Articles

Distribution of sengis in the Horn of Africa

Galen B. Rathbun[1], Paolo Agnelli[2] & Gianna Innocenti[2]
[1] Department of Vertebrate Zoology and Anthropology, California Academy of Sciences (San Francisco), c/o P.O. Box 202, Cambria, California 93428, USA; grathbun@gmail.com
[2] Natural History Museum, Zoological Section "La Specola", University of Florence, via Romana 17, I-50125 Florence, Italy; paolo.agnelli@unifi.it, gianna.innocenti@unifi.it

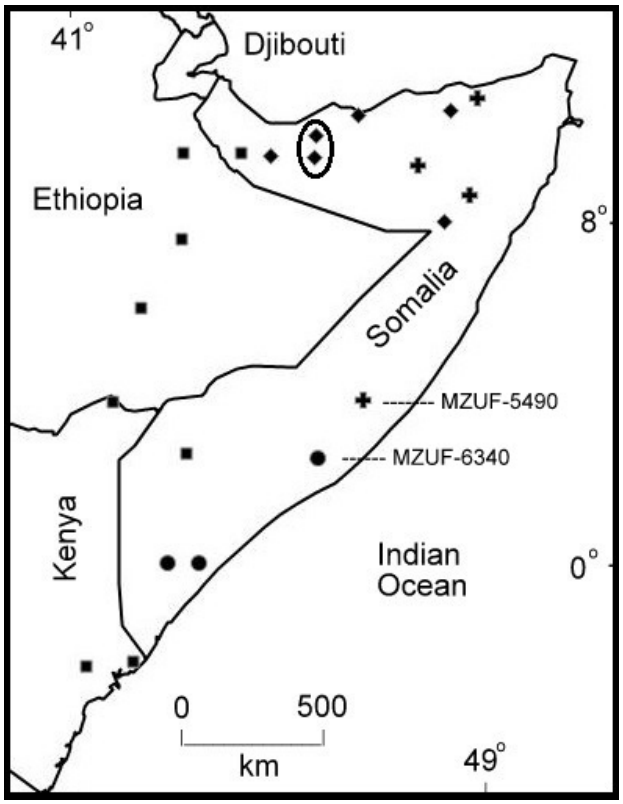
There are 19 recognized species of sengi or elephant-shrew (supercohort Afrotheria, order Macroscelidea), and all are endemic to Africa (Rathbun 2009, Dumbacher *et al.* 2014). The greatest diversity of species is found in southern and eastern Africa, where their distribution and ecology are reasonably well understood (Rathbun 2009, 2014). Among the least well-known species is the Somali sengi, *Elephantulus revoilii*, which is endemic to Somalia. For example, nearly the only information on this sengi is that gathered from 15 museum voucher specimens and presented in the near-definitive taxonomic revision of the order by Corbet and Hanks (1968).

While determining whether there are any sengis in Djibouti, north of Somalia, we (PA and GI) re-examined and re-assessed the identification (criteria from Corbet and Hanks 1968) of sengi specimens in the Zoological Museum of the University of Florence. Although we found no sengi specimens from Djibouti, we discovered three specimens and associated data (Table 1) that extend the distribution of *E. revoilii* in Somalia, mostly to the south by about 475 km (Figs. 1 and 2).

The Somali sengi is thought to be morphologically closely related to the rufous sengi, *Elephantulus rufescens*, (Corbet &Hanks 1968), which also occurs in the Horn of Africa. To better understand the spatial relationship of these two sengis, we mapped all the known locations for *E. revoilii* and all those of *E. rufescens* in Somalia and in adjacent areas of Kenya and Ethiopia (Fig. 1). We did not plot all the known locations of *E. rufescens* because this species is widely distributed, from central Tanzania west into eastern Uganda and the Sudans, and north to the Horn of Africa (Rathbun 2014).

