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Message from the Chair

Andrew Taylor
Chair, IUCN SSC Afrotheria Specialist Group

Dear Afrotheria Specialist Group colleagues,

I hope you are all well. I am excited to introduce the latest edition of our newsletter. Thank you to those who submitted content; this time we have three articles: two on aardvarks and one on sengis

As a reader of this edition, I would encourage you to submit articles and news items for Afrotherian Conservation 19, which will be released in the second half of 2024. News items can be summaries of recent papers or results and updates of ongoing work that is not ready or likely to be published in the scientific literature, but which may be of interest to Afrotheria enthusiasts and researchers. Please also share the details of any publications with links to Afrotheria that you are involved with. Photos and field observations are also welcome, as are any announcements we can post on the noticeboard about conferences, grant opportunities, scholarships and the like. Guidelines for submission are provided at the end of this newsletter..

There have been some exciting species findings for golden moles in South Africa and sengis in Djibouti and Somaliland over the last 18 months, and hopefully these discoveries will be published shortly. I look forward to further news on these developments in future newsletters.

In the previous edition I mentioned that we anticipate starting the Red List process to reassess the conservation status of all our species during the current quadrennium, but we have not yet got around to this. When we do, I would be grateful if some of you would be ready to assist if you are able as it is important for the ongoing conservation support of our species.

Thanks again to PJ Stephenson for continuing as the newsletter editor.

I wish you all the best for the coming year.

Andrew Taylor, Gauteng, South Africa
4 June 2023

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A juvenile common tenrec (*Tenrec ecaudatus*), also known as the tailless tenrec.

The family Tenrecidae is the most speciose taxon in the Afrotheria, with more than 30 species currently recognised.

For a full list of the species our group covers, see our website at http://www.afrotheria.net/systematics.php.

INSIDE THIS ISSUE

Articles

Aardvarks may be energetically challenged even in a mesic environment – summary of a short study in the Waterberg region

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Studies on the feeding ecology of aardvarks (*Orycteropus afer*) have thus far focused on arid and semi-arid regions. Aardvarks in the semi-arid Nama Karoo showed a preference for ants, specifically the pugnacious ant (*Anoplolepis custodiens*), throughout the year, yet, more termites, notably snouted termites (*Trinervitermes trinervoides*), were consumed during the dry winter when ant abundance was at its lowest (Taylor et al., 2002). In the dryer Kalahari, aardvarks predominantly preyed on the northern harvester termite (*Hodotermes mossambicus*), which provided most of their energy and water intake throughout the year (Weyer 2018). During an extreme drought, body condition of the aardvarks in the Kalahari declined and several individuals died, suggesting they might have had a negative energy balance (Rey et al., 2017; Weyer et al., 2020). To expand our understanding of the feeding ecology of aardvarks, the aim of our study was to assess the seasonal variation in the diet of aardvarks in a mesic environment, the Waterberg region in South Africa (Figure 1).

To quantify the diet of Waterberg aardvarks (Figure 2A), we washed and analysed scat samples (Figure 2 B-D) to count and identify their prey items in the wet (n = 26) and dry (n = 26) season of 2022 and estimated the aardvark's daily energy intake.

Energy intake was estimated per season using the equation from Weyer (2018) that calculated the daily energy intake provided by the average dietary contents of an aardvark as follows:

$$E_{24hr} = PI * \sum_{i=1}^{n} (proportion_1 * E_i)) * m_{scats} * n_{scats} * AE_{energy}$$

where:

E_{24hr} = dietary energy input (kJ) of an aardvark in 24 hours; *PI* = prey items (average count per g dry scat mass);

$Proportion_1$ = average proportion of prey item *i* in diet; E_i = energy content of each prey item *i* (kJ per individual extracted from the literature);

m_{scats} = mean dry scat mass (g);

n_{scats} = estimated 6 defecations per aardvark per 24-hour period (Taylor, 1998);

AE_{energy} = 0.65 (65 % energy assimilation efficiency for myrmecophagous mammals (Cooper & Withers, 2004; Williams et al., 1997)).

We found that aardvarks in the Waterberg primarily preyed on ants such as *Pheidole* sp. and *Dorylus* sp. in both the wet and dry seasons (Figure 3A). While the large harvester termite *H. mossambicus* only made up a quarter of the aardvark's diet by count, it was the primary source of energy (~ 40%) in both seasons (Figure 3B), a finding similar to that by Weyer (2018), namely that aardvarks in the Kalahari relied heavily on harvester termites for energy across all seasons.

