

**VII. European Ground Squirrel Meeting
&
Subterranean Rodents Workshop**

BOOK OF ABSTRACTS



1-5 October 2018
Budapest, Hungary

Organized by:

RAPRORSPREY LIFE,

Hungarian Natural History Museum

& Ministry of Agriculture

Organizing committee:

Attila Németh (RAPTORSPREY-LIFE)

Gábor Csorba (Hungarian Natural History Museum)

Botond Bakó (Ministry of Agriculture, Nature Conservation Department)

Olivér Váczi (Ministry of Agriculture, Nature Conservation Department)

Editors: Oliver Váczi & Attila Németh

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Preface

The idea of this bi-annual event goes back to 2002, when a kick-off meeting in Madjarovo, Bulgaria was initiated by BirdLife (Stoycho Stoychev). Since 2006, it has been organised every two years, with the first EGSM in Felsőtárkány, Hungary, the second in Sv. Jan pod Skalou, Czech Republic, the third in Ordu, Turkey, the fourth in Kamień Śląski, Poland, the fifth in Rust, Austria and the sixth in Beograd, Serbia. And now, seventh event has been organized in Budapest, Hungary. In this case, the European Ground Squirrel as favourite target of our attention expanded by another curiosity: the Blind Mole Rat has also been put to the focus. Hungarian Natural History Museum is a worthy home for small mammal research and conservation too. There were many fruitful actions of four years of RAPTORSPREY-LIFE program supporting the evidence based conservation efforts to increase the chance of long term survival and well-being of these two endangered rodents.

Our goal is the same as before: bringing together scientists and practical conservationists from all over Europe working in various areas of European Ground Squirrel's and Blind Mole Rat's biology and conservation. The event gives possibility to present novel scientific results as well as conservation management experiences and practices related to these rodents. We strongly hope that the meeting also gives the opportunity to friendly meetings and fruitful talks. Please, do enjoy yourselves!

The Organizing Committee

Time	Name	Title
9:00-10:00	Registration	
10:00-10:20	Opening	
10:20-10:50	Gábor Csorba	Opening talk: Of blind mole rats and Hungarian researchers
Behaviour and ecology		Chair: Radim Šumbera
10:50-11:10	Sabine Begall	Life expectancy and stress in giant mole-rats (<i>Fukomys mechowii</i>)
11:10-11:30	Ema Hrouzková	Deeper insight in the seismic communication of the Galilean blind mole rat (<i>Spalax galili</i>)
11:30-11:50	Attila Németh, Zs. Hegyeli & G. Csorba	The aboveground activity of Eurasian blind mole rats
11:50-12:00		Discussion
12:00-13:30	Lunch	
Anatomy		Chair: Gábor Csorba
13:30-13:50	Sylvie Horáková	Penial and bacular morphology of mammals - what it can reveal about their owner?
13:50-14:10	Lucie Pleštilová, E. Hrouzková, H. Burda & R. Šumbera	Ear morphology in two root-rats (genus <i>Tachyoryctes</i>) with a different ecology
14:10-14:20		Discussion
14:20-14:40	Coffee Break	
Physiology and Immunology		Chair: Sabine Begall
14:40-15:00	František Vejmělka, J. Okrouhlík, M. Lövy, & R. Šumbera	Thermal insulation of subterranean rodents – complex approach and preliminary results
15:00-15:20	David Michael Scantlebury et al.	Thermoregulatory variation in European and African mole-rats: a case of convergent evolution?
15:20-15:40	Pavčina Wiedenová, Radim Šumbera & Jan Okrouhlík	Social thermoregulation and socio-physiological effect in the subterranean Mashona mole-rat (<i>Fukomys darlingi</i>)
15:40-16:00	Halil Mert Solak et al.	Altitudinal effects on ecoimmunology of Turkish Blind Mole-rats
16:00-16:10		Discussion
16:10-17:10	visit of the HNHM exhibition (facultative)	
17:10-18:10	Evolution of social behaviour underground	
18:10-20:00	Welcome reception – Table of nations	

Time	Name	Title
Evolution and speciation		Chair: Attila Németh
9:00-9:20	Matěj Lövy, Eviatar Nevo & Radim Šumbera	On the speciation research in blind mole rats
9:20-9:40	Ferhat Matur	A new hypothesis for the origin of cytotype diversity of blind mole rats in Anatolia
9:40-10:00	Alexey Yanchukov et al.	Phylogeographic analysis of large-bodied blind mole rats in Ukraine confirms the position of <i>Spalax arenarius</i>
10:00-10:20	Edvárd Mizsei et al.	Evolutionary history of the European mole rats: mitochondrial and nuclear genes do not support the chromosomal hypotheses
10:20-10:30		Discussion
10:30-10:50	Coffee Break	
Distribution and conservation status		Chair: Olivér Váczi
10:50-11:10	Attila D. Sándor	Distribution and broad-scale habitat selection of mole-rats (<i>Spalacinae</i>) in Romania
11:10-11:30	Zsolt Hegyeli, Attila Németh, Szilárd Sugár & Gábor Csorba	Conservation status of large blind mole rat species in Romania: <i>Spalax antiquus</i> , <i>S. graecus</i> and <i>S. isticus</i>
11:30-11:50	Gábor Csorba et al.	Taxonomy, politics and conservation: recent status of Vojvodina blind mole rat (<i>Nannospalax montanosyrmiensis</i>)
11:50-12:00		Discussion
12:00-13:30	Lunch	
Conservation		Chair: Michael David Scantlebury
13:30-13:50	Oliver Váczi, Gábor Csorba, Attila Németh & Botond Bakó	Blind mole rat protection efforts of the Hungarian Official Nature Conservation System
13:50-14:10	Attila Németh et al.	Establishment of new populations as a method to save endangered, exclusively subterranean rodents
14:10-14:30	Endre Sós et al.	Veterinarian participation at the threatened lesser blind mole rat (<i>Nannospalax (superspecies leucodon)</i>) research in Hungary
14:30-14:40		Discussion
14:40-15:10	Poster Session	
15:10-15:30	Coffee Break	
15:30-16:30	Guided visit of the HNHM's Blind mole rat exhibition	
16:30-17:30	Round table discussion: Difficulties of making IUCN Red List risk assessments for subterranean rodents (Lack of knowledge or lack of taxonomical consensus?)	
17:30-17:40	Closing	
18:30-	Moving out together...(facultative) (Élesztőház Pub)	