Corbet and Hanks (1968) speculate that *E. revoilii* probably occurs over much of the arid stony habitats in the Horn of Africa, despite only being documented in the past from a small area in northern Somalia. The new data presented here expand the distribution, but still support the species' occurrence in stony arid habitats. Based on the general distribution of the two *Elephantulus* species, it is evident that the habitats that they occupy are different (Corbet & Hanks 1968), with *E. rufescens* being associated with sandy substrates that are often well-vegetated with bushes and low trees, compared to more stony or rocky substrates with sparse vegetation associated with *E. revoilii*. However, the two species may come in contact in some areas (Fig. 1), and these situations warrant closer attention by ecologists and molecular biologists, especially if these two species are determined to be syntopic, or even taxonomically synonymous based on their genetics.

Figure 1. Distribution of *Elephantulus revoilii* and *E. rufescens* in the Horn of Africa.
Locations for *E. revoilii* from Corbet and Hanks (1968) are indicated by a "diamond", and those from the Zoology Museum at the University of Florence by a "plus". Locations for *E. rufescens* from the University of Florence are indicated by a "solid circle" and selected locations from Rathbun (2014) by a "square". Locations from Corbet and Hanks (1968), and many from Rathbun (2014), are centroids of quarter degree squares, whereas locations from Florence are determined by the location of the nearest geographical feature, and often in consultation with the specimen collectors. The ellipse encompassing two locations (Corbet & Hanks 1968) indicate that both species occur at the two locations, suggesting gross sympatry in the area, although presumably they are allotopic. At the map scale, locations that are near each other, appear as one.



Although there has been speculation that *E. revoilii* and *E. rufescens* occur in Djibouti (Scaramella *et al.* 1974, Laurent & Laurent 2002), we are not aware of any voucher specimens or reliable sightings from there, despite some focused field work (Pearch *et al.* 2001). More recently, Nistri and Vanni (2014, personal communication) found no evidence of sengis in Djibouti during their expedition, and we (PA, unpublished data) similarly found none during a 2013 small mammal collecting trip to Djibouti. Although it is possible that sengis have escaped detection in Djibouti, this seems increasingly unlikely given that they are relatively easy to trap (Rathbun & Rathbun 2006), and they are not difficult to see by keen observers during the day, or at dawn and dusk (Rathbun 1979). We hope that this account will result in a greater effort to resolve this issue, especially given that *Elephantulus* in Djibouti would likely represent the furthest northern occurrence, south of the Sahara Desert (Rathbun 2014).

Figure 2. Comparison of dorsal (A) and lateral (B) views of *Elephantulus rufescens* (top; MZUF-6340; head and body length = 130 mm, tail length = 115 mm) and *E. revoilii* (bottom; MZUF-5490; head and body length = 130 mm, tail length = 143 mm) specimens from Somalia. Note proportionally longer tail and lighter pelage in *E. revoilii*.

Table 1. Data associated with Somali specimens of *Elephantulus revoilii* and *E. rufescens* from the Zoology Museum collection at the University of Florence. Catalogue numbers (MZUF-XXXX) are from the museum. Multiple collection dates in a row are in the same order as the multiple catalogue numbers in that row. If multiple specimens are catalogued from the same locality, they are grouped into the same row. Some locations on Figure 1 are not distinguished due to the precision of the map scale and their proximity to a neighboring location. Catalogue number MZUF-5490 represents a remarkable range extension of *E. revoilii*.

