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Bats (Chiroptera) from the Albertine Rift, eastern Democratic Republic of Congo, with the description of two new species of the *Rhinolophus maclaudi* group

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Abstract. Horseshoe bats of the *Rhinolophus maclaudi* species group were recently revised by Fahr et al. (2002). Known members of the group are located in the mountainous region of West Africa and the Albertine Rift, east of the Congo River basin with a major gap (4300 km) between the two recognized sub-groups. Here we describe two additional species within this species group from the Albertine Rift center of endemism in the eastern Democratic Republic of Congo. One derives from the Misotschi-Kabogo highlands, a heretofore poorly documented region half-way down the western shore of Lake Tanganyika. Additional bat records from this locality are also documented. The second new taxon was collected in Kahuzi-Biega National Park, a World Heritage Site adjacent to the shore of Lake Kivu.

Key words. Rhinolophidae, endemism, new species, Misotschi-Kabogo highlands, Kahuzi-Biega National Park, Albertine Rift, Democratic Republic of Congo.

Résumé. Les espèces de chauve-souris appartenant au groupe de *Rhinolophus maclaudi* étaient récemment révises par Fahr et al. (2002). Les membres connus du groupe sont localisés du côté opposée au basin du Congo avec un vide de 4300 km entre les deux sous-groupes. Nous décrivons deux espèces appartenant au même groupe en provenance de l'est de la République Démocratique du Congo dans le Rift Albertin. L'une dérive des monts Misotschi-Kabogo, un site très mal connu pour sa biodiversité, situé a mi-chemin dans le versant ouest du lac Tanganyika. Les autres chauve-souris de la même région sont aussi documentées. L'autre espèce était collectée au Parc National de Kahuzi-Biega, un site du patrimoine mondial de l'UNESCO bien étudié, adjacent dans le versant ouest du lac Kivu.

Mots clés. Rhinolophidae, endémisme, espèces nouvelles, Misotschi-Kabogo, Kahuzi-Biega NP, Rift Albertine, République Démocratique du Congo.

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), is recognized as one of Africa's biological hotspots due to high levels of species richness and endemism (Küper et al. 2004; Orme et al. 2005; Plumptre et al. 2007). Although numerous 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 surveyed. Here we describe two new species of the *Rhinolophus maclaudi* group of horseshoe bats. The group is readily diagnosed by their large ears and by the absence of a connecting process to the sella (Fahr et al. 2002). Specimens of a new species were first collected in hills overlooking Lake Tanganyika in the Misotschi-Kabogo highlands (5°–6°S). Subsequently, an independent team collected a second new species of this group in Kahuzi-Biega National Park, a World Heritage Site known for its eastern lowland gorilla population (*Gorilla beringei graueri* Matschie). These two new species bring the total number of species described within the *Rhinolophus maclaudi* group to six, four of them largely confined to montane habitats within the Albertine Rift.

MATERIALS AND METHODS

Bats, including three individuals representing a new species, were collected between 14 and 17 February 2007,

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Fig. 1. Above – View of Misotschi-Kabogo foothills from Lake Tanganyika. Note mature forest next to degraded patch near village. Below – Mosaic of forest and grassland as seen from summit of Misotschi-Kabogo escarpment (Photographs A. Plumptre).

during the course of a preliminary small mammal survey in the Misotschi-Kabogo highlands overlooking the western shore of Lake Tanganyika, eastern Democratic Republic of Congo. A fourth individual was subsequently captured nearby, on the Kilicha River on 17 Feb 2007. All bat specimens were collected with mist nets, courtesy of the accompanying ornithologists. With a single exception, the new material discussed herein was collected during the course of the Misotschi-Kabogo expedition. The exception was a single horseshoe bat, also representing a new species, netted a few months later on the slopes of Mt Kahuzi during a survey of terrestrial small mammals and birds of Kahuzi-Biega National Park.

Data collected for all specimens included the macrohabitat, sex, and reproductive condition. The following standard external measurements were taken in the field: total length (Total), tail length (Tail), hind foot length (HF), ear length (Ear), forearm length (FA), and body mass (Mass). Head and body length (H&B) was determined by subtracting Tail from Total. All metrics are given in Tables 1 and 2. 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 (FMNH) in Chicago and transferred to 70% ethanol. The preservation of the specimen is recorded as ssk (skin, skull and skeleton), alc (alcoholic carcass), asr (alcoholic carcass with skull removed), or sko (skull and skeleton only).

External metrics of the bat specimens, excepting *Rhinolophus*, were taken by JCKP, using Mitutoyo CD-6”CSX calipers to the nearest .01 mm for craniodental variables and to the nearest 0.1 mm for external variables. JF took the measurements of the *Rhinolophus* as well as comparative museum specimens with Mahr 16 ES digital calipers and the same precisions. Definition of measurements (Table 1 & 2) is given in Fahr et al. (2002), with the following additional variables: HS-W: width of horseshoe; Trag: length of tragus; $CrnC_{alv}$: length of skull from posterior-most point to front of canine alveolus; $CbsC_{alv}$: length of skull from posterior-most point of condyles to front of canine alveolus; $C\text{-}C_{alv}$: width across alveoli of upper canines; $M^3\text{-}M^3{}_{alv}$: width across alveoli of posterior upper molars; $C\text{-}M^3{}_{alv}$: length of upper (maxillary) toothrow from front of canine to back of posterior molar at alveoli; M^1Br: breadth of first upper molar; $C\text{-}PM^2$: length from front of upper canine to back of posterior premolar; $PM^2\text{-}M^3$: length from front of posterior upper premolar to back of posterior molar; ManA: length of mandible from tip of angular process to anterior-most point, excluding incisors; $C\text{-}M/_{3alv}$: length of lower toothrow from front of canine to back of posterior molar at alveoli. Measurements are given in millimeters, body mass in grams.

Tissue samples were stored in the field in a saturated NaCl / EDTA buffer. Upon returning from fieldwork, tissues were stored in an ultracold freezer at -70°C. In the field, animals were handled in accordance with American Society of Mammalogists guidelines (Sikes et al. 2011).

Specimens were compared with material from the following institutions: American Museum of Natural History, New York (AMNH), Natural History Museum, London (BMNH), Institut royal des Sciences naturelles de Belgique, Bruxelles (IRSNB), Los Angeles County Museum of Natural History (LACM), Muséum d’Histoire naturelle Genève (MHNG), Musée Royal de l’Afrique Centrale, Tervuren (MRAC), Senckenberg Museum Frankfurt (SMF), and Zoologisches Museum of the University of Zürich (ZMUZ). The new collections are deposited at the Field Museum of Natural History, Chicago. D.C.M. refers to the field notes of David C. Moyer. Taxonomy follows Simmons (2005) unless stated otherwise.

STUDY AREAS

The Misotschi-Kabogo highlands of the eastern Democratic Republic of Congo run approximately 100 km along the escarpment above the western shore of Lake Tanganyika at an estimated width of 10–20 km. Topographically these highlands are separated from the Itombwe massif to the north by the Kilombwe valley, which is ca. 10 km wide at an altitude of 800–1100 m. The continuous forest cover of the Misotschi-Kabogo highlands on the one hand and the Itombwe forest on the other hand is separated by a stretch roughly 100 km wide. To the south, the Misotschi-Kabogo highlands are separated from the Marungu highlands, which lack noteworthy forest cover, by the Lukuga valley. With the exception of birds (Prigogine 1960), these highlands have been virtually unexplored by biologists. Prigogine (1955) described a new warbler (currently *Apalis porphyrolaema kaboboensis*) and collected a squirrel that was later described as a distinct subspecies (*Protoxerus stangeri kabobo* Verheyen, 1960). Prigogine also collected the type specimen of a distinct subspecies (Groves, 2005) of Angola colobus monkey, *Colobus angolensis prigoginei* (Verheyen 1959) from ‘Mt Kabobo’. Plumptre et al. (2008) summarized preliminary results of a biodiversity survey of the Misotschi-Kabogo highlands and discussed the conservation significance of this region.

The escarpment is continuously forested from the lakeshore at 770 m up to the highest elevation at ca. 2700 m (Fig. 1 above). The main forest block is approximately 1,000 km² in size. On the western side, the highlands drop to a rather flat area at an altitude of ca. 1000 m, which is characterized by a heterogeneous mosaic of savannas and riverine forests of variable width (Fig. 1 below).

