AFROTHERIAN CONSERVATION

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Number 12 - September 2016 (Edited by C.&M.Stuart)

Dendrohyrax validus *from Unguja Island, Zanzibar Archipelago (© C.&M. Stuart)*

From the editors:

There are 33 members in the Afrotheria Specialist Group (excluding the two Co-Chairs and the editor of the newsletter). Early in March 2016 we sent a circular email to all members to invite contributions to this year's newsletter, we resent this email one week later also asking for read receipts. Twenty days later we had received a total of 15 read receipts (45%) and nine personal replies (27%), no email address bounced back as invalid.

A second group of 58 people have over the years showed interest in the Afrotheria Group and also asked to be sent a copy of the Newsletter. To this group we also sent an email to advise of the upcoming newsletter and to ask for confirmation of continued interest. Twenty days later we had the following results: Two email addresses were invalid (3.4%), 13 read receipts arrived (22%) and seven people sent a personal reply (12%).

These disappointing response levels make the actual received contributions even more valuable. We appreciate this and thank the authors. Unfortunately, no contributions were forthcoming from the golden mole research community!

We are open to anybody contributing an opinion piece for future editorials. We know that there are many issues out there that excite and/or upset members of the group, so why not have your say here.

C. & M. Stuart, Waxenberg, Austria
August 2016 (www.stuartonnature.com)

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Features

The distribution of the genus *Rhynchocyon* in the Eastern Arc Mountains, with an emphasis on the Black-and-rufous Sengi, *Rhynchocyon petersi*.

Hoffmann, M.[1,2], Rathbun, G.B.[3], Rovero, F.[4], Perkin, A.[5,6], Owen, N.[7,8] & Burgess, N.[2,9]

[1]*IUCN Species Survival Commission, International Union for Conservation of Nature, 28 rue Mauverney, CH-1196 Gland, Switzerland; email: mike.hoffmann@iucn.org*

[2]*United Nations Environment Programme World Conservation Monitoring Centre, 219c Huntingdon Road, Cambridge, CB3 0DL, UK*

[3]*Institute of Biodiversity Science and Sustainability, California Academy of Sciences, San Francicso, CA 94118 USA; email: grathbun@gmail.com*

[4]*Tropical Biodiversity Section, MUSE – Museo delle Scienze, Trento, Italy; email: francesco_rovero@yahoo.it*

[5]*Nocturnal Primate Research Group, Oxford Brookes University, Oxford OX3 0BP, UK; email: bwanakomba@gmail.com*

[6]*Tanzania Forest Conservation Group, PO Box 23410, Dar es Salaam, Tanzania*

[7]*Zoological Society of London, Regent's Park, London, NW1 4RY, UK; email: Nisha.Owen@zsl.org*

[8]*Society for Environmental Exploration, 50-52 Rivington Street, London, EC2A 3QP, UK98CMEC,* [9]*The Natural History Museum, University of Copenhagen, Copenhagen, Denmark; email: Neil.Burgess@unep-wcmc.org*

The four giant sengis, or elephant-shrews, (genus *Rhynchocyon*; Rovero *et al*. 2008, Rathbun 2013) are the largest members of the order Macroscelidea. They are associated with closed canopy forest and thicket habitats with dense leaf litter (Rathbun 2009). The Chequered Sengi (*R. cirnei)* has the widest distribution, ranging from northern Mozambique to at least northern Democratic Republic of Congo. The Grey-faced Sengi (*R. udzungwensis)* is endemic to the Udzungwa Mountains of Tanzania. The Golden-rumped Sengi (*R. chrysopygus)* is endemic to Kenya, narrowly distributed along the coast between Mombasa and the Tana River. On the north-eastern side of the Tana River, a distinct but taxonomically undescribed form of *Rhynchocyon* occurs (Andanje *et al*. 2000). The Black-and-rufous Sengi, the focus of this note, only occurs in south-eastern Kenya and north-eastern Tanzania, including the islands of Unguja and Mafia (but not Pemba).

Although the gross distribution of the giant sengis has been known for decades (e.g., Corbet and Hanks 1968; Kingdon 1974; www.sengis.org/distribution), our recent understanding has increased due to focused survey work in East Africa's coastal and montane forests, including the use of camera traps. Nonetheless, an accurate up-to-date summary of the current distribution of these diurnal but elusive sengis (Rathbun 2009) is needed, but difficult to do for several reasons.

Giant sengi habitats in the montane areas of eastern Africa are isolated islands that are often separated naturally from each other by large expanses of unsuitable habitat (Figure 1). These montane areas are often further fragmented by human activities and the mosaic of forest reserves, national parks and other reserve types, which can result in dynamic and varying levels of protection (e.g., Newmark 1998). While some areas have been relatively well surveyed, several of the more isolated areas have not (Rovero *et al*. 2014), and in the latter cases failure to record sengis cannot necessarily be taken as confirmation of absence.

Figure 2A: *Black-and-Rufous Sengi Rhynchocyon petersi camera-trapped in the Nguru North Forest Reserve, Nguu, Eastern Arc Mountains in 2007. © Francesco Rovero.*

Figure 2B: *Chequered Sengi R. cirnei camera-trapped in Matundu forest, Udzungwa, Eastern Arc Mountains in 2004 © Francesco Rovero.*

Below and in Figure 1 we summarize the occurrence of giant sengis in each of the isolated portions of the Eastern Arc Mountains, with emphasis on the Black-and-rufous Sengi. We reviewed records taken from the literature (www.sengis.org/bibliography), museum specimens, grey literature, and unambiguous reliable observations (www.sengis.org/distribution). We also include priorities for further survey work. Additional details of the Eastern Arc Mountain forests are provided by Burgess *et al*. (2007), Platts *et al*. (2011) and Rovero *et al*. (2014). We do not address the distribution of giant sengis in coastal forests, which are similarly fragmented and in various levels of anthropogenic decline, degradation, and protection (Burgess & Clarke 2000, Burgess *et al*. 2016).

Taita Hills: These isolated mountains, including Mount Kasigau and Mount Sagala, form the northernmost extent of the Eastern Arc Mountains in Kenya and have been relatively well surveyed (e.g., Bytebier 2001). No *Rhynchocyon* has ever been recorded.

North Pare: Black-and-rufous Sengis have been observed in Kamwalla II, Kindoroko, Minja, and Mramba forest reserves (Cordeiro *et al*. 2005). There are no records from Kiverenge Forest Reserve, which has been poorly surveyed.

South Pare: Black-and-rufous Sengis have been recorded by several observers from Chome Forest Reserve, the largest forest in the South Pare (e.g., Coster & Ribble 2005). Key survey priorities include Chambogo and Kwizu forest reserves.

West Usambara: Black-and-rufous Sengis are recorded from several localities, including a museum specimen from what is now Magamba Nature Reserve, but recent records are rare. In 1996, W.D. Newmark found a snared sengi at an elevation of 1,297 m near Ambangulu (reported by Stanley *et al*. 2011). Several large forest reserves, including Shaguya, Mkussu, Baga II, Ndelemai, Mafi Hill and Bangalai, are in need of survey.

East Usambara: The East Usambaras have been the focus of extensive survey work. Besides Amani Nature Reserve, the Black-and-rufous Sengi is reported from: Nilo Nature Reserve and Bamba Ridge*, Kambai*, Kwamarimba*, Kwamgumi, Manga*, Mgambo, Mtai* and Segoma forest reserves (* denotes records from the 1990s). Evans *et al*. (1992) reported *R. cirnei* from Mtai Forest Reserve in the East Usambara, but this can only have been *R. petersi*. Surveys by Frontier Tanzania in Longuza North and Bombo East I/II forest reserves failed to record them, but they may be present; Longuza South and Bombo West are in need of survey.

Nguu: Cordeiro *et al*. (2005) observed Black-and-rufous Sengis in Nguru North Forest Reserve (and see Figure 2a), and they have been observed in Kilindi Forest Reserve at 900 m asl (F. Rovero. pers. obs. 2008; coordinates: 5.594S, 37.485E). Survey priorities include Derema, Mkuli, Pumila and Rudewa forest reserves.

Nguru: Black-and-rufous Sengis have been camera-trapped in Nguru South Forest Reserve up to 2,020 m, the maximum recorded elevation for the species, and also camera-trapped in Kanga and Mkindo forest reserves (Owen *et al*. 2007b).

Uluguru: This is the southern limit of Black-and-rufous Sengis in the Eastern Arc Mountains. They have been observed in both Uluguru North and Uluguru South forest reserves (e.g., Bracebridge *et al*. 2005a,b); there is one older museum specimen from Mkangazi (Lukangazi) by Swynnerton & Hayman (1951). Many of the reserves surveyed by Doggart *et al*. (2004), who documented them in Kasanga, are in need of further survey (e.g., Ruvu Forest Reserve).

Malundwe: This is the most eastern area of the Eastern Arc Mountains for Chequered Sengis, which have been recorded at approximately 1,100 m (Stanley *et al*. 2007) and also camera-trapped in 2006 (L. Collett and G. Norton pers. comm.).

Ukaguru: Chequered Sengis have been camera-trapped in 2007 in the Mamiwa-Kisara Forest at 1,815 m (6.417S, 36.990E; Frontier Tanzania, unpubl.), and documented by Evans *et al*. (1992) from an undisclosed location at 1,800 m. Given that Ukaguru could be where hybridization and / or misidentification with Black-and-rufous Sengis may be plausible, we confirmed the camera-trap images from Mamiwa-Kisara were Chequered Sengis. More extensive sampling for sengis in this mountain block would be desirable, especially from Milindo. This is the northern limit of *R. cirnei* in the Eastern Arc Mountains.

Rubeho: Chequered Sengis are confirmed in Mang'alisa (Doggart *et al*. 2006; F. Rovero, T. Jones & N. Owen, unpubl.), and have been camera-trapped in 2006/2007 in Mafwomero (6.911S, 36.556E), Ilole (7.442S, 36.734E), and Pala-Ulanga (7.209S, 36.816E) forests (F. Rovero, T. Jones & N. Owen, unpubl.). The highest recorded elevation in the Eastern Arcs is 2,100 m in Mang'alisa and Mafwomero (F. Rovero, T. Jones & N. Owen, unpubl.). Survey work (including camera trapping) in Ukwiva Forest Reserve (a large forested area) has yet to document the presence of giant sengis, but further investigation is needed. The Wota Mountains (with Wota and Ligunga forests) to the west, and Image Forest Reserve to the south, often considered Rubeho isolates, require further surveys.

