, 1997) où elle est estimée aujourd'hui à environ 160 000 individus, elle a considérablement régressé en dehors du Parc.

Conclusion

L'aire de répartition et l'effectif de la population du babouin au Sénégal sont en régression.

Remerciements.

Les auteurs remercient la Direction, les cadres et les agents des Parcs Nationaux du Sénégal et les populations des villages enquêtés. Financements ORSTOM, IRD, DDR, FAC.

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Bibliographie

- Adie, F. A. Galat-Luong & G. Galat. 1997. *Les grands Mammifères du Niokolo-Badiar*. Fonds Européen de Développement régional No 4213/REG Ed & Anh Galat-Luong, eds.
- Dekeyser, P.L. 1955. *Les Mammifères de l'Afrique noire française*. IFAN. Dakar.
- Dorst, J. & P. Dandelot. 1970. *A Field Guide to the Larger Mammals of Africa*. Collins Ed. London.
- Galat, G., A. Galat-Luong, M. Benoit, H. Chevillotte, A. Diop, J. -M. Duplantier, & G. Pichon. 1994. Primate density in the Niokolo Koba National Park, Senegal. *Folia Primatologica*. 62: 197.
- IUCN. 1996. *1996 IUCN Red List of Threatened Animals*. IUCN Species Survival Commission. IUCN, Gland, Switzerland
- Sarmiento, E. 1998. Current problems with *Papio* taxonomies. *African Primates* 3: 48-52.
- Verschuren, J. C. 1982. Notes de bio-écologie des grands mammifères du Parc National du Niokolo-koba. Examen comparé avec le Zaïre de l'Afrique de l'est. Recherches scientifiques dans les parcs nationaux du Sénégal. *Mémoires de l'Institut Fondamental d'Afrique Noire*. 92: 233-278.

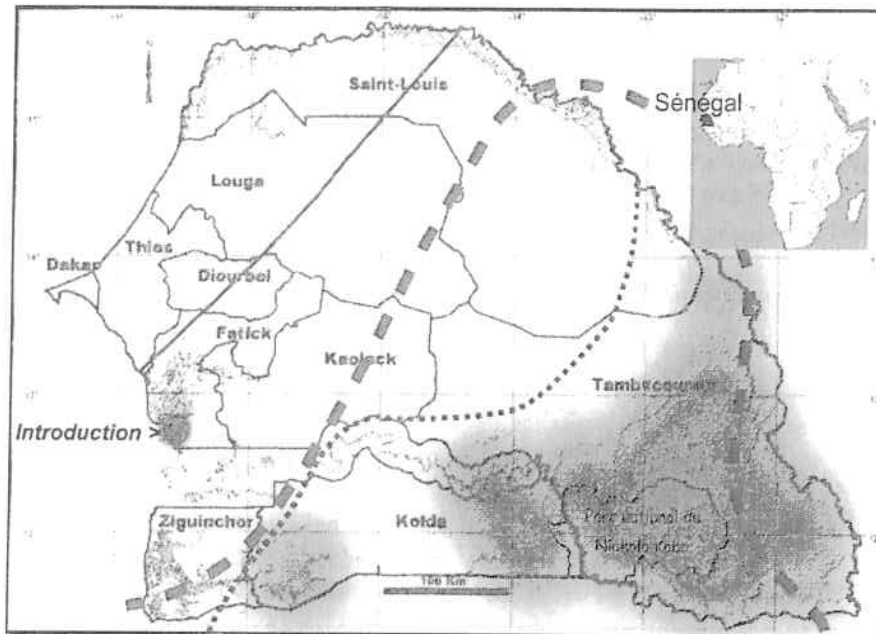


Figure 1. Distribution actuelle (zones grisées) du Babouin *Papio papio* au Sénégal et limites nord selon Dekeyser (1955, trait plein), Dorst et Dandelot (1970, tirets gras) et Galat et Galat-Luong, obs. pers., 1975 (pointillé). Fond cartographique CSE, 1999.

FRAGMENTATION DE LA DISTRIBUTION ET STATUT ACTUEL DU CHIMPANZE *PAN TROGLODYTES VERUS* EN LIMITE D'AIRE DE RÉPARTITION AU SÉNÉGAL

Abstract: Data on the distribution of chimpanzees *Pan troglodytes verus*, in Senegal, at the extreme northwest of their distribution, come only from the Parc National du Niokolo Koba. Formore than 20 years, it was said that chimpanzees were only located in the Park. Data collected during IRD's (French Institute of Research for Development) «Perturbations and Large Wild Fauna» program update the distribution of this species in Senegal. Field surveys, inside and outside of the Park, together with local inquiries of inhabitants (more than 100 villages since 1996) were carried out from 1988 through 2000. Direct observations and indirect indices of the presence of chimpanzees were recorded and a map of the distribution of the chimpanzee in Senegal was compiled.

Though the main refuge of chimpanzees in Senegal is the Niokolo Koba National Park, chimpanzees are still relatively abundant outside the protected area. Chimpanzees occur in the Bassari country south of the Park, and south of the Falémé Hunting Area. Inhabitants of 26 villages of the Kédougou department regularly see or hear chimpanzees. Our findings indicate that the estimation of the number of chimpanzee in Senegal should be revised and doubled. Figures in the literature vary from 150 to 200, but a more realistic figure is about 300 individuals, one half of which are living in the Park.

The distribution area of the chimpanzees in Senegal, as well as the population estimate, are larger than has been said for 20 years. However, chimpanzee populations are fragmented.

Acknowledgements. National Parks Senegal, Populations of the villages, Dr O. Skovmand (IIC). Financial support. ORSTOM, IRD, DDR, FAC.

Introduction

Le chimpanzé *Pan troglodytes verus* est une espèce menacée en Afrique de l'Ouest (EN A1cd + 2cd, IUCN, 1996). Les informations disponibles ne concernent que le Parc National du Niokolo Koba (Dupuy, 1970 ; Larivière & Dupuy, 1978; McGrew *et al.*, 1981). Des données acquises récemment dans le cadre de l'opération de recherche scientifique *Perturbations et Grande Faune Sauvage* de l'IRD, l'Institut de recherche pour le développement, permettent de faire le point sur l'aire de répartition actuelle de cette espèce au Sénégal et ainsi de préciser la carte présentée dans le volume 3 de *African Primates* (pS5, d'après Oates (1996) in Bowen-Jones, 1998) à l'extrême nord-ouest de son aire de répartition en Afrique.

Méthode

Pour connaître la distribution et le statut actuel du chimpanzé au Sénégal une série de prospections, dans et hors du Parc National du Niokolo Koba, et d'enquêtes

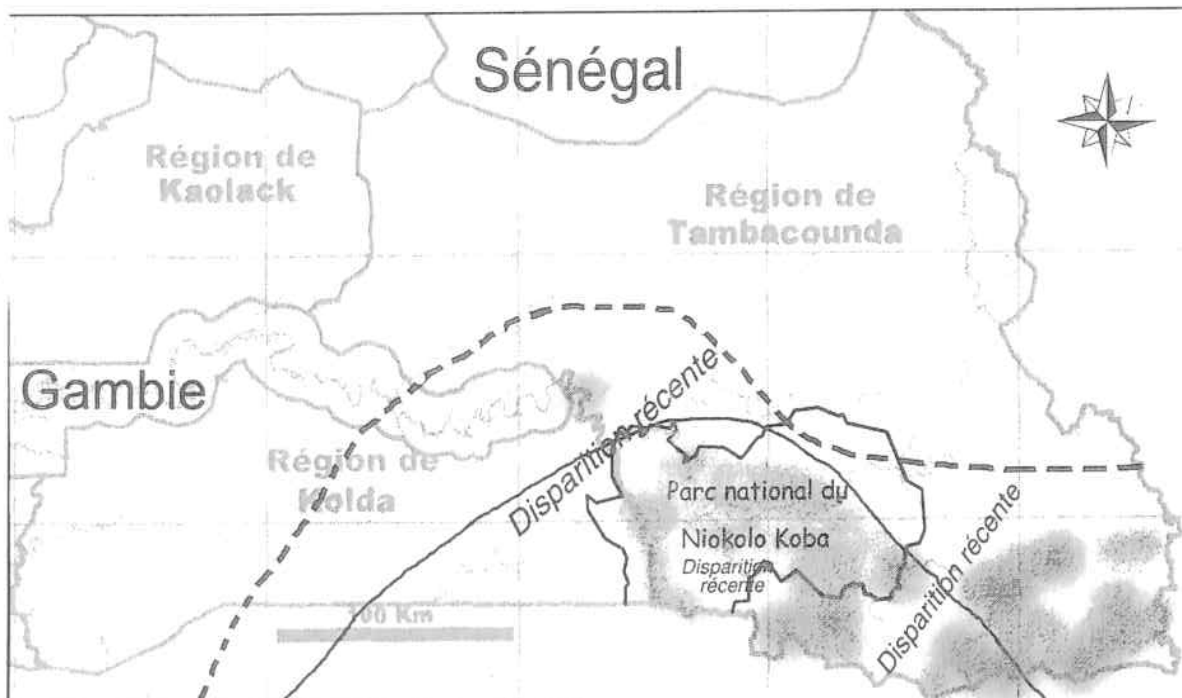


Figure 1. Distribution actuelle (zones grisées) du chimpanzé *Pan troglodytes verus* au Sénégal et limites nord selon Dekeyser (1955, trait plein) et Dorst et Dandelot (1970, tirets gras). Fond cartographique CSE, 1999.

récentes auprès des populations humaines locales dans plus d'une centaine de villages a été conduite de 1996 à 2000 au sud-est du Sénégal. Les observations directes et les indices indirects de la présence du chimpanzé ont été relevés et cartographiés.

Résultats

Le chimpanzé au Sénégal est rencontré (figure 1) dans le Parc National du Niokolo Koba (au Mont Assirik surtout, mais aussi occasionnellement dans toute l'étendue du Parc au sud de la route nationale 1) et, au sud du Parc, en pays Bassari dans le département de Kédougou, ainsi que, au sud-est du pays, dans la partie sud de la Zone d'Intérêt Cynégétique de la Falémé. Dans cette zone, les populations de 26 villages voient ou entendent régulièrement les chimpanzés.

Discussion

Depuis plus de 20 ans, il était couramment admis au Sénégal que le chimpanzé n'existait plus que dans la Parc du Niokolo Koba (Larivière & Dupuy, 1978). Si le refuge principal du chimpanzé au Sénégal reste bien le Parc, la figure 1 montre qu'il est encore relativement abondant en dehors de l'aire protégée. Ces résultats conduisent à doubler l'effectif estimé de la population de chimpanzés au Sénégal. Les estimations rencontrées dans la littérature ne concernent que la seule population du Parc National du Niokolo Koba et varient de 150 à 200 (Larivière & Dupuy, 1978; Galat *et al.*, 1994; Galat-Luong, 1995). Une estimation actuelle de la population de chimpanzés au Sénégal, prenant en compte les populations vivant en dehors du Parc, serait d'environ 300 individus, dont la moitié vivrait hors du Parc National du Niokolo Koba. Toutefois, on constate une fragmentation des populations, celles-ci se réfugiant dans les zones les plus inaccessibles, les galeries forestières dans les vallées et sur le sommet des collines.

Conclusion

L'aire de répartition du chimpanzé au Sénégal, ainsi que l'effectif de sa population sont plus importants qu'on ne le pensait récemment, mais on constate une fragmentation importante de la population.

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Bibliographie

- Bowen-Jones, E. 1998. A review of the commercial bushmeat trade with emphasis on central/west Africa and the great apes. *African Primates* 3: S1-S37.
- Dekeyser, P.L. 1955. Les mammifères de l'Afrique noire française. IFAN. Dakar.
- Dorst, J. & P. Dandelot. 1970. *A Field Guide to the Larger Mammals of Africa*. Collins, St James Place, London.
- Dupuy, A. 1970. Sur la présence du chimpanzé dans les limites du Parc National du Niokolo Koba (Sénégal). *Bulletin de l'Institut Fondamental d'Afrique Noire* 32: 1090-1099.
- Galat, G., A. Galat-Luong, M. Benoit, H. Chevillotte, A. Diop, J.-M. Duplantier & G. Pichon. 1994. Primate density in the Niokolo Koba National Park, Senegal. *Folia Primatologica* 62: 197.
- Galat-Luong, A. 1995. Du statut et de l'avenir des Primates au Sénégal. *African Primates* 1: 12-13.
- IUCN 1996. *1996 IUCN red list of threatened animals*. IUCN Species Survival Commission. IUCN, Gland.
- Larivière, J. & A. R. Dupuy. 1978. *Sénégal, ses parcs, ses animaux*. Fernand Nathan.
- McGrew, W. C., P. J. Baldwin & C. E. G. Tutin. 1981. Chimpanzees in a hot, dry and open habitat: Mont Assirik, Senegal, West Africa. *Journal of Human Evolution* 10: 227-244.
- Oates, J. F. 1996. *African Primates: Status survey and Conservation Action Plan*. Revised edition. IUCN/SSC Primate Specialist Group. Gland.

UNDERWATER SWIMMING BY BABOONS *PAPIO ANUBIS* IN NIGERIA

Diving and underwater swimming by rhesus monkeys *Macaca mulatta* is known from laboratory and wildlife observations (Anderson *et al.*, 1992; Linfield's BBC TV documentary, 1997).

In 1989 and 1990, I observed underwater swimming in olive baboons *Papio anubis* at the Wikki Warm Springs tourist camp (7°44' N; 10°31' E) in the Yankari Game Reserve, Nigeria. The observations took place

during approximately 60–80 hours over about 23 days. The site consisted of a river, which is 12–15 m wide and for the most part less than 1 m deep. The river emerges from a cave with crystal-clear water at a constant temperature of 31° C. Wikki Warm Springs was regularly used as a swimming pool by tourists. The shores were inhabited by two groups of baboons which frequently intermingled and showed no hostility towards one another (at least during my hours of observation).

Both groups were fully accustomed to the tourists and often robbed them of anything edible or interesting, either by means of quite ingenious tactics and strategies, or by straightforward intimidation. Baboons that were too much of a nuisance were reportedly shot. The small group (about 15 baboons) ranged predominantly on the northern shore, which was covered by savannah vegetation with isolated tall trees. The tourist camp site was located in this area. The larger group (about 25 baboons) mostly inhabited the southern shore, which was forested except for a small beach. Both groups regularly visited both shores and the beach during the daytime by crossing the river on a small footbridge made for tourists, or by taking a detour behind the springs. During the night, each group usually slept on its “own” side of the river.

Surprisingly, while both groups were quite familiar with both shores (*e.g.*, for drinking), only the members of the small group regularly waded, swam, dived and played in the river. They frequently crossed the river by wading and/or swimming, sometimes by first diving forwards, or vertically, head up, off a tree. They sometimes also crossed by jumping from a high branch above the water directly onto the opposite shore. I never saw members of the large group wade in the water or swim. I was never able to get any of the baboons to dive for bananas thrown into deep water. With regard to the small group, the adults swam rarely, if ever, but the half grown baboons obviously enjoyed doing so. They sometimes swam in groups of 4–6 individuals. Swimming to collect a floating banana was seen once. Sunken bananas were never seen to be retrieved by diving or swimming underwater. It therefore seems that these aquatic activities were a form of motor play.

One may wonder which local conditions could explain this “cultural” difference between the two adjacent groups. In the sleeping trees the small group usually used several branches overhang the water, and occasionally a branch even dipped into the water when weighed down by a heavy baboon. This may have resulted in individuals falling or jumping into the water while fleeing from a larger baboon. Once in the water, they perhaps discovered both the possibility and the pleasure of swimming in a warm pool. Since the large group rarely slept in trees overhanging the water, its members probably had less opportunity to make such fortuitous discoveries.

One might guess that diving and underwater swimming developed in order to search for food at the bottom of the water. This, however, is not plausible, both because the water and shores were regularly cleaned by camp site personnel and because no baboons were observed to obtain food (bananas) from the bottom, even when it sank there. Diving and underwater swimming seemed to be play activities that perhaps developed as an extension of social swimming “for fun” among the half-grown baboons.

Five (or possibly six) types of locomotion in or under the water were seen during 23 days of intermittent observation at this site: (1) quadrupedal wading (mainly by adults and subadults); (2) bipedal wading (mainly by medium-sized individuals, owing to the depth of the water); (3) quadrupedal swimming in the manner of a dog (mainly by half grown baboons); (4) apparent upright swimming, probably while wading bipedally on the riverbed; (5) quadrupedal underwater swimming, entirely submerged and without inhalation for 5–10 seconds. (This was seen by me on at least five occasions in 4 days of observation, and at other times by different observers.); and (perhaps) (6) quadrupedal underwater walking (not observed and, while it can't be ruled out, considered unlikely). The distance covered by underwater swimming varied from 6–9 m.

The absence of swimming among members of the large group is interesting. Long ago, the abundance of crocodiles *Crocodylus niloticus* and their effective invisibility in the murky waters of most African rivers may have led to the evolution by terrestrial African mammals of an instinctive fear of entering water. In the clear, fish-free water at Wikki Warm Springs, however, there are no crocodiles. This situation, together with their greater habituation to tourists and the likelihood of their fortuitously entering the water from overhanging branches, may have helped the members of the small group to overcome their natural fear of entering water and swimming. Nevertheless, one wonders why this was not learned by the other group, since the two groups regularly intermingled without antagonism. At any rate, one finds here a cultural difference in play between two groups. It may prove worthwhile to repeat observations on the large group at a later date to see whether they have taken up swimming in the meantime.

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References

- Anderson, J.R., P. Peignot & C. Adelbrecht. 1992. Task-directed and recreational underwater swimming in captive rhesus monkeys (*Macaca mulatta*). *Laboratory Primate Newsletter* 31: 1-4.
- Linfield, M. 1997. The Temple Troop (16 mm TV film). Green Umbrella/BBC-NHU Bristol.

NOTE ON WATER-"PLAY" BY AN OLIVE BABOON *PAPIO ANUBIS* IN GILGIL, KENYA

As an addendum to the report above, during the period between January, 1981 and July, 1982, I was conducting behavioural work with olive baboons *Papio anubis* on Kekopey Ranch, Gilgil, Kenya. At that time, the baboons obtained most of their drinking water from stock troughs for the domestic livestock that were raised on the ranch.

One afternoon, while the baboons were resting in the shade around one of the troughs after drinking, I observed a large juvenile female jump down into the trough. The water was probably no more than 30-45 cm deep. The female stuck her head under water and walked the length of the trough in that manner. She surfaced at the other end, did an about-face, put her head under water again, and walked back to her starting point. A number of her troop-mates watched this performance, some from perches on the edge of the trough. None emulated her. She climbed out of the trough after the second pass. I never saw this behavior repeated by her or any other troop member.

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LEOPARD'S PURSUIT OF A LONE LOWLAND GORILLA *GORILLA GORILLA GORILLA GORILLA* WITHIN THE DZANGA-SANGHA RESERVE, CENTRAL AFRICAN REPUBLIC

It is rare to witness an African pongid as prey to a natural predator (Jones & Sabater Pi, 1971; Fossey, 1983; Wrangham, 1983; Cheney & Wrangham, 1986; Goodall, 1986). This is attributed to poor visibility within the rainforest (Tutin & Fernandez, 1990); the apes' tendencies to live in groups (a possible defence mechanism) (McKenna, 1982; Tutin & Benirschke, 1991); and their large size (Tutin & Fernandez, 1990; Tutin & Benirschke, 1991). However, there are a few

accounts of predation by large cats both on chimpanzees *Pan troglodytes* (Boesch, 1991; Inagaki & Tsukahara, 1993; Tsukahara, 1993) and on gorillas *Gorilla gorilla* (Fay *et al.*, 1995). The following is a description of a leopard's *Panthera pardus* pursuit of a western lowland gorilla *G. g. gorilla*.

A lone adult male gorilla was observed on November 7, 1998 being chased by a leopard at the Mongambe research camp within the Dzanga-Sangha Reserve, Central African Republic. Mongambe is situated 13 km west of the town of Bayanga (2°51'N; 16°28'E). Our purpose at this site was to collect behavioural data on lowland gorillas while they visited the bais (open grassland areas).

