Acta Chiropterologica, 9(2): 323–337, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

A new species of *Kerivoula* (Chiroptera: Vespertilionidae) from Southeast Asia

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A new species of *Kerivoula* is described from Seima Biodiversity Conservation Area, Cambodia. It is widely distributed in mainland Southeast Asia, with referred material from 12 additional localities in Myanmar, Thailand, Lao PDR and Vietnam. Superficially similar to *Kerivoula flora*, it is distinguished by its flattened skull, a character shared with the larger, recently described, *Kerivoula kachinensis*. It is known from a variety of habitat types, both pristine and disturbed, including deciduous dipterocarp forest, moist evergreen and semi-evergreen forest, forest on limestone karst and upper montane forest.

Key words: *Kerivoula* sp. nov., Cambodia, Myanmar, Thailand, Lao PDR, Vietnam, taxonomy, skull morphology

Acta Chiropterologica, 9(2): 339–345, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

First records of *Kerivoula kachinensis* (Chiroptera: Vespertilionidae) from Cambodia, Lao PDR and Thailand

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Kerivoula kachinensis is reported for the first time from Cambodia, Lao PDR and Thailand. In April, 2005 and January, 2006, three individuals were collected in deciduous dipterocarp forest, near bamboo, in the Seima Biodiversity Conservation Area, Mondul Kiri Province, Cambodia. In September, 2007, two individuals were collected in lower montane forest, which included some mixed deciduous forest, bamboo groves and banana trees, in the hills of Phu Suan Sai National Park, Loei Province, and a single individual was collected in mixed deciduous forest, near bamboo, in the Nam Nao National Park, Petchabun Province, Thailand. In 1996–1998, seven specimens were collected from five localities in north, central and southern Lao PDR; most were associated with evergreen forest at altitudes between 150–800 m a.s.l. The species appears to be relatively widespread in continental Southeast Asia. Locally common, it is probably not currently at risk.

Key words: *Kerivoula kachinensis*, Vespertilionidae, Thailand, Lao PDR, Cambodia, distribution, first record

Acta Chiropterologica, 9(2): 347–360, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Environmental correlates of species richness of European bats (Mammalia: Chiroptera)

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We use data of bat species richness of 58 European countries and larger islands from Fauna Europaea augmented by recent faunal surveys of particular countries to evaluate the effects of area, latitude, annual temperature range, and mean winter length (days < 0°C), geographical heterogeneity, number of plant species, and distance from Turkey on bat species richness. Area, latitude, and temperature range explained more than 73% of the total variability in European bat species richness. Latitude and temperature corrected species-area relationships of vespertilionid bats were fitted by the power function model with mainland countries having a lower slope (z = 0.09) than islands (z = 0.15) consistent with current theory. The area corrected centre of vespertilionid species richness was at about 46°N with Croatia being most species rich (34 species). Non-vespertilionid bats peaked at 41°N and did not show a simple latitudinal gradient. The inclusion of plant species richness in the model for Vespertilionidae did not lower the significant influence of area and latitude on species richness. Plant species richness itself was not a major predictor of bat species richness. Three environmental characteristics (latitude, area and temperature) are the main predictors of bat species richness in Europe. These attributes act in an additive manner. This phenomenon allows potential covariates to be eliminated from species-area relationships using simple regression techniques. Further, additive models constructed in this way allow for a ranking of countries with respect to species richness.

Key words: Chiroptera, species-area relationship, macroecology, latitudinal gradients, non-linear regression

Acta Chiropterologica, 9(2): 361–378, 2007
PL ISSN 1508-1109

Biogeography of the recently described *Myotis alcathoe* von Helversen and Heller, 2001

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Since its description in 2001 Alcathoe's myotis (*Myotis alcathoe*) was recorded from several locations across Europe. Here we describe the first records of this species from Germany, Poland, Albania, and from the European part of Turkey, including the northernmost locality in central Germany (51°23'N, 11°01'E). Compilation of all up-to-date records shows that *M. alcathoe* has a wide European distribution although it seems to be rare at most places. The habitats where the bat was recorded are natural, moist and deciduous forests with old trees and water streams as can be found, for example, in canyons or forests of alluvial origin. Such habitats suggest that the species probably has a more continuous and wider distribution than currently known and might be expected to occur even further to the North.

