22nd International Conference on Subterranean Biology

31 st August - 5th September 2014

Juriquilla, Querétaro, México

22nd ICSB
México, Querétaro 2014

ABSTRACTS BOOK

SIBIOS ISSB

Laboratorio de Ecología y Sistemática, Facultad de Ciencias, UNAM, México.

Campus Juriquilla, Facultad de Ciencias, UNAM.

22nd International Conferenceon Subterranean Biology

31st August- 5th September 2014Juriquilla, Querétaro, México

ABSTRACTS BOOK

SIBIOS
ISSB

Laboratorio de Ecología y Sistemática, Facultad de Ciencias, UNAM, México.Campus Juriquilla, Facultad de Ciencias, UNAM.

22st International Conference on Subterranean Biology
31 August- 5 September 2014, Juriquilla, Querétaro, México Abstract book

Organizers:Laboratorio de Ecología y Sistemática, Facultad de Ciencias, UNAMUMDI-Facultad de Ciencias, Campus Juriquilla, UNAM

Published by José G. Palacios Vargas

Edited by José G. Palacios Vargas, Hugo Mejía Madrid, Gabriela Castaño Meneses, Juan B. Morales Malacara, Blanca E. Mejía Recamier, María Razo González, Ricardo Iglesias Mendoza

Typography: Cover design: María Martínez
Printed by:

ISBN

22st International Conference on Subterranean Biology
31 August- 5 September 2014, Juriquilla, Querétaro, México

Contents

FOREWORD

It is an honor for us to welcome the scientific community dedicated to the study of cave fauna from different regions of the world and to attend the 22nd International Conference on Subterranean Biology at Juriquilla Campus, Querétaro, of the Universidad NacionalAutónoma de México.

This is the second time that such important conference is held in Latin America, and we appreciate the support and help of ISSB-SIBiOS, to show this important community some of our contributions on the study of this extraordinary fauna that lives underground.

The knowledge of Mexican caves antedates the European discovery of the Americas.Petroglyphs and pictographs were then painted in caves, especially in Northern Mexico and Baja California, but also in the Sierra de El Abra, San Luis Potosí and Tamaulipas. Elaborate paintings, including a jaguar, were found in the Olmec cave, Grutasde Juxtlahuaca, Guerrero. Burials and caches of pottery and other artifacts have been found in caves throughout Mexico. Naturally mummified remains have been found in dry caves in Chihuahua, Coahuila, and Nuevo León.Evidence for cave utilization prior to 1,200 BC is limited; cave rituals became more frequent during the late Classic Period (600-900 AC) and continued in northern Yucatán and the Maya highlands until 900-1,550 AC. Cenotes(from the Yucatec Maya, dzonot, a sinkhole) are still the primary water source for the Maya peoplein rural areas.They used caves as burials and have deployed various types of construction within the cave: stone walls with low doorways, pavements, stairs, and dams in caves with seasonal flooding.

Human sacrifices were an important part of the ancient Mayan religious rituals. Theseincludedthrowingvictims into cenotes, most notably at the Cenote de Sacrificios in Ruinas de Chichen Itza. In their cosmology, the first appearance of humans on the earth was in caves. Caves are the house of ancestors and supernatural beings.

The first biological investigations of caves in Mexico were conducted in 1866 by the Austrian Reverend DominikBilimek, who accompanied the Emperor Maximilian, when he visited Grutas de Cacahuamilpa (Guerrero). He reported 11 species that included one troglobite. The next important contribution was that of the Mexican Alfonso Herrera on the fauna in Grutas de Cacahuamilpa.

In 1932 E. P. Creaser, F. G. Hall and A. S. Pearse investigated 35 cenotes and caves in Yucatán. The volume, published in 1936, emphasized the description anda faunallist (70 species with only four stygobite crustaceans). Later, in 1936 Pearse explored 27 caves in Yucatán and the results were published in 1938 by the Carnegie Institution of Washington; a total of 306 species were identified of which 8troglobites and two stygobites were added to the cave fauna of Mexico plus 2 Araneaethree Collembola, one Orthoptera and two Pisces.

In 1938, two Spanish biospeleologists, Federico Bonet and Cándido Bolivary Pieltain, immigrated to Mexico and began an intensive study of the Mexican cave fauna during the next 20 years. They along with members of the EscuelaNacional de CienciasBiológicas de México studied many caves in several states and published articles describing theirfauna.

With the organization in 1962 of the Speleological Survey of Mexico in Austin, Texas, (now called Association for Mexican Cave Studies) a new period in the study of the cave fauna of Mexico began. In 1971 James R. Reddellpublished the first checklist of the cave fauna of Mexico, and in 1981 the most significant book on the history of explorations and the cave fauna of Mexico, with distribution maps of species and a complete bibliography,was published not until 1980.

Many articles have been published that describe the cave fauna of Mexico, but in the Faculty of Sciences, UNAM, those studies began in September 1977 (37 years ago), where professors and their students have accomplished to publish many contributions, mainly describing new species and giving newrecords for caves. As a result of such endeavors, a manual on Biospeleology was published by Hoffmann, Palacios-Vargas and Morales Malacarain 1986.

In 1994 we published a review of the cave fauna of Mexico in the EncyclopediaBiospeologica and Hoffmann et al. (2004) published a comprehensive review of the arthropod fauna of Mexican caves.

From 1996 to 2005 the chemoautotrophic cave, Cueva de Las Sardinas and its fauna were studied, and it seems to comprise a great diversity of animals. Castaño-Meneseset al. in 2005 studied the impact of tourism on Grutas de Juxtlahuaca, Guerrero. They discovered a significantly reduced biodiversity in the aforementioned cave as compared to records from earlier studies.

In recent years Oscar F. Francke, curator of Arachnida at Institute of Biology, of the Universidad NacionalAutónoma de México has supervised studentswhose work has resulted in the description of many new species of cave-dwelling arachnids.

We are sure that this important International Conference of Subterranean Biology in Querétaro will increase the study of caves of Mexico and will give new ideas about the protection that thiscave fauna needs.

We wish you will enjoy Querétaro, a beautiful and historical city.

On behalf of the Organizing Committee

José G. Palacios-Vargas

GENERAL INFORMATION

Conference venue

Conference Hall

The conference will take place at the CAC (Centro Académico y Cultural) in Campus Juriquilla, National Autonomous University of Mexico (UNAM).

Welcome cocktail

Sunday 31 August

17:00 Welcome cocktail at Restaurant "Fin de Siglo"

1 Hidalgo Street, downtown Querétaro.

Registration

Sunday 31 August

14:00 Venue at Restaurant "Fin de Siglo"

Lunch

Lunches on a daily basis will be organized during the conference. Prices are included in your registration fee. Only soft drinks will be available. Closure dinner is also included in the fee. Lunch will be served at the CAC (Centro Académico y Cultural) in Campus Juriquilla.

Other Places to eat

Some fancy hotels have their own restaurants. For people staying at Querétaro, they can find many good places to have breakfast and dinner.

Mid-conference exclusion

Wednesday, 3 September.

Please confirm your participation in the excursion at the time of registration in order to have your seat reservation in the bus.

Bus will depart from downtown Querétaro, later we will tell exactly where we will meet at 7:00 AM. Tennis shoes are recommended**because** the town of Bernal is very easy to walk and the cave is touristic and with artificial light. The temperature ranges from 10 to 20 °C degrees. You do not need a flashlight or head lamp to visit the cave.

Instructions for speakers, chairpersons and poster presenters

Key lectures are limited to 25 minutes plus additional five minutes for discussion. The oral presentations will have only 15 minutes and five minutes for discussion.

Chairpersons

Please just mention the name and title of the contributions and ask the speaker to keep talk within limits indicated.

Posters

Posters will be hung on Monday September 1 so people can see them for two days. Please stand close to your poster during the poster exhibition during the session on Tuesday.

SCIENTIFIC PROGRAM

"Biodiversity and Conservation"

Organized under the auspices of the International Society for Subterranean Biology and Faculty of Sciences, UNAM

Sunday 31 August

14:00 Venue at Restaurant "Fin de Siglo"

17:00 Welcome cocktail at Restaurant "Fin de Siglo"

1 Hidalgo Street, Down Town Querétaro.

Scientific program at Centro Académico y Cultural (CAC) at UNAM, Campus Juriquilla, Querétaro.

Monday 1st September

09:00 **INAUGURATION** by Juan B: Morales Malacara, Coordinator of Unidad de Docencia e Investigación, Fac. Ciencias, UNAM, Campus Juriquilla. Ľubomír Kováč, president of SIBIOS.Master of ceremony Hugo H. Mejía Madrid.

09:30 HISTORY OF MEXICAN BIOSPELEOLOGY (key lecture)

Juan B. Morales Malacara

SYMPOSIUM: CONSERVATION OF SUBTERRANEAN LIFE

Chair: D. Zeppelini

10:00 *RED LISTED CAVE COLLEMBOLA IN BRAZIL: IUCN's CRITERIA APPLIED TO CAVE INVERTEBRATES*

Douglas Zeppelini

10:20*THE FIRST TWO HOTSPOTS OF SUBTERRANEAN BIODIVERSITY IN SOUTH AMERICA*

Marconi Souza Silva, Rodrigo Lopes Ferreira

10:40*MANAGMENT CONSERVATION IN SHOW CAVES (SKOCJAN CAVES, SLOVENIA*

Samo Sturm, Tomaz Zorman, Janez Mulec, Tanja Pipan, Slavko Polak

11:00 Coffee break

SYMPOSIUM: SUBTERRANEAN DIVERSITY

Chair: Ľubomír Kováč

11:20*DISTRIBUTIONAL PATTERNS OF CAVE COLLEMBOLA (HEXAPODA) IN ASSOCIATION WITH HABITAT CONDITIONS, GEOGRAPHY AND PALEOREFUGIA IN THE WESTERN CARPATHIANS*

Kováč L., A. Parimuchová &D. Miklisová

11:40 *INVERTEBRATE COMMUNITIES IN THE TEMPORARILY FLOODED CAVE*

Dumnicka, E. & J. Galas

13:00 Lunch

SYMPOSIUM: ECOLOGY AND BEHAVIOUR

Chair: Oana Teodora Moldovan

15:00 *COLLEMBOLA COMMUNITIES OF FORESTED LIMESTONE AND BASALT TALUS DEPOSTS IN THE WESTERN CARPATHIANS, SLOVAKIA*

Michal Rendoš, Natália Raschmanová, Ľubomír Kováč

15:20*THE IMPORTANCE OF TIME SCALE IN SUBTERRANEAN HABITATS MONITORING*

Oana Teodora Moldovan

15:40 Coffee break

17:00 TOURISTIC VISIT OF THE CITY

Tuesday 2nd September

SYMPOSIUM: ANCHIALINE AND CENOTES ECOSYSTEMS

Chair: Luis M. Mejía Ortiz

09:00 *DISTRIBUTION OF MEXICAN STYGOBIONTIC CRUSTACEAN (30) (key lecture)*

Luis M. Mejía Ortiz

09:30 *PREDATION AND SPATIAL-TEMPORAL USE OF YUCATÁN CENOTES BY STYGOBITIC CRUSTACEANS: CREASERIAMORLEYI AND TYPHLATYA SPP. PRELIMINARY RESULTS*

Efraín M. Chávez Solís, Maite Mascaró, Fernando Nuno, Simões Dias Marques

09:50 *AGONISTIC BEHAVIOR FROM TWO ANCHIALINE SHRIMPS IN COZUMEL ISLAND*

Mejía-Ortíz, L. M. & M. López-Mejía

10:10 *PRELIMINARY SURVEY OF THE INVERTEBRATE FAUNA OF THE GUNUNG MULU WORLD HERITAGE KARST AREA, SARAWAK, MALAYSIA*

Timothy Moulds

10: 30 Videos: Las Sardinas Cave (by José G. Palacios-Vargas), Cave fauna from Croacia (by Marko Kulić, Encounters with Demons (by Zdenek Motycka).

11:10Coffee break

11: 30 *THE MICROSCALE IS A MAJOR DRIVER FOR SUBSURFACE FAUNA*

Schmidt, S.I., M.O. Cuthbert & M. Schwientek

11:50 *DIFFERENCES BETWEEN GROUPS OF TROGLOFAUNA IN SPECIES' RANGES AND GENETIC VARIABILITY*

Halse, S.A. & A.J. Trotter

SYMPOSIUM: MICROBIOLOGY

Chair: A. Nováková

12:10*MICROSCOPIC FUNGI IN UNDERGROUND TUNNELS IN THE CZECH REPUBLIC*

Kubátová, A., M. Kolařík, A. Nováková & P. Špryňar

12:30*THE POTENTIAL USE OF ECOPHYSIOLOGICAL GROUPS OF BACTERIA*

FROM CAVE SEDIMENTS AS INDICARTORS OF PALEOENVIROMENTS

Laura Epure, Oana Teodora Moldovan

13:00 Lunch

15: 00 **<u>POSTERS EXHIBITION</u>**

- *THE CAVE TYPE LOCALITIES ATLAS OF CROATIAN FAUNA*
  Tamara Cukovic, Branko Jalzic, Martina Pavlek

- *MEXICAN ANCHIALINE FAUNA*
  Fernando Calderón-Gutiérrez, Carlos A. Sánchez-Ortiz

- *TROGLOBITE AND TROGLOMORPHIC SPECIES IN BRAZILIAN SPELEOLOGICAL LEGISLATION: CRITIQUES AND SUGGESTIONS*
  Araujo-Soares, G., G. Pisa-Perroni, D. Demarchi-Guarda & A. Sarreiro-Auler

- *DECAPOD CRUSTACEANS DISTRIBUTION IN UNDERGROUND CAVE SYSTEMS OF THE RIVIERA MAYA*Christian O.Martínez-Lozano, Luis M.Mejía-Ortíz, Lopez- Marilu Mejía, Joey Pakes M.

