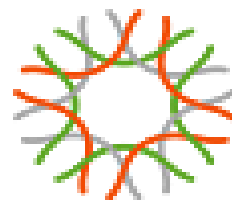
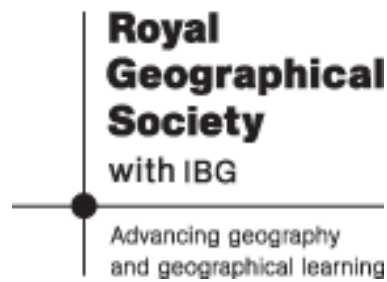


Report of the 2011 Sengi expedition to Northern Mozambique

10th June – 3rd July 2011

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Peter GR Coals



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Personnel:

Field Team:

Mr Peter Coals, University of Oxford, UK (Expedition Leader)

Dr Galen Rathbun, California Academy of Sciences, USA (Scientific Advisor)



Peter Coals and Galen Rathbun handle giant-sengi *Rhynchocyon cirnei*

Background:

Sengis are members of the supercohort Afrotheria (www.afrotheria.net), which represents an ancient group of mammals with a common African ancestry that evolved over 100 million years ago. The Afrotheria includes seven distinct, but phylogenetically related groups (elephants, sea cows, hyraxes, sengis, the armadillo, tenrecs, and golden moles), which together represent nearly a third of extant orders of mammals. However, they only contribute about 77 of the approximately 1260 species of mammals found in Africa and Madagascar. Thus, with relatively few species extinctions, entire groups of mammals would cease to exist, and therefore it is especially important to document their diversity.

The sengis (Macroscelididae) are divided into two subfamilies; the soft-furred sengis and the giant sengis. In 1847 the first giant sengi was described from the type locality of Quilimane in the Zambezia province of Mozambique, and it was named *Rhynchocyon cirnei*. Currently, 6 subspecies of *R. cirnei* have been described (Corbet and Hanks, 1968), which range from south of the Congo River through Zambia, Malawi and Tanzania to the Zambezi river in Mozambique.

These 6 subspecies of *R. cirnei* are described, based upon pelage colouration and distribution, in the seminal and largely definitive work on sengi taxonomy by Gordon Corbet and John Hanks published in 1968. In addition to the 6 named subspecies, Corbet & Hanks (1968) also mention a possible 7th subspecies located within the present day Quirimbas National Park of the Cabo-Delgado province in Northern Mozambique. The 7th subspecies was not named because “The overall pattern of [*R. cirnei*] variation cannot be assessed until more data [specimens] are available from Mozambique” (Corbet & Hanks 1968).

Objectives:

We travelled to the Mareja Community Reserve in the Cabo-Delgado province of Mozambique, which forms part of the Quirimbas National Park, in order to collect voucher specimens of *Rhynchocyon sengis* so that we may start to better understand its taxonomic status. To accomplish this, we needed to collect up to 8 specimens of *Rhynchocyon*.

We also proposed to present a training course for students and tutors of the Universidade Lurio (Unilurio) located in nearby Pemba in order to increase the capability of local researchers to carry out small mammal research, and to provide education and information on afrotheres.

Any incidental captures of small mammals or larger mammal sightings would be recorded in order to contribute to the species list for the reserve. We would also collect up to 8 voucher specimens of the taxonomically poorly understood four-toed sengi (*Petrodromus tetradactylus*), which belongs to the soft-furred group of sengis.

All field work was to be conducted in conjunction with local rangers; we aimed to give them experience to make them capable field assistants so that they could assist both local and international researchers in the future.

Questions investigated:

Do giant sengis from Northern Mozambique represent the same taxon as *R. cirnei cirnei*?

Do the Northern specimens represent new sub or full species?

Methods:

On our arrival in the Mareja reserve we conducted an introduction and interview with the local team of rangers; they were questioned with the aim of ascertaining how much they knew of the occurrence of *Rhynchocyon* and *Petrodromus* in the reserve and their habits and signs.

