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Mammals, other than bats, from the Misotshi-Kabogo highlands (eastern Democratic Republic of Congo), with the description of two new species (Mammalia: Soricidae)

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Abstract. The Albertine Rift has recently been declared by Plumptre et al. (2007a) as one of Africa's biodiversity hotspots due to the high number of species and high levels of endemism. Here we report on a recent but brief survey of mammals from the Misotshi-Kabogo highlands of the eastern Democratic Republic of Congo. This represents the first effort to document the mammal community of the region. Remarkably, the collection includes at least three species of mammals new to science: two species of shrews (Soricidae) described here and one species of horse-shoe bat (Rhinolophidae, Kerbis Peterhans et al. 2013). A total of five mammal taxa are now known exclusively from this forest. One of the shrews (*Myosorex* n. sp.) which we describe here continues to fill in distributional gaps of this typically montane-restricted genus. Several of the large mammal taxa provide significant range records, especially as southern terminals for species' distribution. Together the data recorded here demonstrate the need for conserving this isolated and heretofore unrecognized reservoir of biodiversity.

Key words. Soricidae, Mammalia, Democratic Republic of Congo, Misotshi-Kabogo Highlands, Albertine Rift, endemism, new species.

INTRODUCTION

The Albertine Rift montane zone of central Africa, extending from the Blue Mountains in the north (ca. 2°N, 30°30'E) to the southern end of Lake Tanganyika (ca. 9°S, 30°30'E) has only recently been declared one of Africa's biological hot spots due to high levels of species diversity and endemism (summarized in Plumptre et al. 2007a). Although many surveys have been conducted and published on the gorilla-inhabited Virunga-Bwindi heartland, many isolated areas, especially Congolese landscapes peripheral to this heartland, have never been properly studied. Such areas include the Blue Mountains to the north and the Itombwe Massif, Misotshi-Kabogo Highlands and Marungu Plateau to the south. The Misotshi-Kabogo highlands (5°–6° S) overlook the middle of Lake Tanganyika. The last survey on vertebrates in the region was conducted by Prigogine in the 1950's (Prigogine 1960) who documented the bird community and described one species new to science, the Kabobo Apalis (*Apalis kaboboensis*). As for mammals, we are only aware of Prigogine's list (1960) of large mammals and short notes on a single squirrel and single colobus monkey both collected by Prigogine during his time there and both described as sub-specifically distinct (Verheyen 1959, 1960). Here we report on a brief survey in these highlands that provides the first records of terrestrial small mammals for the region, including two species (Soricidae) that are new to science. Although some of this information has been published already (see Plumptre et al. 2007b), these data are so important that formal publication is warranted.

MATERIALS AND METHODS

Different means were used to survey the small and large mammal communities. Small mammals were actively collected from three campsites between 28 January, 2007 and 26 February, 2007, in the Misotshi-Kabogo highlands just north of the town of Kalemie (once known as Albertville, 05° 56'S, 29° 12'E), eastern Democratic Republic of Congo. Shrew sampling was attempted using pitfall bucket lines. These consisted of a total of fifteen to seventeen 5 liter buckets individually set five meters apart. Plastic

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sheeting, ca 25 cm high, served as a drift fence over the midline of the buckets (see Voss & Emmons 1996). A pitfall line was set at each of the first two camps (68 bucket nights and 75 bucket nights respectively) but without any success. Fourteen conventional 'rodent' trap lines collected all shrews and mice. Camp one had six trap lines while camps two and three had four each. Trap number ranged from 35 to 63 traps per line. Trap lines varied in trap number and duration due to shifting camps and varying personnel availability. The majority of traps were placed on the ground. Others were set near streams and others above the ground on vines, tree limbs or fallen logs. A mixture of peanut butter and oatmeal was used as bait but occasionally fish and corn kernels were employed. All of the trap lines and pitfall lines were set within 500 meters of the respective camp site.

We used a combination of methodologies to determine which large mammal species currently occur in the Misotshi-Kabogo forest (Plumptre et al. 2007b). We interviewed hunters actively working in the forest today as well as former military who were active there during times of civil strife. These people were interviewed about which large mammal species they had seen in the forest and where they saw them. We used Kingdon's (1997) Field Guide to African Mammals to show local hunters pictures of the animals and then cross-checked their identifications by asking them about the behavior of the animal. We also asked people in villages to show us any skins of animals to cross-check the list obtained by talking to hunters. One hyrax skin and several carnivore skins were purchased from local people. A brush-tailed porcupine (*Atherurus africanus*) was snared by one of the camp staff and a black-fronted duiker (*Cephalophus nigrifrons*) was found in a snare while surveying transects (see below).

We also attempted to collect data on large mammals by walking along transects in fixed compass directions from one of eight camp sites (Plumptre et al. 2007b). Where only gallery forest existed, zigzag transects were covered to maximize the time spent in this forest type before moving towards the next patch of forest. The zigzag transects extended beyond the forest by 500 meters before returning back to the forest. In this way some sampling was made in the woodlands around the gallery forests but most of the effort was concentrated in the forests. Densities for certain species could be calculated for the forest and the surrounding 500 m of woodland from these data. Once a patch of forest had been surveyed with the zigzag transects, a walk was made following a fixed compass direction to the next patch of forest.

At each camp site a transect or reconnaissance walk was made each day following a compass direction where possible but deviating when the terrain became impassable or if in gallery forest. Much of the Misotshi-Kabogo forest consists of very steep hillsides which have been cut by fast running rivers. Many of the rivers have cliffs along their course making traversing them very difficult. We therefore used reconnaissance walk methods whenever we reached a point that was impassable and then selected a new compass direction. GPS positions were taken for any sighting of an animal or its signs (nest or dung of elephant and pigs) and also every 250 m a GPS position was taken with a description of the habitat type. This allowed us to map where teams had visited and also helped ground truth the satellite classifications.

Data collected for all specimens included the macrohabitat, sex, and reproductive condition. On the morning of capture, the following standard external measurements were taken: total length (TL), tail vertebrae length (TV), hind foot length (HF), ear length (E) and mass (WT). Head and body length (HB) is determined by subtracting TV from TL; due to damage to specimens and tails by ants, tables display HB rather than TL. Metrics posted in the Tables are for adult specimens only. For taxa represented by multiple individuals, metrics are pooled, then averaged. CR refers to crown-rump length of embryos. Voucher specimens were prepared as study skins and skeletons or were preserved in 10 % formalin. For the latter group, skulls were later extracted at the Field Museum of Natural History in Chicago and transferred to 70 % ethanol. The nature of the specimen preserved (cond) is recorded as ssk (skin, skull and skeleton), alc (alcoholic carcass), asr (alcoholic carcass with skull removed), or sko (skull and skeleton only).

Cranio-dental measurements were taken at the Field Museum of Natural History using Mitutoyo CD-6"CSX calipers to the nearest .01 mm. These include the following: CI (condylo-incisive length), GB (greatest breadth of skull), MX (breadth of the maxilla), UTR (length of the upper tooth row), HCC (height of the cranial capsule, measured in the sagittal plane), PGL (post-glenoid breadth), IO (inter-orbital breadth), MD (mandible length from the tip of the anteromost incisor to rear of the mandibular condyle), LTR (length of the lower tooth row), COR (height of the coronoid process of the mandible). Measurements are given in millimetres, body mass in grams.

Full technical names (based on the respective chapters in Wilson & Reeder 2005) for larger mammals are listed in Table 2; for the small mammal species they are given in the text.

Tissue samples were stored in the field in a saturated NaCl / EDTA buffer. Upon returning from the field, tissues were stored in an ultra-cold freezer at -70°C. In the field, animals were handled in accordance with American Society of Mammalogists guidelines (Animal Care and Use Committee 1998).

Specimens discussed herein were collected during the course of the Misotshi-Kabobo expedition (see Acknowledgements), supplementing the records of Prigogine (1960). Specimens were compared with material from the

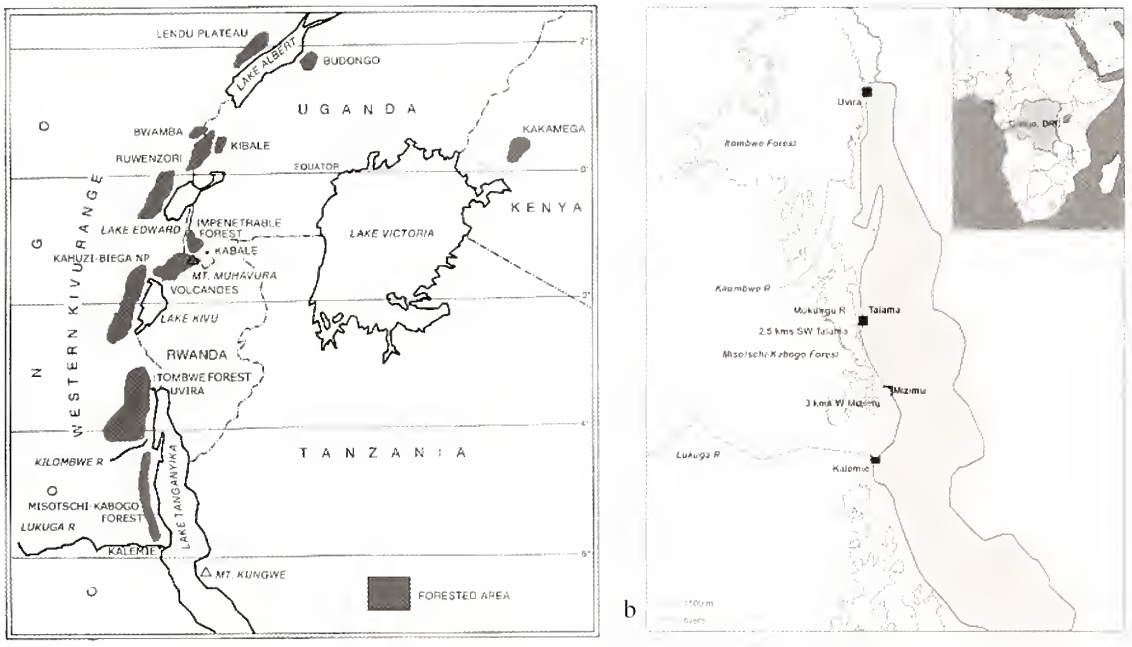

Fig. 1. Map of the Albertine Rift with the Misotshi-Kabogo highlands (a), and position of the three collecting localities (b).

