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African Bat Conservation News

Inside this issue:

Above: Egyptian free-tailed bat (*Tadarida aeygyptiaca*), caught 20.5 km NW Kakamas, next to the main reception at Khamkirri, in a drainage line running into the Orange river, 636 m asl. (28°39'6.9487'S, 20°26'45.28"E), Northern Cape Province, South Africa.

Notes from the Editor:

Contributions to the scientific section have been arriving slowly and there are several papers in the review process that should make interesting reading in future issues. To allow a two month period for review and corrections before appearing in one of the quarterly issues (January, April, July, and October) the deadline for scientific contributions is the first of November, February, May, and August.

In this issue there are papers on the first record of a synanthropic roosting of a new species of *Scotophilus* in Madagascar, and the rediscovery, after some 89 years, of a colony of Short-eared Trident bats (*Cloeotis percivali*) in Swaziland. The recent evidence of a colony of *Cloeotis percivali* at Wylesdale brings to three (with Miggies gat and Jozini Dam Wall) the number of active roosts of *Cloeotis percivali* recorded in southern Africa within the past 20 years.

The Transvaal Museum, one of the sites which is hosting African Bat Conservation News, is about to undergo a name change. This has caused some problems with the updating of the website as the whole organisations website is being revamped for the launch of the new name. I apologise to those persons who are finding it difficult to download issues regularly. Please use the Flying Fur site maintained by Valerie Craig for the latest issues. If there are any other sites that would also like to host the newsletter please contact me. **- Ernest C.J. Seamark**

Download sites for ABCN:

http://www.nfi.org.za/mammal/abcn/ABCN.htm

http://flyingfur.typepad.com/abcn/abcn.html

SCIENTIFIC CONTRIBUTIONS

African Bat Conservation News publishes brief notes concerning the biology of bats, new geographical distributions (preferably at least 100 km from the nearest previously published record), sparsely annotated species lists resulting from local surveys including roost counts and echolocation and sonograms of bat species occurring on the African continent and adjacent regions, including the Arabian peninsula, Madagascar, and other surrounding islands in the Indian and Atlantic oceans.

Rediscovery of the Short-eared Trident Bat (*Cloeotis percivali* Thomas 1901) in Swaziland

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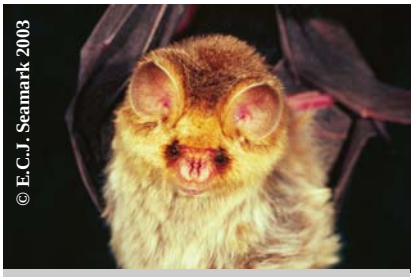
Key words: *Cloeotis percivali*, echolocation call, distribution, Swaziland



Above: Short-eared Trident Bat (*Cloeotis percivali*), from Miggies gat, Mpumalanga, South Africa, December 2002 (TM46644).

Cloeotis percivali Thomas 1901 is patchily distributed in southern and east Africa, with only a few roost sites having been located to date (TAYLOR 2000; SEAMARK 2005). A colony of between 100-200 individuals was observed roosting in inspection tunnels in the Jozini dam wall, KwaZulu-Natal (TAYLOR 1998). The species is also known from the Sudwala area in Mpumalanga (South Africa; JACOBS 2000).

Old specimen records exist from "Wylesdale Mine" in north-western Swaziland near the South African border (collected by A. Roberts in 1916; Transvaal Museum collection- TM 1987 - 1989). However, it was not recorded during the mammal survey of Swaziland (MONADJEM 1998). Although mines in the Wylesdale area were visited in 2002 (MONADJEM 2004), *Cloeotis percivali* was not observed. Hence, this species was designated as "Data Deficient" in the recent Red Data Book for Swaziland's vertebrates (MONADJEM *et al.* 2003), and it was suggested that it may have been overlooked in the country.

The Wylesdale area (25º49´S; 31º17´E) was visited again on 8 January 2005 and several abandoned mine shafts were inspected. A colony of *Cloeotis percivali* was observed in one mine shaft (this shaft was not located during the previous visit in 2004 and hence it is not known whether the bats were present at that time). The main shaft was about 100m in length and relatively humid in the deepest part where the majority of bats were observed. A small trickle of water flowed down its entire length and may have accounted for the humidity. An attempt was made to count the bats, but due to constant movement only a rough estimate, of between 50 to 100 individuals, was possible. The adults were predominantly female, but a small number of adult males were also present. In addition, a large number of free-flying juveniles were also observed, suggesting that this mine shaft was being used as a maternity roost. Judging from the size of the juveniles, they must have been born between October and November 2004.

Two specimens were collected and deposited in the Durban Natural Science Museum (DNSM 8026, DNSM 8027). Recordings of the echolocation calls of two individuals were made using an ANABAT II bat detector (Titley Electronics, Ballina, Australia) by holding each bat about 20 – 30 cm above the detector. Calls were analysed using ANALOOK software (version 4.8). Only calls that were clearly defined were analysed. Parameters that were recorded included minimum frequency of the frequency modulated portion of the call and maximum frequency of the constant frequency (CF) component of the call, and duration.

Mean values based on eleven individual calls recorded were maximum frequency (CF): 103.8 kHz; minimum frequency: 103.0 kHz; and duration: 1.6 ms. The frequency of the CF component was 103.8 kHz, which is very similar to the fundamental frequency of 104 kHz reported in TAYLOR (2000). It is important to note that the fundamental harmonic is usually suppressed or only weakly present in hipposiderid species while the second harmonic (at 208 kHz in the case of *Cloeotis percivali*) contains the maximum energy (TAYLOR 2000; FENTON & BELL 1981; J. FAHR, in litt.). It would thus appear that the ANABAT detector was unable to pick up the main frequency of the call.