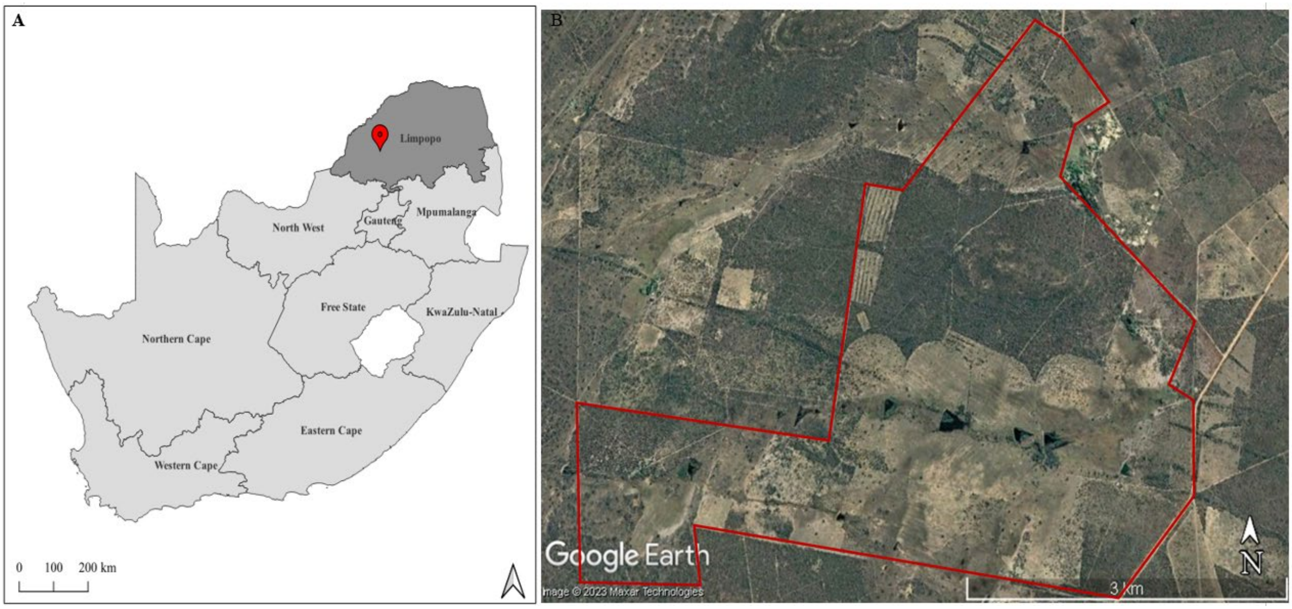

Figure 1. Maps showing the study site location, (A) shows the study site location within Limpopo, South Africa and (B) the study site (outlined in red). Maps were made using QGIS and Google Earth Pro.

Figure 2. Top: A picture of an aardvark from the Waterberg region, foraging during daytime at the end of the dry season (12 August 2021) (A) Photo: J. Calcott. **Bottom:** Aardvark scat collected from the Waterberg (B), washed and dried aardvark scat (C), a process to remove the sand and leave organic matter (ant and termite heads) behind, and a microscopic view of the organic matter found in aardvark scats (note the *Psammotermes* sp. head in the centre of the photo) (D); Photos: A. Chen.

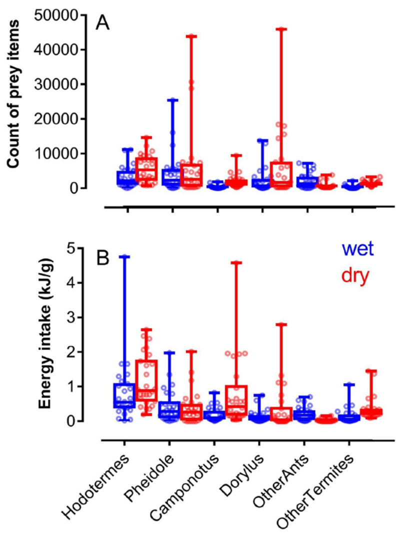

Figure 3 .Count of prey items (A) and energy intake (kJ/g) (B) per scat of various prey items identified in the scats of aardvarks in the Waterberg in the wet (blue) and dry (red) season of 2022.

Scat samples in the dry season had a higher energy composition per gram of organic matter as compared to the wet season scat samples (3.11 kJ g^{-1} in the dry season vs. 1.94 kJ g^{-1} in the wet season, $t = 2.98$. $p = 0.004$) potentially due to the higher fraction of organic matter found in the dry season compared to the wet season (14.6 ± 6.8% organic matter in the dry season vs. 9.3 ± 5.3 % organic matter in the wet season, $t = 3.163$, $p < 0.05$). This higher energy composition per gram of organic matter resulted in daily energy intake estimates in the dry season (5,190 kJ per 24 h) to be nearly double that of the wet season (2,382 kJ per 24 h). The low energy intake of Waterberg aardvarks in the wet season resembled the overall energy intake of aardvarks in the Kalahari (Weyer, 2018) and would provide only one fifth of the daily energy requirements of an equivalent-sized desert mammal (~ 11,700 kJ per 24 h, equation no. 8, Nagy et al., 1999). Like other myrmecophagous mammals, aardvarks might have a particularly low basal metabolic rate (0.128 cm^3 O_2 g^{-1} per hour; McNab, 1984; which is equivalent to a daily expenditure of 2,150 kJ per 24 h; Weyer, 2018). While aardvarks in the Waterberg may be able to meet their basal energetic requirements (energy required for an animal to maintain at rest), they might struggle to meet their total energetic requirements (energy required to perform other tasks such as foraging for food or digging a burrow) in both seasons.

Rainfall during the wet season of the study (867.51 ml from October 2021 to April 2022) was much higher compared to the average rainfall from the last 40 years (542.80 ml ± 117.52 ml between 1981 and 2020) which likely altered prey availability in the Waterberg. High rainfall can reduce surface activity and foraging efficiency of both ants (Farji-Brener et al., 2018) and termites (Ohiagu, 1979; Braack, 1995; Davies et al., 2015). Previous studies have shown that aardvarks might struggle to meet energetic requirements during extremely dry seasons in the arid Kalahari (Weyer et al., 2020) but our study shows that aardvarks might also struggle to meet energetic requirements in extremely wet seasons in the mesic Waterberg. Therefore, aardvarks may be walking a nutritional tightrope in that both particularly dry seasons and particularly wet seasons appear to negatively affect their prey availability and hence energy intake. In areas where climate change is predicted to increase the frequency and severity of extreme events (such as floods and drought), aardvarks might be at risk of extirpation, which might not bode well for the numerous animals that rely on aardvark burrows (Pike & Mitchell, 2013). Aardvarks are currently listed as Least Concern (LC) on the IUCN Red List of Threatened Species (Taylor & Lehmann, 2015); but no data exist on aardvark population numbers (Taylor et al., 2019). Learning more about aardvarks' physiology, behaviour and ecology and how they cope under various environmental stressors might help us better conserve this species. Our study indicates that aardvarks might be more vulnerable than previously thought, highlighting the need to increase conservation efforts for this species.