following institutions: The Field Museum of Natural History, Chicago (FMNH); the United States National Museum, Washington D.C. (USNM); and the Zoologisches Forschungsmuseum Alexander Koenig, Bonn (ZFMK). All specimens are deposited at the Field Museum of Natural History, Chicago, IL. JCKP are the abbreviations for the senior author. Unless otherwise noted, taxonomy and distributional notes for all mammals are from the relevant chapters in Wilson & Reeder (2005) and Kingdon (1997).

STUDY AREA

Prigogine (1960) and Plumptre et al. (2007b) reviewed some of the biology of the area and provided notes on biogeographic boundaries. The Misotshi-Kabogo highlands are separated from the Itombwe massif to the north by a 50 km wide savannah through which crosses the Kilombwe River (Fig. 1a). This savannah constitutes a barrier for some bird species (Prigogine 1960), which must be true for some mammals as well. The absence of forest in the Kilombwe valley may be caused by the low rainfall and low humidity due to strong winds that favour herbaceous vegetation. The Marungu highlands lie to the south and are separated from the Misotshi-Kabogo highlands by the Lukuga River. Both rivers formed following the tectonic activity and uplift that created these highlands on the western shore of Lake Tanganyika. To the west, gallery forest and savannah continue for hundreds of kilometres south of the main Congo Basin Forest Block (Plumptre et al. 2007b). The Misotshi-Kabogo highlands run approximately 100 km along the escarpment above Lake Tanganyika at an estimated width of 10–20 km. On the western slopes, the forest descends the valleys as gallery forest; while in the east, it is continuous along Lake Tanganyika where it reaches 2500–2750 m (Prigogine 1960; Plumptre et al. 2007b). The forested escarpment persists uninterrupted to the lakeshore at 770 m. The main forest block is approximately 1,000 km^2 in size.

Three camps (Fig. 1b) for small mammals within the Misotshi-Kabogo forest were accessed from two different fishing villages along the Lake Tanganyika shoreline (Huhndorf & Kalcme 2007). The first camp (29 Jan–7 Feb) was established approximately 3 km west of Mizimu fishing village (5°28'45"S, 29°16'22"E) at an elevation of 1250 meters. Traps were placed in primary forest along the ridge and peripheral to a creek edge. Trap lines at this location were then relocated along the forest edge and secondary growth. This habitat can be described as transitional between lowland and montane and was close to the forest edge. The other camps were established further north and were accessed from Talama fishing village near the base of Mt. Misotshi. After climbing a steep grassy ridge, the forest was reached and camp was set within a horseshoe bend of the Mukungu River. The second camp (4°59'29"S, 29°4'49"E, 1950 m) (13 Feb 2007–17 Feb 2007) was established approximately 4 km southwest of Talama. Some traps were again set along the riverbank but mostly along a dry hill slope. Later, traps were shifted to higher ground with fewer, but larger trees

Table 1. Small terrestrial mammals of the Misotshi-Kabobo highlands. Bold = Albertine Rift endemic, SL = southern limit of distribution.

Camp		**1**	**3**	**2**
Habitat	Degraded	lowland-montane forest transition	drier forest on eastern escarpment	wet montane forest
Elevation	790 m	1250 m	1600 m	1950 m
Species				
Crocidura c.f. *dolichura*			1	
Crocidura c.f. *fuscomurina*		1		
Crocidura olivieri	1	7		
***Crocidura* n. sp.**		1		
***Myosorex* n. sp.**				1
Graphiurus murinus				1
Lophuromys aquilus	3	3	5	
Hybomys aff. *univittatus*		3		6
Hylomyscus stella		12	1	
Mus minutoides	2			
Mus triton	1			
Pelomys minor		1		
***Praomys degraaffi* SL**				2
Praomys jacksoni	4	43	15	1
Praomys sp.			1	
Rattus rattus		1		
Total specimens (# species)	11 (5)	72 (9)	23 (5)	11 (5)
Trap effort and success	Na	72/783= 9.2 %	23/630= 3.7 %	11/520= 2.1 %

and more abundant undergrowth. This habitat was typical wet montane forest. The third camp (4°59'05"S, 29°5'34"E, 1600 m) was located approximately 2.5 km southwest of Talama between 20 and 25 February, 2007. Here, traps were set along a ridge adjacent to a fern prairie, and others along large rocks and a stream along the slope of the ridge. The camp 3 habitat can be described as drier forest, located on the eastern edge of the escarpment, also close to the forest edge. Finally, eleven specimens were collected in a degraded agricultural area on the outskirts of Mizimu at 790 m (5°27'59"S, 29°17'16"E) while switching between camps (February 6–7, 2007).

RESULTS

Results of the trapping efforts for small mammals at the four camps are presented in Table 1. Trap success markedly declined with elevation. At 1250 m, trap success was 9.2 % (nine species and 783 trap nights); at 1600 m, 3.7% (five species and 630 trap nights); at 1950 m, 2.1 % (five species and 520 trap nights). Results from the large mammal surveys are presented in Table 2, along with historical data from Prigogine (1960). Metrical data on the shrews collected, including identification, date, sex, age and external measurements are presented in Table 3. and their cranio-dental measurements are presented in Table 4. For the rodents, external measurements are presented in Table 5 and select cranio-dental measurements are found in Table 6. Although each camp was not trapped with identical intensity, trap success and species diversity was highest at 1250 m. Small mammal abundance decreased with elevation although species diversity (n = 5) was similar at 1600 m and 1950 m. Of the two species new to science, one was captured at the lowest camp (*Crocidura* n. sp.) and one (*Myosorex* n. sp.) at the highest.

The following details some of the more noteworthy reproductive, taxonomic, and distributional issues posed by the specimens as well as formal descriptions of the two new species of Soricidae.

Hyracoidea

***Dendrohyrax* c.f. *dorsalis*.** This dorsal pelt, recovered from a local hunter, cannot be definitively identified to species as diagnostic elements are missing (e.g. skull, chin and rostrum portion of the pelt) while others show mixed affinities. The dorsal white patch is long (90–100 mm) and creamy white. The midline dorsal hair is black, forms a

Table 2. Large mammals of the Misotshi-Kabogo Highlands. PL = Plumptre et al. (2007b); PR = Prigogine (1960); FMNH, catalogue #; **SL** = demarcates southern limit of species; Albertine Rift endemics in **bold**; S = sight record; **F** = feces record; **N** = nest record; **H** = reported by at least 3 hunters.

