

**DISTRIBUTION OF THE POTTO *PERODICTICUS POTTO*
(PRIMATES: LORISIDAE) IN EASTERN AFRICA, WITH A
DESCRIPTION OF A NEW SUBSPECIES FROM MOUNT KENYA**

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ABSTRACT

The potto *Perodicticus potto* is a small, arboreal, nocturnal primate with an extensive, but poorly-known, distribution through tropical Africa, and a debated taxonomy. This paper (1) examines the Eastern Rift Valley as a major barrier to primate distribution in eastern Africa, (2) reviews the taxonomy of *P. potto*, (3) describes the distribution of the eastern potto *P.p. ibeanus*, (4) summarizes what is known about the body size, abundance, elevation and rainfall limits of *P.p. ibeanus*, (5) provides evidence for the presence of *P. potto* east of the Eastern Rift Valley, and (6) describes, names, and discusses a new subspecies of *Perodicticus* for Mount Kenya (the 'Mount Kenya potto' *Perodicticus potto stockleyi*). The geographic range for *P.p. ibeanus* is ca. 850 000 km² and extends from western Democratic Republic of Congo to western Kenya. *P.p. ibeanus* occurs where the mean annual rainfall is between 1300–2000 mm, and is not known to be present below 600 m or above 2300 m. Densities range from <2–28 individuals/km². *P.p. stockleyi* is described from one specimen that is phenotypically distinct from *P.p. ibeanus* and that derives from a population that is probably isolated from the nearest population of *P.p. ibeanus* by >175 km.

Keywords: potto, *Perodicticus potto ibeanus*, *Perodicticus potto stockleyi*

INTRODUCTION

Study region

The Eastern (Gregory) Rift Valley extends from Lakes Eyasi, Manyara and Natron in northern Tanzania northward through Kenya and Ethiopia to the Red Sea and Jordan Valley. Within Kenya, the floor of the Eastern Rift Valley is marked by Lakes Magadi, Naivasha, Elementaita, Nakuru, Bogoria, Baringo and Turkana, while in Ethiopia the floor is marked by Lakes Chew Bahir, Chamo, Abaya, Awasa, Shalla, Abijatta, Langano, Ziway and Koka to the Awash River and Afar Depression (see figures 1 & 2). Due to its considerable depth (mostly below 2000 m), width (>32 km), length, relative aridity and scarcity of forest, the floor of the Eastern Rift Valley has long served as major natural barrier to the distribution of

many forest-dependent taxa of animals that occur on the more mesic and better forested highlands and mountains to the west and east (see figure on page 9 in Kingdon, 1974). This includes several species and many subspecies of arboreal (and some terrestrial) primates (table 1).

Table 1. Species and subspecies of primates in Tanzania, Kenya, and Ethiopia for which the Eastern Rift Valley appears to be a barrier to dispersal (Dandelot, 1974; Kingdon, 1974, 1997; Hill & Meester, 1975; Groves, 2001, 2005; Grubb et al., 2003).

| West of the Rift | East of the Rift |
|---|---|
| <i>Tanzania</i> | |
| Northern silver galago <i>Otolemur monteiri argentatus</i> (Lönnerberg, 1919) | Pangani small-eared galago <i>Otolemur garnettii panganiensis</i> Matschie, 1905 |
| Uganda lesser galago <i>Galago senegalensis sotikae</i> Hollister, 1920 | Kenya lesser galago <i>Galago senegalensis braccatus</i> Elliot, 1907 |
| Mau Forest guereza <i>Colobus guereza matschiei</i> Neumann, 1899 | Mount Kilimanjaro guereza <i>Colobus guereza caudatus</i> Thomas, 1885 |
| <i>Tanzania and Kenya</i> | |
| Naivasha vervet <i>Chlorocebus pygerythrus callidus</i> (Hollister, 1912) | Johnston's vervet <i>Chlorocebus pygerythrus johnstoni</i> (Pocock, 1907) |
| Stuhlmann's blue monkey <i>Cercopithecus mitis stuhlmanni</i> Matschie, 1893 | Tanzania Sykes's monkey <i>Cercopithecus albogularis monoides</i> I. Geoffroy, 1841 |
| <i>Kenya</i> | |
| Northern silver galago <i>Otolemur monteiri argentatus</i> | Kikuyu small-eared galago <i>Otolemur garnettii kikuyuensis</i> (Lönnerberg, 1919) |
| Senegal lesser galago <i>Galago senegalensis senegalensis</i> É. Geoffroy, 1796 | Kenya lesser galago <i>Galago senegalensis braccatus</i> |
| Mau Forest guereza <i>Colobus guereza matschiei</i> | Mount Kenya guereza <i>Colobus guereza kikuyuensis</i> Lönnerberg, 1912 |
| Naivasha vervet <i>Chlorocebus pygerythrus callidus</i> | Heller's vervet <i>Chlorocebus pygerythrus arenarius</i> (Heller, 1913) |
| Stuhlmann's blue monkey <i>Cercopithecus mitis stuhlmanni</i> | Kolb's white-collared monkey <i>Cercopithecus albogularis kolbi</i> Neumann, 1902 |
| Schmidt's red-tailed monkey <i>Cercopithecus ascanius schmidti</i> Matschie, 1892 | None |

| West of the Rift | East of the Rift |
|--|--|
| <i>Kenya and Ethiopia</i> | |
| None | Somali galago <i>Galago gallarum</i> Thomas, 1901 |
| Boutourlini's blue monkey <i>Cercopithecus mitis boutourlinii</i> Giglioli, 1887 | None |
| <i>Ethiopia</i> | |
| Senegal lesser galago <i>Galago senegalensis senegalensis</i> | Ethiopian lesser galago <i>Galago senegalensis dunnii</i> Dollman, 1910 |
| Omo River guereza <i>Colobus guereza guereza</i> Rüppell, 1835 | Djaffa Mountains guereza <i>Colobus guereza gallarum</i> Neumann, 1902 |
| Sudan grivet <i>Chlorocebus aethiops aethiops</i> (Linnaeus, 1758) | Hilgert's vervet <i>Chlorocebus pygerythrus hilgerti</i> (Neumann, 1902) |
| Matschie's grivet <i>Chlorocebus aethiops matschiei</i> (Neumann, 1902) | Bale Mountains monkey <i>Chlorocebus djamdjamensis</i> (Neumann, 1902) |
| Western gelada <i>Theropithecus gelada gelada</i> (Rüppell, 1835) | Eastern gelada <i>Theropithecus gelada obscurus</i> Heuglin, 1863 |

The only area along the entire length of the Eastern Rift Valley that is above 2000 m lies between Lake Naivasha and Lake Elementaita in the vicinity of Gilgil. Here there is a narrow (*ca.* 5 km wide) ridge of relatively flat land that gradually reaches an elevation of *ca.* 2100 m. It is probable that, during periods of forest expansion and contraction, the first and last corridor of moist forest across the Eastern Rift Valley existed here. This corridor of relatively high ground is today a bush-covered plain that is too dry (<1000 mm/year rainfall) to support even dry forest.

Biogeographical history of the Eastern Rift Valley

Current evidence indicates that from *ca.* 38 000 B.P. until *ca.* 28 000 B.P., conditions in tropical Africa were much wetter and slightly warmer than during the (most recent) major glacial period that followed (Hamilton, 1982). Moist forests would have been widespread at this time, probably covering the floor of the Eastern Rift Valley in the region between Suswa and Lake Bogoria, thereby linking the highlands to either side. After *ca.* 28 000 B.P., conditions became increasingly arid. For example, by *ca.* 27 750 B.P. there was little forest on the Cherangani Range, and by *ca.* 23 000 B.P. there was almost no forest on Mount Elgon. Thus, the probable corridor of moist forest across the Eastern Rift Valley between Suswa and Lake Bogoria likely also disappeared around 28 000 B.P.

There have been at least four major glacial periods in East Africa (Hamilton, 1982). The most recent major glaciation occurred *ca.* 22 000–10 000 B.P., with maximum glaciation *ca.* 18 000 B.P. During this period, temperatures are estimated to have been *ca.* 6.7–8.3°C lower than at present (Livingston, 1980) and conditions became much dryer (Hamilton, 1982). As such, forests on the highlands on both sides of the Eastern Rift Valley were greatly

reduced in extent, leaving them isolated for perhaps >18 000 years. Throughout this time, Mount Elgon and the Cherangani Range were particularly arid and harboured little forest, whereas fairly extensive forest is believed to have persisted on Mount Kenya (Hamilton, 1982).

From *ca.* 10 000–8000 B.P. conditions in tropical Africa became especially wet and increasingly warm. During this period, forest cover in Kenya probably reached its maximum (Hamilton, 1982). From *ca.* 9000–6000 B.P., Lakes Nakuru, Elementaita and Naivasha were much deeper and larger than they are today. At times they reached a depth of about 190 m (Butzer *et al.*, 1972). As such, they essentially bridged the east and west walls of the Eastern Rift Valley (see figure 19 in Hamilton, 1982). When these lakes were at their highest levels, it is estimated that rainfall in the region was 50–65% greater than at present. This is enough of an increase in precipitation to, once again, support moist forest across the floor of the Eastern Rift Valley. It is likely that during this period, there were at least three corridors of moist forest connecting the highlands to the east and west of the Eastern Rift Valley; one to the south of Lake Naivasha, one between Lake Naivasha and Lake Elementaita-Nakuru, and one to the north of Lake Elementaita-Nakuru. Indeed, there may have been a broad connection of moist forest for at least 150 km along the Eastern Rift Valley from at least as far south as Suswa to at least as far north as Lake Bogoria. After *ca.* 8000 B.P., there was a decline in rainfall towards 4000 B.P. It is likely that the corridor of moist forest across the Eastern Rift Valley in the vicinity of Lakes Naivasha, Elementaita and Nakuru was again lost soon after *ca.* 8000 B.P.

The picture for Africa is of repeated contractions and expansions of moist forests during the Quaternary (present to 2.5 million B.P.), with subspeciation and speciation related to the isolation of populations during extended cold, arid, periods (Hamilton, 1982). In East Africa, this isolation has likely been particularly severe and prolonged as a result of the additional barrier posed by the Eastern Rift Valley.

In Kenya, there were, in historic times, two large areas of contiguous moist forest west of the Eastern Rift Valley (Mount Elgon and Kakamega-Nandi-Cherangani-Mau), and one large area of moist forest to the east of the Eastern Rift Valley (Aberdares-Mount Kenya). Over the past 100 years or so, these three large areas of moist forests have been both greatly reduced in size and severely fragmented. This has occurred as a result of the extensive clearance of forest for agriculture and human settlement. One result is that the corridors of moist forest that once connected Kakamega, Nandi, Cherangani and Mau Forests have been destroyed, as has the corridor between the Aberdares Range and Mount Kenya (Kingdon, 1974; Hamilton, 1982; Bennun & Njoroge, 1999; Akotsi *et al.*, 2006)

Primate biogeography and the Eastern Rift Valley

Primate distribution and primate evolution appear to have been greatly affected both by the barrier created by the dry, forest-free floor of the Eastern Rift Valley, as well as by the substantial retreat of forest on the highlands to the east and west on at least a few occasions (table 1).

The olive baboon *Papio anubis* (Lesson, 1827) and the patas monkey *Erythrocebus patas* (Schreber, 1775) are the two most terrestrial, savannah- and woodland-dependent species of primate in this region. As such, they probably readily move across the floor of the Rift. It is not surprising, therefore, that there is little, if any, differentiation among their populations in the highlands on either side of the Rift.

