On small mammals of the Nyika Plateau, Malawi

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Introduction

A characteristic topographical feature of eastern Africa is the chain of isolated mountain groups that runs parallel to the Indian Ocean coast from Ethiopia in the north to the Drakensberg Mountains in the south. These high plateaux are separated by lowland savannas and woodlands and form, from a biogeographical point of view, one of the most famous continental island archipelagos of the world. They contain some of the biologically most diverse and endemic-rich montane ecosystems in the world (WHITE, 1981; HAPPOLD and HAPPOLD, 1989).

The Nyika Plateau in the northern region of Malawi is probably one of the more important yet also the least known of these mountain islands. Its average altitude is 2,300 (600 - 2,600) m above sea level and it includes many of the habitats found throughout Malawi. The most characteristic feature of the Nyika Plateau, however, is the rolling hills covered by grasses. The Nyika Plateau became Malawi's first National Park in 1968. It covers 3,134 sq km and is largely uninhabited and inaccessible (ANSELL and DOWSETT, 1988; HAPPOLD and HAPPOLD, 1989). Although it represents the type locality for several species and subspecies of mammals (some of which bear the name "*nyikae*"), it has remained relatively unstudied from a mamma-

logical point of view. Our knowledge of the mammalian fauna of the Nyika Plateau is mainly based on incidental records.

Material and methods

Two surveys (trapping, mist-netting, digging, collecting remnants of dead animals) of small mammals were conducted in several remote sites on the Nyika Plateau at altitudes ranging from 1,530 - 2,250 m. The first survey was in March-April 1997 (three weeks at the end of the rainy season) and covered the localities Nganda and Mondwe (see below). During the second survey in July 1998 (two weeks in the middle of the dry season), localities Nganda, Chipome and Sawi were visited.

Chipome Valley (S10.20, E33.50, altitude about 1,530 m). *Brachystegia* woodland, tall grasses, shrubs at the river banks.

Mondwe Valley (S10.24, E33.50, altitude 1,760 m). *Brachystegia* woodland, tall grasses, shrubs at the river banks.

Nganda on the South-West Nganda slopes (S10.26, E 33.51, altitude 2,200-2,300 m). Alpine meadows with shrub patches at the river banks.

Sawi River at Bunthukwa Msisya village (S10.20, E33.53; altitude about 1,500 m). High grasses and shrubs at the river banks.

Live traps (Sherman, Longworth and small cage traps) were baited with peanut butter mixed with canned fish-oil. The number of trap nights was 475 in 1997 and 370 in 1998. Mist-netting was performed only incidentally at some suitable places where bats were sighted.

Reference specimens are deposited in the Senckenberg Museum, Frankfurt am Main, Germany. Chromosome preparations were obtained in the field, directly from the bone marrow of long bones using the standard method (LEE, 1969; LEE and ELDER, 1977), and are deposited at the Department of General Zoology, Faculty of Biosciences, University of Essen, Germany. Authorship and publication dates of rodent species are given in Table 1, otherwise quoted in the text.

Results

The mammals recorded during our surveys include two species of macroscelids (*Rhynchocyon cirnei* and *Elephantulus brachyurus*) from Nganda and Chipome respectively, four species of shrews: *Crocidura luna* (Chipome, Nganda, Mondwe), *C. nigrofusca* (Nganda), *C. occidentalis* (Nganda), and *C. hirta* (Nganda, new record for Nyika) and new records of bats for the Nyika Plateau (see below). We also recorded 20 species of rodents out of the 39 currently known to occur on the Nyika Plateau (our results being included, cf. table 1).

Noteworthy species records

Crocidura hirta hirta Peters, 1852: New for the Nyika Plateau and montane regions of northern Malawi in general.

Epomops dobsonii (Bocage, 1889): Previously known from few Malawi localities only, this species is recorded for the first time from the Nyika Plateau in Chipome Valley. Its presence here may be seasonal in dependence of available food sources.

Plerotes anchietae (Seabra, 1900): Details of this addition to the Malawi fauna have been published by KOCK *et al.* (1998).

