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A bibliography of elephant-shrews or sengis (Macroscelidea)

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INTRODUCTION

The phylogenetic relationships of the elephant-shrews or sengis, a purely African order of small mammals, have long been uncertain (Patterson 1965). In the past they have been allied to many other mammalian orders, but recently it has been suggested that they are best placed in the superorder Afrotheria, along with elephants, sea cows, hyraxes, aardvark, golden moles and tenrecs (Hedges 2001).

These taxonomic proposals have brought additional attention to sengis. While many aspects of their biology have been studied in the past, this information is scattered in a range of different publications and formats and a significant amount was published before the start of electronically searchable databases such as Zoological Record.

To help mammalogists obtain information on this group, we have collected references to publications on all aspects of their biology, from both popular and technical sources. This database is now available in a web-based, searchable bibliography of 750 citations, extending from pre-1800 to early 2001.

METHODS

The references were obtained by searching text and electronic-based databases, by following up citations in reference lists, and by personal contact with authors.

The references were entered in a computer-based bibliographic manager (PAPYRUS) that included standard citation details and keywords to allow searching on subject area (Table 1), species (Table 2), language and geographical area. The database can be accessed at: http://www.calacademy.org/research/bmammals/eshrews/. This site has comprehensive instructions indicating how the database can be searched for authors, titles, journal names or keywords, which can be linked by operators (and, or, not) to allow more detailed and specific searching.

RESULTS

In the 1800s there were only a few references to elephant-shrews each decade, but in the 1900s the numbers increased steadily and there has been a marked increase in the last three decades (Fig. 1).

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Table 1. The list of keywords for subject areas of elephant-shrew references and the number of references for each keyword. Keywords are not mutually exclusive

Keyword	Numbers	Keyword	Numbers
Behaviour	1	Morphology/Embryology	17
Behaviour/Maintenance	47	Morphology/Morphometrics	107
Behaviour/Nutrition	45	Morphology/Nutrition	19
Behaviour/Reproduction	33	Morphology/Reproduction	81
Behaviour/Senses	35	Morphology/Senses	45
Behaviour/Social	39	Morphology/Skeletal	103
Behaviour/Spatial	46	Morphology/Skin	86
Behaviour/Temporal	40	Physiology/Biochemistry	15
Evolution/Molecular	37	Physiology/Circulation	6
Evolution/Palaeontology	49	Physiology/Maintenance	6
Evolution/Phylogeny	167	Physiology/Nutrition	49
Evolution/Taxonomy	115	Physiology/Physiometrics	13
General/Biogeography	167	Physiology/Reproduction	109
General/Distribution	41	Physiology/Senses	1
General/Natural History	71	Population/Commensals	1
Management/Conservation	17	Population/Demographics	7
Management/Ethnobiology	29	Population/Densities	15
Management/Husbandry	68	Population/Habitats	27
Management/Techniques	23	Population/Mortality	30
Morphology	1	Population/Parasites	57
Morphology/Circulation	18	Population/Reproduction	23

Expansions of these keywords, indicating what terms they cover, are given in the web site (see text).

Table 2. List of keywords for living and fossil taxa of elephant-shrews and the numbers of references for each. Taxa named in italics are considered synonyms

Living taxa	Numbers	Fossil taxa	Numbers
Elephant-shrews	100	Chambius kasserinensis	2
Elephantulus	36	Elephantulus antiquus	5
Elephantulus brachyrhynchus	118	Elephantulus broomi	3
Elephantulus brachyura	*1*	Elephantulus langi	5
Elephantulus edwardii	53	Elephantulus typicus	1
Elephantulus fuscipes	26	Herodotius pattersoni	3
Elephantulus fuscus	16	Hiwegicyon	2
Elephantulus intufi	79	Hiwegicyon juvenalis	1
Elephantulus myurus	135	Metoldobotes	7
Elephantulus revoili	16	Metoldobotes stromeri	2
Elephantulus rozeti	83	Miorhynchocyon	2
Elephantulus rufescens	122	Miorhynchocyon clarki	1
Elephantulus rupestris	67	Mylomygale spiersi	6
Macroscelides	1	Myohyrax oswaldi	9
Macroscelides proboscideus	142	Palaeothentoides	2
Petrodromus	2	Palaeothentoides africanus	2
Petrodromus sultani	*12*	Pronasilio	1
Petrodromus tetradactylus	140	Pronasilio ternanensis	1
Petrodromus tordayi	*5*	Protypotheroides	3
Rhynchocyon	21	Protypotheroides beetzi	2
Rhynchocyon chrysopygus	63	Rhynchocyon clarki	4
Rhynchocyon cirnei	72	Rhynchocyon pliocaenicus	2
Rhynchocyon macrurus	*1*	Rhynchocyon rusingae	1
Rhynchocyon petersi	37		
Rhynchocyon stuhlmanni	*12*		