Acknowledgements

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Wilhelm Peters' mysterious *'Macroscelides intufi'* from Mozambique

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The bushveld sengi in Mozambique?

In his extensive travel reports from Mozambique (Naturwissenschaftliche Reise nach Mossambique, auf Befehl seiner Majestät des Königs Friedrich Wilhelm IV. in den Jahren 1842 bis 1848 ausgeführt), the German naturalist Wilhelm Peters (Fig. 1) collected and examined several specimens of sengis from south-east Africa. He first described the species *Macroscelides fuscus* (now *Elephantulus*) from Boror (20 km north-west of Quelimane), *Petrodromus tetradactylus* from Tete and *Rhynchocyon cirnei* from Quelimane (Peters 1846, 1847, 1851, 1852). Less well known is that Peters also reported on specimens of the bushveld sengi *Macroscelides intufi* (now *Elephantulus*) collected at several localities in Mozambique (Tette [sic], Senna, Inhambane, Boror [Peters 1852]; Fig. 1). The (current) geographic range of *E. intufi*, however, is limited to most of Namibia, southwester Angola, southern and central Botswana, north-westernmost region of South Africa and the extreme south of Zimbabwe (Fig. 1). This species prefers very arid woodlands and bushlands with open canopies, predominantly low shrubs and scrub with some scattered grasses (Rathbun, 2005; Heritage, 2018). The more mesic Zambezian and Mopane-Miombo woodlands of central and southern Mozambique thus renders it unlikely that *E. intufi* occurs in this region. Peters himself admitted some differences between his specimens and the original description of *E. intufi* by Andrew Smith

(1836, 1839): (i) Smith found only a single specimen in the arid type region of *E. intufi* whereas Peters found it to be the most common sengi species in Mozambique; (ii) Peters described the pelage color of the Mozambique *intufi* as less greenish than the one depicted by Smith from northwestern South Africa; (iii) he also noted that the blackish tone of the pelage is much more pronounced in females than in males (whereas no blackish pelage is known in true *E. intufi*).

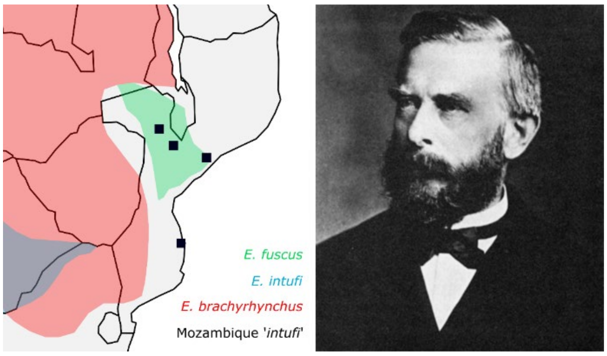

Figure 1. Left: Map of south-east Africa indicating sampling localities of Peters' Mozambique *intufi* and the geographic range of valid species according to the IUCN Re List of Threatened Species (IUCN, 2022). Right: Portrait of German naturalist Wilhelm Peters.

Most surprisingly, Peters described the Mozambique *intufi* as having a third lower molar (Fig. 2). Smith did not mention tooth number in the original description of *E. intufi*. A third lower molar is known only in *E. brachyrhynchus*, *E. fuscus* and *E. fuscipes* (and some extinct Plio-Pleistocene "*Elephantulus*" taxa) and has never been observed within *E. intufi* (Corbet & Hanks, 1968). *E. brachyrhynchus* and *E. fuscus* are known from central Mozambique (Fig. 1) and Peters suggested a closer relationship of his *intufi* to the two species (based on the presence of the third lower molar). However, he noted a larger body size and greater skull width in his specimens and therefore regarded them as a different species. Given the clear discrepancy in morphology and habitat to Smith's *E. intufi*, the status of Peters' specimens remains dubious.

Comparison with Mozambique sengi species

To trace the case of Peters' mysterious *intufi* from Mozambique and to draw some inferences on its taxonomic relationships, I examined available sengi specimens in the mammalogy collection of the Natural History Museum in Berlin (Museum für Naturkunde Berlin). Six specimens could be identified as belonging to Peters' *intufi* (Table 1; Fig. 2). Two are still labelled and listed as *E. intufi*. The other four have been relabelled as *E. brachyrhynchus* by unknown researchers or museum staff members. The later assignment to *E. brachyrhynchus* was probably based on geography as this species was, for a long time, the only *Elephantulus* known from Mozambique (*E. fuscus* species level status was not accepted until 1971; Corbet, 1971). The sampling localities for these specimens fit with Peters' original description. Due to their age and probable struggles with the collections during World War II, the specimens are in overall bad condition (skulls/mandibles broken and incomplete; tails, nose tips, fur missing on study skins). Many diagnostic characters could therefore not be examined or measured.

Figure 2. Specimens in the mammalogy collection of the Natural History Museum Berlin identified as Wilhelm Peters' '*Macroscelides intufi*'. (A) Oldest (original?) label indicating Peters' original assignment. ZMB_Mam_00642 skin in dorsal (B) and ventral view (C). ZMB_Mam_00643 skin in lateral (D), dorsal (E) and ventral view (F). Skulls of ZMB_Mam_84905 (G), ZMB_Mam_84903 (H) and ZMB_Mam_84913 (I) in dorsal view. (J) Right mandible of ZMB_Mam_84913 (arrow indicates third lower molar).

