

ACADEMY OF SCIENCES OF THE CZECH REPUBLIC  
**INSTITUTE OF VERTEBRATE  
BIOLOGY**



BIENNIAL REPORT

**2013–2014**

BRNO 2015

## RENEWED INFRASTRUCTURES

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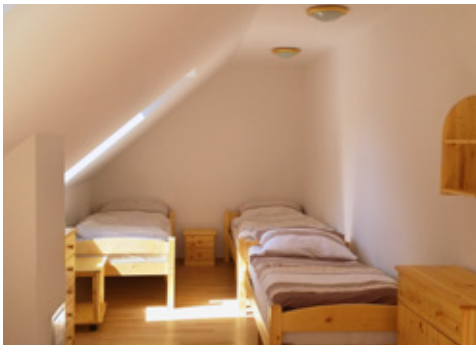


before



after

### MOHELNO FIELD STATION



accommodation facility



new lecture hall

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## STUDENEC RESEARCH FACILITY



2012



2013

*(Photo by P. Bártoová)*

# BIENNIAL REPORT

INSTITUTE OF VERTEBRATE  
BIOLOGY

ACADEMY OF SCIENCES  
OF THE CZECH REPUBLIC

2013–2014



## BRNO 2015

### BIENNIAL REPORT 2013–2014

A periodical continuation of the Institute's previous bulletins: *Vertebratologické Zprávy* (1969–1987), *Zprávy ÚSEB* (1988–1991) and the *ILE Biennial Report* (1993–1994).

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Front cover: A pair of European bitterling (*Rhodeus amarus*) prior to oviposition in a unionid mussel.

(*Photo by C. Smith*)

Back cover: Experimental pools situated at the institute garden are routinely used for long-term mesocosm experiments with bitterling fish. (*Photo by M. Reichard*)

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# CONTENTS

PREFACE .....	5
<b>1. BASIC FACTS .....</b>	<b>7</b>
STRUCTURE OF THE INSTITUTE OF VERTEBRATE BIOLOGY AS CR .....	7
STAFF AND BUDGET .....	8
Addresses .....	11
HEADQUARTERS .....	11
RESEARCH FACILITIES .....	11
FIELD STATION .....	11
MANAGEMENT AND SERVICES .....	11
BOARD OF THE INSTITUTE .....	12
SUPERVISORY BOARD .....	12
RESEARCH STAFF .....	13
<b>2. RESEARCH PROJECTS .....</b>	<b>19</b>
Projects supported by the Grant Agency of the Academy of Sciences of the Czech Republic (GA AV ČR) .....	19
Projects supported by the Czech Science Foundation (GA ČR) .....	19
Projects supported by the Ministry of Environment .....	20
Projects supported by the Ministry of Education, Youth and Sport .....	21
International projects .....	21
<b>3. SCIENTIFIC RESULTS .....</b>	<b>23</b>
SUMMARY OF PUBLICATION OUTPUT .....	23
Geographical distribution of selected research activities abroad .....	25
Complete list of publications .....	26
Books, textbooks, edited proceedings .....	26
Chapters in books .....	26
Papers in journals included in the databases Web of Science .....	26
Papers in other refereed journals .....	41
Papers in proceedings .....	42
Book reviews .....	43
Popularization books and articles .....	43
<b>SELECTED SCIENTIFIC ACHIEVEMENTS .....</b>	<b>46</b>
EVOLUTIONARY ECOLOGY .....	49
BIODIVERSITY .....	65
PARASITES AND DISEASES .....	79
<b>4. OTHER ACTIVITIES .....</b>	<b>91</b>
MEETINGS ORGANISED BY THE INSTITUTE .....	91
POPULARISATION ACTIVITIES AND COLLABORATION WITH UNIVERSITIES AND HIGH SCHOOLS .....	95
MEMBERSHIP IN EDITORIAL BOARDS .....	99

<b>  EDUCATION AND TEACHING ACTIVITIES .....</b>	<b>100</b>
Teaching at universities .....	100
Supervising of university students .....	100
PhD students working at the Institute and/or supervised by the Institute's fellows over 2013–2014.....	101
PhD theses defended over 2013–2014 and supervised by the Institute's fellows:.....	103
<b>  EDITORIAL ACTIVITIES .....</b>	<b>104</b>
<b>  AWARDS .....</b>	<b>105</b>
<b>  OBITUARIES .....</b>	<b>106</b>



## PREFACE

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Dear reader,

It is my great pleasure to introduce you to the Biennial Report of the Institute of Vertebrate Biology (IVB) for 2013–2014. The major goal of this traditional publication is to provide both a representative overview of the extensive range of research activities undertaken at the IVB and to inform the reader about the most important news and events occurring at the IVB over 2013–2014, all in a style that is fully accessible to the interested layperson. Furthermore, the report is a means of advertising our achievements to the wider research community, of attracting new students and post-doctoral researchers and of providing a baseline against which to measure our future progress.

At the IVB, we focus on advanced research at the frontiers of evolutionary ecology, biodiversity and medical zoology and the studies undertaken have both fundamental and applied significance. The majority of scientific papers resulting from these studies have been published in high ranking journals; indeed, the last two years can be considered the most productive in the history of the IVB in terms of both scientific output measured by simple criteria such as number of papers and Impact Factors achieved.

Our research is distinctly based on broad international collaboration and I believe that you will find the vast majority of our results to be both novel and exciting. Of particular note in recent years has been the active involvement of IVB fel-

lows in educational activities and science popularisation. Several educational projects have recently been successfully completed, supported through the European Social Fund via the Education for Competitiveness Operational Programme. Furthermore, our huge participation in education activities at Czech universities, and the amazing number of graduate and post-graduate students (more than 100) studying with us, is further strong evidence of the IVB's important position in the Czech educational system.

Our scientists are highly competitive and successful in obtaining research grants and effective in fund-raising from both national and foreign sources. These research grants and other contract funds contributed significantly to the IVB budget, representing an additional 45 and 44 million CZK in 2013 and 2014, respectively. At this point, I would like to express my deepest appreciation to all the fellows of the Institute who successfully applied for research grants and to express a vote of heartfelt thanks for the truly excellent results achieved over the past two years.

It also gives me pleasure to announce that over the past two years we have been able both to complete the long-term renovation of our Mohelno field station and to open a new pavilion at our Studenec research facility. As regards further development, we have recently begun the building of a new modern breeding facility at Studenec.

To conclude, I sincerely hope that our work will continue to be guided by a spirit of mutual understanding and collaboration, allowing us to reach even greater achievements over the coming years.

With my very best wishes,

Marcel Honza  
Director of the Institute of Vertebrate Biology

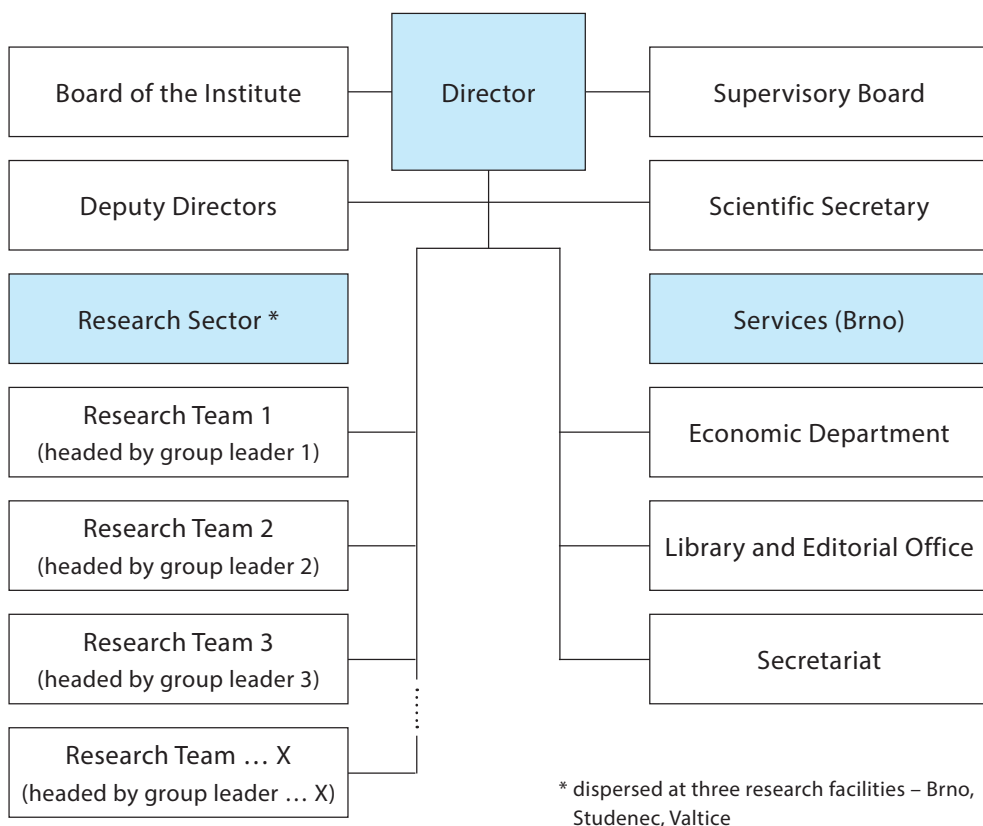
May, 2015





# 1. BASIC FACTS

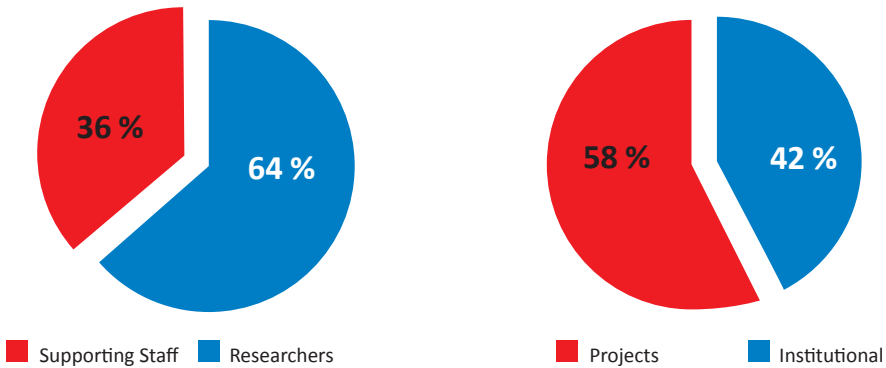
## | STRUCTURE OF THE INSTITUTE OF VERTEBRATE BIOLOGY AS CR



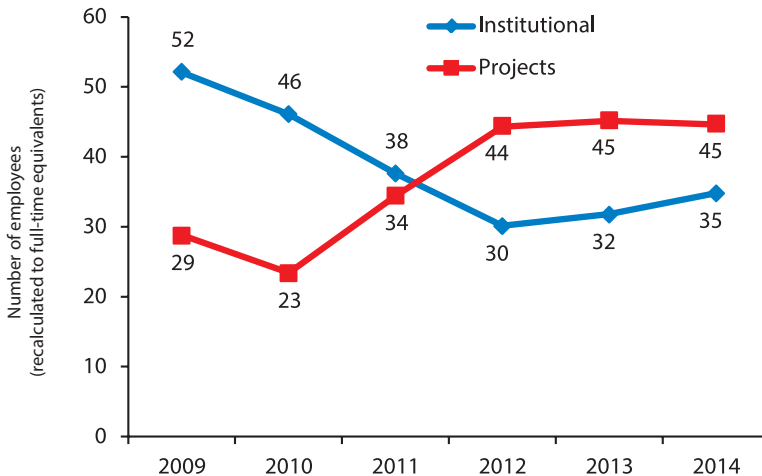
The Institute of Vertebrate Biology is a relatively small institute of the Academy of Sciences and hence is not structured into separate research departments. Senior researchers are usually principal investigators of national and international projects and are responsible for creating and maintaining their teams, predominantly through external funding. Principal project investigators are directly subordinate to the Director. Research teams are highly flexible and composed of junior researchers, post-doctorates, research assistants, technicians and pre- and post-graduate students. Research subjects can be divided into three main domains – evolutionary ecology, biodiversity and pathogens and diseases (see below); however, individual projects can cover wider topics and researchers often use interdisciplinary approaches.

## STAFF AND BUDGET

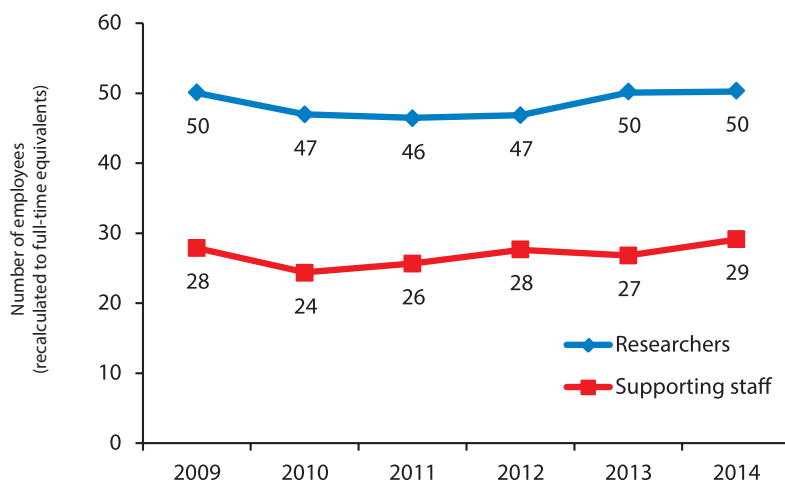
The Institute of Vertebrate Biology is relatively small (regarding number of employees and budget) but is important in scientific output and other activities. Seventy-seven people were employed full-time in 2013, a number that rose to 80 in 2014. Staff structure was similar in both years. A significant decreasing trend in the number of institutional employees has stopped though the number of workers (mainly post-doctorate students, PhD students and technicians) employed on the basis of (unpredictable) external project funding is still almost 60 %.



Staff structure of the Institute of Vertebrate Biology AS CR over 2013–2014 (mean values for both years recalculated to full-time jobs).

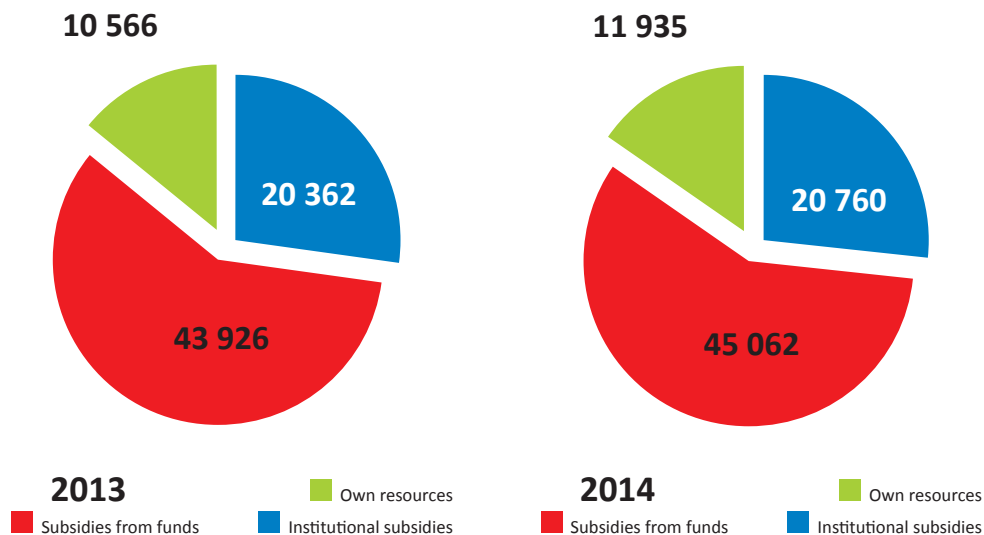


Over the last three years, a high proportion of employees have been dependent on short-term projects. This may have long-term consequences for the stability of the research environment due to the unpredictability of success in grant competitions. In 2014, the IVB had only 25 institutional researchers and 10 institutional technicians and administrators.

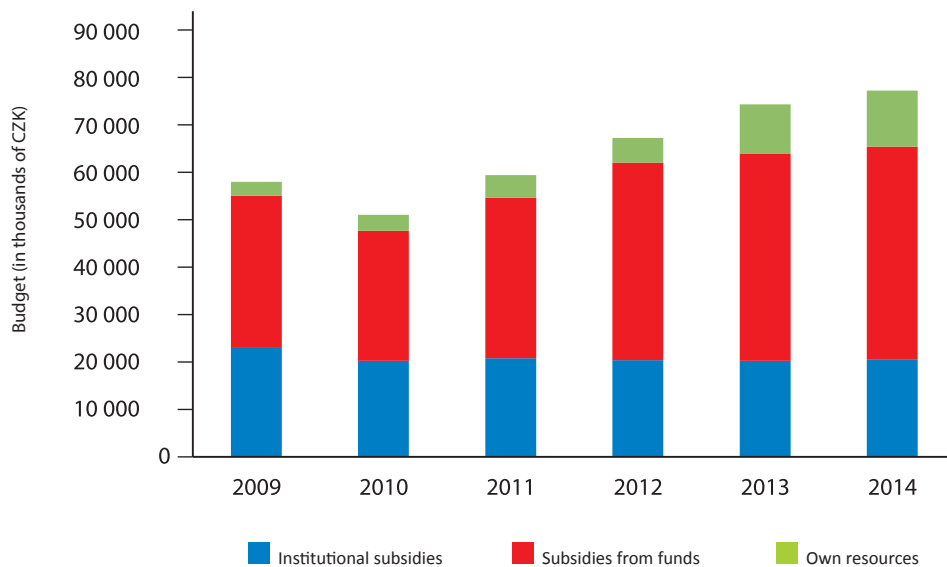


Staff structure is relatively stable, with researchers forming ca. 65% of employees.

The Institute's budget was 75 and 78 million Czech crowns in 2013 and 2014, respectively. While institutional funding from the Academy of Sciences has now stabilised (following a significant decrease in 2010), funding from grant competitions is increasing. Institutional subsidies represented only 27 % of the budget in 2013–2014, which may increase risk due to the unpredictability of future project success.



Budget structure of the Institute of Vertebrate Biology AS CR over 2013–2014. Numbers are in thousands of Czech crowns.



The total budget of the Institute has increased slightly but institutional subsidies remain stable (following a drop in 2010).

## Addresses

### | HEADQUARTERS

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(Head of administration department)*

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Prof. RNDr. Zdeněk HUBÁLEK, DSc  
Assoc. Prof. RNDr. Martin REICHARD, PhD  
Prof. RNDr. Jan ŽIMA, DSc

### External members

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(*Czech University of Life Sciences, Prague*)

Assoc. Prof. RNDr. Milan GELNAR, PhD  
(*Masaryk University, Brno*)

Prof. RNDr. Miloš MACHOLÁN, PhD  
(*Institute of Animal Physiology and Genetics AS CR, v. v. i., Brno*)

## | SUPERVISORY BOARD

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### Vice-chairman

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## | RESEARCH STAFF

Only people with an employment contract are shown, i.e. not all PhD students are listed (for a complete list of PhD students see below). Numerous fellows contracted on the basis of external grant funding have only part-time jobs (not shown here), often limited to a short period of time (specified here only in research scientists).

### BRNO RESEARCH FACILITY

Research facilities in Brno include zoological collections, a breeding facility for experimental fish (incl. that for semi-natural experiments), a basic laboratory for molecular genetics and a laboratory containing optical microscopy equipment and high-quality equipment for field research. Research teams at Brno use model vertebrate groups to study basic questions in the fields of ecology and evolutionary biology, ethology, applied zoology, the roles of parasites and invasive species and protection and management of freshwater and terrestrial ecosystems. The main topics studied include:

- reproductive strategies in fish and birds;
- adaptation and coevolution between parasites and hosts (e.g. cuckoo vs. passerine birds; bit-terling vs. bivalves);
- population biology, ecology and biogeography of annual fishes (e.g. *Nothobranchius*, *Cynolebias*);
- the relationship between metazoan parasites and their hosts (fish, birds);
- fish communities and populations of key species in various aquatic habitats;
- invasive species in the aquatic environment;
- migration connectivity and seasonal interaction of long-distance migrants;
- ecology and behaviour of bats, especially during hibernation;
- population genetics and interspecies hybridisation;
- ecology and conservation of carnivores in fragmented landscapes;
- food ecology of herbivorous mammals and their impact on the environment;
- diet and parasites of primates.

