

XII EUROPEAN BAT RESEARCH SYMPOSIUM

**August 22-26, 2011
Vilnius, Lithuania**

**PROGRAMME
ABSTRACTS
LIST OF PARTICIPANTS**

SYMPOSIUM ORGANIZATION



Lithuanian Society for Bat Conservation (LSBC)

Address: Naftininkų str. 16-36, Mažeikiai

Chairman: Deividas Makavičius

E-mail: nature@kli.lt

Website: www.chiroptera.lt

HOSTING INSTITUTION



The Nature Research Centre

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ORGANIZING COMMITTEE

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Peter H. C. Lina - the Netherlands

Nomeda Vėlavičienė - Lithuania

Mečislovas Žalakevičius - Lithuania

SCIENTIFIC COMMITTEE

Stéphane Aulagnier – France

Linus Balčiauskas – Lithuania

Kazimieras Baranauskas – Lithuania

Ivan Horáček – Czech Republic

Peter H. C. Lina - the Netherlands

Paul A. Racey – United Kingdom

Abigél Szodoray-Paradi – Romania

EDITORS OF ABSTRACTS

Anthony M. Hutson

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SYMPOSIUM SECRETARIAT

ViaConventus 

Meeting Management & Association

Management Company

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www.vpu.lt



Bioexperts



Ministry of Environment
of the Republic of Lithuania
www.am.lt



GENERAL INFORMATION

SYMPOSIUM VENUE

The symposium will take place in the Best Western Vilnius Hotel (address: Konstitucijos Ave. 14, LT-09308 Vilnius, Lithuania). The hotel is situated on the bank of the River Neris in the centre of Vilnius, only a 10-minute walk to the Medieval Old Town. It is easily accessible by taxi or public transport from the airport.

OFFICIAL LANGUAGE

English. No simultaneous translation will be provided.

REGISTRATION AND HOSPITALITY DESKS

The Registration and Hospitality Desks of the Symposium are located at the entrance to the Glass Hall (Hall A) and will be open on:

Sunday, August 21st: 15.00 – 19.00
Monday, August 22nd: 08.00 – 18.00
Tuesday, August 23rd: 08.00 – 20.00
Wednesday, August 24th: 08.00 – 12.00
Thursday, August 25th: 08.00 – 18.00
Friday, August 26th: 08.00 – 13.00

SYMPOSIUM HALLS

The meeting and breaks of the symposium will be held in the following halls:
Glass Hall (A) – Main Hall, Oral presentations and Workshops
Amber Hall (B) – Poster presentations
Winter Garden (C) – Coffee breaks

CERTIFICATE OF ATTENDANCE

Each participant will receive an official certificate of attendance after the symposium. The certificates will be issued on August 26th (or earlier upon request).

ON-SITE REGISTRATION FEES

Registration types	Registration fees
Full participation	95
Students *	75
Accompanying persons	50
Full participation (special rate) **	85
Students (special rate) **	65
Accompanying persons (special rate) **	40

* Residents and students have to provide a written certification by their institution, head of department or employer.

** Participants from economically challenged countries (Eastern and Central European, CIS countries) may register for the symposium at the lower rate.

PRESENTATION REQUIREMENTS

Oral presentations

To guarantee a smooth presentation flow, please have your presentation ready on CD, DVD or pen drive before your presentation. It is recommended to submit your presentation earlier (before the session starts) in the main hall of the symposium.

Poster presentations

The posters will be displayed from Monday to Wednesday (August 22nd-24th). Presenting authors are requested to display their posters in the Amber Hall (B) on Monday, August 22nd. The poster reception and discussions will take place on Tuesday, August 23rd from 19.30. Authors are required to be present beside their posters at this time. The posters must be taken off by 12.00 on Wednesday, August 24th. Posters which are not taken off by the deadline will be removed. The best poster will be selected during the Poster Reception and honoured with an Award for the best poster.

COFFEE BREAKS

Coffee breaks will be served in the Winter Garden and around the area of the Glass hall (A).

LUNCHESES

Lunch tickets can be purchased on-site at the Registration Desk.

The following restaurants are offered:

1. Best Western Restaurant “Europa Classic” (4*)

Address: Konstitucijos Ave. 14, Vilnius

Price/day: 10 Euro

2. “Riverside” restaurant in Radisson BLU Hotel Lietuva (4*)

Address: Konstitucijos Ave. 20, Vilnius

Distance from the venue: 3 minutes

Price/day: 13 Euro

3. “Lunch@Bank” restaurant in the premises of Swedbank, AB, -1 floor.

Address: Konstitucijos Ave. 20A, Vilnius

Distance from the venue: 3 minutes

Price/day: 7 Euro

4. “Vapiano” Italian food restaurant

Address: Konstitucijos Ave. 7A, Vilnius

Distance from the venue: 5 minutes

Price/day: 7 Euro

For more information about lunch places, please contact the Registration Desk.

INTERNET AVAILABILITY

There is free wireless internet access in the venue. Please contact the Registration Desk for the internet password.

EXHIBITION

An exhibition, that will form an integrated part of the symposium, will take place in the Lobby and near the Glass Hall (A).

SOCIAL EVENTS

Welcoming reception sponsored by

Sunday, August 21st

19.00 – 21.00

Best Western Hotel



Opening ceremony

Monday, August 22nd

09.00 – 09.30

Best Western Hotel (Glass Hall)

European gastronomic party

Monday, August 22nd

19.00 – 21.00

The venue for the gastronomic party will be announced on-site

Participants are kindly invited to bring a bottle with a special drink (alcoholic or non-alcoholic) and a traditional delicacy from their country or region of origin to be shared with their colleagues.

Symposium Banquet

Thursday, August 25th

19.00 – 24.00

Sky Bar in Radisson BLU Hotel Lietuva (4*)

Address: Konstitucijos Ave. 20, Vilnius

Price - 30 Euro (tickets available at the Registration Desk)

Closing Ceremony

Friday, August 26th

11.30

Best Western Hotel (Glass Hall)

EXCURSIONS

We will run a Hospitality Desk throughout the symposium. At this Desk, you will receive precise information regarding the symposium activities, public transport to the locations, bus schedules, catering places and information on different tours offered during the symposium. Please do not hesitate to ask for any information.

Below you will find short descriptions of the excursions to be held during the symposium.

EXCURSION TO AUKSTAITIJA NATIONAL PARK

Departure at 14.00

Dinner at 19.00

Return to Vilnius at about 23.00

Duration: approximately ~ 9 hours (by bus)

Date & time: August 24th, 14.00

Price includes: Bus trip, English speaking guide, Entrance fees, Dinner

Price: 30 Euro

EXCURSION TO TRAKAI

Duration: approximately 4 hours (by bus)

Date & time: every day, 11.00 or 14.00

Price includes: transport, English speaking guide, ticket to Trakai Castle.

Lunch: 1hour free time in Trakai for lunch.

Price: 30 Euro

EXCURSION TO TRAKAI AND KERNAVE

Duration: approximately 6 hours (by bus).

Date & time: August 24th, 13.00

Price includes: transport, English speaking guide, ticket to Trakai Castle.

Lunch: 1hour free time in Trakai for lunch.

Price depends on the group gathered (please contact the Hospitality Desk on site)

VILNIUS AT NIGHT

Duration: 2.5 hours (on foot)

Date & time: August 24th, 21.00

Price depends on the group gathered (please contact the Hospitality Desk on site)

For tickets and more information, please contact us at the Hospitality Desk.

SOUVENIRS

During the symposium you will be able to buy some souvenirs with the attributes of the XIIth European Bat Research Symposium. There will be original T-shirts, pins and reflectors and hand-made bat brooches made out of clay. These souvenirs can be a great gift for your family, kids, friends and colleagues, or simply a dear remembrance of this symposium. Please contact the Hospitality Desk for EBRs 2011 souvenirs.

PROGRAMME

21st – 26th AUGUST 2011

SUNDAY 21st AUGUST

15.00

Registration Desk open

19.00

Welcoming reception sponsored by



MONDAY 22nd AUGUST

08.00

Registration Desk open

09.00

Welcome to Delegates and Official Opening

Morning Session

Convener: Stéphane Aulagnier

09.30 – 09.50

FORAGING BY *MYOTIS EMARGINATUS* IN THE MEDITERRANEAN: WHAT IS BEHIND IT? Urtzi Goiti, Joxerra Aihartza, Maria Napal, Egoitz Salsamendi and Inazio Garin

09.50 – 10.10

COEXISTENCE OR COMPETITION - WHAT DIETARY ANALYSIS CAN TELL ABOUT THE ECOLOGICAL NICHE OF TWO SIBLING BATS? Frauke Krüger and Robert Sommer

10.10 – 10.30

FEEDING IN NATHUSIUS'S PIPISTRELLE DURING AUTUMN MIGRATION Jurgis Šuba

10.30 – 10.50

MOLECULAR DIET ANALYSIS: INFERRING ECOLOGICAL ASPECTS BEYOND FEEDING HABITS Antton Alberdi, Ostaizka Aizpurua, Joxerra Aihartza and Inazio Garin

10.50 – 11.10

DOCUMENTARY FILM: *MYOTIS CAPACCINII* FISHING IN THE WILD Joxerra Aihartza, Ostaizka Aizpurua, Antton Alberdi, Hans J. Baagøe and Inazio Garin

11.10 – 11.40

Coffee/Tea sponsored by



11.40 – 12.00

INVESTIGATION OF FEEDING HABITS OF BAT SPECIES USING STABLE ISOTOPE ANALYSIS FROM FAECES Ioanna Salvarina, Monika Lam and Kamran Safi

12.00 – 12.20

FORAGING HABITATS OF THE GREATER HORSESHOE BAT (*RHINOLOPHUS FERRUMEQUINUM*) IN THE CAMARGUE DELTA, SOUTH-EASTERN FRANCE Delphine Quekenborn

12.20 - 14.30

Lunch

Afternoon Session

Convener: Friederike Spitzenberger

14.30 – 15.00

WHITE-NOSE SYNDROME IN NORTH AMERICA: STATUS AND NEXT STEPS Nina Fascione

15.00 – 15.20

WNS GEOMYCOSIS IN BATS IN THE CZECH REPUBLIC: RESULTS, EXPERIENCES, HYPOTHESES Ivan Horáček, Natália Martínková and ČESON (Czech Bat Conservation Trust)

15.20 – 15.40

DISEASES AND CAUSES OF DEATH IN FREE-RANGING EUROPEAN BATS Kristin Mühlendorfer, Stephanie Speck and Gudrun Wibbelt

15.40 - 16.10

Coffee/Tea sponsored by



16.10 – 16.20

AMPLIFICATION OF EMERGING VIRUSES IN A MATERNITY COLONY OF THE GREATER MOUSE-EARED BAT (*MYOTIS MYOTIS*) Florian Gloza-Rausch, Jan Felix Drexler, Victor Corman, Tom Wegner, Adriana Fumie Tateno, Rodrigo Melim Zerbinati, Antje Seebens, Marcel A. Müller and Christian Drosten

16.20 – 16.40

DOES HIBERNATION IMPAIR IMMUNOCOMPETENCE OF *MYOTIS MYOTIS* LEUCOCYTE COUNTS BEFORE AND AFTER AROUSAL FROM HIBERNATION? Gabor Arpad Czirjak, Gudrun Wibbelt and Christian C. Voigt

17.00 – 19.00

Free

19.00 – 21.00

European gastronomic party

TUESDAY 23rd AUGUST

08.00

Registration Desk open

Morning Session

Convener: Joxerra Aihartza

09.00 – 09.45

BAT CONSERVATION: PAST, PRESENT AND FUTURE Paul A. Racey

09.45 – 10.05

OPTION ZERO IS POSSIBLE: BAT ASSESSMENT PREVENTS WIND FARM CONSTRUCTION Pamela Priori

10.05 – 10.25

CHIROTECH, A MULTI-FACTORIAL MITIGATION PROCESS TO REDUCE BAT FATALITIES AT WIND ENERGY FACILITIES

Hubert Lagrange, Erwan Roussel, Anne-Lise Ughetto, Frédéric Melki, Guillaume Steinmetz and Christian Kerbirou

10.25 – 10.45

A BAT FRIENDLY COLOUR SPECTRUM FOR ARTIFICIAL LIGHT?

Herman Limpens, Marinus Jan Veltman, Jasja Dekker, Eric Jansen and Hans Huitema

10.45 – 11.05

UNDERSTANDING RARE *MYOTIS* SPP. IN AN IRISH LANDSCAPE: RESEARCH AND CONSERVATION PLANNING Emma Boston, Daniel Buckley, Mathieu Lundy, David Scott, Paulo Prodohl, Ian Montgomery and Yann Gager

10.05 – 11.25

THE OCCURRENCE OF BATS IN FORESTS IN LUXEMBOURG

Christine Harbusch

11.25 – 11.55

Coffee/Tea sponsored by



11.55 – 12.45

Workshop Wildlife Accoustics

12.45 – 14.30

Lunch

Afternoon Session

Convener: Pavel Hulva

14.30 – 14.50

POPULATION GENETIC STRUCTURE IN *MYOTIS BECHSTEINII* IN THE IBERIAN PENINSULA WITNESSES THE HISTORY OF DEFORESTATION

OF MEDITERRANEAN LANDSCAPES. Maria Napal, Inazio Garin, Joxerra Aihartza and Gerald Kerth

14.50 – 15.10

GENETIC STRUCTURE OF EGYPTIAN FRUIT BAT IN NORTHERN DISTRIBUTION LIMITS Pavel Hulva, Cheliana Dundarova, Tereza Maresová, Raşit Bilgin, Petr Benda, Tomáš Bartonička and Ivan Horáček

15.10 – 15.30

PARAPHYLY IN SMALL-SIZED HOUSE BATS (SCOTOPHILUS, VESPERTILIONIDAE) IN WEST AFRICA Peter Vallo, Petr Benda, Jaroslav Červený and Petr Koubek

15.30 – 16.00

Coffee/Tea sponsored by  Pettersson Elektronik AB

16.00 – 16.20

WHAT TO DO WITH A PENIS BONE: HISTOLOGICAL AND X-RAY MICROTOMOGRAPHICAL APPROACHES TO BACULUM VARIATION, FUNCTION, AND ONTOGENY Anna Nele Herdina, Hans Plenck, Petra Pokorný, Helge Hilgers, Barbara Herzig-Straschil and Brian D. Metscher

16.20 – 16.40

BATS AND PEST CONTROL IN RICE PADDY LANDSCAPES OF SOUTHERN EUROPE Carles Flaquer, Emilio Guerrieri, Maurilia Monti, Ruth Rafols, Xavier Ferrer, David Gisbert, Ignacio Torre, Xavier Puig-Montserrat and Antoni Arrizabalaga

17.00 – 18.30

BatLife Europe First Partnership Meeting
Conveners Julia Hanmer and Hannah Rawnsley

18.30 – 19.30

Free

19.30 –

Poster session and reception

WEDNESDAY 24th AUGUST

08.00

Registration Desk open

Morning Session

Convener: Paul A. Racey

09.00 – 09.20

20 YEARS OF EUROBATS – CELEBRATING YEAR OF THE BAT 2011 – 2012
Andreas Streit

09.20 – 10.45

LAUNCH OF BATLIFE EUROPE

Julia Hanmer

10.45 – 11.15

Coffee/Tea sponsored by



11.15 – 12.30

I.U.C.N. CHIROPTERA SPECIALIST GROUP, Open meeting

Conveners Paul A. Racey and Anthony M. Hutson

12.30

Lunch

Excursions

THURSDAY 25th AUGUST

08.00

Registration Desk open

Morning Session

Convener: Per Øle Syvertsen

09.00 – 09.20

BAT MIGRATION ALONG THE EAST-FRIESIAN ISLANDS (GERMAN NORTH SEA COAST) Lothar Bach, Petra Bach and Kerstin Frey

09.20 – 09.40

HOW MANY BATS MIGRATE ALONG ESTONIAN COASTS DURING LATE SUMMER? Matti Masing

09.40 – 10.00

THE EFFECT OF MIRROR ORIENTATION ON BATS' PERCEPTION OF ECHOACOUSTIC MIRROR IMAGES Sándor Zsebók, Stefan Greif, Daniela Schmieder and Björn, M Siemers

10.00 – 10.20

FEMALE *RHINOLOPHUS MEHELYI* PREFER MALES WITH HIGH FREQUENCY ECHOLOCAION CALLS Sebastien Puechmaille, Maïke Schuchmann, Sándor Zsebók, Ivailo Borissov, Emma Teeling and Björn Siemers

10.20 – 10.40

HABITAT DIFFERENTIATION AMONG 17 MEDITERRANEAN BAT SPECIES USING AUTOMATIC ECHOLOCAION CALL IDENTIFICATION Yves Bas, Alexandre Haquart, Thierry Disca and Jean-François Julien

10.40 – 11.10

Coffee/Tea sponsored by



11.10 – 11.30

ASSESSING BROWN LONG-EARED BAT (*PLECOTUS AURITUS*) POPULATION CHANGE FROM SUMMER COLONY COUNTS IN IRELAND Tina Aughney, Niamh Roche, Steve Langton, Ferdia Marnell and Deirdre Lynn

11.30 – 11.50

SEASONAL TRENDS IN HAWAIIAN HOARY BAT (*LASIURUS CINEREUS SEMOTUS*) HABITAT OCCUPANCY AND FOOD HABITS ALONG A GRADIENT OF ELEVATION Frank Bonaccorso, Corinna Pinzar, Christopher Todd, Riley Bernard and Marcos Gorresen

11.50 – 12.10

PARENTAGE AND ROOSTING BEHAVIOUR REVEALS THAT DAUBENTON'S BATS (*MYOTIS DAUBENTONII*) REGULARLY MATE AT SUMMER SITES Jorge A. Encarnação

12.10 – 14.30

Lunch

Afternoon Session

Convener: Christine Harbusch

14.30 – 14.50

POPULATION STRUCTURE, SPATIAL PATTERN, AND FORAGING TACTICS OF AN ISOLATED POPULATION OF *ROUSETTUS AEGYPTIACUS* LIVING AT THE MARGIN OF THE SPECIES' DISTRIBUTION Radek Lučan, Tomáš Bartonička, Petr Jedlička, Šimon Řeřucha, Wael Shohdi and Ivan Horáček

14.50 – 15.10

INFLUENCE OF TEMPERATURE ON SITE SELECTION BY HIBERNATING BATS Kamila Wawrocka, Wout Willems, Fons Bongers, Kris Boers, Ruud Kaal and Tomasz Kokurewicz

15.10 – 15.30

FACTORS DETERMINING TROPHIC NICHE OVERLAP OF THREE SYMPATRIC RHINOLOPHID BATS, DIET AND FORAGING HABITAT OF RHINOLOPHUS EURYALE Michal Andreas, Antonin Reiter and Helena Svitavska-Svobodova

15.30 – 16.00

Coffee/Tea sponsored by



16.00 – 16.20

ROOSTING ECOLOGY OF THREE CRYPTIC WHISKERED BATS (*MYOTIS ALCATHOE*, *MYOTIS MYSTACINUS*, *MYOTIS BRANDTII*) LIVING IN SYMPATRY Radek Lučan, Tomáš Bartonička, Tereza Březinová, Helena Jahelková, Martin Šálek and Tereza Vlasatá

15.20 – 16.40

COUPLING BEHAVIOUR IN *ROUSETTUS AEGYPTIACUS*

Helena Jahelková and Pavla Vašičková

16.40 – 19.00

Free

19.00 – 24.00

Symposium Banquet

FRIDAY 26th AUGUST

08.00

Registration Desk open

Morning Sessions

Convener: Peter Lina

10.00 – 10.20

HABITAT ASSOCIATIONS AND THE IMPACT OF URBANISATION ON BROWN LONG-EARED BAT (*PLECOTUS AURITUS*) SUMMER ROOSTS IN IRELAND Niamh Roche, Tina Aughney, Ferdia Marnell and Deirdre Lynn

10.20 – 10.40

DIETARY ANALYSIS OF TWO SIBLING BAT SPECIES *MYOTIS MYOTIS* AND *MYOTIS BLYTHII OXYGNATHUS* IN SOUTH-EASTERN EUROPE Antonia Hubancheva and Björn M. Siemers

10.40 – 11.00

A FORESTER WENT TO THE VILLAGE: ECOLOGY OF *BARBASTELLA BARBASTELLUS* COLONIES IN SOUTHERN TYROL (ITALY)

Dino Scaravelli, Eva Ladurner, Pamela Priori and Christian Drescher

11.00 – 11.30

Coffee/Tea sponsored by



11.30 –

Business Meeting

Venue for the 13th EBRS in 2014

Venue for the 14th EBRS in 2017

Conclusions and Closing Remarks

ABSTRACTS OF ORAL PRESENTATIONS

DOCUMENTARY FILM: *MYOTIS CAPACCINII* FISHING IN THE WILD

JOXERRA AIHARTZA¹, OSTAIZKA AIZPURUA¹, ANTTON ALBERDI¹,
HANS J. BAAGØE² and INAZIO GARIN¹

¹*University of The Basque Country, BILBAO, Basque Country, Spain*

²*Zoological Museum, University of Copenhagen, COPENHAGEN, Denmark*

In 2003 the consumption of fish by the Long-fingered bat *Myotis capaccinii* was confirmed in the Iberian Peninsula. It was the first evidence of fishing in a European bat, and since then, the fishing behaviour of Long-fingered bats has also been reported in Italy and the Near East. In addition, fish remains were found in faeces throughout the active seasons in the Iberian Peninsula and during the mild winter of Israel. In 2010 we started a project to describe the fishing behaviour in order to understand the sensorial and ecological circumstances in which a mainly insectivorous bat species is able to catch heavier items than the usual insect prey. We have already recorded several fishing attempts in the wild using a low-light high-speed video camera, infrared lights and an ultrasound detector, and we are currently studying the kinematics of flight and echolocation during fishing. We present a short documentary film about the work we are carrying out in Denia (Alicante, Iberian Peninsula), showing the reasons why we started this project, the technical and methodological ways we are developing it, and the first results obtained from the field work in 2010 and 2011.