Rhinolophus simulator Andersen, 1904: A single specimen obtained at Nganga Hill, is of dimensions comparable to other specimens of *R. simulator* from this part of central Africa (HAPPOLD *et al.*, 1988). A horseshoe bat only doubtfully referred to *R. simulator* was colleted by ANSELL and ANSELL (1973: postscript) on the Zambian Nyika Plateau. That specimen is clearly larger and its specific identity remains to be confirmed.

Pipistrellus nanus (Peters, 1852): Of this species widely distributed in Malawi, two males from Chelinda, 2,300 m, represent the first record on the Nyika Plateau. These specimens do not possess paired glands on the tail. Such glands were found by HAPPOLD and HAPPOLD (1996) in thatch-roosting *P. nanus*, whereas leaf-roosting individuals

	Rodentia recorded in Nyika	1997	1998	Localities	note
1	*Heliosciurus mutabilis* (PETERS 1852)	-	-		
2	*Paraxerus lucifer* (THOMAS 1897)	-	-		
3	*Paraxerus cepapi* (A. SMITH 1836)	-	-		
4	*Tatera boehmi* (NOACK 1887)	-	-		
5	*Cricetomys gambianus* WATERHOUSE 1840	-	-		
6	***Saccostomus campestris* PETERS 1846**	-	1	C	nrN
7	*Beamys major* DOLLMAN 1914	-	-		
8	***Dendromus nyikae* WROUGHTON 1909**	-	3	N	
9	*Dendromus melanotis* A. SMITH 1834	-	-		
10	*Dendromus mesomelas* BRANTS 1827	-	-		
11	*Dendromus mystacalis* HEUGLIN 1863	-	-		
12	***Steatomys pratensis* PETERS 1846**	-	1	C	nrN
13	***Acomys spinosissimus* PETERS 1852**	-	14	C,S	nrN
14	*Pelomys fallax* (PETERS 1852)	-	-		
15	***Mylomys dybowskii* (POUSARGUES 1893)**	1	-	N	nrM
16	*Lemniscomys rosalia* (THOMAS 1904)	-	-		
17	***Rhabdomys pumilio* (SPARRMAN 1784)**	21	8	N	
18	***Zelotomys hildegardeae* (THOMAS 1902)**	2	3	C, N	
19	*Dasymys incomtus* (Sundevall 1847)	-	-		
20	*Grammomys cometes* (THOMAS & WROUGHTON 1908)	-	-		
21	**Grammomys ibeanus (OSGOOD 1910)**	22	7	M, N, S	nrM
22	***Mus triton* (THOMAS 1909)**	14	14	C, M, N, S	
23	*Mus minutoides* A. SMITH 1834	-	-		
24	***Lophuromys flavopunctatus* THOMAS 1888**	17	10	N	
25	***Praomys delectorum* (THOMAS 1910)**	1	1	C, N	
26	***Mastomys natalensis* (A. SMITH 1834)**	2	1	C	
27	***Aethomys chrysophilus* (DE WINTON 1897)**	-	7	C, S	
28	***Aethomys nyikae* (THOMAS 1897)**	1	-	N	
29	***Rattus rattus* (LINNAEUS 1758)**	1	-	Chelinda	
30	*Otomys angoniensis* WROUGHTON 1906	-	-		
31	*Otomys denti kempi* DOLLMAN 1915	-	-		
32	***Otomys typus uzungwensis* LAWRENCE & LOVERIDGE 1953**	-	1	N	
33	*Graphiurus murinus* (DESMAREST 1822)	-	-		
34	***Graphiurus microtis* (NOACK 1887)**	2	2	C, N	
35	*Graphiurus kelleni* (REUVENS 1890)	-	-		
36	***Cryptomys whytei* (THOMAS 1897)**	1	-	M	
37	***Heliophobius argenteocinereus angonicus* THOMAS 1917**	2	1	N	
38	*Thryonomys gregorianus* (THOMAS 1894)	-	-		
39	***Hystrix africaeaustralis* PETERS 1852**	1	-	M	

Table 1
Comparison of the results (species and numbers of specimens of Rodentia obtained) of our recent survey in 1997 and 1998 with the complete list of rodent species reported from Nyika until present (as summarized by ANSELL and DOWSETT 1988, HANNEY 1965, CRITCHLOW in press, results of our surveys being incorporated). Conventional taxonomy is followed. The number of caught specimens is given, nrM = new records for Malawi, nrN = new records for Nyika. Localities: C = Chipome, M = Mondwe, N = Nganda, S = Sawi.

do not have these glands. Pending further generic revisions, the older name *P. africanus* (Rüppell, 1842) is not used here.

