

**A new species of *Kerivoula* (Chiroptera: Vespertilionidae)
from peninsular Malaysia**

CHARLES M. FRANCIS¹, TIGGA KINGSTON², and AKBAR ZUBAID³

¹*National Wildlife Research Centre, Canadian Wildlife Service, Environment Canada, Ottawa K1A 0H3, Canada*

E-mail: charles.francis@ec.gc.ca

²*Department of Biological Sciences, Texas Tech University, Lubbock, Texas 79409, USA*

³*Jabatan Zoologi, Fakulti Sains Hayat, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia*

A new species of small *Kerivoula* is described from peninsular Malaysia. It is similar in size and form to *Kerivoula hardwickii* Miller 1898 or *K. intermedia* Hill and Francis 1984, but is distinguished by its distinctive colouration — dorsal fur has extensive black bases with shiny golden tips, ventral fur has dark grey bases with whitish-buff tips — as well as several characters of dentition and skull shape. Sequence analysis of the first 648 base pairs of cytochrome oxidase I gene (DNA barcode) indicates a divergence of at least 11% from all other species of *Kerivoula*, a difference comparable to that between other species of *Kerivoula*.

Key words: DNA barcode, *Kerivoula*, new species, Malaysia

A new species of *Hipposideros* (Chiroptera: Hipposideridae) from Sulawesi

PAUL J. J. BATES¹, STEPHEN J. ROSSITER², AUGUSTINUS SUYANTO³, and TIGGA KINGSTON⁴

¹*Harrison Institute, Centre for Systematics and Biodiversity Research, Bowerwood House, St. Botolph's Road, Sevenoaks, Kent, TN13 3AQ, United Kingdom; E-mail: harrisoninstitute@btopenworld.com*

²*School of Biological and Chemical Sciences, Queen Mary, University of London, London, E1 4NS, United Kingdom*

³*Museum Zoologicum Bogoriense, Research Centre for Biology, Indonesian Institute of Sciences (LIPI), Widyasatwaloka Building, Jl. Raya Bogor Km 46, Cibinong 16911, Indonesia*

⁴*Department of Biological Sciences, Texas Tech University, Lubbock, TX 79409, USA*

A new species of *Hipposideros* is described from South-East Sulawesi, Indonesia. Morphologically, it shows close affinities to *Hipposideros papua* but is substantially smaller. It is currently only known from Rawa Aopa Watumohai National Park, an area of semi-disturbed lowland rainforest, where it was the most common species of hipposiderid recorded. In this paper, data on its morphometrics and echolocation are included, along with a brief discussion of its ecology and reproductive biology.

Key words: *Hipposideros* sp. nov., *Hipposideros papua*, echolocation, Sulawesi, Indonesia

Taxonomy of little bent-winged bats (*Miniopterus*, Miniopteridae) from the African islands of São Tomé, Grand Comoro and Madagascar, based on mtDNA

JAVIER JUSTE^{1,3}, ALMUDENA FERRÁNDEZ¹, JOHN E. FA², WILL MASEFIELD²,
and CARLOS IBÁÑEZ¹

¹*Estación Biológica de Doñana (CSIC), P.O. Box 1056, 41080 Sevilla, Spain*

²*Durrell Wildlife Conservation Trust, Les Augres Manor, Trinity, Jersey JE3 5BP, United Kingdom*

³*Corresponding author: E-mail: juste@ebd.csic.es*

Due to a morphological uniformity typically shown by bent-winged bats, the taxonomic recognition of species and subspecies within the sole genus *Miniopterus* has been much questioned and revised. The situation and definition of the African species *M. minor* is particularly confused. This species is known from scattered and discontinuous records on both mainland coasts, Madagascar, São Tomé and Grand Comoro islands. The island forms have been included either within *M. minor* or considered as endemic species. To clarify their taxonomy, we compare mitochondrial DNA sequences of all the island forms with other related African *Miniopterus*. The genetic distances found in this study support a taxonomic recognition of the island forms at species level and the phylogenetic reconstructions based on these data suggest that the *M. minor*, as considered traditionally, is not a monophyletic group. The morphological similarities between the *Miniopterus* from São Tomé (West Africa) and Grand Comoro (East Africa) may reflect convergent evolution rather than a common ancestry.

Key words: Chiroptera, molecular differentiation, phylogeny, cytochrome *b*, island evolution, Africa

Late Pleistocene bat fossils from Anjohibe Cave, northwestern Madagascar

KAREN E. SAMONDS

*Redpath Museum, McGill University, 859 Sherbrooke St. W., Montréal, Québec H3A 2K6, Canada
E-mail: karen.samonds@mcgill.ca*

In spite of decades of research on Madagascar's unique and endemic modern fauna, the evolutionary history of the island's bat fauna remains largely unknown. Their origin and evolution is largely unknown because of the nature of the fossil record; the deepest well-dated glimpse of Madagascar's mammal groups comes from only 26,000 years ago. Bat remains have frequently been recovered from paleontological sites, but have been rarely identified or described. It therefore remains unknown whether bats underwent a reduction in species diversity similar to that seen in many of Madagascar's vertebrate clades. Herein I describe a collection of newly discovered subfossil bats from Anjohibe Cave, northwestern Madagascar, some estimated to have been deposited about 80,000 years ago. Five bat genera are represented as subfossil (*Rousettus*, *Eidolon*, *Hipposideros*, *Triaenops*, and *Myotis*) with four of these genera present in Anjohibe Cave today. The subfossil material has yielded two new species, indicating that Malagasy bats experienced recent species turnover, paralleling what is seen in much of the island's terrestrial vertebrate fauna.