9:00-9:35	Registration	
9:40-9:55	Openings	
Evolution		Chair: Zsolt Hegyeli
10:00-10:15	Gábor Sramkó et al.	Phylogeographic and population genetic structure of the Pannonian ground squirrel populations
10:20-10:35	Attila Virág & Piroska Pazonyi	How landmark analysis can help unraveling the phylogenetic relationships of ground squirrels?
10:40-10:55	Coffee Break	
Ethology		Chair: Vilmos Altbäcker
11:00-11:15	Eva Millesi, Jill Gaasch & Sandra Steinerberger	Ovarian activity, glucocorticoid secretion and prehibernation fattening in European ground squirrels
11:20-11:35	Barbara Győri-Koós, A. Posautz, A. Kübber-Heiss & F. Suchentrunk	Individual diet data of the European Ground Squirrel (<i>Spermophilus citellus</i>) from stomach content analysis in a vineyard habitat population
11:40-11:55	Ilse Hoffmann & Warner Haberl	Evidence for European ground squirrels (<i>Spermophilus citellus</i>) utilizing food caches
12:00-12:15	Irena Schneiderová, L. Štefanská & L. Kratochvíl	Whistling at the Tower of Babel: geographic variability in alarm calls of the European ground squirrel
12:20-13:55	Lunch	
Ecology I.		Chair: Yordan Koshev
14:00-14:15	Roland Reginald Zana	New Method in Small Animal Tracking by Automated Radiotelemetry System (ARS)
14:20-14:35	Prommer et al.	Analysing Habitat Use of EGS (<i>Spermophilus citellus</i>) by Using Automatized VHF Tracking System
14:40-14:55	Zsolt Hegyeli, J. Bagyura, A. Marton & A. Nagy	Diet of Saker Falcon (<i>Falco cherrug</i>) in Western Romania during the chick-rearing period
15:00-15:15	Márton Horváth	The disappearance of the European Ground Squirrel and the Common Hamster from the diet of the Eastern Imperial Eagle in Hungary
15:20-15:35	Coffee Break	
Ecology II.		Chair: Eva Millesi
15:40-15:55	János Bagyura, M. Váczi, J. Fidlóczky & M. Prommer	Prey composition of Saker Falcon (<i>Falco cherrug</i>) during the breeding period between 2015 and 2017 in Hungary with special reference to EGS
16:00-16:15	Mátyás Prommer & János Bagyura	Prey and Predator Interactions: A Dissolving Bond Between EGS (<i>Spermophilus citellus</i>) and Saker Falcon (<i>Falco cherrug</i>)
16:20-16:35	Tamás Cserkész et al.	Persistent decline of the European Ground Squirrel (<i>Spermophilus citellus</i>), an iconic steppe rodent in the heart of its distribution
16:40-16:55	Zsófia Szórádi, S. Csete & V. Altbäcker	Habitat characteristics of the largest European Ground Squirrel (EGS, <i>Spermophilus citellus</i>) colonies in Hungary
17:00-17:15	Tihamér Fülöp & Zsolt Hegyeli	Severe habitat loss of European ground squirrel in the Pannonian region of Romania
17:20-17:45	RAPTORSPREY LIF Movie	
17:50-19:30	Poster session	
20:00-	Farewell party – table of nations	

Time	Name	Title
Conservation I.		Chair: Ilse Hoffmann
8:40-8:55	Attila Németh, Cs. Kiss, G. Csorba & T. Cserkés	Endangered agricultural pests: How common pests became strictly protected species?
9:00-9:15	Yordan Koshev, M. Kachamakova, S. Arangelov & D. Ragyov	Overview of the repatriations of European ground squirrel (<i>Spermophilus citellus</i>) at Bulgaria
9:20-9:35	Jitka Větrovcová, M. Jariabková & J. Matějů	Releases of European Ground Squirrels within the Czech Action Plan for this species
9:40-9:55	József Fidlóczky et al.	Successes and Lessons: experiences of three decades of resettlement of European Ground Squirrel in Hungary
10:00-10:15	Maria Kachamakova & Yordan Koshev	First results on of <i>Spermophilus citellus</i> (EGS) dispersal after translocation in Bulgaria
10:20-10:35	Ervin Hapl, Denisa Lobbova & Monika Chrenkova	Sousliks - tips and tricks to support populations
10:40-10:55	Coffee Break	
Conservation II.		Chair: Jan Matějů
11:00-11:15	Zsófia Nagy & Vilmos Altbäcker	Successful laboratory breeding, raising and release of sousliks (<i>Spermophilus citellus</i>)
11:20-11:35	József Fidlóczky et al.	Raptor conservation by conservation of small mammals. Changing attitude towards small mammals. Main achievements of RAPTORSPREYLIFE project.
11:40-11:55	Kateřina Poledníková & Lukáš Poledník	Trademarks „Souslik friendly vineyard“ and „Souslik friendly orchard“ – two years' experience
12:00-12:15	Krisztina Györkő & Zoltán Magyaródi	Social responsibility to maintain the ground squirrel population by an international company
12:20-12:35	Olivér Váczi & Botond Bakó	EGS protection efforts of the Hungarian official nature conservation system
12:40-13:55	Lunch	
14:00-16:00	Two parallel round table discussions: EGS translocation: theoretical and practical approaches/ IUCN Red List EGS data sheet revision of EGS	
Coffee Break		
16:05-17:45	HNHM visit	
18:00-18:15	Closing	

ORAL PRESENTATIONS

Subterranean Rodents Workshop

ABSTRACTS



In order of timeline

Of blind mole rats and Hungarian researchers

Gábor Csorba

Studying subterranean rodents has a long tradition in Hungary. Blind mole rats reach the westernmost edge of their distribution area in Hungary, inhabiting the typical Carpathian Basin grasslands. Due to this special situation Hungarian researchers were among the firsts, who studied the taxonomy and behaviour of these unique mammals. The first scientific description of a blind mole rat from Hungary is known from 1799. In 1909, Lajos Méhely, following Darwins' theory of evolution, was the first who established a comprehensive (and revolutionary) systematics of blind mole rats. Later, further outstanding studies were made related to their anatomy and behaviour.