The camps within the Misotschi-Kabogo forest were accessed from two different fishing villages along the Lake Tanganyika shoreline. The camp where all but one of the bats were collected is located approximately 4 km south-

west of the village of Talama, north of the town of Kalemie at 1950 m (4°59’29’’S, 29°04’49’’E). After exiting the forest and climbing a steep grassy ridge, the forest was again reached and the camp was set within a horseshoe bend of the Mukungu River. One specimen of the new *Rhinolophus* was collected at a separate locality referred to here as the Kilicha River locality at 1880 m (5°06’19”S, 29°03’56”E). Dominant tree species included *Syzygium guineense* (Willd.) DC., *Garcinia volkensii* Engl., and *Tabernaemontana johnstonii* (Stapf) Pichon. The climate of the two survey sites is characterized by a single wet season from October until April and a dry season from May until September, with an annual average precipitation of 1500–1550 mm, mean annual minimum temperature of 11.8°C, and mean annual maximum temperature of 21.5°C (Prigogine 1960, Hijmans et al. 2005).

The specimen from Kahuzi-Biega National Park was collected on the western slopes of Mt Kahuzi at an elevation of 2600 m (2°15’09’’S, 28°40’9’’E) in secondary forest with dominant tree species of *Nuxia floribunda* (Benth.)*, Agauria salicifolia* (Hook.f. ex Oliv.)*, Macaranga kilimandscharica* (Pax) and *Afrocarpus usambarensis* (Pilg.). The canopy was semi-closed at a height of 12 meters. The sub-canopy was semi-closed with dominant species of *Chassalia subochreata* (De Wild.) Robyns, *Polygala ruwenzoriensis* (Chodat), *Sericostachys scandens* (Gilg & Loper.), *Mimulopsis solmsii* Schweinf., *Mikania chevalieri* (C.D. Adams) W.C. Holmes & McDaniel, *Sinarundinaria alpina* (K. Schum.) *C.S. Chao & Renvoize* and *Tricalysia* sp. (A.Rich. ex DC). The climate is characterized by a single wet season from September until May and a dry season from June until August, with an annual average precipitation of 1850 mm, mean annual minimum temperature of 10.2°C, and mean annual maximum temperature of 18.6°C (Hijmans et al. 2005).

RESULTS

Myonycteris angolensis (Bocage) ssp.

FMNH 195081 (original number MHH 844), subadult female, collected on 16 February 2007 by B. D. Marks. Skin, skull and skeleton. Collected 4 km southwest of the village of Talama, N of Kalemie: 4°59’29’’S, 29°04’49’’E, 1950 m.

The single specimen slightly exceeds the dimensions of *Myonycteris angolensis ruwenzorii* (Eisentraut, 1965) and, despite being a subadult (basioccipital suture incompletely fused), falls within the size range of the largest subspecies, *M. a. goliath* (Bergmans, 1997). The latter author listed three females of *M. a goliath* from eastern Zimbabwe with FA 82.1, 83.8 and 89.6 (vs. FMNH 195081 with FA = 84.0) while Monadjem et al. (2010) gave a mean FA length of 83.9 ± 2.1 (range: 81.4–87.4) for six females from northern Mozambique. FA-ranges of 83 females of *M. a. ruwenzorii* are shorter with 72.8–83.0 (Bergmans 1997). Crn of FMNH 195081 is 43.85 and agrees with three females of *M. a. goliath* (45.8, ≥42.3, ≥42.2) while corresponding measurements of *M. a. ruwenzorii* range smaller (39.1–43.2, n=58; Bergmans 1997). In terms of distribution, the present specimen is located within the range of *M. a. ruwenzorii*, stretching from southern Sudan to southeastern D.R. Congo, while it is rather distant from the currently known distribution of *M. a. goliath* (E Zimbabwe & Mozambique). These data suggest that more material is needed to assess the taxonomic relationships of both taxa and their distributions; the elevation of *M. goliath* to species rank proposed by Cotterill (2001) seems premature. The transfer of *Lissonycteris angolensis* to genus *Myonycteris* follows Nesi et al. (2013).

Hipposideros* cf. *ruber (Noack)

FMNH 195085 (original number MHH 842), adult female, collected on 16 February 2007 by M. H. Huhndorf. Teats small (nulliparous). Skin, skull and skeleton. Collected 4 km southwest of the village of Talama, N of Kalemie: 4°59’29’’S, 29°04’49’’E, 1950 m.

The taxonomy of the *Hipposideros caffer*/*ruber* group is in flux due to pronounced cryptic diversity revealed by molecular genetics (Vallo et al. 2009). The latter study demonstrated that morphometrics previously used to distinguish species and subspecies show very limited match with molecular clades; hence we refrain from assigning the single specimen to any of the available names within this species complex. Our tentative identification as *H. ruber* follows the traditional concept, as the specimen is clearly larger than *H. caffer* (Sundevall); however, molecular data would be required for an unambiguous identification.

Hypsugo* cf. *eisentrauti (Hill)

FMNH 195086 (original number MHH 845), adult female, collected on 17 February 2007 by C. Kahindo. Teats small (nulliparous). Skin, skull and skeleton. Collected 4 km southwest of the village of Talama, N of Kalemie: 4°59’29’’S, 29°04’49’’E, 1950 m.

Our specimen is of large size (FA: 37.8), has a small upper premolar (PM^1) visible in lateral view, a broad and bicuspid inner upper incisor (I^1), a bicuspid outer incisor (I^2), and I^2 nearly reaches in height the lateral cusp of I^1. It is very similar in measurements to a specimen (SMF 79444) collected in the Nyungwe National Park, Rwanda, at 2500 m, referred to as *Hypsugo eisentrauti* by Volleth & Heller (1994), Heller et al. (1995), and Volleth et al. (2001). Although both of these specimens have similar external measurements compared to type specimens of *Hypsugo eisentrauti* from Cameroon, they are distinctly

Table 1. External and craniodental measurements of Chiroptera other than *Rhinolophus.*

	Myonycteris angolensis	*Hipposideros* cf. *ruber*	*Hypsugo* aff. *eisentrauti*			*Hypsugo eisentrauti*		
Museum	FMNH 195081	FMNH 195085	FMNH 195086	SMF 79444	ZFMK 68.5	ZFMK 68.6	BMNH 67.2129 #	BMNH 84.1684 §
Country	DR Congo	DR Congo	DR Congo	Rwanda		Cameroon		
Sex	♀	♀	♀	♂	♂	♀	♀	♂
Mass	82	10	9.8	12*(full)	7.0	8.3		
Total	136	93	93		84	88		
H&B	126	59	58		48	48		
Tail	10	34	35	36	40			
Ear	25	16	12	12.2	11	13		
Tragus			4.0	4.7	5.1	4.6		
FA	84.0	52.3	37.8	35.8	33.9	36.3	34.2	35.5
3Meta	57.7	38.7	34.6	34.3	30.9	33.2		31.2
3Pha1	41.7	16.4	12.5	13.2	10.7	12.5		
3Pha2	51.3	17.2	11.2	10.1	10.8	10.3		
3Pha3			5.9	6.2	5.1	5.6		
4Meta	54.9	36.3	33.2	33.4	30.1	32.8		
4Pha1	31.7	11.9	11.1	12.1	9.9	11.0		
4Pha2	33.1	9.0	9.6	9.2	9.2	9.0		
5Meta	54.4	31.8	32.6	33.0	28.9	31.7		
5Pha1	27.0	14.5	8.0	9.1	7.3	7.8		
5Pha2	31.2	10.4	5.5	5.0	5.0	5.0		
Tibia			13.8	14.2	12.1	13.4		
HF_{su}	17.8	7.9	7.1	6.9	7.0	6.8		
HF_{cu}	21.6*	9.9*	8.6	7.3		8.1		
Crn	43.85	18.63	14.76	14.88	13.68	14.16	14.0	14.0
CrnC	42.72	18.35	14.59					
Cbs	41.86	16.42	14.10	14.39	13.16	13.63	13.3	13.7
CbsC	40.52	16.03	13.76					
Mast	16.47	9.93	8.60	8.45	7.77		7.9	8.1
Zyg	24.32	9.53	10.74	10.65	9.61	[9.54]		
BcB	17.04	8.44	7.83	7.50	7.36	7.46	7.2	7.0
BcH	12.07	6.79	5.83	5.70	5.54	5.38		
C-C	8.01	4.15	4.95	5.20	4.60	4.23	4.5	5.0
M^3-M^3	12.31	6.37	6.73	6.75	6.06	6.3 #	6.3	6.3
C-M^3	16.8	6.34	5.34	5.59	5.22	5.1 #	5.0	5.3
PoC	8.77	3.11	4.48	4.10	4.27	4.25	4.2	3.9
ManC	32.7	11.32	10.87	11.10	10.33	10.73	9.9	10.9
C-M_3	18.44	6.68	5.72	5.98	5.51	5.67	5.5	5.8

