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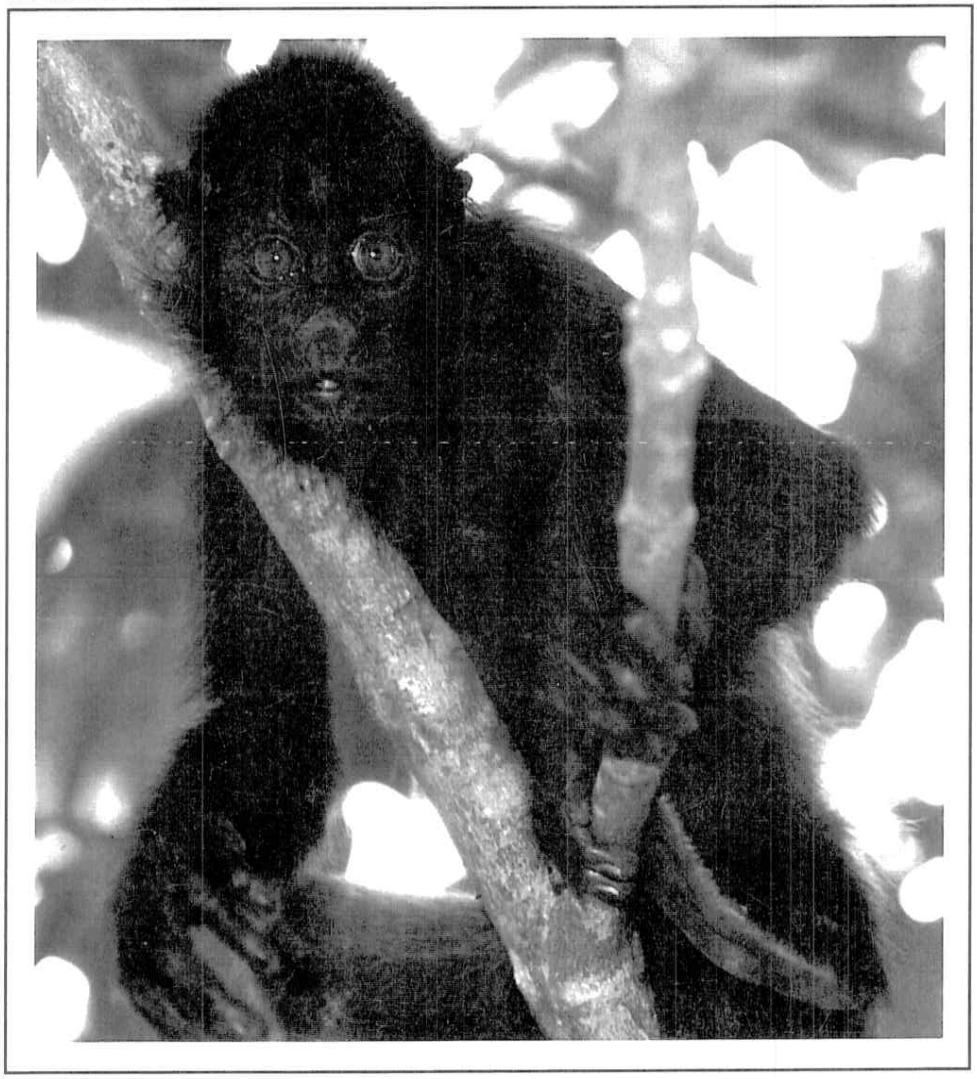

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**Front Cover. Juvenile black-headed uacari *(Cacajao melanocephalus melanocephalus)* from the Rio Negro region of central Brazilian Amazonia (photo by Russell A. Mittermeier).**

# A Word from the Editors

With the publication of this issue of *Primate Conservation*, we have adopted a modified format from that of previous issues. In particular, we have dropped the Announcements section, which has held up publication many times in the past. We have made this change in recognition of the fact that *Primate Conservation* has evolved principally into a format that would best be described as a yearbook for primate conservation. Over the past decade, since it was launched in 1981 (with the first four issues appearing under the title *Newsletter of the IUCN/SSC Primate Specialist Group*), this publication has appeared 11 times, or just about once a year. Furthermore, it has always appeared late (the actual publication date of this issue is July 1994), an unfortunate but unavoidable reality given the other responsibilities of the largely volunteer network that produces it. The lateness and the once-a-year nature of the publication have largely negated the value of the Announcements section, since most of the events and activities announced have already taken place before the publication comes out. In recognition of these facts, we have decided to focus *Primate Conservation* on important papers on the conservation of primates in the field and in captivity, a niche that we feel it has effectively filled over more than a decade.

We will also continue to include a section on miscellaneous items of interest to primatologists, such as the appearance of stamps, t-shirts and other materials incorporating a primate motif, books of interest to primatologists, legislation impacting primates in different countries, etc. This section will be entitled Primate Miscellany, and a few items under this heading are included in this issue.

Needless to say, we believe that there continues to be a great need for rapid dissemination of newsworthy information on primates. However, given the growth of the field of primate conservation, we have found it necessary to decentralize this function (along with many other functions of the Primate Specialist Group) to the four major regional subsections of the Group: Asia, Africa, Madagascar and the Neotropical region. To do this, we have basically gone back to the original format of the 1981-1984 Newsletter of the IUCN/SSC Primate Specialist Group, but at a regional level. The first of these newsletters, *Asian Primates*, was launched in 1991 by Dr. Ardith Eudey and has come out eight times. The second, *Neotropical Primates*, first appeared in March 1993 and is edited by Dr. Anthony Rylands of Brazil and Dr. Ernesto Rodriguez-Luna of Mexico, and is now in its fifth issue. The third, *Lemur News*, first appeared in May 1993 and is edited by Rod Mast. Arrangements are now being made for the last of the newsletters, *African Primates*, to be produced as well. Addresses of each of the editors are given in the Instructions to Contributors section at the end of this publication.

This combined format, with a global "yearbook" of primate conservation, and regional newsletters to appear 2-4 times per year, will be a first for an IUCN Species Survival Commission Specialist Group, and will hopefully enhance communication among the world's primate conservationists still further. As in the past, *Primate Conservation* itself will be circulated free-of-charge to all PSG members, and the regional newsletters will go to all members within the region. At the end of each year, together with the mailing of *Primate Conservation*, we will also send a full set of *all* regional newsletters that have appeared in that year to all PSG members. If you are a member of one regional section, but would like to receive the newsletter from one or more of the other regions, please enter directly into contact with the editors from that region, since they will be handling regional mailings themselves.

As always, we welcome your support, contributions and patience, and hope that you will continue to send material both for *Primate Conservation* and for the appropriate regional newsletters. Any suggestions as to how communication might be further enhanced would be most welcome.

Russell A. Mittermeier
Chairman, IUCN/SSC Primate Specialist Group

William R. Konstant
Editor, *Primate Conservation*

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# NEWS FROM THE FIELD

## Neotropical Region

### Further Field Notes on Red Uacaris, *Cacajao calvus ucayalii*, from the Quebrada Blanco, Amazonian Peru

**by Eckhard W. Heymann**

The red uacari remains one of the least known Neotropical primates. Sightings of this species generally are limited to very short episodes (e.g. Aquino, 1978, 1988; Fontaine, 1979), and many efforts to search for red uacaris in specific areas have failed (R. Aquino, pers. comm.; U. Bartecki, pers. comm.). At the Quebrada Blanco (formerly named Río Blanco), a tributary of the Río Tahuayo in northeastern Peru, groups of *Cacajao calvus ucayalii* have been repeatedly sighted during the last few years (Bartecki and Heymann, 1987).

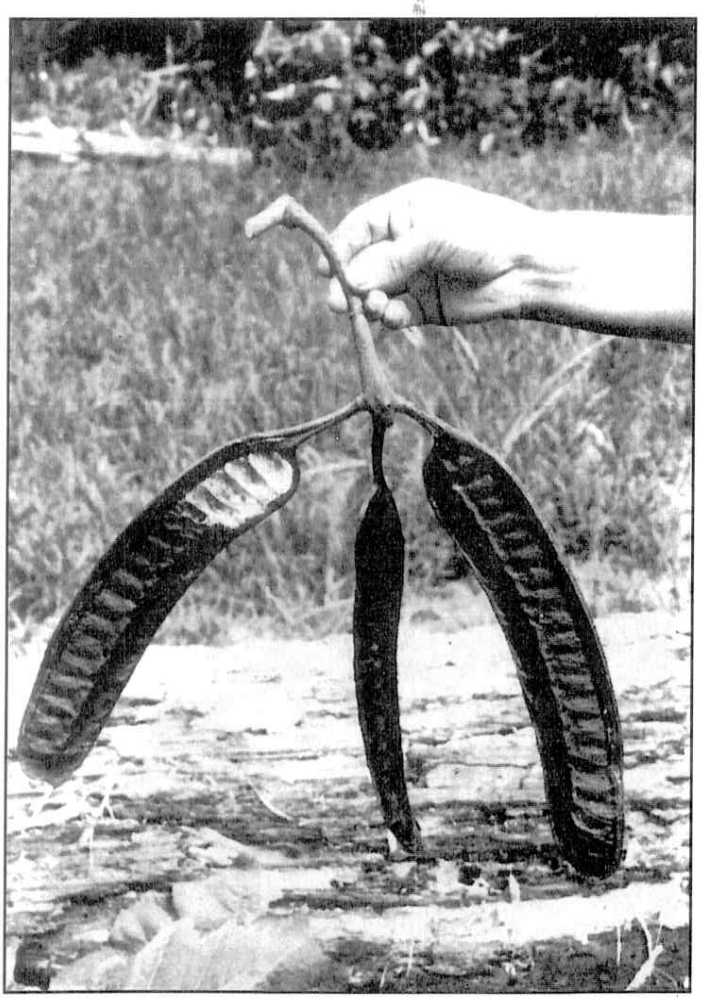

**Fig. 1. Pods of *Parkia oppositifolia* (photo by Eckhard W. Heymann).**

During a field study on tamarins from June-September 1990, red uacaris were encountered again in the Quebrada Blanco study area (Estación Biológica Quebrada Blanco, EBQB; 40'S 73$^0$W; for details of the study site see Bartecki and Heymann, 1987) on three occasions. The first encounter took place on August 19 at 0845 h. Immediately detecting the observer and his field assistant, the red uacari group split into two (or more?) units. One unit followed by the author contained about six individuals. Another unit was followed by the field assistant, who counted at least 36 individuals passing along an arboreal pathway. Contact with both units was lost after about 15 minutes.

The second encounter took place on August 25. At about 1620 h, the author and his field assistant heard the calls of red uacaris. A solitary animal was encountered as we approached the source of the calls. It emitted barking calls continuously, a vocalization not heard before during encounters with red uacaris in 1986 (Bartecki and Heymann, 1987) and which did not resemble any of the vocalizations described by Fontaine (1981). The animal re-established contact with its group of at least 30 animals after about 10 minutes. Subsequently, several animals entered a *pashaco* tree (*Parkia oppositifolia*, Leguminosae) and began feeding on the pods (Fig. 1), eating the seeds and the sticky, gum-like layer that surrounds them. It could not be seen whether the seeds were chewed or simply swallowed whole. This *pashaco* tree was also a feeding site for a moustached tamarin study group.

During this encounter, a female red uacari that had been sitting in an upright position was approached by a young individual (about 1/3 adult size; age category Infant 2, according to Fontaine and Dumond, 1977). It entered into a ventral-ventral position with the female and very likely began to suckle (the female's dense fur inhibited clear observation). The young animal remained in this position for about 3-4 minutes and then walked away. At least three more animals of its size were observed in this group. At about 1650 h, a group *Saimiri sciureus macrodon* joined the red uacaris.

Fresh remains of *Micrandra spruceana* (Euphorbiaceae) were found in an area where the uacari group had moved through. Whole fruits, parts of fruits and small pieces of seeds were found, but no entire seeds, indicating that the seeds may have been fed on by the uacaris. Impressions of canine teeth were found on one of the fruits (Fig. 2). The distance between the impressions was 14 mm, indicating that it might have been bitten by an immature animal (in adult *Cacajao calvus* the distance between the upper canines ranges from 23.8-39.8 mm [Hershkovitz, 1987]). While in the case of *Micrandra*, uacaris appear to act as seed predators, it remains unclear whether the seeds of *Parkia* are dispersed or preyed upon. The closely related white uacaris, *Cacajao calvus calvus*, feed mainly on the seeds of unripe fruits (Ayres and Johns, 1987).

The third encounter took place on August 26. A mixed troop of *Cacajao* and *Saimiri* was located by their calls at 0650 h. At least 30 uacaris were seen, again including at least three young animals.

The Quebrada Blanco area has been proposed as a reserve (Bartecki *et al.*, 1986; Bodmer and Moya Ibañez, 1987; Moya Ibañez, 1989), but approval by the Peruvian government is pending. Threats to the area and its fauna are the ongoing commercial hunting (including primates like the red uacari) and increasing agricultural activities, especially clearing the forest for buffalo pasture.

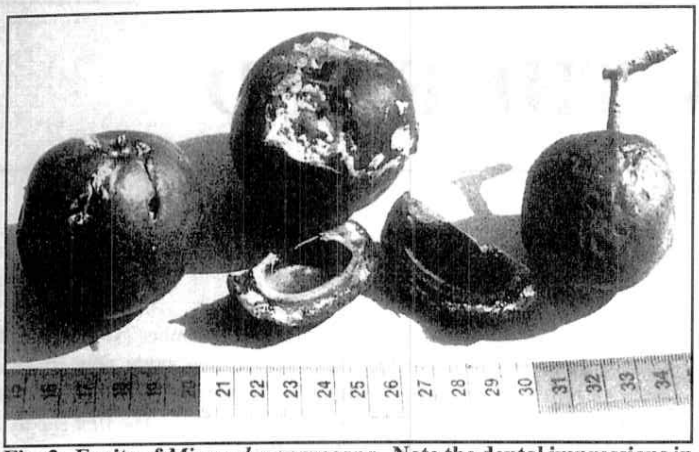

**Fig. 2. Fruits of *Micrandra spruceana*. Note the dental impressions in the fruit on the left (photo by Eckhard W. Heymann).**

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# Sightings of the Golden-backed Uacari, *Cacajao melanocephalus ouakary*, on the Upper Rio Negro, Amazonas, Brazil

**by Alexia Celeste da Cunha and Adrian Ashton Barnett**

According to the most recent revision (Hershkovitz, 1987), the genus *Cacajao* contains two species, *C. calvus*, the bald uacari with four subspecies (*calvus*, *novaesi*, *rubicundus* and *ucayalii*) and *C. melanocephalus*, the black-headed uacari with two sub-species (*melanocephalus* and *ouakary*). Although the existence of two subspecies of *C. melanocephalus* has been recognized for some time (see Hernando-Camacho and Cooper, 1976; Mittermeier and Coimbra-Filho, 1981), their status has only recently been formalized by Hershkovitz (1987). The common names suggested by Hershkovitz incorporate the names of the original describers of each subspecies (Humboldt and Spix, respectively) and are not descriptive. We propose "black-headed uacari" for *C. m. melanocephalus* and "golden-backed uacari" for *C. m. ouakary* (Fig. 1). In concentrating on salient color features of pelage, these names follow the canonical framework of those given to subspecies of *C. calvus*.

*C. melanocephalus* is listed as Vulnerable by the World Conservation Union (IUCN, 1990) and is on Appendix 1 of CITES. It is included on the Brazilian Threatened Species List (Bernardes *et al.*, 1990) and is also protected by law in Colombia. Known distributions for the two *melanocephalus* subspecies are given in Figure 2.

**Fig. 1. Golden-backed uacari (*Cacajao melanocephalus ouakary*) (photo by Marc van Roosmalen).**

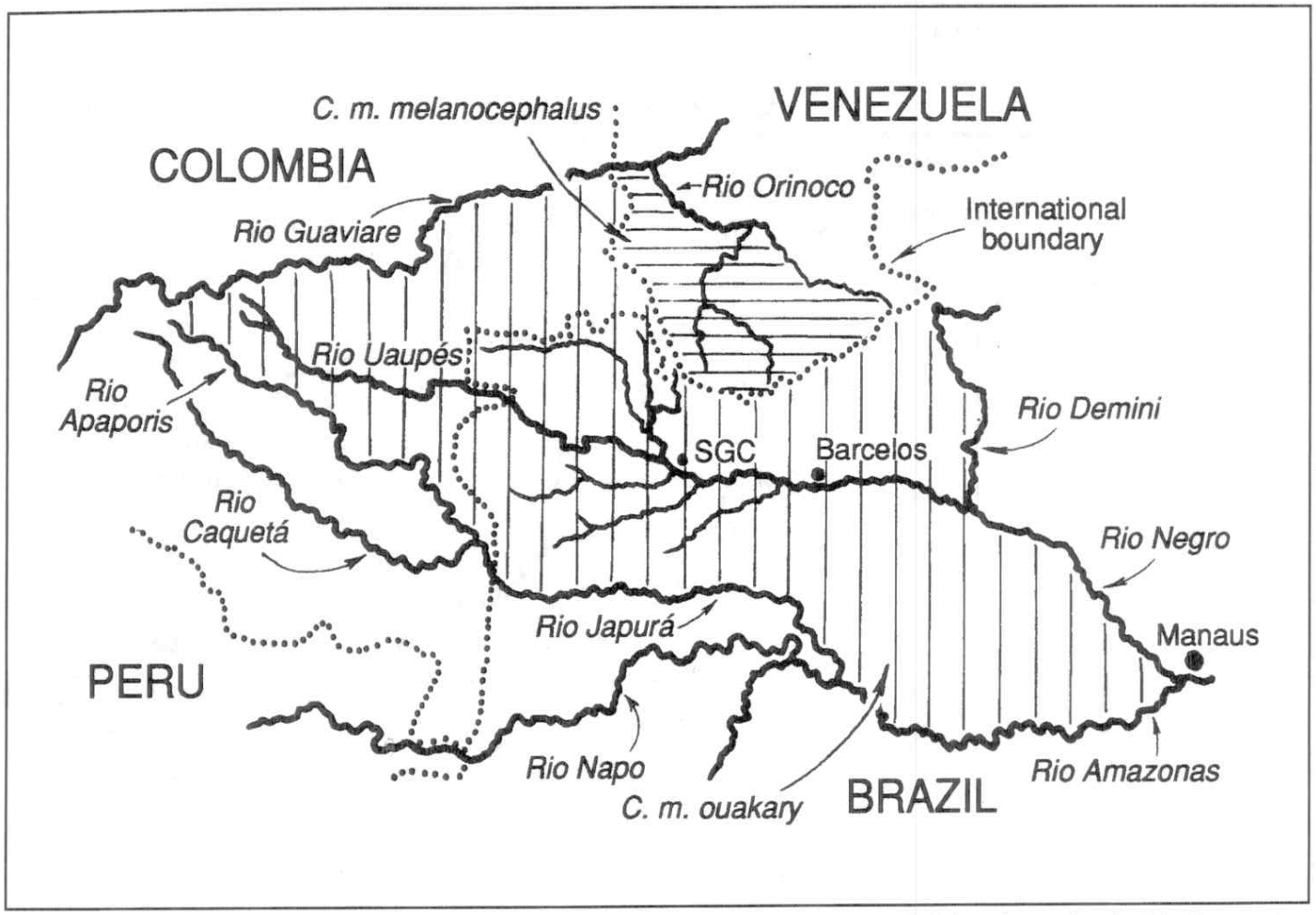


**Fig. 2. Known distributions for *Cacajao m. melanocephalus* and *C. m. ouakary* (map by Stephen Nash based on authors' original).**

Both species of *Cacajao* spend at least part of the year in forests subject to annual inundation. Floodwaters may reach a height of 11 meters and may last several months. Inundated forests of this kind on white-water rivers are called *várzea*, those on black-water rivers *igapó* (see Prance, 1979). *C. c. calvus*, the white uacari, has been studied by Ayres (1986, 1987). *C. c. rubicundus*, the red uacari, has been studied in captivity (Fontaine, 1981; Fontaine and Dumond, 1977), and observations of wild populations are reported by Aquino (1978, 1988), Bartecki and Heymann (1987), Fontaine (1979) and Mittermeier and Coimbra-Filho (1977). *C. c. ucayalii* is an old name; *novaesi* is a newly described subspecies only recently studied in the wild (Aquino, 1988), although Bartecki and Heymann (1987) note that the *C. c. rubicundus* they observed may, in fact, have been *C. c. ucayalii*.

Data on wild populations of *C. melanocephalus* is sparse (Thornback and Jenkins, 1982). In 1973, R. A. Mittermeier and colleagues conducted a four-month status survey of the genus *Cacajao* (Mittermeier and Coimbra-Filho, 1977). Rylands (1976) conducted primate surveys on the upper Rio Negro and obtained information on the distribution of *C. melanocephalus* from local informants and from sightings. Hernandez-Camacho and Cooper (1976) reported the status of the species in Colombia.

The field observations reported here were made during a preliminary survey of *C. m. ouakary* on the upper Rio Negro, state of Amazonas, Brazil. The survey (May 10 - July 2, 1989 on the Rio Curicuriari and Rio Uaupés) was conducted with the objective of locating an area suitable for long-term study. One group was sighted on the Rio Curicuriari and four contacts were made on the Rio Uaupés (Fig. 3).

All sightings were in *igapó* forests. *Igapó* occurs in two main forms (Barnett and Cunha, 1989): creek *igapó*, which is very dense, dominated by low shrubs and with occasional trees that form a broken canopy standing no more than three meters above the highest water level; and riverine *igapó*, which is more open, composed of large trees (up to 2 m dbh) and with a closed canopy up to 15 meters above high-water level. Creek *igapó* was the dominant type along the Rio Curicuriari. It was searched for 10 days without contacting *C. m. ouakary*. On the Rio Uaupés, creek *igapó* of the Igarapé Iauiari was searched for only one day with identical results. All sightings reported below were made in riverine *igapó* forests.

The first contact was made on the Rio Curicuriari at 1810 h on May 30. Four uacaries were seen on the western bank of the river moving rapidly just above water level in dense vine tangles. It was impossible to estimate group size due to the density of the vegetation and the fading light, but these animals may have been part of a much larger group.

On the Rio Uaupés we based ourselves near the Tucano Indian village of Açaí. This locality had been chosen because high densities of golden-backed uacaries had been reported there by river traders interviewed in the town of São Gabriel de Cachoiera ( Fig. 3). Also, Brazilian military aerial photographs showed large areas of *igapó* forest there. This includes Ilha Matapi, an *igapó* island formed by the divergence of the Igarapé Açai from the main channel of the Rio Uaupés ( Fig. 3).

On June 27, after a search of almost two hours from canoe, a group of 15 to 20 uacaries was seen at a range of 10 m in the *igapó* of Ilha Matapi, about 30 minutes paddling distance from the village of Açaí. The group had been located by our Indian guide by their vocalizations and from the sounds of fruit falling into the water. Part of the group was observed in the tops of large trees 10 m above the water; a smaller number was moving just above water level in the branches of small trees and bushes. Five minutes after contact the group became aware of our presence and began a series of high-pitched calls that bore a resemblance to the alarm and contact calls of *Amazona*


**Fig. 3. Map of the study area on the Rio Curicuriari and Rio Uaupés, Amazonas (map by Stephen Nash based on authors' original).**

parrots. As the group moved off, some of the uacaries making leaps of up to 2.5 m across open spaces in the canopy, several larger individuals remained behind and faced us. They adopted a hunched posture and wagged their tails, the wagging having a regular amplitude and a frequency of two to three beats per second.

At 1340 h the following day (June 28) we observed two individuals in approximately the same location, 10-15 m high in the canopy. The two were soon joined by four more, and were seen feeding on *uaraba* (*Swartzia polyphylla*, Leguminosae, Pap.), *abiu do igapó* (*Gomphiluma gomphifolium*, Sapotaceae) and *cupa-uba* (*Labatia macrocarpa* or *Pseudolabatia pennicillata*, Sapotaceae). *Uaraba* is one of the most common trees in the *igapó* forest of Ilha Matapi.

Contact was again made at Ilha Matapi at 1100 h on June 29, providing 80 minutes of observation. A large group was located by the sounds of contact calls and fallen fruits. Subgroups of four, seven and 15 individuals were recorded. The main group was very vocal and remained at a height of 3 m in trees of 5-10 m. Vocalizations decreased in frequency as the group moved away to feed on *uaraba* fruits, eventually splitting into two smaller groups, each containing one adult carrying an infant dorsally. At 1400 h a group of six adults and two juveniles was spotted on the opposite bank of the river, at a height of 7-8 m in trees of 10-12 m. Our presence caused occasional vocalizations and descents to water level. Animals of this group were also seen feeding on *uaraba*, and broken fruits of *cupa-uba* were found floating in the water.

*Cacajao* taxa have traditionally been regarded as specialists feeding on hard fruits (Kinzey and Norconk, 1990). Bartecki and Heymann (1987) observed the red uacari feeding on fruits of four tree species, all having thick shells. Ayres (1986) reported that the white uacari feeds almost exclusively on seeds of *mata-mata* (*Eschweilera turbinata*, Lecythidaceae) at certain times of the year. Its fruits are also hard. A related species, *E. tenuifolia*, is common at Ilha Matapi, but we did not observe the uacaries in this tree, nor did the local people report ever seeing them feed in it. A check of the seed crop from 30 *E. tenuifolia* trees revealed no damage that we could attribute to uacaries.

Of the three fruits we observed them feeding on in this study, that of *abiu do igapó* is the size and shape of a European fig, with a thin skin and sweet-tasting pulp. *Cupa-uba* is the size and shape of a tennis ball and has a hard shell up to 4 mm thick. *Abiu do igapó* is quite often eaten by local people; *cupa-uba* is eaten on occasion. The walls of the *uaruba* pods are spongy, up to 10 mm thick and with a large white aril that tastes slightly sweet. *Uaruba* pods can be up to 18 cm in length and weigh as much as 290 gm. We were not able to determine which parts of the fruits the uacaries were eating, so we cannot determine whether these monkeys are acting primarily as seed predators or seed dispersers.

Interviews with local people indicate that the golden-backed uacari moves out of *igapó* forest during the dry season (roughly August to November), either to terra firma forest or to an unknown or unspecified locale. Mittermeier and Coimbra-Filho (1977) report similar findings. If this is so, it has important implications for planning conservation initiatives.

At present there is no area in Brazil set aside specifically to protect the golden-backed uacari. Thornback and Jenkins (1982) say it occurs in two Brazilian protected areas: Pico da Neblina and Jau National Parks. Pico da Neblina is considered one of the most endangered protected areas in the Brazilian Amazon (Rylands, 1990), having many management problems.

For example, an estimated 1,000 people are mining gold illegally within the park boundaries, and there are plans to construct a road, BR 210, through the park.

Results of our preliminary fieldwork and of a detailed questionnaire (see Cunha and Barnett, 1989, for details) suggest that *C. m. ouakary* is still abundant in parts of the upper Rio Negro, especially in the more remote Rio Uaupés region. Additional fieldwork will provide data useful in planning a special protected area for populations of this subspecies. The Açai study site is adjacent to the Rio Negro Forest Reserve on its northern bank. Though forest reserves allow consumptive land use, a portion of the Rio Negro Forest Reserve could be upgraded in status to offer greater protection for wildlife. The contiguous area of protected forest across the international border in Colombia's Vaupés region (Bunyard, 1989a, 1989b) make this an attractive possibility.

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# Africa

## Primates of the Harenna Forest, Ethiopia

By Giuseppe M. Carpaneto and Spartaco Gippoliti

The Harenna Forest, in the southern sector of the Bale National Park, comprises almost half of the park's total area and is one of the few large tracts of tropical forest remaining in Ethiopia (Fig. 1). This forest begins below the Harenna escarpment, which represents the southern edge of the high altitude plateau systems. It is an interesting example of Afromontane rain forest (1,500-3,000m), where animal and plant communities are unique but poorly known.

Records of primates in Ethiopia were revised by Yalden *et al.* (1977), at which time only two species were known from the area of Bale National Park: the olive baboon (*Papio anubis*) and the guereza (*Colobus guereza*). A third species of monkey was later reported from this area by Hillman (1986a), who considered it a member of the *Cercopithecus aethiops* complex and referred to it provisionally as both *C. pygerythrus* and *C. aethiops*.

More recently, an expedition to the Harenna Forest organized by J. C. Hillman found evidence of Sykes' monkey (*Cercopithecus albogularis*), previously unrecorded in Ethiopia, from Katcha in the Harenna Forest. In the same expedition, the lesser galago (*Galago senegalensis*) was also recorded (Hillman, 1986b; Bekele, 1988). The latter reference made no mention of any vervet or grivet monkeys, thus the occurrence of a representative of this taxonomic group remained unconfirmed.

During a brief visit to southern Ethiopia in October 1990, the authors brought to light some new data of interest: the occurrence of a rare and endemic form of the *Cercopithecus aethiops* complex in the Harenna Forest and geographical variation among *Colobus guereza* in this region. Furthermore, our investigations lead us to conclude that Sykes' monkey *does not* occur in the Harenna Forest.

### The Djam-Djam or Bale Guenon

In 1902, Neumann described a new species of guenon he named *Cercopithecus djamdjamensis*. The species was named for the Djam-Djam Mountains (Fig. 1), a region east of Lake Margherita (= Lake Abaya) and approximately 30 km west of the Harenna Forest that has been severely deforested. There is no information regarding the current status of primates in these mountains.