Unfortunately these papers were mostly published in Hungarian, therefore remained almost completely unknown for the international scientific community. Not only the works of these researchers but the Mammal Collection of the Hungarian Natural History Museum, which houses the most comprehensive collection of blind mole rats, will also be introduced.

Life expectancy and stress in giant mole-rats (*Fukomys mechowii*)**Sabine Begall**

Giant mole-rats live remarkably long (> 23 y) and have uncommon life-history traits. Families comprise one reproductive pair (breeders) and offspring, that forego reproduction (non-breeders). Breeders live twice as long as non-breeders, contradicting the classic trade-off reproduction vs lifespan. We re-analysed our dataset and took into account, whether non-breeders grew up in "complete" (both parents alive) or "incomplete" (one/both parents dead) families. Orphans lived significantly longer than those from complete families.

To test whether long-term stress is responsible for the observed difference, we measured cortisol from hair by ELISA in 71 giant mole-rats. Offspring from complete families had significantly higher cortisol levels than breeders or orphans. Group size and cortisol level correlated positively. Since dispersal is not possible in the lab, offspring from complete families might be stressed by their parents and/or increasing family size. The findings have implications for keeping social animals in the lab, and this life history aspect should be considered in future ageing studies. Expression analyses will hopefully elucidate the underlying molecular mechanisms.

Deeper insight in the seismic communication of the Galilean blind mole rat (*Spalax galili*)

Ema Hrouzková

Life underground provides many advantages, but it brings also problems. Among the biggest belongs the difficult communication. Even within one burrow system all classical communication signals are transmitted only for short distances. The communication between burrows is practically impossible. The strictly subterranean and solitary blind mole rats evolved seismic signals for these occasions. They are produced by thumping of the head against the burrow ceiling. The seismic signals in *Spalax ehrenbergi* superspecies were described as species specific. We focused on the one species, *S. galili*, to find out what other information could be transmitted by the seismic signals. The digging of tunnels is energetically demanding, therefore any information about neighbours which could be obtained for longer distance and without need to meet is valuable. We discovered that seismic signals carry information about individuality, sex and distance of the territory from the focal individual. It does not transmit any information about weight or allegiance to the population.

The aboveground activity of Eurasian blind mole rats

Attila Németh, Zsolt Hegyeli & Gábor Csorba

Blind mole rats are known to be extremely specialised to a subterranean lifestyle, which is believed to protect them from almost every predator. However, the fact that they do come to the surface occasionally has been reported in numerous cases. So far, various interpretations of their surface activity have been put forth, such as unusual climatic events, flooding, foraging activity, collecting hay for bedding material, dispersal of the young and the sub-adults, intraspecific aggression, illness or searching for a mate. During their surface movements, blind mole rats are also vulnerable to predation. This previously little known behaviour is discussed based on the literature, unpublished scientific reports and personal observations, and amalgamate all these together with a wide variety of scientific results on diverse aspects of blind mole rat biology. All these puzzle pieces are being put together in order to create a comprehensive picture about the behaviour of blind mole rats and their ecology in steppe ecosystems.

Penial and bacular morphology of mammals - what it can reveal about their owner?

Sylvie Horáková

The reproductive organs exhibit an extraordinary morphological variability. A positive allometry and a high degree of phenotypic variability have been described for the characters associated with the reproduction apparatus. The penis of some mammalian groups contains a penis bone (baculum), that also displays an astonishing morphological diversity. And it's assumed that the baculum was lost and gained several times during the evolution of mammals.

There is also increasing evidence of interdependence of the penial and bacular morphology with life history parameters (mating system, ovulation type, seasonality of reproduction, degree of sociality). Seasonality of reproduction, unpredictable mating opportunities, high degree of sperm competition, risk of multiple-mating or ovulation induction could be the driving force for the diverse and complex morphology of reproductive organs.

Our research is focused on the description of genital morphology, the detection of correlations the penial-bacular morphology with life-history parameters and application of morphological traits to the phylogeny with the particular emphasis on several groups of rodents, including also subterranean mammals.

Ear morphology in two root-rats (genus *Tachyoryctes*) with a different ecology

Pleštilová Lucie, Hrouzková Ema, Burda Hynek & Šumbera Radim

Underground acoustic conditions are unique and shaping the hearing abilities of subterranean species. This is reflected in the ear morphology, typically by freely-mobile type of the middle ear ossicles and by low ratios between the areas of eardrum and stapedial footplate (AR) and between levers of malleus and incus (LR). Regarding the inner ear, low frequency specialists possess higher and more coiled cochlea and longer basilar membrane.

Studied species are of the same genus (*Tachyoryctes*) but of the different lifestyle. African root-rat (*T. splendens*) is the subterranean species, whereas the giant root-rat (*T. macrocephalus*) is fossorial, i.e. regularly active aboveground. Both root-rats possess the freely-mobile type of middle ear. The ratios are lower in *T. splendens* (AR = 19.3 ± 0.3 , LR = 1.9 ± 0.0) than in *T. macrocephalus* (AR = 21.8 ± 0.6 , LR = 2.1 ± 0.1 , $p=0.01$). Cochlea consists of 3.5 coils in both species, but the basilar membrane is longer in *T. splendens* ($p=0.03$). Higher ratios in *T. macrocephalus* can be caused by either different ecology or body size, while the longer basilar membrane occurs in smaller species, which corresponds with the low frequency specialization.