Udzungwa: The recently described Grey-faced Sengi, which is known only from the western Ndundulu-Luhomero forest and the eastern Mwanihana forest (Rovero et al. 2008, 2013), and the Chequered Sengi (subspecies *R. c. reichardi*) occur in parapatry, with evidence of introgression (Lawson *et al*. 2013; but see Carlen 2015). Extensive camera trapping efforts (see Figure 2B) over the last decade have provided a comprehensive understanding of the distribution of sengis.

Mahenge: This is the southernmost isolated outlier of the Eastern Arc Mountains (Figure 1). Owen *et al*. (2007a) reported both *R. petersi* and *R. cirnei* in Sali Forest Reserve, on the central part of the mountains. However, the *R. petersi* sighting was considered questionable, and this record is attributable to *R. cirnei* although further survey work should be undertaken.

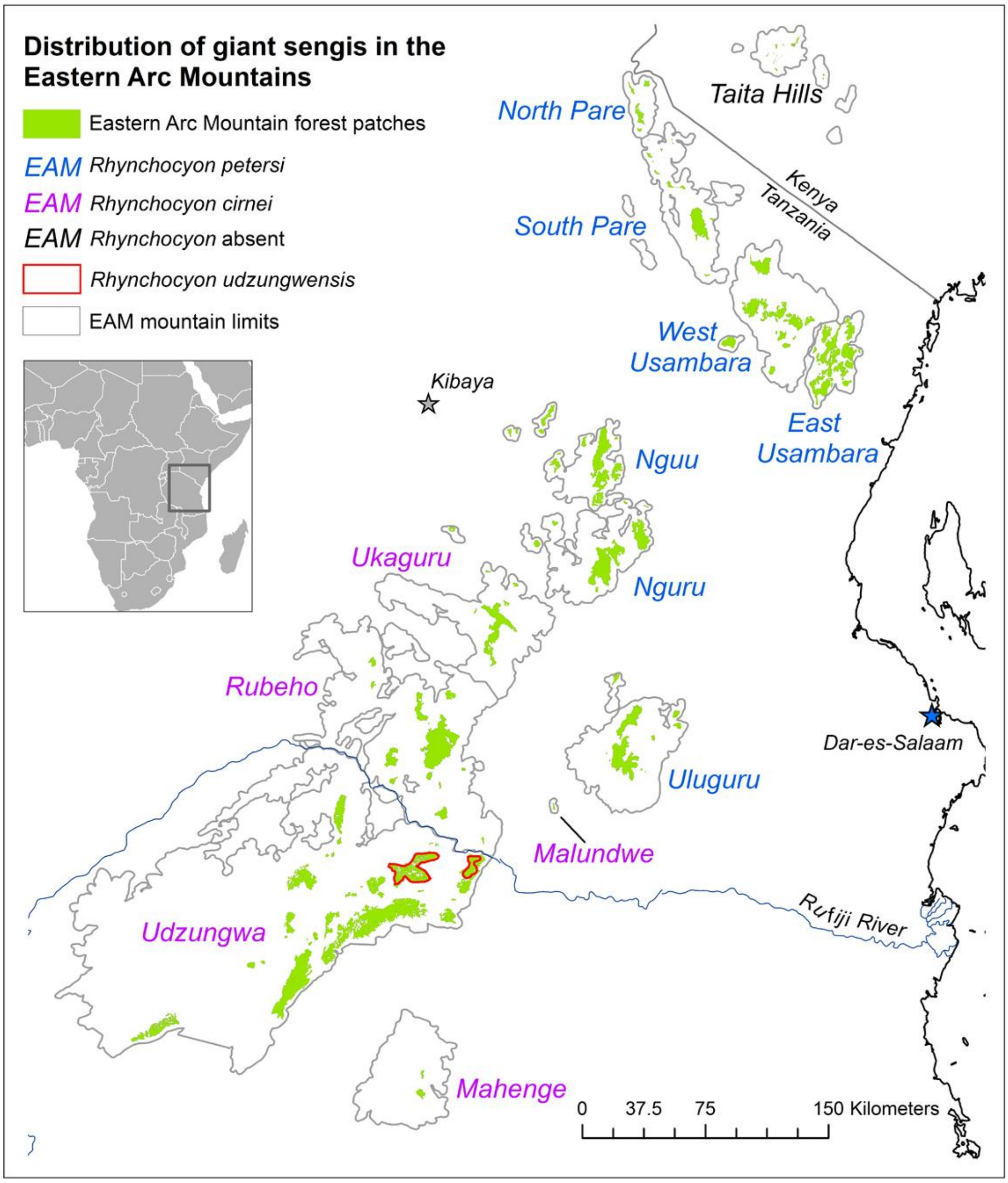

Figure 1 . *The occurrence of giant sengis (genus Rhynchocyon) in the Eastern Arc Mountains of Kenya and Tanzania. Eastern Arc Mountain range limits and forest blocks from (Platts et al. 2011); forest blocks (in green) represent possible minimal extent of giant sengi occurrence in the mountains. The names of each isolated Eastern Arc Mountain (EAM) are colour-coded to species present (see legend and text). Parapatry is only known between R. udzungwensis (red polygon) and R. cirnei reichardi. Data on giant sengi distribution in lowland and coastal suitable habitats are not shown.*

In summary, while the distributions of the genus in the major mountain blocks of the Eastern Arc Mountains appear to be relatively well resolved, especially with clarification of the identity of sengis on Malundwe and Mahenge, our brief review suggests some mountain blocks, such as Nguu and West Usambara, require further surveying. In addition, although not part of the Eastern Arc Mountains, the westernmost record of *R. petersi* from "Kibaya" (5.283S, 36.567E) mentioned by Swynnerton & Hayman (1951) and presumed to be an isolated forest habitat (Corbet & Hanks 1968), is urgently in need of a survey. We hope this short note will encourage researchers to be vigilant for the presence of giant sengis during field surveys and provide their data to the conservation community.

Acknowledgements
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A fully resolved tenrec phylogeny, with implications for taxonomy and ancestral habitats

Kathryn M. Everson (University of Alaska Museum, kmeverson@alaska.edu)

Over the last 15 years several studies have produced molecular phylogenies of tenrecs (e.g., Asher and Hofreiter 2006, Poux et al. 2008), but no study had included data from all 35 currently recognized species. These studies also produced conflicting results regarding relationships among major tenrec lineages, resulting in multiple reinterpretations of the number and timing of historical transoceanic dispersal events between Africa and Madagascar.

This study is the result of over 20 years of hard work from dozens of collaborators. The original article is published in the June 2016 volume of *Systematic Biology* and may be found at http://sysbio.oxfordjournals.org/content/65/5/890.abstract. Here we present a summary.

Using DNA sequence data from 10 genes, we reconstructed the first phylogeny of tenrecs to include all recognized species. Our phylogeny is fully resolved, with high support values at all nodes including the speciose genus *Microgale* (the shrew tenrecs). We hope that this phylogeny will serve as a backbone for future studies and for placing new species, which have been discovered at a rate of nearly one every two years since 1992.

Our comprehensive phylogeny led us to make three important taxonomic revisions that reflect the evolutionary history of tenrecs:

1) We formally recognize the continental African otter shrews as a distinct family (Potamogalidae), thereby rendering extant Tenrecidae entirely endemic to Madagascar. This decision is based on several lines of evidence: reciprocal monophyly, an estimated divergence date much older than other mammal families (and many orders, see Meredith et al. 2010), and a number of unique morphological traits in otter shrews, including syndactyly and the absence of clavicles.

2) We found that the semiaquatic tenrec *Limnogale* is nested within Madagascar's shrew tenrecs (*Microgale*), confirming a recent and rapid evolutionary specialization for the semiaquatic lifestyle; we therefore subsume the genus *Limnogale* within *Microgale*.

3) The two largest shrew tenrecs, *M. dobsoni* and *M. talazaci*, form a sister clade to all other *Microgale*, which, in light of several craniodental synapomorphies, supports their re-elevation to the genus *Nesogale* Thomas 1918.

We also estimated divergence times and colonization timing using six fossil calibrations within Afrotheria (four of which, to our knowledge, had never been used to calibrate a phylogeny). Following Parham *et al* (2012), we selected fossils using three criteria: (1) the locality and age/stratigraphic level for the fossil must be specified and published; (2) the fossil must represent the oldest known member of its respective lineage; and (3) membership of the fossil in its respective lineage must have been determined or verified by a published phylogenetic or cladistic analysis. See Table 1 in Everson et al. (2016) for the full list of fossil calibrations. Our divergence timing analysis placed the colonization of tenrecs on Madagascar at 30-56 million years ago.

Finally, we used recently summarized habitat data (Goodman and Raherilalao 2013) to test the hypothesis that diversification rates differ between humid and arid habitats on Madagascar, and we compared three common methods for ancestral biogeographic reconstruction. These analyses suggest higher speciation rates in humid habitats and reveal a minimum of three and more likely five independent transitions to arid habitats.

