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Find out more about the Group on our website at http://afrotheria.net/ASG.html and follow us on Twitter @Tweeting_Tenrec

To help PJ focus on our conservation work, Chris and Mathilde Stuart have kindly agreed to take on the role of editing the next edition of *Afrotherian Conservation.* Their contacts are in the guidelines for submissions (page 17). We hope you'll send them plenty of material for the next edition.

Galen Rathbun, Cambria, California, USA
&
PJ Stephenson, Gland, Switzerland
1 October 2015

Message from the Chairs

Galen Rathbun & PJ Stephenson
Co-Chairs, IUCN/SSC Afrotheria Specialist Group

It's been a busy twelve months for the group. Sadly, 2015 started with the terrible news that Peter Vogel had passed away. Peter was a global expert on shrews but he was a long-term member of the group due to his specialist knowledge of otter-shrews; he was one of the few biologists to capture and study these illusive afrotheres. We include an obituary to Peter on page 8 and send our condolences to his family, friends and colleagues.

Many group members have been helping update the IUCN Red List assessments for the smaller afrotheres under our charge, and we thank Andrew Taylor, our Red List Co-ordinator, for keeping us on track. Most of the tenrec section met in Madagascar in April to start developing an action plan for the Malagasy tenrecs (a workshop report is summarized on page 10). It gave PJ a chance to visit Andasibe, his main PhD study site, for the first time in 25 years and reminisce with old colleagues.

There has been some restructuring in the group. We are now co-chairs, PJ having been officially appointed by the SSC Chair Simon Stuart in June. We undertook this change to better spread the workload and to improve the conservation activities of our group. We have divided responsibilities that best fit our interests and strengths. Galen will largely continue to deal with the information and research aspects of our group, whereas PJ will focus on developing and implementing conservation projects. The co-chairs' roles are explained in more detail on page 13. One of the first things PJ did as a co-chair is to represent our specialist group at the IUCN/SSC Leaders' Conference in Abu Dhabi, 15-18 September (See the Afrotheria News section).

Chequered sengi (*Rhynchocyon cirnei*) by Jonathan Kingdon

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Articles

Evidence of an undescribed form of tree hyrax in the forests of western Nigeria and the Dahomey Gap

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Introduction

Tree hyraxes (*Dendrohyrax*) are nocturnal, arboreal and highly cryptic. They are almost impossible to observe in the wild at night because they do not have a reflective eye-shine, but their presence is advertised by conspicuous loud calls at all hours of the night. Populations referred to as western tree hyraxes (*Dendrohyrax dorsalis* Fraser 1854) have a wide distribution in west and central Africa. The western part of their range extends from Sierra Leone and Guinea to eastern Ghana, but until very recently there were no published records from east of the Volta river in Ghana, or from Togo and Benin (the Dahomey gap; Schultz & Roberts 2013, Grubb *et al.* 1998). The known distribution continued in the moist forest zone of Nigeria and countries to the east and south (Shultz & Roberts 2013). Here we present preliminary observations of a distinctive form of tree hyrax that occupies the Dahomey Gap, and closed forests in Nigeria west of the Niger River.

The long calls (great calls) of tree hyraxes consist of a series of units arranged into characteristic sequences that vary between species (Roberts 1999); these calls are one of the most characteristic sounds of west and central African forests at night. A number of individuals may call in answer to one another and the calls soon spread throughout the forest. Such calls are particularly useful for distinguishing between species since they appear to attract members of the opposite sex and are species-specific (Roberts 2001).

During surveys of nocturnal primates in southern Nigeria in January 2009, two of us (SKB, JFO) noticed major differences in the loud calls of tree hyraxes in forest close to the Cameroon border in the east compared to those in forest west of the River Niger. FDL and RJD conducted field work in eastern Ghana, Togo and Benin spanning mostly the years 2008-11 and 2015 and found that tree hyraxes throughout this area produced long calls like those we heard in western Nigeria. Tape recordings were made in each of these areas and compared with recordings made by ourselves and others at a range of sites in western Africa, including specimens from Bioko (Fernando Po), the type locality of *D. dorsalis*. We also examined museum specimens of tree hyraxes at the Natural History Museum in London.

Methods

Our field observations were carried out in the Iko Esai Forest of Cross River State in southeastern Nigeria on 14-18 January 2009, and in the Okomu National Park in Edo State, southwestern Nigeria, on 21-26 January 2009. The Iko Esai Forest is to the west of, and contiguous with, the forests of the Oban Division of Cross River National Park; it is a lowland moist forest area with a mosaic of mature high forest, secondary forest, and farmland; our base was the Rhoko camp of the Cercopan primate sanctuary at 5°41'N; 8°16'E. Okomu National Park is located within Okomu Forest Reserve; its vegetation is moist lowland forest, selectively logged prior to 1985; our base was the A.P. Leventis Conservation Centre at Arakhuan at 6°19'N; 5°21'E.

Tree hyraxes were heard calling frequently at both sites during the night. We made sound recordings of these calls while conducting surveys of nocturnal primates during the evening and early morning, and around the forest camps where we stayed. Recordings were made with a Marantz PMD222 cassette tape recorder and Sennheiser K6 ME67 shotgun microphone, and processed with Avisoft Bioacoustic software SASLab Pro. Our tape recordings are available for download, together with examples of hyrax calls from other parts of Africa, on the website: http://www.wildsolutions.nl/vocal-profiles/hyrax-vocalizations/.

Our comparison of skins and skulls of *Dendrohyrax* specimens in the mammal collection of the Natural History Museum, London, was limited to two days in December 2011 (SKB and JFO – Fig 2) and July 2012 (JFO and Colin P. Groves) prior to a long period of closure of the Mammal Section for maintenance, thus limiting a more detailed analysis. During this pilot study we examined 20 individuals and selected four for photographic comparison, two from either side of the Niger River.

Results

Calling patterns

The long calls recorded after dark at Rhoko were the well-known 'klaxon calls' of *D. dorsalis*, each consisting of a series of between 9 and 90 single units that start quietly and gradually get louder as the call progresses, building to a crescendo at the end (N = 244, median = 20-29, Bearder & Honess 1992). The duration of each unit and the interval between them remains regular until towards the end when the interval gradually increases.

The calls from Okomu on the other hand were very different; each call consisting of a series of between 27-60 unit-sequences (N = 15, median = 30-39) of two distinct types. The initial sequences (N = 5-27, median = 10-20) start with a squawk followed by a rattling sound made up of ~20-25 rapid units. The call then changes to a series of staccato barks, without an initial squawk (N = 22-50, median = 30-39) which continue to the end without a crescendo. The spacing of the bark sequences is irregular, but the number of units within each sequence tends to decrease (~6 to ~3) and the time between them tends to increase as the call progresses.

Figure 1 illustrates the main differences be-tween the two call types using spectrograms and oscillograms showing 10 second sections from the start, middle and end of a call from each population.