Neumann's type specimen consisted of a single skin he collected himself "near Abera" (*terra typica*) in bamboo forest at about 3,000m . The skin was placed at the Berlin Museum. In subsequent years, owing to the incomplete description made by Neumann (1902) and the existence of only a single specimen, opinions differed as to the species' validity. Although those who first revised the taxonomic record maintained its status as a species (Pocock, 1907; Elliot, 1913), later authors (Schwarz, 1926; De Beaux, 1943; Dandelot, 1951; Hill, 1966) either ignored or overlooked this form, treating it as synonymous with *C. aethiops matschiei*, *C. a. ellenbecki* or *C. a. hilgerti*, which were also described by Neumann (1902).

However, Dandelot and Prévost (1972), based upon new records and specimens, resurrected *C. aethiops djamdjamensis* as a distinct form within the vervet/grivet complex. They examined seven specimens collected in two localities west of Dodola (18 km WSW of Koffolé, alt. 2,400m) and quoted two field observations made at Uondo (=Wendo) and Abera (the type locality). These authors redescribed Neumann's monkey, adding new characters, and confirmed its subspecific status. Their opinion was not accepted by Yalden *et al.* (1977), who considered the distribution of this subspecies too small and not geographically isolated from that of other "supposed races."

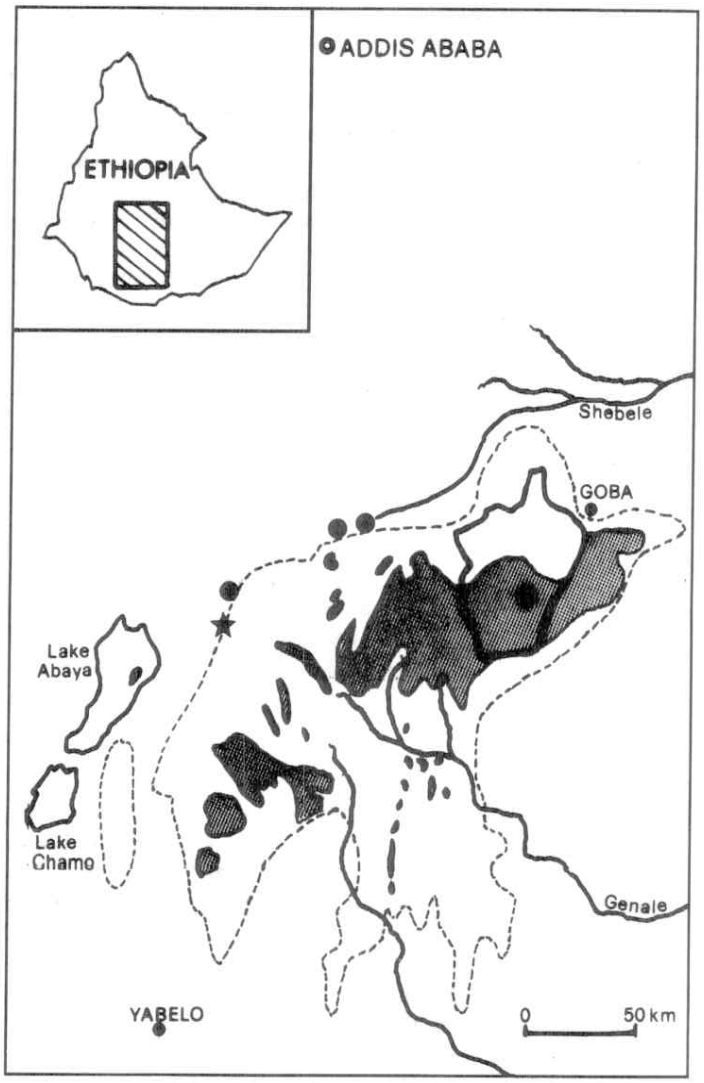


**Fig. 1. The Bale Massif and its major forest blocks (shaded areas); records of the Bale grivet (solid circles) and type locality (solid star). (Map provided by authors).**

In the most recent review of guenon classification, Lernould (1988a) adopted a well-balanced solution, in which four subspecies of *C. aethiops* (*sensu stricto*) are considered: *aethiops*, *djamdjamensis*, *hilgerti* and *matschiei*. His opinion was based on personal observations in Ethiopia (1967-69), during which time he held two captive specimens obtained by natives.

During the authors' expedition, a specimen of grivet was observed and photographed (Fig. 2) in the Harenna Forest along the track from Katcha to Rira (alt. 2,800m). The grivet was perched on a tree branch at a height of six to eight meters, while a small troop of guerezas was foraging above it. Neither species seemed concerned by our presence.

The appearance of this monkey corresponded well with the description of *C. a. djamdjamensis* given by Dandelot and Prévost (1972), and was very similar to the photo that accompanied their work. We noted the following characters: face entirely black; whiskers short but dense, not curved or sickle-shaped, well separated from both the narrow, well-defined white fringe on the upper lip; tail short and dark gray above; fur thick and long; upper body grayish-green with reddish nuances, but dark gray on arms and legs; underside of body and tail pale, almost white.

The locality where the above mentioned grivet was observed is very close

**Fig. 2. A Bale grivet (*Cercopithecus aethiops djamdjamensis*) in the Harenna Forest (photo by E. Young).**

to those reported by Hillman (1986a), which leads us to conclude that his records refer to *Cercopithecus aethiops djamdjamensis*. Furthermore, we received two photos (courtesy of D. Yalden) of the unique specimen of guenon captured at Katcha, preserved in the Natural History Museum of Addis Ababa, and previously identified as *Cercopithecus albogularis* (Hillman, 1986b; Bekele, 1988). Thus, we were able to verify that all individuals observed in the Harenna Forest belong to the same taxon, *Cercopithecus aethiops djamdjamensis*, while the Sykes' monkey must be deleted from the list of primates inhabiting Bale National Park and probably Ethiopia. Our sighting enlarges the known range of *djamdjamensis*, and leads to the supposition that it may occur in montane forest along the entire Bale massif. We suggest that it represents an example of adaptation to high altitude forest, similar to the golden monkey (*Cercopithecus mitis kandti*). According to Fedigan and Fedigan (1988), this is the only population of the vervet/grivet complex adapted to closed canopy forest, and it raises new questions about the evolution of guenons.

According to Lernould (1988b), the only known breeding group of *djamdjamensis* is held at the Jihlava Zoo in Czechoslovakia (Fig. 3). One of the authors (S. Gippoliti) conducted a brief visit to this zoo in October 1991, and confirmed a breeding group of grivets consisting of 1.1 wild-caught adults, 0.3 captive-born adults and 2.0 captive-born juveniles; one captive-born adult male was kept alone, off exhibit. The place of origin of this group is unknown. Some morphological characters observed in these individuals differed from our description of the *C. a. djamdjamensis* observed in the Harenna Forest: paler body color overall; longer tails; shorter whiskers and shorter, not very dense fur. All have a faint, but distinct forehead band which is separated from the whiskers by a wide black temporal area (Fig. 3). Lernould (pers. comm.) also considers that these animals are not entirely typical.

Unfortunately, we cannot reliably assess the taxonomic status of the Djam-Djam or Bale grivet based upon descriptions of its morphological characteristics from only a few scattered field observations. Further field research is required, as are laboratory analyses and captive breeding research, to improve our knowledge of the relationships between the different forms of grivet monkey.

### *Colobus guereza* in the Harenna Forest

According to Dandelot and Prévost (1972) and Napier (1985), two subspecies of *C. guereza* are present in Ethiopia: the typical form, *C. g. guereza*, is said to be widespread in the west and south of the country, and *C. g. gallarum* is believed to occur only in the northeastern part of the Rift Valley, in the Harrar and Arussi Mountains. Yalden *et al.* (1977) mapped

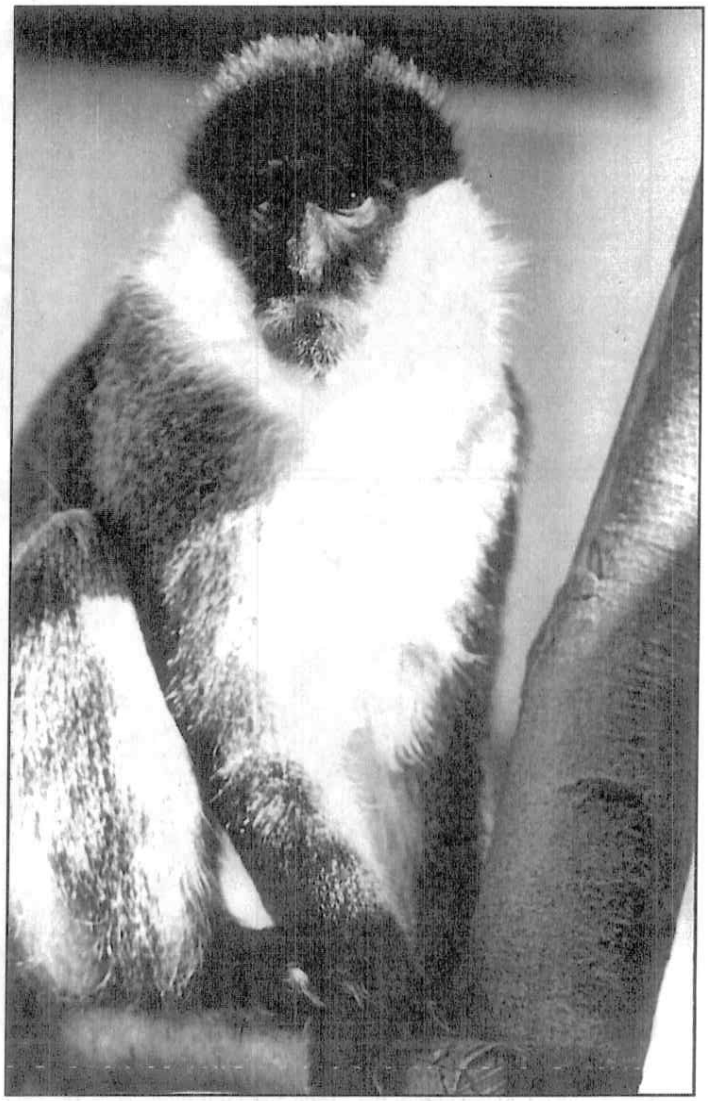

**Fig. 3. Bale grivet from the Jihlava Zoo; note the inconspicuous forehead band separated from the whiskers by a wide black temporal area (photo by S. Gippoliti).**

localities for *C. guereza* in Ethiopia without differentiating between the two forms, thus the geographic boundary between subspecies is not well-defined.

A craniometric study by Hull (1979) pointed to a high distinctiveness between *C. g. gallarum* and all other guerezas. However, as far as the shape of the tail and color pattern are concerned, the nominal form may include a number of populations which attain a degree of distinctiveness comparable to that found between other widely-accepted East African guereza subspecies. Only light-tailed guereza populations have been documented from southwestern Ethiopia; those from Mago National Park, in particular, have completely white tails (Fig. 4). Populations from the Kaffa region (near Jima) have tails that are grayish white at the base and have a bushy caudal tuft. Guerezas with these features are not recognized in recent taxonomic arrangements (Rahm, 1970; Napier, 1985), and these populations may belong to the abandoned race described as *poliurus* by Thomas (1901).

The individuals we observed and photographed in the Harenna Forest, in association with the Bale grivet, had short tails with well developed, bushy white tufts at the end of a black basal half (Fig. 5). Our opinion is that this form represents a population adapted to high mountain environments, whose relationship within the guereza complex also merits further study.

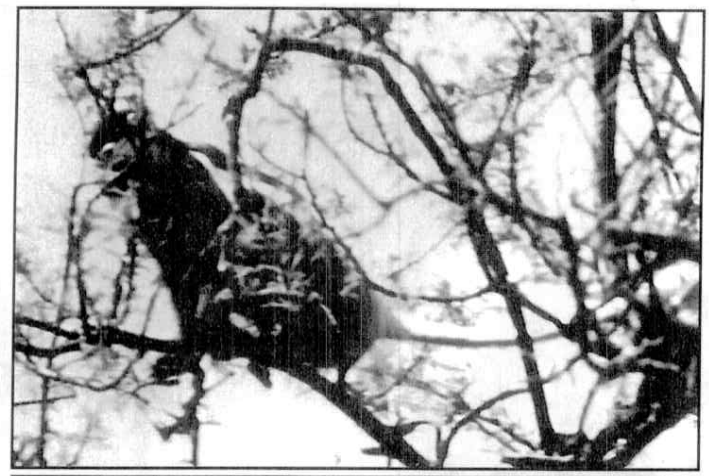

**Fig. 4 (top). Guereza from the Mago National Park; note the entirely white tail (photo by S. Gippoliti). Fig. 5 (bottom). Guereza from the Harenna Forest; note the short tail and well developed tuft (photo by S. Gippoliti).**

Geographic variation among animals is often not given sufficient consideration in the development of action plans for wildlife conservation and management. Populations such as the grivets and guerezas of the Harenna Forest, which appear significantly different from closely related forms, should be given high conservation priority ratings. The Djam-Djam or Bale grivet is the most significant primate of the Harenna Forest. Its rarity and uniqueness warrant further research toward a better understanding of its taxonomic status, distribution, population biology and behavioral ecology.

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# Madagascar

## Sighting of *Avahi* (Woolly Lemur) in Western Madagascar

**By Thomas Mutschler and Urs Thalmann**

*Avahi* has long been thought to be a monotypic genus representing the only nocturnal member of the family Indriidae. Two different subspecies are recognized, the eastern avahi or woolly lemur, *Avahi l. laniger*, and the western avahi, *A. l. occidentalis* (*e.g.*, Petter *et al.*, 1977; Tattersall, 1982; Harcourt and Thornback, 1990). On the basis of cytogenetic studies, Rumpler *et al.* (1990) suggested that the western avahi should be classified as a separate species, *Avahi occidentalis*. These authors make a convincing case, and the division of *Avahi* into two species, *A. laniger* and *A. occidentalis*, is used here.

The eastern avahi is still widespread (Fig. 1) in the remaining rainforest of eastern Madagascar between Taolonaro (Fort Dauphin) and Sambava. The western avahi, on the other hand, is apparently restricted to the dry deciduous forests north of the Betsiboka River from the region of the Ankarafantsika Nature Reserve and the Ampijoroa Forestry Station to the Bay of Narinda (Petter *et al.*, 1977; Tattersall, 1982; Harcourt and Thornback, 1990). According to Tattersall (1982), early specimens were collected much further north on the west side of the Ampasindava peninsula. Raxworthy and Rakotondraparany (1988) reported *Avahi occidentalis* from the Manongarivo Special Reserve. Floristically, this reserve belongs to the moist Sambirano region (Nicoll and Langrand, 1989) and is a very different habitat by comparison to the dry deciduous forests of western and northwestern Madagascar. One juvenile specimen of *Avahi occidentalis* (collected by Van Dam in 1868) was said by Tattersall (1982) to come from the Morondava region in western Madagascar. This would indicate a much larger previous distribution for the western avahi, but no *Avahi* identified as originating from the "Morondava" locality is known to the curator of the Rijksmuseum van Natuurlijke Historie in Leiden (Dr. Smeenk, pers. comm.) where the specimen is reportedly stored.

During a field trip to Madagascar (August - October 1990) we spent several days in the region north of Bekopaka (Fig. 2). We made a short visit of a few days to the Tsingy de Bemaraha Nature Reserve, the largest protected area in Madagascar (Nicoll and Langrand, 1989). In the vicinity of our camp it was nearly impossible to penetrate into the "tsingy" for more than a few hundred meters because of the seriously eroded karst landscape, thus we confined our surveys to the forest at the foot of the Tsingy de Bemaraha.

This forest contrasts with the typical dry deciduous forest of the western region in that a larger percentage of trees retain green leaves during the dry season (May to November) and because the canopy is considerably higher. The forest grows as a narrow band several hundred meters in width along the base of the tsingy formations. Several lemur species inhabit this forest. We observed groups of diurnal Decken's sifaka (*Propithecus verreauxi deckeni*) and red-fronted lemurs (*Eulemur fulvus rufus*). The nocturnal sportive lemur (*Lepilemur edwardsi*) was present and very probably the fork-marked lemur (*Phaner furcifer*), but we did not see any mouse lemurs

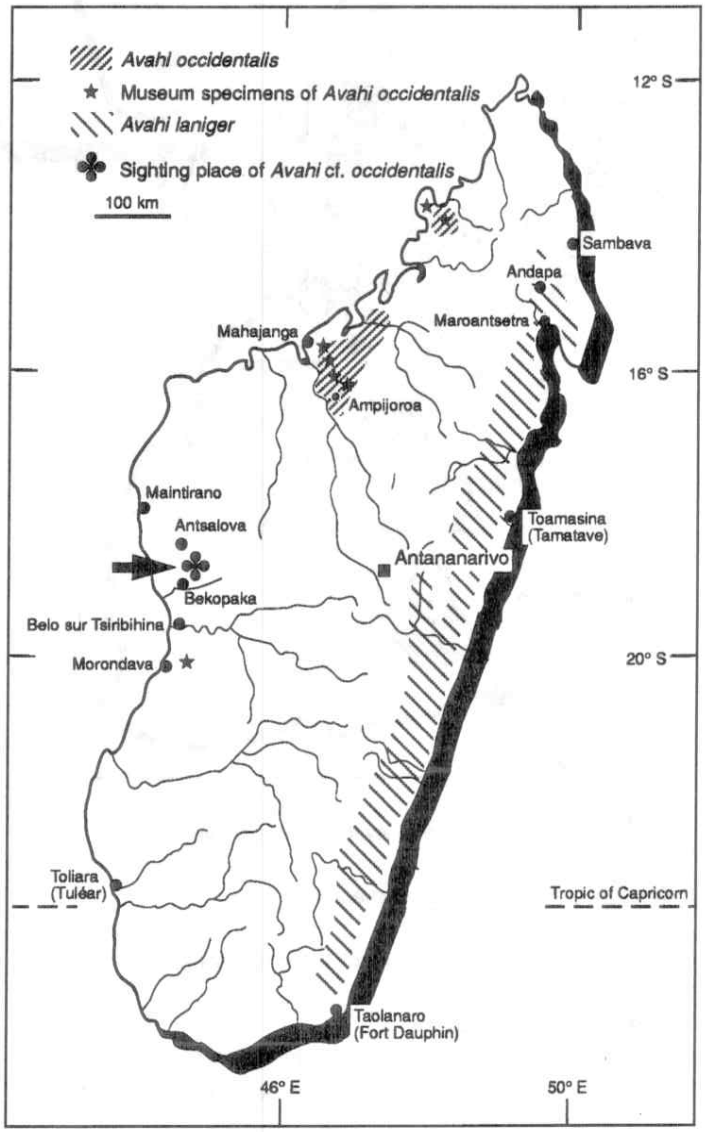


**Fig. 1. Known distribution of *Avahi occidentalis* and *Avahi laniger* and site of the recent sighting of *Avahi* cf. *occidentalis* in western Madagascar (based on Tattersall, 1982; Harcourt and Thornback, 1990). The origin of the museum specimen indicated near Morondava is doubtful (see text). (Map provided by authors).**

or fat-tailed dwarf lemurs (which would probably have been inactive at this time of year).

At about 1500 hrs on the afternoon of September 3 we located a group of lemurs about 3 km south of our camp (ca. 19°01'S 44°47'E). The group consisted of three adults and subadults and one very young infant; the infant presumably was carried by its mother. These animals were resting on virtually vertical trunks of about 10 cm in diameter and a height of between 6-8 m.

Their dorsal fur was a sandy brown to ochreous color and their tails were long and bushy. The face appeared relatively dark, the eyes were large and

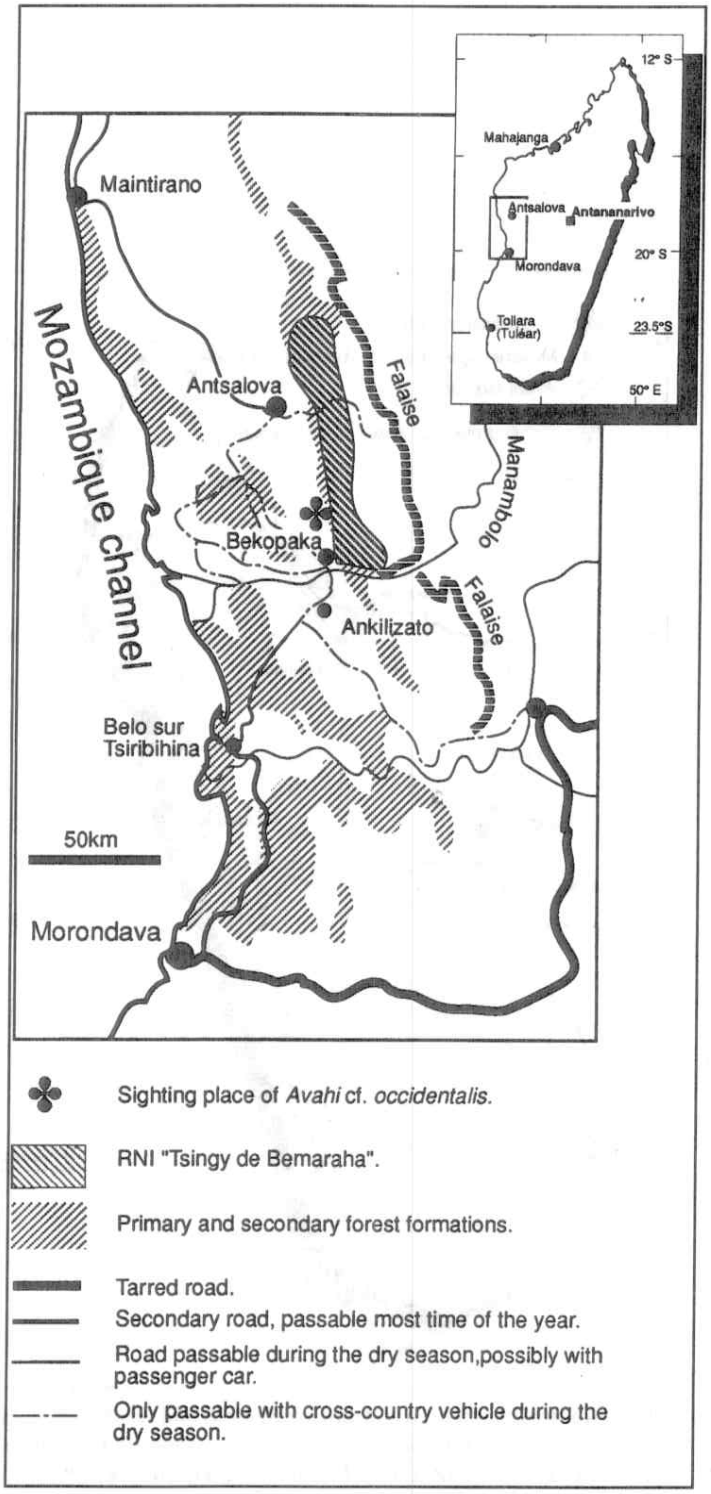


**Fig. 2. Region north of Morondava with the Tsingy de Bemaraha Nature Reserve, indicating the locality where *Avahi* cf. *occidentalis* was sighted. Based on FTM, Carte Routière de Madagascar 1:2,000,000 (1990) (map provided by authors).**


**Fig. 3. Two lemurs, identified as *Avahi* cf. *occidentalis*. One animal (A) is in the typical resting posture with the tail held between the ventral side of the body and the substrate. The other animal (B) has started moving and the long tail is clearly visible. Note the white fur in the perianal region and on the dorso-medial aspect of the thighs (arrow) and the relatively long hindlimbs (photo provided by authors).**

**Fig. 4. Moving *Avahi* cf. *occidentalis* seen from behind. Note the position of the tail, moving from its resting position (between the ventral side of the body and the substrate) to the locomotor position. The pale fur on the dorso-medial aspect of the thighs is clearly visible. The ears are very short and protrude very little (photo provided by authors).**

brown, and the ears were virtually invisible from behind, but the openings were obvious in frontal view. Unfortunately, the animals fled soon after they were noticed. Our guide reported that the local name of these animals was "Bekola," which in this region is usually given to the western gentle lemur (*Hapalemur griseus occidentalis*). Although *Hapalemur griseus occidentalis* is reported to occur in the Tsingy de Bemaraha Nature Reserve (Nicoll and Langrand, 1989) and in surrounding forests between Ambato, Maromandia and Antsalova (Petter *et al.*, 1977), it is unlikely that the lemurs we saw were of this species. Time did not permit further field observations, but later analyses of our photographs, combined with the data we did record, suggested that these lemurs should most probably be identified as *Avahi* cf. *occidentalis* (Figs. 3 and 4).

The body size was in the range of *Lepilemur edwardsi* and *Hapalemur griseus* (Petter *et al.*, 1977; Tattersall, 1982; Razanahoera, 1988; Jungers, 1985; Martin, unpubl. data). *Lepilemur edwardsi* can easily be excluded. Its tail length is relatively shorter than or equal to head + body length. In the animals we observed, tail length appeared considerably longer. Also, the ears of *Lepilemur* are relatively large and protrude from the fur (Petter *et al.*, 1977; Tattersall, 1982), in contrast to the less prominent ears of the lemurs we observed.

*Hapalemur griseus occidentalis* has a relatively long tail, which would not permit us to distinguish it from the lemurs we observed. However, its ears appear more prominent than those of *Avahi* (Tattersall, 1982: Fig. 3.19). In addition, *H. griseus* has much shorter hindlimbs than *Avahi* (Walker, 1967), which is recognizable even in photographs (compare Fig. 3 with Tattersall, 1982: Fig. 3.19). Further differences include pelage coloration. In *Avahi*, the perianal region and the insides of the thighs are white and clearly demarcated from the surrounding fur (Fig. 4). When resting, *Avahi* usually holds its tail between the ventral side of its body and the substrate, hiding the tail almost completely (Fig. 3 and confirmed by our observations of *A. occidentalis* at Ampijoroa).

There is little doubt that the animals depicted in Figures 3 and 4 belong to the genus *Avahi*. Within the genus, they more closely resemble *A. occidentalis*. The fur is not as reddish and dark as in the eastern form. Though not discernible in the photographs, the faces of these animals were light gray to white and the eyes were surrounded by narrow black circles. In the eastern form, the face appears to be darker overall (Petter *et al.*, 1977: Fig 138).

Our observations suggest a range extension for *Avahi* in western Madagascar of at least 400 km south of populations previously recorded. It is not known, however, how abundant *Avahi* is in the region of the Tsingy de Bemaraha Nature Reserve. For example, we did not observe *Avahi* in the Forêt de Tsimembo about 100 km to the north of our camp, nor to the south of the Manambolo River.

The region included between Antsalova, Morondava and the western coast has been designated as a United Nations World Heritage Site. The entire region is severely threatened by environmental destruction (Petter, 1988). Accordingly, the United Nations Development Program initiated a project in 1990 in the region between Bekopaka and Antsalova, promoting limited tourism to several sites. The sites include the *Tombeau Vazimba* (an ancient Malagasy cemetery), the Manambolo River gorges and the Tsingy de Bemaraha Nature Reserve. Without a doubt, the forest at the foot of the tsingy formations will be adversely affected by uncontrolled tourism. However, the reserve is presently difficult to reach. Public transportation only reaches the village of Ankilizato, about 20 km south of the Manambolo River. In advance of the eventual increase in tourism, we plan further studies of this region's fauna and flora.

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# Asia

## Recent Sightings of Rare Primates on Java

**by Roland and Julia Seitre**

The grizzled leaf monkey, *Presbytis comata* (Desmarest 1822), is one of two species of langur occurring on the island of Java, Indonesia (Pocock, 1934; Weitzel and Groves, 1985). Aside from the fact that it is apparently restricted to montane forest, little is known about this species. Two subspecies are described, *P. c. comata* from western Java and a melanistic form, *P. c. fredericae*, known from central Java. This animal was described in 1930 by Sody from a specimen collected in 1910-1912 on the south side of Gunung Slamat at about 1,500 m. A handful of specimens are known to originate from the same area, Dieng Plateau and Gunung Lawu, but nothing has been reported on the status of the langur in any of these localities for decades. *P. comata* has been assigned a very high conservation priority rating by the IUCN/SSC Primate Specialist Group (Eudey, 1987).

On a recent trip to Java, we visited Gunung Slamat to see if the langur still occurs there. We already had made a visit to the zoo in Bogor to see what the animal looked like. For two days we camped near the mountain resort village of Baturraden, famous for its hot springs. The volcano (3,428 m) situated on the road between Jakarta and Yogyakarta is still covered by extensive forest, at least on its south side, down to the 1,500 m level. Between this forest and Baturraden is a large Forestry Department plantation of introduced *Araucaria* sp., where local people claimed the langurs could be found. The plantation consists of large stands of relatively old trees, often cut through by ravines where some natural vegetation occurs.

On the second day of searching the plantation we saw two dark langurs in a stand of *Araucaria* near a ravine, noting that they appeared quite different from the ebony leaf monkey (*Trachypithecus auratus*), a common langur in southern Java. On the third day we located a group of five to six langurs, again in A*raucaria* trees, and followed them for about 100 m to a point outside the plantation. Another pair of langurs was observed about 500 m from this site, but none of them allowed us to approach closer than 100-150 m.