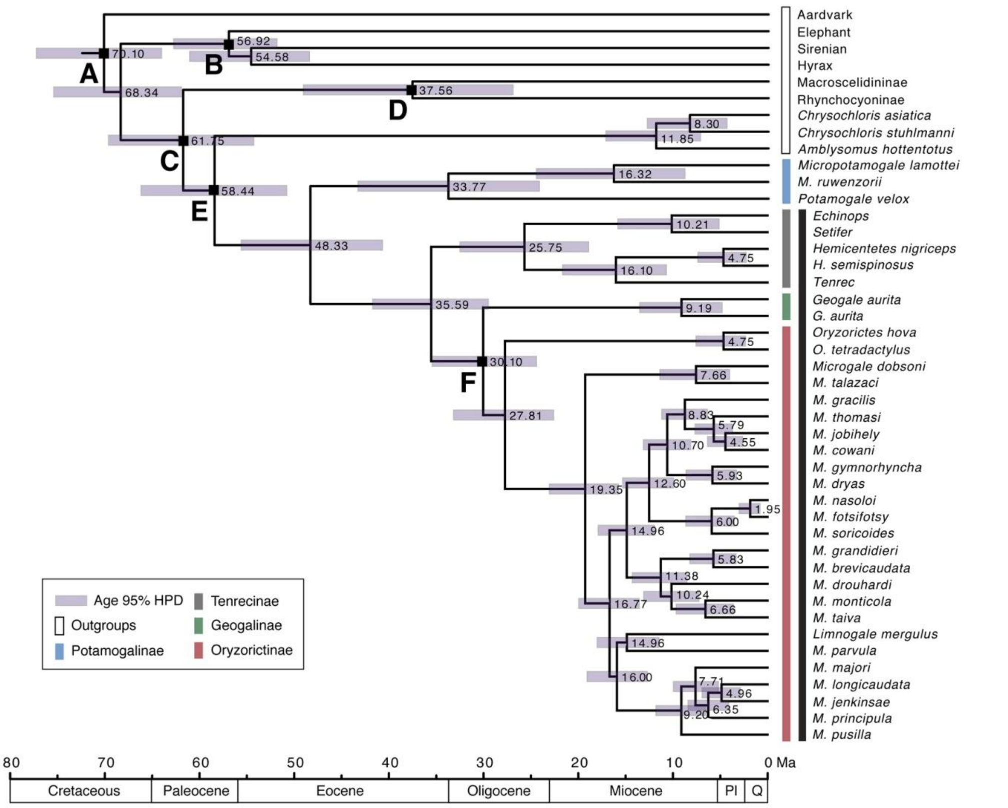

Figure 4. Divergence time chronogram produced using BEAST. Fossil calibration points are indicated by letters A-F next to black squares. Mean divergence time estimates (in millions of years) are noted adjacent to their respective nodes. Purple nodal bars correspond to the 95% highest posterior density regions. "Pl" = Pliocene, "Q" = Quaternary. The black vertical line denotes Malagasy taxa. Tree was rooted using an armadillo (*Dasypus novemcinctus*) as the outgroup.

This figure (4) is taken from the original paper.

Taboos and sustainability of tenrec hunting in Madagascar

Kim E. Reuter [1*] & Brent J. Sewall[2]

[1]Africa & Madagascar Field Division, Conservation International, Koitobos Road, Hardy Office Park, Karen, Nairobi, Kenya
[2]Department of Biology, Temple University, 1900 N. 12th St., Philadelphia, PA, 19122, USA

*Corresponding author: *email:* kimeleanorreuter@gmail.com, *phone:* 202-758-5036, *address:* Conservation International, Koitobos Road, Hardy Office Park, Karen, Nairobi, Kenya.

Introduction:

There are ten genera and 34 species of tenrecs (Tenrecidae Family) in Madagascar (Afrotheria Specialist Group 2016). Eight of these species are listed on the IUCN Red List as Near Threatened, Vulnerable, or Endangered (IUCN 2015). Species in this family can be found across the entire island of Madagascar.

Tenrecs are widely hunted in Madagascar, particularly the larger species that do not resemble mice or rats (common tenrec, *Tenrec ecaudatus;* greater and lesser hedgehog tenrecs, *Echinops telfairi,* and *Setifer setosus*). Tenrec hunting has been documented in the southeast (Goodman & Raselimanana 2003), southwest (Tucker 2007), west (Smith et al. 1997; Randriandriana et al. 2010), east (Jenkins et al. 2011), center (Reuter et al. 2016b), north (Reuter et al. 2016b), northwest (Garcia & Goodman 2003), and northeast (Golden 2009) parts of the country. Tenrecs are captured by digging up their burrows (Goodman & Raselimanana 2003) while they are estivating (Tucker 2007), by using traps, and with dogs (Garcia & Goodman 2003; Golden 2009). Tenrecs are hunted both outside (e.g. Goodman & Raselimanana 2003) and inside protected areas (Smith et al. 1997), for subsistence (Golden 2009) and sold in restaurants and urban markets (Jenkins et al. 2011). They are often kept alive for a period of days or weeks prior to consumption (KER unpublished data). As such, they can function as a type of fallback food in lower income communities (Reuter et al. 2016a). It is legal to hunt tenrecs in Madagascar; they are considered game species and the legal hunting season typically begins in May and ends in October (reviewed in Reuter et al. 2016b).

Tenrec ecaudatus may be especially favored for consumption. In one study, when compared with lemurs and freshwater fish, this species was the only species with a positive net acquisition rate; in other words the energy gained from consuming one *T. ecaudatus* was higher than the energy spent by a person foraging for that individual animal (assuming that the tenrec was estivating when captured, Tucker 2007). Also, *T. ecaudatus* is favored in some areas of Madagascar for its “large size and fatty meat” (Gardner and Davies 2014).

In 2013, the authors of this paper as well as other collaborators conducted an extensive survey of households, meat sellers, and inter-city transporters across 11 urban and 10 rural towns in central and northern Madagascar. These surveys collected information regarding the capture, trade, and consumption of nine different wild animal groups, including tenrecs. Outputs from this survey included an examination of the live capture and ownership of lemurs (Reuter et al. 2015), the consumption of wild meat in Madagascar (touching on issues of food security, micro- and macro-drivers of consumption, and popularity as a food item; Reuter et al. 2016a) as well as the commodity chain for these meats (capture, movement, trade, and consumption; Reuter et al. 2016b). While these papers provided an overview of the capture and consumption of tenrecs in Madagascar they did not provide finer detail or some of the more anecdotal aspects of tenrec hunting. Therefore, in this research note, we aim to provide this information. Specifically, our objectives are to discuss: 1) taboos surrounding the hunting and consumption of tenrecs; and 2) the sustainability of tenrec hunting. To our knowledge, this is the first study with an explicit focus on these topics.

Methods

Data were collected in 2013 via surveys conducted with male and female heads-of-households (n = 1343), meat sellers (n = 520), and inter-city transporters (n = 61) across 11 urban and ten rural towns in central and northern Madagascar. The methods for these surveys are described in detail in Reuter et al. (2015), Reuter et al. (2016a), and Reuter et al. (2016b). Of note, survey respondents could not typically distinguish between photographs of different species of tenrecs although various local Malagasy names (e.g. *Sokina*, *Tandraka*) were used by respondents. Based on these local names, it appears that the communities surveyed are consuming *T. ecaudatus*, *E. telfairi*, and *S. setosus*, as well as (rarely) some of the tenrecs that superficially resemble mice (e.g., *Microgale* spp.). Because survey respondents could not always distinguish between the different species of tenrecs, we discuss the capture of tenrecs broadly and sometimes without referencing individual species. In addition to the data collected in the surveys, we also present some of the more anecdotal observations that we made regarding the capture of tenrecs during our surveys.

Results and Discussion

Taboos and Tenrecs

Of the 1343 heads-of-households surveyed, 397 held taboos against tenrecs (Reuter et al. 2016a); in Madagascar, taboos typically restrict or prohibit the consumption of a meat for cultural or religious reasons as well as to avoid supernatural repercussions (Jones et al. 2008). Such taboos in Madagascar can be regional, village- or family-based, or impact just a few individuals (Lambek 1992). Based on the use of local Malagasy names for tenrecs, we determined that many of these households (n = 158) had taboos against eating smaller tenrecs (*E. telfairi* and *S. setosus*). In contrast, far fewer households (n = 20) specifically cited taboos against the larger tenrecs (*T. ecaudatus*). In our study, only one survey respondent specifically described having a taboo against a "mouse-like" tenrec. It is important to note that rodents are not typically eaten in Madagascar (they do not seem to be considered a food item (Reuter et al. 2016a); many respondents reported that Islamic law prohibits the consumption of forest animals, including rodents) and smaller tenrecs that look like mice or rats might not be eaten even if there are no explicit taboos against them.

While we broadly classified and described the types of taboos held by individuals in Madagascar against tenrecs in Reuter et al. (2016a), our previous work did not allow for discussion of the nuances surrounding these taboos. First, several individuals stopped eating tenrecs for religious and cultural reasons. For example, one individual indicated that he/she stopped eating lesser tenrecs when he/she became a traditional healer because tenrecs are "animals which are curled up and he/she needs to be open with his/her life." Second, tenrecs were associated with bad or good luck/omens. For example, approximately 15 individuals told us that tenrecs are associated with rainfall. Specifically, respondents felt that when there are more tenrecs there is more rainfall and because tenrecs have been hunted to rarity, there is now less rain. In Madagascar, tenrec hunting and habitat degradation often occur simultaneously (e.g. Ganzhorn et al. 1990); for example, the authors of this paper have observed this phenomenon in the perimeter of the Ankarana National Park where defaunation and forest degradation are occurring simultaneously. If habitat degradation (such as deforestation) then leads to changing rainfall patterns (a phenomenon noted across the globe, e.g. Aragao et al. 2008), some people might conclude there is a link between lower tenrec populations (due to unsustainable hunting) and changing rainfall patterns (due to habitat degradation more broadly). The perceived link between rainfall and tenrecs has been noted elsewhere in Madagascar; informants interviewed by Gardner and Davies (2014) noted that tenrecs were abundant in years with heavy rains and rare during drought. However, these informants hypothesized that certain parasites might kill tenrecs during dry years, causing a decrease in population sizes (Gardner and Davis 2014). Gardner and Davis (2014) also indicated that some individuals had supernatural taboos against eating hedgehog tenrecs during the rainy season; these individuals felt that eating those types of tenrecs would increase the likelihood of being struck by lightning.

Interestingly, in our study, there were several respondents who indicated that they did not capture juvenile tenrecs; tenrecs were the only group of wild animals (out of the nine groups that we studied) for which respondents specifically mentioned a taboo that is related to an animal's life history stage. This "life history taboo" was also noted by Jones et al. (2008) who indicated that tenrecs are not traditionally harvested in Madagascar until they have reproduced just prior to hibernation in April or May. This taboo has been described as promoting sustainable harvesting practices for tenrecs (specifically for *T. ecaudatus*, Jones et al. 2008).