Key words: *Myotis alcathoe*, biogeography, ecology

Acta Chiropterologica, 9(2): 379–389, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Patterns of genetic diversity within and between *Myotis d. daubentonii* and *M. d. nathalinae* derived from cytochrome *b* mtDNA sequence data

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We analysed the phylogenetic relationships between *M. d. daubentonii* and *M. d. nathalinae* based on 1,010 bp of the cytochrome *b* mtDNA gene. The inference based on molecular phylogenetics methods shows that these two morphotypes correspond to two mitochondrial groups within the Iberian Peninsula. Our results also support the model of 'refugia within refugia', where *M. d. daubentonii* has spread north and *M. d. nathalinae* has became an Iberian endemism. The haplotype network indicates haplotype sharing between Monfurado and S. Mamede (Portugal) and Bavaria (Germany), demonstrating current or recent dispersal and gene flow between these populations. *Myotis d. nathalinae* displays a substructure showing that populations under the same climate type are more related. As a distinct Iberian endemism, the conservation status of *M. d. nathalinae* should be reviewed.

Key words: phylogeography, phylogeny, *M. d. daubentonii*, *M. d. nathalinae*, Iberian Peninsula, cytochrome *b*

Acta Chiropterologica, 9(2): 391–399, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

The taxonomic status of *Chaerephon pumilus* from the western Seychelles: resurrection of the name *C. pusillus* for an endemic species

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We investigate the taxonomic status of a molossid bat from the western Seychelles that has been previously considered distinct and then subsequently synonomized with the widespread *Chaerephon pumilus*. We compare specimens available from the Seychelles (Aldabra and Amirantes), including the holotype and paratype of *C. pusillus*, to specimens assigned to *C. pumilus* from Kenya, the Comoros Archipelago (Mayotte, Mohéli, Anjouan, and Grande Comore), and from lowland areas of the northern half of Madagascar. Based on these comparisons, the animals from the Aldabra and Amirantes are distinctly smaller than these other regional island and mainland populations and we conclude that the name *C. pusillus* should be resurrected for this endemic Seychelles species.

Key words: *Chaerephon pusillus*, specific status, Aldabra, Amirantes

Acta Chiropterologica, 9(2): 401–407, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

The fishing bat *Noctilio* (Mammalia, Chiroptera) in the Middle Pleistocene of central Argentina

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We report the record of a canine tooth assignable to an undetermined species of *Noctilio* from the Middle Pleistocene of the Atlantic coast in central Argentina. This is the southernmost record for the genus and the first paleontological record of *Noctilio* in southern South America. In addition, this finding supports the hypothesis of an episodic warm climatic pulse suggested by other micromammals recovered from the same fossil-bearing levels.

Key words: *Noctilio*, Pleistocene, Argentina, paleoclimates

Acta Chiropterologica, 9(2): 409–422, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Noteworthy bat records from the Pacific Tropical rainforest region and adjacent dry forest in northwestern Peru

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The bat fauna of the Pacific Tropical rainforest region in Peru is poorly known. Here we report noteworthy range extensions of 12 bat species, including: *Diaemus youngi*, *Chrotopterus auritus*, *Micronycteris minuta*, *Mimon crenulatum*, *Vampyrum spectrum*, *Chiroderma salvini*, *Enchisthenes hartii*, *Noctilio leporinus*, *Thyroptera discifera*, *Eptesicus chiriquinus*, *Rhogeessa io*, and *Myotis riparius*. These document the first confirmed records for the department of Tumbes. All, except *E. hartii* and *N. leporinus*, are also first records for the western slope of Peru. The record of *R. io* is the first for Peru, while that of *C. auritus* is the first for the Pacific versant of the Andes. In total, 41 bat species are present in the Pacific Tropical rainforests and surrounding dry forests, at the new Parque Nacional Cerros de Amotape, in Tumbes. This region requires urgent conservation programs, because the Pacific Tropical rainforest is threatened by human settlement, and resource exploitation in spite of its protected status.

