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Afrotherian Conservation is published annually by the IUCN Species Survival Commission Afrotheria Specialist Group to promote the exchange of news and information on the conservation of, and applied research into, aardvarks, golden moles, hyraxes, otter shrews, sengis and tenrecs.

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Message from the Chair

Andrew Taylor
Chair, IUCN SSC Afrotheria Specialist Group

Dear Afrotheria Specialist Group colleagues,

I am pleased to introduce the latest edition of our newsletter, compiled by our editor, PJ Stephenson. Many thanks to PJ and everyone who contributed content.

The year 2026 marks the start of a new IUCN quadrennium (2026–2029). We have a new SSC Chair, Vivek Menon, who has taken over from Jon Paul Rodríguez after two terms in the role. I will continue as Chair of our Specialist Group and will be working with the SSC Chair's office to identify a Co-Chair and a Red List Authority.

For most members, there should be no significant change, as Specialist Group membership is now renewed automatically. You do not need to reapply, but you may receive an email from the SSC Chair's office asking whether you wish to continue. Please keep an eye out for this communication and respond accordingly. If you have any questions, or if you do not wish to continue as a member, please feel free to contact me.

In 2025, IUCN asked us to re-assess the species under our remit for the Red List of Threatened Species. This is a vital process for understanding the conservation status of our taxa, particularly as it has been a decade since our last full assessment. This is, however, a substantial task, especially for our section coordinators, who undertake this work on a voluntary basis alongside their professional commitments. Nonetheless, I hope that we will be able to assess many of our species in 2026, and I would be very grateful if those of you with relevant knowledge or expertise would be willing to assist if requested. If you would like to be involved in this round of assessments, and have new information to contribute but have not yet been approached, please do get in touch with me or the relevant section coordinators.

Finally, I encourage you to consider submitting material for the next *Afrotherian Conservation*. Contributions may include research articles, summaries of recent papers, updates on ongoing research, or other items of interest to Afrotheria researchers and enthusiasts. Photos, field observations, and announcements such as conferences, grant opportunities and scholarships are also very welcome. Submission guidelines can be found at the end of this newsletter.

I wish you all the very best for the year ahead.

Andrew Taylor
Gauteng, South Africa; 2 February 2026

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Articles

Aardvark population surveys using camera traps in two west African protected areas

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Introduction

Reliable estimates of animal density and abundance are essential for effective wildlife conservation and management. Camera trapping has proven efficient for sampling multiple species and determining their densities in various habitats (Rovero & Zimmermann, 2016), but usually necessitates species to be individually recognizable (Howe et al., 2017). Statistical estimators of density from camera trapping data for species that cannot be individually identified are still in development (Howe et al., 2017), but several methods have been described for unmarked populations (Palencia, 2021). Notably, Random Encounter Models (Rowcliffe et al., 2008) have been used to estimate the density of species such as pine marten (*Martes martes,* Balestrieri et al., 2016) and lion (*Panthera leo*, Cusack et al., 2015). While many tools are available for estimating abundance from individually identifiable animals, it is much more difficult to estimate abundance of unmarked animals. Most species have no natural markings and capturing them to apply artificial marks is invasive and costly (Moeller, 2017) and not always feasible.

Aardvarks (*Orycteropus afer*) are ecological engineers digging burrows that provide shelters for numerous sympatric animals and, as such, are keystone mammals in sub-Saharan Africa (Weyer, 2018). Aardvarks occur across sub-Saharan Africa, but local and regional distributions are frequently unknown (Epps et al., 2021). Although there is no good evidentiary reason to adjust the IUCN Red List of Threatened Species assessment status of the species at present, there is limited knowledge of aardvark population status and trends which is concerning (Taylor et al., 2019). The reason for this lack of information on the species is that aardvarks cannot be monitored easily due to their nocturnal habits and the complexity to attach monitoring devices such as GPS collars to them. Data are particularly lacking in west Africa.

The aim of this study was to provide the first estimates of aardvark population densities in two west African protected areas by using camera traps.

Methods

Study Areas

This study was carried out in the Niokolo-Koba National Park (NKNP) in Senegal and Mole National Park (MNP) in Ghana. NKNP contains many Sudano-Guinean bioclimatic zone ecosystems, such as major rivers (the Gambia, the Sereko, the Niokolo, the Koulountou), gallery forests, floodplains of savanna grassland, ponds, dry dense or open forests with undergrowth, rocky slopes and hills (World Heritage Committee, 2010; IUCN World Heritage Outlook, 2020). The park has a remarkable diversity of fauna and flora, with more than 70 mammal species, 329 bird species, 36 reptile species, 20 amphibian species and a large number of invertebrates (World Heritage Committee, 2010; IUCN World Heritage Outlook, 2020). Lions form a particular tourism attraction, as do Derby elands (*Taurotragus derbianus*), both critically endangered at the regional level. Other important species present include leopard (*Panthera pardus*), wild dog (*Lycaon pictus*) and western chimpanzee (*Pan troglodytes verus*). The richness of the habitats is demonstrated by the diversity of the flora, with more than 1,500 important plant species (World Heritage Committee, 2010; IUCN World Heritage Outlook, 2020).

Mole National Park is the largest of Ghana's protected areas and covers approximately 4,600 km^2 of woodland savanna habitat in the country's Northern Region (09°11'–10°06' N and 01°22'–02°16' W). Elevation ranges from 120–490 m and open savanna woodland is the dominant habitat type, with tree cover averaging about 30% and grasses reaching 2–3 m in height during the April- to-October wet season (Wildlife Division of Ghana, 2005; Burton et al., 2012). Mole has a diverse mammal fauna, including elephant (*Loxodonta africana*), western kob (*Kobus kob*), waterbuck (*Kobus ellipsiprymnus*), bushbuck (*Tragelaphus sylvaticus*), warthog (*Phacochoerus aethiopicus*), western hartebeest (*Alcelaphus buselaphus*), roan antelope (*Hippotragus equines*), west African buffalo (*Syncerus caffer*), red-flanked duiker (*Cephalophus rufilatus*), oribi (*Ourebia ourebi*), olive baboon (*Papio Anubis*), patas monkey (*Erythrocebus patas*), and green monkey (*Chlorocebus sabaeus*) (Mole National Park Management Plan, 2011, Yahaya et al., 2021).

Data collection

In the NKNP, a total of 139 camera traps (44 PantheraCams Model V6 infrared, 94 PantheraCams Model V7 flash-led, and 1 Browning Model BTC-6HDX with infrared LED) were distributed in 72 stations and deployed from March to June 2021. They were separated by an average distance of 3 km and deployed over a surface area of 1,523 km^2. Cameras ran for 108 days and were distributed from the Zone Centre to the Niokolo guard post along the N1 road, passing through the Mount Assirik area and the Badoye plateau (south-east of the park) (Fig. 2). Most stations (n=63) included two cameras facing each other with a slight shift to avoid flash blinding and to photograph both flanks of the animals passing in front of them, placed at a height of 30-40 cm from the ground on a natural support (mostly, attached to trees).

A total of 100 camera traps (PantheraCam V7) divided into 50 paired stations according to a 3x3 km grid were deployed from January to April 2022 in MNP. A total of 95 trapping days were achieved. The 50 camera trap stations, separated on average by 2.1 km, were deployed in the south, east and centre of the park, over an area of 523 km^2 (Fig. 3). Cameras were placed approximately 30-45 cm above ground level, usually attached to trees or to field-built supports. We considered two pictures of the same species taken by the same camera trap station as independent if at least 30 minutes elapsed between them. In case of paired camera stations, captures of the same individual at the same location by both cameras were considered as a single capture (Tanwar et al., 2021).

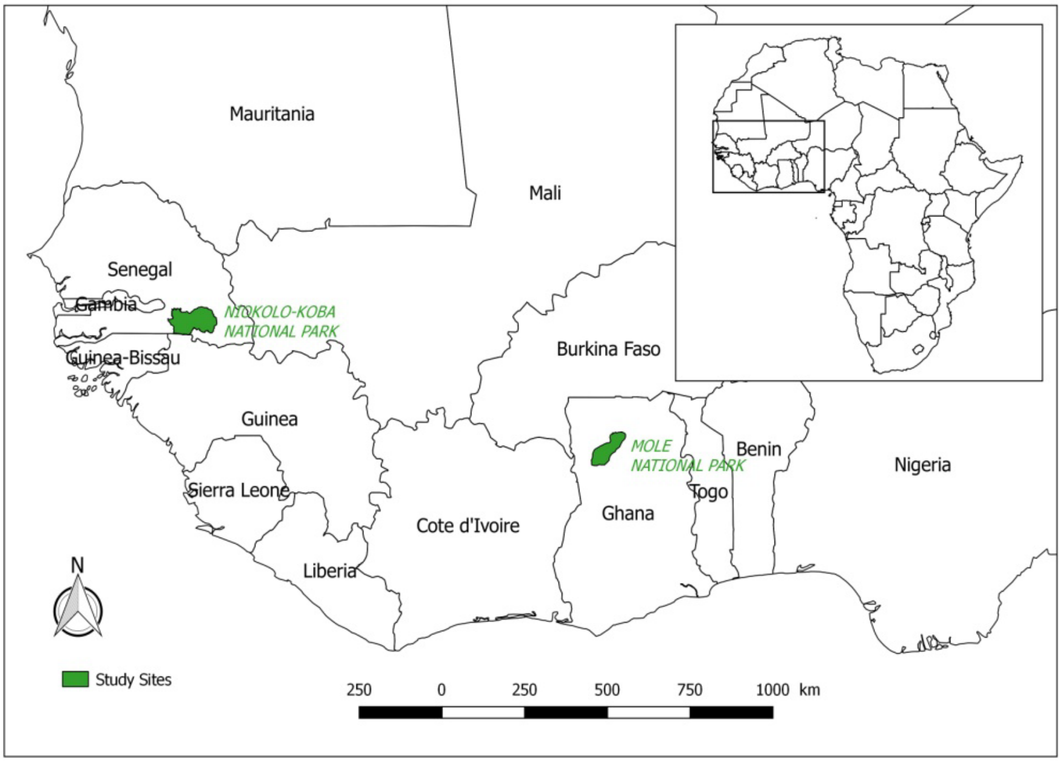

Figure 1. Map of geographical location of Niokolo-Koba National Park (Senegal) and Mole National Park (Ghana) within west Africa.