This is the only known colony of *Cloeotis percivali* in Swaziland. The species is listed as Vulnerable A2bc, A3bc, C1 (global; MICKLEBURGH *et al.* 2004) and Critically Endangered A2a (South Africa: FRIEDMANN and DALY 2004). Its status in Swaziland now requires re-evaluation. Based on the fact that this species has only ever been recorded from a single locality in Swaziland, and that gold mining is being reconsidered at Wylesdale, we suggest it be placed in the Endangered category of the national Red List of Swaziland. Should the threat of mining become real, then the Critically Endangered category may be more appropriate.

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The first records of the synanthropic occurrence of *Scotophilus* spp. on Madagascar

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Key words: *Scotophilus*, Madagascar, synanthropic occurrence

Until recently, little information was available on Malagasy species of *Scotophilus* LEACH, 1821. In their review of the bats of Madagascar, PETERSON *et al.* (1995) noted that only one endemic species, *S. robustus* MILNE-EDWARDS, 1881, occurred on the island and was represented by a limited number of specimens. Further, they remarked that no evidence had been found of Malagasy *Scotophilus* using houses or other human-built structures for their day roosts. This is unusual as members of this genus often occur in synanthropic situations across their broad Old World range (e.g., KINGDON 1974, BATES & HARRISON 1997). In recent years there has been a renewed interest in the bats of Madagascar, including extensive field surveys of poorly known regions and associated studies of museum specimens. It is now clear that at least four species of *Scotophilus* exist on the island, including *S.* cf. *borbonicus* (E. GEOFFROY, 1803), *S. robustus*, and two new to science (GOODMAN *et al*. in press a, in press b). With continued efforts in documenting the bat fauna, considerable new details have emerged about their distribution and natural history. We have recently found the first evidence of the synanthropic occurrence of *Scotophilus* on the island, which is the subject of this note.

Scotophilus robustus MILNE-EDWARDS, 1881

This species was previously thought to be possibly limited to the northern portion of the island (PETERSON *et al.,* 1995), but more recent information indicates that it is broadly distributed across the island in both dry western and humid eastern areas, as well as montane central localities (GOODMAN *et al*. 2005, in press; unpublished data of the authors). During a 2005 survey of synanthropic bat species occurring in the lowland areas of eastern Madagascar the first author found this species in synanthropic situations at three different day-roost sites.

The first locality was in a house within the village of Anjiro (18°53'S, 47°58' E) at 850 m above sea level and close to non-native scrubby forest and a bottomland with rice cultivation. The house was of a classical local architectural style – about 5 m in height, constructed out of clay and bamboo, metal roofing, and a false ceiling of *bararata* (*Phragmites* sp.). A single adult male with large scrotal testes and convoluted epididymis was captured on 7 February 2005 with a hand net as it was exiting at 18h 50 a A-4 paper size hole in the clay wall of the house, about 4.5 m above the ground.

The second site is within the coastal village of Manakara (22°09' S, 48°00'E) and at 35 m above sea level. The building is a primary school of colonial architecture built around 1900 and with a maximum roof height of 5 m. The construction style included walls made out of kiln fired-brick, roof of metal, and the ceiling of narrow wooden lath. The upper external portion of the roof had paired aeration openings that were originally covered with a fine screen, but these have subsequently been broken and the holes provided access to the space between the roof and the ceiling. Two females, both with small mammae, were captured on 19 May 2005 with a mist net as they were entering the aeration holes at 19h30.

On 9 May 2005 in the village of Vohipeno (22°21'S, 47°50'E), at about 30 m above sea level, four individuals were obtained at a government office constructed around 1950 and with a roof height of about 5 m. The building is composed of several different construction materials including walls of kiln-fired brick, roof of sheet metal, and ceiling of thin wood lath. The four trapped individuals, including two adult males with enlarged scrotal testes and two females with small mammae, exited the building from a narrow space between the roof and ceiling joists. They were captured between 18h45 and 19h00 in

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different portions of a 6 m mist net placed perpendicular to the building axis. It is not clear if these bats were roosting together, in pairs or solitarily.

Scotophilus nov. sp.

The description of this species, currently known from three localities in the lowland central western portion of the island, will appear shortly (GOODMAN *et al*., in press b). The holotype, an adult male (Field Museum of Natural History 184050), was obtained in December 2004 at a roost site near the village of Marovaza (14°57'S, 47°16'E), within several dense layers of palm leaves (*Bismarckia nobilis*) attached to the roof soffit of a building (Fig. 1). In late April 2005, when the site was revisited, three additional examples of this bat were found roosting together in the same exact place. These included two females and a third unsexed individual that escaped before it could be captured, but was pursued to three different buildings with the same style of palm thatching. At each of these four sites, all with the distinct musky odour of this *Scotophilus* and within 30 m of one another, the thatching formed a dense cluster and hung vertically with the opening facing the ground. The roosting space was in a small pocket formed by the curled dried leaves of the palm, just anterior to the leaf petiole, and there was a collection of faeces on the ground directly below. Thus, it can be discerned that this group of bats had several day sites in the immediate vicinity of one another.

Bismarckia nobilis is a widespread palm of western Madagascar, and often is the dominant arboreal plant in degraded environments. Many standing individuals have dried leaves hanging vertically that form similar pockets for roost sites as found in the building at Marovaza. We suspect that this bat species naturally inhabits day-roost sites in the leaves of standing palms and have transferred to the architecturally similar shaped leaves of the roof thatching. Something on the order of an additional 15 buildings in the village of Marovaza with similar palm thatched roofs were visited and no sign of this bat was found. At all of these other sites the tips of the palm leaves were trimmed, forming a dense straight edge to the roofing, while those at the bat roost site were uncut, notably shaggy, and with numerous small interior pockets.