Cranial width as well as the length of the body, tail and upper tooth row of these few Mozambique *intufi* specimens all fall in the variation reported from *E. brachyrhynchus* and *E. fuscus* (Corbet & Hanks, 1968; Heritage, 2018). They are thus not obviously deviating from *E. brachrhynchus* and *E. fuscus* in size. Dorsal pelage of the Mozambique *intufi* is dark greyish-brown with some yellow blending at the flanks. Ventral pelage is much paler and more of a greyish white colour (Fig. 2). True *E. intufi* differ from Mozambique specimens in being much paler. Differentiation from *E. brachyrhynchus* is difficult as this species shows great clinal variation in pelage colour across its wide geographic distribution (Corbet & Hanks, 1968). There is similarity between Mozambique *intufi* and *E. brachyrhynchus* specimens from Malawi. Overall pelage colour of Mozambique *intufi* is also similar to *E. fuscus*. Pale *E. fuscus* specimens are known from Malawi (Rathbun et al., 2018). Peters' type specimen of *E. fuscus*, however, is particularly dark, with the ventral pelage lacking the greyish white blending; the skin of the type is also lacking a white eye ring (Fig. 3). This might be the reason that Peters did not take into account that the Mozambique *intufi* could represent paler variants of *E. fuscus*. Pelage colour thus suggest that the Peters' *intufi* could also belong to *E. fuscus*.

The most prominent difference to discriminate *E. fuscus* from *E. brachyrhynchus* is the shape of the enlarged supratragus of the inner ear (Fig. 4; Corbet & Hanks, 1968). Size and orientation of the supratragus of the Mozambique *intufi* specimens is very similar to *E.fuscus* (Fig. 4).

Table 1. List of Mozambique '*intufi'* specimens in the Natural History Museum Berlin.

Collection number	Sampling locality	Preparation
ZMB_MAM_00642	Tete	skin
ZMB_MAM_00643	Tete	skin
ZMB_MAM_2791	Tete	alcohol
ZMB_MAM_80085	Tete	alcohol (very young)
ZMB_MAM_84903	Senna	skull
ZMB_MAM_84905	Inhambane	skull
ZMB_MAM_84905	Tete	skull (very young)
ZMB_MAM_84913	Mozambique?	skull

Figure 3. Holotype specimen of *Elephantulus fuscus* (ZMB_Mam_00644). Original depiction in Peters (1852; upper left); skin in lateral (upper right), ventral (bottom left) and dorsal view (bottom right).

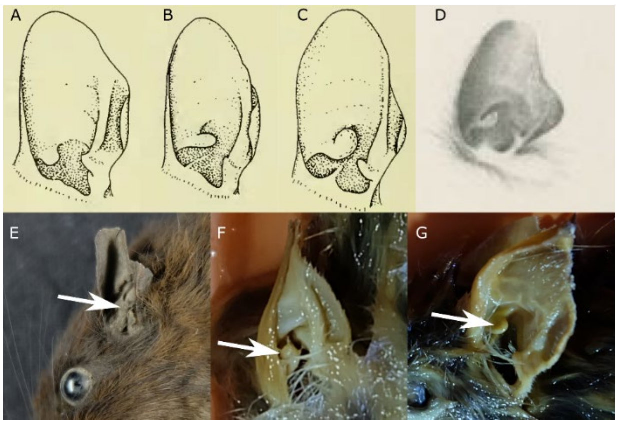

Figure 4. Supratragus shape in sengis. Corbet & Hanks' (1968) depiction of supratragus shape in *E. brachyrhynchus* (A), *E. fuscus* (B) and *E. fuscipes* (C). (D) Depiction of supratragus shape in the original description of *E. fuscus* by Peters (1852). (E) Supratragus shape in Peters' type specimen of *E. fuscus* (ZMB_Mam_00644). Supratragus shape in Mozambique *intufi* specimens ZMB_Mam_80085 (F) and ZMB_Mam_2791 (G). White arrows indicate supratragus in museum specimens.

Inferences on sengi conservation in south-eastern Africa

Overall, Peters' assignment of his specimens from Mozambique to *E. intufi* can be rejected based on geography, morphology and habitat. The specimens are similar to *E. brachyrhynchus* and it cannot be ruled out that they are part of the clinal variation in this species. However, all sampling localities are outside the currently known range of *E. brachyrhynchus* (its presence around Tete is currently not confirmed; Fig. 1). The pelage colour of the Mozambique *intufi*, although differing from the type, fits into the known variation of *E. fuscus*. Their supratragus shape also supports assignment to *E. fuscus*, although this trait has never been investigated systematically. Most of the sampling localities fall into the known range of *E. fuscus*. Therefore, the assignment of Peters' *intufi* from Mozambique to this species is likely. Final clarification will probably require genetic analyses of some of the specimens.

However, the specimen sampled from Inhambane would extend the known range of *E. fuscus* by around 500 km to the southern coast of Mozambique. It is well documented that Peters travelled through and collected in the area of Inhambane in 1846/47. For instance, he described the yellow golden mole (*Calcochloris obtusirostris*) from a series of specimens collected around Inhambane (Peters, 1851). One can nevertheless not exclude the possibility that "Inhambane" refers to the province rather than the town. If sampled from a locality in the very north of the province, the Mozambique *intufi* would extend the range of *E. fuscus* by about 150 km.

The Southern Zanzibar-Inhambane coastal forest mosaic and Miombo woodlands in the Inhambane province would fit with *E. fuscus'* habitat preferences. There is no obvious habitat discontinuity that could limit the southern rang of *E. fuscus*. *E. fuscus* is the least known species of *Elephantulus* (and perhaps of all soft-furred sengis) and its presence in eastern Zambia outside the known range has only recently been reported (Krásová et al., 2021). Its range might therefore be underestimated given the current data. Similarly, new data on the range and population density of the Somali sengi (*Galegeeska revoilii*) have recently helped to change the species' IUCN conservation status from Data Deficient to Least Concern (Heritage et al., 2020). Nevertheless, the Save River forms the border between the Inhambane and northern provinces since the colonial era. As rivers are known to constitute dispersal barriers in sengis (Rathbun, 2009), the Save River potentially limits the southern range of *E. fuscus*. The single Mozambique *intufi* from Inhambane would then represent an erroneous sampling locality.