Small mammal capture and processing methods:

We trapped from the 14th June 2011 – 28th June 2011 (Table 1) using 14 Tomahawk double door live traps (16x16x61cm), 28 Sherman traps (5x6.3x16.5cm), and 6 nylon gills nets (1500x 60cm, ~5cm stretch mesh).

Table 1: Trapping effort by day and effort in Mareja Community Reserve, Mozambique.

Date	No. Tomahawks	No. Nets	No. Shermans
14 June 2011	14	0	28
15 June 2011	14	3	28
16 June 2011	14	4	28
17 June 2011	14	4	13
18 June 2011	14	4	3
19 June 2011	14	5	3
20 June 2011	14	6	0
21 June 2011	14	6	0
22 June 2011	14	6	0
23 June 2011	14	6	0
24 June 2011	14	6	0
25 June 2011	0	0	0
26 June 2011	0	0	0
27 June 2011	10	1	28
28 June 2011	10	1	0

We targeted *Petrodromus* and *Rhynchocyon* using the 14 Tomahawk double door live-traps. Captures of *Petrodromus* and *Rhynchocyon* sengis were carried out simultaneously in closed canopy riverine forest on the Mareja reserve. The locations of trapping sites were chosen based upon their largely closed canopies and presence of leaf litter, the ecology of giant-sengis (*Rhynchocyon*) necessitates this habitat type (Rathbun 1979).

We captured *Petrodromus* by placing traps along their easily identifiable trails, which were characterised by straight lines of “landing pads” ; cleared bare patches in the leaf litter that were approximately 5 cm in diameter, separated by ~30 cm, and maintained by the sengis.

Because *Rhynchocyon* does not normally build or use trails (Rathbun 1979), we captured them with Tomahawk traps placed at “choke points” in the forest where thicker understory vegetation would force animals to pass through a trap. We did not bait the traps because Sabuni *et al.* (2011) demonstrated that there is no positive response by *Rhynchocyon* to a variety of baits in traps.

We left traps open at night to catch *Petrodromus* as they are largely crepuscular. They were checked before dusk and at dawn. Throughout the day Tomahawks were left open in order to capture *Rhynchocyon* as they are strictly diurnal. Traps were checked at intervals of approximately 2-3 hours throughout the day; minimising the amount of time animals spent in traps in order to reduce stress and injury.

We also used gill nets to capture *Rhynchocyon*. The nets were loosely strung vertically so that the top of the net was ~ 30 cm above the ground and the remaining 30 cm of net fell onto the ground in loose folds, allowing the animals to become entangled when trying to pass through the net (http://researcharchive.calacademy.org/research/bmammals/eshrews/protocols_for_surveying_rhynchocyon.html#capture). The nets were placed in areas of forest with more open understory so that the animals would become entangled as they hurried through the more exposed area. The nets were raised at dawn and checked every 2-3 hours before being collapsed at night to prevent bycatch of nocturnal mammals, such as small antelopes.

Rodents were caught using 28 Sherman traps baited with a maize-chaff/ peanut butter mix and placed either opportunistically, e.g. at burrow entrances, or systematically along measured transects in the bush. Sherman traps were deployed in the late afternoon and checked at dawn.

Voucher specimens were euthanized and prepared as classical museum study skins. Standard morphological measurements were taken, along with GPS coordinates of the capture locations. All the skulls and most post cranial material were either air dried in preparation for cleaning by a *Dermestid* beetle colony at the California Academy of Sciences, or preserved, along with soft tissues in formalin. Tissue samples (leg muscle, liver, kidney) taken for later DNA analysis were stored in 95% Ethyl Alcohol; DNA analysis shall be conducted at the California Academy of Sciences in the future.

All voucher material was exported by hand to the California Academy of Sciences, but on the way back to California G. Rathbun briefly compared our specimens with those at the Distong National Museum of Natural History (formerly known as the Transvaal Museum) in Pretoria, South Africa, and The Natural History Museum in London, UK.