Analyses

To estimate aardvark population densities in NKNP and MNP, we used presence-absence data from camera stations set up in each field site separately. The sampling effort was the sum of the number of operational days of a camera station (Tanwar et al., 2021). To estimate aardvark population density from camera station presence-absence data in both national parks, we used the Royle–Nichols' abundance induced heterogeneity model in program PRESENCE 13.35 (Hines 2006). The Royle–Nichols' abundance induced heterogeneity model allows estimation of abundance from repeated observations of the presence/absence of animals without having to uniquely recognize individuals in the population (Royle and Nichols, 2003). This model assumes that heterogeneity in detection probability among camera-trap sites is due to heterogeneity in abundance (i.e., more individuals lead to higher probability of detecting the species at a site). Input data for this model are the presence-absence or detection/non-detection (1/0) of the species in each survey at each sample site. The Royle–Nichols' model provides estimates of two main parameters, λ and r, representing average abundance (per site) and probability of detection (per individual of the species). The parameter λ can be interpreted as point abundance. Two parameters are derived from this model, psi (ψ): general occupancy in each study site and N: total abundance. We used the software QGIS 3.10 (QGIS Development Team 2019) to graphically represent the spatial distribution of aardvarks based on the number of independent captures at each camera trap station in both national parks.

Results

A total of 114 and 146 independent photos of aardvark were captured in both NKNP and MNP, respectively. Aardvark presence was detected at 48.61% (35/72) of the camera trap stations in NKNP and at 70% (35/50) of the camera trap stations in MNP (Figures 4&5).

The point abundance (λ) estimated using the Royle–Nichols' abundance induced heterogeneity model for aardvark populations was 0.85 ± 0.16 (95% CI: 0.59-1.24) in NKNP and 1.45 ± 0.29 (95 % CI: 0.97-2.17) in MNP. The detection probability parameter r was estimated to be 0.016 ± 0.002 (95 % CI: 0.013-0.023) for NKNP and 0.020 ± 0.003 (95 % CI: 0.014-0.029) for MNP. The derived parameter, N, estimated the total abundance of the aardvark population to be 61.71 ± 11.75 (95 % CI: 42.49-89.63) in the sampling area in NKNP and 72.76 ± 14.89 (95 % CI: 48.72-108.65) in the sampling area in MNP. The density was thus estimated to be 4.05 ± 0.77 aardvarks/100 km2 in NKNP and 13.91 ± 2.84 aardvarks/100 km2 in MNP (Table 1).

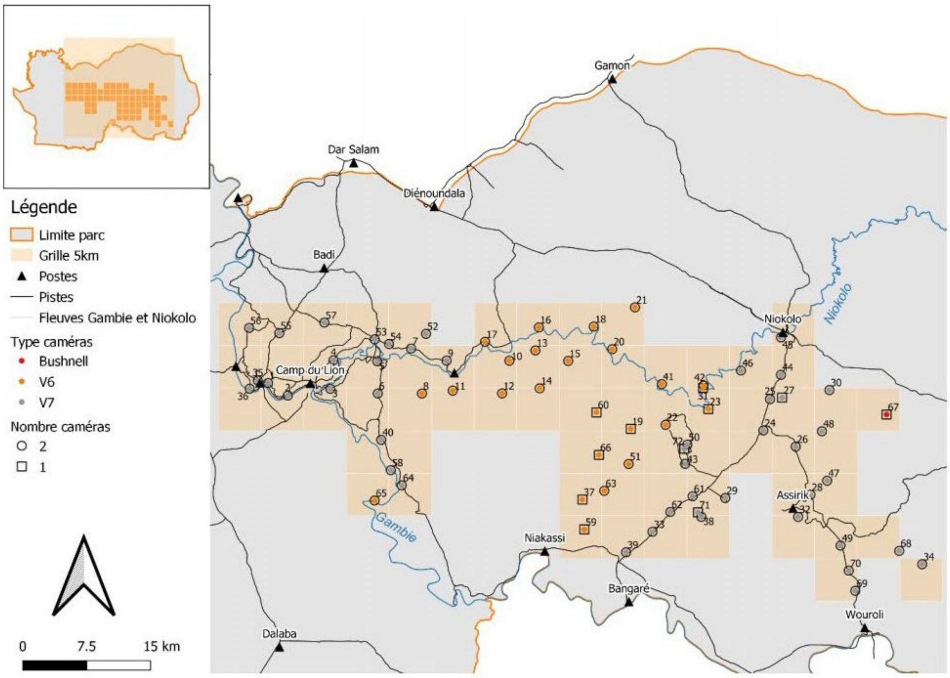

Figure 2. Map of locations of camera trap stations for the study in Niokolo-Koba National Park, Senegal

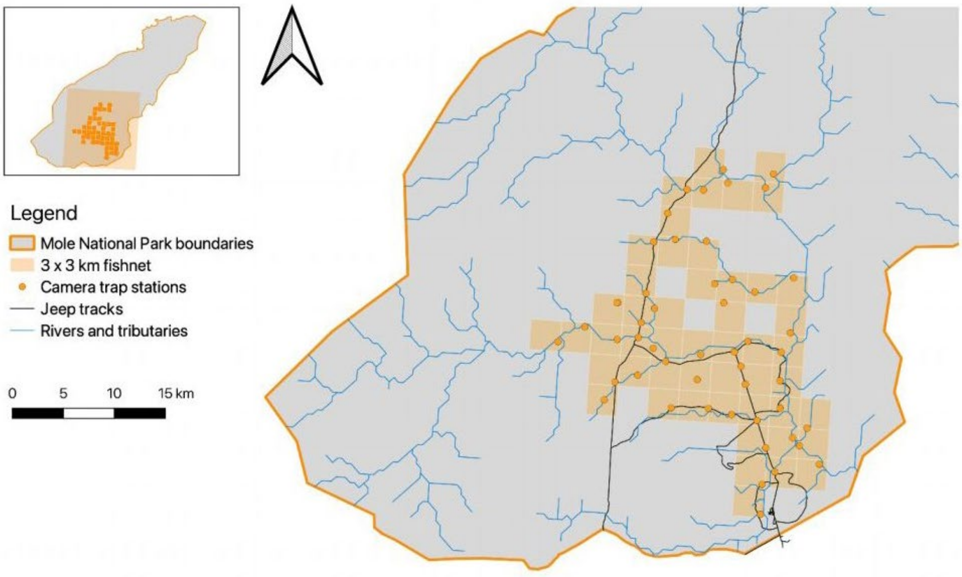

Figure 3. Map of locations of camera trap stations for the study in Mole National Park, Ghana

Table 1. Summary of parameters estimated for the aardvark populations. SE = Standard Error; CI = Confidence Interval; NKNP = Niokolo-Koba National Park; MNP = Mole National Park.

Site	No. camera stations	No. camera days	Independent captures of aardvark	Point abundance ± SE (95% CI)	Occupancy ± SE (95% CI)	Detection probability ± SE (95% CI)	Total abundance ± SE (95 % CI)	Density ± SE (/100 km^2)
NKNP	72	108	114	0.85 ± 0.16 (0.59-1.24)	0.57 ± 0.06 (0.43-0.71)	0.016 ± 0.002 (0.013-0.023)	61.71 ± 11.75 (42.49-89.63)	4.05 ± 0.77
NP	50	95	146	1.45 ± 0.29 (0.97-2.17)	0.76 ± 0.06 (0.63-0.90)	0.020 ± 0.003 (0.014 - 0.029)	72.76 ± 14.89 (48.72 - 108.65)	13.91 ± 2.84

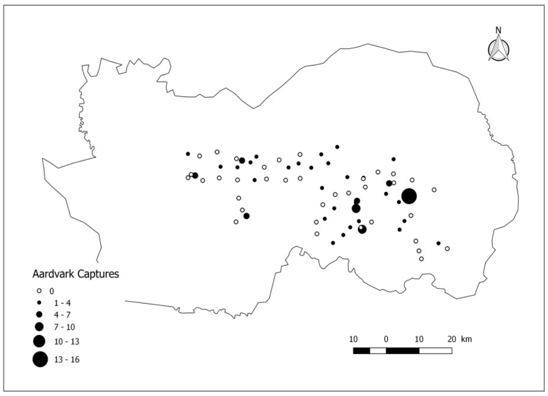

Figure 4. Map of spatial distribution of aardvarks in the study site in Niokolo-Koba National Park. The black circles show the number of independent captures of aardvark at each camera trap station. The white circles shows the camera trap stations where aardvarks were not captured during the sampling period.

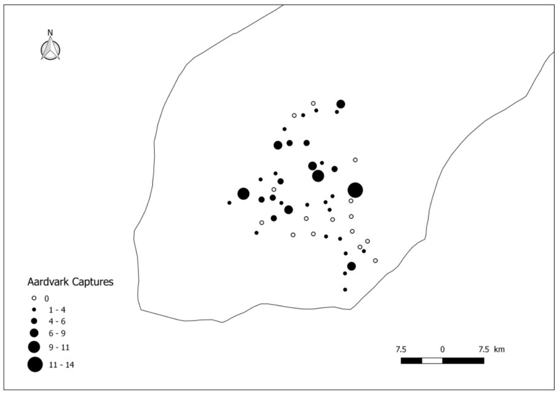

Figure 5. Map of spatial distribution of aardvarks in the study site in Mole National Park. The black circles shows the number of independent captures of aardvark at each camera trap station. The white circles show the camera trap stations where aardvarks were not captured during the sampling period.

Discussion

This study presents the first estimates of aardvark population densities in two national parks in west Africa, by using camera trap data and the Royle-Nichols' model. Although trapping effort varied between the parks, it seems that the aardvark population is more abundant and has a higher occupancy in the MNP than in NKNP.