Key words: Chiroptera, Pacific Tropical rainforests, diversity, Peru, Tumbes, dry forests, Parque Nacional Cerros de Amotape

Acta Chiropterologica, 9(2): 423–435, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Mist netting bias, species accumulation curves, and the rediscovery of two bats on Montserrat (Lesser Antilles)

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Mist nets are commonly used to survey bat populations and to estimate bat biodiversity, but several studies have found that mist net capture data and methods are biased due to a number of factors, including size and placement of nets, and the frequency at which investigators check their nets. Despite the wealth of literature and anecdotal reports, few investigators have quantified the interactions of bats with mist nets directly. We employed night vision camcorders to monitor bat behavior when bats encountered a mist net and then utilized these data to re-evaluate years of survey data collected on Montserrat, Lesser Antilles. We recorded 2,523 bat passes during 43.3 hours of videotaping in July 2005 and June 2006. Observations conducted on successive nights provide evidence of avoidance-learning behavior in bats. When a mist net was present, 5.4% of bats in the airspace came into contact with the net giving an overall capture rate of 3.2% (range 0–10.3%). Mist nets are not accurately sampling bats that utilize flyways on Montserrat and such fieldwork thereby generates potentially misleading data. Biodiversity assessments and conservation guidelines based on short-term mist net surveys alone are not sufficient or reliable in regards to bats. A pragmatic solution to reduce mist net bias is to repeatedly sample a target region, utilize a variety of netting sites, use variable net sets, and carefully analyze species accumulation curves.

Key words: mist net bias, species accumulation curve, Lesser Antilles, rediscovery, *Chiroderma improvisum*, *Sturnira thomasi*

Acta Chiropterologica, 9(2): 437–443, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Maternal feeding of offspring with vertebrate prey in captive Indian false vampire bat, *Megaderma lyra*

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We studied relationships between mother and weaned young of captive Indian false vampire bats, *Megaderma lyra*. Four out of eight young (Group 1) at 60–63 days of age began to capture freshly killed frogs we pulled with a long thread on the sandy floor of flight room. However, the mothers continued to suckle until their young became 84.7 ± 3.97 ($\bar{x}$ ± SE) days of age. When the remaining four young (Group 2) were 59.5 ± 1.85 days of age their mothers stopped suckling. Nevertheless, these mothers transferred either entire or partly consumed frogs (bodies with no heads, half bodies, paired hind limbs, and single hind limbs) to their young solicitors. Such food transfers occurred based on the body lengths of frogs. Mothers transferred small frogs entirely, but as the body length of frogs increased, mothers transferred smaller body parts to their young. Audible vocalizations of mothers and young were associated with food transfers. When these young bats became 74.0 ± 2.63 days of age, their mothers stopped food transfers. It appears that lactating females of *M. lyra* provision offspring by supplementing milk with solid food, similar to what has been observed in other megadermatid bats.

Key words: *Megaderma lyra*, mother-young relationships, food transfer, frogs, lactation, weaning

Acta Chiropterologica, 9(2): 445–450, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Diet, reproduction and roosting habits of the Madagascar free-tailed bat, *Otomops madagascariensis* Dorst, 1953 (Chiroptera: Molossidae)

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Otomops madagascariensis is a large (24–27 g) molossid bat endemic to Madagascar. Unlike its congener *O. martiensseni*, in nearby mainland Africa, little is known about its ecology although it appears to roost only in caves. It is only known from a few sites in the west and occupies a small percentage of the available caves. We studied roosting colonies in seven vertical erosion domes in the roof of a cave in Parc National Tsingy de Bemaraha during July and October 2003. We also captured bats as they emerged from and returned to a roost cave in the south. Female bats examined in the west during October and in the south during November were pregnant. In the roosting colonies, one group contained 57 pregnant females and five adult males. Most other groups also consisted of both sexes but three male-only groups were encountered in October. Diet consisted mainly of Lepidoptera and Coleoptera and there was variation between sites and study locations in the contribution of these prey types. *Otomops madagascariensis* is an obligate cave dweller that appears to be rare within its known range and should be a target species for conservation and research.