In conclusion, there are reasonable arguments for and against the southern extension of *E. fuscus* from Peters' Mozambique *intufi*. No species of *Elephantulus* is, however, currently known from southern coastal regions of Mozambique. To fully assess the conservation status (currently Data Deficient) and range of *E. fuscus*, this area should be in included in future field surveys on sengi distribution.

Acknowledgements

I am grateful to Frieder Meyer and Christiane Funk for providing access to the mammalogy collection in the Berlin museum.

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Insights into the population trends, conservation status and threats for aardvark populations in protected areas in sub-Saharan Africa

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Introduction

Africa presents significant sub-regional and national variations in biodiversity that reflect climatic and geophysical differences, as well as the continent's long and varied history of human interactions with the environment (IPBES, 2018). The continent will have around 2 billion inhabitants by 2050 and, as the population's needs grow, the fragmentation of the environment is expected to accelerate, leaving fewer and fewer natural areas. In this context, the pressures on protected areas (PAs) are likely to rise and their ability to conserve biodiversity in the long term is increasingly uncertain (Chardonnet, 2019). Wildlife populations are declining, and PAs which serve as breeding grounds for animal species are not effectively protected to allow populations to regenerate (Williamson & Bakker, 2005).

Sub-Saharan Africa benefits from large investments in biodiversity conservation (Leisher et al., 2022). However West and Central Africa receive less investments compared to East and Southern Africa (Aalen et al., 2015). The national and international funding for PAs in West Africa remains limited (Commission Européenne, 2016). The species receiving most funding for conservation are emblematic herbivores such as elephants, rhinos and great apes, and big cats such as lions, leopards and cheetahs; other mammal species are less well studied and information on threats and conservation status can be sparce (Stephenson et al., 2021). This is the case for aardvarks.

The aardvark (*Orycteropus afer*) is widely distributed south of the Sahara from Senegal to Ethiopia to South Africa, being absent from the Sahara and Namib deserts (Taylor & Lehmann, 2015). However, a combination of factors, including their nocturnal activity patterns, solitary habit, elusive behaviour, and low population densities, have made aardvarks difficult to study (Taylor et al., 2019). The aim of this study was therefore to obtain information on aardvark population trends, conservation status and threats in sub-Saharan PAs by interviewing PA managers.

Methods

We searched websites, reports, articles and social media (Facebook) for the contact details of PA managers and other organisations working for biodiversity conservation in PAs in each country where aardvarks occur according to Taylor & Lehmann (2015). We then sent them a questionnaire in English or French. The main questions asked in the questionnaire concerned:

- aardvark population trends; respondents had the choice to choose from "increase", "stable", "decrease" or "unknown".
- the local conservation status of aardvark populations in PAs; the respondents had the choice between "threatened", "not threatened" or "unknown".
- threats and their impacts on aardvark population; the respondents could choose among "poaching", "logging", "agriculture" and "climate change" with space to add other threats as necessary; for each threat, respondents had to choose the expected level of impact on aardvark populations (high, medium, low or negligible).

The questionnaire was sent in Word format to 437 email addresses across 42 countries. Data were collected from March to June 2022. Responses from the questionnaire were coded and processed using Excel (Microsoft Corporation, 2013). We calculated the relative frequency of each answer to each question and presented the results graphically. The World Database on Protected Areas (WDPA) version January 2022 (UNEP-WCMC, 2022) and the questionnaire data were used to map aardvark population trends and local conservation status of aardvark in the PAs with the software QGis 3.10.

Results

We received responses from 47 PAs in 20 countries (Table 1; Fig. 1), representing a return rate of 10.7%. The PAs where aardvarks do not occur but who received the questionnaire notified us of the absence of the species. In two countries (Djibouti and Somalia) we received the notification that aardvarks were thought to be absent from the country.

Aardvark population trends

The trend in the aardvark population was unknown in 70.2% (n=33) of the surveyed PAs, stable and decreasing in 12.8% (n=6) and increasing in only 4.2% (n=2) (Fig. 2).

Local conservation status of aardvark population

The aardvark is considered to be locally threatened in 61.7% (n=29) of the PAs that replied to our questionnaire, to have an unknown status in 23.4% (n=11) and to not be threatened in 14.9% (n=7) (Fig. 3; Fig. 4). Despite the fact that the trend of the aardvark population is unknown in a large number of the PAs that responded to our questionnaire, the species is mostly considered to be threatened, especially in West Africa. This is due to several threats that aardvarks are facing and that can threaten its long-term survival, even in PAs.