Densities of aardvarks vary according to habitat suitability, including the abundance of food, but cannot be directly tied to observed burrow densities as aardvarks change burrows frequently and an area may contain many abandoned burrows (Taylor 2013, Taylor et al., 2016).According to Taylor and Lehmann (2015) in eastern, central, and western Africa, aardvark numbers may be declining as a result of the expansion of human populations, the destruction of habitat, and hunting for meat. Although not quantified, aardvarks in Senegal and Ghana are facing various threats. Poaching for meat and body parts are abundant in both sites and dried aardvark feet were frequently found on markets surveyed in Ghana (Drouilly, 2022, pers. comm.).

The Royle-Nichols' model estimated abundance at each camera location, but because animals moved beyond the detection view shed, the effective sampling area of each camera location is a larger unknown region (Gilbert et al., 2020). The Royle-Nichols' model assumes that heterogeneity in detection probability among camera-trap sites is due to heterogeneity in animal abundance (Royle and Nichols, 2003) and implies that once an animal is detected by a camera, it is not likely to be detected during subsequent replicate survey periods (Gilbert et al., 2020). Because aardvarks move widely each night to seek food, some individuals might have been detected by more than one of the study camera trap stations. Therefore, the density of aardvarks in NKNP and MNP may be lower than estimated in this study.

We encourage further study of the distribution and abundance of aardvark populations in west Africa to inform conservation decisions around this important ecosystem engineer and keystone species.

Acknowledgement

This work was realized as part of the voluntary Aardvarks Conservation Initiative project. We especially thank Panthera and the west Africa Leopard Project team, la Direction des Parcs Nationaux du Sénégal and the Wildlife Division of the Forestry Commission of Ghana for sharing their data with us and for their collaboration.

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Tracking Pleistocene afrotherians on South Africa's Cape Coast

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Introduction

Since the inception of the Cape South Coast Ichnology Project in 2007, more than 350 Pleistocene vertebrate ichnosites have been identified in coastal aeolianites (cemented dunes) and cemented foreshore deposits preserved intermittently along a 750 km stretch of coast (Helm, 2023). 'Ichnology' is the study of tracks and traces, and the term 'ichnosites' thus includes tracksites and sites that exhibit other animal traces. The traditional body fossil record is generally better known than the ichnology record, although the latter has enjoyed increasing attention over the past few decades (Lockley, 1991). The two types of record are best viewed as complementary, each providing its own insights and perspectives, leading to a comprehensive palaeontological record.

Stratigraphically, the aeolianites make up the Waenhuiskrans Formation (Malan, 1989) and the foreshore deposits are part of the Klein Brak Formation (Malan, 1991). The two formations form part of the Bredasdorp Group (Malan, 1990). Coastal aeolianites crop out at a global level between latitudes 20° and 40° in both hemispheres (Brooke, 2001), and the South African deposits provide excellent examples of this rock type. The rocks, and hence the ichnosites, range in age from marine isotope stage (MIS) 11 (~400 ka) to MIS 3 (~35 ka), with the majority dating to MIS 5e (~125–90 ka) (Bateman et al., 2011; Roberts et al., 2012; Cawthra et al., 2018; Carr et al., 2019). At the time of their formation, the unconsolidated dunes would have been situated at the margin of the extensive Palaeo-Agulhas Plain, most of which is currently submerged (Marean et al., 2020).

As a result of this ichnological research, more than 50 peer-reviewed scientific papers have been published to date. As detailed below, six of these deal with the tracks and traces of afrotherians, and another is currently under review. One involves golden mole traces and another describes aardvark traces. Our research on the traces of the rock hyrax is under review. Four additional papers involve proboscidean traces. The purpose of this article is to briefly review the salient findings of our published work as it relates to the smaller afrotherians.

Golden mole traces

Our mentor, the late Martin Lockley, led our paper on golden mole traces (Lockley et al., 2021). In contrast with the other traces we had described, which were 'epifaunal' (registered on a surface), these were 'infaunal', registered below the dune surface. The traces took two forms – firstly, typical golden mole burrows (Fig. 1a), similar to those found in the region today and often made by a member of the genus *Amblysomus.* In addition, however, we recorded evidence of 'sand-swimming' golden moles, similar to the traces registered by the Namib mole (*Eremitalpa granti*), which now only inhabits the extensive dune fields of the arid west coast region of Namibia and northwestern South Africa (Fig. 1b). Nothing like these traces had previously been described in the global palaeoichnology record. Consequently, the new ichnogenus *Natatorichnus* was erected, along with two new ichnospecies, *N. subarenosa* and *N. sulcatus*. In the former case the roof of the subsurface burrow did not collapse following the passage of the golden mole, whereas in the latter case the substrate was less cohesive and the roof did collapse. *Eremitalpa* does not occur on the Cape south coast or southeast coast today, and the palaeoenvironmental inference was that substantial Pleistocene dune fields must have existed on the Cape coast. This is corroborated by the offshore geological record, as Cawthra et al., (2020) mapped extensive swaths of palaeo-dune material on the adjacent continental shelf, deposited on lower-than-present sea level regimes.

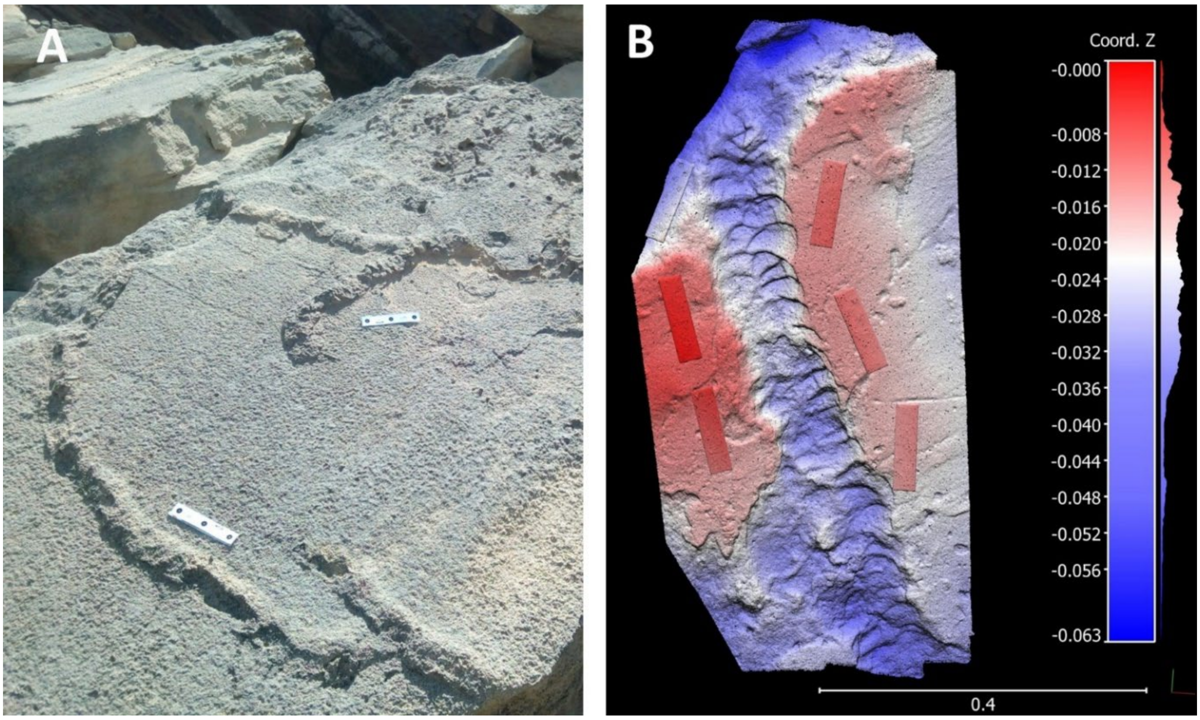

Figure 1. (A) Golden mole burrows (probably made by *Amblysomus*) in Robberg Nature Reserve; scale bars = 10 cm. (B) 3D digital elevation model of golden mole traces resembling those of *Eremitalpa*; horizontal and vertical scales are in metres.

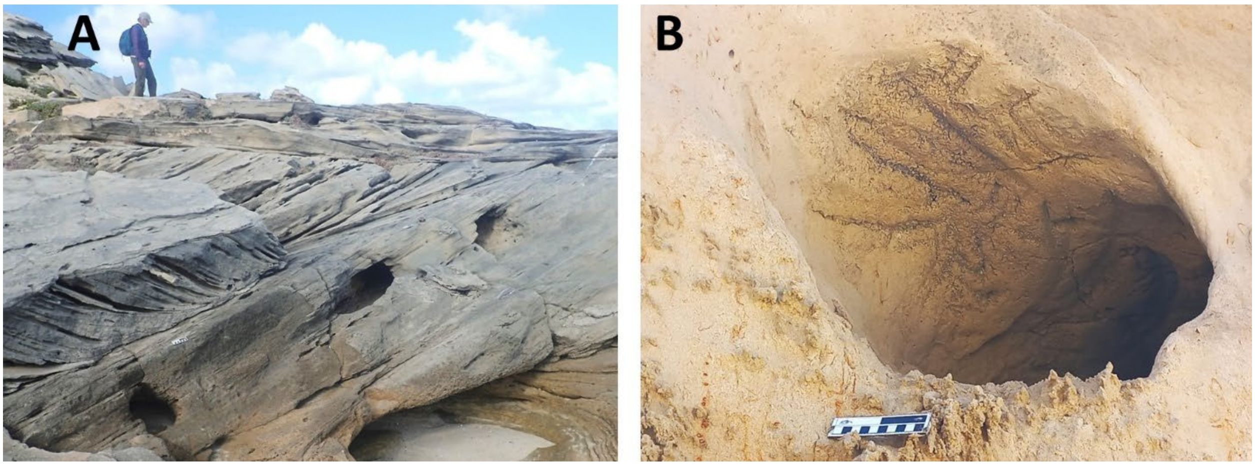

Figure 2. (A) Three aardvark burrows in the Walker Bay Nature Reserve. (B) Aardvark burrow in the Addo Elephant National Park, dated to 126 ka; note the claw scratch marks in the wall. Scale bars = 10 cm.