Key words: Madagascar, subfossil, Chiroptera, Anjohibe Cave, Late Pleistocene

Bats of the Sangkulirang limestone karst formations, East Kalimantan — a priority region for Bornean bat conservation

AGUSTINUS SUYANTO¹ and MATTHEW J. STRUEBIG^{2,3}

¹*Museum Zoologicum Bogoriense, Widyasatwaloka Building, Jl. Raya Bogor Km 46, Cibinong 16911, Indonesia*

²*School of Biological and Chemical Sciences, Queen Mary, University of London, London, E1 4NS,
United Kingdom*

³*Corresponding author: E-mail: m.struebig@qmul.ac.uk*

Borneo has a significant role to play in the conservation of bat diversity in Southeast Asia, yet there is little taxonomic and distribution information available for the Indonesian states that represent over two thirds of the island. We report the results of a four week harp-trap and mist-net survey of four limestone karst formations on the Sangkulirang peninsula in East Kalimantan during August 2004. We recorded 36 taxa, including two (a *Pipistrellus* and *Rhinolophus*) that may represent new species, and three (*Hipposideros bicolor*, *Myotis horsfieldii* and *M. montivagus*) that are new records for Kalimantan. Several species, including the karst dependent and patchily distributed *Hipposideros larvatus*, *Rhinolophus creaghi* and *R. pusillus*, were highly abundant at the formations. In Borneo, many of the species were previously known from only a few, or scattered, localities including four Red-Listed species (*R. creaghi*, *M. montivagus*, *Murina rozendaali* and *Kerivoula minuta*). We review the Bornean distributions of individual species given recent surveys in Kalimantan and present taxonomic data from 135 specimens collected during this study. This represents the largest bat collection in Kalimantan so far undertaken and highlights the Sangkulirang peninsula as a key site for bat diversity and conservation in Borneo. Threats to this area include disturbance from bird nest collection in caves, but also mass disturbance from logging and forest fires. We advocate inclusion of the formations and associated forests into a protected area to safeguard this biological resource.

Key words: Chiroptera, Indonesia, Sangkulirang-Mangkaliat, East Kalimantan, Borneo, Southeast Asia, distribution, harp-traps, karst, conservation

Bats of Saba, Netherlands Antilles: a zoogeographic perspective

HUGH H. GENOWAYS¹, PETER A. LARSEN², SCOTT C. PEDERSEN³,
and JEFFREY J. HUEBSCHMAN⁴

¹*University of Nebraska State Museum, W436 Nebraska Hall, Lincoln, NE 68588, USA*
E-mail: hgenoways1@unl.edu

²*Department of Biological Sciences and Museum, Texas Tech University, Lubbock, TX 79409, USA*

³*Department of Biology/Microbiology, South Dakota State University, Brookings, SD 57007, USA*

⁴*Department of Biology, University of Wisconsin-Platteville, Platteville, WI 53818, USA*

Data presented herein provide records of four species of bats new to the fauna of the Antillean island of Saba — *Monophyllus plethodon*, *Ardops nichollsi*, *Tadarida brasiliensis*, and *Molossus molossus*. Together with three species previously recorded from the island — *Brachyphylla cavernarum*, *Artibeus jamaicensis*, and *Natalus stramineus* — the chiropteran fauna of the island is documented to be composed of seven species. Our analysis of species/area relationships for West Indian bats provides a slope value of $z = 0.177$ and $R^2 = 0.76$; therefore, the bat fauna of the West Indies has the flattest slope for this relationship of any West Indian group. This relationship is best explained by a propensity for over water dispersal by West Indian bats. We propose to unite the chiropteran faunas of the islands of Anguilla, Antigua, Barbuda, Nevis, Saba, St. Barthélemy, St. Eustatius, St. Kitts, and St. Martin by recognizing them as the Northern Antillean Faunal Area. Given the small size of Saba (12 km²) and the even smaller effective habitat for non-molossid bats (4 km²), conservation concerns are expressed for the future of the fauna and some recommendations are made for its preservation.

Key words: Caribbean, Chiroptera, conservation, Mammalia, Saba, zoogeography

Critical times of the year for *Myotis myotis*, a temperate zone bat: roles of climate and food resources

ANDREAS ZAHN¹, LUÍSA RODRIGUES², ANA RAINHO², and JORGE M. PALMEIRIM³

¹Ludwig-Maximilians-Universität München, Großhaderner Str. 2, D-82152 Planegg - Martinsried, Germany
E-mail: Andreas.Zahn@iiv.de

²Instituto da Conservação da Natureza e da Biodiversidade, Rua de Santa Marta 55, 1150-294 Lisboa, Portugal

³Departamento de Biologia Animal and Centro de Biologia Ambiental, Faculdade de Ciências,
Universidade de Lisboa, 1749-016 Lisboa, Portugal

In highly seasonal temperate zones climate may cause fluctuations in the accessibility of prey for insectivorous bats. The main objective of this project was to evaluate if these fluctuations can result in resource bottlenecks that affect the body condition of a temperate zone bat — *Myotis myotis*. Seasonal changes in body condition followed different patterns in Portugal and Germany, which have different climates. In Germany bats use thermally better hibernacula, which allow them to minimize energy expenditure, but because of the longer winters they emerge from hibernation in poorer condition. Except during the hibernation period, food was always abundant in Germany, but the condition of the animals was poor when bad weather constrained foraging, particularly in early spring. In Portugal food was limiting during the long dry summer, and this affected the condition of the animals for several months. The conclusion that food resources can act as a limiting factor is relevant for conservation because, like other bat species, *M. myotis* forages mostly in agricultural and forestry habitats, and can be affected by practices that accentuate resource bottlenecks. Where necessary, the management of agroecosystems near colonies of *M. myotis* and of other threatened bats should aim at minimizing seasonal food bottlenecks.

