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Authors: Butynski, Thomas M., and de Jong, Yvonne A.

Source: Primate Conservation, 2015(29) : 107-113

Published By: Conservation International

URL: https://doi.org/10.1896/052.029.0107

Primate Conservation 2015 (29): 107–113

Distribution and Conservation Status of the Mount Kilimanjaro Guereza *Colobus guereza caudatus* Thomas, 1885

Thomas M. Butynski and Yvonne A. de Jong

Eastern Africa Primate Diversity and Conservation Program, Lolldaiga Hills Research Programme, Sustainability Centre Eastern Africa, Nanyuki, Kenya

Abstract: The Mount Kilimanjaro guereza *Colobus guereza caudatus* is considered to be endemic to northeast Tanzania. This paper presents the first records for *C. g. caudatus* in Kenya, describes the distribution of this subspecies, and assesses its conservation status. In September 2014, we found *C. g. caudatus* in southeast Kenya in Kitobo Forest Reserve (1.6 km²) and Loitokitok Forest Reserve (4.2 km²). This subspecies has an altitudinal range of *c.* 660–3,050 m asl and an 'Extent of Occurrence' of *c.* 4,040 km². These findings are important as they: (1) add one subspecies of primate to Kenya's primate list; (2) remove one endemic subspecies of primate from Tanzania's primate list; (3) establish *C. g. caudatus* as the most threatened primate subspecies in Kenya; (4) change the priorities for actions necessary to maintain Kenya's primate diversity; and (5) indicate that detailed biodiversity surveys within Kitobo Forest and Loitokitok Forest are likely to yield new data crucial to the conservation of biodiversity in southeast Kenya.

Key Words: biogeography, *Colobus guereza caudatus,* colobus monkey, Kenya, Kitobo Forest, Loitokitok Forest, Mount Kilimanjaro

Introduction

Africa harbors a high diversity of primates, most of which are endemic to the continent. Of the 25 genera and 93 species of primate in Africa, 12 genera, 19 species, and 24 subspecies occur in Kenya (De Jong and Butynski 2012). Although primates are one of the best studied taxonomic groups in East Africa, many questions remain concerning their taxonomy, biogeography, abundance, and conservation status.

The large (*c*. 10 kg), arboreal, guereza colobus *Colobus guereza* Rüppell, 1835, is endemic to Africa. Eight subspecies are currently recognized (Napier 1985; Groves 2001, 2007; Grubb *et al.* 2003; Fashing and Oates 2013; Groves and Ting 2013), three of which occur in Kenya; Mau Forest guereza *C. g. matschiei* Neumann, 1899 (Fig. 1)*,* Mount Kenya guereza *C. g. kikuyuensis* Lönnberg, 1912 (Fig. 2)*,* and Mount Uarges guereza *C. g. percivali* Heller, 1913. The latter two subspecies are endemic to central Kenya.

The Mount Kilimanjaro guereza *C. g. caudatus* is considered to be endemic to northeast Tanzania (Fig. 3), occurring on Mount Kilimanjaro and Mount Meru (Matschie 1895; Kingdon 1971; Rodgers 1981; Groves 2001, 2007; Fashing and Oates 2013), with smaller populations in several forest reserves on the lower south and east slopes of Mount Kilimanjaro (Napier 1985; Grimshaw *et al.* 1995; Foley *et al*. 2014). These include Rau, Kahe I, Kahe II, and Kileo Forest Reserves (Fig. 4). *Colobus guereza* is well known for its ability to persist, sometimes at high density, in small, isolated, disturbed, forest patches (Fashing and Oates 2013).

This paper is primarily concerned with presenting the first records for *C. g. caudatus* in Kenya, and with the distribution and conservation status of this subspecies.

Methods

Diagnostic phenotypic traits for the subspecies of *C. guereza* are presented in Dandelot (1974), Napier (1985), Groves (2001, 2007), and Fashing and Oates (2014). Drawings on Plate 45 in Mittermeier *et al.* (2013, p.698) provide a visual comparison of the eight subspecies of *C. guereza.* In the field, the primary diagnostic traits for *C. g. caudatus* are as follows: white mantle hairs cover >29% of the base of the tail, proximal part of the tail is black with scattered grey hairs, 71–88% of the tail is white, and the white tail tuft is very full (Figs. 3, 5 and 6).