- *PATTERNS OF SUBTERRANEAN BIODIVERSITY IN THE APPALACHIANS AND INTERIOR LOW PLATEAUS OF THE UNITED STATES*Matthew Niemiller, Mary C. Christman, David C. Culver, Daniel H. Doctor,TanjaPipan, David Weary, John Young, Kirk Zigler

- *OVERVIEW OF THE HUNGARIAN NIRPHARGUS (CRUSTACEA: AMPHIPODA) SPECIES*
  Angyal, D. & G. Balázs

- *ORDER NEELIPLEONA (COLLEMBOLA)REVEALSITS DIVERSITY IN CAVE HABITATS*
  Papáč, V., M. Lukić & Ľ. Kováč

- *OVERVIEW OF THE HUNGARIAN NIPHARGUS (CRUSTACEA: AMPHIPODA) SPECIES*
  Angyal, D. & G. Balázs

- *RESEARCHES AND MANAGEMENT RECOMMENDATIONS FOR LONGTERM CONSERVATION OF ROMANIAN CAVE*
  Ruxandra Nastase-Bucur, Daniela Borda

- *ASPERGILLUS SPP. ASSOCIATED WITH CAVES: A SOURCE OF NOVEL SPECIES AND RATE TAXA*
  Alena Nováková, Vit Hubka, Miroslav Kolarik, Michael J. Vaugham

16:00 Coffee break

16:20 Cultural activity: Ballet from Querétaro

Wednesday 3 September

Middle term expedition to Peña Bernal and Grutas de los Herrera

Thursday 4 September

SYMPOSIUM: SUPERFICIAL SUBTERRANEAN HABITATS

Chair: Alberto Sendra

10:00 *ARE THERE LIMITS TO THE SUBTERRANEAN FAUNA?*

Alberto Sendra (key lecture)

10:30 HOW SHOULD WE CLASSIFY SHALLOW SUBTERRANEAN HABITATS?

Tanja Pipan, David C. Culver

10: 50*ADVANCES IN THE STUDY OF THE SHADOW SUBSTRATUM IN MEDITERRAEAN REGION: ARTHROPOD DIVERSITY OF A COLLUBIAL DEBRIS IN EASTER SPAIN*

Alberto Jiménez-Valverde, José Domingo Gilgado, Alberto Sendra, Gonzalo Pérez-Suarez, Juan J. Herrero-Borgoñón & Vicente M. Ortuño

11:10 Coffee break

SYMPOSIUM: MORPHOLOGY AND PHYSIOLOGY

Chair: Rodrigo Lopes Ferreira

11:30 *SEXUAL REVERSAL WHAT DO CAVE ENVIRONMENTAL TRAITS HAVE TO DO WITH IT?*

Rodrigo Lopes Ferreira

11:50 *WORLD CAVE DWELLERS ECHINODERMS AND ECOLOGICAL STUDY IN EL AEROLITO SYSTEM, COZUMEL, MEXICO*

Fernando Calderón-Gutiérrez, Francisco A. Solís-Marín, Carlos A. Sánchez-Ortiz.

12:10 *DISTRIBUTION AND SITES CLASSIFICATION OF PROTEUS ANGUINUS LAURENTI, 1768 IN CROATIA, BOSNIA AND HERZEGOVINA AND MONTE NEGRO*

Katarina Koller

12:30 *POPULATION ECOLOGY OF AQUATIC CAVE SALAMANDER PROTEUS ANGUINUS: POPULATION SIZE ESTIMATES REVEAL HIGH DEPENDENCE ON ORGANIC DRIFT AND WATER CURRENT BUT NOT ON CAVE SYSTEM MORPHOLOGY*

Dušan Jelić

12:50: SKYPE CONFERENCE AT JURIQUILLA WITH THE CAVE INVERTEBRATE SPECIALIST GROUP.

Tony Whitten (co-chair of the cave invertebrate specialist group), David Culver, Alberto Sendra, Stefano Taiti, L'ubomir Kováč& Elzbieta Dumnicka, José Palacios (proposed by Sonia Khela).

13:00 Lunch

15:00 Conference close. By L'ubomir Kováč, President of the SIBIOS

Obituary of René Ginet, Guy J. Magniez and Beatrice Sambugar

Pierre Strinati – honorary member of the SIBIOS-ISSB

Presentation of the next conference venue

General Assembly of the International Society of Subterranean Biology

17:00 Coffee break

17:20 Folkloric Mexican Music

20:00 Conference dinner

Abstracts

2. TROGLOBITE AND TROGLOMORPHIC SPECIES IN BRAZILIAN SPELEOLOGICAL LEGISLATION: CRITIQUES AND SUGGESTIONS

Araujo-Soares, G., G. Pisa-Perroni, D. Demarchi-Guarda & A. Sarreiro-Auler

Carste Associated Consultants. Rua Brasopolis, 139 - Floresta - Belo Horizonte/Minas Gerais, Brazil

Brazilian speleology has undergone numerous legal and professional changes that may result in either gains or losses to cave biodiversity depending on the technical knowledge applied. Further discussions and better technical definitions about specific issues in the analysis of cave relevance are needed so that the g ains are greater than the losses. This study aimed to present and conceptually discuss how troglobite and troglomorphic organisms are addressed in the current cave legislation and propose a series of actions that may contribute to managing cave biodiversity in Brazil. Initially, it should be noted that the concepts adopted to define troglobite and troglomorphic organisms are confusing and overlapping, to the point that the two groups are often treated indistinguishably. Starting from this premise and according to the analysis of relevance criteria, there are three types of troglobite/troglomorphic organisms: relictual or endemic troglobites, rare troglobites, and non-rare, non-endemic, non-relictual troglobites. Despite this conceptual characterization, these terms are not defined in the Brazilian legislation. Because of the lack of clear technical guidelines and regulations, studies on cave relevance are often subjective and based on the researcher's knowledge and professional experience, hindering comparisons between studies. Thus, we suggest that the following measures be adopted to solve these problems and improve the management of cave biodiversity in Brazil: 1) Review of all concepts in the Brazilian cave legislation and adoption of the most current definitions of these terms; 2) Clear definition of the terms endemic troglobite, relictual troglobite, and rare troglobite; 3) Creation of a national reference collection of troglobite/troglomorphic species, allocating financial resources and incentives to improve knowledge in this area; 4) Furthering of studies, considering not only the cave environment, but the entire subterranean system.

4. INVERTEBRATE COMMUNITIES IN THE TEMPORARILY FLOODED CAVE

Dumnicka, E. & J. Galas

Institute of Nature Conservation, PolishAcademy of Sciences, al. A. Mickiewicza 33, 31-120 Kraków, Poland

Cave Na Kamieniu, is located on the northern border of Krakow-Czestochowa Upland. The raise of underground water level after heavy rains is the main cause of its flooding. Such an event happened in May 2010 and the studies started one year later when some water pools still remained. Additional samples were taken once in 2013.
The aim of this of study was to determine the effect of cave inundation on terrestrial and aquatic invertebrate communities composition as well as on the parietal fauna.
The studied cave is shallow, horizontal and has multiple entrances, what influences high fluctuations of air humidity and temperature (values below zero have been observed in most parts of its corridors). Water temperatures have been more stable, with changeable oxygenation and small amount of organic matter in the sediments.
Fauna of the water bodies was dominated by freshwater crustacean *Asellus aquaticus*, which reproduced there. Dark, partially or completely discolored specimens lived together. Moreover copepods (*Diacyclops bicuspidatus* and *Megacyclops viridis*), ostracodes, oligochaetes (Tubificinae) and *Mochlonyx* sp. (Chaoboridae) were noted.
In terrestrial sediments aquatic fauna prevailed because flood water receded only recently. Among non-aquatic taxons *Oniscus* spp., a few oligochaete taxons and one specimen of *Tetrodontophora bielanensis* (Collembola)were noted. Empty shells of some snails species were found also.
Parietal fauna was represented by numerous Culicidae, some isopods (*Oniscus* sp., *Porcellio scaber*), spiders (*Nesticus cellulanus, Pachygnathaclercki*), slugs (*Arion* spp.), and snails (*Oxychilus draparnaudi, Alinda biplicata, Cochlicopa lubrica, Pupilla muscorum*). Two specimens of *Scoliopteryx libatrix* and one *Inachis io*have been found exclusively.
It seems that temporary flooding eliminated some taxons, such as spring tails, acarids and a spider *Meta menardi*, which inhabit many Polish caves. On the other hand enrichment in the organic matter promoted an increase in the density of *Asellus aquaticus*. A few years after flooding the recolonization of the cave by spring tails was observed.

5. DIFFERENCES BETWEEN GROUPS OF TROGLOFAUNA IN SPECIES' RANGES AND GENETIC VARIABILITY

Halse, S.A. & A.J. Trotter

Bennelongia Environmental Consultants, PO Box 384, 6913 Wembley WA, Australia

Nearly all subterranean fauna species have small ranges unless they have a surface dispersal phase, with troglofauna tending to have smaller ranges than stygofauna. Species' ranges are an important issue in environmental impact assessment of projects affecting subterranean habitat because of the potential for the entire range of a tightly restricted species to lie within the disturbance footprint of a large project. However, given the convergent morphology exhibited by many troglofauna species, it is often difficult to distinguish closely related species morphologically. DNA analysis has shown that many species previously thought to be quite wide-ranging actually consist of several distinct species with small ranges. This identification of new species with small ranges often has important implications for environmental impact assessment and species conservation. However, interpretation of DNA results is not always straightforward and errors may occur. The capacity of troglofauna to disperse below-ground is limited and this can lead to significant genetic structuring within species. As a consequence, a large number of samples from across the range of a species' (or species cluster) may need to be collected to distinguish between intra- and interspecific variation. However, logistical constraints mean that often few samples are available and these samples are clumped rather than distributed across the species' range. Under current paradigms, this pattern of sampling can lead to too many species being recognized and species' ranges being underestimated. Genetic variability and species ranges of troglofauna are discussed, with particular reference to schizomids, pseudoscorpions, cockroaches and thysanurans.

6. DISTRIBUTIONAL PATTERNS OF CAVE COLLEMBOLA (HEXAPODA) IN ASSOCIATION WITH HABITAT CONDITIONS, GEOGRAPHY AND PALEOREFUGIA IN THE WESTERN CARPATHIANS

Kováč L.[1], A. Parimuchová [1] & D. Miklisová [2]

[1] Department of Zoology, Institute of Biology and Ecology, Faculty of Science, P.J.ŠafárikUniversity, Moyzesova 11, 040 01 Košice, Slovakia
[2] Institute of Parasitology, Slovak Academy of Sciences, Hlinkova 3, 040 01 Košice, Slovakia

During 2010–2012 diversity and distribution patterns of Collembola (Hexapoda) were surveyed in 28 caves in the Western Carpathians, Slovakia. The caves were situated in 12 orographic units regarding bedrock, type of karst and altitude. Of 105 species registered, 17 were closely associated with caves (eutroglophiles). Obligate cave forms (troglobionts) were represented by 13 species belonging to genera *Pseudosinella* (5), *Deuteraphorura* (3), *Megalothorax* (2), *Protaphorura* (1), *Pygmarrhopalites* (1) and *Neelus* (1). Elevation of cave entrance, internal air temperature, amount of organic material and geographic location played important role in distribution of cave Collembola. Species diversity had increasing trend with internal air temperature and decreasing with altitude. NMS ordination, cluster and IndVal analyses were applied to discriminate similarity between communities of the particular caves. Troglobionts are restricted to specific karts areas: 1/ caves at lower elevations in the Slovak Karst and neighbouring karst areas with characteristic species *Pseudosinella aggtelekiensis* and *Pygmarrhopalites aggtelekiensis*, 2/ cold karst and pseudokarst caves at higher elevations with *Protaphorura janosik*, 3/ caves of central karst areas with *Deuteraphorura kratochvili* and *Pseudosinella paclti*, and 4/ caves of eastern karst areas with *Neelus koseli*. The increase in number of troglobiotic taxa with cave elevation, characteristic for some southern European karst regions, was not observed. In the Western Carpathians communities of cave Collembola display clear geographic pattern. Slovak and Aggtelek Karst and adjacent areas with plateau type of karst have high species diversity and number of troglobionts conversely to karst areas of the central Western Carpathians that host only few obligate cave forms. Northern karst areas are obviously less diverse and troglomorphic taxa are absent there. The study supported the idea that some karst areas in the Western Carpathians might represent paleorefugia of the subterranean fauna, specifically the central and southern karst units.
The study was supported from the SlovakScientificGrantAgency, project 1/0199/14.

7. DECAPOD CRUSTACEANS DISTRIBUTIONS IN UNDERGROUND CAVE SYSTEMS OF THE RIVIERA MAYA, QUINTANA ROO, MEXICO

Martínez-Lozano C. O.[1], L. M. Mejía-Ortíz [2], M. López-Mejia [2] & J. M. Pakes [3]

[1] Lic. En Manejo de Recursos Naturales Universidad de Quintana Roo, Cozumel, México
[2] Biospeleology & Carcinology Lab. University de Quintana Roo, Cozumel, México
[3]University of California, Berkley, USA

This work shows the distribution of decapod shrimps in subterranean network (cenotes, caves and grottos) of the Riviera Maya (Tulum, Solidaridad and BenitoJuárezMunicipalities). Which is characterized by a calcareous soil where the trickle of water and time has produced significant underground formations. Sampling was conducted in the area of influence of the sea - coast of the Mayan Riviera Quintana Roo using an aquarium net, traps made with PVC with 2-4'' diameter and chicken as bait to lure individuals into, within 24 hours or sometimes handle with Scuba equipment. In each sub-system was recorded geographic location from entrance as well as the values of temperature, dissolved oxygen, pH and salinity. Organisms were preserved for later laboratory analysis using dichotomous taxonomy keys for identification. Decapods were recorded in 2 different environments; a) *Anquihaline: Barbouria sp., Tricanthoneous akumalensis, Callismata nohochi, Janicea antiguensis, Parhippolyte sterreri* ; b) *freshwater: Macrobrachium carcinus, Macrobrachium acanthurus, Creaseria morleyi* , *Typhlatya pearsei* and *Typhlatya mitchelli*. These results show that species richness is similar in both environments however, the abundance of freshwater species have a greater representation in the underground systems of the Riviera Maya.

8. AGONISTIC BEHAVIOR FROM TWO ANCHIALINE SHRIMPSIN COZUMEL ISLAND

Mejía-Ortíz, L. M.[1] & M. López-Mejia[2]

[1]Biospeleology & Carcinology Lab, &[2]Evolutionary Biology and Population Genetics Lab, División de Desarrollo Sustentable, University of Quintana Roo, Mexico

The anchialine caves are natural laboratories to identify several adaptations process in the animals exclusively from these environments. Among the adaptations to cave life the behaviour aspects (feeding, reproductive and agonistic) are the more difficult to see because in the most of cases is necessary transfers the animals to laboratory conditions that induce factors that in almost times the researchers can't controlled. By this reason we designed a system to obtain records directly from environments like caves avoid additional alterations. *Barbouria yanezi* is a shrimp that live in a cenote in Cozumel Island that have 30 meters of depth, and the animals are more abundant after 20 meters of depth where the oxygen conditions are almost anoxic. *Agostocaris bozanici* inhabit other cenote with a 25 meters of depth, the animals are more abundant where the H_2S values increase. We introduce two water resistant video-cameras connected directly to recorder outside from cenote and registered ten times observations series (each series had a duration for two days) in order to identify for feeding and agonistic behaviour. In the case of reproductive we don't yet registered it. In general the outcome shown that response to food of shrimps is very quickly and the use of antennulae and antennae complex is very common to identify the food and some congeners but in general they not fight as others shrimps from epigeal environments. Also we compare the responses and norms with a previous study on feeding behaviour in lab for the same species. In case of agonistic behaviour the animals identify very quickly using the antennal complex and in some occasions they touch between them using the cheliped appendages. The guideline charts for feeding and agonistic behavior for both species are shown.

