

Primate Survey on the North Coast of Kenya

Biogeography, Diversity and Conservation



Yvonne A. de Jong
Thomas M. Butynski

Eastern Africa Primate Diversity and Conservation Program
P.O. Box 149, 10400 Nanyuki, Kenya. www.wildsolutions.nl

August 2011

INTRODUCTION

Kenya holds 12 genera, 19 species and 23 subspecies of primate (De Jong & Butynski, 2010c, 2011, in press). Although primates represent one of the best-known taxonomic groups found in Kenya, numerous important questions remain concerning their taxonomy, distribution, abundance, conservation status, and priorities for conservation actions.

“Undiscovered” species or subspecies of primates are still being found. Knowledge about how many species and subspecies of primates occur in Kenya, where they occur, and the level of extinction risk each taxon faces, is vital for primate conservation. In particular, there might well be additional unrecognized “cryptic” species in the genera *Otolemur*, *Galago*, and *Galagoides*.

Since 2003, the Eastern Africa Primate Diversity and Conservation Program has conducted primate surveys at many sites in Kenya and Tanzania (De Jong & Butynski, 2011). The aim of the Program is to fill knowledge gaps concerning primate taxonomy, diversity, biogeography, abundance, and threats. This information is essential for designing effective primate conservation actions.

In May 2011, we surveyed the north coast of Kenya for primates and other mammal species including warthogs and antelopes. This survey complements earlier surveys conducted farther south along the Kenya coast (De Jong & Butynski, 2009) and aimed to answer a number of questions concerning the primates of the area, including:

- Which subspecies of gentle monkey *Cercopithecus mitis* occurs in the forested areas between Kipini Conservancy and the Somali border?
- Do either the Tana River red colobus *Procolobus rufomitratus rufomitratus* or the Tana River mangabey *Cercocebus galeritus* occur between the Tana River/Delta and the Somali border?
- Which galago species/subspecies occur between Kipini Conservancy and the Somali border?
- Does the Somali lesser galago *Galago gallarum* occur south (west) of the Tana River?
- Does the common warthog *Phacochoerus africanus* occur north of the Tana River?

The principal aims of this survey of the north coast of Kenya were to (1) document which species of primates and other large mammals are present, (2) assess the geographic range and altitude limits for the primates, and (3) examine intra-specific variation (phenotypic, vocal, habitat-use, etc.) for the primates. Additionally, this assessment was designed to provide (1) a rough indication of relative abundance, and (2) a baseline against which to monitor change.

METHODS

Field surveys were conducted during 5 - 15 May 2011 by T.M. Butynski and Y.A. de Jong. A total of 114.3 h of survey were conducted, covering a distance of 1,630 km (Figure 1). In order to confirm presence of diurnal and nocturnal primates, assess the relative abundance of primates, and meet the need to cover large areas in a limited time, rapid assessment survey methods were used.



Figure 1. Transects (red line) along which surveys were conducted during May 2011 in north-east Kenya (starting in Mombasa, ending in Nanyuki), all camps are depicted with a green tent symbol.

Diurnal primate surveys

A total of 80.3 h of diurnal surveys were completed during 11 surveys (Figure 1). Surveys were conducted from a vehicle or on foot by two to four people. The number of primate groups encountered per kilometre and per hour were the indices used to assess relative abundance (Butynski & Koster, 1994; White & Edwards, 2000; Nekaris & Jayewardene, 2004).

Information collected during each survey included date, weather conditions, start time, end time, sites surveyed (GPS), walking/driving speed (GPS), and distance covered (GPS). When primate groups were encountered during a survey, the following data were collected: date, time, GPS coordinates (Garmin Oregon 550), altitude (by GPS), primate species/subspecies, vegetation type, and a visual assessment of tree density. The focus during every primate encounter was on obtaining a detailed description of as many individuals in a group as time and visibility allowed. Photographs were taken with a Nikon D70 digital camera fitted with a 400 mm Nikon lens, and with a Canon EOS 40D digital camera fitted with a Canon 100-400 mm lens. Photos were shot in 'raw' format. As many of the individuals as possible in each group were photographed. Each primate group was appointed a unique number (hereafter referred to as the 'group number'). The track of each survey was saved in a GPS and downloaded in a Dell Inspiron notebook using Garmin MapSource software.

Nocturnal primate surveys

The presence of galagos was recorded during a total of 34 h nocturnal foot, vehicle, or listening surveys at each camp between 18:45-23:00 h and 04:00-06:30 h. Reflection from the

eyes of galagos can be observed at >100 m in suitably open habitats. Torches (Maglights and Petzl Tikka XP headlamps) were used to scan the vegetation. Foot surveys and vehicle surveys were conducted slowly (ca 0.5-1.0 km/h on foot and ca 5-10 km/h by vehicle) with pauses to scan the vegetation, observe primates, and/or record vocalisations. The following were recorded: date, weather conditions, moon phase, start time, end time, sites surveyed (GPS), walking/driving speed (GPS), and distance covered (GPS). When galagos were encountered, binoculars (Zeiss Victory 10x42 and Zeiss Dialyt 7x42B) were used. The following data were collected when primates were encountered: date, time, moon phase, GPS coordinates, altitude, primate species/subspecies, vegetation type, tree density, number of individuals, and height above ground. Additionally, phenotypic descriptions were obtained and photographs taken using a Canon EOS 40D digital camera with a 100-400 mm Canon lens combined with a Canon Speedlite 420EX flash.

The advertisement call of galagos provides species specific information that can be used for species identification (Zimmermann, 1995; Bearder *et al*, 1995; Butynski *et al*. 2006). Listening from a fixed point can reveal the presence of galago species. Audio recordings of galago vocalizations (and of other nocturnal mammals and birds), preferably the loud advertisement call, were made during surveys, or opportunistically, using a Marantz Digital PMD660 recorder with Sennheiser Shot-Gun ME-66 microphone. The time and date of every recording is automatically saved within the audio file and additional notes were made. Nocturnal listening surveys were mainly conducted from camp or from a higher point at dusk, dawn, and before and after nocturnal vehicle or foot surveys.