To dissuade the forest elephants *Loxodonta africana cyclotis* from entering the camp, a primitive, split-rail type fence was erected around the perimeter. At 19:10 h (shortly after dark) there were a total of seven people in the camp. One of the Bantu tribesmen heard something running towards camp from the direction of the river. As he glanced up a lone gorilla was entering the camp, apparently hitting its head on the rail fence. He was able to see only the form of the gorilla in the darkness. Everyone in camp heard the gorilla bark and then realised that the gorilla was being chased by a leopard. The gorilla veered off to its left and ran along the side of the camp and into the forest followed by the leopard.

At 05:30 h the next morning, four of us followed the animals' tracks from the edge of the camp towards the river and beyond. It appeared that the leopard had begun chasing the lone male gorilla approximately 5 km from the camp to the north-west along the road. Both animals crossed the river using the wooden bridge and proceeded to the edge of our camp. The tracks were followed for another 0.5 km from the place where the gorilla hit its head and turned into the forest. An elephant had walked over the area and it was impossible to follow the gorilla and/or leopard tracks beyond 0.5 km. There was no evidence that the leopard wounded the gorilla along the 1.0 km of the flight path we examined. Unlike the incident reported by Richard Carroll (Fay *et al.*, 1995), we did not hear gorilla vocalisations near our camp in the immediate hours after the animals ran past our camp. Most likely the gorilla fled far past the camp.

Other researchers within Dzanga-Sangha have reported hearing and/or finding evidence of leopard attacks on lowland gorillas (Goldsmith, 1996, pers. comm.; Remis, pers. comm.; Carroll, pers. comm.). Gorillas' evasive behaviour in the form of barking vocalisations and leaving an area where later leopard tracks were found has been observed by Olejniczak (pers. comm.) in the Mbeli bai region of the Republic of the Congo. Fay *et al.* (1995) present cases in which forest leopards, in the absence of competing megacarnivores, prey upon much larger species than their

savannah counterparts. In the Dzanga-Sangha region, examples of their larger-sized prey are young forest buffalo *Syncerus cafer nanus* and immature male bongo *Tragelaphus euryceros*. The present incidence, coupled with the qualitative reports of other gorilla researchers in the Dzanga-Sangha and Ndoki Forest areas, adds the gorilla to the forest leopards' list of prey species. The importance of the gorillas' evasive behaviour has yet to be completely quantified. Until such measures are taken as outlined in Fay *et al.* (1995), we will not know the full influence of this predator/prey relationship on the gorillas' social structure and evolution (Cheney & Wrangham, 1986; Dunbar, 1988).

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References

- Boesch, C. 1991. The effects of leopard predation on grouping patterns in forest chimpanzees. *Primates* 22: 445–458.
- Cheney, D. L. & R. W. Wrangham. 1987. Predation. In *Primate Societies*. B. Smuts, D. Cheney, R. Seyfarth, R. Wrangham & T. Struhsaker, eds. Chicago University Press, Chicago. Pp. 227–239.
- Dunbar, R. I. 1988. *Primate Social Systems*. Comstock Publishing Associates, Ithaca, New York.
- Fay, J. M., R. Carroll, J.C. Kerbis Peterhans & D. Harris. 1995. Leopard attack on and consumption of gorillas in the Central African Republic. *Journal of Human Evolution* 29: 93–99.
- Fossey, D. 1983. *Gorillas in the Mist*. Houghton Mifflin, Boston.
- Goodall, J. 1986. *The Chimpanzees of Gombe: Patterns of Behaviour*. Harvard/Belknap, Cambridge, Massachusetts.
- Inagaki, H. & T. Tsukahara. 1993. A method of identifying chimpanzee hairs in lion feces. *Primates* 34: 109–112.
- Jones, C. & J. Sabater-Pi. 1971. Comparative ecology of *Gorilla gorilla* (Savage and Wyman) and *Pan troglodytes* (Blumenbach) in Rio Muni, West Africa. *Bibliotheca Primatologica* 13: 1–96.
- McKenna, J. 1982. Primate field studies: The evolution of behaviour and its socioecology. In *Primate Behaviour*. J.L. Fobes & J.E. King, eds. Academic Press, New York. Pp. 53–79.
- Tsukahara, T. 1993. Lions eat chimpanzees: The first evidence of predation by lions on wild chimpanzees. *American Journal of Primatology* 29: 1–11.
- Tutin, C. & K. Benirschke. 1991. Possible osteomyelitis of skull causes death of a wild lowland gorilla in the Lope Reserve, Gabon. *Journal of Medical Primatology* 20: 357–360.
- Tutin, C. & M. Fernandez. 1990. Responses of wild chimpanzees and gorillas to human observers. In *Primate Responses to Environmental Change*. H. O. Box, ed. Chapman and Hall, London. Pp. 187–197.
- Wrangham, R. W. 1983. Ultimate factors determining social structure. In *Primate Social Relationships*. R. A. Hinde, ed. Blackwell Scientific Publications, Oxford Press, Oxford. Pp. 255–262.

ENCOUNTER IN UGANDA BETWEEN CHIMPANZEES *PAN TROGLODYTES* AND A LEOPARD *PANTHERA PARDUS*

While developing a chimpanzee *Pan troglodytes* ecotourism programme at Queen Elizabeth National Park in western Uganda, I observed an encounter between a group of chimpanzees and a leopard *Panthera pardus*. The encounter occurred 200 m north of Project Headquarters at Fig Tree Camp.

On 25 January, 1992, at 05:20 h, I sighted a group of three chimpanzees (one adult female, two adult males) 30 m from me on the savanna plains about 50 m from the lip of the Kyambura Gorge. This gorge is about 11 km long, 100 m deep, and varies in width from 0.4 to 2.4 km. The forest in the gorge is the chimpanzees' primary habitat in the region. The vegetation within the gorge is riparian lowland deciduous forest while the slopes are covered with a mix of grassland and forest.

The vegetation was sparse between the chimpanzees and me, which gave me an unobstructed view. I had observed the chimpanzees for approximately 20 minutes when alarm screams were suddenly heard from a second group of chimpanzees located on the rim of the gorge. The three adults that I was watching rushed toward the noise. I followed them. A second group of chimpanzees was located in a small grove of trees and comprised an adult female, an adolescent female, and an infant male. All three members of this group were giving alarm screams.

Upon reaching the trees, the adult female ascended into the trees with the second group of chimpanzees. Meanwhile, the two adult male chimpanzees made

loud, threatening screams as they rapidly descended the slope into the gorge. About 15 m in front of the two adult males I saw a leopard also running into the gorge. Remaining on the rim of the gorge, I lost sight of the three running animals as they entered the forest understory at the bottom of the gorge. All six of the chimpanzees continued to vocalize for several minutes after the leopard was chased into the gorge. Within 5 minutes after the chimpanzees stopped vocalizing, the four chimpanzees on the rim of the gorge slowly descended into the gorge and out of sight.

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TRIBUTE

CLIVE MARSH (1951-2000) AND THE TANA RIVER: A TRIBUTE

On the 16th of October 2000 tropical conservation suffered a major setback and a great many of us lost a friend and colleague when Clive Marsh passed away. His tragic and premature death was due to complications resulting from encephalitis that he contracted while working in Laos. Most of Clive's professional life was spent conserving tropical forests in Southeast Asia (Peninsular Malaysia 1978-1981; Sabah 1981-1996; Laos 1996-2000). This is described in detail along with personal notes about Clive in an eloquent tribute written by Julian Caldecott, Tom Evans, and Christopher Tuite (see *Asian Primates*, vol. 7, nos. 3 & 4, December 2000 and March 2001). What I wish to do here is pay tribute to Clive's important work on the Tana River in Kenya, to provide some historical perspective to his primate research and conservation work there, and to express my personal loss with his passing.

I first met Clive in 1971 when, as a 20-year old undergraduate, he came to the Queen Elizabeth National Park, Uganda, for a study of the feeding ecology of pied kingfishers. Taking a break from this study, he and the late Peter Jewell visited John Oates and me in the Kibale Forest. My first impressions of Clive were that he was very enthusiastic about field biology and that he was notably independent. After all, he came to Uganda with no prior experience in the tropics and with little assistance and had successfully initiated a study.

In the following year I was asked by my employer (New York Zoological Society) to develop more field projects in Africa and to recruit and train students to conduct these studies. An obvious project centered on

the two endangered primates of the Tana River; the Tana River red colobus and the Tana River crested mangabey. Although the issue of funding had been solved, finding good students who would thrive under field conditions was more difficult. Clive was an obvious choice for the Tana and he leapt at the opportunity. So, in January 1973, Clive began his study of the Tana River red colobus.

Clive was an ideal student. Although I visited him in the field on several occasions from my base in Uganda, he needed very little assistance. With minimal guidance and direction Clive took the helm. His very detailed studies on the behavior and ecology of the Tana red colobus are excellent models of what every teacher hopes for in a student. His numerous publications on the Tana colobus have been critical to our understanding of the dynamics and variability of primate behavioral ecology in general, as well as to the specific problems currently facing one of Africa's most endangered primates.

Early in the development of Clive's research on the Tana we agreed that the ultimate goal of this project should be to enhance the conservation status of this endangered ecosystem and its endemic primates. Clive's dedication to this effort is exemplified by the fact that after completing his field studies and with more than ample data, he delayed the completion of his Ph.D. thesis for another year so that he could remain on the Tana to develop a management plan and to lobby for the creation of the Tana River Primate National Reserve. His diligence paid off and the reserve was established in 1976. Following this, Clive was awarded his Ph.D. in 1978 from the University of Bristol under Dr. John Crook.

Clive was part of a cohort of outstanding students working on African forest primates. His study on the Tana was contemporaneous with the studies of John Oates (Kibale black and white colobus), Katherine Homewood (Tana crested mangabeys), Rudy Rudran (Kibale blue monkeys), Doyle McKey (Douala-Edea, Cameroon black colobus and secondary compounds), and Peter Waser (Kibale grey-cheeked mangabeys). Another close companion of Clive's on the Tana was Jim Allaway who studied the elephants there. All of these outstanding scientists had the good fortune of visiting or working with Clive on the Tana. Clive was always a warm and generous host and these exchanges were not only important in terms of developing ideas, but also led to life-long friendships.

At the time of Clive's study, the Tana was in much better health than it is today. When I first surveyed the Tana in 1971 and when Clive began his studies in 1973, elephants and rhino were still abundant in what is now the Tana River Primate National Reserve. Now the rhino are gone and the elephants are few. The Tana forests and their primates are under increasing siege due to agricultural expansion by the Pokomo and river-

flow alteration by hydroelectric dams upstream. The new generation of conservationists working to save the endemic primates and their forest habitats on the Tana must take heart from Clive's precedent and be given every possible support in their efforts.

After Clive completed his Ph.D. he moved to Malaysia where he increasingly spent more time and effort on conservation. This is a recurring theme among those who study forest primates. Following an intensive period of detailed scientific study, we try to protect what we have come to understand, value, and love. And, as it did with Clive, this often results in a major career shift. During this period I had the good fortune to visit him three times in Malaysia and once again back on the Tana. I always enjoyed our reunions where the discussions and debates ranged from natural history and sociobiological theory to conservation strategies and politics. And, of course, we drank beer and swapped lies.

Eventually, Clive's energies were largely taken up by all the administration, negotiations, and lobbying that are essential to conservation implementation. One of the most tangible results of Clive's conservation work in Malaysia is the Danum Valley Conservation Area (438 square km) in Sabah. This important area of tropical forest stands as a living tribute to Clive's dedication to conservation. He loved this forest and spent years working to protect it. Now his ashes rest there. Clive's life will serve as an inspiration to all of us who care about tropical forests and the creatures who live there. He had a passion for life and did his best to conserve a beautiful part of it.

I last heard from Clive in January 2000 shortly before he became seriously ill. We were hoping that he and his family might join us here in North Carolina where he would spend some time writing and discussing ideas relevant to tropical conservation. Now I must be content with the thought of toasting him when I am next on the banks of the Tana at sundown—listening to the hippos and mangabeys, and watching the crocodiles.

Note: Clive is survived by his wife (Ignatia Valentina Olim), two sons (Marco born 1989 and Carl born 1993), his mother (Ann Robson Marsh), and two brothers (Adrian and Roger). Clive's father, Hugh Marsh, passed away 2 years ago.

The Clive Marsh Conservation Fund covers small grants for Southeast Asian students to undertake field research related to conservation of wildlife and wildlands. It is administered by the Wildlife Conservation Society Asia Program as a small endowment, with grants to be funded from investment earnings only. WCS will match contributions on a dollar to dollar basis. All monies donated to the fund will go 100% to field projects, none to administrative costs. *Payment Details:* All donations should be sent to:

Wildlife Conservation Society (Clive Marsh Conservation Fund), c/o Linda Krueger, Program Manager, Asia Program, Wildlife Conservation Society, 2300 Southern Boulevard, Bronx, NY 10460-1099, USA, Tel: 718-220-3973, Fax: 718-364-4275, E-mail: lkrueger@wcs.org

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NEWS

GORILLA TOURISM AND HUMAN DISEASE

Gorillas are highly susceptible to a large number of human pathogens, which has led to concern that current trends in tourism may be placing them at risk. Tourists seeking out close encounters with endangered species in their natural habitat may be unaware of the potentially harmful consequences of their presence. A report by Jacob Homsy for the International Gorilla Conservation Program has made several recommendations regarding visits to habituated gorilla groups in order to minimise the risk of disease transmission.

Some of the recommendations concern limiting the contact between humans and gorillas. These recommendations include limiting the frequency of visits to one visit per day, and limiting the number of visitors to 10 people per group, including guides, trackers and rangers. A minimum distance of 7.5 m between visitors and gorillas was also set, and the duration of the tourist visits was to be limited to one hour.

Other recommendations involve imposing restrictions on the behaviour of visitors when at the field sites. Visitors and guides should maintain a 5-minute minimum walking distance away from gorillas when eating and remove food remains; any human faeces should be treated with antiseptic and buried at least 0.5 m deep. Littering in parks is currently prohibited, but it was recommended that this be monitored more carefully. Attempts should also be made to control certain other behaviours in the presence of the gorillas, including smoking, sneezing, spitting, coughing and nose-blowing in the presence of gorillas.

Finally, recommendations were also made restricting eligibility of certain individuals to visit gorillas. Individuals are currently required to self-report any illnesses, but it is unlikely that they would have the motivation to do so. It is recommended therefore that visitors and guides be immunised against specific diseases. A minimum age limit of 15 is also intended to

prevent the transmission of "childhood" diseases.

[Source: *Gorilla Journal*, 20 June, 2000 via *IPS Bulletin* 27(2): 6]

EMBATTLED MOUNTAIN GORILLAS SURVIVE

Kenneth Cameron got the emergency call after only a few months in Rwanda. A young female mountain gorilla had a snare around her ankle and was in danger of losing a foot, maybe her life.

What he didn't know when he headed for the Congo forest was that she had a protector—a 400-pound male gorilla who dealt with the human interloper by sitting on him. "He came walking over, turned and sat on one leg, reached over my head and grabbed some leaves and ate for several minutes while he had me pinned," Cameron said. Cameron, an associate veterinarian at the Cincinnati Zoo, is in the midst of a 2 year stint with the Mountain Gorilla Veterinary Project, which tries to monitor the health of the rare animals. Mike Cranfield, head veterinarian of the Baltimore Zoo, is the project's director.

The gorilla project was established by the Denver-based Morris Animal Foundation in 1985, the year gorilla expert Dian Fossey was killed at her camp in Parc National des Volcans in Rwanda, where she studied the animals for 18 years and waged a personal war to protect them from poachers. For nearly a decade, scientists have been stymied in their efforts to help mountain gorillas because of ethnic fighting near their home—a densely-forested volcanic mountain range at the borders of Rwanda, Uganda and the Congo. Parc National des Volcans, where the gorillas live at elevations between 9,000 and 13,000 feet, has become so dangerous that Cameron has been unable to visit the project's veterinary centre in the park in Kinigi since his arrival in June 1997. Fossey's camp, Karisoke, has been stripped of lumber and metal sheeting. Several times the project's centre has been looted and destroyed.

The military recently provided an escort for trackers with the Atlanta-based Dian Fossey Gorilla Fund, International, another research group that collaborates with the Mountain Gorilla Veterinary Project, to count Fossey's gorillas. Trackers found 63 gorillas in September representing two of Fossey's original three groups. The following month they located the third group of 16, a bit smaller than when last counted in the 1980s. Two infants were among the groups. "It is surprising with the turmoil that the gorillas are still around and appear to be doing all right," said Dieter Steklis, the Gorilla Fund's chief scientist.

Cranfield, who returned from a 2 week visit in early December, said he's hopeful the veterinary centre can

be re-opened in the next few months. "Rwanda is much more settled and we were able to make it to the edge of the park," he said.

The number of mountain gorillas left is in dispute. None live in captivity. About 300 are believed to live in parks in Rwanda, Congo and Uganda. A second population of smaller gorillas with broader faces in the Bwindi Impenetrable National Park in Uganda could double that number depending upon whether they are mountain gorillas or a different subspecies. Genetic testing indicates that the two gorilla populations are genetically the same, but scientists want more testing to determine whether the Bwindi gorillas, which live at lower altitudes, are truly mountain gorillas. The two populations are divided by a large swath of farmland in a broad valley in the volcanic mountain range.

Normally, Cameron would expect to provide emergency veterinary care for at least two or three injured gorillas a year. But the call in October 1997 was a rare opportunity, in large part because rebel fighting prevents trackers and park guards from entering the forests. "It's frustrating," he said. "We're just not getting the calls. No one is there to see and report." Rebel fighters aren't the only ones giving Cameron trouble. Sometimes it's the gorillas. After travelling for five hours, he found the young female gorilla and a silverback—the name given to dominant males for the grey hairs down their backs. Trackers formed a defensive line so Cameron and his assistant could begin their work, or so they thought. "He unfortunately moved through that defensive line and was looking for someone to take out his anger on. Unfortunately it was me," Cameron said. As the male gorilla sat on him, Cameron made guttural noises to calm him. After about 5 minutes, the silverback let him crawl away.

Cameron found the young female in thick underbrush. He clipped dead skin from where the snare had amputated the end of her toe, took blood, urine and stool samples, and gave her an antibiotic. He finished just as the silverback broke through the underbrush, 10 ft away.

"It came right down to the wire," Cameron said.

If not for rebel fighting, Cameron said, he probably could have saved a young male gorilla in Bwindi. The youngster was malnourished and weakened by parasites, and couldn't keep up when his group fled, probably after encountering another gorilla group. Cameron had to delay his departure for about 12 hours because it is not safe to travel at night. The gorilla died several hours before Cameron reached him.

Things went better during Cranfield's visit when the team was called to help a young male gorilla in Uganda with a snare on its right hand. The group found the injured gorilla in dense bamboo among a group of eight gorillas, which included two silverbacks who twice charged the intruders. The young gorilla was darted and the team got to work, cleaning the wound and

administering an antibiotic. Even so, the gorilla will probably lose two fingers, Cranfield said.

As part of their research, the project team of Cameron, his assistant, and two local veterinarians, is gathering data on the gorillas' vulnerability to human diseases. Since mountain gorillas and humans share about 97% of the same DNA, they get the same diseases, including polio and tuberculosis. Scientists want to know what diseases the gorillas are being exposed to and whether they are developing resistance. The information will be used to develop a new protocol for tourist groups. Several mountain gorillas died in 1988 and 1990 of respiratory problems caused by human measles. "Something like a nasty flu virus can go through that population and ravage it," Steklis said.

When Cameron returned to Rwanda in late October, he took back a portable blood chemical analyser that will allow veterinarians to test for kidney and liver problems, anaemia and dehydration. So far, about 100 hair, tissue, blood and faeces samples have been sent to the University of California-Davis to be analysed for parasites, bacteria, viruses and other infections, as well as clues to nutrition and genetics.

The project also hopes to educate the locals about alternative sources of protein besides bush meat, such as cane rats, goats and rabbits, that won't require hunting with snares in the parks.

Cranfield said being able to help the young gorilla was one of the greatest thrills of his life. "They are magnificent animals and there are very few of them left."