9. PATTERNS OF SUBTERRANEAN BIODIVERSITY IN THE APPALACHIANS AND INTERIOR LOW PLATEAUS OF THE UNITED STATES

Niemiller, M.[1], M. C. Christman [2], D. C. Culver [3], D. H. Doctor [4], T. Pipan [5], D. Weary [4], J. Young [6] & K. Zigler [7]

[1] Department of Biology, University of Kentucky, Lexington, KY, USA
[2] Departments of Statistics and Biology, University of Florida, Gainesville, FL, USA
[3] Department of Environmental Science, American University, Washington, DC, USA
[4] U.S. Geological Survey, Reston, VA, USA
[5] Karst Research Institute at ZRC-SAZU, Postojna, Slovenia
[6]U.S. Geological Survey, Reston, VA, USA
[7] U.S. Geological Survey, Leetown, WV, USA
[8] Department of Biology, University of the South, Sewanee, TN, USA

Subterranean species richness was mapped for the major cave regions of the eastern United States. Based on more than 11,000 records for 750 species for more than 3000 caves, the hotspot of terrestrial subterranean biodiversity was in northeast Alabama/southcentral Tennessee; the hotspots for aquatic subterranean biodiversity were southern Indiana and the MammothCave (Kentucky) region. Overall, species richness appears to be about 2/3 that of comparable areas in Europe, but comparisons are difficult because the microcrustacean subterranean fauna in the U.S. is very poorly known. Some genera (the beetle genus *Pseudanophthalmus)* occurred throughout the study area, some were geographically restricted (the beetle genus *Ptomaphagus),* and some appeared to exclude each other (the amphipod genera *Crangonyx* and *Stygobromus*). This study was funded by a grant from the Appalachian Land Conservation Cooperative and the U.S. Fish and Wildlife Service.

10a. MICROSCOPIC FUNGI IN UNDERGROUND TUNNELS IN THE CZECH REPUBLIC

Kubátová, A.[1], M. Kolařík [1,2], A. Nováková [2,3] & P. Špryňar [4]

[1] Department of Botany, Faculty of Science, Charles University in Prague, Benátská 2, 128 01 Praha 2, Czech Republic
[2] Institute of Microbiology AS CR, v.v.i., Vídeňská 1083, 142 20 Praha 4-Krč, Czech Republic
[3] Institute of Soil Biology, Biology Centre AS CR, v.v.i., Na Sádkách 7, 370 05 České Budějovice, Czech Republic
[4]Nature Conservation Agency of the Czech Republic, Regional Department Praha a Střední Čechy, Podbabská 2582/30, 160 00 Praha 6, Czech Republic

In the last years, a diversity of microfungi in underground spaces in the CzechRepublic was studied. Psychrophilic fungus *Pseudogymnoascus destructans* (syn. *Geomyces destructans*) causing the dermatomycosis of bats is in the centre of our interest. However, underground tunnels are inhabited also by a variety of other microscopic fungi, often with similar ecological requirements or related phylogenetically. They are living in sediments, on faeces of small mammals, or insect cadavers. The current study carried out mainly in old mining tunnels in Bohemian Karst (CzechRepublic). Several methods were used for cultivation and isolation of these fungi: cultivation on agar media, incubation in moist chambers or hair baiting technique. All samples were incubated at ca 10 °C (the temperature close to the sampled milieu) for several weeks to several months. Morphological and molecular methods (ITS rDNA, LSU rDNA) were applied to identify the fungi. We found frequently zygomycetous fungi (mainly *Mucor* and *Mortierella*, less frequently *Chaetocladium, Thamnidium* or *Coemansia*). Among Ascomycota, members of Leotiales (e.g. high diversity of *Pseudogymnoascus pannorum* s.l. isolates), Onygenales (*Gymnoascus, Arthroderma, Auxarthron,* and *Oncocladium*), Microascales, Eurotiales, Xylariales, and Hypocreales (e.g. *Cordyceps* on a moth *Triphosa dubitata*) were recorded. Majority of the fungi belong to psychrotolerant organisms, some of them are typical for soil environment (e.g. *Pseudogymnoascus pannorum*), and some are coprophilous fungi (esp. zygomycetes). Very interesting is the group of keratinophilic fungi (*Gymnoascus, Oncocladium*) including potential opportunistic pathogens (*Arthroderma, Auxarthron*). Quite different is a group of entomopathogenic fungi (e.g. *Cordyceps, Isaria*).
The study is partly supported by a project of the Czech Science Foundation P506/12/1064.

10b. *ASPERGILLUS* SPP. ASSOCIATED WITH CAVES: A SOURCE OF NOVEL SPECIES AND RARE TAXA

Nováková, A.[1,2], V. Hubka [2,3], M. Kolařík [2,3] & M. J. Vaughan [4]

[1] Institute of Soil Biology, Biology Centre AS CR, v. v. i., Na Sádkách 7, 370 05 České Budějovice, Czech Republic
[2] Laboratory of Fungal Genetics and Metabolism, Institute of Microbiology AS CR, v.v.i, Vídeňská 1083, 142 20 Praha 4, CzechRepublic
[3] Department of Botany, Faculty of Science, CharlesUniversity in Prague, Benátská 2, 128 01 Praha 2, CzechRepublic
[4] The Ohio State University, Department of Plant Pathology, 1680 Madison Ave., Wooster, OH 44691, U.S.A.

Since 2002, microscopic fungi were studied from various substrates collected in seventy-nine European caves (Czech Republic, Slovakia, Slovenia, Croatia, Hungary, Romania, France and Spain), one North American cave (USA), and one Lebanese cave. Study sites included karst (ice caves, eutrophic, oligotrophic, dystrophic, chemoautotrophic) and pseudokarst caves, tourist inaccessible and public show caves, and caves with paleolithic or neolithic paintings. Filamentous microfungi were isolated from cave air, cave sediments, moonmilk, fovals, stalactite or cave wall surfaces, bat guano, cadavers, vertebrate and invertebrate dung, and organic matter of unknown origin. Cave microfungal communities were compared with those in the surface environment, i.e. outside air and soil above the caves. In addition to their ecological roles, the occurrence of *Aspergillus* spp. in caves is of special interest due to their possible impacts on human health. A number of of aspergilli are known to be opportunistic human pathogens or to produce allergens. To date, more than 75 species of the genus *Aspergillus* were identified among the isolates (ca. 1,500 isolates total) using macro- and micromorphological characteristics and molecular analyses (calmodulin, β–tubulin). A rich spectrum of aspergilli was isolated, especially from the warmer caves of southern European countries like the Cueva del Tesoro and the Cueva de Nerja (Spain) and the MovileCave (Romania). Novel species were isolated from caves, or soil above caves, and named after geographical localities, e.g., *A. baeticus*, *A. thesauricus*, *A.ardalensis*, *A. spelaeus*, *A. movilensis*, and *A. mangaliensis*. The description of several novel species is currently under preparation. Potential pathogenic aspergilli were also isolated. Of these, *A. fumigatus* (subgenus *Fumigati*) was the most common and occurred even in relatively cold caves. Another species of this subgenus *A.felis*, was previously known only from mycoses on cats, but was isolated from cave sediment of the Gruta de las Maravillas. *A. flavus* (subgenus *Circumdati*) was found frequently in cave air during some sampling periods, and it was commonly isolated from cave sediment and organic matter. The most common species causing allergic – *A. fumigatus* and *A. clavatus* (subgenus *Clavati*) – were found in caves, too. Other interesting and rarely isolated fungi were also obtained from soil samples collected above caves, e.g. *A. novofumigatus*, *A. fumigatiaffinis* (subgenus *Fumigati*), and *A. affinis* (subgenus *Circumdati*). These studies highlight caves as a rich source of rare and novel taxa, even among well-characterized fungal groups, and demonstrate the need better understand the impacts of these fungi on caves and their visitors.

11. ORDER NEELIPLEONA (COLLEMBOLA) REVEALS ITS DIVERSITY IN CAVE HABITATS

Papáč, V.[1], M. Lukić [2] & Ľ. Kováč [3]

[1] State Nature Conservancy, Slovak Caves Administration, Železničná 31, 979 01 Rimavská Sobota, Slovak Republic.
[2] Croatian Bisopeleological Society, Demetrova 1, 10000 Zagreb, Croatia.
[3] Institute of Biology and Ecology, Faculty of Science, P. J. Šafárik University, Moyzesova 11, 040 01 Košice, Slovak Republic.

Collembola are relatively well studied in some karst areas while in some they remain heavily understudied and undersampled. Neelipleona are the smallest of the four Collembola orders in term of species number and body size. Until recently, 44 species in five genera has been described. Due to small body size and lack of good morphological characters their diversity was underestimated. However, the molecular phylogeny approach indicates that Neelipleona are more diverse than previously considered. This phylogenetic pattern was confirmed by current discovery of new congeners in the subterranean environment. Despite the many records of world-wide genera *Megalothorax* Willem, 1900 and *Neelus* Folsom, 1896,the taxonomy of Neelipleona has remained unresolved for a century.

Of all neelid species 11 are cave dwelling with troglomorphic traits and distribution limited to caves. Specific features are associated with their mode of life in cave environment (larger proportions of body, elongated claws), which are not observed in surface members of Neelipleona order. Moreover, cave forms have more restricted ranges with endemic distribution in contrast with more widely distributed surface species. Specifically, of 29 species of the genus *Megalothorax*, nine are obligate cave species. Here we report on discovery of two new *Megalothorax* species from Croatian caves. Individuals have specific combination of characters with highly evolved troglomorphic features that separate them from Pyrenean and Carpathian cave congeners. Of six described species of the genus *Neelus* two are obligate cave dwellers: *N. koseli* Kováč & Papáč, 2010 and *N. klisurensis*Kováč & Papáč, 2010. Here we inform about two recently discovered undescribed species from Croatian caves. These new species are recorded for several caves and bear unique morphological features compared to other *Neelus* species. High frequency and abundance in Croatian caves was confirmed for troglophilic species *N. murinus*. We discuss the differences in distributional pattern of particular species of the genus and give a new insight into its systematics.

12. HOW SHOULD WE CLASSIFY SHALLOW SUBTERRANEAN HABITATS?

Pipan T.[1] & D. C. Culver [2]

[1] Karst Research Institute at ZRC-SAZU, Titov trg 2, Postojna SI-6230, Slovenia.
[2]Department of Environmental Science, AmericanUniversity, 4400 Massachusetts Ave. NW, Washington, DC20016, USA.

Shallow subterranean habitats (aphotic habitats less than 10 m from the surface) occur in a variety of geological settings, landscapes, and with a variety of environmental conditions, the most basic of which is whether they are water-filled or not. Among the described habitats are calcrete aquifers, epikarst, hyporheic, hypotelminorheic, and milieu souterrain superficiel (MSS). To these, some biologists add soil and lava tubes since both occur near the surface. Typically, each of these habitats was described from a small number of sites, and with a narrow focus. For example, the hypotelminorheic was originally described as an aquatic habitat in areas of moderate to high relief, but later authors included sites with low relief. In addition new habitat types have been proposed, including alluvial MSS by Ortuño et al. (2013) and macropore springs by Denton and Scott (2013). Rather, we emphasize both the similarities of all shallow subterranean habitats (SSHs), and the blurring of the distinction between apparently well established, distinct SSH types. For example, nearly all MSS sites are embedded in a soil matrix. Where does the MSS start and end? What is the difference, if any between a terrestrial epikarst site and a MSS site in karst? What is the difference between a hyporheic site isolated from groundwater and a hypotelminorheic site? Rather than refine existing terms and define new terms, we propose that the use of technical terms be kept to a minimum, and instead focus on parameters that have an impact on the ecological (especially the frequency of stygobionts and troglobionts) and morphological characteristics (body size and shape) of the species living in the habitats. These characteristics include (1) size of the spaces, (2) proximity to photic habitats, (3) carbon flux, and (4) interspecific competition. As much as possible, existing ecological and geological terminology should be used.

13. COLLEMBOLA COMMUNITIES OF FORESTED LIMESTONE AND BASALT TALUS DEPOSITS IN THE WESTERN CARPATHIANS, SLOVAKIA

Rendoš, M., N. Raschmanová & Ľ. Kováč

Institute of Biology and Ecology, Faculty of Science, Pavol Jozef Šafárik University, Moyzesova 11, 040 01 Košice, Slovakia.

In the period 2008–2012, collembolan communities in the depth gradient of forested talus deposits were investigated. Three localities situated in different orographic units of the Western Carpathians (Slovakia) were selected: (1) northeast-facing limestone talus deposit covered with linden-maple wood in the Čierna hora Mts, 530 m a. s. l., (2) southwest-facing talus deposit built on basaltic rocks overgrown with oak-hornbeam wood in the Cerová vrchovina Highland, 460 m a. s. l. and (3) north-facing limestone talus deposit covered with beech-hornbeam wood in the Drienčanský Karst, 315 m a. s. l. Specimens were collected by series of subterranean traps spanning to depth of 5-95 cm. Collembola communities of talus deposits differed considerably in number, species richness and distribution along the depth gradient. Collembola were more abundant in the limestone talus deposits, 10 species were common to all three sites. A total of 8 346 individuals and 40 species were trapped in scree of the Čierna hora Mts where *Lepidocyrtus lignorum* (D=87.0%), *Desoria tigrina* (D=4.0%) and *Protaphorura armata* (D=2.3%) predominated. Most springtails occurred at 5 cm below the soil surface, in deeper layers both number of individuals and species number declined sharply. In the Drienčanský Karst, 1 031 individuals and 38 species were collected. *Folsomia kerni* (D=28.2%), *Pygmarrhopalites pygmaeus* (D=16.9%) and *Pseudosinella thibaudi* (D=11.06%) represented the most numerous species. Collembola were concentrated mainly between the depths 15–45 cm. In volcanic scree of the Cerová vrchovina Highland, the community was characterized by lower number of individuals captured (711 inds.) and relatively high species number (34 spp.). *Lepidocyrtus lignorum* (D=31.0%), *Pseudosinella thibaudi* (D=14.6%) and *Pseudosinella horaki* (D=9.6%) had highest activity. Number of individuals and species number decreased gradually deeper from 5 cm. Several unique species were observed: troglobionts *Neelus koseli* (Čierna hora Mts) and *Pseudosinella paclti* (Drienčanský kras Karst), and two undescribed, partly troglomorphic species of genus *Pseudosinella* (Cerová vrchovina Highland, Drienčanský Karst). In general, troglobionts occurred more regularly in the lower half of the depth gradient (from 45 cm down the profile). The study was supported by the grants VVGS-PF-2013-104 and VEGA 1/0199/14. Participation in 22nd ICSB was supported by project KVARK, ITMS: 26110230084.