Figure 1. Adult male Mau Forest guereza *Colobus guereza matschiei,* Lake Naivasha, southwest Kenya. In this subspecies, 36–57% of the tail is white. Photograph by Yvonne A. de Jong and Thomas M. Butynski.

Figure 2. Adult male Mount Kenya guereza *Colobus guereza kikuyuensis*, Nanyuki, central Kenya. In this subspecies, 71–81% of the tail is white. Photograph by Yvonne A. de Jong and Thomas M. Butynski.

Primate surveys were conducted 27–28 September 2014 from a vehicle and on foot by the two authors. Transects were run along dirt roads and foot paths. These were selected to maximize the chances of encountering as many individuals of as many species of primate as possible. As time was very limited, the rapid assessment survey method was used, as described in Butynski and Koster (1994), White and Edwards (2000), and Butynski and De Jong (2012).

Zeiss Victory 10×42 and Zeiss Dialyt 7×42B binoculars were used to scan for primates. Photographs were taken with a Nikon D200 digital camera fitted with a Nikon 80–400 mm lens, and with a Canon EOS 40D digital camera fitted with a Canon 100−400 mm lens. Photographs were shot in 'raw' format. As many individuals as possible in each primate group were photographed. All primate encounters were mapped with the help of a GPS (Garmin Oregon 650), Garmin MapSource v. 6.14 software (Garmin, Olathe, USA), and MapInfo Professional v. 10.5 software (Pitney Bowes Mapinfo, Troy, USA).

Literature and museum databases (for example, GBIF 2015) were searched to obtain locality records for *C. g. caudatus.* Additional locality records were obtained from our own field notes, through correspondence with colleagues, and through iNaturalist (De Jong and Butynski 2015). These records were used to map the geographic range and estimate the 'Extent of Occurrence' (IUCN 2001).

Kitobo Forest Reserve

Kenya's Kitobo Forest Reserve (03.44375ºS, 37.62165ºE) is a coastal forest located in Taita-Taveta County. This small (1.6 km²), indigenous, evergreen, closed-canopy forest lies at *c.* 750 m asl on the lower southeast slope of Mount Kilimanjaro (*c.* 2 km east of the Tanzania border, *c*. 10 km south-southwest of Taveta, and *c.* 225 km northwest of the Indian Ocean; Fig. 4). Kitobo is a groundwater forest supported by springs that originate on Mount Kilimanjaro, particularly the Njoro Spring. This forest is isolated, lying in a vast semi-arid region of grassland, woodland, and bushland dominated by species of acacia *Acacia* (Fabaceae) and commiphora *Commiphora*