Mary Pemberton Associated Press Writer

[source: owner-primfocus@waste.org 4 January, 1999 and Associated Press, Baltimore]

CONGO'S GORILLAS MARKED FOR EXTINCTION BECAUSE OF POLITICS

Congo's Kahuzi-Biega National Park is located in the highlands overlooking Lake Kivu. It is prime mountain rainforest and the home of 280 gorillas. This is one of the last remaining gorilla sanctuaries in the world. Further it abounds with other wildlife including forest elephants. Truly it deserves its World Heritage listing! Miraculously the park survived Congos' political upheavals and wars, that is until three years ago when Rwanda invaded this part of the Congo. Now the Rwanda-backed government has disarmed the park rangers and left the poachers free to slaughter the gorillas in the park. The slaughter of wildlife is appalling. This is January 2000, the dawn of the new millennium. Mankind rejoices because it has now the

scientific, technological knowledge and the human and humane wisdom necessary to plan a bright future for the planet. Yet on the dawn on the new millennium, precisely on January 1, 2000, the remnants of three gorillas slaughtered by poachers were found in the Kahuzi-Biega National Park. In January 2000 there remain in the Park at most 99 gorillas, three years ago there were 280 gorillas. Out of four habituated families there remain only two. In plain words, Only one gorilla out of 3 has survived Rwanda's military invasion of Congo three years ago. The slaughter of gorillas continues today as you read this news.

Other wildlife has also suffered even worse. There remain at best 20 elephants, at worst 5 elephants. Three years ago there were at least 320 elephants. That is a 95% extinction rate. The park rangers are very keen and motivated. However the Rwanda-backed government has disarmed them (this area of Congo has been paired with the small Butare province of Rwanda). The park rangers do patrol the park, but they are unarmed. They are facing poachers who have automatic weapons, including Kalachnikov. It is no contest, the poachers' bullets versus the body of park rangers! The gorillas lose every time and every day and pay with their life. The park rangers are attacked and killed by the poachers and without weapons they cannot defend themselves. The rangers can't even sleep in the park anymore, they come early morning in the park and count more slaughtered gorillas weekly. All the park rangers can do is stay with the last two habituated families in daytime and hope for the best. However when the armed poachers come in, the unarmed park rangers have to flee. The park rangers are no cowards, indeed until they were disarmed by Rwanda-backed government they were patrolling the park efficiently, they had no fear to track and stop the armed poachers, there was virtually no poaching. I met Mugaruka, the young habituated silverback gorilla. Recently, after Rwanda disarmed the park rangers, this 200-kg gorilla lost a hand. He tore it from a steel trap set by poachers. Imagine the pain, the anguish, the suffering? His eyes expressed the fear and the knowledge he is condemned to death by man. So much for man's enlightenment in the new Millennium!

What is the reason? It is not money. It is not starvation of The people. It is not an accident. It is human greed and geopolitics. The Kahuzi-Biega is a repeat of the situation in Rwanda's 6000 km² Akagera National Park. To avoid the Western World outrage if the park was degazetted outright, the Akagera National Park was destroyed one step at a time by the Rwanda government over the last 4 years. First the rangers were disarmed and poachers run free; then the army slaughtered the dangerous animals such as lions; then cattlemen with the correct political connection were allowed in; then the charcoal burners were allowed in to deforest the area; and step by step the land was

unofficially but efficiently opened for settlers with the correct political connections. Finally when fauna and flora were all gone and the park was de facto not a park anymore, the bulk (75%) of the park was degazetted. Government ministers became rich landlords in the process.

Unfortunately this scenario seems to be repeated in Congo's Kahuzi-Biega National Park. The same Rwanda government is effectively in control. The policy clearly seems to be to let the poachers eradicate gorillas in order for officials to seize the land once the park loses its value after the gorillas are gone. In Rwanda none of the large conservation groups and societies uttered a word of protest to the press or to the Rwanda government when the Akagera National Park was destroyed. They were afraid to be accused to be insensitive to the human tragedy. Certainly people have suffered untold miseries in the ethnic cleansing in Rwanda. Nevertheless that does not excuse a deliberate policy of bringing gorillas to extinction. There is a precedent for that. In World War II in Poland the last European wild buffaloes were preserved by all sides at war (the Nazis, the communists and the Polish underground) in the middle of untold human misery, a war, mass murders and mass starvation, because the people believed that when peace returns these wild animals were an important heritage of their country and had to be preserved. This demonstrates that human misery does not excuse bringing rare animals to extinction.

There is no reason to repeat with the gorillas of Kahuzi-Biega National Park the mistake of the Akagera National Park, namely to stay silent. The situation in Kahuzi-Biega is, plain and simply, barbaric - just look into the suffering eyes of Mugaruka and you will understand that we owe it to humanity to save the gorillas of the Kahuzi-Biega National Park before Rwanda destroys this park and its gorillas.

Money is not the issue here. Please do not send money! Instead, please write your concern to the press. Mainly and most importantly for the people from the USA, Japan and EEC reading this, please write to your representative in parliament and request that your democratic government stops all financial aid to Rwanda until it abandons its policy of leading gorillas to extinction. Rwanda is totally dependent on foreign aid, your message will bite and count and will help save the gorillas of Kahuzi-Biega. It is your taxpayer money that is now helping Rwanda bring gorillas to extinction. You have control on that money. Only you can save the gorillas. Only you writing to your government representative to stop financial assistance to Rwanda until Rwanda stops promoting the slaughter of gorillas and their ultimate extinction.

PLEASE WRITE. USE YOUR DEMOCRATIC RIGHTS.

Sebastien Honore

GENOCIDE OF GORILLAS OCCURRED IN THE KAHUZI-BIEGA NATIONAL PARK

Frequent and a massive poaching for gorillas occurred in the Kahuzi-Biega National Park this year. All four habituated groups that had accepted tourists no longer exist, and it is suspected that more than half of the population (240 gorillas) in the original sector of the park (600 km²) have been killed recently. Poaching activities in the lowland sector (the rest of 6,000 km²) are anticipated to be more severe. The eastern lowland gorillas (Grauer's gorillas) are now critically in danger of extinction.

During my stay in DRC in October, 1999, I had frequent long talks with the Conservators (Mr. Mushenji Lusenge and Mr. Mankoto ma Oyisenzoo) and all the guides and trackers of the Kahuzi-Biega National Park. In summary of their stories, the genocide occurred continually throughout this year.

Until the end of July last year (1998), four groups of gorillas had been monitored by the Park on a daily basis for tourism. Mushamuka group consisted of 10 gorillas (1 blackback, 4 females and 5 immatures), Maeshe II (Lambchop) group consisted of 15 gorillas (1 silverback, 10 females and 4 immatures), Nindja group consisted of 25 gorillas (13 females and 12 immatures), and Mubalala group consisted 21 gorillas (1 silverback, 1 blackback, 10 females and 9 immatures). Because of an outbreak of internal war in the beginning of August and the following control by the rebel government, the Park staff was disarmed and could not enter the park. The main entrances (Tshibanga and Kahuzi) were closed and transport stopped between Bunyakiri and Bukavu (Lowland sector and Highland sector). No direct observations had been made and little information had been available on the four groups until the end of March 1999 when the Park resumed the monitoring of the groups and the regular patrols without arms.

Mubalala group had been lost in their former range since last July. In February 1999, the Park staff found a large number of gorilla bones scattered within the range of the group. Piles of bones were burned in some places. They also heard from the villagers nearby that dead bodies of gorillas had been seen being transported by poachers to Kalonge (a village beside the lowland sector of the Park). It is suspected that most members of Mubalala group were killed by poachers for the trade in bushmeat.

Since then no gorilla group has been found in this area. In June 1999, the Park staff found a fresh nest site of gorillas and counted 12 nests including 3 juvenile's nests. They tried to contact them and confirmed that at least 2 females showed no fear of their approach. These females may be the immigrants from the habituated groups (most possibly from Mubalala group). The Park named this group Mufanzala

and started to monitor them. In September, the Park staff counted 14 nests. In October, the Mufanzala group moved to the base of Mt. Biega, which the regular patrol does not cover, but efforts to contact them have been continuously made until now.

Maeshe II group was found as a large group (23 gorillas) in the beginning of April 1999, when the Park staff started to monitor this group again. Several females had immigrated and some babies had been born in this group since August 1998. However, the group moved to the former range of Mubalala group where poachers activities were high and the sound of gunfire was frequently heard. At the end of July, the group was lost and no new nest has been found in this area. On 17 August the Park staff found a poacher's hut. A lot of gorilla skulls remained there. Poachers seemed to cut gorilla meat and to smoke it. In September, the Park arrested a group of poachers with numerous fragments of gorilla fur, skull and bone. It is possible that most members of Maeshe II group were slaughtered by these poachers for the bushmeat trade.

Mushamuka group was not found when the Park staff resumed monitoring and patrol in April 1999. This group had probably disintegrated before. However, a small group consisting of a silverback/blackback, three females, a juvenile and an infant was found in the former range of Mushamuka group. The maturing silverback, named Kaboko, was confirmed to have been born in the Mushamuka group in 1987. He lost the right hand by snare during his childhood. This year he was given a new name, Mugaruka (the name of the present chief in the village nearby Tshibanga Station). A female had also lost her right hand and had a disabled left hand. When I observed her this time, a wire rope was still tight on her right wrist. She walked bipedally. It was a pity! Nevertheless Mugaruka and the other gorillas showed no fear at our approach. The park staff have continued to monitor this group.

Nindja group consisted of 19 nest-builders with five infants when I visited them on 7 April, 1999. On 11 April the sound of gunfire was frequently heard from the range of Nindja group and since then the group has been lost from the area. Later, a number of dead gorilla bodies were seen being carried by poachers in villages nearby. It seems likely that most members of the group were shot dead by the poachers. In July a group of gorillas who had formally ranged in Mbayo (the north of Tshibanga Station) moved into the former range of Nindja group. The Park started to monitor and to habituate this group. They found at least three females of Nindja group associating with the group. They counted 16 nests in July and 26 nests in September. Apparently other gorillas have joined the group recently. In October, the group included a silverback and at least five juveniles and three infants and the total number reached 31. The silverback, who had a disabled left hand (probably from snare), was named Mishebere (the name

of a dedicated tracker in the Kahuzi-Biega National Park). A 3-year-old juvenile also had a disabled right hand. Mishebere and the other members of the group habituated quickly and accepted visitors in September.

I also got sad news about my study group (Ganyamulume group). Although I could not visit them this time because of insecurity in their ranging area near Tshibati, my field assistant and trackers have visited them on a daily basis. A young silverback was shot dead by poachers in August and a solitary male has recently associated with the group. Fortunately all the females and immatures continue to move together. So the group size has not changed. However, neighbouring groups have disappeared from this area. Four groups had ranged around Tshibati until August last year. Three of them have not been found this year. They were possibly slaughtered for bushmeat, like the habituated groups.

In September, the Park authorities summoned the suspected 67 poachers and asked them about their recent activities (they were promised would not be punished for poaching during the war). They reported their active poaching, due to starvation, in detail. Most of them reported experiences of poaching both elephants and gorillas recently—even close to the Tshibanga Station. The Park decided to employ 40 of them to assist tracking gorillas and patrolling in the Park to break snares and poacher's huts. Guides and trackers visited Mugaruka, Mishebere and Mufanzala groups every day, and a few of them remained with each group to watch them from 06:00 h to 18:00 h. Since this decision was made, poaching activities have greatly decreased and no gorilla has been lost in a habituated group.

Now, the Park staff keep half of the original park safe for gorillas with frequent patrols (Kahuzi-Biega-Kasirusiru-Tshibanga-Tshibati). The other half is not monitored by the Park staff and seems to be frequented by poachers. The lowland sector is completely out of the Park's control. From the tragedies of the former habituated groups, it is estimated that more than 60 gorillas were killed by poachers. If the disappearance of the three groups around Tshibati and the possible killing of gorillas in unmonitored areas of the Park is taken into account, more than half of the gorilla population was lost this year. The situation in the lowland sector may be worse. Starvation and the spread of guns among the local people during the war are the main cause of this situation. During my stay in Bukavu, I heard that the meat of gorillas was sold at US\$ 0.25 (half the price of beef!) everywhere.

Mr Guy Debonnet (GTZ) has proposed a census of the mammal population in the original part of Kahuzi-Biega National Park. Although the political situation is still difficult, the number of surviving gorillas and the present status of other mammals should be surveyed as soon as possible to allow urgent conservation measures to be taken. An international survey team should be

organised and financed to conduct this survey in the near future. The survey team should include the Congolese researchers and the resident people. It will hopefully attract international attention to the tragedy of the gorillas at Kahuzi and will improve attitudes of local people towards the

eastern lowland gorillas as a national and a world heritage.

Juichi Yamagiwa

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SUMMARY OF THE "WILD CHIMPANZEE FOUNDATION" ACTION PLAN

Scientists studying wild chimpanzees, bonobos and gorillas in various study sites throughout tropical Africa are continuously faced in their research with the disastrous effect on these animals of habitat loss through human population expansion, wars, industrial logging, fires, human infectious diseases (such as Ebola, measles), and poaching for meat. Christophe Boesch has experienced this very profoundly during his 21-year long study of chimpanzees in Côte d'Ivoire, West Africa. To counter this fate, the "Wild Chimpanzee Foundation" (WCF) was created by him and Fabrice Fayd'Herbe de Maudave, a management consultant with extensive experience in environmental project financing and management in Africa. The Scientific Committee of the Foundation is so far constituted by Richard Leakey, Toshida Nishida, Richard Wrangham and Claude Martin. A Steering Committee of 30 members including all main field researchers on chimpanzees and bonobos is supporting and advising the WCF. This committee will act as an advisory board on questions related to the survival of the chimpanzees and provide expert opinions for actions, as well as campaign actively throughout the world to promote the cause of the chimpanzees. The action plan can be downloaded from our internet site (www.wildchimps.org).

Chimpanzees are at the edge of extinction and their disappearance will not only be another impoverishment of our world as such, but due to the chimpanzee's closeness to human beings, it will also be the loss of the living link to our own history and evolution.

The main objectives on the ground of the WCF are to establish:

- a "Pan-African green network for chimpanzees" with the aim to assure protection of 20,000 to 25'000 chimpanzees,

- a "Pan-African monitoring programme" to guarantee the preservation of the green network by involving local people and by increasing our knowledge of the populations being protected.

The philosophy of the project is three-fold, based on Education-Conservation-Research, involving the local human populations around the protected key sites, school children from developed and sub-Saharan countries, and scientists.

The action plan elaborated by the WCF includes a first 5-year period and has two major objectives:

- 1) *Protection of key chimpanzee populations reinforced:* Conservation is needed where the chimpanzees and their habitat still exist and, whenever possible, the aim is to protect the largest viable chimpanzee populations throughout sub-Saharan Africa. Analysis of satellite pictures will guide the search of key sites and their censuses. Collaboration with the local authorities and other organisations involved in related matters (Bushmeat Task Force, Ape Alliance) will be promoted with the aim to implement an international ban on hunting and trading of African great apes. The constant presence of researchers in a region has proven to be an effective method of improving the protection as well as the knowledge of an area. Implantation of micro-research projects will facilitate the monitoring of the sites and guarantee a continuous presence of researchers in the field. The foundation will strive to develop the awareness of the local population and involve them in the protection of the chimpanzee key sites. To achieve this objective, we plan to implement specific actions to achieve the three following outcomes:
 - Habitat of key populations conserved,
 - Poaching is reduced,
 - Conservation/development policies include environmental interests.

- 2) *Human/chimpanzee co-existence improved:* The foundation aims at developing the interest of the younger generation for the African rain forest environment and the chimpanzee, our closest living relative. An internet based network will be developed by schools of different European countries to share information on wild chimpanzees and provide information to teenagers all over the world, particularly in tropical Africa. Members of the steering committee will contribute to this and share their knowledge on chimpanzees. To reach this objective, the WCF plans to develop actions aimed at promoting the three following outcomes:

- Young people develop awareness of the need to protect chimpanzees,
- Human/chimpanzee conflicts are reduced,
- Research findings are more widely disseminated.

The first 5-year phase of the project is planned to cost US\$ 7.6 millions. The WCF will have an African office to coordinate and implement the actions in the field. Financial accounting will use the ACCPAC program for Windows and a manual for the financial policy, and annual external financial audits will guarantee the efficiency of the management of the Foundation.

As we plan to be active even before having collected all the funding needed to implement the 5-year project, we have already started to collect information on awareness material used in other great ape projects (such as the Mahale Mountains Conservation Society, the Jane Goodall Institute, the Budongo Forest Projects, International Gorilla Conservation Programme) and will launch an awareness programme around the Taï National Park with the support of the WWF-Germany and the Columbus Zoo, USA. To be able to start working efficiently rapidly, the WCF would need two salaries so as to be able to set up the foundation, pursue fund raising, establish networks of schools and scientists, and coordinate the flow of information on the present situation of the wild chimpanzees and the actions already taken by other conservation agencies.

With the help of the members of the Steering Committee and other experts, we have started collecting information on the situation concerning the chimpanzees in 21 African countries with the specific intention to select sites where large populations of chimpanzees are surviving in relatively good conditions and where the prospect of survival is reasonably good. This will allow us to rapidly select sites for establishing the Pan-African green network for chimpanzees and will guide us to set up priorities for starting actions. With these we hope to increase awareness of the conservation community about the need for specific sites and to coordinate actions to improve the situation.

The ideal situation of obtaining the total budget very quickly is probably not a realistic view. But the situation is urgent—we are fighting for the last remnant areas of pristine forest and their fauna.

Wild Chimpanzee Foundation

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studying wild chimpanzees, I implore you to support our proposal that UNESCO take special measures to save the great apes. When Professor Richard Wrangham came to Japan last year for an international symposium at Inuyama, he expressed his vision that great apes be given special status, such as "World Heritage Species," by UNESCO, to give them greater protection.

Many people may still believe that great apes have decreased in number mainly because their habitat has been transformed into farmland. This is not the case. Several conservation NGOs, such as the UK-based "Ape-Alliance" and the USA-based "Bushmeat Crisis Task Force," have demonstrated that now the greatest threat to African great apes is posed by people eating them as bushmeat. There are many apparently "pristine" forests in central African countries such as DRC, Congo, and Gabon, where you can still find giant trees but rarely mammals. The process happens in the following way: first, selective loggers make a long road to exploit valuable timber, then hunters come to provide meat for employees of the logging company, and subsequently begin to transport bushmeat to local cities and even capital cities. This is not subsistence hunting but commercial hunting. Major victims of the bushmeat trade are duikers, monkeys, and larger rodents. Great apes account for less than 1% of the bushmeat trade. However, since their reproductive rate is very low, they suffer the greatest damage from this market system.

Therefore, African great apes have been disappearing much more quickly than people had expected. Orangutans have a different problem. They are being direly threatened by illegal logging. Consequently, special measures are urgently needed to protect the great apes if indeed we hope to avoid their extinction. My proposal is to persuade the governments of developed countries not to extend overseas development aid to such habitat countries that do not take effective measures to protect the great apes. Namely, I am proposing a policy of swapping great ape conservation for overseas development aid. In order to make this approach most effective, UNESCO should declare the importance of great apes and grant the special status to them.

Great ape researchers have started to prepare the preamble for the World Heritage Species. I have drafted a resolution by IPS to express our grave concern about the destiny of our closest relatives. Meanwhile, we will begin an e-mail campaign to obtain as many supporters as possible. I beg all of you to help this movement so that our lobbying activities may ultimately succeed.

Toshisada Nishida

[Source: *IPS Bulletin* 27(2):1]

WILL APES SURVIVE THE 21ST CENTURY?



Four years have passed quickly, and this is the last opportunity for me to write an essay in this column.

As a primatologist who has been

THE BUSHMEAT CRISIS

The bushmeat crisis is analogous to the near-extinction of the American bison (buffalo). American Indians hunted bison sustainably for millennia using traditional methods. Then contact with Europeans brought horses, guns, and railroads. It became easier to kill bison, and the railroads made it possible to send meat and hides to urban markets. With markets, hunters turned professional. The result was one of the greatest animal slaughters in recorded history. Bison numbers dropped from about 50,000,000 to fewer than 1,000 by 1890.

And yet, nobody was doing anything "wrong". Indians had always hunted bison; Europeans were only participating in an existing hunt; it would seem capricious to deny Indians weapons, or Easterners access to food and hides being obtained in the West. Nobody was "wrong" and yet we almost lost the bison.