We also recorded other types of taboos against hunting tenrecs that have not been recorded in previous studies. In one case, a respondent associated a house fire with the act of having caught and killed a tenrec on the day prior. The linking of taboos to such supernatural repercussions is well documented in Madagascar (Jones et al. 2008). In another case, a respondent indicated that he/she stopped eating tenrecs after seeing tenrecs near a tomb and thereafter began associating tenrecs with the deceased. It should be noted that meat-related taboos are not unique to Madagascar; religious, philosophical, and theoretical hypotheses have been used to explain consumption norms in many other areas of the world (reviewed by Morris 1994).

The sustainability of tenrec hunting

Based on our experiences in Madagascar, and in accordance with several prior studies, we hypothesize that not all tenrec species are equally affected by hunting. Specifically, our surveys suggest that *T. ecaudatus*, *E. telfairi*, and *S. setosus* are the most commonly consumed tenrecs, though additional research is needed to confirm these findings.

It is difficult to estimate the volume of tenrec extraction in Madagascar, though it is likely that, at minimum, hundreds of tenrecs are extracted annually in each of Madagascar's large urban towns. As an illustration: our surveys found eight restaurants in the two cities of Antsohihy (population: 105,317 people; Ilo 2003) and Antsiranana (population: 87,569 people; Ilo 2003) that sold, on average, between 7.5 – 11 meals containing tenrec per day during the rainy season (a 2-3 month period from January to May in which tenrecs are typically easier to catch). If we assume that this season lasts 60-90 days, and that one tenrec provides enough meat for 5-10 meals (male tenrecs provide between 400-560 grams of edible meat depending on the time of year; Tatayah and Driver 2000) then each venue would sell between 45 and 198 tenrecs during the rainy season per year. In Antsiranana, where we were able to locate five meat sellers selling tenrecs (though it is likely that there are more), this would amount to 227 to 990 tenrecs sold in one city during the rainy season. Of course most tenrecs that are captured and consumed are done so without being sold via meat sellers (83% and 88% of urban and rural respondents, respectively, received tenrecs from free sources either by hunting, finding the animal as road kill, or receiving it as a gift; Reuter et al. 2016b). This would imply between 1324 and 5824 tenrecs are consumed in just one urban town, Antsiranana, per year.

This is a rough estimate, and additional research needs to be conducted to more precisely estimate the total number of tenrecs that are being extracted by hunting from wild habitats per year across Madagascar. Because of a lack of robust island-wide extraction estimates, the uncertainties surrounding the species identity of tenrecs that are consumed, and demographic parameters of many species of tenrec, it is also not clear whether current extraction rates are sustainable. *T. ecaudatus* (the species that many studies indicated was most extracted in their study areas) has one of the highest reproductive capacities of any mammal, and could therefore have the potential to be extracted sustainably (Gardner and Davies 2014). Nevertheless, several respondents in our study noted that tenrecs were no longer locally available for consumption (Reuter et al. 2016b) and other authors have noted that tenrec populations are declining (Tucker 2007), which suggests the need to examine this issue more closely.

Finally, it is not clear how large the threat of hunting is relative to other threats that tenrecs might face. For example, Ganzhorn et al. (1990) found that logging itself did not directly impact *E. telfairi* or *T. ecaudatus*. Indirect and synergistic effects may occur, however; hunting of both animals increased in areas where logging occurred, and logging indirectly resulted in microhabitat changes that negatively impacted *E. telfairi*. It is also unclear how the various threats faced by tenrecs may change in importance across their ranges.

Conservation and outreach

There are several opportunities for conservation programming related to tenrec hunting in Madagascar. Reuter et al. (2016a) and Reuter et al. (2016b) highlighted a wide range of conservation initiatives that could help regulate and decrease wild meat extraction and consumption. However, there are additional strategies specific to tenrecs that could also be considered, given that national enforcement of hunting rules have been considered unrealistic for tenrecs (Sommerville 2010). First, the taboo prohibiting the harvesting of juvenile tenrecs is an opportunity for targeted outreach. In Madagascar, taboos are generally prohibitive, and are therefore rather conservative (Jones et al. 2008). While taboos there do not universally apply across the island, the prevalence of this taboo provides an opening for expanded discussion and outreach on the benefits of capturing only tenrecs that have reached a certain age and size; taboos have been leveraged to increase community participation in conservation initiatives in other contexts in Madagascar (Westerman & Gardner 2013). Second, the observation by many Malagasy people that tenrecs are associated with rainfall provides an opening for discussions about the connections between sustainable extraction of fauna and flora and ecosystem health. Several non-profit organizations are already undertaking such holistic outreach to communities on habitat degradation issues (e.g., Conservation Fusion, www.conservationfusion.org), and the discussion could be extended to tenrecs and tenrec habitat. Finally, further consideration of the conservation status of some species of tenrecs may be warranted. *T. ecaudatus, E. telfairi,* and *S. setosus* are all currently listed as Least Concern without a major range-wide threat from hunting identified in their species accounts on the IUCN Red List (IUCN 2015). Our data, and other studies (as reviewed, above) suggest that hunting of these three species does occur across their range and additional research is needed to understand whether current hunting rates are sustainable or not.

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Aardvark Ecophysiology Research Project Report

Nora M. Weyer[1], Robyn S. Hetem[1], Mike D. Picker[2], Andrea Fuller[1]

[1]Wildlife Conservation Physiology, Brain Function Research Group, School of Physiology, University of the Witwatersrand, Johannesburg, South Africa; weyer.nora@gmail.com

[2] Department of Biological Sciences, University of Cape Town, Rondebosch, South Africa

A report on an ongoing PhD study on the ecophysiology of aardvarks in the Kalahari (field work conducted July 2013 - September 2015).

Aardvarks are one of Africa's most elusive large mammals; they are nocturnal and spend their days in burrows, from which they emerge usually after dusk to forage. Being specialist myrmecophages, their prey consists solely of ants and termites (Taylor *et al.* 2002). Apart from arid zones, aardvarks occur across most habitats of sub-Saharan Africa, where they play a key role as ecosystem engineers. Indeed, not only do aardvarks modify landscapes by generating numerous subterranean burrows, but the burrows are also used by a wide range of animal species as refuges from predators and temperature extremes (Whittington-Jones *et al.* 2011). Aardvark burrows will likely become increasingly relevant as thermal refuges in the context of current climate change (Pike & Mitchell 2013).

Aardvark emerging from burrow at night in summer.
(©Nora Weyer / Tswalu Kalahari)

The aardvark is one of Africa's charismatic large mammals likely to be challenged by the predicted future climate change. Large parts of its range are predicted to experience increasing temperatures, reduced and less predictable rainfall, and more severe droughts (Christensen *et al.* 2007). These environmental changes will be particularly pronounced in the Kalahari semi-desert at the south-western edge of the aardvark's geographical range. Being one of the hottest and driest regions currently inhabited by aardvarks, the Kalahari may currently represent the severe conditions expected to become prevalent throughout much of the aardvark's range in the near future.

Aardvark emerging from burrow during daytime in winter.
(© Nora Weyer / Tswalu Kalahari)

Higher temperatures and aridity can potentially imperil aardvarks in two ways: either by affecting their physiological well-being directly, or indirectly by negatively impacting their prey species. Populations of these social insects are susceptible to changes in ambient temperature, plant productivity, and precipitation, and might thus be particularly sensitive to climate change. Entire colonies of termites can be wiped out by droughts (Nel & Hewitt 1969), and ants will retreat deeply underground (Tevis 1958), depriving aardvarks of a predictable food resource.

During periods of draught Aardvark may be active during daylight hours.
(©Nora Weyer / Tswalu Kalahari)

In the Kalahari, where free-standing water is scarce, a lack of prey does not only limit the aardvark's access to energy but also to water. In very hot environments, mammals require sufficient body water to support evaporative cooling required to regulate body temperature. Therefore, a decline in ant and termite numbers will likely compromise aardvark survival by challenging its energy and water balance. Indeed, high aardvark mortality occurred during a summer drought in the Kalahari in 2012/13, and surviving aardvarks were emaciated. As the Kalahari semi-desert becomes hotter and drier with climate change, such harsh summers may become the rule and their devastating consequences for the aardvark population might in turn jeopardize the continued existence of other animals dependent on aardvarks' burrows. A crucial step towards predicting a species' survival under future conditions, and developing successful conservation strategies, is to understand the physiological and behavioural mechanisms employed to cope with current seasonal fluctuations in climate and resource availability. Despite the aardvarks' ecological significance, no previous studies have examined their capacity to cope with extreme heat, aridity, and fluctuating resource availability.

We therefore studied the physiological and behavioural responses of wild, free-living aardvarks at Tswalu Kalahari Reserve (Northern Cape Province, South Africa) for two years, beginning in the winter of 2013 that followed the summer drought. We implanted aardvarks with VHF-tracking units and miniature dataloggers to record body and muscle temperature, and activity. Camera traps at entrances of our study aardvarks' burrows recorded their time of emergence, and, during behavioural observations, we scored the aardvarks' body condition and collected fresh scat samples for analysis of diet. The abundance of prey and its availability to aardvarks was assessed monthly using pitfall traps and surface signs of prey activity.

Here we report some of the findings from our preliminary analyses. At the start of our study in winter 2013, soon after drought, many aardvarks were in poor body condition and started foraging unusually early, at midday. Some aardvarks were even observed basking in the warm sand outside their burrows for extended periods in the morning, apparently to gain heat. This behaviour is more typical of animals incapable of effectively regulating their body temperature by means of their own metabolism (Geiser *et al.* 2004; Geiser & Pavey 2007, Signer *et al.* 2011). The idea that the aardvarks were energetically compromised is supported by our physiological data, which indicate that during this period of intense nutritional stress, aardvark body temperature regulation became less precise. The aardvarks' minimum 24h body temperatures, normally ca. 35 - 34 °C, dropped as low as 26 °C, resulting in an increased 24h body temperature range. Such body temperature patterns typically appear in food-stressed animals (Hetem *et al.* 2016). Moreover, aardvarks began to forage earlier in the day, likely to meet their energetic needs; however, their digging activity (recorded with implanted dataloggers) appeared less intense at the same time. In the spring of 2013, environmental conditions became more favourable for aardvarks. They were able to meet their energetic requirements, allowing their body condition to pick up again. Their body temperatures returned to a more narrowly controlled 24h pattern. By the summer of 2013, during which good rains occurred, all aardvarks were exclusively nocturnal and in excellent body condition. This pattern continued until the end of our study period in September 2015, only briefly interrupted by cold-spells in winter which lured aardvarks out of their burrows before nightfall. An earlier start of foraging activity in the late afternoon hours during winter has previously been reported in aardvarks in the South African Nama Karoo, a region with a milder climate than the Kalahari (Taylor & Skinner 2003). No major loss of body condition was evident in our study of aardvarks during these times. Measurements of body temperature range and activity patterns thus appear to reliably indicate stress and well-being in aardvarks.