Species		Common Name	FMNH	Reference
Dendrohyrax c.f. *dorsalis* (Fraser, 1855)	**SL**	Tree hyrax	195080	Skin
Loxodonta africana (Blumenbach, 1797)		African elephant		PR, H
Cercopithecus ascanius (Audebert, 1799)		Red-tailed monkey		PL (S)
Cercopithecus denti (Thomas, 1907)		Dent's mona monkey		PL (S)
Cercopithecus lhoesti (P. Sclater, 1899)	**SL**	L'Hoest's monkey		PR, PL (S)
Cercopithecus doggetti (Pocock, 1907)	**SL**	Blue monkey		PR, PL (S)
Lophocebus albigena (Gray, 1850)		Grey-cheeked mangabey		PL (S)
Papio anubis (Lesson, 1827)		Olive baboon		PL (S)
Colobus angolensis prigoginei (Verheyen, 1960)	**SL**	Angola colobus		PR, PL (S)
Pliocolobus foai oustaleti (Trouessart, 1906)		Red colobus		PR, PL (S)
Pan troglodytes (Blumenbach, 1775)		Chimpanzee		PL (N, S)
Manis gigantea (Illiger, 1815)	**SL**	Giant pangolin		PL (H)
Manis tricuspis (Rafinesque, 1821)		Tree pangolin		PL(H)
Leptailurus serval (Schreber, 1776)		Serval		PL(H)
Profelis aurata (Temminck, 1857)		Golden cat		PL (H)
Civettictis civetta (Schreber, 1776)		African Civet		PR
Genetta genetta (Linnaeus, 1758)		Common genet		PL(H)
Genetta maculata (Gray, 1830)		Rusty-spotted genet	195087– 195088	Skin Skin
Nandinia binotata (Gray, 1830)		2 spotted palm civet	195089	Skin
Galerella sanguinea (Rüppell, 1835)		Slender mongoose	195090	Skin
Mungos mungo (Gmelin, 1788)		Banded mongoose	195091	Skin
Crocuta crocuta (Erxleben, 1777)		Spotted hyena		PR
Canis adustus (Sundevall, 1847)		Side striped jackal		PL (H)
Mellivora capensis (Schreber, 1776)		Honey badger		PR
Hylochoerus meinertzhageni (Thomas, 1904)	**SL**	Giant forest hog		PR, PL (F)
Potamochoerus larvatus (F. Cuvier, 1822)		Bush pig		PR, PL (F)
Oreotragus oreotragus (Zimmermann, 1783)		Klipspringer		PR
Syncerus caffer (Sparrman, 1779)		Cape buffalo		PR
Tragelaphus euryceros (Ogilby, 1837)	**SL**	Bongo		PR, PL (F)
Tragelaphus scriptus ornatus (Pocock, 1900)		Bushbuck		PR, PL (S, H)
Cephalophus nigrifrons kivuensis (Lönnberg, 1919)		Black-fronted duiker		PR, PL (S, H)
Cephalophus weynsi (Thomas, 1901)		Weyn's duiker		PR, PL (H)
Philantomba monticola (Thunberg, 1789)		Blue duiker		PL (H)
Funiscirus carruthersi chrysippus (Thomas 1923)	**SL**	Carruther's mountain squirrel		PR, PL (S, H)
Funisciurus pyrropus akka (de Winton, 1895)		Fire-footed rope squirrel		PR
Heliosciurus rufobrachium ssp. (Waterhouse, 1842)		Red-legged sun squirrel		PL (H)
Heliosciurus ruwenzorii vulcanius (Thomas, 1909)	**SL**	Ruwenzori sun squirrel		PR
Paraxerus boehmi vulcanorum (Thomas, 1918)		Boehm's bush squirrel		PR
Protoxerus stangeri kabobo (Verheyen, 1959)	**SL**	Giant forest squirel		PR
Atherurus africanus (Gray, 1842)		Brush tailed porcupine	195178	Skull, skin

sort of dorsal crest and is quite long (60–80 mm in front of the dorsal white patch, 45–65 mm behind it), similar to *Dendrohyrax dorsalis sylvestris* skins from Ghana, West Africa in the collections at the FMNH. If confirmed as *D. dorsalis*, this would prove to represent the SE terminus of the species' distribution.

Proboscidea

Loxodonta africana. Elephants no longer occur in the forest but occasional crop raiders are reported. Prigogine (1960) stated that in the 1950's elephants of small size (*Loxodonta cyclotis*?) were known from the area.

Primates

Cercopithecus l'hoesti. This Albertine Rift endemic recorded here and before by Prigogine (1960) reaches its southern limit in these highlands.

Cercopithecus doggetti. Current taxonomy recognizes this taxon as a distinct species, adding it to the expanding list of Albertine Rift endemics. It also reaches its southern limit here.

Colobus angolensis prigogineei. This taxon, notable by its all-white tail, is only known from these highlands. It is endangered as only one sight record of this taxon was made during the recent survey, and none were seen along transects.

Pan troglodytes. Surprisingly, chimpanzees were not discussed or listed by Prigogine (1960). Chimpanzees reach their southern limit on the Marungu highlands to the south where Noack (1887) described a population under the name *marungensis*. However, our aerial reconnaissance shows grassy highlands with only traces of gallery forest remaining there. Details on our chimpanzee surveys and estimates can be found in Plumptre et al. (2007b). Their surveys documented nests suggesting a density of 1.22 chimpanzees per km^2 in the Misotshi-Kabogo Highlands. With a forest block of approximately 804 km^2, this translates into an estimated population of 977 ± 252. It appears that local taboos against hunting chimpanzees in the forest highlands have been effective in their conservation.

Pholidota

Manis gigantea. The Misotshi-Kabogo highlands appear to represent the southern terminus for this forest dependent species.

Carnivora

Genetta maculata. Two skins (FMNH 195087–195088), one of a juvenile. Both skins have tails with black tips and with dorsal crests starting midway down the torso, as described in Kingdon (1977). The spots are not in discrete linear rows.

Artiodactyla

Hylochoerus meinertzhageni. This record represents the southern limit for this spectacular suid. As it is in Kenya, the species was only found at high elevation (2500 m). Prigogine (1960) also confirmed this high elevation restriction (2400 m) in the Misotshi-Kabogo highlands.

Tragelaphus eurycerus. As for the previous record, this also represents the southern limit for a magnificent animal (Ralls 1978). As for Prigogine (1960), our record is from high elevation at 2500 m, sharing a distinct biotope with *Hylochoerus meinertzhageni* in areas at the periphery of its range (Ralls 1978). Given the shared elevation range of this population with the montane Kenyan population, the possibility of taxonomic similarities between these populations should be investigated.

Soricomorpha

Crocidura* c.f. *fuscomurina (Heuglin,1865). A single representative (FMNH 195071) was taken in a Museum Special trap. As it was prepared as a skeleton, no details of the pelage coloration or caudal bristles are available. The identification of the specimen remains tentative. Sex was not determined. In size, it ranks as one of the smaller *Crocidura* known for the region (4.8 g, CI=17.3 mm). Braincase is small in both height (HCC 4.1 mm) and breadth (GB 7.6 mm); maxilla is narrow (MX 5.3 mm), dentition light. First upper unicuspid by far the largest, 2–3 times larger than second and third, both of which are sub-equal in size. Cingula of unicuspids well developed; parastyle reduced and not projecting; upper P4 vacuous posteriorly; upper M3 short (reduced). Lower incisor smooth and without denticulations; lower M3 simple and without talonid basin.

This specimen approximates *Crocidura ansellorum* (Hutterer & Dippenaar, 1987) from Northern Zambia in many cranio-dental dimensions (CI=17.3 mm vs. *C. ansellorum* with CI of 16.8–17.7 mm) but its small brain case (GB=7.6 mm, HBC=4.1 mm) distinguishes it (*Crocidura ansellorum*, GB=8–8.4 mm, HBC 4.6–4.7 mm). All cranial measurements fall within the ranges of members of the *Crocidura fuscomurina* group, as reviewed in Hutterer (1983) who described this as a savannah species; here it was captured at the forest edge in a transitional brushy area near a grassy hillside.

Crocidura* c.f. *dolichura Peters, 1876 (FMNH 195070).This taxon is recognized by its delicate dentition, three upper unicuspids with heavy cingula, and a naked tail that is significantly longer then HB. Originally described from Cameroon, its range extends from Nigeria in the west across the Congo basin into western Uganda, Burundi and Rwanda in the east (Hutterer 2005; FMNH specimens). Variation within the group is not trivial and the taxon, as currently recognized, is in need of revision.

Adult male, testes 3x2 mm. Teeth minimally worn. Captured in museum special trap; skull broken at capture. Dorsal pelage with silvery grey base (70 % of hair length), followed by light brown (15 %) and tipped with darker brown (15 %) yielding an appearance that is dark grey washed with brown. Belly fur silvery grey throughout. Tail length ca. 130 % of HB. Lower first incisor with two subtle denticulations. Maxillary unicuspids with heavy cingula. First upper unicuspid the largest, twice as large as second, third unicuspid the next largest, 50 % larger than second. These proportions differ from those evident in Brosset et al.'s (1965) figure of the type specimen of *Crocidura dolichura* where the second and third unicuspids are sub-equal in size, and only slightly smaller than the first. Upper P4 lightly built, vacuous posteriorly. Upper M3 well developed. Dental characteristics similar to FMNH 162198 from Gabon, but differing in its longer tail (132 % of HB compared with 111 %) and more grey-like dorsal pelage (vs. cinnamon brown).

Crocidura olivieri (Lesson, 1827) (FMNH 195072–195078, 195180).These ubiquitous 'giant shrews' of forested sub-Saharan Africa were quite common at lower elevations of the Misotshi-Kabogo Highlands where they represented 8/83 (9.6 %) of snap trap captures at camp 1 (Table 1). Frequency of capture at Camp 1 was 7/783 (.009). They were readily caught with conventional break-back traps baited with peanut butter and oatmeal. However, not a single specimen was caught at 1600 m and 1950 m (34 specimens captured during 1150 trap nights). Five of the 8 specimens collected were adult, four of seven sexable specimens were female, two of three adult females were pregnant, and male testes size averaged 7x3.5 mm.

Using the sub-species recognized by Hutterer (2005) and the key of Dollman (1915a), these specimens need comparison with *C. olivieri kivu* (Osgood, 1910) described from Lake Kivu to the north, and *C. olivieri zuleika* (Dollman, 1915b) described from southern Zimbabwe. In his key, and with access to the relevant type material at the British Museum (Natural History), Dollman (1915a) distinguished these taxa based on dorsal pelage, the former being a 'dark chocolate brown' while the latter is 'a dull coffee-brown'. Our series are more referable to the 'dull coffee' type but the dorsal pelage has grey bases, tipped with coffee brown. In any case, we realize that this character must be locally plastic and cannot have great taxonomic weight. However, in his description, Dollman (1915b) also distinguishes *C. olivieri zuleika* from *C. olivieri kivu* based on the larger teeth of the former. However, the UTR of our series (adults only) averages 13.6 mm compared to 14.8 mm for the type of *C. o. zuleika*. Therefore, we are unable to associate this series with a currently recognized sub-species.