The potto *Perodicticus potto* (Müller, 1776) is a small (*ca.* 1.0–1.5 kg), compact, slow-climbing, arboreal, nocturnal, highly cryptic primate that occurs in primary and secondary moist forest across tropical Africa from Guinea to southwestern Kenya (Schwarz, 1931; Hill, 1953; Wolfheim, 1983; Groves, 2001; Grubb *et al.*, 2003; Stump, 2005, figure 3). The distribution of *P. potto* is not well documented. This paper (1) reviews the taxonomy of *P. potto*,

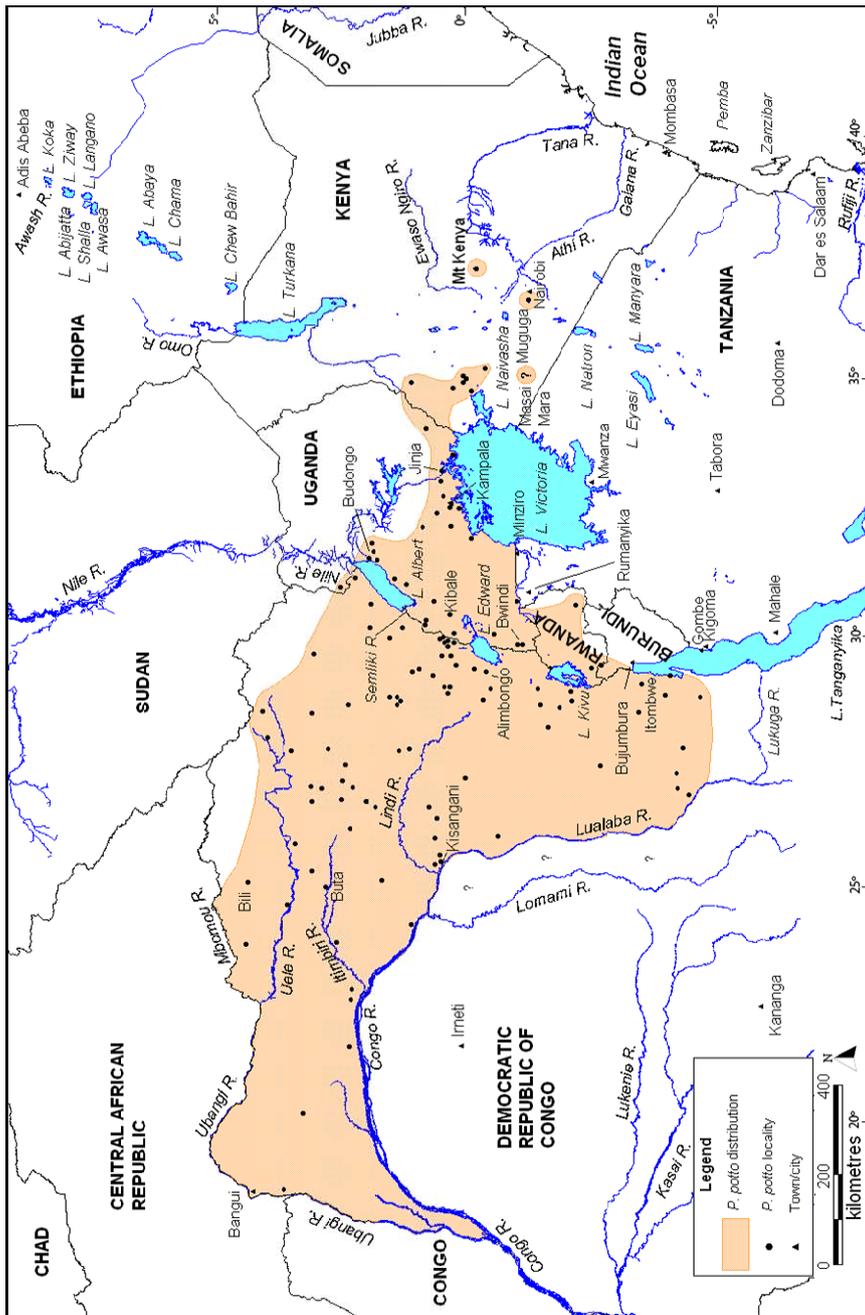


Figure 1. Geographic distributions of the eastern potto *Perodicticus potto ibeanus*. The region to the south of the Congo River, west of the Lomami River, north of the Lukenie River, and west of the Congo and Ubangi Rivers is occupied by the 'central potto' *Perodicticus potto edwardsi*, if *P. p. faustus* Thomas, 1910, is taken as a synonym of *P. p. edwardsi* (Schouteden, 1944; Hill, 1953; Kingdon, 1997). The distribution for *P. p. edwardsi* is not shown on this map. It is not known what subspecies of *P. potto* is present between the Lomami River and Luabala River, DRC. Names of the sites plotted on this map, and the sources of these data, are available at www.wildsolutions.nl.

(2) describes the distribution of the eastern potto *P.p. ibeanus* Thomas, 1910 (including the Democratic Republic of Congo (DRC)) (figures 1 & 2), (3) summarizes what is known about the body size, abundance, elevation and rainfall limits of *P.p. ibeanus*, (4) provides evidence for the presence of *P. potto* east of the Eastern Rift Valley, and (5) describes, names and discusses a new subspecies of *P. potto* for Mount Kenya.



Figure 3. Eastern potto *Perodicticus potto ibeanus*. This photograph was taken in the Kakamega Forest, western Kenya. Photograph by H. Schuetz. Other colour photographs of *P.p. ibeanus* by H. Schuetz are presented in Boy (2004) and in Butynski & de Jong (2004).

POTTO PERODICTICUS POTTO

Current taxonomy

The taxonomy of the forms within *Perodicticus* Bennett, 1831 is far from resolved (Elliot, 1913; Schwarz, 1931; Hill, 1953; Hill & Meester, 1975; Jenkins, 1987; Bearder, 1998; Sarmiento, 1998; Schwartz & Beutel, 1995; Stump, 2005) and is primarily based on differences in size of the body, size and shape of the teeth, skull and vertebrae, pattern of dental development and eruption, pattern, texture and colour of the pelage, and length of the hair (Thomas, 1910; Schwarz, 1931; Hill, 1953; Schwartz 1974, 1975, 1996; Jenkins, 1987; Schwartz & Beutel, 1995; Stump, 2005; Smeenk *et al.*, 2006). There is, obviously, much need for detailed study of the various forms and their distributions across the geographic range of this genus. The four most recent taxonomies (Jenkins, 1987; Groves, 2001, 2005; Grubb *et al.*, 2003) are in agreement in recognising *Perodicticus* as comprised of one extant species (*P. potto*) with three subspecies:

P.p. potto (Müller, 1776) – Western potto. From Guinea east to Nigeria, perhaps to the Niger River. Synonyms: *bosmannii*, *geoffroyi*, *guineensis*, *ju-ju*.

P.p. edwardsi Bouvier, 1879 – Central potto. From the Niger River (07°01'E), Nigeria, south to northern Angola, and east into the Congo Basin (left/south bank of the Congo River) to Irneti (00°07'N; 21°38'E), and south to Mayumbe, perhaps to the Kasai River, DRC. Synonyms: *batesi*, *faustus*.

P.p. ibeanus Thomas, 1910 – Eastern potto. From the left/east bank of the Ubangi River in northern and northwestern DRC, south to the right (north) bank of the Congo River, south along the right (east) bank of the Lualaba River to the Lulindi River, east to the Itombwe Mountains (Baraka) and the northwestern corner of Lake Tanganyika, and northeast through northwest Burundi, Rwanda, western and southern Uganda to southwestern Kenya (figures 1, 2 & 3). Synonyms: *arrhenii*, *nebulosus*.

The above taxonomy is the one followed in this paper.

Variation within potto *Perodicticus* relative to other prosimians

As concerns variation in pelage pattern, texture and colour within *Perodicticus*, Stump (2005) found differences that help to validate the subspecies *P.p. potto*, *P.p. edwardsi* and *P.p. ibeanus*. These are supported by corresponding dental and cranial traits, as well as by differences in the length of the tail. Stump (2005) compared the degree of difference between the three currently recognized subspecies of *P. potto* and other closely related primates (*i.e.* *Loris* É. Geoffroy, 1796, *Nycticebus* É. Geoffroy, 1812, *Arctocebus* Gray, 1863, *Galago* É. Geoffroy, 1796, *Galagoides* A. Smith, 1833), as well as the degree of difference recognised as taxonomically relevant in these genera. He (Stump, 2005: 37) states that,

“The size and pelage differences present in the different species of Nycticebus are comparable to the level of difference in the subspecies of Perodicticus potto.”

One conclusion of his study (Stump, 2005: 172) is that,

“If the establishment of significant differences in phenotype, often referred to as diversity, is the primary criterion for defining species, then the morphology, development, and genetics definitely point to species-level differences existing in the genus Perodicticus.”

Similarly, Schwartz (1974, 1975) found that there are considerable differences between *P.p. edwardsi* and *P.p. ibeanus* in the timing of dental eruption; so much so that he equated this difference to species-level differences in *Tarsius* Storr, 1780, *Propithecus* Bennett, 1832 and *Lemur* Linnaeus, 1758.

In addition, C. Roos (pers. comm. in Stump, 2005: 171),

“...cites a within-group comparison based on a small sample of the three primary subspecies (ibeanus, edwardsi, and potto) looking at differences in the mitochondrial cytochrome b gene sequence. The differences between the three potto taxa studied were between 7 and 9%, which is comparable to species-level differences in the same gene for Nycticebus taxa (3 to 13% difference) and Microcebus (4 to 14% difference).”

Among African lorises (using the taxonomy of Grubb *et al.*, 2003), we find that the differences in the pattern, texture and colour of the pelage of the two species in the '*Galagoides demidovii* Group', the three species in the '*Galagoides zanzibaricus* Group', the five species in the '*Galagoides granti* Group', the four species in *Galago*, and the three species in *Sciurocheirus* Gray, 1872, are less than the level of difference observed among the three subspecies of *P. potto*. This argues for species level designation for these three taxa. Indeed, the level of size and pelage difference among the genera *Galagoides*, *Galago* and *Sciurocheirus* may be no greater than that observed among the three subspecies of *P. potto*. It appears, however, that there is far more pelage (and probably size) variation within each of the three recognized subspecies of *P. potto* than occurs within *Galagoides*, *Galago* and *Sciurocheirus*, and herein lies a serious problem for those concerned with the taxonomy of *Perodicticus*.

The holotype of *P.p. ibeanus* is a male collected at "Kakamega Forest, near Mount Elgon, British East Africa, alt. 6000 ft." (Thomas, 1910: 536). Note that the maximum elevation of Kakamega Forest is ca. 5400 ft (1650 m). On this basis, it might be suspected that the holotype was not actually collected in the Kakamega forest, but rather in the higher, contiguous Nandi Hills or eastern slope of Mount Elgon. Information provided by Hobley (1911) and Kemp (1911), however, leave no doubt that the holotype was obtained from Kakamega Forest. As such, it can be concluded that the elevation given by Thomas (1910) for the holotype of *P.p. ibeanus* is an over-estimate by ca. 200 m (600 ft).