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Fish ecology

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Milena KONÍČKOVÁ

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Ecology of bats

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Ichthyology

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Wildlife ecology

Mgr. Kristína CIVAŇOVÁ, PhD  
Molecular genetics

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Fish parasitology

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RNDr. Jaroslav KOLEČEK, PhD  
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Caroline METHLING, PhD  
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Mgr. Milica POŽGAYOVÁ, PhD  
Mgr. Radomil ŘEŽUCHA, PhD  
Romain ROUCHET, PhD  
Mgr. Milan VRTÍLEK, PhD  
Ing. Lucie VŠETIČKOVÁ, PhD  
Mgr. Markéta KONEČNÁ-MRKVOVÁ, PhD  
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Ing. Petr KONUPKA

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Mgr. Kateřina FRANCOVÁ  
Mgr. Václav JELÍNEK  
Mgr. Eva KAŠPAROVÁ  
MSc. Vadym KRASNOVYD  
Mgr. Eva MAREŠOVÁ  
Mgr. Veronika MICHÁLKOVÁ  
Mgr. Libor MIKL  
Mgr. Luděk ŠLAPANSKÝ  
Mgr. Michal ŠULC  
Mgr. Soňa URBÁNKOVÁ

### Technicians

Jiří FARKAČ  
Lukáš KOPEČEK



## VALTICE RESEARCH FACILITY

The Valtice research facility is well-equipped with state-of-the-art molecular equipment and houses a modern animal facility that fully complies with all safety measures needed for handling laboratory animals. Research is mainly focused on the ecology and eco-epidemiology of zoonotic macroorganisms, with a main emphasis on emerging and re-emerging pathogens, the role of endotherm vertebrates (hosts to pathogenic agents) and haematophagous arthropods (biological vectors) in the circulation of zoonotic pathogens and natural and socio-economic factors driving the emergence of particular infections. The main issues addressed include:

- isolation and identification of novel macroorganisms, including human pathogens (microbe hunting);
- ecology of arthropod-borne microorganisms (e.g. West Nile and tick-borne encephalitis flaviviruses, the spirochaete *Borrelia burgdorferi*, rickettsiae *Anaplasma phagocytophilum* and the protozoan *Babesia spp.*);
- implementing the 'one health' concept for studying emerging zoonoses;
- risk of introduction of new invasive mosquito vectors and mosquito-borne diseases into Central Europe;
- provision of expert advice regarding prevention and control of zoonoses (contribution to preventive human and veterinary medicine);
- provision of expert opinion on emerging infectious diseases.

### Head

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### Fellows contracted on the basis of external grant funding:

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Mgr. Kristýna VENCLÍKOVÁ

Mgr. Petra STRAKOVÁ

## STUDENEC RESEARCH FACILITY

The Studenec Research Facility is a very dynamic part of the Institute that has evolved significantly in recent years. The facility maintains modern well-equipped molecular/genetic, physiological and microscopic laboratories; a breeding facility for small mammals, birds and amphibians (currently undergoing substantial reconstruction) and facilities allowing experiments under semi-natural conditions. Empirical data from observations, laboratory analysis and experiments (supplemented by simulation modelling) are used for investigating important questions related to the evolutionary biology of populations. Research activities cover mostly fundamental aspects but applied studies are also undertaken in the fields of biomedicine, species conservation and epidemiology. Examples of research topics include (model organisms given in parentheses):

- hybrid zones as barriers against gene flow and their role in speciation (rodents);
- phylogeography, reconstruction of historical colonisation and mechanisms of biodiversity evolution (mainly African rodents and amphibians);
- conservation genetics and the study of factors affecting population structure (fish, rodents, carnivores);
- mating systems, analysis of reproductive success and factors affecting fitness (passerines);
- immunogenetics – links between adaptive genetic variation and fitness (rodents, passerines);
- host-parasite co-evolution, genetic variation of pathogens and their hosts (rodents, bats, pathogenic fungi, helminths, RNA-viruses);
- mechanisms and evolution of thermal physiology traits in ectotherms (newts);
- functional approaches in studying morphological adaptations (amphibians and reptiles).

The results of both basic and applied research have been presented to the public within projects supported by the Vysočina Region, Norway Funds and the Ministry of Education, Youth and Sports of the Czech Republic.

### Head

Assoc. Prof. Mgr. & Mgr. Josef BRYJA, PhD  
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Molecular ecology, immunogenetics,  
phylogeography

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Mgr. Tereza KRÁLOVÁ  
Mgr. Peter KRISTÍN  
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## 2. RESEARCH PROJECTS

### Projects supported by the Grant Agency of the Academy of Sciences of the Czech Republic (GA AV ČR)

**IAA600930903** Cues, recognition and responses in a coevolutionary arms race between brood parasites and their hosts.

*Recipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Investigator:* Marcel Honza. *Research years:* 2009–2013.

### Projects supported by the Czech Science Foundation (GA ČR)

**GA206/09/1163** Personalities, male mating tactics and role of females in sexual selection: studies on fish model systems. *Recipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Investigator:* Martin Reichard. *Research years:* 2009–2013.

**GA505/11/P646** Adaptive coexistence of distinct life history strategies in fish of the genus *Nothobranchius*. *Recipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Investigator:* Matej Polačik. *Research years:* 2011–2013.

**GAP506/10/0983** Comparative phylogeography of the Zambebian region in Southeastern Africa using small mammals as a model. *Recipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Investigator:* Josef Bryja. *Research years:* 2010–2014.

**GA506/11/0112** The evolution and life-history consequences of rapid ageing. *Recipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Investigator:* Martin Reichard. *Research years:* 2011–2015.

**GAP505/10/1871** Toll-like receptors in passerine birds: description, characterisation of polymorphism and evolutionary consequences of allelic variation. *Recipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Investigator:* Josef Bryja. *Research years:* 2010–2014.

**GAP505/11/1617** Functional determinants of geographical gradients in avian diversity in sub-Saharan Africa. *Recipient:* Charles University in Prague, *Principal Investigator:* David Hořák. *Subrecipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Co-Investigator:* Petr Procházka. *Research years:* 2011–2015.

**GAP506/10/2170** The role of predator-prey interactions in the coadaptation of thermal biology. *Recipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Investigator:* Lumír Gvoždík. *Research years:* 2010–2013.

**GAP505/11/1768** Non-native goby fishes: exploitation of a free niche or a threat to Central European fishes? *Recipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Investigator:* Pavel Jurajda. *Research years:* 2011–2015.

**GCP502/11/J070** Biogeography and evolutionary history of two RNA viruses in Africa. *Recipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Investigator:* Joëlle Goüy de Bellocq (replaced by J. Bryja during her maternity leave). *Research years:* 2011–2013.

**GAP506/11/1792** Population structure, dispersal, and explorative behaviour in the zone of secondary contact of house mice. *Recipient:* Institute of Animal Physiology and Genetics AS CR, v.v.i., Liběchov. *Principal Investigator:* Miloš Macholán. *Subrecipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal*

**Co-Investigator:** Barbora Vošlajerová (replaced by Kateřina Janotová during her maternity leave). **Research years:** 2011–2014.

**GAP505/12/G112 ECIP** European Centre of Ichthyoparasitology. **Recipient:** Masaryk University in Brno. **Principal Investigator:** Milan Gelnar. **Subrecipient:** Institute of Vertebrate Biology AS CR, v. v. i., Brno. **Principal Co-Investigator:** Pavel Jurajda. **Research years:** 2012–2018.

**GAP505/12/0375** Evolutionary-immunological and ecological aspects of parasitism in hybrid and polyploid cyprinid fish. **Recipient:** Masaryk University in Brno. **Principal Investigator:** Andrea Vetešnicková Šimková. **Subrecipient:** Institute of Vertebrate Biology AS CR, v. v. i., Brno. **Principal Co-Investigator:** Lukáš Vetešník. **Research years:** 2012–2016.

**GAP506/12/1064** Bat adaptations to the fungal disease geomycosis. **Recipient:** Institute of Vertebrate Biology AS CR, v. v. i., Brno. **Principal Investigator:** Natália Martínková. **Research years:** 2012–2015.

**GAP506/12/2404** Host-parasite interaction as an extreme form of parent-offspring conflict. **Recipient:** Institute of Vertebrate Biology AS CR, v. v. i., Brno. **Principal Investigator:** Marcel Honza. **Research years:** 2012–2016.

**GAP506/12/2472** Post-copulatory sexual selection and the biology of sperm: within population processes and interspecific patterns in passerine birds. **Recipient:** Institute of Vertebrate Biology AS CR, v. v. i., Brno. **Principal Investigator:** Tomáš Albrecht. **Research years:** 2012–2016.

**GAP505/12/2569** The role of parasites during the invasion process of Ponto-Caspian gobies into artificially interconnected European rivers. **Recipient:** Institute of Vertebrate Biology AS CR, v. v. i., Brno. **Principal Investigator:** Markéta Ondračková. **Research years:** 2012–2014.

**13/05872S** The effects of non-native species on host-parasite relationships. **Recipient:** Institute of Vertebrate Biology AS CR, v. v. i., Brno. **Principal Investigator:** Martin Reichard. **Research years:** 2013–2017.

**13/06451S** Linking events through the annual cycle: the importance of carry-over effects for the ecology of migratory birds. **Recipient:** Institute of Vertebrate Biology AS CR, v. v. i., Brno. **Principal Investigator:** Petr Procházka. **Research years:** 2013–2017.

**13/12580S** Which mechanisms affect the diversity of clones and their coexistence with sexual species? European loaches of the genus *Cobitis* as a model. **Recipient:** Institute of Vertebrate Biology AS CR, v. v. i., Brno. **Principal Investigator:** Karel Halačka. **Research years:** 2013–2017.

**14/35009S** Quantifying viral gene capture, and the host's response, during passage across a species barrier: Murine cytomegalovirus in a house mouse hybrid zone. **Recipient:** Institute of Vertebrate Biology AS CR, v. v. i., Brno. **Principal Investigator:** Joëlle Göuy de Bellocq. **Research years:** 2014–2016.

## Projects supported by the Ministry of Environment

**11560/SOPK/2010** Monitoring of the large carnivores at the Beskydy Mountains. **Recipient:** Institute of Vertebrate Biology, AS CR, Brno. **Principal Investigator:** Petr Koubek. **Research years:** 2011–2014.

**CZ.1.02/6.1.00/10.06482** Monitoring and full-area mapping of important European species as a basis of Natura 2000 in Czech Republic. **Recipient:** Institute of Vertebrate Biology, AS CR, Brno. **Principal Investigator:** Karel Halačka. **Research years:** 2012–2015.

## Projects supported by the Ministry of Education, Youth and Sport

**KONTAKT USA LH14045** Evolution of sexual ornaments and their information content: a comparative study in isolated populations with divergent signal traits and preferences. *Recipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Investigator:* Tomáš Albrecht. *Research years:* 2014–2016.

**CZ.1.07/2.3.00/20.0303 NextGenProject**  
– Next-generation technologies in evolutionary genetics. *Recipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Investigator:* Josef Bryja. *Research years:* 2012–2015.

**CZ.1.07/2.3.00/35.0026** Science for all senses. *Recipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Investigator:* Anna Bryjová. *Research years:* 2012–2014.

**CZ.1.07/2.4.00/17.0138 PROVAZ** – Connecting education and new approaches in zoological and ecological research. *Recipient:* Institute of Vertebrate Biology ASCR, v. v. i., Brno. *Principal Investigator:* Josef Bryja. *Research years:* 2011–2014.

## International projects

### European Union – 7<sup>th</sup> Framework Programme

**EDENext** Biology and control of vector-borne diseases in Europe (coordinated by Renaud Lancelot, CIRAD-Département Systèmes Biologiques, Campus de Baillarguet, Montpellier, France). *Principal Investigator for Czech Republic:* Zdeněk Hubálek. *Research years:* 2011–2015.

**ConGRESS** Conservation genetic resources for effective species survival (coordinated by Mike Brufford, School of Biosciences, Cardiff University, UK). *Principal Investigator for Czech Republic:* Josef Bryja. *Research years:* 2010–2013.

**EuroWestNile** European West Nile Collaborative Research Project (coordinated by Carlos Curia Martinez, Instituto de Salud Carlos III, Majadahonda-Madrid, Spain). *Principal Investigator for Czech Republic:* Zdeněk Hubálek. *Research years:* 2011–2014.

### Other EU projects

**VBORNET** European Network for Arthropod Vector Surveillance for Human Public Health (coordinated by Avia GIS Zoersel, Belgium). *Principal Investigator for Czech Republic:* Zdeněk Hubálek. *Research years:* 2009–2013.

### Individual projects

**M200931201** The importance of migratory connectivity for the population ecology of long-distance migrants: a model study on the Reed Warbler (*Acrocephalus scirpaceus*). *Principal investigator:* Petr Procházka. *Research years:* 2012–2015.

**National Speleology Society U.S.** Utilisation of genetic resources for effective conservation of endangered species. *Principal investigator:* Natália Martínková. *Research years:* 2012–2013.

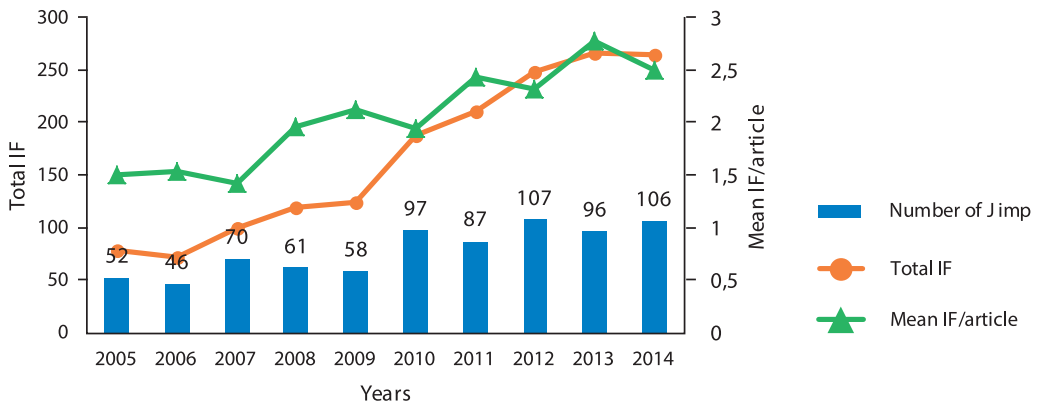
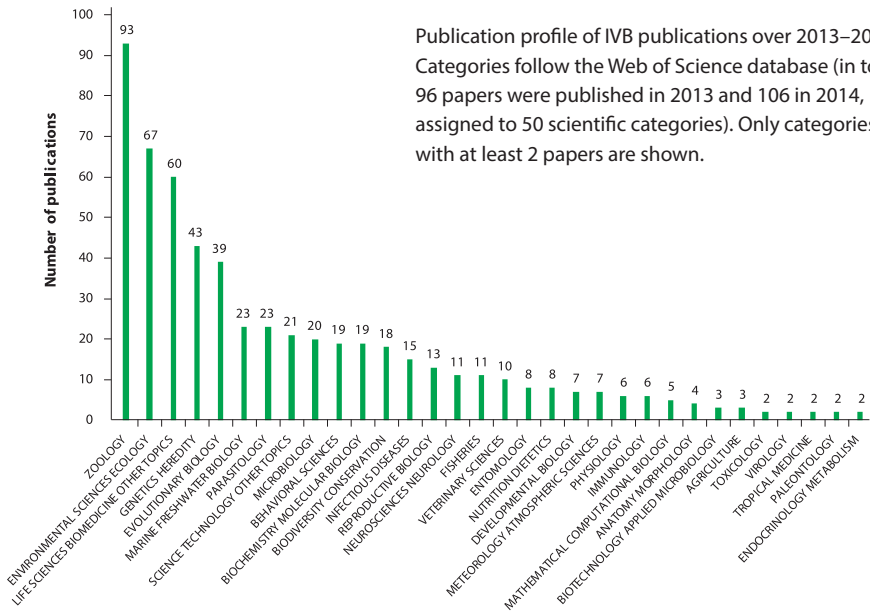




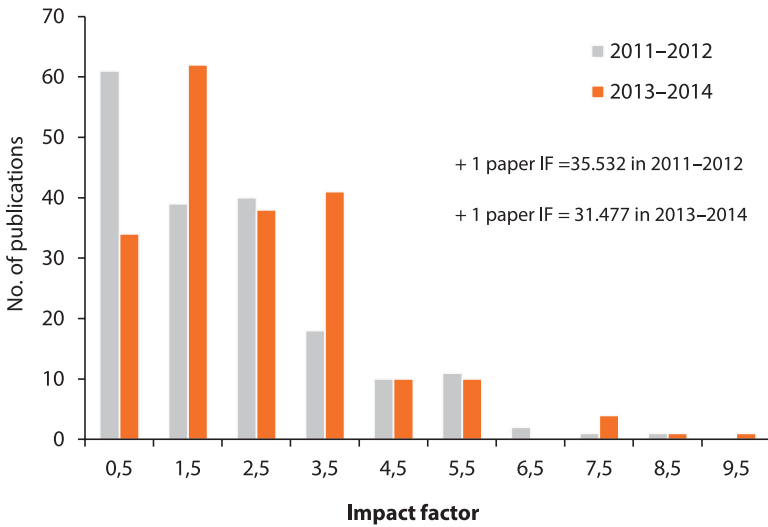
### 3. SCIENTIFIC RESULTS

## | SUMMARY OF PUBLICATION OUTPUT

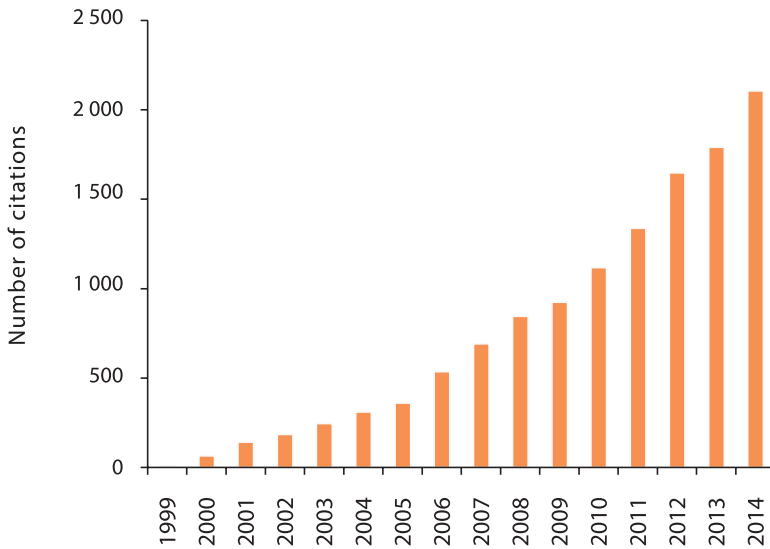
IVB researchers produced numerous scientific publications in 2013–2014, mainly in the form of research articles in international peer-reviewed journals. The publication profile and main scientometric criteria are shown below.



The number of published papers stabilised in 2013-2014, though their quality, measured by journal impact factor, is still growing (source: Database ASEP, Academy of Sciences of the Czech Republic and Web of Science).



Distribution of impact factors for published articles shifted toward higher values in 2013–2014.



The Institute of Vertebrate Biology ASCR was founded in 1998. Since that time the outputs of scientific research at IVB were cited 12312 times (source: Web of Knowledge, search limited only to publications of IVB researchers from 1998–2014).

## Geographical distribution of selected research activities abroad



GERMANY



DR OF CONGO



CENTRAL AFRICAN REPUBLIC



TURKEY



CAMEROON



TANZANIA



ANTARTICA



CHINA



ZIMBABWE

Publication Output

## Complete list of publications

### Books, textbooks, edited proceedings

- BRYJA J, DROZD P (eds), 2014. *Zoologické dny Ostrava 2014*. ÚBO AV ČR, Brno, 253 pp. ISBN 978-80-87189-16-0.
- BRYJA J, ŘEHÁK Z, ZUKAL J (eds), 2013. *Zoologické dny Brno 2013*. ÚBO AV ČR, Brno, 283 pp. ISBN 978-80-87189-14-6.
- DOSTÁL D, KONVIČKA M, ČÍŽEK L, ŠÁLEK M, ROBOVSKÝ J, HORČIČKOVÁ E, JIRKŮ M, 2014. *Divoký kůň (Equus ferus) a pratur (Bos primigenius): klíčové druhy pro formování české krajiny*. Česká krajina, Kutná Hora, 125 pp.
- WOOTTON RJ, SMITH C, 2014. *Reproductive biology of teleost fishes*. Wiley-Blackwell, Chichester, 496 pp. ISBN 978-0-632-05426-8.

### Chapters in books

- ESTRADA-PENA A, HUBÁLEK Z, RUDOLF I, 2013. Tick-transmitted viruses and climate change. In Singh, SK (ed.), *Viral infections and global change*. Wiley, Hoboken: 573–602. ISBN 978-1-118-29787-2.

### Papers in journals included in the databases Web of Science

- ACOSTA R, LITERÁK I, SYCHRA O, ČAPEK M, 2013. Fleas on wild birds in Costa Rica. *Proceedings of the Entomological Society of Washington* 115: 1–8.
- ALBRECHT T, KLEVEN O, KREISINGER J, LASKEMOEN T, OMOTORIOGUN TC, OTTOSSON U, REIF J, SEDLÁČEK O, HOŘÁK D, ROBERTSON RJ, LIFJELD JT, 2013. Sperm competition in tropical versus temperate zone birds. *Proceedings of the Royal Society. B - Biological Sciences* 280: 20122434.
- ALBRECHTOVÁ J, ALBRECHT T, ĎUREJE L, PALLAZOLA VA, PIÁLEK J, 2014. Sperm morphology in two house mouse subspecies: Do wild-derived strains and wild mice tell the same story? *PLoS ONE*: e115669.
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- ARSLAN A, ARISOY A, ZIMA J, 2014. Comparison of the chromosome banding pattern in the 2n = 5 6 cytotypes of *Nannospalax leucodon* and *N. xanthodon* from Turkey. *Scientific World Journal* 2014: 121690.
- ARSLAN A, ZIMA J, 2013. Distribution of C-heterochromatin and nucleolar organizer regions in the karyotype of marbled polecat, *Vormela peregusna* (Carnivora: Mustelidae). *Acta Zoologica Bulgarica* 65: 557–560.