After the specimens are fully curated and analyses completed, they shall be distributed to the Eduardo Mondlane Museu de Historia Natural in Maputo, the California Academy of Sciences in San Francisco, and The Natural History Museum in London.

All research, collection and export was conducted in accordance with the regulations and protocols of the participating institutions and countries, and the terms of the research, collection and export permits issued to us by the Universidade Eduardo Mondlane Museu de Historia Natural and the Parque Nacional das Quirimbas (QNP).



P. Coals shows local rangers how to set a tomahawk trap where a sengi trail moves through vegetation forming a “choke point”.



P. Coals demonstrates study skin preparation to the director of research for Quirimbas National Park (with cap), tutor (with camera), and students of Unilurio



The director of research for QNP, students, tutors and rangers (in red) participate in setting Tomahawk traps in the forest during the field course. A ranger carries a .375 rifle for protection against dangerous game (mainly elephants) which live in the forest.

Interview:

Our initial talks with the rangers and community indicated that although they recognised the existence of *Rhynchocyon* and *Petrodromus*, they knew little of the spoor, signs and habits of the species. However, when in the forest the majority of rangers grasped what we were looking for. When presented with spoor and other signs knew fully what we were looking for and where we would need to set our traps and nets to catch specimens. This experience highlighted the difficulty of gathering information from relatively isolated communities where few people have a sophisticated understanding of the aims and needs of foreign scientists asking questions about ‘obscure’ wildlife. There was also a tendency for local people to give us the answers they thought we wanted to hear rather than the facts. However, with patience we were able to overcome much of the confusion that resulted from our interviews.

We ascertained that in the Macua language *Rhynchocyon* is called “M’ Pili”, which is not shared with any other species; we attribute this to the large size and bizarre appearance of *Rhynchocyon*, rendering it unique and memorable, even if it is rarely encountered by locals and only seems to form a relatively minor source of bush meat.

Petrodromus is referred to in Macua as “Raté”, a name it shares with the majority of small rodents including rats, mice, and gerbils. Nevertheless rangers were able to make distinctions between different kinds of “Raté” even though they do not have separate names. Once it was clear that the type of “Raté” we wanted to catch was *Petrodromus* we had little difficulty with mistaken identities.

Rhynchocyon captures:

Eight *Rhynchocyon* were captured and taken as voucher specimens. The *Rhynchocyon* specimens weighed up to 630g, making them the second heaviest giant-sengi recorded after the Grey-faced sengi (*Rhynchocyon udzungwensis*), which weigh up to 710g (Rovero *et al.* 2008).

Initial morphological comparisons by Rathbun of our Mareja specimens with a skin from Quilimane (the type location for *Rhynchocyon cirnei cirnei* which is housed at the Detong Museum of Natural History) and specimens of *Rhynchocyon* at The Natural History Museum, London, and the California Academy of Sciences, suggest that the Mareja *Rhynchocyon* are representatives of *R. c. cirnei*, which is the same taxon that occurs further south in the Quilimane area.

This preliminary assessment needs to be confirmed with an analysis of DNA. However, we are relatively confident that the “subspecies 7” mentioned in Corbet & Hanks (1968) is not valid and that *Rhynchocyon* in north-eastern coastal Mozambique is very likely *Rhynchocyon cirnei cirnei*.

Petrodromus captures:

A total of 16 *Petrodromus* were caught during the research period. Of these seven were retained as voucher specimens. We immediately noticed the animals we captured lacked ventral bristles on the tail, which are often present in taxa from other areas of central and eastern Africa, including *P. t. rovumae* from eastern Tanzania and north-eastern Mozambique (Corbet & Hanks, 1968). The lack of tail bristles in the specimens from Mareja suggests that they are not representatives of *P. t. rovumae* as suggested by the distribution in Corbet & Hanks (1968). Based on the absence of tail bristles, the Mareja specimens more closely resemble *P. t. beirae* from Beira and Gorongosa districts in Mozambique, and *P. t. warreni* from Northern Kwa-Zulu Natal in South Africa. Additional research on *Petrodromus* will be needed to resolve the confusion on taxonomy and distribution of this taxon.