Key words: *Myotis myotis*, diet, prey availability, resource bottlenecks, body condition, Portugal, Germany

A reanalysis of apparent survival rates of Indiana myotis (*Myotis sodalis*)

JUSTIN G. BOYLES¹, BRIANNE L. WALTERS¹, JOHN O. WHITAKER, JR.¹, and JAMES B. COPE²

¹*Center for North American Bat Research and Conservation, Department of Ecology and Organismal Biology,
Indiana State University, Terre Haute, 47809, USA*

²*Department of Biology, Earlham College, Richmond, Indiana 47374, USA*

³*Corresponding author: E-mail: jboyles3@indstate.edu*

The estimation of demographic rates is important for conservation and management of species. However, with the exception of an estimate for adult survival by Humphrey and Cope in 1977, there are no estimates of any demographic rates for the endangered Indiana myotis (*Myotis sodalis*). Their estimate is based on techniques that have been replaced by newer, more flexible, and less biased techniques. Therefore, we reanalyzed a subset of the data first analyzed by Humphrey and Cope using a Cormack-Jolly-Seber model. Two models [$\phi(\text{year})p(\text{year})$ and $\phi(\text{year})p(\text{sex} \times \text{year})$] are equally parsimonious, so we used model averaging to estimate apparent survival. We used this estimate to calculate the average cumulative survival each year after banding for four un-aged cohorts. Our estimate suggests that apparent survival is considerably higher than estimated by Humphrey and Cope the first year after banding and lower the second year after banding. Subsequent to the first two years after banding, our estimates are similar, but slightly lower than those reported by Humphrey and Cope. These results, while useful, cannot be taken as true survival rates for Indiana myotis because of limitations in the data and we suggest this estimate be used appropriately when making management decisions. We discuss limitations in this type of data and make suggestions for experimental design of future studies to collect data more appropriate for estimation of demographic rates in bats.

Key words: *Myotis sodalis*, demography, survival, Cormack-Jolly-Seber model

Field identification of the cryptic vespertilionid bats, *Myotis lucifugus* and *M. yumanensis*

THEODORE J. WELLER¹, SHONENE A. SCOTT^{2, 5}, THOMAS J. RODHOUSE³,
PATRICIA C. ORMSBEE⁴, and JAN M. ZINCK²

¹*Pacific Southwest Research Station, USDA Forest Service, 1700 Bayview Drive, Arcata, CA 95521, USA*
E-mail: tweller@fs.fed.us

²*Portland State University, Department of Biology, P.O. Box 751, Portland, OR 97201, USA*

³*National Park Service, Upper Columbia Basin Network Inventory and Monitoring Program,
2600 NW College Way, Ponderosa Bldg., Bend, OR 97701, USA*

⁴*Willamette National Forest, USDA Forest Service, 211 E. 7th Avenue, Eugene, OR 97401, USA*

⁵*Present address: University of Maine, 5755 Nutting Hall, Room 210, Orono, ME 04469, USA*

Recent advances in molecular techniques have provided new tools for confirming species identities, however they can be expensive and results are not immediately available. *Myotis lucifugus* and *M. yumanensis* are morphologically cryptic species of bats sympatric in western North America that can be difficult to distinguish in the field. We evaluated a set of models that used morphological and echolocation call characters obtained in the field to predict species identity as determined by DNA analysis. We constructed models using data from 98 *M. lucifugus* and 100 *M. yumanensis* captured throughout the Pacific Northwest from which we had obtained high-quality, time-expansion recordings of their echolocation calls. The best model for distinguishing the species combined forearm length and characteristic frequency of echolocation calls and was able to identify 92% of *M. lucifugus* and 91% of *M. yumanensis* individuals, with $\geq 95\%$ confidence. We evaluated the applicability of our model by testing it on additional datasets. Our model correctly classified 83% of *M. lucifugus* ($n = 30$) and 93% of *M. yumanensis* ($n = 29$) individuals captured in north-central Oregon, whose echolocation calls were recorded using a zero-crossings echolocation detection system. It also correctly classified 86% of *M. lucifugus* ($n = 22$) and 85% of *M. yumanensis* ($n = 26$) individuals, captured throughout our study area, for which only poor-quality time-expansion recordings of echolocation calls were obtained. Combining morphometrics with echolocation call characteristics may be a useful approach for distinguishing among pairs of cryptic species of bats in other areas.