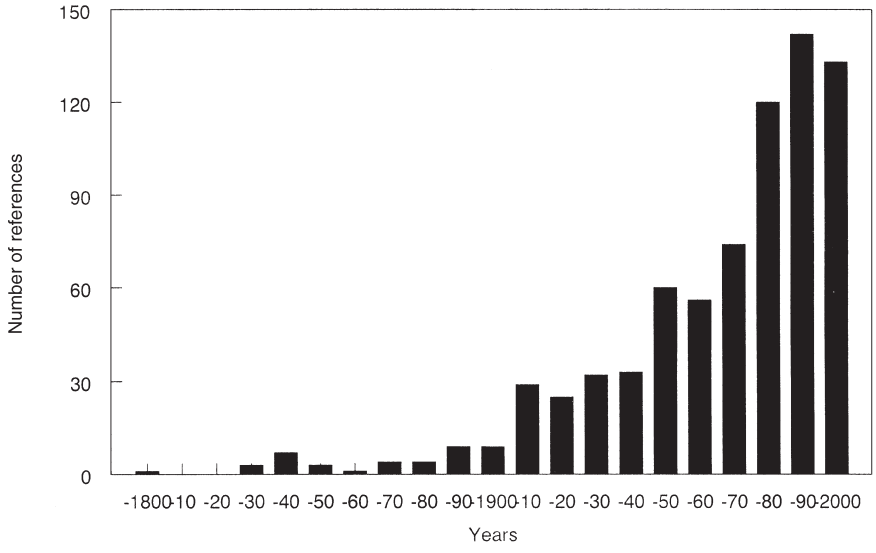

Fig. 1. The number of published references to elephant-shrews in each decade from pre-1800 to 2000.

This recent increase in the number of references has not been consistent across all subject areas. Some areas, such as General Studies, Morphology and Taxonomy (Table 1), have remained relatively stable across the 1900s (Fig. 2a) while other fields, such as Behaviour, Management, Phylogeny, Physiology and Population Studies (Table 1), have all showed a marked increase in the latter part of the century (Fig. 2b).

The majority of the references are in English (620), followed by German (58), French (55), Italian (5), Russian (3), Japanese (2), Spanish (2) and Portuguese (1). In some cases a translation is available for non-English papers and this is indicated by the keyword 'Translation'.

References that cover results from a particular country or region of Africa were assigned country keywords. A large number of references that dealt with laboratory studies in non-African locations were not assigned a country keyword. Southern Africa had the greatest number of references (213: Botswana 5, Lesotho 1, Mozambique 13, Namibia 35, South Africa 128, Southern Africa 12, Swaziland 2, Zimbabwe 17), followed by Central Africa (201: Angola 9, Central Africa 3, Democratic Republic of the Congo 26, East Africa 19, Kenya 58, Malawi 12, Rwanda 1, Tanzania 32, Uganda 6, Zambia 30, Zanzibar 5) and North Africa (70: Algeria 11, Egypt 6, Ethiopia 8, Libya 2, Morocco 14, North Africa 5, Somalia 8, Sudan 3, Tunisia 13).

Fifteen extant and 17 fossil species are represented in the database (Table 2). Ordinal or generic keywords were used for some references that did not refer to species. The best-covered species, in decreasing order, are *Macroscelides proboscideus*, *Petrodromus tetradactylus*, *Elephantulus myurus*, *E. rufescens* and *E. brachyrhynchus*.

DISCUSSION AND CONCLUSIONS

Even though sengis are a relatively small and obscure group of mammals restricted to Africa, there is a surprisingly large body of published information on them that has increased considerably in recent years. The 750 references, which we consider quite complete, compares favourably with the 1050 references recently assembled for the African Elephant *Loxodonta africana* by Bossen (1998).