Camera trap surveys

Three infrared 2010 Bushnell Trophy camera traps were installed to take photographs or record 30 second videos during nocturnal hours at each survey site. The traps were set in the vicinity of camps by both members of the survey team.

Primate photographic maps

A selection of photographs of primates and warthogs taken during this survey were uploaded to our Photographic Maps (or PhotoMaps; (De Jong & Butynski, 2011). The PhotoMaps, at < www.wildsolutions.nl >, provide a 'living' collection of photographs of the primates of Kenya and Tanzania. These are a practical tool for documenting and discussing primate diversity, taxonomy, biogeography, distribution and conservation status and, therefore, for developing and implementing actions for primate conservation (De Jong & Butynski, 2010a).

RESULTS

A total of 70 diurnal primate groups, belonging to five species, were encountered: Tana River red colobus *Procolobus rufomitratu rufomitratu*; Tana River mangabey *Cercocebus galeritu*; Ibean yellow baboon *Papio cynocephalu ibeanu*; Hilgert's vervet *Chlorocebu pygerythru hilgerti*; Pousargues's monkey *Cercopithecus mitis albotorquatu*.

Four prosimian species (five subspecies) were encountered: white-tailed small-eared galago *Otolemur garnettii lasiotis*; Kikuyu small-eared galago *Otolemur garnettii kikuyuensis*; Kenya lesser galago *Galago senegalensis braccatu*; Somali lesser galago *Galago gallarum*; Kenya coast galago *Galagoides coco*.

The following section summarizes the primate groups/individuals encountered per day, the rate of encounter, and other species of mammal observed.

Watamu to Mpeketoni (5 May 2011)

Primates encountered:

- Three *P. c. ibeanu* groups along the road (0.63 groups/h, 0.01 groups/km).

Distance: 212.5 km. Driving time: 7.4 h. Average speed (while moving): 44 km/h

Mpeketoni (5 May 2011; S2.40855; E40.68576, 11 m asl)

Camp: KWS compound in a patch of neem *Azadirachta indica* dominated forest on the shore of Lake Kenyatta. A group of *P. c. ibeanu* and *C. p. hilgerti* occupied the forest and the surrounding agricultural land. Both *O. g. lasiotis* and *G. coco* were common in the neem forest and in a patch of coastal forest. The first *O. g. lasiotis* call was heard at 18:45 h. First *G. coco* call heard at 18:57 h, last heard at 05:45 h. Vocalizations of both galagos were recorded. Photographs of all four species are uploaded to our photomaps (www.wildsolutions.nl).

Camera traps recorded: common hippopotamus *Hippopotamus amphibiu* (Figure 2).



Figure 2. Common Hippopotamus *Hippopotamus amphibiu*, Lake Kenyatta, Mpeketoni. Photo taken by Bushnell camera trap.

The phenotype of *O. g. lasiotis*, observed in the neem forest patch, was strikingly different from those seen at other sites in that individuals had a yellow-orange tint on the throat, face, chest and upper arms. A large adult male in this forest had a bright yellow-orange throat

(Figure 3). It was particularly interesting to find that most *G. cocos* in this patch of neem forest also had a yellowish tint on their throats, face, chest and upper legs. Not all individuals, however, had this colouration. An adult male *O. g. lasiotis* and two other individuals, in a patch of coastal forest which lacked neem trees (only 100 m away from the ‘yellow throated’ individuals), had no yellow-orange tint in the pelage. *Otolemur garnettii lasiotis* in Witu Forest (a coastal forest ca 20 km west of Mpeketoni), observed later in this survey, did not have yellow-orange tint. We observed *G. cocos* in the Boni-Dodori area (60 km north) during this survey, and on Manda Island (35 km northeast) in July 2008, and none showed this colouration. Additionally, at least two adult male *C. p. hilgerti*, encountered in the neem forest patch, showed an unusual faint yellow-rusty colouration around the scrotum (Figure 4).



Figure 3. *Galagoides cocos* (left) and adult male *Otolemur garnettii lasiotis* (right) in a patch of neem forest, Mpeketoni, north coast of Kenya. Note the yellow colouration on the throat, face, chest and upper arms in both species.



Figure 4. Adult male *Chlorocebus pygerythrus hilgerti* in a patch of neem forest, Mpeketoni, north coast of Kenya. Note the yellow-rusty colouration around the the scrotum.

We suggest that the yellow–orange tint in these three species originates from rubbing/scent-marking on neem bark. This suggestion is based on the fact that (1) all three species within the neem dominated patch of forest show the yellow-orange fur, (2) other members of these three species outside the neem-dominated patch, and in the vicinity of Mpeketoni, lacked this colouration, and (3) neem bark is used by people as a source of amber dye.

We showed 12 colleague primatologists the photographs of *O. g. lasiotis* and *G. cocos* from Mpeketoni and requested their opinion on the fur colour. Seven out of the 10 responses agreed that the fur colouration is likely related to scent marking (C. Groves, S. Bearder, R. Lewis, A. Perkin, L. Pozzi, P. Honess, L. Ambrose). Two of the 10 respondents reported additional cases of encounters with galagos that, apparently, had stained fur:

- Thomas's galago *Galagoides thomasi* with orange colour at Mt Kupe in Cameroon (S. Bearder, pers. Comm.);
- *Otolemur garnettii* with yellow staining on the chest and belly at Pugu Hills, NE Tanzania (A. Perkin, pers. comm.);
- Zanzibar galago *Galagoides zanzibaricus* with yellow staining on the chest and belly at Pugu Hills, NE Tanzania (A. Perkin, pers. comm.)

Paul Honess (pers. comm.) and L. Ambrose (pers. comm.) commented that not only the tree might be a source of the colouring but that the secretions of the sternal gland might also be responsible for the colouration. Difference in intensities of scent marking/rubbing could account for some variation in the spread and depth of the colour variation. Rebecca Lewis (pers. comm.) suggested that the glandular secretion is staining the fur and that neem bark sticks to the glandular secretions. Neem is used in the treatment of malaria. Leslie Ambrose (pers. comm.) speculated that these galagos might be rubbing themselves on neem to protect themselves from ecto-parasites.