Comparisons with calls at other sites

On comparing the recordings made during this study with tape recordings from either side of the Dahomey Gap, the distribution of the two call types (klaxon versus rattles and barks) was clarified. In addition to the calls from Okomu, west of the Niger river, barking calls have been recorded in closed forests at the following sites in southeastern and eastern Ghana: Kalakpa Wildlife Reserve (6°28'N; 0°25'E to 6°23'N; 0°19'E); Tanyigbe (6°42'N; 0°31'E); Biakpa/Amedzofe (6°50'N; 0°24' to 0°26'E); Afadjato Hills (7°01'N; 0°34'E); Togo Plateau Forest Reserve (F.R.) (7°20'N; 0°24'E); Odomi River F.R. (7°21'N; 0°29'E), as well as several forests in western Togo: Klouto (6°57'N; 0°34'E); Kpété Béna (7°26'N; 0°36'E); Bénali (7°35'N; 0°44'E), in southeastern Togo: Togodo-sud Faunal Reserve (6°52'N; 1°37'E) and southern Bénin: Pahou F.R. (6°23'N; 2°10'E); Niaouli (6°44'N; 2°08'E); Lama F.R. (6°59'N; 2°05'E); Tobé farm (8°19'N; 1°50'E); Kouffé Mts F.R. (Adjiro stream at 8°32'N; 1°58'E).

Conversely, we have tape recorded the klaxon calls typical of southeastern Nigeria in Cameroon (throughout the rain forest, from the west to the extreme southeast), Gabon, Democratic Republic of Congo, Uganda and northwest Tanzania as well as countries to the west of the Dahomey Gap: southwest Ghana (throughout the rain forest zone west of the Volta River) and Côte d'Ivoire. In one part of Ghana however (Kalakpa Wildlife Reserve), klaxon calls were heard together with barking calls along the Kalakpa River (Djakpo camp), and also at Zitoe and Agodeke: at Djakpo there were two individuals with klaxon calls and five with barking calls occupying adjacent but distinct territories (Dowsett-Lemaire & Dowsett 2011a). Kalakpa is closer to the Volta River than any other forest in eastern Ghana.

Figure 1. Spectrograms and oscillograms comparing the long calls of the western tree hyrax, *Dendrohyrax dorsalis* from Iko Esai Forest, Nigeria (left) and the Benin tree hyrax from Okomu, Nigeria (right).

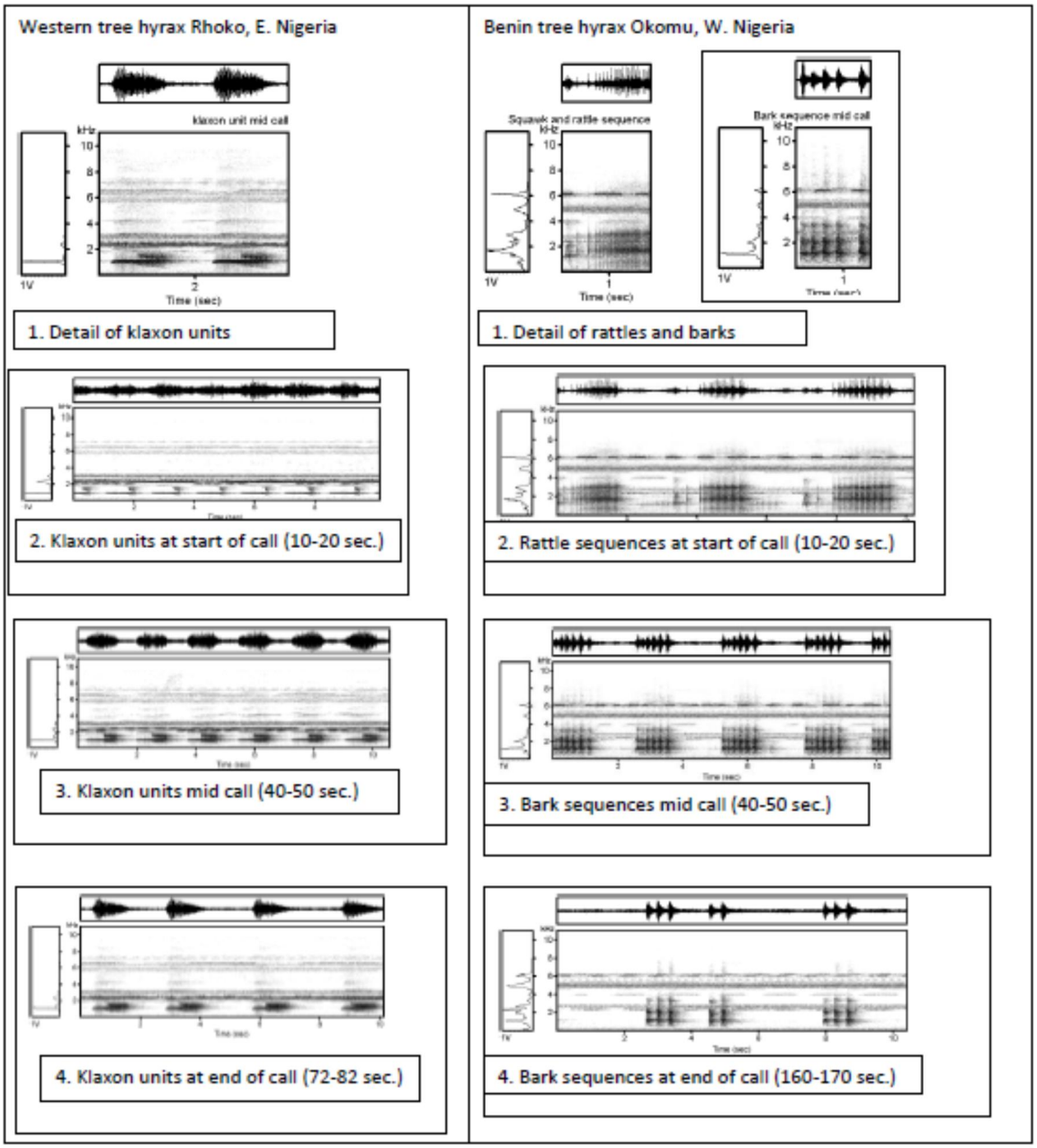
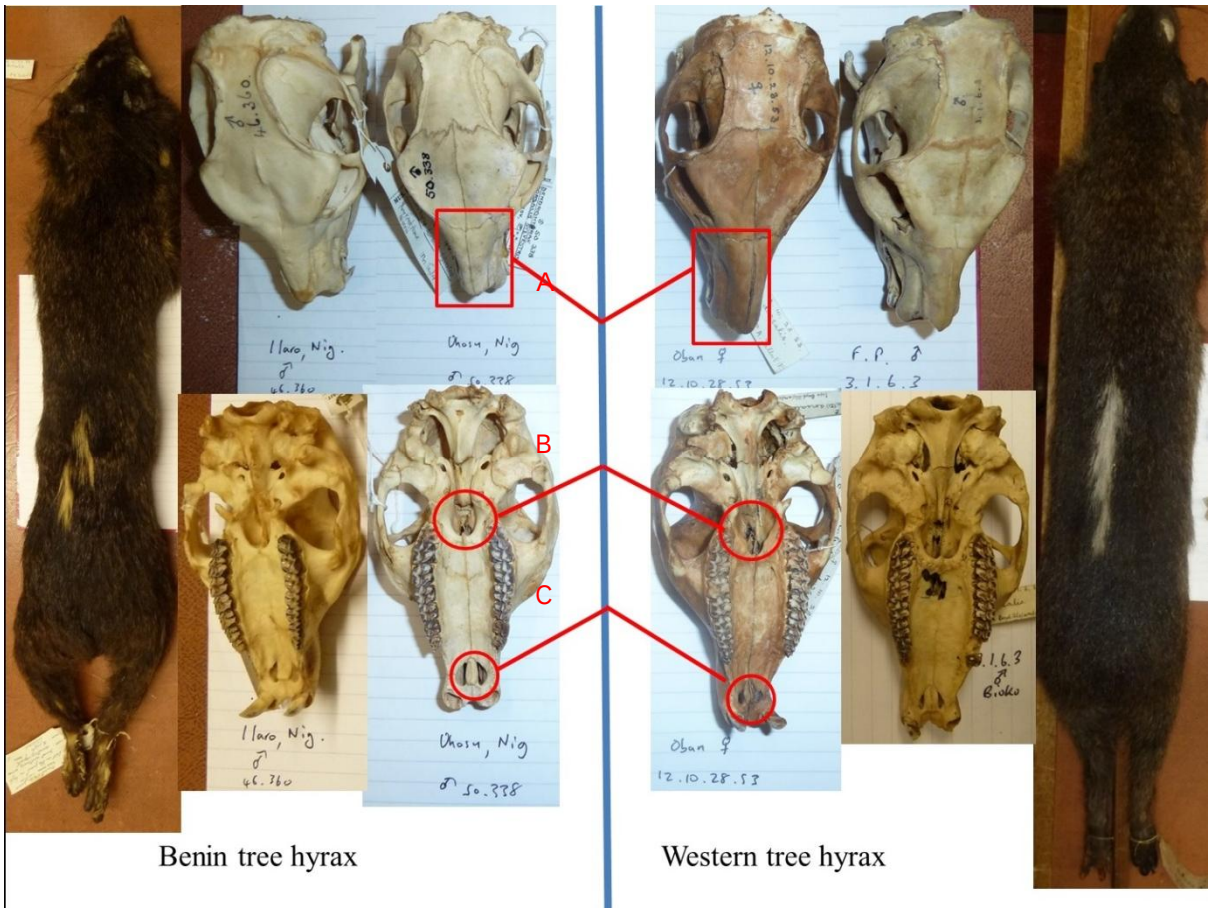