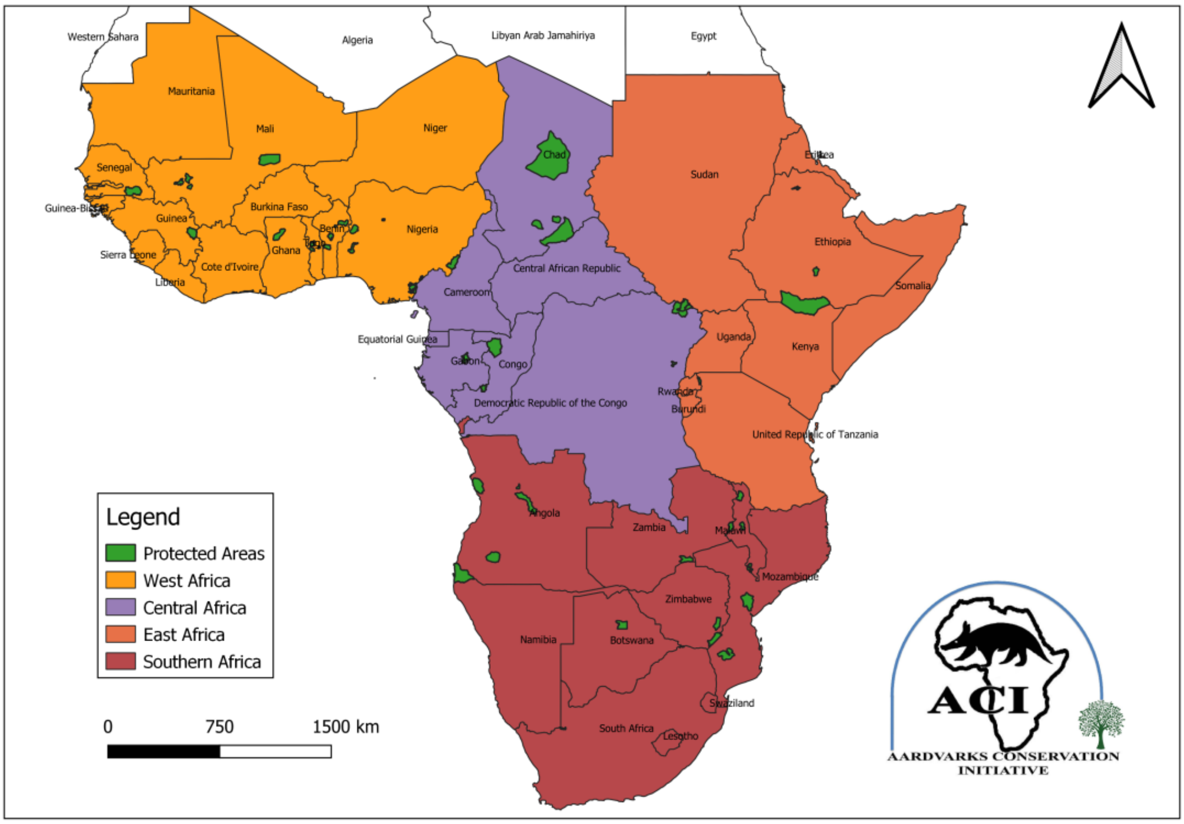

Figure 1. Map of sub-Saharan Africa showing the PAs for which we received questionnaire responses. The different colours represent the different regions: yellow: West Africa, violet: Central Africa, orange: East Africa, red: southern Africa.

Table 1. List of the protected areas for which data were acquired through the questionnaire survey.

Regions	Countries	No. of PAs	Protected area	Area (ha)
West Africa	Benin	3	Monts Kouffé Protected Forest	180,300
			Ouémé Supérieur Protected Forest	107,542
			Trois Rivière Protected Forest	259,500
	Ghana	1	Mole National Park	457,700
	Guinea	1	Park DIWASI (Kankan Natural Reserve)	104,000
	Mali	2	Gourma Reserve	8,300,000
			Boucle du Baoulé Biosphere Reserve	918,000
	Nigeria	5	Cross River National Park	400,000
			Gashaka Gumti National Park	650,000
			Kamuku National Park	112,000
			Kainji Lake National Park	534,100
			Old Oyo National Park	251,000
	Senegal	1	Niokolo Koba National Park	913,000
	Togo	2	Fazao-Malfakassa National Park	192,000
			Abdoulaye Wildlife Reserve	30,000
Central Africa	Chad	4	Aouk Hunting Area	1,185,000
			Zakouma National Park	305,000
			Siniaka Minia Wildlife Reserve	426,000
			Ouadi Rime-Ouadi Achim Wildlife Reserve	8,000,000
	Congo	1	Odzala-Kokoua National Park	1,354,600
	DR Congo	2	Garamba National Park and adjacent protected areas	1,479,500
			Tayna Reserve	70,000
	Gabon	2	Plateaux Batéké National Park	203,400
			Ivindo National Park	300,000
East Africa	Ethiopia	3	Simien National Park	22,000
			Bale Mountains National Park	222,000
			Borena National Park	4,536,000
	Rwanda	1	Akagera National Park	112,200
Southern Africa	Angola	6	Bicuar National Park	790,000
			Iona National Park	1,515,000
			Cangandala National Park	63,000
			Quissama National Park	996,000
			Integral Nature Reserve of Luando	828,000
			Cuatir Reserve	40,000
	Botswana	1	Makgadikgadi Pans National Park	390,000
	Malawi	5	Lengwe National Park	88,700
			Majete Wildlife Reserve	71,500
			Nyika National Park	320,000
			Nkhotakota Wildlife Reserve	179,400
			Kasungu National Park	231,600
	Mozambique	2	Banhine National Park	725,000
			Gorongosa National Park	400,000
	South Africa	2	Augrabies Falls National Park	82,000
			Mapungubwe National Park	28,000
	Zambia	1	Lower Zambezi National Park	409,200
	Zimbabwe	2	Savé Valley Conservancy	364,000
			Gonarezhou National Park	505,300
				39,651,542

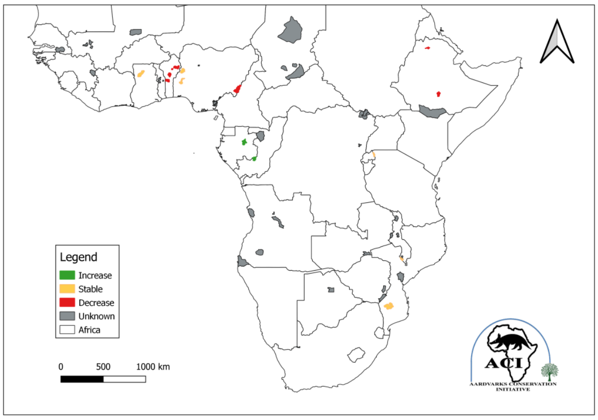

Figure 2. Map of sub-Saharan Africa showing the trend of the aardvark population in different PAs according to responses obtained through our questionnaire.