MOLECULAR DIET ANALYSIS: INFERRING ECOLOGICAL ASPECTS BEYOND FEEDING HABITS

ANTTON ALBERDI, OSTAIZKA AIZPURUA, JOXERRA AIHARTZA
and INAZIO GARIN

University of The Basque Country, BILBAO, Basque Country, Spain

The detailed description of diet composition may provide extensive information on the habitat and foraging ecology of the studied species. In this respect, the accuracy of the methods traditionally used to analyse the diet of bats has often been poor, particularly because precise prey identification in faeces is subject to the presence of visual morphological clues in prey remains. Fortunately, new molecular techniques now allow us to determine diet composition at the species level and thus offer a greater

chance to unravel a number of aspects of the ecology of bats, particularly of elusive and/or hard-to-track species. First recognised in 2002, the Alpine long-eared bat (*Plecotus macrobullaris*) has been found in the main mountain ranges in Europe and the Middle East, and several aspects of its ecology are still to be ascertained, such as its altitudinal distribution, diet, habitat use or hunting strategies. We studied the diet of *P. macrobullaris* by analysing 580 prey sequences obtained from faeces from 29 bats captured in the summers of 2009 and 2010 in the Pyrenees. Altogether, 40 different prey species were detected, 26 of them being identified at the species level. All but one sequence belonged to lepidopterans, and most of them to the family Noctuidae. Overall, *P. macrobullaris* fed almost exclusively on tympanate moths, which suggests the need for special adaptations for hunting. Based on the known ecology of the prey species, we inferred that *P. macrobullaris* foraged in open areas such as meadows and rocky places, hunting very often in alpine meadows above 1800m a.s.l.. The variability of its diet along the mountain chain likely reflects the mosaic-type distribution of food resources in the alpine environments.

FACTORS DETERMINING TROPHIC NICHE OVERLAP OF THREE SYMPATRIC RHINOLOPHID BATS, DIET AND FORAGING HABITAT OF *RHINOLOPHUS EURYALE*

MICHAL ANDREAS¹, ANTONIN REITER²
and HELENA SVITAVSKA-SVOBODOVA³

¹*The Silva Tarouca Research Institute for Landscape and Ornamental Gardening, PRŮHONICE, Czech Republic*

²*South Moravian Museum in Znojmo, ZNOJMO, Czech Republic*

³*Institute of Botany AS CR, PRŮHONICE, Czech Republic*

We netted three sympatric rhinolophid bats (*Rhinolophus euryale*, *R. hipposideros*, *R. ferrumequinum*) in southern Slovakia and analysed faecal samples under a microscope. All three species forage close to vegetation and have similar echolocation and flight morphology. The diet of all three species was dominated by Lepidoptera. The smallest species, *R. hipposideros*, feeds especially on the smallest Lepidoptera and smaller nematoceran Diptera. Medium-sized *R. euryale* hunts mainly medium-sized Lepidoptera, and to a much lesser extent also Trichoptera, Tipulidae, Culicidae, and Neuroptera. The largest, *R. ferrumequinum*, feeds on the largest Lepidoptera and to a lesser extent on larger and medium-sized Coleoptera. Comparison of the trophic niches of these three rhinolophids in sympatry showed that the crucial factor for resource partitioning is the body size and the consequent differences in the size of consumed prey.

R. euryale belongs among the less-studied species. The northern margin of its distribution corresponds well with the northern limits of the occurrence of submediterranean shrublands and steppe habitats. This may lead to a hypothesis that *R. euryale* depends especially on those habitats. Current information concerning habitat preferences of the species is a bit contradictory. Some authors emphasize edges and interface habitats between pastureland and scrubland or forest; others mention preference for forest. We additionally analysed composition of faeces from a guano heap deposited in the cave under a colony of *R. euryale*. The diet composition was similar to the diet of netted individuals. Nevertheless, interesting results were obtained from pollen analysis. The guano of *R. euryale* contained almost entirely forest arboreal pollen of mostly entomophilous plants. It shows that *R. euryale* does not depend on the mediterranean and submediterranean scrublands and steppes but prefers more humid forest habitats. Foraging habitat is not therefore a limiting factor delineating the northern margin of its distribution range. The northern border is most likely determined by some other, probably climatic, factors.

ASSESSING BROWN LONG-EARED BAT (*PLECOTUS AURITUS*) POPULATION CHANGE FROM SUMMER COLONY COUNTS IN IRELAND

TINA AUGHNEY¹, NIAMH ROCHE¹, STEVE LANGTON²,
FERDIA MARNELL³ and DEIRDRE LYNN³

¹*Bat Conservation Ireland, VIRGINIA, COUNTY CAVAN, Ireland*

²*Steve Langton, MALTON, NORTH YORKSHIRE, United Kingdom*

³*National Parks and Wildlife Service, DUBLIN 2, Ireland*

The Brown long-eared bat monitoring scheme, in operation in the Republic of Ireland, takes advantage of roost fidelity of the Brown long-eared bat and involves counts of individual bats inside or emerging from roosts in buildings during summer months. In general, buildings with no access to the roof space are surveyed by emergence dusk counts only. Buildings with exit points too high to clearly see emerging bats are monitored using internal counts if the roof space is accessible. In total, 252 surveys were completed from 2007-2010 with a total of 57 roosts surveyed twice annually (May-September).

Power Analysis was carried out on the count data and simulations for various numbers of roosts and years were undertaken. Power Analysis uses, as its basis, information about how much sites vary from year to year. In general, this involves estimating the patterns of variability in the real data using REML analysis and then simulating a large number of artificial datasets with added trends. GAM models

are then fitted to the artificial datasets to see how frequently the trends are detected with different numbers of sites and years. The two standard levels of decline - Amber Alert, representing a 25% fall over 25 years (i.e. 1.14% per year), and Red Alert, representing a 50% fall over 25 years (i.e. 2.73% per year) - were used as the basis for Power Analysis. Power analysis indicates that the current target of 30-50 roosts counted twice annually should provide robust data to determine red or amber alert declines, or 50% increases in brown-long eared bat populations.

The scheme included a major contribution from voluntary bat workers, of the 252 completed surveys, 143 (57%) were completed with volunteer assistance. This scheme was funded by National Parks and Wildlife Service, Department of Arts, Heritage, Gaeltacht and the Islands.

BAT MIGRATION ALONG THE EAST-FRIESIAN ISLANDS (GERMAN NORTH SEA COAST)

LOTHAR BACH, PETRA BACH and KERSTIN FREY

Bach Freilandforschung, BREMEN, Germany

The Friesian Islands are known to play an important role in bird migration, as well as in butterfly, hover-fly and dragonfly migration. During the last decade several short bat surveys were carried out on several Friesian Islands, mainly to study bat migration. However, since 2008 systematic bat migration studies have been conducted on two islands, using AnaBat systems. The study periods were April - June at Wangerooge in 2008, and April - October 2009 and 2010 at Wangerooge and Mellum.

The results show that bat migration was recorded on both islands. Out of eight recorded species *Pipistrellus nathusii* was the most common. During autumn, migration was regularly observed. Activity increased from mid-August until mid-September and was followed by a period of less activity until mid-October. In contrast, the migration pattern during spring was more variable. Migration usually took place during a few nights of good weather conditions only between mid-April and mid-May. Another typical phenomenon was that migration activity was much lower in spring than in autumn. There was no clear connection between wind speed and bat migration. The majority of migration activity occurred within a wide range of wind speeds (1.5 to 6.2 m/s).

However, because the observed spring activity on Wangerooge was much lower than on Mellum we recorded the activity at different points on a transect across Wangerooge. We compared these with the activity recorded previously at the one fixed study location. This showed that bats crossed the island in a broad cor-

ridor and did not only follow guiding structures such as dunes. Since our fixed AnaBat location was close to a dune, it turned out that we recorded bat migration during special weather conditions only. Therefore the migration activity on Wangerooge has been underestimated compared with the activity on Mellum.

HABITAT DIFFERENTIATION AMONG 17 MEDITERRANEAN BAT SPECIES USING AUTOMATIC ECHOLOCATION CALL IDENTIFICATION

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The development of long duration and high sampling rate from unattended recording devices have both dramatically increased both our sampling efficiency. However, the use of such data is limited by the amount of time necessary for the analysis, often much greater than the time spent in the field. To circumvent this problem, we developed a new automatic identification tool, named SonoChiro and based on (i) random forest classification algorithms, (ii) accurate parasite filtering and (iii) a huge reference library including more than 30,000 calls from more than 5,000 different recordings of 31 European bat species. This great variety ensured both an efficient identification power and an excellent robustness with respect to the diversity of field situations, all the more because poor-to-medium quality recordings were voluntarily included in the reference library. Here, we used the automated identification of recordings from more than 300 sampling points in southern France to study habitat use by 17 bat species. Results revealed interesting patterns in both habitat use and seasonal activity, including marked differences between species previously thought to be indistinguishable according to their echolocation calls (e.g. *Pipistrellus kuhlii* and *P. nathusii*, *Myotis daubentonii* and *M. capaccinii*). This habitat modelling allowed us to predict each species density across the whole Languedoc-Roussillon region, using cokriging techniques. Such a mapping of species density has, inter alia, the value of pointing out locations of previously unknown colonies in order to improve the local knowledge of several gregarious threatened species (*Miniopterus schreibersii*, *Myotis capaccinii*, *Rhinolophus* spp.). Furthermore, to best improve that knowledge, we also mapped the prediction accuracy to direct future sampling towards the least predicted areas.

SEASONAL TRENDS IN HAWAIIAN HOARY BAT (*LASIURUS CINEREUS SEMOTUS*) HABITAT OCCUPANCY AND FOOD HABITS ALONG A GRADIENT OF ELEVATION

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We monitored trends in Hawaiian hoary bat occupancy during five years along a gradient of elevation from 200 to 2000 m on the island of Hawaii. Sampling was stratified by elevation to permit assessment of bat distribution and movements over seasons and between years. Echolocation calls were recorded with Anabat II detectors and stored on memory cards with unique date and time stamps. Bat detectability was estimated with the program PRESENCE2. Hawaiian hoary bats are most active at elevations of <1000 m during the reproductive season from May through to September while patterns of activity at higher elevations were often highest in winter months. Food habits from faecal pellets of net captured individuals were examined to view trends with elevation, site, season, sex and age group. Prey items identified from 256 faecal pellets and 72 bats included six orders of Insecta and the family Macrochelidae representing the Order Acari, Class Arachnida. Lepidoptera were represented by three families in prey consumed, Coleoptera by four families, and Hemiptera, Diptera, Isoptera, and Neuroptera by one family each. Invasive insects represented 75% of the taxa identified to species. Similar to other studies of both Hawaiian and North American hoary bats, Lepidoptera were the most abundant component in the diet and represented 67.1% of the total volume of all prey remains while being found in 78.3% of the faecal pellets in our study. At high elevation sites, Coleoptera were selected as food items well above their proportional availability from light-trapped insects; whereas, in lowland sites Coleoptera and Lepidoptera each were consumed approximately in proportion to their abundance in light trap captures. There were no significant differences in the proportion of prey consumed by bats captured during different seasons.

UNDERSTANDING RARE *MYOTIS* SPP. IN AN IRISH LANDSCAPE: RESEARCH AND CONSERVATION PLANNING

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The Centre for Irish Bat Research was contracted to undertake a study to better understand Ireland's rare *Myotis* spp. for which little data was available to inform conservation planning, required under national and EU directives. Here we present results from a multi-disciplinary research study on *Myotis mystacinus* and *Myotis nattereri* examining diet, habitat use, activity patterns, roost usage and population genetic structure in Ireland's highly managed landscape. These two studies demonstrate the need for species-specific conservation strategies and give novel insight into the use of the Irish landscape by bats, Ireland's most numerous group of mammals.

DOES HIBERNATION IMPAIR IMMUNOCOMPETENCE OF *MYOTIS MYOTIS* LEUCOCYTE COUNTS BEFORE AND AFTER AROUSAL FROM HIBERNATION?

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Mammalian hibernation consists of prolonged periods of reduced basic metabolic rate and body temperature, which are interrupted by intermissions of arousal when most of the physiological functions are temporarily restored. Hibernation also affects the immune function, and it has been hypothesized that arousals may activate the dormant immune response to combat accumulated pathogens. Despite a plethora of studies on hibernating rodents and insectivores, we know virtually nothing about the immunocompetence of hibernating bats. However, this field is of highest priority due to the emergence of white-nose syndrome (WNS) in North America. We collected blood samples from 76 Greater mouse-eared bats (*Myotis myotis*) in order to compare the circulating white blood cells (total and differential) of pre-hibernating, hibernating and aroused individuals. Due to their low numbers, eosinophilic and basophilic granulocytes were excluded from the analysis, while the effect of sex, physiological status (pre-hibernation, hibernation and tempo-

rary arousal from hibernation) and their interaction on the other white blood cell counts was analyzed in a general linear model with post-hoc Tukey-Kramer tests. In accordance with previous studies on non-Chiropterans, hibernating bats showed reduced numbers of total leucocytes, both lymphocytes and monocytes being affected. After arousal, the number of these cells was restored, however at a lower rate compared with other hibernating species, while the number of circulating neutrophils was not affected as their values remain similar for all three physiological conditions.

Our study is one of the first to demonstrate an effect of hibernation on immune responses in Chiroptera. Contrary to all animal species studied so far, hibernation of greater mouse-eared bats has no influence on circulating neutrophils indicating a continuous preparedness of the immune system against pathogens.

PARENTAGE AND ROOSTING BEHAVIOUR REVEALS THAT DAUBENTON'S BATS (*MYOTIS DAUBENTONII*) REGULARLY MATE AT SUMMER SITES

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This report presents evidence for successful mating of *Myotis daubentonii* at summer sites in Hesse (Central Germany) established by behavioural surveillance and paternity analysis. Based on the results of several long-term studies on the phenology and life-history strategy of Daubenton's bats, parentage in individuals at a minimum age of two years with high fidelity for the studied summer site were verified and backdated. Resident males showed a high individual paternity assignment of 20%. The roosting behaviour of identified parents and the multiple fatherhood of a single resident male support the hypothesis for a regular 'resource-defence-polygyny' strategy in male Daubenton's bats. The mating behaviour of single-male/multi-female and multi-male/multi-female colonies appears to be promiscuous in mating roosts within roost sites of nursery colonies. Based on the assumption that successful mating of many European bat species occurs at summer sites after the young are fledged and prior to hibernation, anthropogenic habitat changes should steer clear of the seasonal activity period of European bats to prevent a reduced reproduction rate of local bat populations.

WHITE-NOSE SYNDROME IN NORTH AMERICA: STATUS AND NEXT STEPS

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White-nose Syndrome (WNS) has devastated bat populations across the eastern United States since it was first discovered in a single cave in New York in 2006. The disease has likely killed millions of bats, leading biologists to say it is causing “the most precipitous wildlife decline in the past century in North America.” Nine bat species in 19 U.S. states and four Canadian provinces have been documented with either WNS or the fungus, *Geomyces destructans*, that is the likely cause of this devastating disease.

The emergence and spread of WNS as a pathogenic fungus that infects hibernating bats has the potential to undermine the basic survival strategy of more than half the bat species in the US and all species of bats that occur in the higher latitudes of North America. In a 2010 issue of *Science* magazine, a study predicted that WNS could lead to regional extinction of the Little brown bat (*Myotis lucifugus*), previously one of the most common bat species in North America. Now the fungus has made leaps that apparently open western states and perhaps Mexico to this disease.

As this relentless disease keeps spreading into new areas, BCI is working with agencies, organizations and individuals to understand and stop WNS and begin restoring these decimated bat populations.

BATS AND PEST CONTROL IN RICE PADDY LANDSCAPES OF SOUTHERN EUROPE

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Insects considered as plagues, which often concentrate in large quantities in cultivated landscapes, have been found in the diet of a variety of bats, and many insectivorous bat species are known to be opportunistic hunters that prey on the most abundant resource available. Yet, the extent of pest control exerted by

bats remains unclear and is generally difficult to assess. A study to uncover the relationship between bats (Soprano Pipistrelle bats, *Pipistrellus pygmaeus*) and the striped rice borer moth (*Chilo suppressalis*) plague populations was carried out from 2007 to 2010 in the Ebro Delta (NE Iberian Peninsula), one of the largest rice paddy landscapes in Europe. During previous years (from 2000 onwards) an important Soprano Pipistrelle population had been encouraged in a particular part of the study area by providing appropriate artificial roosts, a limiting factor to this synanthropic species in such deforested and homogenous environments. Bat activity related to the striped rice borer activity peaks was studied during three seasons by means of bat detectors, providing a significant relationship between target pest density and intensity of use of the rice paddies by bats. Molecular techniques provided further evidence of the presence of *Chilo suppressalis* in the faeces of Soprano pipistrelles. Around the bat boxes, which house up to 4500 bats in a relatively small patch of less than a 100 ha, and thus where bat density was at its highest, the impact of the striped rice borer on the rice crops was low enough to minimize and even to avoid the use of insecticides, a practice necessary elsewhere within the study area to ensure a proper rice yield. We discuss the particular conditions that allow the bats to act as efficient pest controllers in the study area.

AMPLIFICATION OF EMERGING VIRUSES IN A MATERNITY COLONY OF THE GREATER MOUSE-EARED BAT (*MYOTIS MYOTIS*)

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Bats host noteworthy viral pathogens, including coronaviruses, astroviruses, and adenoviruses. Knowledge on the ecology of reservoir-borne viruses is critical for preventative approaches against zoonotic epidemics. We studied a maternity colony of *Myotis myotis* in the attic of a private house in a suburban neighbourhood in Rhineland-Palatinate, Germany, during 2008, 2009 and 2010. One coronavirus, 6 astroviruses, and 1 novel adenovirus were identified and monitored quantitatively. Strong and specific amplification of RNA viruses, but not of DNA

viruses, occurred during colony formation and after parturition. For CoV, our study indicates clearly that virus amplification takes place in maternity colonies. High peak RNA concentrations in the range of 109-1010 copies/g were observed, which is very much higher than CoV concentrations observed in earlier studies outside the parturition period. Similarly high RNA virus concentrations are observed in human diseases transmitted through the faecal-oral route, e.g. picornaviruses or noroviruses, which suggests that maternity roosts may involve an elevated risk of virus transmission to other hosts. To determine whether the presence of these viruses has any influence on bats' health, the reproductive success of the maternity colony was evaluated in 2008 and 2010. The breeding success of the colony was significantly better in 2010 than in 2008, in spite of stronger amplification of coronaviruses and astroviruses in 2010, suggesting that these viruses had little pathogenic influence on bats. However, the general correlation of virus and bat population dynamics suggests that bats control infections similarly to other mammals and that they may well experience epidemics of viruses under certain circumstances. The data also indicate a feasible and ecologically sensible means of prevention; because carnivores are known to enter maternity roosts to feed on newborn bats, bat maternity roosts should be left undisturbed by humans and kept inaccessible to domestic cats and dogs.