On the basis of recently collected information we can now confirm that at least two of the four species of *Scotophilus* on Madagascar can be found in synanthropic settings. For *S. robustus* the sites were in the lowland eastern, in brick and clay-constructed buildings, and in spaces showing parallels, in an architectural sense, to natural rock outcrops or large hollows in trees. This species has been captured in native forest settings considerable distances from rock outcrops and, hence, it is probably best to be considered a dweller of natural cavities. In the case of *Scotophilus* nov. sp., a species of the dry central west, the animals occurred in dense palm thatching, very similar to cavities in the natural leaves of standing local palm trees. Not enough information is available on the age and sex composition of the individuals in these roosts to infer much on the social group patterns in these species.

Figure 1: Building where a small group of *Scotophilus* nov. sp. were found in a day-roost site within the palm thatch roof . The arrow points to the direction and exact place of entry into the roost site.

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RECENT LITERATURE

Presentations at the 32nd CONFERENCE of the ZOOLOGICAL SOCIETY OF SOUTHERN AFRICA

Rhodes University, Grahamstown, South Africa, 12-15 July 2005.

Poster Presentations


Leigh Richards

Morphometric variation in populations of *Otomops* (Chiroptera: Mollosidae) from mainland Africa and Madagascar.

Richards, L. R.[1], Contrafatto, G. C.[1], Lamb, J. [1] & Taylor, P. J. [2]

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The taxonomy of the genus *Otomops* has been a contentious issue. Much of the debate arises from the proper classification of *Otomops martiensseni* (large-eared free-tailed bat) from mainland Africa and the Arabian Peninsula, and the morphologically similar *Otomops madagascarensis* from Madagascar. Some authors doubt the validity of two distinct species in Africa and Madagascar, and suggest that one polytypic species occurs in both Africa and Madagascar. Others indicate that within the genus three distinct species occur namely, *O. martiensseni* from East Africa, *O. icarus* from Southern Africa, and *O. madagascarensis* from Madagascar. Some describe *O. icarus* and *O. madagascarensis* as subspecies of *O. martiensseni*. Current literature cites only two species from Africa and Madagascar, both carrying a vulnerable International Union for the Conservation of Nature (IUCN) Red Data List rating. Using geometric morphometrics, we examined possible species limits of *O. martiensseni* and *O. madagascarensis*. Size and shape variation between seven geographical populations were described using 14 dorsal and 19 ventral landmarks collected from the left half of the cranial surfaces. Using Generalized Procrustes superimpositions methods, landmark coordinate data were subjected to a principal component analysis. Preliminary analyses of dorsal landmark data revealed four distinct clusters corresponding to geographic localities, namely East Africa, West Africa, South Africa and Madagascar. Preliminary analyses of ventral landmark coordinate data provided a higher resolution of clustering of the four geographic populations, with the Madagascar population displaying the greatest phenetic cohesion and a clear segregation from other geographic populations along the first principal component axis. Principal component analyses of dorsal and ventral coordinate data suggest that populations from East Africa and South Africa are morphologically similar to each other, than West African populations. Our preliminary results suggest that geographic populations may be morphologically identifiable, with a possible morphological divergence occurring between African and Malagasy individuals.

Prenatal growth and development in the banana bat, *Neoromicia nanus*.

Smit, W. & Van Der Merwe, M.

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Growth of the fetus of the banana bat, *Neoromicia nanus*, is described. The gestation period in this species is 84 days. Birth mass is taken as 1.1g from measurements of near term fetuses and new born. The most reliable criterium for age determination proved to be body mass, and all fetal ages were estimated by using the equation $t = W^{1/3}/0.0176 + 25.2$. At an age of 38-42 days the head is still incomplete with no defined rostrum and no neck. The limb buds are prominent with eyes open and no eyelids. At an age of 63-67 days all external characteristics are differentiated and the first signs of pigmentation can be seen. From this time on only elongation of the various parameters occurs with increasing body mass. At this stage the deciduous teeth i2/3, c1/1, pm2/2 also become visible just below the surface of the gums.

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The reproductive biology of the banana bat, *Neoromicia nanus*, in a population from Mpumalanga.

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The banana bat, *Neoromicia nanus*, has a reproductive cycle that is characterized by seasonal monoestrous breeding. The study examined the reproductive timing and strategies used by *N. nanus* in Mpumalanga, South Africa (25ºS, 31ºE). Spermatogenesis in the male banana bat was found to begin in November and spermatozoa are released into the caudal epididymides from late April to about mid August. Mating is initiated in May and it appears that frequent copulations occur until the beginning of August when ovulation and fertilization occur. Birth takes place from late October to late November. Although sperm storage in the banana bat has been described in other localities where they were studied, the present study in Mpumalanga does not show strong evidence to support sperm storage in this locality.