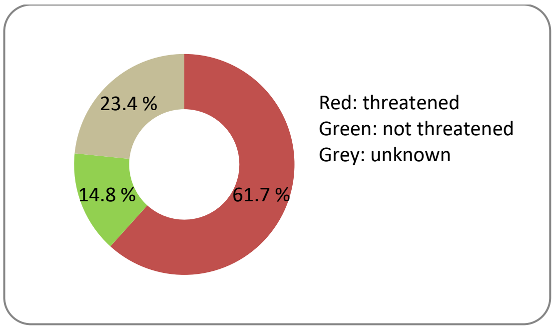

Figure 3. Percentage of answers regarding the local conservation status of aardvark populations in the PAs that responded to our questionnaire.

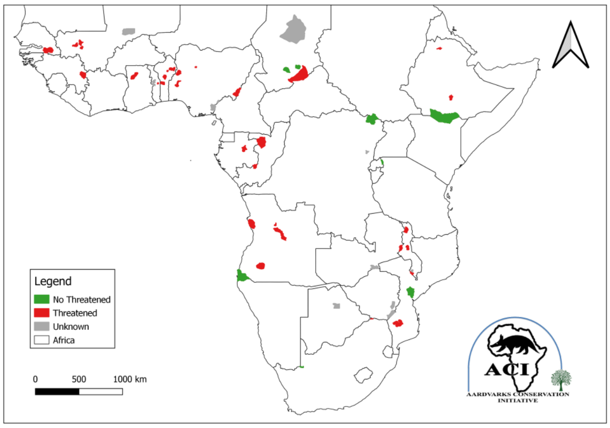

Figure 4. Map of sub-Saharan Africa showing the local conservation status of aardvark populations within the PAs that responded to our questionnaire.

Threats to aardvarks and their impacts

Six main threats to aardvarks were identified in the PAs that took part in the survey. Poaching or illegal hunting was the most common threat, occurring in 78.7% (n=37) of responding PAs, followed by climate change with 59.6% (n=28), agriculture with 57.4% (n=27), logging with 49% (n=23), road kill with 10.6% (n=5) and human-wildlife conflict with 8.5% (n= 4) (Fig. 5).

Poaching was felt to have the highest impact on the aardvark populations, mostly in West African PAs where aardvarks are highly sought after for bushmeat and for the use of body parts in traditional medicine and belief systems (Fig. 6).

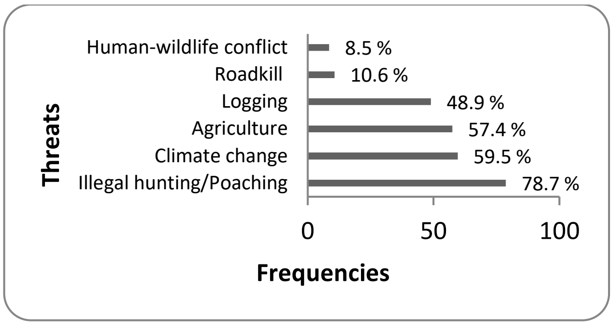

Figure 5. Proportion of reported threats on aardvark populations in PAs in sub-Saharan Africa according to responses from the questionnaire survey.

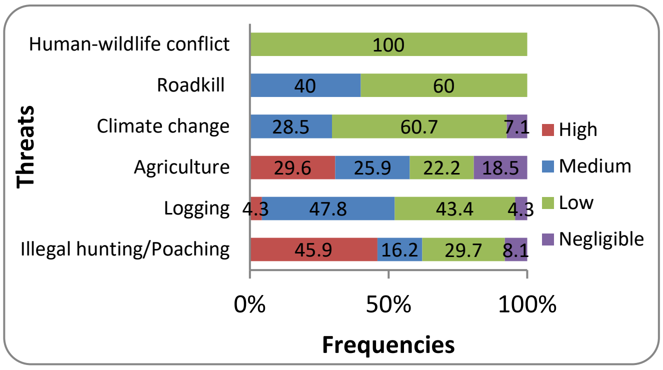

Figure 6. Impact level for each threat mentioned through the questionnaire survey for the aardvark populations in sub-Saharan Africa.

Discussion

This study provided the first insights into the population trends, threats and conservation status of aardvarks living in PAs across sub-Saharan Africa. We found that aardvark population trends are unknown in many PAs, but that the species is considered locally threatened in several of them, especially in West Africa due to poaching.

Koutchédi and Nobimè (2021) found that poaching was the most important threat to aardvarks in Monts Kouffé Protected Forest in Benin, due to bushmeat consumption by the local communities and the use of their body parts in traditional African medicine and for use in mystical customs (Koutchédi, 2022). Studies on aardvarks from the Kalahari in South Africa indicate that their survival can be threatened by climate change related droughts, which likely cause a decline in their prey (Rey et al., 2017; Weyer et al., 2020). In western Kenya, local hunters have been recorded to flood burrows occupied to kill aardvarks for food (Rathbun, 2011). The bushmeat trade in African savannas may pose a genuine threat to aardvark populations in some countries (e.g., Zambia, Mozambique). Other localized threats include habitat loss due to agriculture and subsistence hunting (Taylor & Lehmann, 2015). Gbankoto et al. (2011) noticed that aardvark body parts were sold at a high price in local markets from villages around the W National Park in Benin, which led to different techniques being used to capture the species.

Bushmeat, is an important protein source for many people in Africa and, due to human population growth and the commercialization of the bushmeat trade, the hunting pressure upon wild animal populations is increasing (Williamson & Bakker, 2005). While the demand for bushmeat in large sub-Saharan African cities contributes to household incomes for a large number of families living in rural areas (Kyamakya et al. 2018), it is perceived as a major threat to many species (Luiselli et al., 2018). Unsustainable and illegal bushmeat hunting is responsible for the significant depletion of ungulate populations across more than half of African PAs, and the decline of overall wildlife populations in PAs across most of West and Central Africa (Sosnowski et al., 2021). Ecological consequences of illegal hunting include overall wildlife population declines, reductions in biodiversity, local disappearances of many species from both within and outside PAs, and associated loss of ecosystem functionality (Lindsey et al., 2015).