Panoramic view of Tswalu Kalahari Reserve. (©Nora Weyer / Tswalu Kalahari)

Analyses of aardvark diet and of prey abundance assessments will serve to clarify the connection between resource abundance, aardvark body condition, and foraging effort. In the Nama Karoo, a study on diet choice of aardvarks during winter and summer revealed that termites appear to be the preferred food item in winter, whereas ants become more important in aardvark diet in summer (Taylor *et al.* 2002). Of the species consumed in the Karoo, some are also very abundant in the Kalahari, viz. pugnacious ant (*Anoplolepis custodiens*), snouted termite (*Trinervitermes* sp.), and Northern harvester termite (*Hodotermes mossambicus*). Our initial results indicate that ants are predominantly active during summer and retreat deeper into the soil in winter, a period when termites become more abundant in the traps. So far, our aardvark scats have contained high numbers of termites during all seasons and of ants mainly during summer. However, these results are currently based on a very small sample size and require confirmation.

From the initiation of the aardvark study in mid-2012 by Dr Benjamin Rey, a postdoctoral fellow in our research team, until late 2015, we obtained records of body temperature, muscle temperature, and activity of free-living aardvarks at Tswalu. Data loggers recorded these physiological variables at 5-minute intervals for varying periods in 13 individuals. Our study has yielded the most complete record of physiological, behavioural, and nutritional data for the elusive aardvark to date. Moreover, this is one of the first studies in which body temperature, muscle temperature and activity data of a free-living large mammal have been obtained over a period longer than one year. Ultimately, this study shall contribute to a better understanding of whether the charismatic aardvark will be able to tolerate the increasingly hot and arid environment predicted under future climate change.

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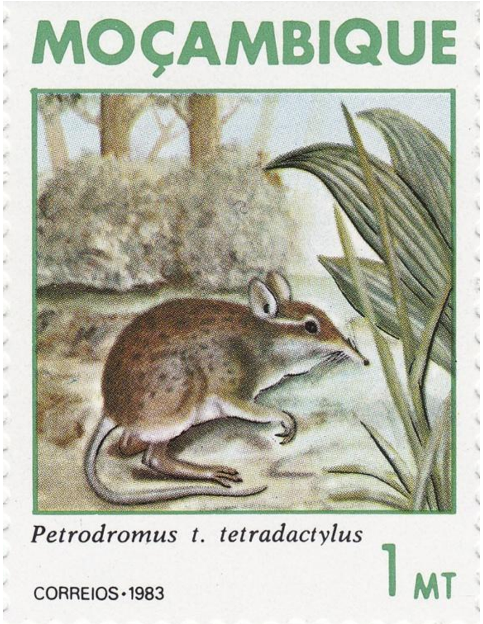
Sengi Biology According to Postage Stamps

Galen Rathbun[1]

[1]*Institute of Biodiversity Science and Sustainability, California Academy of Sciences, San Francicso, CA 94118 USA; email: grathbun@gmail.com*

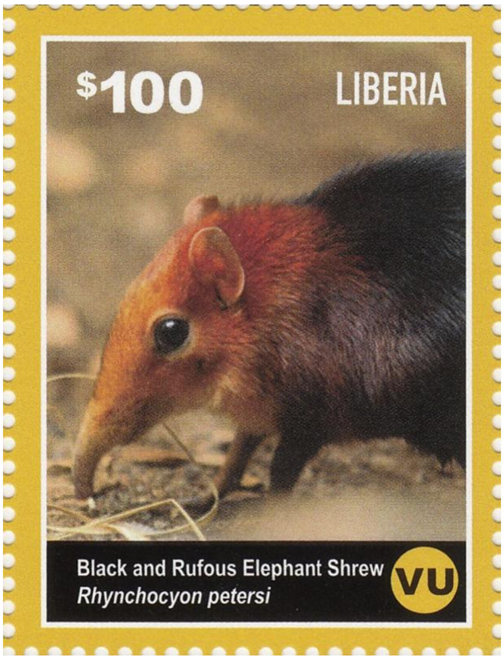
The objectives of our specialist group include education and increasing public awareness of the smaller afrotheres. We have done this through this newsletter; back issues and other information can be found at www.afrotheria.net. Recently, I discovered that five African countries (are there others?) featured sengis on their postage stamps, which is a novel way of raising public awareness of these little-known mammals. But what is disturbing to me is that the species identification does not match the illustration on some stamps. Also, with little personal philatelic knowledge, it seems to me that the featured sengis should be found in the country that issued the stamp. The only stamp that appears flawless in these regards is the one issued in Mozambique with *Petrodromus tetradactylus* (Four-toed Sengi).



Rhynchocyon cirnei (Checkered Sengi, spelled as on stamp!) is found in Uganda (www.sengis.org/distribution-table.php), but unfortunately the stamp image is of*Rhynchocyon petersi* (Black-and-rufous Sengi), which is only found in southeastern Kenya and eastern Tanzania!

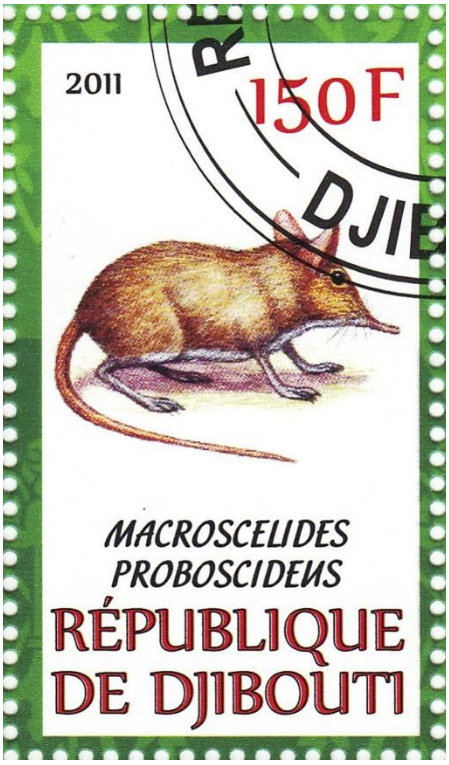
Zanzibar (Tanzania) has a stamp that claims *Petrodromus tetradactylus* is shown, and although this sengi does occur on Zanzibar, the image is clearly one of the three *Macroscelides* species (Round-eared Sengis), all of which are only found in the Southwestern Arid Zone of Africa.

There are no sengis found in far western Africa, but Liberia features an image of *Rhynchocyon petersi* on one of its stamps.



The Djibouti stamp features the Karoo Round-eared Sengi (*Macroscelides proboscideus*) that is found in southern Namibia and western South Africa – a loooong way from the Horn of Africa. Indeed, there are no records of any sengis in Djibouti, although the Somali Sengi

(*Elephantulus revoilii*) and Rufous Sengi (*Elephantulus rufescens*) are possible (see 2014 issue of this newsletter). To my eye, the stamp image is an *Elephantulus*, (ears are much too tall for a round-eared sengi), but the image lacks the very distinctive facial pattern found on the two most likely *Elephantulus* for Djibouti.



Despite these oddities, it was a pleasant surprise that sengis found their way onto so many postal stamps! Indeed, three of the five sengi genera landed on stamps – the most species rich genus (*Elephantulus*) being left out! I wonder if other afrotheres, other than the relatively common elephants and sea cows, have found their way onto postage stamps, and also defy our understanding of biogeography and taxonomy!?

The occurrence of Chequered Giant Sengis (*Rhynchocyon cirnei*) in Mutinondo Wilderness and their distribution in Zambia

By Frank Willems, Mutinondo Wilderness Ltd, fwls01@gmail.com

Introduction

The Chequered Giant Sengi (*Rhynchocyon cirnei*) occurs in isolated populations in a belt through central and south-eastern Africa, from northern Democratic Republic of Congo, through the Albertine Rift system, into northern Zambia, south-eastern Tanzania, and northern and central Mozambique (IUCN 2016). All known localities in Zambia are in the far north of the country (Ansell 1978).

I assembled recent observations of Chequered Giant Sengis in the Mutinondo Wilderness area and elsewhere in Zambia based on personal observations and discussions with colleagues familiar with northern Zambia.

Site description

Mutinondo Wilderness is a 10,650 ha private reserve within the Muchinga Plateau (Fig. 1), about 25 km west of the main escarpment edge, which forms the border of South-Luangwa National Park (N.P.). Lavushi Manda N.P. is about 30 km to the west, on the edge of the Bangweulu basin. The elevation of Mutinondo Wilderness is predominantly between 1350 and 1480 m asl, and is dominated by *miombo* woodlands and *dambo* grasslands (Fanshawe 1971). Granite boulder outcrops rise above the woodlands up to a height of 1684 m asl (Fig 2).