Paper Presentations


David Jacobs

The evolution of echolocation in bats

Eick, G.[1], Jacobs, D. S.[2] & Matthee, C.A.[1]
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Bats are the only mammals capable of both powered flight and sophisticated laryngeal echolocation. We used a phylogeny for 18 of the 19 extant families of bats to elucidate the evolution of echolocation in this group. We sequenced portions of 4 novel nuclear intron markers for multiple representatives of the 18 families and combined the results from all 4 markers into a single topology. Three echolocation call characters were mapped onto this topology: 1) high duty cycle versus low duty cycle 2) high intensity versus low intensity call emission and 3) oral versus nasal emission. Our phylogeny divided bats into two major groups, the Pteropodiformes and the Vespertilioniformes. The Pteropodiformes included the non-echolocating Pteropodidae and the echolocating Rhinolophoidea (high duty-cycle echolocators). The Vespertilioniformes, on the other hand, were all (with the exception of one species), low duty-cycle echolocators. Furthermore, all families in the Rhinolophoidea shared a characteristic that is not present in any of the other families that use echolocation viz. ossification of the first costal cartilage and its fusion to the manubrium as well as to the first rib. This character may be an adaptation for echolocating while stationary, but is absent in the nycterids (and other Vespertilioniformes families) also adapted for echolocating while stationary. High-duty-cycle echolocation may thus have evolved independently of low-duty-cycle echolocation. Phylogenetic patterns in the other two echolocation characters are less pronounced. Low intensity echolocation calls, often associated with gleaning, have evolved independently at least six times in both Vespertilioniformes and Pteropodiformes lineages (i.e. in the Phyllostomidae, Thyropteridae, Nycteridae, Furipteridae, Vespertilionidae and Megadermatidae). The nasal/oral emitting dichotomy also shows no phylogenetic pattern, with at least two switches from oral emission to nasal emission within the Vespertilioniformes (Nycteridae and Phyllostomidae), and three independent origins of nasal echolocation within the Chiroptera.


Taryn Ralph

Analysis of the genetic diversity of *Otomops* (Chiroptera: Mollosidae) in Africa and Madagascar

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Otomops is part of the family Mollosidae. In Africa and Madagascar two species, *O. martiensseni* and *O. madagascarensis*, are currently classified as “vulnerable”, according to the International Union for the Conservation of Nature (IUCN) and the 2004 SA Mammal Red Data Book. Within the Afrotropical region there has been much controversy about the taxonomy of the genus. Some accept two species, whereas others propose either three species, *O. martiensseni*, *O. icarus* (African) and *O. madagascarensis*, or one, *O. martiensseni*. This project aims to determine the genetic diversity of Otomops populations from Africa and Madagascar. Samples were obtained from South Africa, Ethiopia, Kenya, Ivory Coast and Madagascar, and both cytochrome *b* and D-loop regions of mitochondrial DNA were amplified and sequenced. Sequence comparisons were then made within and between *Otomops* individuals and populations with the analysis program PAUP*(v. 4.0). Cytochrome *b*: Overall mean distance for all samples was 0.031. Samples formed clades based on geographical location. Kenyan and Ethiopian samples formed one monophyletic clade and Malagasy, Durban and Ivory Coast samples formed another within which each formed a distinct clade (100% bootstrap value). Net mean genetic distance between the Ethiopian and Kenyan samples was 0.000, and these were most closely related to Durban (0.014), followed by Madagascar (0.039) and Ivory Coast (0.053) Genetic distances between Malagasy samples, and Durban and Ivory Coast samples were 0.035 and 0.080, respectively. Genetic distance between Durban and Ivory Coast was 0.042. D-loop: Results indicate a possible imperfect repeat in *O. martiensseni*, not found in *O. madagascarensis*. Overall mean distance was 0.0313. Mean genetic distance within the Malagasy population was 0.01638, indicating minimal variation. Genetic distance between Ethiopian and Malagasy samples is 0.1879, also indicating a possible separation according to geographical location. These are preliminary analyses and further work is needed in order to make any definite conclusions.

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Samantha Stoffberg

The evolution of echolocation in the genus *Rhinolophus*

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The horseshoe bats (genus *Rhinolophus* Lacépède 1799) are exclusively Old World with approximately 71 currently recognized species. Species are often distinguished on the basis of body size, position of the anterior upper premolar, size and shape of the noseleaf and the peak frequency of the echolocation call. Within this genus some species make use of lower frequencies which are within the hearing range of tympanate moths, whereas others use high frequency calls. The high frequencies used by some species may have evolved to circumvent moth hearing (allotonic frequency hypothesis) or they may be the result of allometric relationships with body size, or an adaptation to the habitats occupied by the bats. To investigate the evolution of echolocation in the genus *Rhinolophus* we are using a molecular phylogenetic approach and are thus constructing a robust molecular phylogeny for the group. We made use of the mitochondrial cytochrome *b* gene as well as nuclear introns to conduct parsimony, likelihood and Bayesian analyses.

Congratulations to Samantha for being awarded prizes at the ZSSA for the best student presentation and the best overall student.

The defensive role of ultrasonic moth clicks against bat predation; a mathematical modeling approach.

Ribeiro, D.
Zoology Department, University of Cape Town.

Insectivorous bats are considered the main predators of nocturnal, aerial insects and are believed to be the major selective force behind the evolution of tympanal organs (ears) in nocturnal insects, especially moths. Hearing allows moths to detect echolocating bats and to execute evasive manoeuvres to escape predation. In addition to these flight defenses some moths produce brief, broadband, high-frequency clicks in response to bat echolocation. These clicks often cause an incoming bat to break off its attack. Three hypotheses, not necessarily mutually exclusive, have been advanced to explain the function of these ultrasonic clicks. The Aposematism hypothesis proposes that the clicks provide information to the bat about the unpalatability of the prey allowing the bat to make a decision about whether or not to abort its attack. The Jamming hypothesis proposes that moth clicks interfere with the bats' echolocation calls, disorientating it and causing it to miss its attack. The Startle hypothesis proposes that the clicks confuse the bat by altering the normal sequence of expected events during the attack i.e. surprising the bat. Due to the fact that we are dealing with nocturnal species that use inaudible (to humans) high-frequency sounds, and rapid, erratic flight behavior, it is extremely difficult to observe bat-moth interactions in their natural situation. An alternative approach to this problem was to use mathematical modeling. Based on simple single species interactions, the three hypotheses yielded models with different dynamics. The Aposematism hypothesis was density dependant and was the most stable when relatively high proportions (40% to 60%) of moths were using the strategy because it diluted the cost of the strategy. The Jamming hypothesis was density independent and the model indicated a constant increase in the proportions of moths using this strategy. Thus the Jamming hypothesis model predicted high proportions of clicking moths in natural populations. The Startle hypothesis was density dependant, but unlike the aposematism hypothesis, it was negatively affected by larger numbers of moths using the strategy. As the number of moths using the strategy increased, the success of the strategy decreased predicting that the proportion of moths using this strategy should be low (5% to 15%) in natural populations. Field data indicate that the proportions of clicking moths are in fact low supporting the startle hypothesis. This hypothesis required the least amount of assumptions to fit the field data.