Mpeketoni to Bodhei (6 May 2011)

Primates encountered:

- *C. p. hilgerti*, two groups (0.62 groups/h; 0.02 groups/km)
- *P. c. ibeanus*, two groups (0.62 groups/h; 0.02 groups/km)

Other species:

- Common warthog *Phacochoerus africanus*: three individuals together (S2.26709; E40.69139, 13 m asl; Figure 5)
- Haggard's oribi *Ourebia ourebi haggardi* (Vulnerable; IUCN, 2011), one individual (S2.20512; E40.74224, 16 m asl). Degraded coastal shrub with short grass, including doum palm and mango.
- Coastal topi *Damaliscus lunatus topi* (Near Threatened; IUCN, 2011): one individual (S1.94553; E40.76188, 20 m asl). Coastal shrub and patches of open grassland.

To our best judgement, this is the first confirmed 'visual record' for *P. africanus* on the coast of Kenya north of the Tana R. All other *Phacochoerus* records in the vicinity of this *P. africanus* encounter are for the desert warthog *Phacochoerus aethiopicus delamerei* (closest 55 km to the north, encountered during this survey).

Distance: 84.7 km. Driving time: 4.6 h. Average speed (while moving): 26 km/h



Figure 5. Common warthog *Phacochoerus africanus* and yellow baboon *Papio cynocephalus ibleanus* intermingled while foraging for roots in open degraded grassland surrounded by doum palm woodland.

Bodhei (6 May 2011; S1.86374; E40.71279, 37 m asl)

Camp: KWS station at Bodhei (Boni and Dodori National Reserves) next to airstrip in dense coastal bushland (including *Acacia* and *Erythrina*).

One group of *C. m. albotorquatus* observed briefly during a foot survey in Bodhei in a patch of coastal forest within agricultural land. Phenotype of two *C. m. albotorquatus* differed from those in Witu Forest and Tana River Primate NR. A second group (two individuals) was observed in the early morning at the camp. A more detailed phenotypic description and discussion concerning *C. m. albotorquatus* is presented on page 18.

Both *G. cocos* and *O. garnettii* present around the camp but in low densities based on the few calls heard (of both species) during the night. First *G. cocos* loud call was at 18:26 h. No galagos observed during a 1.4 h foot survey.

Camera traps: No images

Bodhei to Kibokoeni, Dodori National Reserve (7 May 2011)

Primates encountered:

- *C. p. hilgerti*, one group (0.27 groups/h; 0.01 groups/km)
- *C. m. albotorquatus*, three groups (0.82 groups/h; 0.04 groups/km)
- *P. c. ibleanus*, three groups (0.82 groups/h; 0.04 groups/km)

Other species:

- *D. l. topi*: two individuals (S1.74536; E40.90362, 45 m asl). Coastal shrub and patches of open grassland.

Distance: 72.5 km. Driving time: 4.6 h. Average speed (while moving): 26 km/h

Kibokoeni Camp, Dodori National Reserve (7 May 2011, S1.80192; E41.17619, 20 m asl)

Camp: Kibokoeni Camp, on the edge of riverine vegetation, grassland and coastal shrub (including *Terminalia*, *Acacia* and doum palm).

Chlorocebus p. hilgerti and *P. c. ibleanus* groups heard from camp. *Damaliscus l. topi* (Figure 6), bushbuck *Tragelaphus scriptus*, and ellipsen waterbuck *Kobus ellipsiprymnus* seen and *H. amphibius* heard.

During the night, *O. garnettii* and *G. cocos* both heard (low densities presumably). No observations. Other species that night: lion *Panthera leo*, hyena *Crocuta*, *H. amphibius* and *P. c. ibeanus*. The weather restricted surveys after 20:00 h.

Camera traps: *Genetta* sp.



Figure 6. Coastal topi *Damaliscus lunatus topi* (Near Threatened; IUCN, 2011) at the Dodori River, Dodori National Reserve, Kenya.

Kibokoeni to Kiunga (Boni and Dodori National Reserves, 8 May 2011)

Primates encountered:

- *C. p. hilgerti*, two groups (0.73 groups/h; 0.04 groups/km)
- *C. m. albotorquatus*, seven groups (2.55 groups/h; 0.15 groups/km)
- *P. c. ibeanus*, one group (0.36 groups/h; 0.02 groups/km)

Other species:

- Aders' duiker *Cephalophus adersi* (Critically Endangered; IUCN, 2011) one individual (S1.70287; E41.25801, 29 m asl)

Distance: 46.9 km. Driving time: 4.2 h. Average speed (while moving): 17 km/h

Kiunga (8 May 2011; S1.75218; E41.48023, 4 m asl)

Camp: KWS station at Kiunga in medium dense *Acacia-Commiphora* woodland on the edge of mangrove forest. *Chlorocebus pygerythrus hilgerti* foraging on the KWS compound.

Other species encountered include Kirk's dik dik (*Madoqua kirkii*, Figure 13).



Figure 7. Adult Somali galago *Galago gallarum* in *Acacia – Commiphora* woodland in Kiunga, extreme north coast of Kenya

A minimum of two *G. gallarum* observed in *Acacia-Commiphora* woodland. No loud calls heard but various other vocalizations produced by this species recorded (Figure 7). Photographs uploaded to the PhotoMap. Due to weather restriction no surveys were completed after 20:00 h.

Camera traps: *M. kirkii*

Kiunga to Bodhei (9 May 2011)

Primates encountered:

- *C. p. hilgerti*, four groups (0.95 groups/h; 0.04 groups/km)
- *C. m. albotorquatus*, four groups (0.95 groups/h; 0.04 groups/km)

Other species:

- *O. o. haggardi*, one individual (S1.81820; E40.76545, 37 m asl; Figure 8).



Figure 8. Adult Haggard's oribi *Ourebia ourebi haggardi* (Vulnerable; IUCN, 2011) in open grassland east of Bodhei.

Distance: 106.6 km. Driving time: 6.5 h. Average speed (while moving): 25 km/h
Bad weather and very bad road conditions.

Bodhei (9 May 2011; S1.86374; E40.71279, 37 m asl)

Camp: KWS station at Bodhei (Boni and Dadori National Reserves) next to airstrip in dense coastal bushland (including *Acacia* and *Erythrina*).