Figure 2. A comparison of tree hyrax specimens from either side of the Niger river showing three key differences: A) the rostrum; B) the choanae; C) the incisive foramina (left - western Nigeria; right – eastern Nigeria and Bioko). Courtesy of the Natural History Museum, London.



Museum specimens

The pelage of two specimens from western Nigeria and the Niger Delta did not have a markedly different appearance from that of two specimens from Ghana to the west and Oban (eastern Nigeria) and Bioko to the east, but the dorsal pelage of the Nigerian animals was judged to be less evenly dark, with a yellowish-brown brindled appearance as a result of the hairs having a longer region of fawn coloration at the tips (Fig. 2).

Our preliminary impressions from the comparison of skulls is that specimens from western Nigerian have shorter and broader rostrums than specimens from Bioko and Oban. The nasal and premaxillary bones are relatively shorter and the frontal bones broader when comparing adults (A). The posterior paletine shape around the posterior nasal apertures (choanae) is smaller, more rounded and less splayed posteriorly (B) and the incisive foramina at the front of the palate are larger and rounder (C).

Discussion

Rosevear (1939) had already noted that populations of *D. dorsalis* either side of the Niger River had different calls. The existence of this possibly distinct population has also been mentioned recently by Akpona *et al.* (2011), Dowsett-Lemaire & Dowsett (2011b) and by Oates (2011), who took account of some of the information we document here. In the Red List for Benin, Akpona *et al.* (2011) recognised that the voices of tree hyraxes in eastern Ghana and Benin were very similar but differed substantially from calls recorded in Cameroon. Although they tentatively assigned these populations to the subspecies *D. dorsalis sylvestris* (Temminck 1853), for which the type locality is "Guinea coast" to Ashanti (Ghana), they concluded that this tree hyrax might be new to science and that its identification was a priority.

Here we confirm the differentiation between tree hyraxes of western Nigeria and the Dahomey Gap and those living further to the west (i.e., west of the Volta River) and to the east (i.e., eastern Nigeria, Cameroon, the Congo Basin, Uganda and northwestern Tanzania). We provide initial evidence of phenotypic differences between specimens collected east and west of the Niger and we show that their calls are distinctly different (klaxon calls versus rattle and bark calls). Our observations, and especially the differences we found in long calls in forests adjacent to the Volta River (where both call types were heard in the same forests), suggest that the tree hyraxes of western Nigeria and the Dahomey Gap belong to a population evolutionarily distinct from those living to the east and west of this region. We provisionally call this population the "Benin tree hyrax" and distribution maps indicating that tree hyraxes are absent from the Dahomey Gap should be altered accordingly.

The fact that the call of the Benin hyrax starts with a rattle suggests that it may be allied to *Dendrohyrax arboreus* from east and southern Africa, where all populations have calls with similar rattles. This may also explain the statement by Akpona *et al.* (2011) that

Dendrohyrax arboreus has been cited as present in Benin in the past, although they do not give details. To test our hypothesis, quantitative study of museum specimens would be useful, together with an analysis of DNA in tissue samples. One of our colleagues has already collected fresh tissue from two western Nigerian tree hyraxes, but samples are still lacking from east and west.

If an evolutionarily distinct population of tree hyraxes is confirmed in western Nigeria and the Dahomey Gap, this would support the proposition that there was a Pleistocene forest refuge in this region that led to the differentiation of several vertebrate taxa (Booth 1958, Grubb 1978a, Oates 2011). This area has distinct forms of potto (*Perodicticus potto juju*), guenon monkey (*Cercopithecus erythrogaster*) and small forest duiker (*Philantomba walteri*) (Grubb 1978b, Colyn *et al.* 2010, Oates 2011), and two closely-related genetic clades of soft-furred mouse, *Praomys misonnei,* which are distinct both from those found east of the Cross River and from *Praomys tullbergi* west of the Volta River (Nicolas *et al.* 2010).

Conclusion

Given the major qualitative difference in the long calls of the Benin tree hyrax (rattles and barks) and the western tree hyrax (klaxon calls), in addition to our evidence of differences in their anatomy, it would be surprising if these animals did not prove to be a separate species. Tree hyraxes in general are under threat from deforestation and bushmeat hunting and our understanding of their taxonomy is a vital first step towards clarifying their distribution and status. Based on our extensive library of hyrax calls, built up over the last 35 years, we believe that a major taxonomic revision of this highly cryptic group is long overdue.

Acknowledgements

We are grateful for the help provided by Colin Groves, Diana Roberts and the staff of the Mammals Section, Natural History Museum, London. Additional tape recordings were provided by Yvonne de Jong and other members of the Nocturnal Primate Research Group. We thank those who contributed useful input through the peer review process.

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Notes on hyrax in South Sinai's high-mountains

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Introduction

Of the three extant genera of hyrax, *Procavia* is the most widely distributed, ranging from the Cape of South Africa to Lebanon at the northernmost extent of its range (Barry *et al.* 2008a). The number of species recognized in *Procavia* varies greatly. The taxon has been divided into five species by Kingdon (2011), with mitochondrial DNA variation indicating two species in South Africa (Prinsloo & Robinson 1992). However recent classification recognises a single species, *Procavia capensis*, commonly referred to as the rock hyrax or rock

dassie (Shoshani 2005, Barry *et al.* 2008a).

Rock hyrax habitat typically encompasses areas of bare rock in the form of outcrops, cliffs, and boulders with colonies centred around crevices and holes (Sale 1966). They inhabit a wide altitudinal range from below sea level along the margins of the Dead Sea (Koren *et al.* 2006) to over 4,000 m in the alpine zone of Mount Kenya (Young & Matthew 1993). Rock hyraxes are able to adapt to a wide range of ambient temperatures (Brown & Downs 2006) and tolerate aridity in desert environments (Kingdon 2011).