Hill 1968, De Vree, 1972; § measurements courtesy of Dieter Kock. SMF 79444: Rwanda, near Cyangugu, Nyungwe NP, 2500 m, leg. K.-G. Heller & M. Volleth, F-N° 339, 28 Mar 1990, skin & skull; ZFMK 68.5 (holotype *eisentrauti*): Cameroon, Rumpi Hills, Dikume-Balue, camp V, leg. M. Eisentraut, F-N° 498, 18 Feb 1967, skin & skull; ZFMK 68.6 (paratype *eisentrauti*): Cameroon, Mt Kupe, camp II, ca. 1100 m, leg. M. Eisentraut, F-N° 198, 30 Nov 1966, skin & skull; BMNH 67.2129 (paratype *eisentrauti*): Cameroon, Mt Cameroon, Buea, leg. M. Eisentraut, F-N° 643, 15 Mar 1967, skin & skull; BMNH 84.1684: Cameroon, Mt Cameroon, 750 m; leg. M. O. Fedden & H. L. Macleod, F-N° 61, 2 Jan 1984, alc. & skull.

larger in several craniodental measurements (e.g. Crn, Cbs, Mast, Zyg, M^3-M^3; Table 1). Similar to true *Hypsugo eisentrauti*, the pelage of our specimen is unicolored dark brown above and slightly bicolored below. However, our specimen is much paler ventrally with brown roots tipped with pale brown. Based on available data, specimens FMNH 195086 and SMF 79444 appear to represent an undescribed species (see also Van Cakenberghe & Happold 2013).

***Rhinolophus willardi* sp. nov.** Kerbis Peterhans & Fahr Willard's Horseshoe Bat

Holotype. FMNH 195182 (original number D.C.M. 1680). Adult male, all teeth in wear. Collected on 17 February 2007 by A. J. Plumptre & E. A. Mulungu. Specimen preserved in alcohol with skull removed.

Fig. 2. Left – Type locality of *Rhinolophus willardi*. Note large amount of epiphytes on trees near Kilicha River. Right – Aerial view of artisanal mining site within forest of Misotschi-Kabogo highlands (Photographs A. Plumptre).

Type locality. Misotschi-Kabogo highlands, north of Kalemie, Kilicha River, above the western shore of Lake Tanganyika, South Kivu Province, eastern Democratic Republic of Congo, 5°06'19"S, 29°03'56"E, 1880 m. The holotype was captured in a clearing near a stream in a deep valley (Fig. 2, left). The forest covering the surrounding slopes was dense with tall trees (40–50 m) covering the surrounding slopes and had a fairly open understorey. The clearing was formed in an area where the stream had deposited gravel in the wet season but was at a much lower level at the time of capture (dry season).

Paratypes. All from 4 km SW of the village Talama, 'Camp 2', 4°59'29''S, 29°04'49''E, 1950 m, and all preserved as skin, skull and post-cranial skeletons. FMNH 195082, adult male, original number MHH 837, collected by B. D. Marks on 14 Feb 2007, with convoluted epididymes and abdominal testes (3x2 mm). FMNH 195083, adult female, original number MHH 838, collected by B. D. M. on 14 Feb 2007, with enlarged nipples but nulliparous. FMNH 195084, adult female, original number PK 754, collected by B. D. M. on 16 Feb 2007 without embryos.

Etymology. The specific epithet honors Dr. David Willard (Collection Manager, Division of Birds, FMNH) in recognition of his unparalleled 35+ years of service to the Field Museum of Natural History. While devoting 80+ hours a week to the job and generously sharing his time and expertise as an ornithologist and educator, Dave also brings an unmatched ethical standard. Although he did not collect these particular bats, Dave has contributed to the documentation of Chiropteran diversity throughout his career and, as a consequence, has documented the distribution of more mammal species in the Neotropics, Asia and Africa than the vast majority of field mammalogists.

Diagnosis. Immediately recognized as a part of the *Rhinolophus maclaudi* species group (Fahr et al. 2002) due to the large ears and the poorly developed connecting process behind the sella (Fig. 3). Within this group it is the smallest in most metrical dimensions, particularly FA, cranium, and palatal length. Twelve internal ear folds.

Description. Secondary horseshoe leaflet present and trilobate, connecting process and anterior face of sella clad with long hairs, horseshoe densely clad with short hairs (Fig. 4); dorsal pelage somewhat wooly (length of hairs ca. 11.9 mm), hairs unicolored, smoky-brown; ventral pelage more grayish with a slight sheen (length of hairs ca. 9.4 mm); membranes dark smoky-brown; skin of noseleaf dark grey. Connecting process of sella shoulder-like in lateral view where meeting sella from behind (point of insertion of shoulder to tip of sella: 1.45 mm). Ears relatively short (49–56% of FA-length), twelve internal folds. Bulla length: 4.1–5.0, bulla width: 2.05–2.06. Skull axis in lateral view more or less straight (as opposed to *R. maclaudi*). Profile of parietal, in lateral view, is variable (Fahr et al. 2002, Fig. 3), with both concave (as *R. ruwenzorii*) and more straight outlines (as *R. hilli*). Position of anterior margin of rostral swelling, in lateral view, ranges between the front and the center of upper M^1. Saddle between inflation and frontal pronounced, posterior slope of inflation both illustrating steep (more similar to *R. ruwenzorii*) and moderately steep profiles (more similar to *R. hilli*) in lateral view (ibid). Squamosal root of zygoma at

Table 2. External and craniodental measurements of *Rhinolophus willardi* sp. nov., *R. kahuzi* sp. nov., *R. hilli*, and *R. ruwenzorii*.