Road survey conducted 6:30-20:55 h. We drove from Bodhei north towards Ijara for 15 km (on a bad road). We conducted a foot survey along the main road that runs through part of a forest which is located 9 km northwest of Bodhei (onwards referred to as Bodhei Forest; S1.79383; E40.66617, 36 m asl). This is a nice patch of dry coastal forest through which the road runs for ca. 1 km.



Figure 9. Adult desert warthog *Phacochoerus aethiopicus* northwest of Bodhei.

Two *P. a. delamerei* observed in short grassland on the edge of Bodhei Forest (S1.77663; E40.65594, 42 m asl; Figure 9).

One group of *C. m. albotorquatus* heard in Bodhei Forest (palms absent)

During 17:50-19:30 h we conducted a foot survey along the road through Bodhei Forest. About 10 *G. cocos* were heard and one was seen. Vocalizations were recorded. First *G. cocos* loud call heard at 18:28 h.

The fact that we heard ca. 10 *G. cocos* and only saw one suggests that *G. cocos* does not favor, or even avoids, forest edge. *Otolemur garnettii* was not seen or heard, suggesting that this species is either absent or at low density in Bodhei Forest.

While driving back to Bodhei, two *G. cocos* were observed in dry *Acacia* woodland. This was surprising in that *G. senegalensis* is the species associated with this vegetation type. It appears that *G. cocos* is able to use *Acacia* woodland where *G. senegalensis* is absent or at low density.

Other species observed or heard on our way back to Bodhei include:

- *O. o. haggardi*, four encounters with singletons
- *T. scriptus*, one or two individuals
- *K. e. ellipsiprymnus*, at least one herd
- *P. leo* (heard only)
- *Crocuta* (heard only)
- Leopard *Panthera pardus* (heard only)

From the camp in Bodhei, one or two *O. garnetti* vocalizations were heard in the distance. *Galagoides cocos* was heard close to camp.



Figure 10. Fiery-necked nightjar *Caprimulgus pectoralis*, Bodhei, Kenya

Bodhei to Mpeketoni (10 May 2011)

Primates encountered:

- Three groups of *P. c. ibeanus* (1.12 groups/h; 0.04 groups/km)
- One group of *P. c. ibeanus* at KWS station, Mpeketoni

Distance: 84.0 km. Driving time: 3.5 h. Average speed (while moving): 31 km/h

Mpeketoni to Witu Forest Reserve to Mpeketoni (10 May 2011)

Primates encountered:

- Three groups of *P. c. ibeanus* (2.0 groups/h; 0.09 groups/km)
- Two groups of *C. m. albotorquatus* seen/heard in Witu Forest

We conducted a foot survey in Witu Forest Reserve (coastal forest) during 17:30-19:40 h. One group of *C. m. albotorquatus* was seen and photographed, and a second group was heard. Tracks of *C. cynocephalus* and *H. amphibius* were encountered. We conducted a vehicle survey along the main road through Witu Forest (19:40-20:50 h). *Otolemur garnettii* and *G. cocos* were both heard, while three *O. garnettii* were seen from a distance. Both species appear to occur at relatively low density.

Distance: 69.4 km. Driving time: 7 h. Average speed (while moving): 22 km/h



Figure 11. African wood owl *Stix woodfordii*, Witu Forest, Kenya.

Mpeketoni (10 May 2011; S2.40855; E40.68576, 11 m asl)

Camp: KWS station in Mpeketoni on the shore of Lake Kenyatta. Large numbers of *O. g. lasiotis* and *G. cocos* were heard, recorded and photographed. We observed several yellow stained individuals (of both species) in the neem forest patch (see 5 May 2011 above). Additionally, we observed non-stained adults in the coastal shrub patches outside the neem forest.

Camera traps: *P. c. ibeanus*, and bushy-tailed mongoose *Bdeogale crassicauda omnivora*

Mpeketoni to Tana River Primate National Reserve (11 May 2011)

Primates encountered:

- *C. p. hilgerti*, one group (0.19 groups/h; 0.01 groups/km)
- *C. m. albotorquatus*, two groups (0.38 groups/h; 0.01 groups/km)
- *P. c. ibeanus*, eight groups (1.52 groups/h; 0.05 groups/km)

The phenotype of *C. m. albotorquatus* in Witu Forest Reserve is different from that observed in the Boni and Dodori National Reserves. A description and discussion can be found on

page 18. *Papio cynocephalus ibleanus* was encountered in all vegetation types that we drove through this day, including neem forest, coastal forest, riverine forest, degraded agricultural land, and dry *Acacia* bushland.

Other species encountered include:

- *M. kirkii*, two individuals within Tana River Primate NR.

Phenotypically, *M. kirkii* at the Tana River Primate NR (Figure 12) is very different from those at Kiunga (Figure 13). The Kiunga individuals have far less red on the legs and head. The rump and flanks of the Tana River Primate NR *M. kirkii* are grizzled grey and show greater contrast with the white ventrum. We have taken photographs of *Madoqua* from many sites in Kenya and northern Tanzania since 2004. Detailed phenotypic analysis (using photographs and descriptions), combined with molecular studies, are required to describe geographical phenotypic variation within *M. kirkii* in East Africa.



Figure 12. Adult Kirk's dik dik (*Madoqua kirkii*) at Tana River Primate NR, Kenya



Figure 13. Adult Kirk's dik dik (*Madoqua kirkii*) at Kiunga, extreme north coast of Kenya

Distance: 171.1 km. Driving time: 8.7 h. Average speed (when moving); 33 km/h

Tana River Primate National Reserve (11 May 2011; S1.87696 E40.13867, 30 m asl)

Camp: Mchelelo Camp in Mchelelo Forest. Primate species present at or near camp where:

- *C. m. albotorquatus*
- *C. p. hilgerti*
- Tana River red colobus *Procolobus rufomitratu rufomitratu*

- Tana River mangabey *Cercocebus galeritus*

Photographs of *C. m. albotorquatus*, *C. p. hilgerti*, and *P. r. rufomitratu*s now uploaded to the PhotoMaps. The phenotype of *C. m. albotorquatus* resembles that of the Witu Forest animals, but differs considerably from those in the Boni and Dodori NRs (see page 18).