Sighting locations and habitat description

In the period November 2015 – August 2016, I recorded Chequered Giant Sengis (Fig. 3) at several localities within the reserve (Fig. 4). All records were made in riparian habitats between 1400 and 1435 m asl, either along the Musamfushi River, which is a perennial stream of some 10 m wide, or the mostly perennial Mafonie and Mayense streams, which are 1-2 m wide. The streams are tributaries to the Mutinondo River, which in turn flows into the Luangwa River, part of the Zambezi system. My sightings were always in or very close to evergreen riparian closed-canopy forest with dominant tree species including *Uapaca lyssopyrena*, *Gardenia imperalis*, *Syzygium cordatum*, *S. guineense*, *Rhus longipes* and *Vitex madiensis*, and in one location the palm *Raphia farinifera* (Fig. 5). The sengis have also been sighted in woodland at some distance from closed-canopy forest by other observers. Mike and Lari Merrett, who recorded the species here as early as 1995, once sighted a Chequered Giant Sengi on top of one of the granite outcrops in woodland vegetation dominated by *Brachystegia spiciformis*, but still with a dense understory and thick leaf litter layer, the result of 20 years without any fires. This locality (main camp, Fig. 4) lies at 1450 m asl and is about 400 m from the Musamfushi River.

Occurrence elsewhere in Zambia

In response to my queries, Chequered Giant Sengis were reported from a further five locations. Two of these locations are well outside the previously known distribution (Fig 1, Table 1). Unfortunately, I obtained no images or specimens confirming several reports of sightings, hence these should be treated as unconfirmed. All reported sightings come from closed-canopy vegetation. In the Lake Tanganyika and Lake Mweru Wantipa areas, Chequered Giant Sengis occur in *Sumbu* (*Itigi*) thickets at elevations as low as 760 m asl. Other reports (Nyika N.P., Shiwa N'gandu and Lavushi Manda N.P.) are from evergreen forest at elevations between 1400 and 2100 m asl (Tab. 1).

From areas without *Sumbu* thickets at elevations <1400 m asl, none of the respondents reported Chequered Giant Sengis. These areas include Kasanka N.P. and Bangweulu Game Management Area in the Bangweulu basin, North Luangwa N.P. and South Luangwa N.P. in the Luangwa Valley, and the Kafue N.P. in western Zambia. It seems likely that the Chequered Giant Sengi is genuinely absent from these lower elevation sites, because several are very well studied. I never recorded the species during my eight years of residence in Kasanka N.P. (predominantly 1150-1200 m asl), nor did any of the other numerous naturalists resident or visiting over the decades. Also, members of the local community which I interviewed never recognized the species from illustrations. I therefore believe it to be absent, despite the presence of substantial surfaces of seemingly suitable closed canopy vegetation types, which include typical riparian forest, *mushitu* swamp forest and *mateshe* dry evergreen thickets, the latter resembling the *Sumbu* thickets (Fanshawe 1971, Smith *et al.* 2000, J. Timberlake *pers. comm.*). These vegetation types are in excellent ecological condition, reflected by the presence of a wide range of species typical for such vegetations types, such as Blue Duiker (*Cephalophus monticola*), Gaboon Viper (*Bitis gabonica*) and African Pitta (*Pitta angolensis*) (own data). Similarly, it can be expected that a presence of Chequered Giant Sengis in the "valley floor" (560-900 m asl) of the nearby Luangwa Valley would have been noted by the many resident guides, researchers or visiting naturalists. Extensive blocks of seemingly suitable closed canopy thickets do occur, for instance, in the southern parts of South Luangwa N.P. These are well known for their typical thicket avifauna, which includes breeding populations of African Pitta (Dowsett *et al.* 2008). Numerous parties in search of this bird never recorded Chequered Giant Sengis to my knowledge or that of the respondents.

Discussion and conclusion

The records of Chequered Giant Sengis I present indicate an extension of the known range (IUCN 2016). It is not known whether the occurrence in Mutinondo Wilderness represents an isolated population.

Giant sengis are usually closely associated with closed-canopy habitats (Rathbun 2009), and this was the case with all sightings in Mutinondo Wilderness. Because many of the records were made during the wet season, and none were from habitats dominated by grasslands, despite the presence of grasslands in close proximity to sighting locations, there is no support for Kingdon's (1997) suggestion that *R. c. reichardi* inhabits grasslands in the wet season and only retreats into forest patches in the dry season.

A wider distribution may be expected based on the unconfirmed reports from two more sites in Muchinga Province, as well as the wider occurrence of closed-canopy habitats at similar elevations. Many of the seasonal and perennial streams in the Muchingas are lined by closed-canopy evergreen forest. Plateau grounds at elevations above 1400 m asl are more or less continuous throughout the Muchingas. There is only a relatively short stretch of some 75 km, east of Kasama, with elevations along the watershed between 1200 and 1400 m asl, separating the Muchinga highlands from those in the extreme north of the country (Surveyor General 1986).

In conclusion, it is likely that the Chequered Giant Sengis occurs more widely in the Muchingas region than Mutinondo Wilderness only, possibly linking up with the known populations in the extreme north of the country, some 300 km NNE of Mutinondo Wilderness. Further fieldwork is required to establish the extent of the range in Zambia.

Acknowledgements

I wish to thank Galen Rathbun, Chris & Mathilde Stuart, Clare Mateke and Mike & Lari Merrett for their contributions to this paper. Further, I wish to thank all that replied to the request for information: Matt Becker, Phil Berry, Bastiaan Boon, Adrian Carr, Yash Gharat, Charlie Harvey, Carl Huchzermeyer, Victor Kunda, Pete Leonard, Rachel McRobb, Ed Sayer, Robin Pope and Craig Zytkow.

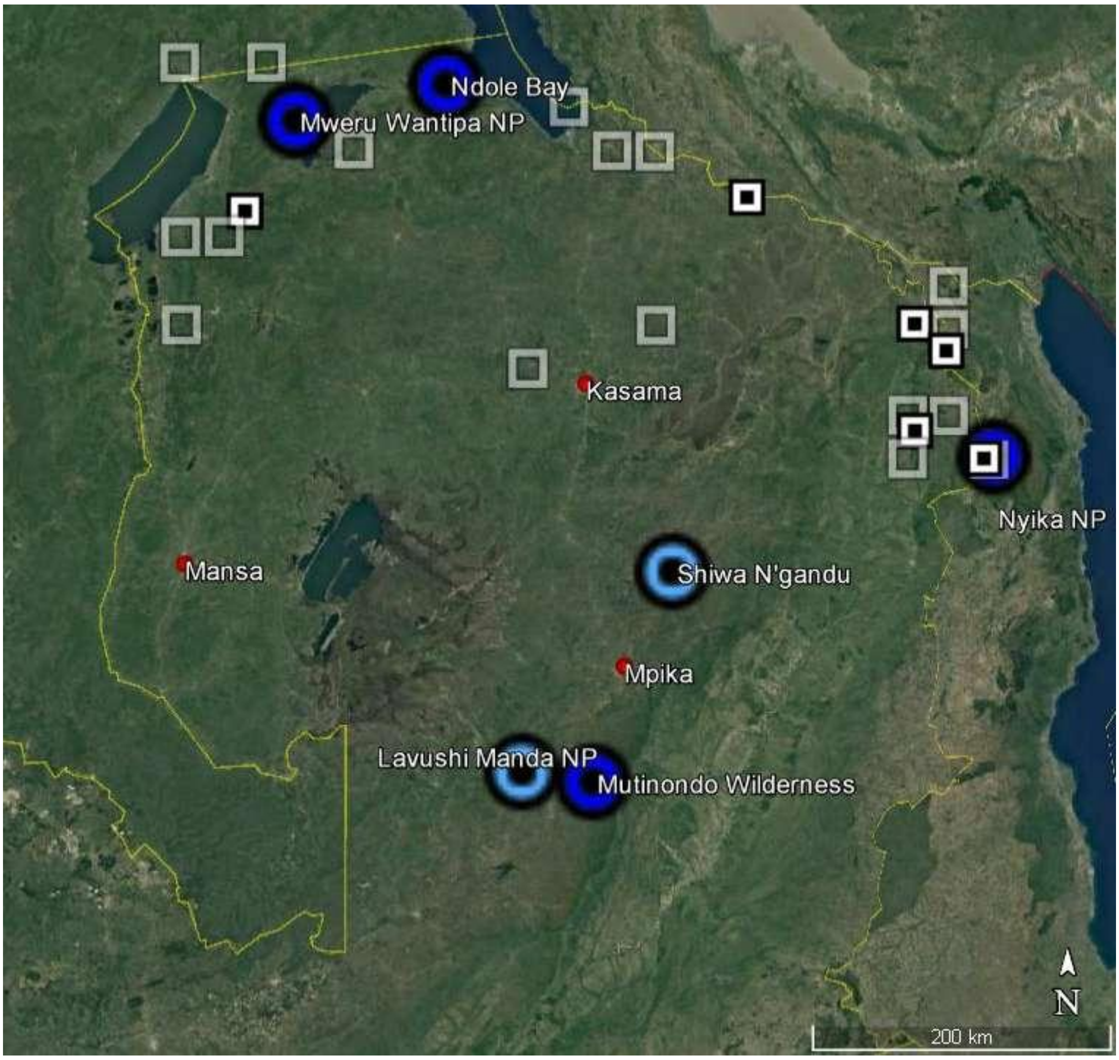


Figure 1: *Google Earth image showing the location of Mutinondo Wilderness and other known localities of Chequered Giant Sengis in north-eastern Zambia. Red dots indicate major cities, black-centred squares indicate localities of museum specimens (Corbet & Hanks 1968, Ansel & Dowsett 1988, Livingstone Museum collection), open squares indicate localities given by Ansell (1978; 1/16th degree squares), circles indicate localities presented in this publication (see table 1 for details for each sighting record). Dark blue circles are for confirmed records, and pale blue circles for unconfirmed records, as discussed in text.*

Figure 2*: Typical vegetation and landscape of Mutinondo Wilderness, which is dominated by large granite outcrops (Quentin's and Vicky's Rock shown here) surrounded by miombo woodlands and dambo grasslands, with evergreen closed-canopy forests limited to drainage lines, (c) Frank Willems, 18 June 2016.*

Figure 3*: Chequered Giant Sengi at Mutinondo Wilderness. The very prominent chequering on the back indicates the subspecies Rhynchocyon cirnei reichardi. 16 December 2015, (c) Frank Willems.*