The threat to Africa is much greater than it seems. The effects of logging during the 1990s created the "bushmeat crisis", but during this time Africa was supplying only 5% of the global demand for tropical timber. The largest markets are in Asia, and roughly 60% of global demand was met from SE Asian and Pacific forests. Between 1990-1995, Malaysia, Thailand and Philippines all suffered deforestation rates > 2%/year, and their forests are giving out. As the Asian "tigers" recover from recent recessions, they will look to new sources for timber and Africa is the obvious place to start. The level of global demand responsible for the current bushmeat crisis has been just a fraction of what is coming.

Jim Moore

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[source: *Bushmeat Digest*, 3 February, 2000

GREENPEACE DISCOVERS ILLEGAL IMPORT OF TROPICAL TIMBER FROM CAMEROON RAINFOREST—AFRORMOSIA LOGS IMPORTED BY "VANDECASTEELE HOUTIMPORT" CONFISCATED BY BELGIAN POLICE

Three weeks ago, Greenpeace launched a new campaign to denounce the import of tropical timber from Cameroon to Belgium. Industrial logging is the biggest single threat to the Central African rainforests of the Congo Basin, the second biggest rainforest in the world. Logging operations in central Africa (Cameroon, Gabon, Central African Republic, Congo-Brazzaville and Congo-Kinshasha) are highly destructive: all experts agree that the so called "selective" logging

operations are in fact equal to mining operations: logging the most valuable trees without caring for the rest of the forest. This system puts very high pressure on specific timber species that are commercially valuable. Many tree species are threatened with extinction due to over-harvesting. Moreover, the logging roads pave the floor for industrial poachers who follow the loggers and kill many endangered (and legally protected) species such as the western lowland gorilla, the forest elephant and the chimpanzee. Logging is also creating more and more social conflicts in Central Africa as local people hardly receive benefits from these activities. Indigenous communities such as the Bakapymies from east-Cameroon are totally ignored by the logging industry and the local government. Greenpeace challenges the Belgian timber importers to tell the public where their African wood is coming from. Greenpeace urges the Belgian timber industry to phase out all timber supplies that come from rainforest destruction and start looking for alternative suppliers. Only a week after the launch of the campaign, Greenpeace discovered the illegal import of the timber species *Afrormosia* from Cameroon. *Afrormosia* is listed as "endangered" by IUCN/WCMC, which means that the timber species is facing a very high risk of extinction in the wild in the near future. The trade in *Afrormosia* is regulated by CITES (Convention on International Trade in Endangered Species). *Afrormosia* is listed on appendix II which means that trade in *Afrormosia* is only allowed with a CITES-certificate and an export license from the country of origin (Cameroon) and an import license delivered by the importing country (Belgium).

Greenpeace received a fax which the timber importing company "Vandecasteele Houtimport" sent to all its customers. The fax mentions the new arrival of 71 logs of *Afrormosia* (640m³). Greenpeace contacted the ministry of Agriculture which confirmed that the company did not have the legal documents to import *Afrormosia*. Greenpeace started an investigation and was able to relocate some 20 *Afrormosia* logs. These logs are currently confiscated by the ministry of agriculture and the police.

This is the first time ever that illegal import of *Afrormosia* into Belgium has been discovered. The Belgian timber importers federation is claiming it is very exceptional that companies don't respect CITES-legislation. But the fact that Greenpeace discovered illegal import of *Afrormosia* in Belgium after only 3 weeks of active campaigning on this issue indicates that the opposite might be true. Greenpeace asked a forest engineer (with an official mandate to control CITES-legislation in Belgium) to take samples of the suspected logs to confirm that it is *Afrormosia* indeed. The expert confirmed to Greenpeace that this was the first time ever that he was asked to carry out a field inspection!!

Greenpeace stresses the fact that this is not just an issue of illegalities. In fact, all timber that is imported from Cameroon comes from rainforest destruction. Greenpeace will advise consumers not to buy wood from ancient forest destruction and only purchase wood from well managed forests. Greenpeace urges the Belgian importers to tell the public where their wood is coming from and to start phasing out wood which comes from ancient forest destruction.

Contact: Filip Verbelen, Tel: 32 2 274 02 15 or Bill Barclay, Forests Campaign, Greenpeace, 965 Mission St., Suite 625 San Francisco, CA 94103, USA, Tel: 1-415-512-7136, Fax: 1-831-466-0153, E-mail: bbarclay@sfo.greenpeace.org

[source: *Bushmeat Digest*, 10 June, 1999]

FIVE AFRICAN NATIONS COMBINE TO PROTECT THREATENED FORESTS IN THE CONGO BASIN, CENTRAL AFRICA

In Yaounde, Cameroon, 17 March, 1999, at a groundbreaking Forest Summit hosted by President Paul Biya of Cameroon and chaired by HRH Prince Philip, President Emeritus of the World Wide Fund For Nature (WWF), five African Heads of State signed the "Yaounde Declaration"-containing plans to protect vast tracts of forest in the Congo Basin, Central Africa-the second largest tropical forest in the world.

The President of Cameroon, joined by Heads of State and representatives from the governments of Gabon, Central African Republic, Congo-Brazzaville and Equatorial Guinea, jointly announced plans to create new cross-border forest protected areas.

Some of the new initiatives signed and celebrated by the Heads of State include: Establishing a new trans-border conservation initiative between Gabon, Cameroon and Congo-Brazzaville-protecting more than 3.5 million hectares of forest.

Endorsing the existing tri-national network of protected areas between Cameroon, the Central African Republic and Congo-Brazzaville-covering more than one million hectares of forests.

Creating two new forest reserves as Gifts to the Earth (GTTE) in Cameroon and celebrating three other GTTE's given by the Cameroon and Gabon governments in 1998: protection for 220,000 hectares of the Lobeke Forest in Cameroon, protection for 600,000 hectares of pristine rainforest in the Minkebe Forest Reserve in Gabon and protection of 332,000 hectares of rainforest in Monts Doudou in Gabon.

Within Africa, the forests of the Congo Basin form one quarter of the world's rainforests and are home to

more than half of Africa's wild plants and animals, including forest elephant, western lowland gorilla and forest buffalo.

The Congo Basin is a challenging environment for forest conservation because of difficult economic circumstances and civil disturbances in some countries, and criticism about corruption and weak governance. However, one of the most encouraging signs for forest protection in the region is the growing support amongst the governments and communities of some Central African countries for forest conservation—and with large intact areas of forests remaining, regional deforestation rates being half the global average and population pressures relatively low there is a huge opportunity for forest protection. "WWF is calling on these Central African governments to collaborate across national boundaries and to work in partnership with international aid agencies, such as the World Bank and the European Commission, so that forest protection is put into practice on the ground," said Dr Claude Martin, Director-General of WWF. "WWF will encourage these governments to adopt an integrated approach to conservation which gives forests greater protection whilst providing a livelihood for indigenous people and local communities who have traditionally lived in and around the forests," he said.

To ensure that these new commitments to conserve Africa's forests are put into practice, the Government of Cameroon announced the launch of a new Trust Fund in Cameroon to help finance the effective management of forest protected areas. With an initial donation of US\$ 500,000 from WWF, it is hoped that governments and aid agencies will allocate funds to ensure these crucial commitments are implemented.

"The World Bank welcomes the commitment of the heads of state to focus on the problems of forests, and is encouraged that these issues are receiving such high level attention. This demonstrates the importance of working together to deal with problems which affect not just the countries of the region but the rest of the world," said Ian Johnson, Vice President of the World Bank, WWF's alliance partner in forest conservation.

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[source: *WildNet Africa News Archive*, <http://www.wildnetafrica.com/wildlifeneews/1999>]

PEOPLE CROWD OTHER SPECIES IN EARTH'S BIODIVERSITY HOTSPOTS

More than 1.1 billion people live within the 25 areas on Earth that are simultaneously the most species rich and environmentally threatened, reveals a report by Population Action International.

The report documents, for the first time on a global scale, the impact of population growth on biological diversity. It highlights the need to concentrate conservation efforts on critically threatened regions.

Population Action International (PAI) used census data from countries around the world to determine the population density and projected population growth in each of 25 biologically rich "hotspots" and three major tropical wilderness areas. PAI's report, "Nature's Place: Human Population and the Future of Biological Diversity," represents the first examination of human population within hotspots defined by Conservation International (CI). Conservation International's 25 biodiversity hotspots are outlined in red; the three major tropical wilderness areas are outlined in green.

The hotspots are 25 highly threatened areas that together contain more than 60 percent of the world's plant and animal species—within just 1.4 percent of the planet's land surface.

British ecologist Norman Myers developed the concept of hotspots in 1988, and CI, the MacArthur Foundation and other groups have adopted the concept to help set conservation priorities. "We found that human population density levels and growth rates in the hotspots significantly exceed those of the world as a whole, a potentially alarming finding for environmental conservation," said lead author Richard Cincotta, ecologist and senior researcher for PAI.

"However, the current slowing of world population growth offers hope for easing the pressure of human activities on these ecologically valuable yet fragile areas," he said.

In 19 of the 25 hotspots, population is growing faster than in the world as a whole. In 16 of 25, population densities are at or above the average density of the planet. Today, each hotspot retains no more than 25 percent of its original natural vegetation.

In 16 of the 25 hotspots, population densities are at or above the average density of the planet. The report finds that the human population of six billion—combined with human demand for natural resources, waste disposal methods, and concentration in hotspot regions—underlies and fuels the more direct causes of recent and current plant and animal extinctions.

These extinctions are proceeding at least 1,000 times faster today than in the pre-human past, PAI notes, and this rate is expected to accelerate in the 21st century.

PAI's findings are consistent with the beliefs of many scientists. A 1998 Harris poll found that almost 70 percent of biologists polled believe that a mass extinction is already underway, and that one-fifth of all living species could disappear within the next 30 years.

"Today's species extinction rate is comparable in scale to the loss of the dinosaurs some 65 million years ago," said Russell Mittermeier, president of Conservation International.

"Scientists are becoming increasingly convinced that human beings have caused ecosystem change and species extinction almost since our own species emerged," the PAI report notes. "Between 50,000 and 10,000 years ago, as early populations of humans expanded across the continents, more than 200 species of large animals disappeared forever. Then, between 1,500 and 500 years ago, as human populations reached the farthest oceanic islands, over 1,000 species of island birds went extinct."

In 19 of the 25 hotspots, population is growing faster than in the world as a whole. "Today's wave of extinctions, however, is even more extensive," the report continues. "It is fundamentally different from its two predecessors in ways that relate strongly to the pervasiveness and size of today's human population." For the first time, human activities are affecting species of all types and habitats, at all points of the globe, and pushing many toward extinction, PAI finds. Habitat loss alone could drive at least half of all living species to extinction, the report says. Other agents of human caused extinction, including pollution, overhunting, overfishing and introduction of exotic species into weakened ecosystems could cause the loss of even more species.

In the U.S., about 90 percent of the plant species listed as endangered by the U.S. Fish and Wildlife Region are found within three hotspot regions: the California Floristic Province, the Caribbean hotspot (southern Florida and the Everglades) and the Polynesia/Micronesia hotspot (Hawaii). In each of these areas, population growth and migration have led to suburban sprawl and the rapid breakdown of biological communities, PAI finds.

More than 75 million people, or about 1.3 percent of the world's population, now live within the three major tropical wilderness areas—Upper Amazonia and Guyana Shield, the Congo Basin, and New Guinea and the Melanesian Islands. Population growth in these regions averages about 3.1 percent per year—more than twice the world's average population growth rate. The result is rapid deforestation and increased hunting of native species.

"Earth is being transformed into a world that is genetically poorer," said Cincotta. "The roots of this

loss lie in the spectacular success of just a single species: us, *Homo sapiens*.”

Cincotta noted that there are more human babies born each day—about 350,000—than there are individuals left in all the great ape species combined, including gorillas, chimpanzees, bonobo and orangutans. PAI notes some reasons for hope. Population experts say human fertility—measured as the number of children borne by each woman—is declining in most regions. Women are choosing to have fewer children, and to have them later in life. The use of contraceptives is increasing. “Nature’s Place” offers a plan of action to help save a critical mass of the planet’s remaining biological diversity, including steps to slow population growth. Ensuring that women have the education, the freedom and the means to choose when to start or expand a family would go a long way toward stemming the population boom, PAI says. “The surest way to preserve our natural heritage is to invest in meeting the needs of people,” said Amy Coen, president of PAI. “That is why family planning and conservation advocates in the U.S. support the administration’s budget request of \$542 million for international family planning programs in fiscal year 2001. This amount is just a few hundredths of one percent of the U.S. budget, but the only way to support the current positive trend of slowing population growth. It’s an investment we can’t afford not to make.”

PAI recommends that:

The U.S. Congress should ratify the Convention on Biological Diversity, an international agreement created at the 1992 United National Conference on Environment and Development, to save the planet’s biodiversity and equitably share its benefits. Governments, donors and individual communities should elevate the priority of biological diversity and invest in its conservation. Donor and developing countries should increase their financial and policy commitments to the Programme of Action of the International Conference on Population and Development, to ensure that family planning services are available to all who want them by 2015. “If we act now, we can still conserve the majority of the species and ecosystems with which we share the planet. The impact of human population within the biodiversity hotspots is another powerful example of why we must strive to protect each and every piece of what still remains within these incredibly important fragments of biodiversity rich real estate,” says Mittermeier. “Nature’s Place” is available online at: http://www.populationaction.org/pubs/biodiv00/biodiv_index.htm

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[source: Heather E. Eves, Coordinator, Bushmeat Crisis Task Force, 8403 Colesville Road, Suite 710, Silver Spring, MD 20910-3314, USA, Tel: 301.706.6028, Fax: 301.562.0888, Email: HEves@aza.org via Cat Lazaroff, Washington, DC, USA, February 8, 2000 (ENS)]

WORLD WILDLIFE FUND SUPPRESSES OWN REPORT ON FORESTS AND THE ENVIRONMENT

It isn’t possible! One of the world’s premier conservation organisations holding back its own environmental report. Yet that is just what the World Wildlife Fund for Nature (WWF) based in Gland, Switzerland, did with its \$300,000 world-wide logging study supported by the European Commission. Why? The study found that the biggest lawbreaking international forestry companies were from Asia, not from Canada, not the United States, and not from Latin America. WWF worried that the report might be viewed as racial. Also, it worried that the complicit governments supporting the illegal logging operations of their own national companies overseas would shut down WWF regional offices in their countries. The primary authors of the WWF study were Dominiek Plouvier with WWF Belgium and Nigel Sizer at the World Resources Institute (WRI) in Washington, D.C.

The first version of the report completed in 1997 named the companies. Not acceptable to WWF, a second version was prepared with the names removed, but the countries of origin named. A third, more washed, version was prepared, but it too was not released to the public. Paul Brown of the *Manchester Guardian* said that, “the (first) report names companies prepared to bribe and bully their way to lucrative logging concessions.” Had the first version been released in 1997, we would have had three years in which to identify and stop the pirate logging operations. The suspect forestry companies are from countries like Malaysia, Indonesia, and China. Two of the major consumer countries purchasing the pirated wood products are Japan and China. Already stripping their own countries, these forestry companies have moved quickly into Africa and the Pacific Rim countries. The WWF report called for an immediate logging moratorium in countries affected by these companies. The countries are Cameroon, Gabon, Congo-Brazzaville, The Central African Republic, Equatorial Guinea and the Republic of Congo, in central Africa; Belize, Surinam and Papua New Guinea, and the

Solomon Islands in the South Pacific Rim.

WWF forestry report found that IMF and World Bank pressure to repay loans exacerbated logging

Continuing, the World Wide Fund for Nature report on world-wide logging activities, "blamed the International Monetary Fund and the World Bank for inducing forested countries to sell their forests for a quick cash return to pay off debts to Western countries." It found that, "European Union's funds being poured into developing countries to ensure forests are carefully managed are frequently wasted. Forest laws were enacted, but not enforced." It reported that, "the Solomon Islands, Papua New Guinea, Cameroon and Belize were all named as suffering large scale corruption. This corruption allowed the Asian logging firms to bribe their way into clear cutting protected forests, national parks, and conservation zones." The report found that, "the majority of countries studied, the decision making is controlled by a small group of powerful people or clans within the government that look at primary forests of their country as a short term source of personal revenue."

The *Guardian* also said that the WWF "report adds that although European and North American companies have in the past indulged in bad practices, the scale of the new incursions was much larger (by the Asian multinationals)." Stating that, "the logging itself is often very careless with high collateral damage to the surrounding forest. The roads built to extract the timber, often hundreds of kilometres long, create access to frontier areas that facilitate the entry of commercial hunters, farmers, miners and others who cause further environmental damage. The companies frequently end up in violent clashes with local people and native tribes."

Source: "Report on Forests Suppressed", by Paul Brown, *Guardian Weekly*, 1 to 7 June, 2000, London, U.K. Web site: <http://guardianweekly.com/> For more information contact the Rainforest Action Network, 221 Pine Street, Suite 500, San Francisco, California 94104, USA, Web site <http://www.ran.org>

[source: *The Gallon Environment Letter*, Vol. 4, No. 24, 21 June, 2000]

WORLD WILDLIFE FUND RESPONDS TO ASIAN REPORT ON OVER LOGGING



The World Wildlife Fund has responded quickly and straight forwardly to the accusations that it held back for almost three years a study critical of the over

logging by a new breed of multinational forest companies in Asia. In 1996, WWF was commissioned by the European Commission to co-author with the World Resources Institute a report entitled "Increased Investment and Trade by Transnational Logging Companies in Africa, the Caribbean and the Pacific." The report examined the influence and impact of logging companies, and in particular Asian logging companies, in Africa, the Caribbean and Pacific. This work built on a report published by WWF in 1995 entitled "Bad Harvest" which examined the impacts of the global timber trade. It became clear at this time that Asian logging companies were rapidly increasing their impact on forests outside Asia and it was decided to conduct further research to examine this impact in more detail.

WWF reported that, "there has been a considerable delay in the publication of this report. This has been caused by the need to undertake further research to ensure that the report is as accurate as possible. This has been necessary in order to bring the report up to date following the Asian economic crisis and to minimise the threat of litigation from some of the world's most powerful transnational companies whose trade practices are examined in this report."

WWF reports that 2,000 copies of the report have been recently printed and are now being distributed by the European Commission and WWF to WWF representative regional offices. WWF will be publicly releasing the report in July 2000 and will be making it available on the internet. WWF will be using the report to lobby for improved forestry practice around the world.

For further information contact Chris Hails, Tel: 41 22 364 95 26; Jean-Paul Jeanrenaud, Tel: 41 22 364 9011; Olivier van Bogaert, Tel: 41 22 364 9554; Anita Neville, Tel: 44 1483 412 385; Mobile: 44 468 721 170. Website: <http://www.panda.org/>

[source: *The Gallon Environment Letter*, Vol. 4, No. 25, 27 June, 2000]

HISTORIC BREAKTHROUGH FOR GREAT APES IN NEW ZEALAND

New Zealand's Parliament has created a world first by putting specific protection for non-human hominids, also known as great apes, into legislation.

In passing its new Animal Welfare Act, the New Zealand Parliament has prohibited the use of all great apes in research, testing, or teaching "unless such use is in the best interests of the non-human hominid" or its species.

There are five great ape species: chimpanzees, bonobos, gorillas, orang-utans, and humans, and all

are in the same genetic family.

"This requirement recognises the advanced cognitive and emotional capacity of great apes," said New Zealand's Minister for Food and Fibre, John Luxton, who was responsible for the passage of the bill through Parliament.

Such recognition is based on scientific evidence that the non-human great apes share not only our genes but also basic human mental traits, such as self-awareness, intelligence and other forms of mental insight, complex communications and social systems, and even the ability to master some human language skills.

"New Zealand is the first country in the world to legislate in this way," said Mr Luxton.

The Great Ape Project-International (GAP) has hailed the groundbreaking legislation as part of the trend toward recognising the complex mental, social and individual realities of other animals' lives.

That trend is also evident in the explosion of interest shown by U.S. law schools in the status of other animals, most recently confirmed by Harvard University's decision to offer an animal law course in the Spring of 2000. "Ultimately, GAP would like to see the non-human great apes accorded standing in legal systems throughout the world," said the organisation's vice-president, Paul Waldau. "This would permit them to be protected by rights to life, liberty, and freedom from torture. Additionally, we'd like to have the United Nations provide realistic recognition and protections."