Three galago taxa were observed, photographed and their vocalization recorded.

- *G. s. braccatus*
- *G. cocos*
- *O. g. lasiotis*

Both *O. g. lasiotis* and *G. cocos* are abundant in riverine Mchelelo Forest. Two *G. s. braccatus* were observed (presumably a female with a large juvenile, Figure 14) and photographed in *Acacia* on the edge of the forest. *Galago s. braccatus* honks (loud call) were heard just after dusk. Although Butynski & Mwangi (1994) confirmed the presence of *G. s. braccatus* in the Tana River Primate NR, we failed to locate this species during our brief visits to this National Reserve in August 2005 and June 2006. The photographs of *G. s. braccatus* obtained during this survey might be the first taken at the Tana River Primate NR.



Figure 14. Juvenile Kenya lesser galago in the Tana River Primate National Reserve, Kenya

There is phenotypic variation among *O. g. lasiotis* within the National Reserve. At least one of the individual (photographed) was reddish-brown on the head, dorsum, sides, and chest (with mouse grey underfur), blackish tail tip (15-20%), and pale brown to grey ventrum. The muzzle and chest were particularly reddish. Other individuals were greyer overall, some lacked the reddish tint while others showed a faint reddish-brown tint. Tails varied from brown to grey, but all had a darker tail tip, varying from dark grey to blackish. All individuals had slightly paler underparts.

There is considerable phenotypic variation in *O. garnettii* over its distributional range (Olson, 1979). The Galagidae PhotoMap illustrates this well. Along the coast of Kenya, *O. g. lasiotis* varies from silver grey to dark brown. Not only is there considerable geographic variation, there is also considerable variation among animals at the same site. For instance, at Usa River, northern Tanzania, of the five individuals in the same tree, three were reddish-brown or dark brown with a blackish tail tip, while two were brownish-grey with white chin and ventrum, and an extensive white tail tip (Butynski & De Jong, pers. obs). It appears that

pelage colour alone is not a good diagnostic character for distinguishing some of the subspecies of *O. garnettii*.

Other species include:

- *M. kirkii*
- Red bellied coast squirrel *Paraxerus palliatus tanae* (Figure 15).

Camera traps: *T. scriptus*, common genet *Genetta genetta* (Figure 16), unidentified duiker *Cephalopus* sp.



Figure 16. Common genet *Genetta genetta* at Tana River Primate National Reserve, Kenya. Image from 20 seconds footage taken by camera trap.

Figure 15. Red bellied coast squirrel *Paraxerus palliatus tanae* at Tana River Primate National Reserve, Kenya.

Tana River Primate National Reserve to south of Garissa (12 May 2011)

Primates encountered:

- One group of *P. c. ibeanus* (0.17 groups/h; 0.01 groups/km)

Distance: 151.9 km. Driving time: 6.1 h. Average speed (when moving): 33 km/h

Garissa south (12 May 2011; S0.75256 E39.65390, 200 m asl)

Camp: medium dense *Acacia-Commiphora* bushland (grass absent). No galagos heard or encountered from camp or during night foot survey. *M. kirkii* present.

Garissa south to Agarbul (13 May 2011)

Primates encountered:

- None

Other species:

- Good numbers of *M. kirkii* encountered in *Acacia* and in *Acacia-Commiphora* bushland/woodland.
- One male *P. a. delamerei* in dry, medium dense, *Acacia-Commiphora* woodland on red sandy soil (S0.73766; E39.63803, 204 m asl; Figure 17). One group (five

individuals) encountered in medium dense *Acacia-Commiphora* bushland on red rocky soil (S0.52748; E39.54553, 245 m asl; Figure 17).

Distance: 104.1 km. Driving time: 6.0 h. Average speed (when moving): 26 km/h



Figure 17. Adult female desert warthog *Phacochoerus aethiopicus* (left) and adult male *P. aethiopicus* (right), south of Garissa, Kenya

Agarbul (13 May 2011; S0.12789 E39.95013, 182 m asl)

Camp: dry *Acacia-Commiphora* woodland, close to dry dam. *Madoqua kirkii* and unstriped ground squirrel *Xerus rutilus* common. Eyeshine seen of two unidentified galagos (to shy to identify) during a night foot survey (2 km, 1 h). One *G. gallarum* observed in tall *Commiphora*.

The one *G. gallarum* observed was shy. Of the many *G. gallarum* that we have observed, this was the first individual that acted shy (which is a characteristic that we have come to associate with *G. senegalensis*). It is common for *G. gallarum* to be surprisingly unafraid of the observer, to often approach the observer, and to hunt insects in the light beam of a torch. We strongly suspect that the two unidentified (shy) galagos encountered during this survey were also *G. gallarum*.

Phenotypically, this *G. gallarum* looked similar to those encountered in central Kenya and in Kiunga (see page 22). No galago vocalizations were heard during the night.



Figure 18. Dusky nightjar *Caprimulgus fraenatus*, Agarbul, Kenya.

Agarbul to Masinga (14 May 2011)

Primates encountered:

- One group *P. c. ibeanus* (0.13 groups/h; 0.003 groups/km)
- One group *C. p. hilgerti* (0.13 groups/h; 0.003 groups/km).

Distance: 340.1 km. Driving time driven: 9.9 h. Average speed (when moving): 44 km/h

Masinga (14 May 2011; S0.89298 E37.59225, 1069 m asl)

Camp: shore of Masinga Dam close to a patch of *Acacia* bushland with tall exotic trees. One *C. p. hilgerti* male observed close to camp. The Kikuyu small-eared galago *Otolemur garnettii kikuyuensis* (Figure 19) was heard and seen. The first *O. g. kikuyuensis* call was heard at 19:00 h. Some southern tree hyrax *Dendrohyrax arboreus* calls heard from camp.

No galagos were heard or seen during a night vehicle survey that passed through riverine vegetation and exotic plantations (9.81 km, 1 h). Three *O. g. kikuyuensis* were seen during a foot survey close to camp (1.4 km, 1 h). Individuals observed (one seen very well); dorsum brown-grey, muzzle, eye-rings, ears, hands and feet blackish, ventrum off-white with a faint brownish tint, tail full, light brown-grey with a blackish tip (Figure 19).