Both the rock hyrax and the bush hyrax, *Heterohyrax brucei,* have been recorded as occurring in the Egyptian Sinai peninsula (Barry & Shoshani 2000, Kingdon 2011). However other literature on the region's mammalian fauna does not include Sinai within the range of the bush hyrax (Osborn & Helmy 1980, Harrison & Bates 1991). Hoath (2003) treats the ranges of *P. capensis* and *H. brucei* as indistinguishable in Sinai and implies that greater evidence exists for the presence of *P. capensis*. Recent assessments regard records of *H. brucei* from Egypt (and Sinai) as erroneous, with no confirmed reports (Hoffmann *et al.* 2008). Thus Sudan represents the northernmost extent of that species' distribution (Barry *et al.* 2008b). Basuony *et al.* (2010) also emphasize that the persistent recording of *Heterohyrax* in Sinai by international authors is a long-term mistake and that it is definitively absent from Egypt. Through the distributional literature and sightings of wild and captive individuals we can confidently assume that observations in South Sinai refer to the rock hyrax *P. capensis*.

Rock hyrax distribution is recorded as occurring throughout Sinai's rocky regions, predominantly in the Governorate of South Sinai, being absent from the sandy desert of North Sinai (Barry *et al.* 2008a). Hoath (2003) documents hyrax occurrence in South Sinai from the low-lying areas of Ras Mohammed, Wadi Kid, and Al-Tor, along with the higher altitude mountainous area around the town of Saint Katherine.

Throughout its range the rock hyrax is categorized as 'Least Concern' by the IUCN Red List (Barry *et al.* 2008a). The overall population trend is unknown, but they may be subject to local decline and extinction (Kingdon 2011) as they have high site fidelity with low levels of dispersion (Barry & Mundy 1998, Gerlach & Hoeck 2001). Hyraxes are hunted for bushmeat which may cause localised population declines (Barry *et al.* 2008a, P. Coals, *pers. obs.*). However, in Israel range expansions have been recorded with new agricultural land use (Moran *et al.* 1987), where they are regarded as economically significant orchard pests (Moran & Keidar 1993).

Information on population trends and threats in Egypt is limited and contradictory. Hoath (2003) reports that hyrax numbers are 'much reduced' throughout their Egyptian range due to hunting and clearance of acacia trees for charcoal. However, *Acacia tortilis*i occurs at lower altitudes on sandy plains and wadis (Boulos 1999), is rare in the high mountains of South Sinai and, therefore, unlikely to form a large part of the diet of the rock hyraxes found there. Perceptions of hyraxes by Jebaliya Bedouin and monks of the monastery of St Catherine in South Sinai vary. Hobbs (1995) records hunting of hyrax for meat and skins, and, due to the mammal's taste for shoots and fruits (Barry *et al.* 2008a, Kingdon 2011), some monks and Bedouin view hyraxes as destructive pests and set traps to prevent damage to gardens and orchards. Other Bedouin believe the hyrax to be a distant relative of humans which should not be hunted or eaten (Hobbs 1995).

Site and Methods

Informal conversations were held with Bedouin tribesmen and opportunistic field surveys (in conjunction with vegetation surveys) were carried out from late October to mid-December 2014 in the St Katherine Protectorate, South Sinai.

The St Katherine Protectorate covers 4,350 km^2 of the southern Egyptian Sinai peninsula, encompassing the majority of the high-altitude south Sinai massif to form one of Egypt's largest protected areas (Grainer & Gilbert 2008). The massif is made up of 600 million-year-old red granite, with an igneous pre-Cambian ring-dyke covering 640 km^2 of the centre of the Protectorate (UNESCO 2002). The ring-dyke contains Egypt's highest mountain, Mt St Katherine, at 2,643 m. The mountainous terrain is traversed by steep-sided, dry wadis (valleys). South Sinai receives above-average rainfall (62 mm) (Zahran & Willis 2008) and generally cooler temperatures (summer mean 30^{o}C) than the rest of Egypt, and is the only region where snow can settle (Grainger & Gilbert 2008). The Jebaliya Bedouin tribe inhabit the high-mountains surrounding the town of St Katherine. Unique amongst Bedouin cultures, the Jebaliya have strong historical and cultural ties with the Monastery of St Catherine and retain aspects of Byzantine monastic cultural influence in the form of tended gardens and orchards which they maintain in the high mountains (Hobbs 1995; Zalat *et al.* 2001).

Field observations were carried out in mountainous areas predominantly within the geological ring-dyke over an altitude range of 1,324 m to 2,629 m. In addition to sightings of live animals, we looked for animal signs, specifically middens and urine stains on rocks, which can persist for millennia and provide an historical record of the presence of past colonies (Scott & Bousman 1990, Scott 1996).

Informal conversations were conducted with male members of the Jebaliya tribe. Conversations were held in Arabic with clarification and explanation of specific terms in the Jebaliya Bedouin dialect provided by local Bedouin guides. During conversations relating to hyrax populations and numbers, it was made clear that our area of interest was the high mountains of the Jebaliya territory and not further afield or lowland regions outside of Jebaliya territory. Anecdotal evidence presented here therefore refers to knowledge of hyrax populations within the high mountains of the South Sinai ring-dyke.

Findings and Discussion

From 36 wadis and gullies visited for vegetation surveys, along with trips by foot through the mountains totalling 54 days, five adult hyrax were sighted at a single location in Wadi Jebel Ahmar (Lat. 28.5316333, Long. 33.9617500 Decimal degrees) at an elevation of 1,900 m. The wadi is a steep-sided gully of north-easterly aspect with a bed-gradient of approximately 20 degrees. The easterly wadi wall comprises black volcanic rock, whilst the west is red-coloured granitic rock. The gully bottom is strewn with boulders of 1-2 m^2 with infrequent larger boulders of up

to about 4 m diameter (Fig. 1). The hyraxes were observed feeding upon leaves of a wild fig tree (*Ficus palmata*) for approximately five minutes before retreating into holes between large boulders. There was no visible evidence of middens or urine staining in the area; it is likely that any dung is deposited in inaccessible cracks between large boulders. The individuals in Wadi Jebel Ahmar were the only evidence of hyrax recorded throughout the duration of surveys in the high-mountain region.

Figure 1. Hyrax habitat in Wadi Jebel Ahmar, 1900 m, Lat. 28.5316333, Long. 33.9617500 (Decimal degrees)

At the base of Wadi Jebel Ahmar in a Bedouin orchard-garden, known as Ramadan's Garden, a colony of about 15 captive hyrax is maintained. They serve as a curiosity for tourists and travellers passing through the garden which, as with many orchards in the area, serves as a campsite for tourists and an area where local Bedouin sell handcrafts and curios. Despite the existence of this captive colony, wider efforts have not been made to domesticate the species as a source of meat to supplement household supply or income, as has been attempted in Yemen (Stevenson & Hesse 1990). However, it is thought that the hyraxes from Ramadhan's Garden are occasionally sold to Saudi Arabians, who believe that hyrax blood and meat have medicinal (aphrodisiac) properties (F. Gilbert, *pers. obs*). Hobbs *et al.* (1998) report a Gararsha tribal community at al-Hiswa in the lower altitude west of South Sinai watching over a hyrax colony, but no consumptive use is mentioned for this colony.

The Jebaliya said that hyraxes are much rarer in the high mountains than they once were, asserting that large-scale decreases have taken place in the last 10-15 years. They conceded that hunting may play a role in these declines, but they do not think that hunting pressure has increased. Instead they believe hyrax population declines are in large part due to the spread of red fox (*Vulpes vulpes*), a hyrax predator, into the high mountain region.