METHODS

During this study, one or both of the authors examined the collections of *P. potto* at the following museums: National Museums of Kenya (Nairobi; NMK), United States National Museum (Washington, D.C.; USNM), American Museum of Natural History (New York; AMNH) and Natural History Museum (London; BMNH). In addition, we obtained the *P. potto* specimen data set for each of the following museums: Royal Museum for Central Africa (Tervuren), Field Museum of Natural History (Chicago), Museum Alexander Koenig (Bonn), Naturhistorisches Museum (Berlin), Museum of Comparative Zoology (Harvard), Los Angeles County Museum of Natural History, Carnegie Museum of Natural History (Pittsburg), and several other smaller museums.

During the course of their research on the taxonomy and distribution of *Perodicticus*, the authors conducted a thorough review of the literature and corresponded with many experienced naturalists/primatologists/conservationists (*e.g.* C. Groves, I. Parker, G. Boy, R. Boy, A. Root, R. Watson, C. Church, Q. Luke, D. Hunt, B. Finch, D. Martins, R. Dyer, T. Stevenson, T. Young, R. Barnley, J. Barnley, T. Seth-Smith, G. Powys, S. Spawls, H. Henley & R. Glenn).

Nocturnal censuses were conducted by the two authors walking along a footpath or road at the rate of about 1 km/h. Using light from headlamps, the surrounding areas were visually searched for the eye-shine of *P. potto*. Most of the censuses were conducted during the several hours following dusk (*i.e.* after ca. 19:00 h) or during the few hours before dawn (*i.e.* prior to ca. 06:00 h). The following data were recorded for each census: location, date, start and end times, weather, moon phase, distance travelled, vegetation type, elevation, primates encountered. A GPS (Garmin, E-trex Venture) was used to determine the location, elevation and distance travelled.

In an effort to locate *P.p. stockleyi* to the east of the Eastern Rift Valley, six questionnaire surveys were undertaken by one or two field technicians. All of these surveys were conducted on or near Mount Kenya and the Aberdares Range between 2002 and 2007 (figure 2). During all of the questionnaire surveys, residents were asked if they know *P. potto*. They were shown pictures of several species of primates, including *P.p. ibeanus* and *Otolemur garnettii kikuyuensis*, as well as the southern tree hyrax *Dendrohyrax arboreus* A. Smith, 1827. The characters that best distinguish these three species in the field were pointed out (particularly the length of the tail and structure of the forefeet) (Kingdon, 1974, 1997).

Microsoft Office Access (XP) software was used to compile the *P. potto* locality database. MapInfo (version 8.0) software was used to create the *P. potto* distribution maps, calculate distances and the size of the geographic ranges (*i.e.* extent of occurrence).

RESULTS AND DISCUSSION

Distribution of the eastern potto *Perodicticus potto ibeanus*

The main references for information on the distribution of *P. potto* are Elliot (1913), Schwarz (1931), Schouteden (1944), Hill (1953), Rahm (1966), Kingdon (1974, 1997), Wolfheim (1983), and Jenkins (1987). The eastern limit of the distribution of *P. potto* is uncertain. Based on our review of the literature, on the collections at the above-mentioned museums and on correspondence with experienced naturalists/primatologists/conservationists, it appears that, in Kenya, *P. potto* is only confirmed for Kakamega Forest (*ca.* 120 km² of forest, 1550–1650 m), Nandi Forest (*ca.* 210 km² of forest, 1700–2130 m), and for the vicinity of these two forests (figure 2).

Although it is stated that *P. potto* is in the Mau Forest (>2000 km² of forest, 1800–3000 m) on the west escarpment of the Eastern Rift Valley (Schwarz, 1931; Allen, 1939; Hill, 1953; Kingdon, 1974; Hill & Meester, 1975; Jenkins, 1987; Dunn, 1992; Reuling *et al.*, 1992), we have found no evidence for this, neither among museum collections (see above) nor in the literature (*e.g.* Wilson, 1988; ERL, 1990; Davies *et al.*, 1991; Wily, 1991).

Of those people contacted who have lived and/or undertaken research in the Mau Forest, all but one said that they had never encountered *P. potto* there (*e.g.* H. Dufresne, B. Finch, D. Martins, J.H. Wreford Smith & A. Seth-Smith, pers. comm.; T. Butynski, pers. obs.). The one exception is L. Wedd (pers. comm.), who lived in Kericho, on the western edge of the Mau Forest, for 35 years (1963–1998). He reports that he "...saw potto on the road at night on several occasions." One of his sightings was at *ca.* 2000 m and another was at *ca.* 2100 m (0°25'08''S; 35°17'35''E). During his 35 years at Kericho he visited the Masai Mara area more than 120 times. He reports that in about 1981, one *P. potto* entered his camping trailer near Leopard Rocks (1°11'24''S, 35°09'29''E). The site is *ca.* 13 km west of Ol Doinyo Mesereji (figure 2).

Kingdon (1974) and Eley (1989) mention *P. potto* for the Uganda side of Mount Elgon (*ca.* 1700 km² of forest, 1460–4320 m). We have, however, found no evidence for *P. potto* either in the forests of Mount Elgon or in the Cherangani Range (*ca.* 605 km² of forest, 2000–3365 m). There seem to be no museum records for *P. potto* at either site, or other reports in the literature (Kemp, 1911; Dollman, 1914; Lönnberg, 1918; Williams, 1967; Howard *et al.*, 1996; Ambrose, 2002). Those people whom we contacted (who have much experience in one or both of these forests), have never encountered *P. potto* in them (J. Barnley, R. Barnley, A. Carn & V. Carn, pers. comm.).

R. Boy, born in 1929, grew up on a farm at Endeless (1920 m). Although Endeless is today *ca.* 10 km from the Mount Elgon Forest, at that time there was extensive forest in the vicinity of Endeless. In 1954, he moved to another farm at 2210 m which, today, remains on the edge of the Mount Elgon Forest. Here he lived until 1979. Thus, R. Boy lived next to the Mount Elgon Forest for 50 years. He spent much time fishing for trout on all of the rivers (but principally the Suam, Kaptega, and Koitobos/Kimothon Rivers) on the Kenya side of Mount Elgon and became an Honorary Warden of the Mount Elgon National Park as of the time it was established in 1968. His son, Gordon. Boy, born in 1957, lived on the edge of the Mount Elgon Forest until 1975 and undertook almost daily walks in the forest in search of birds and other animals. Neither ever encountered, or heard reports of, *P. potto* on Mount Elgon, although they never undertook night walks in the forests of Mount Elgon in search of *P. potto* or other animals. Given the strategic location of the Boy Farm as a staging post for entering the Mount Elgon Forest, many parties of naturalists and researchers stayed there. Among these were John G. Williams, Alec Forbes-Watson and Wilfred Thesiger. In spite of all this activity that might have led to an encounter with a *P. potto* in the area, no encounter occurred (G. Boy, pers. comm.).

Similarly, J.H. Wreford Smith (pers. comm.) was also born and raised at the foot of Mount Elgon and spent many nights camping on Mount Elgon during the 1940s. He never encountered *P. potto* there, nor did he ever hear anyone refer to *P. potto* as present on Mount Elgon or on the Cherangani Range.

De Jong (2004) conducted a primate questionnaire survey in Busia District (western Kenya). None of the 28 residents who provided responses had ever encountered *P. potto* in the area.

That *P. potto* has not been confirmed (with photographs or specimens) for the forests of the Mau Range, Mount Elgon or Cherangani Range is surprising given (1) the relatively large size of these forests, (2) the proximity of the Kakamega and Nandi Forests where *P. potto* are present and common in places, (3) that the lower forests of these sites appear suitable for *P. potto*, and (4) that all of these forests must have been broadly connected in the not too distant past. We expect that future research will confirm *P. potto* at these three sites, albeit localized, at low densities, and in the lowest, wettest, remaining forest.

The localities for *P.p. ibeanus* are shown in figure 1. The vast majority of these localities are supported by collected specimens housed at the museums mentioned above, but some are based upon sightings by experienced primatologists and naturalists. The geographic range size (*i.e.*, 'extent of occurrence') was estimated for *P.p. ibeanus* in each of the five countries where it is known. The results are as follows:

- Kenya: 14 000 km² (2% of land surface area).
- Uganda: 86 000 km² (43% of land surface area).
- DRC: 727 000 km² (32% of land surface area).
- Rwanda: 19 000 km² (77% of land surface area).
- Burundi: 2000 km² (9% of land surface area).

The total extent of occurrence for *P.p. ibeanus* is very roughly 850 000 km². It should be noted, however, that there are large areas of, apparently, unsuitable habitat within this geographic range where *P.p. ibeanus* is probably absent, especially in Kenya, Uganda, Rwanda, and Burundi where conversion of natural forest to agriculture has occurred on a massive scale. As such, the 'area of occupancy' is much less than 850 000 km².

Somewhat surprisingly, there are no museum specimen records of *P. potto* for Tanzania, nor reports in the literature (Swynnerton & Hayman, 1951, 1958; Kingdon, 1974; Wolfheim, 1983; Stump, 2005). None of the naturalists and primatologists that we contacted, all of

whom have many years of experience in the forests of Tanzania, had ever encountered *P. potto* in Tanzania (A. Rodgers, C. Foley, N. Baker, B. Wallauer, M. Wilson, M. Huffman, K. Howell, D. Moyer, B. Stanley, T. Nishida, T. Davenport & A. Perkin, pers. comm., T. Butynski & Y. de Jong, pers. obs.). This includes Minziro Forest, Rumanyika Forest, Gombe Stream, and Mahale Mountains, four of the sites along the northwestern border of Tanzania, where *P.p. ibeanus* is most expected. Perkin and Bearder (2004), in September, 2004, conducted 58 h of night surveys in Minziro Forest, but no *P. potto* was detected. In October, 2000, T. Butynski and C. Ehardt (pers. obs.) camped for four nights and undertook 10 h of night surveys in Rumanyika Forest without finding *P. potto*. We suspect, however, that *P. potto* will eventually be found to occur in the mid-altitude (transition) and montane forests of northwestern Tanzania.

Mean annual rainfall over the geographic range of *P.p. ibeanus* is from ca. 1300 mm to ca. 2000 mm. Only a small portion of Kenya (or East Africa) receives a mean annual rainfall of > 1300 mm.

Based on elevations at the following five sites where *P.p. ibeanus* is confirmed present, this subspecies occurs from ca. 600 m to ca. 2300 m.

- Bili, north-central DRC (04°23'N, 24°55'E, 600 m; T. Butynski, pers. obs.).
- Semliki Forest, western Uganda (0°50'N, 30°05'E, 670 m; T. Davenport, pers. comm.).
- Ruhizha, Bwindi-Impenetrable Forest, southwestern Uganda (01°01'S, 29°43'E, 2300 m; T. Butynski, pers. obs.).
- Soyot, West Nandi Forest, southwestern Kenya (0°04'S, 35°08'E, 2130 m; J. Mayers, pers. comm.).
- North Nandi Forest, southwestern Kenya (0°04'N, 35°00'E, 2170 m.; D. Martins, pers. comm.).