- ARSLAN A, ZIMA J, 2013. The banded karyotype of the  $2n=58$  chromosomal race of mole rats from Erzincan, Turkey. *Folia Zoologica* 62: 19–23.
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- BELOTTI E, KREISINGER J, ROMPORTL D, HEURICH M, BUFKA L, 2014. Eurasian lynx hunting red deer: is there an influence of a winter enclosure system? *European Journal of Wildlife Research* 60: 441–457.
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## SELECTED SCIENTIFIC ACHIEVEMENTS



Evolutionary  
Ecology



Biodiversity



Parasites  
and diseases



# Evolutionary Ecology

Reproductive behaviour in bitterling fish .....	49
Ecology and behaviour of bats .....	50
Carnivores and birds of prey in Central European farmland .....	51
Interspecific parasitism in birds: a model system for the study of coevolution .....	52
Temperature and metabolism: Towards an understanding of amphibian ecology .....	53
Male mate choice and strategic sperm allocation: insights from model fish taxa .....	54
Ecology and evolution of annual killifish .....	56
The use of stable isotopes for the study of migratory connectivity .....	58
Sexual selection and sperm competition – case studies in birds .....	59
Dampening of vole population cycles .....	60
Breeding ecology of birds .....	61



## EVOLUTIONARY ECOLOGY

### Reproductive behaviour in bitterling fish

Hybrid zones between genetically diverged populations are widespread among animals and plants. Hybrid zone dynamics usually depend on selection against admixture and dispersal of parental forms within the zone. Although many studies have utilised indirect estimates of selection, dispersal, and especially its behavioral background, has been neglected. We studied the dispersal strategies in males of two house mouse subspecies: *Mus musculus musculus* and *M. m. domesticus*,



*Mus m. musculus* male mice are less aggressive but more flexible in dynamic and stressful situations than *M. m. domesticus*.

(Photo by M. Polák)

both of which meet at a secondary contact zone stretching across Central Europe. These taxa are known to differ through numerous genetic, morphological, physiological and behavioural traits, such as aggression (*M. m. musculus* being less aggressive) or odour preference (*M. m. musculus* being choosier and preferring males of the same subspecies). Such studies, focused on behavioural strategies during dispersal, contribute to our knowledge of the mosaic of specific differences between subspecies. Both wild and wild-derived inbred males of the two subspecies showed differences in exploration of an unfamiliar environment, with *M. m. domesticus* males adopting a longer risk assessment, followed by more 'self-confident' exploration than *M. m. musculus* males. A similar pattern was observed in motivation tests aimed at overcoming a water barrier. Interestingly, when the two subspecies had to cope with a stressful situation, we found that males of the less aggressive *M. m. musculus* subspecies were more successful in solving the Morris water task. This suggests that *M. m. musculus* is more flexible and may be more successful under stressful and/or dynamic situations typical of dispersal bouts. It is quite likely, therefore, that the behavioural differences in dispersal strategy observed in our studies may have had an influence on secondary contact between *musculus* and *domesticus* populations in the past and, perhaps, could still be affecting the dynamics of the European hybrid zone between the subspecies.

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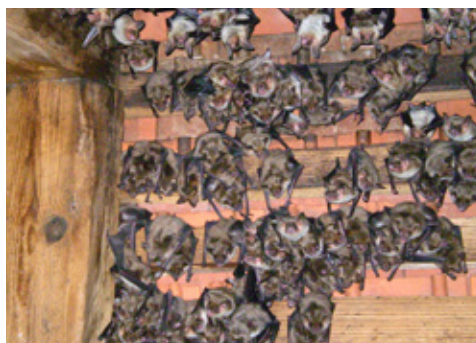
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## Ecology and behaviour of bats

Bats are amongst the most diverse and widespread mammal species on Earth. We study various aspects of their diverse ecology, including roost selection, intraspecific variation in echolocation calls, anti-predation behavior and seasonality of reproduction. Availability of suitable roosting sites is a key factor determining distribution and limiting population size in bat species. Various features may have an important role in the selection and use of a building roost site by bats. We have demonstrated that summer colonies of greater mouse-eared bat *Myotis myotis* females do not select building features from suitable detached and uninsulated churches and chalets and that they tend to select building roosts that are not connected to woodland by hedges. The protection of such roosts is an important conservation issue and significant changes to roost sites or exclusion of the colony from well-established roosts should be avoided. Echolocation pulse features may vary between maternity roosts and this can theoretically be caused either by intercolony genetic differences or by vocal dialects learned during ontogeny within a roost (or a combination of both). We found that individual colonies of common pipistrelle *Pipistrellus pipistrellus* in Central Europe differ significantly in mtDNA, whereas nuclear marker structure is almost absent. The genetic differentiation between mtDNA matrilineages was associated with significant intercolony echolocation parameter differences. Because the genetic component of echolocation is not likely to be encoded by mtDNA, the results support the hypothesis of maternal echolocation dialect transmission to offspring, and the role of learning in this process.

Mobbing in animals is a cooperative aggressive behaviour performed against a potential predator. In bats, the existence of mobbing is based on both intra- and interspecific behavioural responses



The colony of reproducing females of the greater mouse-eared bat (*Myotis myotis*) in the church attic in the village Lysice. (Photo by H. Berková)

of freely flying individuals to distress calls emitted by live bats or recordings played back by researchers. Our report of mobbing by free-living naked-bellied tomb bats *Taphozous nudiventris* on a barn owl *Tyto alba* was the first direct observation of mobbing by a bat on its potential avian predator. Synchronisation of reproduction with periods of high food availability is often considered as the driving force behind the annual course of mammalian reproduction. Reproductive seasonality in the Egyptian fruit bat *Rousettus aegyptiacus* was characterised by distinct bimodality in birth timing, regardless of climatic differences. A low incidence of simultaneous pregnancy and lactation indicated that both seasonal bimodal polyestry with and without postpartum estrus may occur. Shifts observed in birth timing between Mediterranean and desert study areas corresponded with regional differences in fruiting phenology of major dietary plants. The male reproductive cycle was synchronised with that of females. *R. aegyptiacus* is the sole species with seasonal bimodal polyestry among Palearctic bats.

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## Carnivores and birds of prey in Central European farmland

The study of top predator spatio-temporal ecology in human landscapes is a challenging issue for understanding species-specific adaptations to highly dynamic ecosystems and has a number of consequences for prey abundance and distribution. Our studies have focused particularly on (i) fine-scale habitat utilisation by different carnivore species in intensively used agricultural landscapes or urban ecosystems, (ii) distribution

and habitat preferences of invasively spreading golden jackal *Canis aureus* or the rapidly declining steppe polecat *Mustela eversmannii* and (iii) spatial activity of highly endangered owl predators in Central European farmland. Our results have extended knowledge of top predator ecology and habitat preferences and should contribute greatly to successful conservation strategies and management.

Institute of Vertebrate Biology v.v.i. in cooperation with Czech Society for Ornithology is preparing the proposal of action plan for Little Owl (*Athene noctua*).  
(Photo by M. Šálek)



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## Interspecific parasitism in birds: a model system for the study of coevolution

Interspecific brood parasitism represents a prime example of the coevolutionary arms race wherein each party has evolved strategies in response to the other. On the side of the brood parasite, we investigated whether common cuckoos *Cuculus canorus* actively select nests within a host population (great reed warbler *Acrocephalus arundinaceus*) to match egg appearance of a particular host clutch. Our results suggest that the ability of cuckoos to actively choose host nests based on egg-shell appearance imposes a strong selection pressure on host egg recognition. In a further study

however, remain largely unknown. To explore this puzzle, we used a set of 15 polymorphic microsatellite loci, including a previously detected candidate locus (Ase64), to link genotypes of female great reed warblers with their egg rejection responses. We failed to find any consistent association of egg rejection response with host female genotype or age. It would appear that host decisions on egg rejection show high levels of phenotypic plasticity and are likely to depend on spatio-temporal variation in parasitism pressure. Several additional parameters affect parasitic egg recog-



Marcel Honza searching for nests of the Red Bishop in South African reed beds.

(Photo by M. Honza, M. I. Cherry)

we found that nest visibility, reed density and timing of breeding predicted brood parasitism by the cuckoo. Our results demonstrate that host vulnerability to brood parasitism varies temporally and that cuckoo females are able to optimise their nest-searching strategy. We also observed that cuckoos may exploit hole-nesting hosts that usually have inaccessible nests, supporting a recent view that host suitability is a continuous phenomenon. On the side of the host, egg rejection is a widely used host tactic to bypass the costs incurred by avian brood parasitism. The genetic basis of this behaviour and the effect of host age on the probability of rejecting the parasitic egg,

certain light environments, for example, may hinder egg discrimination by hosts of foreign eggs which could, in some circumstances, lead to acceptance of non-mimetic eggs by the hosts. We measured light parameters at red bishop *Euplectes orix* nests and used a model of avian visual processing to quantify the detectability of eggs in the light environment in which they are perceived. The avian visual processing model revealed that nest luminosity had no influence on host response toward eggs painted dark brown. Nest defence against a brood parasite is a very efficient strategy for avoiding parasitisation. Our study on a polygynous host revealed that monog-

amous males defend their nests most aggressively while polygynous males allocate nest protection effort unevenly between their two mates, responding more vigorously on primary nests. Our results, therefore, suggest that, while monogamous females receive more assistance with nest defence than females of polygynous males, this has no effect on the probability of parasitism. Repeatability of aggressive nest defence has not yet been studied in hosts of brood parasites. We studied this phe-

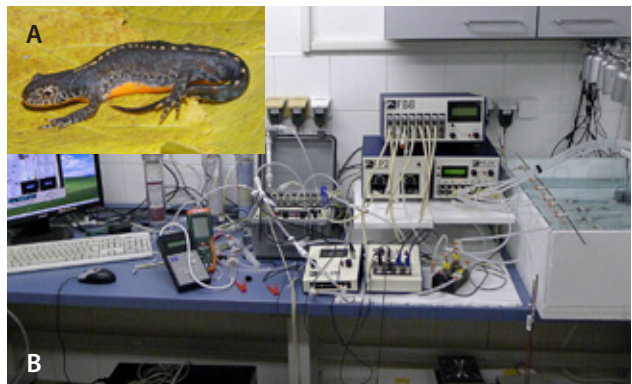
nomenon and found that, under a relatively stable risk of brood parasitism across breeding seasons, female responses to a cuckoo were highly repeatable, whereas male responses were variable. We suggest that the observed patterns of female and male behaviour may due to the female's prominent role in offspring care and nest protection, and in her lower re-nesting potential compared to males.

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## Temperature and metabolism: Towards an understanding of amphibian ecology

All functions and processes in living organisms require energy. The acquisition and allocation of energy into growth, survival and reproduction determines individual fitness in a given environment, hence it is not surprising that organisms employ various adjustments to fulfil these tasks. Ectothermic (“cold-blooded”) organisms obtain energy in two ways, i.e. by metabolising ingested food and by transferring heat from the surrounding environment. We used the Alpine newt *Ichthyosaura alpestris*, a rarely used amphibian study species, to examine (i) sources of variation in energy metabolism and thermal physiology traits, and (ii) the consequences of this variation on individual survival and body condition. We showed that seasonal variation in energy metabolism is induced by a shift from the aquatic to ter-

restrial phase. Individual variation in energy metabolism persists over the wintering period and influences the depletion of body reserves in wintering individuals. In contrast, individual differences had a negligible effect on newt antipredator responses, which were



(A) Study species, the Alpine newt *Ichthyosaura alpestris*, and (B) a continuous respirometry system for measuring newt metabolism.



largely affected by sex and environmental (body) temperature. Environmental temperature also had a major influence on the outcome of predator-prey interactions during the larval stages. Prolonged exposure of newt larvae to elevated water temperatures accelerated their growth and development at the expense of higher susceptibility to predation. Predator-prey interactions under acute exposure

to simulated heat waves, however, had a surprisingly low impact on larval survival due to disparate predator and prey behavioral responses to rising temperatures. Thermally-induced plasticity in behavioral and physiological traits has the potential to reduce species exposure and sensitivity to climate change in these threatened vertebrates.

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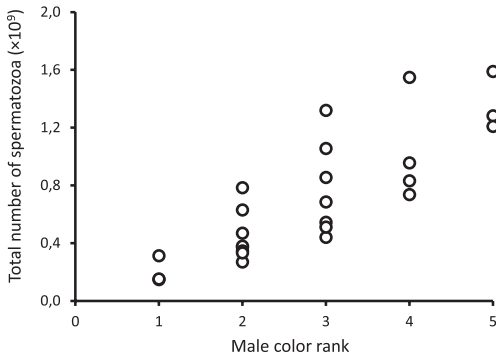
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### Male mate choice and strategic sperm allocation: insights from model fish taxa

Sexually selected traits are generally believed to confer benefits leading to increased mating success. Female mate choice in response to male control of resources, dominance, quality of sexually selected traits or other phenotypic characters has been explored for decades. In contrast, our understanding of male mate choice is limited due to the general assumption that males accept most opportunities to mate. We studied how males modify their investment into mating opportunities using a set of three

fish species with different mating systems. Two study species, the European bitterling *Rhodeus amarus* and the Chinese rose bitterling *Rhodeus ocelatus*, use living freshwater mussels for oviposition. We found that male choice of the quality of mating resource (freshwater mussel) was opportunistic and males quickly concurred to match the preference of a female. Male sperm allocation into the mussels was prudent. Consistent with the choice of mussel for mate attraction during courtship, however, male sperm investment was not related to mussel quality. Dominant males invested more sperm in novel mussels (representing novel mate opportunities) but subordinate males distributed sperm less prudently. We then modelled scenarios of male sperm investment and made predictions on the evolution of strategic sperm use to ensure fertilisation while distributing sperm economically among the mussels. Finally, we tested the predictions using the two bitterling species. We demonstrated that male *R. amarus* (a species with a short reproductive season and high temporal clustering of reproductive events) exhibited high rates of ejaculation and inspection of the siphons of mussels. They also increased their ejaculation rate in response to presence of females in spawning condition and effectively maintained sufficient sperm levels in the mussels. In contrast,



Total number of spermatozoa stripped from *Rhodeus amarus* males as a function of male colour rank.



Male *Poecilia wingei*.

(Photo by R. Blažek)



Behavioural recording during a field experiment on mate choice in the European bitterling.

(Photo by C. Smith)

male *R. ocellatus* (with a longer reproductive season and lower temporal clustering of ovipositions) showed lower overall rates of ejaculation but engaged more directly in sperm competition with rivals. In another study, we demonstrated a link between the quality of male nuptial colouration and sperm density, indicating that male colouration may signal direct benefits to females via fertility insurance. We also examined the role of a strongly female-biased sex ratio and found that, even in a reproductive system where males guard resources and court females, females may compete for males and defend territories when male abundance is very low. We further explored the role of social environment on male mating behaviour. We experimentally manipulated access to rivals and mates by population sex ratio. Using Endler's guppy *Poecilia wingei*, a fish with internal fertilisation, we found that males in a female-biased social environment (i.e. with a lack of rivals) decreased their overall mating effort

but were more likely to court females rather than attempt forced copulation. Males from a male-biased social environment maintained a high level of mating effort and increased the rate of forced copulation attempts compared to courting effort related to consensual mating. When males courted females in a male-biased environment, they strategically explored their asymmetries in orange colouration (a signal of quality and the target of female choice), i.e. males showed their best side to females. Collectively, this research demonstrates that males frequently modulate their mating effort, both in terms of costly behaviour and sperm investment. Importantly, they strategically modify their effort to ensure successful fertilisation in competition with rivals but appear less discriminate toward female identity and perceived quality. Studies on other taxa with different mating systems should provide a broader understating of male mate choice and its implications.

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## Ecology and evolution of annual killifish

Annual killifish are highly adapted to an extreme environment, i.e. seasonal pools that contain water for only part of the year. The annual killifish life cycle includes a drought-resistant egg that persists throughout the dry season buried in the bottom sediment. When the pool fills with water during the rainy season the resting embryos hatch and rapidly grow to maturity and found the next generation of fish. Indeed, some species of the African genus *Nothobranchius* inhabiting a particularly dry region with very erratic and unpredictable rainfall are recognised as the fastest maturing vertebrate in the world. Our study, for example, recently revealed that, in order to economise on the limited amount of time available during the wet phase of their habitat, *N. kadleci* and *N. furzeri* are capable of maturing within just 17 and 18 days, respectively. The two species also have minimum generation time of less than 40 days. These characteristics, together with their small size, naturally short lifespan, high intrapopulation variability in life history traits, natural distribution across a climatic gradient, clearly separated populations and cohort hatching make annual killifish an especially valuable taxon for ecological and evolutionary research.

Our research group has a long-term interest in the evolution and ecology of annual killifish. We mainly focus on those *Nothobranchius* species living in southern Mozambique, a dry part of the genus' distribution close to its southernmost margin. Recently, we also started to work on the ecology of South American annual fish of the genera *Austrolebias* and *Cynopoecilus*. African and American annual killifish have evolved as independent evolutionary lineages but their adaptations to temporary environments appear to be strikingly convergent. We have undertaken two studies on their trophic ecology and these have revealed that the same basic rules apply to coexistence of annual fish communities on both continents. Sympatric species generally show high qualitative dietary overlap but interspecific trophic niches are separated on a long-term basis. The segregation of trophic niches is facilitated by diverse food availability and interspecific differences in size, resulting in the capability of larger species to utilise prey unavailable to smaller fish. Species coexistence is also reinforced by the dynamic nature of the ecosystem, i.e. conditions differ

considerably across individual pools and rarely remain stable for long and hence competitive exclusion of a species rarely takes place.

A further large-scale study focused on the effect of environmental conditions on the adult sex ratio in wild populations of four *Nothobranchius* species. Populations of three species were female-biased, pointing to selective male mortality. Vegetated pools generally had more males than sites with little vegetation, thus limiting opportunities for fish to hide and implying selective predation on conspicuous males by birds. In addition, the proportion of males showed a negative correlation with the abundance of large predatory hemipterans. On the other hand, turbid water, as a potential means of decreasing fish visibility to avian predators, did not result in higher male abundance. There was a decline in the proportion of males with age in one species but not in the other. We concluded that the effect of environmental factors on adult sex ratios varied dramatically, even in closely-related ecologically similar species. The complexity of the environmental effects is most likely caused by the high ecological stochasticity of temporary pools.

Environmental unpredictability is a key factor influencing the evolution of annual killifish, at least in the species inhabiting regions with erratic rainfall. They have evolved extreme variability in the length of embryonic development to ensure that at least some eggs will be ready to hatch whenever the rain comes. In *N. furzeri*, for example, an embryo may develop into the pre-hatching stage within about three weeks but it can also take more than a year. As a result, all the variability takes place within the progeny of the same parents and under constant conditions. We experimentally tested whether length of embryonic development was linked to a particular life history strategy. Fish that hatched from eggs with a short development time were smaller but grew faster, matured earlier, reached a smaller size and had a shorter lifespan. This is an adaptive alternative life history strategy as fast developing eggs can give rise to a second generation of fish within a single rainy season. In some cases, a pool can dry up but re-fill again within the same rainy season. In this case, the fast developing eggs hatch but the fish will have a shorter time to complete their life cycle. As such, they have evolved an accelerated life



Displaying red and yellow *Nothobranchius furzeri* male morphs. This species is one of the fastest maturing vertebrates on Earth.

(Photo by R. Blažek)

history differing from that of slow developing embryos due to the higher risk of extrinsic mortality, surviving through the dry season and hatching only in the next rainy season.

A higher risk of pool desiccation also has interpopulation consequences on lifespan. As part of our research on the evolution of ageing, we compared the lifespan of 10 *Nothobranchius* populations from pools of different duration. We found that captive populations from a dry region had a shorter lifespan than those from a humid region. Similarly, histological markers of ageing showed that senescence was accelerated in wild populations with the prospect of relatively short pool duration. Populations with naturally differing longevities provide a potential basis for identification of underlying genetic sources of lifespan variance.

In *N. furzeri*, intraspecific genetic variability is high, with profound inter-regional differences. Extensive sampling across all the species' range revealed that there were two ancient, deeply separated lineages that have recently come into secondary contact (but did not show any reproductive isolation). Colonisation of new habitats occurs over short distances in a step-by-step manner. Surprisingly, rather than being a linear vector facilitating dispersal, as in many other fish taxa, large rivers functioned as barriers to gene flow. Our data suggest that *Nothobranchius* fishes spread during occasional major flood events when large parts of the savannah are flooded. Our current understanding of the biology of *Nothobranchius* fishes, and *N. furzeri* in particular, has been recently summarised in a thorough review paper.