Key words: cryptic species, echolocation, geographic variation, mtDNA, species identification, *Myotis lucifugus*, *M. yumanensis*

A comparison of conventional capture versus PIT reader techniques for estimating survival and capture probabilities of big brown bats (*Eptesicus fuscus*)

LAURA E. ELLISON¹, THOMAS J. O'SHEA¹, DANIEL J. NEUBAUM², MELISSA A. NEUBAUM²,
ROGER D. PEARCE², and RICHARD A. BOWEN²

¹*U.S. Geological Survey, Fort Collins Science Center, 2150 Centre Ave., Bldg C, Fort Collins, CO 80526, USA; E-mail: ellisonl@usgs.gov*

²*Department of Biomedical Sciences, Colorado State University, Fort Collins, CO 80526, USA*

We compared conventional capture (primarily mist nets and harp traps) and passive integrated transponder (PIT) tagging techniques for estimating capture and survival probabilities of big brown bats (*Eptesicus fuscus*) roosting in buildings in Fort Collins, Colorado. A total of 987 female adult and juvenile bats were captured and marked by subdermal injection of PIT tags during the summers of 2001–2005 at five maternity colonies in buildings. Openings to roosts were equipped with PIT hoop-style readers, and exit and entry of bats were passively monitored on a daily basis throughout the summers of 2002–2005. PIT readers 'recaptured' adult and juvenile females more often than conventional capture events at each roost. Estimates of annual capture probabilities for all five colonies were on average twice as high when estimated from PIT reader data ($\hat{p} = 0.93\text{--}1.00$) than when derived from conventional techniques ($\hat{p} = 0.26\text{--}0.66$), and as a consequence annual survival estimates were more precisely estimated when using PIT reader encounters. Short-term, daily capture estimates were also higher using PIT readers than conventional captures. We discuss the advantages and limitations of using PIT tags and passive encounters with hoop readers vs. conventional capture techniques for estimating these vital parameters in big brown bats.

Key words: *Eptesicus fuscus*, mark-recapture, PIT tags, Program MARK, survival

Light tagging disrupts social dynamics of bat harems

CHAD M. HOXENG¹, MATTHEW M. APLING¹, PETER I. RITSON¹, and CHRISTINE V. PORTFORS^{1,2}

¹*School of Biological Sciences, Washington State University, Vancouver, USA 98686*

²*Corresponding author: E-mail: portfors@vancouver.wsu.edu*

Light tags are used to study bats because they allow visual observations of these nocturnal animals. In this study, we document changes in roosting behaviors of the greater spear-nosed bat, *Phyllostomus hastatus*, when light tags were applied. Roost behaviors of eight light-tagged female bats were recorded using reflectance infrared videography and compared to roost behaviors of untagged harem members. Light-tagged females were recipients of more aggressive interactions from their harem mates than untagged individuals; they were more often chased away from a group, moved away from (disengaged), and rejected by harem members than were untagged individuals. In addition, light-tagged bats spent significantly more time roosting alone than untagged individuals. These findings indicate that roosting behaviors of *P. hastatus* were altered when light tags were applied. Our results clearly document altered behavior in *P. hastatus* as a result of the application of light tags, and consequently caution should be used when applying light tags to this and others bat species when investigating roosting behavior.

Key words: *Phyllostomus hastatus*; chemiluminescent light tagging; roost behavior; Trinidad and Tobago

Summer foraging habitats of bats in a Mediterranean region of the Iberian Peninsula

ANA RAINHO

*Instituto da Conservação da Natureza e da Biodiversidade, Rua de Santa Marta 55, 1150-294 Lisboa,
Portugal; E-mail: rainhoa@icn.pt*

Preservation of foraging habitats is a fundamental approach to bat conservation. Yet, knowledge on the primary foraging sites of Mediterranean bats remains scarce, particularly during the summer when the availability of prey can be limiting. This study was designed to determine in which habitats bats forage in Southern Portugal, during this potentially stressful period. During the summers of 1994 and 1995, bat foraging activity was monitored in representative habitat types using an ultra-sound detector. The number of feeding-buzzes and bat-passes were counted and species identified through the analysis of recorded echolocation calls. None of the recorded species restricted its foraging activity to a single habitat type, but water sites were preferred by most bats. *Tadarida teniotis* was an exception to this habitat use. Further analysis confirmed that riparian habitats when surrounded by autochthonous broad-leaved forests seem to provide optimal foraging areas for bats during summer. Opposite, water sites within habitats resulting from intensive agriculture or forestry, provide very poor foraging areas. The typical Mediterranean landscape of Iberia, dominated by oak-woodlands and with numerous, scattered and well vegetated water sites, seems to grant optimal foraging habitat for bats during summer. However, this landscape is itself at risk. Current production demands are causing substantial land-use changes and, despite some European programmes on the preservation of Mediterranean oak woodlands and their biodiversity, the furtherance of this landscape is at stake. The preservation of traditional management strategies of oak-woodlands and associated water sites should be strongly encouraged.

Key words: foraging bats, summer habitat use, Mediterranean, bat-detectors

Cavity roost site availability and habitat use by bats in different aged riparian cottonwood stands

MICHAEL B. SWYSTUN¹, JEFFREY E. LANE^{2,4}, and R. MARK BRIGHAM³

¹*Chinook Health Region, Taber, AB T1G 1M8, Canada*

²*Department of Biological Sciences, University of Alberta, Edmonton, AB T6G 2E9, Canada*

³*Department of Biology, University of Regina, Regina, SK S4S 0A2, Canada*

⁴*Corresponding author: E-mail: jelane@ualberta.ca*

Riparian forests provide important roosting habitat, abundant prey and access to drinking water for many bat species but to date there has been little research on the differential quality of habitats within riparian areas. We quantified the density of potential roost cavities in three age classes (i.e., young: ca. 20 years, mature: ca. 60 years, and old: ca. 100 years) of riparian cottonwood (*Populus deltoides*) forest stands. Bat activity was also sampled using acoustic detectors in one representative stand of each age class. Stands were situated along an 80 km stretch of the Missouri River in southeastern South Dakota and northwestern Iowa, USA. We predicted the highest density of potential roosts and the highest activity of bats to occur in the oldest age class. Contrary to our predictions, and previous work in aspen dominated upland sites, we found that the density of potential roosts was not significantly different between mature and old stands. However, there were no potential roosts in young stands. Data from guano traps verified the use of a number of cavities in both mature and old stands. Both commuting and foraging activities were highest in the mature, relative to the old and young stand. In total, our data indicate that mature and old stands represent high quality roosting habitat, with the mature being used preferentially for commuting and foraging. Trees in the oldest stands, however, are nearing the end of their lifespan and falling. Younger cohorts must therefore be retained for future recruitment of natural cavities.