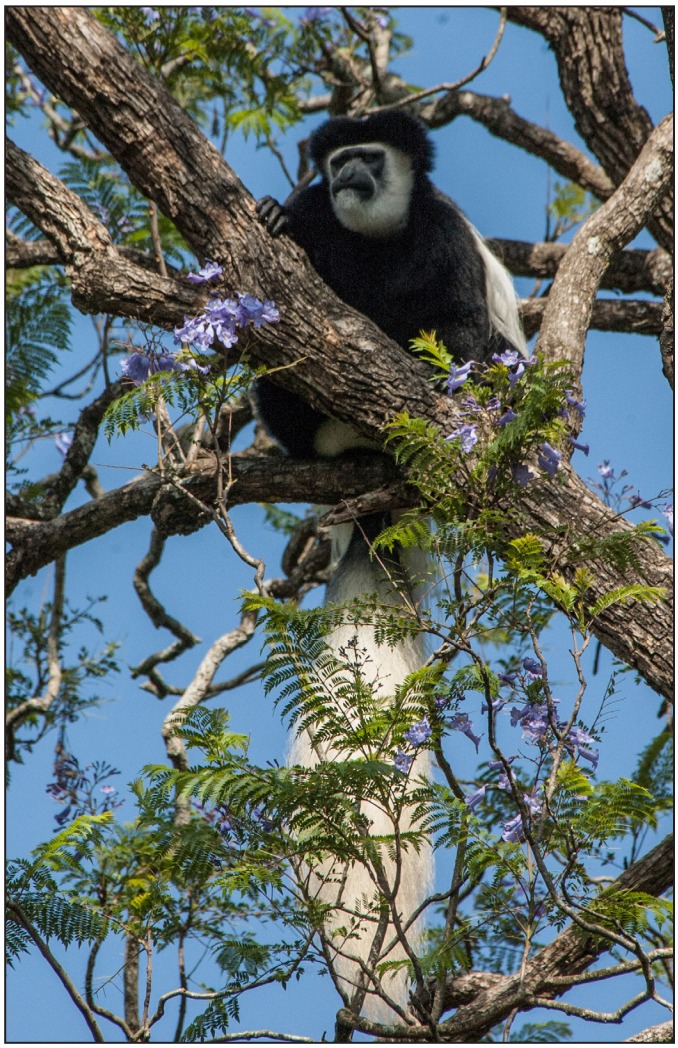

Figure 3. Adult male Mount Kilimanjaro guereza *Colobus guereza caudatus,* Usa River, northeast Tanzania. In this subspecies, 71–88% of the tail is white and the tail tuft is extremely full. Photograph by Yvonne A. de Jong and Thomas M. Butynski.

(Burseraceae). Mean annual rainfall is *c.* 600 mm and mean annual temperature is *c.* 23ºC (<climate-data.org>).

Kitobo is surrounded by small-holder farms on which the main crops are maize, rice, beans, bananas, and mangoes. The more common emergent trees in Kitobo include *Acacia xanthophloea, Albizia glaberrima* (Mimosaceae), *Celtis africana* (Ulmaceae), *Cordyla africana* (Caesalpiniaceae), *Diospyros mespiliformis* (Ebenaceae), *Ficus* spp. (Moraceae), *Milicia excelsa* (Moraceae), *Newtonia buchananii* (Mimosaceae), and *Trichilia emetica* (Meliaceae) (NEMA 2009). Kitobo is one of the most important sites in Kenya for the conservation of reptiles and amphibians (Malonza *et. al.* 2011), and supports at least three threatened bird species (Mlamba *et al*. 2013).

The authors conducted a survey of the primates of Kitobo from 14:00 h on 27 September until 08:00 h on 28 September 2014. Three groups of *C. g. caudatus* (composed of at least 6, 6, and 8 individuals) were encountered (Fig. 5; also Butynski and De Jong 2015). Based on the choruses of loud 'roar' calls heard during the night and early morning, there are at least six groups of *C. g. caudatus* in Kitobo. This is the first record for *C. g. caudatus* in Kenya. Kitobo, at 750 m asl, is considerably lower than the next lowest site in Kenya for *C. guereza* (*C. g. kikuyuensis* is present at *c.* 1,720 m asl near Nairobi).

Five other primates are found in Kitobo. We encountered at least eight groups of Zanzibar Sykes's monkeys *Cercopithecus mitis albogularis*, one group of central yellow baboons *Papio cynocephalus cynocephalus*, one group of Hilgert's vervet monkeys *Chlorocebus pygerythrus hilgerti*, 10–15 Pangani small-eared galagos *Otolemur garnettii panganiensis*, and four Kenya lesser galagos *Galago senegalensis braccatus*. With six species, the primate community of Kitobo is surprisingly diverse considering its small size, isolation, and semi-arid surroundings. Overall primate abundance is high.