The first record of the Middle Eastern red fox, *Vulpes vulpes arabica*, in Sinai was made in the late 1990s (Saleh & Basuony 1998) and has reportedly followed human settlement to become the commonest fox species found in the St Katherine area (Gilbert & Zalat 2009). The red fox is listed amongst the 100 worst invasive species in the world (Lowe *et al.* 2000). In both the Old and New Worlds, expansion of non-native red fox distributions is widely documented to have had detrimental effects upon indigenous species across a range of taxa, since they are predators of reptiles, birds, and small- and medium-sized mammals (Dickman 1996, Lewis *et al.* 1999, Risbey *et al.* 2000, Hardin *et al.* 2001, Saunders *et al.* 2010).

Better documented declines in mammal abundances in Sinai of Dorcas gazelle, *Gazella dorcas* (El Alqamy & Din 2006), and Nubian ibex, *Capra nubiana* (El Alqamy *et al.* 2010), are attributed to direct human impact (hunting). Anecdotal evidence from the Jebaliya Bedouin concerning perceived declines in hyrax abundance, if indeed due to expansion of red foxes around St Katherine, may represent wider-scale undocumented impacts of the red fox in Sinai. No quantitative data are available to assess the absolute extent of hyrax declines in South Sinai's high mountain area. However, indigenous perception should serve as an alarm bell as to the state of species and ecosystems in the region and has been shown to be an effective addition to the methods of evaluating conservation status (Ziembicki *et al.* 2013).

We cannot prove categorically that hyrax numbers have been impacted by red fox expansion, nor are there quantitative figures relating to hyrax numbers or red fox range expansion in the region. Nevertheless, local knowledge suggests there may be a link. Only through long-term, comprehensive, quantitative monitoring studies of South Sinai's mammals (cf. Gecchele 2013) can more accurate population trend predictions be made and assessed.

Acknowledgements

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Afrotheria News

Obituary: Professor Peter Vogel

5 February 1942 – 12 January 2015

Nicole Chuard © UNIL

It is with great sadness that we report the loss of one of our specialist group members. Professor Peter Vogel passed away on 12 January 2015 following a serious heart operation. He was 24 days away from his 73rd birthday.

Peter was a member of the Tenrec Section of the Afrotheria Specialist Group due to his work on otter-shrews. However, he will be remembered first and foremost as one of the world's leading shrew experts. In the last edition of *Afrotherian Conservation* (September 2014) Peter summarized some of the lessons from his long career:
http://www.afrotheria.net/PDFs/Afrotherian_Conservation_10_Sept_2014.pdf

Peter's research career began in 1965 when he started a PhD at the University of Basel on the ontogeny of shrews. After completing his thesis he went on to become director of the *Centre Suisse de Recherches Scientifiques* in Côte d'Ivoire from 1970 to 1973.
In west Africa he continued to study shrews and also became interested in the Nimba otter-shrew, successfully capturing and studying some of these rare afrotheres.

In 1973 Peter became professor of zoology and ecology at the University of Lausanne in Switzerland and he was to stay affiliated with this institution for the rest of his career. His research continued on the biology and systematics of shrews and some of his students continued to work in west Africa. He retired in 2007 but maintained regular contact with his colleagues in Lausanne. Peter had a very productive career and, in his article for *Afrotherian Conservation*, he ended by saying "I am very happy to have been involved in the adventure of biological research for over 40 years."

Peter was the external examiner for my PhD and I had the chance to meet him on several occasions afterwards. He was a very bright and charming man, with a contagious enthusiasm for all living creatures, especially small mammals. I'll never forget visiting him at his home near Lausanne one summer evening. After checking all the traps in his garden (where he had been monitoring his resident shrews for many years), he took me down to the lake and tossed rabbit pellets on the ground to bring rats out of the rocks onto the waterfront. I can never walk by Lake Geneva without thinking about Peter and his rats.

I also remember him explaining over dinner at my house one night his study of the mice of the Simplon Tunnel. He got special permission from Swiss railways to go into the train tunnel between Switzerland and Italy and catch rodents; it emerged that the tunnel mice were genetically Swiss and survived by feeding on refuse from trains. Even many of his family holidays further afield were organized around where he could find a certain small mammal species – usually a shrew.

Many small mammal colleagues remember Peter's shrew-themed New Year cards that were designed by Jacques Hausser. Paula Jenkins received the one shown below in 1993. Many years on, we followed his example and produced greetings cards featuring afrotheres for our specialist group.

Gary Bronner, the Golden Mole Section Co-ordinator, was privileged to have Professor Vogel as one of his external PhD examiners in 1995. He remembers that Peter's informed and balanced perspective was vital in reconciling divergent views on some of his PhD research findings. This, and subsequent interactions over the next 20 years, reinforced Gary's impression of Peter as "a true gentleman among scientists."

Peter was a dear and valued colleague and will be much missed. Our heart-felt condolences go out to his family, especially his wife, Charlotte, and their five daughters.

For those who read French, you can find homages to Peter from his University of Lausanne colleagues at:
http://www.unil.ch/getactu/wwwfbm/1422968009662/
and
http://www.unil.ch/getactu/wwwfbm/1422864150338/

A summary in English of Peter's career, as well as a full list of his publications, is posted at:
http://www.unil.ch/dee/en/home/menuinst/people/honorary-professors/prof-peter-vogel.html

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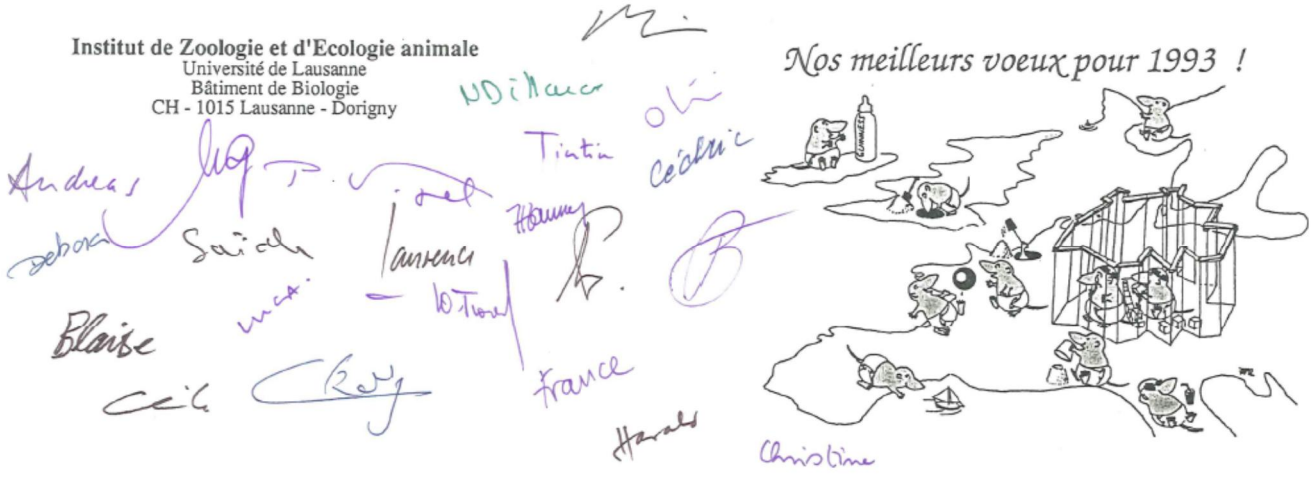

The conservation of tenrecs (Tenrecidae) in Madagascar: a conservation planning workshop

One of the goals of the IUCN/SSC Afrotheria Specialist Group (ASG) is to develop research and conservation programmes for its target species. On 15 April 2015, the Tenrec Section of the ASG held a workshop around the edges of the Twelfth African Small Mammal Symposium (ASMS12) held in Mantasoa, Madagascar, to develop key elements of a conservation strategy for Malagasy tenrecs. Malagasy tenrecs include 31 species of Tenrecidae in the subfamilies Geogalinae, Oryzorctinae and Tenrecinae.