Interestingly, as pointed out by C. Groves (pers. comm.), nowhere is *P. potto* known to be sympatric with any of the three species of *Otolemur* Coquerel, 1859 (small-eared greater galago *O. garnettii* (Ogilby, 1838), thick-tailed greater galago *O. crassicaudatus* (É. Geoffroy, 1812), silver greater galago *O. monteiri* (Bartlett, 1863)). Nonetheless, according to Olson (1979), the miombo silver galago *O. monteiri monteiri* (Bartlett, 1863), a subspecies strongly associated with miombo *Brachystegia* spp. woodland, is present just to the south of *P.p. edwardsi* from Angola (Cabinda) through much of DRC, and, apparently parapatric (if not narrowly sympatric; Omari *et al.*, 1999) with *P.p. ibeanus* in southeast DRC and southwest Uganda. In southwest Kenya the northern silver galago *Otolemur monteiri argentatus* (a subspecies of woodlands and montane forest), is present just to the south and southeast of *P.p. ibeanus* (if not parapatric), and the Kikuyu small-eared galago *O.g. kikuyuensis* is present to the east, across the Eastern Rift Valley.

These distribution patterns, and the fact that *O. monteiri* (ca. 1.2 kg) and *O. garnettii* (ca. 0.8 kg), not only have a body size similar to *P. potto* (ca. 1.0–1.5 kg), but are also arboreal, nocturnal and omnivorous, suggest that competitive exclusion may be present here. They also suggest that where species within these two genera are sympatric (if such sites exist), one of the two species, if not both, will be present at a relatively low density as a result of this competition. The current distribution of *P. potto* and of the three species of *Otolemur* (Olson, 1979), suggests that *P. potto* is the more competitive species in the relatively species-rich Guineo-Congolian forests and montane forests of West Africa, Central Africa, and central East Africa (to Kakamega and Nandi Forests, western Kenya), and that *Otolemur* spp. has the competitive advantage in the relatively species-poor woodland/forest mosaics and montane forests of the region to the south and east of the Guineo-Congolian forests.

External appearance of the eastern potto *Perodicticus potto ibeanus*

For *Perodicticus*, there is a high level of inter-population variation, and for some populations there is also a high level of intra-population variation (see specimens from Cameroon and DRC at BMNH). For the most part, this variation remains largely unstudied and, therefore, unexplained. It may well be that a number of 'cryptic' species and subspecies remain 'hidden' within *Perodicticus*, and that the total number of taxa is well beyond the currently recognized one species and three subspecies (Jenkins, 1987; Schwartz & Beutel, 1995; Bearder, 1998; Grubb *et al.*, 2003; Stump, 2005).

Thomas (1910: 536) describes the pelage of the holotype of *P.p. ibeanus* as follows:

"Fur soft and thick, the wool hair on the back nearly 20 mm in length, and the straight hairs 25–26 mm." "General colour grizzled ashy, but the shoulders and fore-back blackish; these dark tips broadening posteriorly so as to make the nape and fore-quarters almost black with a hidden suffusion of dark clay-color. The long bristle hairs of the crown and nape black. Rest of the body, behind the withers, grizzled ashy, the longer hairs dark with grayish-white tips, the woolly under fur dark slaty basally, then broadly clay-colored, with dark tips. Under surface grayish, not sharply defined, the hairs slaty basally, dull grayish white terminally (gray No. 8). Arms and legs grizzled ashy like the body; hands and feet brownish. Tail comparatively long, cylindrical, ashy gray."

The tail of the holotype is given as 68 mm. Thomas (1910: 536) is incorrect in stating that the tail of the holotype is "*comparatively long*". In fact, *P.p. ibeanus* is the subspecies with the shortest mean tail length ($x = 72$ mm, range = 43–95, $n = 13$, see below).

Importantly, Thomas (1910: 537) states that the pelage is the distinguishing feature for *P.p. ibeanus*:

"P. ibeanus is at once distinguishable from all others by the hoary colour of its back, which contrasted markedly with its blackish shoulders, the difference being due to the long hairs of the former being broadly tipped with ashy, a character not found in any other potto."

Subsequently, Hill (1953: 193) describes *P.p. ibeanus* as follows:

"A highland subspecies characterized by dense, soft, woolly coat in which both wool hairs and bristle hairs are proportionately longer than in the lowland forms." "Dark, almost blackish, colour of forepart of back contrasted with greyer posterior parts. Head brownish, with the hairs black-tipped; remainder grizzled ashy-grey; hairs with slaty bases. Under parts grey with slaty bases to hairs. Hands and feet buffy-brown; tail ashy."

Most recently, Stump (2005: 14), upon examination of 132 specimens from the entire known range for *P. potto*, states the following concerning *P.p. ibeanus*:

"...large, long bodies and a distinctive tri-colored pelage (in particular a dark zone across the shoulders/nuchal region) were found which conform to the previous descriptions of P.p. ibeanus; however, they did not possess the relatively long tails originally described for the taxon."

Later, Stump (2005: 149) provides the following, additional, description for *P.p. ibeanus*:

“...light brown head/forelimbs, dark shoulders, and uniform grey to reddish brown posterior...” He refers to this as a “tripartite color pattern”.

The following are among Stump’s (2005: 156) conclusions as concerns the pelage of *P.p. ibleanus*:

“The most readily spotted taxon is *P.p. ibleanus*...” “The taxon is reliable, but the morph is distinguished primarily by overall body size and coloration.”

There is considerable colour polymorphism within *P.p. ibleanus* over its large geographic range, as well as variation in length and texture of the hair. For example, all six of the southwestern Kenya and eastern Uganda adult *P.p. ibleanus* housed at NMK have a smoky-grey ventrum, while only two of the 35 *P.p. ibleanus* that Ambrose (2002) observed in the field in central and southwestern Uganda had a grey ventrum; the remainder had a brown or “orangey” (one individual) ventrum (although not all of the *P. potto* were viewed well enough to determine the colour of the ventrum). Of the two individuals with a grey ventrum, one was in eastern Uganda (South Busoga Forest) and one was at the north extreme of the range of *P. potto* in Uganda (Budongo Forest). It appears, therefore, that there may be a west to east cline in the colour of the ventrum of *P.p. ibleanus* from brown in western Uganda to grey in western Kenya, with animals of either colour present in central Uganda.

In addition to the six skins of *Perodicticus* of known provenance at NMK (all of which are *P.p. ibleanus*), TMB examined all of the *Perodicticus* skins of known provenance at the AMNH (ca. 45 skins of which 26 are *P.p. ibleanus*), at USNM (ca. 64 skins of which five are *P.p. ibleanus*), and at BMNH (ca. 85 skins of which 10 are *P.p. ibleanus*). Of the 47 *P.p. ibleanus* skins of known provenance at NMK, AMNH, USNM, and BMNH, 12 are from Kenya, three are from Uganda, and 32 are from DRC.

Examination of the 32 skins of *P.p. ibleanus* from DRC indicates that there is far more variation in hair length, and pelage pattern, texture and colour among ‘*P.p. ibleanus*’ in DRC than is present among the 12 specimens from Kenya. Many DRC specimens do not have nearly as much frosting on the dorsum and the vibrissae on the dorsum are often not as prevalent as among the *P.p. ibleanus* of Kenya. Indeed, some DRC specimens lack the frosting on the dorsal hairs and the long vibrissae all together. Schwarz (1931) also noted the considerable variation in pelage colour among ‘*P.p. ibleanus*’ from DRC, as did T. Butynski (pers. obs.) for live specimens in the field; four at Alimbongo (Sarmiento & Butynski, 1997) and two at Bili. One result of this variation is that Lönnberg (1917) described *Perodicticus arrhenii* from Masisi, DRC, and Lorenz (1917) described *Perodicticus nebulosus* from Ukaika, Ituri Forest, DRC. Both of these taxa are presently regarded, rightly or wrongly, as synonyms of *P.p. ibleanus*.

Of three adult specimens labelled ‘*P.p. ibleanus*’ from DRC examined at the BMNH, there is great variation in hair length and in pelage colour, pattern and texture; one (ZD 1919.5.8.6, Poko, Uelle Basin) looks like the *P.p. ibleanus* of Kenya, while the other two (ZD 1923.8.1.3, Ituri Forest and ZD.1982.449, Ungu, Uelle River) have a particularly reddish pelage, and look more like *P.p. edwardsi* than *P.p. ibleanus* of Kenya. The one BMNH specimen from Kenya (ZD.1920.10.12.1) looks like a typical *P.p. ibleanus* from Kenya.

In short, it appears that phenotypic variation for *P.p. ibleanus* is ‘relatively’ low in Kenya (which is on the eastern extreme of the range of *Perodicticus*) compared to ‘*P.p. ibleanus*’ in DRC, nearer the centre of the range of *Perodicticus* where at least one other subspecies,

P.p. edwardsi (here including *faustus* as a synonym), is parapatric. *P.p. edwardsi* is thought to be north and west of the Ubangi River and south of the Congo River.

There are likely a large number of barriers to gene flow from east to west through the range of *P.p. ibeanus* in DRC, with the Albertine Rift on the Uganda/DRC border and a large number of big rivers. To the west of Kisangani-Buta-Bili in DRC, there appears to be an area of intergradation of the pelage traits of *P.p. ibeanus* and *P.p. edwardsi*. There may be little gene flow into this region from eastern *P.p. ibeanus* due both to the Itimbiri River and the tributaries that flow into this river from the north, and to the Uele River and the tributaries that flow into this river from the south. Similarly, gene flow for *P.p. edwardsi* into this region is also probably greatly restricted by the very large Ubangi and Congo Rivers.

During this study, no attempt was made to quantify the observed pelage differences among the *P. potto* specimens from DRC. This should be done. Also, the skulls of *P. potto* from DRC were not examined. This too should be done, especially for specimens obtained west of Kisangani in the region between the Ubangi River and Congo River where there appears to be considerable mixing of *P.p. ibeanus* and *P.p. edwardsi* phenotypic characters. In central and southwestern Uganda, however, we already begin to find *P. potto* which differ considerably from the holotype of *P.p. ibeanus* and from the *P.p. ibeanus* that we examined from southwestern Kenya. For example, see BMNH specimen ZD.1936.3.14.2 from Mabira Forest, Uganda, as well as Ambrose (2002).

Abundance of the eastern potto *Perodicticus potto ibeanus*

Unlike the galagos (*Galagidae* Gray, 1825), *P. potto* is secretive and lacks a loud advertisement call (Charles-Dominique, 1977; Bearder *et al.*, 2003). This means that the presence of *P. potto* at a site is most often determined by visual contact at night using torchlight (see below) to elicit tapetal reflection. Like the eyes of all prosimians, those of *P. potto* shine in the dark when in the beam of a torch. Nonetheless, verifying that *P. potto* is present at a particular site can be time-consuming, especially, of course, where at low densities, which often seems to be the case.