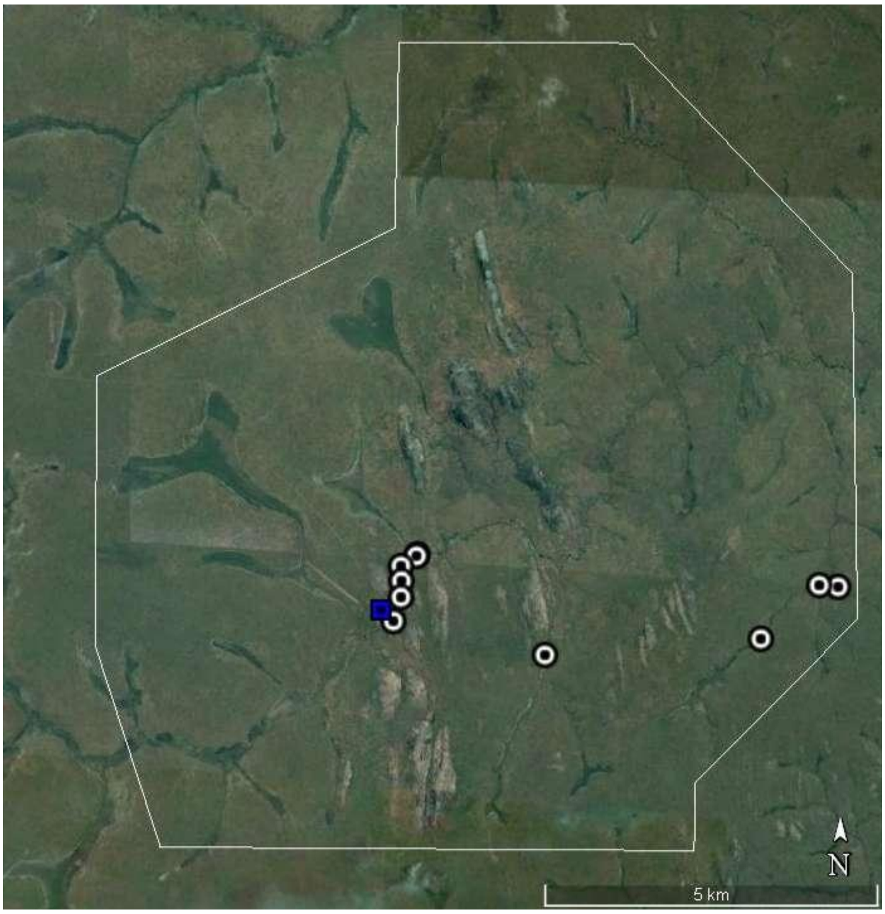


Figure 4*: Google Earth image of Mutinondo Wilderness showing location of the main camp (blue square) and observation sites of Giant Chequered Sengi in November 2015 – August 2016 (white circles).*

Figure 5A *Mafonie Stream, S12.4585/E031.3438;*

Figure 5B *Musamfushi River, S12.4487/E030.2942;*

Figure 5C *Musamfushi River, S12.4473/E031.2963,*

Figure 5*: Riparian forest habitats at sighting locations of Chequered Sengis within Mutinondo Wilderness in Zambia..(c) Frank Willems, 13/14 August 2016.*

Table 1: reported presence and absence of Giant Chequered Giant Sengi in northern Zambia.

Location	Lati-tude	Longi-tude	Elevation (approx, m asl)	Info	Source	New or previously known (IUCN 2016); status
Mutinondo Wilderness	S12.45	E031.29	1420	Present	this article	New; confirmed
Lavushi Manda NP	S12.39	E030.87	1600	In evergreen forest near source of Mulauzi Stream	Victor Kunda *pers. comm.*	New; unconfirmed
Shiwa N'gandu	S11.25	E31.75	1400	Thought to be present in several locations	Charlie Harvey, Bastiaan Boon *pers. comm.*	New; unconfirmed
Nyika NP	S10.58	E033.68	2100	Regular mainly in Chowo Forest	Robin Pope *pers. comm.*	Known; confirmed
Ndole Bay, Sumbu area, Tanganyika Lake shore	S08.47	E030.44	760+	Common at Ndole Bay near lake shore, as well as in Sumbu thickets in nearby Sumbu N.P.	Craig Zytkow *pers. comm.* (pictures available)	Not previously known from lake shores; confirmed
Mweru Wantipa NP	S08.68	E029.57	920	Regular in Sumbu thickets	Adrian Carr *pers. comm.*	Known; confirmed

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Notes from the Field

Sengi meets Adder

During a stay in the Erongo Mountains of Namibia, my husband and I were doing research on sengis or "elephant-shrews" and some other mammals. On December 4th, 2002 I was returning from a long walk on a sandy track well beyond the lodge that was hosting us, when I encountered an event rarely seen or recorded by people.

The vegetation next to the track was sparse with dried grasses and small, desiccated bushes and shrubs. Boulders and rocks lay scattered over the firm, sandy ground. A baboon troop barked from a nearby granite outcrop on the other side of the road......close enough that I could distinguish individual males and females, but far enough not to make me feel too apprehensive.

As I slowly walked, I scanned the areas near the road for birds, mammals, and insects, or anything else unusual. The afternoon sun was slowly descending and casting long shadows, and the air was warm and dry.

Bushveld Sengi, Elephantulus intufi, at study site near Omaruru, Namibia.
Photo Galen Rathbun ©California Academy of Sciences

Suddenly I saw some quick movement next to the road close to where I was walking. A bushveld sengi (*Elephantulus intufi*) was clearly visible, and at first I thought its focus was me. But as it darted about, I saw what was upsetting the sengi - a small and beautifully marked horned adder (*Bitis caudalis*) lying close to the base of a leafless bush, obviously waiting to ambush a meal incautious enough to wander into its presence. It was about a meter from where I stood, but off the road.

Intrigued, I stopped immediately to watch. Focusing more carefully on that particular patch of ground where the snake lay, I watched the little sengi run towards the snake, stopping just beyond striking distance.

I wasn't afraid of the snake because it was only about 40 cm long, and they are of a phlegmatic nature, so I stayed put to observe the sengi advance and retreat numerous times. The sengi saw me but seemed oblivious to my presence as long as I didn't move, and several times came to within a meter of me. It was completely focused on the snake, repeatedly dashing forward and retreating to a safer distance, periodically drumming it's rear feet on the ground, producing a distinctive audible rattle that easily carried far enough for me, the snake, and any nearby sengis to hear it.

The adder didn't react except to watch and occasionally move it's head to follow the direction of the sengi. This went on for about 15 minutes (I lost track of time) and then suddenly the sengi disappeared into the bushes, rocks and boulders behind the snake.

I walked on, thrilled to have witnessed something I never thought I would see, and only later learned that what I had observed was indeed unusual.

My husband told me that there were few published records of snakes preying on *Elephantulus*, although on December 18th, 2000 he had captured a horned adder nearby that eliminated a ball of fur containing a large number of small insect fragments, which he was sure represented a digested sengi. I also learned that there are at least 14 publications documenting sengis in regurgitated owl pellets (www.sengis.org/bibliography), but little else has been recorded on how sengis disappear (other than habitat destruction due to human activities and the occasional predation by cats, including the house variety).

The distinctive foot drumming that I witnessed has been studied in captive *Elephantulus*, and likely communicates to a predator "I see you so do not bother to try and catch me," or tells nearby sengis "beware, there is danger here" or both.

Carolyn Rathbun
Cambria, California
crathbun1@gmail.com

Afrotheria News

Message from the Chairs

Sadly, for the second consecutive newsletter, we have to announce the loss of one of our specialist group members. Bill Stanley's obituary is on page 26, and we send our condolences to his family, friends and colleagues.Nearly all the outstanding Red List assessments were finalized for our taxa and published on the IUCN Red List in June (see summary on page 25). Assessments involve a peer review and verification process that was protracted for some species this time, often when limited data made it difficult to calculate accurate species range (extent of occurrence or area of occupancy). Some species had their status changed due to more rigorous application of criteria, which were modified early in this cycle of assessments. The distribution and abundance data remain scant for the two threatened otter shrews, and revised estimates of extent of occurrence meant *Micropotamogale lamottei* was downlisted from Endangered to Near Threatened (NT) and *Micropotamogale ruwenzorii* was downlisted from NT to Least Concern (LC). Similarly, the black-and-rufous sengi (*Rhynchocyon petersi*) was downlisted from Vulnerable (VU) to LC due to the listing protocol related to occurrence in multiple fragmented habitats. In disagreement with the LC listing, Galen withdrew his support for the assessment. This giant sengi only occurs in relatively small, isolated, and often greatly degraded (or destroyed) forest patches in north-eastern Tanzania and south-eastern Kenya (see article by Hoffmann et al. on page 3). These forests have generated considerable scientific attention and conservation concern because of their status as biodiversity hotspots. Seeing afrothere species like the two otter shrews and the giant sengi considered LC when we have cause for concern for their conservation status, raises a number of questions around the quality of data available to conduct Red List assessments and the apparent lack of flexibility in the application of criteria that are intended for all taxa. In these three cases the result of the process is Red List categories that very likely mask the true vulnerability of the species to extinction. Perhaps it is time to review the Red List criteria and consider modifying the way they are applied.

PJ has worked with section leaders and their teams to develop conservation fact sheets for our species to highlight priority actions needed in the short to medium term (see page 26). It is notable that a common need identified across all taxa is improved data on distribution, abundance and threats to enhance the quality and robustness of Red List assessments. With tenrecs, there is growing evidence that the hunting of larger species may be unsustainable (see the article by Kim Reuter on page 9); threats to these and other afrotheres need to be assessed and quantified.

The Chair of the IUCN Species Survival Commission can hold the post for only two terms (two IUCN quadrennials), so Simon Stuart will be stepping down at the IUCN World Conservation Congress in September, when a new Chair will be elected by members. We appreciate and thank Simon for his hard work over the last eight years and his encouragement and support for the lesser known taxa like the Afrotheria. Soon after the new SSC chair is chosen, at the end of the current quadrennium, the IUCN will reappoint or replace specialist group chairs, and in turn the chairs will do the same with group members. Thus, 2017 will bring some changes to our group.

We are very grateful to Chris and Mathilde Stuart for stepping in and editing this edition of *Afrotherian Conservation.* We hope you enjoy reading it.