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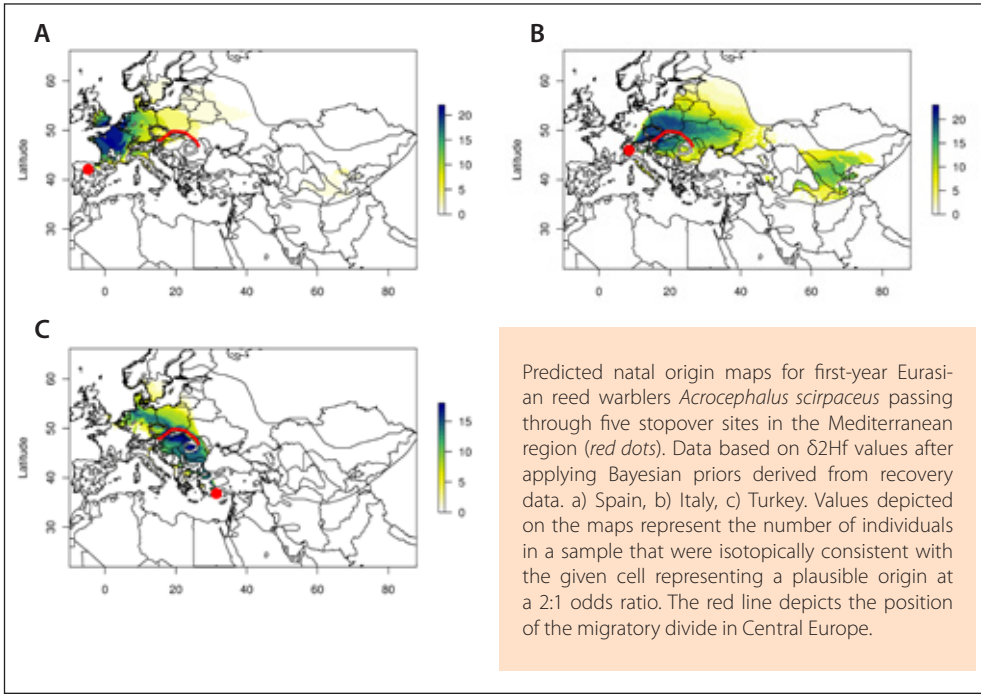
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## The use of stable isotopes for the study of migratory connectivity



Localisation of the annual whereabouts of long-distance migratory birds has always been challenging due to the high vagility of these species over vast geographic distances throughout the year. Nevertheless, establishing links between breeding and non-breeding grounds is a critical prerequisite for our understanding of how conditions across the annual cycle affect demography of migratory species. Using two passerine species, we exemplify the use of feather stable isotope ratios and ring recoveries to connect breeding and non-breeding grounds. Integrating such information within a Bayesian modelling framework will provide an extremely useful toolbox for the study of animal movements in the future.



The Eurasian reed warbler *Acrocephalus scirpaceus*.  
(Photo by P. Marques)

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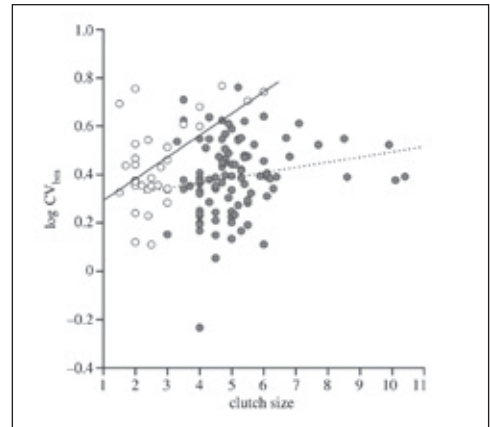
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## Sexual selection and sperm competition – case studies in birds

Sexual selection is a powerful process responsible for the evolution and maintenance of costly pre-copulation signals of individual quality, typically the condition-dependent ornamentation of males. Females are expected to preferentially mate with highly ornamented males. In promiscuous organisms, however, it has recently been recognised that sexual selection might continue after insemination. We studied both pre-copulation mate choice mechanisms and post-copulatory sexual selection in birds. In the monogamous grey partridge *Perdix perdix*, we compared the health- and stress-indicating capacity of melanin-based feather ornamentation and putatively carotenoid-based skin ornamentation. We found that both redness of skin ornament and area of feather ornament may serve as honest indicators of individual health and long-term stress (heterophil/leucocyte ratio). In the same species, we evaluated the immunological background of the phytohaemagglutinin (PHA) skin-swelling test, often used to describe individual quality in relation to secondary male ornamentation, and found that the PHA test actually measures the inflammation process, which is part of the innate immune defence and not an adaptive immune response. Apart from reflecting individual male condition secondary ornament may also signal male provisioning rate and, therefore, direct benefit to females. We analysed potential relationships between intensity of parental care, male ornamentation, the occurrence of extra-pair paternity and male extra-pair fertilisation success in a small promiscuous passerine bird, the scarlet rosefinch *Carpodacus erythrinus*. We found no evidence for an association between male ornamentation and male provisioning rates in this species. Our data also indicate that direct selection against female promiscuity is weak or absent in rosefinches as male food provisioning was independent of paternity loss. In socially monogamous birds, extra-pair fertilisation leads to sperm competition and may intensify the strength of sexual selection. In the same way, post-copulatory sexual selection is thought to be the major evolutionary force driving diversity in sperm phenotypes. We investigated geographic variation in sperm size in subspecies of barn swallows *Hirundo rustica*, a socially monogamous passerine with a wide Holarctic breeding distribution. Variation between European *rustica* populations was much lower than differ-

ences between subspecies, indicating that sperm traits reflect phylogenetic distance. This study also found a strong negative relationship between male sperm size variation and extra-pair paternity rates among barn swallow subspecies, suggesting that variance in male sperm length in a population is shaped by the strength of stabilising post-copula-



Relationship between clutch size and coefficient of between-male variation in sperm total length (CV<sub>bm</sub>) for 31 Afro-tropical (open circles) and 99 temperate zone (filled circles) passerine species. The association between clutch size and CV<sub>bm</sub> is significant in tropical species only and is indicated by a solid line. The points are species averages and relationships are not controlled for phylogeny. Higher values of CV<sub>bm</sub> indicate lower values of extra-pair paternity, and hence sperm competition.



The double-collared sunbird *Nectarinia reichenowii* (right) and the Cameroon sunbird *Nectarinia oritis* (left). (Photo by P. Munclinger)

tory sexual selection. In a follow up study, we used between-male variation in sperm length as a novel proxy to estimate species-specific levels of sexual promiscuity in birds inhabiting tropical regions of Africa. It has been argued that the level of bird sperm competition declines toward the equator; however, sperm competition estimates are primarily available only for avian species inhabiting the northern temperate zone. Although we found no difference in sperm competition risk between tropical and temperate zone species, our findings strongly indicate that sperm competition risk in tropical and

temperate species is differently associated with particular life-history traits, and clutch size in particular. In investigating how selection against long sperm may function in birds, it has been suggested that developmental constraints modulated by the external environment may set limits for sperm length evolution. By comparing the occurrence of sperm abnormalities in various songbird species from the Chernobyl area and control localities across Europe, we demonstrate that species with long sperm are prone to sperm damage, suggesting a trade-off between sperm length and integrity (level of sperm damage).

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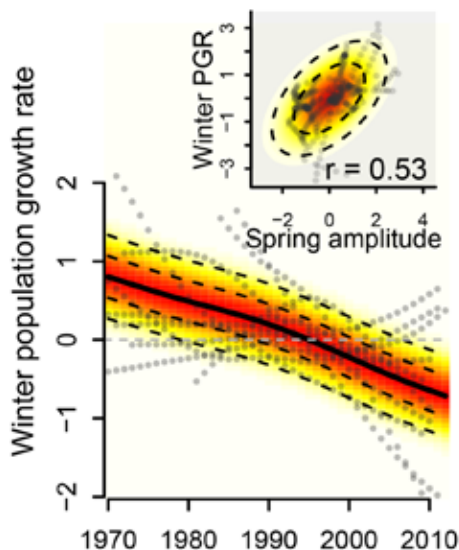
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### Dampening of vole population cycles



Suggestions of collapse in small herbivore cycles since the 1980s have raised concerns about loss of essential ecosystem functions. Whether such phenomena are general and result from extrinsic environmental changes or from intrinsic process stochasticity is currently unknown. Using a large compilation of vole abundance time-series from much of Europe, we demonstrate consistent cycle amplitude dampening associated with a reduction in winter population growth, although regulatory processes responsible for cyclicity have not been

The general pattern of declining winter population growth rates with time as revealed in most European vole population dynamics in an attempt to explain the phenomenon of collapsing population cycles. The insert indicates the positive correlation between the cycle amplitude and winter population growth rates

(adapted from Cornulier et al. 2013).

lost. The underlying syndrome of change throughout Europe and in grass-eating vole species suggests a common climatic driver. Increasing intervals of low-amplitude small herbivore population

fluctuations are expected in the future and these may have cascading impacts on trophic webs across ecosystems.

CORNULIER T, YOCCOZ NG, BRETAGNOLLE V, BROMMER JE, BUTET A, ECKE F, ELSTON DA, FRAMSTAD E, HENTTONEN H, HÖRNFELDT B, HUITU O, IMHOLT C, IMS RA, JACOB J, JEDRZEJEWSKA B, MILLON A, PETTY SJ, PIETIÄINEN H, TKADLEC E, ZUB K, LAMBIN X, 2013: Europe-Wide Dampening of Population Cycles in Keystone Herbivores. *Science* 360: 63–66.

## Breeding ecology of birds

Birds represent an important model group in studies of ecology, evolutionary biology and conservation. We used various avian taxa to study brood parasitism, nest predation and general breeding biology. Factors affecting hatching success were investigated in Mallards *Anas platyrhynchos*, focusing on the protective roles of intermittent incubation and covering of the clutch with nest lining during the laying period as a protection provided by the female against bacterial trans-shell infection (BTSI). Intermittent incubation and clutch covering had no effect on the probability or degree of BTSI. We also showed that presence of BTSI inside the egg could significantly affect hatchling weight. We analysed prevalence of conspecific brood parasitism (CBP) in a common pochard *Aythya farina* breeding population. Compared to related species, pochards showed a relatively high level of CBP, with 39% of genotyped pochard eggs laid parasitically and 89% of nests containing at least one parasitic egg. In addition, we observed relatively high rates of interspecific brood parasitism (13% of eggs), caused predominantly by mallard *Anas platyrhynchos* and tufted duck *Aythya fuligula*. In a separate pochard population, we showed that the number of parasitic eggs was negatively related to the number of host eggs in the clutch, hence implying that parasitism was associated with costs for the host.

Nest predation represents an important selective force leading to the emergence of sophisticated anti-predator strategies. We studied patterns of nest predation in both real passerine nests and artificial dummy nests in three coexisting thrush species (*Turdus* spp.) in an urban habitat (the town of Bardejov, NE Slovakia). A major factor affecting the predation rate in fieldfares *Turdus pilaris* and common blackbirds *Turdus merula*

was the distance between nests and the distance to paths and buildings along with the height



Grey Partridge (*Perdix perdix*) with radio transmitter.  
(Photo by D. Rymešová)

of trees and the distance to the town centre. We also used artificial nests to study spatial patterns of avian nest predation in wetlands. Wetland habitats are some of the most endangered ecosystems in the world. In accordance with the “edge effect on nest predation” hypothesis, an increased predation rate along wetland/grassland edges (compared to habitat interiors) was observed for both artificial shrub nests and ground nests. We conclude that an increase in the size of wetland patches, which would lead to a reduced proportion of edge areas, may be a suitable management practice to protect wetland bird species in cultural European landscapes. In order to protect bird populations, the impact of introduced individuals also has to be evaluated. Captive-bred mallards *Anas platyrhynchos* have been released in Eu-

rope for hunting purposes in huge numbers since the mid-1970s. We assessed the genetic structure of modern wild mallards in the Camargue, southern France, using two samples: one originating from shot birds in hunting bags and one from presumed wild ducks captured live in a hunting-free reserve. Reference samples originated from five mallard farms and from museum samples collected prior to the massive release of mallards. Our results indicate that the genetic signature of wild wintering mallards has not changed significantly as both museum and wild samples from the Camargue hunting-free nature reserve were similar and clearly differentiated from the farmed mallards. This suggests that massive mallard releases have not translated into complete admixture

of wild and captive genomes, most likely due to the low survival rate of released birds once in the wild. Low survival of released commercially-reared individuals was also demonstrated in another species, the grey partridge *Perdix perdix*. In total, 110 locally caught wild individuals and 75 commercially reared game-farm partridges (matched for age) were released and radio tracked within the same study area in the Czech Republic between 2009 and 2011. None of the commercially reared birds survived in the wild until the end of the nesting period, and none produced a fledged brood. These results suggest that the release of adult commercially-reared partridges into the wild in an effort to establish viable populations has little chance of success.

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# Biodiversity

Speciation mechanisms and hybrid sterility using the house mouse as a model species .....	65
Genetic analysis of small African mammals uncovers cryptic diversity and evolutionary mechanisms .....	66
Assessing and protecting the genetic diversity of European vertebrates .....	68
Karyotypes of Turkish mammals .....	70
Evolution on islands .....	71
Diversity, phylogeny and biogeography of African amphibians and reptiles .....	72
Gobiid invasion of European rivers – drivers, patterns and impacts .....	73
Effectiveness of legal bird protection in Central and Eastern Europe .....	74



## BIODIVERSITY

### Speciation mechanisms and hybrid sterility using the house mouse as a model species

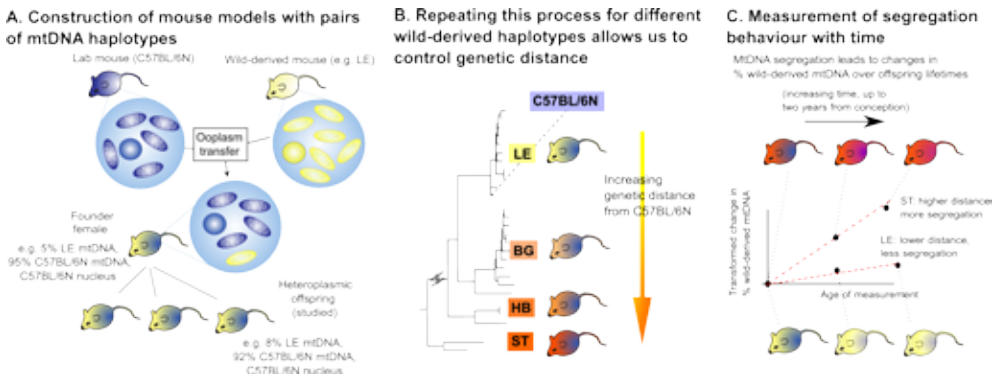
The ranges of two house mouse subspecies, *Mus musculus musculus* and *M. m. domesticus* (Fig. 1), meet and form a narrow hybrid zone (HMHZ) in Europe. The HMHZ is maintained by a balance between dispersal of parental genotypes into the zone and selection against hybrids. We have been undertaking a long-term study in this zone and have already identified male hybrid selection targets with lowered fitness caused by spermatogenic defects. Experimental mating was employed to explore the spectrum of spermatogenic failure phenotypes and map loci affecting male sterility. We found that (i) the first mammal sterility gene *Prdm1* on chromosome 17 both controls (allelically) and delays onset of spermatogenesis, (ii) the 4.7 Mb region on Chromosome X harbouring the *Hstx2* locus causes asymmetrical spermatogenic arrest in reciprocal intersubspecific F1 hybrids and (iii) an uncharacterised *1700093K21Rik* gene located on chromosome 11, expressed specifically within spermatogenic cells, may hamper gene flow in the HMHZ. Unlike male fitness de-



Portrait of the two house mouse subspecies, *Mus musculus musculus* (right) and *M. m. domesticus* (left). (Photo by P. Munclinger)

fects, which contribute directly to reproductive isolation in the initial stages of speciation, maternal-fetal conflicts represent barriers to post-speciation evolution in the genus *Mus*.

Hybridisation also affects the behaviour of mtDNA. When two mtDNA haplotypes are present in a cell, it is usually assumed that seg-



Creation and measurement of wild-derived heteroplasmic mouse lines with diverse mtDNA haplotypes. (A) Founder females were created by ooplasmic injection from a wild-derived mouse (yellow) into a zygote of a standard laboratory mouse (*C57BL/6N*; blue). (B) This process was repeated for each of four wild-derived mtDNA haplotypes (*LE* shown) to achieve a range of genetic differences between haplotype pairs, thereby allowing us to address, for the first time, the effect of mtDNA diversity on segregation. (C) To compute segregation rates, levels of wild-derived mtDNA haplotype were measured in numerous mice of different ages from each lineage. Our inferential machinery allows us to compute the change in levels of the wild-derived haplotype since conception and to record heteroplasmic change as a function of the age of the each mouse, thereby allowing us to infer segregation rate in each tissue in each lineage.

regation (the proliferation of one haplotype over another) is negligible. Using a three-parent mouse model, we challenge this assumption by showing that segregation in heteroplasmic mice (i) depends on the genetic distance between mtDNA haplotypes, (ii) is related to postmitotic activity

of individual organs and (iii) covers all developmental stages of the mouse. Given that the British Parliament approved the delivery of three-parent children in order to avoid mtDNA-borne diseases in February 2015, this result has direct relevance for therapies in human medicine.

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## Genetic analysis of small African mammals uncovers cryptic diversity and evolutionary mechanisms

Despite their practical importance to humans (e.g. through pest and disease transmission), rodents, shrews and bats are amongst the least known of African mammals. Analysis of the most comprehensive genetic dataset available for the genus *Mus* (represented by the African subgenus *Nanomys*) in sub-Saharan Africa revealed unexpectedly high species diversity with numerous undescribed species. This is surprising for a genus that contains one of the best known mammal species, the house mouse. Some species were re-discovered, as exemplified by a single known species of the endemic Ethiopian genus *Muriculus*, which was unambiguously transferred to the genus *Mus* based on the first genetic analysis of an individual captured for more than 70 years. New systematic arrangements in West African vespertilionid bats revealed cryptic taxa in five commonly known species, suggesting that these West African populations have been isolated from other African regions over a long period and that West Africa may be a biogeographic hotspot with more diversity yet to be discovered. We also provided additional data on the poorly known carnivorous heart-nosed bat and the first complete phylogenetic analysis of the family Megadermatidae, showing early radiation of five currently monotypic lineages.



Dorsal view of an adult „*Muriculus imberbis*” female rediscovered in the Galama Mountains of Ethiopia in November 2012. This is the first individual of the genus caught for 70 years. Genetic analysis, however, revealed that it is in fact one of the oldest representatives of the genus *Mus* in Africa.

(Photo by M. Polák)

This increase in our knowledge of small African mammals allows us to use them as models for understanding general evolutionary processes such as speciation. Each individual that moves to a new area during changes in species distribution carries with it its genetic information, which allows us to identify the source population. Comparison of intraspecific lineage distribution patterns for a specialised forest rodent, the delectable soft-furred mouse *Praomys delectorum*, and the widely distributed African giant shrew *Crocidura olivieri*,





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## Assessing and protecting the genetic diversity of European vertebrates

Genetic data from the whole distribution range of a species provides important information on the history of particular populations, including colonisation routes and location of glacial refugia. Using the European ground squirrel (*Spermophilus citellus*) as a model species, we provided the first genetic evidence of the Pleistocene interglacial “refugia of continental climate” and described colonisation patterns for this steppe specialist. Using a combination of genetic markers, other studies have revealed spatial patterns of genetic diversity for the sika deer (*Cervus nippon*), little owl (*Athene noctua*) and spur-thighed tortoises (the *Testudo graeca* complex). Such results will provide important guidance for science-based conservation management decisions. Genetic data can also be used to identify population fragmentation and barriers to gene flow, quantification of inbreeding level and delimitation of evolutionary significant units and management units. A detailed analysis of all Slovakian chamois populations, for example, has provided evidence of very low genetic diversity in the only indigenous population of Tatra chamois (*Rupicapra rupicapra tatri-*

*ca*) in the Tatra Mountains and past hybridisation between a back-up population of Tatra chamois from the Low Tatra Mountains and an introduced Alpine chamois (*R. r. rupicapra*) populations from neighbouring mountain ranges.

One of the main problems in science-based conservation management is to transfer genetic knowledge into practical conservation decisions. The Institute of Vertebrate Biology, as a leading Czech institution in conservation genetics, participated in the European ConGRESS Project (Conservation of Genetic Resources for Effective Species Survival; supported under the 7<sup>th</sup> Framework Programme of the European Commission). The main aim of this project is to create a bridge between conservation genetics researchers, nature conservation policy makers and practical managers. As part of this project, we actively promoted collaboration between Central European nature conservation organisations and conservation genetics researchers through the organisation of special workshops, supporting bilateral project co-operation and disseminating genetic knowledge to the wider public.

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Tatra chamois (A) a European ground squirrel (B) are both endangered in Central Europe. The results of genetic analysis projects are helping improve science-based conservation management decisions.