	Rhinolophus willardi sp. nov.				*R. kahuzi* sp. nov.	*R. hilli*		*R. ruwenzorii* #	
	FMNH 195182	FMNH 195082	FMNH 195083	FMNH 195084	FMNH 219793	ZMUZ 126639	MRAC 82006M1	Mean±*SD*	Range, sample size
Sex	♂	♂	♀	♀	♂	♀	♀	19 ♂♂, 9 ♀♀	
Mass		14	15	16	13		16.5	17.6±1.5	16.0–19.5, n=7
Total		87	92	95	81	92.0		93.7±5.3	83.0–104.0, n=24
H&B		61	66	73	57	62.7		63.3±5.1	52.0–72.0, n=27
Tail	23.4	26.0	26	22	24.1	29.3		29.5±2.5	25.0–35.0, n=25
Ear	24.2	29	28	29	34.5	28.5		35.6±2.1	32.0–40.0, n=27
HS-W	12.1	10.9*	10.7*	10.3*	11.7			11.8±0.8	10.3–13.0, n=20
FA	49.7	51.5	50.8	51.4	54.5	54.3	54.2	57.6±1.9	55.0–61.7, n=28
3Meta	33.2	35.0	35.3	36.8	38.9	37.1		39.8±1.7	37.4–43.6, n=26
3Pha1	16.0	16.6	15.7	16.8	17.1	17.2		18.3±1.2	15.9–21.1, n=26
3Pha2	25.7	28.0	28.4	27.2	29.5	29.3		30.6±1.4	27.8–32.8, n=26
4Meta	36.7	38.2	37.8	38.8	41.0	40.9		42.6±2.0	39.2–46.9, n=26
4Pha1	10.2	9.8	9.5	10.2	11.3	10.9		11.4±0.8	9.5–12.8, n=26
4Pha2	15.9	16.5	16.3	16.7	18.5	19.1		19.3±0.8	17.7–20.9, n=26
5Meta	36.3	37.9	38.7	39.3	43.3	41.0		43.4±2.0	39.6–46.8, n=26
5Pha1	11.4	12.0	12.9	12.7	11.7	12.7		13.0±0.7	11.3–14.1, n=25
5Pha2	15.2	15.7	15.3	15.2	16.0	18.5		17.4±0.8	15.7–18.9, n=24
Tibia	20.7	20.0		20.7	21.9	23.8		23.5±1.1	21.7–26.0, n=26
HF_{su}	10.7	11.0	11.6	10.7	11.1	11.1		11.6±0.8	10.0–13.0, n=26
HF_{cu}	12.0	12.5	12.5	12.1	12.3	12.2		13.2±0.8	11.7–14.5, n=12
Crn		22.60			24.20	23.89	23.3	25.41±0.73	24.20–26.37, n=9
CrnC	21.74	22.38	22.07	22.25	23.43	23.02		24.48±0.68	23.65–25.55, n=13
$CrnC_{alv}$	21.45	21.96	21.62	21.88	23.19	22.79		24.62±0.48	24.16–25.19, n=4
Cbs		19.96			21.24	21.22	20.7	22.90±0.50	22.00–23.62, n=9
CbsC	19.28	19.72	19.39	19.76	20.47	20.19		21.64±0.66	20.70–22.70, n=13
$CbsC_{alv}$	18.85	19.36	18.93	19.36	20.30	19.97		21.88±0.77	21.10–22.82, n=4
Mast	10.37	10.67	10.64	10.69	11.58	10.90	11.2	11.97±0.26	11.20–12.30, n=18
Zyg	10.30	10.35	10.85	10.57	10.61	10.60	10.9	11.07±0.23	10.50–11.40, n=18
BcB	9.00	9.32	9.45	9.36	9.97	9.96	10.1	10.06±0.26	9.85–10.81, n=12
BcH	6.87	6.93	7.23	7.14	7.07	6.92		7.28±0.27	6.85–7.67, n=12
C-C	5.58	5.66	5.71	5.65	5.04	5.67	5.6	5.61±0.15	5.30–5.90, n=19
$C\text{-}C_{alv}$	5.41	5.44	5.58	5.55	4.96	5.64		5.58±0.10	5.46–5.65, n=3
$M^3\text{-}M^3$	7.72	7.74	8.07	7.84	7.44	7.81	8.0	7.72±0.23	7.30–8.20, n=20
$M^3\text{-}M^3_{alv}$	7.44	7.48	7.75	7.63	7.28	7.91		7.44±0.18	7.05–7.75, n=13
$C\text{-}M^3$	7.73	7.99	7.97	7.99	8.04	8.08	7.9	8.44±0.23	8.15–8.90, n=14
$C\text{-}M^3_{alv}$	7.51	7.66	7.55	7.56	7.88	7.78		8.29±0.28	7.90–8.70, n=6
M^1Br	2.16	2.03	2.24	2.17	1.78	2.12		1.98±0.10	1.88–2.12, n=4
$C\text{-}PM^2$	3.21	3.38	3.30	3.41	3.33	3.55		3.67±0.08	3.59–3.74, n=3
$PM^2\text{-}M^3$	5.95	6.19	6.22	6.13	6.07	6.57		6.46±0.21	6.15–6.80, n=9
InflB	4.16	4.25	4.16	4.30	—	4.55		4.56±0.29	4.40–4.99, n=4
$RostrB_{infl}$	6.06	6.34	6.20	6.43	6.88	6.41		6.74±0.11	6.60–6.97, n=14
PalateL	3.04	3.15	3.12	3.09	3.40	3.58		3.65±0.21	3.25–4.20, n=19
PalateB	3.37	3.43	3.22	3.38	3.20	3.90		3.67±0.17	3.53–3.86, n=3
PoC	3.00	3.06	2.97	2.83	3.21	2.82	2.5	2.83±0.21	2.50–3.30, n=19
ManC	14.37	14.53	14.84	14.49	14.78	14.96	15.4	15.83±0.45	15.10–16.45, n=13
ManA	14.19	14.52	14.64	14.44	14.35	14.86		15.48±0.43	15.00–15.82, n=3
C-M/3	8.16	8.40	8.59	8.42	8.29	8.50	8.5	8.79±0.18	8.45–9.10, n=15
$C\text{-}M/3_{alv}$	7.93	8.21	8.32	8.22	7.95			8.73±0.20	8.54–8.93, n=3

AMNH 82394 (holotype), BMNH 55.1187, 60.99 – 60.101, FMNH 144309 – 144312, 160357, IRSNB 7047, LACM 51751, 57774, 57776, MHNG 1873.10 – 1873.14, MRAC 85006M447, 85006M448, 35170, 35173, 35206, 35208, 35211, 35217, 35218. For further details, see Appendix 2.

* Horseshoe width measured from dried skin, hence shrunk and originally probably larger.

Fig. 3. Photographs (A. Plumptre) of the holotype (FMNH 195182) of *Rhinolophus willardi* sp. nov.

glenoid in ventral view broad and strut-like for a length of 1.2 mm before it steps down anteriorly. Canine and second upper premolar almost in contact, anterior upper premolar extruded from the tooth row. Mast nearly equal to Zyg (ratio: 0.97–1.02).

Comparisons. The following features are shared with all members of the *Rhinolophus maclaudi* group from the Albertine Rift: *R. ruwenzorii* (SW Uganda, eastern DR Congo and NW Rwanda), *R. hilli* (SW Rwanda), and *R. willardi* sp. nov. (western slopes of Lake Tanganyika) and distinguish them from the two West African taxa (*R. ziama* and *R. maclaudi*). Secondary leaflets present beneath the horseshoe. The anterior margin of the horseshoe has a median emargination half the height of the horseshoe rim. The highest point of braincase is at the height of the glenoid process. The chambers of rostral swellings in dorsal view are subcircular with slight but well-defined postero-me-

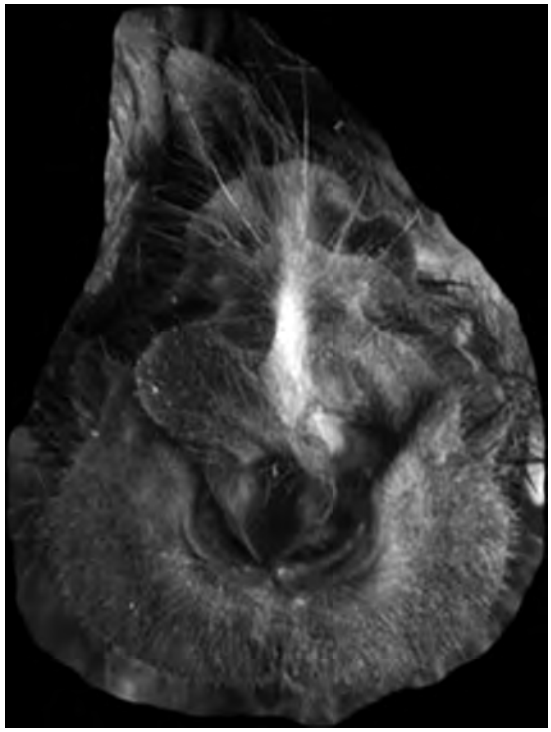

Fig. 4. Noseleaf of the holotype (FMNH 195182) of *Rhinolophus willardi* sp. nov. (Photograph J. Weinstein).

dian angulation. The infraorbital bridge is short and stout. All of the eastern taxa are smaller in size. These shared similarities suggest that the eastern and western taxa represent two distinct clades within the *R. maclaudi* group.

Rhinolophus willardi sp. nov. averages smaller than *R. ruwenzorii* in most measurements, with no overlap in Ear, FA, 3Meta, 4Meta, 4Pha2, 5Meta, Tib, CrnC, CbsC, Mast, BcB, C-M^3, C-PM^2, InflB, $RostrB_{infl}$, PalatL, PalatB, and ManC. Its body mass is also lower. However, the anterior upper molar (M^1) of *R. willardi* sp. nov. appears broader than in *R. ruwenzorii* while it averages similar to *R. ruwenzorii* in a few craniodental measurements (C-C, M^3-M^3, PoC). Compared to *R. hilli*, the smallest currently recognized member of the group, *R. willardi* sp. nov. is smaller in most measurements, with no overlap in FA, 3Meta, 3Pha1, 3Pha2, 4Meta, 4Pha1, 4Pha2, 5Meta, 5Pha2, Tib, CrnC, CbsC, Mast, BcB, InflB, and PalatL. However, it is similar or slightly larger than *R. hilli* in some craniodental measurements (Zyg, C-C, M^3-M^3, PoC, M1Br) with tooth rows that are proportionately long (C-M_3, C-M^3) and a proportionately higher braincase (BcH).

