Primate census and habitat evaluation in the Tana delta region, Kenya

P. K. Muoria, G. M. Karere, N. N. Moinde and M. A. Suleman

Institute of Primate Research, National Museums of Kenya, Karen, Nairobi, Kenya

Abstract

Nineteen indigenous forest patches in the Tana River delta region, Kenya were surveyed between October and November 2000 for primates and habitat disturbance. Special emphasis was placed on the endangered Tana River red colobus (*Procolobus rufomitratus* Peters) and crested mangabeys (*Cercocebus galeritus galeritus* Peters), both of which are endemic to the region. Habitat disturbances evident in the forests included cutting of trees, harvesting of thatching material, firewood collection, dyke construction, cultivation, palm wine tapping and charcoal burning. A total of 85 groups of five primate species were counted. These comprised eighteen, ten, 22, 31 and four groups of red colobus, crested mangabey, baboons (*Papio cynocephalus* L.), sykes monkeys (*Cercopithecus mitis* Wolf) and vervet monkeys (*Cercopithecus aethiops* L.), respectively. A wider distribution of red colobus and crested mangabeys than was documented previously was noted, implying that they are probably more abundant than hitherto reported. It is hypothesized that extensive studies on some fauna considered endangered world-wide would probably redefine their conservation status. Future studies in the lower Tana River region should cover the previously unsurveyed forests and focus on ways of curbing forest destruction.

Key words: endangered primates, group density, habitat disturbance

Résumé

En octobre et novembre 2000, on a surveillé les primates et les perturbation de l' habitat dans dix-neuf îlots de forêt indigène de la région du delta du fleuve Tana, au Kenya. On a spécialement fait attention au colobe bai du fleuve Tana (*Procolobus rufomitratus* Peters) et au cercocèbe à crête (*Cercocebus galeritus* Peters) qui sont tout deux endémiques de la région. Les perturbations de l' habitat, évidentes dans la forêt, comprennent des coupes d'arbres, la récolte de matériau pour les toitures, le ramassage de bois de feu, la construction de digues, des cultures, la récolte de vin de palme et la préparation de charbon de bois. On a dénombré un total de 85 groupes appartenant à 5 espèces de primates. Ils comprenaient 18 groupes de colobes bais, 10 de cercocèbes à crête, 22 de babouins (*Papio cynocephalus* L.), 31 de cercopithèques à diadème (*Cercopithecus mitis* Wolf) et 4 de grivets (*Cercopithecus aethiops* L.), respectivement. On a noté une distribution plus importante de colobes bais et de cercocèbes à crête que ne le rapportaient de précédentes études, ce qui signifie qu' ils sont probablement plus nombreux qu'on ne l'avait noté jusqu'alors. On émet l' hypothèse que des études approfondies de certaines espèces considérées comme étant en danger à l'échelle mondiale conduiraient probablement à en redéfinir le statut de conservation. De nouvelles études dans la région de la basse-Tana devraient couvrir les forêts jusque-là non étudiées et s' intéresser aux moyens d' infléchir la destruction de la forêt.

Introduction

Tana River forests are home to eight primate species (Butynski & Mwangi, 1994). These include the endangered Tana River red colobus (Pro*colobus rufomitratus* Peters) and crested mangabey (*Cercocebus galeritus galeritus* Peters), both of which are endemic to the region. The need to conserve these two primate species and the biodiversity of their unique riverine forest habitats necessitated the establishment of Tana River Primate National Reserve (TRPNR) in 1976. They are endangered due to

Correspondence: Mbaruk A. Suleman, Division of Ecology, Conservation and Diseases, Institute of Primate Research, National Museums of Kenya, PO Box 24481, Karen, Nairobi, Kenya. Tel.: +254-2-882571/4; fax: +254-2-882546; e-mail: takaungu@hotmail.com

the continued destruction of their habitats (IUCN, 1996). Previous studies have shown that habitat destruction can lead to decline in primate populations (Gillespie *et al.*, 1999; Steic & Overdorff, 1999) and even to their extinction (Yongzu *et al.*, 1989; Boinski, 1994). It is therefore important that distribution and population sizes of the endangered primate species are monitored regularly to develop effective long-term conservation and management strategies.