14. THE MICROSCALE IS A MAJOR DRIVER FOR SUBSURFACE FAUNA

Schmidt, S.I.[1], M.O. Cuthbert [2] & M. Schwientek [3]

[1] Centre for Systems Biology, School of Biosciences, University of Birmingham, Birmingham, B15 2TT, UK.[2] Water & Earth System Science (WESS) Competence Cluster, Keplerstr. 17, 72074 Tübingen, Germany.[3] Water Sciences Group (Hydrogeology), School of Geography, Earth and Environ-mental Sciences, University of Birmingham, Birmingham, B15 2TT, UK.

While it is well acknowledged that subterranean ecosystems, their functions as well as their elements, are influenced by large scale impacts from the catchment, glaciation, and climate, micro-scale effects from the bottom up have not been at the centre of attention yet. However, as in other systems, micro scale heterogeneity guarantees that a plethora of ecosystem services can take place at the same time. Even if the resources occur extremely patchily due to grain scale processes, they are thus used when and where they become available, e.g. by microbial microcolonies. Bacterial microcolonies are probably the major food source for protozoa and metazoan fauna, and from the bottom up, thus influence faunal occurrences. Fauna, being larger by several orders of magnitudes than most microbes, integrates over this micro scale and vice versa acts on an intermediate scale. In order to understand groundwater ecological processes, the interplay between influences on the various scales need to be integrated in a similar way as they are for abiotic conditions

16. SUBTERRANEAN HOTSPOTS FACING POTENTIAL DESTRUCTION: A CASE OF VILINA ŠPILJA – IZVOR OMBLA CAVE SYSTEM IN DINARIDES, CROATIA

Ozimec, R.[1], M. Lukić [1], J. Bedek [1], M. Pavlek [1,2], B. Jalžić [1,3], N. Matočec [2], G. Karaman [4] & R. Slapnik [1]

[1] Croatian Biospeleological Society, Demetrova 1, HR–10000 Zagreb, Croatia
[2] Rudjer Boskovic Institute, Bijenička 54, HR–10000 Zagreb, Croatia.
[3]Croatian Natural History Museum, Department of Zoology, Demetrova 1, HR-10000 Zagreb, Croatia.
[4] Montenegrin Academy of Sciences and Arts, Ul. Riste Stijovića 5, 81000 Podgorica, Montenegro.

Cave system Vilina špilja – izvor Ombla is situated in south Dalmatia in Croatia, near the town of Dubrovnik. With the length of 3036 and depth of 192 m, it is second largest cave in Dalmatia. Cave system comprises of two entrances, one at the 137,6 m a.s.l. and second as coastal karst spring at the 2,5 m a.s.l. from which water flows immediately into the Adriatic sea. The catchment area is estimated to be about 600 – 1000 km^2 with small part in Croatia and larger in Bosnia and Herzegovina. Measured water discharge of Ombla spring is in minimum 3.96 m^3s^{-1} and in maximum 117 m^3s^{-1}. Topology of cave system is fairly simple, with two fossil levels and lower, permanently submerged channel, that can be reached also by two artificial tunnels.

Cave system is type locality for eight cave taxa, recognized as one of the faunistically richest caves in Croatia being a Natura 2000 site for habitat type 8310 – Caves not open to public. Recent biospeleological research reveals that this cave is one of the hotspots of subterranean fauna and cave fungi in Dinarides with numerous endemic, endangered, rare and undescribed taxa. Literature data and recent research reveals a total number of 150 taxa, 33 being troglobiotic and 35 stygobiotic taxa. Two recorded species are listed on Annex II and Annex IV of the EU Habitats Directive: *Proteus anguinus* and *Congeria kusceri*. However these species have not been found during recent research. Further 18 taxa are listed in the IUCN Red List of Threatened Species, and 23 taxa are listed in the Red Book of Cave Fauna of Croatia. This cave system is the only known locality for 14 taxa, and 12 of them are species new to science. For 32 taxa this is the only finding place in Croatia. In addition it is also a Natura 2000 site for nine bat species listed in Annex II and Annex IV of the EU Habitats Directive.

This unique subterranean hotspot is endangered by possible construction of underground hydro-electric power plant which should exclusively use groundwater from the Ombla spring karst aquifer. The grout curtain with the total length of 1470 m and depth of 410 m ought to be injected 200 m behind the existing karst spring in the karst massif, and the top of the curtain is planned to be at an altitude of 130 m a.s.l. This curtain should form underground karst reservoir, permanently submerging and fragmenting main terrestrial cave habitats, and changing conditions and ecology of aquatic habitats. Most of the endangered taxa will suffer significant habitat loss and changes in habitat conditions would very probably led to extinction of some of them.

Literature data on impact of such large scale underground construction on subterranean fauna are scarce. It is hard to predict the influence of mentioned changes on aquatic habitats and populations of numerous stygobionts, both during and after the construction.. Positive outcomes of compensation and mitigation measures given in Environmental Impact Assessment are highly questionable. However it is expected that the negative consequences to this vulnerable and ecologically extremely valuable karst system will be serious and that monitoring of such disturbed habitats and taxa will be very limited due to their inaccessibility.

17. PRELIMINARY SURVEY OF THE INVERTEBRATE FAUNA OF THE GUNUNG MULU WORLD HERITAGE KARST AREA, SARAWAK, MALAYSIA.

Timothy Moulds

GHD Ecology and Marine Science 9/448 Murray St 6000, Perth Western, Australia.

The Gunung Mulu World Heritage Area (Mulu) is situated in the north eastern corner of Sarawak ,Malaysia on the Island of Borneo, adjacent to the South China Sea. The area was prescribed as a national Park in 1974 and is the largest national park in Sarawak covering an area of 528 km^2 . The area contains significant karstic limestone, with some of the world's largest caves by volume known from the area.

In 2012 a team of Australian speleologists undertook a preliminary survey of the invertebrate biodiversity of eight caves within Mulu. The caves were a mix of tourist, adventure and wild caves within the park. Invertebrates were recorded from a mixture of different microhabitats found within the caves and reference specimens from each cave were collected and preserved for future study.

The aims of the study were to:

1. Document the biodiversity of the caves.
2. Provide a photo inventory of species recorded.
3. Compare the invertebrate diversity and abundance between different cave zones and microhabitats.
4. Compare the invertebrate diversity and abundance between caves used for different tourism purposes.

The survey recorded over 19,000 specimens using a combination of collection and observation of species that presently represents 100 different morpho-species, from 28 orders and 9 classes. The number of morpho-species is expected to increase with additional sampling. Forty different species have been photo-inventoried thus far.

Preliminary analysis of data has shown no discernible differences in invertebrate diversity or abundance between tourist caves and wild caves. Observed differences in invertebrate populations are related to microhabitat variability and availability within sampled caves, with greater invertebrate abundance related to bird and bat guano deposits. Longer term sampling and research will be required to provide a greater understanding of species diversity and patterns of abundance throughout the Mulu karst.

18. FOOD WEB IN CAVES

Marko Lukić

Croatian Biospeleological Society, Demetrova 1, HR–10000 Zagreb, Croatia.

Due to the relatively small number of invertebrate groups and species in cave ecosystems it is relatively easy to reconstruct an assumed food web. However records of feeding and predating of cave fauna in situ are scarce, and rarely published. One of the reason is probably minute size of most of the cave invertebrates and the fact that most of the species are disturbed by human close presence, high temperature of flash and video lights that usually results in changing their behavior and quitting their normal activities.

Having collected a large number of pictures and video sequences from the caves of Dinaric karst a multimedial presentation is made to present feeding and predating of different invertebrate groups: Araneae, Pseudoscorpiones, Opiliones, Acari, Palpigrada, Collembola, Isopoda, Decapoda, Diplopoda, Chilopoda, Coleoptera, etc. This multimedial presentation is made up from in situ pictures and video sequences of the archive of the Croatian Biospeleological Society.

19. OVERVIEW OF THE HUNGARIAN *NIPHARGUS* (CRUSTACEA: AMPHIPODA) SPECIES

Angyal, D.[1] & G. Balázs [2]

[1] Hungarian Natural History Museum, Department of Zoology, 13. Baross u., Budapest, H-1088, Hungary.
[1] University of Pannonia, Georgikon Faculty, 16. Deák Ferenc utca, Keszthely, H-8360, Hungary.
[2] Eötvös Loránd University, Faculty of Science, Departement of Systematic Zoology and Ecology, 1/C Pázmány Péter sétány, Budapest, H-1117, Hungary.

Research of the Hungarian *Niphargus* species was a rather neglected field during the last decades. Clarification of the species in quastionable position could be the starting point of all the further inland research. In our present study we list the nine currently valid Hungarian *Niphargus* species with the addition of the new distributional data revealed by us. *N. hrabei* S. Karaman, 1932 is widely distributed in the Danube's middle and lower river basin. In Hungary it occurres in lakes at Hungarian plains, River Danube, River Dráva and the Lake Balaton catchment area. The species is closely related to *N. thermalis* Dudich, 1941, which was described from the Lake Malom of the Lukács Bath (Budapest), therefore their taxonomic relationship needs to be investigated further. Recently *N. thermalis* was also detected in the Molnár János Cave, which is hidrologically connected with the Lake Malom. *N. valachicus* Dobrenau & Manolache 1933 has regular records of relative high abundance from lakes and slow flowing rivers. *N. gebhardti* Schellenberg, 1934 and *N. molnari*Méhelÿ 1927 are endemic species of the caves of the Western-Mecsek Mts. (SW Hungary). Coexistence was observed in three caves. While *N. gebhardti* inhabits small pools formed by dripping water, *N. molnari* can be found in streaming water. *N. forroi* G. Karaman, 1986 was described from the Diabáz Cave from the Bükk Mts. (NE Hungary) and was treated to be the endemic species of that cave, until it was found in four other caves of the same karstic area, most cases in coexistence with *N. tatrensis* Wrzesniowky 1888. *N. aggtelekiensis* Dudich, 1932 inhabits the underground waters of the Aggtelek Karst (NE Hungary), it was detected in several caves of the area. Further studies are needed to clarify the state of the species within the *N. tatrensis* species complex. *N. hungaricus*Méhelÿ 1937 was described from springs of the Kőszegi Mts. (NW Hungary), however recently the species was found in pools of a mine tunnel close to the type locality.

20. MANAGEMENT AND CONSERVATION IN SHOW CAVES (ŠKOCJAN CAVES, SLOVENIA)

Sturm, S., T. Zorman [1], J. Mulec [2], T. Pipan [2] & S. Polak [3]

[1] Skocjan Caves Park Public Service Agency, Skocjan 2 SI-6215 Divača, Slovenia.
[2] IZRK ZRC Postojna – Karst research institute Slovenia, Titov trg 2, Postojna
[3] Notranjski muzej Postojna, Kolodvorska c. 3, Postojna, Slovenia.

The ŠkocjanCaves ranks among the most important karst phenomena not only in Slovenian Karst region, but worldwide. The ŠkocjanCaves are on the UNESCO World Heritage list. It is also featured on the Ramsar list of wetlands of international importance as the first registered underground wetland in Europe and designated as Man and Biosphere program (MAB) as the Karst Biosphere Reserve

So far, twenty-seven stygobiotic and troglobiotic organisms have been described in ŠkocjanCaves. Epikarst fauna (i.e., Copepoda) is particularly abundant. Moreover, numerous troglophile organisms make their home in ŠkocjanCaves. Of particular importance are the greater horseshoe bat, the long-fingered bat, and the common bent-wing bat as well as so called human fish (Proteus anguinus) as a biggest and most famous cave salamander (Natura 2000 protected species).

The Park's main priority is nature conservation which is a key task for managing such a vulnerable area as karst area and caves are. Proper implementations of conservation issues into the management plan are essential for managing a place where tourism and conservation are taking place. A part of the cave system is since the tourist exploitation started in 1819 opened for tourism. Therefore the proper carying capacity of the cave should be done. Main results should concern the stability of the underground ecosystem using data to establish proper lightning, »suitable« number of visitors, definition of sensitive and quiet zones, protection of the nature and natural cycles in the surface. Zonation of cave system is on progress, using all mentioned data.

1.) We are executing a monitoring and set up the observations of percolation water in the underground (epikarst fauna).

2.) Bats colonies monitoring in tourist part

2.) Furthermore, we observe the state of the underground terestric troglobiont fauna in the tourist-accessible part of Škocjanske Jame.

3.) We also start project with replacing halogen lights in tourist part of the cave to decrease lampenflora (energy input in the cave system).

4.) We also monitor the quality of cave air with the microbiological parameters, which will help in ways to prevent the spread lampenflore the air flow (1), determining the quality of the cave air (2) and "load" the cave of the number of visitors, especially in the silent cave (3).

5.) We are monitoring microclimatic conditions due to tourist flow – 1300 visitors per day in peak season.

6.) Quality of the Reka river from entrance to the end of the Cave.

7.) On walking paths we monitor the impact of visitors (swabbing a variety of surfaces to determine the impact of tourist visits to the pit entry of alien organisms and their viability).