Rhinolophus willardi has twelve internal ear folds compared with 8–9 in *R. ruwenzorii* / *hilli*. The shape of sella, in frontal view, is constricted at the base and rounded terminally. Maxillary bone in dorsal view visible along the entire length, whereas in *R. hilli* and *R. ruwenzorii* it is concealed by the rostral inflations. Anterior portion of rostral sinus in lateral view steeply rising, inflation almost completely included in rostral sinus (more similar to *R. hilli*). The new species differs from *R. hilli* with a braincase that, in dorsal view, is constricted behind the mastoid process. Posterior slope of braincase in lateral view more horizontal than the sharply dropping slope of *R. hilli*. Relative size of lower molars very large (even slightly larger than in *hilli*). Zygomatic breadth is more or less equal to the mastoid width as opposed to *R. hilli/ruwenzorii* where the zygomatic breadth is narrower.

***Rhinolophus kahuzi* sp. nov.** Fahr & Kerbis Peterhans Kahuzi Horseshoe Bat

Holotype. FMNH 219793 (original number JCK 5406). Subadult male. Collected on 28 July 2007 by R. Kizungu. Specimen preserved in alcohol with skull removed.

Type locality. Western slope of Mt Kahuzi, Kahuzi-Biega National Park, South Kivu Province, eastern Democratic Republic of the Congo, 2°15’09’’S, 28°40’09’’E, 2600 m. Found within mixed *Afrocarpus* and *Nuxia* forest on the slope of Mt Kahuzi.

Etymology. The specific epithet refers to the type locality, and is used as a noun in apposition.

Diagnosis. Immediately recognized as a part of the *Rhinolophus maclaudi* species group (Fahr et al. 2002) due

Fig. 5. Partial noseleaf and sella of the holotype (FMNH 219793) of *Rhinolophus kahuzi* sp. nov. (Photograph J. Weinstein).

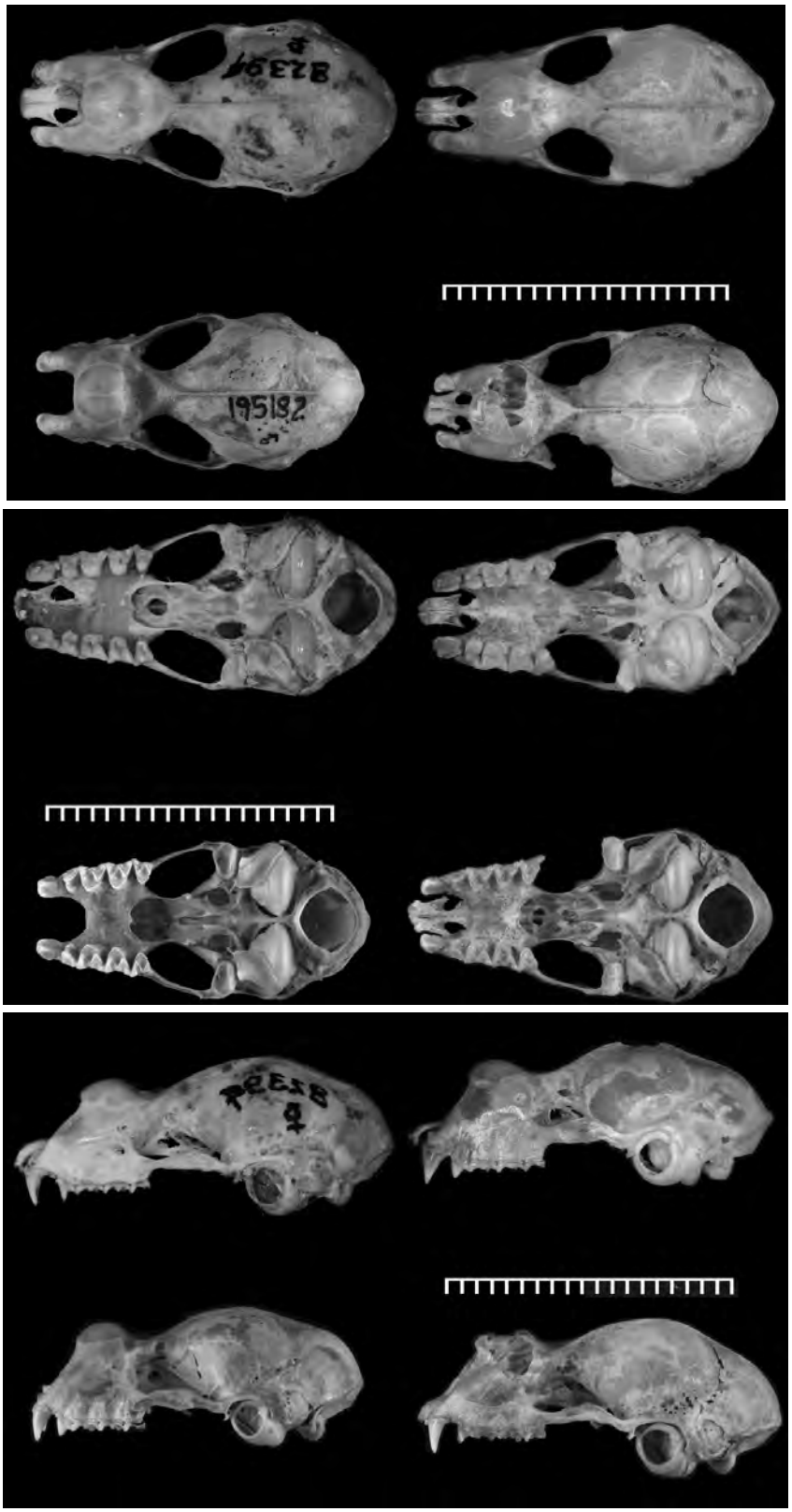

Fig. 6. Skulls in dorsal, ventral, and lateral views. From upper left, clockwise: *Rhinolophus ruwenzorii*, holotype, AMNH 82394; *R. hilli*, holotype, ZMUZ 126639; *R. kahuzi* sp. nov., holotype, FMNH 219793; *R. willardi* sp. nov., holotype, FMNH 195182.

to the large ears and the poorly developed connecting process behind the sella. Within this group, it is recognized by its large ears with 11 internal ear folds.

Description. Body – Moderately large rhinolophid (FA: 54.5 mm, Mass: 13 g). Pelage somewhat wooly with unicolored hairs, dorsally dark smoky-brown (length of hairs ca. 11 mm), ventrally barely paler and slightly more grayish (length of hairs ca. 9 mm). Membranes dark smoky-brown; noseleaf dark gray.

Noseleaf & ears – Horseshoe with deep median emargination, margin slightly "wavy" on the left side, ragged (coarsely serrated) on the right side (probably injured). One distinct triangular flap at the posterior point before the horseshoe meets the noseleaf, with a rim leading from cup of nostril backwards to base of triangular flap. Tip of sella broad and rounded with its greatest width at 4.9 mm and with a mid-length constriction of 3.8 mm (Fig. 5). Anterior face of sella and horseshoe densely clad with very short hairs. Weakly developed secondary leaflets with ragged edge, completely concealed by horseshoe. Lancet triangular with narrow tip; connecting process low. Ears relatively very long (63 % of FA-length), conch with 11 internal folds.

Skull & dentition – Upper incisors bilobed. Anterior upper premolar (PM^1) present on both sides and small, only slightly extruded from tooth row, canine and anterior upper premolar (PM^2) not in contact; PM^2 clearly not as broad as first upper molar (M^1). In lateral view (Fig. 6), upper edge of zygomatic arch without notch. Anterior slope of rostral sinus very angular below inflations (cf. fig. 6 in Fahr et al. 2002). Moderately developed sagittal crest along the anterior half of the braincase. Infraorbital bridge short and very stout. In dorsal view (Fig. 6), braincase constricted behind mastoid process. Premaxillae moderately broad; molars completely concealed by rostrum. Lower incisors trilobed, slightly imbricated. Middle lower premolar (PM_2) present on both sides and small, completely extruded from tooth row. Mastoid width broader than zygomatic width (ratio: 0.92), width across canines (C-C) small, and anterior upper molar (M^1) narrow.

