

## SENGI (ELEPHANT-SHREW) OBSERVATIONS FROM NORTHERN COASTAL KENYA

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### ABSTRACT

The biodiversity of northern coastal Kenya is poorly understood because security problems and poor infrastructure have discouraged access to the area. However, the wooded areas in the region have great potential for harbouring unique and rare species, including sengis or elephant-shrews (Macroscelidea). Based on recent surveys of the Boni and Dodori National Reserves, which are between the Tana River and the Somali border, the ranges of the rufous sengi (*Elephantulus rufescens*) and four-toed sengi (*Petrodromus tetradactylus*) have been extended. Although the golden-rumped sengi (*Rhynchocyon chrysopygus*) of coastal Kenya south of the lower Tana River was assumed to occur in the Boni forest region, this now appears to be incorrect. The *Rhynchocyon* east of the lower Tana River is definitely not *R. chrysopygus*, but rather resembles taxa found hundreds of kilometres to the south. Determining the taxonomic status of what may be a new form of *Rhynchocyon* will require the collection of voucher specimens and DNA tissues for detailed analyses.

**Keywords:** Boni Forest, distribution, elephant-shrew, Macroscelidea, *Rhynchocyon*

## INTRODUCTION

The sengis or elephant-shrews are a well-defined mammalian order endemic to Africa (Corbet & Hanks, 1968). There are only 17 species in a single family (Macroscelididae), which has two well-defined sub-families: the soft-furred sengis (Macroscelidinae) with three genera and 13 species, and the giant sengis (Rhynchocyoninae) with a single genus (*Rhynchocyon*) and four species (Rathbun, 2009). The montane and coastal forests of Tanzania and Kenya are the centre of diversity for *Rhynchocyon* (Rathbun, 2009), with Kenya harbouring two species (the black-and-rufous sengi *Rhynchocyon petersi* Bocage, 1880, and the endemic golden-rumped sengi *Rhynchocyon chrysopygus* Günther, 1881). Tanzania has three species (the chequered sengi *Rhynchocyon cirnei* Peters, 1874, the endemic grey-faced sengi *Rhynchocyon udzungwensis* Rathbun and Rovero, 2008, and *R. petersi*). Unlike the smaller and often cryptic soft-furred species, which have fur colouration that varies between shades of brown and grey (Rathbun, 2009), the giant sengis are colourful and more easily distinguished (Rovero & Rathbun, 2006), a feature that has great taxonomic importance to this genus (Corbet & Hanks, 1968). Although the phylogeography of sengis is poorly understood, molecular research on some soft-furred species has recently been published (Douady *et al.*, 2003; Smit *et al.*, 2007). Relying mainly on pelage colouration and distribution information, however, has resulted in some controversy over the taxonomy and phylogeography of the giant sengis (Corbet, 1970; Corbet & Hanks, 1968; Kingdon, 1974). The confusion has resulted in several recent efforts to better understand the distribution of *Rhynchocyon* and its conservation (IUCN, 2010), and also to gather biodiversity information on the forested areas of eastern Africa (Doggart, 2008). Indeed, it was during a survey in the remote areas of the Udzungwa Mountains in south-central Tanzania that the newly described *R. udzungwensis* was discovered in 2005 (Rovero & Rathbun, 2006; Rovero *et al.*, 2008). A survey of sengis in the coastal areas of Kenya east of the lower Tana River has long been needed (Nicoll & Rathbun, 1990), but due to security and logistical problems, the survey has been difficult to implement until recently.