Aardvark tracks and traces

Stuart and Stuart (2019) described the aardvark (*Oryecteropus afer*) as the 'master digger' of Africa. This fossorial species has a wide distribution range (not obviously dissimilar from its Pleistocene range) and is found wherever its dietary choice of termites or ants is found. Despite frequently having been described from the body fossil record (Avery, 2019), and despite leaving several types of distinctive traces, there had previously been only a single case of an aardvark trace fossil that had been described, an undated ovoid burrow feature in northern Namibia (Pickford, 2018). Most notably, traces which could be sought in the fossil record would include large burrows, tracks, wedge-shaped tail impressions, feeding traces (often a hole in a termite mound) and coprolites (which would be distinctive as they would display the heads of termites and ants) (Liebenberg 2000;

Stuart & Stuart 2019; Gutteridge & Liebenberg 2021; Van den Heever 2024).

We described five Pleistocene aardvark burrow sites on the Cape coast, as well as one possible aardvark tracksite (Helm et al., 2025) (Fig. 2). Two of the sites exhibited claw drag impressions. In one case this took the form of a natural cast of an aardvark burrow, with the claw scratches evident on the surface. In the other case a hollow burrow was found in the lower section of cliffs dated to ~126 ka, and showed clear evidence of scratch marks in the burrow walls.

Subsequent to this publication, we have found better examples of fossilised termitaria. Sometimes these occur in the vicinity of the aardvark burrows. There is thus no doubt that the aardvark's favourite food source was available to it in the Pleistocene.

Rock hyrax tracks and traces

We have recently submitted a paper on the tracks and unique traces of the rock hyrax (*Procavia capensis*). These include tracks that often indicate a bounding gait pattern, buttock-drag traces (similar to what domestic dogs exhibit when afflicted with parasitic infections), rocks that are polished by hyrax fur, dust-bathing hollows, and distinctive droppings (Liebenberg 2000; Stuart & Stuart 2019; Gutteridge & Liebenberg 2021; Van den Heever 2024). In addition, there is the subject of hyraceum, a petrified product of accumulated rock hyrax urine which has been used in traditional remedies (Olsen, 2008; De Vynck, 2015). This may act on and fuse with large masses of droppings to create extensive 'rock hyrax middens', which may be tens of thousand of years old (Chase et al., 2011, 2012; Quick et al., 2011). Hyraceum provides a fine example of a urolite, a special kind of rarely-described ichnological trace. Probable examples of fossilised rock hyrax tracks, a buttock-drag feature, polished rocks have been identified, in addition to large middens and concentrations of hyraceum (Fig. 3).

Figure 3. Hyraceum on rock surfaces in South Africa – it is a urolite, a form of rock hyrax trace fossil.

Discussion

Ideally, trace fossils of other afrotherians such as tenrecs, sengis and sirenians can be identified, but this probably presents challenges. As yet, our search has been confined to the Cape coast of South Africa, not Madagascar or central African forests. While sengi tracks are quite distinctive when registered in fine-grained substrates (Stuart & Stuart, 2019; Van den Heever et al., 2024), the tracks of small mammals are not usually well preserved in the relatively coarse-grained substrates of Cape coastal dunes and beaches. They are therefore often difficult to distinguish from each other in the Pleistocene deposits on which we conduct our research. And while we have already added to the very sparse record of fossilised pinniped traces (Helm et al., 2022), as prior to that point there was just a single case of walrus traces (Gingras et al., 2007), the likelihood of identifying sirenian traces may be negligible.

The summary provided here thus documents the types of afrotherian trace fossils that are most likely to be identified, and there is ample potential for further discoveries. An example would be encountering a fossilised termitarium that contains an aardvark feeding burrow.

Whereas the fossilised traces of aardvarks and rock hyraxes as yet do not have palaeo-environmental or distribution implications, other than confirming the presence of these afrotherians on the Cape coast during the Pleistocene, the inference for *Eremitalpa* golden moles is more pertinent. It appears that the genus may have inhabited large dune fields elsewhere in southern Africa and had a substantially wider distribution range in contrast to the limited current range along the African west coast in Namibia and northwestern South Africa. This finding may therefore have consequences for conservation assessments of the species.

The work done to date can hopefully act as a spur to future finds. Palaeo-ichnology can thus supplement or corroborate the traditional body fossil record, and can provide a complementary lens through which to view afrotherian palaeontology.

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Historical evidence for the presence of Somali sengi (*Galegeeska revoilii*) in northern Ethiopia

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Introduction

Out of the 20 species of sengi (Macroscelidea), only two are known to inhabit the Horn of Africa – the sister species belonging to the recently recognized genus *Galegeeska*: *Galegeeska rufescens* (the rufous sengi) and *Galegeeska revoilii* (the Somali sengi; Heritage et al., 2020; Krásová et al., 2021). While the distribution of *G. rufescens* is quite extensive and ranges from Tanzania to northern Somalia, *G. revoilii* is only documented in Somalia and Djibouti (Corbet & Hanks, 1968; Heritage et al., 2020; Rayaleh, 2021). The two species are documented to be sympatric in parts of Somalia (Corbet & Hanks, 1968). *G. revoilii* has been recorded close to the Ethiopian territory, with a Djiboutian specimen located just 3 km away from the border (Heritage et al., 2020). The northern parts of Ethiopia were also identified to provide suitable habitat for the species based on ecological niche modelling, but to date no specimen identified as *G. revoilii* has been known from Ethiopia. However, according to Heritage et al., (2020), there are only 47 confirmed voucher specimens in worldwide museum collections so far, with only 44 of them having sufficient geographic information. A 45th voucher specimen with geographic information (the 48th in total) is housed in the Museum für Naturkunde Berlin (ZMB-80069). It was collected around Dadab, Wadi Abedabileh, near Zeila and the Somalian-Djibouti border (approximated coordinates: 11.1602, 43.2814) during the joint expedition through northern Somalia and Ethiopia of German zoologists Carlo von Erlanger and Oscar Neumann 1899-1901 (Neumann, 1902). Genetic data of this specimen confirmed its assignment to *G. revoilii* (Hagemann et al., 2023). Nevertheless, the low number of voucher specimens highlights the still limited knowledge on this species.

Comparison and re-identification of specimens in the Paris collection

During a detailed examination of sengi specimens housed in the mammalogy collection at the Muséum national d'Histoire naturelle (MNHN) in Paris, two voucher specimens of *G. revoilii* were discovered whose country of origin is Ethiopia. The first specimen, MNHN-ZM-MO-1911-524 (Fig. 1a-b), was identified as *Macroscelides fuscus* at the time of discovery and later (tentatively) re-assigned to *Elephantulus revoili.* It was collected in July 1901 (roughly between the 2nd-3rd and the 30th) during the expedition of Du Bourg de Bozas in the "Dagato" valley (whose official spelling now seems to be Daketa; further alternative spellings are Dakata or Dakhatto; approximated coordinates for the middle of the route through the valley:

7.6817, 42.6836), which is located south-east of Dire Dawa (Du Bourg de Bozas, 1906). This specimen consists only of a skull from a juvenile/subadult. The permanent premolars are visible underneath the decidual premolars, and both first and second molars are erupted.

" Macroscelides fuscus "
= Elephantulus revoili ?
vallée du Dagato (= Dakata R.)
alc. + cr.

Muséum d'Histoire Naturelle de Paris
du Bourg de Bozas
Ethiopie
C. G. 1911 N° 524

macroscelides fuscus Peters
vallée du dagato juillet 1901
Mission du Bourg de Bozas
C G 1911 N° 524

TEL - AVIV UNIVERSITY / ZOOLÒGY
Loc. Deir-e-Dawa (Incode) M. 2152
~~Born~~ 3.X.1958 Died 19 Sex ♂
Coll
Coll Amoz Zahavi

Elephantulus revoili CG1981-502
Wght. gr., Corpus 120 mm, Cauda 140 mm
P 38 mm, A 21 mm, Gonad
, Prep. M. Cohen
soricidae skin + skull p + c

Figure 1. Overview of labels, crania and skin. Voucher labels (a) and cranium (b) of MNHN-ZM-MO-1911-524; voucher labels (c), skin (d-e) and cranium (f) of MNHN-ZM-MO-1981-502.

The second specimen, MNHN-ZM-MO-1981-502 (Fig. 1c-f), was collected from Dire Dawa (coordinates: 9.6097, 41.8542) by evolutionary biologist and ornithologist Amotz Zahavi in 1958, seemingly during a mainly ornithological survey conducted in the region by his mentor Henrich Mendelssohn (Online collection database of the Steinhardt Museum of Natural History/Tel Aviv University). This specimen was first kept at the University of Tel-Aviv, and there is no information as to why the MNHN came into possession of it. It consists of a skin and a skull from an adult individual. It was identified as *Elephantulus revoili*. Its labels include a handwritten note from Christophe Douady (who himself studied sengis: Douady et al., 2003) to highlight the Ethiopian provenance of the specimen.

The morphology of the two vouchers was compared to a set of available specimens (direct observation, CT scans or photographs) of *G. revoilii* and *G. rufescens* from the MNHN, the American Museum of Natural History (AMNH) and the Museum für Naturkunde Berlin (ZMB). CT data originally derive from Benoit et al., (2014). The commonly accepted dental character used to discriminate between *G. revoilii* and *G. rufescens* is the relative size of the second upper incisors (Corbet & Hanks, 1965; Heritage et al., 2020): I^2 is (sub)equal to I^1 and I^3 in *G. revoilii* and noticeably smaller than to I^1 and I^3 in *G. rufescens*. On specimen MNHN-ZM-MO-1911-524, this diagnostic trait proved inconclusive, as I^2 is clearly still in the process of erupting on the right side – and therefore perhaps on the left side too (Fig. 2c-c'). Upper molars M^1 and M^2 were the only other loci that seem to somewhat differ between the two species and at the same time were accessible on this juvenile specimen. MNHN-ZM-MO-1911-524 presents M^2/M^1 ratios (for both mesiodistal length and buccolingual width) that are similar to those of *G. rufescens*, and a M^2 with a talon basin that is noticeably pinched distally and that opens lingually (Fig. 3c). In contrast, the distal end of M^2 of *G. revoilii* is blunter and does not properly open lingually. Thus, both the size ratios and the overall morphology of M^2 in MNHN-ZM-MO-1911-524 point to *G. rufescens*.