MZUF Catalogue Number	Species	Collection Locality	Collection Date	Latitude	Longitude
5490	*E. revoilii*	Bud Bud	16 Aug 1968	4.194	46.469
7852, 7853, 7854, 7855	*E. revoilii*	Migiurtinia (Galgalo)	10, 11, 12, 17 Oct 1973	10.984	49.062
3432, 3433	*E. revoilii*	Run (Garoe, Noghal plains)	7 Aug 1969	8.811	48.892
6279	*E. revoilii*	Run (Garoe, Noghal plains)	12 Aug 1969	8.811	48.892
6284, 6285	*E. revoilii*	Run (Garoe, Noghal plains)	13 Aug 1969	8.811	48.892
6289	*E. revoilii*	Run (Garoe, Noghal plains)	15 Aug 1969	8.811	48.892
6293, 6294	*E. revoilii*	Run (Garoe, Noghal plains)	16 Aug 1969	8.811	48.892
6306, 6310	*E. revoilii*	Run (Garoe, Noghal plains)	19, 20 Aug 1969	8.811	48.892
4200	*E. revoilii*	Somaliland (Ovole/Ovale?)	1896	9.460	47.705
2846, 2847, 2848	*E. rufescens*	Afmadu	8 Aug 1962	0.516	42.062
5811, 5812, 5813, 5814	*E. rufescens*	Afmadu	21 Aug 1970	0.495	42.085
2843, 2844	*E. rufescens*	Afmadu (ca. 14 km W)	7, 8 Aug 1962	0.513	41.946
2973	*E. rufescens*	Gelib (near the Giuba river)	13 Aug 1962	0.492	42.767
6343, 6344	*E. rufescens*	Giohar (6 km N)	28 Aug 1969	2.854	45.457
6340	*E. rufescens*	Giohar (ex Villabruzzi)	28 Aug 1969	2.756	45.478

Because so little is known about *E. revoilii*, it is difficult to determine its status for the Red List of Threatened Species (IUCN 2014). Indeed, in past and current assessments, this Somali endemic sengi is listed as Data Deficient. This difficulty is exacerbated by the lack of recent information. For example, all the sengi specimens at the Florence Museum (Table 1) were collected prior to 1974. Nevertheless, we hope that the new insights we have on its distribution will encourage biologists to gather additional information on this poorly understood sengi so that its status can be more accurately determined.

Acknowledgments

We thank Professor Alberto Maria Simonetta (Department of Biology, Florence University) and Dr Lorenzo Chelazzi (Institute of Ecosystem Study, CNR, Italy) for the information about their expeditions in Somalia and the ecological details on the localities where sengis were captured.

References

Corbet G.B. & Hanks J. 1968. A revision of the elephant-shrews, Family Macroscelididae. *Bulletin of the British Museum. (Natural History) Zoology,* 16: 47-111.

Dumbacher J.P., Rathbun G. B., Osborne T.O., Griffin M., & Eiseb S.J. 2014. A new species of round-eared sengi (genus *Macroscelides*) from Namibia. *Journal of Mammalogy,* 95: 443-454.

IUCN 2014. Red List of Threated Species. Available from http://www.iucnredlist.org/ [13 July 2014].

Laurent A. & Laurent D. 2002. Djibouti au Rythme du Vivant: Les Mammiferes d'hier à aujourd'hui pour demain. Beira CFP, Toulose.

Nistri A. & Vanni S. 2014. Contribution to the knowledge of Djibouti herpetofauna. *Scr. Herp.* 2014: 117-128.
Pearch M.J., Bates P.J.J. & Magin C. 2001. A review of the small mammals of Djibouti and the results of a recent survey. *Mamm,*. 65: 387-409.
Rathbun G. B. 1979. The social structure and ecology of elephant-shrews. *Z. Tierpsychol. (Suppl.),* 20: 1-77.
Rathbun G.B. 2009. Why is there discordant diversity in sengi (Mammalia: Afrotheria: Macroscelidea) taxonomy and ecology? *African Journal of Ecology,* 47**:** 1-13.
Rathbun G.B. 2014. Distribution of sengis or elephant-shrews. Available from http://www.sengis.org/distribution.php [13 July 2014].
Rathbun G.B., Rathbun C.D. 2006. Social structure of the bushveld sengi (*Elephantulus intufi*) in Namibia and the evolution of monogamy in the Macroscelidea. *Journal of Zoology, London,* 269**:** 391-399.
Scaramella D., Russo L.F., D'Enrico F.P. 1974. I mammiferi della Somalia (a livello della sottospecie). *Boll. Soc. Natural. Napoli* 83: 269-331.