Other primate species found in the lower Tana River forests are the lowland sykes monkey (*Cercopithecus mitis* Wolf), vervet monkey (*Cercopithecus aethiops* L.), yellow baboon (*Papio cynocephalus* L.), garnett's galago (*Otolemur garnettii* Ogilby), senegal galago (*Galago senegalensis* E. Geoffroy) and Zanzibar galago (*Galago zanzibaricus* Matschie). A number of primates are often important agricultural pests (Masau & Strum, 1984; Fortham-Quick, 1986; Else, 1991; Boulton, Horrocks & Baulu, 1996; Naughton-Treves *et al.*, 1998; Naughton-Treves, 1998; Siex & Struhsaker, 1999; Hill, 2000; Saj, Sicote & Paterson, 2001). The crop raiding activities of primates can lead to the affected human communities having negative attitudes towards conservation, thus jeopardising the long-term survival of the endangered species and their habitat. Therefore, data on the number and the distribution of all primate species in the Tana delta area is needed for the formulation of appropriate conservation and management strategies.

Tana River red colobus and crested mangabeys have been censused in the past to determine their distribution and population sizes (Groves, Andrews & Horne, 1974; Andrews, Groves & Horne, 1975; Homewood, 1976; Marsh, 1978, 1986; Ochiago, 1990). In 1994, Butynski & Mwangi (1994) surveyed the two endangered species and other primates inside and outside of the TRNPR. However, not all the forest patches in the lower Tana River were surveyed during that year. In our study, we additionally covered some of the forest patches that had not been censused before. Data collection took place between October and November 2000. The objectives of this study were to determine: (1) the destructive human activities in the Tana River gallery forests in the south of TRPNR, (2) the number and distribution of Tana River red colobus, crested mangabeys, yellow baboons, sykes and vervet monkey groups in these forest patches, and (3) the relationships between primate groups density and the level of forest destruction, forest patch size and the distance from the nearest forest patch.

Study area

This study was carried out in nineteen forest patches along the lower Tana River basin about 30 km south of the TRPNR (Fig. 1). The forest patches are some of the over 70 forests located on either side of the Tana River. The maximum daily temperature ranges from 30 to 38°C while the minimum daily range is 17–25°C. January and February are the hottest months. Annual rainfall is from 500 to 600 mm and is bimodal in distribution with peaks in March–April and November–December. The main vegetation types in the region are grassland, wooded grassland, bushland, deciduous woodland and lowland evergreen forest (Andrews *et al.*, 1975). Periodic disturbance through flooding and human activities has led to the creation and maintenance of a patchy distribution of isolated forests on either side of the river. The presence of mature mango trees (*Mangifera indica* L.) in some of the forest patches indicate that they were under cultivation in the past.

Tana Delta Irrigation Project (TDIP) is a rice irrigation project located south of the TRPNR on the lower course of Tana River (Fig. 1). It covers an area of 160 km^2. About 20% of the total population of the two endangered primate species inhabit forest patches within TDIP (Butynski & Mwangi, 1994). The Tana and Athi Rivers Development Authority (TARDA) administer the project and the forest patches within the area. Twelve of the nineteen forest patches in which this study was conducted are located within this area.

Materials and methods

Forest status

The presence or absence of destructive human activities, which included cutting of trees, burning, dyke construction, charcoal burning, harvesting of thatching material, wine tapping or complete clearing mainly for cultivation, observed in each forest patch was recorded. The overall status of the forests was assessed by observation of the damage using a scale of 1–4. Scale number 1 was recorded if little or no destruction was seen. Scale 2 was used when moderate levels of disturbance were observed, whereas scale 3 was used when extensive human disturbances were observed but no section of the forest was completely cleared. Forests in which sections had been cleared were assigned category 4