(Photo by J. Książek and Š. Řičanová)

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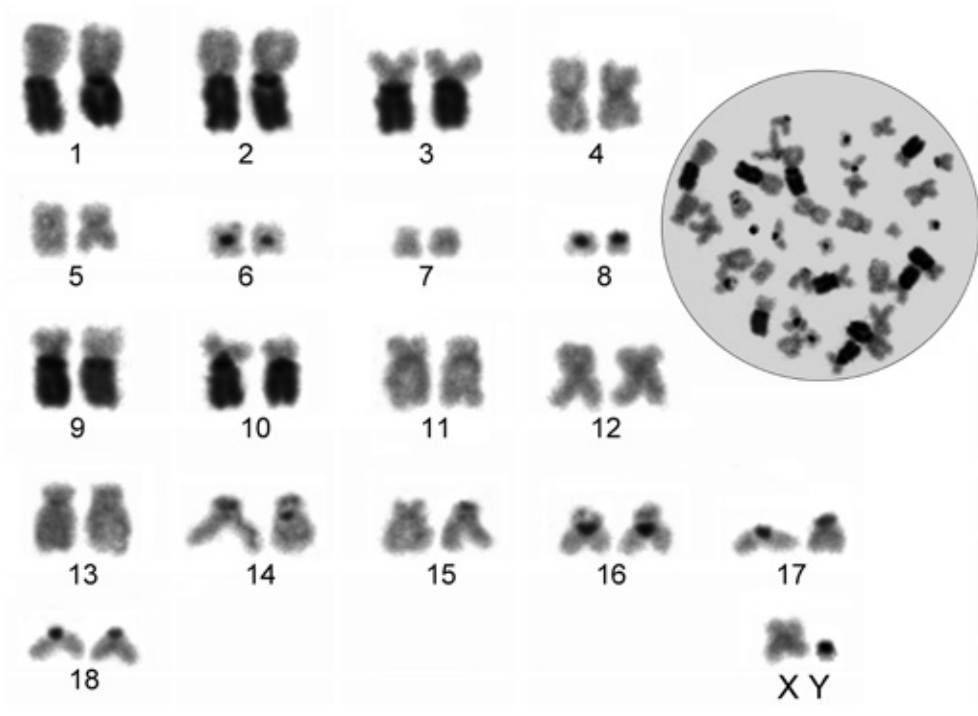
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## Karyotypes of Turkish mammals

Turkey, which is situated in the north-east Mediterranean, maintains a diverse range of biota and landscape and climate types. The region is of prime biogeographical interest due to its position between Europe and Asia, meaning that the biota has been affected by complex vicariant interactions between the two continents. Over recent decades, intensive cytogenetic research has taken place on mammals in Turkey and its neighbouring regions, with the result that most species occurring in this area have been studied. Karyological studies have also been undertaken by mainly Turkish researchers, and dozens of papers have been published reporting karyotypes and chromosomal variation in local mammals. The results of such chromosomal investigations have contributed significantly to our understanding and to the resolution of a range of systematic and zoogeographical questions in the region.

In collaboration with colleagues from Selçuk University in Konya, we summarised and reviewed the available data on mammal karyotypes from Turkey and its surroundings in order to highlight the implications to taxonomy and systematics. We also included findings derived from our own original research. One hundred and nine karyotypes have now been published for species within Turkey, with further records on Turkish mammals also available from other geographic regions. Intraspecific chromosomal variation (polymorphism or polytypy) was reported in 22 species. In 17 Turkish species, a different karyotype was reported than that recorded in other regions. Within the report, we provide proposals for possible future directions in cytogenetic investigations of Turkish mammals.



C-banded karyotype of the marbled polecat (*Vormela peregusna*) from Turkey. The complement includes large blocks of C-heterochromatin in several autosomal pairs.

(Photo by A. Arslan)



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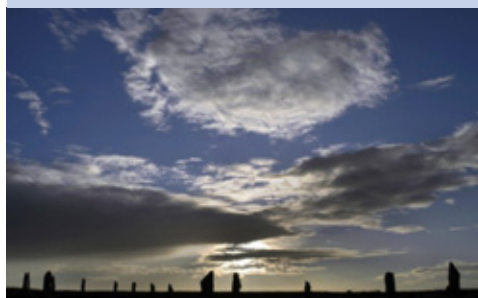
## Evolution on islands

Small offshore islands usually harbour a fraction of the biodiversity found on the mainland. Through our genetic studies we have not only identified a clear exception to this rule, we have also been able to map actual historical events in the island's past associated.

The Orkney Islands in the North Sea represent a “genetic ark”, preserving much of the diversity that has been lost on the mainland. The genetic variability of common voles (*Microtus arvalis*) on Orkney, for example, rivals that found across the rest of Western Europe. Through our studies, we have been able to confirm that the initial loss of biodiversity on the mainland coincided with increased human influence on the landscape from the Neolithic period on. Moreover, our results indicate continuous and lively, long-distance seafaring by Neolithic farmers. In this way, the results of wildlife research have been able to provide important additional information about human history. Isolated small mammal populations on islands tend to exhibit morphological changes leading to gigantism following island colonisation, with such changes often co-occurring with increased area of pasture and the introduction of commensal pest rodents. Our study on Orkney has clearly shown that



Natália Martínková trapping voles on the Orkney islands. (Photo by S. Martinek)



Research on Orkney voles revealed that they had a lively historical sea connection with present-day Belgium. (Photo by S. Martinek)

humans have inadvertently changed the ‘shape’ of wild mammals throughout history, thereby

clearly demonstrating the enormous influence humanity has had on the Earth.

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## Diversity, phylogeny and biogeography of African amphibians and reptiles

African biodiversity is still largely underestimated, and this is particularly true for the lower vertebrates and some geographical regions, such as the Congo Basin. To partially address this, we have been studying the diversity, phylogeny and biogeography of amphibians and reptiles from forested regions of tropical Africa. Our revision of the type material for East African montane *Leptopelis* tree frogs has resulted in several taxonomic and nomenclatural changes, including synonymisation of *L. barbouri* with *L. flavomaculatus*, and resurrection of *L. grandiceps* through redescription. This study serves as a stepping-stone for an ongoing thorough systematic and biogeographic assessment of the genus. African torrent frogs have a disjunct distribution with species endemic to West (*Odontobatrachus*), Central (*Petropedetes*) and East Africa (*Arthroleptides*). A molecular phylogeny provided insights into their evolutionary and biogeographical histories and revealed several candidate undescribed species. The colonisation history of reed frog species endemic to the oceanic islands of São Tomé and Príncipe in the Gulf of Guinea (*Hyperolius mollerii* and *H. thomensis*) was inferred based on phylogeographical structure in the *H. cinnamomeoventris* species complex, which is distributed across continental Central Africa. Our analysis supported a single dispersal event from the Ogooué or Congo Basins to the island of São Tomé, with subsequent divergence within the island and dispersal to Príncipe. We published new data on the morphology, systematic position and distribution of an almost unknown colubrid snake (*Helophis schoutedeni*) from the Congo Basin based on both museum

specimens and new data from the field. Finally, we have also published the results of a herpetological survey of the western Democratic Republic of the Congo.



(A) *Leptopelis grandiceps* from Tanzania was resurrected and redescribed as a valid species. (B) *Helophis schoutedeni* from the central Congo Basin was described in 1922, though the first photographs of a live specimen and detailed data on morphology and distribution were only published in 2014. (Photos by V. Gvoždík)



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## Gobiid invasion of European rivers – drivers, patterns and impacts

Several Ponto-Caspian gobiid species have greatly extended their ranges into several major European watersheds (middle and upper Rhine, Vistula and Danube) since the 1990s, mainly through introduction into ports in ship ballast-water or as fishing bait. The same introduction routes are believed to have introduced gobies into the Laurentian Great Lakes and the Baltic Sea. Following their spread into the Czech Republic, our team have been studying aspects of round (*Neogobius melanostomus*) and Western tubenose (*Proterorhinus semilunaris*) goby range expansion, including dispersal mechanisms, diet, habitat competition with native fish species and life-history trait shifts. In a review of the historical expansion of five gobiid species, we showed that the main expansion nodes coincide with several important geopolitical changes (e.g. the collapse of the Soviet Union and the Yugoslavian conflicts) or economic events such as expansion of middle/upper Rhine ports. Our studies have shown that, while ship transport is the primary driver of large-scale range expansion, observations of 'secondary invasion' into and along non-navigable tributaries confirm their ability to disperse effectively without 'ship-hiking'. We suggest a secondary invasion process involving colonisation of distant upstream sites through dispersal of a small number of pioneers (or through bait-bucket introduction by anglers), followed by colonisation of the downstream stretch through passive drift of early life-stages. Hydroelectric power stations have proved insignificant barriers to downstream expansion as early life-stages have been shown to drift through the turbines with very low damage rates. Other long-term projects currently underway suggest that (i) shifts in life-history traits following invasion (e.g. fecundity, age-at-maturity, growth rate) are due to biotic pressures such as decreased predation or competition and do not occur unconditionally (as has



Transport in ballast water of large cargo vessels is the primary driver of large-scale gobiid expansion (River Danube, Bulgaria).

(Photo by R. Blažek)



Drift of early life-stages plays an important role in downstream gobiid expansion following introduction or pioneer colonisation upstream.

(Photo by L. Šlapanský)

recently been suggested for the species), and that (ii) tubenose gobies, previously considered a low-risk species due to its patchy distribution and low abundance, can reach relatively high abundances when it is the only gobiid invader, suggesting that it is an inferior competitor to most other gobiid species. In quantifying dietary preference in both round and tubenose goby, we have focused on less

er-studied aspects such as seasonal changes and differences related to age, sex and diel period. Our results demonstrate that both species are generalist feeders that only compete with native species when resources are highly restricted. Contrary to general opinion, we found no evidence for feeding on native fish eggs and juveniles. Furthermore, we showed that round gobies are capable of consuming the carcasses of fish larger than itself, thereby

helping clarify its trophic position and role in energy and contaminant transfer in newly colonised ecosystems. During our studies, we investigated the role of methodology and equipment on sampling success. We were able to show that rod-and-line angling, a commonly used method in some countries, showed distinct sex and size bias.

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## Effectiveness of legal bird protection in Central and Eastern Europe

The protection of species is one of the major focuses of conservation efforts. Large-scale assessments of the effect of species protection on animal populations are, however, rare. While legal protection has been shown to benefit birds in Western Europe and the United States, assessments have yet to take place in Eastern Europe, where modern

environmental legislation was only established in the early 1990s following large-scale political change. We found that, after 1990, trends in protected species improved more than in unprotected species. This suggests that, while there was high variability in population trends between countries, national legislation has helped prevent declines in protected species. In particular, protected species population trends showed great improvement in those countries providing ‘narrow and deep’ protection to fewer species. In contrast, protected species trends remained almost unchanged in those countries providing ‘broad and shallow’ protection to many species, while some unprotected species showed adverse population trends in these countries. We suggest that a combination of ‘broad and shallow’ and ‘narrow and deep’ protection might be more efficient in securing healthy bird populations for the future. In order to develop effective conservation measures, however, it is crucial that we understand how ecological and life-history traits relate to risk of species extinction. Our results from the Czech Republic suggest



The crested lark (*Galerida cristata*), a farmland bird species whose numbers have fallen dramatically over recent decades. (Photo by J. Koleček)

that a slow life history increases the risk of extinction in habitat-specialist passerine birds, but reduces such risk in habitat generalists. This higher threat to habitat specialists is consistent with their higher sensitivity to human-induced environmental perturbation, and most notably to habitat loss. Nevertheless, the negative effects of habitat specialisation appear to be somewhat compensated for by a faster life history. Finally, we also found

that species breeding in warmer areas experience higher extinction risk than those breeding in colder areas. Although the effect of climatic niche is usually attributed to the impact of climate change, we suggest that habitat destruction is a more likely explanation as warmer lowland regions are more heavily exploited through intensive agriculture, industry and urban development.

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# Parasites and diseases

Emergence and spread of arthropod-borne viruses in Central Europe – new threats for human health . . . . .	79
Neglected and emerging tick-borne pathogens – an urgent need for rapid surveillance . . . . .	80
Diversity of parasites and microbiota in two house mouse subspecies . . . . .	81
Variability and evolution of Toll-like receptors, key players in innate immunity of rodents and birds . . . . .	82
White-nose syndrome fungus: a generalist pathogen of hibernating bats . . . . .	83
Causative agents of infection in passerine birds and nymphal ticks . . . . .	84
New parasites and host-parasite associations from the Neotropical and Palearctic Regions . . . . .	86
Parasites of great apes vs. human . . . . .	87
Parasite infection in 0+ juvenile fish . . . . .	88
MHC genes and parasitism - patterns and processes linked to fish hybridisation and polyploidisation . . . . .	88
Viruses in African bats . . . . .	90





## PARASITES AND DISEASES

### Emergence and spread of arthropod-borne viruses in Central Europe – new threats for human health

Mosquito-borne zoonoses represent a significant health threat to Europe. We report on the first occurrence of West Nile virus (WNV) in the Czech Republic and its role as the agent of recent West Nile Fever outbreaks in Europe. We isolated WNV lineage 2 (WNV-2) from *Culex modestus* mosquitoes collected at local fish ponds. Phylogenetic analysis demonstrated that the Czech WNV-2 strain is closely related to other WNV strains circulating simultaneously in Europe. Our findings represent the current northernmost range of WNV in Europe. Early detection of emerging WNV in a new area is essential for rapid response during European WNV outbreaks. A serological survey for WNV infection between 2008 and 2011 involved 395 horses from 43 administrative districts in the Czech Republic (163 animals) and 29 districts in Slovakia (232 animals). Non-vaccinated horses in Slovakia had a seropositivity rate of 8.3% and autochthonous local infection with WNV occurred in at least 11 horses, i.e. 4.8%. All seropositive horses lived in six lowland districts of southern Slovakia, situated relatively close to the border of Hungary, where WNV has been reported in birds, horses and humans since 2003. We also described isolation of the pathogenic Tahyna virus (TAHV) from *Anopheles hyrcanus* mosquitoes. *A. hyrcanus*, which preferentially feeds on mammals, including humans, is a new potential vector for TAHV in Europe. Newly emerging viruses, including WNV, pose a significant threat to the human population. We identified the complete polyprotein gene sequence of a novel divergent WNV strain found in a pool of *Uranotaenia unguiculata* mosquitoes. This new strain, which constitutes either a ninth lineage of WNV or a sublineage of lineage 4, highlights the remarkable genomic diversity of WNV in nature. In a further study, we isolated the Central European lineage of Usutu virus (USUV) from a blackbird *Turdus merula* that was found dead in the city of Brno, Czech Republic, in 2011. The USUV has only recently emerged in Central Europe and represents a health risk for local bird populations (mainly blackbirds). Molecular char-



The mosquito collection from the Sedlec study site in South Moravia. Human pathogenic West Nile virus was isolated from (*Culex modestus*) mosquitoes trapped at this locality.

(Photo by J. Peško)

acterisation of a novel Sedlec virus (Orthobunyavirus, Bunyaviridae), which is genetically similar to the veterinarily important Schmallenberg virus, raises questions about the emergence of new vertebrate pathogens in the foreseeable future. Finally, we published a comprehensive review of known data on arboviruses pathogenic to domestic and wild animals. Forty-five arthropod-borne viruses pathogenic to animals have been documented worldwide. The corresponding diseases (e.g. American equine encephalomyelitis, West Nile encephalitis, Nairobi sheep disease, Rift Valley fever, Akabane fever, Schmallenberg disease, African horse sickness, bluetongue, vesicular stomatitis and African swine fever) can cause significant losses in animals. This paper is the first modern complete and systematic review of such zoopathogenic arboviruses. Our studies highlight the growing public health risk connected with globalisation and the spread of emerging viral infections in Europe.

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## Neglected and emerging tick-borne pathogens – an urgent need for rapid surveillance



Engorged ticks collected from sheep (above). Ticks were screened for multiple pathogens using molecular methods (below).

(Photo by J. Peško)



Tick-borne diseases represent a major public and animal health issue worldwide. The castor bean tick *Ixodes ricinus*, primarily associated with deciduous and mixed forests, is the principal vector of causative agents of viral, bacterial and protozoan zoonotic diseases in Europe. Recently, abundant tick populations have been observed in European urban green areas, which are of public health relevance due to the exposure of humans and domesticated animals to potentially infected ticks. We published a review summarising the known data on emergence of tick-borne pathogens in urban areas of Europe. Understanding the ecology of ticks and their associations with hosts in European urbanised environments is crucial for quantifying the parameters necessary for risk pre-assessment and identification of public health strategies for control and prevention of tick-borne diseases. In a second study, six proven human-pathogenic genomic species were recorded in *I. ricinus* ticks, i.e. *Borrelia afzelli*, *B. garinii*, *B. burgdorferi* s.s., *B. valaisiana*, *B. lusitaniae* and *B. spielmanii*. Emergent *B. spielmanii* was detected in *I. ricinus* ticks for the first time in the region. These results highlight the need for zoonotic tick-borne pathogen surveillance, even in urban areas. A further study provided first data on the occurrence of human pathogenic rickettsiae in the Czech Republic in questing *I. ricinus* ticks. Serologic surveillance of arboviruses is a useful method for indicating contact of a population with a particular agent, and retrospective epidemiolog-

ical analysis. An unexpectedly high infection rate (26%) by tick-borne encephalitis virus (TBEV) was identified in a herd of 257 horses of the same breed distributed between three Austrian federal states. Using the ELISA test, the horses cross-reacted with WNV; however, a confirmatory neutralisation test indicated that the antibodies were formed against TBEV. This study highlights the importance of us-

ing appropriate serological methodology for diagnosis of flavivirus infections. Our studies show that the monitoring of tick vectors, and the pathogens they transmit, along with serosurveys of vertebrate reservoirs within the scope of epidemiological surveillance, is an important tool for improving prevention and control of tick-borne diseases in the human population.

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## Diversity of parasites and microbiota in two house mouse subspecies

There has been a long-term debate as to the factors that keep divergent house mouse genomes apart, despite interbreeding along their contact zone. In an earlier study, we challenged the dogma that parasites, which were thought to be more abundant in hybrid mice from the hybrid zone (HMHZ), were the selecting factor decreasing fitness in hybrids. We found that *Toxoplasma gondii* and *Neospora caninum* infection prevalence was too low (0.6 and 3.6%, respectively) to have any significant effect on HMHZ dynamics. We controlled for the low level of *T. gondii* infection independently using the “magnetic capture method”, which has been shown to detect < 10 tachyzoites in mice brains. Sequencing of the *M94* gene for murine cytomegalovirus in 520 mice revealed co-divergence of the virus with its host. Such a finding, which corroborated our previous results, suggests that hybrid zones may be genera-

tors of new genetic (and perhaps also phenotypic) variation in parasites.

In order to assess whether the genetic differentiation observed between two house mouse subspecies, *Mus musculus musculus* and *M. m. domesticus*, was also corroborated within their symbionts, we used pyrosequencing of 16S rDNA from the gastrointestinal tract microbiota in wild and inbred mice. No subspecific differences between the subspecies were detected in wild mice from either side of the HMHZ. Similarly, inbred and wild populations showed the same level of microbial diversity. On the other hand, we found ca. 16% differentiation in microbiota composition between wild and inbred mice. The distinctness of inbred mice from their wild counterparts may have implications for biomedical research, where almost all experiments utilise classical inbred laboratory strains.

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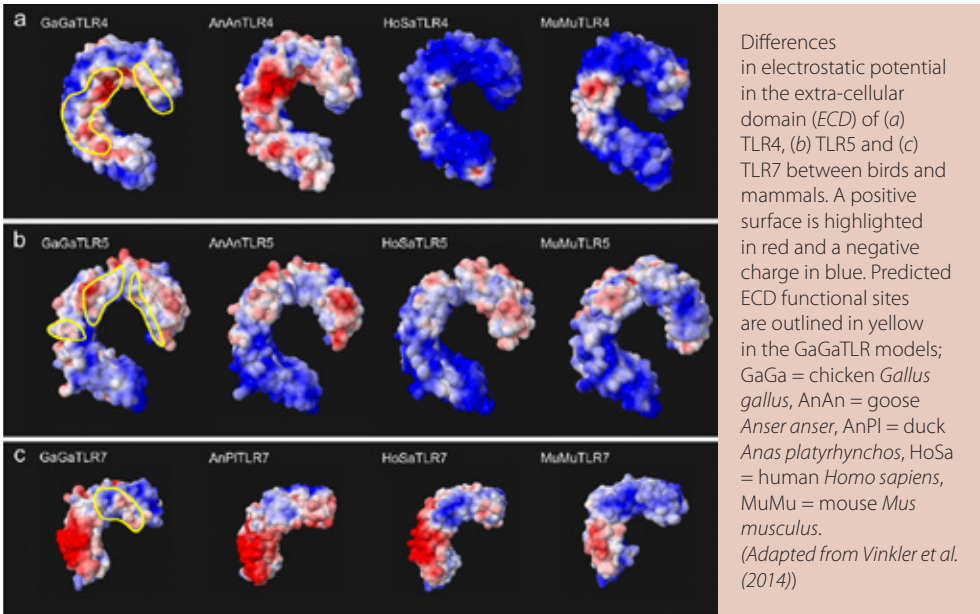
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## Variability and evolution of Toll-like receptors, key players in innate immunity of rodents and birds

Studies of immune responses to parasite infection are an important sector of disease ecology. Until very recently, most such studies in free-living vertebrates focussed on genetic variability and selection processes affecting the major histocompatibility complex (MHC), a crucial element of adaptive immunity. Evolutionary mechanisms of innate immunity, on the other hand, have often been overlooked. In our research, we have undertaken intensive studies on Toll-like Receptors (TLRs), which are responsible for identification of pathogen-associated molecular patterns (PAMPs) and initiation of innate (and later also adaptive) immune responses. As PAMPs are often very conservative, it was expected that TLRs would also have very low variability. We sequenced

genes, however, with a more intense signal in bacterial-sensing TLR4 than the viral-sensing TLR7. Of those sites evolving under positive selection in TLR4 and TLR7, 92% and 100%, respectively were located in the extracellular domain, which is responsible for ligand binding. In a further study, we found that even closely related wild house mice populations (subspecies) can have very different allelic TLR4 composition. As this TLR recognises bacterial lipopolysaccharide, the differences observed may indicate different selection pressures in the past.