The numbers of non-human great apes have plummeted this century, as free-living populations have increasingly fallen victim to the commercial bushmeat trade and deforestation. More than 3,000 individuals are held in captivity around the world. All of the non-human great ape species are listed as threatened.

The Great Ape Project, P.O. Box 19492, Portland, OR 97280-0492, E-mail: GAP@envirolink.org and GAPNews@aol.com Web sites: The Great Ape Project Homepage: <http://www.enviroweb.org/gap> and The Declaration on Great Apes: <http://www.enviroweb.org/gap/gapdeconline.html>

FUND FOR ANIMALS HAILS CONGRESSIONAL PASSAGE OF HISTORIC MEASURE TO PROTECT GREAT APES

In Washington, DC, on Friday, 20 October, 2000, the US Senate unanimously passed the Great Ape Conservation Act, HR 4320. This legislation, authored by Congressman George Miller (D-CA), creates a federal fund of up to \$5 million from which grants will be made to conservation projects protecting great apes—gorillas, chimpanzees, bonobos, orangutans, and

gibbons—in their natural habitat. The House of Representatives overwhelmingly passed HR 4320 in late July, and the legislation headed to President Clinton, who was expected to sign it.*

Christine Wolf, Director of Government and International Affairs for The Fund for Animals, who testified before the House Resources Committee on the bill, stated, "All over the world, chimpanzees, gorillas, bonobos, orangutans, and gibbons are disappearing at lightening speed due to habitat destruction and hunting for the bushmeat trade. Logging concessions are continually cropping up in previously uncharted sections of forest, providing access to these rare animals, and leading to their destruction."

Added Wolf, "The Great Ape Conservation Act comes at a time when we are seeing the unchecked extermination of our closest genetic relatives. I have had the privilege of spending time with the apes in the wild, and when I look in their eyes I see that our future is inextricably linked with theirs."

This Great Ape Conservation Act is modeled after three existing conservation funds which are administered by the US Fish and Wildlife Service: the African Elephant Conservation Act, the Asian Elephant Conservation Act, and the Rhino and Tiger Conservation Act.

*This bill has now been signed.

Christine Wolf

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THE PRIMATE SPECIALIST GROUP'S PRIMATE TAXONOMY WORKSHOP

The Primate Specialist Group (PSG) held a workshop, "Primate Taxonomy for the New Millennium", at the Disney Institute, Orlando Florida, 25-29 February 2000. It was organised by the PSG Chairman, Russell A. Mittermeier, in collaboration with Don Melnick, Executive Director of the Center for Environmental Research and Conservation, Columbia University, N.Y., and John F. Oates, Hunter College, City University of New York, N.Y., and sponsored by the Margot Marsh Biodiversity Foundation, Virginia, and the Disney Institute, Orlando, Florida, which kindly provided the venue and excellent accommodation.

The workshop involved the collective brainstorming of approximately 25 field primatologists, taxonomists,

biogeographers, morphologists and geneticists in discussions of three major questions:

1) the identification of taxa for which little is known or for which there is conflicting evidence and opinions from the different disciplines regarding their systematics and the validity or otherwise of described forms;

2) the establishment of a single taxonomic listing for the primates, based on the evidence available today, most particularly from the morphological and genetic research; and

3) the degree to which the identifiable taxa are currently threatened, based upon the most reliable information.

The participants were divided into working groups dealing with each of the four major primate regions: the Neotropics, Africa, Madagascar, and SE Asia. Those who contributed to the group for the Neotropical primates included: Russell A. Mittermeier (Conservation International, Washington, DC), Colin P. Groves (Australian National University, Canberra), Horacio Schneider (University Federal do Pará, Belém, Brazil), Ernesto Rodríguez-Luna (Universidad Veracruzana, Xalapa, Mexico), Alfredo Langguth (Universidade Federal do Paraíba, João Pessoa, Brazil), Peter Grubb (London, UK), and Anthony B. Rylands (Center for Applied Biodiversity Science, Conservation International, Washington, DC). Particularly important was the contribution of Colin Groves, whose book on primate taxonomy is soon to be published by the Smithsonian Institution Press, Washington, DC.

Participants in other groups included: Simon Bearder (Nocturnal Primate Research Group, Oxford Brookes University, Oxford, UK) Douglas Brandon-Jones (Natural History Museum, London, UK), Thomas M. Butynski (PSG Vice Chair for Africa, Africa Biodiversity Conservation Program, Zoo Atlanta, Nairobi), Todd R. Disotell (New York University, New York), Ardith Eudey (PSG, Vice Chair for Asia, Upland, California), Jörg U. Ganzhorn, PSG Vice Chair for Madagascar, Hamburg University, Hamburg), Thomas Geissmann (Institute für Zoologie, Tierärztliche Hochschule, Hannover), Kenneth Glander (Duke Primate Research Center, Durham, North Carolina), William R. Konstant (PSG Deputy Chair, Conservation International, Washington, DC), Juan Carlos Morales (Center for Environmental Research and Conservation, Columbia University, New York), Myron Shekelle (Washington University, Saint Louis, Missouri), Caro-Beth Stewart (University of Albany, SUNY, New York), Thomas T. Struhsaker (Duke University, Durham, North Carolina) and Ian Tattersall (American Museum of Natural History, New York).

The results of this workshop are still being compiled, and will form the basis for the Action Plan for Critically

Endangered and Endangered Primates, currently being prepared by the PSG.

[source: Dr Anthony Rylands, *IPS Bulletin* 27(2):6]

GORILLA SPECIES

A familiar criterion for species-level separation of two populations is whether or not they interbreed. Since western and eastern gorillas never meet in the wild, however, other methods must be relied upon in order to determine taxonomy. Several recent studies of genetic distance have now concluded that western and eastern gorillas may have been reproductively isolated for as long as 2 or 3 million years. Analysis of mitochondrial DNA suggests that the difference between the two gorilla populations is about the same as that seen between common chimpanzees and bonobos. And since chimps and bonobos are considered different species, it has been suggested that we should recognise two species of gorilla. Indeed, at a recent meeting, convened to discuss the effects of new findings in genetics, anatomy, ecology and behavioural research on primate systematics, primatologists concluded that western and eastern gorillas should be considered to be different species.

However, at the same meeting it was noted that analysis of DNA sequence variations in the nuclear genome has provided conflicting evidence, suggesting that eastern and western gorillas are not nearly as different from each other as are chimps and bonobos. The discrepancy between the findings for mtDNA and nuclear DNA is not easily explained.

Other suggestions that derived from the same meeting included increasing the number of recognised primate species from 275 to 310, recognising four, as opposed to two, orangutan taxa, and introducing a new subspecies of chimpanzee, *Pan troglodytes vellerosus*, from Nigeria.

[Source: *Gorilla Journal* 20 and *ASP Bulletin* 24, via *IPS Bulletin* 27(2): 6]

DRAFT GUIDELINES FOR NON-HUMAN PRIMATE RE-INTRODUCTIONS

A draft document prepared by the SSC Re-introduction Specialist Group, "Guidelines for Non-Human Primate Re-Introductions", is available for comment on the SSC website at <<http://www.iucn.org/themes/ssc/programs/rsg.htm>>. These guidelines were developed in response to the increasing number of primate re-introduction projects worldwide. They are based on

the *IUCN Guidelines for Re-introductions* (1998), *IUCN Guidelines for the Placement of Confiscated Animals* (2000), a review of case histories, and consultation across a range of disciplines.

[Source: *IUCN Species Survival Commission (SSC)*. Anna Knee, Communications Officer SSC/IUCN.]

we want to thank all of those who supplied us with these important resources. We will continue to expand the offerings, and if you have anything you would like to contribute, please contact Kate Bronislawski, Resource Center Curator at kbronislawski@aza.org or by calling (301) 562-0777 x259.

[source: AZA.org Listserv Sysop]

REVISED RED LIST CRITERIA

The new improved categories and criteria used for listing plants and animals on the *IUCN Red List of Threatened Species* are now available after a four-year review, called for by IUCN members. The review, coordinated by SSC, involving broad consultation with users and organisations from around the world, has produced a clearer, more open, and easy-to-use system for assessing species. With particular attention paid to marine species, harvested species, and population fluctuations, the review has refined the effectiveness of the *Red List* categories and criteria as indicators of extinction risk. See <<http://www.iucn.org/themes/ssc/redlists/RLcategories2000.html>> for more details.

[Source: *IUCN Species Survival Commission (SSC) E-Bulletin-March 2001*. Anna Knee, Communications Officer SSC/IUCN.]

VERSION 2.0 OF RAMAS RED LIST SOFTWARE AVAILABLE

Version 2.0 of the RAMAS® software used for assessing the conservation status of species for possible inclusion in the IUCN Red List of Threatened Species, is now available. The software incorporates the revised Red List Categories (2000). To purchase a copy, please contact Isabelle Weber, IUCN/SSC, Rue Mauverney 28, Gland CH-1196 Switzerland, Fax: +41-22-9990015, e-mail: <isc@iucn.org> or Applied Biomathematics, 100 North Country Road, Setauket, NY 11733, USA, Fax: +1 516-751-3435. Single-user and site-licensed copies of the software are priced US\$295 and US\$445 respectively.

[Source: *IUCN Species Survival Commission (SSC)*. Anna Knee, Communications Officer SSC/IUCN]

AZA RESOURCE CENTER

AZA Tired of reinventing the wheel for every new project? Want your information now, without waiting for packages, mail, or faxes to arrive?

Let your mouse do the walking, check out the online AZA Resource Center! This "Members Only" service can be found at <http://www.aza.org>

To log on, simply click on "Members" then on "Members Only" then type in your first initial and last name (no spaces) and your AZA member number (it's on your *Communique* label and your membership card). You'll find yourself in a haven of documents that will help you develop a crisis communications plan, rejuvenate your Board of Directors, raise those precious dollars or outline an ambitious new strategic plan. Also included are more than 500 organized, annotated links to other Web sites—connecting you to information on environmental education curricula, professional organizations, taxonomy databases, accessibility guidelines, and federal funding programs.

The Resource Center has a wealth of practical, working documents contributed by AZA members, and

"CAREERS IN PRIMATOLOGY", A NEW PIN WEB SITE

The Wisconsin Regional Primate Research Center (WRPRC) has introduced a new PIN web site, "Careers in Primatology". This site is designed to answer questions by individuals wishing to know how they can begin a career working with nonhuman primates. The site contains pieces by experts in the fields of Biomedical Research, Psychology, Sanctuaries, etc. There is a web form for submitting questions.

For suggestions on further additions, development of the site, or submission of written pieces in areas not already covered, contact mhoffman@primate.wisc.edu

Other suggestions or comments can be sent to Larry Jacobsen, Careers in Primatology Co-ordinator, WRPRC Library and Information Service, Wisconsin Regional Primate Research Center, University of Wisconsin-Madison 1220 Capitol Court, Madison, WI USA, 53715, Tel: +1 608 263 3512, Fax: +1 608 263 4031, E-mail: jacobsen@primate.wisc.edu

The consultant to the site on content and organisation is Dr Sue Howell, Research Director, Primate Foundation of Arizona, P.O. Box 20027, Mesa, AZ

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FUNDING AND TRAINING

OXFORD BROOKES UNIVERSITY SCHOOL OF SOCIAL SCIENCES AND LAW AND SCHOOL OF BIOLOGICAL AND MOLECULAR SCIENCES MSc IN PRIMATE CONSERVATION

Brief Course Overview

The approaching extinction of many of our closest living relatives, monkeys, apes and prosimians, and the destruction and loss of their habitats, highlights the issues of what must be done to offset the effects of the current decline in natural resources. This one-year Master of Science course combines the expertise of anthropologists and biologists to examine primate conservation biology in a broad context, with particular emphasis on the interrelationships between humans and wildlife in forest and woodland environments. The destruction of forests often brings irreversible loss of soil, fresh water and renewable reserves of food and fuel, as well as the loss of innumerable species of animals and plants. Changes to the local climate and global effects of forest clearance are becoming increasingly apparent. But what can be done to alter these trends? The course provides an international and multidisciplinary forum to help understand the issues and promote effective action.

Course Overview

1. Introduction

Oxford Brookes University is planning a Masters Course in Primate Conservation to begin in September 2000. This paper provides some initial details about the course, but it should be noted that these are still subject to validation by the University.

2. Course Structure and Management

The Postgraduate taught Masters of Science in Primate Conservation is part of the postgraduate programmes within the Schools of Social Sciences and Law, and Biological and Molecular Sciences at Oxford Brookes University. The M.Sc. is structured so that students may take it either on a full-time or part-time basis, with teaching primarily confined to one day per week. For part-time students in particular, who may commute to Oxford from London or other parts of the South of England and the Midlands, this pattern of delivery is organized to mesh well with other commitments.

The course aims to provide a high quality

postgraduate research qualification relevant to the careers of anthropologists, conservation biologists and educators who have a particular interest in primates and their habitats, and practical solutions to their continuing survival. An important theme that runs through the course is its emphasis on anthropological perspectives. It draws on the expertise of both social and biological anthropologists to provide insights into the social, political and economic dimensions of conservation, leading to a better understanding of what can be achieved and how to instigate change. In this way it is hoped to provide a stimulating and practical foundation for a wide range of conservation-related careers, beyond those that focus on primate biology and forest ecology.

Prof. Simon Bearder and Dr Allister Smith are the joint course managers. The course team currently includes 3 permanent members of staff: Simon Bearder (primatology), Allister Smith (population genetics), Catherine Hill (human ecology), and a number of post-graduate researchers who are able to help with part-time teaching, including: Lesley Ambrose (ecology/biogeography), Michelle Bayes (genetic analysis) and Helen Lantsbury (museum studies). The external advisors are Caroline Harcourt (primate behaviour and distribution), Michael Clark (captive management) and Malcolm Whitehead (environmental education).

3. Course Description

Students will develop a broad overview and understanding of the main areas of research on the conservation of primates and their habitats. Each student will be encouraged to build on their own strengths and interests through the choice of practical assignment and co-authorship of a relevant chapter of the Course Manual. In addition there will be opportunities to specialise in appropriate research methods by selection from a range of options provided by training courses in the two Schools as well as those integral to the course (fieldwork, zoo-based and museum studies).

The course is built around 8 major themes:

1. Primate diversity and biogeography (e.g., taxonomy, speciation, ecology, behaviour, biodiversity)
2. Socio-political aspects of conservation (e.g., hunting, pest control, eco-tourism, economic pressures on forests, design and management of reserves and parks)
3. Environmental education (e.g., philosophy—the relationship of awareness to action; planning and practice—media, evaluation, case studies)
4. Molecular and population genetics (e.g., DNA sequencing, studbooks, minimal viable populations)
5. Fieldwork training and methods (e.g., sampling, surveys, statistics, social and political sensitivity)
6. Captive management (e.g., enclosure design,

- breeding, display, rehabilitation)
7. Museum studies (e.g., taxonomy, systematics, functional anatomy)
 8. Habitat protection and the future of rainforests (e.g., threats to primates, decline of renewable resources, sustainable use, strategies for action)

Maximum use will be made of appropriate Information Technology (discussion groups, web-page authoring, virtual fieldwork, *etc.*), with a view to developing the course for distance learning. Each year-group of students will collaborate to co-author a Primate Conservation Handbook (which can be largely web-based), providing an up-to-date overview and bibliography on each topic covered during the course.

A combination of lectures, workshops, seminars and tutorials will be used, with the emphasis on group sharing of skills and knowledge. The course will build on the facilities and teaching support available in the Schools of Social Sciences and Law, and Biological and Molecular Sciences. Facilities include laboratory space, a primate sound archive and a conservation library and reprint collection. There is also an active research group (the Nocturnal Primate Research Group) with strong international links and over 30 years of experience of primate fieldwork. Links with zoos, museums and wildlife sanctuaries will be used to provide practical training and the possibility of establishing a field course in a habitat country is currently being explored.

4. Entrance Requirements

A first or second class honours degree in anthropology, biology or an acceptable cognate discipline or, an academic equivalent to an honours degree such as a conversion course or demonstration of graduate-level knowledge, abilities and skills.

Overseas students must be able to demonstrate an acceptable level of proficiency in English.

5. Qualifications Awarded and Duration

M.Sc.—180 M-level credits

Postgraduate Diploma—120 M-level credits

Postgraduate Certificate—60 M-level credits

1 year full time

2 years part time

For further details please contact:

Simon Bearder B.Sc. M.Sc. Ph.D., Professor of Anthropology

or

Helen Lantsbury

School of Social Sciences and Law and School of Biological and Molecular Sciences

Oxford Brookes University

Oxford OX3 0BP, UK

Tel. ++44 (0)1865 483760 (work), (0)1869 252082 (home)

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E-mail: skbearder@brookes.ac.uk

hlantsbury@brookes.ac.uk

GREAT APE CONSERVATION FUND

The Division of International Conservation of the US Fish and Wildlife Service invites submission of grant proposal for the conservation of apes (gorillas *Gorilla gorilla*, chimpanzees *Pan troglodytes*, gracile chimpanzees *Pan paniscus*, orangutans *Pongo pygmaeus*, and gibbons *Hylobates* spp.) throughout their ranges. The Great Ape Conservation Fund supports projects that develop local capacity to manage, conserve, research, or protect apes through the provision of funding, training, equipment and technical support.

The US Congress enacted the Great Ape Conservation Act of 2000 (GACA) in response to the decline of ape populations in Africa and Asia, which are now at the point that their long-term survival in the wild is in serious jeopardy. The Act has two purposes:

- to sustain viable populations of apes in the wild;
- to assist in the conservation and protection of apes by supporting the conservation programmes of countries in which ape populations are located.

To accomplish these purposes the GACA created the Great Ape Conservation Fund (GACF) to support and provide financial resources to conservation programmes of countries within the range of apes, and to projects of persons and organisations with expertise applicable to the conservation of apes.

The GACF assists the conservation of apes by supporting:

- implementation of conservation programmes to protect ape populations at risk and their habitats;
- *in situ* research on ape populations and habitats, including surveys and monitoring;
- community outreach and conservation education;
- compliance with CITES and other applicable laws that prohibit or regulate the taking or trade of apes or regulate the use and management of ape habitat;
- protected area/reserve management in important ape ranges;
- development and execution of ape conservation management plans;
- efforts to decrease human-ape conflict;
- strengthening the local capacity to implement conservation programmes.

Proposals may be submitted by any wildlife

management authority of a country within ape ranges, the CITES Secretariat, or any individual or organisation with relevant conservation experience. Proposals must be submitted in English (with the exception noted below), have support of local government(s), and have matching funds, or in-kind support (salaries, equipment, etc.) provided by the organisation receiving the grant or other partners. Applicants from Francophone Africa have the option of submitting proposals in French. French versions may require additional processing time and must be accompanied by a copy, on diskette, in MS Word or WordPerfect.

One original and one unbound copy of the proposal should be accompanied by an introductory covering letter and a cover page form. Documentation must demonstrate the participation and/or endorsement of the local government(s).

Because of the limited funds available, preference will be given to proposals requesting \$30,000 or less, but higher amounts may be requested. Funding is usually for 1 year or less, but projects lasting more than 1 year may be proposed. Those requiring more than 1 year funding may be required to compete on an annual basis through submission of additional proposals.

Proposals postmarked by 1 March 2001 will be included in the first review. Proposals may be submitted through the year, and those postmarked after 1 March 2001 will be reviewed during the subsequent sessions. Reviews and processing may require up to 6 months. Applicants are advised to specify a particular starting date bearing in mind the necessary processing and administrative time.

Further information and application details can be obtained from The Great Ape Conservation Fund at Division of International Conservation, US Fish and Wildlife Service, 4401 N. Fairfax Drive, ARLSQ 730, Arlington, VA 22203 1622, USA, Tel: +1 703 358 1758, Fax: +1 703 358 2849, E-mail: dave_ferguson@fws.gov Proposals should be submitted to Chief, Division of International Conservation at the above mailing address and fax, Tel: +1 703 358 1754.