Comparisons. Due to its small size (FA<55) and the presence of a secondary leaflet beneath its horseshoe, *R. kahuzi* sp. nov. needs comparison only with those species of the *R. maclaudi* group inhabiting the Albertine Rift: *R. willardi* sp. nov. (described above from the Misotschi-Kabogo highlands), *R. hilli* (from SW Rwanda) and *R. ruwenzorii* (SW Uganda, eastern DR Congo and NW Rwanda). *Rhinolophus kahuzi* sp. nov. is larger than *R. willardi* sp. nov. in most external (e.g. Ear, FA, 3Meta, 3Pha1, 3Pha2, 4Meta, 4Pha1, 4Pha2, 5Meta, 5Pha2, Tib) and several craniodental measurements (CrnC, CbsC, Mast, BcB, $RostrB_{infl}$, PalatL, PoC) while smaller in a few dental measurements (C-C, M^3-M^3, M^1Br).

In most dimensions, the new taxon is similar to *R. hilli*, another small member of the group (Table 2). *Rhinolophus kahuzi* boasts 11 internal ear folds compared with 12 in *R. willardi* sp. nov. and 8–9 in *R. ruwenzorii* / *hilli*, and has very large ears (34.5 vs. 24.2–29 in *R. willardi* sp. nov., and 28.5 in *R. hilli*. Compared to *hilli*, *R. kahuzi* sp. nov. has very similar external measurements, but with much smaller width across upper canines (C-C) and molars (M^3-M^3), shorter PM^2-M^3, shorter palatal breadth, but broader rostrum at height of inflations. The shape of the sella, in frontal view, is constricted at the base and rounded terminally. Maxillary bone, in dorsal view, visible along entire length (as in *R. willardi*) whereas in *R. hilli* and *R. ruwenzorii*, it is obscured by the rostral inflations. As does *R. willardi*, the new species differs from *R. hilli* with a braincase that, in dorsal view, is constricted behind the mastoid process. Posterior slope of braincase in lateral view drops sharply at 45° degree angle unlike the more horizontal plane of *R. willardi*.

Conservation status. *R. ruwenzorii* – VU B1ab(ii,iii,iv,v) (six out of 15 localities in protected areas), *R. hilli* – CR B1ab(iii,v)+2ab(iii,v) (both localities in one protected area), *R. kahuzi* (single locality in protected area) & *R. willardi* (both localities in unprotected areas): DD?

DISCUSSION

The *Rhinolophus maclaudi* complex now boasts six species, three having been described in the past decade. Shared characters unite the western and eastern branches of the complex into sister clades, but these relationships have not been confirmed with molecular data. There appears to be a cline of decreasing size as one moves from west to east and then, in the east, from north to south.

Our survey essentially presents the first bat records for the Misotschi-Kabogo highlands. Since these records were collected by the ornithological team, the documented richness of four bat species is certainly only a glimpse of the total bat diversity. In addition to our records, there is a single specimen of *Eidolon helvum* (MRAC 27113, leg. A. Prigogine, 18 Feb 1957) from Mt Kabobo. Given that these few records included a new horseshoe bat (*Rhinolophus willardi* sp. nov.), as well as a potentially undescribed pipistrelle bat, *Hypsugo* cf. *eisentrauti*, additional discoveries are highly likely. Furthermore, the elevational gradient with continuous forest cover across the eastern slope of the Misotschi-Kabogo highlands would provide untapped opportunities to study bat diversity in relation to altitude in this outstanding biogeographic hotspot (see Curran et al. 2012).

These discoveries, over the course of only a few nights in collecting effort, highlight the importance of surveying remote, undocumented African habitats and further in-

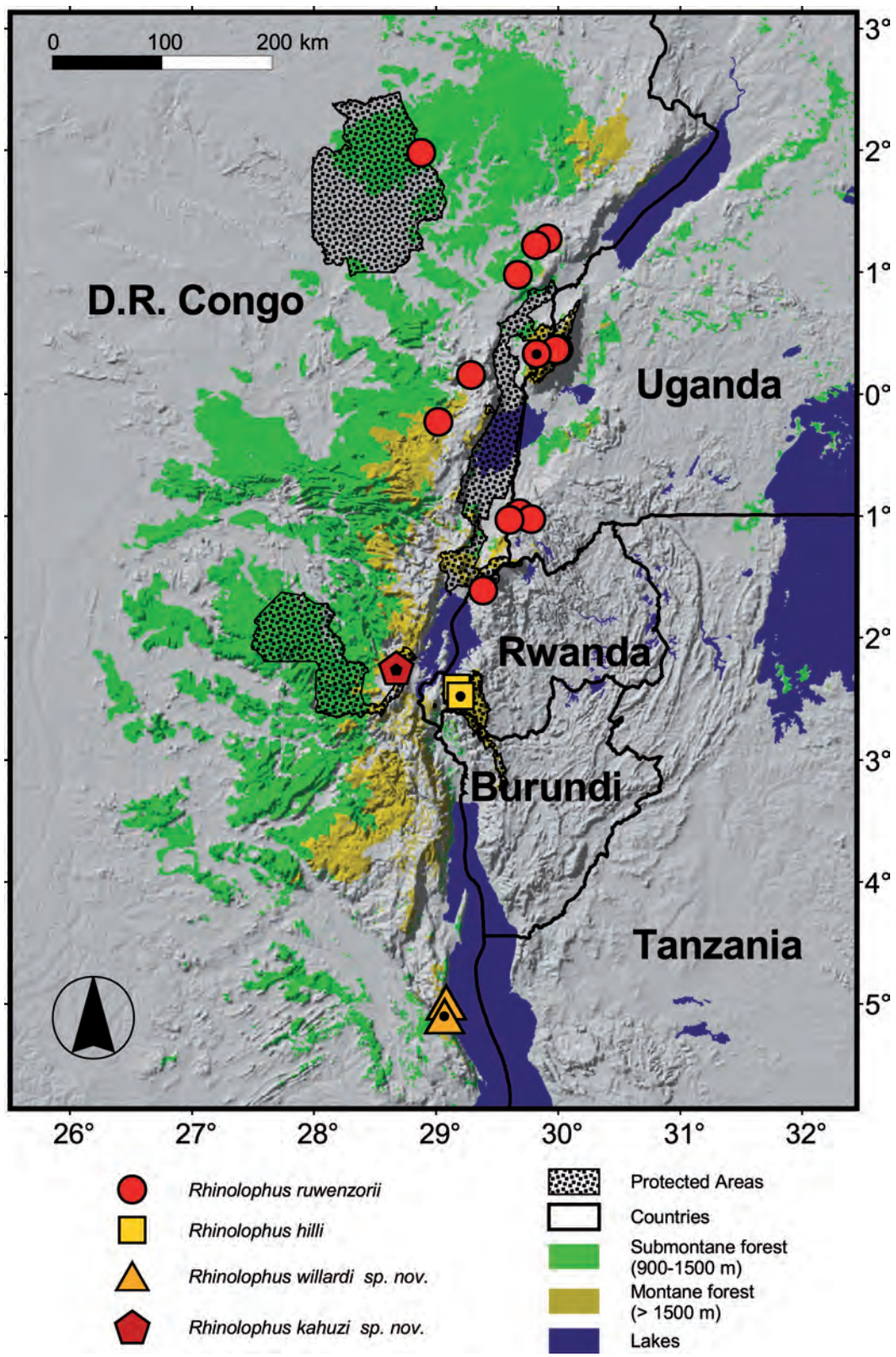

Fig. 7. Distribution of species of the *Rhinolophus maclaudi*-group in the Albertine Rift. Type localities indicated with a black central dot. Extent of montane and submontane forest from GLC 2000 (Mayaux et al. 2004), protected areas (IUCN categories II & IV, World Heritage Sites) from WDPA (IUCN & UNEP 2010). For data on localities, see Appendix 2.

Table 3. List of mammal species currently recognized as endemic to the Albertine Rift.

