

## **A new species of the genus *Murina* (Chiroptera: Vespertilionidae) from the Central Highlands of Vietnam with a review of the subfamily Murininae in Vietnam**

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The subfamily Murininae has high species diversity in Vietnam, but taxonomic studies are limited. In this paper, we describe a new species of the genus *Murina* based on a specimen collected from Ngoc Linh Nature Reserve, Kon Tum Province in the Central Highlands of Vietnam. It is a medium-sized species with ‘*suilla*-type’ dentition. A taxonomic review of Murininae from Vietnam was also conducted based on combined morphological, DNA, and karyological characteristics. Molecular phylogenetic analyses based on the mitochondrial cytochrome *c* oxidase subunit (COI) gene supported the subfamily Murininae, while the genus *Murina* proved to be paraphyletic in relation to the genera *Harpiocephalus* and *Harpiola*. Fourteen species of the genus *Murina*, one species of *Harpiocephalus*, and one species of *Harpiola* are recognized from Vietnam. *Murina tiensa* is regarded as a junior synonym of *M. harrisoni*; strong sexual dimorphism was observed in *M. harrisoni*. Relations between forearm length and total length of skull showed different trends among species and sexes. Karyotypes of *Murina huttoni*, *M. cyclotis*, *M. lorelieae*, *M. beelzebub*, *M. feae*, and *Harpiola isodon* were  $2n = 44$ ,  $FN = 50$ , while that of *Harpiocephalus harpia* was  $2n = 44$ ,  $FN = 52$ .

*Key words:* DNA barcode, karyotype, morphology, taxonomy, tube-nosed bats

## **Description of a new species of the genus *Aselliscus* (Chiroptera, Hipposideridae) from Vietnam**

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Trident bats found in mainland Southeast Asia are currently subsumed into a single species, *Aselliscus stoliczkanus*. In this study, we examined morphological and genetic data from different populations from Southeast Asia, with a special focus on specimens from Vietnam. Our analyses support the existence of a further species of *Aselliscus* in northeastern Vietnam that separated from *A. stoliczkanus* sensu lato (s.l.) during the late Miocene. Within the latter taxon, we identified five geographic lineages that diverged from each other during the Plio-Pleistocene epoch. Some of them may also correspond to further separate taxa, but additional molecular and morphological data are needed to test this hypothesis. Herewith, based on the combined evidences we describe the northeastern Vietnamese population as a separate species.

*Key words:* taxonomy, phylogeography, mtDNA, morphology, karst, bat, Southeast Asia

## **Bat diversity in the Simandou Mountain Range of Guinea, with the description of a new white-winged vespertilionid**

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Tropical West Africa has a high diversity of bats, which are relatively poorly studied. In this baseline biodiversity assessment of bats in the Simandou Mountain Range of southeastern Guinea (Guinea Forestière), 312 individual bats belonging to 26 species were captured, four of which represent new species records for the country. Combined with the results of a previous survey, 35 bat species have been recorded at Simandou to date, including a new species (*Neoromicia* sp. nov.), which we describe here, and an additional species potentially new to science. A neotype for *Neoromicia tenuipinnis* is designated. We present an annotated checklist of the bats at Simandou and neighbouring sites, including some pertinent field notes on their habitat requirements and conservation status. Furthermore, we discuss the estimated maximum species richness and show that Simandou supports one of the most diverse bat communities in tropical Africa. Finally, we outline conservation concerns with respect to bats in the face of the iron ore extraction activities at Simandou.

*Key words:* conservation, morphology, Africa, molecular systematics, Guinea, bat diversity, *Neoromicia*, monophyly

## **First record of bats (Chiroptera, Mammalia) from the Middle Miocene non-karstic site Hasznos (Hungary, Nógrád County)**

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We record the first fossil bats from the Middle Miocene non-karstic marshy-lagoonal deposits at Hasznos, northern Hungary. The bat material consists of mandible fragments of *Miostrellus* cf. *petersbuchensis* and *Myotis bavaricus*, the vespertilionid species until now recorded only from the Miocene sites of Germany. The discovery suggests an extensive palaeogeographical distribution of these species and connectivity of distribution ranges over the Central Paratethys region during the Late Badenian.