The TLR5 receptor is responsible for detection of microbial flagellin in vertebrates and hence recognition of potentially pathogenic bacteria. We reported on the emergence of a TLR5 pseu-



genes encoding TLR4 and TLR7, two of the key innate immunity bacterial- and viral-sensing receptors, across 23 species within the subfamily Murinae. Sequence analysis revealed that major parts of both TLRs are evolving under strong purifying selection, most probably due to functional constraints. A number of signatures for positive selection have also been found in both

rodent in several phylogenetic passerine bird lineages. Of 47 species examined, 18 possessed the TLR5 pseudogene. Both phylogenetic analysis and the form of mutation responsible for pseudogenisation indicate that the TLR5 pseudogene has emerged independently at least seven times in passerines. Lack of any functional copy of the gene has been verified in four species (rep-



representing the four main passerine lineages possessing the TLR5 pseudogene) based on TLR5 mRNA blood expression. Further research is needed to assess the impact of TLR5 loss on immunological performance in birds.

In two further studies, we provided a detailed description of the genetic structure and polymorphism of several TLRs in Galloanserae birds. We found that physiochemical properties varied according to the TLR analysed, mainly with regards to the distribution of surface electrostatic potential. Predicted ligand-binding features (mainly

in TLR4 and TLR5) differed between avian proteins and their fish and mammalian counterparts, but also varied within the Galloanserae birds. We identified 20 positively selected sites in the three TLRs, several of which were topologically close to ligand-binding sites reported for mammalian and fish TLR. To our knowledge, these are the first studies to depict evolutionary pressures on Galloanserae TLR and to estimate the validity of current knowledge on TLR function (based on mammalian and chicken models) for non-model species of this clade.

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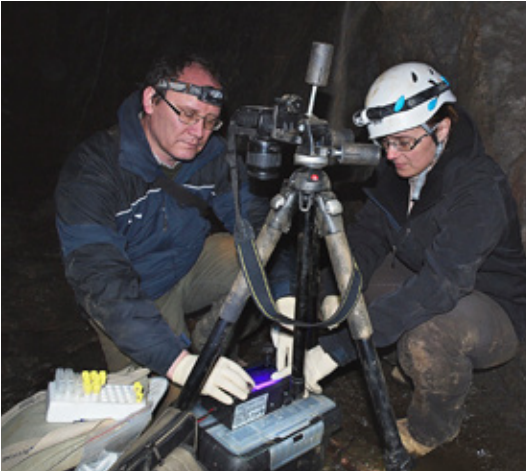
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## White-nose syndrome fungus: a generalist pathogen of hibernating bats

Bats control night-flying insect populations in temperate zones, hence changes in bat population sizes influence costs of pest management in agriculture. In North America, a fungal infection that causes white-nose syndrome in hibernating bats has led to unprecedented regional population declines. In Europe, the disease is present at high prevalence levels yet European bat populations have not declined. Differences in hibernation survival of bats from North America and Europe infected with the white-nose syndrome fungus have led to the conclusion that European bats do not develop the disease. We developed a novel method of detecting skin lesions diagnostic for white-nose syndrome. The method can be readily used in the field, is non-lethal and enables guided biopsy for definitive proof of the disease. Using this method, we demonstrated the full diagnostic criteria of white-nose syndrome in multiple bat species surviving



White-nose syndrome sometimes manifests as a white, puffy growth on hairless body parts of hibernating bats.  
(Photo by J. Pikula)



hibernation in Europe. Together with the development of immortalised cell lines from bat tissues, we are now investigating interactions between the host and pathogen across a scale from community level to cell-to-cell interactions. Worryingly, we found that the disease affects unrelated bat species with varied ecological and behavioral characteristics. We predict that all bats within the pathogen's range may be susceptible.

Natália Martínková and Jiří Pikula examine a bat with ultra-violet light transillumination to detect white-nose syndrome.

(Photo by H. Bandouchová)

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## Causative agents of infection in passerine birds and nymphal ticks

Infectious diseases are disorders caused by a range of organisms that can be devastating, and sometimes fatal, to the host. We studied avian host-parasite systems in South America and Central Europe, examining a total of 1,364 birds belonging to 84 species. Parasitic infections caused by trematodes and bacteria were found in birds and nymphal ticks from Brazil and Peru. Eye trematodes were identified in the edematous conjunctival sac of 11 (48%) of 23 resident many-coloured rush tyrants *Tachuris rubrigastra*. The trematodes were identified as *P. lucipetus* based on morphometric characteristics. The combined ITS2 and CO1 genes in those specimens examined showed a 99% similarity to an Iranian isolate of *Philophthalmus* sp. from the intermediate host the red-rimmed melania *Melanoides tuberculata*, an invasive freshwater snail, suggesting that these two isolates represent the same species with a wide geographical range. Moreover, prevalence of infection with the philophthalmid cercariae was 31% in 744 *M. tuberculata* examined in Peru. Clearly, *P. lucipetus* occurs throughout the world, includ-

ing Eurasia and South America. We were the first to report this trematode in Peru, however, and the first to sequence any of South American eye trematode. The low host specificity of *P. lucipetus* and the invasive character of *M. tuberculata* as a competent intermediate host suggests that eye trematodosis caused by *P. lucipetus* may emerge frequently in various parts of the world, and especially in the tropics. We predict an increase in the zoonotic potential of *P. lucipetus* associated with the present invasion of this snail across the world, which should be of interest for further research.

Ticks collected from Brazilian birds were tested for the presence of rickettsiae. Seven birds (5%) were infested with four *Amblyomma calcaratum* nymphs (silver-beaked tanager *Ramphocelus carbo*, 3 infested/12 examined) and five larvae of *Amblyomma* sp. (rufous hornero *Furnarius rufus*, 2/5; pale-breasted thrush *Turdus leucomelas*, 1/6; and yellow-billed cardinal *Paroaria capitata*, 1/8). All four *A. calcaratum* nymphs tested (using a polymerase chain reaction targeting rickettsial genes





A many-coloured rush tyrant *Tachuris rubrigastra* parasitised with the eye trematode *Philophthalmus lucipetus*.

(Photo by M. Čapek)

gltA and ompA and by amplicon sequencing) were found to be infected with *Rickettsia* sp. strain NOD, a *Rickettsia parkeri*-like agent. Further, *A. calcaratum* infected with the rickettsial bacterium were found for the first time. Neither *A. calcaratum* nor the closely related *A. nodosum* have ever been

reported to have bitten humans, whereas *A. longirostre* has been reported as infesting humans, but only sporadically. Even though the chance of these three tick species transmitting the NOD strain to humans is presumed to be quite low, the fact that the NOD strain was found to infect three different tick species collected from birds does suggest horizontal transmission, possibly via birds. The role of *A. calcaratum* in the epidemiology of spotted fever, therefore, clearly requires further study.

We recorded ticks of the *H. marginatum* complex in birds from Central Europe during the spring migration. Sixteen individuals of six passerine species (great reed warbler *Acrocephalus arundinaceus*, the Eurasian reed warbler *A. scirpaceus*, the marsh warbler *A. palustris*, the sedge warbler *A. schoenobaenus*, Savi's warbler *Locustella luscinioides* and the common nightingale *Luscinia megarhynchos*) were found to be transporting 30 *H. marginatum* ticks over five spring seasons. All of these Central European breeders are migratory species wintering in Africa. This is the first study to record ticks of the *H. marginatum* complex on the great reed warbler and Savi's warbler. Ticks of the genus *Hyalomma* are well-known vectors for transmitting infectious agents that can result in severe and potentially fatal diseases in humans. Migratory birds may carry infected ticks over long distances.

ČAPEK M, LITERÁK I, KOCIANOVÁ E, SYCHRA O, NAJER T, TRNKA A, KVĚREK P, 2014: Ticks of the *Hyalomma marginatum* complex transported by migratory birds into Central Europe. *Ticks and Tick-borne Diseases* 5: 489–493.

LITERÁK I, HENEGER P, SITKO J, WETZEL EJ, CARDENAS-CALLIRGOS JM, ČAPEK M, VALLE BASTO D, PAPOUŠEK I, 2013: Eye trematode infection in small passerines in Peru caused by *Philophthalmus lucipetus*, an agent with a zoonotic potential spread by an invasive freshwater snail. *Parasitology International* 62: 390–396.

OGRZEWALSKA M, MARTINS T, ČAPEK M, LITERÁK I, LABRUNA MB, 2013: A *Rickettsia parkeri*-like agent infecting *Amblyomma calcaratum* nymphs from wild birds in Mato Grosso do Sul, Brazil. *Ticks and Tick-borne Diseases* 4: 145–147.

## New parasites and host-parasite associations from the Neotropical and Palearctic Regions



The black-faced solitaire *Myadestes melanops*, in which *Myrsidea hrabaki*, a chewing louse new to science, was discovered.

(Photo by M. Čapek)

Parasites represent a significant percentage of the diversity of life on earth. In parts of the world where the most biologically diverse and complex habitats occur (e.g. in the Neotropics) we know very little about the diversity and distribution of both external and internal bird parasites. We concentrate on studying host-parasite systems in Central and South America and in Central Europe. A total of 2,509 individuals of 303 bird species were examined for the presence of parasites. We concentrated on mites (Acariformes), chewing lice (Phthiraptera) and fleas (Siphonaptera). Newly discovered species

and their type hosts included *Piciformobia cinnyerthiae* sp. nov. ex rufous wren *Cinnyerthia unirufa*, *P. henicorhinae* sp. nov. ex white-breasted wood wren *Henicorhina leucosticta*, *Myrsidea fasciata* sp. nov. ex fasciated wren *Campylorhynchus fasciatus*, *M. assimilis* sp. nov. ex white-throated thrush *Turdus assimilis*, *M. cerrodelamuertensis* sp. nov. ex black-billed nightingale-thrush *Catharus gracilirostris*, *M. hrabaki* sp. nov. ex black-faced solitaire *Myadestes melanops*, *M. obsoleti* sp. nov. ex pale-vented thrush *Turdus obsoletus*, *M. quinchoi* sp. nov. ex ruddy-capped nightingale-thrush *Catharus frantzii*, *M. tapanti* sp. nov. ex slaty-backed nightingale-thrush *Catharus fuscescens* and *M. tapetapersi* sp. nov. ex sooty thrush *Turdus nigrescens*. A portion of the mitochondrial cytochrome oxidase I gene was sequenced from some *Myrsidea* and *Penenirmus* species in order to assess their relative genetic divergence. Subsequently, we found a specific host association between *Androlaelaps fahrenheitzi*-like mites and the spotted barbtail *Premnoplex brunnescens* in Costa Rica. Adults (both females and males), deutonymphs and protonymphs were found on 14 *P. brunnescens* examined (prevalence 100%) with a mean abundance of 42 (2–222). The nest environment plays an important role in the evolution of parasites and could explain the evolutionary path of Laelapinae toward parasitism. In this context, we hypothesise that colonisation of *P. brunnescens* took place from sympatrically living rodents quite recently. The morphology and ecology of *A. fahrenheitzi* from *P. brunnescens* may constitute, at least, a new variation of *A. fahrenheitzi*, and possibly a new species.

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KOUNEK F, SYCHRA O, ČAPEK M, LITERÁK I, 2013: Chewing lice of genus *Myrsidea* (Phthiraptera: Menoponidae) from Turdidae (Passeriformes) of Costa Rica, with descriptions of seven new species. *Zootaxa* 3620: 201–222.

LAESCHI M, LITERÁK I, ČAPEK M, SYCHRA O, 2013: Specific association between the mites *Androlaelaps fahrenheitzi* (Acari: Laelapidae) and birds *Premnoplex brunnescens* in Costa Rica: possible evidence of a recent host switch. *Experimental and Applied Acarology* 60: 281–287.

SYCHRA O, KOUNEK F, PAPOUŠEK I, ČAPEK M, CÁRDENAS-CALLIRGOS J, FRANCO S, LITERÁK I, 2014: Chewing lice (Phthiraptera: Amblycera et Ischnocera) from wrens (Passeriformes: Troglodytidae), with description of a new species of *Myrsidea*. *Acta Entomologica Musei Nationalis Pragae* 54: 1–27.

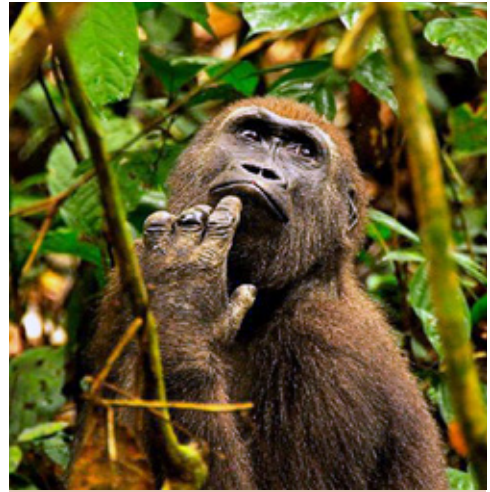
MIRONOV SV, LITERÁK I, SYCHRA O, ČAPEK M, 2014: Two new species of the feather mite family Gabuciniidae (Acariformes: Pterolichoidea) from wrens (Passeriformes: Troglodytidae). *Acta Parasitologica* 59: 568–579.

## Parasites of great apes vs. human

In order to evaluate the impact of close contact with humans on the occurrence of potentially zoonotic parasites in great apes, we conducted long-term monitoring of microsporidia, *Cryptosporidium*, *Giardia* and hookworm infections in great apes at different stages of the habituation process and in humans in the Dzanga-Sangha Protected Areas in the Central African Republic. We also studied protists in mountain gorillas in the Volcanoes National Park, Rwanda. We detected several genotypes (including some novel genotypes) of *Encephalitozoon cuniculi*, *Enterocytozoon bieneusi*, *Giardia intestinalis* subgroup A II and *Cryptosporidium bovis* in lowland gorillas, but only *G. intestinalis* subgroup A II in humans. As *G. intestinalis* was recorded primarily in gorilla groups with close human contact, we suggest that human-gorilla transmission has occurred. Our results also indicated the possible presence of several species of *Necator* hookworms in both humans and great apes. We conclude that *Necator* hookworms can be shared between humans and great apes co-habiting the same tropical forest ecosystems.

In mountain gorillas, we detected several genotypes of *E. bieneusi* and *E. cuniculi*, *C. muris* and *C. meleagridis*. *Cryptosporidium* sp. infections were only identified in the research groups and occurrence of *E. cuniculi* in the research groups was significantly higher compared with tourist groups.

Based on our results, we call attention to a potentially negative impact of human pressure on



Habituated eastern lowland gorilla, Makumba group, Dzanga Sangha Protected Areas, Central African Republic.

(Photo by A. Mihalca, G. D'Amico)

selected pathogens that could occur as a result of more frequent presence of humans in the vicinity of both gorillas under habituation and habituated apes, rather than as a consequence of close contact with humans, which tends to be the more traditional assumption. We encourage the observation of those sections concerning hygiene in the IUCN best practice guidelines for all sites where increased human-gorilla contact occurs.

SAK B, PETRŽELKOVÁ K, KVĚTOŇOVÁ D, MYNÁŘOVÁ A, SHUTT KA, POMAJBÍKOVÁ K, KALOUSOVÁ B, MODRÝ D, BENAVIDES J, TODD A, KVÁČ M, 2013: Long-term monitoring of microsporidia, *Cryptosporidium* and *Giardia* infections in western lowland gorillas (*Gorilla gorilla gorilla*) at different stages of habituation in Dzanga Sangha Protected Areas, Central African Republic. *PLoS ONE* 8: e71840.

SAK B, PETRŽELKOVÁ K, KVĚTOŇOVÁ D, MYNÁŘOVÁ A, POMAJBÍKOVÁ K, MODRÝ D, CRANFIELD MR, MUDAKIKWA A, KVÁČ M, 2014: Diversity of *Microsporidia*, *Cryptosporidium* and *Giardia* in Mountain Gorillas (*Gorilla beringei beringei*) in Volcanoes National Park, Rwanda. *PLoS ONE* 9: e109751.

HASEGAWA H, MODRÝ D, KITAGAWA M, SHUTT K.A, TODD A, KALOUSOVÁ B, PROFOUSOVÁ I, PETRŽELKOVÁ K, 2014: Humans and great apes cohabiting the forest ecosystem in Central African Republic harbour the same hookworms. *PLoS Neglected Tropical Diseases* 8: e2715.

## Parasite infection in 0+ juvenile fish

Young-of-the-year (0+) fish are generally more vulnerable than adults to stressors such as predation, disease, parasite infection, starvation or thermal stress during overwintering. Condition during the juvenile period, therefore, is crucial for fish survival and, consequently, for fitness in adults.



Experimental ponds located on the premises of the Břeclav Division of the Moravian Angling Club were used for evaluation of fish mortality during overwintering. The ponds were covered with large nets to prevent hunting of free-moving fish by piscivorous birds. (Photo by K. Francová)

We tested how parasite infection affects overwinter survival and body condition of juvenile European bitterling *Rhodeus amarus* (Cyprinidae). Under natural conditions, larger bodied fish (early hatched) were less affected by decreased food intake and increased parasite infection than small (late-hatched) fish during overwintering, resulting in a trend of better condition and overwinter survival in larger fish. We also confirmed the direct negative effect of parasites on overwinter survival, showing increased mortality in experimentally infected bitterling with the trematode *Diplostomum spathaceum*. Overall winter mortality, therefore, is the result of an interaction between more than one stressor. We then tested variance in parasite infection of juvenile perch *Perca fluviatilis* in different habitats along the longitudinal and transversal profile of a reservoir. Longitudinal profile (inflow, reservoir body, outflow) appeared to be a more important factor affecting the perch parasite community than transversal profile (littoral, pelagic), primarily reflecting differences in parasite (and parasite intermediate host) availability in particular habitats.

**FRANCOVÁ K, ONDRAČKOVÁ M**, 2014: Effect of habitat conditions on parasite infection in 0+juvenile perch (*Perca fluviatilis* L.) in two Czech reservoirs. *Hydrobiologia* 721: 57–66.

**MICHÁLKOVÁ V, ONDRAČKOVÁ M**, 2014: Experimental evidence for parasite-induced over-winter mortality in juvenile *Rhodeus amarus*. *Journal of Fish Biology* 84: 1377–1388.

**FRANCOVÁ K, ONDRAČKOVÁ M**, 2013: Overwinter body condition, mortality and parasite infection in two size classes of 0+ year juvenile European bitterling *Rhodeus amarus*. *Journal of Fish Biology* 82: 555–568.

## MHC genes and parasitism - patterns and processes linked to fish hybridisation and polyploidisation

The gibel carp *Carassius gibelio*, an extraordinary fish species displaying dual reproduction forms (gynogenetic and sexual), coexists in mixed diploid-polyploid populations in the Czech Republic. Several hypotheses have been proposed to explain the coexistence of reproductive and sexual forms living in sympatry. Stable coexistence of asexual and sexual forms assumes some disadvantage for asexuals that balances the evolutionary costs of sex. Following the Red Queen (RQ) assumption, asexual organisms are targets for parasite ad-

aptation due to their low genetic diversity. The major histocompatibility complex (MHC) in genes is considered a suitable candidate for testing the RQ hypothesis. We tested whether the asexual form of *C. gibelio* suffers from higher parasite loads than the sexual form. Differences in MHC diversity and different patterns in the positively selected sites in MHC genes found in gynogenens and sexuals are in accordance with the prediction of sexually-mediated selection and fulfil a prerequisite of the RQ hypothesis. We showed that



the most common MHC genotypes of gynogenetic triploids are the target of parasite selection. We also hypothesised that there would be differences in physiological traits between gynogens and sexuals. Such differences could reflect the advantages enjoyed by one form over the other and may also potentially explain the historical shift from gynogenetic unisexual populations to the more recent mixed diploid-polyloid populations. We measured physiological investment using parameters associated with the biochemical profile of blood. The results showed that gynogenetic females had better condition (measured by total protein concentration) than sexual diploids. Higher concentrations of triacylglycerols and cholesterol in triploid females (compared to diploids) indicate a higher metabolic rate and higher energy intake, which may represent a disadvantage for triploids. Differences in blood biochemical analyte concentrations between triploid and diploid females suggest a potential difference in the regulation of a wide range of physiological and biochemical processes.