The Four-toed sengi *Petrodromus tetradactylus*



Rangers assist in building a photo corral which allowed us to photograph captured sengis in their natural forest environment. A corral was necessary as it is extremely hard to get close enough to a free running sengi in the forest to take close up portraits. A ~1.5m high chicken wire arena was constructed round a tree. The wire was buried in the leaf litter and weighted down with logs. Sengis do not burrow so did not attempt to squeeze below the wire. Within the corral they could be easily shepherded into position for photographing.

Petrodromus tetradactylus is examined before being photographed.

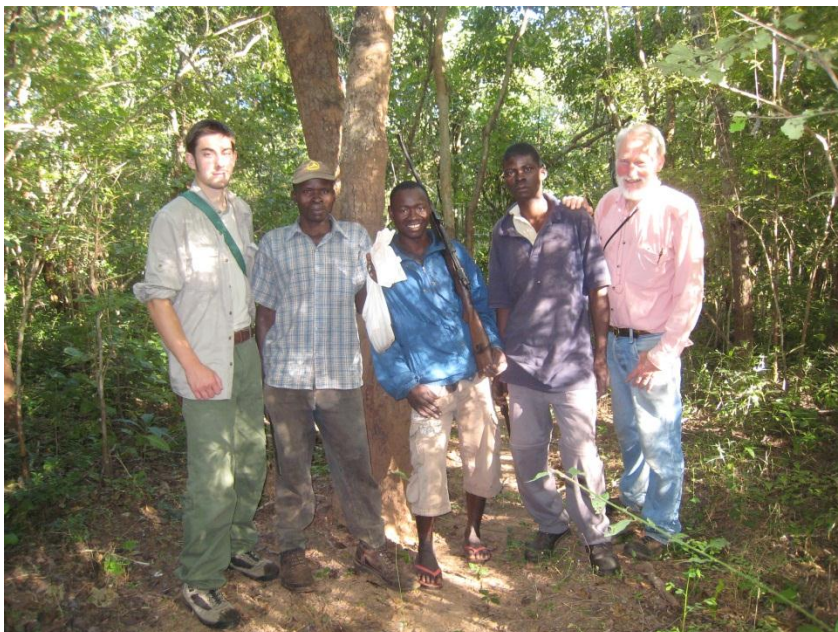
Rodents:

Rodent trapping yielded: *Mastomys sp.*; *Acomys sp.*; *Gerbilliscus* (Formerly *Tatera*) *leucogaster*; *Lemniscomys rosalia*

Only *Gerbilliscus* was already on the Mareja reserve's biological inventory of species occurring there. This inventory is used to direct conservation and management activities, and serves as a baseline for local and international visiting researchers



Bushveld Gerbil *Gerbilliscus leucogaster*



G. Rathbun (right), P. Coals (left) and local rangers with giant-sengi in cloth bag



P. Coals finishing preparation of a *Rhynchocyon* museum study skin at dusk. A tooth brush was used to align the fur before it dried into position.



G. Rathbun shows Mareja reserve scientific coordinator Sophie Scott a sengi in a cotton bag. Each sengi not released immediately was placed individually into a cotton bag to keep it calm and so that it could be safely carried.



The primary target species of our research was the Chequered Sengi *Rhynchocyon cirnei*



Rhynchocyon cirnei is commonly known as the Chequered Sengi due to the patterning of pelage on its back; alternating chestnut and lighter patches. We believe after morphological comparisons conducted by G. Rathbun that these individuals represent the subspecies *Rhynchocyon cirnei cirnei*

Training of local students, tutors and rangers:

Mareja Community Reserve rangers accompanied all work in the field and during this time they became familiar with all aspects of our research, including how to set Tomahawk and Sherman traps as well as gill nets.