One of us (GBR) visited the area east of the lower Tana River from 18–20 August 1972 to determine whether *R. chrysopygus* occurred there. About 5 km north-west of the village of Milimani, capture nets (Rathbun, 1979b) were set for two days, but no sengis were caught. However, during visual surveys on foot a single sighting of a giant sengi was made, but the fleeing animal was seen too briefly to determine the pelage colouration. Given that *R. chrysopygus* occurred in coastal forests only about 50 km south-east of the lower Tana River (FitzGibbon, 1994), and there were no other *Rhynchocyon* species known from the region (Corbet & Hanks, 1968), the sighting was assumed to be *R. chrysopygus*. A single sighting of a four-toed sengi *Petrodromus tetradactylus* Peters, 1846 was also made, but no rufous sengis *Elephantulus rufescens* Peters, 1878 were seen. During the same visit, study skins of *P. tetradactylus* and *R. chrysopygus* were used to interview local villagers. Both sengis were identified as present during the interviews, but no attempt was made to distinguish other colour forms because it was assumed that the only giant sengi in the region would be *R. chrysopygus*. Thus, the distribution of *R. chrysopygus* was extended into the Boni forest region between the Tana River and Somali border (Rathbun, 1979a, b; IUCN, 2010).

The 1991–92 survey of *R. chrysopygus* by FitzGibbon (1994) excluded areas east of the lower Tana River because of security concerns, and thus no sengi surveys or sightings from the Boni forest region that we are aware of have occurred since 1972. However, one of us (GWN) conducted a sengi survey in the region in March 2008. During the 13-day visit, colour photographs of several mammals, including *P. tetradactylus*, *R. chrysopygus*, *R. petersi*, and *R. cirnei*, were used to interview local residents (Ngaruiya, 2009), who indicated that *R. petersi* was present. In order to clarify the findings from this survey, an expedition was organized to

deploy camera-traps and attempt to capture a specimen. In this report we present the results of this latest survey and summarise the results from the previous surveys.

## MATERIALS AND METHODS

The wooded habitats north of the Tana River are 10–15 m high and are naturally fragmented with interspersed areas of savannah woodland and bushland. As pointed out by Kuchar & Mwendwa (1982), the area should be described as a semi-evergreen bushland rather than a true forest. Nevertheless, the area is still considered part of the Eastern Africa Coastal Dry Forest complex (Burgess & Clarke, 2000), which is considered a “Biodiversity Hot Spot” with global significance (Conservation International, 2009). The dominant woody plants include *Lannea schweinfurthii* (Engl.) Engl., *Oldfieldia somalensis* (Chiov.) Milne-Redh., *Manilkara sulcata* (Engl.) Dubard, *Salacia madagascariensis* (Lam.) DC, *Nectaropetalum kaessneri* Engl., *Uvaria acuminata* Oliv., *Cassipourea euryoides* Alston, *Diospyros* spp, *Combretum* spp, *Strychnos* spp, *Heinsia crinita* (Afzel.) G.Taylor, *Dovyalis* sp, *Grewia plagiophylla* K.Schum., *Philenoptera bussei* (Harms) Schrire, and *Cassia* spp. (Kuchar & Mwendwa, 1982; Q. Luke, pers. comm.).

There are two gazetted reserves that straddle the main Hindi-Bodhei-Kiunga road that include “coastal forest” habitats (figure 1). The Boni National Reserve covers 1339 km<sup>2</sup> while the Dodori National Reserve covers 877 km<sup>2</sup>. The region is populated by about 2000 Awer or Boni people (Farm Africa, 2004), which are concentrated in several villages that are closely associated with the main road. The people subsist on hunting wildlife, gathering native plants, and farming subsistence crops. Northern coastal Kenya experiences two wet seasons in April and during October–November, when roads often become impassable.