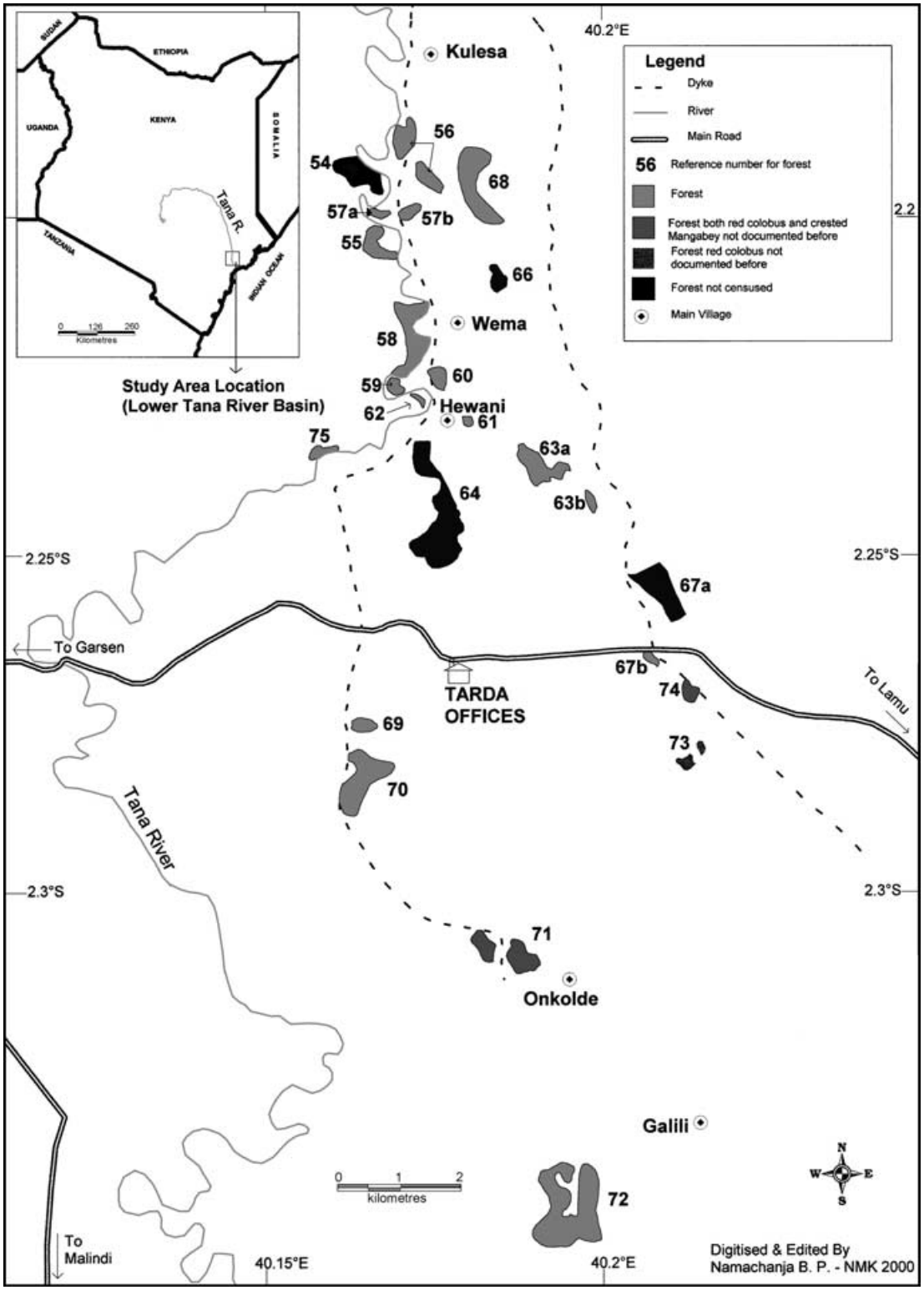

Fig 1 Location of forest patches in the Tana River basin. Inset: map of Kenya showing the location of the Tana River.

(i.e. the highest level of disturbance). The dimensions of forest patches were measured using Geographical Positioning System (GPS) (Garmin Corporation, 1998). Forest patch size was calculated from the length and width. Where the forest was irregular in shape, GPS readings were taken on several points along the periphery of the forest. The points were plotted on graph paper and the area calculated. The GPS was also used to determine distances between forest patches.

Primate census

The quadrat census method described by Struhsaker (1981) was used in this study. It had previously been used in this region (Marsh, 1978, 1986; Kahumbu & Davies, 1993; Butynski & Mwangi, 1994). The census was carried out from 06:00 to 10:00 hours and between 17:00 and 18:30 hours when primates were most active. Pairs of observers started at a baseline and walked parallel to one another through the forest at 50–100 m intervals ensuring maximum coverage so as to enumerate all primate groups. The observers moved silently at an estimated speed of 1 km per hour and made frequent stops to look and listen for primates. Each pair of observers recorded data on check sheets. The data included date, observers' names, forest name and number, time when the census began and ended, time at which an encounter with primates began and ended, the primate species encountered, and the number of monkeys seen. Ten minutes were spent with a group of monkeys once encountered. To avoid double counting, the tree species in which the monkeys were seen and the direction they moved when the encounter ended were recorded. In addition, when primates vocalized, the species, time, compass bearing and the estimated distance of the vocalizing primate from the observers were recorded. After censusing primates in each forest, the counting team discussed and summarized the data.

Data analysis

Group density for each primate species in each forest patch was calculated by dividing the number of groups of the species found with the area of the forest. The Kruskal–Wallis procedure (Zar, 1996) was used to test for variations in group density with the level of forest destruction. Spearman's rank correlation (Zar, 1996) was used to test for the relationship between group density and the size of the forest patch and the distance of forest patch from the neighbouring patch.