The monkeys were definitely not *Trachypithecus auratus*. We noted the pear-like shape of the head, longer fur, pale mouth and whitish underparts and tail. *T. auratus* has a round head, uniformly dark face, a uniform black, gray or orange coat and no contrast between tail and body colors. We also were of the impression that *Presbytis comata* is a slightly smaller animal.

Our stay was too brief to determine the subspecies or the conservation status of this langur population, but it appears that a reasonably good population may survive. In addition to the langurs, we also observed a single Javan gibbon (*Hylobates moloch*) which, 10 years ago, was only known to survive in central Java, in a 10 km$^2$ area of forest on Gunung Lawu.

The Gunung Slamat area, already under some protection, appears to be a prime target for research and conservation of two of Java's most endangered endemic primates. The area is also very interesting for birds, including the endemic hawk eagle (*Spizaetus bartelsi*), which is becoming very rare (Meyburg et al., 1989).

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## Status of Formosan Macaques in Taiwan

**By Ling-Ling Lee and Yao-Sung Lin**

The Formosan macaque (*Macaca cyclopis*) is the only nonhuman primate native to Taiwan. Limited information exists about the distribution and status of this endemic species (Swinhoe, 1862; McCullough, 1974; Poirier, 1979; Dien, 1985; Masui et al., 1986; Tanaka, 1986). Scientists who have studied the status of the Formosan macaque are deeply concerned about its future. As the problems of poaching and habitat loss continue to threaten the survival of this species, it is important to continue monitoring its status and to collect data concerning its ecology.

Between October 1986 and June 1987, we conducted a general survey of the Formosan macaque. We surveyed different parts of Taiwan, observing macaques and interviewing people living close to macaque habitat. We also distributed questionnaires to foresters at district offices of the Taiwan Forestry Bureau, and to members of various hiking clubs. Reports of macaque sightings also were reported by our colleagues.

The information recorded for each sighting included the date, location, and number of troops sighted; estimated troop size; the type of habitat; whether macaques were hunted in the area; whether the macaques were known to damage crops in the area; and basic information about those individuals who reported the sighting. Our own sightings from July 1987 through December 1989 are included as well.

**Survey in 1986-87**

While a total of 170 reports were collected during the survey, only data from 120 reports (containing sightings of 134 troops during 1986) were included for analysis. Of the 120 reports, 30 were provided by foresters and 20 by hikers; 29 were interviews and 41 were our own observations. The macaques were sighted in every county of Taiwan, except Penghu and Yunlin. Most troops were sighted along the Central Mountain Range and the Coastal Mountain Range in southeast Taiwan (Fig. 1).

The macaques could be found from 100-3,300m above sea level. Foresters reported more troops at elevations between 1,000-1,500m. Hikers, who were the only people who reported macaques at elevations greater than 3,000m, saw more monkeys between 500-1,000m. We and the people we interviewed sighted more troops at lower elevations (Fig. 2).

Troop sizes ranged from two to more than 20 monkeys (Fig. 3). More cases of troops larger than 20 individuals were noted in interviews, rather than observed directly. Hikers generally saw smaller troops or solitary animals. The largest troop reported, which we were unable to verify, was said to be greater than 100 monkeys. Members of the Japanese Monkey

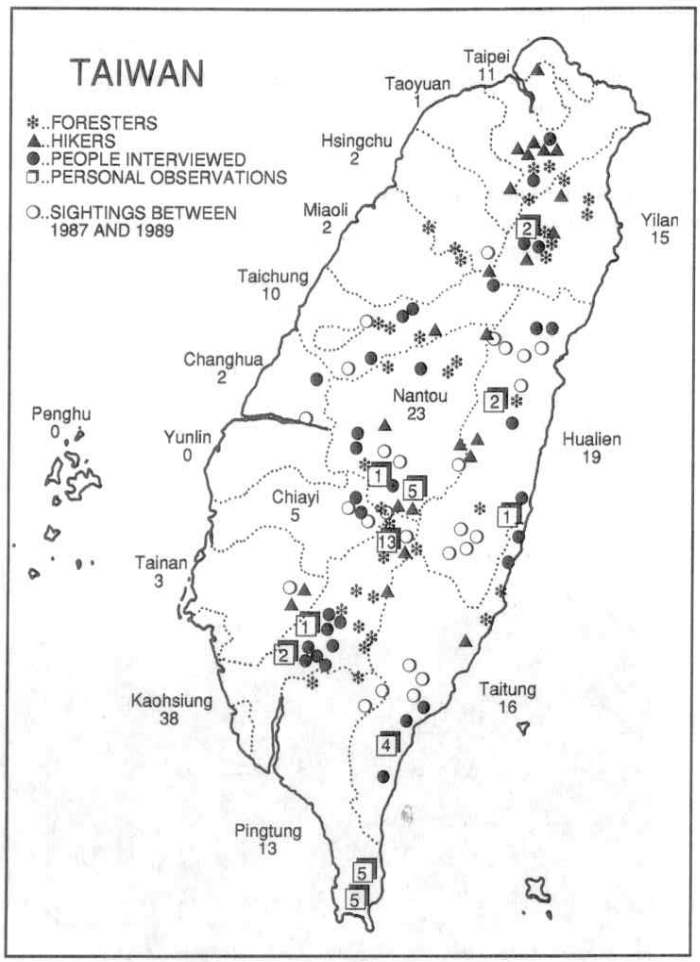


**Fig. 1. The distribution of Formosan macaques sighted in 1986, and between 1987 and 1989. Numbers represent the number of sightings reported in each county.**

Research Group reported a troop of 50-60 animals at Chipen, Taitung County. The largest troop we observed included 33 animals. When the location and size of troops were compared, it was found that troop size appeared to decrease with increasing elevation. Troops larger than 20 monkeys were rarely seen above 1,500m. Only solitary macaques and troops of 2-5 animals were sighted over 3,000m.

Macaques were most often sighted in natural and secondary forest (83.9% of total sightings). They also were seen in plantations (4.7%), on rocky outcrops, and in orchards and bamboo forest. Thirty-five per cent of the reports stated that the macaques would damage crops, including papaya, orange, pear, lichee, passion fruit, bamboo shoots, corn, sweet potatoes and other vegetables, especially at the lower elevations. The response of farmers toward the macaques varied. Some might ignore the animals if damage was not serious. Some would use firecrackers to scare them away, while others would use traps or guns against them. Repellants, including poison and bitter powders or liquids, also were used by some farmers.

Seventy-two of the 120 reports (53.8%) indicated that macaques were hunted. Few macaques are hunted for food nowadays, but infants are often captured in the spring to be sold as pets. Illegal hunting pressure on *Macaca cyclopis* remains substantial.

**Sightings from 1987-1990**

Since the survey of 1986-87, 26 additional locations for macaques were identified (Fig. 1). All except one troop were sighted in primary or secondary forest. One troop was sighted at 3,100m. The areas where new sightings were reported include: the borders of Taipei, Yilan and Taoyuan counties; Taipingshan in Yilan; Taroko National Park in Hualien; Yushan National Park in Nantou and Kaohsiung; Tawu Mountain Nature Reserve in Taitung; and Kenting National Park in Pingtung. Most of these areas are officially protected.

Macaques were found in all counties except Penghu and Yunlin. While the Formosan macaque is not native to Penghu (the Pescadores Islands), the lack of macaque sightings in Yunlin may be due to greater habitat change, especially at lower to middle elevations.

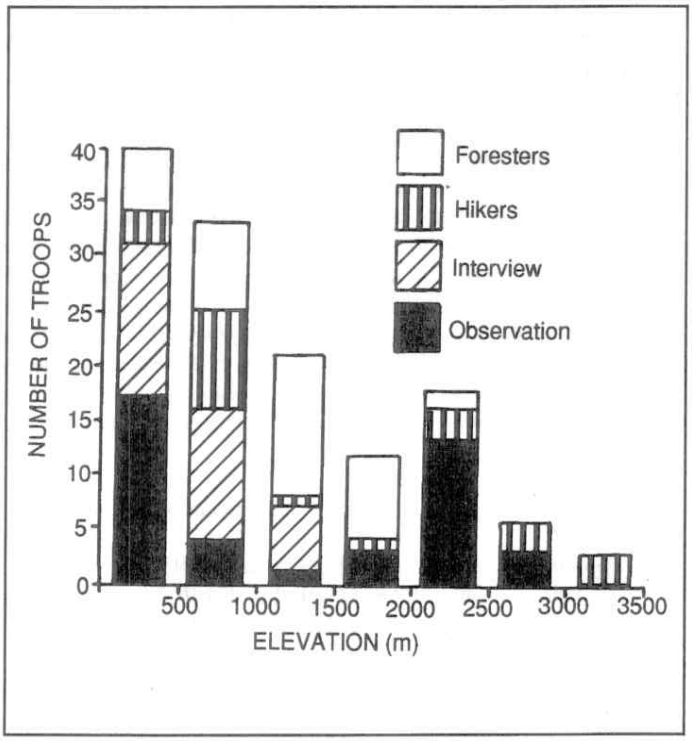


**Fig. 2. Sightings of macaque troops by elevation (according to 1986 sightings).**

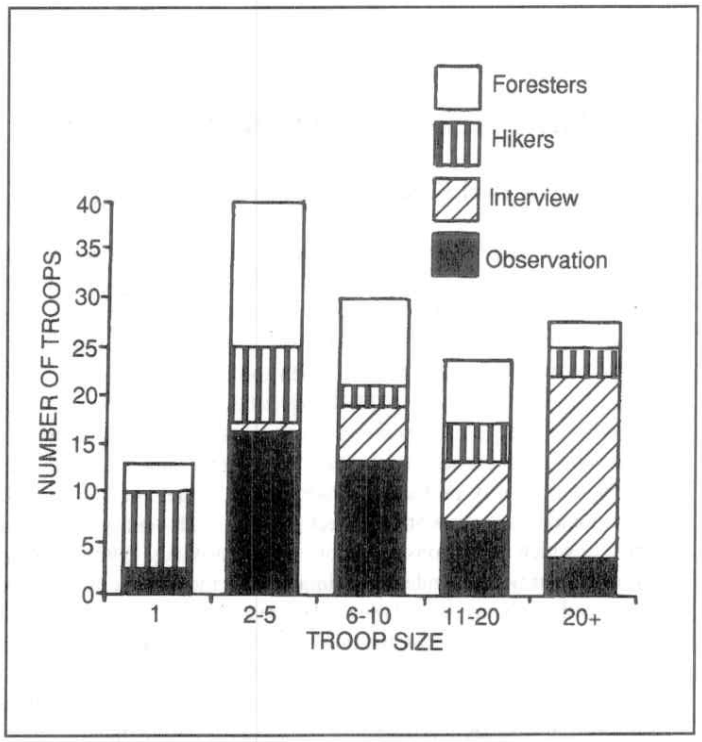


**Fig. 3. Sizes of Formosan macaque troops sighted in 1986 by people of different occupations.**

Habitat loss and illegal hunting remain serious problems threatening the existence of this species. However, macaque populations in protected areas appear to be stable, and some may be increasing. It is hoped that with the enactment of the 1989 Wildlife Conservation Law, which protects hundreds of species from both hunting and trade, and better law enforcement in protected areas, the survival of the Formosan macaque can be ensured. Finally, if protection is truly successful, we may see more conflict develop between this species and Taiwanese farmers, and preventive measures should be considered in advance to forestall this problem.

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# The Black-crested Gibbon of China

### By Lori K. Sheeran and Frank E. Poirier

Black-crested gibbons were once widely distributed throughout China (*Hylobates concolor*) and Vietnam (*Hylobates leucogenys*). In China, *Hylobates concolor* is found in isolated pockets in Yunnan Province and on Hainan Island. The status of *Hylobates leucogenys* in Vietnam remains poorly known (Geissman, 1989; Bleisch and Chen, 1991).

Of the various subspecies of black-crested gibbons, *Hylobates concolor jingdongensis* and *H. c. concolor* remain the most widespread. Even so, the conservation status is equivocal. The Chinese government accords them a number one priority protection ranking - the highest ranking possible. While numerous laws exist to protect gibbons, each county varies in the degree to which restrictions are enforced (Ji and Wang, 1990). Additionally, each county independently maintains only those sections of reserves falling within county boundaries. The result is variable protection of reserves depending on the motivation of, and the resource allocation to, the county government which dictates policies for its reserve.

During 1990, 180 days were spent in the field studying the above-mentioned subspecies of *H. concolor*. Subspecific designations in this area of China are related to geographic isolation in two adjacent mountain ranges (Ma and Wang, 1986; Ma *et al.*, 1989). *H. c. jingdongensis* is found in the Wuliang Mountain chain, and *H. c. concolor* inhabits the Ailao Mountain chain (Fig. 1). The demographic status of both subspecies was assessed, as well as their ecological and social patterns. Data collected indicate that more research is needed to elucidate how gibbons survive in marginal habitats such as those that are found in southern China.

**Wuliang Mountain Reserve**

The study site in the Wuliang Mountains was visited from March through May 1990 and again from September through November 1990. Because more data were collected in the Wuliang Mountain Reserve (350 $km^2$), this reserve is discussed more fully here. The Ailao Mountain Reserve (550 $km^2$) is treated briefly, but infrequent contact with gibbons makes it difficult to draw more than superficial conclusions about *H. c. concolor*.

The same gibbon groups were contacted during both visits to the Wuliang Mountain Reserve. An area of 11 $km^2$ was surveyed, which allowed regular contact with three groups.

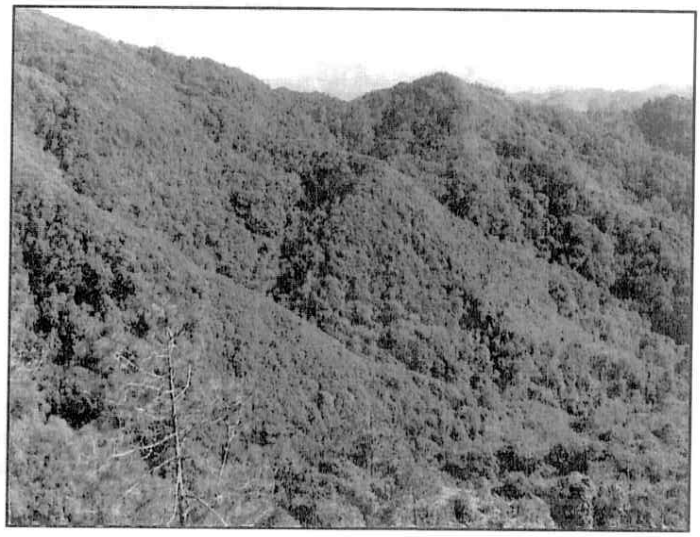

**Fig. 1. Study site at the Wuliang Mountain Reserve. Two of the three main study groups occupied this area (photo by Joseph R. Sheeran).**

Attempts were made to determine the age and sex composition of each group. Unfortunately, the coat color patterns of *H. concolor* yield ambiguous results in this regard. Infants (IN 1) are distinguishable by a buff natal coat. The next age category (IN 2) includes those infants who have lost their natal coat and are able to locomote independently, but are still nursed by the mother. At this point the infant is black. Juveniles and young adults of both sexes cannot be distinguished; this category was simply called "black."

During our study, all individuals in this category were roughly the same size as the adult females (AF). Adult females could be detected unequivocally, as these animals are a creamy or reddish-buff color. Adult males (AM) could sometimes be distinguished during morning duets.

Group composition of the three study groups was as follows:

| | |
|---|---|
| Group 1: | n=4; 1 AF, 1 black, 1 AM, 1 IN 2* |
| Group 2: | n=6; 1 AF, 3 black, 1 AM, 1 IN 2 |
| Group 3: | n=5; 1 AF, 2 black, 1 AM, 1 IN 2 |

** The habitat of this group had been severely disrupted by logging; thus this group may not be typical of this subspecies.*

These figures give a total study site population of 15 animals, with an average group size of 5 individuals. Gibbon density within forests of the

study area is 2 individuals/km$^2$, when one considers that 30% of the habitat within this area has been severely disrupted by logging and is not available to gibbons. Group 1's habitat appeared to be the most affected by logging activities.

*H. c. jingdongensis* appears to be both monogamous and inbred. Inbreeding is inevitable in Wuliang because of the loss of forest corridors between remaining forest patches and the subsequent retention of offspring in the natal group. Among the Wuliang study groups, Group 1 was totally isolated, while Groups 2 and 3 could exchange individuals only with each other and with one group to the north. It is possible that some groups are, or appear to be, polygynous due to retention of offspring in natal groups, as was first suggested by Bleisch and Chen (1991).

The Wuliang study site is under the jurisdiction of Jingdong County. Most reserve officials are located in the county seat of Jingdong. Signs prohibiting hunting were erected at reserve boundaries prior to our departure in November. We did not observe poaching of gibbons, nor did any local people admit to this practice. The apparent lack of poaching could very well be linked to a significant research presence in this area in recent years.

A leopard living in this reserve was said to be responsible for the disappearance of village goats. Local people were permitted to bring guns into the reserve while searching for goat remains. The government will reimburse them for the goat if the owner is able to prove the leopard was responsible (Y.-L. Jiang, pers. comm.). Many villagers carried guns while in the forest for protection from wild animals.

Livestock grazing is permitted within the reserve, a practice which slows forest regeneration. Plans for a road which will bisect the Ailao and Wuliang Mountain Reserves were still underway as of November 1990. As noted in Bleisch and Chen (1990), this road will effectively cut the two reserves in half and will damage suitable habitat on both sides of the road. It also will make it easier for humans to exploit previously inaccessible parts of the reserve.

Other primates were observed infrequently in the vicinity of the Wuliang Mountain Reserve. *Macaca mulatta* apparently was found in the reserve at one time, but villagers said that permission was given in 1989 to shoot 100 monkeys because they had been raiding nearby crops. This policy appears to have exterminated rhesus monkeys in this section of the reserve. A solitary *Trachypithecus* (= *Presbytis*) *phayrei* was observed twice. D. Y. Lan (pers. comm.) described a larger group living in this area of the reserve, and we hope that this solitary individual is not the remnant of a once larger population.

While in Jingdong, we observed nonhuman primate parts for sale in the streets (Fig. 2). The vendors described medicines which could be made from these remains. Most of the skulls appeared to belong to macaques; none was hylobatid.

**Ailao Mountain Reserve**

The site in the Ailao Mountains is under the jurisdiction of the city of Xingping. This area is more remote than Wuliang. Although we saw signs prohibiting hunting, there is no enforcement. While there, one of our research team found a skin of *Macaca arctoides*. It had apparently been left in the reserve by poachers. The wariness of all animals in the reserve may indicate heavy hunting pressure in recent years. Gibbons were particularly cautious. For example, while at Wuliang we saw gibbons 60 times in 115 days, compared to only once in 65 days at Ailao.

Within the reserve there are several fallow fields, and one villager told us that permission to farm in the reserve is sometimes given. We also were told that a local woman kept a gibbon as a pet, but the animal was said to have died by the time we visited her home.

Although both *Macaca mulatta* and *M. arctoides* were observed at the Ailao study site, we noted that local people consider macaques to be vermin because of their crop-raiding propensities. Their conservation status is probably more precarious than that of gibbons. Everyone appeared aware that it is illegal to hunt gibbons, while macaques were always described disparagingly.

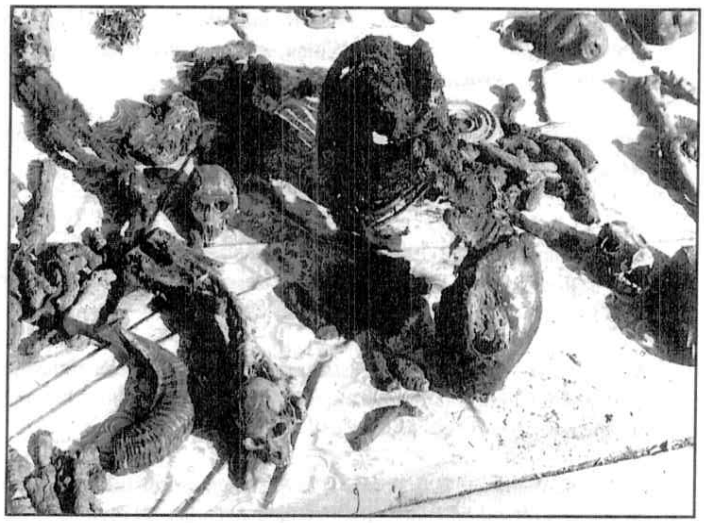

**Fig. 3. The selling of animal remains to make traditional medicines in Jingdong, Yunnan Province (photo by Joseph R. Sheeran).**

As Kunming is the provincial capital and is in close proximity to Xingping and Jingdong, some poachers go there to sell animals and animal parts. At the Bird and Flower Market it is possible to buy slow lorises, (70 Yuan or $17 each), rhesus monkeys (price not disclosed), leopard kittens (170 Y or $37 each), snakes (prices not disclosed) and other rare and endangered animals. For the most part, selling was done openly and we were not prevented from asking questions or taking photographs. Police were often seen in the market, but no one confiscated these illegal animals. We visited the market five times between March and November 1990. Each time the same array of animals was available. We also saw nonhuman primate parts for sale, none of which was recognizably hylobatid. As was the case in Jingdong, all remains appeared to be of macaques.

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# ARTICLES

# Neotropical Region

## A Hunt for *"Monos" (Brachyteles arachnoides)* in the Foothills of the Serra da Paranapiacaba, São Paulo, Brazil

by Frederico Lane
January 20, 1977

*In this issue, the editors would like to present a very unusual article by an old hunter who spent time hunting monos, or muriquis, in the Rio Verde region of coastal São Paulo, Brazil. This interesting piece by Frederico Lane was written in response to a 1977 article on PSG member Celio Valle's work on muriquis at Fazenda Montes Claros in Minas Gerais. Frederico Lane was an American who lived most of his life in Brazil, and he describes here in detail a 1928 expedition that subsisted largely on the meat of the muriqui. We print it here for the first time because of its historical interest and because of the precise locality data it provides on the muriqui in this region 62 years ago. The original article was in Portuguese, and has been translated by the editors of* Primate Conservation. *PSG member Adelmar F. Coimbra-Filho provided scientific names for the plants mentioned. We are grateful to Celio Valle for making it available to us for publication.*

An article that appeared in the newspaper *O Estado de São Paulo* (January 7, 1977) entitled "Monkey Survives in Minas," stated that 40 muriqui (*Brachyteles arachnoides*) were located at Fazenda Montes Claros (property owned by Sr. Feliciano Miguel Abdala) during a University of Minas Gerais expedition led by Celio Valle. This very interesting article about a species on the verge of extinction contained several small errors.

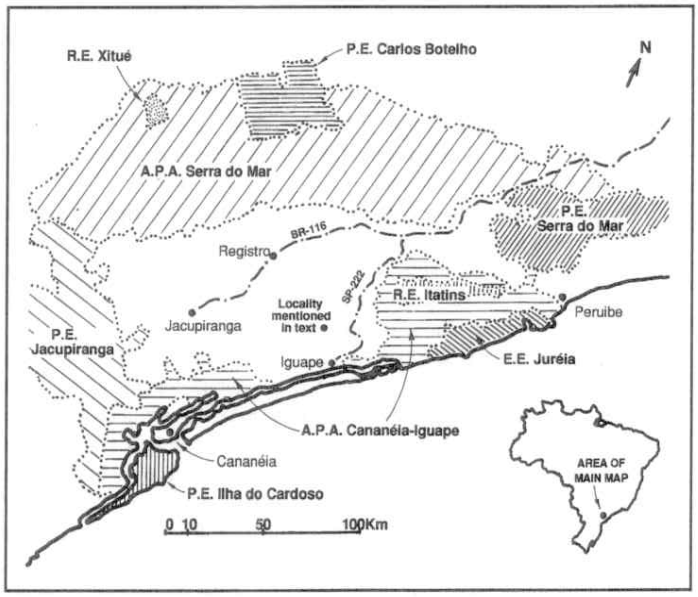


**Fig. 1. Region of São Paulo through which Lane's 1928 expedition travelled (map drawn by Stephen Nash)**

The name of this monkey in São Paulo is simply *mono*, and only the adult males with darker pelage are called by the name *carvoeiro*, which is Portuguese for "coal miner." Another mistake was the statement that muriquis can be found in the Cantareira forests near the city of São Paulo. There is no evidence that *Brachyteles* ever inhabited the Serra da Cantareira, although 50 years ago they were abundant on the slopes of the Serra de Paranapiacaba.

Rudolph von Ihering (1940) devotes only a few paragraphs to this species and does not appear to be very familiar with it. In truth, the *mono* appears to avoid inhabited areas, preferring extensive and continuous forests where man has not penetrated, or at least not significantly. In the above-mentioned case, protection by the landowner guarantees its survival. Good conditions for the survival of the *mono* existed in the 10,000 alquiere (24,200 ha) tract of forest given by the Brazilian government to an American citizen, James Monroe Keith, in 1890, supposedly for gold extraction. Years later, in 1905, Keith sold part of this land for 1,000,000 cruzeiros to Dr. Augusto Eliseo de Castro Fonseca, David MacKnight, Giles Williams Lane and Job Lane, their land being delimited as follows, "... it begins on the right bank of the Rio Verde and climbs along the major mountain ridge between the Rio Claro and the Ribeirão dos Moços, up to the summit of the Serra da Paranapiacaba; from there it follows up to the ridge which forms the source of the Ribeirão Branco and the Ribeirão dos Moços; from there it descends the same ridge to Rio Verde and at this point crosses the same Rio Verde and continues south up to the summit of the Serra da Balança; from there it continues along the Serra da Balança until it comes to a line running from the Ribeirão Cachorros Novos to the Rio Verde, in front of a ridge which separates the Ribeirão dos Moços from the Rio Claro and from there by the same line to the point of departure" (Fig. 1).

In 1928, my cousin Horacio (son of my uncle Job) asked to visit Fita Branca, the name of James Monroe Keith's property, of which Job Lane and the others had acquired a part. At that time, my brothers and I lived at Fazenda Poço Grande on the banks of the Rio Juquia. The road which connected Piedade to the Rio Juquia, constructed during the government of Dr. Armando de Salles Oliveira, did not yet exist. A little beyond Piedade there exists an "entrance to the wilderness" (*boca de sertão*) that is the start of a precarious trail that descended to Corujas, site of the most remote habitations on the Rio Juquia. To Corujas, it was eight leagues (4,800m) through the wilderness. This trail was used but once each year by pilgrims from Sorocaba who descended the mountains in order to participate in the feasts of Bom Jesus de Iguape, using burros as a means of transportation and nourishing themselves on the journey with palmito and small rations of corn. My brother Frank and I used this trail a few times to drive cattle and young breeding mares from Santo Amaro to Poço Grande, but the journey was a true penance in times of rain, as it also must have been for the mountain pilgrims, especially in stretches where dense bamboo formations covered the road. At that time the old road from Prainha (today Miracatu), which links the mountains to São Paulo, was in disuse. In fact, it never was more than a trail. In order to reach Fazenda Poço Grande, we used to take the Ingleza- Santos road, then the South São Paulo Railway to the end of the line at the Rio Juquia, and from there by canoe to the fazenda, or by the narrow trail cleared once a year, which served as an alternate route for the region's inhabitants.

Preparations for the above-mentioned journey with Horacio finished, we left Poço Grande on course for Fita Branca. Accompanying Horacio were

my two brothers, Jack and Frank, the Swede Bruno Bayer, an inhabitant of the region, two herdsmen and myself, now apparently the last survivor of the group that made that journey. Bruno was an ex-sailor residing in Juquia, where he made excellent canoes and repaired firearms. At Barra, which at that time belonged to Bento Sanches, we left the Rio Juquia and went up the left bank of the Rio Assunguy to Capela do Porto, a small village of a few houses. It was the rainy season, and at one of our stops we were chased from our house at nightfall by an invasion of an enormous quantity of cockroaches which emerged from under the floorboards (Fig. 2).

**Fig. 2. The house that we were forced to leave because of cockroaches. The author (to the left) is cleaning a shotgun.**

The house was surrounded by old secondary forest and game was abundant. Horacio brought 12-gauge shotguns, and a *jacutinga* (*Pipile jacutinga*) was taken close to the house - we all know that no one turns down *jacutinga* with rice. We left from there in the direction of Serra da Balança and finally arrived at the Rio Verde. By shooting into the air, we attracted the attention of the only inhabitant of these parts, Bertoldo Alves da Costa, who continued to guard the land belonging to James Monroe Keith. We arranged with Bertoldo to cross the river the next day and we camped on the left bank for the night (Fig. 3). Soaking wet, Jack removed the bark from a fallen tree to get some dry wood for a fire. As soon as it became dark, the bark he had collected gave off a strange greenish luminescence, probably caused by bacteria.

**Fig. 3. Camp on the bank of the Rio Verde. Horacio is seated and Jack is lying down.**

On the following morning, we crossed the Rio Verde using a typical wilderness technique. Bertoldo cut down a tree on his side of the river and we did the same on our side. The crowns fell together, securing the trees against the action of the current and turning the two trunks into a rustic bridge (Fig. 4).