Crocidura lwiroensis **n. sp.** Kerbis Peterhans & Hutterer.
(Fig. 2; Tables 3, 4); The Misotshi-Kabogo Crocidura.

Holotype. FMNH 195181, original number MHH 828 (Fig. 2). Adult female with swollen mammae (3+3). Basioccipital suture closed. Dentition with moderate wear. Left leg (tibia) broken post-mortem. Prepared as an alcoholic carcass with skull removed (asr). Captured in a 'museum special' mouse trap with peanut butter and oatmeal as bait. Collected on 06 February, 2007 by B. Ndara.

Type Locality. Approximately 45 km NE of Kalemie and 3 km W of the village of Mizimu above the western shore of Lake Tanganyika, Katanga Province, eastern Democratic Republic of Congo (29°16'22"E 5°28'45"S, 1250 m).

Etymology. The specific epithet honors the biological research team based at Lwiro (Centre National de Recherche Scientifique), the biological research station 25 km north of Bukavu, South Kivu, eastern Democratic Republic of Congo. This group has persisted in their academic inquiries despite difficult socio-economic conditions and civil strife over the past 15 years. Their academic accomplishments have been inspiring and this represents but one of the team's impressive findings.

Diagnosis. *Crocidura lwiroensis* is distinguished from other members of the genus both externally and cranio-dentally. Externally, it features very small body small size (5.6 g) and a tail that is nearly naked with only 8–10 bristles on the basal 20 %. Dark grey above, slightly lighter below. Skull very small (CI=18.26 mm). Parastyle of P4 long, heavy and broad, projecting forward, and providing a medial pocket for the large third unicuspid. Third unicuspid large, 40 % larger than second; 30 % of its length eclipsed by the upper P4.

Description. External measurements are presented in Table 1. Pelage dark grey in appearance. Dorsal fur short (2.7 mm) with dark grey roots tipped with drab brown. Occasional silver ticks to dorsum. Belly fur appearing slightly more light grey as the tips are only faintly brown. Six swollen inguinal teats. The tail is naked except for 8-10 bristle hairs located on the bottom 20 % of the tail. Pes sparsely haired with dark hairs, foot scales darker laterally giving an impression of a darker colour on outside aspect. Foot 11.5 mm with claw, 10.2 mm without.

Cranio-dental measurements are presented in Table 2. Maxilla short (UTR 7.9 mm) and broad (6.04 mm). Infra-orbital bridge narrow (0.69 mm; figured in Meester 1963). First upper incisor lightly built. Cingulum on upper unicuspids very heavy, especially on first and third. The third upper unicuspid is exceptionally large, 25 % larger than UP2, and projects posteriorly so that fully 1/3

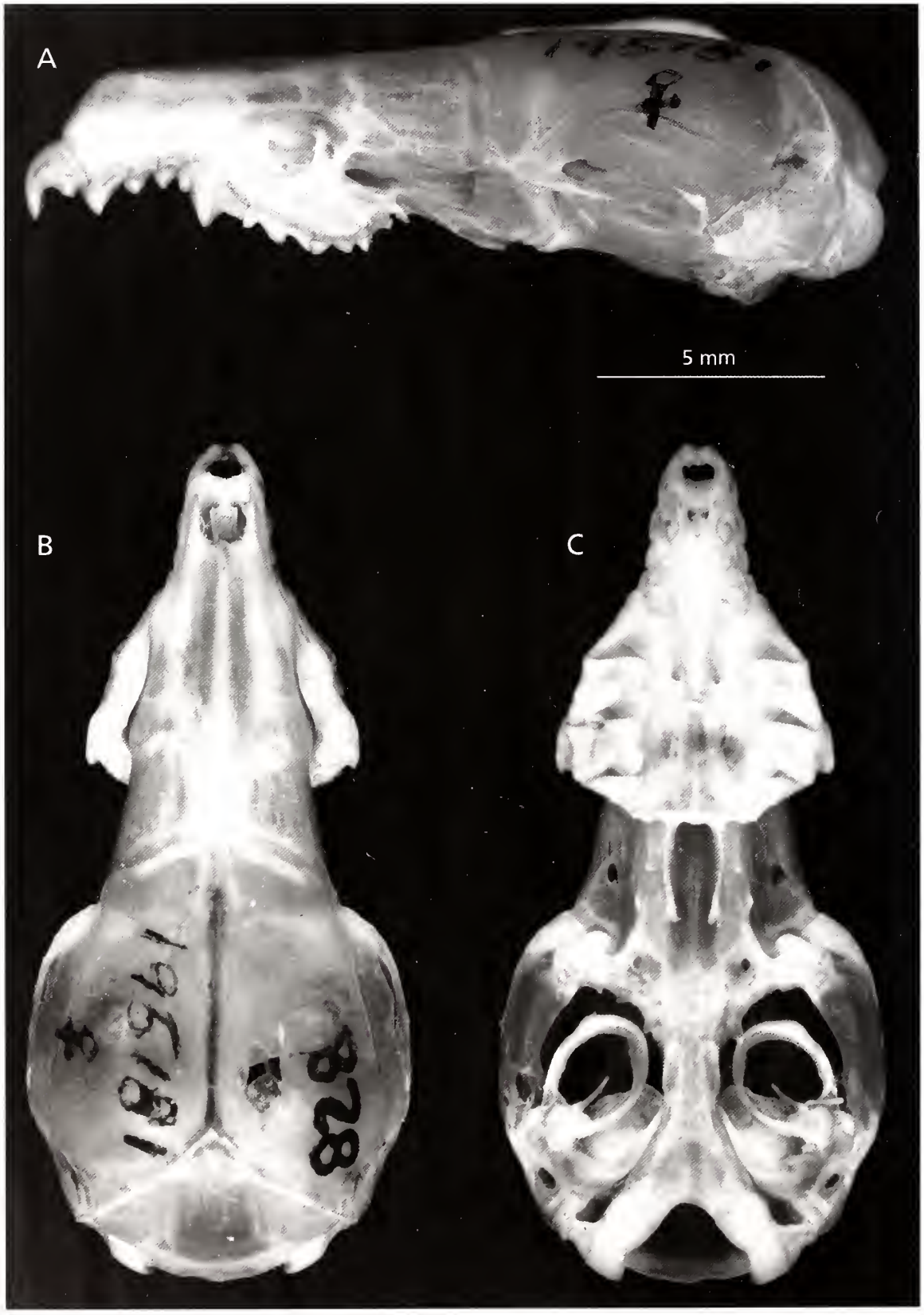

Fig. 2. *Crocidura lwiroensis* n. sp., holotype FMNH 195181 in dorsal, ventral, and lateral view. Scale is 5 mm.

of its length is overlapping with the medial aspect of the upper P4. Parastyle of upper P4 prominent. Upper P4 fairly weak and vacuous. Upper M3 modest in dimensions (0.62 x 1.35 mm). Lower incisor with slight denticulation. Lower M3 simple and without talonid.

Comparisons. The small size (CI <19 mm) and nearly naked tail aligns the new species with a small subset of members of the genus (e.g. *C. niobe*, *C. pitmani*) with tail pilosity at or below 50 %. The new species resembles *Crocidura niobe* due its small size, nearly naked tail and heavy unicuspids with prominent cingulum. However, it is significantly smaller in all cranio-dental dimensions than *C. niobe* (CI 18.2 vs 20.0 mm). All maxillary unicuspids more rectangular than those of *C. niobe* which are broader than they are long. Upper P4 more slightly built than the stocky form seen in *C. niobe*, especially the talonid. Anterior palatal foramina positioned across from the anterior half of the M1 in the new form compared with their positioning across the posterior half in *C. niobe*. Lower incisor relatively smooth compared with the denticulate appearance of *C. niobe*. *C kivuana* is also much larger (CI>20 mm) and is void of tail bristles. The new species is approached by *Crocidura pitmani* (Barclay, 1932) in cranio-dental dimensions but *C. lwiroensis* has a more narrow braincase (GB: 3.92 vs. 4.4 mm), and a much larger third unicuspid that overlaps with the upper P4. *C. lwiroenesis* has shorter fur (2.7 vs. 4–5 mm) and a shorter and virtually naked tail with very few bristle hairs (vs. hairs over the basal 50 % in *C. pitmani*).

In cranial dimensions, *Crocidura hildegardeae* ssp. is comparable. However, the new form has long bristle hairs on only 20 % of its length, whereas in *C. hildegardeae* this ranges from 50–75 %. The new species also differs from it in its darker and more unicolored pelage above and below, vs. the brown/grey bicoloured pattern of *C. hildegardeae*. The skull in the new form is shorter and heavier as reflected in the more rounded braincase (vs. the oval form found in *C. hildegardeae*) and broader maxillary region (compared to the length of the upper tooth row). Upper P3 much larger compared to P2 in *C. lwiroensis* compared to the subequal form in *C. hildegardeae*. One variety of *C. hildegardeae* (*C. h. lutreola* Heller, 1912) also has a much larger upper third premolar but does not overlap greatly with the upper P4 as the new form. It is further distinguished by its more bristled tail, narrower maxilla and broader infra-orbital bridge. The last two unicuspids are larger and more elongate in *C. lwiroensis* than the more squared/rounded form seen in *C. hildegardeae*. The last upper unicuspid in *C. lwiroensis* protrudes posteriorly and contrasts the squared-off form in *C. hildegardeae*. As noted above, the upper P3/P4 complex of *C. lwiroensis* is unique among these small *Crocidura* ssp.