We established base camps at Mangai and Basuba villages, close to the border of Dodori National Reserve from 16–26 September 2008. Twenty-four people from several villages were interviewed to determine where sengis occurred. During the interviews we also assessed habitats and searched for evidence of sengis (nests, trails, and foraging holes; Rathbun, 1979b). Based on our interviews, we identified six sites between 25–40 m above sea level (Mararani, Ardhi Dam Road, Dodori Creek, Mangai, Basuba, and Kiangwe; figure 1) where we focused our efforts. We deployed 10 digital camera-traps (Stealth model I430IR): one each at Kiangwe and Mangai and two at each of the remaining four sites. The cameras were located within a radius of 100 m of each site and periodically moved within each site to enhance the probability of captures. We also deployed two capture nets (Rathbun, 1979b) at Dodori Creek, Mararani, Mangai, and Basuba. The nets were open from 06:00–18:00 hrs on two consecutive days at each site. We also haphazardly set 150 Sherman folding traps (23.5 x 9 x 7.5 cm) at Mangai, Ardhi Dam Road, Mararani, and Basuba to assess the presence of other small mammals, including *Elephantulus*. The traps were baited with fried coconut mixed with peanut butter, left open day and night for a total of 1500 trap days, and checked at 07:00 and 16:00 hrs. Lastly, we set eight film camera-traps (Stealth model MC2-GV) from 27 September–20 October 2008 at Mararani, Mangai, Basuba, and Milimani; the last being a seventh site. Locations from the 1972 survey were estimated from field notes and Google Earth (2009). All other locations were determined with a handheld global positioning system (GPS) receiver (Garmin model 12 XL).

## RESULTS

During the September–October 2008 survey we accumulated 302 camera-trap days at the seven sites, resulting in 16 images of giant sengis, 31 of four-toed sengis, and none of rufous

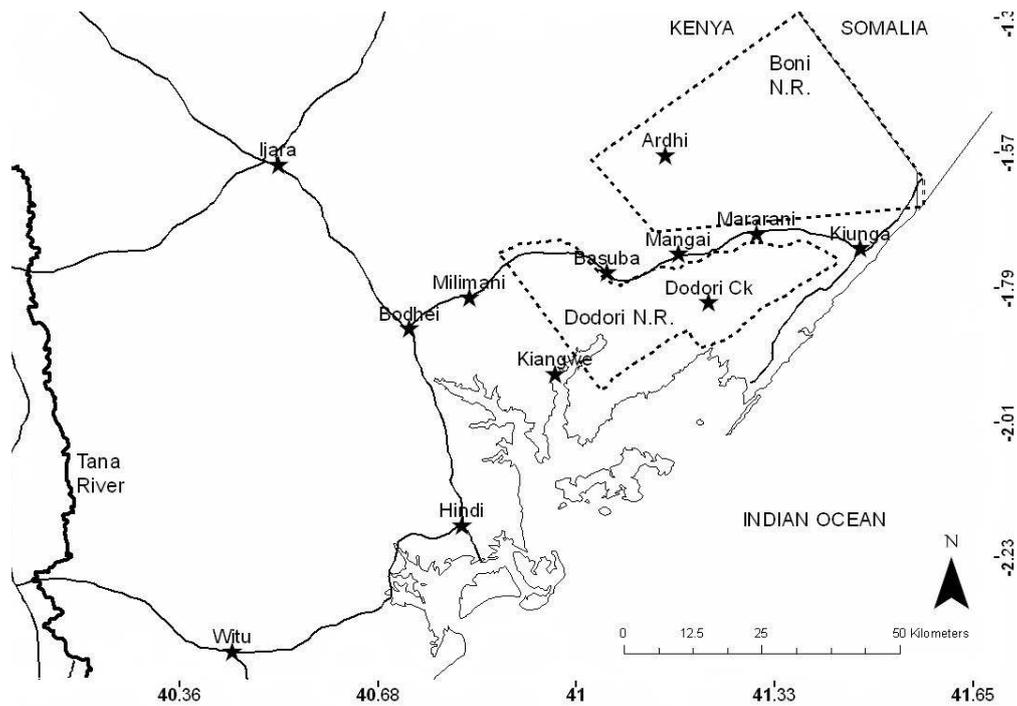


Figure 1. Study area in northern coastal Kenya near the border with Somalia, illustrating roads (thin lines), Boni and Dodori National Reserves (bold dotted lines), Tana River (bold line), and study sites (stars). See table 1 for sengi occurrences within 100 m of the centres of study sites.

sengis. One or the other of giant sengi and four-toed sengi was recorded at all of the sites. One rufous sengi (National Museums of Kenya accession number NMK168236) was captured in a Sherman trap at Mararani and one four-toed sengi (NMK168261) was netted at Managai (table 1, figure 1). The locations of the visual sightings from the 1972 and March 2008 surveys are also included in table 1.