Results

Destructive human activities

A variety of human activities were observed in the nineteen forest patches in the lower Tana River basin. Cutting of poles was the most common activity (Table 1). Burning and dyke construction were also observed at high frequencies. Other activities recorded were harvesting of thatching materials, cultivation, palm wine tapping, honey harvesting, trapping of wild animals and charcoal burning (Table 1). Some forest patches, for example 59, 61 and 62 (Fig. 1), were particularly affected by the human activities. They have been cleared either for cultivation or expansion of human settlements. Regenerating shrub vegetation was seen in forest number 61, which is located near two schools. In forest number 59 only a 1-ha patch of regenerated *Ficus* sp. was observed, while forest number 61 had mango trees only.

Number of groups and distribution of five primate species in the lower Tana forest patches

Table 2 shows the distribution of 85 groups of five primate species found in the nineteen forest patches censused in the lower Tana River. The groups included eighteen red colobus, ten crested mangabey, 22 baboon, 31 Sykes and four vervet monkey groups. Red colobus monkeys, crested mangabeys, yellow baboons, Sykes and vervet monkeys were encountered in 47%, 32%, 53%, 74% and 16%,

Table 1 Human activities observed in nineteen forest patches in the Lower Tana Basin in 2000

Human activity	Percentage of forest patches in which activity was observed
Cutting of poles	68
Burning	53
Dykes	32
Harvesting of thatching material	21
Cultivation	21
Wine tapping	21
Honey harvesting	16
Snares	11
Charcoal burning	5

Table 2 Number of groups and group densities of five primate species found in forest patches in lower Tana River between October and November 2000

					Number of groups (group density, i.e. number of groups ha^{-1})					
Forest name	Forest reference number	Disturbance level	Area (ha)	Distance from nearest forest (km)	*Procolobus rufomitratus*	*Cercocebus g. galeritus*	*Papio c. cynocephalus*	*Cercopithecus mitis albotorquatus*	*Cercopithecus aethiops pygerythrus*	Number of species
Langu la Mwoyo	75	1	2	1.2	0 (–)	0 (–)	0 (–)	0 (–)	0 (–)	0
Daruka Karicho 1	74	3	5	0.7	2 (0.4)	0 (–)	0 (–)	0 (–)	0 (–)	1
Daruka Karicho 2	73	1	4	0.7	1 (0.25)	1 (0.25)	(0.25)	1 (0.25)	0 (–)	4
Galili	72	3	56	3.1	0 (–)	0 (–)	0 (–)	5 (0.09)	0 (–)	1
Onkolde	71	1	29	2.2	2 (0.03)	0 (–)	2 (0.07)	4 (0.14)	0 (–)	3
Mitapani 2	70	3	63	0.2	0.03	0 (–)	5 (0.08)	2 (0.03)	2 (0.03)	4
Mitapani 1	69	1	12	0.2	0 (–)	0 (–)	5 (0.33)	1 (0.08)	1 (0.08)	3
Wema East 4	68	4	63	0.2	0 (–)	3 (0.05)	4 (0.03)	4 (0.06)	0 (–)	3
Hewani South 1a	63a	2	18	0.3	3 (0.17)	0 (–)	1 (0.06)	1 (0.06)	1 (0.06)	4
Hewani South 1b	63b	2	3	0.3	0 (–)	0 (–)	0 (–)	0 (–)	0 (–)	0
Hewani West 2	62	4	1	0.2	1(1.00)	1 (1.00)	0 (–)	1 (1.00)	0 (–)	3
Hewani East 3	61	4	8	0.4	0 (–)	0 (–)	0 (–)	0 (–)	0 (–)	0
Hewani East 2	60	2	3	0.5	1 (0.17)	0 (–)	2 (0.33)	2 (0.33)	0 (–)	3
Hewani East 1	59	4	4	0.5	1 (0.25)	1 (0.25)	0 (–)	1 (0.25)	0 (–)	3
Hewani West 1	58	4	22	0.6	6 (0.27)	2 (0.14)	2 (0.09)	5 (0.23)	0 (–)	4
Wema East 2a	57a	3	7	0.1	0 (–)	0 (–)	0 (–)	1 (0.14)	0 (–)	1
Wema East 2b	57b	3	25	0.3	0 (–)	1 (0.40)	0 (–)	1 (0.40)	0 (–)	2
Wema East 1	56	4	23	0.1	0 (–)	0 (–)	1 (0.04)	0.09	0 (–)	2
Wema West 3	55	1	13	0.6	0 (–)	0 (–)	2 (0.11)	0 (–)	0 (–)	1

– means that the species was not present in the forest patch.

respectively, of the nineteen forests censused. The distribution range of both red colobus and crested mangabeys extended south of the previously documented range (Fig. 1).