More distant comparisons include forms from West Africa, Ethiopia, and northern Kenya. *C. crossei* from Nigeria has a longer (51 vs. 45 mm) and more bristled tail ('evenly scattered throughout except at the extreme tip'; Thomas 1895). It is more unicolored, being slate grey above and below (Hutterer & Happold 1983). It also has a longer skull (19.3 vs. 18.26) and upper tooth row (8.3 vs. 7.91) whilst having a more narrow maxilla (5.6 vs. 6.04). The Ethiopian *C. harrenna* (Hutterer & Yalden, 1990, Hutterer, pers. obs.) is larger (mass 8.5 vs. 5.6 g) with higher pilosity of the tail (80 % vs. 20 %), a longer skull (19 vs. 18.26 mm), and a broader braincase (9.2 vs. 8.42 mm) while having a narrower maxilla (5.6 vs. 6.04 mm) (Hutterer & Yalden 1990). Likewise, *C. phaeura* Osgood, 1936, also from Ethiopia, has a darker pelage (blackish brown to dark brown) with a longer foot (15 mm). Cranio-dental measurements are longer than the new species described here: CI (19.3–21.1 mm) and UTR of 8.8, with a longer upper M3 (0.81–0.88 mm). Finally, *C. macowi*, known only from Mt. Nyiro in northern Kenya, is more dark brown (and with more sharp contrast to the grey of the belly). *C. macowi* also has a longer tail (up to 58 mm), longer skull (19.7 mm), and a longer, yet more narrow maxilla, and with a broader interorbital region (4.6 mm). The third upper unicuspid and its medial eclipse of the parastyle of the upper P4 are again distinctive in the new form.

Ecology and accompanying small mammal community. The new species of *Crocidura* was captured along a creek in primary forest at 1250 m. The small mammals with which it was caught include the following: *Crocidura olivieri* (n = 7), *Crocidura* c.f. *fusconurina* ssp. (n = 1), *Lophuromys aquilus* (n = 3), *Hybomys* aff. *univittatus* (n = 3), *Hylomyscus stella* (n = 12), *Pelomys minor* (n = 1), *Praomys jacksoni* (n = 43), and *Rattus rattus* (n = 1).

***Myosorex kabogoensis* n. sp**. Kerbis Peterhans & Hutterer.
(Figs 3, 4; Tables 3, 4); The Misotshi-Kabogo Myosorex.

Holotype. FMNH 195079, original number MHH 840. Adult male, testes not convoluted, 2 x 1 mm. Basioccipital suture closed. Dentition with very little wear. Prepared as a skin with skull and skeleton (ssk). Captured in a 'museum special' mouse trap with peanut butter and oatmeal as bait. Collected on 15 February, 2007 by P. Kaleme.

Type locality. Mt. Misotshi area, 4 km SW of the village of Talama, above the western shore of Lake Tanganyika, South Kivu Province, eastern Democratic Republic of Congo (29°4'49"E 4°59'29"S, 1950 m).

Etymology. Named for the montane forest in which it was found.

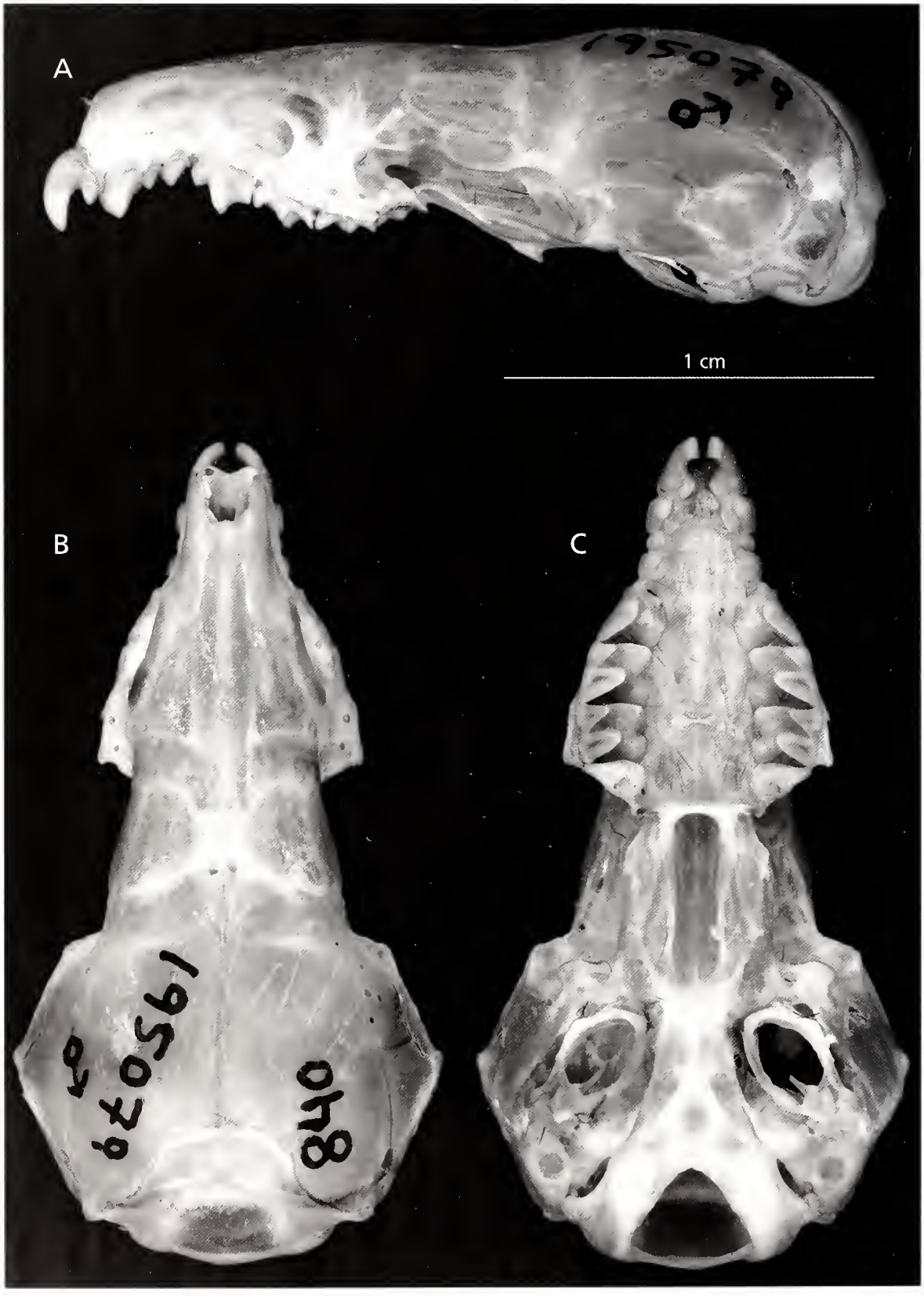

Fig. 3. *Myosorex kabogoensis* n. sp., holotype FMNH 195071 in dorsal, ventral, and lateral view. Scale is 10 mm.

Fig. 4. *Myosorex kabogoensis* n.sp., holotype FMNH 195071, view of palate and upper dentition. Scale is 5 mm.

Table 3. External measurements of Misotshi-Kabogo Soricidae.

FMNH	Species	Date	Cond	Sex	Age	TOT	TL	HF	E	WT	Tail bristles
N=5 +	*Crocidura olivieri*	var.	var.	2 m 3 f	Ad	201	74	20	11	40.5	56 %
195071	*Crocidura* c.f. *fuscomurina*	Feb 4 2007	sko	?	Ad	113	49	11	8	4.8	na
195181	*Crocidura lwiroensis*	Feb 6 2007	asr	F	Ad	110	45	11.5	8	5.6	20 %
195079	*Myosorex kabogoensis*	Feb 15 2007	ssk	M	Ad	117	28	14	5	12	0 %
195070	*Crocidura* c.f. *dolichura*	Feb 15 2007	ssk	M	Ad	167	95	15	11	7.8	0 %

* specimen eaten in trap, re-measured in Chicago
\+ mean of the five adult specimens (195072, 195073, 195074, 195076, 195077: 2 m, 3 f)

Diagnosis. Among members of the genus, *Myosorex kabogoensis* is easily diagnosed both externally and cranio-dentally. Externally, it has an exceptionally short tail in relation to head and body length (28/89=31.5 %). The pelage is very dark slate blue/grey above and below, the individual hairs unicolored to their base. Braincase broad but short. The maxilla is particularly broad, both absolutely and in relation to the breadth of the braincase. Upper 4th unicuspid very small (1/6 the size of the 3rd), lies within the toothrow and is visible in lateral view. Upper 3rd unicuspid, ¾ the size of the 1st. Upper M3 proportionately large. Lower P2 not visible in lateral view. Mandibular corpus of moderate depth.