FORAGING BY *MYOTIS EMARGINATUS* IN THE MEDITERRANEAN: WHAT IS BEHIND IT?

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We carried out research on a maternity colony of Geoffroy's bat (*Myotis emarginatus*), studying habitat selection and diet analysis simultaneously in the central Iberian Peninsula (Spain). The colony inhabited a diverse area where, among others, dehesa was widely available (24% of the area). The loosely forested Mediterranean dehesa (also known as montado in Portugal) is an agrosilvopastoral ecosystem widely acknowledged as a primary biodiversity hot spot in the Iberian Peninsula. The bulk of the females' diet consisted of spiders (which could not be identified to family level), reaching an individual mean of 79% by volume in faeces (and a median of 88%). Bats preyed upon spiders in the habitats characterised by high cover, positively selecting pine plantations and riparian woodland, and using scrubland opportunistically. Interestingly bats preferred to forage in habitats with a continuous vertical vegetation strata, even if it was formed by shrubs.

In contrast, the dehesa was avoided in comparison to its availability. Within this habitat trees are abundant but loosely scattered, and the herbaceous stratum is generally disconnected from the tree canopy. We discuss such unexpected preference and hypothesize about its causes.

THE OCCURRENCE OF BATS IN FORESTS IN LUXEMBOURG

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The present study (2005-2010) investigated the distribution of forest-dwelling bats in relation to forest structures in various forest ecosystems in Luxembourg and, as a consequence, aimed to develop protection measures and give advice for a forest management more favourable for bats.

The investigation took place only during the activity period of bats in summer. Two forest sites were chosen each year which were representative for the respective natural area and of sufficient size (> 100 ha). Assessment of habitat use by bat species was undertaken using ultrasonic detectors and mist-netting. In order to find maternity colonies for forest-dwelling bats, reproductively active females of those species were fitted with radio-transmitters and radio-tracked subsequently. Altogether 6 forest sites were visited in the natural area of Gutland (southern part of Luxembourg) and 6 sites in the natural area of Ösling (northern part). As a result, 17 out of 19 bat species known to occur in Luxembourg were identified. The bat fauna of the Gutland is richer (17 species) than in the Ösling, where only 13 species were found. Also more individuals were captured in the deciduous forests of the Gutland than in the Ösling and especially in the northern parts of the Ösling. Here, planted spruce monocultures and oak coppice apparently offer neither sufficient roosting sites nor favourable foraging areas. Only those forest sites with natural stands (beech forests) provided adequate habitats for bats. The southernmost part of the Gutland, the Minette area, proved to be a hot-spot of bat diversity in Luxembourg with 14 bat species present. This area is rich in diverse forests and in subterranean mines, thus offering a variety of adequate summer and winter roosts as well as swarming sites.

As a consequence the influence of natural silviculture in conjunction with the location and regional climatic conditions shows to be of great importance for the distribution of forest-dwelling bat species in Luxembourg.

WHAT TO DO WITH A PENIS BONE: HISTOLOGICAL AND X-RAY MICROTOMOGRAPHICAL APPROACHES TO BACULUM VARIATION, FUNCTION, AND ONTOGENY

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The baculum serves as a macroscopic character for species identification in bats. Even so, little is known about its ontogeny and its function remains controversial. The mammalian baculum probably has multiple overlapping functions. During intromission it can provide mechanical support, affect the penile shape, and/or effect reproductive isolation. The baculum can also protect the urethra from compression, enable protracted copulations, stimulate the female reproductive tract, or provide information about male size or quality during intromission. High-resolution X-ray microtomography (microCT) and histomorphological images of undecalcified, surface-stained ground sections are used to gain a more comprehensive understanding of the three-dimensional shape and micromorphology of the baculum in relation to surrounding tissues of the penis. While microCT enables us to examine and compare statistically relevant numbers of bat bacula in three dimensions, ground sections can confirm details at the cellular and tissue level. In microCT images of unstained whole specimens, penis bone microstructures as small as osteocyte lacunae (10x20µm) are visible. Functional and ontogenetic information can be derived from the histomorphology of the bacula of adult and juvenile bats. Bats of the genera *Plecotus* and *Pipistrellus* have Y-shaped bacula that seem to be single-osteon bones. The two proximal branches are attached to the tunica albuginea of the two corpora cavernosa making the baculum and corpora cavernosa a functional unit which can act as a stiffening element in the erect penis. The caudal groove of the distal end frames the urethra and protects it from compression. Interspecific variations in outer form and vascular canals of the penis bones were successfully used to discriminate the cryptic species *Plecotus austriacus*, *P. auritus* and *P. macrobullaris*. In ongoing studies, we are quantifying intraspecific variation in the genus *Pipistrellus*, and we will also investigate the ontogeny of *Myotis* bacula.

WNS GEOMYCOSIS IN BATS IN THE CZECH REPUBLIC: RESULTS, EXPERIENCES, HYPOTHESES

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Since 2009 when the first cases of suspected geomycosis were recognized at seven sites in the Czech Republic, the standard monitoring of bat hibernacula (ongoing since 1969, covering now about 800 sites) was supplemented with screening for clinical signs of geomycosis. In winter 2010, we found infected bats (mostly *Myotis myotis* plus single individuals of a further 5 species) in 33 sites, in 2011 in at least 42 sites. The greatest incidence of infected bats was recorded in submontane regions while lowland and karst sites were less affected. *Geomyces destructans* was also found on mine walls and isolated from a skin lesion of a living bat, and two bats with geomycosis were found dead. However, no direct proof of mortality caused by geomycosis was obtained. Photographs of over 6000 hibernating bats taken between 1994 and 2010 revealed presence of individuals suspect for geomycosis since 1995. It suggests that (i) *G. destructans* was present in Europe before its first appearance in North America. We further hypothesize that (ii) its effect upon bats is restricted to skin lesions that do not severely compromise survival unless it is combined with obligatory hibernation tactics of mass clustering in underground roosts and domino effects of uncontrolled arousing in large clusters, (iii) in European bats these tactics were suppressed supposedly due to previous exposures to geomycosis - including avoidance of underground hibernacula (e.g. in *M. bechsteinii* which predominate in the fossil record in cave deposits), (iv) the curious life history traits of *G. destructans* do not fit to the presumed qualities of an invasive agent, but correspond well with the conditions of deeper layers of scree formations, which cover considerable part of submontane regions in Central Europe. The multidisciplinary research programme now in progress in the Czech Republic is expected to provide reliable information on these topics.

DIETARY ANALYSIS OF TWO SIBLING BAT SPECIES *MYOTIS MYOTIS* AND *MYOTIS BLYTHII OXYGNATHUS* IN SOUTH-EASTERN EUROPE

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The Greater mouse-eared (*Myotis myotis*) and the Lesser mouse-eared bats (*Myotis blythii oxygnathus*) occur sympatrically in southern and south-central Europe. In the northern part of their sympatric range (Switzerland) they show very clear diet partitioning. There, the main prey of *M. myotis* are large epigeatic arthropods such as carabid beetles, which are found in a habitat with open accessible ground. In contrast, *M. b. oxygnathus* forages mostly for bush-crickets (Tettigoniidae) that are typical of open steppes and pastures with dense grass.

Our study is the first dietary analysis of the sibling mouse-eared bat species from south-eastern Europe, likely a more ancient site of natural coexistence than central Europe, where they depend on buildings for roosting.

We analysed droppings of both species from wild-caught bats in Bulgaria between June and August. The results show that, as in Switzerland, the diet of *M. b. oxygnathus* is dominated by bush-crickets (75 %). More astonishingly, *M. myotis* also ate a considerable share of bush-crickets (21 %). This new finding matches with predictions from recent stable isotope ecology (Siemers et al. 2011, Oecologia) and behavioural studies (Jones et al. 2011, Behav Ecol Sociobiol) on Bulgarian mouse-eared bats. Additionally, *M. myotis* foraged on carabid beetles (43 %), Lithobiidae (9 %) and, again astonishing, the very silent and thus acoustically hard-to-detect Opiliones (10 %).

It will be interesting to further explore the less clear-cut dietary segregation of the Balkan populations of mouse-eared bats, compared to the clear segregation in central European populations, and to relate this to foraging behaviour, ecology and prey abundance.

GENETIC STRUCTURE OF EGYPTIAN FRUIT BAT IN NORTHERN DISTRIBUTION LIMITS

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The family Pteropodidae is characteristic, with many unique traits often connected with its frugivorous foraging strategy. The centre of distribution of this group is in the Old World tropics with the radiation centre in South-east Asia. Africa was colonized by fruit bats in three waves, including by the genus *Rousettus*. This radiation has specific phylogeographic structure with distribution in Africa and Asia; the northern margins of the range in the Eastern Mediterranean are represented by the Egyptian fruit bat (*Rousettus aegyptiacus*). The mode of dispersal of this group is influenced by its echolocation ability, enabling roosting in caves, spread independent of forest corridors and inhabiting northern territories with a Mediterranean type of climate. To assess genetic variability in this region, we have sequenced part of the mitochondrial control region and genotyped 20 microsatellite loci in all known colonies from Turkey, Cyprus, Syria, Lebanon, Jordan, Egypt, Yemen and Iran. We have used outgroups from eastern Africa. We have found the distance position of eastern African lineages and clinal variability among northern demes, with a basal position of Iran, the Arabian Peninsula and Egypt, and distal position of the Eastern Mediterranean demes. We have assessed the role of particular historical and ecological factors to the recent distribution of genetic variability.

COUPLING BEHAVIOUR IN *ROUSETTUS AEGYPTIACUS*

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Social calls and social behaviour of *Rousettus aegyptiacus* were recorded in a captive colony composed of 50-60 males and females in Prague Zoo. The area available for free flight is about 25x2x3m corridor, with an extra feeding place in a half-open display space. Individuals were marked by colour combinations of plastic thumb rings. Social activity was recorded 90 minutes before 'bat night' with the use of infra-red light and two cameras. Mixed groups hung in one to four clusters.

Parturition was synchronous and took place in March/April and August/September. Coupling and mating attempts occurred during the whole year but were more pronounced in a two-week period before and after parturition. Long-lasting couples (M&F) were formed mostly prior to and after copulation. Temporary couples (M&F; M&F with juvenile; M&juvenile) and triples (M&2F, M&2F with juvenile) also seem to have a social function of protection against harassment. Males obtained access to females by force (tight couples) or by grooming (free couples) and emitted two special types of vocalization calls.

COEXISTENCE OR COMPETITION - WHAT DIETARY ANALYSIS CAN TELL ABOUT THE ECOLOGICAL NICHE OF TWO SIBLING BATS?

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Where similar species rely on similar resources, competition is likely to occur. This competition is thought to be an important trigger in community shaping and has been related to the decline of less competitive species. This study addresses whether or not the European trawling bat species *Myotis dasycneme* (Boie, 1825) and *Myotis daubentonii* (Kuhl, 1817), occurring in the same habitat, show interspecific competition based on their diet. Dietary data of both species are analysed to draw conclusions on possible dietary overlap, competition, coexistence mechanisms and community structure. In this study, *M. dasycneme* and *M. daubentonii* fed mainly on Chironomidae (*M. dasycneme*: 44.4%; *M. daubentonii*: 32.8%) and Trichoptera (*M. dasycneme*: 20.4%; *M. daubentonii*: 22.2%), showing a high niche overlap and similar niche breadth. Nevertheless, there were differences in the diet of the two species for certain prey groups. We could not find evidence for resource competition for prey resources between *M. dasycneme* and *M. daubentonii*. A different micro-habitat distribution of both species in time and space, and high resource abundance are likely to enable coexistence of both species - in the same foraging habitat.

CHIROTECH, A MULTI-FACTORIAL MITIGATION PROCESS TO REDUCE BAT FATALITIES AT WIND ENERGY FACILITIES

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An increasing number of bat fatalities is reported from some European wind energy facilities, raising questions about the impact of these infrastructures on the viability of bat populations. Since the middle of the 1990s it has been supposed that most bat fatalities could be avoided by stopping wind turbines when periods of high bats activity overlapped with wind turbine production. In order to check this hypothesis, we have built a multi-factorial algorithm based on 10 experimental sites, describing bats' theoretical activity under a range of environmental conditions and integrated it in a plug-in of wind turbine SCADA (Supervisory Control And Data Acquisition). It has allowed us a remote arrest of wind turbines according to theoretical bat activity. The efficiency of this device, called 'Chirotech', was tested in two consecutive years on 8 wind turbines in Bouin, a wind power facility in northeastern France, during bats' fatality period. Analysis of the number of carcasses found under regulated and controlled wind turbines demonstrates a significant decrease of fatalities under regulated wind turbines (deviance = 4.682, Df=1, p=0.030), with a power output loss of < 0,1 % of annual production. Analysis of the ratio number of carcasses found under regulated and controlled wind turbine / bats acoustic activity also demonstrates a significant decrease of fatalities under regulated wind turbines (deviance =4.682, Df=1, p=0.030). These promising results are relevant to those obtained in North America but need further experimentation to assess precise estimates of mortality decrease, costs and benefits at other locations.

A BAT FRIENDLY COLOUR SPECTRUM FOR ARTIFICIAL LIGHT?

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To prevent disturbance of bats by artificial light several parameters are available. The possibility to adapt the frequency spectrum of the light disturbance has not yet been tried. We have developed an experimental ledlamp with a bat friendly colour spectrum (Amber), based on the frequency response of bat eyes versus human eyes. In the absence of such information on European bat species we have worked with available information on neotropical species close to European species.

In a field experiment in the summer of 2010, we compared the effects of different 'light treatments' (darkness, Amber, traditional white street lamps and a green 'nature friendly' colour) on a flight path of Pond bats (*Myotis dasycneme*) following a canal. Five units of automatically recording stereo HET detectors were positioned floating approximately in the middle of the canal, with the direction of the commuting bats in the evening leading from 1 to 5. The lights were set to light one half of the canal near recording units 2 to 4, using lamps with a strict cut-off. Units 1 and 5 were always without light. From the amplitude of the recordings on the left or right channel, it was possible to detect whether the bats were passing the units clearly on their left or right side, or in the middle (amplitude difference not clear). The results showed a tendency to have a lower total of bat passes on all detectors and without discriminating between sides, when white and green were used as compared to darkness, and no difference between darkness and Amber, suggesting avoidance of white and green. Looking at which side the bats passed the units revealed a strongly significant shifting of the chosen route to the unlit area, proving avoidance of white and green as compared to darkness, and again no difference between amber and darkness.

ROOSTING ECOLOGY OF THREE CRYPTIC WHISKERED BATS (*MYOTIS ALCATHOE*, *MYOTIS MYSTACINUS*, *MYOTIS BRANDTII*) LIVING IN SYMPATRY

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Based on data collected between 2008-2010 in a model study area (Kostelecká Forest, Central Moravia, Czech Republic) we compared the roosting ecology of *Myotis alcathoe* (Ma), *M. mystacinus* (Mm) and *M. brandtii* (Mb). Altogether, we radio-tracked 34 Ma, 18 Mm and 9 Mb of both sexes and found 71 roosts of Ma, 39 roosts of Mm and 15 roosts of Mb. All but one roost of Ma were localised in crevices in tree trunks or side branches, usually located high in the canopy of old broad-leaved trees. Roughly half of the roosts of Mm and Mb were in crevices in buildings located outside forests or at forest edges. The other half of the roosts of Mm and Mb were tree-roosts, however, unlike Ma, these two species preferred roosts under exfoliated bark. While Mm and Mb frequently shared the same roosts during the reproductive period, Ma always formed monospecific colonies. The largest aggregations were found during the reproductive period when up to 90, 60 and 200 adult females of Ma, Mm and Mb respectively occupied individual roosts. The absence of a synanthropic tendency in Ma, along with its specific habitat requirements, emphasises its high conservation value and direct future conservation priorities.

POPULATION STRUCTURE, SPATIAL PATTERN, AND FORAGING TACTICS OF AN ISOLATED POPULATION OF *ROUSETTUS AEGYPTIACUS* LIVING AT THE MARGIN OF THE SPECIES' DISTRIBUTION

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An isolated population of *Rousettus aegyptiacus* in Oasis Dakhla (Western Desert, Egypt) and composed of c. 2500 individuals has been intensively studied since 2010. We studied the nature of occupancy of 28 colony sites in the ruins of 11 medieval settlements, temporal turnover in roost occupancy, size of colonies and exploitation of particular foraging grounds (mostly orchards of date palms). 65 individuals were radio-tracked using automated radio-tracking system BAARA (in total 760+ bat-nights). A further 9 individuals were tracked by GPS transponders. Despite immediate roost change with any disturbance, the vast majority of radio-tracked individuals showed stable occupancy of major roosts and preferred foraging in feeding grounds in close vicinity to them (as well as preference for their own individual-specific feeding sites). Despite that, some individuals performed quite long flights (even crossing the whole oasis, i.e. c. 60 km) at the beginning of night activity.

The amount of spatial activity (roost changing and night exploitation of foraging grounds) was significantly reduced by the end of winter (i.e. the time of particular shortage of food resources). The reproduction showed a broadly polymodal pattern, reproducing females appeared in almost all particular colonies but prevailed in only a few of them. Correspondingly, we found a separation of older-age adult males in a single colony by the end of winter. Despite 1:1 sex ratio in juveniles, the adult sex ratio has been excessively skewed (males:females = 2-3:1). Most probably this results from a reduced ability of lactating females to escape from the devastating effects of fumigation efforts frequently applied by local people. In these respects, the population under study differs from other studied populations of the species and demonstrates a capability of the species to react flexibly to unfavourable factors and survive under quite stressful conditions at the margin of the range.

HOW MANY BATS MIGRATE ALONG ESTONIAN COASTS DURING LATE SUMMER?

MATTI MASING

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The aim of this study is to estimate the numbers of bats passing along Estonia's five coasts during the migration period in August and September. Bats were counted at 20 selected points between August 20 and September 15 (2005-2009) using an ultrasound detector. Four 15-min counting points were established on each coast, forming "coastal lines" (CL). These points were selected either on the coastline or in the vicinity of it, in places where bats converge during migration. Distances between the points varied between 2 and 15 km on each coast. Nightly counts were carried out along the following CL: a) Kabli, b) Laulasmaa, c) Karepa, d) Kodavere, and e) Salme. Sound samples were taken to identify both the species and numbers of animals passing the observer (95% of the bats were identified to species level). Point counting indices (bat passes per hour, BPPH) were calculated for each coast. The following BPPH values were calculated for four migratory species at each 'coastal line' (a-b-c-d-e): *Pipistrellus nathusii* (24-6-5-21-4), *P. pipistrellus* (1-0-0-1-0), *Vespertilio murinus* (4-1-1-7-1) and *Nyctalus noctula* (1-1-0-3-1). Additionally, *P. pygmaeus* was found on the coast (Kabli, Karepa), but not during the counts. *P. nathusii* dominated (70% of the passes), while *P. pipistrellus* (2%) was the rarest species. The numbers of migrating bats passing Estonian coasts can be estimated using a simple formula: bat passes per season (BPPS) = BPPH x 180 (approximate number of hours when bats fly on the coast). However, numbers of flight hours are different on each coast, depending on the weather. Numbers of bats passing each point also differ. The following BPPS values were calculated for each CL (a-b-c-d-e, 4 species together): 5760-1584-1260-5904-972. They apply to a 50-100 m wide strip of the coast (area detectable with a detector).

DISEASES AND CAUSES OF DEATH IN FREE-RANGING EUROPEAN BATS

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The emergence of important viral diseases and their potential threat to humans has increased the interest in bats as potential reservoir species. Whereas the ma-

jority of studies have determined the prevalence of specific zoonotic agents in chiropteran species, actual bat pathogens and their impact on bat mortality were largely neglected. Combined pathological and microbiological investigations in free-ranging bats are sparse and often limited by small samples sizes.