The workshop was attended by seven of the eight current members of the Tenrec Section, two former members, two members of the ASG Golden Mole Section and a handful of interested symposium participants (Fig. 1). Rarely have so many tenrec experts been able to meet in one place, and the venue ensured more mammal biologists were able to get exposure to our favourite beasts (see Fig. 2).

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Figure 1. Link Olson (back to camera) discussing ideas with some of the workshop participants (left to right): Voahangy Soarimalala, Paula Jenkins, Felix Rakotondraparany, Kathryn Everson, Nigel Bennett and Sarita Maree.

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Figure 2. Tenrec Section member Steve Goodman (centre, striped shirt) explains the morphology and behaviour of a lowland streaked tenrec (*Hemicentetes semispinosus*) he caught (inset) to delegates from the ASMS12 during a field trip to Andasibe National Park, Madagascar.

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Figure 3. Martin Nicoll (centre, with colleagues on the ASMS12 field trip) co-authored the original action plan for tenrecs back in 1990. As part of the current planning exercise, he'll work with PJ Stephenson to link tenrec habitat conservation with other NGO priorities in Madagascar.

Following plenary and working group sessions, the following outputs were agreed:

Conservation targets and scope - The action plan will focus on the seven species of Malagasy tenrec identified as threatened or Data Deficient in the latest IUCN Red List of Threatened Species (Table 1), and the habitats of threatened tenrec species within their range.

Table 1: Threatened or Data Deficient Malagasy tenrecs after the Red List Assessment of 2015. (IUCN in press).

Species	Status
Limnogale mergulus Aquatic tenrec	VU B2ab(ii,iii)
Microgale dryas Dryad shrew tenrec	VU B1ab(iii)
Microgale jenkinsae Jenkin's shrew tenrec	EN B1ab(iii)
Microgale jobihely Northern shrew tenrec	EN B2b(ii, iii)
Microgale monticola Montane shrew tenrec	VU D2 or EN B1ab(iii)
Microgale nasoloi Nasolo'sshrew tenrec	VU B1ab(iii)
Oryzorictes tetradactylus Four-toed rice tenrec	DD

Priority threats to address - The greatest threat to tenrec species is habitat loss and degradation. Whilst not a threat as such, the lack of knowledge on many tenrec species directly hinders the formulation and implement-ation of conservation plans. All threatened tenrec species are known from ten or fewer locations with few individuals having been captured, making it hard to determine accurately their distribution, abundance and habitat preferences, let alone population trends and threats. Few species have been studied alive and little

information exists on their behaviour. In addition, the taxonomy of the Tenrecidae is changing regularly.

Draft goal and objectives – The plan will be structured around a goal to improve the conservation status of threatened species, and objectives around habitat conservation and science. This is based on a draft theory of change that states: *By conserving the habitat of threatened tenrecs in Madagascar, and improving our knowledge of their biology, taxonomy, distribution and threats, we expect to see an improvement in the status of those species most at risk.*

Participants identified some activities and outputs under the habitat conservation and science objectives.

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Figure 4. Felix Rakotondraparany (left) and PJ Stephenson in Parc Tsimbazaza, Antananarivo, in April 2015, 25 years after working together there on captive breeding tenrecs (http://tenrec.lima-city.de/pjs94.htm).

In coming months, the ASG will work with other stakeholders to finalize a conservation plan (in English and French) for Malagasy tenrecs. The ASG Tenrec Section will continue to build on workshop results and develop research priorities under the science objective. A small sub-group will talk to governmental and non-governmental stakeholders to identify ways to link tenrec habitat conservation to other conservation and development strategies (e.g. for other species like lemurs, broader ecosystem programmes, etc.). There will follow a process for engaging key stakeholders, especially Malagasy people and agencies, and both national and international experts (in addition to ASG members) in the finalization of the Tenrec Action Plan, to ensure that we secure input and buy-in and that we tap areas of expertise not covered in the ASG (e.g. forest conservation and management, education, etc.).

The participants committed to ensure we move quickly from planning to action and start at least some of the key conservation actions identified in the final plan. This will include establishing projects and fund-raising for them.

We are grateful to Voahangy Soarimalala and Steve Goodman for helping arrange the meeting as part of the ASMS12. For more information, or a copy of the workshop report, please contact me directly.

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An update on Arabuko-Sokoke Forest, Kenya

Standing inland of the great Watamu-Malindi Marine Reserves, Arabuko-Sokoke Forest is a stronghold of east African endemism, and the largest intact stretch of coastal forest in the region. Although its range extends much further north, the forest is also the main stronghold of the golden-rumped sengi, *Rynchocyon chrysopygus*, which is listed by IUCN as Endangered.

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Golden-rumped sengi, *Rynchocyon chrysopygus*,

Since the early 1980's Arabuko-Sokoke has been the focus of a growing array of conservation and development activities, led by a mix of local, national and international players and funders. Many of the forest's flagship species, including the sengi, have been the focus of detailed studies, and a steady stream of local and overseas researchers have contributed to a wealth of knowledge on Arabuko-Sokoke's flora and fauna. Innovative community programmes led by the pioneering Kipepeo Project (which established butterfly farming), and the Arabuko-Sokoke Schools and Ecotourism scheme (which helps with secondary school scholarships) have built support for the forest over three decades. Core to local people's engagement has been the role of Arabuko-Sokoke Forest-Adjacent Dwellers' Association (ASFADA), a dynamic group whose members include those of three Community Forest Associations. Working with Nature Kenya (the BirdLife International partner in Kenya) and others, and with financial support from the European Union's Community Development Trust Fund, the Dwellers' Association recently completed developing accommodation for student and other visitors close to the forest headquarters at Gede.

Despite all these positive developments, threats remain, and the most recent of these was a massive push to explore for oil and gas in the forest by the Texas-based oil company CAMAC. After a vigorous campaign in late 2014, the threat receded earlier this year. Profiled in three articles in the Times of London and widely covered in the national press, the campaign was led locally by the Dwellers' Association and Watamu residents including, among others, the Local Ocean Trust, and A Rocha Kenya. This coalition managed to prevent seismic exploration within the forest. Nature Kenya backed up local efforts in Nairobi through visits to CAMAC's Nairobi HQ, as well as on-the-ground assistance to forest-based lobbying efforts. Numerous other organisations and

individuals provided additional support.

The role played by the Dwellers' Association and the joint forest management team (which includes the Kenya Forest Service, Kenya Wildlife Service, National Museums of Kenya, and Kenya Forests Research Institute) was critical. However, it is important to point out that the seismic surveys continued outside the forests, and caused considerable damage to individual farms. Staff from the Local Ocean Trust and the Kenya United Against Poaching group carried out a post-survey analysis of the damage done to farms, but none have been compensated.

Quite apart from the success of the campaign to keep exploration at bay, the CAMAC crisis and its immediate resolution provides a model case for building local conservation support. Without the two decades of conservation investment by communities adjacent to forested lands, led by Nature Kenya, and many others, the Arabuko-Sokoke might have had a very different look.