Table 4. Cranio-dental measurements of Misotshi-Kabogo Soricidae.

FMNH	Species	CI	GB	MX	UTR	HCC	PGL	IO	MD	LTR	COR
N=5 +	*Crocidura olivieri*	29.8	12.1	9.6	13.6	6.7	8.4	5.5	19.0	12.3	7.85
195071	*Crocidura fusconurina*	17.3	7.6	5.32	7.37	4.1	5.0	3.63	10.22	6.72	4.09
195181	*Crocidura lwiroensis*	18.26	8.42	6.04	7.91	4.75	6.09	3.92	11.11	7.31	4.32
195079	*Myosorex kabogoensis*	21.83	11.54	7.18	9.75	6.04	7.33	4.97	13.9	8.72	5.62
195070	*Crocidura* c.f. *dolichura*	^	^	5.53	8.04	^	5.95	4.02	11.17	7.27	4.13

^ skull broken

Description. Pelage dark slate grey, hairs unicolored to their base. Color identical above and below. Tail very dark above and below; extremely short (28 mm), only 31.5 % of head and body length. Foreclaws long, longest 3.15 mm (III), hindclaws shorter, longest 2.4 mm (III). Long dark hairs (1.4 mm) clothing dorsum of pes and manus (see Table 1).

Braincase broad but short (as reflected in the antero-lateral length of the hexagon), fitting well within the range of broad-headed *Myosorex* (GB/CI=>0.5, Table 2, see Kerbis Peterhans et al. (2010). Maxilla broad. Interorbital region bugling in ventral view. Narrow anterior opening (ca. 30 degrees) to the combined foramen opticum, rotundum and lacerum anterius (Meester, 1963). The foramen magnum narrow and oval-shaped.

Upper unicuspids broad. Upper U4 lies within the tooth row and is visible in lateral view (Fig. 4). Upper P4 heavily built without expansive posterior concavity. Upper M3 large (long). Lower incisor with two clear denticulations. Lower unicuspids large. Only one lower P2 present (or at least visible in medial view). Medial articular facet of the mandibular condyle short and straight. Lower M3 long and narrow.

Comparisons. Cranially, the new *Myosorex* aligns with the broad-skulled forms of *Myosorex* (GB/CI=>0.5: *M. blarina, M. babaulti, M. bururiensis, M. geata, M. kihaulei, M. okuensis, M. rumpi, and M. zinki* (see Kerbis Peterhans et al., 2010). Its maxillary and braincase breadth (GB/CI=.529) and broad inter-orbital region distinguish it from the more narrow-headed forms (GB/CI<0.5: *M. cafer, M. eisentrauti, M. gnoskei, M. longicaudatus, M. jejei, M. schalleri, M. sclateri, M. tenuis, M. varius*).

The West African taxa, *M. rumpi* and *M. okuensis* are both only known from a single plateau or mountain peak 2000 miles to the west. *M. rumpi* is substantially larger, CI>23.0 mm, and with a proportionately narrower maxilla (max/GB: .587 vs. .622 in *M. kabogoensis*). *M. okuensis* possesses a much narrower maxilla in absolute breadth (6.72 mm vs. 7.18 mm). *M. zinki* has a much

Table 5. External measurements of adult Rodentia.

Species	FMNH	Sex F, M	Age	HB	TV	HF	WT
Graphiurus murinus	195179	F	ya	95	70	18	19
Lophuromys aquilus	means	7F, 2M	ad	126	—	21	59
Hybomys c.f. *univittatus*	means	2F, 4M	ad	128.5	111	29.7	54
Hylomyscus stella	means	4F, 5M	ad		130	18	21
Mus minutoides	195116	F	ad	71.5	40.5	12	9
Mus minutoides	195117	F	yad				
Mus triton	195118	F	ad	88	55	14	20
Pelomys minor	195187	M	ad	124	122	27	51
Praomys degraaffi	195120	M	ad	109	126	23.5	30.5
Praomys degraaffi	195122	F	-	101	123	23	26
Praomys jacksoni	means	3F	yad	147.7	105.3	23.7	36.3
Praomys jacksoni	means	7F	ad	141	113.7	24	40.5
Praomys jacksoni	means	4M	yad	134	101	23.7	31
Praomys jacksoni	means	6M	ad	149	118	24.2	50.2
Rattus rattus	195177	M	juv	133	152	31	69
Atherurus africanus	195178	F	ad	475	165	75	na

Table 6. Select cranio-dental measurements of adult Rodentia.

Species	FMNH	Sex F,M	Age	CI	IO	BC	UTR
Graphiurus murinus	195179	F		23.6	4.4	13.2	3.1
Lophuromys aquilus	means	3F		28.5	6.3	12.8	5.0
Hybomys c.f. *univittatus*	means	3F, 4M		29.5	5.7	14.3	5.2
Hylomyscus stella	means	3F, 5M		23.6	4.6	11.4	3.8
Mus minutoides	195116	F		17.5	3.4	8.8	3
Mus minutoides	195117	F		17.6	3.3	8.7	3.2
Mus triton	195118	F		20.9	3.9	9.9	3.5
Pelomys minor	195187	M		29.0	4.6	13.5	5.3
Praomys degraaffi	195120	M	ya	27.25	4.75	12.6	4.95
Praomys degraaffi	195122	F	ya	25.8	4.9	11.9	4.45
Praomys jacksoni	means	3F	ya	27.7	4.8	12.1	4.5
Praomys jacksoni	means	5F	ad	27.9	4.7	12.2	4.8
Praomys jacksoni	means	5M	ya	26.4	4.7	11.7	4.6
Praomys jacksoni	means	15M	ad	29.2	5	12.4	4.8
Rattus rattus	195177	M		32.1	4.9	15.2	6.7
Atherurus africanus	195178	F		86.2	24.8	32.3	17.8

onger skull and narrower maxillae (22.8 mm and 6.5 mm vs. 21.83 mm and 7.18 mm) and is only known from Mt. Kilimanjaro.

Although this species is exceeded in breadth by several others, including neighboring *M. bururiensis*, *M. blarina* and *M. babaulti*, it has the hexagonal 'gestalt' and metrics of the more broad-skulled group. The braincase is short and smaller overall than these three. In ventral view, the interorbital region is convex and bulging compared to the parallel-sided or often concave-sided *M. babaulti, M. blarina* and *M. bururiensis*. Narrow anterior opening (ca. 30 degrees) to the combined foramen opticum, rotundum and lacerum anterius (Meester 1963) compared with ca. 40–45 degrees in *M. babaulti*. Only slightly narrower than that seen in *M. bururiensis*. The foramen magnum is more narrow and oval-shaped than either.

Upper unicuspids less broad than those seen in *M. bururiensis* but similar in their proportions. The breadth and size of the upper unicuspids are comparable to those of *M. babaulti* and *M. blarina* but unlike *M. babaulti*, the upper 4th unicuspid is visible in lateral view. This is because it lies within the tooth row and is not medially displaced and to a lesser extent, the parastyle of the following upper P4 does not protrude forward. Upper M3 much larger and longer than that of *M. blarina*.

The mandibular corpus, articular facet of the mandibular condyle and the lower unicuspids of *M. kabogoensis* are much less robust than in *M. bururiensis*. The lower unicuspids are comparable in size to *M. babaulti*. The lower M3 is clearly more narrow, especially the talonid. The medial facet of the mandibular condyle is very short and straight as opposed to the longer and more concave condition seen in *M. babaulti*.

The dark slate-grey of the pelage is unicolored and without the tricolored mottling seen in certain members of the genus (e.g. *M. gnoskei*, *M. geata* (?) and the S African *M. cafer* and *M. varius*). This also contrasts with the bicolored pelage (basal 80 % slate grey, distal 20 % dark brown) seen in the more northern forms (*M. blarina*, *M. bururiensis* and *M. babaulti)*. Externally, its short tail, in relation to head and body length is met only by *M. bururiensis* (Table 2 in Hutterer et al. 2001; Table 2).

Ecology and the small mammal community. The new species was captured along a dry hill slope in primary forest where a few large trees emerge from dense and shrubby undergrowth (1950–2000 m). It had rained the previous early morning, ca 24 hours prior to capture. Rodents collected in the same general area include *Graphiurus murinus* (n = 1), *Hybomys univittatus* (n = 6), *Praomys degraaffi* (n = 2), and *Praomys jacksoni* (n = 1).

Rodentia

Funisciurus carruthersi chrysippus. Our observations and Prigogine (1960) mark the southernmost occurrence known for this Albertine Rift endemic.

Heliosciurus ruwenzorii vulcanius. The record from Prigogine (1960) marks the most southerly record known for this Albertine Rift endemic.

Protoxerus stangeri kabobo. This giant squirrel is widespread in tropical Africa and is an indicator of good forest. This subspecies is recognized as distinct and is confined to the Kabogo-Misotshi highlands.

Graphiurus murinus (Desmarest, 1822). The sole specimen (FMNH 195179), a young-adult with first premolar in early wear, is a nulliparous female and was prepared as a skin with skull and skeleton. We refer this species to *Graphiurus murinus* due to its size (external and craniodental), dark coloration towards the rear of the manus and pes and the lack of a white tip to the tail.