Taxon (number of endemics, 43–49)	(Author) Reference
Primates (1)	
Gorilla beringei	(Matschie, 1903) Groves 2005
Eulipotyphla (16–19)	
Crocidura kivuana	(Heim de Balsac, 1968) Hutterer 2005
Crocidura lanosa	(Heim de Balsac, 1968) Hutterer 2005
Crocidura maurisca[2]	(Thomas, 1904) Hutterer 2005
Crocidura niobe	(Thomas, 1906) Hutterer 2005
Crocidura stenocephala	(Heim de Balsac, 1979) Hutterer 2005
Crocidura lwiroensis (sp. nov.)	(Kerbis Peterhans & Hutterer, 2013)
Myosorex bururiensis	(Kerbis Peterhans et al., 2010)
Myosorex jejei	(Kerbis Peterhans et al., 2010)
Myosorex kabogoensis (sp. nov.)	(Kerbis Peterhans & Hutterer, 2013)
Myosorex babaulti	(Heim de Balsac & Lamotte, 1956) Hutterer 2005
Myosorex blarina	(Thomas, 1906) Hutterer 2005
Myosorex schalleri	(Heim de Balsac, 1966) Hutterer 2005
Paracrocidura graueri	(Hutterer, 1986) Hutterer 2005
Paracrocidura maxima	(Heim de Balsac, 1959) Hutterer 2005
Ruwenzorisorex suncoides	(Osgood, 1936) Hutterer 2005
Scutisorex somereni [1,2]	(Thomas, 1910) Hutterer 2005
Suncus hututsi[2]	(Kerbis Peterhans & Hutterer, 2009)
Sylvisorex lunaris	(Thomas, 1906) Hutterer 2005
Sylvisorex vulcanorum	(Hutterer & Verheyen 1985) Hutterer 2005
Afrosoricida (1)	
Micropotamogale ruwenzorii	(de Witte & Frechkop, 1955) Bronner & Jenkins 2005
Chiroptera (4)	
Rhinolophus hilli	(Aellen, 1973) Fahr et al. 2002
Rhinolophus kahuzi (sp. nov.)	(Fahr & Kerbis Peterhans, this volume)
Rhinolophus ruwenzorii	(Hill, 1942) Fahr et al. 2002
Rhinolophus willardi (sp. nov.)	(Kerbis Peterhans & Fahr, this volume)
Rodentia (21)	
Funisciurus carruthersi	(Thomas, 1906) Thorington & Hoffman 2005
Heliosciurus ruwenzorii	(Schwann, 1904) Thorington & Hoffman 2005
Tachyoryctes ruandae	(Lönnberg & Gyldenstolpe, 1925) Musser & Carleton 2005
Delanymys brooksi	(Hayman, 1962) Musser & Carleton 2005
Dendromus kahuziensis	(Dieterlen, 1969) Musser & Carleton 2005
Lophuromys medicaudatus	(Dieterlen, 1975) Musser & Carleton 2005
Lophuromys rahmi	(Verheyen, 1964) Musser & Carleton 2005
Lophuromys stanleyi	(Verheyen et al., 2009)
Lophuromys woosnami	(Thomas, 1906) Musser & Carleton 2005
Dasymys montanus	(Thomas,1906) Musser & Carleton 2005
Dasymys rwandae	(Verheyen et al., 2003) Musser & Carleton, 2005
Grammomys dryas	(Thomas, 1907) Musser & Carleton 2005
Hybomys lunaris	(Thomas, 1906) Musser & Carleton 2005
Hylomyscus denniae	(Thomas, 1906) Musser & Carleton 2005
Hylomyscus vulcanorum	(Lonnberg & Gyldenstolpe, 1925) Musser & Carleton 2005
Mus bufo	(Thomas, 1906) Musser & Carleton 2005
Praomys degraaffi	(van der Straeten & Kerbis Peterhans, 1999) Musser & Carleton 2005
Thamnomys kempi	(Dollman, 1911) Musser & Carleton 2005
Thamnomys venustus	(Thomas, 1907) Musser & Carleton 2005
Otomys denti	(Thomas, 1906) Musser & Carleton 2005
Otomys dartmouthi	(Thomas, 1906) Musser & Carleton 2005
Carnivora (0–1)	
Genetta victoriae[1]	(Thomas, 1901) Wozencraft 2005
Artiodactyla (0–2)	
Syncerus matthewsi^	(Lydekker, 1904) Groves & Grubb 2011
Cephalophus rubidus^	(Thomas, 1901) Jansen van Vuuren & Robinson 2001

^taxonomic status in question
[1] species extends westward into Congo Basin but distribution centered on Albertine Rift
[2] montane status unclear

dicate how much there is yet to learn of African biodiversity. Montane communities contain reservoirs of biodiversity that are inherently isolated. Their exploration must be placed at the forefront of survey and conservation efforts, especially in this era of dramatic climatic change. It had been previously claimed that the Albertine Rift did not warrant recognition as a biodiversity hotspot due to inadequate knowledge (Myers et al. 2000). Continued surveys, such as the ones reported on here, are rapidly dispelling this notion. Since 1999 our teams have described eight small mammal species new to science from the Albertine Rift region (Van der Straeten & Kerbis Peterhans 1999; Kerbis Peterhans & Hutterer 2009; Kerbis Peterhans et al. 2010; Kerbis Peterhans et al. 2013; this paper). The four new species from the Misotschi-Kabogo Highlands and Kahuzi-Biega National Park described in this volume bring the total of Albertine Rift montane endemics to a minimum of 43–49 species, by far the largest endemic montane fauna in Africa (Table 3, see also Kerbis Peterhans et al. 1998; Kaleme et al. 2007; Carleton et al. 2006). Clearly it is time to prioritize the status of this exceptional reservoir of biodiversity as it also houses the richest endemic montane faunas of birds (Strattersfield et al. 1998; Voelker et al. 2010), butterflies (Carcasson 1964) and perhaps reptiles and amphibian (i.e. Greenbaum & Kusamba 2012 for a recent review) on the continent.

All of the newly described forms have been uncovered through traditional field surveys to remote areas followed up by morphological diagnoses and comparisons with representatives from adjacent montane blocks. Such efforts are not possible without the use of museum collections and their associated reference materials. None of these forms was resurrected from synonymy nor first diagnosed through molecular techniques. Our methods are available to all parties, especially to those custodians in tropical regions and not just those with access to modern laboratories and facilities.

We are pleased to recognize interest and support from non-governmental organizations (NGOs), who have provided various groups with the resources to begin surveys of the unexplored pockets within the ecoregion (see Acknowledgements). Discoveries of rare species or species new to science have the potential to serve as flagship species for areas that lack formal protection. Finally, the timely turnover from field survey to academic manuscript (as exemplified by this journal) further illustrates that the oft-ignored small mammal community should be fundamental in biodiversity surveys.

Acknowledgements. The expedition to the Misotschi-Kabogo highlands was initiated by the Wildlife Conservation Society (WCS). Field work was spearheaded by A. J. Plumptre and D. Kujirakwinja in conjunction with the Research Staff at Lwiro (CRSN, Democratic Republic of Congo), the Field Museum of Natural History (Chicago) and the World Wide Fund for Nature (WWF). Additional funding came from the Daniel K. Thorne Foundation, the John D. and Catherine T. MacArthur Foundation, and the US Fish and Wildlife Service. In the Kabogo highlands, we acknowledge J. Badesire for logistical support, E. A. Mulungu provided critical field support, and G. Lukole and G. M. Mwankasala provided security and field logistics and local introductions. D. Pazo (CRSN, Lwiro) provided details on the botanical communities of Mt. Kahuzi. We thank J. Mwanga (Head, Biology) and B. Bajope (Director) of the Centre de Recherche en Sciences Naturelles at Lwiro for continuous assistance in collecting and with export permits. ECHO provided air transport. We recognize FMNH staff for their assistance: M. Schulenberg, J. Phelps, and W. T. Stanley. The senior author acknowledges the Barbara Brown Fund and the African Council of the Field Museum for financial support and an award from Roosevelt University (Dean's Office), which enabled him to work on this publication in Germany with JF. We are indebted to Cäsar Claude (ZMUZ) for the loan of the type of *R. hilli*, Manuel Ruedi (MHNG) for a short-term visitor grant to JF that allowed the study of collections under his care, which includes new material of *R. ruwenzorii*, Eileen Westwig and Darrin Lunde (AMNH) for photographs of the type specimen of *R. ruwenzorii*, and John Weinstein (FMNH) for skull and noseleaf photographs of the new species. Finally, the cooperation of the ornithological community provides vital continuous support in documenting Chiropteran diversity.

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Appendix 1.

Collecting localities of *Rhinolophus ruwenzorii*, *R. hilli*, *R. willardi* sp. nov., and *R. kahuzi* sp. nov.