The relationships between primate group density and the level of forest destruction, forest patch size and the distance from the nearest forest patch

Sykes monkeys had the highest mean group density followed by red colobus, whereas the lowest group density was recorded for vervet monkeys (Table 2). Group density was not affected by the level of habitat destruction for the crested mangabeys ($H = 1.104$, $P > 0.05$, $df = 3$), red colobus ($H = 2.707$, $P > 0.05$, $df = 3$), baboons ($H = 2.604$, $P > 0.05$, $df = 3$) and Sykes ($H = 0.576$, $P > 0.05$, $df = 3$) as shown by Kruskal–Wallis test. This analysis could not be performed on vervet monkeys because they were found in three forest patches only (Table 2).

There was no correlation between group densities of the five primate species (Spearman's rank correlation: $P > 0.05$, $n = 19$) and forest patch size. There was also no correlation between group densities in the five primate species (Spearman's rank correlation: $P > 0.05$, $n = 19$) with distance from the nearest forest patch.

Discussion

This study has shown that the Tana red colobus and crested mangabeys have a wider distribution than was previously reported (Groves *et al.*, 1974; Butynski & Mwangi, 1994). This finding has significant conservation implications because wider distribution might translate into higher population sizes and possible revision of their conservation status. There is therefore need to survey all forest patches within Tana delta to confirm those inhabited by Tana red colobus and crested mangabey groups. Similar studies on other endangered fauna can redefine their conservation status.

Primate group densities were not significantly associated with the level of forest destruction, forest patch size and the distance from the nearest forest patch. Clearing of forests reduces forest size leading to reduction in food availability. Primates in the affected forest patches might respond by either migrating to other forest patches or by concentrating in excessively high group densities. Alternatively, forest disturbance would lead to reduced group sizes and not necessarily reduced group densities. Interaction of these forces probably led to lack of significant relationships between group densities and forest disturbance level or forest size. In addition, there could be other parameters that determine primate densities in the forest patches. These include the density and diversity of plant species, canopy cover, age of the forest, the distance of forest patch from the river, the frequency of flooding in a particular forest patch and the level of the water table. A study is needed to relate these parameters with primate population sizes on forest patches along the lower Tana River. The method used to categorize forest disturbance was limited by its subjective nature. Future studies should correlate primate group density with quantifiable parameters related to forest disturbance. Such parameters would include proportion of forest cleared, density of cut tree stumps and intensity of wine tapping.

In the forest patches surveyed during this study, 22 baboon groups were encountered. With their opportunistic life-style and nonspecialized, omnivorous diets (Forthman-Quick, 1986), baboons are highly adaptable and readily take to living alongside humans in rural areas (Hill, 2000). They are notorious agricultural pests in most of their habitat range (Naughton-Treves, 1998; Hill, 2000; Muoria, 2001). In the lower Tana River area, baboons are one of the most important mammalian agricultural pests (Marsh, 1986). The lifestyle of baboons put them into conflict with humans. The conflict makes local communities develop negative attitudes towards baboons, their habitat and associated fauna, including the endangered ones. The conflict is likely to intensify with reduced availability of food in the forest resulting from habitat destruction by man. In addition, baboon's diet overlaps with that of the endangered crested mangabeys (Wahungu, 1998). This means that reduction in forest area/habitat degradation can lead to intense competition for food among these two sympatric primate species resulting in negative impacts on the endemic crested mangabeys. It is therefore important that the population of all primate species and their interspecific interactions be monitored in order to develop appropriate conservation strategies.

To curb further forest destruction in order to safeguard the survival of the endangered Tana red colobus and crested mangabeys, we recommend that local communities be trained and encouraged to set-up self-sustaining forest resource utilization projects, such as honey harvesting and butterfly farming. Such projects would

boost the income of the local people and reduce pressure on the forest resources. Such a project has been shown to improve the attitude of the local communities towards forest conservation in Arabuko-Sokoke Forest (Maundu, Sojah & Kilili, 1997). Ecotourism should also be explored as another way of empowering the local communities economically.

Acknowledgements

The World Bank's Tana River Global Environmental Facility (GEF) Project funded this study with a grant to Dr M. A. Suleman through the Kenya Wildlife Service (KWS). We are grateful for this assistance and the tremendous support provided by KWS. Many people including the local administrators and Kenya Police Reserve (KPR) personnel were very helpful. Other people who contributed to this survey include Serah Munguti, Ibrahim Khwatsima and Samuel Sang. We thank all of them.

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(Manuscript accepted 29 May 2002)