MNHN-ZM-MO-1981-502, in contrast, displays a suite of traits that are characteristic of *G. revoilii*. It possesses a large I^2 (even larger than I^1 because of the advanced wear; Fig. 2b) and a blunt M^2 (Fig. 3b). The skin indicates a higher tail-to-body size ratio (1,17; see Heritage et al., 2020) and the presence of a tuft of hair at the tip of the tail.

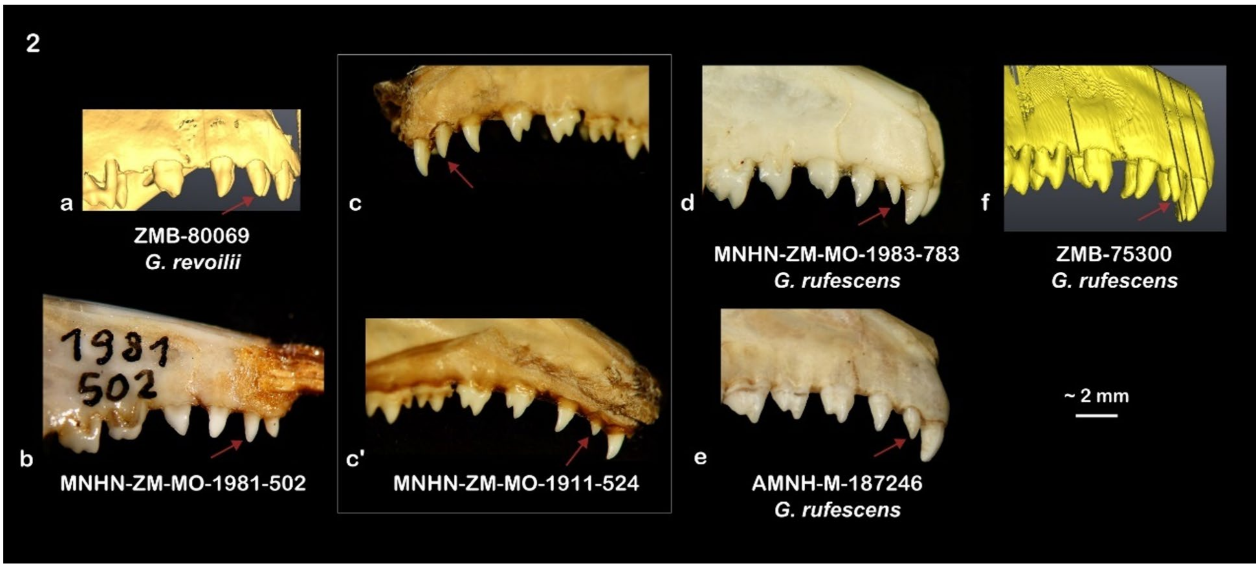

Figure 2. Comparison of incisors. Labial views of ZMB-80069 *G. revoilii* (a), MNHN-ZM-MO-1981-502 (b), MNHN-ZM-MO-1911-524 (c-c'), MNHN-ZM-MO-1983-783 *G. rufescens* (d), AMNH-M-187246 *G. rufescens* (e) and ZMB-75300 *G. rufescens* (f). Red arrow indicates I^2.

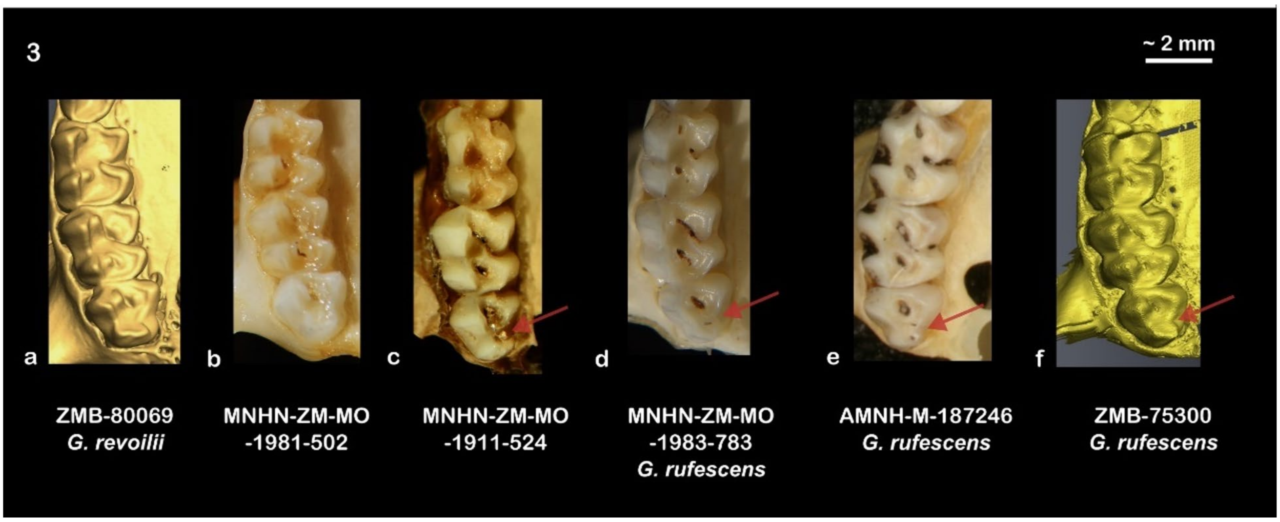

Figure 3. Comparison of molars. Occlusal views of ZMB-80069 *G. revoilii* (a), MNHN-ZM-MO-1981-502 (b), MNHN-ZM-MO-1911-524 (c), MNHN-ZM-MO-1983-783 *G. rufescens* (d), AMNH-M-187246 *G. rufescens* (e) and ZMB-75300 *G. rufescens* (f). Red arrow indicates the marked lingual notch on the talon basin of M^2 in *G. rufescens*.

Implications for the Somali sengi's distribution and conservation

MNHN-ZM-MO-1911-524 can most likely be assigned to *G. rufescens* rather than to *G. revoilii*. Its collection locality (Daketa valley; Fig. 4) is much more south than the known range of *G. revoilii* and even outside its putatively suitable habitat previously estimated by ecological niche modelling (Heritage et al., 2020). In the original publication, the Daketa is described as a seasonal or intermittent river and the vegetation of the valley as a sort of grassland and bushland (Du Bourg de Bozas, 1906). This would match with the habitat preferences of *G. rufescens*: arid woodlands and bushlands with open canopies and compact sandy soils dominated by scrub vegetation and dry grasses (Koontz & Roeper, 1983; Perrin & Rathbun, 2013; Heritage, 2018). The Daketa valley is also not far from other known sampling localities of *G. rufescens* in southern and eastern central Ethiopia (Corbet & Hanks, 1968).

For MNHN-ZM-MO-1981-502, in contrast, we can quite confidently conclude that this specimen is indeed *G. revoilii*, rendering it the 46th confirmed museum voucher specimen with geographic information of this species (the 49th in total) and the first from northern Ethiopia. Its collection locality at Dire Dawa lies at the northern foot of the Ahmar Mountains, which separates it from the other specimen in the south (Fig. 4). The locality is just barely within the area of habitat suitability estimated for *G. revoilii* in Heritage et al., (2020), but at the low >0.1 threshold. No description of the landscape and vegetation in and around Dire Dawa is available from the expedition. However, Dire Dawa is characterized as BSh (hot semi-arid steppe) in the Köppen-Geiger climate classification system with an average monthly temperature range of 25–31.5 °C throughout the year. Climatic conditions are thus very similar to reported sites in Djibouti with *G. revoilii* presence (Heritage et al., 2020). Dire Dawa is also located in the Afar Depression ("Afar Triangle") that is characterized by heat, drought and limited vegetation, and offers habitat continuity to Djibouti. More southern regions (including the Daketa valley) are separated by the Ahmar Mountains and habitat connectivity is therefore unlikely.

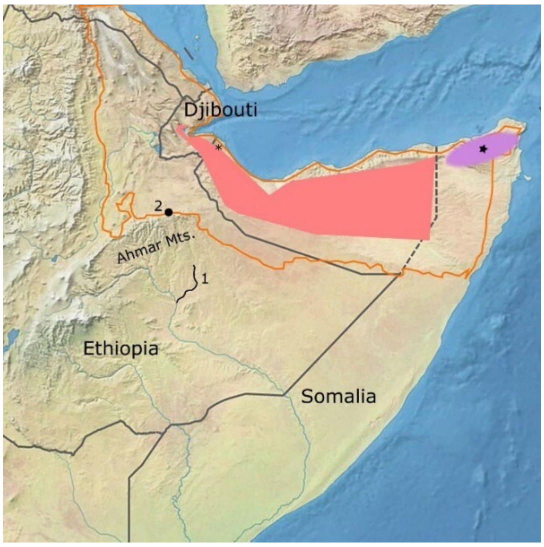

Figure 4. Map of Horn of Africa and the known and potential distribution of *G. revoilii*. The pink polygon represents the known range based on world-wide museum voucher specimens. The putative area of origin of the holotype is shown in violet with star. The orange outline represents habitat suitability (>0.1; after Heritage et al., 2020). #1 MNHN-ZM-MO-1911-524 (Dakato valley specimen; estimated expedition route though the valley). #2 MNHN-ZM-MO-1981-502 (Dire Dawa specimen). The asterisk indicates the Berlin specimen (ZMB-80069).

This new identification confirms the suspicion about *G. revoilii*'s presence in Ethiopia, at least in recent historical times. It further expands its current documented range south-westwards by some 170 km (Fig. 4). Most importantly, this finding implies that the area of habitat suitability estimated for *G. revoilii* in Heritage et al., (2020) provides an appropriate proxy even at the low >0.1 threshold. This could then indicate connectivity of the core distribution (pink polygon in Fig. 4 based on museum voucher specimens) and other areas of high habitat suitability, such as in north-eastern Somalia (tip of the Horn where the holotype was likely collected) or other parts of the Ethiopian Afar region and north-western

Somali region (Sitti/Shinile zone). As the Eritrean Southern Red Sea region also includes a larger area of high habitat suitability, there might even be a continuous distribution from Djibouti to the north, as previously suggested (Heritage et al., 2020).