[Source: *Oryx* 35(2): 174]

MARGOT MARSH BIODIVERSITY FOUNDATION



Project Guidelines

The mission of the Margot Marsh Biodiversity Foundation is to contribute to global biodiversity conservation by providing strategically targeted, catalytic support for the conservation of

endangered nonhuman primates and their natural habitats. Projects submitted to the foundation should have one or more of the following characteristics: projects focusing on critically endangered and endangered nonhuman primates living in their natural habitats;

1. primate projects being conducted in areas of high overall biodiversity and under great threat (*e.g.*, "threatened hotspots", "megadiversity" countries) to ensure maximum multiplier effect for each project;
2. projects being carried out by nationals from the tropical countries to increase local capacity for implementing biodiversity conservation;
3. projects that strengthen international networks of field-based primate specialists and enhance their capacity to be successful conservationists; and
4. projects that result in publication of information on endangered primate species in a format that is useful both to experts and the general public.

Projects should contribute to at least one, and preferably more, of the following themes:

1. enhancement of scientific understanding/knowledge of the target species/ecosystem;
2. improved protection of a key species, habitat, or reserved area;
3. demonstration of *economic* benefit achieved through conservation of a species and its habitat, as compared to loss thereof;
4. increased public awareness or educational impact resulting from the project in question;
5. improved local capacity to carry out future conservation efforts through training or practical experience obtained through project participation; and
6. modification of inappropriate policies or legislation that previously led to species or habitat decline.

Grant Application Format

The foundation will accept grant applications only from qualified tax-exempt organizations. All proposals for grant support should include verification that the organization requesting the grant is at present an organization exempt from taxation under the United States of America's Internal Revenue Code Sections 501(c)(3) or 509(a). Copies of the determination letter from the Internal Revenue Service must accompany the grant request. If you are not based in the United States, please indicate the U.S.-based institution that has tax-exempt status and will act as the sponsor of your project, with full fiscal responsibility for the grant. A letter from the U.S.-based tax-exempt organization

indicating their willingness to serve in this way should accompany the proposal. Failure to include such information will result in return of the grant proposal.

The following format should be used for your grant application, which should not exceed five (5) double-spaced typed pages of main text (not including attachments):

1. *Title of project.* Include a descriptive title that includes the name(s) of the target species and the geographic location of the project (e.g., "Conservation of the muriqui, *Brachyteles arachnoides*, in the state of Minas Gerais, Brazil").
2. *Abstract of the project.* Include an abstract of not more than one paragraph summarizing the principal objectives of the project.
3. *Project personnel and institutional affiliations.* Provide information on the principal investigator with *curriculum vitae*, plus mention all other major collaborators, and their institutional affiliations. (Do not include curricula for everyone, only the principal investigator).
4. *Objectives of project.* Describe the main objectives of the project, its specific activities, how they will contribute to conservation of the target species and ecosystems, and how these are consistent with the Foundation's mission. This should be the main body of the application and should be specific, while at the same time not exceeding five double-spaced pages. Include a map of the project area and any other relevant supporting information.
5. *Time frame of the project.* Describe the time frame of the project, expected starting date and duration. Note that a progress report is required six months after receipt of the grant, and a final report upon termination.
6. *Expected project outputs.* Describe the specific outputs of the project, e.g., expected scientific publications, popular articles, conservation action plans, management plans, etc. Presumably each project will have one or more outputs of this kind as one of its objectives. If this is not the case, please explain why and what other impacts the project is likely to have.
7. *Collaborating institutions in the project country.* Please describe the collaborating institutions with which you will be working in the project country, and include letters of support from them if at all possible. This is especially important for applicants who are not nationals from the country in which the work is to be conducted.
8. *Professional references.* Please list three references that the Foundation can contact about your project should it choose to do so. The list of references should include mailing addresses, phones, fax numbers, and e-mail addresses if available.
9. *Budget of the project.* Please give as detailed a

budget as you can for the project, including support (if any) from other sources. Amounts should be given in U.S. dollars, not in other currencies. Note also that the Foundation does not pay overheads, only direct project expenses.

Please note that you will be responsible for providing the Foundation with the following materials during and at the end of the project:

1. A progress report six months after receipt of the grant.
2. A final report upon termination of the project.
3. Full financial accounting of the project.
4. Five copies each of any scientific or popular publications, newspaper or magazine articles, or reports, action plans, etc., resulting from the project. Grant recipients are encouraged to publish at least some of their findings in the newsletters and journal of the IUCN/SSC Primate Specialist Group (i.e., *Primate Conservation*, *Asian Primates*, *African Primates*, *Neotropical Primates* and *Lemur News*).

Please submit your application in duplicate. If you want to send a preliminary version by fax or e-mail, please do so, but a hard copy will be required for formal consideration of the project. Do not submit computer disks of your project, but rather paper copies.

Please note that applications are accepted and reviewed on a rolling basis, but are considered for funding at semi-annual meetings of the Board of the Foundation. Notification of awards will take place within one month after each Board meeting date.

All grant applications should be sent to: Dr. Russell A. Mittermeier, Margot Marsh Biodiversity Foundation, P.O. Box 923, Great Falls, Virginia 22066, USA.

WILDLIFE CONSERVATION SOCIETY-RESEARCH FELLOWSHIP PROGRAM

Bi-annual deadlines: Must be post-marked by 1 January and 1 July of every year. Geographic preferences: Africa, Asia, Latin America and their regional marine areas. Please note that the RFP does not support research in North America (excluding Mexico), Australia, or Europe and their territories. The RFP will not limit any individual from applying, however, most of the grantees are professional conservationists from the country of research, and/or post-graduates pursuing a higher degree. There are the following restrictions: Organizations are not eligible for funding; previous research fellows are not eligible for funding

for the same project; faculty and/or research advisors should not be listed as principal investigators unless they plan to carry out the majority of the field work; the principal researcher must write the proposal (those written on behalf of another individual will be disallowed). Application information: Interested applicants may download the application from the website or e-mail the Program Coordinator and request an electronic RFP Application. Any queries or further information, please contact: Christina Ojar, Research Fellowship Program, Wildlife Conservation Society-International, 2300 Southern Blvd., Bronx, NY 10460, USA, Tel: +1 (718) 220-6828, Fax: +1 (718) 364-4275, E-mail: fellowship@wcs.org URL: <http://wcs.org/home/wild/researchfellowship/4596>

THE LINCOLN PARK ZOO-SUPPORT FOR FIELD RESEARCH

The Lincoln Park Zoo Neotropic and Africa/Asia Funds support field research in conservation biology around the world. The Africa/Asia fund, launched in 1997, focuses on projects throughout Africa, Asia, and the Pacific. Each fund typically supports between five and ten projects annually, including project renewals for a second year. Most awards fall into the range of \$3,000-\$6,000. Initial support is for up to 12 months from the date of award, and the maximum duration of support is two years. The current deadline for receipt of proposals is October 1st. For additional information and application procedures go to <www.lpzoo.com/conservation>, E-mail: conservation@lpzoo.org or write to: Lincoln Park Zoo NF/AA Funds, Department of Conservation and Science, Lincoln Park Zoo, 2001 N. Clark St, Chicago, IL 60614, USA.

THE PRIMATE CONSERVATION & WELFARE SOCIETY PRIMATE CONSERVATION GRANT SMALL GRANT

The Primate Conservation & Welfare Society is proud to announce the availability of our first annual Primate Conservation Grant Small Grant!

For details, including the Application Packet in .PDF Format, please see our website at: <http://www.primates-online.com/apps.html>

To receive a hard copy of the Conservation Grant Application Packet, please send a self-addressed stamped envelope to: PCWS-Conservation Grant, PO Box 2101, Port Townsend, WA 98368 USA, E-mail: gorillas@waypt.com

Please note: Due to the volume of requests, application requests MUST be accompanied by a self-addressed stamped envelope. Applicants outside the US should contact PCWS via email with appropriate contact information. The grant deadline is June 30, 2000.

Stamp Donations Are Welcome For This Project!

THE MIAMI METROZOO CONSERVATION AND RESEARCH FUND

The Miami Metrozoo Conservation and Research Fund issues small grants (up to \$ 5,000) to support wildlife conservation efforts. Evaluation criteria are based on maximum impact on wildlife conservation. Applications will be accepted from individuals (*i.e.* zoo and aquarium personnel), non-profit organisations or municipalities. Guidelines and application forms available upon request. Proposals must be received by 1 August. Contact: Phyllis Tamburello, Zoological Society of Florida, +1 305 255 5551.

MEETINGS



XIXth Congress of the International Primatological Society (IPS), Beijing, China, 4-9 August, 2002. The main theme of the event will be "Caring for Primates": Progress in, and prospects for, primatology and the conservation of non-human primates in the 21st Century. This will be China's first major international primate meeting. We are very enthusiastic about this big event and will do what we can to make this gathering go smoothly and combine a first-class scientific programme with a cultural and social experience that will be enjoyable and memorable to all. Most of all we hope that it will make a major contribution to the development of primatology and especially to our ongoing efforts to conserve primates in China and around the world. In addition to plenary sessions, a variety of symposia and workshops will be convened during the meeting.

For additional information, contact: Professor Fuwen WEI, Secretary General, 19th Congress of the International Primatological Society, c/o Institute of Zoology, the Chinese Academy of Sciences, 19 Zhongguancun Lu, Haidian, Beijing 100080, China, Fax: (86-10)82627388, E-mail: IPS_Beijing@panda.ioz.ac.cn Home Page: <http://www.ips.ioz.ac.cn>

RECENT LITERATURE

SUSTAINING THE UNSUSTAINABLE

Ecology of an African Rain forest. Logging in Kibale and the Conflict between Conservation and Exploitation by Tom Struhsaker. 1997. 434 pages, 103 figs, 43 tabs. Florida University Presses. Price: HC GB£ 35.95, PB GB£ 27.00. ISBN: HC 0-8130-1490-5, PB 0-8130-1666-5.

Tropical forests occupy only seven percent of the Earth's land, yet probably harbour more than half of the Earth's species. Tropical forests perform critical ecosystem services, such as carbon sequestration, erosion protection, and maintenance of the hydrological cycle and climate patterns. Tropical forests are also rapidly being felled. About half of the Earth's tropical forests have already been converted into nonforested lands. In many parts of the tropics, forests are represented by only tiny remnants. The need is clear for writings that apply current knowledge of ecology, economics, and policy to tropical forest conservation. Particularly useful are works that combine analyses of proximate and ultimate drivers of deforestation and forest degradation, and address these drivers with workable solutions. Thomas Struhsaker provides such a careful and thoughtful multidisciplinary analysis in his 1997 book, *Ecology of an African Rain Forest. Logging in Kibale and the Conflict between Conservation and Exploitation*.

Struhsaker thoroughly considers the biological, economic, and policy issues surrounding tropical forest logging and conservation. He uses a case study approach that is widely applicable. The book begins with a brief review of relevant Ugandan history and summary of the book's objectives. This is followed by a chapter on the ecology of the Kibale Forest (his case study) and a chapter on seasonality and El Niño effects. Subsequent chapters analyse the effects of logging in Kibale on trees, forest gap and edge dynamics, primates, rodents, duikers, and elephants. The highlight of the book comes at the end with a chapter on tropical forest management and a chapter analysing the causes of deforestation and recommendations to prevent it.

The book has two weaknesses. First, the author has an unfortunate tendency to slip into superlatives, with "extremely" and "very" leading the charge. Such writing weakens his arguments, which in themselves are logical. Second, the book is marred by its anecdotal treatment of the subject and lack of statistical analysis, particularly the chapter on primates. This is partially a reflection of the infancy of research on logging and its consequences in tropical forests. Words such as "suggests" and "appears" demonstrate this lack of

rigour, and are an appeal for the use of strong inference in the study of logging and ecology.

The concluding two chapters on management are well written and inspired. Struhsaker argues effectively that the concept of sustainable development is not supported by fact, and that its invocation as the arbitrator of conflicts between conservation and development is a red herring. His examples clearly demonstrate how misguided conservation, often in the guise of sustainability, damages more than it fixes. Even developed countries with vast resources to apply towards sustainable development have failed to meet their goals. How then, argues Struhsaker, can poor tropical nations with exploding populations and frequent instability, war, and corruption hope to sustainably harvest their quickly disappearing forests? Most tropical countries no longer have enough forest to meet even the demands of domestic consumption, leading to the conclusion that sustainable forestry in these countries is impossible.

Terms such as "selective logging" are used by proponents of sustainable forestry even though most selective logging operations destroy more than half of the canopy. As Struhsaker points out, such felling practices more closely resemble clear cutting than anything "selective". Struhsaker concludes that harvest levels and incidental damage must destroy less than five percent of the canopy to ensure integrity of the ecosystem.

Many other important topics are well covered in these two concluding chapters, but two other points deserve special mention here. First, Struhsaker effectively challenges politically-correct critics who stymie conservation efforts by contending that the conservation movement is a Western value imposed on people of the tropics. Conservation values cross lines of latitude and race. Nor are conservation efforts a breach of national sovereignty when the people of many tropical nations are ruled by dictators, not representatives.

Second, foreign aid for conservation projects can be counterproductive and even maddening. Among other problems, large sums of money often lead to infighting among government agencies and NGOs rather than co-operation. Misdirection of funds often leads to demoralisation and breakdown of co-operation. As an example, Struhsaker presents the case of an expatriate advisor on vehicles and roads in Ugandan parks who was paid \$ 144,000 per year while the director of parks (a Ugandan) earned \$ 200 per year. The irony of another example is exasperating: "Approximately 90% of the \$1.5 million in this new two-year [USAID-funded project for the Kibale forest] was budgeted for expatriate consultants to advise the Ugandans as to how they might make the Kibale project financially self-sustaining and to help them define their goals."

Struhsaker's book is a critical contribution to

conservation biology. For the first time, a book has been composed that draws together a disparate and fragmented literature on ecological consequences of logging on trees and mammals in tropical forests (not just Kibale). Such a synthesis should inspire research and debate. The book also includes important management recommendations that if implemented will prove to be a boon to tropical forests.

Frank A. von Hippel

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NEW BOOK ON CENTRAL AFRICAN PRIMATES

Histoire Naturelle des Primates d'Afrique Centrale.
By Annie Gautier-Hion, Marc Colyn & Jean-Pierre Gautier. 1999. 162 pp. ECOFAC, Libreville, Gabon. Price: UK£ 35.99

This is a wonderful little book on monkeys and apes, beautifully presented by leading specialists in the field. Artwork is of the highest standard. Twenty-three excellent colour plates are based on watercolours by Maël Dewynter. No less than 51 maps, histograms or sonograms and 18 tables accompany the text, and in a folder at the end there is a CD of vocalisations prepared by Catherine Bouchain and recorded by her, Jean-Pierre Gautier, and others. The book covers the primate fauna of Central African forests, extending north-west to the Sanaga River in Cameroon and east as far as the Albertine Rift in Congo-Kinshasa. For this extensive Francophone region a French text is clearly the most appropriate. The authors are concerned to supply first-hand knowledge, avoiding secondary sources of data, and have produced a natural history of the best kind, far more than anecdotal, certainly attractive, but also reliable, authoritative, and jam-packed with information.

The introductory section includes essays on climate, and on the general biology of catarhine primates. An instructive map showing centres of endemism and zones of hybridisation accompanies an account of speciation and biogeography. In a succinct historical analysis we are reminded how the primate fauna were gradually discovered and that new species and subspecies are still being described. One of the authors (Marc Colyn) and his colleagues have named *Cercopithecus cephus ngottoensis*, *C. mitis heymani*, *C. hamlyni kahuziensis*, *Procolobus pennantii parmentieri* and *P. p. semlikiensis* within the last 15 years. Other subspecies and two full species have been described during the same period.

The main section addresses 62 species and subspecies and alludes to other taxa just marginal to the book's geographic limits. Every subspecies within Central Africa is pictured. Many have never been illustrated before. Distribution maps have been prepared for all species and show how the forest zone has been geographically partitioned in different ways by different species-groups. The range of every subspecies is displayed. Such detailed information is not available in any other single source and nowhere else is it so up to date. Distributions of some species or subspecies occurring just beyond the book's limits appear on the maps, but not all these outlying taxa are included. Body measurements and weights are given, mainly from data collected by the authors. One can be confident in their estimates of biomass. First hand accounts of movements, feeding, habitat preferences, home range and social organisation provide vivid profiles for each species, amply supported by quantitative data, for instance on diet or preferred foraging heights. Frequent allusions are made to interspecific resemblances of phylogenetic significance, reminders of the biota's evolutionary dynamism.

Primate communities of seven well-studied protected areas in the rainforest are analysed, with maps and annotated tables. Preferences for *terra firma* rather than inundated forest, or arboreal as opposed to semi-terrestrial habit provide the basics for ecological segregation. Though this subject is not discussed in great detail, the diversity within and between communities is most lucidly presented. Problems of conservation are recounted, including transmission of viruses from humans to great apes and protection of hybrid zones, a topic rarely considered.

The CD allows the monkeys and apes to communicate most directly with the reader-turned-listener, and is much more than an evocative appendix to the text. Each vocalisation is discussed and interpreted. Sonograms display frequency and amplitude separately, encouraging the reader to 'see' the physics of these calls in different modes. Incidental bird calls and songs are meticulously identified. The book ends with a glossary, index, and list of plates.

The text is not encumbered with references, though I would like to have seen a fuller bibliography of the authors' previous publications. The omission of primates found in Cameroon north-west of the Sanaga River leaves a gap in an otherwise comprehensive production. '*Miopithecus ogoouensis*' and '*P. p. parmentierorum*' are 'subsequent spellings' whose status may need to be assessed. But these are niggling criticisms.

This work is much more than a résumé of published knowledge. The species profiles are updated reports by experienced observers. The historical commentary is original. There is a new biogeographical interpretation of Central Africa distinguishing major

biotic zones of the Atlantic Coast and the Congo Basin. New systematic information is provided on the distinction between typical *Cercopithecus pogonias* of Bioko and the unnamed black-armed population of the adjacent mainland, on the extensive zone of secondary hybridisation between *C. pogonias nigripes* and *C. p. grayi*, and on variation in *Procolobus pennantii oustaleti* which appears to be divisible into no less than six subspecies.

The *Histoire Naturelle des Primates d'Afrique Centrale* is aimed at all kinds of naturalists, whether they are academic professionals or not. One hopes that it will have an important role in disseminating knowledge and stimulating interest and appreciation of vulnerable faunas. It should aid in encouraging concern, pride and respect for the national heritage within Central African countries. As an exceptional field-guide plus monograph, it is well prepared for these tasks.

Available from: ECOFAC, B.P. 15115, Libreville, Gabon www.ecofac.org

Peter Grubb

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Behaviour in the Adult Male; Socioendocrinology and Sexual Behaviour.

Available from: Oxford University Press, www.oup.co.uk/www.oup-usa.org

Chimpanzee and Red Colobus: The Ecology of Predator and Prey. By Craig B. Stanford. Forward by Richard Wrangham. Harvard University Press. Price: cloth US\$ 35.00.

This book, the first long-term field study of predator-prey relationship involving two wild primates, documents a six-year investigation into how the risk of predation moulds primate society. Taking us to the Gombe National Park in Tanzania, the book offers a close look at how predation by wild chimpanzees—observable in the park as nowhere else—has influenced the behaviour, ecology, and demography of a population of red colobus monkeys. Because chimpanzees are often used as models of how early humans may have lived, Stanford's findings offer insight into the possible role of early hominids as predators, a little understood aspect of human evolution.

"Excellent. An important study of the relationship between chimpanzees and their prey." Jane Goodall.

Available from: Harvard University Press, www.hup.harvard.edu

Books

Primate Sexuality: Comparative Studies of the Prosimians, Monkeys, Apes, and Human Beings.

By Alan Dixson. 1998. Oxford University Press, Oxford. Price: hardback UK£ 80.00/US\$ 140.00, paperback UK£ 32.00/US\$ 60.00.

This book is a uniquely comprehensive synthesis of our knowledge about the sexual behaviour of primates. In it, Alan Dixson reviews and integrates both the evolutionary biology and the physiological basis of sexual behaviour across the whole spectrum of primates, from prosimians to humans. No other book written on the subject of primate sexuality exhibits the comparative breadth or technical depth of this outstanding volume, drawing on and collating work from over 2000 references, and illustrated throughout with hundreds of original drawings and figures.