The efforts to secure the forest continue. Recently, Dr Paul Matiku (the CEO of Nature Kenya) established a cordial working relationship with Augustine Nkuba, the CAMAC Kenya CEO, and secured assurances that there will be no exploration within Arabuko-Sokoke. This allayed anxiety that arose when the Chinese company undertaking the seismic survey re-occupied their premises outside Gede Ruins. It emerged this was because of a contract they had secured under the Lamu Port-South Sudan-Ethiopia-Transport Corridor Project (a massive initiative to establish a transport corridor between the planned port at Lamu on the northern coast of Kenya, South Sudan and Ethiopia). While this and other mega-projects will transform much of Kenya, it poses no immediate threat to the Arabuko-Sokoke. But, concerns for the Boni-Dondori forests further north adjacent to Lamu, where a unique endemic form of giant sengi occurs, remain. For now, the presence of Al-Shebab in the border region with Somalia seriously complicates the development and conservation situation in the region.

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Rump of golden-rumped sengi, *Rynchocyon chrysopygus*,

In conclusion, the key recent lesson for golden-rumped sengi populations and afrotherian conservationists is that we must redouble efforts to build local constituencies on the ground. Around Arabuko-Sokoke, ASFADA needs assistance to meet the multiple needs of its members, and similar groups need to be built around other coastal Key Biodiversity Areas. Nature Kenya has the experience and the presence to help, but also faces challenges in keeping the necessary resources flowing to work at the coast, where its indefatigable coastal officer, Francis Kagema, has been a vital catalyst for the Dwellers' Association not only in the Arabuko-Sokoke, but also in the threatened and unprotected Dakatcha woodlands north of the Galana River.

Most recently, in mid-2015 Francis and the Dwellers' Association chairman Charo Ngumbao (one of the pioneer community butterfly farmers) have been working alongside people from Malindi, Watamu, Nairobi and overseas to revitalize the Friends of Arabuko-Sokoke Forest. This support group, consisting of individuals, institutions and businesses, aims to support monitoring of the forest and develop education and research activities that will supplement and support conservation efforts and help secure the habitat of the golden-rumped sengi along with the other endemic forest dwellers.

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Can IUCN Specialist Groups do more to collect species monitoring data?

Between 15-17 September, I represented the Afrotheria Specialist Group at the IUCN Species Survival Commission Leaders' meeting in Abu Dhabi, United Arab Emirates. I made some very useful contacts to help drive the group's conservation agenda and had meetings specifically to, for example, finalize some Red List assessment queries, consider species offtake in conservation planning, and develop partnerships (especially with the zoo community). On 17 September I facilitated an interactive session to discuss the main challenges with the collection and use of species monitoring data (populations, habitats, threats, etc.) and identify how specialist groups can work together and with partners (especially NGOs and donors such as species conservation funds) to implement potential solutions.

Species populations and their habitats and threats are monitored for a range of different reasons by a range of different people. Monitoring is important, for example, for conservation project managers to demonstrate and adapt the changes they bring about in biodiversity, for donors to show the impact of their funding, for scientists and NGOs to identify threatened species and stimulate action, for local communities to manage their natural resources, and for governments to demonstrate the delivery of national biodiversity strategies and their contribution to the goals of Multilateral Environment Agreements (e.g. the Convention on Biological Diversity). Efforts are therefore being made to track temporal and spatial trends in, for example, species populations, species range, legal and illegal offtake and trade, habitat cover, protected area coverage and protected area management effectiveness.

Many challenges exist in the collection of data and its use in monitoring and related decision-making, including inadequate capacity or resources for monitoring, weak indicators and monitoring plans, gaps

in existing databases, and blockages to data access and sharing. Therefore, there is urgent need for increased capacity building in national agencies, enhanced collection of data by conservation and research projects, improved harmonization of indicators and methods, and greater sharing of data in formats of use to conservation practitioners.

As the world's largest body of scientific expertise on species, the IUCN Species Survival Commission is already playing an active role in species monitoring. Many specialist groups (e.g. those concerned with birds and large mammals) collate and share data of use in Red List assessments and in monitoring local and global conservation goals. However, some of the other groups are struggling. The Afrotheria Specialist Group is a good example. In conducting Red List assessments, we had no accurate population data for our 80 target species and limited data on distribution, habitats and threats. Reasons for data shortages include difficulties in monitoring small, nocturnal, cryptic species, as well as challenges with taxonomy and the lack of interest in small mammals. Other groups have their own unique challenges.

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Scientists reflect on species monitoring at the IUCN/SSC Leaders' meeting.

In the workshop, 65 scientists reviewed the challenges with data collection and use across taxa (vertebrates, invertebrates and plants) and identified a set of feasible, realistic actions that specialist groups can take, working with partner NGOs and donor agencies, to increase data on their species for use in Red List assessments and national and global monitoring efforts. The workshop report will be available shortly and we will move quickly into identifying some follow up actions. Please get in touch if you would like to receive a copy and to be included in further discussions and activities on this topic.

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Noticeboard

Afrotheria SG co-chair roles

Since June 2015 the IUCN/SSC Afrotheria Specialist Group has had two co-chairs. We are breaking down the roles as follows:

Galen Rathbun, Co-chair (Information and Research)

1. Jointly appoints and removes group members
2. Jointly plans and reports to SSC Chair on group's work
3. Co-ordinates sections on research issues
4. Oversees website
5. Serves as co-editor to newsletter
6. Co-ordinates Red List Updates with Red List Co-ordinator
7. Co-ordinates species information requests
8. Supports applications for research funding.

PJ Stephenson, Co-chair (Conservation)

1. Jointly appoints and removes group members
2. Jointly plans and reports to SSC Chair on group's work
3. Co-ordinates sections on conservation issues
4. Develops and supports implementation of species conservation plans
5. Co-ordinates conservation efforts with other specialist groups and partners
6. Fund-raises for conservation and research (including some cost recovery for core group functions)
7. Supports applications for conservation funding
8. Consults and communicates with IUCN teams and partners to enhance collaboration and lesson sharing.

To help free up more of PJ's time for developing conservation plans and projects across the group, he will be looking to find a replacement co-ordinator for the Tenrec Section in the near future. He will also relinquish his role as newsletter editor after 13 years. We are very grateful to Chris and Mathilde Stuart who have agreed to take on the next edition in 2016. Galen will continue to assist with the newsletter by begging, pleading and chain-rattling everyone to contribute.

We trust that all these changes will result in more visible results for our afrotheres, and a sensible workload for the co-chairs.

Hyrax vocalization project seeks collaborators

The mammalian order Hyracoidea contains only the family Procaviidae. This family includes as many as 50 species and subspecies, yet the exact taxonomic and phylogenetic divisions have been long disputed (e.g. Hoeck 1978, Shoshani 2005). Thus, the number of recognized species has decreased from 11 in the 1990's to four or five in recent years, belonging to three genera (e.g. Bothma 1971, Meester *et. al.* 1986, Schlitter 1993, Roberts *et. al.* 2013).

Darwin may have been the first to note that birds of the same species sing differently in varying geographical areas (Darwin 1871). Modern studies show that bird vocalizations can vary in what has been referred to as "dialects", in accordance with genetic or geography-ical variation (e.g. Leader *et al.* 2000). Similarly, it has been found that the structural features of the song of the male rock hyrax (*Procavia capensis*) differs in step with geographical distance, within a 5 km range. The genetic/geographical variation of animal "dialects" and "languages" largely parallel the variation of human dialects and languages (Henry *et. al.* 2015).