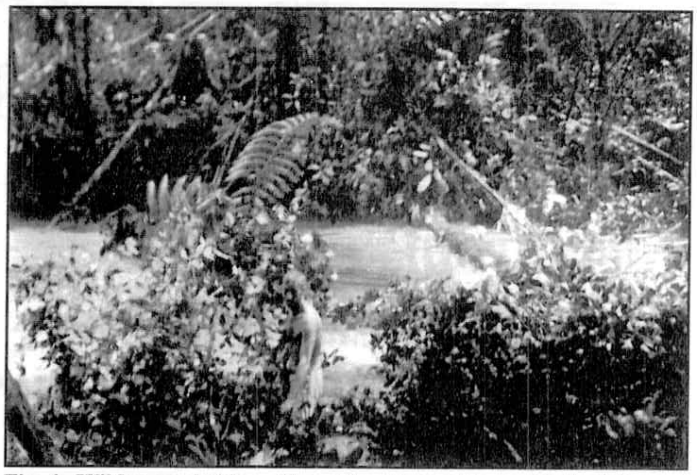

**Fig. 4. Wilderness bridge. The author is standing amid the foliage of the tree cut down on the left bank of the Rio Verde.**

In Fita Branca there were still signs of old gold mines, which reminded me that my Uncle Guilherme once had said the extraction of 4,500 reis of gold in this region cost about 5,000 reis. For Bertoldo, however, time and expense were very relative. He prospected carefully and without haste, and once each year he went up to the mountain with his oldest son to Piedade, where he sold his year's production of gold to an established customer, a dentist. To another customer he sold a few rolls of special tobacco that he had grown in the lonely interior. For his return, he bought lead, gunpowder, fuses, salt, calico and other things to support himself for another year. My old friend, Olympio Adorno Vassão, told me that Bertoldo had died about 20 years ago. It appears that, after dying, he came back to life, stood up, played the violin, sang some local folk songs and then lay down again upon his death bed, this time for good. Stories of the interior typically intertwine fact and fiction. Bertoldo's farm, seen at a distance from the Serra da Balança, appeared as a small square of manioc and corn surrounded by an immense virgin forest that climbed unbroken up the slope of the Serra de Paranapiacaba.

The abundant and easily hunted game that fed Bertoldo's family included the *mono*, of which numerous groups existed on the mountain slopes. *Mono* meat was what we ate while at his farm, and it was very good.

The virgin forest of the mountain slopes was easy to move through, making hunting very easy. The *guariroba*, or sweet *palmito* (*Euterpe edulis*), was common. Its mature fruits attracted many flocks of *jacutinga*, for which this palm is the major food source at certain times of the year - as it probably is for the *mono* as well. In these forests, the great abundance of trees of the family Myrtaceae was another important attraction for the *mono*. The variety of fruits in this family is quite large and includes the *araça piranga* (*Psidium* sp.) with a reddish shell, the *guabiroba arborea* (*Campomanesia* sp.), the *cambuci* (*Paivea* sp.), the *jaboticaba* (*Myriciaria* sp.), various *cambuis* and others.

We ate a fair amount of palmito during our hunting trips. Commercial exploitation of *palmito* had not yet begun in this region. For this trade, both mature and immature palms were extracted, the immature ones sold in batches of three, or "three for one," as they said. In addition, the *palmito* harvesters fed young plants to their pack animals.

The mono, *Brachyteles arachnoides* (E. Geoffroy, 1806) is the largest South American monkey. Its color is described locally as *baio* (buff brown), but varies with age and sex. Adult males have blackish heads and dark bodies (Fig. 5), while females and younger animals are lighter and more yellow in color (Fig. 6). The hair is thick and long, but may vary according to the season. My impression is that the *mono* is not as fast as *Cebus* in moving through the forest. In the open forest at Fita Branca the hunter can run easily and profit from his shots, all the more because the *monos* were quite numerous in the foothills of the mountains, with some troops that seemed to have 50 or more monkeys. We used 12-gauge shells with heavy shot. The animals we killed were carried like packs on our backs

**Fig. 5. The male *mono*, or *mono carvoeiro*, one of the largest specimens killed during the hunt.**

**Fig. 7. Returning from the hunt with *mono* backpacks, or *malas*, their long tails wrapped around their necks.**

**Fig. 8. Skinned and hung, the *monos* appear almost human-like.**

**Fig. 6. Bruno Bayer and the author holding an immature *mono* with lighter pelage.**

(Fig. 7), an arrangement called *mala* (suitcase) in the southern part of São Paulo.

Fig. 8 shows two monos hung by their necks on the crossbeam of our hut after having been skinned. On one occasion, when I showed this photo to a group of friends, one of them - more gullible than the rest - asked with shock if these were human beings. I said that they were and that in the wilderness hunger often makes it necessary to sacrifice the weaker comrades so that the stronger can survive. However, for obvious reasons, these matters are never discussed!

Gilmore (1950) observed that Ignacio de Armas (1888) believed that many cases of cannibalism described in the old Spanish travelogues, especially those involving children, were based on accounts of people eating monkeys and not human beings. Armas also noted that Humboldt, Schomburgk and Bates had pointed out how easy it was to arrive at this conclusion while taking part in a meal of monkey meat.

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# A Pilot Study of Genetic and Morphological Variation in the Muriqui (*Brachyteles arachnoides*)

**By Rosa M. Lemos de Sá, Theresa R. Pope, Kenneth E. Glander, Thomas T. Struhsaker and Gustavo A. B. da Fonseca**

One of the most endangered primates of South America is the muriqui (*Brachyteles arachnoides*). It occurs only in Brazil's Atlantic forests and may number as few as 400-500 individuals. These are subdivided into perhaps eleven or so small populations that are widely separated from one another (Fonseca, 1983; Mittermeier *et al.*, 1987). Many of these fragmented populations contain less than 20 animals and one has only 12. These numbers are well below the demographic and genetic thresholds above which a population can be expected to persist over time. Most of these populations are likely to become extinct in the near future unless intensive conservation management is implemented.

The purpose of this research project was to collect baseline data on genetics, morphometrics, disease and parasites of the muriqui and to develop the most effective and safest methods of capture. These data are intended to contribute to an action plan for the conservation of the muriqui.

## Methods

In an attempt to maximize the probability of capturing muriqui and demonstrating whether or not there are significant differences between populations, we worked at two sites where there were trail systems, and populations of muriqui that were relatively well protected against hunting and which represented extremes in the geographic range and visible phenotypes of muriqui. Field work was conducted from 21 August to 5 September 1990.

The first site was a forest estimated to be 44-65 ha at Fazenda Esmeralda near Rio Casca in Minas Gerais (Figs. 1, 2). There was a population of 12 muriqui at Fazenda Esmeralda representing the variety whose faces are mottled pink and black in adulthood. The forest patch containing muriqui was badly degraded by logging, with few tall trees (20-25m) remaining, many breaks in the canopy and abundant, dense thickets of bamboo and shrubs. The area of this forest has been estimated at 44 ha, but this did not account for the very steep slope which may, in fact, double the surface area. This forest patch was separated from two other, badly degraded patches by about 200 meters of open pasture. There were about 11-12 km of trails in the study forest.

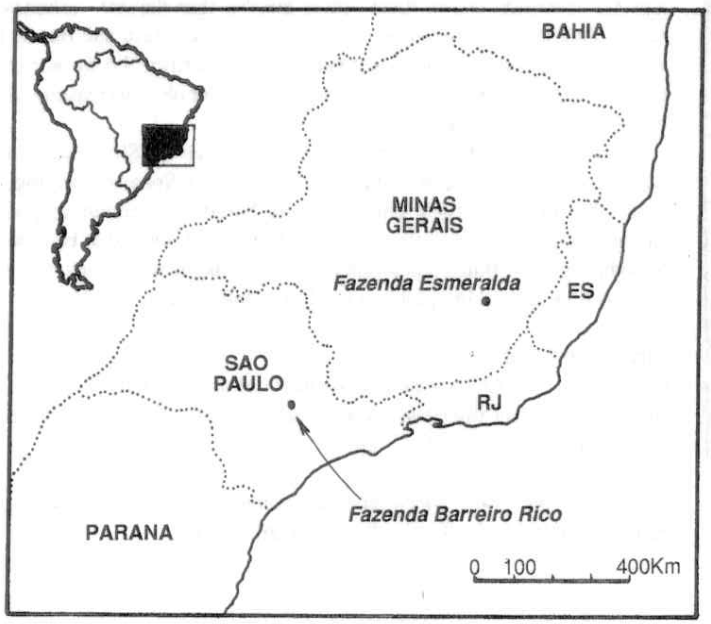



**Fig. 1. Locations of study sites at Fazenda Esmeralda (Minas Gerais) and Fazenda Barreiro Rico (São Paulo).**

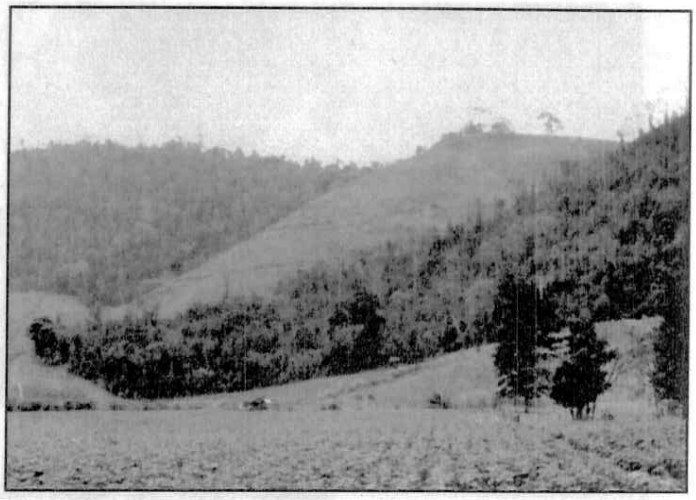


**Fig. 2. Fragmented forest patches of Fazenda Esmeralda (photo by Thomas T. Struhsaker).**

The second site was a forest of about 1,000 ha at Fazenda Barreiro Rico (Fig. 1) near Santa Maria da Serra in São Paulo state with a population of approximately 25 muriqui representing the black-faced form. The forest patch we worked in at Fazenda Barreiro Rico was approximately 1,000 ha in flat terrain. Virtually all of this forest had been selectively logged, but there were areas of forest with tall trees (25m) and relatively open understory. These areas were interspersed amongst larger areas of low stature and degraded forest with a very dense understory of lianas and shrubs. This forest was in much better condition than that at Fazenda Esmeralda. Our greatest disadvantage at Fazenda Barreiro Rico was that the trail system (about 10 km) covered only a relatively small part of the forest (about 3.6%) and home range of the muriqui.

The study forest at Fazenda Barreiro Rico was separated from another forest on an adjacent fazenda by a dirt road and a distance of 50-60 m. The possibility of successful dispersal by female muriqui between these two forests seemed much greater than at Fazenda Esmeralda, where successful dispersal by females to other social groups seemed impossible.

Other primate species seen at Fazenda Esmeralda were *Cebus apella, Callithrix aurita* and *Callicebus personatus*, and at Fazenda Barreiro Rico *Cebus apella, Alouatta fusca, Callicebus personatus* and *Callithrix aurita*.

## Capturing Techniques

One of the main conclusions of this pilot project is that muriquis of both sexes and all ages can be safely and effectively captured by standard darting techniques.

Ten of 12 muriquis at Fazenda Esmeralda were caught. These included three adult males, one juvenile male, three adult females (one pregnant and one with a clinging young infant female estimated to be two months old), one subadult female and one juvenile female. Two adult males were not darted. Most individuals had what appeared to be body lice. No ticks or fleas were found.

Two of the estimated 25 muriqui at Fazenda Barreiro Rico were captured, one adult male and one adult female. No ectoparasites were found.

All animals recovered fully from the immobilizing drug and processing procedure (Figs. 3-5). They appeared in excellent physical condition after being released back to the forest (Figs. 6,7). For example, one adult male was seen climbing, jumping and brachiating very well five days after he was released. Most of the muriqui began feeding immediately upon release. Those animals who were given chain collars usually pulled and tugged on these for the initial one to two hours after release, but then later ignored them.

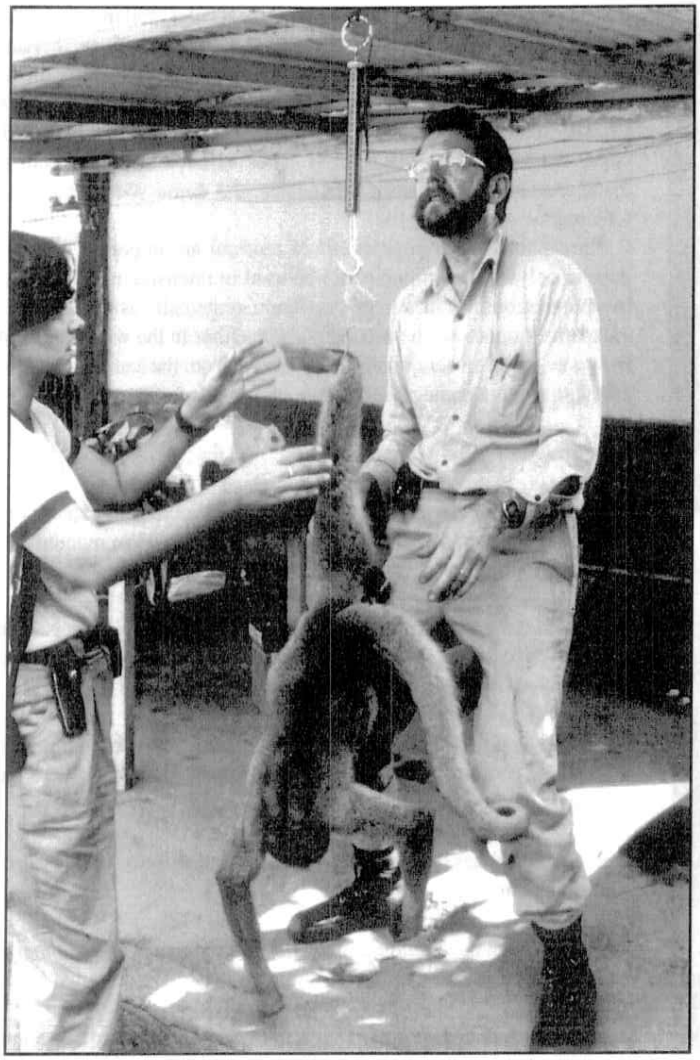


**Fig. 3. Kenneth Glander and Rosa Lemos de Sa weighing a muriqui (photo by Thomas T. Struhsaker).**

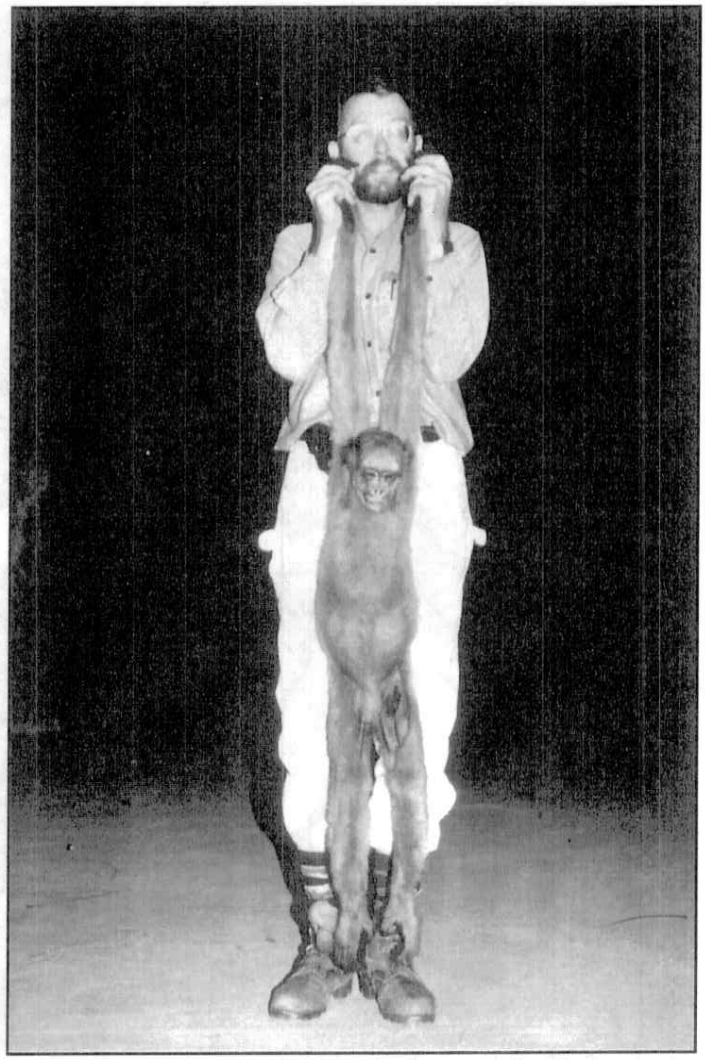


**Fig. 4. Kenneth Glander (1.88 m tall) demonstrating the impressive size of an adult muriqui (photo by Rosa Lemos de Sá).**

After the initial one or two shots at a particular foraging party on any one day, the muriquis moved 200-400m away and then stopped abruptly and remained motionless in dense vegetation or high in the canopy. This often made it difficult to relocate them. We also believe that in the normal course of the day the muriquis are often very quiet and difficult to locate. In cases where they were thought to be nearby, the best strategy for locating them was to remain quiet and listen for coughs, sneezes or foliage movement.

Only one to three shots were possible during any one encounter with a given foraging party before they moved away from us. It was our impression that monkeys that had been darted were, upon release, even more habituated than prior to darting. The process of darting and capture may, however, have led to a temporary increase in the dispersion of group members. It appeared that once disturbed by the darting procedure they moved in smaller foraging parties. This was temporary at least for the Fazenda Esmeralda group, because two weeks later all group members were together and moving as a cohesive unit.

**Differences Between Populations**

One of the most striking results is the difference in external appearance of the two populations of muriqui. Those in the north (Fazenda Esmeralda) had small, but obvious thumbs (Fig. 8), whereas those in the south (Fazenda Barreiro Rico) had no thumbs at all (Fig. 9). Museum specimens in which the hands had not been cut off corroborated these observations. All 14 museum study skins from the northern part of the species' range had thumbs. None of the three study skins from the southern part of the range had thumbs, although one of them had an extremely small nub where the thumb should be. Adults of the Fazenda Esmeralda (northern) muriqui had faces and scrotums mottled pink and black (Fig. 10) while adults at Fazenda Barreiro Rico (southern) had entirely black skin in these areas (Fig. 11).

The one adult male from Fazenda Barreiro Rico had longer upper canines than any of the 10 from the north. The canines of the single female from Fazenda Barreiro Rico did not differ in length from those at Fazenda Esmeralda. Data from live animals combined with that from museum skulls indicate that canine length is sexually dimorphic in the southern form of the muriqui. There was no significant difference in canine length between males and females in the northern form.

Considerable genetic variability was detected in both populations. Overall genetic polymorphism for combined populations was 34.4%(11 out of the 32 loci examined), which is among the highest recorded for vertebrates. Mean heterozygosity was 10%. These results suggest that high levels of genetic variability were characteristic of this species prior to population fragmentation and decline. Comparison of generations at Fazenda Esmeralda indicates that genetic diversity is already being lost at a rapid rate. Polymorphism declined from 28.2% in breeding adults to 25% in offspring born during the past seven years, representing the loss of three alleles - one of which was unique to this population. Although mean heterozygosity was higher than expected in breeding adults, it was lower than expected in the offspring.

Genetic differentiation between the two populations was enormous. The overall $F_{ST}$ value indicated a 41.3%difference in allele frequencies. This is

**Fig. 5. Rosa Lemos de Sá with a young muriqui recovering from anesthesia (photo by Kenneth Glander).**

one of the highest values recorded within a species, and indicates that these two populations have been separated for a very long time. Measures of genetic distance between the two populations indicated a high level of genetic divergence. Roger's modified distance (Wright 1978) was 0.343, Cavalli-Sforza and Edwards (1967) chord distance was 0.330, and Nei's (1972) distance was 0.137. The latter value was comparable to Nei distances reported between subspecies and some species of the genus *Cercopithecus* (Ruvolo 1988).

The small isolated populations of muriqui are important reservoirs of genetic polymorphism that could be used in intensive management. The two populations are sufficiently different genetically as to warrant recommendations opposing the mixing of them either in the wild or in captivity. However, more closely related populations from the same region could be mixed through a managed exchange of animals in the wild.

**Recommendations**

**Improvement of Capture Procedure:** The efficiency of capture depends largely on locating muriquis as rapidly as possible. We recommend four ways in which this procedure can be improved:

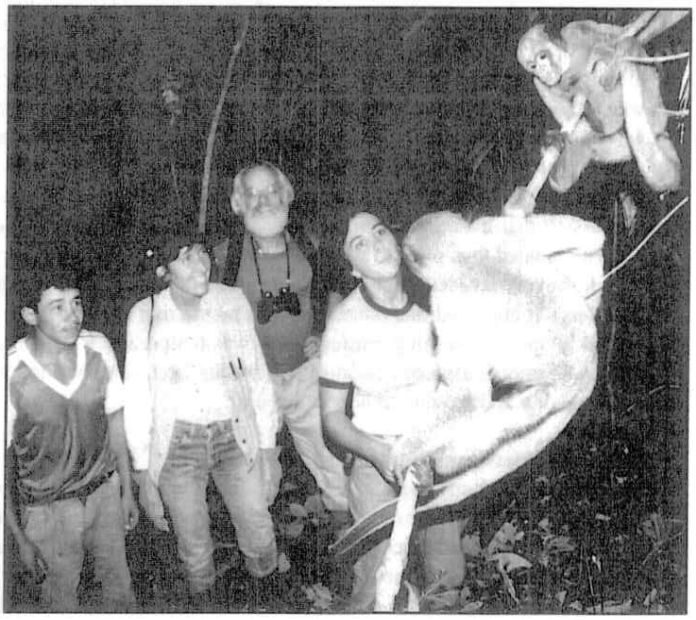
1. A more extensive trail system should be established prior to the capture operation. A grid of 50m intervals is preferable. This was our major limitation at Fazenda Barreiro Rico.

2. A field assistant should be employed at least one month prior to the capture operation to improve habituation of the animals and ease of locating them.

3. Walkie-talkies should be used to coordinate activities of the search and capture team.

4. Radio collars should be placed on some of the captured muriqui to facilitate the location of other animals.

**Muriqui Population Management:** It is premature to make detailed recommendations on population management at this time. However, we agree in principle with a previous suggestion that the exchange of some animals between related populations would be desirable in terms of genetics (Fonseca, 1983). Furthermore, all available evidence suggests that it is the



**Figs. 6 and 7. Research team releasing captured muriquis to the forest (photos by Kenneth Glander).**

**Fig. 8. Small thumbs present in muriquis of Minas Gerais (photo by Thomas T. Struhsaker).**

**Fig. 9. Hand of muriqui from São Paulo, showing no external evidence of thumb (photo by Thomas T. Struhsaker).**

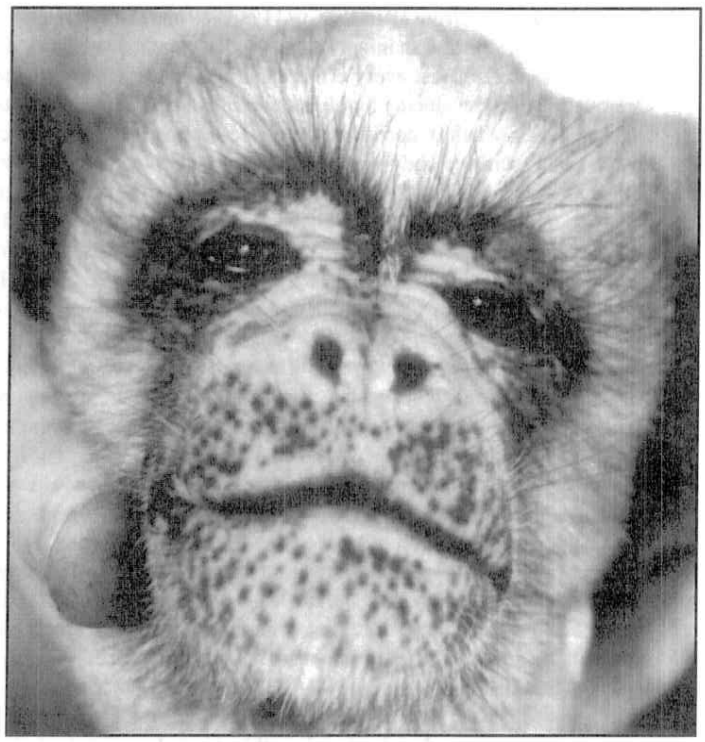


**Fig. 10. Mottled face of muriqui from Minas Gerais (photo by Thomas T. Struhsaker).**

**Fig. 11. Black face of muriqui from São Paulo (photo by Thomas T. Struhsaker).**

old juvenile and subadult females who disperse and transfer between social groups (K. Strier and R. Lemos, pers. comm.). Consequently, it is precisely such females that should be considered for exchange between isolated populations. Any such transfer should be preceded by a detailed examination of the specific animals to ascertain genetic and hygienic compatibility. This may require a period of quarantine. Initially, any such translocation should involve only 2-3 animals with close monitoring after release as part of a pilot study in management.

At this time we would recommend against the mixing of the northern (mottled skin) with the southern (black skin) varieties of muriqui either in the wild or captive breeding facilities because of their pronounced genetic and morphological differences.

The two populations at Fazenda Esmeralda and Fazenda Barreiro Rico should be monitored on a frequent and regular basis to ascertain population and ecological trends and to determine which animals may be suitable for translocation to other groups in other areas. Other areas should be identified for exchange translocations. This might best be done by Brazilian graduate students as part of an integrated program for the management and protection of these two populations.

**Habitat Management:** Extensive logging over large portions of a muriqui group's range apparently leads to population decline. This is best documented by information from Fazenda Esmeralda where extensive logging for charcoal was carried out in the 1960s and 1970s (Fonseca, 1983), and then more logging for timber was done in 1987. The muriquis at Fazenda

Esmeralda declined from 18 in 1986 to 11 in 1989 and then increased to 12 in 1990 with the birth of an infant (Lemos de Sá, unpublished data). These limited data suggest that every effort should be made to prevent further degradation of these already highly damaged and fragmented habitats.

The creation of habitat corridors between forest fragments would encourage genetic exchange and improve the chances of successful transfer of females between groups. The need for corridor establishment was particularly apparent at Fazenda Esmeralda where it appears that with relatively little investment the present habitat could be linked with two other forest patches which are within 200m of it. At present, dispersing females have nowhere to go and most, if not all, are probably killed by dogs when they wander into the pastures.

The situation at Fazenda Barreiro Rico is more promising because the habitat is larger and the two main forests are separated only by a road. Artificial arboreal pathways might enhance exchange between these two populations. Radio-tracking would increase our understanding of any exchange or movement between these forest blocks that may already be occurring, although there are no records of muriqui crossing the road (J. C. R. de Magalhaes, pers. comm.).

Habitat protection and management on private lands is complicated by the vicissitudes of land tenure and inheritance. As private lands become further subdivided among successive generations of a family, their role as conservation areas becomes problematic at best. Private reserve status in Brazil, as summarized by Fonseca (1983), is not as popular as one would hope because private land owners often doubt that the government will protect the forests once their land is given this status. In some cases, private land owners are simply unwilling to forfeit economic assets, no matter how small, for conservation.

The concept of a federation of private land owners dedicated to the conservation of muriquis and other endemics of the Atlantic forests of Brazil should be explored. For such a plan to be effective would require an education and lobbying campaign that would rely heavily on a sense of pride and aesthetics among private land owners and those who will inherit the land from them.

Although it is clear that only the larger parks and reserves offer hope for the long-term conservation of muriquis, the small and isolated populations on private lands represent important genetic reservoirs and, as such, should be conserved and integrated into a broadly based conservation action plan.

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# Africa

## Status, Distribution and Conservation of the Mountain Gorilla in the Gorilla Game Reserve, Uganda

by Thomas M. Butynski, Samson E. Werikhe and Jan Kalina

The gorilla, *Gorilla gorilla*, is listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973), in Class A of the African Convention on the Conservation of Nature and Natural Resources, by IUCN (Lee et al., 1988) as vulnerable to extinction, and by the U.S. Fish and Wildlife Service (1989) as endangered. Of the three subspecies of gorillas, the mountain gorilla, *G. g. beringei* (Fig. 1), has the lowest numbers and must be considered the most endangered (Vedder, 1987). IUCN (Lee *et al.*, 1988) lists the mountain gorilla as a subspecies in danger of extinction.