Saccostomus campestris elegans Thomas, 1897: Records from northern Malawi are rather rare and the finding of this species in Chipome Valley is new for the Nyika and montane regions in general (ANSELL and DOWSETT, 1988). In regard of the chromosomal variability of neighbouring populations, we assign the single specimen collected to the subspecies *elegans*, described from Karonga at Lake Malawi.

Steatomys pratensis Peters, 1846: Known mainly from southern Malawi, a single specimen has been collected in Chipome Valley, for the first time on the Nyika and in montane regions of northern Malawi in general.

Mylomys dybowskii (Pousargues, 1893): This species is new to the Malawi fauna. Our finding apparently documents an isolated population. The nearest known occurrences of this species are in the Mahali Mts. on the western side of Lake Tanganyika, eastern Tanzania (ROSEVEAR, 1969) and in southern Kenya (KINGDON, 1974). Compared to specimens from the west side of Lake Kivu, NE-Zaire, the present specimen is smaller in external dimensions (probably due to age), but no characters were observed in coloration or skull features to distinguish between the two populations.

Grammomys ibeanus (Osgood, 1910): Although MUSSER and CARLETON (1993) quote ANSELL and DOWSETT (1988, under *G. cometes*) for the occurrence of this species in Malawi, it is here formally listed for the first time in Malawi. ANSELL & DOWSETT (1988) quote specimens and records of *G. cometes* (THOMAS and WROUGHTON, 1908) from the Nyika Plateau, but it has not been confirmed if these are indeed *G. ibeanus* or belong to G. *dolichurus* (SMUTS, 1832), the latter being known from the Zambian part of the Nyika as well as from its Malawian part (INGLES, 1965; HAPPOLD and HAPPOLD, 1989).

Acomys spinosissimus (Peters, 1852): While THOMAS (1898) recorded this species (as *A. selousi* De Winton, 1896) from the Nyika Plateau at 6-7,000 ft., and LAWRENCE and LOVERIDGE (1953) confirmed its occurrence, based on specimens from above Nchenachena, 7,500 ft., no spiny mice were obtained by HANNEY (1962). Consequently ANSELL (1964) noted that the occurrence of this species on the Nyika

Plateau was unconfirmed, and finally HANNEY (1965) stated *Acomys* to be absent from the Nyika. The above material confirms *A. spinosissimus selousi* to be present.

Elephantulus brachyrhynchus (A. Smith, 1836): This elephant shrew was recorded from the Nyika by THOMAS (1898), but ANSELL (1978) thought it likely that this occurrence was below the true montane part. No substantiation coming forth, ANSELL and DOWSETT (1988) and ANSELL (1989) stated that *E. brachyrhynchus* is not found in montane zones of the Nyika Plateau. The present specimen, being collected on the Sawi River, 1,500 m, demonstrates the species to be at least fringing the montane region of the Nyika.

Remarks on nomenclature

Crocidura occidentalis (Pucheran, 1855): Used since *C. olivieri* (Lesson, 1827) is a *nomen dubium* (see HEIM DE BALSAC & BARLOY, 1966). The neotype fixation by CORBET (1978) is based on a bibliographical reference only and therefore *C. olivieri* is validated by this act and has to be quoted from CORBET (1978). However, *C. olivieri* is antedated by *C. flavescens deltae* Heim de Balsac & Barloy, 1966 (with identical neotype as *C. olivieri*). If conspecifity of the giant shrew from Lower Egypt with the West African shrew of similar size, *C. occidentalis*, is assumed, the latter name has priority.

Crocidura nigrofusca nyikae Dollman, 1915: This is the *C. zaodon* Osgood, 1910 of ANSELL and DOWSETT (1988).