Here is a summary of mean rates of encounters with *P. potto* along transects and of densities at several sites:

- Near Bili, DRC, T. Butynski (pers. obs.) camped in the forest at about 600 m for 23 days in 2001, searched for prosimians near several camps for a total of 30 h, and never found *P.p. ibeanus*. Nonetheless, *P.p. ibeanus* is present as demonstrated by at least two captive individuals in a nearby village.
- T. Butynski (pers. obs.) searched the Mau Forest in 2000 for prosimians (at 2280–2770 m) for a total of 27 h over 10 nights but failed to find *P.p. ibeanus*, although *P.p. ibeanus* is said to be present in the Mau Forest (see above).
- At Kanyawara, Kibale Forest (1500 m), south-western Uganda, Weisenseel *et al.* (1993) walked 70 km over 43 nights along two transects (1530 m and 1700 m in length) in search in prosimians. *P.p. ibeanus* were encountered six times. In unlogged forest they encountered *P.p. ibeanus* at the rate of *ca.* 0.12/h (0.16/km), while in selectively logged forest they encountered *P.p. ibeanus* at the rate of only 0.02/h (0.03/km). The density of *P.p. ibeanus* in these two forest types was estimated at 17.7/km² and 1.8/km², respectively.
- Also at Kanyawara, Kibale Forest, Off (2003) walked 202 km over 60 nights along two 2.5 km transects; one in unlogged forest and one in forest that was selectively logged in

1969. *P.p. ibeanus* were encountered nine times. In selectively logged forest they were encountered at the rate of 0.04/km, while no *P.p. ibeanus* were encountered in unlogged forest. The density in the selectively logged forest was estimated at 11.7 individuals/km². Note that these findings are very different from those of Weisenseel *et al.* (1993).

- At seven widely spaced sites in Uganda where *P.p. ibeanus* is known to occur, the mean rate of encounter was 0.18/h (range 0.04–0.48/h, Ambrose, 2002). These surveys ranged in elevation from *ca.* 800 m to 1500 m.
- In 1997, during 4 h of survey at 1800 m over three evenings in secondary forest at Alimbongo, eastern DRC, T. Butynski (pers. obs.) located four *P.p. ibeanus* (rate = 1.0/h).
- In 2004, during a 3 h survey during one evening at Kakamega Forest (*ca.* 1600 m), Y. de Jong (pers. obs.) encountered two *P.p. ibeanus* (rate = 0.7/h).
- At Makokou (500 m), central Gabon, the mean density of *P.p. edwardsi* in primary forest was 8–10/km² but a density of 28/km² occurs in forest which is flooded from time to time (Charles-Dominique, 1977).
- In secondary and farm bush on Mount Kupe (1500 m), southwestern Cameroon, the density of *P.p. edwardsi* was about 4.7/km² (Pimley, 2002).

Based on the above, it seems that *P. potto* generally occurs at densities where rates of encounter during nocturnal primate censuses are between 0.02/h and 0.25/h. *P. potto* might, therefore, be considered 'relatively common' when encountered at a rate of 0.20/h. On the basis of the above encounter rates and densities, it is suggested that sites of a few square kilometres need to be searched at night for at least 50 h before concluding, with some confidence, that *P. potto* is not present at that site. Since the distribution of *P. potto* can be highly localised, a number of sites need to be searched in the larger forests before concluding that *P. potto* is likely absent.

Evidence for *potto Perodicticus potto* east of the Eastern Rift Valley

As for several other taxa of primates, *P. potto* has long been thought to be a species whose eastern limit is determined by the Eastern Rift Valley (table 1). The major museum collections do not hold a specimen of *P. potto* from east of the Eastern Rift Valley, and the primary literature for *P. potto* indicates that the species' limit is the western edge of the Eastern Rift Valley (figure 2, see above). Experienced naturalists who have spent much time in forests to the east of the Eastern Rift Valley (*e.g.* the Aberdares Range, Mount Kenya, Ngong Hills) have not encountered *P. potto* in these forests (M. Brown, T. Young, C. Church, B. Finch, R. Glenn, D. Hunt, D. Martins, Q. Luke, I. Parker, H. Henley, M. Prettejohn, H. Dufresne, P. Ilesley, A. Root & R. Watson, pers. comm.), nor is *P. potto* reported in the literature for these forests (Thomas, 1900; Lönnberg, 1912; Moreau, 1944, 1944/45; Coe & Foster, 1972; Milner *et al.*, 1993; Young & Evans, 1993; Butynski, 1999), with one exception.

Peirce (1975) obtained one *P. potto* while conducting studies on the parasites of mammals at Muguga on the southern end of the Aberdares Range (*ca.* 12 km northwest of Nairobi) (1°14'S, 36°40' E, 2100 m; figure 2). This appears to be the first, and only, published observation of *P. potto* east of the Eastern Rift Valley. Peirce states,

"The P. potto from which the above parasites were recovered had been brought in from one of the local villages..."

The montane forests near Muguga are not very dissimilar to forests in western Kenya or Uganda where *P. potto* are present, and the altitude is within the known range of *P. potto* (*i.e.*, 600–2300 m, see above). While it is likely that this *P. potto* originated from the forest near Muguga, there is also, of course, the possibility that it was carried there from a site west of the Eastern Rift Valley.

The most compelling evidence for the occurrence of *P. potto* east of the Eastern Rift Valley comes, however, from a specimen (catalogue number MK-24) in the Mammalogy Department's collection at NMK (figures 4 & 5). The specimen tag indicates that this adult female *P. potto* was collected by Lt.-Col. C.H. Stockley at 6000 ft (1830 m) on "Mount Kenya" on 20 June 1938. There is no skull. The original specimen tag is attached to the specimen and the information on it is neatly and clearly written, almost certainly in Stockley's own hand. Stockley used his own specimen tags on which his name was printed. The specimen is extremely well prepared and in excellent condition. Unfortunately, the precise collection site on Mount Kenya is not stated.

The 1830 m contour around Mount Kenya falls within the following coordinates: 0°12'N–0°25'S, 37°02'E–37°36'E. At the 1830 m contour, the distance around Mount Kenya is roughly 270 km. Stockley lived for some years (it seems from at least 1936 until at least 1952) somewhere in the Nyeri/Kiganjo area (*ca.* 1800 m, figure 2) at the foot of Mount Kenya on the southwest flank (Stockley, 1953; I. Parker, pers. comm.).

Examination of the specimen records at NMK indicates that Stockley collected at least two *O.g. kikuyuensis* at the same elevation (and one on the same day) that he collected *P. potto* MK-24:

O.g. kikuyuensis. MK-24, NMK No. 998. Adult female collected 20 June 1938 at 6000 ft (1830 m) on Mount Kenya.

O.g. kikuyuensis. MK-25, NMK No. 999. Adult female collected 7 July 1938 at 6000 ft (1830 m) on Mount Kenya.

We examined these two specimens and confirm that they are *O. g. kikuyuensis*, a distinctive subspecies endemic to the highlands of Kenya to the east of the Eastern Rift Valley (table 1).

That Stockley collected at least two other prosimians at the same elevation on Mount Kenya, and one of them on the same day, as *P. potto* MK-24, and that the two prosimians belong to a subspecies found only in the 'Central Kenya Highlands' to the east of the Eastern Rift Valley, is evidence that this *P. potto* was indeed procured on Mount Kenya.

Combined, BMNH and NMK hold eight *O. garnettii* that Stockley collected. Five of these were collected on Mount Kenya (two at 1740 m and three at 1830 m), and three along the lower Tana River at *ca.* 100 m. The five other specimens collected by Stockley in Kenya, and which are recorded in the NMK database (all rodents) were all collected to the east of the Eastern Rift Valley. As such, there is no evidence, that we are aware of, that Stockley ever collected any *P. potto* other than *P. potto* MK-24, or that he ever collected from sites to the west of Mount Kenya, such as in the Nandi Hills or in the Kakamega Forest (where *P. potto* is common). This helps to rule out the possibility that *P. potto* MK-24 was collected to the west of the Eastern Rift Valley and that the provenance of this specimen, as written on the specimen tag, is a mistake.

P. potto MK-24 not only moves the eastern limit of *P. potto* from Soyot, Nandi Forest (the nearest confirmed site), at least 210 km to the east, it puts the species to the east of the Eastern Rift Valley (figure 2).

As indicated above, the Eastern Rift Valley appears to be a major geographic barrier to primates (table 1). All of the arboreal, forest-dependent primates that have managed to cross the Rift have, with molecular change, time, and isolation, differentiated into distinct forms at the species and/or subspecies levels. It is, therefore, expected that *P. potto* from either side of the Rift would also exhibit a suite of unique and distinct phenotypic traits.

Description of a new subspecies of *potto* *Perodicticus potto* from Mount Kenya

At NMK there are six specimens of *P.p. ibeanus* that are of known provenance (five from Kakamega Forest, western Kenya, and one from Jinja, eastern Uganda). Kakamega Forest is the type locality for *P.p. ibeanus*. Jinja is located ca. 190 km to the west of Kakamega Forest (figure 1). These specimens have the following catalogue numbers: 1020, 1021, 1919, 6357, 8686 and 8688. What is immediately obvious when examining the specimen of *P. potto* from Mount Kenya and the six adult specimens of *P.p. ibeanus* from west of the Eastern Rift Valley is that the Mount Kenya specimen is phenotypically different. The main differences are summarized in table 2 and shown in figures 3–8. The distinctiveness of the Mount Kenya specimen remains when compared to the five adult *P.p. ibeanus* at the USNM (Hollister, 1924) and two adults at the BMNH, all of which originate from the Kakamega/Kaimosi area of southwestern Kenya. All specimen were examined in natural light.

Table 2. Main phenotypic differences between the adult female 'Mount Kenya *potto*' *Perodicticus potto stockleyi* specimen (MK-24) and the specimens of adult eastern *potto* *Perodicticus potto ibeanus* from Kakamega Forest and Kaimosi, southwestern Kenya ($n = 9$), and Jinja, eastern Uganda ($n = 1$), that are housed in the National Museums of Kenya ($n = 6$) and in the United States National Museum ($n = 4$). The *P.p. ibeanus* sample is comprised of five adult males and five adult females. See figures 3–7.

| Character | Mount Kenya <i>Perodicticus potto stockleyi</i> | Southwest Kenya and east Uganda <i>Perodicticus potto ibeanus</i> |
|---|--|--|
| Pelage of ventrum | Less woolly. Glossy. Cream-grey. Base of hairs medium grey. Hairs relatively short (ca. 10 mm, longest ca. 17 mm). | More woolly. Less glossy. Smoky grey. Base of hairs dark slate-grey. Hairs relatively long ($x = ca. 15$ mm, range ca. 13–16 mm, longest ca. 20–26 mm, $n = 6$). |
| Pigment of skin of chin, inner ears, bottoms of hands and feet (on dry study skins) | Pale yellow to yellowish-brown | Tan to brown |
| Pelage of chin | Silvery | Brown to black |
| Pelage of face | Cinnamon. Line from upper inner corner of eye down side of muzzle to corner of mouth indistinct. | Yellowish-brown to blackish-brown. Line from upper inner corner of eye down side of muzzle to corner of mouth very distinct. |
| Pelage on crown | Hairs on crown relatively short (ca. 5 mm), strongly tipped glossy cinnamon. | Hairs on crown relatively long (ca. 9 mm), weakly tipped glossy cinnamon. |

| Character | Mount Kenya <i>Perodicticus potto stockleyi</i> | Southwest Kenya and east Uganda <i>Perodicticus potto ibeanus</i> |
|---|---|---|
| Pelage over shoulders (i.e., 'saddle') | Less woolly. Glossy. Short, rippled, dark brown overall. Bases of hairs light smoky-grey. Hairs over shoulders strongly tipped glossy cinnamon. | More woolly. Less glossy. Long, blackish. Bases of hairs medium to dark slate grey. Hairs over shoulders weakly tipped glossy cinnamon. |
| Pelage of dorsum behind shoulders | Less woolly. Short, very rippled, cinnamon to dark russet. Hairs on back, thighs, distal, dorsal ca. 30% of tail, and entire ventral side of tail, strongly tipped glossy cinnamon. Hairs on outside of arms, hands, legs, feet and dorsal ca. 70% of tail tipped glossy silver-grey. | More woolly. Long, yellowish-brown. Hairs on back, thighs, tail, and outside of arms and legs tipped glossy silver-grey giving a 'frosted' or 'hoary' appearance. |
| Underfur of dorsum | Smoky-grey to medium slate-grey. | Dark slate-grey to blackish. |
| Mean length of hairs of dorsal saddle | 14 mm | 22 mm (range = 19-25), n = 10 |
| Mean length of longer vibrissae on back of neck | 14 mm | 43 mm (range = 33-53), n = 8 |
| Mean length of longest vibrissae on back of neck | 16 mm | 50 mm (range = 43-66), n = 6 |
| Median dorsal stripe Saddle over shoulders and upper back | Present but indistinct. Not obvious, pelage short, dark brown. | Absent. Obvious, long, black or blackish-brown. |
| Ears | Prominent (due to short pelage of head). | Not prominent (due to long pelage of head). |
| Mean length of tail | 96 mm | 63 mm (range = 43-95, n = 9) |
| Tail length: body length index | ca. 1:3.6 | ca. 1: 5.4 (n = 4) |
| Length of index finger (from dry study skins) | 6 mm | Longest: 3 mm (n = 10) |