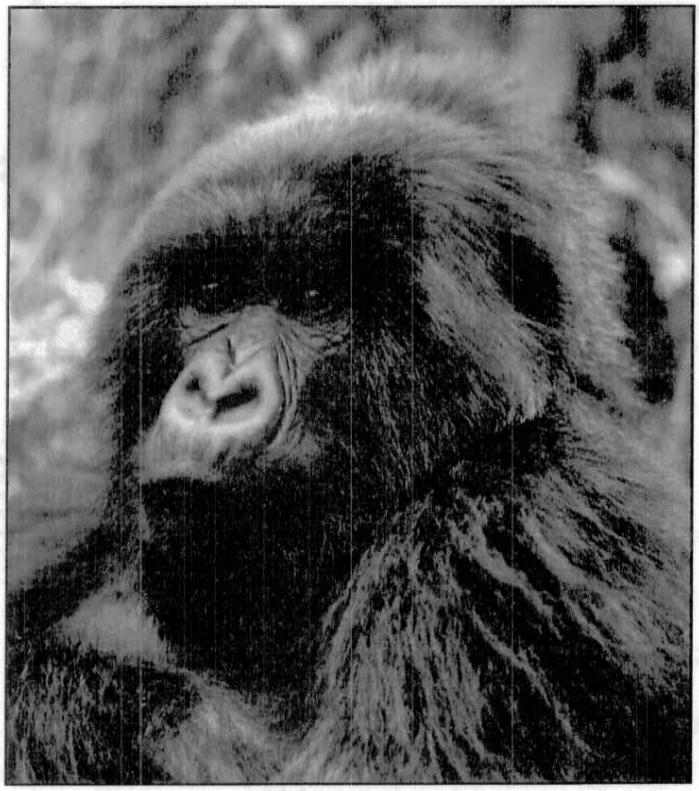

**Fig. 1. The mountain gorilla, *Gorilla gorilla beringei* (photo by Russell A. Mittermeier).**

The mountain gorilla is known to occur in only two populations. The Virunga Volcanoes' population straddles the international boundaries of Rwanda (Parc National des Volcans, 160 km$^2$), Zaire (Parc National des Virunga-Sud, 240 km$^2$) and Uganda. This population numbered about 309 gorillas in 1989 (Sholley, 1990). The 427 km$^2$ area used by this population is conveniently referred to as the "Virunga Conservation Area" (Weber and Vedder, 1983).

Uganda's Impenetrable (Bwindi) Forest (321 km$^2$), located about 25 km north of the Virungas, currently holds roughly 320 mountain gorillas (Butynski, unpubl. data). It is encouraging to note that this last figure, based upon more detailed research, is two to three times higher than previous estimates (Kawai and Mizuhara, 1959; Schaller, 1963; Harcourt, 1981; Butynski, 1984, 1985). Even with this revised figure for the Impenetrable Forest, however, the world population of mountain gorillas is only about 640 animals.

Both the Virunga Volcanoes and Impenetrable Forest gorilla populations are surrounded by some of the most densely settled and intensively cultivated land in Africa (200 people/km$^2$). Hence, both are island populations, isolated from one another and from other areas of suitable habitat.

Several conservationists working in the Virunga Volcanoes have noted that protection was almost entirely lacking in that portion of the Virunga Volcanoes which lies in Uganda, the Gorilla Game Reserve (GGR) - formerly the Kigezi Gorilla Sanctuary/Reserve - and Mgahinga Forest Reserve (MFR) (Harcourt, 1980; Malpas and Infield, 1981; Aveling and Harcourt, 1984; Vedder and Aveling, 1986; Vedder, 1987). Indeed, the GGR has suffered from serious encroachment and high levels of other illegal activities. As early as 1959 it was clear that no longer did any group of gorillas live permanently within the GGR (Kawai and Mizuhara, 1959; Schaller, 1963).

The information available on the boundary changes of the GGR and the MFR is confusing and sometimes incorrect. Data on changes in the number and distribution of gorillas in the GGR and MFR are scattered, sometimes in obscure publications, or remain unpublished. This paper reviews the histories of the GGR and MFR, and what is known concerning the past and present number and distribution of gorillas in these two areas. It also describes recent conservation achievements and current activities, and presents plans for future conservation initiatives in the GGR, particularly as they relate to the mountain gorilla.

### Gorilla Game Reserve and Mgahinga Forest Reserve

The GGR (Zones 1, 2 and 3 in Fig. 2) is located in the extreme southwestern corner of Uganda on the international borders with Rwanda and Zaire, and includes the Uganda portion of three of the Virunga (Bufumbira) Volcanoes - Mt. Muhavura, Mt. Mgahinga and Mt. Sabinyo - (Figs. 3 and 4). The MFR (Zone 1) lies entirely within the GGR and shares a common boundary with it on the east, west and south.

The GGR and MFR were established in 1930 and 1941, respectively (Kingston, 1967; Malpas and Infield, 1981; Yeoman *et al.*, 1990). The two Reserves shared a common boundary until 1951 (Zones 1 and 2 - 33.7 km$^2$). The northern boundary (Line B) approximately followed the 2,450 m contour. In 1951, the MFR was reduced to 23.3 km$^2$ to provide the local people with additional agricultural land. The northern boundary was moved up the slope to approximately the 2,740 m contour (near Line A). Farmers destroyed most of the natural vegetation in Zone 2 sometime between 1954 and 1957 (Donisthorpe, 1959). This settling was illegal since Zone 2 was still part of the GGR. In 1963 the last adjustment to the MFR was made when it was enlarged to 24.5 km$^2$ (Zone 1) and Line A was established as the northern boundary.

The GGR's boundaries remained unchanged until 1964 when its northern boundary was moved down the slope to roughly the 2,280 m contour (Line C). This enlarged the GGR to approximately 47.5 km$^2$ (Zones 1, 2 and 3). The area added (Zone 3 - 13.8 km$^2$) was, however, already largely settled and cultivated (Malpas and Infield, 1981; Yeoman *et al.*, 1990). The people in Zone 3 were never relocated and the new boundary (Line C) was never demarcated. As indicated above, Zone 2 (9.2 km$^2$) was no longer within the MFR and was being settled. An area about 2.5 km$^2$ of former District Council Forest (Fig. 2) lies in Zone 2 on the northern boundary of the MFR (Line A) and is now under the management of both Forest

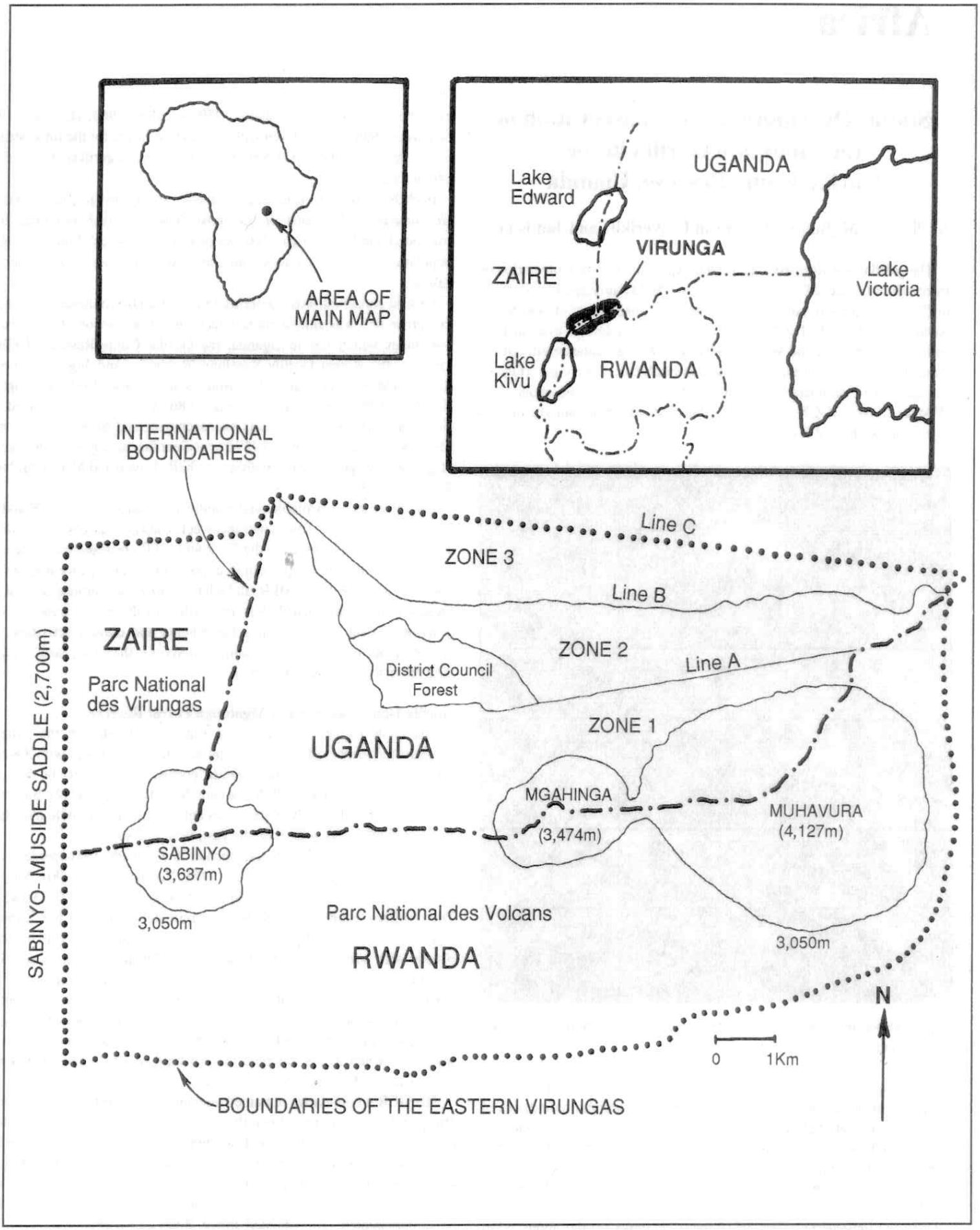


**Fig. 2. The Eastern Virungas Conservation Area centers on the Sabinyo, Mgahinga and Muhavura Volcanoes. Zones 2 and 3 are no longer considered part of the Eastern Virungas Conservation Area since their cover of natural vegetation has been destroyed. Uganda's Mgahinga Forest Reserve lies within Zone 1, while the Gorilla Game Reserve covers Zones 1, 2 and 3. See text for details.**

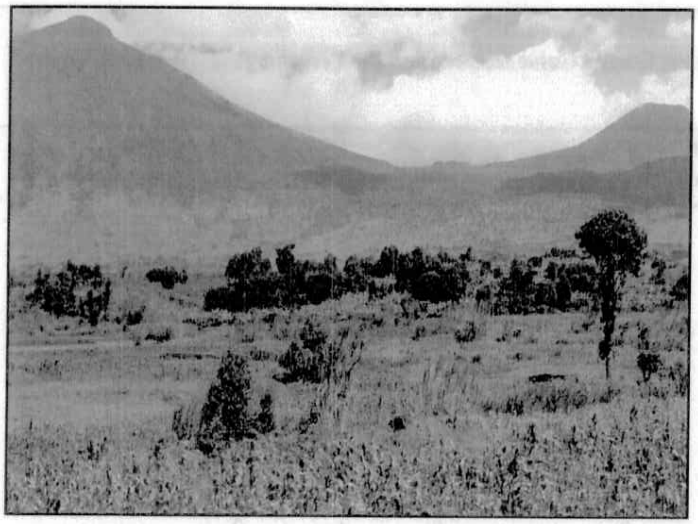

**Fig. 3. Mt. Muhavura and Mt. Mgahinga (photo by Thomas Butynski).**

**Fig. 4. Mt. Sabinyo (photo by Thomas Butynski).**

Department and Game Department.

At the present time, only the MFR (Zone 1) and the former District Council Forest area are covered by natural vegetation (27 $km^2$). All of the remaining 20.5 $km^2$ of the GGR (Zones 2 and 3) have been cleared of natural vegetation and are now intensively cultivated. From about the late 1950s, ever-increasing numbers of people have moved into Zones 2 and 3 (CARE/IFCP, 1990). Since Zones 2 and 3 are still gazetted as part of the GGR, the Uganda Government continues to view the people living there as encroachers.

The GGR and MFR protect a watershed vital to the people of the region (Bufumbira County) and provide them with some firewood, building poles, bamboo and other forest products (Yeoman *et al.*, 1990). The areas have considerable potential for tourism and scientific research. In addition, they protect a large number of plant and animal species endemic to the Albertine Rift (Kalina *et al.*, 1990). The Forest Department Working Plan for the MFR (Kingston, 1967) states that the principal objectives of the Reserve are to protect the soil, water catchment, vegetative cover, and the flora and fauna, particularly the gorilla.

The region has suffered serious overpopulation since at least the 1940s (Kingston, 1967). The 1980 census (Ntozi, 1982) found that this region has 197 people/$km^2$, making it one of the most densely populated rural areas in Africa. As such, there has been considerable pressure on the GGR and MFR by agriculturalists and politicians.

**Censusing Methods**

From February 6-13, 1989, we conducted an intensive census of gorillas throughout the GGR with the assistance of 14 game guards and guides. Most of the guards and guides knew the area well and were excellent trackers with considerable experience locating the night nests of gorillas.

The methods used to census, age and sex gorillas were the same as on previous censuses of the Virunga gorilla population (Schaller, 1963; Harcourt and Groom, 1972; Groom, 1973; Harcourt and Fossey, 1981; Weber and Vedder, 1983; Aveling and Harcourt, 1984; Vedder and Aveling, 1986; Sholley, 1990). In brief, we searched for gorillas in teams of two to five people. Each team walked a predetermined route until a gorilla trail of less than about one week old was found. The trail was then followed to the night nests. Every adult and weaned immature gorilla builds its own nest each night. Almost always the animal sleeping in the nest defecates within or on the edge of the nest. Dung bolus size is correlated with animal size. Counts of the nests and measurements of dung give a good indication of the size and composition of each group (Schaller, 1963). This method does, however, underestimate the number of infants (animals less than one year of age) as their dung is often not present or is covered by vegetation and not seen. Another problem is that young adult males (blackbacks) and adult females have the same size dung bolus and can only be distinguished if the adult female has the dung of an infant in her nest. For the purposes of this report, we combined adult females and blackbacks. Gorillas were placed into one of five age-sex classes (Table 1). These are described by Schaller (1963).

All nest sites were examined by one or more of the authors. We also plotted on a map the locations of the tracks and nests. An attempt was made to count the night nests of each group at least three times. This was not always possible, however, as the gorillas often left Uganda for Rwanda or Zaire before sleeping three nights in the GGR. The GGR was intensively searched for 91 man-days. Excepting infants less than one year of age, we regard this as a complete count of the gorillas present at the time of this census.

From January 1989 through January 1990, S. Werikhe lived in the GGR and closely monitored the gorilla population as part of an ecological survey. He was assisted by seven game guards. The borders with Rwanda and Zaire were checked two to three times each week to see whether any groups of gorillas had entered the GGR. All gorillas entering the GGR were monitored daily. The methods used were the same as described above for the gorilla census. During the ecological survey, 1,597 man-hours were spent searching for gorillas and 522 night nests at 141 sites were examined. This provided considerable additional data, particularly on group size and composition, total number of gorillas using the GGR, areas used and proportion of time each group spent in Uganda.

As part of the 1989 ecological survey, a map of Zone 1, plus the former District Council Forest, was divided into 27 one square kilometer blocks. These 27 blocks included all of the area which remains covered by natural vegetation. All 27 blocks were entered and searched intensively for human use.

**Gorilla Census Results**

During the February 1989 census there were only two groups of gorillas in the GGR. These were the Nyakagezi Group of nine animals and the Sabinyo Group of eight animals (Table 1).

Feeding sites of the Muhavura Group were located near the top of Mt. Muhavura but these were about 1 month old. No nests of this group were found in Uganda, thus no count was made. However, the September 1989 census, organized by the Rwanda Mountain Gorilla Project, found three groups of four, seven and eight gorillas on the Rwanda side of Mt. Muhavura (Sholley, 1990). We do not know which of these three groups

**Table 1. Size and Composition of Gorilla Groups Entering the Gorilla Game Reserve and the Percentage of Time Each Group Spends in the Reserve (January 1989 - January 1990)**

| Group | Adult Males | Other Adults* | Sub-adults | Juveniles | Infants | Total | Percent Time in Reserve |
|---|---|---|---|---|---|---|---|
| Nyakagezi | 1 | 4 | 2 | 1 | 1 | 9 | 42 |
| Sabinyo | 2 | 4 | 0 | 0 | 2 | 8 | 34 |
| Rutagara | 2 | 1 | 0 | 0 | 0 | 3 | 29 |
| Nyabirerema | 2 | 3 | 0 | 0 | 1 | 6 | 15 |
| Rugezi | 1 | 1 | 0 | 0 | 1 | 3 | 13 |
| Mgahinga | 1 | 2 | 1 | 0 | 0 | 4 | 2 |
| River | 1 | 1 | 0 | 0 | 0 | 2 | 1 |
| Muhavura ** | ? | ? | ? | ? | ? | 7? | 1 |
| Rutagara LM+ | 1 | 0 | 0 | 0 | 0 | 1 | 78 |
| Kumuheno LM+ | 1 | 0 | 0 | 0 | 0 | 1 | 43 |
| Total | 12 | 16 | 3 | 1 | 5 | 44 | - |

* Adult females plus blackback males
** Composition not known, size probably seven or eight animals
\+ Lone adult male

entered Uganda near the top of Mt. Muhavura in January, but for the sake of our calculations, we assume it was the group of seven.

The group of four found on the Rwanda side of Mt. Muhavura in September 1989 is likely the same group of four which entered Uganda near the top of Mt. Mgahinga during our 1989 ecological survey. We referred to this group as the Mgahinga Group.

No lone males were located during the census, although game guards insisted that at least one lone male spent most of his time in the GGR.

In summary, during the February 1989 census we found that three groups of gorillas, totalling about 24 animals, were using the GGR. It was clear, however, as already noted by previous workers (Schaller, 1963; Harcourt *et al.*, 1983), that no group spent all of its time in Uganda.

A much clearer picture of the gorilla population of the GGR emerged during the 13-month ecological survey. We now know that a minimum of eight groups of gorillas, totalling about 42 animals, plus at least two lone males, used about 80% of the 27 one square kilometer blocks (Tables 1 and 2). All elevations between 2,330 and 3,620 m were used.

The 44 gorillas using the GGR varied considerably in the proportion of time spent in Uganda. None of the groups or lone males used the GGR exclusively (Table 1). During the period from January 1989 through January 1990, the Nyakagezi and Sabinyo Groups were in Uganda roughly 42% and 34% of the time, respectively. The other six groups spent between 1% and 29% of their time in the GGR.

Figure 5 shows the known home ranges of gorilla groups and lone males in the GGR. No gorillas have been on the Uganda side of Mt. Muhavura since the Muhavura Group came over from Rwanda in January 1989. Likewise, the Uganda part of Mt. Mgahinga was little used by gorillas during 1989. Home range areas in Uganda during 1989 varied from about 700 ha for the Nyakagezi Group to less than 10 ha for the Mgahinga and Muhavura Groups.

Mt. Sabinyo is certainly the stronghold for gorillas in the GGR at this time. A minimun of six groups totalling about 31 individuals, plus at least one lone male, used the Uganda portion of Mt. Sabinyo.

There are some data suggesting that, due to increased protection and reduced human activity in the GGR during 1989/90, gorillas are already using a larger proportion of the GGR than in 1988. For example, no gorillas have been observed on the lower northeastern slope of Mt. Mgahinga since the late 1970s and none are known to have used Zone 2 since 1962 (K.-J. Sucker, pers. comm.). Currently, the Nyakagezi Group forages on the lower eastern slope of Mt. Mgahinga, and this group, and the Rutagara and Kumuheno lone silverbacks, are now entering Zone 2. Also, in June 1990, elephants (*Loxodonta africana*) moved from Mt. Sabinyo to the Muhavura-Mgahinga saddle for the first time in many years (K.-J. Sucker, pers. comm.).

Illegal human activities were found throughout the GGR during the 1989 ecological survey. These included wood and bamboo cutting, cattle grazing, burning and, especially, encroachment, hunting and smuggling. Trespassing and/or smuggling occurred in all 27 one square kilometer blocks. Twelve major footpaths were in use, mostly by smugglers. Approximately 110-140 people per day were using these paths. Poaching and bamboo cutting were noted in 71% and 63% of the blocks, respectively. Firewood removal, beekeeping and livestock grazing were present in about one-third of the blocks. Since early 1989, however, all of these illegal activities have been reduced at least 95%. In addition, about 3 $km^2$ in Zone 1 have been reclaimed from encroachers. At this time, encroachment is limited to Zones 2 and 3.

**Table 2. Comparison of the Results of Gorilla Censuses on Each of the Three Volcanoes of the Eastern Virungas (1959-1989).[a]**

| Place | Year | Number of Groups | Adult Males | Other Adults[b] | Sub-Adults | Juveniles | Infants | Total in Groups | Lone Males | Total Gorillas |
|---|---|---|---|---|---|---|---|---|---|---|
| Muhavura | 1959[c] | 4 | 4 | 13 | 0 | 5 | 12 | 39[d] | ? | ≥39 |
| | 1972 | 2 | 2 | 6 | 1 | 1 | 2 | 12 | 1 | 13 |
| | 1973 | 2 | 2 | 6 | 1 | 1 | 2 | 12 | ? | ≥12 |
| | 1978 | 1 | 1 | 3 | 1 | 1 | 1 | 7 | ? | ≥ 7 |
| | 1981 | 1 | 0 | 3 | 1 | 2 | 1 | 7 | 0 | 7 |
| | 1986 | 2 | 2 | 5 | 0 | 2 | 0 | 9 | 1 | 10 |
| | 1989 | 3 | ? | ? | ? | ? | ? | 19 | ? | ≥19 |
| (GGR)[e] | 1989 | 1 | ? | ? | ? | ? | ? | 7? | ? | 7? |
| Mgahinga | 1972 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1973 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ? | ? |
| | 1978 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ? | ? |
| | 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1986 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| (GGR) | 1989 | 1 | 1 | 2 | 1 | 0 | 0 | 4 | 1 | 5 |
| Sabinyo | 1972 | 8 | 9 | 14 | 3 | 4 | 1 | 31 | 1 | 32 |
| | 1973 | 5 | 6 | 10 | 3 | 4 | 1 | 24 | 5[f] | ≥29 |
| | 1978 | 4 | 4 | 14 | 2 | 1 | 6 | 27 | 1[f] | ≥28 |
| | 1981[g] | 2-4 | 2-4 | 9-15 | 2-3 | 3-6 | 2-5 | 18-33 | 0 | 18-33 |
| | 1986 | 4 | 4 | 12 | 7 | 2 | 3 | 28 | 3 | 31 |
| | 1989 | ? | ? | ? | ? | ? | ? | ? | ? | ? |
| (GGR) | 1989 | 6 | 9 | 14 | 2 | 1 | 5 | 31 | 1 | 32 |
| Totals for Eastern Virungas | | | | | | | | | | |
| | 1959[h] | 4 | 4 | 13 | 0 | 5 | 12 | 39[d] | ? | ≥39 |
| | 1972 | 10 | 11 | 20 | 4 | 5 | 3 | 43 | 2 | 45 |
| | 1973 | 7 | 8 | 16 | 4 | 5 | 3 | 36 | 5 | ≥41 |
| | 1978 | 5 | 5 | 17 | 3 | 2 | 7 | 34 | 1 | ≥35 |
| | 1981[i] | 3 | 2 | 12 | 3 | 5 | 3 | 25 | 0 | 25 |
| | 1986 | 6 | 6 | 17 | 7 | 4 | 3 | 37 | 4 | 41 |
| | 1989 | 9 | ? | ? | ? | ? | ? | ? | ? | 52 |
| (GGR) | 1989[j] | 8 | 10 | 16 | 3 | 1 | 5 | 42 | 2 | 44 |

a. Sources of data:
1959 (Kawai and Mizuhara, 1959)
1972 (Groom, 1973)
1973 (Harcourt, unpublished data)
1978 (Weber and Vedder, 1983)
1981 (Harcourt, unpublished data)
1986 (Vedder and Aevling, 1986)
1989 (McNeilage, unpublished data)
1989 GGR (this study)

b. Adult females plus blackback males
c. These data for both Muhavura and Mgahinga
d. Total includes five (5) unidentified gorillas
e. Number of gorillas in the Gorilla Game Reserve, Uganda
f. Total number of lone males for the Eastern Virungas (data indicating on which volcano they were found are not available)
g. Two groups, one of seven and the other of nine gorillas, were found in the saddle between Sabinyo and Visoki, but it is not known whether they were located within the Eastern Virungas
h. These data for Muhavura and Mgahinga only; no data for Sabinyo
i. Two groups found in the large saddle between Sabinyo and Visoki are not included here as it is unkonown whether they were located within the Eastern Virungas
j. Total includes a group of about seven (7) gorillas from Muhavura for which age-sex data are not available

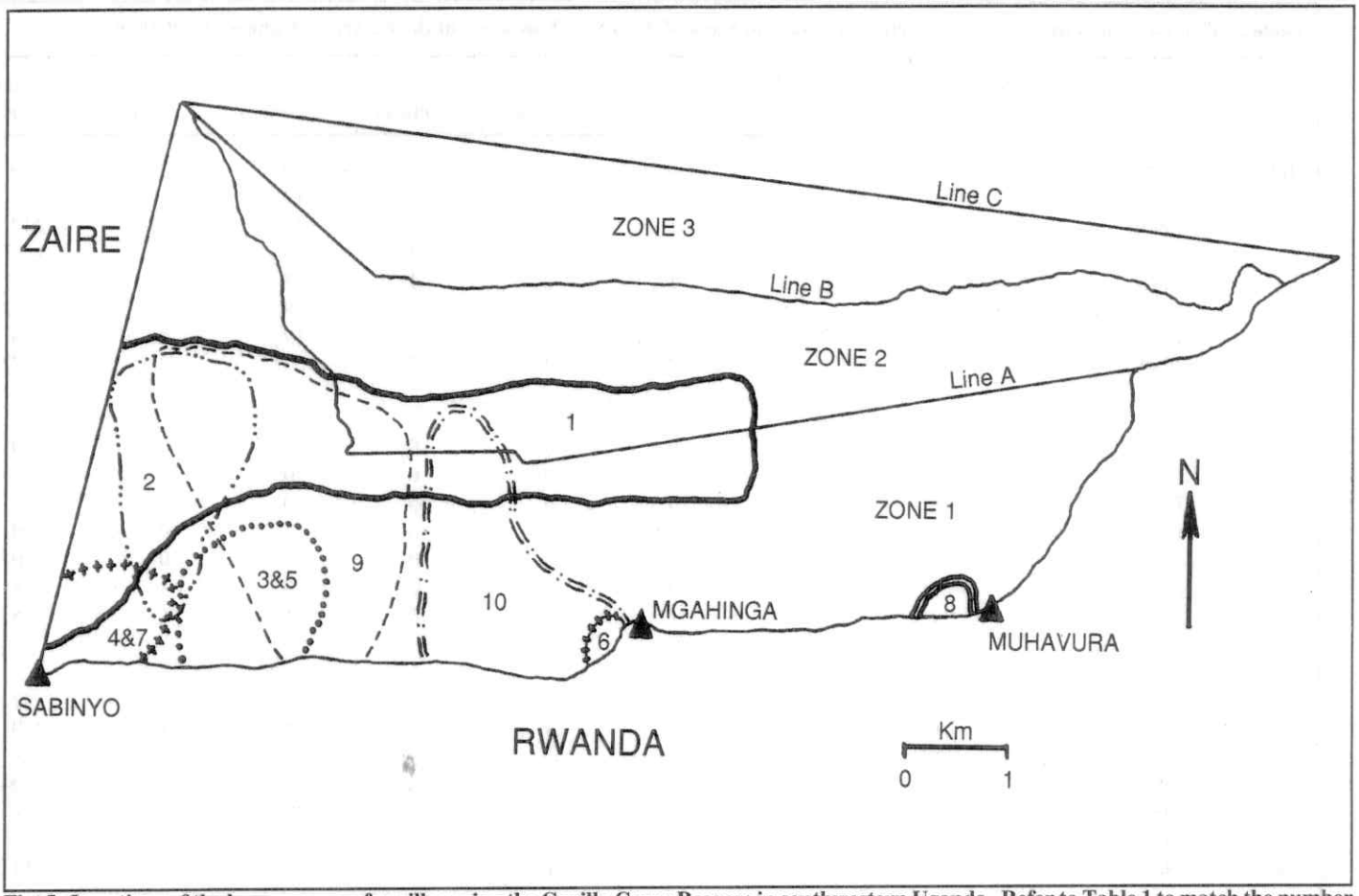


**Fig. 5. Locations of the home ranges of gorillas using the Gorilla Game Reserve in southwestern Uganda. Refer to Table 1 to match the number with the name of the group or lone male.**

**Results of Previous Gorilla Censuses**

There are only fragmentary data on the numbers of mountain gorillas in the GGR prior to 1959 when Kawai and Mizuhara (1959) found 39 gorillas in four groups using the GGR portion of Mt. Muhavura and Mt. Mgahinga. Kawai and Mizuhara spent little time on Mt. Sabinyo and did not survey it above the bamboo zone (*i.e.*, c. 2,600 m).

In 1961 it was noted that only one group of six to seven gorillas was using the Muhavura and Mgahinga portions of the GGR (Baumgartel, 1961). Schaller (1963) reported that, later in 1961, two groups of six gorillas each still entered this part of the GGR from Rwanda.

All of the area covered by natural vegetation on the Muhavura, Mgahinga and Sabinyo Volcanoes in Uganda, Rwanda and Zaire (c. 60 $km^2$) is referred to here as the "Eastern Virungas" (Fig. 2). We take the western extreme of the Eastern Virungas to be the saddle between Mt. Sabinyo and Mt. Muside (2,700 m).