PJ Stephenson, Gland, Switzerland
&
Galen Rathbun, Cambria, California, USA
[July 2016]

Are we meeting our specialist group educational objectives?

One of the principal objectives of our specialist group is to educate the public and our colleagues about afrotherians, including their conservation. We have done this mainly through our web site and the production of our (almost) yearly newsletter (Afrotherian Conservation). To try and get an idea of how well we are doing in terms of disseminating information, we have assembled some data on the use of our web site.

However, the data were rather difficult to assemble and interpret because of numerous variables. For example, the URLs for hyraxes, sengis and the aardvark are not hosted on our web site, thus these sites do not figure into the following data summary. Also, the data vary greatly depending on the availability of data and the sometimes rather obtuse definitions of use (i.e., “hits”, versus “visits”, versus “pages”, etc.). In any case, the following summary provides us with a rough metric of interest during the month of December 2015, when we had 1,532 “visits”).

The countries with the most “hits” (including robot “hits” that are much greater than actual “visits”), in decreasing order during December 2015, were: United States (6,753), United Kingdom (1,371), Ukraine (888), Germany (557), France (520), South Africa (510), Sweden (386), Canada (367), Russia (324), Romania (323), Japan (284), India (244), and China (201). Note that there were also 236 of unknown origin, plus a scattering of many other countries.

“Visits” to PDF files on the web site included 169 to our membership list, and between 70 and 90 to individual years of our newsletter. PDF files downloaded totalled 66.

“Visits” to the different sections of our web site, in decreasing order, were: golden moles, home page, tenrecs, systematics, what is Afrotheria, conservation, mission, and donate. Although donate was visited 51 times, we received NO donations. Also remember that only the golden mole and tenrec clades are actually hosted on our web site, the other clades have their own URL and do not figure into this summary. However, in January 2016 www.sengis.org had 807 “visits”, compared to 2,891 for www.afrotheria.net.

We believe these data suggest that the material on our web site is being accessed frequently enough to continue maintaining our web site.

Galen Rathbun, Department of Birds and Mammals, California Academy of Sciences.
Charles Fox, Avian Design (http://www.aviandesign.net/)

Afrotheria Red List Reassessments Complete

The IUCN Red List of Threatened Species is a global approach to assessing the conservation status of species. In 2012 the IUCN started the process of updating the Red List for mammals and, over the last three years, the Afrotheria Specialist Group (ASG) has reassessed 79 out of 80 species that fall under our remit. With four Orders of mammals to assess, including many poorly known species, this was a big task, but thanks to the contributions of our group coordinators, members and other non-member experts, we completed this process in early 2016.

Forty-nine (49) out of the 79 species reassessed (62%) were listed as Least Concern (LC), which was up from 47 species in 2008 when the previous assessments were completed (Table 1). This change was the result of two species (*Micropotamogale ruwenzorii* & *Rhynchocyon petersi*) being downlisted (i.e. moved to a less threatened category), one species (*Dendrohyrax validus*) being uplisted (moved to a more threatened category), and one new species being described (*Microgale grandidieri*). Both downlistings were the result of non-genuine changes, meaning that the new assessments were based on either more accurate information or changes in listing protocols or their application, rather than a genuine improvement of the conservation status of the species. The uplisting of the hyrax was the only example of a genuine category change and indicates a decline in conservation status. Although a LC category indicates that a species does not qualify for a threatened status, it may nonetheless be facing threats or experiencing population declines. In addition, *Neamblysomus julianae* was moved from Vulnerable (VU) to Endangered (EN), while *Micropotamogale lamottei* was moved from EN to Near Threatened (NT). Both of these were non-genuine changes. *Rhynchocyon cirnei* has not yet been reassessed.

Table 1. Threatened categories of species covered by the Afrotherian Specialist Group.

Red List Category	2008	2016	Change?
Least Concern	47	49	⇧
Near Threatened	4	4	⇔
Vulnerable	11	9	⇩
Endangered	8	8	⇔
Critically Endangered[1]	1	1	⇔
Data Deficient	8	8	⇔
Total	**79**	**79**	

[1] The Bronberg Ridge Subpopulation of Neamblysomus julianae is listed as CE in both assessments, but is not counted here because it is not presently considered a full species.

Overall, most of our afrotherian species are holding their own in relation to the ongoing and ever increasing threats to biodiversity. However, we still have 22 species that are listed as threatened to some extent (which is 28% of the total), a handful of species that may be more threatened than their LC status suggests, and eight species listed as Data Deficient, meaning that there was inadequate information to make an assessment of their risk of extinction. We still have much work to do to protect our Afrotheres.

Andrew Taylor
The Endangered Wildlife Trust, Pinelands Office Park, Modderfontein, Johannesburg
taylor.wa@gmail.com

Priority Conservation Actions for the Afrotheria

The IUCN/SSC Afrotheria Specialist Group aims to facilitate the conservation of hyraxes, the aardvark, sengis, golden-moles, tenrecs, and their habitats. In order to highlight the threats facing our taxa and to publicize the most urgent conservation and research actions needed to conserve them, the Group has been compiling Conservation Factsheets. Five factsheets have been produced (one for each taxon), with each one describing: the contact person, the species in the taxon and their Red List status, the main threats and pressures on the species, and the main conservation and research action required (including locations and budgets).These factsheets are available online through the IUCN website (http://www.iucn.org/species/ssc-specialist-groups/about/ssc-specialist-groups-and-red-list-authorities-directory-8) and through a link on www.afrotheria.net.

Many of the priority conservation actions reflect the lack of data for many species (see Stephenson 2015), so emphasis is given to filling information gaps relating to distribution, abundance and threats. Most of the concrete conservation actions focus on the protected areas that offer safe havens for threatened species. Some of the priority conservation and research actions identified in the factsheets include:

- Tenrecs: Integrate the monitoring of tenrecs into the management of key protected areas (e.g. Anjanaharibe-Sud Special Reserve and Marojejy National Park in Madagascar) to track their conservation status and threats and plan key actions.
- Sengis: Determine and document the proportion of sengi species distributions that fall within protected areas to help identify priority conservation sites and actions.
- Golden moles: Use innovative environmental DNA techniques to assess the dietary and habitat requirements of the giant golden mole to help determine the conservation needs of the species.
- Hyraxes: Conduct surveys (range-wide but with a focus on the Dahomey Gap in West Africa and the islands on the East African coast) to determine the distribution and abundance of hyrax species, combined with a genetic study to facilitate taxonomic revision and to verify species diversity.
- Aardvark: Conduct a study on the impact of the bushmeat trade on the aardvark in Ghana, Democratic Republic of Congo and Benin.

The factsheets will be constantly updated and improved and will form the basis for the Group's fund-raising in coming months.

Stephenson, P.J. (2015). Can IUCN Specialist Groups do more to collect species monitoring data? *Afrotherian Conservation,* 11: 12-13.

PJ Stephenson
Co-chair, IUCN/SSC Afrotheria Specialist Group
Gland, Switzerland.
StephensonPJ@gmail.com

Obituary: Bill Stanley

Bill and the type specimen of Rungwecebus kipunji, the new monkey he co-described in 2006. The specimen was trapped by a farmer in 2005 while raiding his maize crop.
Photograph courtesy of Tim Davenport, Wildlife Conservation Society.

Bill Stanley, Director of Collections at the Field Museum in Chicago USA (video) and an invaluable teacher, friend, and colleague to many of us, suffered a fatal heart attack while on a mammal collecting expedition in Ethiopia in early October 2015. He was 58. Bill was an active member of the IUCN-SSC Afrotheria Specialist Group, most recently contributing to Red List updates. He also mentored and inspired an untold number of students, and worked closely with many colleagues world-wide, but especially from Africa, Europe, and the United States. Bill was an accomplished scientist (profile) whose many publications on the systematics, ecology, and biogeography of the mammals of eastern Africa (and beyond) significantly improved our understanding of the region's biodiversity, especially Tanzania. While profoundly saddened by his untimely death, let us be grateful for the kindness and inspiration he so generously shared with all who knew and worked with him.

Link Olson, University of Alaska Museum, Fairbanks, Alaska, USA
Galen Rathbun, California Academy of Sciences, San Francisco, California, USA

Noticeboard

Funding & Training Opportunities

Rainforest Trust -- Rainforest Ark Initiative 2016
https://www.rainforesttrust.org/ark-initiative/

The Rainforest Ark Initiative provides partnership and funding opportunities to local conservation NGOs across the tropics. Funded projects aim to establish and/or expand protected areas for critically endangered and endangered wildlife and birds. The Initiative invites applications for conservation partnerships from non-profit entities and NGOs for projects in tropical Latin America, Africa, and Asia. Applying organizations may submit proposals for either a land purchase or a protected area designation.
Deadline: January 21, 2017.

Rainforest Action Network -- Protect-an-Acre Fund
http://www.ran.org/protect_an_acre_application_guidelines

The Protect-an-Acre Fund makes small grants to protect forests, promote local self-sufficiency, and strengthen the rights and livelihoods of forest communities. Grants are to local forest communities, indigenous federations, and NGOs active in rainforest zones worldwide. Grants generally do not exceed US$5 thousand.
Deadline: Rolling.

Rare -- Partnerships in Conservation
http://www.rare.org/partner#.VznGDeTzK2q

Rare addresses environmental threats in targeted regions of the developing world by building community support for conservation. Rare provides training, mentoring, and technical support to partners to manage Rare's signature Pride campaigns in their communities. Rare currently supports programs in the China, Indonesia, Latin America, Micronesia, Mozambique, and the Philippines. Organizations interested in partnering with Rare in the future are invited to send information to Rare's regional offices (contacts are provided).

Deadline: Rolling.

The Rufford Foundation
https://apply.ruffordsmallgrants.org/

The Rufford Foundation is a UK registered charity which funds nature conservation projects across the developing world. To date the Foundation has awarded grants to over 3000 projects in 155 countries. There are five stages of funding and applications from conservationists are welcome through the dedicated website. Through its Conference programme, the Foundation encourages the sharing of knowledge and best practice throughout the conservation world

Recent Literature

Compiled by Lee Koren, Thomas Lehmann, Galen Rathbun and PJ Stephenson.

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