Loitokitok Forest Reserve

Little remains of the indigenous montane forest that once occurred in Kenya's Kajiado District on the lower north slope of Mount Kilimanjaro. In 2000, only *c*. 4.2 km² of the area was covered with forest, representing a 35% decline in forest cover since 1973 (Campbell *et al.* 2003). The forest fragments that remain are located south (up-hill) from the town of Loitokitok (= Oloitokitok) in the Loitokitok Forest Reserve on the Kenya-Tanzania border (Fig. 4). Loitokitok is *c.* 57 km north-northwest of Kitobo. Mean annual rainfall is *c.* 900 mm and mean annual temperature is *c.* 18ºC (<climate-data.org>). The more common tree species here include *Acacia* spp., pencil cedar *Juniperus procera* (Cupressaceae), wild olive *Olea europaea* (Oleaceae), cabbage tree *Cussonia holstii* (Araliaceae), croton *Croton megalocarpus* (Euphorbiaceae), *Ficus* spp., and several exotics, particularly eucalyptus *Eucalyptus* (Myrtaceae).

On 28 September 2014, during 13:00−15:30 h, we conducted a primate survey in forest on the property of the Outward Bound Trust at Loitokitok. One group of *C. g. caudatus*, composed of two adult males, was encountered *c.* 800 m into Kenya from the Tanzania border (02.94368ºS; 37.50682ºE; 1,835 m asl; Fig. 6). It is likely that additional groups were present. According to the staff of the Outward Bound Trust, the only other diurnal primate here is *C. m. albogularis.*

Distribution and Conservation Status of *Colobus guereza caudatus*

Colobus g. caudatus was first discribed and named by Oldfield Thomas (1885) based on a specimen collected by Harry Johnston in 1883 at Useri, Tanzania, on the northeast slope of Mount Kilimanjaro (03.08098ºS; 37.59384ºE; 915 m asl). Useri is *c.* 8 km southwest of the Kenya border, *c.* 40 km north of Kitobo, and *c.* 20 km south-southeast of Loitokitok (Fig. 4). Kitobo is probably the eastern limit for *C. g. caudatus* and Loitokitok is probably the northern limit.

There are some errors in the literature and on the internet as concerns claimed localities for *C. g. caudatus* (which include localities in Burundi and Ethiopia). Some of this is