Thermal insulation of subterranean rodents – complex approach and preliminary results

František Vejmělka, Jan Okrouhlík, Matěj Lövy, & Radim Šumbera

The subterranean niche is challenging for its inhabitants due to not only high humidity, limited air ventilation, and relatively high temperatures, but also the limited availability of food resources. Subterranean rodents search for food mainly by digging, which places extreme physiological demands on a burrowing animal, as its body temperature increases. Therefore, in combination with the environmental conditions of the subterranean ecotope, overheating might imperil the digging individual. Thus, a question arises of the heat dissipation in the underground burrows. The most common way is via thermal conduction. For heat dissipation via conduction, subterranean mammals utilize thermal windows - weakly insulated body regions. We used infrared thermography and fur analysis to (i) detect the thermal windows and (ii) ascertain the thermal insulation of the subterranean rodents with a different degree of fossoriality and sociality. Both factors appear to play a role in the issue of the fossorial rodent thermal insulation.

Thermoregulatory variation in European and African mole-rats: a case of convergent evolution?

David Michael Scantlebury, János Farkas, Gábor Csorba, Dávid Czabán & Attila Németh

Subterranean mammals are adapted to specific sets of conditions (temperature, humidity, soil structure) but are vulnerable to disturbance, because of difficulties in dispersal. We examined heat production and heat dissipation from two systematic groups: blind mole rats (*Nannospalax*) and African mole-rats (*Crypromys*) in response to varying ambient temperature by measuring oxygen consumption, surface temperature via thermal imaging and core body temperature. Both groups contained an arid and a mesic-adapted species. For both blind and African mole-rats, the arid-adapted species' had a higher oxygen consumption and greater thermal conductivity at lower ambient temperature than the mesic adapted species, indicating increased insulation in the latter. Thermal-imaging revealed that there was greater variability in body surface temperatures in response to ambient temperature change in both of the mesic species compared to the respective arid species, and that heat loss varied according to body part. Results indicate that consistent differences emerge between both clades of subterranean mammal and that even in morphologically similar animals, large differences in physiology occur.

Social thermoregulation and socio-physiological effect in the subterranean Mashona mole-rat (*Fukomys darlingi*)

Pavλίna Wiedenová, Radim Šumbera & Jan Okrouhлік

A strict underground lifestyle is one of the greatest challenges for mammals due to the high energetic cost of obtaining food by digging. Energy saving adaptation is thus very important. Social mammals may suffer from “isolation stress” if measured alone. This is known as a socio-physiological effect should be conspicuous when the metabolism of huddling individuals is measured within a species' thermoneutral zone (TNZ). We measured the resting metabolic rates of a social species, the Mashona mole-rat, in individuals, pairs and groups. Measurements were carried out at ambient temperature below the species' TNZ (20 °C) and at a temperature within the species' TNZ (30 °C). In pairs, animals saved 25 % of its individual energetic expenses at the temperature below the TNZ. With increasing group size, energetic savings rose up to four animals, but savings diminished in larger groups. At the temperature within the TNZ, mole-rats saved 10 % of individual energetic expenses in pairs, but the difference was not significant. No energetic savings were found in larger groups. Our results are in contrast with extremely high energetic savings in other African mole-rats.

Altitudinal effects on ecoimmunology of Turkish Blind Mole-rats

Halil Mert Solak, J. C. Winternitz, A. Yanchukov, C. Ayanoğlu, F. Çolak, F. Matur, & M. Sözen

Optimal investment into immune defense should depend on the risk of infection and the price of competing energetic demands. Altitude is a natural environmental gradient predicted to reduce parasite abundance and increase energetic demands. Using the Turkish blind mole rat *Nannospalax xanthodon* (cytotype $2n = 58$, $N=23$), we test the hypothesis that altitude affects the evolution of host immunity by comparing parasite abundance, levels of stress, and innate immune response between high and low elevation populations (1030 and 3000 m) in the Central Taurus mountains. We find that bacteria killing ability of serum is greater in high altitude samples. However, there was no significant difference in stress levels between sites and there was no significant difference in parasite abundance or intensity across site, season, or sex. Small sample sizes may have reduced our power to detect true differences, but our finding of greater standing innate immunity in high altitude animals may reflect greater investment into the first line of defense against pathogens. Future studies will focus on induced innate immune response and on adaptive immune response between the two populations.

On the speciation research in blind mole rats

Matěj Lövy, Eviatar Nevo & Radim Šumbera

Ecological speciation has attracted attention of evolutionary biologists in the last two decades. Although speciation in Israeli blind mole rats has been assumed to be exclusively allopatric/peripatric, ongoing ecological speciation has been proposed in *Spalax galili* mole rats inhabiting two ecologically different soils at a microsite. We hypothesized that sharp inter-soil differences in soil and vegetation characteristics cause different selection pressures on mole rats and can be a driving force of ecological speciation. To test this hypothesis, we experimentally tested habitat- and mate-choice, as two mechanisms possibly restricting gene flow between the two soils. Our findings show that mole rats from both soil types preferred to burrow in their familiar soil, when the tested soils were moist. In contrast, females did not prefer males from their own soil type in neither of the two soil-populations. The absence of soil-based female mate-preferences suggests there is likely no sexual selection for assortative mating. Under such circumstances, ecological speciation might be facilitated mainly by ecological reproductive isolation due to divergence in habitat (soil) preferences.

**A new hypothesis for the origin of cytotype diversity of blind mole rats
in Anatolia**

Ferhat Matur

Turkey is located within a structurally complex geological part of the recently folded mountain belt of Eurasia. A wide variety of tectonic processes shaped the Anatolian complex landscapes over millions of years and continue still as evidenced by frequent earthquakes. The fault lines formed by the earthquakes are known to release radon gas, which is radioactive and highly mutagenic. A number of studies claim that ionizing radiation can induce a variety of chromosomal aberrations. Because mole rats spend all of their lives in the underground tunnels, and have limited movement/dispersal ability compared to other species, they could be particularly exposed to the radon gas. This, in turn, might trigger chromosomal aberrations in the mole rats more often than in other rodents. If the aberrations fix in the germ line, the new chromosome sets can disperse in the population through sexual reproduction. In this study I briefly review the previous studies that provide a clue for new hypothesis: the radiation emerged from fault lines affect the distributions of cytotypes in the mole rats.