Key words: breeding, caves, *Otomops*, diet, Madagascar, Molossidae, reproduction

Acta Chiropterologica, 9(2): 451–461, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Prey consumed by *Corynorhinus townsendii ingens* in the Ozark Mountain region

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Moths are known to be the primary prey of the Ozark big-eared bat (*Corynorhinus townsendii ingens*); however, data do not exist as to which species, families, and sizes of moths are eaten. We investigated patterns of prey consumption of *C. t. ingens* from 2003 to 2005 by collecting discarded moth wings and other insect parts beneath roosts in three maternity areas: north-central Arkansas, northwest Arkansas, and northeast Oklahoma. A total of 42 visits to roosts resulted in 579 remnants of insect prey representing eight insect orders. Of the discarded remains, 57.2% (n = 331) were Lepidoptera, with 81.3% (n = 269) of these identified beyond the ordinal level. Moths representing eight families and 49 species were eaten by *C. t. ingens*. Noctuidae was the most common family occurring in the diet with 25 species represented. Noctuidae and Notodontidae were typical prey of *C. t. ingens* in all areas, but consumption of other moth families varied. *Corynorhinus t. ingens* preyed upon a limited size range of moths, consistent with data for *Corynorhinus* in other locations in eastern North America. Our data increase the number of species (n = 31), genera (n = 27), and families (n = 3) of moths known to be eaten by *Corynorhinus*. Because two of the new families of moths documented as prey of *Corynorhinus* were discovered beneath feeding roosts in Oklahoma on the western edge of our study, we suggest additional surveys are needed at feeding roosts of *Corynorhinus* in western North America to fully understand the diets of *Corynorhinus*.

Key words: big-eared bats, *Corynorhinus*, diet, hardwood forest, insect prey, Lepidoptera, moths

Acta Chiropterologica, 9(2): 463–475, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Assessment of fecal testosterone metabolite analysis in free-ranging *Saccopteryx bilineata* (Chiroptera: Emballonuridae)

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Acquiring hormonal data from small, free-ranging mammals can be challenging when conventional techniques pose too much stress on animals, e.g., by trapping, handling, and bleeding. We assessed the feasibility of measuring plasma testosterone levels indirectly via fecal testosterone metabolites (T_{met}) in a small, tropical mammal, the greater sac-winged bat. *Saccopteryx bilineata* forms stable, harem-polygynous societies, in which males defend female groups throughout the whole year. Firstly, we validated fecal T_{met} measurements by performing a challenge experiment using gonadotropin releasing hormone (GnRH). Secondly, we compared T_{met} concentrations of harem males and subordinate males in fecal samples collected during the mating season, expecting that fecal T_{met} concentrations should be higher in harem than in subordinate males. Thirdly, we monitored fecal T_{met} concentrations, courtship intensity and territoriality of harem males during and after the mating season, expecting that fecal T_{met} values in conjunction with courtship intensity and territoriality drop after the estrous period of females passed. Our study shows that fecal T_{met} concentrations responded to injections of GnRH in male *S. bilineata*. Fecal T_{met} concentrations were higher in harem males than in subordinate males, suggesting that plasma testosterone values were related to either age or social status. Intensity of courtship and territoriality of harem males decreased towards the end of the mating season, but fecal T_{met} concentrations remained constant. Male courtship intensity and territoriality were not related to fecal T_{met} levels, either because short-term social challenges are not reflected in fecal hormone measurements owing to the propensity of fecal hormone metabolites to integrate over several hours, or because androgen levels are not strongly related to social activities in this species.