In the present study about 500 deceased bats of different European vespertilionid species were necropsied followed by histo-pathological and bacteriological investigations. Virologic examinations were performed in external cooperation. The bat carcasses originated from different geographical regions of Germany and were provided by bat researchers and bat conservationists.

Trauma and disease represented the most important causes of death in deceased free-ranging bats from Germany. The lung was the predominantly affected organ (40%) irrespective of bat species, sex and age. By comparing histo-pathology and bacteriology.

results, we found that microbial agents do indeed have an impact on free-ranging bats succumbing to infectious diseases, since 21 different bacterial species were clearly associated with inflammatory lesions. At least 12% of all bats died due to bacterial, viral or parasitic infections. Our results show that free-ranging bats are vulnerable to various pathogenic infections at all stages of life. Also, we found clear seasonal and individual variations in prevalence of disease-related mortality indicating that susceptibility to infectious diseases in free-ranging bats is strongly influenced by host physiology and seasonal roosting behaviour.

POPULATION GENETIC STRUCTURE IN *MYOTIS BECHSTEINII* IN THE IBERIAN PENINSULA WITNESSES THE HISTORY OF DEFORESTATION OF MEDITERRANEAN LANDSCAPES

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Habitat fragmentation and isolation have been identified as a major concern for the conservation of many species, and especially for habitat specialists with limited dispersal ability. Bechstein's bat (*Myotis bechsteinii*) is one of the European species most strongly dependent on forest resources. The species has been only seldom reported in Mediterranean areas, where its preferred forests have limited distribu-

tion, due both to climatic factors - warming and increased aridity following the last glacial period - and human activity. Local abundance in sites where remnants of the original forest are preserved, suggests it might have been much more abundant in the area during the early and mid-Holocene, before extensive deforestation occurred. Destruction and isolation of populations resulting from forest clearance are likely to have left a noticeable footprint in their genetic structure.

We examined the genetic structure of three geographically distinct Iberian populations of *M. bechsteinii*, in two climatic domains (Mediterranean and Atlantic). Using 10 polymorphic microsatellites, we characterized and compared genetic diversity of each population, as well as genetic divergence among them. We also applied Bayesian clustering methods to infer population structure.

The studied Iberian populations, altogether, did not appear to be genetically impoverished. Inferred social structure conformed to the data available: i.e. colonies are closed societies of philopatric females, while gene flow is mediated by outbreeding. The population appeared to be divided into two clusters, which could be explained by the Iberian mountains acting as a reservoir for deciduous forests and thus as a refuge for forest species. The isolated population (Cazorla) demonstrated signs of genetic impoverishment, which raises concern about its future prospect. That could also be the case in other populations of the Mediterranean region. The preservation and enhancement of suitable habitats emerge as the only reliable option to sustain viable local populations, since restoration of connectivity is not feasible nowadays.

OPTION ZERO IS POSSIBLE: BAT ASSESSMENT PREVENTS WIND FARM CONSTRUCTION

PAMELA PRIORI

ST.E.R.N.A. and Museo Ornitologico "F. Foschi", FORLÌ (FC), Italy

One of the main problems in pre-operational assessment for industrial planning consists of the possibility to have the so-called "zero option", which means to abandon the site because of the presence of species or habitats of a particular conservation level.

In general, social and economic conditions related to the building "need", local development, the financial statements and related assumptions seem to have greater decision-making powers than the presence of species that require a high level of protection. So the best that is normally achieved is mitigation procedures, restoration or recreation of habitats and monitoring programmes on the conservation status of the different local populations.

Here is described a case where the presence of species and colonies of bats in a site was recognized as a important decision point, and, thanks to the awareness of the wind farm company and local administration, it changed the scenario and did not allow the development of a wind farm.

The area is in northern Tuscany, Central Italy. A field study was performed, following EUROBATs's recommended protocol for wind farm assessment and was conducted over a year of monitoring with roost exploration and acoustic methods.

In the area 11 bat species were found: *Pipistrellus pipistrellus*, *Pipistrellus kuhlii*, *Hypsugo savii*, *Eptesicus serotinus*, *Tadarida teniotis*, *Nyctalus leisleri*, *Myotis daubentonii* and among the species of Annex II of Council Directive 92/43/EEC *Myotis emarginatus*, *Barbastella barbastellus*, *Rhinolophus ferrumequinum* and *Rhinolophus hipposideros*. The distribution of records and the soundscape of the area are described for the potential site and in similar habitats in the zone.

Also a reproductive colony of *R. hipposideros* was found in a historical building less than 3 km from the site and also some small roosts of associated males in other buildings.

Taking this information into account, the project was abandoned and, in cooperation with the bat specialists and the local protection group, new development ideas are now on the table to access to the green economy.

The perceived value of the presence of different species of bats is becoming an important part of the local culture as the awareness and attention to the problem is demonstrating.

FEMALE RHINOLOPHUS MEHELYI PREFER MALES WITH HIGH FREQUENCY ECHOLOCATION CALLS

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Echolocation calls produced by bats contain information on the emitter that could be used in social interactions and especially in the context of sexual selection and mate choice. Nevertheless, little is known about whether such information is being used by bats. Here we tested the ability of *Rhinolophus mehelyi* to discriminate male and female conspecifics' calls. We show that individuals were able to discriminate male and female calls, providing evidence that cues on the sex of the emitter are encoded in echolocation calls. We then examined the response of female *R. mehelyi* to high and low frequency calls of males and show that, dur-

ing the mating season, females prefer calls of males with a high frequency. These results, combined with correlation analysis between an individual's body size/condition, suggest that high frequency is an honest signal of body condition and that female *R. mehelyi* use a male's frequency in a mate choice context.

FORAGING HABITATS OF THE GREATER HORSESHOE BAT (*RHINOLOPHUS FERRUMEQUINUM*) IN THE CAMARGUE DELTA, SOUTH-EASTERN FRANCE

DELPHINE QUEKENBORN

Groupe Chiropteres de Provence, LA JAVIE, France

During the last century, the greater horseshoe bat (*Rhinolophus ferrumequinum*) faced a severe decline all over Europe, and particularly in South-eastern France. However, in several areas, small populations seem to have remained for years. This situation is well illustrated in the Camargue delta where recent investigations, started in 2005, revealed a cluster of seven colonies, about 20km from each other, and amounting to about 600 individuals during the parturition period. Whereas it is well described in the north of its distribution area, the ecology of the species in the Mediterranean area is hardly documented. In order to assess this population status and requirements, four studies have been carried out on the colonies. In 2006, 2007, 2008 and 2010, 45 greater horseshoe bats were radio-tracked in the delta itself and its surrounding habitats. The study area is sparsely inhabited and is composed of large land areas dedicated to agriculture scattered with some traditional buildings. The area is mainly occupied by paddy fields and extensive cattle pastures. These studies allowed us to discover new roosts and sometimes new colonies, in which greater horseshoe bats were mixed with Geoffroy's bats (*Myotis emarginatus*). The largest one includes 400 greater horseshoe bats. Tracked individuals foraged in specific habitats: wet meadows and swamps, both being pasture habitats, woodlands and hedgerows of deciduous species. Woodlands located close to the maternity roost were intensively used by juveniles. Individuals covered long distances (often more than 10 km) to reach quite small foraging sites (less than 10 ha). These results have led us to investigate further the ecology of the local population, especially with respect to diet, roost selection, and a landscape predictive model (LIFE+ Chiromed).

BAT CONSERVATION: PAST, PRESENT AND FUTURE

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I will present my personal view of what has been achieved in worldwide bat conservation to date and where the gaps lie. Bat conservation is strongly correlated with economic development and with the development of civil society, and half the world is a conservation void so far as bats are concerned. The most pressing need is for capacity building and I will review the opportunities for achieving this, together with indicators of success and failure.

HABITAT ASSOCIATIONS AND THE IMPACT OF URBANISATION ON BROWN LONG-EARED BAT (*PLECOTUS AURITUS*) SUMMER ROOSTS IN IRELAND

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A combination of GIS mapping and aerial photography datasets was used to investigate habitat types around Brown long-eared bat summer roosts in buildings in Ireland. Roosts that were included for systematic counting in the 2007-2010 monitoring scheme were included in this analysis, along with sites from historical records where very few or no bats now occur. The analysis was completed using ArcView 9.2 with woodland coverage based on data collated from Ireland's Forest Service Forest Information Planning Service (FIPS) and National Parks and Wildlife Service (NPWS) Native Woodland Inventory. Information on urbanisation was derived from Ordnance Survey of Ireland historical maps. For extant roosts, 2005 aerial photographs were used to calculate the shortest distance from extant roosts via a linear landscape feature (treelines and hedgerows) to the nearest woodland block. Additional habitat data and landscape feature data was also digitised from aerial photographs.

Analysis was carried out to determine whether any factors such as habitat coverage within known distances of existing roosts could be used as predictors of average summer roost numbers in Ireland. Possible predictive factors investigated include location in a rural or urban context, total area of woodland and distance to nearest woodland block along a linear landscape feature. One factor showing significant correlation with average roost count numbers was the roost's location

in Urban/Rural areas with significantly higher numbers found in rural roosts. Historical Ordnance Survey maps were examined in the context of historical records for brown long-eared bat roosts that had been rejected for inclusion in the monitoring scheme on the basis that no bats or too few bats (<8 individuals) were now present. A statistical comparison of formerly occupied roosts was made with extant roosts in the context of urbanisation of habitats and the results are presented here.

INVESTIGATION OF FEEDING HABITS OF BAT SPECIES USING STABLE ISOTOPE ANALYSIS FROM FAECES

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Faeces best represent recent diet and are easier to collect and less invasive for the animals compared to tissues such as hair or wing tissue. Stable isotope analysis of faecal samples from bats can provide information on their feeding habits and discriminate between aquatic and terrestrial origin of the prey. In order to test the method and validate its further utility for ecological research we collected faeces from wild bats of colonies of the species *Myotis myotis*, *M. daubentonii* and *M. mystacinus* in South Germany and Switzerland from two different seasons. In addition, the accuracy of the isotope analysis method in bat faeces was also tested with a feeding experiment with labelled mealworms. We analysed the isotopic composition of carbon, nitrogen and sulphur in the faecal samples. The results showed significant differences in the isotope signature for the species corresponding to the known terrestrial and aquatic feeding habits of the species under study. The current study highlights the suitability of stable isotopic analytical methods for faeces and will be further applied in a pan-European study with the aim of assessing the importance of aquatic ecosystems for terrestrial consumers, such as bats.

A FORESTER WENT TO THE VILLAGE: ECOLOGY OF BARBASTELLA BARBASTELLUS COLONIES IN SOUTHERN TYROL (ITALY)

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Barbastelle bat (*Barbastella barbastellus*) is a species widespread in central and southern Europe, but is rare and is considered “vulnerable” and threatened. The Barbastelle shows a quite remarkable plasticity, but recently is mainly reported as a typical forest dwelling species largely associated with tree cavities as roosts and with mature woodlands as feeding areas. Wintering occurs in caves and other underground, cold environments.

To have a wide knowledge of the ecological flexibility of Barbastelle bats a study is in progress in South Tyrol, in northern Italy. In this region a few small colonies are known in the valleys, thanks to the Natural History Museum of Bolzano and a network of interested people who send sightings to local conservation officers.

For the observations and the counts videocameras were used in order to minimize the impact on the animal groups, which seem to be very sensitive to any disturbance.

In these valleys, the species seem to have a particular habitat selection. All the groups of animals were found in small villages close to agricultural or agricultural/forest edge habitat. Altitudinal range varies between 280 and 920 m and all the colonies have their roost behind the shutters or in the box of window blinds. The colonies seem to be absent from Dolomiti area and the Lower Atesina valley but are present in all the other valleys. Colony sizes, feeding grounds and wintering sites are described as well as the departure time from these particular refuges in houses.

FEEDING IN NATHUSIUS’S PIPISTRELLE DURING AUTUMN MIGRATION

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Autumn migration is particularly demanding for bats in its energetic cost. Unlike passerine birds, bats are not able to store much fuel as body fat by feeding during the day and may be forced to compensate the loss of energy by intensive feeding during the migration flight. The aim of this study was to investigate how migratory

Nathusius's pipistrelle bats divide their time between feeding and migration flights. It was hypothesised that feeding and migration may occur on the same nights or alternatively bats might spend most time on feeding when conditions for migration are unfavourable. In year 2010, activity and feeding rate of Nathusius's pipistrelles was recorded from August until September at seven sites by means of heterodyne detector and audio recorder. At all sites, feeding buzzes were recorded continuously during the whole night, but the highest feeding rate was recorded during the first and the last quarter of the night. There was a positive relationship found between migration activity and activity at potential feeding sites. No significant differences in feeding rate were found among the sites. The results suggests that Nathusius's pipistrelles feed and migrate on the same nights and may be capable of fuelling their migration flight directly by consumed insect prey.

**PARAPHYLY IN SMALL-SIZED HOUSE BATS
(SCOTOPHILUS, VESPERTILIONIDAE) IN WEST AFRICA**
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The Palaeotropical genus *Scotophilus* represents one of the taxonomically most complicated bat groups within the family Vespertilionidae. Three house bat species of similar external appearance occur in the northern savannah belt of sub-Saharan Africa: *S. dinganii*, *S. leucogaster*, and *S. viridis*. They underwent frequent synonymy in the past and particular populations were assigned to these species rather intuitively. Recently, sequence data revealed intricate phylogenetic relationships in the genus and, among others, showed paraphyletic relationships of the West African *S. viridis* to the respective topotypical form, and thus confirmed its taxonomical delimitation as *S. nigrivetellus*. In several West African regions, we captured a number of small-sized house bats varying in colour from greyish-brown to greenish yellow, which were tentatively assigned to *S. nigrivetellus*. Analysis of mitochondrial cytochrome b sequences showed existence of two paraphyletic mitochondrial lineages within the collection differing by c.12% genetic distance. While the lineage comprising greenish-yellow specimens could be reliably identified with *S. nigrivetellus*, the greyish-brown specimens clustered as a sister lineage to a different species, *S. leucogaster*. Interestingly, despite substantial morphological differences between the sister lineages, their genetic distance

was only c.3%. On the other hand, the two sister forms differed substantially in sequences of the gene coding for zinc finger protein on the Y chromosome, and both differed in this marker also from *S. nigrtellus*. We thus consider the divergent form a separate species, and support our conclusion through detailed morphological analysis of skulls. Its taxonomic affinity to any known form could not yet be confirmed. Very likely, introgression of mitochondrial DNA played a role in evolution of these species.

INFLUENCE OF TEMPERATURE ON SITE SELECTION BY HIBERNATING BATS

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Bats in Europe utilize underground or buffered sites for hibernation, such as caves, bunkers and fortifications. During 2005 - 2010 an annual census of bats was undertaken at Miedzyrzecz Fortified Front in Western Poland, and the fort belts and bunkers around the city of Antwerp in Belgium. The data used for analysis were collected in 6 Polish bunkers not connected to the large underground system, and in 18 Antwerp forts and 61 bunkers. Temperatures were taken from the months of November to January. For counts during December, January temperatures were not used.

In Poland there were no significant differences in bat numbers ($\bar{X} = 217$ individuals). A decline was observed in 2008 ($n = 173$) when the average temperature was much lower than in previous years ($\bar{X} = 1.6^{\circ}\text{C}$). The average temperature decreased from 1.5°C in 2005 to -2.85°C in 2010.

In Belgium numbers ranged from 164 to 244 bats in bunkers and 3581 to 4289 bats in forts. Trends in bat numbers for both types of site are increasing. In lower temperatures, significant increases were seen in *Myotis nattereri*, *Barbastella barbastellus* and *M. myotis*. Decrease in temperature showed a decrease in *M. dasycneme* (-26.7%). The number of *M. mystacinus/brandtii* declined in smaller sites (-39.1%) when temperature lowered ($\bar{X} = 5.3\text{C}$), but large sites showed an increase of 13% in these species. No significant changes were proven for *M. daubentonii*, *Plecotus auritus* and *Plecotus austriacus*. Despite temperature fluctuations, *M. emarginatus*, a sensitive species bound to a few sites, shows a steady yearly increase.

Our findings demonstrate that temperature has an impact on the selection of hibernation sites by bats. This influence is more distinct for species that are less restricted to a specific micro-climate and therefore have a higher number of potential sites available to select from.

THE EFFECT OF MIRROR ORIENTATION ON BATS' PERCEPTION OF ECHOACOUSTIC MIRROR IMAGES

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Smooth water surfaces are the only extended acoustic mirrors in nature. Bats recognize water bodies by their mirror-like echo reflection properties: they try to drink from different solid materials provided the surface is acoustically smooth and hence mirror-like (Greif & Siemers, *Nature Communications*, 2010, Vol.:1, Article No.: 107). In our modern world, we create many artificial smooth surfaces ranging from horizontal to vertical orientation. It is as yet unclear how bats react to such artificial echoacoustic mirrors. Here, we tested the significance of the absolute orientation of acoustic mirrors on the bats' interpretation of the respective echo scenes. In a completely dark flight room, an acoustic mirror (smooth metal plate, 120 x 200 cm) was placed on the floor (horizontal orientation) or mounted at the wall (vertical orientation). We tested 21 naive *Myotis myotis*, each in a session with both the horizontal and the vertical mirror. At the vertical mirror, 19 out of 21 bats collided at least once, while none of them tried to drink from the mirror. No bat was visibly injured by a collision, though. As for the horizontal mirror, 12 out of the 21 bats attempted to drink, but none tried to fly through the mirror on the ground. Most of the bats collided with the vertical mirror when approaching at an acute angle. Absolute orientation fundamentally affects the bats' interpretation of the echo scene they perceive as a reflection from the same acoustic mirror. Horizontal mirrors are taken to be water, vertical mirrors to be open flyways. Human buildings and constructions contain many horizontal and vertical echoacoustic mirrors (large smooth glass, metal and plastic surfaces) that may cause problems for the orientation of bats.

ABSTRACTS OF POSTER PRESENTATIONS

UNVEILING FISHING BEHAVIOUR: PREY SPECIES, SIZE AND QUANTITY CONSUMED BY *MYOTIS CAPACCINII*

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Among the three European ‘trawling’ bat species, fishing has been reported only for *Myotis capaccinii*, and it has been experimentally demonstrated that they are able to hunt live fish. In 2009 and 2010 we surveyed a colony in the Iberian Peninsula for which fishing had been reported. In order to determine the species of fish preyed upon, the size of prey items and the amount of fish consumed by individual bats, we studied the morphology, the size and the number of otoliths found in faeces. 97 otoliths were isolated from 2600 guano samples collected using both guano collectors placed in a cave and individual captures. All otoliths were identified as belonging to mosquitofish *Gambusia holbrooki*. In addition, since the somatic size of fish is correlated with otolith size, the size of prey consumed by *M. capaccinii* was estimated using an exponential regression. We developed the regression linking otolith length and fresh fish size using 50 fishes collected in the field. We found that *M. capaccinii* fed on fish ranging from 1.5-3.6 cm in length, not consuming the biggest, and hence heaviest, items. Although having large feet, the small body size of *M. capaccinii* may be an energetic and morphological constraint to handling the largest mosquitofish. We also found more than 10 otolith pairs in droppings of some individuals captured in June, so a single individual is able to eat between 8 and 15 fishes in one or two nights. Nevertheless, those fishes were smaller than the average size of consumed prey, maybe because available fishes were smaller in that period.

THE ATLAS OF MOROCCAN MAMMALS (INCLUDING BATS): A NEW SYNTHESIS

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In 1986 the “Catalogue des Mammifères sauvages du Maroc” was the first attempt to map the distribution of all terrestrial (and flying) mammal species living in Morocco on a common grid basis. Twenty five years later, taxonomic changes, population and/or range regression, and knowledge improvement, highlighted the need to update this reference. For this second edition we tried to collect the largest available set of data (including Museum collections) thanks to the contribution of Moroccan workers and visitors. The main chapters of the book will deal with identification, distribution, habitat and conservation status of the 105 “historical” species on the basis of texts facing maps that will be issued from a large database (> 10,000 locations) on a 15' x 15' grid (> 5,200 filled grids, 1 for *Gerbillus simoni*, up to 239 for *Lepus capensis*). They will be complemented by invited contributions on marine mammals and a history of the mammal fauna during the Quaternary, including palaeontological and engraving syntheses. A comprehensive list of references will be added to each chapter. This publication is scheduled for 2012. All additional (published or unpublished) data are urgently welcome.