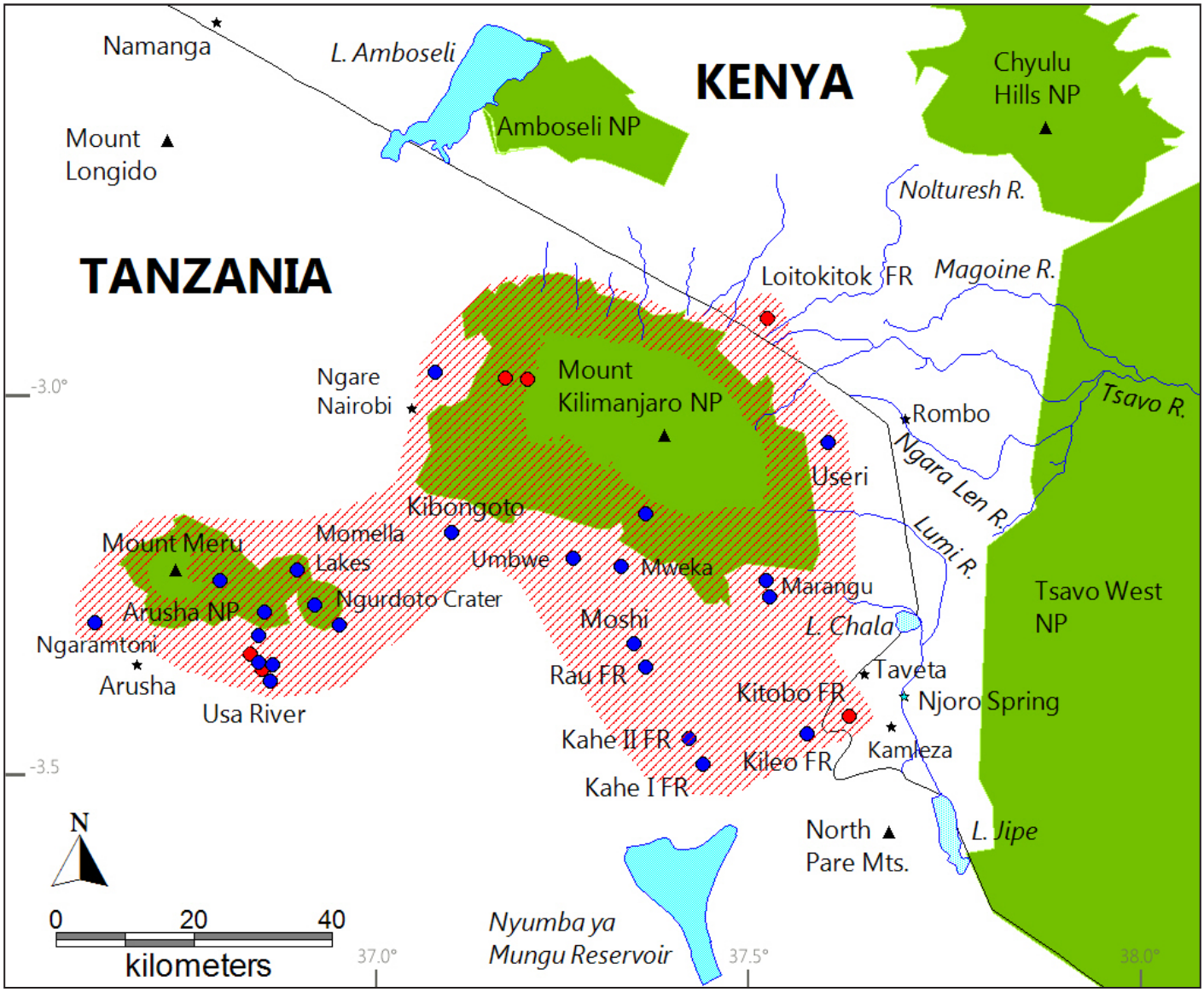

Figure 4. Distribution of the Mount Kilimanjaro guereza *Colobus guereza caudatus*. 'Extent of Occurrence' is depicted by the red polygon (*c.* 4,040 km²). Areas of Mount Kilimanjaro and Mount Meru >3,050 m asl are excluded from the polygon as *C. g. caudatus* is not known to occur above this altitude. Green represents national parks. Red dots represent sites where T. M. Butynski and Y. A. de Jong encountered *C. g. caudatus*. Blue dots represent other sites for *C. g. caudatus* (Thomas 1885; Lönnberg 1910; Schwarz 1929; Rodgers 1981; Napier 1985; Grimshaw *et al.* 1995; Foley *et al*. 2014; De Jong and Butynski 2015; GBIF 2015; N. J. Cordeiro pers. comm.; A. Semerdjian pers. comm.; M. Grimm pers. comm.; J. A. Ratzlaff pers. comm.; R. Knocker pers. comm.; F. Reid pers. comm.). Only the rivers draining Mount Kilimanjaro into Kenya are shown.

due to misidentified museum specimens, and also, perhaps, to the application of a taxonomy in use at the time. For example, *C. guereza* specimen ZS.1935.3.14.1 at the Natural History Museum (London) is referred to *C. g. caudatus* by Napier (1985). This specimen was obtained at Handajega in the western Serengeti. As such, it should be referred to *C. g. matschiei*. The Global Biodiversity Information Facility database (GBIF 2015) presents additional examples of this problem. For the purposes of establishing the distribution of *C. g. caudatus*, we accepted no records for west of the Eastern (Gregory) Rift Valley (i.e., west of 36ºE), west and northwest of which *C. g. matschie* occurs, or for north of the lower north slope of Mount Kilimanjaro (i.e., <1,800 m asl; north of 02.8°S), north of which *C. g. kikuyuensis* occurs (Kingdon 1971; Napier 1985; Fashing and Oates 2013; Y. A. de Jong and T. M. Butynski pers. obs.). Locality records for *C. g. caudatus* beyond these western and northern limits are considered to be erroneous (Fig. 4).