Figure 19. Kikuyu small-eared galago *Otolemur garnettii kikuyuensis*, Masinga, Kenya.

Masinga to Nanyuki (15 May 2011)

Primates encountered:

- *P. c. ibeanus*, one group (0.17 groups/h; 0.01 groups/km)
- *C. p. hilgerti*, three groups (0.61 groups/h; 0.02 groups/km)

Distance: 184.5 km. Driving time: 6.6 h. Average speed (when moving): 38 km/h

DISCUSSION AND CONCLUSIONS

Boni and Dodori National Reserves

This brief survey confirmed that at least six primate species occur in the for Boni and Dodori National Reserves: Ibean yellow baboon *Papio cynocephalus ibleanus*, Hilgert's vervet *Chlorocebus pygerythrus hilgerti*, Pousargues's monkey *Cercopithecus mitis albоторquatus*, small-eared greater galago *Otolemur garnettii* (most likely ssp. *lasiotis*), Somali lesser galago *Galago gallarum*, and Kenya coast galago *Galagoides cocos*. The Senegal galago *Galago senegalensis* is likely present, but this species has yet to be encountered in the Boni-Dodori area. There is no evidence for the Tana River red colobus *Procolobus rufomitratu*s or Tana River mangabey *Cercocebus galeritu*s in this area. It appears increasingly likely that these two species are confined to the forests of the floodplain and delta of the Tana River.

Pousargues's monkey *Cercopithecus mitis albоторquatus*

In April 2009, Ian Craig (Northern Rangeland Trust) reported to us that he had encountered 'an extraordinary' Sykes's monkey close to Bodhei, north coast of Kenya. He described the animals as a smaller sized Sykes's monkey with Sykes's-like facial markings and behaviour, but with a straight tail and russet red on the back of the hindlegs. With the help of camera trap images from the Boni-Dodori area (Andanje *et al.* 2010) we confirmed the presence of *Cercopithecus mitis albоторquatus*. The phenotype, however, was different from what we observed in other parts of the geographical range of this subspecies (particularly Witu Forest Reserve and Tana River Primate NR).

During our survey we observed at least 17 groups of *C. mitis* in the Bodhei area and while travelling slowly on the main road from Bodhei to Kiunga. All individuals observed resembled the type *C. m. albоторquatus* (of Tana River Primate NR), but differed considerably.

The phenotype of *C. m. albоторquatus* in the Boni and Dodori National Reserves (Figure 20) differs from that of Witu (Figure 21) and Tana River Primate NR in that the white on the chest, shoulders and inner frontlegs of the Boni-Dodori animals is more extensive, the reddish-brown on the back of hindlegs is much darker and more extensive, the pattern of colours is more sharply demarcated, body size appears smaller, and length of the tail relative to the length of the body appears greater.

Cercopithecus mitis albоторquatus is a relatively poorly-known subspecies that is widely recognised by primate taxonomist (Pocock, 1907; Hill, 1966; Rahm, 1970; Kingdon, 1971, 1997; Dandelot, 1974; Napier, 1981; Lernould, 1988; Groves 2001, Grubb 2001, Grubb *et al.* 2003). Several authors suggested that this subspecies is confined to the forests along the lower Tana River (Gartlan & Brain, 1968; Rahm, 1970; Kingdon, 1971; Andrews *et al.*, 1975; Napier, 1981; Lernould, 1988; Groves, 2001). During a primate survey in 2003 we found this subspecies to be present (and common) far up the Tana River in Meru National Park and Kora National Park (De Jong & Butynski, 2004; Figure 22). This extended the known range *ca.* 100 km to the west (Saka being the closest record; Napier, 1981). In June 2006, we found *C. m. albоторquatus* to be common in Witu Forest, 60 km south of Bodhei. With the confirmation of *C. m. albоторquatus* in the Boni and Dodori National Reserves during this survey, the confirmed geographical range of this subspecies is much larger (Figure 22) than previously described (De Jong & Butynski, 2009; IUCN, 2011).



Figure 20. Pousargues's monkey *Cercopithecus mitis albotoquatus*, on and along the road that separates the Boni and Dodori National Reserves, north coast of Kenya.



Figure 21. Pousargues's monkey *Cercopithecus mitis albitorquatus*, Witu Forest Reserve, north coast of Kenya.

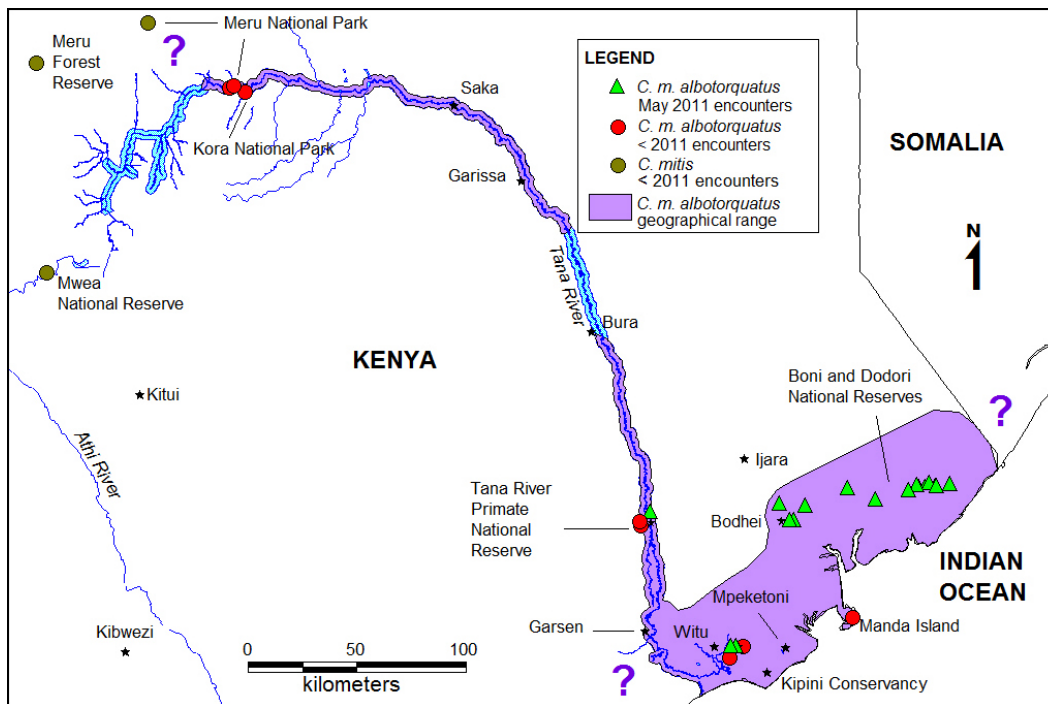


Figure 22. Approximate geographical range of Pousargues's monkey *Cercopithecus mitis albotorquatus*, Kenya.