BREEDING BAT COLONIES FOUND IN BAT BOXES IN EASTERN LITHUANIA 2010

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For some bat species bat boxes are very useful for shelters throughout the warm season of the year. The purpose of the present study in East Lithuania was to assess the occupancy rate of bat boxes of three models by breeding bat colonies during the summer season. The bat box NET was prepared during 2004-2009. A total of

392 bat boxes (62 three-five chamber bat boxes, 258 standard bat boxes and 72 'flat' bat boxes) were erected in 20 areas (60 groups of bat boxes, each consisting of 4 – 8 bat boxes). Bat boxes were attached to trees (pine and oak trees) growing in open areas in forest clearings surrounded by mixed or pine forest. Boxes were checked for bats on 5–15 June in 2010.

In the bat boxes were found females with youngsters of *Pipistrellus nathusii* (31 colonies), *Pipistrellus pygmaeus* (4 colonies) and *Plecotus auritus* (1 colony). 24 bat breeding colonies were found in three-five chamber bat boxes (occupancy rate of bat boxes: 38.7%) and 12 breeding colonies found in standard bat boxes (occupancy rate: 4.7%). No breeding bat colony was found in any 'flat' bat box. In each three-five chamber bat box occupied by bats, there were about 60-200 adult bats, in standard bat boxes between two and approximately 50 adult bats.

Non-breeding bats (single or small social groups) were found in three-five chamber bat boxes, standard bat boxes and 'flat' bat boxes. In total, in the bat boxes about 2000 adult bats of eight species were found – *Pipistrellus nathusii*, *P. pygmaeus*, *P. pipistrellus*, *Myotis dasycneme*, *Plecotus auritus*, *Nyctalus noctula*, *Eptesicus serotinus* and *Eptesicus nilssonii*.

The authors are grateful to the Department for Environment, Food and Rural Affairs (DEFRA), Bristol, U.K. for supporting financially this project.

BAT FAUNA RESEARCH IN THE UZHANSKY NATIONAL PARK (WESTERN UKRAINE)

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Uzhansky NP is the Ukrainian part of a three-party (Ukraine-Poland-Slovakia) National Park 'Eastern Carpathians'. The bat fauna of this park was relatively poorly investigated. Our researches started in 2010. The aims were investigations of the bat diversity in relation to spatial, habitat and seasonal distribution. Several methods were used for obtaining the data: setting up mist-nets on different biotopes, ultrasound detection transects, inspections of summer shelters (underground sites and buildings, e.g. churches) and winter shelters (caves and mines). As a result, 17 bat species were recorded. 11 of them were noted in this area at the first time: *Rhinolophus ferrumequinum*, *Myotis mystacinus*, *M. brandtii*, *M. nattereri*, *M. daubentonii*, *Eptesicus nilssonii*, *Vespertilio murinus*, *Nyctalus leisleri*, *Pipistrellus pipistrellus*, *P. nathusii* and *P. pygmaeus*. *E. serotinus*, *E. nilssonii* and *V. murinus* were the most common species here. The caves and mines are the hibernation places for *R. hipposideros*, *R. ferrumequinum*, *M. myotis*, *M. brandtii*

and *Barbastella barbastellus*. *R. hipposideros*, *M. brandtii* and *M. nattereri* were noted in these underground sites in the summer period. *E. nilssonii* was recorded in surprising high numbers. *B. barbastellus*, *P. pipistrellus* and *P. nathusii*. *P. pygmaeus* was recorded at the lower altitudes only, up to 250 m a.s.l.; *P. pipistrellus* was also recorded in the mountains, usually to 800–900 m. Maternity colonies of *E. serotinus*, *P. auritus* and *R. hipposideros* were noted during the visits to religious buildings (usually old wooden churches) in the area of the NP.

TAXONOMIC REVISION OF THE GENUS *ASELLIA* (CHIROPTERA: HIPPOSIDERIDAE)

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Two species are currently recognised within the genus *Asellia*, a typical inhabitant of arid areas of northern Africa and southwestern Asia. Most of the distribution range of the genus is covered by the species *A. tridens*, while the other species, *A. patrizii*, is restricted to Ethiopia, Eritrea and several Red Sea islands. We analysed morphological variation in an extensive set of *Asellia* samples covering the entire range of the genus, including most of the available type material. In a representative subset of samples, we inferred mitochondrial cytochrome *b* phylogeny of the broadly distributed *A. tridens*. Morphological comparisons revealed four distinct morphotypes. Apart from the endemic *A. patrizii*, all African *Asellia* and most of the Middle Eastern specimens belonged to the same morphotype, which was unambiguously identified as *A. tridens*. Two other morphotypes of tentative *A. tridens* were delimited based on skull shape; one in the southern Arabian region of Dhofar, the other in Socotra. Phylogenetic analysis yielded three main monophyletic groups, which corresponded with the demonstrated morphotypes. Significant genetic divergences exceeding 5% and 12%, respectively, were discovered between them. Based on the morphological and molecular data, we propose a split of the current *A. tridens* into three separate species: *A. tridens* in Africa and most of the Middle East, *A. italosomalica* in Socotra and Somalia, and *Asellia* sp. nov. in southern Arabia. Molecular dating along with available palaeontological and geological information supports an Arabian origin of the contemporary *Asellia*. While profound divergence of the Socotran form may be linked with the split of Socotra from the southern Arabian coast in the Middle

Miocene, low sequence variation of *Asellia* in most of Africa and the Middle East suggests a colonisation of this vast area during the Pleistocene. The newly described form from southern Arabia probably represents a relict of aridification during the Miocene/Pliocene transition.

DISTRIBUTION PATTERNS OF BATS IN THE EASTERN MEDITERRANEAN REGION THROUGH A CLIMATE CHANGE PERSPECTIVE

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The impact of climate change on different species has been analyzed many times in various geographical areas. The main aim of this study was to determine how climate change will affect 18 different bat species in the eastern Mediterranean region. Using presence only modelling techniques and relevant bioclimatic data forecasts according to two different climate change scenarios (A2A and B2A) of the Intergovernmental Panel on Climate Change (IPCC), the potential geographic distribution of bat species in the eastern Mediterranean region for the current period and the years 2020, 2050 and 2080 were modelled. The results suggest that climate change will affect bats negatively throughout the 21st century in the studied area on two fronts: i) species richness will deteriorate, and ii) the total area occupied by bats will decline. These impacts will be more severely observed in Turkey's coastal areas, northwest Turkey, Red Sea coasts, Israel, and the west of Syria and Jordan. Using only bioclimatic variables as factors, and thus not using any land cover (or habitat) data, was the main limitation of the study. Hence the models and results of the study present 'best case' scenarios.

FACTORS DETERMINING THE USE OF CULVERTS UNDER HIGHWAYS AND RAILWAY TRACKS BY BATS IN LOWLAND AREAS

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In urbanising environments the construction of suitable underpasses for bats under highways and railway tracks is becoming increasingly important to avoid

habitat fragmentation. Culverts provide valuable and low cost underpasses as they are already an intrinsic part of highway design and many bat species associated with water are likely to follow the streams or canals that flow through them. Bat detectors were employed to study the use of 54 culverts by bats in The Netherlands. The aim of the study was to define the factors that determine bats' use of culverts.

Bats were observed in the vast majority of the culverts that were studied, thereby underlining the importance of culverts in habitat de-fragmentation. Species adapted to hunting in open habitats, such as the Noctule (*Nyctalus noctula*) and Serotine (*Eptesicus serotinus*), were often recorded in front of the entrance but rarely inside culverts. For the three species that were regularly recorded inside culverts, Daubenton's bat (*Myotis daubentonii*), Pond bat (*Myotis dasycneme*) and Common pipistrelle (*Pipistrellus pipistrellus*), cross sectional area was the most important factor that determined their use of culverts. Height was the most important component of the cross-sectional area for bats. Length proved a non-significant factor, suggesting that bat underpasses are not affected by the widening of the above-lying infrastructure. Additional guidance by treelines along the banks did not increase the use of culverts by the three species. The implication of the different preferences for cross-sectional area on the design of infrastructure is discussed.

DATA REGARDING THE BAT COMMUNITIES (MAMMALIA: CHIROPTERA) IN SIBIU COUNTY, ROMANIA

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The study was conceived within the framework of the iBats program, researching the bat fauna of Sibiu County, Romania, in the years 2007 - 2009 (June - September). Each year we made seven transects, which were chosen so as to occupy different habitat types at different altitudes. The purpose of this study was to obtain data on the abundance of species from different regions of the county and to design species distribution maps. Using the iBats method, we identified ultrasounds belonging to twelve bat species, five of which have not been cited in Sibiu previously: *Nyctalus leisleri*, *Eptesicus nilssonii*, *Hypsugo savii*, *Pipistrellus*

pygmaeus, *P. kuhlii*. The most common species were *N. noctula* and *E. nilssonii*. The species found on all transects, but with a small number of individuals, was *Vespertilio murinus*. Only a few individuals of *P. pygmaeus*, *P. kuhlii*, *Miniopterus schreibersii* and *N. leisleri* were found. The greatest number of individual bats per km was found on a transect with heavy traffic, but also with a nearby river and deciduous forests, the most active period being in June. In spite of the fact that the existing literature indicates the presence of *Rhinolophus* species, we did not identify their ultrasound during the present study.

GENETIC STRUCTURE OF GREATER MOUSE-EARED BAT (*MYOTIS MYOTIS*) POPULATIONS IN THE CARPATHIANS

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In the present study, we assessed the genetic diversity and population structure of Greater mouse-eared bat (*Myotis myotis*) colonies in the Carpathian Region. We have analyzed 100 individual bat samples from five maternity colonies and compared our data set with those in existing publications. At the microsatellite level, colonies from the region are highly polymorphic, even on the European scale, and show significant levels of differentiation. The mitochondrial DNA analysis places our colonies in the middle of Europe's diversity, as they have both Iberian and Balkan lineages present in their genetic makeup. Results suggest a mixed origin for populations in this region and ongoing gene flow across parts of the Carpathians and the Rhodopes. Also, we demonstrate that both roost types occupied by *M. myotis* (caves and artificial roosts) have great and comparable diversity, highlighting the importance of the protection of both types. Due to the fact that Romania is one of the few countries in Europe where the Greater mouse-eared bat is abundant, our study in the future, besides the conclusions from genetic data, will also have direct applications in establishing proper conservation and protection strategies for the target species.

BATLAS 2010: RESULTS OF A BAT DISTRIBUTION MAPPING PROJECT FOR IRELAND

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The BATLAS 2010 survey of the Republic of Ireland and Northern Ireland was conducted during two field survey years (2008 and 2009) to ascertain the distribution of four targeted bat species. The targeted species were; Common and Soprano pipistrelle (*Pipistrellus pipistrellus* and *P. pygmaeus*), Daubenton's (*Myotis daubentonii*) and Leisler's bats (*Nyctalus leisleri*). The BATLAS 2010 project was a field-based study that used a standardised bat detector-based survey protocol developed by Bat Conservation Ireland. This protocol was used by all participating surveyors.

In total, 751 10km x 10km survey squares were surveyed. Soprano and Common pipistrelles were found in 640 and 538 squares, respectively. Leisler's bat was found in 466 squares and Daubenton's bat was found in 444.

Both pipistrelle species were widely distributed in the survey and although the Common pipistrelle occurred in many of the same sites as the Soprano pipistrelle, the latter was detected in more of the surveyed squares in the northern and western regions of the country. Daubenton's bat has a wide distribution within the island and was detected in every county. However, it was noticeably absent along coastal edges. Leisler's bat was also widely distributed across the country, but was not found in northern extremes, some midland areas and along some more exposed coastal areas. During the survey of targeted species, additional, 'ad hoc', observations of other bat species were also noted and recorded.

The resulting distribution map of each of the targeted species provides a fundamental baseline to which further records can be added over time and a repeat of the BATLAS 2010 national survey is recommended in 2020 and thereafter at ten-year intervals with specific surveys of selected targeted areas of special interest being conducted every five years, if necessary. Finally, recommendations are presented for future bat atlases of Ireland.

THE ROLE OF AN ARTIFICIAL EMBANKMENT IN BAT MIGRATION

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It is well known, that bats use the coastline of different water bodies as a route for autumn migration. The Gulf of Finland is not an exception. We observed bat

migration in this area during 2005-2009. Most of our findings, however, were connected to an artificial embankment, which was build in the second half of the 20th century near St.Petersburg. On 20 August, we constantly observed a migration stream of such species as *Nyctalus noctula* and *Pipistrellus nathusii* along this embankment. This fact was registered by ultrasound detector. It should be noted that bats were not observed in this area during the summer period; incidents of finding of the bats concerned was only towards the end of this season. Interestingly, also, during the time of research, we did not find migration activity of bats on the southern coast of the Gulf of Finland. We propose that the artificial embankment offers bats a shorter route for their migration. However, routes of bat migration are not yet clear.

HABITAT USE BY BATS IN A MOSAIC LANDSCAPE OF THE POLISH LAKELAND AND BALTIC SEA COAST

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Only a few studies refer to large-scale habitat preferences of multi-species bat assemblages of temperate mainland Europe. The aim of the following study was to describe habitat and landscape associations of foraging and commuting bats in postglacial lakeland and coastal plain of northern Poland (Gdańsk region). In total, 100 UTM squares (10x10 km) were selected at random. In each square, bat calls were recorded on linear walked transects, using Pettersson D-980 and Pettersson D-1000x ultrasound detectors. 29 basic habitat classes were distinguished. Bats appeared to prefer lakes and ponds, rivers and canals, roads in mixed forests, tree lines in open farmland and edges of deciduous forests, but avoided arable land, roads in coniferous forests, meadows and pastures. *Nyctalus noctula* appeared to be an eurytopic species with the broadest habitat niche, but also preferred lakes and ponds, edges of coniferous forests and roads inside such stands. *Eptesicus serotinus* strongly preferred villages; otherwise it remained eurytopic, with relatively broad habitat niche. These two taxa did not avoid open areas but used them according to their availability. Much narrower habitat niches were occupied by pipistrelle bats, which avoided all open habitats. *Pipistrellus pipistrellus*, being the most eurytopic member of its genus, preferred tree lines, roads in coniferous stands, and, to a lesser extent, various bodies of water. It did not avoid villages, contrary to *P. nathusii*, a stenotopic species, strongly preferring lakes and ponds, as well as roads in mixed forests. *P. pygmaeus*, the rarest and the most stenotopic pipistrelle, revealed a habitat niche more similar to *P. nath-*

usii than to *P. pipistrellus*, strongly preferring lakes and ponds. *Myotis* species, represented mostly by *M. daubentonii*, revealed the narrowest niche amongst the studied taxa, preferring most bodies of water but avoiding all open habitats, roads in coniferous forests, tree lines and built-up areas.

IDENTIFICATION AND PROTECTION OF IMPORTANT BAT CAVES IN TURKEY

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Many of the cave habitats that are important for bat populations in Turkey are under constant pressure due to factors such as cave tourism, or construction of water dams and stone quarries. The lack of information on the distribution of bat colonies makes it difficult to prepare effective conservation management plans. In this study, we planned to: 1) identify important bat caves in Turkey, 2) initiate the protection assessment of these caves in collaboration with the Cave Conservation Unit in the Ministry of Environment and Forestry, 3) establish a network among interest groups, 4) set up a baseline for a long-term monitoring programme, and 5) raise public awareness about bat conservation. Last year, a website targeting cavers was launched, and up to now more than 50 caves have been reported to harbour bat colonies. Some of these sites were surveyed to identify bat species and their population sizes. Caves with high conservation priority were reported to the Cave Conservation Unit to establish a status of legal protection.

POPULATION TRENDS OF DUTCH BAT POPULATIONS FROM 25 YEARS OF NATIONAL HIBERNACULA COUNTS

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Every year between 15 December and 15 February, about one hundred voluntary bat workers from many local bat groups count hibernating bats in sites such as limestone mines, bunkers, fortresses, etc. in a systematic manner, and report their counts to the Dutch Mammal Society (DMS). Currently, about a thousand hibernacula are surveyed. The DMS collates and validates the data, and sends them to Statistics Netherlands, who calculate trends and indices using the computer application TRIM. The DMS reports the results back to the volunteers and to

governments. Although a number of sites have been counted since the 1940s, we calculate trends with the data from 1984 onward, as, since that year, the counts cover the whole country, and have been standardised.

Trends and indices are calculated for the seven most abundant species: *Myotis daubentonii*, *M. mystacinus/brandtii*, *M. nattereri*, *Plecotus auritus*, *M. dasycneme*, *M. emarginatus* and *M. myotis*. Remarkably, over the period 1984-2009, these species all show a positive trend.

Until the early 1980s, *Rhinolophus ferrumequinum*, *R. hipposideros* and *Barbastella barbastellus* were encountered in the limestone mines, but these species have disappeared from the Netherlands.

Pipistrellus pipistrellus, *Eptesicus serotinus*, *M. bechsteinii*, *P. austriacus* are encountered, but either in too low numbers, or the species hibernates in far larger numbers in other types of hibernacula (trees, hollow walls of houses), so that these counts do not properly represent the population.

SPATIAL BEHAVIOUR , HABITAT USE AND CONSERVATION OF FEMALE GEOFFROY'S BAT (*MYOTIS EMARGINATUS*) AT ITS TWO NORTHERNMOST MATERNITY ROOSTS

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Myotis emarginatus has two known breeding colonies in the Netherlands. Both colonies have received Natura 2000 status. In order to collect ecological data needed for the management plan of these two sites, seven female *Myotis emarginatus* from the two breeding colonies in The Netherlands were radio-tagged and tracked during their foraging trips.

The animals used woods, stables of cattle and sheep, and tree lines, to a maximum distance of eight kilometres from the maternity roost. The animals used tree lines to fly from their roosts to the hunting areas, but also to forage. Most time was spend in stables (38%), woods (34%) and in tree lines (25%), the remaining time (3%) was spend in urban areas, open fields and orchards. We observed no movement of individuals between the two colonies. The percentage of the night spend in stables was negatively correlated with outside temperature.

Based on the ecology of Geoffroy's bat and the data gathered in the telemetry

study, a number of actions for protection of the species are formulated. These are conservation of the breeding colony buildings and adapted management in an area of 8 kilometres around the colonies: conserving tree lines, insect-rich stables and woods, and cooperation across the Dutch-German border in development projects (construction of roads or estate development) and in other projects that affect these landscape structures.

CAVE BAT FAUNA OF SKADAR LAKE NATIONAL PARK, MONTENEGRO

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An inventory of caves was made for Skadar Lake National Park, as part of the project 'Nature for the Future', within the framework of the transboundary co-operation Programme of IPA between Montenegro and Croatia. The inventory contains a range of data on each particular cave (e.g. geographical coordinates, maps, inventory of morphological features, geological substrate, climate features, archeological remains, etc.) and including the data on bats. Additional field research was made (mist-netting, visual identification and bone collection) in the late winter and spring of 2011. Bats or signs of their presence were observed in all of the twelve thoroughly investigated caves. Together with older data, nine species were detected so far: *Rhinolophus hipposideros*, *R. ferrumequinum*, *R. euryale*, *Myotis myotis*, *M. blythii oxygnathus*, *Myotis nattereri*, *M. emarginatus*, *M. capaccini*, and *Miniopterus schreibersii*. Some species were found hibernating or as nursery colonies of 300 to 800 individuals, exceptionally up to 5000 strong, while for other species only individuals or small numbers were observed. A list of important cave roosts for bats in the area was made. Information on bats, the ecology of species present and necessary conservation measures, will be included on information boards throughout the park.

BIOMETRICS AND TAXONOMIC STATUS OF MYOTIS BLYTHII FROM THE CRIMEA

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Various researchers attributed Crimean *Myotis blythii* either to the European subspecies, *M. b. oxygnathus*, or to the Middle East subspecies, *M. b. omari*. We

analyzed 29 craniometric and 82 odontometric traits of *M. blythii* from different regions. The multivariate analysis of skull variation indicates that Crimean *M. blythii* belong to *M. b. oxygnathus*. According to the multivariate analysis of dental variation, Crimean *M. blythii* occupy an intermediate position between Caucasian and Transcarpathian *M. blythii* and vary in wide range. Carpathian and Crimean *M. blythii* bats differ in measurements of lower molars. Taking into account both skull and dental traits, we conclude that Crimean *M. blythii* should be attributed to *M. b. oxygnathus*.