*Key words:* Vespertilionidae, *Miostrellus* cf. *petersbuchensis*, *Myotis bavaricus*, Badenian, MN 6, Carpathian Basin

## **Genetic structure among hibernacula of the endangered gray bat (*Myotis grisescens*)**

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In an attempt to fill knowledge gaps relating to genetic structure in the endangered gray bat (*Myotis grisescens*), we investigated geographic patterns in multilocus microsatellite DNA (msDNA) genotypes and mitochondrial DNA (mtDNA) haplotype frequencies across eight primary hibernacula. Isolation-by-distance (IBD) was absent in the msDNA data and no bottlenecks were detected, with genotypic diversity ( $A_R = 6.52$ ,  $H_o = 0.64$ ) and overall genetic differentiation ( $F_{ST} = 0.024$ ,  $P < 0.001$ ) being comparable to other *Myotis* and North American vespertilionids. Genetic structure ( $\Phi_{CT} = 0.063$ ,  $P < 0.001$ ) among groups of populations ( $K = 2$ ) was observed. We also identified a pattern of slight east-west regional genetic structure, likely attributable to the natural barrier of the Mississippi River Alluvial Plain, in the haplotype data ( $\Phi_{CT} = 0.086$ ,  $P < 0.05$ ), along with moderate IBD ( $r = 0.486$ ,  $P < 0.05$ ). Though genetic differentiation among populations was generally low, significant interpopulation genetic structure, likely arising from some degree of philopatric behavior and a lack of hibernacula-associated mating sites within the Mississippi River Alluvial Plain, was observed.

*Key words:* genetic diversity, guano, hibernacula, maternity colony, microsatellites, mitochondrial DNA, noninvasive sampling, population structure

## **Home-range and foraging areas of the dawn bat *Eonycteris spelaea* in agricultural areas of Thailand**

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We studied the foraging behaviour of the dawn bat *Eonycteris spelaea*, a cave roosting nectarivore widespread in SE Asia, and principal pollinator of economically important crops. We radio-tracked 17 individuals for five to 19 nights over a three month period. The bats were from three cave colonies in agricultural habitats in southern Thailand. They traveled between one and 17.9 km ( $\bar{x} \pm SD$ : 4.4 km  $\pm$  5.07, median = 2.34) from their roosting cave to food sources. The mean home-range size of the individuals varied with the method used in its calculation from 518.4 ha (100% Minimum Convex Polygon, MCP) to 564.5 ha (100% Local Convex Hull method, LoCoH) and 460.8 ha (95% Kernel density estimation, KDE). The mean size of foraging areas used by the bats also varied according to the method of calculation from 14.26 ha (100% MCP), 13.25 ha (100% LoCoH) and 38.52 ha (95% KDE) and accounted for 21.9%, 20.08% and 40.5% of the respective home-range size. The bats foraged in one to three foraging areas each night. The greatest distance between feeding trees varied between 0.25 and 8 km (mean 1.25 km  $\pm$  2.19). Those bats with multiple foraging areas moved from patch to patch of *Durio zibethinus* and did not return to a previously visited patch, whereas those feeding on *Parkia* repeated their visits to several patches in a single night. Ninety percent of foraging areas used by the radio-tagged individuals were in managed habitat such as fruit orchards and yards of houses to which the bats maintained strong site fidelity.

*Key words:* radio-tracking, home range, foraging areas, fidelity, *Eonycteris spelaea*

## **Selection of building roosts by Mexican free-tailed bats (*Tadarida brasiliensis*) in an urban area**

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The Mexican free-tailed bat (*Tadarida brasiliensis*) is one of the most widely distributed bat species in the Western Hemisphere. Despite their prevalence in urban environments, limited research has been conducted to determine the features of buildings or of the surroundings that might affect the likelihood of a building being selected by Mexican free-tailed bats as a roost. Our study objectives were to improve the current understanding of Mexican free-tailed bat's urban roosting preferences with regard to both microhabitat and macrohabitat. Between August 2010 and August 2012, we conducted acoustic surveys and emergence observations and examined 218 buildings in Waco, TX, USA. A total of 54 day-roosts for Mexican free-tailed bats was identified. At the microhabitat scale, modeling of building characteristics and opening characteristics showed that bats preferred to roost in tall and abandoned buildings. Roost exits were more likely the results of structural damage to buildings and less likely to have vegetation blocking the adjacent air space. Roost accessibility seemed to be more important than thermal condition in roost selection. At the broader macrohabitat scale, bats were more likely to roost in areas with lower income and were near tall buildings and water sources.