Body measurements taken from fresh *P.p. ibeanus* are few. We obtained sets of adult body measurements from the specimen tags of three adult females at NMK and one set of adult male measurements from the paper in which the holotype is described (Thomas, 1910). Another five sets of adult measurements (four males and one female) were obtained from Hollister (1924). All nine of these specimens were collected in southwestern Kenya in the Kakamega/Kaimosi area. A summary of the body measurement data is presented in table 3. There appears to be little, if any, sexual dimorphism in *P.p. ibeanus*. This is in accordance with the findings of Stump (2005) for all subspecies of *P. potto*.



Figure 4. The specimen in this photograph is the holotype for the subspecies *Perodicticus potto stockleyi*, the 'Mount Kenya potto'. This adult female was collected on Mount Kenya by Lt.-Col. Charles Hugh Stockley on 20 June, 1938 (Catalogue number MK-24, National Museums of Kenya, Nairobi). Photograph by Y. de Jong & T. Butynski.



Figure 5. Face of the holotype (catalogue number MK-24, National Museums of Kenya, Nairobi). Note the cinnamon face, prominent ears and index finger, and lack of long vibrissae on top of the head. Photograph by Y. de Jong & T. Butynski.



Figure 6. Specimens on the left and right are adult female eastern potto *Perodicticus potto ibeanus* from Kakamega Forest (catalogue numbers 8688 and 8686, respectively, National Museums of Kenya). These two specimens represent the phenotypic extremes present among the seven adult *P.p. ibeanus* specimens of known provenance (four from Kakamega, one from North Nandi, one from Kaimosi, one from Jinja), and two adult specimens of unknown provenance at the National Museums of Kenya, Nairobi. The adult female specimen in the middle is the holotype of the Mount Kenya potto *Perodicticus potto stockleyi* (catalogue number MK-24, National Museums of Kenya). Body measurements for these three *P. potto*, from the left specimen to the right specimen, are: head-body length: 296 mm, 302 mm, 303 mm; tail length: 43 mm, 96 mm, 52 mm; ear length: 24 mm, n/a, 26 mm; hindfoot length: 62 mm, n/a, 64 mm; body weight: 850 g, n/a, 879 g. Measurements for the two *P.p. ibeanus* specimens were taken from the specimen tags. The only measurement on the specimen tag for the *P.p. stockleyi* specimen was head+body length. Thus, tail length for the *P.p. stockleyi* specimen was taken from the dried skin. Several of the characters that distinguish *P.p. stockleyi* from *P.p. ibeanus* (table 2) are shown here. In particular, note that *P.p. stockleyi* has a longer index finger, longer tail, and shorter pelage, rippled pelage on the dorsum, and lacks the blackish dorsal saddle of *P.p. ibeanus*. Photograph by Y. de Jong & T. Butynski.

Rahm (1966) provides the only other published body measurement data for fresh specimens of *P.p. ibeanus* that we are aware of. His sample derives from eastern DRC and comprises two males, one female, and one specimen of undetermined sex. These body measurement data are summarized in table 4. These data suggest that *P.p. ibeanus* in Kenya may be slightly larger than in eastern DRC.

One of the most noticeable characters of the Mount Kenya specimen, compared to eight of the nine Kenya specimens of *P.p. ibeanus*, is the length of the tail (figure 6). Although the

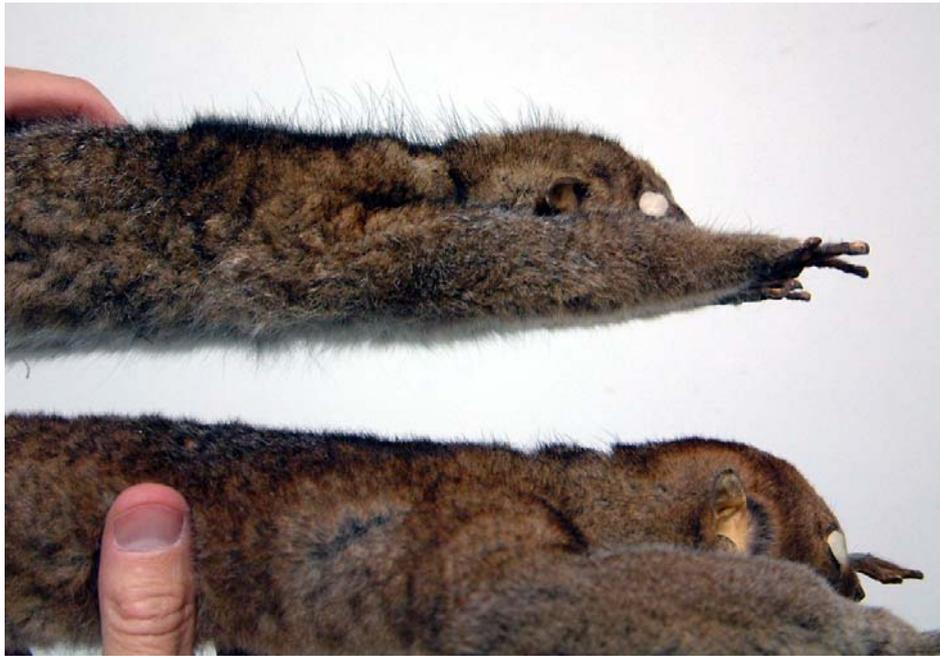


Figure 7. The upper specimen is an adult male *Perodicticus potto ibeanus* from Kakamega Forest (catalogue number 6357, National Museums of Kenya). The lower specimen is an adult female and the holotype for *Perodicticus potto stockleyi* (catalogue number MK-24, National Museums of Kenya). Several of the characters that distinguish *P.p. stockleyi* from *P.p. ibeanus* (table 2) are shown here. In particular, note that *P.p. stockleyi* has a cinnamon (not yellowish-brown) dorsal pelage, shorter pelage, and shorter vibrissae on the head, neck and back, the longest of which is 16 mm. The longest vibrissae on the *P.p. ibeanus* specimen is 43 mm. Photograph by Y. de Jong & T. Butynski.

tail of the Mount Kenya specimen was measured prior to preparation of the specimen, the length was recorded as '308 mm'. This is obviously a mistake. It seems likely that Stockley meant to write '108 mm'. The length of the tail on the prepared (dry) skin is 96 mm. Since the skin of the tail must have shrunk with drying, and as a few millimetres appear to be missing from the tip, it may well be that the tail of the fresh specimen measured 108 mm.

Table 3. Body measurements from nine adult *Perodicticus potto ibeanus* collected in the Kakamega/Kaimosi area, southwestern Kenya. All measurements from fresh specimens. See text for sources of these data.

| Body measurement | Sex | Mean | Range | Sample size |
|------------------|---------|------|---------|-------------|
| Head+body (mm) | Males | 349 | 339–360 | 5 |
| | Females | 326 | 296–366 | 4 |
| Tail length (mm) | Males | 63 | 60–68 | 5 |
| | Females | 62 | 43–95 | 4 |
| Ear (mm) | Males | 27 | 25–29 | 4 |
| | Females | 26 | 24–28 | 4 |
| Hindfoot (mm) | Males | 72 | 68–78 | 5 |
| | Females | 69 | 62–77 | 4 |
| Body weight (g) | Males | - | - | - |
| | Females | 861 | 847–875 | 2 |

Table 4. Body measurements from four adult *Perodicticus potto ibeanus* collected in eastern DRC (Rahm, 1966). Male and female measurements combined. All measurements from fresh specimens.

| Body measurement | Mean | Range | Sample size |
|------------------|------|--------------|-------------|
| Head+body (mm) | 309 | 295-350 | 4 |
| Tail length (mm) | 78 | 70-90 | 4 |
| Ear (mm) | 24 | 20-25 | 4 |
| Hindfoot (mm) | 57 | 50-65 | 4 |
| Body weight (g) | 823 | 600- 1170 | 3 |

The mean length of the tails of the nine adult *P.p. ibeanus* from southwestern Kenya is 63 mm (range = 43-95; table 3), whereas the mean length of the tails of the four adult *P.p. ibeanus* from eastern DRC is 78 mm (range = 70-90; table 4). Thus, the length of the tail of the Mount Kenya specimen is longer than for all 13 specimens of *P.p. ibeanus*, although two of the specimens have only slightly shorter tails at 90 mm and 95 mm.

Mean tail length is 88 mm (range = 50-102) for 20 specimens of *P.p. potto* from Guinea, Liberia, Ivory Coast, Ghana and Nigeria, and 53 mm (range = 37-75) for 46 specimens of *P.p. edwardsi* from Gabon, Nigeria and DRC (Charles-Dominique, 1977; Jenkins, 1987; Stump, 2005). Although the length of the tail of the specimen from Mount Kenya falls within the known range for *P. potto*, there are but a few records of *P. potto* with tails longer than that of the Mount Kenya specimen (the longest being 102 mm).

Stump (2005), based on measurements obtained from dry study skins, obtained the following data for tail lengths; $x = 54$ mm for five *P.p. ibeanus* from Kenya; $x = 76$ mm for 45 *P.p. potto* from Ghana, Ivory Coast, Liberia and Nigeria. He concluded that tail length was a potentially useful trait for distinguishing the subspecies of *P. potto* subspecies.

The second digit (index finger) of the Mount Kenya specimen is about twice as long (6 mm) than for any of the 13 Kakamega/Kaimosi/Jinja specimens at NMK, USNM, and BMNH (figures 4 & 6).

In contrast to the length of the tail and the index finger, the head+body length of the Mount Kenya specimen (302 mm) is smaller than the mean for the nine adult *P.p. ibeanus* from southwestern Kenya ($x = 339$ mm, range = 296-366; table 3), but about the same as for the four adult *P.p. ibeanus* from eastern DRC ($x = 309$ mm, range = 270-350; table 4).

If 96 mm is taken as the length of the tail of the Mount Kenya specimen, then tail length is 31% of the head+body length. If 108 mm is taken as the length of the tail of this specimen when fresh, then tail length is 36% of the head+body length. For the nine adult *P.p. ibeanus* from Kakamega/Kaimosi area (table 3), tail length is, on average, 19% of the head+body length (range = 15-26). For the four adult *P.p. ibeanus* from eastern DRC (table 4), tail length is, on average, 26% of the head+body length (range = 22-33%).