Colobus g. caudatus is the southeastern-most subspecies of *C. guereza* and is isolated from other subspecies by large expanses of unsuitable (semi-arid) habitats. The nearest known population of *C. g. kikuyuensis* is *c.* 170 km to the north-northwest in the Ngong Hills (Napier 1985), while the nearest known population of *C. g. matschie* is *c.* 160 km to the northwest in the Loita Hills (Butynski and De Jong 2012). The nearest known population of another species of colobine is that of Peters's Angola colobus *Colobus angolensis palliatus*, *c*. 75 km to the southeast in the South Pare Mountains (Rodgers 1981). Contrary to what is stated in Foley *et al.* (2014), *C. guereza* is not present in the North Pare Mountains

Figure 5. Adult male Mount Kilimanjaro guereza *Colobus guereza caudatus,* Kitobo Forest Reserve, southeast Kenya. Photograph by Yvonne A. de Jong and Thomas M. Butynski.

Figure 6. Adult male Mount Kilimanjaro guereza *Colobus guereza caudatus,* Loitokitok, southeast Kenya. Photograph by Yvonne A. de Jong and Thomas M. Butynski. For additional images and localities for *C. guereza,* visit the 'Colobinae Photographic Map' at <www.wildsolutions.nl>.

(Rodgers 1981; Cordeiro *et al*. 2005; Doggart *et al*. 2008; T. M. Butynski and Y. A. de Jong pers. obs.). The absence of *C. guereza* and *C. angolensis* from the North Pare Mountains is unexpected given the proximity of these mountains to populations of these two species; *C. guereza* at Kileo and Kitobo *c.* 15 km to the northwest, and *C. angolensis* in the South Pare Mountains *c.* 7 km to the southeast.

Almost all of Mount Kilimanjaro lies in Tanzania; the lower slopes to the north and east extend into extreme south Kenya. Despite the proximity of Kitobo and Loitokito to known sites for *C. g. caudatus* in Tanzania, there are no written records or specimens of *C. g. caudatus* for Kenya. As such, this subspecies has always been considered an endemic to Tanzania. De Jong and Butynski (2012) list *C. g. caudatus* as endemic to Tanzania but indicated that this subspecies might be present in extreme south Kenya. The nearest record of *C. g. caudatus* to Kitobo is from Kileo Forest Reserve in Tanzania (03.46054°S; 37.57005°E; 730 m asl; Doggart *et al*. 2008). Kileo (*c*. 1 km²) lies *c.* 1.9 km southwest of the Kenya border and *c.* 6 km southwest of Kitobo (Fig. 4). .

Colobus g. caudatus is widespread on Mount Kilimanjaro and Mount Meru, being present at many more localities on these two mountains than indicated in Figure 4. In Tanzania, this subspecies occurs as low as 660 m asl in Kahe II Forest Reserve (Cordeiro *et al.* 1995; N. J. Cordeiro pers. comm.) and as high as at least 3,050 m asl on Mount Kilimanjaro (Guest and Leedal 1954). Grimshaw *et al*. (1995) and Foley *et al*. (2014) report that on Mount Kilimanjaro *C. g. caudatus* is most common on the north and west slopes between 1,800 m and 2,300 m asl.

The overall current Extent of Occurrence of *C. g. caudatus* is *c*. 4,040 km² (Fig. 4). In Kenya, the Extent of Occurrence is <80 km², or <2% of the overall Extent of Occurrence. The 'Area of Occupancy'(IUCN 2001) in Kenya is probably <6 km². The number of *C. g. caudatus* in Tanzania is likely well over 10,000, whereas in Kenya the number is unlikely to be >200. The population of *C. g. caudatus* in both countries must be in decline in response to on-going habitat degradation, loss and fragmentation.