The distribution range of *Rhinolophus clivosus* in Africa may be the result of an adaptive shift to an alternative prey type and not a consequence of its niche breadth

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I tested Brown's hypothesis that species' distribution range size is positively correlated with niche breadth, since a broader niche should enable a species to more easily exploit available and novel resources in different habitats. We investigated differences in niche breadths, as defined by diet, wing, and echolocation morphology, of *Rhinolophus clivosus* compared to co-occurring *Rhinolophus* species in five insectivorous bat ensembles representing different biogeographic scenarios in South Africa: (i) four temperate bat ensembles, three occurring in the fynbos biome, and one in the Knysna Forest, and (ii) one semitropical ensemble in Mpumalanga. Among southern African rhinolophids, *R. clivosus* has the widest distribution range across the African continent, and is one of the most genetically derived species. Our previous null model analyses found, as predicted by competition theory, fewer species combinations, and species mass more regularly spaced, within ensembles and 'Clutter' functional groups (composed mainly of *Rhinolophus* species), than expected by chance. In this study there were no significant differences in Mahalanobis distances, obtained from multivariate discriminant function analyses using echolocation and wing parameters that were controlled for mass, between *R. clivosus* and co-occurring rhinolophids. There were also no

significant differences in dietary niche breadths between *R. clivosus* and co-occurring rhinolophids. However, the diets of co-occurring rhinolophids consisted of significantly higher percentages moth and lower percentages beetle compared to the diets of *R. clivosus*. We suggest that the rapid geographic distribution of *R. clivosus* is a consequence of adaptations to hunt mainly beetles, thereby avoiding dietary niche conflict with congeners highly adapted to hunt fluttering moths in dense vegetation.


Robert Barclay

Foraging behaviour of Egyptian fruit bats in Cape Town

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The energy and nutrient demands on male and female bats differ, and they vary depending on the reproductive condition of individuals. Reproductive females require more energy and calcium than do males, and as a consequence, their foraging behaviours may differ. Using radiotelemetry, we studied the foraging behaviour of the Egyptian fruit bat (*Rousettus aegyptiacus*) in the vicinity of Cape Town. We attached radio collars to 21 individuals from a colony on Table Mountain and located them at night while they foraged. Most bats spent the majority of their time in the native forests on the eastern slopes of the mountain, but occasionally ventured up to 7km into neighbouring suburbs, especially when fig trees (*Ficus sur*) were in fruit. Male and female foraging behaviours differed in that males foraged for shorter periods of time during the pregnancy and post-lactation periods. However, foraging periods were equal during lactation and there was no evidence that home range size differed between the sexes. In addition, despite the relatively high calcium content of figs, lactating females made no greater use of fig trees than did males. Our results indicate that the shorter foraging times of males may be due to territorial behaviour rather than differences in energy and nutrient demands. Furthermore, figs represent a periodically abundance fruit that both males and females feed on. Finally, although trees in suburban area are used by *R. aegyptiacus*, individuals rely on native forest stands and protection of them may be important if *R. aegyptiacus* populations in suburban areas are to be preserved.

PUBLISHED PAPERS

BOGDANOWICZ, W., JUSTE, J., OWEN, R.D. AND SZTENCEL, A., 2005. Geometric morphometrics and cladistics: testing evolutionary relationships in mega– and microbats. *Acta Chiropterologica* 7(1): 39-49.

Traditionally, morphometric data have consisted of distances, angles, or ratios, and have been considered inappropriate for cladistic analyses. Recently, geometric morphometrics, based on homologous landmark pointcoordinates, has provided a number of advantages over traditional morphometric data and methods, including the possibility that phylogenetically informative characters and character-states may be extracted and used in cladistic analyses. Using two data sets of 3-dimensional point coordinates collected from skulls of bats, we empirically evaluate this possibility. Partial warps were extracted from the point-coordinate matrix, and these were then re-coded by gap-coding, for use in the cladistic analyses. In the case of samples from *Eidolon helvum* populations (two mainland localities and four islands in the Gulf of Guinea), analyzing males and females separately, our analyses based on these data were unable to detect consistent phylogeographic patterns among the populations. In the case of samples from plecotine bat species, these analyses produced a consensus cladogram showing considerable concordance with an earlier cladistic analysis by us of this group. In both cases, our results reflect those of earlier studies (based on both morphologic and genetic data), suggesting that the data and analytic techniques described herein may have interesting utility in cladistic analyses.

Key words: geometric morphometrics, partial warps, gap-coding, phylogeny, Microchiroptera, Megachiroptera

DECHER, J. AND FAHR, J., 2005. *Hipposideros cyclops*. *Mammalian Species* (763): 1-7.

EICK, G. N., JACOBS, D. S., AND MATTHEE, C. A., 2005. A nuclear DNA Phylogenetic perspective on the evolution of echolocation and historical biogeography of extant bats (Chiroptera). *Mol. Biol. Evol.* 22(9) 1869– 1886.