Key words: Chiroptera, cavities, cottonwoods, forest age, habitat use, riparian forest, roost site availability

The influence of a local temperature inversion on the foraging behaviour of big brown bats, *Eptesicus fuscus*

DEVIN ARBUTHNOTT^{1, 2} and R. MARK BRIGHAM¹

¹*Department of Biology, University of Regina, Regina, Saskatchewan, Canada*

²*Corresponding author: E-mail: darbutn@sfu.ca*

To maximise foraging efficiency, it is reasonable to expect animals to forage in the highest quality patches. Insectivorous bats should therefore travel to and forage at sites with the highest insect abundance. Since insects are ectothermic, their levels of activity should be higher in warmer areas, making these high quality patches for bats. A nightly temperature inversion occurring in the Cypress Hills (Saskatchewan, Canada) presented an opportunity to test our hypothesis that big brown bats (*Eptesicus fuscus*) select foraging sites based on temperature as a proxy for insect abundance. If temperature is an important determinant of the foraging behaviour of *E. fuscus*, we expect bats to forage in the warmest site closest to local night roosts. We tracked 18 bats for a total of 111 nights over two years and found that individuals often spent at least some of each foraging bout in an area where the temperature inversion was small or non-existent. Bats sometimes travelled up to 11 km to reach this site. Foraging in areas where the temperature inversion was small provides indirect evidence that local temperature fluctuations are not a major influence on the selection of foraging area by *E. fuscus*. Also, since there was little difference in the temperature between the nearby predicted foraging sites and actual foraging sites, we argue that the effect of temperature on insect activity cannot be used to predict foraging habitat selection by these bats. We found that the insect community of the foraging area was different than that of the roosting area, and that beetles were more abundant in the foraging site. Our data suggests that insect community composition is potentially a stronger direct influence on bat foraging behaviour than is temperature.

Key words: *Eptesicus fuscus*, foraging behaviour, foraging site selection, environmental variables, insect community, foraging range

Habitat use by phyllostomid bat assemblages in secondary forests of the ‘Sierra del Rosario’ Biosphere Reserve, Cuba

CARLOS A. MANCINA^{1,2}, LAINET GARCÍA-RIVERA¹, and RENE T. CAPOTE¹

¹*Instituto de Ecología y Sistemática, Carretera de Varona km. 3½, Capdevila, Boyeros, A.P. 8029 C.P. 10800, Ciudad de La Habana, Cuba*

²*Corresponding author: E-mail: mancina@ecologica.cu*

Using mist-nets, we studied the composition of bat assemblages in four distinct secondary habitats of the Sierra del Rosario Biosphere Reserve, Cuba. For each individual captured we recorded reproductive condition, seeds in feces, and pollen species. Of the 550 bats captured during 41 nights of sampling, 97% belonged to six species of Phyllostomidae, and 88.7% belonged to just three: *Artibeus jamaicensis*, *Phyllonycteris poeyi* and *Monophyllus redmani*. The total number of captures varied among the four sites, being higher in the two more disturbed sites although this may have been an artifact of the use of ground-level mist-nets in vegetation of different structure. However the higher capture frequencies found in these sites could be related to the availability of understory fruits and the less dense understory vegetation too, allowing some species to exploit resources farther from forest edges. On three sites, the captures included a common large frugivore, two common nectarivores, and two uncommon species. The species composition of these assemblages resembled that observed in previous studies in the better-conserved core zone of the Biosphere Reserve. This implies that food availability and vegetation structure might be more important influences than the conservation level of vegetation on the composition and structure of assemblages of Cuban phyllostomids. In spite of the reduced diversity of the assemblage we studied compared with mainland assemblages, the relative abundances of Cuban bats tend to be higher than some continental ones. This could be related to lower bat diversity and a higher degree of gregariousness of the Cuban phyllostomids.

Key words: bat assemblages, Cuba, food habits, night activity, phyllostomids, reproduction activity, secondary habitats

Quantifying phyllostomid bats at different taxonomic levels as ecological indicators in a disturbed tropical forest

ALEJANDRO A. CASTRO-LUNA¹, VINICIO J. SOSA^{1,2}, and GONZALO CASTILLO-CAMPOS¹

¹*Departamento de Ecología Aplicada, Instituto de Ecología, A.C., A.P. 63, Xalapa 91000, Veracruz, Mexico*

²*Corresponding author: E-mail: vinicio.sosa@inecol.edu.mx*

With the aim of quantitatively evaluating the usefulness of phyllostomid bats as ecological indicators, we compared intra-family levels and feeding guilds between tropical old-growth forest and patches of secondary vegetation growing where the land had been used for shifting agriculture. There were significant differences between vegetation types in bat species composition, with the frugivore guild most abundant in secondary vegetation and the animalivore guild most abundant in the old-growth forest. These results are congruent with the findings for other Neotropical zones and appear to be associated with the type of soil management that allows secondary vegetation to grow. Using the Indicator Value method, two subfamilies, five genera and five species were found to have a significant indicator value. However, these numbers only represent a small proportion of the five subfamilies, 20 genera and 28 species recorded, indicating that under the disturbance conditions that characterize the study area, phyllostomid bats were poor ecological indicators. Even so, some species and subfamilies are useful as disturbance detectors.