The southern limit of the geographical range of *C. m. albotorquatus* is uncertain. There appears to be a gap of suitable forest habitat for 80 km between the ranges of *C. m. albotorquatus* and of the Zanzibar Sykes's monkey *C. m. albogularis*. This gap might be human-made as forest and mangrove likely occurred along the coast between the Tana Delta and Malindi in the recent past. The *C. m. albotorquatus* of Witu Forest Reserve and the (supposed) *C. m. albogularis* at Gedi Ruins are ca. 108 km apart. We found, however, that '*C. m. albogularis*' at Gedi Ruins are phenotypically different from the holotype for *C. m. albogularis* (which was collected on Zanzibar Island). The *C. mitis* at Gedi Ruins appear to be phenotypically intermediate between *C. m. albotorquatus* in Witu Forest and *C. m. albogularis* on the south coast of Kenya (De Jong & Butynski, 2009).

The northern limit of the range of *C. m. albotorquatus* is uncertain. Perhaps it reaches as far north as the extreme south coast of Somalia. *Cercopithecus m. albotorquatus* occurs on Manda and Lamu Islands (De Jong & Butynski 2009), and is probably also that taxon on Pate Island.

After being listed as 'Data Deficient' in 1996, *C. m. albotorquatus* was assessed as 'Vulnerable' B1ab(i,ii,iii,v) in 2008 (Butynski & De Jong, 2008; IUCN, 2008) on the basis of (1) the small extent of occurrence (<20,000 km²), (2) the severely fragmented distribution, and (3) the continuing decline in numbers due to habitat loss and degradation as a result of forest clearance for agriculture and other human activities (e.g., tourism development, settlement schemes, cutting of mangroves, salt mining). The extent of occurrence (Figure 22) is here estimated at ca. 10,250 km². Although the distribution might be described as 'severely fragmented', there are numerous fragments and some of these are large. In addition, most of the fragmentation is natural (i.e., not human-caused). Given that *C. m. albotorquatus* is a semi-terrestrial monkey and that this taxon probably has a long evolutionary history of coping with fragmented/isolated habitats, it appears likely that there is at least some gene-flow among many of the fragments. As such, we suggest that this taxon be assessed as 'Near Threatened'.

Somali galago *Galago gallarum*

De Jong & Butynski designed, established (in 2004), and maintain the locality database for *G. gallarum*, 'GallarumBase'. The aim of GallarumBase is to store and map all localities reported for *G. gallarum*. To the best of our knowledge, all *G. gallarum* localities recorded to date are north or east of the Tana River (Perkin & Butynski, 2003; Butynski & De Jong, 2004; De Jong & Butynski, 2011). It appears that the Tana River is the southern and western geographic barrier for this species. Nonetheless, large areas to the south and west of the Tana River remain unsurveyed and it may be that *G. gallarum* will yet be found at one or more sites in this region. During this survey, two nights (Tana River Primate NR and Garissa south) were spent west of the Tana River. No evidence for *G. gallarum* was obtained, even though the habitats at both sites appeared suitable for this species. *Galago gallarum* was, however, encountered 50 km northeast of the Tana River at Agarbul, and at 160 km east of the Tana River at Kiunga.

Little geographic phenotypic variation has been, thus far, observed in the field for *G. gallarum* in Kenya (De Jong & Butynski, 2010b). Individuals encountered throughout the known geographical range might vary slightly in the intensity of buff on the shoulders and front limbs, and the tail varies from brown to black (De Jong & Butynski, pers. obs.). It is possible that future phenotypic assessments throughout the geographic range will show more pronounced geographic variation for some (isolated) sites.

ACKNOWLEDGEMENTS

We are grateful to Zoo Atlanta, Dian Fossey Gorilla Fund International, Primate Action Fund, Conservation International, Zoological Society for the Conservation of Species and Populations, National Museums of Kenya, Institute of Primate Research, Margot Marsh Biodiversity Foundation, Primate Action Fund, and the Nocturnal Primate Research Group at Oxford Brookes University for various kinds of support to our primate surveys.

We extend our appreciation to the National Council for Science and Technology, Government of Kenya, for research permit NCST/RRI/12/1/MAS/61, and to the Institute of Primate Research for serving as our research affiliate in Kenya.

Juliet King, Ian Craig, Mike Watson, Tara Stoinski, Abdi Mohammed, Boke Diza, Ali Mbwari, Jean-Pierre Dekker, Tim Wacher, Jean-Pierre d'Huart, Colin Groves, Simon Bearder, Rebecca Lewis, Andrew Perkin, Luca Pozzi, Paul Honess, Lesley Ambrose, Caroline Harcourt, Leanne Nash, Todd Olson, John Oates, and staff of the Kibodo Trust, Northern Rangelands Trust, and Kenya Wildlife Service (at the Mpeketoni, Bodhei, and Kiunga stations) are thanked for various kinds of assistance during the field work and in the drafting of this report.