Schaller (1963) suggested that in 1959, 40-50 gorillas in five to six groups used the Eastern Virungas. While the data upon which this estimate is based appear adequate for Mt. Muhavura and Mt. Mgahinga (Donisthorpe, 1959; Kawai and Mizuhara, 1959; Emlen and Schaller, 1960), he apparently had few data for Mt. Sabinyo.

The 31 gorillas in six groups, plus one lone male, found on Mt. Sabinyo during our 1989 ecological survey was surprisingly high. If this number were present on Mt. Sabinyo in 1959, then Schaller's estimate of 40-50 gorillas for the Eastern Virungas was too low by 20-25 animals. That is, the 1959 population may well have been 60-75 animals.

In 1971-72, the first gorilla census of the entire Eastern Virungas was made (Harcourt and Groom, 1972; Groom, 1973). A total of 43 animals in 10 groups, and two lone males, was located (Table 2). Only three to four groups were located in the GGR during this census, but it is likely that then, as now, most of the Eastern Virunga groups found in Rwanda and Zaire also spent time in Uganda (Schaller, 1963). W. Baumgartel reports (K.-J. Sucker, pers. comm.) that, as of 1969, there were no gorillas using the Uganda portion of Mt. Muhavura and Mt. Mgahinga.

In 1973, Harcourt (unpubl. data) found 12 gorillas in two groups on Mt. Muhavura, 24 animals in five groups on Mt. Sabinyo, and five lone males, for a total of 41 gorillas in the Eastern Virungas.

The next census of the Virunga gorilla population was in 1978 (Weber and Vedder, 1983, pers. comm.) when only 34 animals in five groups, plus one lone male, were found in the Eastern Virungas.

In 1981 a fourth census was conducted of the Eastern Virunga gorilla population (Harcourt *et al.*, 1983; Aveling and Harcourt, 1984, unpubl. data). Unfortunately, the data indicating exactly how many gorillas were located on Mt. Sabinyo are not available. We do know, however, that one group of seven animals were found on Mt. Muhavura, none on Mt. Mgahinga, and two to four groups totalling 18-33 gorillas on or near Mt. Sabinyo.

A census in 1986 found 16 gorillas in the GGR. In the Eastern Virungas, six groups were found (37 animals), plus four lone males, for a total of 41 gorillas. It was estimated that at least 29 gorillas used the GGR at that time (Vedder and Aveling, 1986; Vedder, 1989a).

The most recent census of the Eastern Virungas was conducted in September 1989 (Sholley, 1990). Three groups of gorillas (19 animals) were located on Muhavura (all on the Rwanda side), a group of four plus a lone male were found on Mgahinga, and six groups plus a lone male (35 animals) were located on Sabinyo. This total of 59 gorillas is the largest number ever reported for the Eastern Virungas.

**Population Changes**

Considering both the Uganda and Rwanda portions of Mt. Muhavura and Mt. Mgahinga, we see that the number of gorillas (lone males excluded) has changed from at least 39 (four groups) in 1959 to 12 (two groups) in 1972, to seven (one group) in 1978 and 1981, to nine (two groups) in 1986 to 23 (four groups) in 1989 (Table 2).

Information on the number of gorillas (lone males excluded) on Mt. Sabinyo was first gathered in 1972. At that time 31 gorillas (eight groups) were using Mt. Sabinyo. The number of gorillas censused on Mt. Sabinyo was 24 (five groups) in 1973, 27 (four groups) in 1978, 18-33 (two to four groups) in 1981, 28 (four groups) in 1986 and at least 34 (six groups) in 1989 (Table 2). Mt. Sabinyo's population of gorillas seems to be about the same today as in 1972.

Of the 35 gorillas using the GGR (lone males excluded), and for which nests were located during this study, nine (26%) were immatures (Table 1). Although the sample size is small, it is important to point out that this is an unusually low percentage of immature animals (Schaller, 1963; Goodall and Groves, 1977). In 1959, 50% of the 34 known gorillas in the GGR were immature (Kawai and Mizuhara, 1959). In the Virunga population as a whole, the percentage of immature gorillas has ranged from 36% in 1976-78 to 48% in 1986 (Vedder and Aveling, 1986; Aveling and Aveling, 1989) (Table 3). While the low percentage of immatures using the GGR at this time may indicate that this portion of the Virunga population has a low reproductive rate and may not be healthy, the data from the Eastern Virunga censuses show that the percentage of immatures has fluctuated considerably. For example, the 1972 and 1973 censuses found that about 28% of the gorillas were immatures whereas the 1981 census showed that about 44% of the animals were immatures.

**Table 3. Changes in Mean Group Size and Percentage of Immature Gorillas in the Eastern Virungas (1959-1989).**

| Year | Mean Group Size | % Immatures |
|---|---|---|
| 1959 | 9.8 | 50 |
| 1972 | 4.3 | 27 |
| 1973 | 5.1 | 29 |
| 1978 | 6.8 | 34 |
| 1981 | 8.3 | 44 |
| 1986 | 6.2 | 38 |
| 1989 | 5.6 | ? |
| 1989 (GGR) | 5.2 | 24 |

Mean size of the eight groups entering the GGR during this study was about 5.2 gorillas (range 2-9)(Table 3). This is four to five gorillas fewer per group than the mean 9.8 gorillas per group reported for the four groups on the Muhavura and Mgahinga portions of the GGR in 1959 (Kawai and Mizuhara, 1959).

The censuses of the Eastern Virungas indicate that, between 1972 and 1989, the mean group size varied from 4.3 to 8.3 animals. In 1971-73 the mean group size of gorillas in the Virunga population as a whole was 7.9, and this increased to 9.2 by 1986 and remained at 9.2 through 1989 (Vedder and Aveling, 1986; Aveling and Aveling, 1989; Sholley, 1990). Thus, the mean size of groups in the Eastern Virungas in 1989 is considerably smaller than in the Virunga population as a whole.

The Eastern Virungas (c. 60 $km^2$) accounts for approximately 14% of the 427 $km^2$ Virunga Conservation Area. The current density of gorillas in the Eastern Virungas is about 0.92/$km^2$ (59 gorillas/60 $km^2$). This is slightly higher than the 0.72 gorillas/$km^2$ for the Virunga Conservation Area as a whole (309 gorillas/427 $km^2$). About 19% of the gorillas in the Virunga Conservation Area are in the Eastern Virungas.

In 1989, gorillas spent at least 3% of the possible 112,785 "gorilla days" for the Virunga Conservation Area (309 gorillas x 365 days) in the GGR. In other words, at this time, the GGR supports about 3% of the Virunga gorilla population. This is about one half of what one would expect given that the 27 $km^2$ of natural vegetation in the GGR represents about 6% of the Virunga Conservation Area. It appears that the GGR is presently underutilized by gorillas.

In summary, the data suggest the loss of at least 27 gorillas from Mt. Muhavura and Mt. Mgahinga during the period 1959-1972, with most or all of the loss probably occurring from 1959 to 1961. The present gorilla population of the Eastern Virungas, about 59 animals (ten groups plus two lone males), is higher than that in 1972 when there were about 45 gorillas (10 groups plus two lone males). This result is highly encouraging for the survival of the Eastern Virungas' gorilla population, particularly in light of the recent improvements in the conservation of the GGR. The Eastern Virungas appear to have a slightly higher density of gorillas than the more western portions of the Virunga Conservation Area.

**Causes of the Population Changes**

The cause of the rapid drop between 1959 and 1961 in the number of gorillas using Mt. Muhavura and Mt. Mgahinga is not known with certainty. Unfortunately, the gorillas spent most of their time in Rwanda during this period and no observations were made on them once they crossed the border from Uganda.

Prior to 1960 there were no reports of leopards (*Panthera pardus*) killing gorillas in the GGR, although leopards were seemingly common (Blower, 1956; Donisthorpe, 1959; Baumgartel, 1961) and two people were known to have been killed by a leopard in the Muhavura-Mgahinga saddle. Between February 1960 and February 1961, four dead gorillas were found on the Uganda side of Mt. Muhavura and Mt. Mgahinga (Baumgartel, 1961; Tobias, 1961; Schaller, 1963). Three of these - a young female, adult female and adult male - were apparently killed by a large melanistic leopard. In September 1962, the leopard believed to be responsible for the gorilla killings was seen to unsuccessfully stalk a group of gorillas on Mt. Muhavura.

Considering the dense vegetation and rugged terrain where gorillas usually occur, there are a surprisingly large number of references for predation of gorillas by leopards (Schaller, 1963). There is considerable evidence that leopards become "specialists" in their choice of prey (Kingdon, 1977). It seems possible that a large leopard specializing on gorillas, and capable of killing adult males, could have accounted for much of the reduction in the number of gorillas using Mt. Muhavura and Mt. Mgahinga during 1960 and 1961. Baumgartel (1961) felt strongly that leopards were the primary reason for the sudden and dramatic decline in the number of gorillas on Mt. Muhavura and Mt. Mgahinga. The presence of a gorilla-killing leopard in the region may have also caused some gorillas to shift their home ranges westward.

Two other factors which may have adversely affected the gorilla population in the GGR are loss of habitat and disturbance by humans, including the hunting of gorillas. Montane woodland is the preferred habitat of gorillas in the GGR, followed by *Hagenia-Hypericum* woodland. Bamboo is of importance only during the few months of the year when the young shoots are available (Donisthorpe, 1959; Schaller, 1963; Vedder, 1989a). As mentioned above, in 1951 the Forest Department moved the northern boundary of the MFR from about 2,450 m to 2,740 m, excising about 10.4 $km^2$ of what was undoubtedly the best gorilla habitat (montane woodland) in the MFR/GGR (Zone 2 in Fig. 2). See vegetation maps in Schaller (1963), Kingston (1967) and Vedder (1989a). This land was given over to the encroachers.

During the second half of the 1950s, all four of the gorilla groups under study on Mt. Muhavura and Mt. Mgahinga (39 animals) foraged outside of the MFR in the montane woodland of Zone 2 (Donisthorpe, 1959; Kawai

and Mizuhara, 1959). Between 1954 and 1957, most of the montane woodland in Zone 2 was destroyed and it can be assumed that there was a concomitant increase in human activities in Zone 1. By the early 1960s, the farmers had converted all of Zone 2, except the former District Forest Reserve, from montane woodland to agriculture (i.e., approximately 70% of the original 11.5 $km^2$ of montane woodland in the GGR). As of 1961, the gorillas on Mt. Muhavura and Mt. Mgahinga were confining their activities to the MFR (Zone 1) and, increasingly, to the Rwanda side of Mt. Muhavura and Mt. Mgahinga. Coincidently, there was a sudden decline in the number of gorillas using the Uganda portion of Mt. Muhavura and Mt. Mgahinga from about 39 to 12 individuals.

With Zones 2 and 3 currently under cultivation, the only natural vegetation available to gorillas in the MFR/GGR lies in the highest parts of the Uganda Virungas (Zone 1) and the adjoining former District Forest Reserve. This 27 $km^2$ area is composed of about 48% bamboo, 17% *Hagenia-Hypericum* woodland, 14% montane woodland, 9% tree heath, 5% grassland, 5% *Senecio-Lobelia* and 2% swamp-meadow (Kingston, 1967). Due to the small size of the area and the low coverage by preferred vegetation types (montane woodland and *Hagenia-Hypericum* woodland), particularly on Mt. Muhavura and Mt. Mgahinga, these 27 $km^2$ may not be capable of supporting a resident population of gorillas.

The negative impact on gorillas of hunting and uncontrolled human exploitation of their habitat is well documented (Groom, 1973; Goodall and Groves, 1977; Dixson, 1981; Harcourt and Fossey, 1981; Wolfheim, 1983; Aveling and Harcourt, 1984; Vedder, 1987, 1989b). Unhabituated gorillas tend to avoid humans, particularly when they have been hunted or harassed and/or where their habitat has been destroyed. Much of the decline of the Virunga population is directly attributable to the killing of gorillas. As one of the more poorly protected parts of the Virungas, the Eastern Virungas presumably lost its share of gorillas to poachers, particularly during the 1960s and 1970s. Until recently there was a high level of human activity in Zone 1 of the GGR. Most of the activities were illegal.

We conclude that, while the rapid decline in the number of gorillas in the GGR between 1959 and 1961 may have been assisted by an unusual level of predation by leopards, the expropriation of habitat for agriculture, combined with the high level of illegal activities in the GGR during and since the 1950s, was probably the primary cause of the decline in the number of gorillas in the GGR.

**Accomplishments and Present Conservation Efforts**

In mid-1986 the Impenetrable Forest Conservation Project (IFCP) started working with the Uganda Government (primarily Game Department and Forest Department) to improve management and protection of the Impenetrable Forest and GGR, particularly their populations of gorillas. Initially, the focus of the IFCP was on the Impenetrable Forest. This was partly due to insufficient funding and shortage of personnel. Additionally, the Impenetrable Forest had a larger number of gorillas and was in greater need of immediate conservation efforts. Early activities in the GGR were limited to the monitoring of the general situation and providing equipment, moral support and occasional supervision to the game guards.

As illegal activities in the Impenetrable Forest were reduced, the IFCP became more involved in the management and protection of the GGR. In January 1989, the IFCP established a research project in the GGR. S. Werikhe was placed in charge of the day-to-day supervision of the game guards, and began his M. Sc. field work ("Ecological Survey of the Mgahinga Forest"). In December 1989, K.-J. Sucker joined S. Werikhe and a sub-project of the IFCP, the Gorilla Game Reserve Conservation Project (GGRCP), was established. Sucker's primary duties are fund raising, lobbying and providing material and logistic support to the GGRCP and the game guards.

Together, IFCP, GGRCP and the Uganda Government have made considerable progress in developing a broad-based conservation program for managing and protecting the GGR. The following is a summary of achievements during the period January 1989 - September 1990.

1) An ecological survey of the large mammals of the GGR, with a focus on the gorilla, has been completed.

2) The game guard force has increased from three to 13 men and the Game Department has agreed to raise the number to 20. All guards are now much better equipped, trained, disciplined and supervised. As such, they are conducting more frequent and more effective patrols. At least 1,335 wire traps were destroyed (Fig. 6) during the 20 months from January 1989 through September 1990 (K.-J. Sucker, pers. comm.). We are reasonably certain that no gorillas, elephants or buffalo were poached in the GGR during this period. Also of great significance to the conservation of the Eastern Virungas is the fact that nearly all smuggling through the GGR has been stopped. This means that the number of people entering the GGR each day is now but a small fraction of what it was at the end of 1988. Bamboo and firewood theft, livestock grazing and burning have also been virtually eliminated in Zone 1.

**Fig. 6. Bilahuli with traps from anti-poaching patrols (photo by Thomas Butynski).**

3) Encroachers have been removed from 3 $km^2$ of Zone 1. As the lowest part of Zone 1, this is probably the most important area for gorillas in the GGR.

4) A determined move by a tour company to gain complete control over any future tourism activities in the GGR, particularly gorilla tourism, and

to establish a lodge in the middle of Zone 1, has been stopped. It now appears that no tour operator will be permitted to construct a lodge inside the GGR or gain a monoply on tourism.

5) Since May 1989, there has been a complete ban on gorilla viewing in Uganda. This order has provided time for the IFCP and GGRCP to prepare a preliminary tourism development plan for the GGR. This plan has been approved by the Uganda Government and is now being implemented. The gorilla tourism program is modelled after the programs now in operation on the Rwanda and Zaire portions of the Virungas (Aveling and Aveling, 1989; Vedder, 1989b).

6) The IFCP has been lobbying the Uganda Government to upgrade the conservation status of the Impenetrable Forest since 1984 (Butynski, 1984) and the MFR since 1986. In June 1989, Cabinet decided that the MFR (Zone 1 - 24.5 $km^2$) and the Impenetrable Forest Reserve should be degazetted as forest reserves and gazetted as national parks. In August 1990, the Prime Minister confirmed that the two areas would be made national parks. There has, however, been considerable opposition from the Forest Department towards making the Impenetrable Forest a national park (New Vision, 1990). The Forest Department has, however, supported the move to make MFR a national park and, in August 1990, it degazetted the MFR so that it could be gazetted as the Mgahinga Gorilla National Park.

The IFCP and GGRCP have been encouraging the Uganda Government to reclaim Zone 2 (9.2 $km^2$) of the GGR from the encroachers so that the Mgahinga Gorilla National Park takes the same boundaries as the original GGR and MFR (Line B), is increased in size to 33.7 $km^2$ and includes a year-round supply of food for gorillas. One of the Government's primary reasons for establishing this park is to generate foreign exchange from gorilla-based tourism. As such, the IFCP and GGRCP have pointed out to Government that without the 9.2 $km^2$ of potentially prime gorilla habitat afforded by Zone 2, there will probably never be more than two to three groups of gorillas visiting the lower slopes of the volcanoes where they can be more easily viewed by tourists. In addition, it is unlikely that any of these groups will spend more than half of its time in Uganda. Such a situation would not be attractive to tourists determined to see gorillas, nor would it be conducive to the generation of foreign exchange.

Based on the date available for the late 1950s, when gorillas still made some use of Zone 2, we estimate that with Zone 2 incorporated into the new park there will eventually be a minimum of three groups spending 80% or more of their time in this area. Without inclusion of Zone 2 into the park, we can expect only a marginal increase in the utilization of the new park by gorillas.

The main barrier to incoporating Zone 2 into the park is, of course, moving the encroachers out. The present Government, however, now has a clear and effective policy of moving encroachers out of the many protected areas (national parks, game reserves and forest reserves) which were entered during the political, economic and military turmoil of the 1970s and early 1980s. In order to gather information on the encroachers in Zone 2, the IFCP and GGRCP, together with CARE, conducted a socio-demographic survey in June-July 1990 (CARE/IFCP, 1990; Werikhe, 1991). There are approximately 1,773 people in 272 households living in Zone 2, plus about 680 people who cultivate land there but live elsewhere. Of the residents, only 2-3% do not own land outside of Zone 2.

As of September 1990, it appeared that Government would be moving the encroachers out of Zone 2 and gazetting this area as part of the Mgahinga Gorilla National Park.

7) With CARE, the IFCP initiated the Development Through Conservation Project (DTCP). This is a World Wildlife Fund project funded primarily by USAID. It is being implemented by CARE with the cooperation of the IFCP. DTCP is a large, 10-year project with a focus on conducting biological inventories of natural forests, improving land-use practices and promoting agroforestry and conservation education in the areas around the Impenetrable, Mgahinga and Echuya Forests.

It is probable that Zone 3 (13.8 $km^2$) will remain outside of the Mgahinga Gorilla National Park. Zone 3 was never properly demarcated as part of the GGR, and the people living there when it was gazetted were never compensated or moved. Because of this, DTCP plans to focus on Zone 3 and work with the people there to create a substantial buffer zone between the densely populated agricultural lands to the north and the new national park to the south.

**The Future**

The IFCP, GGRCP and DTCP are long-term conservation projects with a focus on the management and protection of the Impenetrable Forest and the GGR. These three projects are working closely together to promote improved conservation and management practices in these forests and in surrounding agricultural areas. In particular, we are cooperating with the Ugandan authorities to collect applied scientific data, develop management policies and plans, and train and support Ugandan students and staff to undertake a broad array of conservation and management activities.

In order to achieve our objectives, we are establishing the Institute of Tropical Forest Conservation, Gorilla National Park Research Station and DTCP headquarters. Strong links have been developed with several Uganda Government ministries, departments and universities, and the support of a large number of international conservation and development organizations and agencies has been obtained.

During the coming two years, we plan to accomplish the following towards the better management of the GGR/Mgahinga Gorilla National Park:

- complete construction of the Gorilla National Park Research Station;
- prepare a preliminary management plan, have it approved by Government and begin its implementation;
- train and equip 20 park rangers and further reduce illegal activities;
- establish a tourism program in the park, and conservation education and agroforestry programs outside the park;
- plant a permanent "live" boundary of trees along the northern edge of the park;
- convert Zone 3 into an effective buffer zone;
- establish a program for monitoring the park's ecology, particularly its population of gorillas, and place two Ugandan M. Sc. students on research projects; and
- obtain Government approval of a gorilla "species recovery plan."

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# Conservation of Chimpanzees in the Budongo Forest Reserve

**by Vernon Reynolds**

Chimpanzees (*Pan troglodytes schweinfurthi*) in the Budongo Forest Reserve (Fig. 1) have been subject to sporadic poaching in recent years. Reports in the Ugandan newspaper, *New Vision*, document the discovery of young chimpanzees in transit at the Entebbe airport, some of which likely originated in the Budongo Forest Reserve. Poachers are known to cross into Zaire with Ugandan chimpanzees, subsequently returning them to Uganda as Zairean imports. Efforts are underway to identify an island sanctuary in Uganda for chimpanzees confiscated in Entebbe, rather than export them to zoos in foreign countries, as did happen in 1990 when four young animals were sent to the Soviet Union.

My original studies of the Budongo chimpanzees were conducted in 1962 (Reynolds, 1963, 1965; Reynolds and Reynolds, 1965). Subsequent research was conducted there by Sugiyama (1968, 1969) and Suzuki (1971a, 1971b, 1975, 1979), and a reassessment of the population was attempted by Albrecht (1976).

The forest itself has also been well studied, in particular by Eggeling (1949), Aldrich-Blake (1970), Friedmann and Williams (1973) and Synnott (1975, 1985), and a series of working plans prepared by the Forest Department give some indication of the pattern of logging in past decades. Budongo has been subject to selective felling over a 60-year period. The effect of logging on forest primates has yet to be studied in Budongo, but was the subject of research conducted in Uganda's Kibale Forest (Skorupa, 1983, 1986, 1988; Johns and Skorupa, 1987). The two forests are actually quite different with respect to composition of common and dominant tree species, which may be due to the higher altitude of the Kibale Forest.

In March-April 1990, with funds from a number of sources including Conservation International, I returned to Uganda to establish the Budongo Forest Project (BFP), accompanied by Ugandan biologist, Christopher Bakuneeta. We established contact with the Uganda Forest, Game and National Parks Departments and with the Zoology Department of Makerere University. The mandate of BFP is to investigate the effects of selective logging on forest primates, and the contribution these primates make to regeneration of the forest. Improved management plans are needed for Budongo, as the projected regeneration of valuable timber trees - especially mahoganies - has been much too ambitious.

Systematic censusing of the forest primates is taking place along transects in eight areas of forest including the area where the project is based, at the Sonso sawmill, accompanied by studies of tree phenology and chimpanzee behavior and ecology. A liaison was also established with the ongoing research program at Kibale, about 150 miles to the south, in an effort to collect comparable data.

Conservation of chimpanzees in the Budongo Forest Reserve can best be discussed in terms of sawmill activity, illegal logging, Forest Department policy, poaching, human population pressure and tourism.

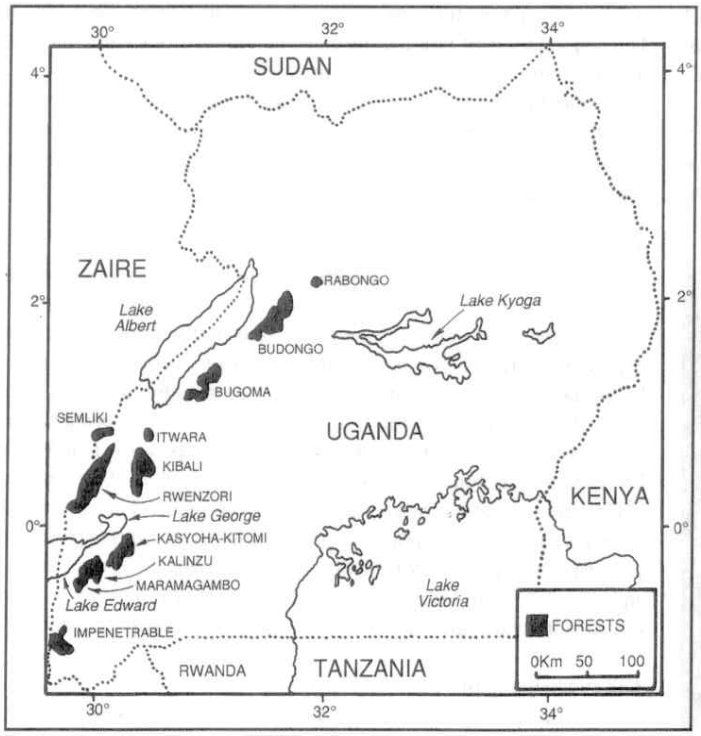


**Fig. 1. Location of Budongo in relation to other major forests in western Uganda (map drawn by Stephen Nash from original provided by the author).**

## Sawmill Activity

There are four sawmills operating in the Budongo Forest. This large number is attributable to the fact that Budongo is Uganda's primary source of mahogany, with four species (*Khaya* - one species; *Entandrophragma* - three species). Budongo Sawmills Ltd., which operates the Sonso site (Fig. 2), is currently rather inactive. The area around this mill has already been selectively logged, the equipment is outdated and the power supply irregular. The main sawmill activity is that of another company, Amaply Ltd., which operates a concession in the northeast part of the forest. It operates a few days a week and processes an appreciable amount of high quality hardwoods. The other two mills are said to be inactive; we did not visit them.

We are now beginning to study the effects of sawmill activity, which is licensed and controlled by the Forest Department, on the forest structure and, in particular, on the chimpanzee's food supply. The effects are likely to be related to the refinement of techniques used, such as the use of chemicals known as arboricides. It is not certain that selective logging always depletes the food supply of frugivorous primates.

## Illegal Logging

Illegal logging camps occur in some areas of the forest. They consist of small wooden-roofed structures in which a small party of people remain sheltered at night during the period of a week or more when they are felling a tree (Fig. 3). Beside such camps are the pit and superstructure used for sawing planks, along with the rejected pieces of mahogany. At a new site, one may find the tree felled but the pit not yet dug. It is said that parties of pit-sawyers sometimes arm themselves with guns, and it is possible that they could become involved in chimpanzee poaching, but we have no direct evidence of this.

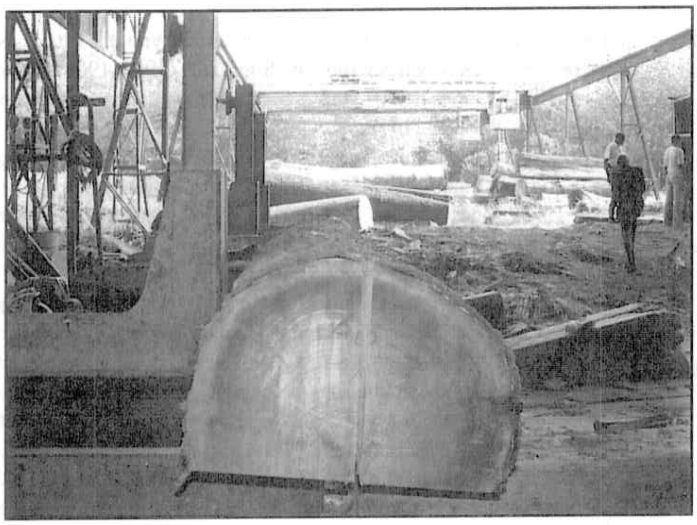

**Fig. 2. Sawmill in operation at the Sonso site in 1990 (photo by Vernon Reynolds).**

### Forest Department Policy

It is no longer part of the Forest Department's policy to poison so-called "weed" tree species, including figs, that have (or had in the past) no value as timber. When my wife and I were studying chimpanzees in Budongo in 1962, we occasionally came across Forest Department personnel with drums of diesel fuel which was mixed with arboricide and then injected into "weed" trees. I am glad to say that practice has now been abandoned.

Mahogany regeneration has to some extent occurred, but not as rapidly or thoroughly as predicted by officers of the Forest Department. Because of the complex interdependence of plant and animal species in the tropics, it may be that mahogany regeneration depends on the presence of other species. In a complex ecosystem, it is often difficult to understand all the interactions between viruses, bacteria, insects, vertebrates and the plant life on which they feed, and so it also is difficult to predict the consequences of selective logging and reforestation schemes. From the perspective of chimpanzee conservation, however, the poisoning policy was something of a disaster, as it was concentrated on some of the species that chimpanzees prefer to eat, most notably figs.

In our discussions with Forest Department personnel, we found a willingness to adopt a conservationist approach, and the Department now employs two full-time Conservation Officers, Mr. Fred Kigenyi, a Ugandan forester, and Dr. Peter Howard, funded by the European Community (EC) as part of the World Bank's Natural Forest Management and Conservation Project. However, it remains the mandate of the Forest Department to provide Uganda with much-needed foreign exchange. While mahogany and other valuable trees remain in the Budongo Forest Reserve, the Forest Department will continue to license sawmills to harvest trees over a certain size (DBH), except in Nature Reserves, which are too small to harbor viable chimpanzee populations.

**Fig. 3. Illegal loggers' camp in the Budongo Forest (photo by Vernon Reynolds).**

The Pabidi area is a zone of virgin forest in the northwest of Budongo in which Forest Department personnel have frequently encountered chimpanzees. It is the next area to be logged by the Amaply company. The only economic alternative to logging suggested thus far has been tourism (see below).

### Poaching

Poaching of wildlife has been common in the Budongo Forest since my original study in 1962. As described by Ghiglieri (1984) for Kibale, at least two of the chimpanzees in our study area are crippled in one hand by snares embedded in their wrists. Nowadays, guns are also used, many of which are still in private hands since the civil war. We were told by local Game Department officials that poaching of medium-sized animals, such as bushbucks and duikers, is most prevalent.