8) Ranger service control on the surface to prevent pollution, unauthorized building, fertilizing control

21. THE CAVE TYPE LOCALITIES ATLAS OF CROATIAN FAUNA

Èukoviæ, T.[1], B. Jalžiæ [1,2], M. Pavlek [1,3] & M. Lukić [1]

[1] Croatian Biospeleological Society, Demetrova 1, 10000 Zagreb, Croatia
[2] CroatianNaturalHistoryMuseum, DepartmentofZoology, Demetrova 1, 10000 Zagreb, Croatia
[3] Rudjer Boskovic Institute, Bijenička 54, 10000 Zagreb, Croatia

The Dinaric karst with a large number of subterranean species covers almost the half of the Croatian territory. Although is the world's hotspot of cave fauna biodiversity, the cave dwelling fauna of the Dinarides is largely unexplored. The Croatian Biospeleological Society in 2000 initiated a project aiming to collect all the data on Croatian cave fauna. As a starting point to achieve these long term goals, caves that are type localities were chosen. In 2010 first volume of The Cave Type Localities Atlas of Croatian Fauna was published listing all Croatian cave type localities and species described from them with detailed presentations of 120 selected cave type localities and 133 taxa. It was very well accepted by the experts and the public and as an upgrade to Volume 1 and supplementation Volume 2 of The Cave Type Localities Atlas of Croatian Fauna was published. Between the publication of Volume I and II the number of cave type localities rose to 271 and the number of described taxa to 427. The Volume 2 of The Atlas presenting 88 type localities and 140 attributing taxa approaches the cave fauna biodiversity in a popular and illustrative way bringing this issue to a wider audience. It also attempts to demonstrate the scientific value of cave type localities and to induce rethinking about proper legislative and management actions for conservation of the entire Dinaric karst area. Considering the large number of cave type localities in Croatia, a third volume will be published in the future, to present the remaining as well as newly discovered type localities and taxa.

22. PREDATION AND SPATIAL-TEMPORAL USE OF YUCATAN CENOTES BY STYGOBITIC CRUSTACEANS: *CREASERIAMORLEYI* AND *TYPHLATYASPP.* PRELIMINARY RESULTS

Chávez-Solís, E. M [1], M. Mascaró [2] & F. N. Dias-Marques-Simões [2]

[1] Universidad Nacional Autónoma de México, Posgrado en Ciencias Biológicas Edificio B, 1º Piso. Circuito de Posgrados, Ciudad Universitaria. C. P. 04510 D.F., México.
[2] Universidad Nacional Autónoma de México, Departamento de Manejo de Zonas Costeras, Unidad Multidisciplinaria de Docencia e Investigación de Sisal. Puerto de Abrigo S/N, C.P. 97356, Hunucma, Yucatán, México.

Studying the distribution, population dynamics and behavior of stygofauna in their natural habitat may be difficult, technically challenging and somewhat dangerous, as cave diving is involved. Nevertheless, many different taxonomical groups have been found, described and studied. Most of these studies focus on taxonomic, evolutionary or genetic trends, allowing the behavioral and ecological questions to surface. Stygobitic crustaceans are the most diverse group found in underwater caves with 42 species.

Two genres of decapods from different trophic levels (Creaseria and Typhlatya) were studied to evaluate the depth distribution during the day and night in the penumbra zone of two cenotes (sinkholes) of Yucatan (Kankirixche and Tza-Itza). Both populations will be observed for a year to assess demographic variations of the population. The trophic interaction between these species was video-recorded with infrared devices under laboratory conditions.

Preliminary results indicate: 1) *Creaseria morleyi* occurs more frequently during the night at the shallow areas that are, otherwise illuminated during the day; 2) Higher densities of both genera are found in cenote Tza Itza; 3) The abundance ratio at which these species occur are: 1:4 and 1:3 *Creaseria*/*Typhlatya* during the day and night respectively in cenote Kankirixche; and 1:16 and 1:2 *Creaseria*/*Typhlatya*, during the day and night respectively in cenote Tza Itza; 4) *C. morleyi* may hunt and feed on live *Typhlatyaspp*.

Whilst both species may take advantage of the entrance of external biomass and organic material at the sinkholes, observed distribution patterns may also be explained by trophic interactions revealed by this study; *C. morleyi* is an active predator that preys on the filter feeders *Typhlatyaspp*.

23. SEXUAL REVERSAL: WHAT DO CAVE ENVIRONMENTAL TRAITS HAVE TO DO WITH IT?

Rodrigo Lopes-Ferreira

Centro de Estudos em Biologia Subterrânea, Setor de Zoologia, Departamento de Biologia, Universidade Federal de Lavras, Cx Postal 3037, Campus Universitário, CEP 37200-000 Lavras, Minas Gerais, Brazil.

The family Prionoglarididae encompasses some of the most interesting psocids currently known. Due to their basal position within the suborder Trogiomorpha and their similarity to fossils of this basal suborder (their plesiomorphic wing venation), the extant prionoglaridids are considered as "living fossils". Specimens from this family can be easily recognized by the forewing venation pattern: the basal portion of Sc developed as a slightly curved vein joining R1 just basally of pterostigma. The family possesses 7 genus and 20 species, distributed in South and North Americas, Africa, Europe and Southeastern Asia. Among the different genus stands out *Neotrogla*, exclusively found in Brazilian caves. All the four species within this genus present a complete sexual reversion regarding their genital parts. The females have a penis-like organ (named gynosome) while the males lack any intromittent organ, and their penises were reduced to a thin arch. The male's genital chamber seems like a vagina, accommodating the female penis during the copula. The sex reversal observed in those species might have occurred due to the special conditions where *Neotrogla* lives. All species live in extremely dry caves or in extremely dry areas of some caves, in which food resources are extremely rare. Accordingly, for a *Neotrogla* female living in a habitat with such food constraints, gather resources to produce eggs is a tough task. Therefore, males are potentially good sources of resource (the seminal gift) that can be used by females, and this could have led to the sex role reversal. The female penis represent, thus, a good tool for getting a nutritious resource from males. At least for one species (*Neotroglacurvata*), the long time spent in copula (55 hours in average) may also be a result of the environmental traits of the caves where they live. Longer matings can allow a higher amount of semen to be transferred. However, during the mating, the couple is more vulnerable to predators. Hence, the copula is usually long enough to ensure that great amounts of semen will be transferred but also fast enough to prevent the couple from predation. In an environment with only few other species (including few predators), the *Neotrogla* species evolved to have a huge time spent in mating, thus, gathering more nutritious resources from males. Further studies regarding those species will include the ontogenesis of the female penis and detailed aspects of the mating behavior.

24. ARE THERE LIMITS TO THE SUBTERRANEAN FAUNA?

Alberto Sendra

Departamento de Ciencias de la Vida, Universidad de Alcalá, Alcalá de Henares, Madrid, Spain.

The answer is yes! There are limits. Everybody agrees with this. The fauna in the subterranean ecosystem would vanish if the conditions for life became unsuitable. This happens for terrestrial fauna in very cold regions with the presence of permanent frosted soil or in very dry areas where the subterranean environment doesn't receive any drop of meteoric water. But that is not all! Two years ago without any idea about what we might find, we had the opportunity to visit a exciting cave in the Eastern Iberian Peninsula. The cave hadn't any entrance until 1983 when several small entrances were opened during the construction of a highway. Inside the cave we found many good places for cave-adapted fauna, but we couldn't see any. What had happened? For us the cave was so odd the passages were interconnected in an anostomotic subterranean net for more than eight kilometres. We wandered for one day descending holes on many occasions with a sudden end or ascending until we stumbled across always the same marl and dolomite bedding. It wasn't a normal cave, it was a hypogenic cave! Over the last 40 years, hypogenic karst/caves have become well known and hypogene speleogenesis has been used to explain the formation of some of the largest subterranean maze caves. These hypogenic systems take place in confined aquifers with upwards flow, responsible for their karstification. Such spaces began and could remain isolated from the surface and the contiguous subterranean habitats, including the shallow ones. That could be an explanation! Then we decided to study the invertebrate fauna and the geology/speleogenesis of this cave. We set pitfall traps, we spent many hours looking for fauna, and as a result non cave-adapted fauna was found. If you looked in the literature about fauna of hypogenic caves in Europe or North-America, you would find the same results, no adapted-fauna inside. In the end we have suggested that there are restrictions for faunal colonization of the hypogenic subterranean ecosystems due to these subterranean spaces being able to remain unconnected with the surface from their speleogenesis formation until the confining layers disappear. We propose differentiating the hypogenic from the epigenic subterranean ecosystem based on the fact that the first one lacks fauna during its genesis. This new scenario may have consequences in the regional biodiversity patterns of troglobiont species and may be useful to better understanding the colonization of the subterranean fauna.

25. THE FIRST TWO HOTSPOTS OF SUBTERRANEAN BIODIVERSITY IN SOUTH AMERICA

Souza-Silva, M. [1] **& R. Lopes-Ferreira**[1]

[1]Universidade Federal de Lavras, Departamento de Biologia, Setor de Zoologia Geral, Centro de Estudos em Biologia Subterrânea, Lavras, MG, Brazil.

Biodiversity conservation currently requires urgent, effective and low-cost measures. In this sense the prevailing approaches to preserving biodiversity are the selection and negotiation of priority areas with high biodiversity, low economic value and where human activities and disturbance factors can be controlled. The evaluation of areas with high diversity arise with strategies to address conservation priorities. Although the caves can show a lower diversity than that of surface habitats, subterranean fauna have attracted much attention because of their singularity and endemism. There are few caves in the world with a number of obligate cave species over 20 species. So far no hotspots of high richness of strictly subterranean species in Neotropics regions have been identified. The objective of this work is to present the first two hotspots of biodiversity in subterranean caves in South America. Toca do Gonçalo cave, located in a semiarid zone in Brazil (Caatinga biome), is 500m long and has 22 obligate cave species. The Areias cave system, 22 km long, has 26 obligatory cave species located in a humid subtropical zone covered by AtlanticRain Forest. The species present in the caves, some of which relicts, belong to the taxa Platyhelminthes (1 sp.), Nemertea (1sp.), Gastropoda (2 spp.), Amphipoda (4), Isopoda (5), Decapoda (1), Collembola (6), Coleoptera (4), Ensifera (1), Hemiptera (1), Zygentoma (1), Diplopoda (6) Chilopoda (5) Araneae (2), Opiliones (1) Palpigradi (2), Pseudoscorpiones (3) and Osteicthyes (2). Both caves have perennial water bodies, however terrestrial invertebrates are dominant in number of species. The caves undergo anthropogenic alterations arising from past and present human activities and deserve special, urgent attention regarding further research and protection, mainly related to preservation of the area under the influence of watershed. The small area where Toca do Gonçalo cave develops certainly elevates its importance for conservation. The Brazilian cave fauna began to be relatively well studied from the 80s, however, few caves have been intensively studied, but systematic inventories in the two caves have revealed a high potential for discovery of new species.

26. ADVANCES IN THE STUDY OF THE SHALLOW SUBSTRATUM IN MEDITERRANEAN REGION: ARTHROPOD DIVERSITY OF A COLLUVIAL DEBRIS IN EASTERN SPAIN

Jiménez-Valverde, A.[1], J. D. Gilgado [2], A. Sendra[2], G. Pérez-Suarez[2], J. J. Herrero-Borgoñón [3] & V. M. Ortuño [2]

[1] Departamento de Biología y Cambio Global, Museo Nacional de Ciencias Naturales, Madrid, Spain.
[2] Departamento de Ciencias de la Vida, Universidad de Alcalá, Alcalá de Henares, Spain.
[3] Departamento de Botánica, Facultad de Ciencias Biológicas, Universitat de València, Valencia, Spain.

Two years ago, in the last symposium of subterranean biology, the authors of this communication announced the start of a large and ambitious project devoted to the study of MSS habitats under Mediterranean climate influence. Last year, we published some of the result highlightening the importance of alluvial stone debris as an MSS habitat that enables the existence of subterranean fauna. More recently, we have focused our attention to evaluate the thorough biodiversity of the colluvium in the same geographic area. The macroinvertebrate fauna of a colluvial was characterized, and the importance of the MSS as refuge for endemic and rare species was assessed. Ten pitfall traps were buried up to 1 meter deep inside multiperforated PVC tubes across the stone debris. Several environmental variables were measured in each sampling point. The completeness of the inventory was assessed, and different diversity patterns - variation in abundance, species richness and species composition - were analyzed. 4150 individuals and 164 species were captured, most of them arthropods. The number of individuals and species varied considerably among traps. Half of the species were represented by one or two individuals, and neither the species accumulation curves nor the curves for the non-parametric estimators showed any sign of stabilizing. Individuals of abundant species aggregated in one or a few traps. No consistent diversity patterns were found, except that distance among traps partially explained the similarity in species composition when considering only the most abundant species. This is a very rich but uneven assemblage, with a significant presence of geophile, hygrophile and mesothermophilous species, and with a high degree of species turnover between traps. Obtaining complete fauna inventories in the MSS has proven to be a challenging task, a fact that hampers the exploration of the community patterns. The study of the MSS reveals important faunistic information, providing new taxa to science as well as interesting records of poorly known species.

27. RESEARCHES AND MANAGEMENT RECOMMENDATIONS FOR LONG-TERM CONSERVATION OF A ROMANIAN CAVE

Nastase-Bucur, Ruxandra[1] & Daniela Borda[1]

[1]"Emil Racovita" Institute of Speleology, Clinicilor 5, 400006, Cluj-Napoca, Romania.

The researches, extended over a year, between May 2013-May 2014, regarded a topoclimatic survey of the Tausoare Cave (Rodnei Mts, Romania) correlated with dynamics of bat colonies and microbial communities analyses. Topoclimatic data were continuously recorded by temperature and humidity data-loggers, installed in the key points of the cave. In order to estimate the quality of cave air and water and, thus, of the human impact upon the subterranean environment we determined the number of colony forming units (CFU) for aerobic mesophilic bacteria.

Five bat species have been identified both through netting and in situ observations: *Rhinolophus hipposideros, Rhinolophus ferrumequinum, Myotis emarginatus* and thesibling species *Myotis myotis* and *Myotis (blythii) oxygnathus.* All species are strictly protected. Bats were found in the cave all year long but only during hibernation the cave shelters important bat colonies, over 8500 individuals being found in the winter 2013-2014. The importance of this cave as bat colonies shelter consists in that just a few Romanian caves have colonies bigger than a couple of hundreds of specimens, none of them in this geographic region. This is due to climatic particularities and the protection status of the cave that ensures optimal conditions for hibernation of *Myotis myotis* and *Myotis* (*blythii*) *oxygnathus*. Along with bats, Tăuşoare cave also shelters other strictly adapted cave invertebrates, such as the troglobiont *Litocampa humilis* and the stygobiont *Niphargus puteanus*. Microbial analysis of the air showed low levels in the cave, with a maximum of 121/20 cm^2/15 min mesophilic aerobic bacteria (NTG), determined only in the air near the entrance. In the underground water we also identified coliform bacteria (3 CFU/ml) and enterococci (3 CFU/ml), indicating a slight pollution caused by organic household products from the surface. The analysis of surface water confirms this aspect all groups of tested organisms being found in appreciable numbers. The plate count showed a maximum of 180 CFU/ml, coliform bacteria 76 CFU /ml, *E. coli* 10 CFU/ml and enterococci 72 CFU/ml.