*Key words:* building, landscape, macrohabitat, microhabitat, roost exit, roost selection, *Tadarida brasiliensis*, urban environment

## **Seed dispersal by frugivorous bats in Central Guyana and a description of previously unknown plant-animal interactions**

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Species of bats in the subfamilies Stenodermatinae and Carollinae are primarily frugivores, and through the ingestion of fruit and defecation of seeds, they play a crucial role in their environment through the dispersal of early successional and pioneer plants contributing to reforestation. These ecosystem services provided by frugivorous bats are becoming more critical with time, as anthropogenic habitat destruction continues to rise. The objective of this study was to survey the plant species dispersed by frugivorous bats in a tropical rainforest in Guyana. Fecal samples were taken from captured frugivorous bats and stomach contents were taken from a representative collection. The four most common bats were *Artibeus planirostris*, *A. obscurus*, *A. lituratus*, and *Carollia perspicillata*, which accounted for 67% of total captures in mist nets set in the forest understory. Twenty plant species were identified in fecal and stomach content samples with the most abundant (*Ficus nymphaeifolia*, *Piper bartlingianum*, *Cecropia latiloba*, and *C. sciadophylla*) accounting for 60% of the total. *Cecropia latiloba*, which is an early colonizer of floodplains throughout the Guiana Shield and Amazon River Basin was previously unknown to be bat dispersed. Seven plant species were documented as being dispersed by nine bat species for the first time. These results enhance our understanding of seed dispersal by Neotropical bats, specifically by revealing previously unknown bat/plant relationships.

*Key words:* *Cecropia latiloba*, bat-plant interactions, recruitment, regeneration, tropical forest, *Artibeus*, *Carollia*, dispersal, Neotropics

## **Factors affecting foraging activity of pipistrelle bats (Chiroptera: Vespertilionidae) on the Islands of Malta**

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In the Mediterranean region, aquatic and riparian habitats are considered amongst the most important for bat survival. These habitats are transient in the Maltese Islands and detailed research on how different bat species cope in these conditions has not been conducted. This paper presents results on the activity of pipistrelle bats across different habitats and seasons using acoustic methods to investigate their foraging habitats in the Maltese landscapes. Regression tree analysis was used to assess the effects of several environmental variables — including climatic conditions, vegetation characteristics, and prey abundance — on foraging activity. Echolocation recordings from pipistrelle bats were obtained during 220 hours of active monitoring between summer 2012 and spring 2013. During each sampling period, a maximum of 36 sites were visited (summer,  $n = 36$ ; autumn:  $n = 33$ ; spring:  $n = 35$ ). Agricultural landscapes, cliffs, shrublands, urban areas, woodland patches, and valleys were all represented by these study sites. Detailed analyses of echolocation calls revealed the presence of two pipistrelle species, *Pipistrellus pipistrellus* and *P. kuhlii*. The former was more frequently encountered, comprising 55% of the total echolocation recordings. *Pipistrellus kuhlii* showed significant seasonality in foraging activity overall (Kruskal-Wallis  $H(2) = 13.83$ ,  $P < 0.01$ ) and within each habitat (all  $P$ -values  $< 0.01$ ). *Pipistrellus pipistrellus* showed seasonality over agricultural land (ANOVA  $F_{2, 14} = 4.13$ ,  $P < 0.05$ ). Differential habitat use by these two species during summer was revealed where *P. pipistrellus* showed higher activity levels over agricultural sites, while *P. kuhlii* showed higher activity over woodland patches. Regression tree analyses indicate insect abundance, maximum temperature, and minimum distance to an urban area to affect foraging activity of *P. kuhlii*, while minimum wind speed, minimum distance to an urban area, and average canopy height were found to affect the foraging activity of *P. pipistrellus*. Both species were found to cope with conditions found in the Maltese Islands by using an optimal foraging scheme, wherein they seasonally alternate between selective and opportunistic foraging strategies.

*Key words:* habitat use, Malta, foraging habitats, seasonality, environmental conditions, echolocation, insect abundance