**Phylogeographic analysis of large-bodied blind mole rats in Ukraine
confirms the position of *Spalax arenarius***

Mikhail Rushin, Ortaç Çetintaş & Alexey Yanchukov

Several conflicting hypotheses have been proposed to explain the phylogenetic relationship among the large-bodied mole rats (genus *Spalax*). In particular, the sandy mole rat (*Spalax arenarius*) was first described as a subspecies of *S. zemni* (see Reshetnik 1939). Later Ognev (1947) elevated it to the species status and based on morphological traits placed it as intermediate between *S. zemni* and *S. arenarius*. Topachevsky (1969) proposed a bizarre hypothesis that *S. arenarius* from Ukraine is the closest relative to *S. giganteus* from Dagestan. The phylogenetic studies of Hadid et al. (2012) brought first light on the relationships in the genus, placing *S. zemni* as the closest relative to *S. arenarius*. Our recent results based on 6 specimens of *S. arenarius*, 4 *S. zemni* and 2 *S. microphthalmus*, genotyped for complete cyt b (mtDNA) and IRBP (nuclear DNA) genes, firmly place the sandy mole rat in the same clade with Podolian blind mole rat. Our work is still in progress as more specimens from Ukraine, Romania and Russia are being analysed.

**Evolutionary history of the European lesser blind mole rats:
mitochondrial and nuclear genes do not support the chromosomal
hypotheses**

Edvárd Mizsei, A. Németh, L. Laczkó, J. Bereczki, D. Czabán, Zs.

Hegyeli, Sz. Lengyel, G. Csorba & G. Sramkó

Lesser blind mole rats has a rather uniform external appearance and gross cranial morphology, therefore their morphology based systematics has been hotly debated over the last century. Since several studies evidenced a high degree of karyotype diversity (with 25 chromosomal forms reported from Europe) the European morphospecies *Nannospalax leucodon* is currently classified as a superspecies. Covering almost all chromosomal forms and taxa described based on morphology we applied a multilocus approach to reveal the phylogenetic relationships and to explore the evolutionary history of the superspecies. Our results shows significant mismatch between evolutionary hypotheses developed on karyotype data and the multilocus phylogeny as in many cases only shallow genetic differentiation were detected among highly distinct chromosomal forms. The new sequence data revealed three deeply divergent lineage in Europe tentatively named as (i) *monticola*, (ii) *turcicus* and (iii) *leucodon*, showing remarkable geographic structuring. These results will help future taxonomic decisions and conservation of threatened populations.

**Distribution and broad-scale habitat selection of mole rats (*Spalacinae*)
in Romania**

Attila D. Sándor

Old-World mole rats (*Spalacinae*) are subterranean rodents with a distribution chiefly in SE Europe, Middle East and NE Africa, with only one species' range laying in W Asia. All the species are blind, fossorial and use generally open habitats, living in individual burrows. Their underground habits, patchy distribution and morphological similarity (shaped by the evolution underground) made them one of the least studied groups among rodents. Recent cariological and molecular studies showed a wide and complicated phylogenetic pattern, with large number of chromosomal forms among the small bodied species. There are two groups (small and large) of mole rats occurring in Romania, with at least 3 large-bodied (*Spalax antiquus*, *S. graecus* and *S. isticus*) and one small species (*Nannospalax leucodons*) with at least 3 chromosomal forms ($2n=48$; 50; 56). Even that for two species the description is based on Romanian material, these rodent species are among the least known mammals from Romania. Here we present data on the distribution and habitat selection of all known mole rat species (and distinct chromosomal forms) from Romania, based on extensive field work from the last ten years.

Conservation status of large blind mole rat species in Romania: *Spalax antiquus*, *S. graecus* and *S. isticus*

Zsolt Hegyeli, Attila Németh, Szilárd Sugár & Gábor Csorba

Three species of the genus *Spalax* have been recorded in Romania. Formerly, all three have been included in *Spalax graecus* but based on mitochondrial DNA sequences as well as anatomical comparisons, are now regarded as valid species, two of them endemic to Romania. Here, we provide a summary of their distribution and conservation status, largely based on extensive field work carried out during the past decade. Méhely's blind mole rat (*S. antiquus*) is confined to steppe regions of Transylvania, and has several isolated populations. Bukovina blind mole rat (*S. graecus*) inhabits open habitats in the north-eastern part of Romania and a small part of Ukraine, and is the most widespread among the three. Oltenia blind mole rat (*S. isticus*), recorded from the southern part of the country, is most probably extinct, as surveys have failed to locate it in the past decade, and apart from old museum specimens, there is no tangible evidence of its existence. Extant species face threats resulting chiefly from intensive agriculture and urbanization, and their inadequate legal protection exacerbates the problem.

Taxonomy, politics and conservation: recent status of Vojvodina blind mole rat (*Nannospalax montanosyrmiensis*)

Attila Németh, Levente Laczkó, Ádám Tamás, Dávid Czabán, Gábor Sramkó & Gábor Csorba

Blind mole rats are among the most threatened mammals of the Carpathian Basin, and the situation of the critically endangered Vojvodina blind mole rat is the most worrying. The taxon was described on chromosomal grounds only in 1973 based on specimens collected in Serbia, but at 2008 it was also discovered along a small section of the Hungarian-Serbian borderline. Later, at 2013 a population of this species was found near Baja, then at 2017 one further near Albertirsa. Based on the recent knowledge the species endemic to the central part of the Carpathian Basin and in the phylogenetic reconstructions represents a deeply divergent clade. Only 4 populations are known and the estimated total number of individuals is less than 1000. The conservation status of the species has significantly changed during the last decade as most of the populations became protected. However the species still have to face many threatening factors and in the recent years the species find itself in the focus of European politics and media. The processes and the conservation efforts behind the scenes are presented herewith.

Blind mole rat protection efforts of the Hungarian Official Nature Conservation System

Oliver Váczi, Gábor Csorba, Attila Németh & Botond Bakó

The strictly protected and endemic blind mole rat species of the Carpathian Basin need coordinated nature protection efforts to have a chance to survive. Recognizing this fact, the state secretary for nature conservation in Hungary initiate a Specialist Working Group of Blind Mole Rat Protection in 2009. Members of the Working Group came from the academic sphere from the spatially relevant national park directorates from zoo and from the ministry responsible for nature conservation.