One giant sengi was netted at Mangai and collected as a voucher specimen (NMK169427). It weighed about 610 g, had a total length of 549 mm, and a tail length of 256 mm. All the images of Boni giant sengis, and the one voucher specimen, showed the same basic pelage pattern and colouration: face a grizzled yellow-brown; sides, shoulders, and back maroon; thighs and lower rump jet-black. The skin of the ears, feet and tail (except for a white band near the tail tip) was dark brown or black (figure 2a, b).

## DISCUSSION

Based on our sightings, images, and single specimen, the Boni giant sengi is similar in body conformation and proportions to other *Rhynchocyon* forms (Corbet & Hanks, 1968; Rovero & Rathbun, 2006). As discussed in the introduction, the expectation was that *Rhynchocyon* east of the lower Tana River would be *R. chrysopygus*, which is found in coastal forests south of the Tana River mouth to the Mombasa area of Kenya (California Academy of Sciences, 2009). Unexpectedly, however, the Boni giant sengi lacked a golden rump (figure 2), indicating that it is not *R. chrysopygus*. Comparisons of pelage

colouration patterns for taxonomic purposes among the remaining forms of giant sengis, however, are more complicated and thus not as readily resolved.



a.



b.

Figure 2. a) Camera-trap image of *Rhynchocyon* sp. from near Basuba (figure 1) on 29 September 2008. b) Specimen of *Rhynchocyon* sp. captured on 21 September 2008 at Mangai, Kenya.

The pelage colouration of the Boni giant sengi only superficially resembles that of *R. petersi*, which has orange skin on its tail and ears rather than the dark brown or black of the Boni giant sengi. The facial pelage of *R. petersi* is bright rufous, rather than grizzled yellow-brown on the Boni giant sengi; and the black on the rump extends well up onto the middle of the back (Rovero & Rathbun, 2006), compared to being restricted to the rump and thighs on the Boni giant sengi (figure 2). Compared to the newly discovered *R. udzungwensis*, the Boni giant sengi lacks the grey face, lacks the lighter fur on some ventral areas, and weighs about 600 g compared to about 700 g for *R. udzungwensis* (Rovero *et al.* 2008). Otherwise, the two are remarkably, indeed unexpectedly, similar. *Rhynchocyon cirnei* typically has a series of well defined dark and light spots in several rows on the back (Corbet & Hanks, 1968; Rovero & Rathbun, 2006), which are absent from the Boni giant

Table 1. Records of sengis from the Boni National Reserve and Dodori National Reserve in north-eastern Kenya, in chronological order for each taxon. Latitude and longitude coordinates are in decimal degrees for ease of plotting with geographic information system software. Only a single (first) record for each taxon with unique coordinates is included, but the total number of records for each set of coordinates is included in brackets in the location column. See Figure 1 for named locations. Image records are from camera-traps.