Key words: *Saccopteryx*, behavioral endocrinology, challenge, testosterone, mating system

Acta Chiropterologica, 9(2): 477–482, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Flight speeds of three species of Neotropical bats: *Glossophaga soricina*, *Natalus stramineus*, and *Carollia subrufa*

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Flight speeds of Pallas's long-tongued bat (*Glossophaga soricina*), the Mexican funnel-eared bat (*Natalus stramineus*), and the gray short-tailed bat (*Carollia subrufa*) were measured in Colima, Mexico, during January 2006. Bats from an abandoned mine tunnel were transported to a nearby simulated flyway, where speeds were determined over a known distance. For *G. soricina*, average speeds for 26 males and 14 females were 4.85 and 4.80 m/s, respectively ($P > 0.05$), which are similar to those reported by other investigators. Averages for *N. stramineus* were 2.84 m/s for 40 males and 2.39 m/s for 23 females, values that were statistically different ($P < 0.05$) despite the fact that body masses for the sexes were similar. For *C. subrufa*, three males and three females averaged 3.67 and 3.52 m/s, respectively. Speeds were unrelated to body mass for any of the species. Speeds for *N. stramineus* and *C. subrufa* are the first reported, whereas those for *G. soricina* are the first recorded under near-field conditions.

Key words: *Glossophaga*, *Natalus*, *Carollia*, flight speed, Mexico, Neotropics

Acta Chiropterologica, 9(2): 483–494, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Echolocation and the thoracic skeletons of bats: a comparative morphological study

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Using analyses of digital images of the thoracic skeletons of 16 species of bats (7 families) known to produce high intensity echolocation calls, we made qualitative and quantitative comparisons of the associations of thoracic skeletal features to echolocation behaviour and classification by family. The bats we examined showed significant differences in rib, sternal, manubrial and xiphoid morphology. Pteropodids (former Megachiroptera, non echolocating or, in the case of *Rousettus aegyptiacus* echolocating using orally-generated signals), were distinctly different from species of former Microchiroptera. Among former Microchiroptera, low duty cycle echolocators (Emballonuridae, most Mormoopidae, Vespertilionidae, and Molossidae) were generally more similar to one another than to high duty cycle echolocators (Hipposideridae and Rhinolophidae). *Pteronotus parnellii*, a high duty cycle echolocator, was more similar in thoracic morphology to other mormoopids than to other high duty cycle echolocators (hipposiderids and rhinolophids). Thoracic skeletal morphology suggests that laryngeal echolocation is associated with some modifications of the thoracic skeleton apparently beyond those related to flight.

Key words: Chiroptera, echolocation, duty cycle, morphology, thoracic skeleton

Acta Chiropterologica, 9(2): 495–501, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

The square-eared anomaly in New World *Myotis*

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We investigated the occurrence of abbreviated pinnae (squared ears) in little brown bats (*Myotis lucifugus*) and northern bats (*Myotis septentrionalis*) in Michigan, USA. Although the trait was not observed in 308 *M. septentrionalis*, squared ears occurred in 56 (0.1%) of 5,863 *M. lucifugus* that were examined. Squared ears were equally common in males and females. Both ears typically were affected to the same degree and most often reduced by 50% of their height, although the amount of pinna that was missing varied from 5 to 50%. Previous authors speculated that the trait was an ontogenetic malformation, but microscopic examination of squared ears from *M. lucifugus* in Michigan indicated that the trait consistently was associated with trauma, most likely frostbite.

Key words: abnormality, anomaly, chilblains, deformity, frostbite, pinna, squared ear, *Myotis lucifugus*

Acta Chiropterologica, 9(2): 503–516, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Small scale activity patterns of *Eptesicus nilssonii* – an indication of habitat preference or interspecific processes?