Contents: Darwin and Friends; Primate Classification and Evolution; Mating systems; Mating Tactics and Reproductive Success; Sexual Behaviour and Sexual Response; Sociosexual Behaviour and Homosexuality; Sexual Selection and Sexually Dimorphic Traits; Sperm Competition; Sexual Selection and Genital Evolution; Sexual Differentiation of the Brain and Behaviour; The Ovarian Cycle and Sexual Behaviour; The Neuroendocrine Regulation of Sexual Behaviour in the Adult Female; Hormones and Sexual

The Hunting Apes: Meat Eating and the Origins of Human Behavior.

By Craig B. Stanford, 1999. Princeton University Press, Princeton. Price: cloth US\$ 24.95. (ISBN 0-691-01160-5).

What makes humans the most successful animal species inhabiting the Earth today? Most scientists agree that the key to our success is the unusually large size of our brains. In this provocative new book, Craig Stanford presents an intriguing new thesis grounded in recent, pathbreaking scientific observation.

According to Stanford, what made humans unique was meat. Or, rather, the desire for meat, the eating of meat, the hunting of meat, and the sharing of meat. Based on new insights into the behaviour of chimpanzees and the other great apes, our now extinct human ancestors, and existing hunting and gathering societies, Stanford shows the remarkable role that meat has played in these societies.

Available from: Princeton University Press, [HTTP://pup.princeton.edu](http://pup.princeton.edu)

Walker's Primates of the World. By Ronald M. Nowak. 1999. Introduction by PSG Chairman Russell A. Mittermeier, Anthony B. Rylands and William R. Konstant. The Johns Hopkins University Press, Baltimore. 272 pp., 179 photos. (paperback, ISBN 0 8018 6251 5). Price: US\$ 19.95.

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Other books

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Parker, Sue Taylor, Robert W. Mitchell, H. Lyn Miles, eds. 1999. *The Mentalities of Gorillas and Orangutans: Comparative Perspectives*. Cambridge University Press. *Available from:* Cambridge University Press, 110 Midland Avenue, Port Chester, N.Y. 10573-4930 USA, Tel: 1-800-872-7423, Fax: 1-914-937-4712, URL: www.cup.org, E-mail: info@cup.org ISBN 0 521 58027 7 (Cloth), Price: US\$ 85.00

Articles

Agoramoorthy, G. & M.J. Hsu. 1999. Rehabilitation and release of chimpanzees on a natural island: methods hold promise for other primates as well. *Journal of Wildlife Rehabilitation* 22: 3-7.

Achoka, I. 1998. Mgahinga: Monitoring of gorillas. *Gorilla Journal* 16: 11.

Achoka, I. 1998. Gorilla groups in Mgahinga Park, August 1997 to July 1998. *Gorilla Journal* 17: 9-10.

Amman, K. 198. A status update of bonobos in the DCR. Threatening effects of logging concessions

and the bush meat trade. *Pan Africa News* 5: 10-11.

Anonymous. 1998. Gorilla tourism in Uganda. *Gorilla Journal* 17: 10.

Anonymous. 1998. The Ape Alliance. *Gorilla Journal* 17:15-16.

Anonymous. 1999. Ape Alliance Bushmeat Working Group Report: The African bushmeat trade—a recipe for extinction? *Primate Eye* 67: 32-35.

Anonymous. 1999. AZA releases consensus statement on bushmeat. *AZA Communiqué* May: 9-10.

Anonymous. 1999. Budongo Forest Project. *Laboratory Primate Newsletter* 38: 15.

Anonymous. 1999. Conservation organizations, zoological parks, animal welfare advocates, and medical researchers call for immediate action to address the commercial bushmeat crisis in tropical African countries. *ASP Bulletin* 23: 7.

Anonymous. 1999. Democratic Republic of Congo: a bleak report. *Gorilla Conservation News* 13: 8-9.

Anonymous. 1999. New Zealand bill proposes rights for apes. *IPPL News* 27: 19.

Anonymous. 1999. New Zealand rejects human rights for great apes. *Lab Animal* 28: 12.

Anonymous. 1999. The Great Ape Conservation Act of 1999 (U.S. Senate #1007-May 12, 1999). *ASP Bulletin* 23: 8.

Anonymous. 1999. The Mongambe Research Camp, Dzanga-Ndoki National Park: Central African Republic (C.A.R.). *Gorilla Conservation News* 13: 5.

Arcadi, A.C., D. Robert & C. Boesch. 1998. Buttress drumming by wild chimpanzees: temporal patterning, phrase integration into loud calls, and preliminary evidence for individual distinctiveness. *Primates* 39: 505-518.

Arcadi, A.C. & R.W. Wrangham. 1999. Infanticide in chimpanzees: review of cases and a new within group observation from the Kanyawara study group in Kibale National Park. *Primates* 40: 337-351.

Aveling, C. 1999. Lowland gorilla tourism in Central Africa. *Gorilla Journal* 18: 18-20.

Baker, A. 1996/1997. The role of zoos in primate conservation. *Primate Conservation* 17: 37-40.

Baldellou, M. & A. Adan. 1998. Diurnal and seasonal variations in vervet monkeys' activity. *Psychological Reports* 83:675-685.

Bar, H. 1999. Gabonese continue to eat monkeys despite AIDS threat. *Australasian Primatology* 13:19-20.

Barrett, L. & C.B. Lowen. 1998. Random walks and the gas model: spacing behaviour of grey-cheeked mangabeys. *Functional Ecology* 12: 857-865.

Bean, A. 1999. Ecology of sex differences in great ape foraging. In P.C. Lee, ed. *Comparative Primate Socioecology*. Cambridge University Press,

- Cambridge. Pp. 339-362.
- Bearder, S.K. 1999. Physical and social diversity among nocturnal primates: a new view based on long term research. *Primates* 40: 267-282.
- Bekoff, M. 1997. Deep ethology, animal rights and The Great Ape/Animal Project: Resisting speciesism and expanding the community of equals. *Journal of Agricultural & Environmental Ethics* 10: 269-296.
- Bekoff, M. 1998. Resisting speciesism and expanding the community of equals. *Bioscience* 48: 638-641.
- Bentley-Condit, V. K. & E.O. Smith. 1999. Female dominance and female social relationships among yellow baboons (*Papio hamadryas cynocephalus*). *American Journal of Primatology* 47: 321-334.
- Bermejo, M. 1999. Update on the Lossi Gorilla Study and future sanctuary of gorillas, 1998. *Gorilla Conservation News* 13: 4.
- Berry, J.P. 1999. The chemical ecology of mountain gorillas (*Gorilla gorilla beringei*), with special reference to antimicrobial constituents in the diet. *Dissertation Abstracts International* B59: 3190.
- Blois-Heulin, C. & B. Girona. 1999. Patterns of social visual attention in the red-capped mangabey (*Cercopithecus torquatus torquatus*) in the context of food competition. *Folia Primatologica* 70: 180-184.
- Boesch, C. & M. Tomasello. 1998. Chimpanzee and human cultures. *Current Anthropology* 39: 591-614.
- Bowen-Jones, E. & S. Pendry. 1999. The threat to primates and other mammals from the bushmeat trade in Africa, and how this threat could be diminished. *Oryx* 33: 233-246.
- Brugiere, D. 1998. Population size of the black colobus monkey *Colobus satanas* and the impact of logging in the Lope Reserve, Central Gabon. *Biological Conservation* 86: 15-20.
- Brugiere, D., J.P. Gautier & S. Lahm. 1998. Additional data on the distribution of *Cercopithecus (lhoesti) solatus*. *Folia Primatologica* 65: 331-336.
- Brugiere, D. & J.P. Gautier. 1999. Status and conservation of the sun-tailed guenon *Cercopithecus solatus*, Gabon's endemic monkey. *Oryx* 33: 67-74.
- Butynski, T.M. 1996/1997. African primate conservation: the species and the IUCN/SSC Primate Specialist Group network. *Primate Conservation* 17: 87-100.
- Butynski, T.M., C.L. Ehardt & T.T. Struhsaker. 1998. Notes on two dwarf galagos (*Galagoides udzungwensis* and *Galagoides orinus*) in the Udzungwa Mountains, Tanzania. *Primate Conservation* 18: 69-75.
- Butynski, T.M. & J. Kalina. 1998. Is gorilla tourism sustainable? *Gorilla Journal* 16: 15-19.
- Butynski, T.M. & J. Kalina. 1998. Gorilla tourism: a critical look. In E.J. Milner-Gulland, ed. *Conservation of Biological Resources*. Blackwell Science, Oxford. Pp. 294-313 (references pp. 359-369).
- Chapman, C.A. & L.J. Chapman. 1999. Implications of small scale variation in ecological conditions for the diet and density of red colobus monkeys. *Primates* 40: 215-231.
- Chapman, K.L., M.J. Lawes & M.M. Macleod. 1998. Evaluation of non-lethal control methods on problematic samango monkeys in the Cape Vidal Recreation Reserve, Greater St. Lucia Wetland Park. *South African Journal of Wildlife Research* 28: 89-99.
- Chism, J. 1999. Decoding patas social organization. In P. Dolhinow, ed. *The Nonhuman Primates*. Mayfield Publ., Mountain View. Pp. 86-92.
- Chivers, D.J. 1996/1997. The role of the International Primatological Society (IPS) and national primate societies in global primate conservation. *Primate Conservation* 17: 18-23.
- Conklin-Brittain, N.L., R.W. Wrangham & K.D. Hunt. 1998. Dietary response of chimpanzees and cercopithecines to seasonal variation in fruit abundance. II. Macronutrients. *International Journal of Primatology* 19: 971-998.
- Cooper, J.E. 1998. Mountain gorilla health network. *Gorilla Journal* 17: 14.
- Cousins, D. 1999. Exploitation of great ape body parts in Africa. *Gorilla Journal* 18: 10-11.
- Cowlishaw, G. 1998. The role of vigilance in the survival and reproductive strategies of desert baboons. *Behaviour* 135: 431-452.
- Cowlishaw, G. 1999. Ecological and social determinants of spacing behaviour in desert baboon groups. *Behavioral Ecology and Sociobiology* 45: 67-77.
- Davies, A.G., J.F. Oates & G.L. Dasilva. 1999. Patterns of frugivory in three West African colobine monkeys. *International Journal of Primatology* 20: 327-357.
- Dormaels, B. 1998. Bonobos in the Lolonga National Park. *Pan Africa News* 5: 10.
- Ellis, S. 1996/1997. Primate conservation and the IUCN/SSC Conservation Breeding Specialist Group: tools, models, and processes. *Primate Conservation* 17: 41-45.
- Fleury, M.C. & J.P. Gautier. 1998. [Adaptation to natural environment of a young hand-raised *Cercopithecus solatus*.] *Revue d'Ecologie (Terre et la Vie)* 53:273-287. (French with English summary.)
- Fruth, B. & W.C. McGrew. 1998. Resting and nesting in primates: Behavioral ecology of inactivity. *American Journal of Primatology* 46: 3-5.
- Fruth, B., G. Hohmann & W.C. McGrew. 1999. The

- Pan* species. In P. Dolhinow, ed. *The Nonhuman Primates*. Mayfield Publ., Mountain View. Pp. 64–72.
- Furuichi, T., G. Idani, H. Ihobe, S. Kuroda, K. Kitamura, A. Mori, T. Enomoto, M. Okayasu, C. Hashimoto & T. Kano. 1998. Population dynamics of wild bonobos (*Pan paniscus*) at Wamba. *International Journal of Primatology* 19: 1029–1043.
- Gage, T.B. 1998. The comparative demography of primates: with some comments on the evolution of life histories. *Annual Review of Anthropology*: 197–221.
- Gagneux, P., C. Boesch & D.S. Woodruff. 1999. Female reproductive strategies, paternity and community structure in wild West African chimpanzees. *Animal Behaviour* 57: 19–32.
- Gautier, J.P. 1998. [Vocal communication in primates.] *Bulletin de la Société Zoologique de France* 123: 239–253. (French with English summary.)
- Gerloff, U., B. Hartung, B. Fruth, G. Hohmann & D. Tautz. 1999. Intracommunity relationships, dispersal pattern and paternity success in a wild living community of bonobos (*Pan paniscus*) determined from DNA analysis of faecal samples. *Proceedings of the Royal Society of London B* 266(1424): 1189–1195.
- Gielen, M. 1998. [Medicinal plant use by chimpanzees.] *Cahiers D'ethologie* 18: 138–140 (French).
- Goldsmith, M. 1999. Gorilla socioecology. In P. Dolhinow, ed. *The Nonhuman Primates*. Mayfield Publ., Mountain View. Pp. 58–63.
- Goldsmith, M.L. 1999. Ecological constraints on the foraging effort of western gorillas (*Gorilla gorilla gorilla*) at Bai Hokou, Central African Republic. *International Journal of Primatology* 20: 1–23.
- Goldsmith, M. & A. Taylor. 1999. Revision of the genus *Gorilla*: 70 years after Coolidge. *Gorilla Journal* 18: 15–17.
- Goodall, J. 1998. Learning from the chimpanzees: a message humans can understand. *Science* 282: 2184–2185.
- Gore, M.A. 1999. PSGB winter meeting 1998 report: contribution of zoos to primate biology and conservation. *Primate Eye* 67: 4–8.
- Goves, J.L. 1999. Gorillas in Takamanda Forest Reserve. *Gorilla Journal* 18: 17–18.
- Groves, C.P. 1997. Taxonomy and phylogeny of primates. In A. Balncher, ed. *Molecular Biology and Evolution of Blood Group and MHC Antigens in Primates*. Springer, Berlin. Pp. 3–23.
- Groves, C.P. 1998. [Bonobo, pygmy chimpanzee, gracile chimpanzee: some comments on Adriaan Kortlandt's proposal.] *Primatologie* 1: 441–442. (French with English summary.)
- Grubb, P. & C.B. Powell. 1999. Discovery of red colobus monkeys (*Procolobus badius*) in the Niger Delta with the description of a new and geographically isolated subspecies. *Journal of Zoology* 248: 67–73.
- Gursky, S. 1998. Effects of radio transmitter weight on a small nocturnal primate. *American Journal of Primatology* 46: 145–155.
- Harcourt, A.H. 1998. Does primate socioecology need non-primate socioecology? *Evolutionary Anthropology* 7: 3–7.
- Harcourt, A. 1998. Ecological indicators of risk in primates, as judged by species' susceptibility to logging. In T. Caro, ed. *Behavioural Ecology and Conservation Biology*. Oxford University Press, New York. Pp. 56–79.
- Hashimoto, C. 1998. Chimpanzees of the Kalinzu Forest, Uganda. *Pan Africa News* 5: 6–8.
- Hashimoto, C., Y. Tashiro, D. Kimura, T. Enomoto, E.J. Ingmanson, G. Idani & T. Furuichi. 1998. Habitat use and ranging of wild bonobos (*Pan paniscus*) at Wamba. *International Journal of Primatology* 19: 1045–1060.
- Henzi, S.P., J.E. Lycett & T. Weingrill. 1998. Mate guarding and risk assessment by male mountain baboons during inter-troop encounters. *55: 1421–1428.*
- Henzi, S.P., T. Weingrill & L. Barrett. 1999. Male behaviour and the evolutionary ecology of chacma baboons. *South African Journal of Science* 95: 240–242.
- Hill, R.A. & R.I.M. Dunbar 1998. Evaluation of the roles of predation rate and predation risk as selective pressures on primate grouping behaviour. *Behaviour* 135: 411–430.
- Hill, R.A. 1999. Size-dependent tortoise predation by baboons at De Hoop Nature Reserve, South Africa. *South African Journal of Science* 95: 123–124.
- Honess, P. 1999. Speciation among galagos (Primates, Galagidae) in Tanzanian forests. *Primate Eye* 68: 34–35.
- Huffman, M.A., R. Elias, G. Balansard, H. Ohigashi & P. Nansen. 1998. [Self-medication in the great apes: a multidisciplinary study of behavior, diet, and health.] *Primatologie* 1: 179–204. (French with English summary)
- Huffman, M.A., H. Ohigashi, M. Kawanaka, J.E. Page, G.C. Kirby, M. Gasquet, A. Murakami & K. Koshimizu. 1998. African great ape self-medication: a new paradigm for treating parasite disease with natural medicines? In H. Ageta, ed. *Towards Natural Medicine Research in the 21st Century*. Elsevier, New York. Pp. 113–123.
- Humle T. 1999. New record of fishing for termites (Macrotermes) by the chimpanzees of Bossou (*Pan troglodytes verus*), Guinea. *Pan Africa News* 6: 3–4.
- Isbell, L.A. 1998. Diet for a small primate: Insectivory

- and gummivory in the (large) patas monkey (*Erythrocebus patas pyrrhonotus*). *American Journal of Physical Anthropology* 45: 381-398.
- Isbell, L.A., J.D. Pruettz, M. Lewis & T.P. Young. 1999. Rank differences in ecological behavior: a comparative study of patas monkeys (*Erythrocebus patas*) and vervets (*Cercopithecus aethiops*). *International Journal of Primatology* 20: 257-272.
- Isbell, L.A., J.D. Pruettz, B.M. Nzuma & T.P. Young. 1999. Comparing measures of travel distances in primates: Methodological considerations and socioecological implications. *American Journal of Primatology* 48: 87-98.
- Itoh, N., T. Sakamaki, M. Hamisi, R. Kitopeni, M. Bunengwa, M. Matumula, K. Athumani, M. Mwami & H. Bunengwa. 1999. A new record of invasion by an unknown unit group into the center of M group territory. *Pan Africa News* 6: 8-10.
- IUCN/SSC Re-introduction Specialist Group. 1998. *IUCN Guidelines for Re-introductions*. IUCN, Gland, Switzerland. 10 pp.
- Janson, C.H., 1998. Testing the predation hypothesis for vertebrate sociality: prospects and pitfalls. *Behaviour* 135: 389-410.
- Jernvall, J. & P.C. Wright. 1998. Diversity components of impending primate extinctions. *Proceedings of the National Academy of Sciences of the USA* 95: 11279-11283.
- Jones, C.B. 1998. Baseline range size distributions in primates. *Primate Conservation* 18: 7-9.
- Kahumbu, P. 1997. The decline of Angolan colobus monkeys *Colobus angolensis palliatus* in Diani. *EAHNS Bulletin* 27: 2-4.
- Kaiser, J. 1998. Ecology: impact of primate losses estimated. *Science* 281: 1780-1781.
- Kano, T. & T. Nishida. 1999. Bilia as an authentic vernacular name for *Pan paniscus*. *Pan Africa News* 6: 1-3.
- Kaplin, B.A. 1999. Ecology of two African forest monkeys: temporal and spatial patterns of habitat use, foraging behavior, and seed dispersal. *Dissertation Abstracts International* B59: 3195.
- Karlowski, U. 1999. Acute danger for the Virunga Park. *Gorilla Journal* 18: 5-6.
- Kirkpatrick, R.C. 1999. Colobine diet and social organization. In P. Dolhinow, ed. *The Nonhuman Primates*. Mayfield Publ., Mountain View. Pp. 93-105.
- Klein, M. & M. van der Wal. 1998. About tropical hardwood, hunters and gorillas: conservation of forest fauna in south Cameroon. In C. Besselink, ed. *The Congo Basin: Human and Natural Resources*. Netherlands Committee for IUCN, Amsterdam. Pp. 110-118.
- Konstant, W.R. 1996/197. Funding for primate conservation: where has it originated? *Primate Conservation* 17: 30-36.
- Kortlandt, A. 1996. Chimpanzee *Pan troglodytes* nestmaking behaviour in Guinea and Uganda. *African Primates* 2: 80.
- Kuester, J. & A. Paul. 1999. Male migration in Barbary macaques (*Macaca sylvanus*) at Affenberg Salem. *International Journal of Primatology* 20: 85-106.
- Lahm, S.A., R.F.W. Barnes, K. Beardsley & P. Cervinka. 1998. A method for censusing the greater white-nosed monkey in northeastern Gabon using the population density gradient in relation to roads. *Journal of Tropical Ecology* 14: 629-643.
- Lambert, J.E., 1998. Primate frugivory in Kibale National Park, Uganda, and its implications for human use of forest resources. *African Journal of Ecology* 36: 234-240.
- Lambert, J.E. 1999. Seed handling in chimpanzees (*Pan troglodytes*) and red-tailed monkeys (*Cercopithecus ascanius*): implications for understanding hominoid and cercopithecine fruit-processing strategies and seed dispersal. *American Journal of Physical Anthropology* 109: 365-386.
- Lindenfors, P. & B.S. Tullberg. 1998. Phylogenetic analysis of primate size evolution: the consequences of sexual selection. *Biological Journal of the Linnean Society* 64: 413-447.
- Lozango, G.A. 1998. Parasitic stress and self-medication in wild animals. *Advances in the Study of Behavior* 27: 291-317.
- Magliocca, F., S. Querouil & A. Gautier-Hion. 1999. Population structure and group composition of western lowland gorillas in north-western Republic of Congo. *American Journal of Primatology* 48: 1-14.
- Magliocca, F. 1999. Update on the gorillas of the Odzala National Park, Popular Republic of Congo. *Gorilla Conservation News* 13: 3.
- Matsumoto-Oda, A. 1999. Mahale chimpanzees: grouping patterns and cycling females. *American Journal of Primatology* 47: 197-207.
- Matsumoto-Oda, A., K. Hosaka, M.A. Huffman & K. Kawanaka. 1998. Factors affecting party size in chimpanzees of the Mahale mountains. *International Journal of Primatology* 19: 999-1011.
- Matsumoto-Oda, A. & Y. Hayashi. 1999. Nutritional aspects of fruit choice by chimpanzees. *Folia Primatologica* 70: 154-162.
- Matsuzawa, T., H. Takemoto, S. Hayakawa & M. Shimada. 1999. Diecke Forest in Guinea. *Pan Africa News* 6: 10-11.
- Matthews, A., A. Matthews & C. Niemitz. 1998. Preliminary report on the distribution of mandrills (*Mandrillus sphinx*) in southwestern Cameroon. *Primate Report* 50: 105-113.
- McGraw, W.S. 1998. Locomotion, support use, maintenance activities, and habitat structure. In E. Strasser, ed. *Primate Locomotion: Recent Advances*.