Key words: assemblages, indicators, Phyllostomidae, shifting agriculture

Temporal and spatial patterns of seed dispersal of *Musa acuminata* by *Cynopterus sphinx*

ZHANHUI TANG^{1,2}, LIANXI SHENG^{1,6}, XUNFENG MA¹, MIN CAO², STUART PARSONS³, JIE MA⁴,
and SHUYI ZHANG⁵

¹Department of Environmental Science and Engineering, North East Normal University, Changchun 130024, China

²Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, Mengla, Yunnan 666303, China

³School of Biological Sciences, University of Auckland, Private Bag 92019, Auckland, New Zealand

⁴Department of Physiological Science, University of California, Los Angeles 90095, USA

⁵School of Life Science, East China Normal University, Shanghai 600026, China

⁶Corresponding author: E-mail: Shenglx@nenu.edu.cn

The foraging behavior of greater short-nosed fruit bats (*Cynopterus sphinx*) on wild banana (*Musa acuminata*) and subsequent dispersal of seeds were studied in the Tropical Rainforest Conservation Area, Xishuangbanna Tropical Botanical Garden, Yunnan province, by direct observation of marked fruits, mist netting, and seed collection. The mean number (\pm SE) of individual *C. sphinx* captured by mist net were $2.2 \pm 0.33/\text{day}$ and $1.4 \pm 0.32/\text{day}$ in the rainy season (September to October) and dry season (November to December), respectively; the difference was not significant. The number of seed pellets expelled was $9.0 \pm 1.12/\text{day}$ and $7.2 \pm 1.37/\text{day}$ in the rainy and dry seasons respectively; again the difference was not significant. The removal curves for marked fruit were similar for 10 focal trees. Fruits were consumed heavily within two weeks after ripening and all the marked fruit were removed within one month. The difference in seed dispersal was significant between different feeding roosts indicating that patterns of seed dispersal may not be uniform. We found the seeds of *M. acuminata* can be dispersed by *C. sphinx* to a distance of about 200 m, and *C. sphinx* can be considered as an effective seed disperser of *M. acuminata*.

Key words: *Cynopterus sphinx*, *Musa acuminata*, feeding, seed dispersal, China

Food habits of Orii's flying-fox, *Pteropus dasymallus inopinatus*, in relation to food availability in an urban area of Okinawa-jima Island, the Ryukyu Archipelago, Japan

ATSUSHI NAKAMOTO¹, KAZUMITSU KINJO^{1,2}, and MASAKO IZAWA^{1,3}

¹*Faculty of Science, University of the Ryukyus, 1 Senbaru, Nishihara, Okinawa 903-0213, Japan*

²*Present address: Faculty of Law, Okinawa International University, Ginowan, Okinawa 901-2701, Japan*

³*Corresponding author: E-mail: izawa@sci.u-ryukyu.ac.jp*

The diet of the Orii's flying-fox, *Pteropus dasymallus inopinatus*, a subspecies of the Ryukyu flying-fox, was investigated on Okinawa-jima Island, Japan. The Orii's flying-fox is a generalist forager that feeds on 78 plant species from 62 genera and 43 families. They consume fruits of 53 species, flowers of 20 species, and leaves of 18 species. Cultivated or naturalized plants composed almost half of the diet. Diversity in the diet may be an adaptation to unstable food conditions on this small subtropical island. The number of individual Orii's flying-foxes fluctuated greatly corresponding to monthly changes in food availability, especially that of *Ficus microcarpa*, which was the animal's main food resource throughout the year. Orii's flying-foxes may adapt to an urban environment by intensively using areas with abundant planted trees.

Key words: food habits, foraging strategy, Okinawa-jima Island, *Pteropus dasymallus inopinatus*, Ryukyu flying-fox, urbanization

Bat frugivory in a remnant of Southeastern Brazilian Atlantic forest

LUDMILLA M. S. AGUIAR^{1,2} and JADER MARINHO-FILHO³

¹*Programa de Pós-Graduação em Ecologia, Conservação e Manejo de Vida Silvestre, Universidade Federal de Minas Gerais, Av. Antônio Carlos, 6627 Pampulha, Belo Horizonte, MG CEP 31270-901, Brazil*

²*Present address: Embrapa Cerrados, Recursos Naturais, BR 020 km 18 - Cx. P. 08223, Planaltina, DF, Brazil 73301-970; E-mail: ludmilla@cpac.embrapa.br*

³*Departamento de Zoologia, Universidade de Brasília, Brasília, DF, Brazil 70910-900*

Knowledge of bat diets may be important for the conservation of small Atlantic Forest fragments because these animals play an important role in seed dispersal and natural recovery of tropical forests. The ‘Reserva Particular do Patrimônio Natural Feliciano Miguel Abdala’ (RPPN-FMA) is a 886-hectare Atlantic forest fragment consisting of a mosaic of distinct successional phases resulting from logging and natural causes, in the state of Minas Gerais, Brazil. We collected 216 fecal samples containing blood, arthropods, pollen-nectar, vegetation (leaflets and fruit peel), fruit pulp (fibers and juice) and seeds, from 18 bat species at the RPPN-FMA. Piperaceae, Solanaceae, Cecropiaceae, and Guttiferae were the most important food resources for frugivorous bats at RPPN-FMA. *Piper* infrutescences were consumed by *Artibeus obscurus*, *A. fimbriatus*, *Carollia perspicillata*, and *Sturnira lilium* throughout the year, functioning as key species, as already observed for other tropical rainforest sites.