In a separate study, we focussed on hybridisation in cyprinid fish species using two phylogenetically closely-related species, common carp *Cyprinus carpio* and *C. gibelio*, with the aim of assessing whether interspecies hybridisation affects parasitism. Different degrees of parasite host specificity within a phylogenetic framework were taken into consideration (i.e. strict specialist, intermediate specialist and intermediate generalist). Hybrids



Hybrid of common carp (*Cyprinus carpio*) and gibel carp (*Carassius gibelio*).

(Photo by K. Halačka)

harboured a greater range of parasite species but total parasite abundance was lower compared with parental species. We also found that interspecies hybridisation affected host specificity of ecto- and endoparasites. Parasite species exhibiting different degrees of host specificity for *C. carpio* and *C. gibelio* were also present in hybrids. Our study did not support strict co-adaptation between host and parasite genotypes resulting in narrow host specificity and showed that hybrid genotypes are susceptible to parasites exhibiting host specificity. The immune mechanisms specific to parental species could represent potential mechanisms to explain the low abundance of parasites in *C. gibelio* × *C. carpio* hybrids.

ŠIMKOVÁ A, DÁVIDOVÁ M, PAPOUŠEK I, VETEŠNÍK L, 2013: Does interspecies hybridization affect the host specificity of parasites in cyprinid fish? *Parasites & Vectors* 6: e95.

ŠIMKOVÁ A, KOŠAŘ M, VETEŠNÍK L, VYSKOČILOVÁ M, 2013: MHC genes and parasitism in *Carassius gibelio*, a diploid-triploid fish species with dual reproduction strategies. *BMC Evolutionary Biology* 13: e122.

VETEŠNÍK L, HALAČKA K, ŠIMKOVÁ A, 2013: The effect of ploidy and temporal changes in the biochemical profile of gibel carp (*Carassius gibelio*): a cyprinid fish species with dual reproductive strategies. *Fish Physiology and Biochemistry* 39: 171–180.

## Viruses in African bats



Peter Vallo and Evans Nkrumah sampling bats in Mole National Park, Ghana. Among the most common bat species here belong Noack's leaf-nosed bats *Hipposideros aff. ruber*, which are hosts of coronaviruses causing respiratory disorders.

(Photo by P. Cvecko)

In recent years, bats have become a focus of attention as hosts of viruses of significant concern as regards human health. We carried out several collaborative studies in West Africa that combine expertise in both the natural and evolutionary history of bats and medical-oriented research. Our research has confirmed the importance of bats as ancestral hosts of hepadnaviruses, which include an agent for a major human disease, hepatitis B (HepB). We detected unique viruses in *Rhinolophus* and *Hipposideros* bats from Gabon and *Uroderma* bats from Panama in co-ancestral relation

to the HepB virus. Bats, therefore, appear to be ancestral sources of primate hepatitis viruses. The zoonotic potential observed could affect future concepts for eradicating hepatitis.

In a further study, we detected viruses in *Nyctotis* bats from Ghana and *Pipistrellus* bats from Europe related to the novel, highly pathogenic, human betacoronavirus EMC/2012, an agent causing the respiratory syndrome known as MERS (Middle East Respiratory Syndrome). Based on their phylogenetic position within the coronaviruses, we discovered that EMC/2012 originated from bats. Genomic data suggests that EMC/2012 may be another human coronavirus, as in the agent causing SARS (Severe acute respiratory syndrome), for which an animal reservoir of closely related viruses exists in Old World insectivorous bats with a possibility of switching to humans.

In addition to discoveries related to evolutionary origin and virus diversity, we also explored factors affecting viral richness in bats. The rising incidence of emerging infectious diseases is mostly linked with biodiversity loss, changes in habitat use and increasing habitat fragmentation. These factors could have implications for the role of bats as potential reservoirs in the 15 species of African bats examined in Central and West Africa. Viral richness was higher in large-bodied bats, which had larger and more fragmented distribution areas. Accumulation of viruses may be related to the historical expansion and contraction of bat distribution ranges. Consideration of fragmentation in the geographical distribution of bats should become a relevant condition, therefore, for understanding the role of bats in the circulation of viruses in Africa.

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ANNAN A, BALDWIN HJ, CORMAN VM, KLOSE SM, OWUSU M, NKUMAH EE, BADU EK, ANTI P, AGBENYEGA O, MEYER B, OPPONG S, SARKODIE YA, KALKO EKV, LINA PHC, GODLEVSKA EV, REUSKEN C, SEEBENS A, GLOZA-RAUSCH F, VALLO P, TSCHAPKA M, DROSTEN C, DREXLER JF, 2013: Human betacoronavirus 2c EMC/2012-related viruses in bats, Ghana and Europe. *Emerging Infectious Diseases* 19: 456–459.

DREXLER JF, GEIPEL A, KÖNIG A, CORMAN VM, VAN RIEL D, LEIJTEN LM, BREMER CM, RASCHE A, COTTONTAIL VM, MAGANGA GD, SCHLEGEL M, MÜLLER MA, ADAM A, KLOSE SM, BORGES CARNEIRO AJ, STÖCKER A, FRANKE CR, GLOZA-RAUSCH F, GEYER J, ANNAN A, ADU-SARKODIE Y, OPPONG S, BINGER T, VALLO P, TSCHAPKA M, ULRICH RG, GERLICH WH, LEROY E, KUIKEN T, GLEBE D, DROSTEN C, 2013: Bats carry pathogenic hepadnaviruses antigenically related to hepatitis B virus and capable of infecting human hepatocytes. *Proceedings of the National Academy of Sciences of the United States of America* 110: 16151–16156.



## 4. OTHER ACTIVITIES

### | MEETINGS ORGANISED BY THE INSTITUTE

#### “Zoological Days” Conference 2013

[*Zoologické dny 2013*] – Brno. February 7–8, 2013

“Zoological Days” Conference 2014 [*Zoologické dny 2014*] – Ostrava. February 6–7, 2014

As in previous years, the IVB was the main organiser of the “Zoological days” (*Zoologické dny*) Conference in 2013 and 2014, a traditional and very popular meeting of Czech and Slovak zoologists, that has been organised in Brno since 1969. Since 2008, the conference has only been held in Brno in years with an odd date and in other Czech university towns in each even year. In 2013, the conference was once again organised in collaboration with Masaryk University’s Institute of Botany and Zoology (Faculty of Science). The conference was held at Masaryk University’s Faculty of Economics and Administration, which is an ideal site situated just next to the IVBs headquarters, providing a very representative location for such a large and important conference. In 2014, the conference was organised in partnership with the University of Ostrava (Faculty of Science), which again helped to increase the overall quality of the conference. In both years, the two conference days were preceded by a pre-conference workshop focused on methodology of zoological research (supported by the Education for Competitives Operational Programme). We welcomed 487 zoologists to Brno in 2013 and 445 to Ostrava in 2014. Both the number of participants and the number and quality of presentations clearly show that the “Zoological Days” have become an important scientific event for the whole zoological community of the Czech and Slovak Republics.

For more information, please see <http://zoo.ivb.cz/>.



Dan Bárta during the popularisation plenary lecture at “Zoological Days” 2014 in Ostrava.

(Photo by T. Králová).

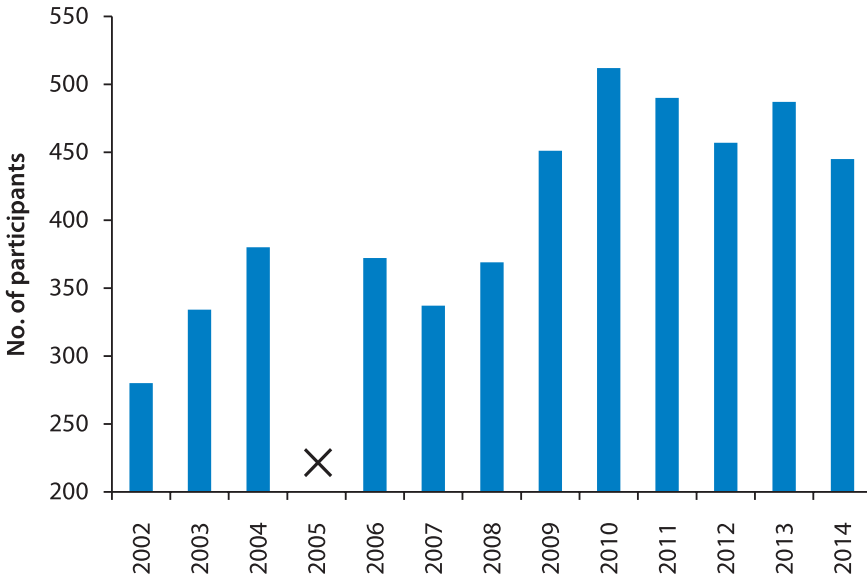


More than 170 posters were presented in Brno 2013.

(Photo by Z. Hladlovská).

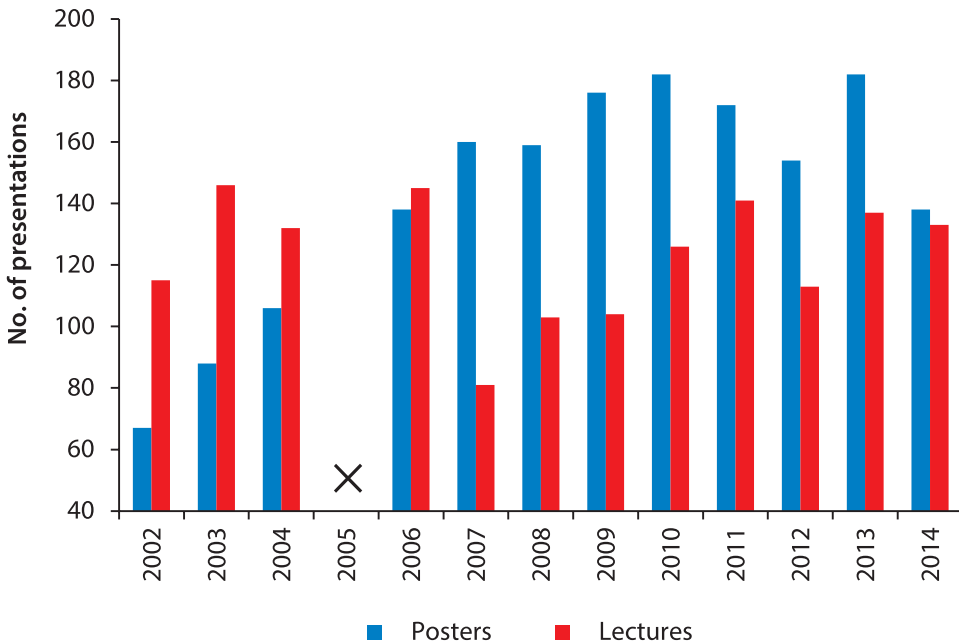


The IVB organises a one-day pre-conference workshop for students focused on zoological research methodology (supported by the PROVAZ project, from the Education for Competitiveness Operational Programme) (Photo by A. Fornůšková).



The number of registered participants of Zoological days has reached a plateau of 450-500 individuals. No conference was organized in 2005.

Other Activities



Zoological days offer the unique opportunity to see hundreds of presentations covering all areas of zoological research performed in the Czech Republic and Slovakia in two days.

**“Basics in biostatistics and computational biology” Winterschool – Brno. December 2-6, 2013**  
**... To celebrate the International Year of Statistics**

In December 2013, a 5-days workshop for 25 Czech master and PhD students from several universities was organised at the IVB headquarter. The workshop was focused on spatial analysis of biological data, using for example approaches of GIS or spatial genetics. The participants at the beginning of workshop obtained basic overview in statistical, GIS and phylogenetic analyses and subsequently they had the opportunity to discuss their detailed research questions with authors and experienced users of recently developed, but widely used approaches like Geneland, MaxEnt or data analyses from geolocators used in the study of bird migration. Lectures were given by experienced lecturers working in the Czech Republic (i. e. S. Pekár and B. Jiménez-Alfaro) and in outstanding institutions abroad (i. e. G. Guillot, M. Pagès, G. Kergoat, T. Emenegger). During three afternoons the students were invited to shortly present their current work and to discuss about the data, analysis tools, and workflows they use to complete their research. The official language of the workshop was English.



Professor Gilles Guillot, author of the computer program *Geneland*, which is widely used for analysis of genetic spatial data.

(Photo by A. Fornůsková)



Professor Stano Pekár explains the basics of statistical analysis in the *R* environment.

(Photo by A. Fornůsková)

„Next Generation Workshop and The Central European Meeting On Genes, Gene Expression And Behaviour“, Nové Hradý. October 27 – November 1, 2014



The main aim of a 3-days workshop was to present current Next Generation Sequencing (NGS) methods and their application in conservation and evolutionary genetics and molecular ecology. Lectures and tutorials were given by experts from different fields and countries (e.g. Mark Blaxter from University of Edinburgh, Emmanuel Heitlinger from Humboldt University of Berlin, Jean-François Martin from Centre de Biologie et Gestion des Populations in Montpellier, or Stuart J. E. Baird from Institute of Vertebrate Biology AS CR), so official language was English. The workshop was designed for 20 Czech master and PhD students and post-docs currently or prospectively using NGS approaches. Part of the workshop was also devoted to practical trainings with the aim to facilitate the analysis of data produced by NGS. During the workshop lectures about analysis of amplicons, RAD sequencing or about the use of NGS genotyping in studies of microbial communities („metagenomics“) were presented. The workshop was followed by the 2-days conference „The Central European Meeting On Genes, Gene Expression, And Behaviour“, co-organized by the Department of Zoology, Faculty of Science, Charles University in Prague, where numerous case studies using NGS data in zoological, ecological and evolutionary projects were presented by eminent European researchers. Both workshop and following conference were held in the Conference centre of Academy of Sciences in the historical empire building of the Castle in Nové Hradý on the south of Bohemia.



Discussion between students and foreign experts, here Mark Blaxter, Director of Edinburgh Genomics, now the largest UK open-access genomics facility.  
(Photo by A. Fornůsková)



Jean-François Martin presents to students a wide range of current sequencing methods.  
(Photo by A. Fornůsková)



Workshop participants in the front of the Conference centre in Nové Hradky.

(Photo by A. Fornůsková)

## | POPULARISATION ACTIVITIES AND COLLABORATION WITH UNIVERSITIES AND HIGH SCHOOLS

In 2013-2014, two projects, supported through the European Social Fund via the Education for Competitiveness Operational Programme (ECOP) and the Ministry of Education, Youth and Sports of the Czech Republic, helped to facilitate intense collaboration between IVB and universities, high schools, nature conservation management bodies and members of the public. Both projects also helped toward partial reconstruction of the Mohelno Field Station (Mohelský Mill), where some of the activities took place.



european  
social fund in the  
czech republic



EUROPEAN UNION



MINISTRY OF EDUCATION,  
YOUTH AND SPORTS



OP Education  
for Competitiveness

INVESTMENTS IN EDUCATION DEVELOPMENT

**provoz**  
od teorie k praxi

The “PROVAZ” Project (Czech acronym for the networking project “Connecting education and new approaches in zoological and ecological research” = **PRO**pojení **V**zdělávání **A** nových přístupů v **Z**oologicko-ekologickém výzkumu – od teorie k praxi) was completed successfully in June 2014. The main aims of this collaborative project, which was led by the IVB, were to (i) or-

ganise workshops, courses, conferences, seminars and internships for students at the IVBs Studeneč research facility; (ii) organise nature conservation seminars and (iii) establish a “Grant Office” to provide financial support for the participation of students and researchers in international internships, conferences and workshops. An important part of the project was the partial reconstruct-



tion of the Mohelno Field Station. In the past, this property has been used as both a field station and a repository. Thanks to its recent modernisation, it now serves as a well-equipped educational centre for students from universities, secondary and primary schools and the general public.

In total, 65 activities (seminars, field excursions, workshops, etc.) have been provided to university students studying zoology and ecology and to people working in nature conservation. In addition, almost 2000 people have received support through activities of the project over the last four years (2011-2014), including 45 that received financial support for international internships and participation at conferences. The grant office regularly informs scientists and students regarding possibilities for financing their projects or internships and information is provided regarding future conferences, workshops and training courses. Over the three-year duration of the project, 185 “Grant Office news” broadcasts were disseminat-

ed and 13 informative seminars organised. A further successful outcome for the Grant Office was the preparation of an application for the BIOM (Educational Centre for Biodiversity - Mohelnský Mill) project, supported through Norwegian funds from 2015 ([www.biom.ivb.cz](http://www.biom.ivb.cz)).

Under the rules of ECOP, the PROVAZ project must be sustainable for an additional five years (i.e. until the 30th June 2019). We therefore aim to set up meetings between project partners and organise field excursions and conferences (e.g. the “Zoological days”, see above). Prior to future “Zoological days” conferences, a one-day workshop will be organised focused on a topical issue. Once-a-year, it is planned that a one-day seminar will be organised on biological research in nature conservation and the use of molecular methods in conservation practice along with field excursions focused on the flora and fauna to be found around the Mohelno Field Station.



An ornithological excursion at the Mohelno Field Station in spring 2014. (Photo by A. Fornůsková)



An ornithological excursion at the Mohelno Field Station in spring 2014. (Photo by A. Fornůsková)



A geobotanical excursion at Havraníky in spring 2014. (Photo by A. Fornůsková)



The IVB Spring Camp at the Mohelno Field Station in spring 2014. (Photo by A. Fornůsková)





Ethologically aimed inter-university seminar 2014 at the Mohelno Field Station.

(Photo by A. Fornůšková)



The statistical workshop held before conference "Zoological Days" in February 2014.

(Photo by A. Fornůšková)



A second project supported through ECOP, entitled "Věda všemi smysly", was also successfully completed in June 2014. This was primarily focused on the popularisation of IVB research activities and on collaboration with high schools in identifying motivated biology students. Ten field excursions were organised for the public, 20 popular lectures were held in public buildings (mainly libraries) and a further 20 lectures (directed specifically at high school students) were organised within the IVBs own lecture rooms. Twenty popular science articles were prepared by junior researchers for publication in magazines and newspapers. Furthermore, a series of documentaries entitled "Tales of Curious Biologists" were prepared by an experienced film production company, which have now become an important contribution to the popularisation of fundamental zoological research undertaken by the IVB. The aim of this series was, on the one hand, to introduce the fundamental research in vertebrate biology undertaken by the IVB to the general public in an attractive way and, on

the other hand, to help enhance the quality of zoological and ecological education at primary and secondary schools.

Two summer schools were successfully organised for biology teachers at the Mohelno Field Station focused on modern ecological research. A series of lectures entitled "Novelties in biology" served as a tool for enhancing secondary school education by providing the most up-to-date information from present biological research to biology teachers. Junior researchers and students prepared ten educational presentations, which are freely accessible and available on the project's website. Collaboration with high schools took a number of additional forms. For example, under the supervision of junior researchers, ten students worked on their own small projects. Furthermore, regular excursions to the Studenec Research Facility (entitled "Science with your own eyes") allowed students and teachers to see the actual process of scientific work. Over the project, 20 lectures by outstanding foreign scientists were provided for both students and



Events for public – field excursions – „A secret of blue frogs” and „Birds around us”. *(Photo by J. Růžičková)*



Filming of „Tales of Curious Biologists”. *(Photo by M. Polák)*

IVB researchers. Specialised workshops, designed to complement university courses, were prepared especially for MasterS and PhD students. Students also received financial support for their participation at scientific conferences.

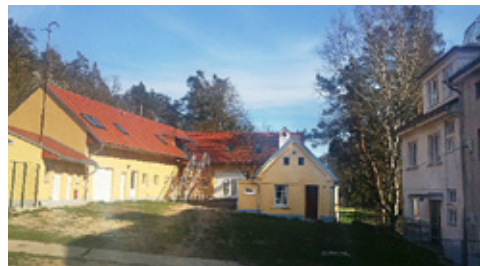
More detailed information about this project is available on the website

[www.zivaveda.ivb.cz](http://www.zivaveda.ivb.cz).

Other Activities

## Mohelno Field Station

The Mohelno Field Station is situated close to the unique Mohelno Serpentine Steppe National Nature Reserve. The station has recently undergone reconstruction (partly supported through the ECOP programme) and is now used for field excursions and seminars organised by the IVB and various universities. The station itself consists of a main building offering accommodation for 23 people and the newly reconstructed section that offers accommodation for a further 30 people. The station has a lecture hall that can hold 30 people and two field laboratories, as well as an outside seating area with fire-pit that are also available for use. The field station serves as an excellent base for educational activities for primary and secondary schools, universities or other organisations and is suitable for use throughout the year.