Cryptomys whytei (Thomas, 1897): Described from Karonga, on the NW-shore of Lake Malawi, was considered a subspecies of *C. hottentotus* by subsequent authors. Other specimens from the same collection, but from a different collecting site, the top of the Nyika Plateau, were referred to the same taxon (THOMAS, 1897, 1898). Although we have ourselves not examined mole-rats from the type locality, we have studied karyotypes of single individuals from Kasama (ref. grid 1031-A) (KAWALIKA *et al.*, this volume) and from Malawian Nyika (ref. grid 1033-B) (BURDA and CHITAUKALI, unpubl. data). Animals from both localities are chromosomally clearly distinct from each other and from all other *Cryptomys* Gray 1864, and particularly from

C. hottentotus (Lesson, 1826) studied to date. Consequently we designate the Nyika specimen provisionally as *C. whytei* on the basis of geographical vicinity to Karonga and since it is clearly distinct from *C. hottentotus* from South Africa, from which it is also geographically widely separated by intervening species, again clearly different.

Preliminary karyological, morphological and morphometrical data suggest that several species differ significantly from the taxa they have been conventionally identified with. They possibly represent taxa until present undefined and may need to be described as new forms: thus *Mus* (2n = 18), *Cryptomys* (2n = 46), *Heliophobius* (2n = 56-58), *Lophuromys* (2n = 60-68), *Grammomys* (2n = 44-48) and *Graphiurus* (2n = 52) possess undescribed karyotypes. Detailed analyses will be published elsewhere.

Discussion

Although several mammalogical surveys have been made on the Nyika Plateau already, the studies cannot be easily compared. W.F.H. ANSELL and some other authors (cf. ANSELL and DOWSETT, 1988) collected mostly on the Zambian side of the Nyika Plateau or in less remote areas (as e.g. near Chelinda settlement). Data which would enable quantitative comparison of ecological parameters were usually not provided by earlier authors. Only two more recent surveys (OVERTON and NURSAW, 1972; HAPPOLD and HAPPOLD, 1989) can be partly compared. In Table 2 we have extracted available data referring to comparable methods and comparable habitats.

One has to be cautious when comparing quantitative (maybe even qualitative) aspects of the above studies. They have been made in different localities, in different years, partly in different seasons, and had different durations. They also used partly different types of traps. Trapping success ranged a great deal according to the particular sites, and seemed to be independent of the period of the year. Since the low mean trapping success in some studies has been compensated by the intensity of trapping, at the end all four studies resulted in comparable numbers of specimens caught. The numbers of specimens caught as well as the spectrum of the most frequently caught species

Locality	Date	Season	Trap nights	Specimens	Mean trap success (%)	Species	Specimens / species	Authors
diverse localities	July-Sept. 1972	dry	1,325	98	7.5	12	8.2	OVERTON & NURSAW 1971
Chelinda	April - May 1985	rainy-dry	525	74	14.1	5	14.8	HAPPOLD & HAPPOLD 1989
Nganda, Mondwe	March-April 1997	rainy	475	83	17.5	10	8.3	present report
Nganda, Chipome, Sawi	July 1998	dry	370	82	22.2	16	5.1	present report

Table 2
Comparison of trapping studies of small mammals performed in Nyika montane grasslands. Only small mammals caught by means of trapping in comparable habitats (montane grasslands with bracken at an altitude of about 1,500-2,300 m) are considered. Trapping success represents a mean value.

(*Lophuromys flavopunctatus*, *Grammomys ibeanus*, *Rhabdomys pumilio*, *Mus triton*) were rather comparable in all four studies. It may be of interest that the number of species recorded in remote areas (present study and study of OVERTON and NURSAW, 1972) was more than twice as high as in the survey of the fauna near the Chelinda settlement (HAPPPOLD and HAPPOLD, 1989). Although one is tempted to speculate whether this may be the effect of human-induced disturbance in the montane habitats, we point out that it would be premature to make such conclusions at the present state of knowledge and further studies are necessary.