The growth of Madagascar's protected areas system and its implications for tenrecs (Afrosoricida, Tenrecidae)

Martin Nicoll & Nanie Ratsifandrihamanana
WWF Madagascar & Western Indian Ocean Programme Office, P.O. Box 738, Antananarivo 101, Madagascar.
menicoll@gmail.com, nratsifandrihamanana@wwf.mg

Introduction

Evolution of Madagascar's protected area network

Madagascar's protected areas system has evolved considerably since the country gained its independence in 1960 with the creation of new institutions, a marked geographical expansion, and a diversification of governance categories tending strongly towards increased local community participation in management.

Madagascar's national parks system was one of the first to be established in 1927 and comprised strict nature reserves representing what we now classify as IUCN Category I sites. By the time of independence in 1960, Madagascar had a network comprising 36 protected areas covering 971,203 ha in three IUCN categories: I (strict nature reserve), II (national park) and IV (special reserve) (IUCN/UNEP/WWF 1987). Subsequently, Madagascar launched an ambitious multi-phase National Environmental Action Plan (NEAP) in 1991 and mandated protected areas management to a new institution, the National Association for the Management of Protected Areas, or ANGAP. By the time the first two NEAP phases had been completed in 2002, the network had increased to 47 protected areas which comprised 39 sites over an area of 1,819,133 ha. The three IUCN categories were retained but all new sites were Category II national parks, signalling a distinct shift in ANGAP's network vision (ANGAP 2001).

The third phase of the NEAP saw the renaming of ANGAP to Madagascar National Parks as well as major changes in protected area management strategies in Madagascar, not least of which was the country's commitment to triple the size of the network to 6 million hectares in five years. In addition, more IUCN management categories were now permitted; these were Category III (natural monument or feature), V (protected landscape/seascape) and VI (protected area with sustainable use of natural resources. Another major change was that protected area creation and management was open to any qualified body including government agencies other than Madagascar National Parks, environmental NGOs, and private entities such as mining companies that were obliged to create new reserves as part of their environmental obligations. The new policy sparked a major effort to design and establish an expanded network based on scientific planning using MARXAN and ZONATION (Kremen *et al.* 2008). These planning exercises aimed to increase the number of species under protection and to establish relatively large protected areas or corridors that would help to maintain ecological processes.

By 2010, when the new Madagascar Protected Areas System (SAPM, including both Madagascar National Parks sites and others) was formally established, the government recognized 148 existing or nascent protected areas covering 6,942,412 ha, though these figures are likely to be significant overestimates (Madagascar National Parks 2014). A significant number of the original proposals to create new protected areas were never realized, in large part because funding for conservation was greatly reduced following a four-year political crisis that began in 2009; there is no reliable estimate of the current number of protected areas although estimates are generally between 80 and 93 (e.g. WWF, in press). All new Madagascar National Parks sites continue to be in Category II while other new protected areas managed by other entities are predominantly in Categories V and VI, with smaller numbers in Category III. These NEAP Phase 3 changes were accompanied by a strong shift towards co-management of protected areas by local communities.

©M.E. Nicoll

Figure 1. Rocky streams in humid forests support the aquatic tenrec, *Limnogale mergulus*, a relatively little known species.

Tenrec diversity, distribution and conservation in Madagascar

The endemic tenrecs are descendants of one of the earliest known mammal groups found on the Madagascar, having rafted from Africa between 42 and 25 million years ago (Poux *et al.* 2005). It is one of four early radiations that dominate Madagascar's living non-volant terrestrial mammalian fauna. Three Malagasy tenrec subfamilies are recognized comprising 32 species