At present, the conservation status of bat species in Tăuşoare cave is considered favorable, as population dynamics indicates a stable population that is likely to remain in the cave for a long term, the natural habitat does not reduce and there is no risk to lose in the foreseeable future if conservation measures will be implemented. Based on the results of our researches, and in the frame of our collaboration with the cave manager, we issued some recommendations meant to be considered in the elaboration of the management plan of Tausoare Cave. All these aspects can result in the long term conservation of the cave, the bat colonies and the strictly adapted cave fauna.

28. THE POTENTIAL USE OF ECOPHYSIOLOGICAL GROUPS OF BACTERIA FROM CAVE SEDIMENTS AS INDICATORS OF PALEOENVIRONMENTS

Epure, Laur[1] & Oana Teodora Moldovan[1]

[1]"Emil Racovita" Institute of Speleology, Clinicilor 5, 400006, Cluj-Napoca, Romania.

Six bacterial ecophysiological groups of six Pleistocene sediment samples collected from two Romanian caves were assessed and included in a multidisciplinary set of data, for evaluating their potential contribution to the interpretation of paleoenvironment. Denitrifiers and nitrite oxidizers were present in the culture plates of all samples, the ammonia oxidizers were completely absent and the iron-reducers were confirmed solely in the deepest sample of one of the caves. The aerobic mesophilic heterotrophs were much less abundant in sediments with high clay content. Ammonifiers were associated with the presence of big vertebrates in one of the caves. OSL dating, geochemical, sedimentological and grain size analyses were also performed. Results point to the importance of surface conditions during the time of sediment inflow inside the caves, but the bacterial communities have continuously been shaped since deposition. The present study is an attempt for obtaining preliminary data which proves that bacteria of old cave sediment deposits can be linked to the paleoenvironment.

29. THE IMPORTANCE OF TIME SCALE IN SUBTERRANEAN HABITATS MONITORING

Oana Teodora Moldovan

"Emil Racovita" Institute of Speleology, Clinicilor 5, 400006, Cluj-Napoca, Romania.

The monthly analysis of the fauna communities in the hyporheic zone was used for the assessment of pollution of the Arieş River and the importance of monthly versus seasonal sampling frequency in detecting the impact of pollution on biodiversity changes in the hyporheic zone is discussed. Finding patterns of biodiversity and abundance at different time intervals in a polluted river and identifying the correct sampling protocol for hyporheic zone quality assessments was applied on a stretch of the most polluted river in Transylvania, the Arieş River. The species considered in this study belong to Crustacea (except for Ostracoda, which was not taken into study) and Oligochaeta that had an increase in abundance in different periods of the year with no correlation between the physico-chemical features and the presence of species, with some exceptions supported at low statistical significance. As compared to monthly sampling, seasonal sampling of hyporheos (for the two most abundant species, *Microcharon* sp. and *Diacyclops languidoides*) shows strong correlations with the four considered environmental features considered (temperature, flow rate, Al and Fe). Frequent sampling can be the only approach in understanding the interrelationships between fauna in both the hyporheic zone and the surface rivers within the ecosystemic assessment of water quality.

30. RED LISTED CAVE COLLEMBOLA IN BRAZIL: IUCN'S CRITERIA APPLIED TO CAVE INVERTEBRATES

Douglas Zeppelini

Laboratory of Systematics of Collembola and Conservation
Universidade Estadual da Paraíba campus V, João Pessoa, Brazil.

As signatory of the UN Convention on Biological Diversity, Brazil prepared the Red List of threatened Fauna, according to IUCN's established criteria, which included seven species of cave Collembola in the category Vulnerable (VU) and two as Data Deficient (DD). The first revision of the Brazilian Red List is being finished in 2014, including about 7000 animal species, in this revision 313 species of Collembola were evaluated, 15 were listed as VU (3spp), Endangered (EN 2spp) or Critically Endangered (CR 10spp). Observing the listed species in Brazil, it is clear that for Collembola, most criteria for evaluation are not applicable. It is true for small non flying invertebrates as a whole, as population studies, demographic data and monitoring is seldom available. Brazilian Red Listed Collembola fauna includes 15 species, where 14 are troglobites (10 CR, 2 EN and 2 VU). The criteria which can fit non flying small invertebrates are those concerned to distribution, mainly Extent of Occurrence (EOO) and Area of Occupancy (AOO). Those criteria must be associated to some threats, which concern to fragmentation or decline of the environment, loss of habitat or fluctuation in distribution and occupancy. Using the Brazilian red listed Collembola as example, we realize that all those distributional criteria are useful for cave invertebrates as they are for cave Collembola. Indeed they are more effective for cave species than it is for those species with epigeic distributions. The only epigeic Collembola species included in the Red List of Brazilian Threatened Fauna is know from an area smaller than 20Km^2 settled in an area with intense mining activities, environmental degradation and habitat loss, even though the species was categorized as VU, the lower risk category.

31. DISTRIBUTION OF MEXICAN STYGOBIONTIC CRUSTACEA

Luis M. Mejía-Ortíz

Lab. de Bioespeleología y Carcinología, Dpto. Ciencias y Humanidades, Av. Andrés Quintana Roo s/n, Cozumel, Quintana Roo, México.

In Mexico there are six karstic provinces and one volcanic region: Sierra Madre Occidental, Edwards Plate, Sierra Madre Oriental, Central Volcanic Belt, Sierra Madre del Sur, Karst System from Chiapas and Yucatan Peninsula, where there have been registered 7500 entrances of caves, karst sinkholes and springs. In many of these formations they can be found crustaceans, which are the best represented group mainly in underground water systems. In Mexico there are over 150 species of crustaceans that inhabit groundwater either brackish or marine. In this study the species richness, genera and families were analysed by state and karst province. The results show that there are five groups in the analysis by state: a) < 5 species, Durango, Hidalgo, Michoacán, Sonora, Tabasco and Puebla; b) 6-10 species, Nuevo Leon, Campeche, Guerrero and Tamaulipas; c) 11-20 species, Quintana Roo, Veracruz, Coahuila, Oaxaca; d) 21 to 30 species, Chiapas and San Luis Potosi; e) > 30 species: Yucatán. In the analysis by karst province, species richness is best represented in the Yucatan Peninsula, Sierra Madre del Sur and Sierra Madre Oriental. However, in the analysis of genera and families, only the Yucatan Peninsula has a wide range while the other two provinces have fewer families. The points of high diversity of cave crustaceans are located in tropical caves and few species have been reported in temperate caves of the Sierra Madre Occidental or Edwards Plate. In the caves of the Yucatan Peninsula there are species of orders and classes that are present only in this area. The analysis showed that richness species, caves abundance, their location in tropical areas and the heterogeneity of environments within the caves explain these diversity patterns.

32. EVIDENCE FOR HEARING LOSS IN AMBLYOPSID CAVEFISHES

L. Niemiller, M. L.[1], D. M. Higgs [2] & D. Soares [3]

[1] Ecology and Evolutionary Biology, YaleUniversity, New Haven, CT06520, USA.
[2] Biological Sciences, University of Windsor, Windsor, Ontario N9B 3P4, Canada.
[3] Department of Biological Sciences, New Jersey Institute of Technology, Newark NJ, 07102 USA.

The constant darkness of caves and other subterranean habitats imposes sensory constraints that offer a unique opportunity to examine how sensory modalities evolve. Hearing in cavefishes has not been well explored, and here we show that cavefishes in the family Amblyopsidae are not only blind but also lost a significant portion of their hearing range. Our results showed that cave and surface amblyopsids shared the same audiogram profile at low frequencies but only surface amblyopsids were able to hear frequencies higher than 800 Hz, and up to 2KHz. We measured ambient noise in aquatic cave and surface habitats, and found high intensity peaks near 1kHz in streams underground, suggesting no adaptive advantage in hearing in those frequencies. In addition, cave amblyopsids had lower hair cell densities compared to their surface relative. These traits may be adaptations that evolved in response to loud high frequency background noise found in subterranean pools and streams. This study represents the first report of auditory regression in a subterranean organism.

33. HISTORY OF MEXICAN BIOSPELEOLOGY

Juan B. Morales-Malacara

Lab. Espeleobiología & Acarología, Unidad Multidisciplinaria de Docencia e Investigación, Facultad de Ciencias, Universidad Nacional Autónoma de México, Campus Juriquilla, Querétaro, México.

Centuries ago, the ancient inhabitants of Mexican territory had an empirical knowledge of caves, for example, for some of them caves were their water source, burial sites, and places for water supply. Specially for the Mayan people caves and cenotes were sacred places, where the "inframundo" or underworld heaven inside the motherland dwells, where different kinds of animals lived, and some of them were idolized as gods. Among these were the bats, known in Mayan language as "sotz".

Long afterwards, in the middle of the XIX century, Empress Carlota, the wife of the Mexican Emperor Maximilian, visited the wonderful cave of Cacahuamilpa in the state of Guerrero. Along with her came her confessor Friar Dominik Bilimek, who was a naturalist, and was the first European who collected and described different cavernicolous animals from Mexico, including one of the first species of troglobitic arthropod.

At the turn of the XX century there were other researchers interested in the study of animals in caves in Mexico. In the year of 1938 two Spanish biospeleologists, Cándido Bolívar and Federico Bonet, came to Mexico as refugees during the civil war in their country, and they formally began with a biospeleological research tradition that would last for more than 20 years. They worked in the National School of Biological Sciences from the National Polytechnic Institute in Mexico, and undertook many expeditions to the underground world of Mexico, collecting fauna, describing new species, even surveying some geological features from these caves. Thanks to their influence some other researchers have followed in their footsteps.

During 1940, 1950, 1960 and1970, several Mexican researchers stand out for their contributions to the study of Mexican cave fauna. Dr. Bernardo Villa (1940-1966), was the pioneer in the study of bats, and especially in the study of rabies problems derived from bites of vampire bats of Mexico, Dr. Caballero (1942-1960), with studies of parasitic Helminths from different hosts that inhabit caves, Dr. Álvarez (1946-1970) with his studies of cave fishes, Dr. Villalobos (1951-1974) with studies of crustaceans, and Dr. Anita Hoffmann (1944-2007) who was the pioneer in the study of mites, including those parasitic of bats.

The Association of Mexican Cave Studies (AMCS) was constituted in the United States, with its headquarters in the State of Texas. This association made intensive expeditions that derived in different contributions to the study of caves. Derived from this association, it is important to mention all the contributions of James Reddell, who brought together all records of fauna from caverns of Mexico, Guatemala, and Belize and published outstanding checklists in 1971 and 1981.

Later in the XXth century, Dr. A. Hoffmann opened a Biospeleology course at the Faculty of Sciences of the National Autonomous University of Mexico the only one in Latin America up to that time. This series of lectures represented a breakpoint in the paradigm of field studies of cave fauna, and gave rise to different contributions, that resulted in the edition of the *Manual of Biospeleology*, authored by Hoffmann, Palacios-Vargas and

Morales-Malacara in 1986, that includes records of cave fauna from several locations in Mexico. Up to the present time this course at the UNAM has been given continuity under the leadership of José Palacios-Vargas, Gabriela Castaño-Meneses, and Juan Morales-Malacara, along with associated professors, Arturo García Gómez, Fernando Álvarez Padilla, Miguel Hernández Patricio, Adriana Espino del Castillo, Ricardo Paredes-León, Itzel Sigala, among others. Some of them represent during the present century the new generation of Biospeleologists of Mexico.
Currently, J. Palacios-Vargas, G. Castaño-Meneses have a group of enthusiastic students that follow this studies tradition. In addition Morales-Malacara, still continues with his work on caves, and he has the responsibility to follow the biospeleological legacy of Hoffmann, and has continued with the course of Biospeleology in the Faculty of Sciences, UNAM, to the point that his present laboratory has the name of Speleobiology and Acarology. Morales-Malacara has different research subjects, as faunal biodiversity, bats and their parasites as his majors, with grants to support his research along other joint ventures with other colleagues (PAPIIT IN219113).

34. PHYLOGENETIC AND BIOGEOGRAPHIC RELATIONSHIPS OF THE GENUS *HALOSBAENA* (THERMOSBAENACEA)

Humphreys, W. F.[1] & T. J. Page [2]

[1] Western Australian Museum, Welshpool DC, Western Australia, Australia.
[2] Australian Rivers Institute, Griffith University, Queensland, 4111, Australia.

Thermosbaenacean are a little known order of stygobitic crustaceans found in anchialine environments in restricted locations worldwide. The only described Southern Hemisphere representative is *Halosbaena tulki*, found amongst the coastal karst of N.W. Australia, with other *Halosbaena* located in the Caribbean, Canary Islands and Okinawa, suggesting to some the influence of the TethysSea as far back as the Mesozoic onwards. We explored the large and small scale phylogenetic and biogeographic relationships of the genus *Halosbaena* by sequencing mitochondrial (COI) and nuclear genes (H3, 28S) from many specimens of *Halosbaena tulki* from across its range in Western Australia (the CapeRange peninsula, BarrowIsland, the PilbaraCoast). These we compared with sequences from two other described *Halosbaena* species (Okinawa, Canary Islands) and a specimen from a new location, Christmas Island in the Indian Ocean.

At the largest scale, *H. daitoensis* (Minamidaito-jima, Okinawa) and *H. fortunata* (Canary Islands) are sister species relative to *H. tulki* (Australia) and Christmas Island. The Daito islands and Christmas Island are isolated seamounts of post Cretaceaous age indicating oceanic dispersal at some stage within the greater tethyan province. The Christmas Island specimen is a distinct species and is sister to the Australian specimens. Although the Australian *H. tulki* specimens form a single phylogenetic lineage, they are likely to constitute a number of distinct species. The existence of "cryptic" species is common amongst subterranean species in N.W. Australia, and worldwide. There are five lineages within *H. tulki* that reflect geographic areas: BarrowIsland, Cape Range East Side, Cape Range West Side, Pilbara High Altitude, Pilbara Low Altitude. This pattern is inferred from both mitochondrial (15-22% COI distances between lineages) and nuclear sequences. The two CapeRange lineages are sister taxa, but the relationship between the other lineages is unclear, although the two Pilbara lineages do not appear to be sisters. Within the Cape Range West lineage, there are clear phylogeographic groupings that equate to the northern, central and southern parts of the western CapeRange, which agrees with patterns from a number of other subterranean species from the same areas, implying a common geological cause.