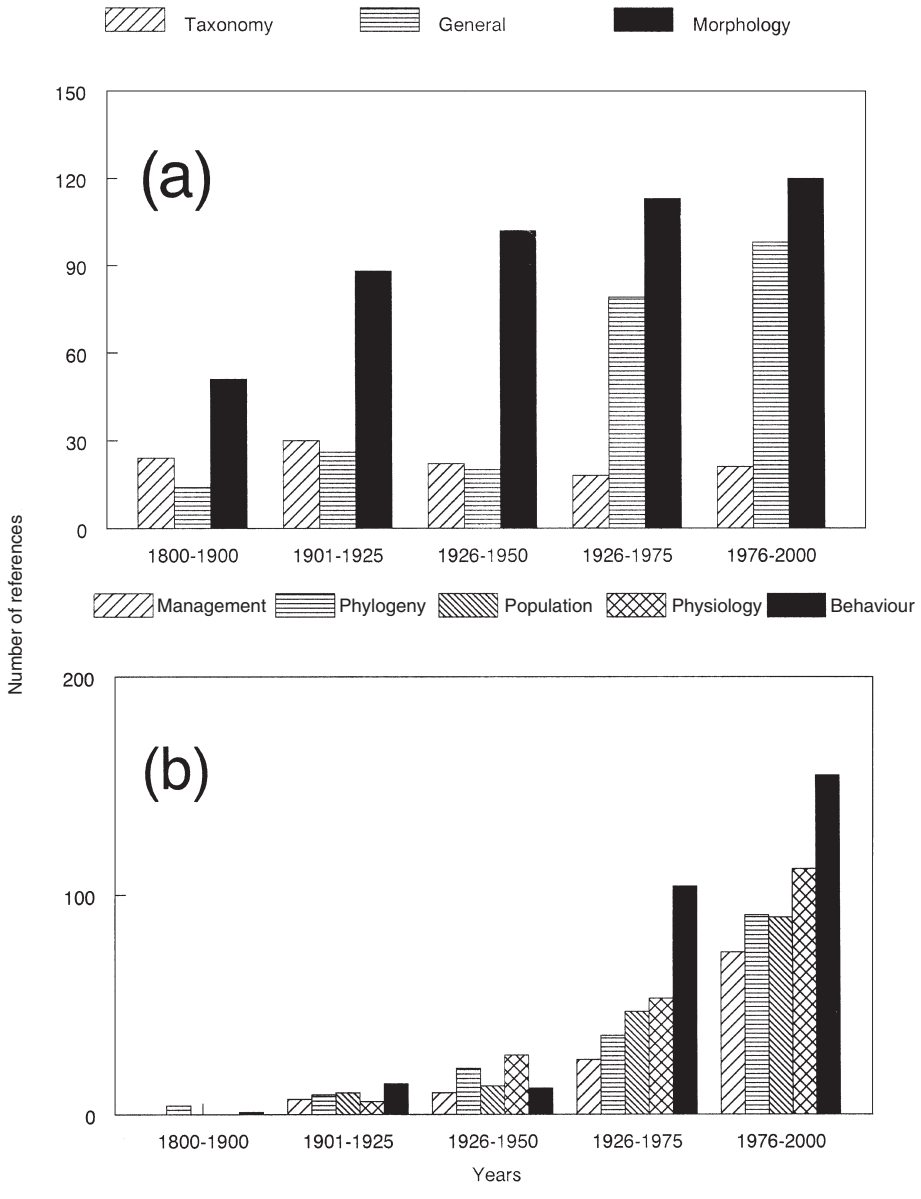

Fig. 2. Changes in the number of published references on elephant-shrews in different subject areas from 1800 to 2000. (a) Subject areas showing little or steady change over this period (General, Morphology and Taxonomy). (b) Subject areas showing marked increases in the last 25–50 years (Behaviour, Management, Phylogeny, Physiology and Populations).

We believe the expanding number of publications on sengis not only reflects the increasing number of biologists working in Africa, but also the expansion of academic institutions and intellectual development in Africa. Those species with wide geographical distributions have been the focus of most publications, and those regions of Africa that support multiple species of sengis similarly have been the focus of most publications. The disproportionate increase in publications on some topics, such as Behaviour and Management, reflects the relatively recent emergence of these disciplines.

A database like ours will never be complete, even for historical records. But in our search for perfection, we would be grateful if authors and researchers would let us know of any errors, omissions or additions to the list for inclusion in future updates.

ACKNOWLEDGEMENTS

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