The face and dorsum of the Mount Kenya specimen are much more cinnamon to dark russet than are the face and dorsum of *P.p. ibeanus* from western Kenya, which are yellowish-brown to blackish-brown. As such, the Mount Kenya specimen lacks the dorsal saddle of long blackish hairs that is a primary distinguishing character for *P.p. ibeanus* (Thomas, 1910; Stump, 2005; figures 3-8).

Another distinctive trait of *P.p. ibeanus* is its long pelage. The Mount Kenya specimen has a much shorter pelage (ca. 14 mm on dorsum) than the *P.p. ibeanus* specimens from western Kenya and eastern Uganda (ca. 22 mm, range = 19-25, $n = 10$). The neck and dorsal vibrissae are, likewise, much shorter on the Mount Kenya specimen (16 mm), then for

P.p. ibeanus from western Kenya and eastern Uganda ($x = 50$ mm, range = 43–66, $n = 6$; figures 6 & 7).

Like *P.p. ibeanus*, but unlike most *P.p. potto* and most *P.p. edwardsi*, the pelage of the Mount Kenya specimen is very woolly and rippled, with the pelage of the dorsum heavily frosted silver-grey (figures 3–8). The pelage of the ventrum of the six adult *P.p. ibeanus* specimens at NMK that come from western Kenya and eastern Uganda is smoky-grey. The ventrum of the Mount Kenya specimen is cream-grey. Other pelage colour and length differences are described in table 2.

As a result of the relatively short pelage, the ears are more prominent on the Mount Kenya specimen. The areas of bare skin, and of sparsely furred skin, are more extensive.

Among the 200 specimens of *P. potto* of known provenance for which the pelage (but not the dentition) was examined at NMK, USNM, AMNH and BMNH, there were a few individuals which 'resembled' the Mount Kenya specimen in some traits. Of the specimens from within what is considered to be the geographic range of *P.p. ibeanus* (figure 1), the specimen with pelage that most resembles the Mount Kenya specimen in pelage colour and pattern is BMNH ZD.1982.449 from Ungu (*ca.* 600 m), near the Uelle River, DRC. At the AMNH, the specimen that most resembles the Mount Kenya specimen in colour and pattern of the pelage is No. 239436 from Grand Gedem, Liberia. This adult *P.p. potto* is, however, much smaller than the Mount Kenya specimen. The specimen that most resembles the Mount Kenya specimen is BMNH ZD.1948.593 from Mamfe, Cameroon. This adult male *P.p. edwardsi* was collected at *ca.* 140 m.

Still, none of the above three specimens is as cinnamon on the face and dorsum as is the specimen from Mount Kenya, nor is the pelage of the dorsum as short, woolly and rippled. In addition, they have more prominent vibrissae on the dorsum and arms. In terms of pelage pattern and colour (but not texture), the specimen from Mount Kenya most resembles *P.p. edwardsi* of Central Africa but, nonetheless, differs from *P.p. edwardsi* in a number of traits.

Several phenotypic characters of the Mount Kenya specimen fall outside the variation observed within *P.p. ibeanus* (table 2), *P.p. potto* or *P.p. edwardsi*. In combination, these characters describe an animal that differs considerably from the three currently recognized subspecies. In addition, the population of *P. potto* to the east of the Eastern Rift Valley is geographically isolated from the nearest 'reported' population of *P. potto* by a distance of > 175 km (*i.e.* Muguga to near Kericho, Mau Forest), as well as by the Eastern Rift Valley, an apparent major physical barrier to all extant taxa of arboreal primates in eastern Africa (figure 2, table 1). The distance between Mount Kenya (at Nyeri) and the nearest 'confirmed' population of *P. potto* (at Soyot, Nandi Forest) is *ca.* 210 km. As such, here we describe a new subspecies of *P. potto*.

***Perodicticus potto stockleyi*, new subspecies**

Holotype: Adult female. Skin only. National Museums of Kenya, Nairobi. Catalogue number MK-24. Collected by Charles Hugh Stockley on 20 June, 1938. There are no paratypes.

Type locality: 1830 m asl on Mount Kenya, Kenya.

Diagnosis: Pelage of dorsum cinnamon to dark russet, short (*ca.* 14 mm long); hairs of crown, dorsum and upper tail tipped glossy cinnamon; dorsal vibrissae short (*ca.* 14 mm,

longest 16 mm), not obvious; dorsal 'saddle' not obvious, dark russet; underfur of dorsum medium grey to smoky-grey; second digit relatively long (6 mm); tail relatively long (>96 mm). Length of tail >31% length of head+body.

Description: Chin nearly bare with light covering of silvery hair; rhinarium, muzzle and face deep cinnamon, lighter on bridge of nose and broadly over centre of forehead; indistinct russet line runs from upper inner corner of eye down side of muzzle to corner of mouth; ears prominent, front naked, back cinnamon; pelage of dorsum behind shoulders short ($x = ca.$ 14 mm long), thick, woolly, rippled, cinnamon to dark russet; guard hairs blackish toward distal end but strongly tipped glossy cinnamon giving a heavily frosted (grizzled) appearance; 'saddle' over shoulders and upper back not obvious, dark brown, frosted with glossy cinnamon tipped hairs; median dorsal stripe present but indistinct; underfur on dorsum medium grey to smoky grey; vibrissae (bristles) relatively short (<17 mm) and black, lightly scattered over top of head, neck, shoulders, upper back and forearms; back of neck, upper tail, outer arms, outer legs, and top of hands and feet brown heavily frosted with glossy cinnamon; tail tip blackish-brown; pelage of throat, ventrum, insides of arms and legs short, glossy cream-grey. Mean length of hairs on ventrum *ca.* 10 mm, longest 17 mm. Pigmentation of skin of chin, inner ears, and bottoms of hands and feet pale yellow to yellowish-brown (in cured study skin). Three pairs of teats. All teats located to the sides of the ventrum: one pair axial, one pair pectoral, and one pair about half way between the forelegs and hindlegs (*i.e.* the number and location of the teats is as in *P.p. ibeanus*). See table 2.

Measurements: Head+body = 302 mm; tail >96 mm; second digit 6 mm (tail and second digit measured on dry study skin). Length of tail >31% length of head+body

Etymology: The name '*stockleyi*' acknowledges the collector of the holotype, Lt.-Col. Charles Hugh Stockley.

Distribution: Known only from the type locality, Mount Kenya, at 1830 m (figure 2).

Remarks: See figures 4–7 for photographs of the holotype. A drawing of the holotype is presented in figure 8.

Although this new taxon for *Perodicticus* is here designated as a subspecies, it should be noted that the single specimen of *P.p. stockleyi* that is available, is not only phenotypically (*i.e.*, diagnosably) distinct from the large number of *P.p. ibeanus* specimens available, it is also (almost certainly) geographically (*i.e.* reproductively) isolated from *P.p. ibeanus* (both by the Eastern Rift Valley and by a distance thought to be at least 175 km). As such, under both the 'Evolutionary Species Concept' (Simpson, 1961; Mayden, 1997; Wiley & Mayden, 2000) and the 'Phylogenetic Species Concept' (Cracraft, 1983, 1992; Groves, 2001), this new taxon should be considered a new species, *Perodicticus stockleyi*. We believe, however, that species designation at this time would be premature given (1) that only one specimen is available and, therefore, we do not know anything about the extent of variation of phenotypic characters present within the population of *Perodicticus* on Mount Kenya (and, apparently, also on the Aberdares Range), and (2) the need for additional field data in support of our contention that this population of *Perodicticus* is indeed isolated.



Figure 8. The Mount Kenya potto *Perodicticus potto stockleyi*. Drawn by Stephan Nash from photographs and detailed written descriptions of the holotype. Checked against the holotype by T. Butynski & Y. de Jong.

Searching for the 'Mount Kenya potto' *Perodicticus potto stockleyi*

It seems that the 'Mount Kenya Potto' *P.p. stockleyi* either occurs at low densities or is highly local in its distribution, or (probably) both. There is also, of course, the possibility that this taxon is extinct. Determining the geographic range, abundance, and conservation status of *P.p. stockleyi* is, therefore, a priority for primate conservation action in Kenya.

The holotype for *P.p. stockleyi* was collected at 1830 m on Mount Kenya. We think that it is highly likely that the *P. potto* obtained by Peirce (1975) at Muguga (2100 m, ca. 1300 mm mean annual rainfall) on the southern slopes of the Aberdares Range was a *P.p. stockleyi*. As noted above, the observed mean annual rainfall at sites with *P.p. ibeanus* ranges from 130–1900 mm, while the observed altitudinal limits are 600–2300 m. It, therefore, is reasonable to assume that *P.p. stockleyi* occurs in areas with a similar rainfall, and up to an elevation of ca. 2300 m. Muguga is ca. 95 km to the south of Nyeri.

In Kenya, there are but two large blocks of moist forest east of the Eastern Rift Valley. These are the Aberdares Range (ca. 2185 km²) and Mount Kenya (ca. 2710 km²), and their foothills and outliers (e.g. Ngong Hills, Kikuyu Escarpment, Marmanet, Nyambeni Range). Unfortunately, relatively little of the extensive area of moist montane forest that once occurred on the Aberdares Range and on Mount Kenya remains today. Most of the moist forest below 2000 m on the Aberdares Range and on Mount Kenya has been destroyed for

agriculture since the holotype for *P.p. stockleyi* was collected 70 years ago (Anon., 1933; Butynski, 1999; KWS/UNESCO, 2006).

On the Aberdares Range, only fragments of moist montane forest (>1300 mm mean annual rainfall) still occur between 1800 m and 2000 m. This is confined to the extreme southern end of the Range.

On Mount Kenya, there are small areas of moist montane forest (>1300 mm mean annual rainfall) to as low as 1800 m on the southwest slope along the lower reaches of the Thego and Sagana Rivers, and to as low as 1500 m on the southeast slope, west of the villages of Kirege, Chuka, Kiini and Mutindwa. Off the northeast flank of Mount Kenya, medium altitude moist forest is present at 1400 m in the Meru Forest and descends to as low as 1050 m in the Ngaia Forest at the northern end of the Nyambeni Range.

Several hundreds of square kilometres of moist montane forest remains at 2000–2300 m on the Aberdares Range and on Mount Kenya. While much of the moist montane forest that remains below 2300 m on the Aberdares Range and on Mount Kenya is degraded to varying degrees and continues to be exploited by people, *P. potto* can persist in secondary moist montane forest (at high densities in some cases) and is often found close to human habitation (Kingdon, 1974; Wolfheim, 1983; Oates, 1984; Pimley, 2002; T. Butynski, pers. obs.).

The authors suspect that *P. potto* will be found at low densities in the lowest moist montane forests of the southern and southeastern Aberdares Range. In addition to Muguga, priority sites to be visited in the Aberdares Range in search of *P. potto* are the secondary forests at Chania, Kieni and Gatamayu, and the patches of moist forest in the Limuru and Tigoni areas (figure 2).

During 1997–98, the senior author worked in the Aberdares National Park and in the Forest Reserves of the Aberdares Range for about 100 days and camped at 16 sites within or on the edge of the Aberdares Range. Although parts of many nights were spent searching for prosimians in habitats where *P. potto* might be expected to occur, no *P. potto* was encountered (Butynski, 1999).