## **Foraging strategies determine the effect of traffic noise on bats**

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Anthropogenic noise is a concern in many ecological systems. One important source of noise pollution is traffic noise as it can dominate the soundscape in urban and peri-urban environments. Taxa that rely on acoustics for behavioural strategies are likely to be especially susceptible to noise, as noise can inhibit the perception of informational sounds. Bats use echolocation to hunt prey while foraging and are therefore prime candidates for adverse effects. Captive studies have shown that foraging efficiency can be significantly reduced in noisy environments for some bat species, and that these species actively avoid noisy areas. However, it remains unclear how this selective sensitivity manifests in urban environments. Given that mode of flying and use of echolocation is entwined with foraging strategies, we hypothesised that different foraging guilds (i.e. fast flyers versus slow flyers) may show different levels of sensitivity to noisy roads. We used transects running perpendicular to a major traffic route in Sydney, Australia, to record bat activity and traffic noise levels. Noise amplitude levels across each frequency band dropped by over 50% in the first 50 m, with high frequency components (> 10 kHz) being especially soft at this distance. Furthermore, all traffic noise above 5 kHz was lost within the first 150 m from the road. Fast flying bats flew close to the road, despite the traffic noise. In contrast, slow flying species appeared to fly more often away from the road. However, few calls of slow flyers were recorded, probably reflecting their difficulty in detecting them using acoustic surveys as well as their earlier decline in these peri-urban environments.

*Key words:* bats, noise, peri-urban, roads, frequency, foraging, traffic

## **Bat activity at a small wind turbine in the Baltic Sea**

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Activity of bats at an old wind park four km off the island of Gotland in the Baltic Sea was monitored during 50 nights from August to October 2013, using an automatic bat detector (Pettersson D500-X) mounted on one of the turbines. Single individuals or pairs of common noctules *Nyctalus noctula* were recorded on five occasions only (26 and 27 August), all in calm weather and when little or no rotor movement occurred. Since such conditions were unusual (five of 50 nights of observation) the visits by the bats were unlikely to be chance events (migrating bats passing the turbine), but more likely involved bats attracted to the turbines. However, no feeding buzzes were recorded and the bats never stayed near the turbine more than one minute. The turbines studied are lit by 250 W white lights and this could have been the reason why bats visited the turbines, because such lights potentially attract insects. The bats could not have been attracted to the turbines by any factor related of the movement of the rotor or the generator, such as Doppler-effects, noise, heat or electric fields.

*Key words:* bat migration, Gotland, off-shore, acoustic monitoring, noctules, *Nyctalus noctula*

## **Impact of wind facilities on bats in the Neotropics**

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We monitored the bat fatalities caused by a 13 turbines wind facility installed in western Puerto Rico (West Indies) over a period of 23 months. The post-construction monitoring includes observed fatalities and a corrected fatality estimate expressed as bats/turbine/year adjusted for bat carcass removal rates, searcher efficiency, and percent area searched. Data on seasonality of fatalities and distance of carcasses from turbines is also provided. Eleven out of the 13 species of bats in Puerto Rico suffered fatalities, including all five species of phyllostomids. These were: *Molossus molossus* and *Tadarida brasiliensis* (Molossidae); *Artibeus jamaicensis*, *Monophyllus redmani*, *Stenoderma rufum*, *Brachyphylla cavernarum* and *Erophylla bombifrons* (Phyllostomidae); *Noctilio leporinus* (Noctilionidae); *Eptesicus fuscus* and *Lasiurus minor* (Vespertilionidae); and *Mormoops blainvillei* (Mormoopidae). This is one of the first published reports of the impact of wind turbines on bats in the Neotropics.

*Key words:* bats, Neotropics, Vespertilionidae, wind installation, Phyllostomidae, Mormoopidae, Molossidae, eolic energy

## **Diet of the meridional serotine *Eptesicus isabellinus* in an urban semiarid Mediterranean landscape**

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The meridional serotine *Eptesicus isabellinus* (Temminck, 1840) has recently been identified as a cryptic species that occurs in the south of the Iberian Peninsula. Little is known about its ecology. We used morphological analysis of droppings from an urban semiarid Mediterranean landscape to determine seasonal differences in diet. We identified 15 insect prey types and found significant seasonal differences in the consumption of seven prey types. The diet of *E. isabellinus* was dominated by Scarabaeidae (Coleoptera) and Diptera, and there were seasonal changes in the consumption of Carabidae (Coleoptera), Lepidoptera and Cercopidae (Hemiptera). Shannon-Wiener and Levins' indices showed that the diet was more diverse during the post-hibernation and pregnancy periods. Pianka's index showed that there was relatively low dietary overlap between periods. The seasonal changes recorded between different physiological periods could be related to changes in the energetic needs of the individual or to variation in prey-availability. Although *E. isabellinus* mainly eats Scarabaeidae and Diptera, it can show flexibility for example by hunting insects that fly around blossoms such as chafers *Melolontha* spp.