Lophuromys aquilus True, 1892. In addition to *Praomys jacksoni*, members of this species complex are typically the most abundant taxon in east African forests. They were not a dominant component of the lower two camps (7/94=7.4 %) and were not documented at 1950 m. Nine of the ten captures were adult. The sex ratio was seven females and three males. Three of the five females inspected were pregnant (one each with two, three and four embryos) with CR ranging from 5–13mm. Testes from a single male measured 7 x 12 mm.

Hybomys aff. ***univittatus*** (Peters, 1876). As is typical for this genus, several specimens were captured near streams within forest. Six of the nine captures were adult. The overall sex ratio was four females and five males. Two of the four females inspected were pregnant (one with two embryos, the other with three) with CR ranging from 8–20. Testes of adult males ranged from 7 x 13 mm to 10 x 16 mm.

These specimens are more comparable to *Hybomys univittatus* than to *Hybomys lunaris*, the only two taxa alluded to in eastern DR Congo. As discussed in the original description (Thomas 1906) and more recently by Musser & Carleton (2005), *H. lunaris* is lightly built compared to *H. univittatus*. Comparisons of true *Hybomys univittatus* with topotypes of *Hybomys lunaris* at Field Museum confirm this. The greatest skull length (33.0–35.1 mm) of the Kabogo series falls within the range of *H. univittatus* (33.5–35.6 mm = 1 standard deviation). These are significantly larger than the *H. lunaris* series at Field Museum (31.25–32.48 mm). The dentition of the Kabogo series is intermediate: UTR (5.05–5.35 mm) and M^1 breadth (1.73–1.85 mm) compared with *Hybomys lunaris* (4.74–5.08 mm and 1.61–1.7 mm) and *Hybomys univittatus* (5.66-6.1 mm and 1.87–1.99 mm = 1 standard deviation).

Hylomyscus stella Thomas, 1911. This species is typical in lowland forest of the eastern Congo basin. Ten of the 12 aged specimens were adult. The sex ratio was seven females and six males. One of the four females inspected was pregnant with two embryos, with a CR of 3 mm. Testes of adult males measured 6 x 12 mm. The absence of members of the *Hylomyscus denniae* group (Carleton et al. 2006) in an Albertine Rift montane context is curious. Evidently, *Hylomyscus vulcanorum* reaches its current southern extent on the Itombwe Plateau, just to the north (Demos, unpublished data). Since these highlands extend beyond 2700 m, we cannot explain that members of the *Hylomyscus denniae* complex were victims of the last interglacial, ca. 12,000 years before present.

Mus musculoides Temminck, 1853. Two specimens were captured in tall grass near the village of Mizumu on the shore of Lake Tanganyika. One female was not pregnant but displayed six large teats while the other was pregnant with two embryos (CR 12x17).

Mus triton Thomas, 1909. One specimen caught in tall grass near the village of Mizumu on the shore of Lake Tanganyika. The adult female, multiparous with six teats, was pregnant with three embryos with a CR of 20 mm.

Pelomys minor Cabrera & Ruxton, 1926. A single adult, scrotal male (FMNH 195187) was taken at the forest edge along the ridge slope.

Praomys degraaffi Van der Straeten & Kerbis Peterhans, 1999. This is the second published record for this Albertine Rift endemic in DRC. FMNH has many specimens of this taxon from Mt. Tshiabirimu, Kahuzi-Biega NP, and the Itombwe Forest. The female, FMNH 195122, displays the charcoal pelage and 8 teats characteristic of the taxon while the male, FMNH 195121 shows the charcoal pelage and long and broad incisive foramina characteristic of the species. Notably, both are recorded at the highest camp (1950m) whereas 62/63 members of *Praomys jacksoni* were found at lower elevations (Table 1). This pattern of altitudinal displacement was discussed in the original description of the species (Van der Straeten & Kerbis Peterhans 1999).

Praomys jacksoni de Winton, 1897. As is typical in much of forested eastern Africa, this is by far the most abundant murid (63/104=61 %) from the surveys. It comprised over 50 % of all captures except for the highest camp where its frequency dropped to 10 % (1/10). It is distinguished from the previous species by its brown vs. black pelage, additional accessory plantar tubercles, and shorter, more narrow incisive foramina. The overall sex ratio for this species was 26 f to 34 m. Forty one out of 61 specimens were adult. Juvenile sex distribution was skewed towards females (13/20). However, this seemingly reversed in adulthood with adult males composing 27 of 40 individuals. Testes size in adult males averaged 9x15 (n=19). Three of seven adult females inspected were pregnant with embryos numbering 2 (CR 20), 3 (CR 20) and 4 (CR 14).

There appears to be no evidence of sexual dimorphism (Table 6).

Rattus rattus Linnaeus, 1758. The recovery of this specimen (FMNH 195177) is surprising as a forest find. An adult scrotal male with testes 13x7 mm was caught in the same trap line as *Crocidura lwiroensis*.

Atherurus africanus. One female (FMNH 195178), uterus enlarged, lactating from two axial mammae, was snared by a camp attendant in primary forest.

DISCUSSION AND CONCLUSION

These discoveries, over the course of a very short period in the field (2 ½ weeks), highlight the importance of surveying undocumented African habitats, particularly isolated montane habitats within the Albertine Rift. The Misotshi-Kabogo highlands represent a particularly important montane forest block as it lies to the south of the main Kivu Highlands (Kahuzi-Itombwe) and is thought to have been long-isolated.

The two new species described here and a new horseshoe bat (Kerbis Peterhans et al. 2013) bring to five the number of unique mammal taxa known from these highlands. It is probable that further new species will be discovered here given the brevity of the 2007 field survey. Further, the one unique primate (*Colobus angolensis prigoginei*) is severely threatened with extinction despite a healthy forest cover. A total of 11 mammal species reach their southern range terminus on the Misotshi-Kabogo Highlands (Tables 1 and 2). These include such remarkable members of the megafauna as the giant forest hog (*Hylochoerus meinertzhageni*) and the bongo (*Tragelaphus euryceros*). The next montane system to the south in the Albertine Rift chain is the Marungu Highlands. Aerial reconnaissance by our team indicated that there is no remaining forest block here. We cannot claim that the barren Marungu Highlands have been deforested by anthropogenic activity or whether it has been in this state throughout historical times. What is clear is that the Misotshi-Kabogo Highlands are a critical montane system at the SE corner of the Congo forest block and provides the southern limit for many endemic Albertine Rift taxa. At present this montane forest has no formal protection; there is a need to establish a protected area here if these recently discovered new species are to be maintained.

These new discoveries indicate how much there is yet to learn of African biodiversity, especially within montane environments. Montane communities contain reservoirs of biodiversity that are inherently isolated. Their exploration must be placed at the forefront of survey and conservation efforts. Only 13 years ago (Myers et al. 2000), it was claimed that the Albertine Rift did not warrant recognition as an international *Hot Spot* due to inadequate knowledge. We have started filling in this void by describing 8 small mammal species from the Albertine Rift since 1999 that are new to science (Van der Straeten & Kerbis Peterhans 1999; Kerbis Peterhans & Hutterer 2009; Kerbis Peterhans et al. 2010; Kerbis Peterhans et al. 2013, this paper). Continued field surveys and collections, such as the one reported on here, are crucial to this effort. Interest from non-government organizations (NGO's) has provided various groups with the resources to begin surveys of the unexplored pockets within the ecoregion. Discoveries of rare or species new to science have the potential to serve as flagship species for areas that lack formal protection. Finally, the fairly rapid turnover from field survey to published manuscript further illustrates that the oft-ignored small mammal community should be fundamental in biodiversity surveys.

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REFERENCES

Animal Care and Use Committee (1988) Guideline for the capture, handling, and care of mammals as approved by the American Society of Mammalogists. American Society of Mammalogists: 1–47

Barclay EN (1932) A new shrew from Northern Rhodesia. Annals and Magazine of Natural History (10) 10: 440

Brosset A, DuBost G, Heim de Balsac H (1965) Une nouvelle espèce de *Crocidura* du Gabon. Mammalia 29: 268–274.