35. MEXICAN ANCHIALINE FAUNA

Calderón-Gutiérrez, Fernando[1] & Carlos A. Sánchez Ortiz[1]

[1]Departamento de Biología Marina, Universidad Autónoma de Baja California Sur, Baja California Sur, México

Due to the poor and scattered information on Mexican anchialine ecosystems we realized a bibliographic review, selecting those that mentioned that were developed in an anchialine systems or the presence of a halocline. We identified a total of 50 works from 1939 to 2013 (50% in the last decade) generally performed just in the cenote (not in the cave). We identified 40 cenote/systems in Quintana Roo and Yucatan, presenting a lot of synonymies, its geographic information was not available in a lot of cases, and inclusive many works do not even mentioned the name of the cenote/systems as all the studies in Campeche. In 24 cenotes/systems were reported fauna with a total of 230 records (including 40 uncertain and 8 common names) corresponding to 11 phyla with a total of 161 taxonomic units, from which 97 were identified to specie level, being the richness the El Aerolito system with 43 records. Unfortunately, despite of the very few studies have been recorded negative anthropogenic effects, inclusively there are species with a grade of extinction danger according to the Mexican legislation NOM-059 (7 spp.) and the red list of the IUCN (7 spp.), including two which are in critic extinction danger, because of that we need to protect cave systems in the short time.

36. WORLDWIDE CAVE DWELLERS ECHINODERMS AND ECOLOGICAL STUDY IN EL AEROLITO SYSTEM, COZUMEL, MEXICO

Calderón-Gutiérrez, Fernando[1], Francisco A. Solís-Marín[2] & Carlos A. Sánchez-Ortiz[1]

[1]Departamento de Biología Marina, Universidad Autónoma de Baja California Sur, Baja California Sur, México

[2]Colección Nacional de Equinodermos "Ma. E. Caso Muñoz", Laboratorio de Sistemática y Ecología de Equinodermos, Instituto de Ciencias del Mar y Limnología (ICML),Universidad Nacional Autónoma de México (UNAM). Apdo. Post. 70-305, México, D.F. 04510, México

As a result of a bibliographic review we found that in 1985 García Valdecasas reported for first time an echinoderm inside of an underwater cave in Canary Islands, Spain; since then had been reported 26 species in Bahamas (1), Canary Islands (2) and Mexico (24), those included two troglobic species: The starfish *Copidaster cavernicola* (Mexico) and the brittle star *Amphicutis stygobita* (Bahamas). Furthermore we realized a quantitative ecological study of echinoderms in the El Aerolito anchialine system, for that we made belt transects of 15x1 m, in whose were counted all the macroinvertebrates. We identified 35 species which correspond to 8 phyla, of which echinoderms were the second richness group (9 species), and the first in density with 47.4 org/10m^2. That contrast with previous reports in other caves in the world where the crustaceans are dominant taxa. El Aerolito system is unique in the world and should be protected before anthropogenic pressures damage it.

37. THE CAVE TYPE LOCALITIES ATLAS OF CROATIAN FAUNA

Čuković, Tamara[1], Branko Jalžić[1,2] & Martina Pavlek[3]

[1]Croatian Biospeleological Society, Demetrova 1, 10000 Zagreb, Croatia.
[2]Croatian Natural History Museum, Department of Zoology, Demetrova 1, 10000 Zagreb, Croatia.
[3]Croatian Biospeleological Society, Demetrova 1, 10000 Zagreb, Croatia
Rudjer Boskovic Institute, Bijenička 54, 10000 Zagreb, Croatia

The Dinaric karst with a large number of subterranean species covers almost the half of the Croatian territory. Although is the world's hotspot of cave fauna biodiversity, the cave dwelling fauna of the Dinarides is largely unexplored. The Croatian Biospeleological Society in 2000 initiated a project aiming to collect all the data on Croatian cave fauna. As a starting point to achieve these long term goals, caves that are type localities were chosen. In 2010 first volume of The Cave Type Localities Atlas of Croatian Fauna was published listing all Croatian cave type localities and species described from them with detailed presentations of 120 selected cave type localities and 133 taxa. It was very well accepted by the experts and the public and as an upgrade to Volume 1 and supplementation Volume 2 of The Cave Type Localities Atlas of Croatian Fauna was published. Between the publication of Volume I and II the number of cave type localities rose to 271 and the number of described taxa to 427. The Volume 2 of The Atlas presenting 88 type localities and 140 attributing taxa approaches the cave fauna biodiversity in a popular and illustrative way bringing this issue to a wider audience. It also attempts to demonstrate the scientific value of cave type localities and to induce rethinking about proper legislative and management actions for conservation of the entire Dinaric karst area. Considering the large number of cave type localities in Croatia, a third volume will be published in the future, to present the remaining as well as newly discovered type localities and taxa.

38. DISTRIBUTION AND SITES CLASSIFICATION OF *PROTEUS ANGUINUS* LAURENTI, 1768 IN CROATIA, BOSNIA AND HERZEGOVINA AND MONTE NEGRO

Katarina Koller

Croatian Herpetological Society HYLA, Lipovac I/7, 10 000 Zagreb,
Zagreb, Croatia Croatia

Proteus anguinus is endemic stygobiont found in Slovenia, sorounding area of Trieste in Italy, Croatia, Bosnia and Herzegovina and Montenegro. It lives in subterranean waters of the Dinaric karst. The analysis of literature data and personal communication with biospeleologists show that in Croatia here is 68 localities where olm presence was recorded at least once. According to recent data, there are 37 confirmed localities, 10 certain, but unavailable, 14 potential and 7 which are most likely to be incorect. According to the latest data in Bosnia and Herzegovina were known 59 localities where proteus have registered. Localities are separated into 3 areas: West Bosnia, West Herzegovina and South Herzegovina. The first and only finding of the olm in Montenegro is from sources close to Nikšić. In the second part of this paper, there is an analysis of *Proteus anguinus* bibliography. It shows that first papers were more related to distribution, while the later studies include anatomy, behavior and biology of the species. The latest researches are dealing with genetics. Also, we want to emphasize the need for active protection of this globally, threatened species. The olm is threatened because of it's limited distribution and small population size. Negative effects of survival of this species are degradation of groundwater systems, infrastructure development, industrial pollution and illegal collection of specimens.

39. POPULATION ECOLOGY OF AQUATIC CAVE SALAMANDER *PROTEUS ANGUINUS*: POPULATION SIZE ESTIMATES REVEAL HIGH DEPENDENCE ON ORGANIC DRIFT AND WATER CURRENT BUT NOT ON CAVE SYSTEM MORPHOLOGY

Dušan Jelić

Croatian Herpetological Society HYLA, Lipovac I/7, 10 000 Zagreb, Zagreb, Croatia Croatia

We present the results of population ecological studies on elusive cave salamander *Proteus anguinus* (Amphibia: Proteidae) inhabiting the deep underground cave systems of Dinaric Karst of Central Europe. Proteus is endemic to small region stretching from NE Italy, over Slovenia and Croatia, to SE of Bosnia and Herzegovina. This study represents the first data on *Proteus anguinus* population densities and ecological interaction with other vertebrate species present in these habitats (mainly fish). We developed several innovative methods for ecological research of cave animals and for defining the unknown size of cave systems. Methodology for population size estimate is based on two independent observers who are doing cave dives on previously set transect lines and recording all visible individuals in 360° environment. Transects are being done every two months and we record observed number of individuals, their position in the cave, depth and behaviour. Data from dive transects is used to calculate population densities and its change compared to food availability and cave configuration. Largest single population is found in Markarova cave with around one individual per square meter and this is currently the highest reported density for *Proteus anguinus*. Rupećica and Pincinova vace systems also exhibited large populations with around 0,1 ind/ m^2. Other caves exhibit much smaller populations which was already obvious based on only few recorded individuals in enormous cave systems. Some of the estimates, as Miljacka II had only 2-3 individuals recorded per visit and these numbers yield very low probability estimates (range 1 – 22000 individuals). Data indicates that systems with direct inflow of organic matter have significantly larger populations and that systems with strong direct current are avoided because of danger of drift.

List of participants

ANGYAL, Dorottya
Hungarian Natural History Museum, Department of Zoology, H-1088 Budapest, Baross u. 13, Hungary and University of Pannonia, Georgikon Faculty, H-8360 Keszthely,
Deak Ferenc u. 16.
Hungary
angyal.dorottya@gmail.com

ARAUJO-SOARES, Gustavo
Carste Associated Consultants.
Rua Brasopolis 139, Floresta -
Belo Horizonte, Minas Gerais
Brazil

BALÁZS, G.
Eötvös Loránd University, Faculty of Science, Department of Systematic Zoology and Ecology, Pazmany Peter sétány 1/C Budapest H-1117,
Hungary

BEDEK, Jana
Croatian Bisopeleological Society,
Demetrova 1, HR-10000 Zagreb,
Croatia
jana.bedek@hbsd.hr

BORDA, D
"Emil Racovita" Institute of Speleology, Clinicilor 5,
400006, Cluj-Napoca,
Romania.

CALDERÓN- GUTIÉRREZ, Fernando Departamento de Biologia Marina, Universidad Autonoma de Baja California Sur
Baja California Sur
fercg12@gmail.com

CHÁVEZ SOLÍS, Efraín M.
Universidad Nacional Autónoma de México, Posgrado en Ciencias Biológicas Edificio B, 1º Piso. Circuito de Posgrados, Ciudad Universitaria. C. P. 04510 D.F.,
México
chavezsolis.efrain@gmail.com

CHRISTMAN, Mary C.
Departmelnts of Statistics
and Biology University of Florida
Gainesville, FL
USA

ČUKOVIĆ, Tamara
Croatian Biospeleological Society,
Demetrova 1, 10000 Zagreb,
Croatia

CULVER, David C.
Department of Environmental Science,
American University, 4400

Massachusetts Ave. NW 20016
Washington DC
USA
dculver@american.edu

CUTHBERT, M. O.
Water & Earth System Science (WESS)
Competence Cluster, Keplerstr. 17,
72074 Tübingen,
Germany

DEMARCHI-GUARDA, D.
Carste Associated Consultants
Rua Brasopolis 139, Floresta - Belo
Horizonte, Minas Gerais
Brazil

DIAS-MARQUES-SIMÕES, Fernando
Universidad Nacional Autónoma
de México, Departamento de Manejo
de Zonas Costeras, Unidad
Multidisciplinaria de Docencia e
Investigación de Sisal. Puerto de Abrigo
S/N, C.P. 97356, Hunucma,
Yucatán, México.
ns@ciencias.unam.mx

DOCTOR, Daniel
C. U.S. Geological Survey
Reston, VA
USA

DUMNICKA, Elzbieta
Institute of Nature Conservation,
Polish Academy of Sciences, al. A.
Mickiewicza 33, 31-120 Kraków,
Poland
dumnicka@iop.krakow.pl

EPURE, L.
"Emil Racovita" Institute of Speleology,
Clinicilor 5, 400006, Cluj-Napoca,
Romania.

ÈUKOVIÆ, T.
Croatian Biospeleological Society,
Demetrova 1, 10000 Zagreb,
Croatia

GALAS, Joanna
Institute of Nature Conservation,
Polish Academy of Sciences, al. A.
Mickiewicza 33, 31-120 Kraków,
Poland

GILGADO, José Domingo
Departamento de Ciencias de la Vida,
Universidad de Alcalá, Alcalá de
Henares,
Spain
josedomingo.gilgado@uah.es

HALSE, Stuart
Bennelongia Environmental Consultants,
PO Box 384, 6913 Wembley WA,
Australia
stuart.halse@bennelongia.com.au

HERRERO-BORGOÑÓN, Juan J.
Departamento de Botánica, Facultad de
Ciencias Biológicas, Universitat
de València, Valencia,
Spain

HIGGS Dennis M.
Biological Sciences, University of
Windsor, Windsor, Ontario N9B 3P4,
Canada

HUBKA, Vit
Laboratory of Fungal Genetics and Metabolism, Institute of Microbiology AS CR, v.v.i, Vídeňská 1083, 142 20 Praha 4, Czech Republic

HUMPHREYS, W.F.
Western Australian Museum, Welshpool DC, Western Australia, Australia
bill.humphreys@museum.wa.gov.au

JALŽIĆ, Branko
Croatian Biospeleological Society, Demetrova 1, HR–10000 Zagreb, Croatia; Croatian Natural History Museum, Department of Zoology, Demetrova 1, HR-10000 Zagreb, Croatia

JELIĆ, Dušan
Croatian Institute for Biodiversity
Croatian Herpetological Society HYLA, Lipovac I/7, 10 000 Zagreb, Croatia
jelic.dusan@gmail.com

JIMÉNEZ-VALVERDE, Alberto
Departamento de Biología y Cambio Global, Museo Nacional de Ciencias Naturales, Madrid, Spain

KARAMAN Gordan
Montenegrin Academy of Sciences and Arts, Ul. Riste Stijovića 5, 81000 Podgorica, Montenegro

KOLAŘÍK, Miroslav
Department of Botany, Faculty of Science, Charles University in Prague, Benátská 2, 128 01 Praha 2, Czech Republic

KOLLER, Katarina
Croatian Institute for Biodiversity
Croatian Herpetological Society HYLA, Lipovac I/7, 10 000 Zagreb, Croatia
katarina.koller@gmail.com

KOVÁČ, Ľubomír
Department of Zoology, Institute of Biology and Ecology, Faculty of Science, P. J. Šafárik University, Moyzesova 11, 040 01 Košice, Slovakia
lubomir.kovac@upjs.sk

KUBÁTOVÁ, A.
Department of Botany, Faculty of Science, Charles University in Prague, Benátská 2, 128 01 Praha 2, Czech Republic

LOPES-FERREIRA, Rodrigo
Universidade Federal de Lavras, Departamento de Biologia, Setor de Zoologia Geral, Centro de Estudos em Biologia Subterrânea, Lavras, MG, Brazil
drops@ldbt.ufla.br

LÓPEZ-MEJIA, Marilú
Evolutionary Biology and PopulationGenetics Lab, División de

Desarrollo Sustentable, University of
Quintana Roo,
Quintana Roo, México

MARTINEZ-LOZANO, Christian O. Lic. En Manejo de Recursos Naturales
Universidad de Quintana Roo, Cozumel,
Quintana Roo, México
christiandiver22@hotmail.com

MASCARÓ, Maite
Universidad Nacional Autónoma de
México, Departamento de Manejo de
Zonas Costeras, Unidad
Multidisciplinaria de Docencia e
Investigación de Sisal. Puerto de Abrigo
S/N, C.P. 97356, Hunucma
Yucatán, México.