Similarly, the search for *P. potto* on Mount Kenya should focus on the wettest and lowest montane forest that remains between 1050 m and 2000 m (see above). For both the Aberdares Range and Mount Kenya, *P. potto* is least likely to occur on the western and northwestern slopes which are relatively dry. Here the flora between 1800 m and 2400 m is relatively species poor, being dominated often by pencil cedar *Juniperus procera* Hochst. ex Endl., wild olive *Olea europaea* L. and podocarp *Podocarpus latifolius* (Thunb.) R.Br. ex Mirb. Field workers in more distant forests, such as those of the Karisa Hills and the Mathews Range should, however, also be on the lookout for *P.p. stockleyi*, although forest at these sites may be too dry for *P. potto* (figure 2).

P. potto is a strictly nocturnal, small, arboreal, cryptic and quiet (no loud call like *O. garnettii* or *D. arboreus*) animal that usually spends the daytime hours sleeping amongst foliage, in dense clumps of lianas, or in tree holes (Charles-Dominique, 1977; Bearder *et al.*, 2003). As such, *P. potto* is rarely encountered during the day. Most diurnal encounters with *P. potto* probably occur when a tree with *P. potto* in it is cut down. Even people who spend much time moving slowly and quietly through forests while looking up into the canopy almost never observe *P. potto* during the day. For example, in Kibale Forest, where *P. potto* occurs at densities of 2 to 18/km² (Weisenseel *et al.*, 1993; Off, 2003), 10 primatologists, working there during the day, never once encountered *P. potto* during roughly 60 person-years of field research (C. Chapman, J. Oates, R. Rudran, T. Struhsaker, J. Mitani, W. Oluput, D. Watts, L. Isbell, P. Waser, pers. comm.; T. Butynski, pers. obs.). In fact, none of these 10 life-long primatologists had ever encountered a *P. potto* during the day anywhere

in Africa. This demonstrates how extremely cryptic and secretive *P. potto* is during the daytime hours.

In an effort to locate *P.p. stockleyi* to the east of the Eastern Rift Valley, six questionnaire surveys and three field surveys were undertaken. These surveys, and the results, are summarized here.

In September 2002, 105 residents were interviewed in or near forest on the southeast slope of Mount Kenya in the vicinity of Gaitu, Tharaka and Kiambere (ca. 1000 m). Of these, 46% (48) said they know *P. potto* (Kirathe & Maranga, 2002). From this survey we learned that most of the people questioned were unable to distinguish between *P. potto*, *O.g. kikuyuensis* and *D. arboreus*.

In September 2003, 52 residents were interviewed in or near forest on the northeast slopes of Mount Kenya (Meru town and Nyambeni Range, ca. 1500–1700 m). During this survey, and during all subsequent surveys, the people being interviewed were not only shown drawings and/or photographs of *P.p. ibeanus*, *O.g. kikuyuensis* and *D. arboreus*, but also museum specimens of *P.p. ibeanus* and *D. arboreus*. Of those interviewed, 8% (4) claimed to know *P. potto* (De Jong, 2004).

In September 2003, we searched for *P. potto* for 8 h over three evenings in the Ngaia Forest (ca. 43 km²) at 1050–1450 m (figure 2). Ngaia is located at the north end of the Nyambeni Range off the northeast flank of Mount Kenya (0°23'22''N, 38°00'53''E). No *P. potto* were found, although the forest here looks like highly suitable habitat for this species. *O.g. kikuyuensis* is common at Ngaia, but no *D. arboreus* were seen or heard. Q. Luke (pers. comm.) has made six visits to the Ngaia and camped within this forest for a total of ca. 14 nights. He has never seen or heard *D. arboreus* in Ngaia.

In November 2003, 34 residents were interviewed in the vicinity of Yatta (1°11'38''S, 37°27'40''E, 1200 m), about 110 km south of Mount Kenya. None of the interviewees claimed to have ever seen *P. potto* (De Jong, 2004).

In July 2004, 171 residents were interviewed in or near forest on the southwestern, southern, and southeastern slopes of Mount Kenya (Nkubu, Chuka, Kerugoya, Kutus, Embu, Chogoria, Runyenje, Karatina, 1300–1700 m). Of these, 30% (53) claimed to have seen *P. potto*.

In April 2005, 107 residents were interviewed in or near forest on the southwest slope of Mount Kenya (Karatina, Karandi, Kihari, Ragati, Kahuru, Itundu, Chehe, Tumutumu, 1400–2000 m), and 75 residents were interviewed in or near forest on the eastern slope of the Aberdares Range (Nyeri, Mathari, Ihururu, 1600–2000 m). Only 2% (2) of those interviewed on Mount Kenya, and but 5% (4) of those interviewed on the Aberdares Range claimed to have seen *P. potto*.

In July 2005, 64 residents were interviewed in and near forest on the southeast slopes of Mount Kenya. The sites selected for this survey (Embu, Kutus, Kerugoya, 1300–2200 m) were those which some of the people interviewed in the July 2004 survey indicated *P. potto* were most often encountered. However, only 20% (13) of those interviewed during this survey claimed to have seen *P. potto*. During this survey, one research assistant spent 3 days with local guides and hunters visiting sites within the Kangaita, Kaso and Irangi Forests where *P. potto* is said to be present. Of two people claiming they knew *P. potto*, one showed a *D. arboreus* in a beehive in the Irangi Forest, and one presented a captive *D. arboreus* at Kerugoya.

In June 2005, we searched for *P. potto* for 7 h over two nights at 2000–2125 m in the vicinity of the Irangi Forest Station (ca. 22 km northeast of Embu town on the southeast

slope of Mount Kenya (0°20'50"S, 37°29'03"E, 2000 m). Both *O.g. kikuyuensis* and *D. arboreus* are present in low densities, but no *P. potto* were found.

In January 2007, we searched for *P. potto* for 3 h during one night at 1730 m in the Meru Forest (0°05'27"S, 37°37'29" E). *O.g. kikuyuensis* and *D. arboreus* are both common at this site but no *P. potto* were encountered.

During all questionnaire surveys, people were asked for the local name used for *P. potto*, *O. garnettii* and *D. arboreus*. Here are the various tribal language names that we were given:

P. potto: *kanongwe* (Kimeru); *gichengi* (Kikuyu); *kiagayu* (Kiambu); *kami* (Kiswahili).

O. garnettii: *ngagaya* (Kimeru, Kikuyu, Kiambu); *kanongwe* (Kikamba); *komba* (Kiswahili).

D. arboreus: *gitereki* (Kimeru); *gitore* or *gotoore* (Kikuyu, Kiambu); *kinyowe* (Kikamba); *perere* (Kiswahili).

Some of the people interviewed provided what might be a unique tribal vernacular name for *P. potto*. Most, however, when shown a study skin, drawing, or photograph of *P. potto*, gave the vernacular for *O. garnettii* or, more often, the vernacular for *D. arboreus*. We remain unclear as to whether the Kimeru, Kikuyu and Kiambu names listed above truly refer to *P. potto* or to some other species. The absence of a widely used, well-known, vernacular name for *P. potto* on Mount Kenya suggests at least three possibilities: (1) the same name is used in the local vernacular for *P. potto* as well as for *O. garnettii* and/or *D. arboreus*, (2) *P. potto* is either absent and/or at very low densities over large parts of Mount Kenya and the Aberdares Range (*i.e.*, *P. potto* is highly localized), or that (3) on the rare occasion they are encountered, *P. potto* is generally not distinguished from *O. garnettii* or *D. arboreus*.

In addition to the above surveys, 10 members of the Mount Kenya Biodiversity Conservation Group made brief searches for *P. potto* on our behalf on Mount Kenya. They also did not find *P. potto* (P. Wambui, pers. comm.).

In summary, although we were often told by the local residents that *P. potto* are present, the appearance and behaviour of the animals they described usually indicated *D. arboreus*, not *P. potto*. Some of the people who seemed to know *P. potto* best were asked to lead our two technicians or ourselves to the places where they claimed they had seen *P. potto*. In no case, however, were they able to show a *P. potto* to us.

Research priorities for the Mount Kenya potto *Perodicticus potto stockleyi*

Obviously, a priority for enhancing the understanding of the taxonomy, biogeography, conservation status, and conservation needs of *P. potto* in Kenya is to define the geographic range of *P.p. stockleyi*, study its ecology and behaviour, and obtain additional specimens for detailed morphological, molecular and phylogenetic analyses, if the current population of *P.p. stockleyi* is such that collection will not threaten the survival of this subspecies. It is particularly important to obtain the skulls of several adult *P.p. stockleyi* so that it can be determined if, and to what degree, the skull and dentition of *P.p. stockleyi* differs from that of *P.p. ibeanus*.

Climatic change, isolation and the Mount Kenya potto *Perodicticus potto stockleyi*

It is now widely accepted that climatic change during the Quaternary (last 2.5 million years) has been a major determinant of the current distributions of species in Africa (Moreau, 1966; Kingdon, 1990; Meadows, 1996). Mount Kenya, Africa's second highest mountain at 5199

m, is *ca.* 2.7 million years old (Coe, 1967). As such, Mount Kenya has probably long served as an eastern refugium for mid-altitude and montane forest plant and animal species, including *P. potto*. During glacial periods, when conditions were dry and cool, forests contracted, and the upper limit of montane forest moved down-slope. During interglacial periods, when conditions were wet and warm, forests expanded, and the upper limit of montane forest moved up-slope. During the period of maximum world glaciation, from 21 000–14 500 B.P., conditions were especially dry and cold and there was apparently little or no moist forest on Mount Elgon and on the Cherangani Range in western Kenya, while fairly extensive forest persisted on Mount Kenya (Hamilton, 1982; Goudie, 1996). Under these circumstances, and for several thousands of years, *P. potto* on Mount Kenya was probably even more isolated from populations to the west than at present. During this period, the nearest population of *P. potto* to the west may not have been in Kenya, but rather in the major refugia of the Albertine Rift in western Uganda, western Rwanda, and eastern DRC.

Mount Kenya and the Aberdares Range are about *ca.* 30 km apart and 'connected' by a broad (> 25 km wide) corridor of high ground through the Kiganjo-Nyeri-Karatina region (KWS/UNESCO, 2006). Mount Kenya, the Aberdares Range, and the region in between them is collectively referred to as the Central Kenyan Highlands. The Central Kenyan Highlands have probably supported mid-altitude and montane forest, and a large number of forest-dependent vertebrate species, for many thousands of years, perhaps through much or all of the Quaternary and probably during long periods of isolation from forests to the west of the Eastern Rift Valley.

As a result of this continuous presence of forest over a large area, together with long periods of isolation, there are today a good number of species and subspecies of plants and animals endemic to Mount Kenya, to the Aberdares Range, and to other parts of the Central Kenyan Highlands (Bennun & Njoroge, 1999). These include three subspecies of primates: *O.g. kikuyuensis*, Mount Kenya black-and-white colobus (guereza) *Colobus guereza kikuyuensis*, and Kolb's white-collared monkey *Cercopithecus albogularis kolbi* (table 1). Indeed, all three of the forest-dependent species of primate found on Mount Kenya and on the Aberdares Range are represented there by endemic subspecies. That a fourth species of forest-dependent primate, the *P. potto*, should also be represented there by an endemic subspecies, *P.p. stockleyi*, is, therefore, not surprising. Indeed, it is expected.

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