We ran a four-day-long training course for two undergraduate students and their tutor from the local university (Unilurio), along with the head of research for Quirimbas National Park. Lessons were given as interactive tutorials; encouraging student participation, and were presented in the context of our work in Mozambique. We covered topics such as basic evolutionary concepts and the diversification of the Afrotheria, along with the conservation of evolutionarily distinct species, how to plan and implement basic biological field studies, the importance of voucher collections, results dissemination and well curated museum collections for taxonomy, and the relevance of taxonomy to conservation.

Students and tutors participated in trapping in the field and learned the applications of different trapping techniques. We were also able to instruct them in how to prepare classical study skins and ensure that they knew why measurements and location data were taken, and emphasise the need for proper museum curation of collections.

At the end of the field course the students prepared a PowerPoint account of their experience, and what they had learned, for presentation to university tutors and students at Unilurio, and some Mareja Community Reserve rangers.

Legacy:

Sengis are thought of as EDGE (Evolutionarily Distinct & Globally Endangered) species (<http://www.edgeofexistence.org>), in addition to their evolutionary distinctness three of the four known species of giant sengis carry an IUCN threatened listing (<http://www.iucnredlist.org>).

Species carrying an IUCN threatened listing and especially EDGE species serve as effective flagship species for conservation. In other areas of threatened coastal forest in East Africa giant sengis have become effective charismatic flagship species for protection not just of the redlisted species but the forests that they inhabit; recognised internationally as important Biodiversity Hotspots (<http://www.biodiversityhotspots.org>). This approach has seen great success in the coastal forest of Kenya in the form of the conservation group “Friends of the Arabuko-Sokoke Forest” which adopted the golden-rumped sengi (*Rhynchocyon chrysopygus*) as their flagship species.

We believe that by actively involving members of the local community along with local students, scientists, national park officials, and other institutions, we have aided in the vital first step towards engaging people in the region with regards to the conservation of these sengis and the threatened forests that they inhabit. Although when planning this expedition we had originally hoped to be able to describe a new subspecies or species of giant sengi in northern Mozambique, which would have served as a strong flagship species, we still believe that we have left a significant legacy to the region in terms of sengi research and conservation.

By the provision of a training course in small mammal field studies, taxonomy and museum specimen curation we hope to have not only increased the research and teaching capacity of the local, poorly resourced, university but also to have stirred interest in local students with regards to studying and conserving their local forests and the wildlife that depends upon them. Some of the specimens we

collected shall be housed at the Universidade Eduardo Mondlane Museu de Historia Natural in Maputo, where as part of collections on three continents they will form a valuable information source to inform future taxonomic, inventory, and conservation work on sengis in Mozambique.

When analyses of the specimens we collected are complete we shall write scientific papers for submission to peer reviewed journals making the results of our research widely and freely available. Information which we collected will also be used to update existing websites on the Afrotheria (<http://www.afrotheria.net>) and sengis (<http://researcharchive.calacademy.org/research/bmammals/eshrews/index.php>) maintained by Dr Galen Rathbun, which collate much of the known information on sengis and are available freely to the public.

Conclusion:

Following our Mozambique expedition and research in June 2011, we believe that the postulated subspecies 7 (Corbet and Hanks, 1968) is not likely to be valid. Little information has been collected on *Rhynchocyon cirnei* in Mozambique since its description in 1847. We were able to confirm new locations in the range of this species, and provide new morphological insights for this taxon in Mozambique.

We were also able to provide new morphological data for *Petrodromus tetradactylus* in northern Mozambique and conclude that they are not representatives of *P. t. rovumae*. Further work is required to resolve the taxonomy and distribution of this taxon.

The existence of *Rhynchocyon* sengis throughout East Africa is threatened by habitat loss and fragmentation (Nicoll & Rathbun 1990). Only by firstly ascertaining which taxa are present in these threatened forests, and secondly by actively engaging the local residents, biologists, and institutions in research and conservation activities can successful conservation of these diverse forests, and the elusive and enigmatic sengis which inhabit them, be achieved.

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