The IUCN Red List status of *G. revoilii* is currently Data Deficient (Rathbun, 2015). However, an update to Least Concern has been proposed due to the discovery of the species' presence not only in Somalia but also in Djibouti (Heritage et al., 2020; Rayaleh, 2021). Our discovery of a confirmed presence in northern central Ethiopia (at least in recent historical time) supports these previous results that *G. revoilii* likely has a larger distribution than assumed before, and highlights again a gap in targeted research within the Horn of Africa that led to the paucity of scientific data concerning this species. Future assessments of the Somali sengi should include surveys evaluating if it is still extant in northern central Ethiopia and if it is also present at sites in northern Djibouti that could bridge to the areas of high habitat suitability in southern Eritrea. This information would help confirm the conservation status of the species.

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Photo Corner

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The black-and-rufous or Zanj sengi (*Rhynchocyon petersi*) is known to interact with ground-dwelling birds in various parts of its East African range (Cordeiro et al., 2022. *Biotropica*, 54:590-595). On 18 November 2024, whilst visiting Jozani-Chwaka Bay National Park in Zanzibar, Norbert Cordeiro chanced on a red-capped robin chat (*Cossypha natalensis*) feeding in close association with the sengi pictured here. The interactions were observed for at least 10 minutes from about 13:20 hours. After the bird was disturbed by a group of tourists, the sengi foraged alone at close proximity in the dense leaf litter for half an hour more.

Research Updates

Range-wide genetic evidence reveals the need for a re-assessment of four-toed sengis (*Petrodromus*)

Over the last 20 years, several sengi species across the genera *Macroscelides*, *Rhynchocyon* and *Elephantulus* have shown to harbour relatively deep intraspecific lineages, most of which have been raised to species level (Dumbacher et al., 2014, Krásová et al., 2021, Rovero et al., 2009, Smit et al., 2008). So far, the *Petrodromus* is accepted as monotypic with the single species of Four-toed sengis (*P. tetradactylus*) that inhabits large parts of central and eastern Africa (Jennings & Rathbun 2001). The species' distribution is divided into two allopatric areas: one stretches along the eastern coast of Africa from northern Kenya down to northern South Africa (including the islands of the Zanzibar archipelago) and inland to Rwanda and western Angola, while the other covers the Congo basin in central and western Democratic Republic of the Congo south of the Congo River and the extreme north-east of Angola (Rathbun & FitzGibbon 2015). Even some morphological differentiation between both areas has been described (Corbet & Neal 1965). Nevertheless, the existence of a biogeographic barrier that has resulted in this bipartite distribution (if there is any) is still puzzling.

Altogether, this encouraged my colleagues and me to conduct a detailed genetic and phylogeographic survey on this unique sengi species (Hagemann et al., 2024). To overcome the limits of obtaining tissue samples for this geographically wide-ranging but locally less abundant species, we made use of recent advances in the field of museomics (i.e., the analysis of archival DNA). We collected small samples of skin tissue (~3x3mm) from historical study skins housed in a number of museum collections (known collection year: 1897–1955). Most of these samples yielded significant amounts of endogenous sengi DNA (particularly from the AfricaMuseum in Tervuren, Belgium), proving that historical skins represent a valuable genetic resource with minimally impact of the sampling on the overall integrity of the specimen. In total, we were able to obtain sufficient genetic data for most of the mitochondrial genome and up to eleven nuclear marker genes from 42 specimens.

The phylogenetic analyses revealed several deeply divergent lineages within *Petrodromus* (Fig. 1) that can be defined as:

I. Specimens from coastal and mountain forests in northeastern Tanzania and coastal Kenya (Northern Coastal linage)
II. Specimens from Zanzibar and Mafia islands (Zanzibar Archipelago lineage)
III. Specimens from Udzungwa mountains (Udzungwa Mountains lineage)
IV. Specimens from all over the rest of the distribution, including the type locality of *P. tetradactylus* in Tete, Mozambique (Peters 1846; *P. tetradactylus s.s.* lineage)

The initial split among these lineages dates back to around 1.5 million years and is thus comparable with the split between *Macroscelides proboscideus* and *M. flavicaudatus* (Krásová et al., 2021).

The latter, widespread lineage (*P. tetradactylus s.s.*) includes further four mitochondrial lineages (but with limited support on the nuclear level). Two of them in southern Tanzania, one south of the Rovuma river down to South Africa, and one west of the Eastern Rift Valley and in the Congo basin. To our surprise, the phylogeographic lineages thus do not correspond to the two allopatric ranges. Rather, the same mitochondrial lineage occurs on both sides of the gap (light blue samples in Fig. 1). Given the lack of any obvious biogeographic barrier, the assumed discontinuous distribution of *Petrodromus* might therefore more likely reflect a historical sampling artifact than actual allopatric populations [as already suggested by Corbet and Neal (1965)]. In contrast to this finding, the genetic diversity of *Petrodromus* is unexpectedly high in the region east of the Eastern Rift valley and north of the Rovuma river that includes the Eastern Arc mountains as well as Northern Swahili coastal forests and woodlands. We hypnotized in the study that the fragmentation of montane and coastal forests driven by Pleistocene climate oscillations might have fueled the diversity of different genetic lineages in this region. The later colonization of more arid woodlands allowed the *P. tetradactylus s.s.* lineage then to spread across most of eastern Africa and to disperse even into the Congo basin. Many of the described lineages show some phylogeographic resemblance with species/subspecies of *Rhynchocyon*, but on a different temporal scale [the split among extant *Rhynchocyon* species was likely much younger (Hagemann et al., 2023)].

We did not aim to do a taxonomic revision of *Petrodromus* as we did not include an analysis of morphological data. Nevertheless, the genetic data already suggest that the phylogeographic structure does not fully match with the traditional taxonomy (Jennings & Rathbun 2001). The Northern Coastal and Zanzibar archipelago lineages are probably congruent with the traditional "forms" *sultan* and *zanzibaricus*, respectively. In contrast, there seems to be no genetic equivalent for other traditional "forms" like *tordayi* (Congo basin) or *swynnertoni* (Chimanimani mountains in Zimbabwe) whereas a separate "form" from the Udzungwa mountains has never been recognized based on morphology.

Altogether, our results open several directions for a future assessment of *Petrodromus* in order to evaluate:

1. the species or subspecies status of the Udzungwa Mountains, Zanzibar Archipelago and Northern Coastal lineages based on combined genetic, morphological (skeletal metrics, pelage variation) and distributional data;
2. the available taxonomic names for the putative species/subspecies;
3. the species' presence in the "gap" between two geographic ranges;
4. the extent and continuity of the distribution of the northern coastal lineage;
5. the population size of the Udzungwa Mountains lineage and its potential gene flow with other lineages;
6. the relationships and status of specimens from northern coastal forests of Kenya (Arabuko Sokoke and Boni forests) for putative parallelism with *R. chrysopygus*.

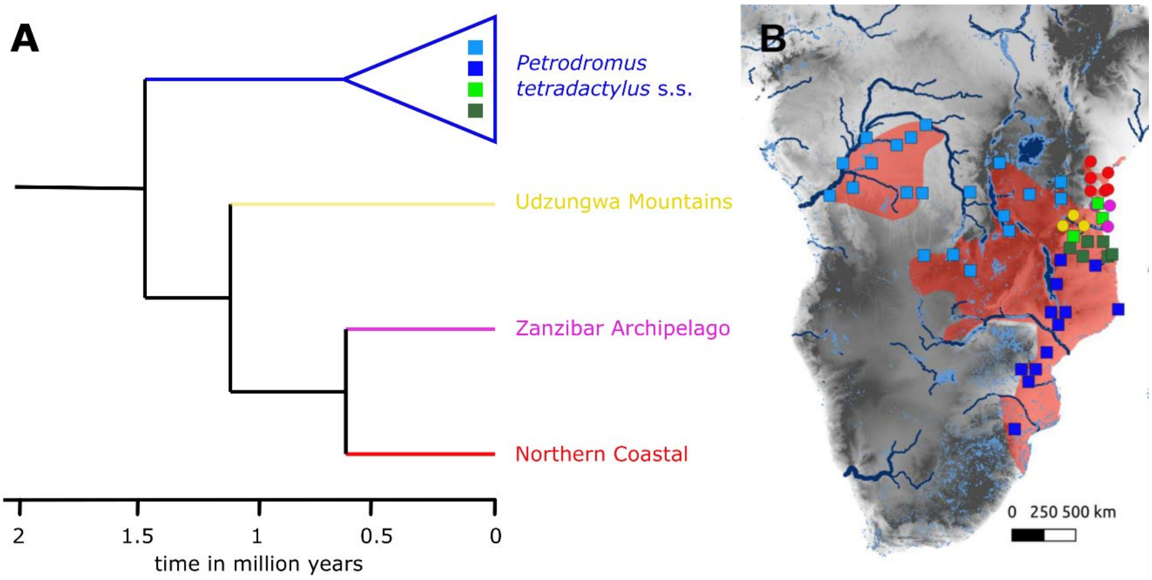

Figure 1. A) Simplified time-calibrated phylogeny of phylogenetic lineages within *Petrodromus*. B) Map of central and southern Africa visualizing sample localities and assignment to phylogenetic lineages (modified after Hagemann et al., 2024).

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Unseen architects of the savannah: The role of aardvarks in habitat dynamics and the challenges they face in Botswana

Increased environmental heat and changes in precipitation may directly affect ant and termite populations as they are prone to heat stress and disruption of their life cycle, thus affecting their distribution and abundance (Stange & Ayres, 2010). Weyer et al., (2020) further highlighted that a reduction in grass productivity has cascading effects on ecological consumers such as termites. Dietary preferences in myrmecophagous animals can also be attributed to prey availability, which can be affected by environmental shifts caused by seasonal variation (Pietersen et al., 2015). This seasonal shift in prey preference is consistent with other studies on myrmecophagous mammals, which often exhibit flexible feeding strategies (dietary plasticity) based on prey abundance (Panaino et al., 2022). Thus, aardvarks (*Orycteropus afer*), like many other species in drylands, are facing increasing pressures associated with climate change, as shifts in climate patterns directly impact the availability of their primary food sources (Weyer et al., 2020).