Species	Date	Location	Latitude	Longitude	Type of Record
<i>Elephantulus rufescens</i>	22 Sep 2008	Mararani (1)	-1.709520	41.288450	Capture
<i>Petrodromus tetradactylus</i>	19 Aug 1972	Milimani (1)	-1.770000	40.830000	Sighting
<i>Petrodromus tetradactylus</i>	11 Mar 2008	Mangai (1)	-1.750960	41.172470	Capture
<i>Petrodromus tetradactylus</i>	19 Sep 2008	Ardhi Dam (1)	-1.661020	41.161650	Image
<i>Petrodromus tetradactylus</i>	22 Sep 2008	Mararani (7)	-1.677490	41.289200	Image
<i>Petrodromus tetradactylus</i>	24 Sep 2008	Mararani (2)	-1.711920	41.285300	Image
<i>Petrodromus tetradactylus</i>	28 Sep 2008	Milimani (20)	-1.814950	40.816990	Image
<i>Petrodromus tetradactylus</i>	30 Sep 2008	Dodori Creek (1)	-1.815100	41.207510	Image
<i>Rhynchocyon</i> sp.	19 Aug 1972	Milimani (1)	-1.770000	40.830000	Sighting
<i>Rhynchocyon</i> sp.	8 Mar 2008	Milimani (1)	-1.811050	40.815700	Sighting
<i>Rhynchocyon</i> sp.	23 Mar 2008	Mangai (1)	-1.666320	41.165050	Sighting
<i>Rhynchocyon</i> sp.	25 Mar 2008	Basuba (1)	-1.818730	40.817830	Sighting
<i>Rhynchocyon</i> sp.	17 Sep 2008	Mararani (3)	-1.711920	41.285300	Image
<i>Rhynchocyon</i> sp.	20 Sep 2008	Kiangwe (4)	-1.930630	40.912180	Image
<i>Rhynchocyon</i> sp.	21 Sep 2008	Mangai (1)	-1.751030	41.172080	Capture
<i>Rhynchocyon</i> sp.	24 Sep 2008	Dodori Creek (4)	-1.818350	41.209510	Image
<i>Rhynchocyon</i> sp.	25 Sep 2008	Mararani (2)	-1.677500	41.289160	Image
<i>Rhynchocyon</i> sp.	29 Sep 2008	Basuba (1)	-1.753160	41.032860	Image
<i>Rhynchocyon</i> sp.	1 Oct 2008	Dodori Creek (2)	-1.815100	41.207510	Image

sengi. However, like many giant sengi forms, very faint and indistinct darker stripes on the back are visible in some images of the Boni giant sengi. *Rhynchocyon cirnei macrurus* from south-eastern coastal Tanzania is exceptionally dark, resulting in a superficially similar colour pattern with the Boni giant sengi, including the general body and facial colouration, indistinct chequers on the back, and dark maroon to nearly black hindquarters. However, the near-black pelage of *R. c. macrurus* extends from the rump well up onto the back and down onto the sides (Corbet & Hanks, 1968; Kingdon, 1974), whereas the jet-black fur of the Boni giant sengi is restricted to the rump and thighs, more similar to *R. udzungwensis*. The one voucher specimen of the Boni giant sengi also has a remarkably pronounced mane (figure 2b) compared to other forms of *Rhynchocyon*.

An intriguing aspect of our discovery at this point is how isolated the Boni giant sengi is from its most similarly coloured congeners. Milimani (figure 1) is about 300 km from the closest known population of *R. petersi*, about 700 km from *R. c. macrurus*, and about 800 km from *R. udzungwensis* (California Academy of Sciences, 2009). Our records of *P. tetradactylus* and *E. rufescens* confirm and extend, respectively, the known distributions of these two species into northern coastal Kenya (California Academy of Sciences, 2009).

On the heels of the recent discovery of *R. udzungwensis* in Tanzania (Rovero *et al.*, 2008), have we discovered yet another giant sengi? It is too soon to say. Additional voucher specimens, tissues, and associated data must be collected in order to carefully compare the potentially new *Rhynchocyon* from the Boni area with other forms of giant sengis, especially the similar *R. udzungwensis* and *R. c. macrurus*. Indeed, to achieve even a partial resolution to the taxonomy and phylogeography of the Boni giant sengi, a better understanding of the

relationship among all the different forms of *Rhynchocyon* is needed, which will only be gained when voucher specimens and fresh tissues for DNA analyses are obtained from areas where enigmatic taxa of *Rhynchocyon* occur (Rathbun, 2009). If we have discovered a new giant sengi, it will not only significantly add to the complicated and still poorly understood phylogeography of this highly unusual clade of African endemic mammals (Rathbun, 2009), but also add to the already rich biodiversity of the East African Coastal Dry Forest biome (Burgess & Clarke, 2000).

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