Function of the Working Group to support the state secretary' s decision by evidence based stands. Work of the Group helped to complete species action plan, establish protected site for a newly detected blind mole rat population, to lay out many successful translocation actions, had coordinated protective actions on the south border line and support awareness raising actions in Mammals of the Year 2018 etc. in one decade of its existence.

**Establishment of new populations as a method to save endangered,
exclusively subterranean rodents****Attila Németh, O. Moldován, L. Szél, T. Horváth, V. Schneider, Á.
Tamás, J. Ruzsa & G. Csorba**

When discussing threatened mammal species, rodents only rarely seem to enter the dispute. However, more than half of all mammals gone extinct during the last 500 years were rodents and the majority of mammal species currently threatened by extinction are also rodents. A special group that presents conservationists with an even more difficult challenge is that of subterranean rodents present tough challenges to conservationist. Even though, some of them endangered and facing serious threats, it is extremely hard to take effective measures for their protection, as most tools of the conservational inventory active conservation practices are developed for surface dwelling species. In Hungary since 2013, a conservation program is running in order to upgrading increase the number of the local Eurasian blind mole rats' populations. Herewith we summarize the current know-how on methodology and the most important aspects of creating a new population in a potential habitat by relocating individuals from a large and stable source population. The careful planning should include vegetation studies, landscape history, size, soil parameters, orography and the status of protection of the target area; timing of captures; number, age, condition and sex ratio of individuals selected for the translocation; spatial configuration of the relocated individuals, etc. The result of the one already finished and experiences of the three two other still in process ongoing translocations will be presented.

**Veterinarian participation at the threatened lesser blind mole rat
(*Nannospalax (superspecies leucodon)*) research in Hungary**

**Endre Sós, Viktoria Sós-Koroknay, Dávid Czabán, Gábor Csorba &
Attila Németh**

Hungary is the north westernmost country, where lesser blind mole rats (*Nannospalax (superspecies leucodon)*) occur. During last decade intensive research took place to investigate the Hungarian members of the species-complex. This complex work focusing not only taxonomical but genetic, ecological, physiological and conservation questions as well, also contains veterinarian elements. Sample collection, which not risking the survival of the individuals, anaesthesia, individual marking via microchip, physical examination and health assessment of the captured individuals are all part the project. During these routine tasks not only safe and easy to follow protocols were developed but some remarkable observation was also made. The susceptibility to peptic ulcer or the first ever reported case of abdominal cystic lymphangiomas are such of these cases.

Evolution of social behaviour underground

Moderator: Sabine Begall

Across the globe approximately 400 mammal species have adapted to a life underground. Since conditions in the subterranean ecotope are generally rather harsh (e.g. low oxygen consumption, low food productivity) it is assumed that competition and a solitary life-style are promoted. Indeed, the majority of subterranean species are strictly solitary like the *Spalacinae* blind mole rats. Nevertheless, there are some highly social species among subterranean rodents as well (e.g. naked mole-rats, *Fukomys* mole-rats). The aridity food-distribution hypothesis considers aridity and the sparse distribution of food as the key factor promoting sociality (many individuals find the sparsely distributed, but large food items in regions with unpredictable rainfall). The hypothesis of phylogenetic constraints on the other hand claims that sociality was an ancestral trait of African mole-rats (note that about 80% of their relatives live in social groups) leading to the question why some bathyergids became solitary.

**Difficulties of making IUCN risk assessments for subterranean rodents
(Lack of knowledge or lack of taxonomic consensus?)**

Moderator: Attila Németh

Determining the conservation status of subterranean rodents is significantly complicated by their specific way of life. Detecting and monitoring changes in their status is also a challenging task. Distribution mapping of these species, estimation of their population size is likewise demanding. All of the above, together with the systematic difficulties typical for almost all subterranean rodent groups, makes it particularly difficult to perform risk assessments for these taxa. Most species are still treated as pests today, but because they are extremely dependent on their habitat and its condition, they can easily become endangered. For most species, no sufficient and adequate data are available, or data do not reach the right places in order to aid correct classification. What could be done to clarify this picture?

ORAL PRESENTATIONS

VII. European Ground Squirrel Meeting

ABSTRACTS



In order of timeline

Phylogeographic and population genetic structure of the Pannonian ground squirrel populations**Gábor Sramkó, Levente Laczkó, Vilmos Altbäcker, Dávid Czabán,
Tamás Cserkész, Tamás Kondor, Endre Sós, Viktória Koroknai,
Zsuzsa Fidlóczky & Attila Németh**

Translocations of European ground squirrels (EGS) (*Spermophilus citellus*) have been conducted for three decades in Hungary in order to provide sufficient prey source for birds of prey, mainly for *Falco cherrug* and *Aquila heliaca*. However, the genetic structure of the Pannonian populations of EGS has been never investigated. In frame of the current project (LIFE13 NAT/HU/000183) we had the opportunity to conduct a comprehensive phylogeographic study using mitochondrial CytB and SSR markers. 30 populations [(3-)8-25 specimens] were sampled in the Pannonian area for the genetic study. Phylogeographic results point to the recent colonisation of the Pannonian area on an evolutionary timescale, and the Pannonian populations fit exactly into the European picture. The population genetic results tell about a meta-population structure existing until recently, where the main rivers were acting as barriers, thus, dividing the Pannonian populations into three main groups: (1) Transdanubian, (2) Duna-Tisza Interfluve, and (3) eastern Tisza plain. Translocations only slightly modified this structure. Population characteristics show worryingly low genetic diversity in the majority of populations.

How landmark analysis can help unraveling the phylogenetic relationships of ground squirrels?

Attila Virág & Piroska Pazonyi

Three ground squirrel taxa are known from the Pleistocene and Holocene of the Carpathian Basin. *Spermophilus* (or *Urocitellus*) *primigenius* (KORMOS, 1934) appeared ca. 2.0 Ma. It was replaced by *S. citelloides* (KORMOS, 1915) ca. 0.5-0.4 Ma. The third taxa, *S. citellus* (LINNAEUS, 1766) migrated into the area around 20 ka. However, without a thorough revision of the available material, this date is dubious due to the high similarity of the teeth and mandible of *S. citellus* to *S. citelloides*. In addition, the root morphology of *S. citelloides* suggests a relationship with the East European *S. suslicus* rather than *S. citellus*.