*Key words:* feeding ecology, hunting behaviour, morphological analysis, seasonal variation, Shannon-Wiener index, Pianka's index, Levins' index

## **Diet of the lesser horseshoe bat (*Rhinolophus hipposideros*) in Central Germany and its seasonal and site-specific variation**

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As a K-strategist and comparatively sedentary species, the lesser horseshoe bat *Rhinolophus hipposideros* is considered sensitive to changes in habitat quality. Knowledge of the species' dietary requirements and use of foraging habitats is thus considered an essential prerequisite to manage its habitats adequately. Based on four large annual samples of faecal pellets from three different nursery colonies, including two consecutive years of sampling from one colony, we studied the diet of Central German populations of *R. hipposideros*. Consistent with findings of similar studies carried out in other parts of the distribution range of *R. hipposideros*, in our study, Diptera, Lepidoptera, and Neuroptera represented the most important groups of prey for the studied colonies. However, Hemiptera made a comparatively larger contribution in our study than in others, and so did Hymenoptera in one of the colonies. We found seasonal compositional variation in all four annual samples, as well as compositional variation between samples from different colonies, but not between the two annual samples obtained in consecutive years from the same colony. Differences between colonies appeared at least to some extent to reflect differences in availability of foraging habitats. Our results are thus in agreement with the assumption of *R. hipposideros* being a largely opportunistic, generalist forager. Our findings are also consistent with a known preference by *R. hipposideros* of woodland as main foraging habitat, as previously established by other studies carried out in the northern part of the distribution range. However, the relative importance of Hemiptera, and in particular of Psyllidae, at certain times during the foraging season, suggests that the Central German colonies of *R. hipposideros* might have utilized commercial orchards and private fruit gardens for foraging during seasonal peaks in abundance of pest species of fruit trees. The implied ability of *R. hipposideros* to respond to seasonal abundance peaks of particular groups of prey in a range of habitats suggests that structural diversity might be key in maintaining viable populations of this species. The potential importance of orchards and fruit gardens in regions where such habitats are prevalent is likely to have relevant management implications.

*Key words:* Central Germany, diet, *Rhinolophus hipposideros*, seasonal variation

## **Spatial and temporal analysis of attacks by common vampire bats (*Desmodus rotundus*) on humans in the rural Brazilian Amazon basin**

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This article attempts to investigate the effects of the notification of wounds caused by *Desmodus rotundus* in humans in the rural zone of the eastern Brazilian Amazon basin. We analyzed data on bat attacks for the period between 2007 and 2012, provided by the Pará State Secretariat for Municipal Public Health (SMS) and the Pará State Agricultural Defense Agency (ADEPARA). We recorded 121 attacks in humans in the municipality of Pacajá, in 28 localities, including both rural and urban areas. Urban cases accounted for almost a fifth (19.8%) of all records. No significant variation was found in the number of cases recorded each year ( $H = 7.28$ ,  $d.f. = 5$ ,  $P = 0.20$ ), although significant variation was found in the spatial distribution of the reports ( $Q = 17.08$ ,  $d.f. = 5$ ,  $P < 0.01$ ), reflecting the heterogeneity of the occurrence of attacks. Our conclusion is that the major reduction in the number of reported attacks on humans by hematophagous bats in the municipality of Pacajá is a positive result of the notification by the local people to the public health authorities, which appears to be an effective tool of the prophylactic scheme to control this epizootic in the rural zone of the Brazilian Amazon basin.

*Key words:* Brazilian Amazon, *Desmodus rotundus*, human rabies, bites

## **Bat species richness (Mammalia, Chiroptera) along an elevational gradient in the Atlantic Forest of Southeastern Brazil**

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The effect of elevational gradients on the richness and composition of communities are reflected by different biotas. The objective of this study was to document changes in the species richness and composition of bats along a tropical elevational gradient between 500 and 2,500 m of elevation in southeastern Brazil. We carried out fieldwork from June 2009 to December 2012 with the use of mist nets. During 32 sampling nights we recorded 270 bats from 22 species. Species richness peaked around low-elevation (500–1,000 m a.s.l.) and there was richness decrease at higher elevations. The analysis of bat assemblage between the elevational range showed a significant difference in species composition along an elevational gradient. Bat richness and abundance were negatively related to altitude.