Bats (Order Chiroptera), the only mammals capable of powered flight and sophisticated laryngeal echolocation, represent one of the most species-rich and ubiquitous orders of mammals. However, phylogenetic relationships within this group are poorly resolved. A robust evolutionary tree of Chiroptera is essential for evaluating the phylogeny of echolocation within Chiroptera, as well as for understanding their biogeographical history. We generated 4 kb of sequence data from portions of four novel nuclear intron markers for multiple representatives of 17 of the 18 recognized extant bat families, as well as the putative bat family Miniopteridae. Three echolocation-call characters were examined by mapping them onto the combined topology (1) high-duty cycle versus low-duty cycle, (2) high-intensity versus low-intensity call emission, and (3) oral versus nasal emission. Echolocation seems to be highly convergent, and the mapping of echolocation-call design onto our phylogeny does not appear to resolve the question of whether echolocation had a single or two origins. Fossil taxa may also provide insight into the evolution of bats; we therefore evaluate 195 morphological characters in light of our nuclear DNA phylogeny. All but 24 of the morphological characters were found to be homoplasious when mapped onto the supermatrix topology, while the remaining characters provided insufficient information to reconstruct the placement of the fossil bat taxa with respect to extant

families. However, a morphological synapomorphy characterizing the Rhinolophoidea was identified and is suggestive of a separate origin of echolocation in this clade. Dispersal-Vicariance analysis together with a relaxed Bayesian clock were used to evaluate possible biogeographic scenarios that could account for the current distribution pattern of extant bat families. Africa was reconstructed as the center of origin of modern-day bat families.

HAPPOLD, M., 2005. A new species of *Myotis* (Chiroptera: Vespertilionidae) from central Africa. *Acta Chiropterologica* 7(1): 9-21.

A specimen of *Myotis*, collected by Jean-Paul Adam and later identified as *Myotis megalopus*, was compared with the holotype of *megalopus* and also with *Myotis longipes* from India and Afghanistan (which currently includes *megalopus* as a synonym). It was also compared with *M. bocagii* (which is sympatric and similar in size), *M. daubentonii* from Europe (which several authors reported as being very similar), and *M. scotti* (another sub-Saharan African species of similar size). Based on cranial and external morphology and morphometric data, Adam's specimen was found to be a new species. It differs in having the combination of a very weakly concave forehead region of the skull, relatively long feet, wing membranes attached to the bases of the tibiae, and no backwardly-curved hairs on the margin of the interfemoral membrane. It was collected in a limestone cave at Loudima in the Republic of Congo, in degraded rainforest near a river.

Keywords: *Myotis* sp. nov.; *Myotis megalopus*; Central Africa; description.

HOLLAND, R. AND WALTERS, D.A., 2005. Echolocation signals and pinnae movement in the fruitbat *Rousettus aegyptiacus*. *Acta Chiropterologica* 7(1): 83-90.

The fruit bat *Rousettus aegyptiacus* has highly mobile pinnae. Little is known about the role that such movements play in sound localisation however and whether they interact with the process of echolocation in this species. Here we report the correspondence of echolocation signals in free flight with the downward wingbeat and forward movement of the pinnae, and demonstrate that the ears have a greater sensitivity to click stimuli in front of the animal when directed forwards than when back and to the side. The potential significance of the production of echolocation signals whilst the ears are moving from their least sensitive to their most sensitive position is discussed.

Key words: fruit bat, *Rousettus aegyptiacus*, echolocation, pinnae movement

HOLLAND, R. A., WINTER, P. AND WATERS, D. A., 2005. Sensory systems and spatial memory in the fruit bat *Rousettus aegyptiacus*. *Ethology* 111(8): 715-725.

The megachiropteran fruit bat *Rousettus aegyptiacus* is able to orient and navigate using both vision and echolocation. These two sensory systems have different environmental constraints however, echolocation being relatively short range when compared with vision. Despite this difference, an experiment testing their memory of a perch location demonstrates that once the location of a perch is learned *R. aegyptiacus* is not influenced by the movement of local landmark cues in the vicinity of the perch under either light or dark conditions. Thus despite the differing constraints of vision and echolocation, this suggests a place is remembered as a location in space and not by associations with landmarks in the vicinity. A decrease in initial performance when the task was repeated in the dark suggested the possibility that a memory of a location learned using vision does not generalize to echolocation.

JACOBS, D. S., BARCLAY, R. M. R., AND SCHOEMAN, M. C., 2005. Foraging and roosting ecology of a rare insectivorous bat species, *Laephotis wintoni* (Thomas, 1901), Vespertilionidae. *Acta Chiropterologica* 7(1): 101-9.

Above: *Laephotis wintoni* displaying its long ears held to the side of the head giving it a flat profile allowing it to roost in crevices— Jacobs *et al*. (2005). The above individual was caught at the Algeria Forest Station, in the Cederberg, Western Cape Province, South Africa.

Laephotis wintoni is a rare bat and little is known about its biology. We studied this species at Algeria Forestry Station in the Western Cape Province, South Africa. A female caught in November 2002 was pregnant and three females caught in November 2004 were all lactating. The three lactating females were radio tagged and roosted in crevices or narrow fissures in a cliff face above the valley where they foraged. *Laephotis wintoni* is a small insectivorous bat (body mass, 0 ± SD = 9.6 ± 0.5 g, *n* = 4) with low wing loading (7.0 ± 0.7 Nm-2, *n* = 4), low aspect ratio (5.7 ± 0.5, *n* = 4), low wingtip shape index (1.2 ± 0.2, *n* = 4) and long ears (20.9 ± 2.3 mm, *n* = 2). Its morphology suggests that it is a slow manoeuvrable flyer that can fly close to vegetation, or the ground or over water surfaces. Its relatively pointed wings suggest that it probably does not fly in dense clutter. Furthermore, it combines this wing shape with echolocation calls of relatively low intensity, short duration (2.6 ± 0.8 ms, *n* = 5), narrow band (13.5 ± 2.9 kHz, *n* = 5) and surprisingly low peak frequency (22.1 ± 0.6 kHz, *n* = 5). The latter two parameters make it unlikely that the calls are used to overcome masking effects associated with flying in dense clutter. Instead, we propose that its echolocation calls are adapted to be less audible to tympanate insects. This is supported by the fact its diet is dominated by moths in a habitat where tympanate moths comprise 90% of the moth population.