In order to clarify the issues related to the taxonomic validity and phylogenetic relationships of *S. citelloides*, we present here a new method, which allows comparing the outline shape of teeth using equidistantly placed landmark points. The developed protocol can also help identifying the position of isolated teeth, studying intraspecific and interspecific shape differences, and tracking evolutionary changes in the case of other taxa as well (especially if DNA analysis is not possible). This research was supported by the NKFIH FK128741 project.

**Ovarian activity, glucocorticoid secretion and prehibernation fattening
in European ground squirrels**

Eva Millesi, Jill Gaasch & Sandra Steinerberger

The aim of this study was to investigate potential benefits of the previously documented second oestrus cycle during the non-breeding period in summer. Elevated progesterone concentrations coincided with the fattening phase and could positively affect the accumulation of body fat reserves. Increased glucocorticoid secretion in response to stressors, however, could counteract ovarian activity. Based on long-term data sets we compared body mass changes, progesterone and cortisol concentrations, reproductive output and immergence dates of both free-ranging females and individuals kept in semi-natural enclosures. We applied capture-mark-recapture techniques and analysed progesterone and cortisol metabolites non-invasively from faecal samples. The results revealed faster fattening and earlier immergence dates in females with peak progesterone concentrations in summer than in those without, while immergence body mass did not differ. Cortisol concentrations in summer were higher in females without luteal activity and positively correlated with the duration of fattening. These results indicate negative effects of stress responses on ovarian activity and prehibernation fattening.

Individual diet data of the European Ground Squirrel (*Spermophilus citellus*) from stomach content analysis in a vineyard habitat population

Barbara Győri-Koósz, Annika Posautz, Anna Kübber-Heiss & Franz Suchentrunk

There are remarkable variability in the diet among individuals, but so far we cannot compare them in terms of sex and age data. Diet composition was investigated in a population of a vineyard characterised landscape in Austria. We have analysed stomach contents from road kills in the active season (March-September) of 2016/17. Based on microhystological analysis the percentages of Dicotyledones and Leguminosae were calculated considering seeds in statistical models (generalized least squares, analysis of variance). Seasonally, from June to August/early September high seed percent reduces significantly the dicot percent in diet. In juveniles males have higher dicot percentages than females while the adults had no sex-difference. Among adults the higher is the seed percentage, the lower is the leguminous percentage. Whole active seasonal calculations for adults have revealed that higher percentage of dicots was earlier in the year; later in the year a significant drop of dicot percentage and an increasing percentage of seeds leads to a significantly smaller percentage of dicotyledones. Moreover, a year effect was found: in 2016 the percentage of dicots was higher than in 2017.

**Evidence for European ground squirrels (*Spermophilus citellus*)
maintaining food caches**

Ilse Hoffmann & Werner Haberl

European ground squirrels do not store food for hibernation; however, it was unknown if they maintain food caches during the active season. Evidence for the latter arose during a 6-year mitigation and compensation project accompanying a building development. From the onset of the project, we observed ground squirrels feeding on tubers of the Earthnut pea (*Lathyrus tuberosus*). When the property developers began their project in 2016, a cache containing 380 g of tubers was excavated under Ecological supervision. No tunnels were visible, and according to our monitoring data, the cache was at least 2 years old. While supervising the expansion of the building site in 2017, we repeatedly observed a ground squirrel inspecting a burrow in the area while carrying a tuber. When the burrow was stripped by layer to ensure its being unoccupied, a cache of 290 g of tubers appeared in a blind-ending tunnel in about 90 cm depth. The burrow consisted of one chamber without nesting material, and one tunnel containing the cache. We hypothesize that it served as a temporary shelter enabling food intake while avoiding predation and/or inclement weather.

Whistling at the Tower of Babel: geographic variability in alarm calls of the European Ground Squirrel

Irena Schneiderová, Lucie Štefanská & Lukáš Kratochvíl

Geographic variability in calls has been documented in many mammals. We examined to which extent it applies to alarm calls of the European ground squirrel, *Spermophilus citellus*. We recorded calls of 82 individuals from five natural sites in the Czech Republic (Raná, Raná – Hrádek, Mohelno, Velká Dobrá, Vyškov) and of 24 individuals from an artificial semi-natural colony in Prague Zoo. Founders of this colony originated from four different sites in the Czech Republic. Discriminant function analysis showed the highest degree of discriminability for the most isolated sites (67–78% of individuals classified correctly), whereas the lowest for two interconnected sites Raná and Raná-Hrádek (35–43% classified correctly). Moreover, calls of the semi-natural colony were often classified into groups of other localities (only 48% classified correctly) likely corresponding to different origins of the founders of the colony. These findings indicate that there is a rather substantial geographic variability in alarm calls of the European ground squirrel. It should be tested whether this variability affects discrimination of alarm calls among individuals from geographically isolated populations.

New Method in Small Animal Tracking by Automated Radiotelemetry System (ARS)

Roland Reginald Zana

The ARS includes programmable radio transmitters attachable to the animals (optionally extrOver the last few years we have developed automated radiotelemetry systems for tracking and monitoring insects, small mammals and non-migratory birds. The system can be used for the simultaneous monitoring of several individuals.

a light and small – with batteries of 0.16 grams – and also of extremely high RF power and range), receiver units and a central data logger and processing unit. Each receiver simultaneously receives and decodes all the transmitter signals without data loss. The preprocessed data are sent to the central unit for storage and post-processing. All the data and system status information are available online to a remote computer. The post-processed data can then be used for the estimation of the habitat usage, daily or seasonal activity, current position as well as the establishing the change in movement (trajectory) over time, or other information relevant to research of the animals. The entire process is demonstrated by the results of various examples such as the ongoing project of relocation and monitoring of European ground squirrels near Kisoroszi, Hungary.