WASTE NOT, WANT NOT – THERMOREGULATION IN MALE DAUBENTON'S BATS

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In order to save energy, small mammals have evolved energy saving strategies, such as reducing their body temperature (torpor). The main drawback of this mechanism is a reduction of reproductive processes such as spermatogenesis in males or foetal development in females. The focus of our study is on male, free ranging bats that were captured during the periods of spermatogenetic resting and spermatogenetic activity. The hypothesis that (1) the factors influencing skin temperature in male Daubenton's bats (*Myotis daubentonii*) differ between periods, and (2) that epididymal filling and thus testosterone level has an influence on torpor behaviour, were tested. To measure skin temperature thermo-sensitive radio transmitters were used and ambient temperature was recorded. Overall skin temperatures fluctuated from 9.8°C to 39.9°C. Factors of body mass, epididymal filling, roost altitude and ambient temperature were used to explain variance in torpor behaviour. During the spermatogenetic resting period roost altitude significantly influenced torpor behaviour, however, the factors changed in the spermatogenetic activity period to epididymal filling and body mass. Epididymal filling can be used as an indicator for testosterone concentrations which seems to alter torpor behaviour, since all males became torpid during sexual inactivity (low testosterone level), but during spermatogenetic activity males with high epididymal filling (higher testosterone level) did not. Body mass might affect torpor since lighter bats cannot afford to invest energy in spermatogenesis, whereas heavier males can invest in spermatogenesis. This study revealed that various factors influence torpor behaviour depending on time of the year and reproductive state.

ENERGY COMPENSATION IN MALES OF A TEMPERATE INSECTIVOROUS BAT SPECIES

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Four major energy compensation mechanisms during times of high energetic demand have been proposed for bats: torpor, activity reduction, increase of energy intake (i.e. higher food consumption), and metabolic compensation. We determined the seasonal usage of these mechanisms for male Daubenton's bats (*Myotis daubentonii*) during different reproductive phases. While torpor, activity and energy consumption were recorded using a combination of telemetry and observation data, metabolic rate was measured via indirect calorimetry. We found that the males varied their energy saving mechanisms through different phases of the reproductive period. Daytime torpor was used as an energy saving mechanism immediately after hibernation during late spring. With the onset of reproductive activity in summer, males increased energy intake through an increase in food consumption, which is facilitated by high insect abundance. During early autumn male bats have to cope with high energetic demands because of the mating season and preparations for hibernation. On the one hand, higher energy intake requires longer foraging bouts. On the other hand, reproduction also incurs costs in the form of the time needed to find mates. The bats appear to solve this trade-off by lowering their metabolic rate during daytime which allows males to remain active with reduced energy expenditure.

THE DISTRIBUTION OF *MYOTIS ALCATHOE* IN HUNGARY – PREDICTING THE OCCURRENCE OF THE SPECIES FROM HISTORICAL DATA

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Myotis alcathoe, the smallest *Myotis* bat in Europe, was described based on Greek and Hungarian specimens in 2001. Before that it was confused with *Myotis mystacinus*, another small whiskered-group bat in the European fauna. The data

on the European distribution is deficient, but more and more papers report the occurrence of the species across the continent.

The identification of whiskered-group bats to species level is not always unambiguous. However, there are good morphological characters, which can be used to identify most mist-netted specimens.

We collected all the available Hungarian data of the species from publications and synthesised with our own data. We could find the species over nearly all the country except for the Great Hungarian Plain. The species is widespread in the mountainous areas of northern Hungary. Our data show that *Myotis alcaethoe* is more frequent there than the other two whiskered bats, *Myotis mystacinus* and *Myotis brandtii*. Most of the locations are in forests or caves in elevated areas, but there are a few occurrences in natural forests near lowland rivers.

We constructed a probabilistic model to predict the occurrence of the species from historical mist-netting data. This method is useful if we would like to predict from the old data of *Myotis* cf. *mystacinus* whether an area that has not been studied in the last decade had/has a significant *Myotis alcaethoe* population or not.

RESPONSE OF EMERGING SEROTINES TO THE ILLUMINATION OF THEIR ROOST ENTRANCE

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A maternity colony of Serotine bats (*Eptesicus serotinus*) occupying a church loft in Central Poland survived the installation of lamps illuminating the outside of the building at night. This poster presents the pattern of evening emergence before and after illumination. At first the bats seemed to completely ignore the light, but after a few years their behaviour seems to have changed.

DIET COMPOSITION OF A GENERALIST GLEANER (MYOTIS BECHSTEINII): KEYSTONE AND VARIABLE ELEMENTS

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We describe the diet composition and prey selection of the forest-dwelling Bechstein's bat (*Myotis bechsteinii*) in three vegetation assemblages (namely Mediter-

ranean oak forest, dehesa and Atlantic oak forest) in two distinct climatic domains. We examined a total of 368 faecal pellets from 85 individuals, and identified prey fragments to the lowest taxonomical level. Arthropod availability in their individual foraging areas was estimated using suction traps.

The main arthropod groups consumed by the bat were not significantly different across vegetation assemblages or climatic domains. Primarily, *M. bechsteinii* preyed upon Lepidoptera, Diptera (Brachycera), Coleoptera and Dermaptera, both in terms of volume and percentage occurrence. Only taxa of secondary importance (percentage volume <10%) varied in proportion to local availability. This is consistent with previous data on the diet of the species, and with the notion that *M. bechsteinii* is a generalist predator that tends to subsist opportunistically on many prey types. The type and spectrum of the prey taxa present in the faeces reflects the functional preference of *M. bechsteinii* for cursorial terrestrial arthropods, or diurnal taxa while they are at rest on the surface of leaves and branches, which is also supported by our occasional direct observations of hunting events.

Considering solely data on prey availability - absolute abundance of selected categories and size of the potential prey items sampled - the Mediterranean localities provided more favourable conditions than the Atlantic ones, which probably resulted in smaller foraging areas.

CORRELATIONS BETWEEN HARDNESS OF FOOD AND CRANIODENTAL TRAITS IN SOME *MYOTIS* SPECIES

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Myotis species retain the ancestral dental formula (38 teeth with P³ being present) and are rather diverse in size and trophic preferences. The task of this research is to analyze how shape and size of the *Myotis* skull are related to the hardness of diet. Hardness of diet was evaluated from the set of data collected by Freeman (J. Mammal., 1981, 62(1): 164-166). Nine species were studied: *M. myotis*, *M. blythii*, *M. bechsteinii*, *M. dasycneme*, *M. emarginatus*, *M. nattereri*, *M. daubentonii*, *M. brandtii*, *M. mystacinus*. We measured 6 skull and 63 tooth measurements (from one side). Correlation between hardness of diet and size of the skull was confirmed. As was expected, *Myotis* bats that eat hard-shelled prey have relatively higher coronoid processes. But contrary to the normal pattern for bats, the studied *Myotis* species tend to have narrowed skull and lengthened toothrows. In the dentition, increase of hardness of prey correlates with increase of relative molar size and reduction of M³ and M₃, but not with reduction of the small

premolars, and the relative height of upper canines. We suppose that adaptation to durophagy in *Myotis* might be connected with relative lengthening of the jaw muscles (thus increasing bite force), but not with the expansion of cross-sectional area of muscles.

THE GALLERY OF ‘LA BÓVEDA’ (SEGOVIA, SPAIN), 30 YEARS LATER

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‘La Boveda’ is an artificial underground gallery located in the gardens of the Royal Palace of La Granja, near the city of Segovia, in the centre of the Iberian Peninsula. In the late 1970s this site was the subject of a detailed study of bat colonies. Some 30 years later, in 2009–2010, we carried out a similar study at the same site covering a full annual cycle which makes ‘La Boveda’ one of the few bat roosts in Spain with this kind of information.

At the end of the 1980s all of the 11 entrances to the gallery were closed with metal gates with openings of 7.7cm x 7.7cm, too small for the bats. In 2000, with the aid of a Life/Nature programme (B4-3200-96-511) two entrances were reopened once again to encourage bats to return. ‘La Boveda’ is currently being used by six of the 10 species reported in the 1970s. Despite the gallery being closed for over 10 years, no significant differences were detected regarding temporal and spatial use by the most numerous species currently present, *Rhinolophus ferrumequinum* and *Myotis escalerai*. The colony of *M. escalerai* is one of the largest known colonies of this species (about 500 adults), and it seems to have increased since the 1970s. *Barbastella barbastellus* and *Miniopterus schreibersii* were not recorded in the second study although both occupied nearby shelters less than 500 m away.

NEW ADENOVIRUSES DETECTED IN HUNGARIAN BATS

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Bats have been incriminated and in some case confirmed as being reservoirs for a variety of dangerous viruses (SARS coronavirus, Ebola, Nipah, Hendra, and rabies viruses). Besides these zoonotic RNA viruses, DNA viruses have also been discovered in bats recently. A rapidly increasing number of specific adenoviruses (AdV) and herpesviruses are known from these flying mammals. AdVs occur in all classes of vertebrates, therefore they are ideal models to examine viral diversity, evolution and co-evolution with the host.

We studied the diversity of AdVs in wild animals. Using a sensitive consensus-nested PCR and sequencing, we screened randomly collected samples for the presence of AdVs.

Although only a limited number of samples have been tested as yet, an astonishingly high (close to 24%) prevalence could be observed in Hungarian bats. From 29 samples representing 13 bat species, 5 putative novel AdVs were detected in 7 individual samples that belonged to 5 bat species in Hungary. These included *Myotis oxygnathus*, *Nyctalus noctula* and *Plecotus austriacus* from the Vespertilionidae, and *Rhinolophus ferrumequinum* and *Rhinolophus hipposideros* from the family Rhinolophidae. Identical viral sequences were found in two samples of each of the two rhinolophid species respectively.

On a phylogenetic tree reconstruction, the AdVs from the two bat families clustered separately. The closest relatives of AdVs demonstrated in vespertilionid bats were canine adenovirus (CAV) types 1 and 2. Since no other AdVs have been found in carnivorous animals, one may hypothesize that CAVs originated from vespertilionid bats. This assumed host switch could explain the relatively strong pathogenicity of CAVs. Similar surveys in Asia revealed much lower prevalence. We plan to continue the screening. Faecal samples or rectal swabs will be obtained directly from mist-netted bats caught in the wild to ensure that no cross-contamination among the samples occurs. Support: NKTH-OTKA K67781.

VARIATION IN BAT ACTIVITY AT ARTIFICIAL LAKES: IMPLICATIONS FOR MONITORING

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The measuring of bat activity is important for studies on habitat use, conservation and monitoring of bats. In practice these measurements are often carried out in different ways, e.g. using point counts or transect counts in a standardized part of the night, or by measuring the overnight activity at fixed points with automated detectors. Irrespective of the method, variation in the data should be known for a proper statistical inference. We studied variation of bat activity at different artificial lakes and at a canal with Pettersson D-500X bat recorders. Our first results indicate that bat activity at these lakes does not always follow the classical pattern with an activity peak in the beginning of the night, but activity can peak several hours after sunset. Day to day variation was very large at some sites, but rather small at others. Apart from counting of bat passes, feeding buzzes have also been counted to check whether they are necessary for measuring foraging activity. Many studies have reported a correlation between the number of feeding buzzes and the number of bat passes. In our study, however, this correlation did not hold. The ratio between feeding buzzes and bat passes might even be site dependent. We concluded that overnight measurements are needed for a proper assessment of the importance of a site, and that the number of feeding buzzes gives important additional information.

BATS MAY BE CARRIERS OF *CAMPYLOBACTER*

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Since the contamination cycles of *Campylobacter* and *Salmonella* are not fully elucidated, it is useful to search for possible reservoirs in the environment. Bats are known to be potential carriers of viral pathogens and they might also be relevant in the contamination cycles of *Campylobacter* and *Salmonella* since they

are warm blooded animals and could possibly act as hosts for these pathogens. In Western Europe, all bat species are insectivorous. Since it is known that insects are able to transmit *Campylobacter* and/or *Salmonella* for instance via faeces of farm animals or water birds, they might be a source of infection for bats. By contaminating water, crops, fruit, feed or soil with their faeces, infected bats might be a part of the contamination cycle of both pathogens. In this investigation, we examined wild bats for the presence of *Campylobacter* and *Salmonella* in 2007 and 2008.

Fresh faecal samples (<10mg -100 mg) were collected from live, wild bats with transport swabs (Copan Diagnostics Inc., 109.USE), kept at 0-7°C and examined within two days for *Campylobacter* using Bolton Broth, Preston Broth and CCDA and for *Salmonella* using BPW, MSRV and BGA/XLD.

Campylobacter was found in 17 out of 632 samples, in 6 (of 14) different bat species from diverse habitats. *Salmonella*, however, was never isolated. Since the aim was to determine the presence of both *Campylobacter* and *Salmonella*, splitting-up of the material and improvisations on the methods were necessary which could lead to an underestimation of the number of positive animals. The isolated strains are currently MLST-typed, preliminary results indicating *C. jejuni* strains similar to the types previously found in environmental waters, humans, wild birds, geese faeces and chicken.

Bats should be considered as carriers of *Campylobacter* and, where possible, necessary action should be taken to avoid contact between bats (faeces) and food/feed.

BATS AND WIND TURBINES: HOW AUTOMATIC ACTIVITY MEASUREMENTS CAN BE USED TO ASSESS THE COLLISION RISK

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In recent years it has become evident that bats are regularly killed at wind turbines. To mitigate the collision risk it is common to cut off wind turbines at times of high risk. However there are significant differences between wind turbines regarding the collision risk depending on the location, and individual surveys are necessary to assess times of especially high risk. A commonly used method is bat fatality searches that are often methodologically difficult, e.g. if the search area is

small due to high vegetation. Acoustic activity monitoring offers another reliable method to estimate the collision risk of bats at wind turbines.

We install automatic bat detectors with standardized calibration inside the nacelle of wind turbines. Bat calls in the rotor-swept area are registered throughout the whole season. These activity data are used to analyze correlations of activity height with meteorological parameters (wind speed, temperature). Furthermore seasonal patterns of activity, e.g. due to migrational movements, become evident. In addition, we use a statistical model based on data from 70 wind farms (Brinkmann et al. 2011, *Umwelt und Raum* 4, 457p) to estimate the number of bat fatalities during sampling time from activity and meteorological data.

The results of these surveys can be used in the planning process to assess if mitigation measurements are necessary to reduce collision risk. Curtailments can be fixed individually based on the analysis of weather and seasonal data. In the future we want to employ a new method to develop turbine-specific bat-friendly curtailment algorithms. If activity patterns are known the actual collision risk can be determined for 10 min intervals using only actual weather data and turbines are cut off when a certain threshold is reached. We propose that these methods will be useful to enable the growth of renewable energies without endangering bat populations.

BATS IN THE CITY OF VIENNA

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An extensive research project on the distribution of bats in the city of Vienna (Austria) was carried out from 2007 to 2010.

The city of Vienna covers urban areas, but also a wide range of different habitat types, including broadleaved forests ('Vienna Wood'), the river Danube and its riparian forests, and several large parks.

To cover the whole area of the city of Vienna (41.5 km²) a grid on the map was established, resulting in 101 elements (approx. 2.08 km x 2.50 km). Every element was checked for the presence of bats with the aid of ultrasound detectors for 3 hours in summer and 1 hour in autumn. Mist-netting and automatic sound recordings were carried out at selected sites. Additionally, data provided from other sources were included.

Special attention was directed to the four Natura 2000 sites situated within the boundaries of the city. Overall, nearly 5000 data sets of 21 bat species were collected.

The species most often detected were: Soprano pipistrelle (*Pipistrellus pygmaeus*), Common pipistrelle (*Pipistrellus pipistrellus*), Noctule (*Nyctalus noctula*), Savi's pipistrelle (*Hypsugo savii*), Serotine (*Eptesicus serotinus*).

Due to the great variety of habitats, Vienna also gives shelter to species one would not expect to be living in a big city, such as Bechstein's bat (*Myotis bechsteini*), Natterer's bat (*Myotis nattereri*), Geoffroy's bat (*Myotis emarginatus*) or the Lesser horseshoe bat (*Rhinolophus hipposideros*). Furthermore, the Alcatheo whiskered bat (*Myotis alcatheo*) was confirmed for the first time in Vienna with a female caught in a mistnet.

Distribution patterns of species groups, such as the genera *Pipistrellus* or *Plecotus*, indicated species-specific habitat selection within these groups.

To sum up, Vienna shelters at least 21 bat species, representing 75% of all the bat species known to live in Austria.

POPULATION DYNAMICS OF FOUR BAT SPECIES IN AUSTRIA

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We studied the population dynamics of bats in Austria over the last decade. Here we present data for four bat species: *Rhinolophus hipposideros*, *Myotis emarginatus*, *Myotis myotis*, and *Barbastella barbastellus*. Estimates of population trends were based on standardised counts in hibernation and maternity roosts. At maternity roosts bats were counted either inside the roosts or during their nightly emergence.

All four bat species showed a positive population trend. However, there were differences in the magnitude of the increase as well as in the variability of the data. The most striking increase was found for *Myotis emarginatus* with a 2.5-fold increase over 10 years. However, the estimates for this species also showed the largest confidence intervals.

For *Rhinolophus hipposideros* and *Barbastella barbastellus* the population increase was less pronounced, but significant, with a 1.8-fold and 1.6-fold population increase respectively. The only species with a more or less constant population size was *Myotis myotis*.

Interestingly, the estimated population trends for *Rhinolophus hipposideros* dif-

ferred depending on the method applied (i.e. hibernation vs. maternity roost counts). We provide possible explanations for these findings and discuss the results of all species with respect to methodological and conservation aspects.

WINTER ACTIVITY PATTERN OF SOPRANO PIPISTRELLES, *PIPISTRELLUS PYGMAEUS*, IN A COLONY IN SOUTHWEST NORWAY

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Little is known about the winter ecology of the Soprano Pipistrelle, *Pipistrellus pygmaeus*. Although common over large areas in South Norway, it was only recently documented as wintering, in coastal areas in the southwest where winter climate is considerably milder than elsewhere in Norway. Here a large number of *P. pygmaeus* was found in a wooden cabin in Sandnes, Rogaland county, in late autumn 2009. A study was initiated to identify the number of bats using the site and their seasonal attendance and activity patterns. Outside flight activity was monitored using an ultrasound logger close to the only entrance hole used (December 2009 - July 2011). Observer emergence-flight counts were made on warm evenings in spring, summer and autumn.

The bats used the cabin throughout the year, but not as a maternity roost. Examples of observed emergence counts are 136 individuals (21 May), 4 (30 June), 355 (27 August) and 108 (25 September). The level of activity (number of one-minute periods with echolocation recordings of *P. pygmaeus* per night) was generally highest in August-September, but was equally high during some mild nights in November - February. The two nights with highest measured activity were in January and December (731 and 654 minutes with activity respectively). Ambient temperature varied considerably during winter, but there were often temperatures below 0°C and snow on the ground. Although bats were most active during mild nights, relatively high activity was recorded also on some nights when temperatures were below 0°C. The lowest temperature with recorded echolocation activity was -16°C.

The function of the winter emergence flights is unknown. There is nothing for the bats to feed on, but they will be able to rehydrate (usually there are areas of open freshwater, otherwise snow to eat). The flights may also play an important social function.