Elephants and buffalo may no longer exist in the Budongo Forest; studies are needed to determine their status. Chimpanzee poaching has undoubtedly occurred in the recent past, and there is little that can be done to stop it beyond the inherent difficulty of smuggling captured animals out of the country. Ugandan authorities are unable to control poaching due to inadequate resources. The presence of research scientists can go a long way to deterring poachers, but associated educational projects are also necessary. The BFP hopes to raise funding for more effective protection of the Budongo Forest and for education of the local people.

### Population Pressure

Since 1962, there has been a great increase in the human population living in and around Budongo. Uninhabited areas that were once covered in elephant grass now have houses and have been converted to banana groves and fields of cassava and sweet potatoes. A bustling market opens twice a week. The population grew through migration from the north during Uganda's period of political turmoil, migration from Zaire and because average family size remains high in western Uganda.

Despite the increasing human population, encroachment into the forest is not yet serious. But it should be expected, and so it is fortunate that the forest reserve's borders are being re-established as part of the EC-funded forest management project.

### Tourism

Experience in Zaire and at other sites where gorilla and chimpanzee tourism projects have been established indicates that the revenue to be gained from this source can greatly exceed that derived from timber exploitation, and is more sustainable. The BFP is currently assisting the Forest Department in an investigation of the possibilities for ecotourism focused on chimpanzees, and chimpanzees in one area are being habituated for this purpose. This part of the forest runs alongside the road leading to Murchison Falls National Park and is therefore well sited for tourism.

Conservation of Uganda's chimpanzees is possible, I believe, if outside agencies continue to support research, education and training projects. The greatest dangers faced by Budongo's chimpanzees are habitat destruction and poaching. If either or both of these activities were to increase significantly, the chimpanzees of this region could easily be exterminated.

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# Nest-building and Population Estimates of the Bonobo from the Lokofe-Lilungu-Ikomaloki Region of Zaire

**by Jordi Sabater Pi and Joaquim J. Vea**

The bonobo (*Pan paniscus*), commonly known as the pygmy chimpanzee (Figs. 1 and 2), is found only in Zaire and was the last species of chimpanzee discovered and described. Due to a series of interesting behavioral and morphological traits, this species has fascinated human evolutionary theorists since the 1930s (Coolidge, 1933; Simons, 1972; Zihlman *et al.*, 1978; Johnson, 1981).

In recent years, several field studies dealing with the ecology and behavior of these primates in their natural habitats have been conducted, concentrated on the regions of Wamba (Kuroda, 1979, 1980; Kano, 1980, 1982; Kitamura, 1983; Kano and Mulavwa, 1984), Lomako (Badrian and Badrian, 1977; Badrian et al., 1981; Badrian and Malenky, 1984), Yalosidi (Kano, 1983), and Lake Tumba (Horn, 1980).

Our investigations, focused on the behavioral ecology of these little-known primates, were carried out in Zaire's Lofoke-Lilungu-Ikomaloki region, District of Ikela, Equateur Province (Fig. 3). Pygmy chimpanzees, because of religious and superstitious beliefs, are not hunted or captured in this region, which permits prolonged study under favorable conditions.

The principal objective of the first phase of this work was to determine the population density of *Pan paniscus* in the study area, describing at the same time the ecological characteristics of its habitat and the modifications made by the human inhabitants. Given that in the Lokofe-Lilungu-Ikomaloki area the chimpanzees are not hunted or captured, the human influence is indirect and based principally on competition for space and other resources.

**Study Area**

The study site is an area of approximately 72 km$^2$ between the Ikela-Lokofe-Ikomaloki highway and the Tshuapa River. The site has a gentle slope from the road down to the river, forming part of the right bank of the valley excavated by the Tshuapa in sedimentary clays and laterites typical of the central Zaire basin. Numerous watercourses create small ravines, the most important of which is the Elankata, which flows in an east-southeast direction with its tributary, the Loshuku. The field camp is located in the town of Lilungu-Nongoyansomi at 1° 7' 36" S, 23° 31' 28" E in the Ikela District (Fig. 4).

Twenty-four human settlements are distributed along the road that joins the plantation of Lokofe with Ikomaloki, the administrative center of the zone. The censused population of villages that have an influence on the study area is 1,421. The villages are separated from each other by a mean distance of 1.41 km.

The effect of the human population on the forest is manifest in various activities. Although there are no permanent settlements in the forest, there are some ephemeral hunting camps and fishing camps on the banks of the Tshuapa River. People use the forest, principally in the proximity of the

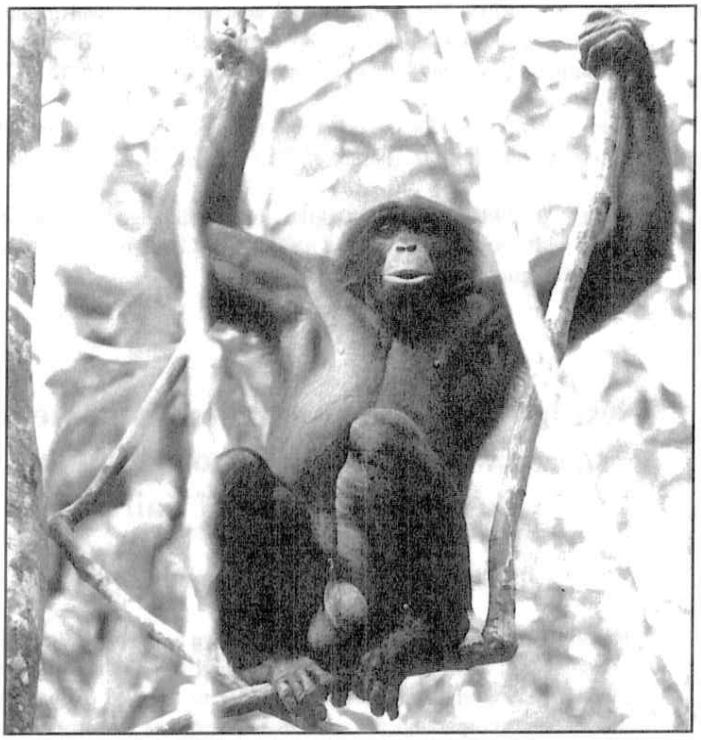

Fig. 1. Male bonobo, *Pan paniscus* (photo by M. Colell).

Fig. 2. Female *Pan paniscus* (photo by M. Colell).

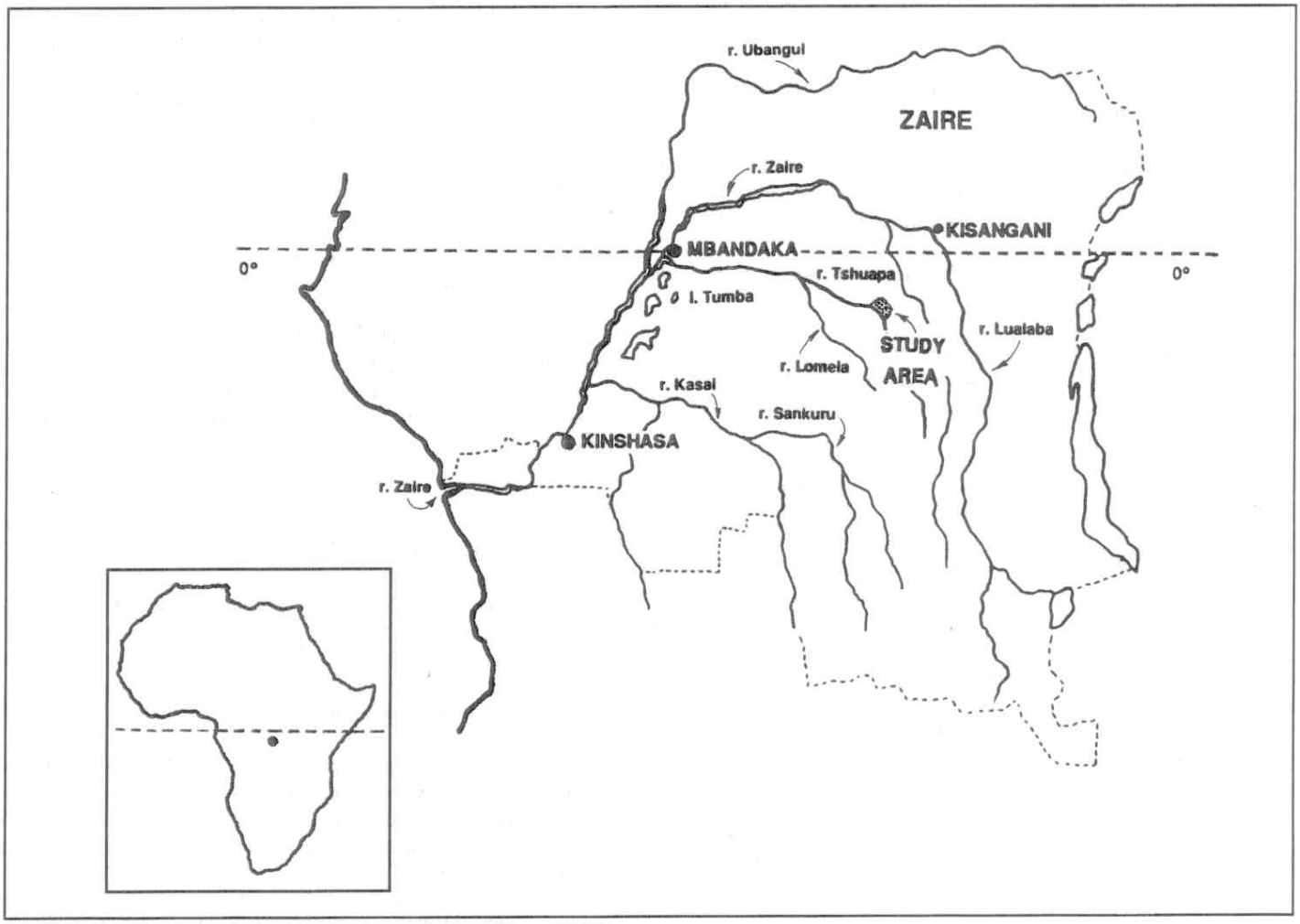


Fig. 3. Location of the Lilungu study area in Zaire (map provided by authors).

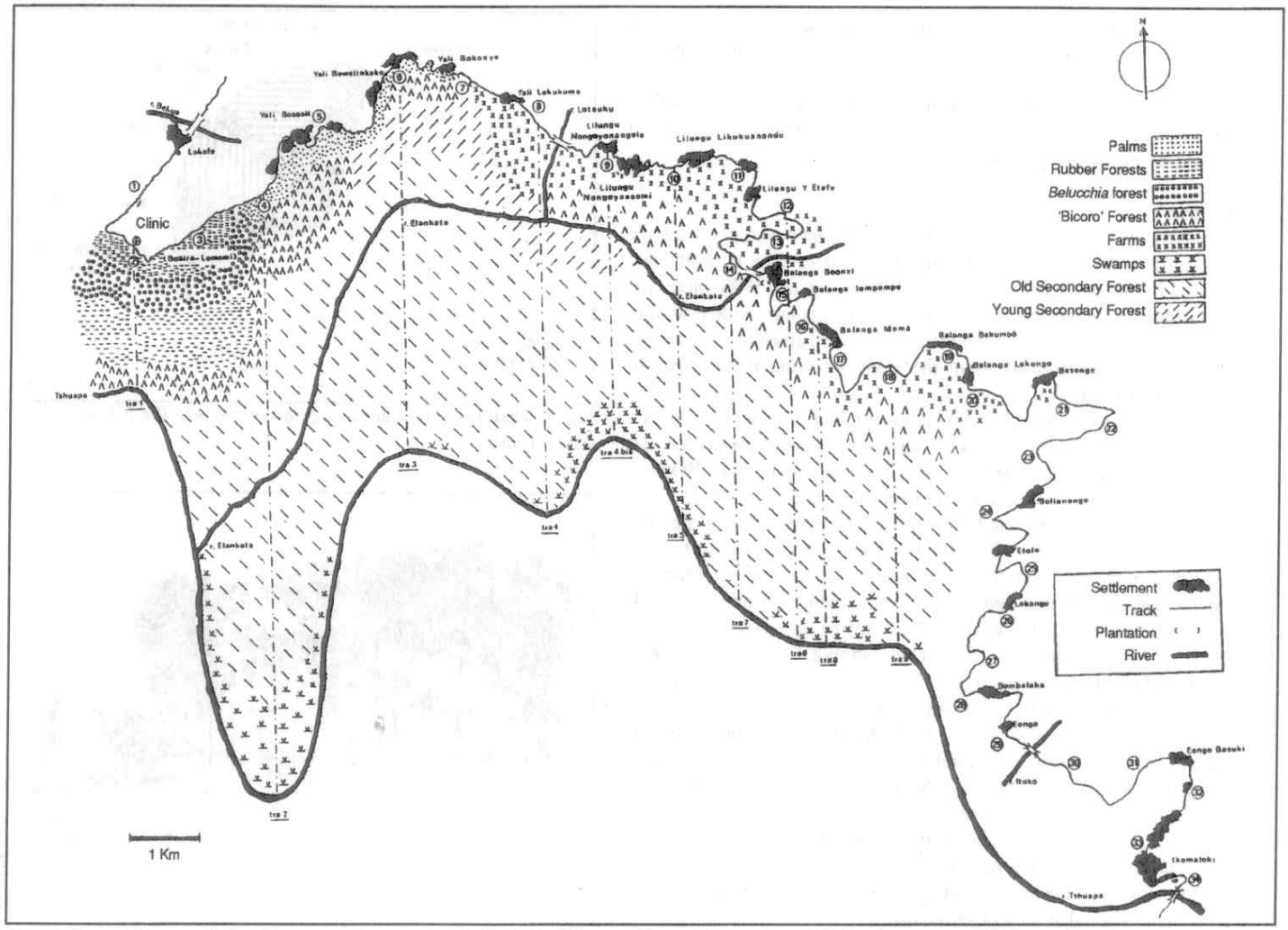


**Fig. 4. Detailed map of the Lilungu study area in the Lokofe-Lilungu-Ikomaloki region of Zaire (map provided by authors).**

villages or along marked paths, mainly for the collection of firewood, fruits and other materials of plant origin. Fishing is infrequent and almost never for one's own consumption. Cassava and coffee are the principal crops, some old rubber plantations still exist, and sugar cane and oil palm are planted in some areas.

Hunting and trapping are the most important human activities affecting wildlife in the study area. We noted the use of 27 different types of traps, set preferentially in degraded forest near settlements. During August and September 1989, a total of 1,048 traps was inventoried in the forest areas to the south of the villages of Lokofe, Yali, Lilungu, Bolianongo, Lokongo, Balanga and Eongo (Fig. 4). During this period, the traps were successful in capturing 15 species of mammals (four of them primates), four reptile species and three bird species.

The meteorological data collected during our study are typical of Equateur Province and consistent with results presented by other investigators (Badrian and Malenky, 1984; Kano and Mulavwa, 1984). There were 150 days of rain from November 1988 to December 1989, with mean monthly precipitation of 141.8 mm; total precipitation for the period was 1,984.7 mm. The maximum precipitation falls between October and December. Temperatures throughout the period of study varied between a minimum of 19.5° C and a maximum of 39° C, with a mean minimum of 22.8° C and a mean maximum of 32.7° C.

The study area contains 72 km$^2$ of forest situated between the highway and the river. The habitats within this forest can be divided into the following categories (listed in order of decreasing size):

**1. Old secondary forest** - The differentiating characteristics of the old secondary forest are the dense understory, greater tree height and the diversity of tree species, with the initial appearance of large lianas.

**2. Cultivated areas** - The most important food crops, planted in rotation, are cassava and coffee; other small plots are dedicated to crops like sugar cane, corn, rice, etc.

**3. Early successional forest (Bikoro)** - This is the first stage of forest regeneration after cultivated areas are abandoned. Herbaceous and rapidly-growing tree species dominate, including *Musanga cecropoides*, *Vernonia* sp., *Myrianthus* sp. and *Aframomun* sp.

**4. Young secondary forest** - This type of secondary forest is the stage that follows early successional forest. Tree species are tall and rapid growing, with an understory rich in climbing palms, Marantaceae, lianas and a large number of epiphytic cryptogams. The most common tree species in this zone are *Sconodophleus zantieri*, *Annonidium manslii*, *Leonardoxa romii*, *Polyalthia mavedens*, *Musanga cecropoides*, *Vernonia* sp., *Anthocleista* sp. and *Dialium* sp. (Sabater Pi, 1984).

**5. Oil palm** - One of the most widely cultivated species in the area, it is used to produce cooking oil.

**6. Rubber forest** - Stands of rubber trees (*Hevea brasilensis*) are present in a state of semi-cultivation or totally abandoned. In the latter case they are mixed with rapidly-growing species characteristic of the first stage of forest regeneration.

**7. *Beluccia* forest** - Near Lokofe there is a large area dominated by arborescent *Beluccia aubletti*, a species introduced for cultivation during the colonial period. The Lokofe *Beluccia* forest undoubtedly represents abandoned plantations.

**8. Swamps** - Along the margin of the Tshuapa River, and to a lesser

extent along the Elankata, there are portions of inundated forest with species characteristic of the banks of large rivers and swamps, and with few arborescent species.

Figure 5 provides an estimate of the relative surface area occupied by each vegetation type identified in the study area; Figure 6 provides a pictorial profile of the different forest types.

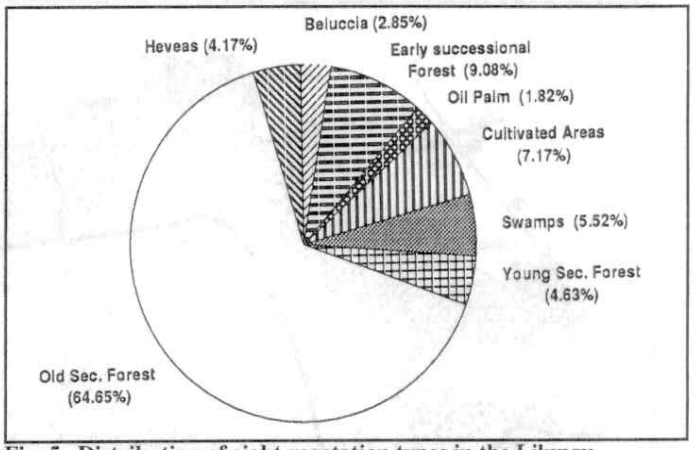


**Fig. 5. Distribution of eight vegetation types in the Lilungu study area.**

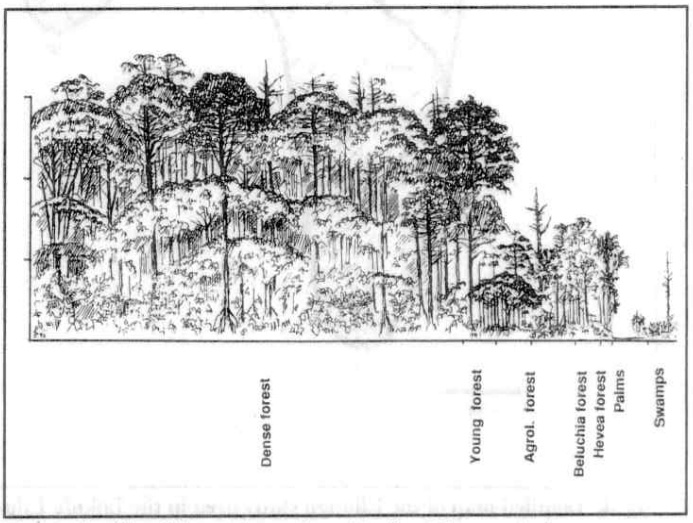


**Fig. 6. Profile of forest types found in the Lilungu study area.**

## Methods

We estimated the density of *Pan paniscus* in the study area from the results of a nest census, using a transect technique. The method used, proposed by Anderson *et al.* (1979) and Burnham *et al.* (1980), notes the sighting distance of the nest, from which one can calculate the detectability of nests. This method was considered appropriate, given the differences between vegetation formations in the study area and the consequent variation in visibility.

The position of the transects was predetermined by tracing lines in a north-south direction from the Lokofe-Ikomaloki highway at intervals of 2 km, ending the transect at the Tshuapa River (Fig. 4). In total, 50 km of transects were conducted in 72 $km^2$ between the road and the river.

For each nest observed, the following data were recorded: 1) sighting distance (distance between the nest and the point along the transect where it had been seen); 2) perpendicular distance to the transect (distance between the transect line and the nest, measured perpendicularly); 3) distance from the start of the transect to the site of the nest; 4) vegetation type (Fig. 7); 5) height of the nest above the ground (Fig. 8); 6) distribution of the nest in and between trees (Fig. 9); 7) diameter of the tree(s) used; and 8) species of tree(s) in which nest was constructed (Fig. 10).

The data were analyzed using the TRANSECT computer program (Laake *et al.*, 1979) to obtain an estimate of nest density. In order to make this calculation, a conceptual model that relates the data to nest density is necessary. The probability of detecting a nest decreases with distance from the transect line, and we can estimate the probability of observing a nest at a given distance from the transect line (Burnham *et al.*, 1980). The estimate of this function and the application of techniques of statistical inference provide a density value for a given sample.

Estimation of nest density permits calculation of population density for *Pan paniscus* by applying the formula used by Ghiglieri (1979, 1984) and Tutin and Fernandez (1983):

$$N/km^2 \times 1/DUR \times 1/EO \times 1/N\text{-}CH\text{-}D \times CH/CH\text{-}N = CH/km^2$$

where:

N = number of nests recorded

DUR = mean duration of a nest in days (until it is unrecognizable)

1/EO = efficiency of observation

CH = number of chimpanzees

N-CH-D = number of nests built by a chimpanzee in a day

CH-N = number of chimpanzee nest builders

For the purposes of this study, $N/km^2$ represents nest density determined by the TRANSECT program. In assigning a value to 1/DUR, it is necessary to know how long a nest can be identified as such before it disappears. Ghiglieri (1979, 1984) and Tutin and Fernandez (1983) determined a mean duration of 110 and 113 days, respectively. We used the higher number in our calculations.

The efficiency of observation, 1/EO, is counted in the estimate of nest density through calculation of the function of detectability and its use as the basis of the statistical inference.

A population estimate for chimpanzees based upon an estimate of nest numbers is also based upon the frequency of nest construction and must consider the reuse of nests already constructed. In areas where chimpanzees have been provisioned, this practice has been observed (e.g. Goodall, 1965, 1968), but it is possible that this is an artifact of abnormal chimpanzee density around the food distribution points. In this study, provisioning was not a factor and we consider that the reuse of nests is rare and insignificant. Construction of day nests, although uncommon, has been observed and may result in an overestimate of the chimpanzee population. It is sometimes possible to distinguish diurnal nests from nocturnal ones by poorer construction of the former type. For the purposes of this study, we have assumed that each chimpanzee constructs a maximum of one nest per 24-hour period, giving D a value of 1.

CH/N-CH-D is introduced to account for non-adults not constructing nests. The population structure in *Pan troglodytes* gives a mean relation of 1.2141 between the total population size and those individuals that build nests (Ghiglieri, 1984). Comparable data for *Pan paniscus* have yet to be obtained.

Another possible source of error, repeatedly observed (Kuroda, 1980), is that pygmy chimpanzees sometimes share nests. The utilization of nocturnal nests by adult pairs would result in an underestimate of population based on the number of nests. Unfortunately, we do not know the proportion of nests shared.

## Results

Analysis with the TRANSECT program and on the Fourier transfor-

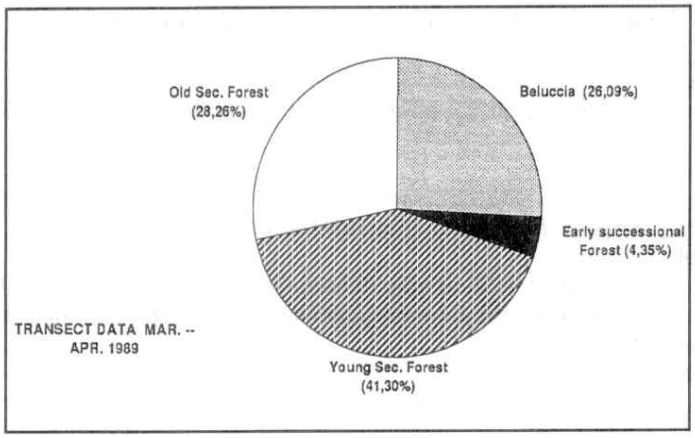


**Fig. 7. Percentages of *Pan paniscus* nests found in four types of forest.**

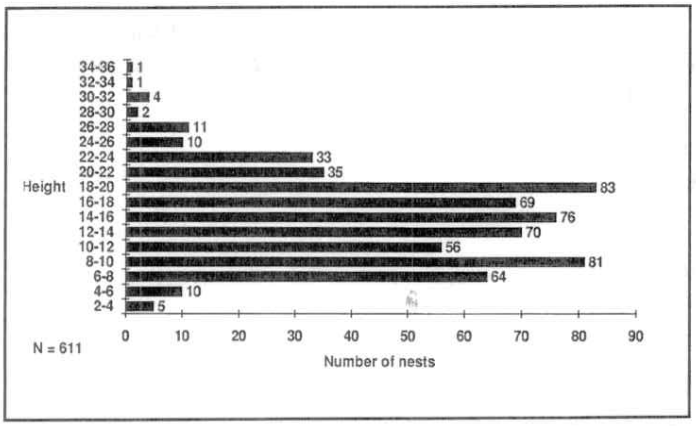


**Fig. 8. Height above ground of *Pan paniscus* nests in the Lilungu study area.**

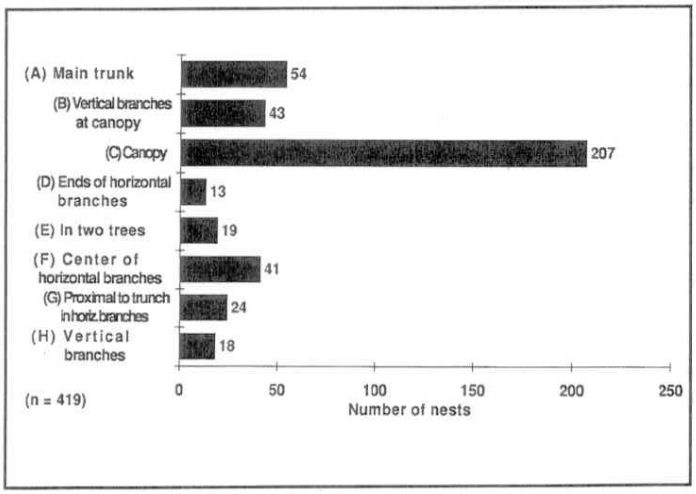


**Fig. 9. Distribution of *Pan paniscus* nests in trees.**

mation (Crain *et al.*, 1978) gives a value of 40.0 nests/km$^2$, with a 95% confidence interval of 25.2-54.7 and a standard error of 7.52 for the 50 km of transect. Using this value yields an estimate of 0.43 chimpanzees/km$^2$ and a total population of 31 chimpanzees in the 72 km$^2$ study area.

$$N/km^2 \times 1/DUR \times 1/EO \times 1/N\text{-}CH\text{-}D \times CH/CH\text{-}N = CH/km^2$$

$$40 \times 1/113 \times 1 \times 1 \times 1.214 = 0.43$$

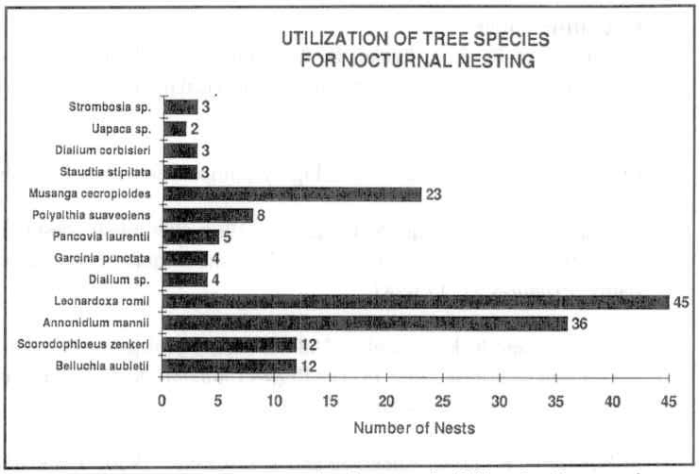


**Fig. 10. Utilization of tree species for nest building by *Pan paniscus*.**

In fact, the absolute number of chimpanzees may be underestimated using this formula. For one thing, it is necessary to consider that only 28.3% of the nests sited were detected in advanced secondary forest, which covers 64.7% of the area examined; the remainder (71.7%) were observed in 16.6% of the study area, including early successional forest, areas of *Beluccia* and, most importantly, young secondary forest (41.3% of the nests).

## Conclusions

The region of the Lokofe-Lilungu-Ikomaloki (Ikela District) in Zaire, where we have completed two years of study concerning the behavior and ecology of the bonobo or pygmy chimpanzee (*Pan paniscus*), is of importance to the conservation of this species because the species is neither hunted nor captured there. This situation has permitted investigations centered on pygmy chimpanzee social structure, their use of different vegetation types, their relation with humans and other species that share their habitat, geographic dispersion, food habits, activity cycles, etc. It has been possible to conduct this work without any type of behavioral manipulation, such as supplementing their diet artificially.