The IUCN Degree of Threat Category for *C. g. caudatus* has never been assessed (IUCN 2015). Applying the current *IUCN Red List Categories and Criteria* (IUCN 2001), a taxon with a declining, fragmented, population, and an Extent of Occurrence of <5,000 km², is 'Endangered', whereas a taxon with a declining, fragmented, population, and an Extent of Occurrence of <100 km², is 'Critically Endangered'. Therefore, once assessed by IUCN, *C. g. caudatus* is expected to be listed as an 'Endangered' subspecies. In Kenya, *C. g. caudatus* is expected to be listed as a nationally 'Critically Endangered' subspecies.

Primate Conservation in Taita-Taveta County and Kajiado County

Kitobo and Loitokitok are likely the only two sites in Kenya where *C. g. caudatus* occurs. Nonetheless, additional, more comprehensive, primate surveys should be undertaken in the forests of Taita-Taveta County and Kajiado County, with a focus on locating more populations of *C. g. caudatus*. For each forest, the survey should assess which species of primate are present, and their abundance, conservation status, and threats. These surveys should focus on ground water forests (for example, Rombo and Kamleza), as well as forest along the rivers that flow from Mount Kilimanjaro into Kenya, including the Rombo (or Ngara Len), Lumi, and Nolturesh, and the many seasonal streams along the Kenya-Tanzania border.

Although *C. g. caudatus* is reasonably well protected in the forest reserves and national parks where it occurs in Tanzania (Rodgers 1981; Foley *et al.* 2014), it is under severe threat in Kenya. The human population in Taita-Taveta County and Kajiado County has increased about five-fold in just the past 30 years. One result is that indigenous forest now covers <0.02% of the landscape (Campbell *et al.* 2003; NEMA 2009). Current pressure to unsustainably exploit the few remaining forests is extremely high. Most, if not all, forests in these two counties suffer from degradation, loss, and fragmentation, and all are small.

Given the circumstances as concerns forest and biodiversity conservation, Taita-Taveta County and Kajiado County, the Kenya Wildlife Service, Kenya Forest Service, county authorities, and people living around Kitobo Forest and Loitokitok Forest, should give particular attention to the long-term survival of these two small forests as their loss will probably mean the extirpation of several vertebrate species from both counties, and of *C. g. caudatus* from Kenya.

Conclusions

The findings presented here are important as they: (1) add one subspecies of primate to Kenya's primate list (now 25 subspecies); (2) remove one endemic subspecies of primate from Tanzania's primate list; (3) establish *C. g. caudatus* as the most threatened primate subspecies in Kenya; (4) change the priorities for actions required to maintain Kenya's primate diversity; and (5) indicate that detailed biodiversity surveys within Kitobo Forest (particularly) and Loitokitok Forest are likely to yield new data crucial to the conservation of biodiversity in southeast Kenya.

Acknowledgments

We are grateful to Patrick Malonza, Edson Mlamba, Norbert Cordeiro, Peter Fundi, Martin Grimm, John Ratzlaff, Alyssa Semerdjian, Richard Knocker, Jules Knocker, Fiona Reid, and Graham Reid for unpublished information, and to Jean-Pierre Dekker for logistic support. Kenya Forest Service staff in Taveta and at Kitobo Forest Reserve, and the Outward Bound Trust of Kenya staff at Loitokitok, provided important assistance in the field. We thank Lorna Depew, Carly Butynski, Norbert Cordeiro, and Anthony Rylands for reviewing the manuscript. The Institute of Primate Research and The National Museums of Kenya served as our institutional affiliates in Kenya. Lolldaiga Hills Ltd. provided us with a base in Kenya. The Kenya National Council for Science and Technology kindly granted permission for this research (Research Permits: NCST/RRI/12/1/MAS/61 and NCST/RRI/12/1/MAS/47). We are particularly grateful to Zoo New England for providing financial support towards this survey.

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Authors' address

Thomas M. Butynski and **Yvonne A. de Jong**, Eastern Africa Primate Diversity and Conservation Program, Lolldaiga Hills Research Programme, Sustainability Centre Eastern Africa, P.O. Box 149, Nanyuki 10400, Kenya. E-mails: <tbutynski@aol.com> and <yvonne@wildsolutions.nl>.

Received for publication: 5 May 2015
Revised: 25 May 2015