MATOČEC Neven
Rudjer Boskovic Institute, Bijenička 54,
HR–10000 Zagreb,
Croatia

MEJÍA-ORTÍZ, Luis M.
Lab. de Bioespeleología y Carcinología,
Dpto. Ciencias y Humanidades, Av.
Andrés Quintana Roo s/n, Cozumel,
Quintana Roo,
México.luismejia@uqroo.mx
cavecrustaceans@hotmail.com

MIKLISOVÁ, Dana
Institute of Parasitology, Slovak
Academy of Sciences,
Hlinkova 3,   040 01 Košice,
Slovakia

MOLDOVAN, Oana Teodora
"Emil Racovita" Institute of Speleology,
Clinicilor 5, 400006, Cluj-Napoca,
Romania

MORALES-MALACARA, Juan B.
Lab. Espeleobiología & Acarología,
Unidad Multidisciplinaria de Docencia
e Investigación, Facultad de Ciencias,
Universidad Nacional Autónoma de
México, Campus Juriquilla,
Querétaro, México.

MOULDS, Timothy A.
GHD Ecology and Marine
Science 9/448 Murray St
6000 Perth Western
Australia
timothy.moulds@yahoo.com.au

MULEC, Janez
ZRK ZRC Postojna – Karst research
institute Slovenia, Titov trg 2,
Postojna

NASTASE-BUCUR, R.
"Emil Racovita" Institute of Speleology,
Clinicilor 5, 400006, Cluj-Napoca,
Romania.

NIEMILLER, Matthew
Ecology and Evolutionary Biology,
Yale University, New Haven,
CT 06520,
USA

NOVÁKOVÁ, Alena
Institute of Soil Biology, Biology
Centre AS CR, v. v. i., Na Sádkách 7,

370 05 České Budějovice,
Czech Republic
ANmicrofungi@seznam.cz

ORTUÑO, Vicente M.
Departamento de Ciencias de la Vida, Universidad de Alcalá,
Alcalá de Henares,
Spain

OZIMEC, Roman
Croatian Biospeleological Society,
Demetrova 1, HR–10000 Zagreb,
Croatia
roman.ozimec@hbsd.hr

PAGE, T. J.
Australian Rivers Institute,
Griffith University, Queensland, 4111,
Australia

PAKES, Joey M.
Department of Integrative Biology
University of California –Berkley
1005 Valley Life Sciences Bldg # 3140
Berkley CA 94720-3140
USA
pakes(at)berkeley.edu

PAPÁČ, Vladimir
State Nature Conservancy, Slovak Caves Administration, Zeleznična 31, 979 01 Rimavska Sobota,
Slovak Republic
papac@ssj.sk

PARIMUCHOVÁ, Andrea
Department of Zoology, Institute of Biology and Ecology, Faculty of Science,
P. J. Šafárik University, Moyzesova 11,
040 01 Košice
Slovakia

PAVLEK, Martina
Croatian Biospeleological Society,
Demetrova 1, HR–10000 Zagreb,
Croatia; Rudjer Boskovic Institute,
Bijenička 54, HR–10000 Zagreb,
Croatia
martina.pavlek@gmail.com

PÉREZ-SUAREZ, Gonzalo
Departamento de Ciencias de la Vida, Universidad de Alcalá, Alcalá de Henares, Madrid,
Spain

PIPAN, Tanja
Karst research ZRC-SAZU, Postojna – institute Slovenia, Titov trg 2, Postojna
Slovenia
pipan@zrc-sazu.si

PISA-PERRONI, G.
Carste Associated Consultants
Rua Brasopolis 139, Floresta - Belo Horizonte, Minas Gerais
Brazil

POLAK, Slavko
Notranjski muzej Postojna,
Kolodvorska c. 3, Postojna,
Slovenia

RASCHMANOVÁ, Natalia
Institute of Biology and Ecology,
Faculty of Science, P. J. Safarik

University, Moyzesova 11,
040 01 Kosice,
Slovakia

RENDOŠ, Michal
Institute of Biology and Ecology,
Faculty of Science, Pavol Jozef
Šafárik University, Moyzesova 11,
040 01 Košice,
Slovakia
Michal.rendos@gmail.com

SANCHÉZ-ORTIZ, Carlos A.
Departamento de Biología Marina,
Universidad Autónoma de Baja
California Sur Baja California Sur,
México

SARREIRO-AULER, A.
Carste Associated Consultants
Rua Brasopolis 139, Floresta - Belo
Horizonte, Minas Gerais
Brazil

SCHMIDT, Susanne I.
Centre for Systems Biology, School of
Biosciences, University of Birmingham,
Birmingham, B15 2TT,
UK
s.schmidt@sidata.eu

SCHWIENTEK, M.
Water Sciences Group (Hydrogeology),
School of Geography, Earth and Environmental Sciences, University of
Birmingham, Birmingham, B15 2TT,
UK

SENDRA, Alberto
Departamento de Ciencias de la
Vida, Universidad de Alcalá, Alcalá
de Henares, Madrid,
Spain
alberto.sendra@uv.es

SLAPNIK Rajko
Croatian Biospeleological Society,
Demetrova 1, HR–10000 Zagreb,
Croatia

SOARES Daphne
Department of Biological Sciences,
New Jersey Institute of Technology,
Newark NJ, 07102
USA
daphne.soares@gmail.com

SOLIS-MARIN, Francisco A.
Colección Nacional de Equinodermos
“Ma. E. Caso Muñoz”, Laboratorio de
Sistemática y Ecología de Equinodermos,
Instituto de Ciencias del Mar y
Limnología (ICML), Universidad
Nacional Autónoma de México (UNAM).
Apdo. Post. 70-305, México, D.
F. 04510, México
fasolis@cmarl.unam.mx

SOUZA-SILVA, Marconi
Universidade Federal de Lavras,
Departamento de Biologia, Setor de
Zoologia Geral, Centro de Estudos em
Biologia Subterrânea, Lavras, MG,
Brazil.
marconisilva@dbi.ufla.br

ŠPRYŇAR, P.
Nature Conservation Agency of the Czech Republic, Regional Department Praha a Střední Čechy, Podbabská 2582/30, 160 00 Praha 6,
Czech Republic

STURM Samo
The Skocjan Caves Park Public Service Agency, Skocjan
2 SI-6215 Divača,
Slovenia
samo.sturm@psj.gov.si

TROTTER, A. J.
Bennelongia Environmental Consultants,
PO Box 384, 6913 Wembley WA,
Australia

VAUGHAM, Michael J.
The Ohio State University,
Department of Plant Pathology, 1680 Madison Ave., Wooster, OH 44691,
USA

WEARY, David
U.S. Geological Survey
Reston, VA
USA

YOUNG, John
U.S. Geological Survey
Leetown, WV
USA

ZEPPELINI, Douglas
Laboratory of Systematics of Collembola and Conservation Universidade Estadual da Paraíba campus V, João Pessoa,
Brazil
zeppelini@daad-alumni.de

ZIGLER, Kirk
Department of Biology
University of the South
Sewanee, TN
USA

ZORMAN, Tomaz
The Skocjan Caves Park Public Service Agency, Skocjan
2 SI-6215 Divača,
Slovenia
tomaz.zorman@psj.gov.si

Author index

Mid-conference

PEÑA DE BERNAL

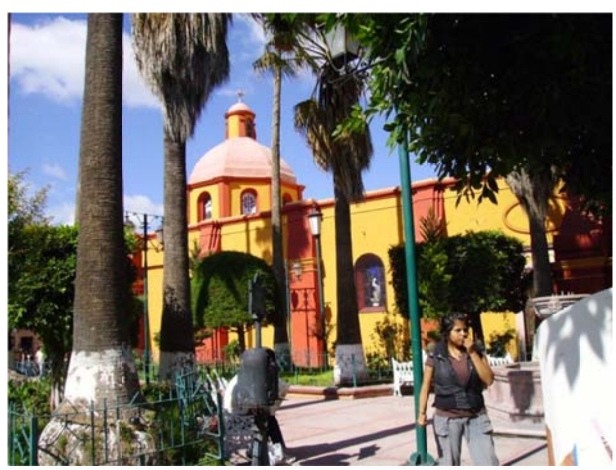
Peña de Bernal (in English, Bernal's Boulder or Bernal Peak) is the third largest monolith in the world, only after the Rock of Gibraltrar in the Mediterranean Sea and the Pan de Azúcar (Sugarloaf) in Rio de Janeiro, Brazil.

It situated at an altitude of 2, 515 masl and a height of 288 meters. This lithic formation is considered to be more than10 million years of age and was originated by the solidification of a volcanic magma chimney after years of inactivity. Time and erosion made the rest of the volcano dissappear and only the solidified magma remained standing.

This monolith is located in the town of Bernal,that belongs to the Ezequiel Montes Municipality and is 57 km distant from the capital of the State of Queretaro, at kilometer 200 of the Mexico-Querétaro highway.

The town was founded in the year of 1642 when several spanish families took possession of the lands that were once inhabited by chichimeca indians. Their source of subsistence during the viceroyalty was mining. In recent years Bernal lives mainly from touristic activities.

In February 2006 Bernal was named as “Pueblo Mágico” (Magic Town), by the Ministry of Tourism of Mexico, because of its symbolic attributes, legends and historical heritage. This recognition is given as an acknowledgement to the preservation of its the cultural and historical patrimony. In November 2007, Peña de Bernal received from the Ministry of Turism of Mexico and TV Azteca the award of one of the 13 Wonders of Mexico and considers the place as a touristic destiny with great historical and cultural relevance.



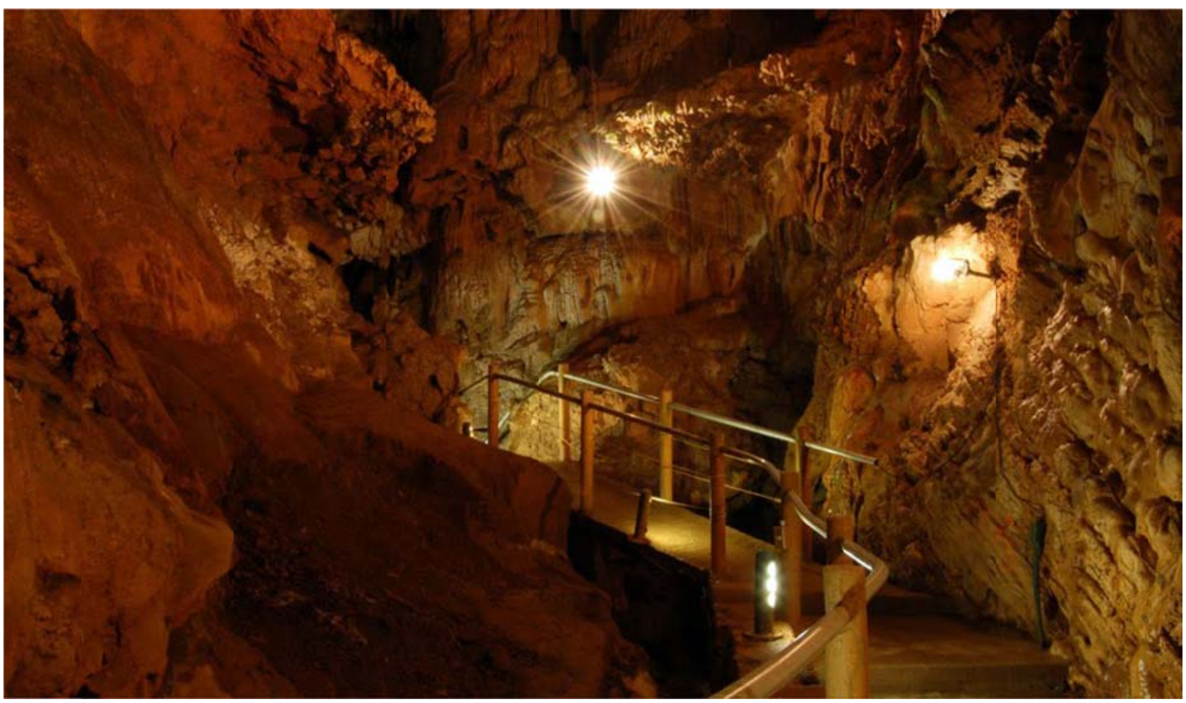
In September 2009, was enrolled in the list of Immaterial Patrimony of Humanis of UNESCO: “Places of memories and live traditions of the otomí-chichimecas of Tolimán: Peña de Bernal, guardian of holy territory”.

Each March 21st, during the Spring equinox, thousands of tourists meet in Peña de Bernal for a mystic-religious festivity. Persons approach to it, as they say, for “charging themselves with energy”, energy thought to be transmitted by the monolith and mineral deposits in its interior.

The Villa de San Sebastián Bernal, recognized as a Magic Town, is a peaceful place that you can walk around by foot, visit its craft shops, among these you can spot the most outstanding ones that include products made of wool and cotton fabric (local name, “manta”) and local sweets.

From every town corner you will be able to appreciate the majesty of Peña de Bernal that is charged with energy as we have been told. We recommend you to use soft shoes.

CUEVA DE LOS HERRERA



The municipality of San Joaquín in Querétaro de Arteaga is located 135 km from de City of Santiago de Querétaro, a municipality that hosts the touristic Gruta de los Herrera (The Herrera Grotto), one of the most impressive places of the State of Querétaro. It is a place within a world of beautiful stalactites and stalagmites that form capricious shapes with animal, objects and persons’ forms.

It originated by the dissolution of calcite rock mixed with carbon from rain water that later formed this stalagmites and other rock bodies. The cavern originated during Mid-Paleozoic times, 400 to 600 million years ago when this area was under the sea. Afterwards, from Carbonifeous until the Early Triassic, 350 to 220 mya, it emerged by tectonic plate movements called orogenies, movements that gave origin to the first mountains in this region of Mexico. During the Jurassic, some 200 mya, the whole Sierra Madre Oriental sinks into the ocean anew. Once more, during the Mid to Late Jurassic, an orogeny takes place again and 140 to 155 mya the seas gradually invaded these emerged places. This is the time when the deposition of calcareous sediments began in what would be the Sierra Gorda because of the accumulation of reef growth in those places that nowadays comprises what is known here as El Abra formation (that means, "opening between two mountains").

Its discovery is very recent because in 1978, two speleologists from Texas, Patty Mottes and Roy Jameson discovered this cave and were the first persons to explore it completely. Despite this fact, they were not the first persons to discover this grotto, as these caves are actually within private property owned by the Herrera Martínez family. Its original discoverer and owner was don Luis Herrera Resendiz (1921-1991).

This cave, because its many interesting formations, is touristic since along time ago, and there is few fauna found inside, except for some bats and few insects, because of its morphology and speleogenesis, so the all the speleothems are very clean with bright colors. The temperature during September is flesh and very nice, minimum 10 ° C and maximum 20 ° C. But there are many chances of rain during this time of year.

Sponsors