CONSERVATION STATUS OF CAVE-DWELLING BATS IN WESTERN ROMANIA

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The carstic areas situated in the Pădurea Craiului, Bihor and Trascău Mountains (western Romania) are home to several important underground roosts, which shelter bat colonies in different periods of the year. In 2010-2011 this area was subject to a survey that targeted 67 underground roosts in different periods of the year. A total of 19 bat species were identified. The Greater and Lesser mouse-eared bats, *Myotis myotis* and *Myotis oxygnathus*, and Schreibers' bat, *Miniopterus schreibersii*, have the most significant nursery colonies in the area, numbering a few thousand individuals (*Myotis myotis* and *Myotis oxygnathus* - 7 colonies, with 500-4,500 individuals; *Miniopterus schreibersii* - 8 colonies, with 400-2,500 individuals). Also, one of the most important nursery colonies of the Mediterranean horseshoe bat, *Rhinolophus euryale*, in Romania is situated in the Pădurea Craiului Mountains, which represents the northern border of the species' distribution in the country. Beside the above mentioned species, during the hibernation period, the Greater horseshoe bat, *Rhinolophus ferrumequinum*, (maximum number/ cave - 489 individuals), the Lesser horseshoe bat, *Rhinolophus hipposideros*, (maximum number/ cave - 72 individuals) and the Common pipistrelle, *Pipistrellus pipistrellus*, (more than 30,000 individuals in a cave) also have important populations in the area. The largest *Miniopterus schreibersii* hibernation group amounts to 40,000-50,000 specimens. Parts of the underground sites are also important for autumn swarming, which fact has to be taken into consideration in the management of these sites. The main threats for bat colonies in the survey area are uncontrolled speleological tourism, disturbance in roosts, deforestation, water pollution, changes in landscape structure and in traditional agricultural practices. To protect the most important underground sites, in the near future 15 caves with bat colonies will be closed with grilles and fences, in a bat-friendly way.

HOW TO ASSES THE POTENTIAL IMPACT OF WIND TURBINES ON BATS USING BAT ACTIVITY SURVEYS? A CASE STUDY FROM POLAND

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In 2009 the coalition of Polish bat conservation NGOs developed national guidelines for assessment of wind turbine impact on bats, based on EUROBATS recommendations and considering regional aspects. The guidelines consist mainly of recommendations for research methods. Although they are widely used in Poland, there are problems with interpretation of results.

We analysed results obtained in studies conducted between 2009 and 2010 on 42 planned wind turbine sites in Poland (13,729 transect/point, 5-15 minute recordings). For each recording and species or species group we calculated 'activity indices' (number of 'activity units', i.e. up to 5 second long, continuous call sequences from one individual, per hour).

To evaluate the activity of bat species, we assumed the 25th, 50th and 75th percentile of non-zero activity index results as the upper thresholds for low (A), moderate (B) and high (C) activity, respectively. Activity above this level is considered very high.

We obtained the following A-B-C threshold values of activity indices: *Nyctalus* spp.: 2.5 - 4.3 - 8.6; *Eptesicus* spp.: 2.5 - 4.0 - 8.0; (*Nyctalus* + *Eptesicus* + *Vespertilio* spp.): 2.7 - 5.0 - 9.0; *Pipistrellus* spp.: 2.5 - 4.1 - 8.0; all species: 3.0 - 6.0 - 12.0.

In order to compare results from different wind farms, we suggest that average values for each separate part of the season, for a given transect section or point, calculated with special formulae, are used.

With some exceptions, we propose the following interpretation of activity indices with regard to mitigation measures (MMs), such as temporary shut down of wind turbines at night when wind velocity is <6 m/s:

0-A: No necessity to take MMs.

>A-B: If observed once, no necessity to take MMs; if observed regularly or in a significant part of the planned wind farm, consider MMs.

>B-C: Take MMs.

>C: If observed for a longer time, change the location of or withdraw from building the turbine, or shut it down overnight in periods of high bat activity.

GEOMYCOSIS IN WINTERING BATS IN THE OPAL MINES AROUND UPPER DUBNIK IN SLOVAKIA

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Opal mines around upper Dubnik are located in the eastern part of Slovakia. It is an important winter roost of several thousand bats among which the most abundant species are Greater mouse-eared Bat (*Myotis myotis*), Lesser horseshoe Bat (*Rhinolophus hipposideros*), Western barbastelle (*Barbastella barbastellus*) and Geoffroy's bat (*M. emarginatus*). During the census of wintering bats in 2010, we found *M. myotis*, *M. blythii* and *M. dasycneme* (100, 17 and 2 individuals) suspected of infection with geomycosis in this locality for the first time. From the collected samples *Geomyces destructans* was cultured and isolated. During a repeat census in 2011 geomycosis was again present, but the incidence had decreased. No winter mortality was recorded in conjunction with clinical signs of geomycosis. Our findings suggest that the opal mines around Dubnik are among the winter roosts most affected by geomycosis in Europe.

PHYLOGENY OF SOME VESPERTILIONID BATS FROM WESTERN AFRICA, SENEGAL - COMPARISON OF MOLECULAR AND CYTOGENETIC APPROACH

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The Vespertilionidae is the largest chiropteran family, comprising almost 50 genera and more than 400 species. Until recently, phylogenetic relationships among the vespertilionid bats were reconstructed mainly with the use of morphological characters and standard Giemsa stained or banded karyotypes. Recently, with the use of molecular techniques, many taxa within the family were taxonomically reevaluated, but the position of some lower-level taxa remains still not completely resolved. So far, the scientific attention of the phylogenetic studies has usually been focused more on Palaearctic and Nearctic zones, rather than on the

Afrotropics. In our study, we analyzed samples belonging mainly to the tribes Pipistrellini, Nycticeini and Vespertilionini collected during seven expeditions at fourteen collecting sites, mainly at the area of the Niokolo Koba National Park in the southeastern part of Senegal (western Africa). Phylogenetic relationships of selected bats from the genera *Myotis*, *Glauconycteris*, *Neoromicia*, *Laephotis*, *Nycticeinops*, *Scotoecus*, *Pipistrellus* originating from Senegal were investigated using non-differentially stained karyotypes and the sequences of five mitochondrial genes (cytochrome *b*, tRNA-Thr, 12S, tRNA-Val, 16S) and two nuclear genes (RAG1, RAG 2), together with data obtained from GenBank. Our findings indicate that current definitions of some genera do not represent phylogenetically natural groups and some species should be transferred to other genera. This is especially the case of several species which are now assigned to *Hypsugo*, *Laephotis* and *Neoromicia*.

MANY A MICKLE MAKES A MUCKLE – FEEDING STRATEGY OF THE EUROPEAN POND BAT

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We conducted a study of the diet of the federally endangered Pond bat (*Myotis dasycneme*) from different roost sites in northern central Europe. We identified 25 prey items. The most common groups of arthropods eaten were: Chironomidae (52% frequency), Trichoptera (6%) and Lepidoptera (14%). We detected temporal fluctuations over the sampled time, but no significant differences between sites. The main food source, mass-emerging chironomids, is consistent over time and space. This strategy, to hunt for low-nutrition prey which in turn are numerous and frequently available all the time, seems to be favourable for bats, especially during the maternity season. Later in the season prey with higher nutrition but lower abundance, compared to chironomids, is added to the diet such as Lepidoptera, Brachycera and Coleoptera. Additional faecal samples of Pond bats were analysed for fish-DNA, as no remains were found by morphological analysis. During the three-year sampling, up to 50% of samples from bats

caught during pregnancy (pre-partum) were positive for fish-DNA. Whether fish is an obligatory or facultative food source for Pond bats during gestation could not be shown yet. Overall, Pond bats show the importance of aquatic ecosystems and mass-emerging insects as food resources for insectivorous bats. As chironomids can be considered an un-limited food resource, other resources must be considered as the limiting factors for Pond bat populations within their distribution area, for instance their synanthropic roosting behaviour.

MITOCHONDRIAL DNA DIVERSITY OF THE NORTHERN BAT (*EPTESICUS NILSSONII*) IN FINLAND

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The patterns of genetic diversity in animal species are expected to bear signatures of their population history and population structures. Currently, little is known about the molecular diversity or genetic population structure of bats in Northern Europe. We have explored patterns of mitochondrial DNA sequence variation to clarify the genetic composition of the Northern bat (*Eptesicus nilssonii*), which is the northernmost of the Eurasian bat species, and has a broad distribution ranging from Siberia to Scandinavia. The current study is restricted to material from Finland.

From 68 bats collected throughout Finland, we sequenced part of the hypervariable segment II (HVII) of the mitochondrial control region, and from a subset of the individuals also a segment of the cytochrome b gene. The material mostly comprised museum specimens, but some samples from live bats were also included.

A high level of genetic variation was detected. Most conspicuously, the mitochondrial diversity of the Northern bat in Finland comprises two strongly diverged, distributionally overlapping lineages. In a previous cytochrome b study, these two lineages were found allopatrically in Siberia and European Russia, respectively (Artyushin *et al.*, *Zootaxa*, 2009, 2262, 40-52). This suggests a history where two Northern bat lineages that previously lived in isolation in Asian and European populations for hundreds of thousands of years have recently been remixed in Northern Europe.

There is considerable diversity within the European lineage of the Northern bat alone, which in Finland is divided into several sublineages. No strong geographical structure in Finland was seen, but at a lower level there was an indication of strict lineage segregation between local colonies.

A MAJOR BAT HIBERNACULUM IN CENTRAL POLAND – SPECIES COMPOSITION, PATTERNS OF CHANGE IN BAT NUMBERS AND THREATS

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The study was conducted in Baszta Michalowska - a small fort built of bricks and situated near the Narew river in Nowy Dwor Mazowiecki town. It was discovered by bat workers at the beginning of 2008 and appeared to be the largest bat hibernaculum in the Mazovia region (central Poland). A census carried out in 2009-2011 (once per month, in the first 10 days of each month) confirmed that it was a major roost for nine species, with Natterer's bat (*Myotis nattereri*) clearly dominant (over 85% of the total number of bats). There were three species from the European list of endangered bats (the Habitats Directive): Greater mouse-eared bat (*Myotis myotis*), Pond bat (*M. dasycneme*) and Barbastelle (*Barbastella barbastellus*). Bat abundance increased from October to February or March, then bats started to depart. The highest number was noted on 4 March 2011: 3363 individuals, which places this site as the second largest winter roost of bats in Poland (following Nietoperek Reserve). Some threats to this site are presented (human activity and a plan for renovation are the most dangerous).

ECOLOGY STUDY OF WHISKERED BAT (*MYOTIS MYSTACINUS*) IN SLOVENIA

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With the help of the molecular techniques, new cryptic species of bats are being described. This is also the case with the *Myotis mystacinus*-group in central Europe, from which *M. alcaethoe* was separated a decade ago. Older studies on the ecology of whiskered bat (*M. mystacinus*) have already been made, but there is now doubt whether they were actually performed by *M. mystacinus* s. str. No ecological study at all was performed in the northern part of the Balkan Peninsula before. In our study we observed a maternity colony of *M. mystacinus* during the roosting season three times a week, from April to September 2010. With visual observation and the help of heterodyne bat detectors we recorded the emergence time and nightly activity. Sex ratio of adult bats and of the juveniles

was determined with mist netting. Throughout the whole observational season, the microclimate conditions of the roost were recorded with the use of humidity and temperature data loggers. Bat faeces were also collected for further dietary analysis. Whiskered bats arrived at the roost on 29 April, their young ones were first observed on 25 June and the roost was abandoned around 20 August. Their number varied from 40 to 50 individual adults, which is probably the result of frequent roost changing, characteristic for this species. The captured adults were all females. The sex ratio between the juveniles was 1:1.25 in favour of females. Before the observation of the first newborn, there was an obvious drop in the number of emerging females. After parturition, the number of emerged bats increased and also the nightly activity around the roost intensified. The main prey of *M. mystacinus*, based on faecal analysis of 90 samples, are Diptera, Arachnida and Lepidoptera. These are our initial observations with further analysis to follow.

RABIES AND BAT CONSERVATION IN EUROPE

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Despite two fatal human bat rabies cases in the former Soviet Union in respectively 1977 (Ukraine) and 1985 (Russia) the occurrence of rabies in European bats was regarded as unimportant and not a potential danger for public health until 1985. However, since in autumn of 1985 a woman in Denmark was bitten by a rabies-positive Serotine bat, *Eptesicus serotinus*, and a bat scientist in Finland died from rabies the interest to test bats for rabies started in several countries. Bat rabies became a new phenomenon for many public health authorities and rabies researchers in Europe. But bat rabies became also a new problem in the world of bat conservation. Bats are legally protected in most European countries and some international treaties and the national nature conservation legislations prohibit the deliberate capture and killing of bats except with permission by the competent authorities. However, bat rabies research is necessary to gain an insight whether bat rabies is a real problem for public health and whether bat conservation is conflicting with public health in some occasions. Therefore, it is important to know which species have prevalence for rabies and in which incidence. Passive surveillance of bat rabies in grounded bats can give information about such prevalence but additional active surveillance is required to identify the real incidence of rabies in particular species in natural situations. Some bat species are dwelling in houses and other buildings where men are living and working. The Serotine

bat, the main carrier of bat rabies in Europe, is such a building dwelling species. This species generally roosts well hidden in cavity wall, eaves or other inaccessible places for men and pets, and occasionally and by accident comes into rooms of buildings. Therefore they are seldom in direct contact with men. The conservation of building dwelling species depends to a large extent into the tolerance of tenants and other users of buildings. The knowledge about the occurrence of bat rabies, the prevalence of rabies in bat species, and the possible risk for public and animal health is also important for bat conservationists to improve public awareness for bat conservation in conjunction with public health. There should be, therefore, a good co-operation between bat conservationists and rabies research and public health bodies.

DIET OVERLAP AND STRESS CONDITION IN A MULTISPECIES *PTEROPUS* COLONY IN SYDNEY (AUSTRALIA).

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Resource competition is an ecological constraint considered to influence some bat species' distribution. Competition between species is highly difficult to determine and monitor because of the multiple variables involved (foraging areas, diet composition, roost availability, behaviour, survival and mortality rates, among others) and the evident lack of a specific methodology to assess it. The use of non-invasive techniques to quantify the stress hormones in faecal samples in wild animals is nowadays increasing because of their multiple advantages (it is not necessary to capture the individuals and disturb them; the measurements are not affected by your own handling, etc.).

This study includes two different parts: a diet composition comparison in order to detect diet overlap in a mixed *Pteropus* colony (*P. poliocephalus* and *P. alecto*) and a glucocorticoids levels comparison in faecal samples of the species involved, which relates to the stress level of the individuals.

The sampling sessions were carried out from May to June 2010 by mist-netting; all individuals (N: 373) were aged, sexed, and faeces were collected to analyse the stress hormones. The Enzyme Immunoassay (EIA) was used to detect the

conjugates of corticosterone in the faeces. Results were compared with the body condition indexes and references for *Pteropus poliocephalus* in captivity for a biological validation.

The results show an evident overlap on the diet composition, with significant differences within species: *P. alecto* fed mainly on different kind of palm trees and Myrtaceae, and *P. poliocephalus* on *Ficus* and Myrtaceae. On the other hand, males and adults showed higher stress levels. Although it is difficult to establish the relation between diet composition and stress, considering the results, corticosterone levels in the faeces in mixed colonies seems to be a suitable non-invasive monitoring method to assess the degree of interspecific stress condition.

PARTI-COLOURED BAT (*VESPERTILIO MURINUS*) FOUND IN ESTONIA DURING WINTER

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Parti-coloured bat (*Vespertilio murinus*) is considered a migratory species, whose breeding colonies occur in central and north-eastern Europe. It often hibernates in southern Europe. Bat-banding has confirmed the existence of the long-distance flights this species undertakes twice a year. Bat detector-based observations have revealed that during the late-summer migration it aggregates on the Estonian coasts. However, not all individuals migrate to the south for winter. During the 20th century single hibernating individuals of this species were found in Leningrad oblast of Russia. Recently, single individuals have been found in Lithuania almost every winter, probably caused by climate warming. Thus far this species has been found in Estonia only during spring and summer (from May till September). Surprisingly, *V. murinus* was found in two major Estonian towns (Tallinn and Tartu) in the winter of 2010/2011. In Tallinn, an active animal was hanging on the wall of a stone building situated near the city centre (Maakri 23A) at 7 p.m. on 2 Dec, 2010. Earlier in the same day, large icicles were chopped from the roof of a nearby building, which might have caused the arousal of this animal. In Tartu, an active bat was found in a modern building situated near the city centre (Vike-Turu 8) on the evening of 15 Feb, 2011 during a period of prolonged frost. It probably hibernated in a ventilation system until frost forced it to move further inside the building. At midday of Feb 18, the bat made noises in one of the rooms of this building, was then caught and shown to bat experts. It was a young female of *V. murinus* (forearm 43 mm, body weight 11.8 g). The

bat was fed with *Tenebrio* larvae (twice a day, each time with 8-10 larvae) till the evening of 21 Feb, when its body weight had increased to 12.6 g.

TRAINING FOR CATCHING BATS

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Bat-catching is a survey technique complementary to other survey methods that allows the answering of scientific or conservation questions. It may be used to confirm species, sex and breeding status, to sample biological tissues or to fit radio-transmitters for further survey work. Given the protected status of all bat species and the fact that this method is invasive, it is essential that bat workers undergo theoretical and practical training in the best interests of the bats. In the context of the French national action plan for bat conservation and in response to requests from volunteer and professional naturalists, a training system is being set up in the French bat workers' community. Training tools (training log, internships) and the procedure for the implementation of the system within the network will be presented in order to compare and discuss what is done in other European countries.

TADARIDA HIGH, PIPISTRELLUS LOW IN LA GOMERA

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The Canary Islands are known as a 'laboratory of evolution'. According to literature, the following four bat species are known from La Gomera Island, Spain: *Barbastella barbastellus*, *Pipistrellus maderensis*, *Hypsugo savii* and *Tadarida teniotis*. In the ultrasound pulses of an European *Tadarida* peak frequency (PF) should be 8-15 kHz, while in *P. maderensis* it should be 42-49 kHz. However, in La Gomera PF 51-59 is also common for *Pipistrellus* (Skiba, R. 2003. Europäische Fledermause. Die Neue Brehm-Bucherei, 648, 212 pp.). Thus, a bat observer can expect the sounds of pipistrelles with PF between 42 and 59 kHz in La Gomera. During my visit to this island in December 2010, I recorded the sounds of flying bats using a Pettersson D240x detector. To my surprise the sounds were 'slight-

ly' different from what I had expected -- *Tadarida* was calling too high while some pipistrelles were calling too low! When flying high over banana fields the *Tadarida*-type bats emitted pulses with PF 12-17 (mean 15.5) kHz. Pipistrelles flying along streets or small roads at Valle Gran Rey usually emitted pulses with normal (*maderensis*-type) PF. But sometimes bats with lower PF (38-41 kHz) appeared. When flying over rocky slopes these low-frequency pipistrelles emitted pulses with even lower PF (37 kHz). Those bats certainly could not belong to *P. maderensis*, the only pipistrelle known to live in La Gomera. In continental Europe the latter pulses could belong either to *P. nathusii* or *P. kuhlii*, which are better separated by their territorial calls. Unfortunately, I did not hear those calls in La Gomera. Thus, it can be assumed that the low-frequency pipistrelles might belong to one of those species. But what about the high-frequency *Tadarida* in La Gomera? Could this be a 'laboratory of evolution' in action?

MONITORING BATS IN VILNIUS DURING SPRING AND SUMMER

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Bats were counted in Vilnius using an ultrasound detector and the point counting method (PC). The aim was to ascertain which bat species occur in this town, how abundant they are, and in which habitats they fly. In August 2007 and May 2009 counts were carried out in the following 6 areas (habitat types): A) banks of River Neris in city centre, B) banks of River Neris away from city centre, C) 'Vilnia' park in city centre, D) Verkiai park away from centre, E) Verkiai forest, and F) Shilas forest. Counts were carried out during all parts of the night, always in good weather. Thus, essential monitoring rules were followed. On riverbanks the counting time was 15 min at each point while in other habitats it was 5 min per point. Total counting time at each habitat type was 60 min. Sound samples were taken to correctly identify both the species and the number of animals. The latter was transferred into a PC index (bat-call-minutes per hour, also considering the number of bats heard during each minute). The following PC indices were received (habitat types A-B-C-D-E-F): *Myotis dasycneme* (0-2-0-0-0-0), *M. daubentonii* (3-28-10-3-0-0), *Plecotus auritus* (0-0-0-4-1-0), *Barbastella barbastellus* (0-0-0-3-1-6), *Pipistrellus nathusii* (29-8-0-3-2-1), *P. pipistrellus* (3-0-0-0-0-0), *P. pygmaeus* (1-1-0-0-0-0), *Eptesicus serotinus* (29-0-4-1-2-1), *E. nilssonii* (7-34-0-1-2-0), *Vespertilio murinus* (0-5-0-0-0-0), *Nyctalus noctula* (5-3-2-9-0-0) and *N.*

leisleri (6-0-0-0-0). The highest concentrations of flying bats were observed by riverbanks with trees, also in Verkiai park. *Myotis*-bats avoided the river in the city centre. Relatively low levels of activity were recorded in Verkiai forest and 'Vilnia' park. Our study can be used as a reliable source for monitoring bats in Vilnius, and for estimating the conservation value of different habitats bats use in this magnificent city.