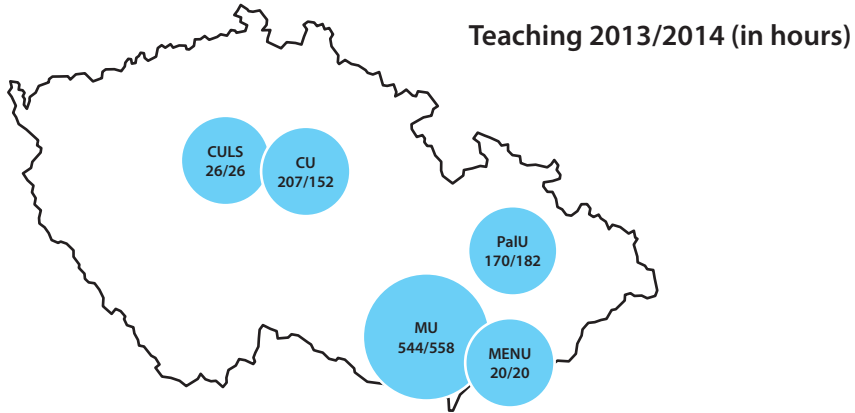
The Mohelno Field Station after reconstruction. *(Photo by PBártová)*

## | MEMBERSHIP IN EDITORIAL BOARDS

Scientist	Journal
Adámek Z.	Aquaculture International
	Pakistan Journal of Scientific and Industrial Research
	Croatian Journal of Fisheries
Baruš V.	Transactions of the Zoological Society of India
	Helminthologia
Čapek M.	International Studies on Sparrows
Glosová L.	Folia Zoologica (managing editor)
Gvoždík L.	Folia Zoologica
	Herpetology Notes
Halačka K.	The Scientific World Journal (Zoology section)
Honza M.	Folia Zoologica
Hubálek Z.	Cryobiology
Jurajda P.	Folia Zoologica
Reichard M.	Evolutionary Ecology
Slabáková H.	Folia Zoologica
Tkadlec E.	Zoology and Ecology
	ISRN Zoology
Zima J.	Comparative Cytogenetics
	Folia Zoologica (editor-in-chief)
	Acta Theriologica
	Scopolia
	Archives of Biological Sciences
	ISRN Zoology
<b>Total 14</b>	<b>23</b>

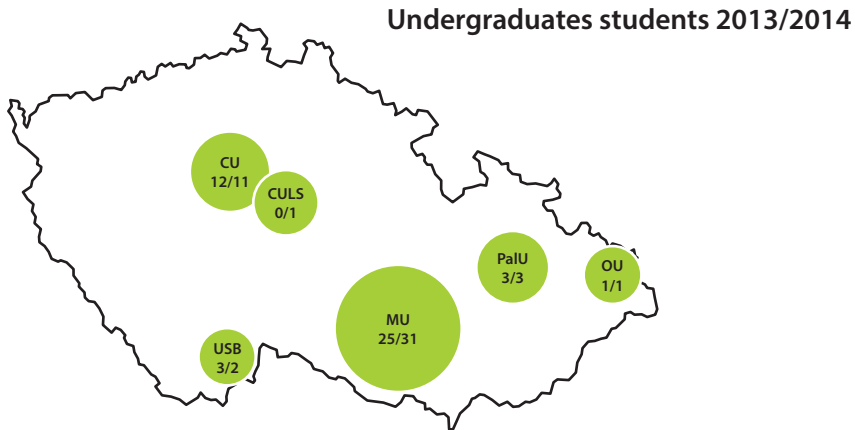
# EDUCATION AND TEACHING ACTIVITIES

## Teaching at universities



IVB employees are very active in lecturing at five universities. In total, they provided 1 025 hours of lectures in 2013, and 962 hours in 2014. MU = Masaryk University, Brno; MenU = Mendel University in Brno; PaU = Palacký University, Olomouc; CU = Charles University, Prague; CULS = Czech University of Life Sciences, Prague. Numbers in the circles indicate hours of lecturing in 2013/2014, respectively.

## Supervising of university students



In total, IVB researchers supervised 44 Bachelor and 50 Masters students over 2013-2014. Twenty-nine students graduated in 2013 (17 Bachelors and 12 Masters) and 13 students graduated in 2014 (8 Bachelor and 5 Masters). Numbers in the circles indicate numbers of Bachelor/Master students supervised at particular universities. MU = Masaryk University, Brno; CU = Charles University, Prague; CULS = Czech University of Life Sciences, Prague; USB = University of South Bohemia, České Budějovice; UO = University of Ostrava; PaU = Palacký University, Olomouc.

## PhD students working at the Institute and/or supervised by the Institute's fellows over 2013–2014

Over 2013–2014, the Institute's fellows supervised 59 PhD students, 12 of them successfully defended their theses at that time.

Student	Supervisor or Consultant	Start of the study	Defended the thesis	Faculty
ABRAHAM Marek Mihai	Honza	2011		1
ADÁMKOVÁ Marie	Albrecht/Tomášek	2013		1
AGHOVÁ Tatiana	Bryja	2012		1
ALBRECHTOVÁ Jana	Piálek	2007		2
BAINOVÁ Hana	Vinkler/Albrecht	2011		2
BARTÁKOVÁ Veronika	Bryja/Reichard	2013		1
BARTOŇOVÁ-Marešová Eva	Lusková/Mendel	2007		1
BENDOVIÁ Martina	Tkadlec	2013		8
BOBEK Lukáš	Albrecht/Tomášek	2013		1
ČEPELKA Ladislav	Heroldová	2010		4
ČERVINKA Jaroslav	Šálek	2011	2014	7
ČÍŽKOVÁ Dagmar	Bryja	2006		1
ELFEKI Mohamed	Tkadlec	2011		8
FORNŮSKOVÁ Alena	Bryja	2009	2013	1,12
FRANCOVÁ Kateřina	Ondračková	2007	2013	1
HIADLOVSKÁ Zuzana	Macholán/Vošlajerová	2008	2014	1
HLAVÁČ David	Adámek	2011		6
HÖNIG Václav	Hubálek	2007		5
CHRENKOVÁ Monika	Šálek	2011		5
JABLONSKI Daniel	Gvoždík V.	2013		11
JANČA Martin	Albrecht	2013		1
JELÍNEK Václav	Procházka	2010		2
KLITSCH Marek	Koubek	2011		10
KOUBÍNOVÁ Darina	Zima	2010	2013	2
KRÁLOVÁ Tereza	Bryja/Albrecht	2012		1
KRISTIN Peter	Gvoždík L	2011		1
KRKAVCOVÁ Eva	Kreisinger/Javůrková	2012		2
MAPUA Mwanahamissi Issa	Petrželková	2011		9
MARTINCOVÁ IVA	Piálek	2012		1
MAŠOVÁ Šárka	Baruš	2009		1

Student	Supervisor or Consultant	Start of the study	Defended the thesis	Faculty
MAZOCH Vladimír	Bryja	2009		5
MICHÁLKOVÁ Romana	Albrecht	2012		2
MICHÁLKOVÁ Veronika	Ondračková/Reichard	2012		1
MIKL Libor	Adámek	2012		1
OPATOVÁ Pavlína	Albrecht	2012		1
PATZENHAUEROVÁ Hana	Bryja	2007	2013	1
PAVLUVČÍK Petr	Tkadlec	2010		8
PETROVÁ Ivana	Tkadlec	2012		8
POMAJBÍKOVÁ Kateřina	Petrželková	2008		9
PROFOUSOVÁ Ilona	Petrželková	2007		9
PRŮCHOVÁ Alexandra	Šálek	2014		5
RYBNIKÁR Juraj	Prokeš	2010		3
ŘEŽUCHA Radomil	Reichard	2010	2014	1
SCHULZ Doreen	Petrželková	2013		1
SOUDKOVÁ Martina	Albrecht	2011		2
SVOBODOVÁ Petra	Hubálek	2009		1
ŠIPOŠ Jan	Tkadlec	2007	2013	8
ŠLAPANSKÝ Luděk	Jurajda	2012		1
ŠULC Michal	Honza	2012		2
TĚŠÍKOVÁ Jana	Goüy de Bellocq/Bryja	2014		1
TOMÁŠEK Oldřich	Albrecht	2009		2
URBÁNKOVÁ Soňa	Mendel	2010		1
VACEK Jaroslav	Koubek	2010		10
VENCLÍKOVÁ Kristýna	Rudolf	2011		1
VLČKOVÁ Klára	Petrželková	2012		9
VRTÍLEK Milan	Reichard	2010	2014	1
VŠETIČKOVÁ Lucie	Adámek	2008	2013	1
WASIMUDDIN	Bryja	2010	2014	1
ZEMANOVÁ Barbora	Bryja	2006	2014	1
<b>Total 59</b>			<b>12</b>	

(1) Faculty of Science, Masaryk University, Brno; (2) Faculty of Science, Charles University, Prague; (3) Faculty of Agronomy, Mendel University in Brno; (4) Faculty of Forestry and Wood Technology, Mendel University in Brno; (5) Faculty of Science, University of South Bohemia, České Budějovice; (6) Faculty of Fisheries and Protection of Waters, University of South Bohemia, České Budějovice; (7) Faculty of Agriculture, University of South Bohemia, České Budějovice; (8) Faculty of Science, Palacký University in Olomouc; (9) Faculty of Veterinary Medicine, University of Veterinary and Pharmaceutical Sciences, Brno; (10) Faculty of Forestry, Wildlife and Wood Sciences, Czech University of Life Sciences, Prague; (11) Faculty of Natural Sciences, Comenius University in Bratislava, Slovakia; (12) Université Montpellier II, France.



## PhD theses defended over 2013–2014 and supervised by the Institute's fellows:

- ČERVINKA Jaroslav, 2014: *Ecology of mammals in fragmented landscape* [In Czech; Ekologie savců ve fragmentované krajině]. Faculty of Agriculture, University of South Bohemia, České Budějovice; supervised by M. Šálek.
- FORNŮSKOVÁ Alena, 2013: *Genes of innate immunity and their significance in evolutionary ecology of free living rodents*. Faculty of Science, Masaryk University, Brno and Université Montpellier II, France; supervised by J. Bryja, N. Charbonnel and J.-F. Cosson.
- FRANCOVÁ Kateřina, 2013: *Host-parasite interactions in 0+ juvenile fishes: effect of host, parasite and environmental characteristics* [In Czech; Parazitohostitelské interakce u 0+ juvenilních ryb: vliv vlastností hostitele, parazita a prostředí]. Faculty of Science, Masaryk University, Brno; supervised by M. Ondračková.
- HIADLOVSKÁ Zuzana, 2014: *Behavioural strategies of two house mouse subspecies (Mus musculus musculus, M. m. domesticus)* [In Czech; Behaviorální strategie dvou poddruhů domácích myší (*Mus musculus musculus*, *Mus m. domesticus*)]. Faculty of Science, Masaryk University, Brno; supervised by M. Macholán and B. Vošlajerová.
- KONVIČKOVÁ Hana (born Patzenhauerová), 2013: *Bathyergid rodents of mesic tropical regions: Phylogeography, kinship structure and mating systems*. Faculty of Science, Masaryk University, Brno; supervised by J. Bryja.
- KOUBÍNOVÁ Darina, 2013: *Phylogeny of selected African bat species based on the cytogenetic and molecular approaches*. Faculty of Science, Charles University, Prague; supervised by J. Zima.
- ŘEŽUCHA Radomil, 2014: *Personalities, reproductive tactics and sexual selection in fishes* [In Czech; Personality, reprodukční strategie a pohlavní výběr u vybraných taxonů ryb]. Faculty of Science, Masaryk University, Brno; supervised by M. Reichard.
- ŠIPOŠ Jan, 2013: *Key biotic and abiotic factors influencing activity of predators of herbivorous insect in spatial gradients of temperate ecosystems* [In Czech; Klíčové biotické a abiotické faktory ovlivňující aktivitu predátorů herbivorního hmyzu v prostorových gradientech temperátních ekosystémů]. Faculty of Science, Palacký University, Olomouc; supervised by E. Tkadlec.
- VRTÍLEK Milan, 2014: *Evolutionary ecology of the annual Nothobranchius fishes*. Faculty of Science, Masaryk University, Brno; supervised by M. Reichard.
- VŠETIČKOVÁ Lucie, 2013: *The evaluation of interactions between fish pond farming and water quality indicators* [In Czech; Hodnocení interakcí mezi chovem ryb v rybnících a indikátory kvality vody]. Faculty of Science, Masaryk University, Brno; supervised by Z. Adámek.
- WASIMUDDIN, 2014: *Genetic variation of selected pathogens in the house mouse hybrid zone*. Faculty of Science, Masaryk University, Brno; supervised by J. Bryja and J. Goüy de Bellocq.
- ZEMANOVÁ Barbora, 2014: *Genetic structure of chamois populations in Central Europe*. Faculty of Science, Masaryk University, Brno; supervised by J. Bryja.

## | EDITORIAL ACTIVITIES

The Institute publishes the international journal *Folia Zoologica* jointly with the Faculty of Environmental Sciences, Czech University of Life Sciences in Prague. The journal has a publishing tradition going back more than 80 years and is currently covered by many reference journals, including the Elsevier Bibliographic Database (Scopus) and the ISI Web of Science by Thomson Reuters.

Eight regular issues were published over 2013 and 2014. Altogether, 71 full papers and four book reviews appeared in the two previous volumes of *Folia Zoologica*, covering various areas of mammalogy, ornithology, herpetology and ichthyology.

### Publishers and Address of the Editorial Office

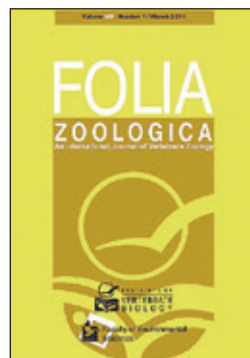
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Vladimír BEJČEK, Praha, e-mail: [bejcek@fzp.czu.cz](mailto:bejcek@fzp.czu.cz)

### Managing Editor:

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### Aims & Scope

*Folia Zoologica* publishes articles containing original insights into various aspects of vertebrate zoology that have not previously been published and are not presently under consideration for publication elsewhere. The journal welcomes significant papers presenting new and original data of more than regional significance. Studies testing explicitly formulated hypotheses are preferred to those presenting primarily descriptive results. Review papers are particularly welcomed and should deal with topics of general interest or of current importance, being synthetic rather than comprehensive in emphasis. Authors should consult with the editors before submitting reviews.

The journal is published quarterly and one volume usually consists of four issues. However, additional issues may be published occasionally. There is no page charge except for colour pages and other extras.

Full papers published in *Folia Zoologica* are available on [http://www.ivb.cz/pubser\\_en.htm](http://www.ivb.cz/pubser_en.htm) one year after publishing. *Folia Zoologica* is indexed by CAB Abstracts, Elsevier Bibliographic Databases incl. Scopus, the ISI Web of Knowledge by Thomson Reuters, and NISC Bibliographic databases. The Journal is distributed in full text format by EBSCO Publishing and Gale/Cengage Learning, Inc.

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All manuscripts should be submitted online at [http://mc.manuscriptcentral.com/fozia\\_zool](http://mc.manuscriptcentral.com/fozia_zool). Correspondence concerning editorial matters should be addressed to the Editorial Office. A comprehensive version of the 'Instructions to Authors' is available on [www.ivb.cz/pubser\\_en.htm](http://www.ivb.cz/pubser_en.htm).

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## | AWARDS

### Otto Wichterle Award for Matěj Polačik

In 2013, Matěj Polačik received the Otto Wichterle Award, which is an honour given by the Academy of Sciences of the Czech Republic to stimulate and encourage selected, exceptionally outstanding and promising young scientists (not older than 35) at the Academy of Sciences of the Czech Republic for their remarkable contribution to the advancement of knowledge in a given area of science. Matej Polačik's main research focus is on the evolutionary and developmental biology of annual killifish. He is also interested in selected aspects of Ponto-Caspian goby invasions and embryonic development of diapausing bitterling fishes.



M. Polačik (*right*) receiving the Otto Wichterle Award from the President of the Czech Academy of Sciences, prof. J. Drahoš (*left*).

(Photo by Akademický Bulletin)

### Patočka Award for Zdeněk Hubálek

In 2014, Professor Zdeněk Hubálek received the Patočka Award, an honour given by the Czechoslovak Society for Microbiology for excellent microbiologists. Zdeněk Hubálek received the award for his outstanding lifelong contribution and teaching activities in the field of microbiology. He is the most-cited researcher of the Institute of Vertebrate Biology ASCR with a remarkable H-index of 33. He is presently working on the long-term ecology and epidemiology of vector-borne pathogens.



Prof. Z. Hubálek (*on the left*) and his team during fieldwork in the vineyard area of Southern Moravia.

(Photo by L. Betášová)

## | OBITUARIES

### Vlastimil Baruš

(1935–2014)

Professor Vlastimil Baruš was a distinguished zoologist and parasitologist whose research activities were mainly linked with our Institute. He was born in Kojetín on October 11, 1935 and, after his graduation from the University of Agriculture in Brno, became a PhD student and later research fellow at the Parasitological Institute of the Czechoslovak Academy of Science. In 1976, he came to Brno and joined the Institute of Vertebrate Zoology of the time. He was later appointed Professor of zoology at the University of Agriculture and Forestry in Brno.



His engagement in organisational and management activities in both the scientific community and in public affairs was extraordinarily broad and intensive. He was a member of the presidium of the Czechoslovak Academy of Agricultural Sciences, Vice-president of the Czechoslovak Academy of Sciences and Rector of the University of Agriculture and Forestry in Brno. He was also appointed as a Deputy of the Federal Parliament of Czechoslovakia. He worked for a considerable period as the Director of the Institute (1976-1990) and influenced considerably the main orientation of research work in individual departments.

This represents only a small part of the organisational efforts of Vlastimil Baruš in public service and it is really amazing that he was able to continue his own research under such a heavy administration load. His publication record is remarkable and the area of his expertise was particularly extensive. He contributed very successfully to an entire range of not necessarily complementary research areas. For example, while his scientific career started with parasitological studies on the biology of helminths, he later switched to ichthyological research and was also interested in general topics of ecology and animal conservation. His research yielded numerous important and original results, many of which had implications in diverse applied fields such as epidemiology and public health, zoohygiene or fisheries. The scientific heritage of Vlastimil Baruš includes more than 400 research papers and 25 books and textbooks. He described 78 new animal taxa and significantly contributed to our knowledge of the relationships between hosts and parasites. Important book publications included several volumes of handbooks on the native fauna of Czechoslovakia or the Czech Republic, dealing with fish, amphibians and reptiles. All these significant achievements earned Vlastimil Baruš a place among the ranks of distinguished and internationally recognised scientists in a range of fields and he received a number of deserved awards in appreciation of his research work. His exceptional professional success was greatly supported by his family background, and especially by his wife Marta.

Vlastimil Baruš died on September 6, 2014 in Brno. He was a man characterised by great enthusiasm, an extreme work ethic and a friendly nature. His extensive knowledge and warm friendly personality will be greatly missed by many.

*Milan Peňáz and Jan Zima*

## Jiří Gaisler

(1934–2014)

Professor Jiří Gaisler was a prominent Czech zoologist who was a colleague, tutor and source of great inspiration to generations of ornithologists, mammalogists and ethologists in the Czech Republic. He was born on July 3, 1934 and died on July 19, 2014 in Brno.

Jiří Gaisler was a naturalist of very broad competence but his prime interests were centered on the study of the biology of bats.

His long-standing interest in bats made him a chiropterologist recognised world-wide and he was able to build an extensive network of collaborators, both in his home country and abroad. He had a natural aptitude for research and the classical skills required to produce seminal papers.

He authored or co-authored more than 160 research papers and published 16 books and textbooks. His university textbooks have become essential study literature for students of zoology and ethology in both the Czech Republic and Slovakia. Jiří Gaisler was an extremely efficient person and he worked literally till the end of his life. In 2012, he co-authored an excellent handbook on Czech mammals and prepared a new edition of the textbook on vertebrate biology. Jiří Gaisler was also a great populariser of science and his broad scientific interests and skill at introducing the animal world to the wider public were displayed in several books, TV and radio programmes and lectures.

Jiří Gaisler spent most of his professional life at the Faculty of Science of Masaryk University in Brno, where he rapidly acquired a deservedly high reputation as a teacher and was appointed as Professor of zoology. An important part of his life was also linked with the Institute of Vertebrate Biology. He worked as a research fellow at the Institute over two periods covering 1960-1969 and 1989-1992. There can be no doubt that these periods deeply influenced his research career and he never interrupted his fertile research collaboration and friendly relationship with the staff of the Institute.

Jiří Gaisler possessed a sharp mind and was gifted with a blazing intelligence. His facility for meticulous work, detailed observation and data collation became the hallmark of his research and publications. He often invested considerable time in discussing topics that were unrelated to his original field of expertise. Over his career, he successfully supervised 20 graduate students and enthused and encouraged a new generation of researchers interested in mammalogy and bat biology.

Jiří was an exceptional person who left a lasting impression on anyone he met. People were touched by his extensive knowledge, his humour and his fancy for music. His sudden death is a huge loss for his family, and his daughters and wife Věra in particular; but also for his students, colleagues and friends, especially those in the field of bat research and conservation. Jiří Gaisler was not only a highly regarded researcher, teacher and scholar, he will remain much admired and loved as a person by all those who were fortunate enough to have him as a friend or enjoyed his support.



*Jan Zima and Jan Zejda*









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