We think that it is important to protect this small population of pygmy chimpanzees because its outlook for survival, which is dependent on a fragile system of local beliefs and superstitions, may change for cultural reasons, including nutritional imperative.

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# Asia

## Survey of Nilgiri Langurs and Lion-tailed Macaques in Tamil Nadu, South India

By Gottfried Hohmann and F. S. Wesley Sunderraj

Nilgiri langurs (*Presbytis johnii*) and lion-tailed macaques (*Macaca silenus*) are endemic to the southern parts of the Western Ghats, a mountain chain running along the southwestern coast of India. Ever since the alarming report by Green and Minkowski (1977), *Macaca silenus* (Fig. 1) has become well known as one of the world's most endangered primates, assumed to number only a few hundred animals in the wild. Recent census data reveal that the first evaluations were too pessimistic (Karanth, 1986). However, because of the limited extent of suitable habitat and fragmentation of the wild population, the status is still considered highly endangered. Evaluations of the status of *Presbytis johnii* (Fig. 2) were made by Daniel and Kannan (1967), Kurup (1975) and Oates (1979). While more flexible in its habitat requirements than *Macaca silenus*, the Nilgiri langur faces severe pressure from poaching because certain parts of its body are believed to have medicinal value.

**Fig. 1. Lion-tailed macaque, *Macaca silenus* (photo by Gottfried Hohmann).**

**Fig. 2. Nilgiri langur, *Presbytis johnii* (photo by Gottfried Hohmann).**

Recently, the authors undertook independent field studies of these two species. F.S. W. Sunderraj studied feeding ecology and ranging patterns of Nilgiri langurs, while G. Hohmann collected data on vocal communication of lion-tailed macaques, Nilgiri langurs and sympatric species. In addition, joint surveys were conducted in selected forests of Tamil Nadu between January and October 1987, and again by G. Hohmann in March and April 1989.

### Study Areas

The areas selected for this study belong to four different hill tracts (Fig. 3). Surveys were conducted in undisturbed and moderately degraded forests within protected areas, as well as in heavily degraded forest areas outside protected zones (Figs. 4-6).

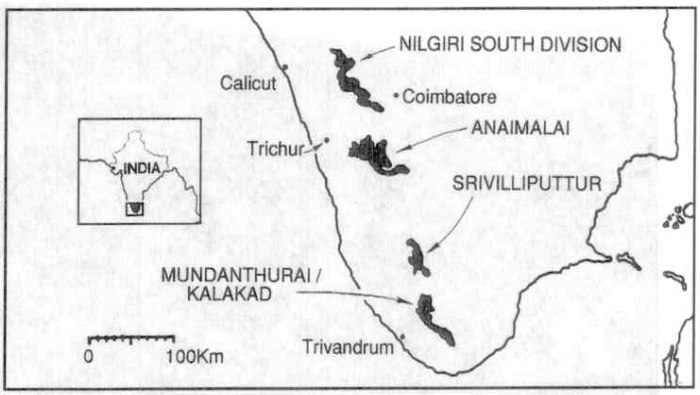


**Fig. 3. Location of the four areas in southwestern India where surveys were conducted.**

**Mundanthurai/Kalakad:** These two wildlife sanctuaries are located in the Agastyamalais or Ashambu Hills, the southernmost part of the Western Ghats. The area contains a number of small- to medium-sized plantations (tea, coffee, cardamon) and several hydroelectric projects. Nevertheless, because of the high number of endemic plant species and the comparatively low degree of habitat destruction, it has been suggested that the area be declared a Biosphere Reserve (Henry *et al.*, 1984). Both sanctuaries form a continuous forest tract of more than 750 km$^2$ and border on the Neyyar Wildlife Sanctuary of Kerala.

**Srivilliputtur:** The Srivilliputtur Reserve Forest is part of an area known as the Megamalais. Located on the eastern slopes of the South Cardamon Hills, it borders the Periyar Tiger Reserve of Kerala. At the time of data collection (September 1987), cattle grazing, poaching, fuelwood collection and other human encroachment were common, and these have already caused severe damage to the entire region.

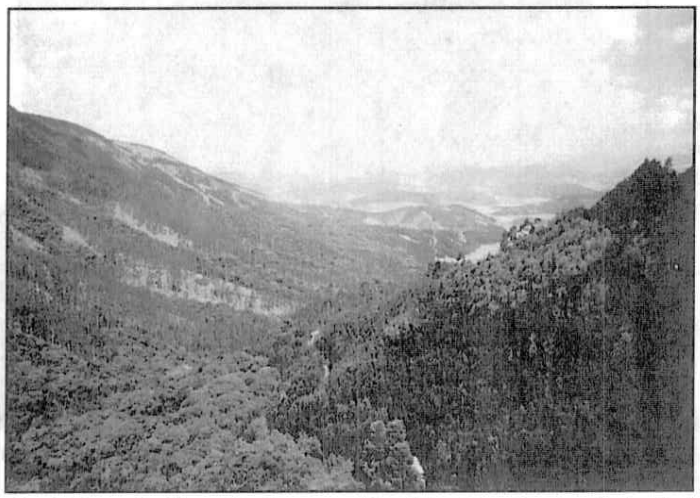

**Fig. 4. Degraded forest in the area of Srivilliputtur showing the typical mosaic of natural vegetation -right and center - and forest plantations - left (photo by Gottfried Hohmann).**

**Anaimalai:** Except for the Nilgiri Biosphere Reserve, the Anaimalais contain the largest area of protected forest in this region. Two wildlife reserves, Parambikulam (Kerala) and Anaimalai (Tamil Nadu) cover an area of more than 2,500 km$^2$. Surveys were conducted in the Ulandhi Range, which consists of a mosaic of teak plantations and a mixture of relatively undisturbed dry deciduous, mixed deciduous and evergreen forests.

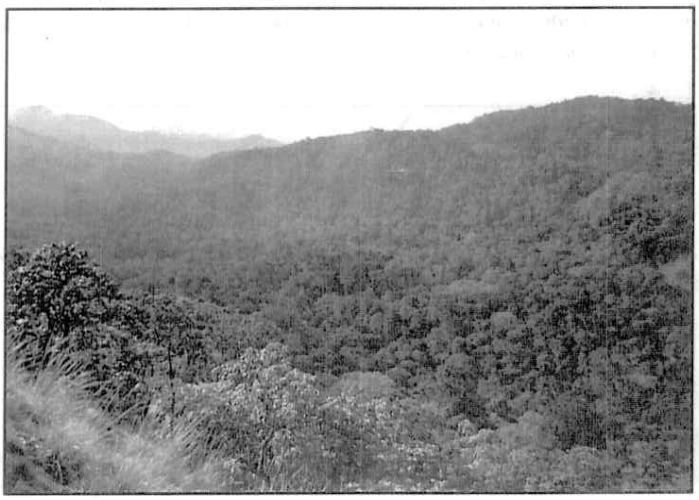

**Fig. 5. Undisturbed *shola* forest in the Anaimalai Wildlife Sanctuary (photo by Gottfried Hohmann).**

**Nilgiri South Division:** This area is part of the 7,000 km$^2$ Nilgiri Biosphere Reserve. Surveys were conducted at two sites, Nilambur and Ambarambalam, which are characterized by a mosaic of relatively undisturbed montane rain forest, grassland and forest plantations of teak, eucalyptus and wattle.

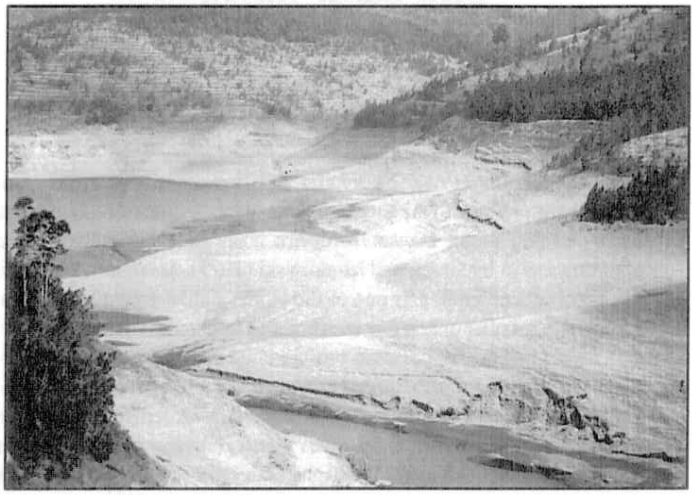

**Fig. 6. Severely degraded habitat at Avalanche, Nilgiri South Division (photo by Gottfried Hohmann).**

## Methods

Since time did not permit systematic transect line or plot investigations, we chose to follow existing trails connecting tribal settlements or other camps. The trails crossed a variety of forest types between 200m and 2,000m in altitude. Surveys were conducted on foot by groups of two to four observers, counting only primate groups actually seen. A total distance of 480 km was covered during the survey, not including repeated walks along the same trails nor walks through unsuitable habitats. A group was recognized as different from its neighbor by: a) difference in time and location of the encounter during a continuous walk along a given trail, b) our ability to identify marker animals, and c) previous knowledge of a particular group and its home range and territory.

For *Presbytis johnii*, leader males of mixed groups utter loud calls, a species-specific vocalization that carries distances of one kilometer or more. Estimates of population densities by using vocal cues have been made for gibbon species (e.g., Chivers, 1974; Marsh and Wilson, 1981; Kappeler, 1984). The method has been described in detail by Brockelman and Ali (1987) and is based upon systematic and repeated counts of vocal events within a given time interval. The formula for calculating population density is **Density =n/p(m)A**, where **n** is the number of loud calls heard during a particular time interval, **p(m)** is the proportion of groups expected to participate in the vocal bout and **A** is the estimated hearing range. For assessments of the vocal activity of a single male and the probability that a male participates in the early morning vocal bout, we used data collected during a field study on habituated groups of two local populations (Hohmann, 1989). The hearing range was calculated according to topographic maps of the respective areas.

## Results

The results of surveys of 35 different trails are shown in Table 1. Out of 177 groups of *Presbytis johnii*, 18 groups were all-male bands (single males were considered to represent an all-male band). All other groups (159) were mixed, containing at least one adult male and more than one mature female. In *Macaca silenus*, only one single male was recorded. However, the adult sex ratio within mixed lion-tailed macaque groups (1:3.8) indicates that, as in other species, the proportion of mature males living outside mixed groups is probably higher than the survey would indicate.

There are significant differences in group size between these two species.

**Table 1. Results of Trail Surveys**

| Name of Location/Trail | Distance Covered (km) | Number of Groups(Animals) *P. johnii* | *M. silenus* |
|---|---|---|---|
| **1. Agastyamalai** | | | |
| Chinabulle Estate | 8 | 4 (17) | 1 (14) |
| Chinabulle-Kodamadai | 12 | 3 (13) | 1 (5) |
| Kodamadai-Valayar | 14 | 9 (44) | 1 (17) |
| Valayar Estate | 14 | 3 (18) | none |
| Karayar-Kanikkati | 6 | 5 (33) | none |
| Kanikkati Estate | 9 | 3 (8) | 1 (16) |
| Kannikati-Kandampari | 12 | 4 (21) | 2 (15) |
| Kandamparai-Kodamadai | 20 | 7 (17) | none |
| Kannikati-Kudaravatty | 17 | 8 (29) | 1 (11) |
| Singampatti Range | 43 | 9 (55) | 4 (41) |
| Sengaltheri-Keelmanimuttar | 10 | 8 (33) | none |
| Sengaltheri-Kakachi | 11 | 5 (13) | 3 (29) |
| Sengaltheri-Mansholai | 14 | 3 (7) | 1 (11) |
| Sengaltheir-Kularatty | 4 | 3 (7) | none |
| Naraikadu Estate | 16 | 7 (37) | none |
| | 210 | 81 (352) | 15 (159) |
| **2. Srivilliputtur** | | | |
| Mudaliyaruthu-Upper Chittar | 18 | 1 (4) | none |
| Mudaliyaruthu-Chinabuttu | 6 | 1 (4) | none |
| Chinabattu-Veiar Valley | 20 | 3 (12) | none |
| Chinabattu-Rockveduthai | 14 | none | none |
| Mudaliyaruthu-Lower Chittar | 5 | 1 (7) | none |
| | 63 | 5 (27) | none |
| **3. Anaimalai (Ulandhi Range)** | | | |
| Varagaliyar-Manampalli | 15 | 23(144) | 1 (9) |
| Anaigundi Shola | 5 | 6 (61) | 1 (12) |
| Kurampaliyar Shola | 20 | 8 (45) | 1 (15) |
| Koliampti Shola | 10 | 8 (50) | 1 (6) |
| Varagaliyar Shola | 7 | 12(104) | 3 (47) |
| Panatiyar Shola | 14 | 10 (79) | 2 (30) |
| Top Slip Range | 6 | 10 (86) | none |
| Ambolian-Varagaliya | 18 | 5 (25) | none |
| | 95 | 82(594) | 9 (119) |
| **4. Avalanche (Nilgiri South Division)** | | | |
| Resthouse Area | 4 | 3 (16) | none |
| Resthouse-Avalanche | 4 | 1 (8) | none |
| Resthouse-Bhavani Camp | 26 | 3 (29) | none |
| Resthouse-Mandu | 6 | 1 (10) | none |
| Mandu-Ellarambuhalla | 14 | none | none |
| Lakkadi-Kolari | 10 | 1 (9) | none |
| Kolari-Thalaikund | 8 | none | none |
| Thalaikund-Bhavani Camp | 5 | none | none |
| | 72 | 9 (72) | none |

*Presbytis johnii* was found to live in smaller groups (mean = 7.6, range: 4-24) than *Macaca silenus* (mean =11.6, range: 5-21). Sightings of Nilgiri langur groups were much higher on all trails by comparison to lion-tailed macaques. The trails used during our surveys were either those used by elephants or paths cut by local people to connect plantations and settlements. In both cases, the vegetation along trails was largely secondary growth with a relatively open canopy. This may represent a preferred habitat for *Presbytis johnii*.

The figures for Nilgiri langurs from our trail surveys are in general accord with earlier estimates made by Oates (1979). From the data presented here and the preliminary information from other locations (e.g., Periyar, Eravikulam and Silent Valley), it becomes clear that the majority of *Presbytis johnii* are concentrated in the protected areas of two different hill tracts (Anaimalai and Agastyamalai) south of the Palghat junction (Table 2). Here, population density may be as high as 36 animals/km$^2$. North of the Palghat junction the species is confined to a few pockets in the extreme

south of the Nilgiri Hills while the range of *Macaca silenus* extends to areas north of the Sharavati River (Karanth, 1985). This is puzzling, as it suggests that the absence of *Presbytis johnii* in the central part of the Western Ghats is not due to a lack of suitable habitat. From our own observations and other reports it is known that these areas are inhabited by *P. entellus*. In contrast to the Nilgiri langur, which is hunted for meat and other purposes, *P. entellus* is well protected by religious taboos. It could be suggested that the current distribution pattern represents secondary invasions by a competing species (*P. entellus*) into areas where Nilgiri langurs have been exterminated.

The distribution of Nilgiri langurs corresponds well with the status of protection of the respective areas surveyed. Populations living outside protected areas have been reduced by poaching and habitat destruction. Within wildlife sanctuaries and national parks, some local tribes still use traditional trapping methods for capturing langurs. However, the fact that population densities within these protected areas remain high suggests that this practice is not a serious threat.

The number of *Macaca silenus* groups sighted during our survey in Mundanthurai/Kalakad, 24 (see Tables 1-2), corresponds well with data published by Green and Minkowski (1975) and indicates that the population may have remained stable during the last decade. The fact that a high number of lion-tailed macaques was found in only one range of the Anaimalai Wildlife Sanctuary (one third of the total area) suggests that this population may have been underestimated in the past.

**Table 2. Estimates of *Presbytis johnii* Population Densities in the Four Areas Surveyed**

| | Study Areas | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Number of Groups/Km (trail survey) | .39 | .76 | .08 | .15 |
| Mean Group Size | 4.36 | 7.24 | 5.40 | 8.00 |
| All-male/Mixed Group Ratio | 1:10 | 1:14 | 0* | 1:9 |
| Number of Groups/Km (acoustic survey) | 1.88 | 2.08 | .52 | .18 |
| Estimated Population Density (Groups/Km$^2$) | 1.98 | 2.15 | .52 | .29 |
| Extension of Potential Habitat (Km$^2$) ** | 650 | 600 | 150 | 800 |
| Estimated Population | | | | |
| Number of groups | 1,290 | 1,288 | 79 | 232 |
| Number of Individuals | 5,625 | 9,325 | 426 | 1,856 |

Study areas: 1) Mundanthurai/Kalakad
2) Anaimalai
3) Srivilliputtur
4) Nilgiri South Division

* : all groups encountered were mixed
** : calculation of extension of potential habitat is based on information from official Forestry maps

Comprehensive programs for the conservation of lion-tailed macaques have been recommended (Green and Minkowski, 1975; Kumar, 1985; Southwick *et al.*, 1986) and also cover the needs of the Nilgiri langur to some degree. A major recommendation resulting from our survey is that more attention be given to actual problems and opportunities that exist at the local level. One example is the logging of dead bamboo for paper production inside the *shola* forests of Anaimalai and other tracts inhabited by *Macaca silenus*. Road construction for transport and the building of worker camps have caused severe damage to these forests. Appeals to local forest officials elicited a positive response, and in one of the most sensitive areas there should not be any further extraction.

A new tendency of habitat transition in cardamon plantations along the border between Mundanthurai and Kalakad is another reason for concern. Traditionally, a cover of natural vegetation was used to protect the soil and shade cardamon crops. With high proportions of trees of the genera *Cullenia*, *Palaquium* and *Litsaea*, these plantations provided sufficient habitat to support reasonable numbers of lion-tailed macaques, Nilgiri langurs and other forest-dwelling animals. The area concerned connects two large forest tracts and thus is the major migration route for many large mammals, including both primate species discussed here. To meet the increasing demand for fuelwood, there is now a trend to replace these semi-natural groves with fast-growing, often exotic species, like eucalyptus and wattle, which are of no value to most native species. Immediate action is advisable to prevent further degradation of this important forest corridor.

The prospect for the survival of these two endemic primates in the wild is actually better today than it was a decade ago. The Srivilliputtur Reserve Forest has become a wildlife sanctuary and the former Mundanthurai Wildlife Sanctuary has been upgraded to the status of Tiger Reserve. Greater public awareness, better administration and improved wildlife protection can be credited with these achievements. Most of the leasing contracts of cardamon plantations in the interior of Mundanthurai are due to expire in the near future, and some have already been abandoned. If this trend continues, the majority of the rain forest of this hill tract will become free of human settlements.

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# PRIMATE MISCELLANY

## Ebola Virus in Monkeys Shipped from the Philippines to United States

The World Health Organization (WHO) has been notified by the U.S. Center for Disease Control (CDC) that Ebola (EBO) virus has been isolated from at least three shipments of *Cynomolgus* monkeys imported from the Philippines into the United States in February 1990. The flights of these shipments were across the Pacific through Tokyo and Taipei.

There have been no reports of human illness associated with these infected monkeys. The normal incubation period in humans is only a few days, and thus there appears to be no immediate danger of illness to those who were exposed to those infected shipments during transport.

Ebola is an African haemorrhagic fever virus which is classified as biohazardous because of its high mortality rate in humans (55-90%). The virus has never caused human disease outside of Africa. We know little about the natural history (i.e. transmission, reservoirs, etc.) of this virus, but it appears related to Marburg (MBG) virus which, in 1967, caused a small but severe outbreak (25% case fatality rate) in Europe among animal handlers and researchers working with African *Cercopithecus* monkeys (i.e. African green monkeys) imported from Uganda.

In December 1989, WHO learned of the isolation and identification of two distinct viruses concomitantly circulating in a group of monkeys recently imported from the Philippines via Amsterdam into the U.S. The viruses were EBO and simian haemorrhagic fever virus, a pathogen only for monkeys. By the end of 1989, epidemiological investigations revealed that EBO virus had been isolated from at least two separate shipments of monkeys imported (in October and November, 1989) into the U.S. from the Philippines.

The source of the infection is still not known. However, the current report of contaminated shipments in February 1990 means that at least five separate shipments over the last six months have yielded EBO virus. This argues against contamination of the monkeys during transport or quarantine. Investigations are continuing in hopes of identifying the source.

Investigations have been underway since the initial outbreak of EBO virus in monkeys in late 1989. These reveal that between 5-15% of monkeys imported from various countries into the U.S. have antibodies to EBO. This includes animals from the Philippines, but also from other countries. One interpretation of this is that there are multiple strains of EBO virus circulating in monkey populations around the world. If this is so, the question remaining is whether these strains are as highly communicable and/or pathogenic as the original African strains.

Clinical symptoms of EBO infection include fever, progressive sore throat, maculopapular rash, abdominal pain and bleeding from multiple sites, with progression in most patients to death. There are no antiviral drugs available, and no licensed vaccine exists.

Groups working with nonhuman primates should be vigilant for unusual morbidity or mortality in their animals. New U.S. guidelines developed in response to the EBO problem were recently reprinted by WHO as background information for countries reviewing procedures on handling and transportation of primates. The WHO can coordinate testing of any additional suspect specimens. Point of contact is WHO, Communicable Diseases Division, Geneva, Switzerland.

## Orang Oetans: De laatste bosmensen?

**by**
**Herman and Ans Rijksen (1988)**

A large format, 207-page book on orangutans, with an emphasis on Gunung Leuser on Sumatra, extensively illustrated with color photographs (Fig. 1). It emphasizes orang ecology and behavior, but with much additional information about the forest environment, other inhabitants, and the conservation challenge. In Dutch. Published by Natuur & Techniek, Maastricht/Brussel.

## New International Primate Studbooks

The IUCN/SSC has approved two new international studbooks for primate species, the mongoose lemur (*Lemur mongoz*) and pygmy loris (*Nycticebus pygmaeus*). Both are listed as Vulnerable in the Red Data Book.

Michael Clark of the London Zoological Society proposed a studbook for the mongoose lemur. The trend in captivity has been one of declining population, going from 156 animals in 34 collections in 1977 to 85 animals in 23 collections in 1987. A July 1989 survey gathered new demographic and reproductive data on the captive population. Seventeen of 25 institutions responded, and it appears now that at least 60 mongoose lemurs (34/28) are now held in 11 collections, with breeding occurring only at the Duke University Primate Center and the Philadelphia Zoo. There is currently an effective breeding population of 14/10 individuals, based upon an unrelated founder stock of 9/7 animals.

Radoslaw Ratajszczak of Poland's Poznan Zoo proposed a studbook for the pygmy loris. This species is presently maintained by at least 10 zoos and scientific institutions, five of which have reported breeding: Moscow, Poznan, Stockholm and San Diego Zoos and the Duke University Primate Center. However, breeding successes to date have been somewhat incidental or the result of importing pregnant females from the wild.


## New Primate Stamps

New primate stamps have recently been produced by Honduras, Djibouti, Brunei, Malaysia and Japan. They are illustrated in Figs. 2-6.



BRUNEI DARUSSALAM
TARSIER
Tarsius bancanus
60 SEN
20 SEN
90 SEN


日本郵便
NIPPON
120
鳥獣人物戯画
INTERNATIONAL LETTER WRITING WEEK 国際文通週間 1990

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All manuscripts should be typewritten and double-spaced with generous margins. Please indicate, in parentheses near the title, the month and year the manuscript was completed. Abstracts are not to be used, footnotes are to be avoided (except for tables or figures), and subdivision titles (such as Methods, Conclusions) are not necessary. Tables are welcome if they provide additional information and do not repeat information given in the text. Please give all measurements in metric units. Please accent all foreign words carefully. 'Literature Cited' should be an alphabetical list of only those publications cited in the text, and should be in the following style:

Example journal article:
Struhsaker, T. T. 1972. Rain-forest conservation in Africa. *Primates* 13:103-9.

Example article in book:
Goodall, A. G. and C. P. Groves, 1977. The conservation of eastern gorillas. In: *Primate Conservation*, Prince Rainier of Monaco and G. H. Bourne, eds. Academic Press, New York, pp. 599-637.

Example book:
Hershkovitz, P. 1977. Living New World Monkeys (Platyrrhini). Vol. 1. Univ. of Chicago Press, Chicago.

Example dissertation:
Homewood, K. M. 1976. Ecology and behavior of the Tana Mangabey (*Cercocebus galeritus galeritus*). Unpubl. Ph. D. thesis, Univ. of London, London.

**Maps**
Please refer to maps in this issue as a guide to style. Maps should always be made as concise as possible and should include an inset showing the location of the area discussed in relation to its home country or continent. If you want us to produce the map for your article, please provide adequate reference material (i.e., rough sketches and photocopies of published maps).

**Photographs**
Black and white prints are ideal. Original color slides from which we can make prints are also acceptable. However, please send only sharply focused, high-quality slides and photographs. Please label each slide with a photgrapher credit and number identifying the caption. Captions should be listed on a separate sheet, or after Literature Cited. We will also consider publishing color illustrations if they add a great deal to the contribution in question. Furthermore, we are always interested in receiving high-quality photographs for our covers, especially those of little known and rarely photographed primates, even if they do not accompany an article.

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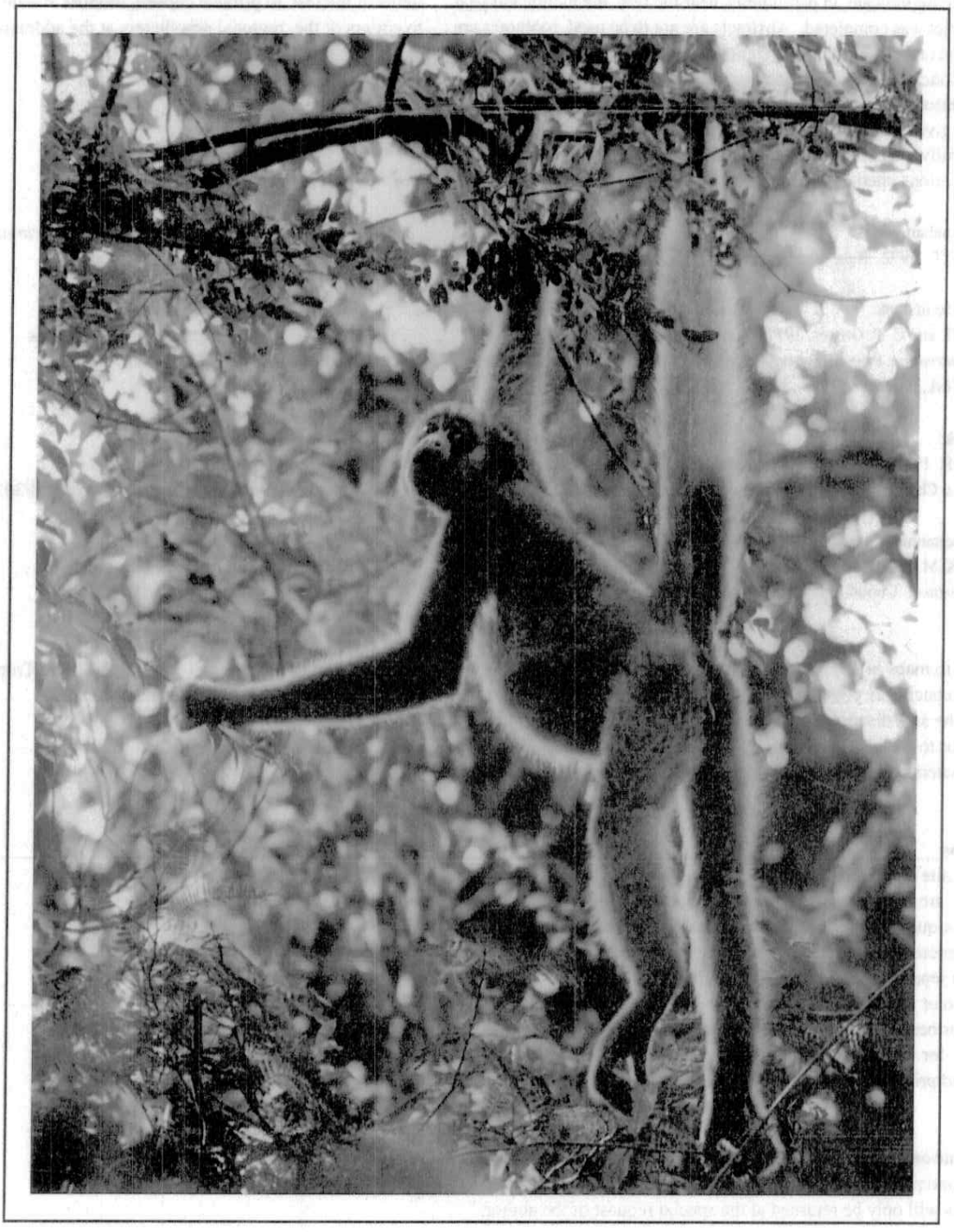

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**Back cover. Muriqui *(Brachyteles arachnoides)* from the Caratinga Biological Station at Fazenda Montes Claros in the forest zone of the state of Minas Gerais, Brazil (photo by Andrew Young). This animal is another representative of the Minas Gerais population of muriquis discussed in the article by Lemos de Sá *et al.* on pp. 26-30.**