Key words: Atlantic forest, *Carollia perspicillata*, conservation, diet, fragmentation, key species, *Piper*, *Sturnira lilium*

Composition of guano produced by frugivorous, sanguivorous, and insectivorous bats

JUSTIN K. EMERSON¹ and ALISON M. ROARK^{1,2}

¹*Department of Zoology, University of Florida, Box 118525, Gainesville, FL 32611, USA*

²*Corresponding author: E-mail: amroark@ufl.edu*

Bat guano supports an assemblage of organisms that varies depending on the species of bat producing it. To determine whether these differences in community structure may be due to differences in guano composition, we analyzed guano from frugivorous (*Pteropus rodricensis*), sanguivorous (*Desmodus rotundus*), and insectivorous (*Tadarida brasiliensis*) bats. We found no differences among species in organic matter or lipid of guano. *Desmodus* guano contained more carbon (C) than *Pteropus* guano. The latter contained less nitrogen (N), and the former contained less phosphorous (P) than guano of the other two species. *Pteropus* guano had a higher C:N ratio, and *Desmodus* guano had higher N:P and C:P ratios than the other two species. These differences in guano composition suggest that guano from bats in different feeding guilds may affect ecosystem structure and dynamics differently.

Key words: Chiroptera, frugivorous, insectivorous, sanguivorous, guano, composition, carbon, nitrogen, phosphorus, stoichiometry

Good DNA from bat droppings

SEBASTIEN J. PUECHMAILLE^{1, 2}, GREGORY MATHY¹, and ERIC J. PETIT^{1, 3}

¹*Ethologie Evolution Ecologie, UMR CNRS 6552, Université de Rennes I, Station Biologique,
35380 Paimpont, France*

²*School of Biological and Environmental Sciences, University College Dublin, Belfield, Dublin 4, Ireland*

³*Corresponding author: E-mail: eric.petit@univ-rennes1.fr*

Amplification of a mitochondrial DNA fragment was used to compare the efficiency of five methods for extracting DNA from bat droppings. The Qiagen DNA Stool Kit, which yielded > 90% mtDNA amplification success, was chosen to extract DNA from 586 samples taken over two years in three French colonies of the lesser horseshoe bat (*Rhinolophus hipposideros*). Samples, for which mtDNA amplification was successful, were subject to the multiplex amplification of eight microsatellite loci. This resulted in > 95% amplification success over 12,592 PCRs. Allelic dropout (ADO) and false allele (FA) rates were low, and consequently, sample and locus quality indexes (QI) were high. These results demonstrate that large scale noninvasive studies of bat colonies are possible.

Key words: Chiroptera, error rate, faecal DNA extraction, microsatellite, mtDNA, noninvasive sampling, *Rhinolophus hipposideros*

A rapid PCR-based test for species identification of two cryptic bats *Pipistrellus pipistrellus* and *P. pygmaeus* and its application on museum and dropping samples

PETER KAŇUCH^{1, 2, 4}, PETRA HÁJKOVÁ¹, ZDENĚK ŘEHÁK³, and JOSEF BRYJA^{1, 3}

¹*Institute of Vertebrate Biology, Academy of Sciences CR, CZ-675 02 Studenec 122, Czech Republic*

²*Institute of Forest Ecology, Slovak Academy of Sciences, Štúrova 2, SK-960 53 Zvolen, Slovakia*

³*Institute of Botany and Zoology, Faculty of Science, Masaryk University, Kotlářská 2, CZ-637 01 Brno, Czech Republic*

⁴*Corresponding author: E-mail: kanuch@netopiere.sk*

The identification of two cryptic bat species of the genus *Pipistrellus* using a non-destructive and quick method of multiplex PCR and agarose gel electrophoresis is described. Two primer combinations were able to produce species-specific bands that identified reliably individuals that were previously identified by mtDNA sequencing. Robustness of the method was subsequently successfully tested on 16 randomly selected free-living animals from central Europe (tissue samples obtained from a 3 mm punch of wing-membrane) identified to species on the basis of echolocation calls. Nine out of 15 museum specimens and 100% of fresh faecal samples from seven individuals were also successfully identified by this method. The described method thus provides a good way to routinely distinguish two *Pipistrellus* species by using non-destructive sampling of living individuals or droppings, and will be used in field studies of their ecology.

Key words: Chiroptera, cytochrome *b*, mtDNA, sibling species, non-invasive sampling

European bat lyssaviruses — an ecological enigma

AD VOS¹, INGRID KAIPF², ANNETTE DENZINGER², ANTHONY R. FOOKS³, NICK JOHNSON³,
and THOMAS MÜLLER^{4,5}

¹*Impfstoffwerk Dessau Tornau GmbH, Streetzerweg 15a, 06862 Rodleben, Germany*

²*Zoologisches Institut, Universität Tübingen, Auf der Morgenstelle 28, 72076 Tübingen, Germany*

³*Rabies and Wildlife Zoonoses Group, WHO Collaborating Centre for the Characterisation of Rabies and Rabies-Related Viruses, Veterinary Laboratories Agency, Weybridge, Woodham Lane, Surrey, KT15 3NB, United Kingdom*

⁴*Friedrich-Loeffler-Institute, WHO Collaborating Centre for Rabies Research and Surveillance, Seestrasse 55, 16868 Wusterhausen, Germany*