Our survey demonstrates that, even in PAs, the status aardvark populations remains poorly known, yet the species is considered endangered in many conservation sites. This raises questions about the presence and status of aardvarks outside PAs where they are likely to be less well protected. Without data we cannot know.

In conclusion, the preliminary results presented in this study demonstrate our poor understanding of aardvark population trends in sub-Saharan African PAs. Population surveys across aardvark range are crucial if we are to improve our understanding of the status of the species and build up a database on population trends. In addition, actions targeting the biggest threats faced by the species, especially illegal and unsustainable hunting, are urgently needed and would benefit other species. Developing conservation and monitoring strategies for aardvarks, especially in West Africa, should be a priority in the next few years if we are to assure a future for this unique and charismatic species.

Acknowledgements

This work was realised as part of the voluntary project "Aardvarks Conservation Initiative" and we thank all the people who contributed data to this survey and completed the questionnaire. We also thank the institutions that helped during the data collection process: the Nigeria National Park Service; the Wild Foundation through "Projet des éléphants du Mali"; la Direction des Resources Forestières (Togo); la Direction Générale des Forêts (Benin); the Wildlife Division of the Forestry Commission (Ghana); l'ONG Non Nobis (Guinea), l'Agence Nationale des Parcs Nationaux (Gabon); Sahara Conservation Fund (Chad); African Parks Network (in DRC, Republic of Congo, Chad, Rwanda, Malawi); the Fundação Kissama (Angola); Elephants for Africa (Botswana); the Department of National Parks and Wildlife (Malawi); the African Wildlife Conservation Fund (Zimbabwe); and Conser-vation Lower Zambezi (Zambia).

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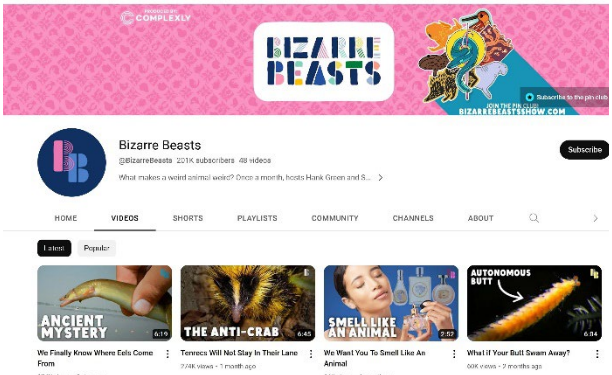
Afrotheria News

Tenrecs on YouTube

The YouTube channel Bizzare Beasts (https://www.youtube.com/@BizarreBeasts) broadcasts once a month to "introduce you to a strange new animal and explore its fascinating weirdness". In April 2023, the channel posted a short film about tenrecs hosted by Sarah Suta. This episode described how adaptive radiation led to a diverse range of species and body forms to fill the available niches on Madagascar. The programme is obviously aimed at a non-scientific audience, and tenrec experts will note one or two small errors in the narration, but it's a stimulating watch and will hopefully help raise awareness about these afrotheres that are not well known among non-scientists. By early June it had received more than 357,000 views.



Watch the video on YouTube here:
https://www.youtube.com/watch?v=RNI1kZ78_yA

Noticeboard

Online Training Courses

Online training courses are proliferating. Here we present a sample that might be of interest to some readers. Please let us know of others we can promote in the next edition.

Mammal (and Reptile) Survey Methods

Oxford University in the UK offers a part-time tutored online course on the skills, techniques and know-how necessary to undertake surveys of mammal and reptile populations or individuals with confidence. The course is aimed at professional ecological consultants, environmental managers and rangers, research and postgraduate students, and volunteers. The techniques covered are universal, and they use international case studies and examples. The course is part of a wider Ecological Survey Techniques Programme that offers a range of standalone short courses.
Find out more at:
https://www.conted.ox.ac.uk/courses/mammal-and-reptile-survey-methods

Online Distance Sampling Course

Do you need to know how to use distance sampling methods for surveying or monitoring afrotheres? Distance sampling is a survey method used to estimate the size and density of wildlife populations. This free course provides an introduction to distance sampling concepts, survey design, field methods and data analysis, and provides lots of links to useful materials. The content of the course was developed at the University of St Andrews Centre for Research into Ecological and Environmental Modelling.
Find out more at:
https://workshops.distancesampling.org/online-course/

Introductory Course on Gender and the Environment

The One Ocean Hub and the UN Environment Programme have developed a new e-learning course on gender and the environment. The course explores the extent to which gender equality has been addressed under international environmental agreements, as well as international human rights processes and looks at access to resources, participation in relevant decisions, mainstreaming, and access to support for people working in different biomes. The course is available on the UNEP e-learning platform InforMEA.
Find out more at:
https://www.iucn.org/story/202304/new-un-e-learning-course-gender-and-environment

Recent Publications

Aardvarks

Ajayi, S.R., Ampitan, T.A., Oyeleye, D.O., Saadu, A.A., Adebayo, O.A. and Okezie, J., 2022. Habitat assessment of aardvark (*Orycteropus afer*) in Kainji Lake National Park, Nigeria. Ife Journal of Science, 24(3), pp.477-487.

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Golden moles

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Hyraxes

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Otter shrews

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Sengis

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Tenrecs

Crespo, V. D., Cruzado-Caballero, P., and Castillo, C., 2023. First afrosoricid out of Africa: an example of Pliocene 'tourism' in Europe. *Palaeoworld*. DOI: 10.1016/j.palwor.2023.03.006

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Articles, species profiles, reviews, research updates, personal perspectives, news items and announcements for the noticeboard are invited on topics relevant to the newsletter's focus. Material for edition number 19 should be sent to Dr PJ Stephenson (StephensonPJ@gmail.com). Articles should be under 3,000 words and follow the format of this edition, (including references in Harvard style). The editor reserves the right to edit all contributions for style and content.

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