RECORDS OF ECTOPARASITES (GAMASIDA, IXODIDA, DIPTERA) ASSOCIATED WITH BATS FROM EASTERN ROMANIA

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There are few records of ectoparasites on bats from Romania. Starting in 2004, ectoparasites were collected from 228 chiropterans, belonging to 16 species: *Barbastella barbastellus*, *Eptesicus serotinus*, *Myotis bechsteinii*, *Myotis brandtii*, *Myotis daubentonii*, *Myotis emarginatus*, *Myotis myotis*, *Myotis mystacinus*, *Myotis oxygnathus*, *Nyctalus noctula*, *Pipistrellus kuhlii*, *Pipistrellus nathusii*, *Pipistrellus pygmaeus*, *Plecotus auritus*, *Miniopterus schreibersii* and *Rhinolophus mehelyi*. The bats were captured in 13 roost sites from the east of the country (ten caves, two buildings and one forest). Altogether 1587 ectoparasites were identified from 35 species, 14 genera, 8 families and 2 classes. Of these, ten species are reported for the first time in Romania, while new host and distributional data are presented. Associations between parasites and hosts are also reported. Regarding the affinities between parasites species, the highest affinity is between the dipterans *Penicillidia conspicua* and *Nycteribia schmidlii*, which together with *Ixodes simplex* and *Spinturnix psi* are considered as the typical parasite fauna of *Miniopterus schreibersii*. *Nycteribia pedicularia*, *Nycteribia kolenatii* and *Spinturnix andegavinus* are linked, because we found these species mostly on *Myotis daubentonii*. High association between *Spinturnix myoti*, *Ichoronyssus scutatus* and *Penicillidia dufourii* reflects that they were recorded only on *Myotis myotis* and *Myotis oxygnathus*. The same can be argued for *Spinturnix acuminatus* and *Steatonyssus noctulus*, which from our data can be identified as the parasite group of *Nyctalus noctula*, together with *Macronyssus flavus*. About the affinities between host species, the first group is formed of *Pipistrellus pygmaeus* and *Pipistrellus nathusii*, which, together with *Pipistrellus kuhlii*, show a high affinity as a consequence of the tick *Argas vespertilionis* and *Steatonyssus* sp. The second

group includes *Myotis myotis* with *Myotis oxygnathus* and *Miniopterus schreibersii*. These species host parasites in common because they form mixed maternity colonies.

WHETHER THE POPULATION IS RISING OR STABLE, SPECIES CAN HAVE UNFAVOURABLE CONSERVATION STATUS – EXAMPLES FROM SLOVENIA

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The EU Habitats Directive, as the key instrument for biodiversity conservation in the European Union, dictates that species have favourable conservation status if: i) a population can maintain itself on a long-term basis, ii) natural range is not being reduced, and iii) there is and will be a sufficiently large habitat to maintain population on a long-term basis.

Results of monitoring of hibernacula (*Rhinolophus hipposideros*) and maternity roosts (*R. hipposideros*, *Myotis myotis*) from 1999 to 2011 show a growth of *R. hipposideros* population (hibernacula counts: +5.2%, 0.6% per year; TRIM) and for *M. myotis* at least stable numbers in specific groups, but in some cases even an extraordinary increase. To our knowledge no shrinkage of natural range of both species has occurred. However, both species are rapidly losing their maternity roosts, the majority of which are situated in attics and belfries. Since 1993, 472 maternity roosts of *R. hipposideros* were recorded in Slovenia. In the years 2008-2010, we inspected 197 roosts and discovered that 8% of them had been destroyed, 3% degraded, and we prevented destruction of an additional 3%. The situation is even worse for *M. myotis*. Since 1999, 58 active maternity roosts have been recorded and, additionally, at least 5 already destroyed roosts have been recorded. Monitoring in 2008-2010 has shown that altogether 21% of maternity roosts of *M. myotis* had been destroyed, 10% degraded and we prevented the destruction or degradation of an additional 3% .

Based on growing or stable population number (Condition i) or retaining natural range (Condition ii), both species are doing reasonably well. Nevertheless, with continuation of loss of nursery roosts, both species cannot maintain population on a long-term basis (Condition iii). Therefore, in Slovenia, *R. hipposideros* and *M. myotis* should be regarded as species with unfavourable conservation status.

A PICTURE OF BAT ACTIVITY AT A CAVE ENTRANCE IN AUSTRIA

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We studied the activity of bats at a cave entrance in Styria, Austria from 13 July until 28 December 2009. Thus, we included the period for autumn swarming followed by the winter activity.

The species assemblage of the cave includes species that are hard to capture, such as *Rhinolophus hipposideros* and species that are difficult/impossible to distinguish from their ultrasound calls, such as *Myotis mystacinus* and *Myotis brandtii*.

Therefore, we used infrared light beams and automatic photography of bats to get reliable results for species that are poorly understood in terms of swarming and winter activity respectively.

More than 109,900 flights into the cave and 101,240 flights out of the cave were recorded during our study period, with 50% of the recordings between mid-August and mid-September. Subsequently the activity at the cave continuously declined. However, we found bat activity on every single day of the study period, even at very low ambient temperatures.

We were able to take 67,769 pictures of bats flying into the cave (= 62% of all flights into the cave). The pictures were assigned to 11 bat species or species groups. By far the most numerous or active bat at the cave was *Rhinolophus hipposideros* (87.9 % of all pictures). Other active species were *Myotis emarginatus* (4.4 %), *Pipistrellus* spp. (3.3 %), *Barbastella barbastellus* (1.6 %) and *Rhinolophus ferrumequinum* (1.5 %). The following species were photographed in much smaller numbers: *Myotis daubentonii*, *Myotis mystacinus* or *M. brandtii*, *Eptesicus serotinus*, *Plecotus* spp., *Myotis myotis* or *M. oxygnathus*, and *Myotis nattereri*.

For five bat species we present species specific activity patterns and we use the results of the activity recording for comparison with the visually counted bats during the hibernation count.

CIRCULATION OF GROUP 2 CORONAVIRUSES IN A BAT SPECIES COMMON TO URBAN AREAS IN WESTERN EUROPE

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Fecal samples of 211 bats representing 13 different bat species from 31 locations in the Netherlands were analysed for the presence of coronaviruses using a genus-wide RT-PCR. Coronaviruses are known for their high potential for interspecies transmission, including zoonotic transmission with bats as reservoir hosts. For the first time a group 2 coronavirus was found in a bat, *Pipistrellus pipistrellus*, in Europe. This is of particular interest for public health as the reservoir host is a species that is common to urban areas in most of Europe and notorious for its close interactions with humans. Four vespertilionid bat species were found to excrete group 1 coronaviruses, viz. *Myotis daubentonii*, *M. dasycneme*, *P. pipistrellus* and *Nyctalus noctula*. The last species is a newly identified reservoir. The overall prevalence was 16.9% and positive bats were found at multiple widespread locations. The circulating group 1 coronavirus lineages were rather species-associated than location-associated.

ROOST SELECTION AND SITE FIDELITY OF BATS USING BAT BOXES

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Roosts are of great importance to the survival of bats as they provide shelter from predators and weather conditions. Since bats spend up to 20 hours a day in their roosts they are one of the key elements in bats' habitats. Roosts also enable females to rear their young in a more or less stable environment. In this study we looked at the factors determining the usage of bat boxes and the site fidelity of bats in Southern Finland. 76 sawdust-concrete bat boxes were monitored in 10 areas from 2004 to

2009. The boxes were checked several times each summer and bats found roosting in them were ringed. To describe the habitats surrounding the boxes, the number of coniferous and deciduous trees, canopy coverage and openness near the boxes were measured. The ringed bats were mostly Daubenton's bats and Brown long-eared bats. No maternity colonies were found in the boxes but several groups of up to 30 individuals used the boxes as day roosts. These groups consisted of both males and females and the sex ratio of the groups varied during summer and between species. Some individuals came to the same boxes in several years showing site fidelity. Bats favored boxes with open surroundings and old boxes were chosen over new ones. The tree composition near the box or the aspect of the box did not affect the usage of boxes. Our results suggest that bat boxes are not important for maternity colonies. Buildings near the boxes may offer more stable conditions for the nursery groups. In the Northern conditions the temperature of the roost may be crucial for bats.

As roost selection is a major part of the habitat selection of bats, we also discuss the implications of our results for bat conservation.

KILLER AT THE DOOR: BARN OWL PREDATION PATTERN ON BATS IN A SARDINIAN CAVE

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The night life offers for the bats at least better protection from many flying predators, a wide niche for feeding, and the possibility to avoid the risk of hyperthermia, as cited in many studies on the night life of this Order. Among natural predators, of course, the owls are the most important, especially in our temperate bioclimate. Here, we examine a particular case of predation by Barn owl (*Tyto alba*) nesting in a crevice at the entrance to an important cave roost for a mixed colony of bats. Thanks to the assistance of M. Mucedda of the Sardinia Center for Bat Research, we visited the cave Sa Rocca Ulari close to Borutta (SS), in northern Sardinia. The cave is a reproductive or wintering refuge for 7 bat species. The entrance is at 485 m.

Here pellets and remains were collected in a crevice under the nest of a pair of *Tyto alba ernesti*, the endemic subspecies of Barn owl.

The analysis of prey was carried out on 228 specimens.

Remarkably, the numerical percentage of Chiroptera in the prey was 12.7%. Other prey in percentage, quoted in brackets, were Insectivora (35.5), Rodentia (49.1), Aves (1.8) and Invertebrata (0.9).

For the first time there are data on predation on *Myotis punicus* (1.8%) and *Rhinolophus mehelyi* (with one case). Both these species have not previously been quoted in Europe as prey of barn owl.

Also, *Miniopterus schreibersii*, the most abundant species in the cave, represents alone 10.5% of the prey. The ecological consideration of the site and on the prey-predator relationships is also described.

HOMERANGES OF BECHSTEIN'S BATS OVERLAPPING A MOTORWAY

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Causing fragmentation and increasing mortality, motorways pose a threat to many bat species. Especially for clutter-adapted bats, motorways are considered to have a barrier effect on their flight paths. To mitigate for the fragmentation of habitats, green bridges are built to regain connectivity for the local populations. Yet little is known about the acceptance of green bridges by clutter-adapted bat species.

As a representative of the group of gleaning bats, we investigated the habitat use of Bechstein's bat (*Myotis bechsteinii*) before and after the construction of a green bridge over an existing motorway in Germany. For our study we examined a very healthy maternity colony of approximately 100 adult females using an ancient 32 ha oak forest cut by the motorway A1 south of Wittlich in Rhineland-Palatinate. The spacial behaviour of the colony was monitored by radio-tracking of 19 females in 2006, 2008 and 2009.

In 2006, before the green bridge was built, half of the radio-tracked females crossed the gap each night, foraging on both sides, in spite of the complete absence of connecting elements bridging the motorway. As early as one month after opening the green bridge in 2008, it was used by bats - the majority being *M. bechsteinii*. In 2008 and 2009 the colony roosted on both sides of the motorway. This was the first proof of roost switching over a heavily used motorway. In both years, the green bridge was used for crossing the motorway by only one of the radio-tracked females.

Although being a heavily trafficked motorway, the A1 does not seem to have a barrier effect on the investigated colony. One obvious reason is the degree of fragmentation and size of ancient woodland available. Another crucial point is the motorway design. In the area where most of the animals crossed, the A1 cuts into the landscape, making it easier for animals to cross the gap.

GENETIC STUDY OF *PIPISTRELLUS PIPISTRELLUS* AND *P. PYGMAEUS* FROM CENTRAL EUROPE SUGGESTS INTERSPECIFIC HYBRIDIZATION

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We analyzed genetic variation at eight nuclear microsatellite loci from 353 individuals of pipistrelle bats *Pipistrellus pipistrellus* and *P. pygmaeus* from Poland. Our aim was to resolve and compare the population structure of these two cryptic species, and to assess their species status in general (level of inbreeding, presence of a bottleneck effect). We document many similarities between the species in respect to heterozygosity, allelic richness, genetic distances, mean relatedness and inbreeding coefficients. However, we also show differences in population isolation and migratory patterns, pointing to *P. pygmaeus* as the more migratory species. We present evidence for recent bottlenecks and high levels of inbreeding in both taxa. Finally, we present a surprising result, contradictory to other recent studies, suggesting species hybridization. Hypothesis of species hybridization was confirmed by three different analyses, two based on the Bayesian approach, but with different assumptions, implemented in New Hybrids and Structure, and one based on genetic distance differences between the individuals (Principal Coordinate Analysis). The overall hybridization rate, depending on the assumed threshold values, ranged from 2% to 12% of introgressed individuals for both species.

BATS AND TRANSPORT INFRASTRUCTURE

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Even if their impacts on bats are still poorly understood, it is certain that transport infrastructure constitutes a physical barrier to bat movements and is probably a major cause of mortality as a result of collisions. Nevertheless, bats appear to make use of some facilities such as underpasses or overpasses in order to negotiate safely these breaks in their routes. The aim of the studies that have been undertaken in this area is to ascertain the effectiveness of these structures and investigate the behaviour of bats in the vicinity of infrastructure.

To this end, monitoring was conducted in 2010 at 20 crossing points on nine roads with a large variety of characteristics. The monitoring protocol involved installing automatic counting stations (Anabat) for 7 days during two or three periods in the year when bat species are likely to be moving. In addition to this protocol, listening surveys were conducted with a detector above the road and in its vicinity. Finally, the behaviour of bats was studied by means of direct visual observations at dusk and the use at one site of a thermal camera (FLIR SC660).

Our monitoring activities confirmed the importance of the crossing points as a means of re-establishing the flyways of certain species. The first impression was that underpasses appear to be more effective, overall when water is present. The studied crossings seemed to be more effective when the landscape structures on either side of the road were restored and connected to the crossing. Lastly, it was also shown that large structures can act as 'guidance' structures for crossing watercourses.

The next step is the evaluation of the benefits of certain ancillary facilities, the specific studies of small structures and the publication of methodological guidance in order to take bats into account in transport infrastructure.

NEW RECORDS AND ECHOLOCATION CALLS OF BATS FROM OMAN

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Twenty-one bat species were recorded during two field trips organised to three basic natural regions of Oman in 2009 and 2011: (1) Al Hajar Mountains and surrounding lowlands at the coast in the north-east, (2) central Omani deserts, and (3) Dhofar region in the southwest of the country. Echolocation calls were recorded using portable bat-detectors directly from bat roosts and/or during search flights of active bats. More than 700 recordings were analysed using acoustic software and based on confirmed species identifications (from animals determined by netting or roost checks). Basic echolocation characteristics (e.g. pulse duration, inter-pulse interval, maximum, start and/or end frequency) of search calls were described and analysed for 13 bat species (*Rhinopoma muscatellum*, *Taphozous nudiventris*, *Asellia tridens*, *Triaenops persicus*, *T. parvus*, *Myotis emarginatus*, *Eptesicus bottae*, *Rhynptesicus nasutus*, *Hypsugo ariel*, *H. arabicus*, *Pipistrellus kuhlii*, *Otonycteris hemprichii*, and *Tadarida aegyptiaca*). As a tool for future field surveys with the help of bat-detectors, discriminant analysis of revealed call characteristics was performed.

IMPORTANCE OF ROOT CELLARS FOR HIBERNATION OF BROWN LONG-EARED BATS (*PLECOTUS AURITUS*) AND NORTHERN BATS (*EPTESICUS NILSSONII*) IN LATVIA

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There are few natural hibernation sites containing large numbers of bats located in northern and north-eastern Europe. It is believed that populations of hibernating bat species largely depend on artificial shelters. The largest hibernacula in this region are found in a few fortifications, large cellars and mines. Another type of hibernaculum is small root cellars, which are widely used by rural populations to store vegetables during winter. However, surveys of this type of hibernaculum have been carried out only in a few countries, such as Poland, Estonia and Sweden.

The purpose of this study was to summarise all data about hibernating bats in small cellars in Latvia collected since 1977, and to compare the species composition with that in other countries.

Until 2010, data on hibernating bats was collected by bat experts, who randomly visited cellars throughout the territory of Latvia. In the winter of 2010/11, a campaign was organized, in which people were asked to report about bats in their cellars, sending data supported by photos to bat experts.

In total 683 bat-inhabited cellars were recorded. *Plecotus auritus* was found in 87% and *Eptesicus nilssonii* in 30% of the inhabited cellars. Two other species were found only exceptionally - *Myotis daubentonii* (3 cases) and *Barbastella barbastellus* (1 case). The numbers of both *P. auritus* and *E. nilssonii* per inhabited cellar were relatively small: on average 3.01 and 2.30 individuals respectively. However we conclude that small cellars because of their countrywide distribution are of great importance as hibernacula for these two species in Latvia. We found similar species composition to that in Sweden and Estonia, but it differed significantly from data obtained in Poland.

DIFFERENT ILLUMINATIONS OF BUILDINGS WITH BAT ROOSTS AND THEIR IMPACT ON BATS

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Light pollution, increased illumination during the night due to artificial lighting, presents a threat to biodiversity that is still poorly understood. Bats are nocturnal animals and as such can be affected by artificial night lighting in different ways: either directly at the roosts, on flight paths and at feeding grounds, or indirectly via negative impacts on diversity and abundance of their insect prey. Many bat nursery colonies are established in buildings of cultural heritage such as churches, which are lit during the night for aesthetic reasons. In a project conducted by six Slovenian partners, we will check whether illumination can be set up in a less polluting way and less disturbing for bats and moths. Bats are monitored in different parts of Slovenia at nine churches, which are organized in triplets according to their geographic position. During a three-year project we will observe how different types of illumination affect the evening emergence time, emergence behaviour and juvenile growth in the lesser horseshoe bat (*Rhinolophus hipposideros*) - a species that in Slovenia forms nursery colonies almost exclusively in buildings. We will observe bats under three different conditions: (1) the original (exaggerated) illumination; (2) illumination with specifically designed lamps

with yellow-orange light and (3) illumination with specifically designed lamps with bluish-white light. The new lamps have a decreased light intensity, tend to reduce the lighting at flight openings and have a UV filter. In some cases their number at a church is reduced. Preliminary results of the first field season in 2011 are presented. The study is a part of a project titled Life at Night - Improving the conservation status of nocturnal animals (moths and bats) by reducing the effect of artificial lighting at cultural heritage sites, and is being co-financed by the European Commission via the Life+ Programme (No. LIFE09 NAT/SI/000378).

NIGHT ACTIVITY OF POND BAT (*MYOTIS DASYCHEME*) AT A NURSERY ROOST, REVEALED BY INFRA-RED CAMERA

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Despite the fact that, in some regions of Europe, numerous and easily available populations of Pond bat (*Myotis dasycneme*) still occur, research on ecology and ethology of this threatened, trawling vespertilionid is relatively scarce. The aim of this study was to examine patterns of emergence, return and associated behaviour of Pond bats from a nursery roost in Poland. We focused on a comparison of activity patterns between pregnancy and lactation, as female bats are known to show different energy demands in those two periods. All bat movements through the entrances were monitored using Infra-Red cameras, while data on weather conditions were recorded with an automatic weather station. In May, during late pregnancy, only one evening peak of emergence (starting between 15-30 min. after sunset, with maximum between 45-60 min.) was observed and almost no bat returned to the colony until c. 2.5 hours before sunrise, when the 'dawn' arrival started (peaking at 0.5-1.0 hour later). In July a second, smaller peak of emergence appeared at dawn, however it cannot be associated with a bimodal pattern of foraging activity (an interpretation given to known data on emergence of aerial-hawking species), because almost no arrivals were noted during the night but only before sunrise, just as in May. On the contrary, we supposed that the 'dawn' peak of emergence is associated with the first flights of juveniles, while the foraging pattern of adult bats remains constantly unimodal during both pregnancy and lactation. Many more bats appeared at the entrance but did not depart in July than in May, also suggesting that a significant proportion of the bats involved in such behaviour were newly volant young. Rain delayed emergence by about 1.5 hour. The study will continue, covering the remaining part of the breeding period.

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