Carleton MC, Kerbis Peterhans JC, Stanley WT (2006) Review of the *Hylomyscus denniae* (Rodentia: Muridae) group in eastern Africa with comments on the generic allocation of *Epimys endorobae* Heller. Proceedings of the Biological Society of Washington 119: 293–325

Dollman G (1915a) On the African shrews belonging to the genus *Crocidura*. Annals and Magazine of Natural History (8) 15: 507–527

Dollman G (1915b) On the African shrews belonging to the genus *Crocidura*. II. Annals and Magazine of Natural History (8) 15: 562–575

Huhndorf M, Kaleme P (2007) Small mammal surveys of Misotshi-Kabogo. In: Plumptre AJ, Kujirakwinja D, Matunguru J, Kahindo C, Kaleme P, Marks B, Huhndorf MH (eds) Biodiversity surveys in the Misotshi-Kabogo and Marungu regions of the Eastern Democratic Republic of Congo, with a focus on chimpanzees. Unpublished report to USFWS (project: 98210-6-G035). Albertine Rift Technical Reports 5: 25–28 (www.albertinerift.org)

Hutterer R (1983) Taxonomy and Distribution of *Crocidura fuscomurina* (Heuglin, 1865). Mammalia 47: 221–227

Hutterer R (2005) Order Soricomorpha. In: Wilson DE, Reeder DM (eds) Mammal Species of the World – a taxonomic and geographic reference, Third edition. Johns Hopkins University Press, Baltimore: 220–311

Hutterer R, Dippenaar NJ (1987) A new species of *Crocidura* Wagler, 1832 (Soricidae) from Zambia. Bonner zoologische Beiträge 38: 1–7

Hutterer R, Happold DCD (1983) The shrews of Nigeria (Mammalia: Soricidae). Bonner zoologische Monographien 18: 1–79

Hutterer R, Yalden DW (1990) Two new species of shrews from a relic forest in the Bale Mountain, Ethiopia. In: Peters G, Hutterer R (eds.) Vertebrates in the Tropics. Museum Alexander Koenig, Bonn: 63–72

Hutterer R, Barriere P, Colyn M (2001) A new myosoricine shrew from the Congo Basin referable to the forgotten genus *Congosorex* (Mammalia: Soricidae). Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Biologie 71 Supplement: 7–16

Kerbis Peterhans JC, Hutterer R, Kaliba P, Mazibuko L (2008) First record of *Myosorex* (Mammalia: Soricidae) from Malawi with description as a new species: *Myosorex gnoskei*. Journal of East African Natural History 97: 19–32

Kerbis Peterhans JC, Hutterer R, Mwanga J, Davenport L, Balagizi Kahargomba I, Ndara RB, Udelhoven J (2010) Two new species of *Myosorex* (Soricidae, Soricomorpha, Mammalia) from the Albertine Rift, central Africa. Journal of East African Natural History 99: 65–74

Kerbis Peterhans J, Hutterer R (2009) The description of a new species of *Suncus* (Soricidae, Mammalia) from Central Africa. Bonner zoologische Monographien 55: 141–150

Kerbis Peterhans JC, Fahr J, Huhndorf MH, Kaleme P, Plumptre AJ, Marks BD, Kizungu R (2013) Bats (Chiroptera) from the Albertine Rift, eastern Democratic Republic of Congo, with the description of two new species of the *Rhinolophus maclaudi* group Bonn zoological Bulletin 62 (2): 186–202

Kingdon J (1977) East African Mammals – An Atlas of Evolution in Africa. Vol IIIA Carnivores. University of Chicago Press, Chicago

Kingdon J (1997) The Kingdon Field Guide to African Mammals. Academic Press, London

Meester J (1963) A systematic revision of the genus *Crocidura* in southern Africa. Transvaal Museum Memoir 13: 1–127

Musser GG, Carleton MD (2005) Order Rodentia. In: Wilson DE, Reeder DM (eds) Mammal Species of the World – a taxonomic and geographic reference, third edition. Johns Hopkins University Press, Baltimore: 745–1600

Myers N, Mittermeier RA, Mittermeier CG, da Fonseca GAB, Kent J (2000) Biodiversity hotspots for conservation priorities. Nature 403: 853–858

Noack T (1887) Beitraege zur Kenntnis der Saeugethier-Fauna von Ost- und Central-Afrika. Zoologische Jahrbücher 2: 193–202, pls 8–10

Osgood WH (1910) Two new African shrews. Annals and Magazine of Natural History 8 (5): 369–370

Plumptre AJ, Davenport TRB, Behangana M, Kityo R, Eilu G, Ssegawa P, Ewango C, Meirte D, Kahindo D, Herremans M, Kerbis Peterhans J, Pilgrim J, Wilson M, Languy M, Moyer D (2007a) The biodiversity of the Albertine Rift. Biological Conservation 134: 178–194

Plumptre AJ, Kujirakwinja D, Baruti A, Mutungire M (2007b) Chapter 2. Chimpanzee and other large mammal surveys. In: Plumptre AJ, Kujirakwinja D, Matunguru J, Kahindo C, Kaleme P, Marks B, Huhndorf MH (eds) Biodiversity surveys in the Misotshi-Kabogo and Marungu regions of the Eastern Democratic Republic of Congo, with a focus on chimpanzees. Unpublished report to USFWS (project: 98210-6-G035). Albertine Rift Technical Reports Volume 5: 15–24 (www.albertinerift.org)

Prigogine A (1960) La faune ornithologique du Massif du Mont Kabobo. Annales de Musée Royal du Congo Belge, series 8, 85: 1–47

Ralls K (1978) *Tragelaphus euryceros*. Mammalian Species 111: 1–4

Thomas O (1895) Descriptions of five new African shrews. Annals and Magazine of Natural History series 6 (16): 51–55.

Thomas O (1906) Descriptions of new mammals from Mount Ruwenzori. Annals and Magazine of Natural History, series 7 (18): 136–146

Van der Straeten E, Kerbis Peterhans JC (1999) *Praomys degraaffi*, a new species of Muridae from central Africa. South African Journal of Zoology 34: 80–90

Verheyen WN (1959) Une nouvelle sous-espèce de *Colobus polykomos* (Zimmerman 1780). Revue de Zoologie et de Botanique Africaines 60: 120–121

Verheyen WN (1960) Deux nouvelles espèces de *Protoxerus stangeri* (Waterhouse 1842) pour la Faune du Congo Belge. Revue de Zoologie et de Botanique Africaines 61: 31–34

Voss RS, Emmons LH (1996) Mammalian diversity in Neotropical lowland rainforests: A preliminary assessment. Bulletin of the American Museum of Natural History 230: 1–115

Wilson DE, Reeder DM (2005) Mammal Species of the World – a taxonomic and geographic reference, third edition. Johns Hopkins University Press, Baltimore

Appendix

Specimens examined for comparison

Dendrohyrax dorsalis sylvestris (Temminck, 1853). Gabon (5): FMNH 54448, 54679–681, 62767.

Crocidura dolichura (Peters, 1876). Gabon (1): FMNH 162198.

Crocidura fuscomurina (Heuglin, 1865). Angola, Humpata, ZFMK 89.48; Kenya, Nairobi, Embakasi Plains, ZFMK 85.65; FMNH 17719, 17723; Sudan, FMNH 86028.

Crocidura hildegardeae altae (Heller, 1912). Kenya: Mt Garguez, North Creek, 6000'–6500', USNM 182426, 182429, 182430.

Crocidura hildegardeae hildegardeae (Thomas, 1904). Democratic Republic of Congo: Mbayu, ZFMK 68.505, Buhenge, ZFMK 89-450, Bukarabwa, ZFMK 89–455. Kenya: Fort Hall, USNM 163948. Wambugu, USNM 163952. Nyeri, USNM 163953–955.

Crocidura hildegardeae lutreola (Heller, 1910). Kenya: Mt Mbololo, summit, USNM 182456, 182459, 182460.

Crocidura hildegardeae phaios (Setzer, 1956). Sudan: Torit, 2300', FMNH 66712.

Crocidura hildegardeae procera (Heller, 1912). Kenya: Mt. Garguez, south creek 3600', USNM 182509, FMNH 47357. Mt. Lololokwi, summit, 6000', USNM 182512, 182513, 182517, 182518; FMNH 47358. Mt. Lololokwi, 182522.

Crocidura niobe (Thomas, 1906). Uganda (5): Ruwenzori Mountains, 6200', FMNH 144181, 144183, 144185, 144190; Mt. Sabinio, FMNH 26477.

Myosorex babaulti (Heim de Balsac and Lamotte, 1956): Burundi, Kibira NP, FMNH 148937 1M, FMNH 148938 1M, FMNH 148265 1M, 2100–2350 m; DR CONGO, Kahuzi-Biega NP, Tshibati, FMNH 189275 1M, ZFMK 68.545, 1F, Lwiro Falls, 2100 m, AMNH 180956–180961, 6M; UGANDA, Bwindi-Impenetrable NP, 1850 m, FMNH 160175 1M, Mgahinga Gorilla NP, 2980 m, FMNH 157410 1M.

Myosorex blarina (Thomas, 1906): DR CONGO, Rwenzori Mountains, FMNH 26285–26287 2M, 1F; UGANDA, Rwenzori Mountains NP, FMNH 144205–144211, 2M, 4F, 1?, 1900–3980 m.

Myosorex bururiensis (Kerbis Peterhans & Hutterer, 2010): Burundi, Mumushwizi Valley, Bururi Forest, 1880m, FMNH 155923 F.

Myosorex geata (Allen and Loveridge, 1927): Tanzania, Uluguru Mountains, Uluguru North Forest Reserve 1345–1535 m, FMNH 158298–158302, FMNH 158487 3M, 3F, Mbete, TRP 2305.

Myosorex gnoskei (Kerbis Peterhans et al., 2008): FMNH 191568, Malawi, Chilinda Rest Camp, Nyika National Park, 2285m.

Myosorex kihaulei (Stanley & Hutterer, 2000): Tanzania, Udzungwa Mountains, New Dabaga/Ulangambi Forest Reserve, 1816–1940 m, FMNH 169509–169516, 1?, 7F; West Kilombero Scarp Forest Reserve, 1140 m, FMNH 169501, 1?.

Hybomys lunaris (Thomas, 1906): Uganda, Ruwenzori Mountains, FMNH 144400, 144405, 144408, 144412, 144429, 144430, 144433, 144444, 4M, 4F.