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Habitat use and interspecific processes are key factors shaping regional distribution as well as local activity patterns of mammals. To assess the importance of differential habitat use and interspecific processes for the distribution of local activity in *Eptesicus nilssonii*, a critically endangered bat species in Germany, a bat detector transect survey was conducted in central Germany. One transect end was close to a maternity roost of *E. nilssonii*. We compared the bats' use of habitat types and the use of distance zones centred around this maternity roost. We arranged the 11 bat species detected into four foraging categories, *E. nilssonii*, *Pipistrellus pipistrellus*, larger open-space bats (*Vespertilio murinus*, *Nyctalus noctula*, *Eptesicus serotinus*) and narrow-space bats (*Myotis* species). General bat activity was highest in lake and lowest in agricultural habitats. We found significant differences in the use of habitats and distance zones between the foraging categories. However, these differences did not lead to inversed activity gradients for *E. nilssonii*, *P. pipistrellus* and narrow-space bats, and these bats were often seen to forage simultaneously at the same transect site. Open-space bats were rarely detected along our transect. We found indications that habitats and distance zones used by *E. nilssonii* were used considerably less by larger open-space bats. Moreover, bats of the latter foraging category were never seen to forage simultaneously with *E. nilssonii*. Our results provide a first indication that interspecific processes rather than habitat use may shape regional activity patterns of *E. nilssonii*. These interspecific processes are relevant for species conservation planning.

Key words: small scale distribution of activity, transect survey, *Eptesicus nilssonii*

Acta Chiropterologica, 9(2): 517–526, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Influence of the microclimate of bat boxes on their occupation by the soprano pipistrelle *Pipistrellus pygmaeus*: possible cause of roost switching

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Between April and October 2003–2004, the changes in occupation of three bat boxes used by *Pipistrellus pygmaeus* were studied using a passive IR monitors and data loggers. Bat boxes were situated in a floodplain forest in south-eastern Moravia. Generalized additive models indicated that internal humidity described better the fluctuation in bat numbers during pregnancy and lactation than did changes in the internal temperature. Three variables (internal humidity, external temperature, and number of bats) described 87% of the variability in internal roost temperature, while the number of bats described only 29% of the variability. A negative correlation was found between the internal temperature and the number of bats roosting in a bat box the next day during pregnancy and lactation. The number of bats was also positively correlated with the internal humidity. The internal temperature of a roost with bats was biased by temperature strategies induced by the bats during particular reproductive periods. Mean temperature of occupied bat boxes was higher during pregnancy than during lactation. Females were able to go into torpor even during lactation period.

Key words: *Pipistrellus pygmaeus*, roost changing, microclimate, bat boxes

Acta Chiropterologica, 9(2): 527–534, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

The effects of the illumination of buildings on house-dwelling bats and its conservation consequences

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As the illumination of buildings at night increases, light pollution and negative impacts on wildlife also increase. In order to assess the effect of direct lighting on house-dwelling bats, we examined colonies of *Rhinolophus ferrumequinum*, *Myotis emarginatus* and *M. oxygnathus* in illuminated and non-illuminated buildings found in close proximity to each other. We investigated the onset and timing of nocturnal emergence and measured the body mass and the forearm length of juvenile bats. Results show that bright artificial lighting delays the onset or significantly prolongs the duration of emergence and, in the worst cases, may destroy the whole colony. Juveniles are significantly smaller in illuminated buildings than in non-illuminated ones. The differences in length of the forearm and in body mass may suggest that the parturition time starts later and/or the growth rate is lower in bats living in illuminated buildings. Thus, the illumination of buildings could have serious implications for the conservation of house-dwelling bat colonies.

Key words: light pollution, bat, conservation, artificial roost, *Myotis oxygnathus*, *M. emarginatus*

Acta Chiropterologica, 9(2): 535–546, 2007
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

SHORT NOTES

Feeding habits of *Noctilio albiventris* (Noctilionidae) bats in the Pantanal, Brazil

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Key words: bulldog bats, *Noctilio*, diet, frugivory, insectivory, wetlands

Seasonal molting in *Myotis petax* (Chiroptera) in the Russian Far East

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Key words: *Myotis petax*, seasonal molting, skin, pregnancy, lactation, Russian Far East

Availability of building roosts for bats in four towns in southwestern Ontario, Canada

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Key words: *Myotis, Eptesicus*, building roosts, foraging habitat