In response to these challenges, aardvarks in semi-arid southern Africa exhibit behavioural flexibility, which is a response to energy deficit and more defined when their metabolic costs associated with thermoregulation are high (van der Vinne et al., 2014). Aardvarks may find it difficult to recover from summer droughts which, when combined with a shortage of prey, can lead to poor physical condition and decreased chances of successful reproduction (Whittington-Jones et al., 2015). In addition, aardvarks struggle in winter after summer droughts because, as nocturnal species, they need to boost their metabolic rates to maintain their body temperature, which could lead to higher energy costs during cooler times of the day or year (Fuller et al., 2021; Weyer et al., 2020). The increased mortality rate in aardvarks with lower minimum body temperatures suggests an energy deficit, highlighting the risk associated with compromised body condition in vertebrates (Hetem et al., 2014). Figure 1 shows a case of compromised body condition in an aardvark.

Aardvarks in Botswana are poorly known due to their elusive and nocturnal nature, contributing to adverse opinions and animosity from humans living alongside them (Lindsey et al., 2013). Like other wildlife, aardvarks are affected by habitat loss from anthropogenic activities such as agricultural expansion, commercialization, and industrialization (Makwati et al., 2024).

My study therefore aims to improve our understanding of how aardvark ecology is affected by environmental changes in Botswana, particularly in the Central Tuli Game Reserve (CTGR). The CTGR is located in eastern Botswana and comprises privately-owned properties, mostly ecotourism lodges or private holiday houses and a few properties with livestock; there are no fences between the properties (Vissia et al., 2021). The study area includes adjacent properties which cover around 212.5 km^2. The area is bordered by the weakly perennial Limpopo River, which flows from South Africa to the Indian Ocean, and supports a diverse biotic life (Vissia, 2023). According to Vissia (2023) the area comprises dense riverine woodland with mainly mopane trees (*Colophospermum mopane)* and experiences a rainy season with an average annual rainfall of 350 mm (December to March), followed by a cold dry season (April to July), then a hot dry season (August to November).

Figure 1. An aardvark with a compromised or low body condition somewhere in Gantsi, Botswana observed during the day (Source: Phale Max Seele). The same aardvark was found dead the following day.

Figure 2. An aardvark captured by a camera trap in the CTGR, Botswana (Source: Research team at Koro River and Island camp).

The study plan will incorporate non-invasive methods of data collection, to avoid interfering with the natural behaviour, movement patterns, and daily routines of the study animals, but will allow for accurate and reliable data gathering. Specifically, burrow mapping will be conducted through walking transects with a trained guide to locate and record aardvark burrows using CyberTracker. Burrow characteristics and activity status will be documented, and detailed maps created in QGIS. Camera traps will be placed at active burrows to monitor usage by aardvarks (Fig. 2) and other species, emergence times, and body condition, along with environmental data collected using data loggers and a central weather station. Generalised linear mixed models will be used to assess how burrows and emergence times vary with environmental factors. Pitfall traps will be installed at foraging sites to assess seasonal prey availability and diversity will be determined using the Shannon Wiener index. Scat collection near burrows will be used to support the identify prey selection and with prey selection ratios will be analysed using MANOVA to determine seasonal variation. Body condition will be scored from the camera trap images using a standardised visual scoring system. The data collected will be analysed in R (v4.4.2) using R studio IDE (v2024.09).

It is hoped this study will form a baseline for aardvark research in Botswana and contribute to efforts to assess species status and plan relevant conservation action.

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Prey preference and dietary overlap between aardvark and Temminck's pangolin in the Kalahari

The aardvark (*Orycteropus afer*) and Temminck's pangolin (*Smutsia temminckii*) feed on ants and termites. Previous research in the Kalahari (Tswalu Kalahari Reserve) in southern Africa has indicated that the diet of the two species does not overlap, with aardvark preying predominantly on harvester termites (*Hodotermes mossambicus*) and Temminck's pangolin preying predominantly on ants (mainly *Crematogaster* spp). However, the research on each species was conducted at different times, so dietary differences might have been due to factors that differed between the study periods. We therefore studied the diet of aardvark and pangolin simultaneously by analysing faecal samples that were collected over one year at Tswalu Kalahari Reserve (Fig. 1). Radiotelemetry was used to track pangolins to obtain scats (Fig. 2).

Figure 1. A) Aardvark defaecation site at Tswalu Kalahari Reserve. The faecal samples are oval pellets containing chitinous remains of insects and soil particles that are inadvertently ingested during foraging. **B)** Defaecation site of Temminck's pangolin (*Smutsia temminckii*) at Tswalu Kalahari Reserve. Pangolins deposit their excrement on the surface or in a shallow hole they dig beforehand.

Figure 2. Tracking a pangolin using radiotelemetry (Photo credit: Wendy Panaino).

We used pitfall trapping to assess the relative abundance of ant prey species bimonthly; however, this method was ineffective for sampling termites. Termite abundance was inferred from their widespread presence in aardvark diets and visible termite activity at the study site. Aardvark preyed predominantly on *Trinervitermes* termites in spring (88%) and summer (43%), and *Hodotermes* termites in autumn (50%) and winter (47%), while pangolins fed primarily on *Crematogaster* ants in spring (62%) and winter (51%), and *Anoplolepis* ants in summer (60%) and autumn (48%). The frequency of occurrence of preferred ants in the diet, as assessed in the pitfall traps, was 16.4% for *Anoplolepis* and 1.5% for *Crematogaster*. Pianka's index revealed that there was considerable overlap in dietary niche between the two mammals when resources were abundant in summer (60%) and autumn (73%), but less dietary overlap when resources became scarcer in winter (45%) and spring (44%). Less dietary overlap when resources are scarce likely reduces direct competition between these two myrmecophagous species, but it is also possible that differences in foraging over time and space may allow the aardvark and pangolin to coexist while exploiting the same food resources. Our study was conducted during an unusually wet year in the Kalahari, so whether niche partitioning occurs to the same extent in drier years remains to be determined.

The full study has recently been published: Phakoago, M., Panaino, W., Maloney, S.K. and Fuller, A., 2025. Prey preference and dietary overlap between the aardvark and Temminck's pangolin in the Kalahari. *Journal of Arid Environments*, *230*, p.105422.

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Seasonal changes in multi-species burrow use and aardvark activity patterns, body condition and diet in the Makgadikgadi Pans, northern Botswana

Aardvarks (*Orycteropus afer*) in southern Africa are anticipated to experience deficits of both free-standing and metabolic water, and dietary energy as the region grows more arid and warmer because of climate change. The seasonal weather variations in Botswana are currently characterised by extreme high and low temperatures, and periods of low and unpredictable rainfall. Aardvarks possess plasticity in their behaviour and physiology in dealing with seasonal changes. For example, they have been shown to exhibit heterothermy and change the timing of their activity patterns across the day (Weyer et al., 2020). Aardvarks are ecosystem engineers. For example, a study in South Africa (Whittington-Jones et al., 2011) showed that at least 27 vertebrate species use their burrows as refuges. The corresponding role of aardvarks in Botswana has not yet been documented but it seems likely that declines in aardvark populations would be detrimental to the populations and conservation status of the other animal species that depend on the burrows for refuge, denning and escape from predators.

Our investigation therefore set out to understand the ecological interactions within burrow-sharing communities in Botswana and the adaptive behaviours of aardvarks in a fluctuating climate. We assessed aardvark diet, body condition, and circadian activity patterns in response to different seasonal conditions and determined the importance of aardvark burrows to other vertebrate species.

Figure 1. Sensors deployed included a weather station, temperature loggers, and camera traps.

Figure 2. Camera trap images of an aardvark

The study area (CT11) is predominantly open barren salt pans characterized by extreme heat and extreme cold. On the fringes, the area hosts palm-studded savanna grasslands with Mopane woodlands. In this site, we mapped burrow distribution and density, used direct observations and camera traps to identify vertebrate species using aardvark burrows, and collected data on aardvark body condition and activity patterns. We used line transects and invertebrate sampling techniques such as pitfall traps and scat collection to quantify the diet of aardvarks in terms of prey availability and selection.

Field data were collected from August 2024 to April 2025 (Fig. 1 & Fig. 2). Data analysis is underway and we will share our results shortly. We hope our findings will identify the ecological significance of aardvarks in ecosystem function and how burrow-dependent animals adjust to seasonal weather variations. This should help natural resources custodians of Botswana plan and implement effective conservation and management measures in the region.

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Afrotheria News

News this edition:

- *A sniffer dog and environmental DNA helps researchers to rediscover a golden mole not seen by scientists since 1937.*
- *Few people have heard of tenrecs; efforts are being made to change that.*

The rediscovery of De Winton's golden mole "breaks the internet"

by Samantha Theron (Mynhardt)

On 29 November 2023, the Endangered Wildlife Trust (EWT) and Re:wild announced the re-discovery of De Winton's golden mole (*Cryptochloris wintoni*). The story was received with great excitement around the world as it steadily became one of the biggest conservation stories of 2023, with media outputs attaining a global reach of 2.7 billion people within a week, and the story going viral on social media.

De Winton's golden mole eluded detection for over 80 years; it was listed on the IUCN Red List of Threatened Species as Critically Endangered: Possibly Extinct (Bronner, 2015), and on Re:wild's list of Top 25 Most Wanted "Lost" Species. As reported in *Afrotherian Conservation 17* (Mynhardt & Theron, 2021), a team from EWT and the University of Pretoria used a scent detection dog, and environmental DNA (eDNA) analyses to locate and verify the presence of the species at Port Nolloth in Northern Cape Province, South Africa. The research findings were published in *Biodiversity and Conservation* (Mynhardt et al., 2023). There has since been a children's version published in the Science Journal for Kids, along with an interactive lesson on finding rare or elusive animals using eDNA. Examples of the numerous media articles include those on CNN, Mongabay, Re:wild Press release, The Conversation and The Guardian.