Keywords: *Laephotis wintoni*, echolocation, wing morphology, diet, radio telemetry.

LAUMANNS, M., SCHMASSMANN, S. AND ADRIAN, H., 2004: The caves of Rwanda - Les grottes du Rwanda. -- Berliner höhlenkundliche Berichte, 11: 1-89, 25 plates; Berlin (Speläoclub Berlin).

Listed are some bat species as part of cave faunas: Grottes de Nyankokoma, 02.18.S - 29.41.E, Butare Prov., NW of Nyanza (p. 17): *Tadarida fulminans*, a few dozen expl. -- Grotte near Nyungwe, 02.20.S - 28.50.E, 2500m, Nyungwe Village, Cyangugu Prov. (p. 18): *Hypsugo eisentrauti* (mentioned by previous authors). -- Grotte near Uwinka, 02.29.S - 29.12.E, Uwinka Village, Cyangugu Prov. (p. 18): *Rhinolophus hilli* (mentioned by previous authors). -- Ubuvumo Gacinyiro 2, 01.27,697 S - 029.35,049 E, 2159m, Virunga Mts., Musanze Secteur, Kinigi Distr., Ruhengero Prov. (p. 46): *Rhinolophus clivosus keniensis*, *Stenonycteris lanosus lanosus* , *Rousettus aegyptiacus leachii*. -- Ubuvumo Ruhombo,01.27,870 S - 20.40,143 E., 1943m, Virunga Mts., Gitinda Secteur, Bukamba Distr., Ruhengeri Prov. (p. 74): *Rhinolophus clivosus keniensis*.

LAUMANNS, M., SCHMASSMANN, S. AND ADRIAN, H., 2005: The caves of Rwanda- Les grottes du Rwanda. -- Berliner höhlenkundliche Berichte, 15 (Supplement 1): 1-62; Berlin.

Ubuvumo Kanyondo (Grotte de Salomon), Virunga Mts., Mutura Distr., Mugongo secteur, 01 35?41,3S - 29 23?11,6E, 2336 m a.s.l. (p. 29): *Rhinolophus clivosus*, ca. n200. -- Ubuvumo Kibumbu 2, Virunga Mts., Kinigi Distr., Parc Natl. des Volcans, 01 24?41,3.S - 29 32?52,1.E, 2610 m a.s.l. (p. 44): *Rousettus lanosus* (low hundreds), *Rhinolophus clivosus* (many, possibly 100s), *Miniopterus inflatus* (high hundreds to 1000s). -- Ubuvumo Kibumbu 3, Virunga Mts., Kinigi Distr., Parc Natl. des Volcans, 01 24?41,3.S - 29 32?52,1.E, 2610 m a.s.l. (p. 44): *Rhinolophus clivosus* (n15), *Miniopterus inflatus* (high hundreds to 1000s). -- Ubuvumo Kibumbu 4, Virunga Mts., Kinigi Distr., Parc Natl. des Volcans, 01 24?41,3.S - 29 32?52,1.E, 2610 m a.s.l. (p. 44): *Rousettu lanosus* (low hundreds), rare *Otomop martiensseni* (about 300), consequently the cave needs protection & should not receive frequent visitors; the bat population is very vulnerable to disturbances. -- Ubuvumo Manjari Deux, Virunga Mts., Mutobo Distr., Rwinzovu secteur, 01 33?12,6.S - 29 32?06,6.E, 2250 m a.s.l. (p. 51): *Rhinolophus clivosus* (colony of about n100).

LAUMANNS, M., 2005: Höhlenforschung in den Virunga-Bergen, Ruanda. -- Mitteilungen des Verbandes der deutschen Höhlen- und Karstforscher e.V. München, 51 (3): 93-95.

Cave Ubuvuma Kibumbu 4, Kibumbu Crater, Parc National desVolcans, Ruhengeri Province, Rwanda, in December 2004, harboured a larger colony of bats (*Rousettus lanosus* and *Otomops matiensseni* [sic, = *martiensseni*]).

PETERSON, A. T., BAUER, J. T. AND MILLS, J. N., 2004. Ecologic and geographic distribution of filovirus disease. *Emerging Infectious Diseases* 10(1): 40-47.

We used ecologic niche modeling of outbreaks and sporadic cases of filovirus-associated hemorrhagic fever (HF) to provide a large-scale perspective on the geographic and ecologic distributions of Ebola and Marburg viruses. We predicted that filovirus would occur across the Afrotropics: Ebola HF in the humid rain forests of central and western Africa, and Marburg HF in the drier and more open areas of central and eastern Africa. Most of the predicted geographic extent of Ebola HF appear to have been observed; Marburg HF has the potential to occur farther south and east. Ecologic conditions appropriate for Ebola HF are also present in Southeast Asia and the Philippines, where Ebola Reston is hypothesized to be distributed. This first large-scale ecologic analysis provides a framework for a more informed search for taxa that could constitute the natural reservoir for this virus family.