- Plenum Press, New York. Pp. 79–94.
- McGraw, W.S. 1998. Three monkeys nearing extinction in the forest reserves of eastern Côte d'Ivoire. *Oryx* 32: 233–236.
- McGraw, W.S. 1998. Posture and support use of old world monkeys (Cercopithecidae): The influence of foraging strategies, activity patterns, and the spatial distribution of preferred food items. *American Journal of Primatology* 46: 229–250.
- McGraw, W.S. 1999. West African monkeys in jeopardy: a report on the cercopithecids of eastern Côte d'Ivoire. *ASP Bulletin* 23: 8–9.
- Meder, A. 1998. Gorilla conservation in Rio Muni. *Gorilla Journal* 16: 23.
- Meder, A. 1999. Gorillas in African culture and medicine. *Gorilla Journal* 18: 11–15.
- Menzel, C.R. 1997. Primates' knowledge of their natural habitat: as indicated in foraging. In A. Whiten, ed. *Machiavellian Intelligence II: Extensions and Evaluations*. Cambridge University Press, Cambridge. Pp. 207–239.
- Milton, K. 1999. A hypothesis to explain the role of meat-eating in human evolution. *Evolutionary Anthropology* 8: 11–21.
- Mitani, J.C. & J. Gros-Louis. 1998. Chorusing and call convergence in chimpanzees: tests of three hypotheses. *Behaviour* 135: 1041–1064.
- Mitani, J.C., K.L. Hunley & M.E. Murdoch. 1999. Geographic variation in the calls of wild chimpanzees: a reassessment. *American Journal of Primatology* 47: 133–151.
- Mitchell, R.W. 1999. Scientific and popular conceptions of the psychology of great apes from the 1790s to the 1970s: Déjà vu all over again. *Primate Report* 53: 3–118.
- Mittermeier, R.A. & W.R. Konstant. 1996/1997. Primate conservation: a retrospective and a look into the 21st century. *Primate Conservation* 17: 7–17.
- Moore, J. 1999. Population density, social pathology, and behavioral ecology. *Primates* 40: 1–22.
- Mori, A., T. Iwamoto, U. Mori & A. Bekele. 1999. Sociological and demographic characteristics of a recently found Arsi gelada population in Ethiopia. *Primates* 40: 365–381.
- Munene, E., M. Otsyula, D.A.N. Mbaabu, W.T. Mutahi, S.M.K. Muriuki & G.M. Muchemi. 1998. Helminth and protozoan gastrointestinal tract parasites in captive and wild-trapped African non-human primates. *Veterinary Parasitology* 78: 195–201.
- Mushengezi, V. K. 1998. Progress report on Mt. Tshiaberimu conservation activities. *Gorilla Journal* 17: 5–7.
- Nakamura, M. & F. Fukuda. 1999. Chimpanzees to the east of the Mahale Mountains. *Pan Africa News* 6: 5–7.
- Naughton-Treves, L., A. Treves, C. Chapman & R. Wrangham. 1998. Temporal patterns of crop-raiding by primates: linking food availability in croplands and adjacent forest. *Journal of Applied Ecology* 35: 596–606.
- Newton-Fisher, N.E. 1999. Infant killers of Budongo. *Folia Primatologica* 70: 167–169.
- Nishida, T. 1998. Deceptive tactic by an adult male chimpanzee to snatch a dead infant from its mother. *Pan Africa News* 5: 13–15.
- Nunn, C.L. 1999. The number of males in primate social groups: A comparative test of the socioecological model. *Behavioral Ecology and Sociobiology* 46:1–13.
- Oates, J. 1998. A report from Nigeria. *Gorilla Journal* 16: 19–22.
- Oates, J. 1999. Update on Nigeria, 1998. *Gorilla Conservation News* 13: 6.
- Oates, J.F., T.T. Struhsaker & G.H. Whitesides. 1996/1997. Extinction faces Ghana's red colobus monkey and other locally endemic subspecies. *Primate Conservation* 17: 138–144.
- Ostro, L.E.T., T.P. Young, S.C. Silver & F.W. Koontz. 1999. A Geographic Information System method for estimating home range size. *Journal of Wildlife Management* 63: 748–755.
- Palombit, R.A. 1999. Infanticide and the evolution of pair bonds in nonhuman primates. *Evolutionary Anthropology* 7: 117–129.
- Palombit, R.A., D.L. Cheney & R.M. Seyfarth. 1999. Male grunts as mediators of social interaction with females in wild chacma baboons (*Papio cynocephalus ursinus*). *Behaviour* 136: 221–242.
- Peignot, P., B. Fontaine & E.J. Wickings. 1999. Habitat exploitation, diet and some data on reproductive behaviour in a semi-free ranging colony of *Cercopithecus l'hoesti solatus*, a guenon species recently discovered in Gabon. *Folia Primatologica* 70: 29–36.
- Peres, C.A. 1999. General guidelines for standardizing line-transect surveys of tropical forest primates. *Neotropical Primates* 7: 11–16.
- Pillinger, C. 1998. Tourist rush poses risk to survival of mountain gorillas. *Australasian Primatology* 13: 22–23.
- Phillips, K.A., C.R. Elvey, & C.L. Abercrombie. 1998. Applying GPS to the study of primate ecology: a useful tool? *American Journal of Primatology* 46: 167–172.
- Plavcan, J.M. 1999. Mating systems, intrasexual competition and sexual dimorphism in primates. In P.C. Lee, ed. *Comparative Primate Socioecology*. Cambridge University Press, Cambridge. Pp. 241–260.
- Poe, E. 1999. Legal rights for all great apes? *Lab*

- Animal* 28: 10.
- Redmond, I. 1999. The African bushmeat trade—A recipe for extinction, published by the Ape Alliance, 1998. *Primate Eye* 67: 26–29.
- Remis, M.J. 1998. The gorilla paradox: The effects of body size and habitat on the positional behavior of lowland and mountain gorillas. In E. Strasser, ed. *Primate Locomotion: Recent Advances*. Plenum Press, New York. Pp. 95–110.
- Remis, M.J. 1999. Tree structure and sex differences in arboreality among western lowland gorillas (*Gorilla gorilla gorilla*) at Bai Hokou, Central African Republic. *Primates* 40: 383–396.
- Rendall, D., R.M. Seyfarth, D.L. Cheney & M.J. Owren. 1999. The meaning and function of grunt variants in baboons. *Animal Behaviour* 57: 583–592.
- Reynolds, V., A.J. Plumtre, J. Greenham & J. Harborne. 1998. Condensed tannins and sugars in the diet of chimpanzees (*Pan troglodytes schweinfurthii*) in the Budongo Forest, Uganda. *Oecologia* 115: 331–336.
- Robbins, M.M. 1999. Male mating patterns in wild multimale mountain gorilla groups. *Animal Behaviour* 57: 1013–1020.
- Schick, K.D., N. Toth, G. Garufi, E.S. Savage-Rumbaugh, D. Rumbaugh & R. Sevcik. 1999. Continuing investigations into the stone tool-making and tool-using capabilities of bonobo (*Pan paniscus*). *Journal of Archaeological Science* 26: 821–832.
- Sept, J. 1998. Shadows on a changing landscape: comparing nesting patterns of hominids and chimpanzees since their last common ancestor. *American Journal of Primatology* 46: 85–101.
- Siex, K.S. & T.T. Struhsaker. 1999. Ecology of the Zanzibar red colobus monkey: Demographic variability and habitat stability. *International Journal of Primatology* 20: 163–192.
- Sikubwabo Kiyengo, C. 1998. Conservation in the Virunga Park. *Gorilla Journal* 16: 3–4.
- Sivha, M. 1998. Progress at the Kahuzi-Biega Park. *Gorilla Journal* 16: 7–8.
- Sleeman, J.M., K. Cameron, A.B. Mudakikwa, S. Anderson, J.E. Cooper, B. Hastings, J.W. Foster, E.J. Macfie & H.M. Richardson. 1998. Field anaesthesia of free ranging mountain gorillas (*Gorilla gorilla beringei*) from the Virunga Volcano region, central Africa. *AAZV/AAWV Joint Conference Proceedings*: 1–4.
- Smith, A.P. 1997. Deforestation, fragmentation, and reserve design in western Madagascar. In W.F. Laurance, ed. *Tropical Forest Remnants: Ecology, Management and Conservation of Fragmented Communities*. Pp. 415–441.
- Stanford, C.B. 1998. The social behavior of chimpanzees and bonobos: Empirical evidence and shifting assumptions. *Current Anthropology* 39: 399–420.
- Stanford, C.B. 1999. Bwindi-Impenetrable Great Ape Project: progress report for 1999. *Gorilla Conservation News* 13: 13.
- Steklis, H.D., N. Gerald-Steklis & S. Madry. 1996/1997. The mountain gorilla: conserving an endangered primate in conditions of extreme political instability. *Primate Conservation* 17: 145–151.
- Strait, S.G., & J.F.V. Vincent. 1998. Primate faunivores: physical properties of prey items. *International Journal of Primatology* 19: 867–878.
- Struhsaker, T.T. & K.S. Siex. 1998. The Zanzibar red colobus monkey: Conservation status of an endangered island endemic. *Primate Conservation* 18: 51–58.
- Sugiyama, Y. 1999. Socioecological factors of male chimpanzee migration at Bossou, Guinea. *Primates* 40: 61–68.
- Thompson, J. 1998. Conservation of *Pan paniscus* at the southernmost research site. *Pan Africa News* 5: 22–24.
- Thompson, J.A.M. 1999. The history, taxonomy and ecology of the bonobo (*Pan paniscus*, Schwartz), with a first description of a wild population living in a forest/savannah mosaic habitat. *Primate Eye* 67: 41–42.
- Tobias, P.V. & H.S.R. Glaser 1999. Memories of Walter Baumgartel (1902–1997): pioneering promoter of the mountain gorillas of Uganda. *South African Journal of Science* 95: 114–116.
- Treves, A. 1999. Has predation shaped the social systems of arboreal primates? *International Journal of Primatology* 20: 35–67.
- Treves, A. 1999. Within-group vigilance in red colobus and red-tail monkeys. *American Journal of Primatology* 48: 113–126.
- Tutin, C.E.G. 1999. Fragmented living: behavioural ecology of primates in a forest fragment in the Lopé Reserve, Gabon. *Primates* 40: 249–265.
- Uehara, S. & H. Ihobe. 1998. Distribution and abundance of diurnal mammals, especially monkeys, at Kasoje, Mahale Mountains, Tanzania. *Anthropological Science* 106: 349–369.
- Usongo, L. 1998. Conservation status of primates in Cameroon. *Primate Conservation* 18: 59–65.
- Usongo, L. 1998. Conservation status of primates in the proposed Lobeke Forest Reserve, south-east Cameroon. *Primate Conservation* 18: 66–68.
- Vanleeuwe, H., S. Cajani & A. Gautier-Hion. 1998. Large mammals at forest clearings in the Odzala National Park, Congo. *Revue D'ecologie (Terre et la Vie)* 53: 171–180.
- van Schaik, C.P., R.O. Deaner & M.Y. Merrill. 1999. The conditions for tool use in primates: implications for the evolution of material culture. *Journal of*

- Human Evolution* 36: 719–741.
- van Schaik, C.P., M.A. van Noordwijk & C.L. Nunn. 1999. Sex and social evolution in primates. In P.C. Lee, ed. *Comparative Primate Socioecology*. Cambridge University Press, Cambridge. Pp. 204–231.
- Vea, J.J., A.P. Perez, M. Baldellou & V. Alea. 1999. Cost-benefit analysis of allogrooming behaviour in *Cercocebus torquatus lunulatus*. *Behaviour* 136: 243–256.
- Verrengia, J.B. 1998. Scientists contact mountain gorillas. *Australasian Primatology* 13: 21–22.
- Vogel, G. 1999. Chimps in the wild show stirrings of culture. *Science* 284: 2070–2073.
- Voysey, B.C., K.E. McDonald, M.E. Rogers, C.E.G. Tutin & R.J. Parnell. 1999. Gorillas and seed dispersal in the Lopé Reserve, Gabon. I: Gorilla acquisition by trees. *Journal of Tropical Ecology* 15: 23–38.
- Voysey, B.C., K.E. McDonald, M.E. Rogers, C.E.G. Tutin & R.J. Parnell. 1999. Gorillas and seed dispersal in the Lopé Reserve, Gabon. II: Survival and growth of seedlings. *Journal of Tropical Ecology* 15: 39–60.
- Wahungu, G.M. 1998. Diet and habitat overlap in two sympatric primate species, the Tana crested mangabey *Cercocebus galeritus* and yellow baboon *Papio cynocephalus*. *African Journal of Ecology* 36: 159–173.
- Wahungu, G.M. 1998. Drinking behaviour in the Tana crested mangabey *Cercocebus galeritus galeritus*. *Folia Primatologica* 69:361–363.
- Watson, S.L., J.P. Ward, K.B. Davis & R.C. Stavisky. 1999. Scent-marking and cortisol response in the small-eared bushbaby (*Otolemur garnettii*). *Physiology & Behavior* 66: 695–699.
- Watts, D.P. 1998. Coalitionary mate guarding by male chimpanzees at Ngogo, Kibale National Park, Uganda. *Behavioral Ecology and Sociobiology* 44: 43–55.
- Watts, D.P. 1998. Long term habitat use by mountain gorillas (*Gorilla gorilla beringei*). I. Consistency, variation, and home range size and stability. *International Journal of Primatology* 19: 651–680.
- Watts, D.P. 1998. Long term habitat use by mountain gorillas (*Gorilla gorilla beringei*). II. Reuse of foraging areas in relation to resource abundance, quality and depletion. *International Journal of Primatology* 19: 681–702.
- Watts, D.P. 1998. Seasonality in the ecology and life histories of mountain gorillas (*Gorilla gorilla beringei*). *International Journal of Primatology* 19: 929–948.
- Werikhe, S., L. Macfie, N. Rosen & P. Miller. 1998. *Can the Mountain Gorilla Survive? Population and Habitat Viability Assessment for Gorilla gorilla beringei*. Unpublished report, SSC/IUCN Conservation Breeding Specialist Group, Apple Valley, MN. 192 pp.
- White, F.J. 1998. Seasonality and socioecology: the importance of variation in fruit abundance on bonobo sociality. *International Journal of Primatology* 19: 1013–1027.
- White, F.J. 1998. The importance of seasonality in primatology. *International Journal of Primatology* 19: 925–927.
- Whiten, A., J. Goodall, W.C. McGrew, T. Nishida, V. Reynolds, Y. Sugiyama, C.E.G. Tutin, R.W. Wrangham & C. Boesch. 1999. Cultures in chimpanzees. *Nature* 399: 682–685.
- Williamson, D.K. & R. Dunbar. 1999. Energetics, time budgets and group size. In P.C. Lee, ed. *Comparative Primate Socioecology*. Cambridge University Press, Cambridge. Pp. 320–338.
- Williamson, L. 1999. News from Karisoke. *Gorilla Journal* 18: 9.
- Williamson, L. 1999. Report from the Karisoke Research Centre. *Gorilla Conservation News* 13: 9.
- Williamson, L. & A. Mudakikwa. 1998. Status of the Rwandan mountain gorillas. *Gorilla Journal* 17: 11–12.
- Wrangham, R.W., N.L. Conklin-Brittain & K.D. Hunt. 1998. Dietary response of chimpanzees and cercopithecines to seasonal variation in fruit abundance. I. Antifeedants. *International Journal of Primatology* 19: 949–970.
- Yamagiwa, J. 1998. An ossified chimpanzee found in a tree nest. *Pan Africa News* 5: 17–18.
- Yamagiwa, J. 1998. About the gorillas in Kahuzi-Biega. *Gorilla Journal* 16: 9.
- Yamagiwa, J. 1999. Socioecological factors influencing population structure of gorillas and chimpanzees. *Primates* 40: 87–104.
- Yamakoshi, G. 1998. Dietary responses to fruit scarcity of wild chimpanzees at Bossou, Guinea: Possible implications for ecological importance of tool use. *American Journal of Physical Anthropology* 106: 283–295.
- Yeager, C.P. & S.C. Silver. 1999. Translocation and rehabilitation as primate conservation tools: are they worth the cost? In P. Dolhinow, ed. *The Nonhuman Primates*. Mayfield Publ., Mountain View. Pp. 164–169.
- Zinner, D. & F. Pelaez. 1999. Verreaux's eagles (*Aquila verreauxi*) as potential predators of hamadryas baboons (*Papio hamadryas hamadryas*) in Eritrea. *American Journal of Primatology* 47: 61–66.
- Zuberbuehler, K.M. 1999. Natural semantic communication in wild Diana monkeys: proximate mechanisms and evolutionary function. *Dissertation Abstracts International* B59: 3730.
- Zuberbuehler, K., D. Jenny & R. Bshary. 1999. The predator deterrence function of primate alarm calls. *Ethology* 105: 477–490.

NOTES FOR CONTRIBUTORS

African Primates publishes information relevant to the conservation of non-human primates and their ecosystems in Africa. Its aim is to facilitate the exchange of information and ideas among primatologists and conservationists working with primates in Africa. It is hoped that this newsletter will enhance the conservation of African primates:

- by increasing interest in their survival,
- by alerting people to situations where primate species and populations are under threat, and
- by providing a forum for useful debate on some of the more pressing, controversial, and sensitive issues that have an impact on the conservation of these primates.

The success of this newsletter depends largely upon the willingness of those people involved with primate conservation in Africa to provide relevant information on research findings, field survey results, advances in field and laboratory techniques, field action alerts, book reviews, events, funding possibilities and recent publications (including reports and theses). *African Primates* also announces letter-writing campaigns and other activities that might benefit from the support of its readership.

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Use metric units only.

Tables, figures and photographs are encouraged. All require complete, but concise captions listed on a separate sheet. Most "articles" should be accompanied by a map that shows all the place names mentioned in the text.

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Front cover illustration: Grey-cheeked mangabey *Lophocebus albigena*. Drawing by Steven Nash. See article on pages 40–50.

Logo: De Brazza's monkey *Cercopithecus neglectus*. By Steven Nash.

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Erratum: In Volume 3(1&2), on page 75, we gave an incorrect website address for the Jane Goodall Institute. The correct address is: www.janegoodall.org We extend our sincere apologies to JGI, and for any inconvenience this may have caused.

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