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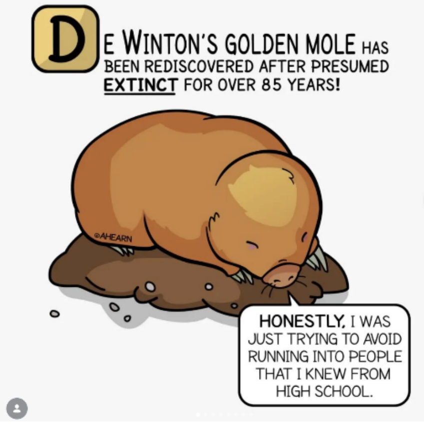
Mynhardt, S. and Theron, C. 2021. Diamond mine or gold mine? Using eDNA to identify golden moles along the west coast of South Africa. *Afrotherian Conservation,* 17, pp.14-16.

Mynhardt, S., Matthew, E., et al. 2024. Environmental DNA from soil reveals the presence of a "lost" Afrotherian species. *Biodiversity and Conservation*, *33*(1), pp.31-50.



A selection of the numerous memes that spread online after the rediscovery.

Tenrec diversity at a glance: poster project highlights Madagascar's endemic afrotheres

by David G. Kupitz

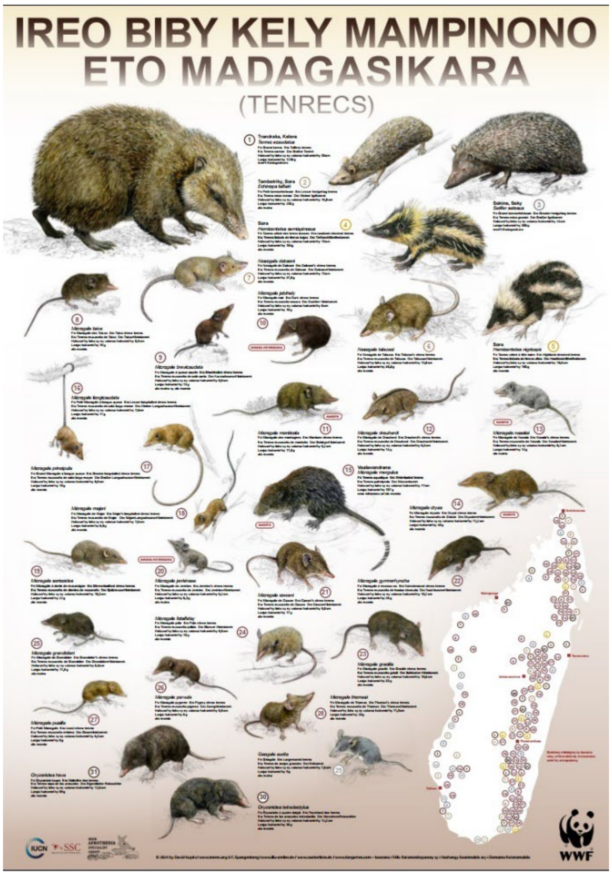
Science communication can take many forms, with posters serving as an accessible means of rapidly conveying information. Tenrecs require effective outreach efforts as little is known about them and their conservation needs both in their native Madagascar and globally (Stephenson et al., 2021. *Oryx*, 55:13–22). To address this, illustrator Frithjof Spangenberg (www.illu-atelier.de) and biologist David Kupitz (https://www.tenrec.org/) collaborated to create a visually appealing poster featuring all 31 currently recognised species of the family Tenrecidae in Madagascar. Valuable scientific assistance and feedback were provided by Félix Rakotondraparany from the Université d'Antananarivo, Voahangy Soarimalala from Association Vahatra and the Université de Fianarantsoa, Domoina Rakotomalala from WWF-Madagascar, and PJ Stephenson of the IUCN SSC Afrotheria Specialist Group.

The posters showcase every tenrec species with illustrations, scientific and common names in multiple languages, as well as body length and mass. Additionally, a map displays simplified distribution ranges.

Two versions of the poster were produced: a Malagasy version with additional information on the species' IUCN Red List status and on habitat type (as well as species names in French, English, Spanish, and German), and a German version (with species names also in English, French, Spanish, and Russian). An electronic version for online use (e.g. on social media) is currently being developed.

To enhance public knowledge of tenrecs in Madagascar, a total of 450 Malagasy posters were printed on environmentally-friendly recycled paper and distributed in July and

August 2024 to various institutions, including WWF-Madagascar, Association Vahatra, the Department of Zoology at the Université d'Antananarivo, Madagascar National Parks, Parc Botanique et Zoologique Tsimbazaza, and a nature guide association. The posters can – for instance – be used for educational purposes in schools, universities, protected areas, and conservation projects.



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The Malagasy version of the tenrec poster.

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David Kupitz handing over the tenrec posters to Nanie Ratsifandrihamanana, Country Director of WWF-Madagascar.

For copies of the Malagasy posters, please contact David Kupitz (dk@tenrec.org). The German poster version is available for purchase through the publisher (https://www.buchkurier.de/de/). A donation to WWF is made for every copy sold.

Recent Publications

Afrotheria general

Bronner, G.N., Mynhardt, S., Bennett, N.C., Cohen, L., Crumpton, N., Hofreiter, M., Arnold, P. and Asher, R.J., 2024. Phylogenetic history of golden moles and tenrecs (Mammalia: Afrotheria). *Zoological Journal of the Linnean Society*, *201*(1), pp.184-213.

Craig, J.M., Fisher, W.L., Thomas, A.S., Hedges, S.B. and Kumar, S., 2025. Completing a molecular timetree of Afrotheria. *Frontiers in Bioinformatics*, *5*, p.1710926.

Gheerbrant, E., 2025. *The Rise of Mammals in Africa*. John Hopkins University Press, Baltimore, USA.

Lindken, T., Anderson, C.V., Ariano-Sánchez, D., Barki, G., Biggs, C., et al., 2024. What factors influence the rediscovery of lost tetrapod species?. *Global Change Biology*, *30*(1), p.e17107. *******This study created a database of lost and rediscovered tetrapod species, and identified patterns in their distribution and factors influencing rediscovery. As demonstrated by the search for De Winton's golden mole discussed above, the paper explains that some lost species may be hard to find due to their intrinsic characteristics and the characteristics of the environments they occupy (e.g. nocturnal species, fossorial species and species occupying habitats that are more difficult to survey such as wetlands). It is noted that "approximately 10% of lost mammal species are golden moles or tenrecs, which are nocturnal species that often live underground". The authors hope the results will foster pragmatic search protocols that prioritise lost species likely to still exist.

Aardvarks

Akpona, H.A., Vargas-Aguilar, J., Akpona, J.D.T., Kassa, B. and Djagoun, C.A., 2025. Burrows spatial patterns and factors predicting habitat selection of aardvark (*Orycteropus afer*) in west African semi-arid savannah. *African Journal of Ecology*, *63*(8), p.e70124.

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Phakoago, M., Panaino, W., Maloney, S.K. and Fuller, A., 2025. Prey preference and dietary overlap between the aardvark and Temminck's pangolin in the kalahari. *Journal of Arid Environments*, 230, p.105422.

Golden moles

Mynhardt, S., Matthew, E., Le Roux, J.P., Little, I., Bloomer, P. and Theron, C., 2024. Environmental DNA from soil reveals the presence of a "lost" Afrotherian species. *Biodiversity and Conservation,* 33(1), pp.31-50.

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Hyraxes

Alehegn, B. and Kifle, Z., 2025. Population size, habitat association, and local residents' attitude towards rock hyrax (*Procavia capensis*) in Zegie Peninsula, Ethiopia. *PloS one*, *20*(6), p.e0323878.

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Otter shrews

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Sengis

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******* This study introduces a non-invasive footprint identification technology (FIT) to classify two cryptic sengi species (*Elephantulus myurus* and *E. intufi*). Front footprints were collected, using a custom Small Mammal Reference Track box, from live-captured individuals that were identified by experts in small mammal taxonomy and verified through genetic analyses. Morphometric features of the footprints were then analysed to achieve a mean classification accuracy of 94–96%, robustly distinguishing the two species using a single footprint image. By integrating field capture locations with data from IUCN expert-defined ranges and the Global Biodiversity Information Facility, the authors "demonstrate that FIT empowers non-experts to contribute reliable, high-resolution occurrence data" and "this scalable approach has the potential to transform community-science efforts, improving the accuracy of species distribution maps and ultimately strengthening conservation outcomes".

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Tenrecs

Borgerson, C., Kling, K.J., Wuchter, A., Pascal, E., Paschalis, E.M., Razafindrapaoly, B.N. and Eppley, T.M., 2026. How economic choices affect livelihoods in Madagascar's park-adjacent communities and what it means for conservation and development. *Environmental Development*, 57, p.101357.

******* Borgerson et al. found that one-quarter of the 241 households surveyed around a protected area in north-eastern Madagascar ate at least one wild animal during the prior year. Common tenrecs (*Tenrec ecaudatus*) were eaten in the greatest numbers (355 households), followed by greater hedgehog tenrecs (*Setifer setosus*; (74). In contrast, only eight households consumed Madagascar flying fox (*Pteropus rufus*) and only two consumed white-fronted brown lemur (*Eulemur albifrons*). The study showed that reliance on wildmeat is linked to limited livelihood options among local communities. The authors argue that, "until entrepreneurship and skilled labour opportunities in park-adjacent Madagascar are improved, families will continue to face strong incentives to clear forests for agriculture and rely on the natural resources within them" – including tenrecs.

A common tenrec (*Tenrec ecaudatus*). © PJ Stephenson

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Guidelines for Authors

Articles, species profiles, reviews, research updates, personal perspectives, news items, announcements for the noticeboard and photos for the Photo Corner are invited on topics relevant to the newsletter's focus.

Material for edition number 20 should be sent to Dr PJ Stephenson (StephensonPJ@gmail.com). Articles should be under 3,000 words and follow the format of this edition, (Harvard style is preferred for references). The editor reserves the right to edit all contributions for style and content.