Rhinolophus ruwenzorii J. Eric Hill, 1942

D.R. CONGO: S-side of **Butahu [= Butawu] Valley** (cave, 7500 ft., W-slope Rwenzori Mts.) (Hill 1942; Fahr et al. 2002; Csorba et al. 2003: as "Butatu Valley"; AMNH 82394, holotype, ♀, alc. & skull, leg. 24.XII.1926); **Butembo** (1760 m, Kivu) (Hayman et al. 1966; Fahr et al. 2002; Csorba et al. 2003; IRSNB 7047, ♂, skin & skull, leg. J. Hiernaux, 16.VIII.1947); **Kibwe Lya Mikako Cave** (1500 m, Kasuo, Lubero Distr.) (Bogdanowicz 1992, Bogdanowicz & Owen 1992; Fahr et al. 2002; MRAC RG 35170, -173, -174, -206, -208, -211, RG 35216 – 219, 3 ♂♂, 4 ♀♀, 3 unsexed, leg. R. P. M. J. Celis & M. Lejeune, 28.XII.1966); **Matata Cave** (1160 m, Kibali-Ituri) (Hayman et al. 1966; Fahr et al. 2002; Csorba et al. 2003; IRSNB 7048, ♂, skull only, leg. J. Hiernaux, 10.VIII.1947); **Matupi Cave** (3500 ft., Mt Hoyo, S of Irumu, Ituri Forest) (Hayman 1960; Fahr et al. 2002; Csorba et al. 2003; BMNH 60.99 – 101, 3 ♂♂, 2 skin & skull, 1 alc., leg. A. E. Wright, 14.&16.IX.1959); **Mt Hoyo** (1200 m, Ituri Forest) (Hayman et al. 1966; Fahr et al. 2002; Csorba et al. 2003; IRSNB 7049, ♀, skull only, leg. J. Hiernaux, 10.VIII.1947); **Mt Hoyo** (Komanda) (MHNG 1873.11 – .14, 3 ♂♂, 1 ♀, alc., leg. F. Meier, 21.VIII.1976); **Pahoni** (N'Duye) (MHNG 1873.10, ♀, alc., leg. F. Meier, 6.VIII.1976).

RWANDA: **Mutura** (2200 m) (Fahr et al. 2002; MRAC 85006 M 447, -448, 2 ♂♂, alc. & skull, leg. Baeten & Janssens, 16.XII.1982).

UGANDA: **Itama Mine** (1615 m, Bwindi-Impenetrable-NP, Kigezi) (Smith & Hood 1980; Fahr et al. 2002; Csorba et al. 2003: as "Kigezi Highlands"; LACM 51750, 57772 – 777, 3 ♂♂, 4 ♀♀, 1 skin & skull, 3 alc. & skull, 3 alc., leg. A. L. Archer, 31.III.1967); **Luhizha Mine [Ruhizha wolfram mine]** (2286 m, Bwindi-Impenetrable-NP, Kigezi) (Smith & Hood 1980; Fahr et al. 2002; Csorba et al. 2003: as "Kigezi Highlands"; LACM 51747 – 749, 2 ♂♂, 1 ♀, 3 skin & skull, leg. R. Glen & A. Williams, 27.III.1967); near **Mahoma River** (cave, 6700 ft., above Ibanda, E-slope Rwenzori Mts.) (Hayman 1957; Fahr et al. 2002; Csorba et al. 2003: as "Ibanda"; BMNH 55.1187, ♀, alc. & skull, leg. G. O. Evans, 22.VIII.1952); right bank of **Mubuku River** (6900 ft., above confluence with Mahoma River, Rwenzori Mts.) (Kityo & Kerbis 1996: as "Rwenzori Mts. at 2100 m"; Fahr et al. 2002; Thorn et al. 2009; FMNH 144309 [at Makerere Univ.], ♂, skin, skel. & skull, leg. W. T. Stanley, 25.XI.1990); **Nteko Parish** (1600 m, edge of Bwindi-Impenetrable-NP, Bufumbira) (Fahr et al. 2002; Thorn et al. 2009; FMNH 160357 [exchanged], ♂, skin, skull & skel., leg. R. M. Kityo, 19.V.1997); **Nyabitaba** (2591 m, Mubuku Valley, E-slope Rwenzori Mts.) (Smith & Hood 1980; Fahr et al. 2002; Csorba et al. 2003; LACM 51751, ♂, leg. R. Glen & A. Williams, 5.VI.1967); **Nyabitaba Hut** (8750 ft., right bank of Mubuku River, below confluence with Bujuku River, Rwenzori Mts.) (Kityo & Kerbis 1996: as "Rwenzori Mts. at 2700 m"; Fahr et al. 2002; Thorn et al. 2009; FMNH 144310, ♂, alc., leg. W. T. Stanley, 11.XII.1990; FMNH 144311, -312, 2 ♂♂, 1 alc., 1 skin, skull & skel., leg. J. C. Kerbis, 19&20.IV.1991).

Rhinolophus hilli Aellen, 1973

RWANDA: **Uwinka** (P.N. de Nyungwe, 2512 m) (Aellen 1973; Fahr et al. 2002; Csorba et al. 2003: as "Cyangugu"; ZMUZ 126639, holotype, ♀, alc. & skull, leg. U. Goepel, 25.VIII.1964, F-N° 481); **Ruta Bansugera** (P.N. de Nyungwe, 1750 m) (Baeten et al. 1984; Fahr et al. 2002; MRAC 82006 M 1, ♀, leg. F. De Vree et al. 19.X.1981).

Rhinolophus willardi sp. nov.

D.R. CONGO: **Kilicha River** (Mt Kabogo, near Kalemie, 1880 m) (FMNH 195182, ♂, alc. & skull, leg. A. Plumptre & E. A. Mulungu, 28.II.2007); **2nd camp** (Mt Kabogo, 4 km SW Talama, 1950 m) (FMNH 195082 – 084, 1 ♂, 2 ♀♀, skin & skull, leg. B. D. Marks, 14. & 16.II.2007).

Rhinolophus kahuzi sp. nov.

D.R. CONGO: **Mt Kahuzi** (Kahuzi-Biega-NP, 2560 m) (FMNH 219793, ♂, alc. & skull, leg. R. Kizungu, 28.VII.2007, F-N° JCK 5406).

Appendix 2.

Gazetteer of collecting localities (updated from Fahr et al. 2002)

D.R. CONGO:		
Kilicha River	5°06’19’’S, 29°03’56’’E	near Kalemie, Misotschi-Kabogo highlands, 1880 m
2nd camp	4°59’29’’S, 29°04’49’’E	4 km SW Talama, Misotschi-Kabogo highlands, 1950 m
Mt Kahuzi	2°12’07’’S, 28°40’24’’E	Kahuzi-Biega National Park, 2560 m
Butahu Valley	0°19’35’’N, 29°49’20’’E	W-slope Rwenzori Mts., 7500 ft. [2286 m]
Butembo	0°09’N, 29°17’E	Kivu Province, 1760 m
Kibwe Lya Mikako Cave	0°14’42’’S, 29°01’E	Kasuo, Lubero Distr., 1500 m
Matata Cave	0°58’30’’N, 29°40’E	Kibali-Ituri, 1160 m
Matupi Cave	1°16’12’’N, 29°54’36’’E	Mt Hoyo, S of Irumu, Ituri Forest, 3500 ft. [1066 m]
Mt Hoyo	1°13’N, 29°49’E	Ituri Forest, 1200 m
Pahoni [= Paoni]	1°58.5’N, 28°52.5’E	N’Duye [= Nduye], near Biasa River, NE edge of “Réserve de Faune à Okapis”
UGANDA:		
Itama Mine	0°59’S, 29°41’E	Bwindi-Impenetrable-NP, Kigezi Highlands, 1615 m
Luhizha Mine	1°01’53’’S, 29°46’42’’E	Bwindi-Impenetrable-NP, Kigezi Highlands, 2286 m
Mahoma River	0°21’39’’N, 30°00’06’’E	above Ibanda, E-slope Rwenzori Mts., 6700 ft. [2042 m]
Mubuku River	0°21’50’’N, 29°59’53’’E	above confluence with Mahoma River, E-slope Rwenzori Mts., 6900 ft. [2103 m]
Nteko Parish	1°02’16’’S, 29°36’E	edge of Bwindi-Impenetrable-NP, Bufumbira, 1600 m
Nyabitaba (Hut)	0°21’26’’N, 29°58’31’’E	right bank of Mubuku River, below confluence with Bujuku River, E-slope Rwenzori Mts., 8750 ft. [2667 m]
RWANDA:		
“near Cyangugu”		Parc National de Nyungwe, 2500 m
Mutura	1°37’S, 29°23’E	2200 m
Ruta Bansugera	2°25’S, 29°10’E	Parc National de Nyungwe, 1750 m
Uwinka	2°29’S, 29°12’E	Parc National de Nyungwe, Préfecture de Cyangugu [= Shangugu], 2512 m