⁵*Corresponding author: E-mail: Thomas.Mueller@fli.bund.de*

The first European case of bat rabies was reported in 1954. Since then, more than 800 cases have been confirmed from 13 countries. The causative agents are European Bat Lyssavirus Type-1 (EBLV-1) and Type-2 (EBLV-2). The natural host of EBLV-1 seems to be the serotine bat (*Eptesicus serotinus*) with more than 95% of all cases reported in this species. Although much fewer EBLV-2 cases have been identified, it seems that *Myotis dasycneme* and *M. daubentonii* are likely to be the principal hosts' species for this virus. The ecological mechanisms underlying the transmission of EBLV-1 and EBLV-2 are still poorly understood. In order to assess the public health risks associated with EBLVs and the implications for bat conservation, some issues need urgent clarification. In this review some of the most pressing topics will be addressed. Only collaboration between a range of disciplines that include virologists, epidemiologists and bat conservationists will be able to elucidate some of these unanswered questions.

Key words: Chiroptera, rabies, EBLV-1, EBLV-2, ecology

Describing roosts used by forest bats: the importance of microclimate

JUSTIN G. BOYLES

*Center for North American Bat Research and Conservation, Department of Ecology and Organismal Biology,
Indiana State University, Terre Haute, 47809 USA; E-mail: jboyles3@indstate.edu*

Adequate descriptions of roosting habitat are vital to the management and conservation of bats. However, most studies on bat roosting preference report only structural characteristics of roosts and surrounding habitat, and ignore potentially important factors in roost selection. I argue that the current methods for describing the roosting habitat of tree-roosting bats can be improved, and that more emphasis should be placed on designing studies to determine why bats choose particular roosts. Herein, I focus on measuring microclimate in roosts because it universally influences habitat selection. Specifically, roost temperature is easily measured and is likely an important microclimate variable used by bats in roost selection. Variation in structural characteristics of roosts is often assumed to correlate with variation in microclimate of the roost; however, empirical data are too scarce to verify this assumption. I suggest improvements to the current methods of describing roost characteristics and suggest the inclusion of new methods to describe microclimate. In summation, I argue that there are methods of measuring roost characteristics that may be beneficial to use in conjunction with the methods currently being used, and that microclimate should be considered when designing future studies.

Key words: Chiroptera, habitat selection, study design

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SHORT NOTES

Winter feeding by bats in Missouri

MIRANDA B. DUNBAR^{1,3}, JOHN O. WHITAKER, JR.², and LYNN W. ROBBINS¹

¹*Missouri State University, Biology Department, Springfield, MO 65804, USA*

²*Indiana State University, Department of Ecology and Organismal Biology, Terre Haute, IN 47809, USA*

³*Current address: University of Regina, Biology Department, Regina, SK S4S 0A2, Canada*

E-mail: milam20m@uregina.ca

Key words: arousal, feeding, hibernation, winter, *Eptesicus fuscus*, *Lasionycteris noctivagans*, *Lasiurus borealis*, *Nycticeius humeralis*

**The diet of *Myzopoda schliemanni*, a recently described Malagasy endemic,
based on scat analysis**

BALSAMA RAJEMISON¹ and STEVEN M. GOODMAN^{2, 3, 4}

¹*Parc Botanique et Zoologique de Tsimbazaza, BP 4096, Antananarivo (101), Madagascar*

²*Field Museum of Natural History, 1400 South Lake Shore Drive, Chicago, Illinois 60605, USA*

³*Vahatra, BP 738, Antananarivo (101), Madagascar*

⁴*Corresponding author: E-mail: sgoodman@wwf.mg*

Key words: Myzopoda schliemanni, Myzopodidae, diet, endemic, Madagascar

Food sharing behavior in the hairy-legged vampire bat *Diphylla ecaudata*

CYNTHIA ELIZALDE-ARELLANO^{1, 5}, JUAN CARLOS LÓPEZ-VIDAL¹,
JOAQUÍN ARROYO-CABRALES², RODRIGO A. MEDELLÍN³, and JOHN W. LAUNDRÉ⁴

¹*Laboratorio de Cordados Terrestres, Depto. Zoología, Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional, Carpio y Plan de Ayala s/n, Casco de Santo Tomás, CP. 11340, México D.F.*

²*Laboratorio de Arqueozoología, Instituto Nacional de Antropología e Historia, Moneda no. 4 Col. Centro, CP. 06060, México D.F.*

³*Instituto de Ecología, Universidad Nacional Autónoma de México. Ap. Postal 70-275 Circuito exterior, Ciudad Universitaria, CP. 04510 México D.F.*

⁴*Instituto de Ecología A.C., Centro Regional Durango, km 5 carr. Durango-Mazatlán, 34100, Durango, Dgo. México*

⁵*Corresponding author: E-mail: thiadeno@hotmail.com*

Key words: Food sharing, *Diphylla ecaudata*, hairy-legged vampire bats, feeding behavior, Tamaulipas, Mexico

**First record of seasonal over sea migration of *Miniopterus schreibersii*
and *Myotis capaccinii* between Balearic Islands (Spain)**

BLANCA AMENGUAL, MARC LÓPEZ-ROIG, and JORDI SERRA-COBO

*Science Group Research of Biology of Vertebrates (96-SGR0072), Departament de Biologia Animal,
Facultat de Biologia, Universitat de Barcelona, Av. Diagonal, 645, 08028 Barcelona, Spain
E-mail: serracobo@areambiental.com*

Key words: Miniopterus schreibersii, Myotis capaccinii, seasonal displacement, over sea migration, Balearic Islands