Classical linguistic science mostly uses a comparative method (Durie & Ross 1996) to group cognates (similar words in different languages) into lingual family trees. The method's efficiency is limited to lingual divisions that occurred 10,000 years before our time (Nichols 1992). In contrast, methods using structural language characteristics to build trees can detect groups of languages that diverged earlier than 10,000 years ago, which the comparative method had not been able to map. The structural method makes use of molecular alignment methods for building phylogenetic trees such as maximum parsimony or maximum likelihood (Dunn *et. al.* 2008).

We intend to use a linguistic approach to compile a phylogenetic tree of the Procaviidae using hyrax vocalizations. The approach will be similar to building a lingual family tree using either the comparative method (in accordance with analogous vocal components) or the structural method (in accordance with structural characteristics of the different "languages"). In order to create a thorough database, we are collecting recordings of hyrax songs from Africa and the Middle East. We are seeking collaborators that have hyrax recordings, or are in the field and can record. Please email files to Lee Koren at Lee.Koren@biu.ac.il or send them using WeTransfer (https://www.wetransfer.com), along with the following information:

1. Your name and contact information
2. Date and time of recording
3. Geographical location (GPS coordinates, if available)

Also, if possible, additional information on:

4. Context (if hyrax were seen fleeing, fighting, mating, any behaviour during/before/after call)
5. Information on size, sex, etc. of caller
6. Picture
7. Species
8. Habitat

If you know of other people who may have hyrax recordings, or are in the field and are willing to record hyrax, please forward this request to them. We're looking forward to collaborating on this exciting project.

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Sengi art in Italian exhibition

Afrotheria Specialist Group member Jonathan Kingdon is exhibiting some of his work in Italy.

EX AFRICA: Explorations in art and science by Jonathan Kingdon is a temporary exhibit of drawings, paintings, sculptures and other work at MUSE – Science Museum, Trento, Italy, from 19 July 2015 to 10 January 2016. (http://www.muse.it/en/Pages/default.aspx).

The exhibit has a special focus on sengis in view of the research work that the Tropical Biodiversity Section at MUSE – Science Museum has conducted in the forests of Tanzania, including the description in 2008 of the new species, *Rhynchocyon udzungwensis*.

Rhynchocyon, most especially *R. udzungwensis*, plays the opening role in this exhibition. Italian audiences have responded very positively (and often sentimentally) to the images of sengis and to the explanatory texts and videos associated with them and with Trento's pioneering research in Udzungwa.

We thank the Gallery Pangolin for providing the images of the sengi art work on permission from Jonathan Kingdon.

Gray-faced sengi (*Rhynchocyon udzungwensis*) by Jonathan Kingdon

Funding and training opportunities

Cambridge Masters in Conservation Leadership
http://www.geog.cam.ac.uk/graduate/mphil/conservation/
The Cambridge Masters in Conservation Leadership programme is now accepting applications for October 2016 entry. The course is a full-time, one year Masters, aimed at graduates of leadership potential with at least three to five years of experience relevant to biodiversity conservation. The unique feature of the course is its delivery by a collaboration between six University of Cambridge departments and nine leading conservation organisations based around Cambridge, and its focus on issues of management and leadership.

As in previous years, there is considerable scholarship funding available for the academic year beginning in October 2016. Competitive scholarships are available to anyone with outstanding conservation leadership potential who is not able to fund their studies from other sources. Priority is given when allocating scholarships to students from countries rich in biodiversity but poor in financial resources.
Deadline for October 2016 entry: 2 December 2015.

Smithsonian Institution Fellowship Programme -- Applications 2016
http://www.smithsonianofi.com/fellowship-opportunities/smithsonian-institution-fellowship-program/
The Smithsonian Institution annually awards fellowships for independent study or research at one or more of the Smithsonian's 19 units and research centres, including the Smithsonian Tropical Research Institute. The awards include: graduate student fellowships; pre-doctoral fellowships; post-doctoral fellowships; and senior fellowships. The fellowship programme is open to qualified applicants worldwide. Applicants contact Smithsonian's staff members (find link in the announcement) to identify potential advisors, and to determine the feasibility of their proposed research.
Deadline: 1 December 2015.

Schlumberger Foundation -- Funding for Women in PhD and Post-Doctoral Studies 2016-2017
https://www.fftf.slb.com/
Schlumberger Foundation's "Faculty of the Future" supports women in developing and emerging economies to pursue PhD and post-doctoral studies at the international level. Grants are in the physical sciences, engineering, and related fields -- including past grants in subjects such as ecology and environment. The deadline for renewal applications is 6 November 2015.
Deadline: 14 November 2015.

WWF Russell E. Train Fellowship: Building Capacity in Wildlife Science and Management
http://www.worldwildlife.org/initiatives/russell-e-train-fellowships

Russell E. Train Fellowships support individuals pursuing a master's or doctoral degree in conservation. Today's conservation challenges are more complex than ever before and require advanced skills and knowledge to tackle pressing issues from climate change and deforestation to wildlife crime and rights-based fisheries management. The programme provides fellowships to rising leaders to address these global challenges. To date, more than 90 percent of our fellows are working to advance conservation efforts in their home countries.
Deadline: 1 March 2016.

Critical Ecosystem Partnership Fund (CEPF) -- Funding for Urgent Conservation Actions in Eastern Africa
http://www.cepf.net/grants/Pages/default.aspx
The CEPF offers grants up to US$10,000 as a rapid response fund to protect key biodiversity areas in eastern Africa that are under immediate and urgent threat. The announcement lists the eligible key biodiversity areas in Burundi, Democratic Republic of Congo, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe. Applications can be made by NGOs, community groups, private enterprises, universities, and other civil society applicants.
Deadline: Rolling.

Rainforest Trust -- Rainforest Ark Initiative 2016
https://www.rainforesttrust.org/ark-initiative/
The Rainforest Ark Initiative provides partnership and funding opportunities to local conservation NGOs across the tropics. Funded projects aim to establish and/or expand protected areas for critically endangered and endangered wildlife and birds. The Initiative invites applications for conservation partnerships from non-profit entities and NGOs for projects in tropical Latin America, Africa, and Asia. Applying organizations may submit proposals for either a land purchase or a protected area designation.
Deadline: 1 February 2016.

French Institute of Development Research (IRD) -- Research in Central Africa
https://en.ird.fr/
IRD and AUF (*L'Agence universitaire de la Francophonie)* jointly call for research projects in central Africa on three themes: population health and well-being; biodiversity and biosphere sciences; and water and sanitation. The objective is to build greater research capacity in the forested zones of the region, particularly through strong North-South consortia. The focus countries are Cameroon, Democratic Republic of Congo and Gabon.
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In the Papers

Field evidence for nectar-feeding by sengis

Pollination of plants by non-flying mammals, such as mice, is a rarely observed phenomenon. Occasional flower visits of captive sengis were originally interpreted as a by-product of the search for insects and, only recently, was it demonstrated that, under laboratory conditions sengis regularly lick nectar from flowers. Now, field observations of flower-visiting sengis licking nectar have been presented. With video camcorders and infrared lights, Cape rock sengis (*Elephantulus edwardii*) have been recorded visiting flowers of the Pagoda lily (*Whiteheadia bifolia*, Asparagaceae) under natural conditions in the Namaqualand of South Africa (Fig. 1).

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Figure 1. A Cape rock sengi licks nectar from flowers of the Pagoda lily.

Read more at:
http://www.pollinationecology.org/index.php?journal=jpe&page=article&op=view&path[]=349
and
Wester, P. 2015. The forgotten pollinators – First field evidence for nectar-feeding by primarily insectivorous elephant-shrews. *Journal of Pollination Ecology,* 16: 108-111.

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