*Key words:* high altitude, species composition, trophic guilds, vegetation types

## **Choice experiments demonstrate that male big brown bats (*Eptesicus fuscus*) prefer echolocation calls of high copulatory females**

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It generally is accepted that bats emit ultrasonic vocalizations that function for echolocation purposes as well as for communication. We tested whether male or female big brown bats (*Eptesicus fuscus*) responded to variation in echolocation calls of the opposite sex in a manner that would suggest calls are used in a mating context. We presented 31 female and 10 male big brown bats with ultrasonic playbacks of differentially mating (i.e., high frequency copulators = HM versus low-frequency copulators = LM) individuals of the opposite sex. We measured 1) which side of the arena each subject selected first (HM versus LM), and 2) duration spent (seconds) on each side of the arena (HM versus LM). For both of these measures (i.e., first choice and duration) male subjects were more likely to select the echolocation calls of HM females, but the same respective tests determined that female subjects did not select echolocation calls of frequently copulating males over calls of infrequently copulating males. These results support the possibility that the echolocation calls of big brown bats provides information about the sender that may be important in a mating context.

*Key words:* bats, choice trials, echolocation calls, mating, sexual dimorphism

## **Acoustic identification of *Otomops wroughtoni* and other free-tailed bat species (Chiroptera: Molossidae) from India**

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The Wroughton's free-tailed bat *Otomops wroughtoni* (Chiroptera: Molossidae) is a globally rare and data-deficient species. This species has been recorded only from four locations, in India and Cambodia, with the type locality in the Barapede caves, India. In this paper, we present an analysis of echolocation and social calls of *O. wroughtoni* from the Barapede caves. Echolocation calls of free-flying *O. wroughtoni* were narrowband and shallow frequency-modulated (shallow-FM), with peak frequency ranging between 14–17 kHz. Social call sequences of roosting *O. wroughtoni* showed five distinct signatures. Multivariate analyses of echolocation calls of *O. wroughtoni* and the other three molossid species found in India (*Tadarida teniotis*, *T. aegyptiaca*, *Chaerephon plicatus*), showed strong support for acoustic differentiation of these species. Our study will help identify probable occurrence of *O. wroughtoni* and the other species in unsurveyed areas through field acoustic surveys. It also proposes hypotheses about the ecology and foraging behaviour of *O. wroughtoni* that could be tested through further studies.

*Key words:* acoustic identification, Barapede caves, *Chaerephon plicatus*, India, Molossidae, *Otomops wroughtoni*, *Tadarida aegyptiaca*, *Tadarida teniotis*

## **Intra- and interspecific variability of echolocation pulse acoustics in the African megadermatid bats**

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The yellow-winged bat, *Lavia frons*, and the heart-nosed bat, *Cardioderma cor*, are sympatric species of the family Megadermatidae resident to East Africa. *Cardioderma cor* roost in groups and disperse to individual foraging areas at night, whereas *L. frons* roost in male-female pairs in Acacia trees within a foraging territory. Nightly foraging areas overlap across species, and thus interspecific differences in echolocation may reflect niche differences crucial for coexistence. Here we compare differences in echolocation from hand-released *C. cor* and *L. frons*, and *L. frons* individuals recorded during fly-bys. Furthermore, megadermatids display a host of social behaviors, including territoriality and singing, and thus intraspecific differences in echolocation may be important for facilitating behavior in this family but has not yet been assessed. We report the patterns of variability of echolocation by sex, body size, and individual of *C. cor*. We measured 354 pulses from 17 *C. cor* individuals and 35 pulses from four *L. frons* individuals in Tanzania. Up to four harmonics were observed in both *C. cor* and *L. frons*, with the second and third harmonics emphasized and the first suppressed. *Cardioderma cor* is a surface gleaner while *L. frons* is an aerial-hawker, and clear differences in frequency metrics ( $F_{\min}$ ,  $F_{\max}$ ,  $F_{\text{peak}}$ ) and duration reflect this. We measured 17 variables including temporal, frequency, and shape metrics for intraspecific *C. cor* pulse analyses. A MANOVA testing individuality on five principle components was significant, but performed poorly in a discriminant analysis. Body mass and forearm length did not correlate with any pulse metrics. Males had significantly lower  $F_{\min}$  and frequency contour parameters than females, although males were slightly smaller than females. These results suggest that *L. frons* and *C. cor* have clear interspecific differences in pulse acoustics that align with guild differences, and may serve heterospecific discrimination, while some intraspecific difference in *C. cor*, particularly by sex, are suggestive of other factors beyond navigation that influence pulse variability.

*Key words:* bats, animal communication, *Cardioderma cor*, echolocation, foraging guild, *Lavia frons*