The seasonal effect on the community of small mammals is apparent from the comparison of the results of the two surveys using the same method at the very same place, SE slope of Mt. Nganda (tabl. 3). In each season eight species (*Rhabdomys pumilio*, *Grammomys ibeanus*, *Lophuromys flavopunctatus*, *Mus triton*, *Zelotomys hildegardae*, *Praomys delectorum*, *Crocidura luna* and *C. nigrofusca*) were constantly recorded, with three additional species (*Graphiurus microtis*, *Aethomys nyikae*, *Mylomys dybowskii*) being trapped during the rainy season and four additional species (*Crocidura hirta*, *C. occidentalis*, *Dendromus nyikae*, *Otomys typus unzungwensis*) in the dry

		Rainy season 1997				Dry season 1998				Total
		M	F	juv	%	M	F	juv	%	%
1	*Rhabdomys pumilio*	8	8	5	25.9	8	0	0	15.7	22.0
2	*Grammomys ibeanus*	7	7	7	25.9	4	3	0	13.7	21.2
3	*Lophuromys flavopunctatus*	9	6	2	21.0	9	1	0	19.6	20.4
4	*Mus triton*	4	7	2	16.0	3	0	8	21.6	18.2
5	*Zelotomys hildegardeae*	2	0	0	2.5	2	0	0	3.9	3.0
6	*Crocidura luna*	1	0	0	1.2	2	1	0	5.9	3.0
7	*Crocidura nigrofusca*	1	0	0	1.2	2	1	0	5.9	3.0
8	*Dendromus nyikae*	0	0	0	0	1	1	1	5.9	2.3
9	*Graphiurus microtis*	0	1	1	2.5	0	0	0	0	1.5
10	*Praomys delectorum*	1	0	0	1.2	0	0	1	2.0	0.7
11	*Aethomys nyikae*	1	0	0	1.2	0	0	0	0	0.7
12	*Mylomys dybowskii*	0	1	0	1.2	0	0	0	0	0.7
13	*Otomys typus unzungwensis*	0	0	0	0	1	0	0	2.0	0.7
14	*Crocidura hirta*	0	0	0	0	1	0	0	2.0	0.7
15	*Crocidura occidentalis*	0	0	0	0	1	0	0	2.0	0.7
	total specimens	34	30	17	100	34	7	10	100	100
		81				51				

Table 3
Comparison of trapping surveys at the same locality (SE slope of Nganda, S10.26, E33.51, altitude about 2,250 m; alpine meadows with shrub patches and the river bank) during the rainy season (March/April 1997) and the dry season (July 1998).

season. Despite the fact that fewer specimens (51) were caught during the dry season (the number of trap nights was lower) than in the rainy season (81), the species spectrum was a little richer during the dry period (note, however, that only two seasons were compared).

Rhabdomys pumilio, *Grammomys ibeanus*, *Lophuromys flavopunctatus*, and *Mus triton* were dominant species in both seasons, and contributed to about 80% of all the catches. Within the habitat generally designed as "montane grasslands", *R. pumilio* and *M. triton* seemed to prefer the open grassland, *L. flavopunctatus* was trapped usually on mesic sites close to swamps and river banks, and *G. ibeanus* was found mostly near bracken and shrubs. Our data do not support

the conclusion by HAPPOLD and HAPPOLD (1989) that there is a competitive exclusion of smaller *M. triton* by larger *R. pumilio*. Whereas in all the rodent species, both sexes and different age/weight classes (including pregnant and lactating females) were trapped during the rainy season, the sex ratio was significantly biased in favour of adult males during the dry period. Indeed, apart from *G. ibeanus* and *Dendromus nyikae*, catches of all other species consisted (almost) only of adult males, indicating their high dispersing activity during the dry season which contrasted with the lowered activity and/or trappability of females and absence of juveniles during this time.

Of a total of 55 species of rodents (according to conventional taxonomy) recorded so far from Malawi, 40 (73%) have been found on the Nyika Plateau. *Otomys typus* and *Mylomys dybowskii* are known in Malawi only from the Nyika Plateau, as is *Plerotes anchietae* (KOCK *et al.*, 1997). For about 15 further species of rodents, the Nyika represents one of altogether only two to ten known localities of occurrence in Malawi. Of a total of 56 species of bats recorded from Malawi, at least 13 (24%) occur on the Nyika, all four species collected during our surveys being new records.

All these aspects demonstrate the species richness, uniqueness, and conservation value of the Nyika Plateau and its importance as an evolutionary theatre where speciation, divergence and adaptive radiation and/or refuge of small mammals have taken place. At the same time the need for further research (both faunistic survey and ecological studies) is apparent.

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