PETERSON, A. T., CARROLL, D. S., MILLS, J. N. AND JOHNSON, K. M., 2004. Potential mammalian filovirus reservoirs. *Emerging Infectious Diseases* 10(12): 2073-2081.

Ebola and Marburg viruses are maintained in unknown reservoir species; spillover into human populations results in occasional human cases or epidemics. We attempted to narrow the list of possibilities regarding the identity of those reservoir species. We made a series of explicit assumptions about the reservoir: it is a mammal; it supports persistent, largely asymptomatic filovirus infections; its range subsumes that of its associated filovirus; it has coevolved with the virus; it is of small body size; and it is not a species that is commensal with humans. Under these assumptions, we developed priority lists of mammal clades that coincide distributionally with filovirus outbreak distributions and compared these lists with those mammal taxa that have been tested for filovirus infection in previous epidemiologic studies. Studying the remainder of these taxa may be a fruitful avenue for pursuing the identity of natural reservoirs of filoviruses.

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TAYLOR, P. J., GEISELMAN, C., KABOCHI, P., AGWNDA, B., and TURNER, S., 2005. Intraspecific variation in the calls of some African bats (Order Chiroptera). *Durban Museum Novitates* 30: 24-37.

This study reports on new field (21 species) and acoustic (20 species) data resulting from surveys of bats in the Maasai Mara and Taita Hills areas of Kenya in May 2001. To test for significance and causes of intra-individual and interindividual call variation, spectral (peak frequency) and temporal (duration) call parameters of some of the species recorded in this study were compared statistically and non-statistically with equivalent data from other regions of Africa. In eight species from five families tested statistically, individual call sequences varied significantly within species, in either peak frequency and/or call duration. Inter-individual differences could be explained by individual signatures, habitat variation, geographical variation, sexual dimorphism and cryptic speciation. Rhinolophoid bat calls were distinguished from other bats investigated in having very low intra-sequence variation in peak frequency.

Keywords bats, Chiroptera, echolocation, intraspecific variation, Kenya, reproduction.

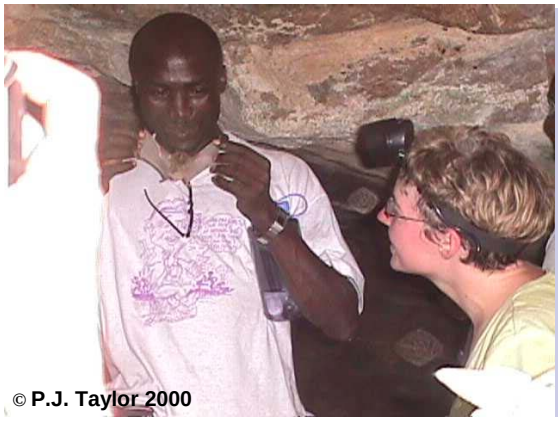
Left: Assisted by members of Bat Conservation International and staff of the National Museums of Kenya, Peter Taylor inspects bat handnetted in a small cave in the Taita Hills

-**PJT**

Right: Individuals of roosting *Cardioderma cor* were hand netted in caves at Kisima Dam in the Kasegau Wildlife Corridoer—Taita—**PJT**

Left: The late Paul Kabochi, pictured here holding a *Lavia frons.*—**PJT**

Right: An adult non reproductive *Otomops martiensseni* was mistnetted in a river bed in the foothills of the Taita Hills.—**PJT**



Left: Bernard Agwanda (left) and Cullen Geiselman (right) examine bats from a cave in the Taita Hills of Keneya.—**PJT**

Right: An adult female *Tadaria ventralis* was caught in aerial nets at approximately 10m height at Taita Discover Centre in the Taita Kasegau Wildlife Corridor.—**PJT**

YODER, A. D., OLSON, L. E., HANLEY, C., HECKMAN, K. L., RASOLOARISON, R., RUSSELL, A. L., RANIVO, J., SOARIMALALA, V., KARANTH, K. P., RASELIMANANA, A. P. AND& GOODMAN, S. M., 2005. A multidimensional approach for detecting species patterns in Malagasy vertebrates. *Proc. Nat. Acad. Sci. USA* 102(Suppl. 1): 6587-6594.

The biodiversity of Madagascar is extraordinarily distinctive, diverse, and endangered. It is therefore urgent that steps be taken to document, describe, interpret, and protect this exceptional biota. As a collaborative group of field and laboratory biologists, we employ a suite of methodological and analytical tools to investigate the vertebrate portion of Madagascar's fauna. Given that species are the fundamental unit of evolution, where micro- and macroevolutionary forces converge to generate biological diversity, a thorough understanding of species distribution and abundance is critical for understanding the evolutionary, ecological, and biogeographic forces that have shaped Malagasy vertebrate diversity. We illustrate the means by which we apply Mayr's "three basic tasks" of the systematist [Mayr, E. (1942) Systematics and the Origin of Species from the Viewpoint of a Zoologist (Harvard Univ. Press, Cambridge, MA)] to identify, classify, and study the organisms that together constitute Madagascar's vertebrate community. Using field inventory methods, specimen-based studies, and morphological and molecular analyses, we formulate hypotheses of species identity that then serve as the foundation for subsequent studies of biology and history. Our experience, as well as that of other investigators, has shown that much of the vertebrate species diversity in Madagascar is "cryptic" for both biological and practical reasons. Beyond issues of cryptic biological diversity, the resolution of species identity in Madagascar has been hampered because of a lack of vouchered comparative material at the population level. Through our activities, we are attempting to remedy these limitations while simultaneously enhancing research capacity in Madagascar.

NOTICE BOARD

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- 37th Annual North American Symposium on Bat Research, tentatively scheduled for Mexico in 2007. [http://www.nasbr.org]
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