REFERENCES

- Andanje, S., Ogwoka, B., Bowkett, A., Buyo, Z., Cheka, M., Omari, M., Wacher, T., Kock, R. & Amin, R. 2010. Preliminary summary camera trapping results Dodori Forest Coastal Kenya. Presentation KWS / ZSL / WWF.
- Andrews P., Groves C.P. & Horne J.F.M. 1975. Ecology of the lower Tana River flood plain (Kenya). *Journal of East African Natural History Society* 151: 1-31.
- Bearder, S.K., Honess, P.E. & Ambrose, L. 1995. Species diversity among galagos with special reference to mate recognition. In *Creatures of the Dark: The Nocturnal Prosimians* (eds L. Alterman, G.A. Doyle & M.K. Izard, M.K.), Plenum, New York. Pp. 331-52.
- Butynski, T. M., de Jong, Y. A., Perkin, A. W., Bearder, S. K. & Honess, P. E. 2006. Taxonomy, distribution, and conservation status of three species of dwarf galagos (*Galagooides*) in eastern Africa. *Primate Conservation* 21: 63–79.
- Butynski, T.M. & Koster, S.H. 1994. Distribution and conservation status of primates in Bioko Island, Equatorial Guinea. *Biological Conservation* 3: 893-909.
- Butynski, T. M. & Mwangi, G. 1994. Conservation status and distribution of the Tana River red colobus and crested mangabey. Unpublished report to the Kenya Wildlife Service and Zoo Atlanta, Nairobi.
- Dandelot, P. 1974. Order Primates. Part 3. In *The Mammals of Africa: An Identification Manual* (eds J. Meester & H.W. Setzer). Smithsonian Institution Press, Washington, D.C.
- De Jong, Y.A. & Butynski, T.M. 2004. Surveys of the Somali lesser bushbaby (*Galago gallarum*) and northern lesser bushbaby (*Galago senegalensis*) in Kenya and Ethiopia. Unpublished report to the Primate Action Fund and Primate Conservation Inc., Washington, D.C.
- De Jong, Y.A & Butynski, T.M. 2009. Primate biogeography, diversity, taxonomy and conservation of the coastal forests of Kenya. Unpublished report to the Critical Ecosystem Partnership Fund. Eastern Africa Primate Diversity and Conservation Program, Nanyuki, Kenya.
- De Jong, Y.A. & Butynski, T.M. 2010a. Photographic maps of the primates of Kenya and Tanzania: a tool for identification and conservation. *Primate Conservation* 25: 27-32.
- De Jong, Y.A. & Butynski, T.M. 2010b. Assessment of the primates, large mammals and birds of the Mathews Range Forest Reserve, central Kenya. Unpublished report to The Nature Conservancy, Washington D.C.
- De Jong, Y.A. & Butynski, T.M. 2010c. *List of the Primates of Kenya*. Website: www.wildsolutions.nl
- De Jong, Y.A. & Butynski, T.M. in press. The primates of East Africa: country lists and conservation priorities. *African Primates* 8
- De Jong, Y.A. & Butynski, T.M. 2011. *Eastern Africa Primate Diversity and Conservation Program* <www.wildsolutions.nl>

Gartlan, J.S. & Brain, C.K. 1968. Ecological and social variability in *Cercopithecus aethiops* and *C. mitis*. In: *Primates: Studies in Adaptation and Variability* (ed. P.C. Jay). Holt, Rinehart, & Winston, New York. Pp. 253-292.

Groves, C.P. 2001. *Primate Taxonomy*. Smithsonian Institution Press. Washington D.C. Pp. 350

Grubb, P. 2001. Synonyms reduce the number of subspecies in the guenon *Cercopithecus mitis*. *African Primates* 5: 24-32.

Grubb, P., Butynski, T.M., Oates, J.F., Bearder, S.K., Disotell, T.R., Groves, C.P. & Struhsaker, T.T. 2003. Assessment of the diversity of African Primates. *International Journal of Primatology* 24: 1301-1357.

Hill, W.C.O. 1966. *Primates Comparative Anatomy and Taxonomy. VI Catarrhini Cercopithecoidea Cercopithecinae*. University Press, Edinburgh, UK. Pp. 757

IUCN. 2011. *IUCN Red List of Threatened Species*. www.iucnredlist.org

Kingdon, J. 1971. *East African Mammals: An Atlas of Evolution in Africa*. Volume I. Academic Press, London. Pp. 446.

Kingdon, J. 1997. *The Kingdon Field Guide to African Mammals*. Academic Press, San Diego, CA. Pp. 464.

Lernould J. M. 1988. Classification and geographical distribution of guenons: a review. In: *A Primate Radiation: Evolutionary Biology of the African Guenons* (eds. A. Gautier-Hion, F. Bourlière, J.-P. Gautier & J. Kingdon). Cambridge University Press, Cambridge. Pp. 54–78.

Napier, P.H. 1981. *Catalogue of Primates in the British Museum (Natural History) and elsewhere in the British Isles. Part II: Family Cercopithecidae, Subfamily Cercopithecinae*. British Museum, London. Pp. 203

Nekaris, K.A.I. & Jayewardene, J. 2004. Survey of the slender loris (Primates, Lorisidae Gray, 1821: *Loris tardigradus* Linnaeus, 1758 and *Loris lydekkerianus* Cabrera, 1908) in Sri Lanka. *Journal of Zoology* 262: 1-12.

Olson, T. R. 1979. Studies on aspects of the morphology and systematics of the genus *Otolemur* (Coquerel, 1859) (Primates: Galagidae). Ph.D. thesis, University of London, London.

Pocock, R.I. 1907. A monographic revision of monkeys of the genus *Cercopithecus*. *Proceedings of the Zoological Society of London*: 677-746.

Rahm U. 1970. Ecology, zoogeography and systematics of some African forest monkeys. In: *Old World Monkeys. Evolution, Systematics and Behavior* (eds. J.R. Napier & P.H. Napier). Academic Press, London. Pp. 591-626.

White, L. & Edwards, A. 2000. Methods for assessing the status of animal populations. In: *Conservation Research in the African Rain Forests: A Technical Handbook* (eds L. White & A. Edwards). Wildlife Conservation Society, New York. Pp. 191-201.

Zimmermann, E. 1995. Loud calls in nocturnal Prosimians: structure, evolution and ontogeny. In: *Current Topics in Primate Vocal Communication* (eds E. Zimmermann, J.D. Newman & U. Jürgens) Plenum Press, New York. Pp 47-72.