Analysing Habitat Use of European Ground Squirrels (*Spermophilus citellus*) by Using Automatized VHF Tracking System

Mátyás Prommer, R. Wohlfahrt, B. Tarján, I. L. Molnár, R. Zana, & M. Jurák

Although European Ground Squirrel (EGS) populations are declining throughout Europe and considerable efforts are done for the conservation of the species, we do not know much about their habitat use, daily movements patterns and “spatial behaviour” – that latter especially in relation to reintroduction. In the LIFE Nature project RAPTORSPREYLIFE (LIFE13 NAT/HU/000183) we tagged 26 individuals between 2016 and 2018 in reintroduction sites and original habitats and we tracked them a newly developed automatized VHF tracking system. We partly used multiple receiver stations enabling us to map movements; partly single receiver stations that allow us receiving information about daily activities only . We recorded EGS holes in the study areas on regular base. We used agro-drone to record changes in vegetation (NDVI).

Translocated individuals inhabit new area in several steps and remain in a few hundred metre away from the reintroduction site. Geography, terrain features and vegetation (NDVI) influences habitat selection (holes) and movements patterns. We found correlation between weather and EGS daily activities and evidences for “nighting out”. Predation was recorded in four occasions.

Diet of saker falcon (*Falco cherrug*) in Western Romania during the chick-rearing period

Zsolt Hegyeli, János Bagyura, Attila Marton & Attila Nagy

The recent expansion of breeding saker falcons from Hungary into western Romania was largely facilitated by the installing of nest boxes. In recent years, the breeding population has been steadily increasing, and the species is still expanding. This phenomenon, as well as the high breeding success may be due to the availability of adequate prey. We investigated the diet of sakers during the chick-rearing period in 2017 and 2018 with motion-sensor cameras placed at 7 and 6 nests, respectively. In the two study years we identified 776 prey animals. The study revealed a diet generally dominated by feral pigeon (*Columba livia f. domestica*) and European ground squirrel (*Spermophilus citellus*). Nonetheless, marked individual preferences were also observed, with certain pairs favouring ground squirrels, while others chiefly taking pigeons or common hamsters (*Cricetus cricetus*) in the study period. Our results support a strong predator-prey connection between falcons and ground squirrels, highlighting the importance of ground squirrel protection as a tool for saker falcon conservation.

The disappearance of the European Ground Squirrel and the Common Hamster from the diet of the Eastern Imperial Eagle in Hungary

Márton Horvath

The diet composition of breeding Eastern Imperial Eagles (*Aquila heliaca*) was analysed in Hungary between 2005 and 2017, and compared with two previously published datasets from the periods of 1982–1991 and 1992–2004. Altogether the distribution of 8543 prey items of 126 different species and 29 other taxa were analysed within a 36-years period. We found that the previously abundant Common Hamster (*Cricetus cricetus*) became marginal (7.42%), while European Souseks (*Spermophilus citellus*) practically disappeared (0.03%) from the diet of Imperial Eagles. The Brown Hare (*Lepus europaeus*) and the Common Pheasant (*Phasianus colchicus*) composed a remarkable part of the diet (28.11% and 11.22% respectively). Temporal changes of the main prey categories were analysed between 1998 and 2017, when the ratio of Hamster and Pheasant showed significant decrease (-27.29% and -6.38%). On the other hand, the ratio of corvids, waterbirds and Roe Deers (*Capreolus capreolus*) within the diet showed significant increase (+18.20%, +6.25% and +5.39%). However, eagles could only shift and survive in those regions, where their traditional preys decreased, if alternative species were available for them.

Prey composition of Saker falcon (*Falco cherrug*) during the breeding period between 2015 and 2017 in Hungary with special reference EGS

János Bagyura, Miklós Váczi, József Fidlóczky & Mátyás Prommer

The Saker is small mammal-specialist. EGS was one of the main prey for long period in the Carpathian Basin. In recent decades, with a drastic decrease of EGS population, their proportion significantly decreased in the Saker's prey. The abundance of prey in a given area significantly influencing the selection of breeding territories. In the last decades prey composition of the Saker was identified from bones and feathers collected from nests. Between 2015 and 2017 surveillance cameras were used 44 times at nests by the LIFE projects. Based on camera surveys, it was found that Saker often catch small mammals and ground nesting small bird species, which can be swollen, therefore those are hardly detected in food remains. The two methods are providing different results about the prey composition. The surveys, shown that mammals are significantly less in the diet of Saker in the Carpathian Basin than in the Asiatic (Russian) Saker, where about 90% of the prey are typically small mammals.

Prey and Predator Interactions: A Dissolving Bond Between European Ground Squirrel (*Spermophilus citellus*) and Saker Falcon (*Falco cherrug*)

Mátyás Prommer & János Bagyura

Small mammals of Eurasian steppe habitats dominate the prey species list of Sakers. In Europe, European Ground Squirrel (EGS) was the most important prey species in the breeding season. Recent decline of EGS populations throughout Europe, however impacts the diet of Sakers.

We analysed data of 58 breeding seasons of 29 satellite-tracked Sakers between 2008 and 2018 in relation of available EGS colonies in Hungary and in West Romania in various LIFE Nature projects.

We found only 3 individuals (two in Hungary and one in Romania) using EGS colonies as regular food source. They used 265 km² on average. We identified 594 visits at EGS colonies. Sakers were ready to fly as far as 25 km away from the nest regularly for EGS and direction of colonies from the nests coincides with prevailing wind. EGS density is an important factor for Sakers when choosing hunting ground. EGS hunting peaks in April, however spring precipitation anomalies may change seasonal patterns.

Saker population in the Pannonian Basin is no longer dependent on EGS, but remaining colonies are preferred food sources in the breeding season. Declining EGS population will impact spatial distribution of breeding Saker population.

Persistent decline of the European Ground Squirrel (*Spermophilus citellus*), an iconic steppe rodent in the heart of its distribution

Tamás Cserkész, L. Nagy, A. I. Csathó, A. Németh, T. Szitta, O. Váczi, Cs. Gedeon & Cs. Kiss

In Hungary no country-wide data on historical range of the European Ground Squirrel (EGS) was available, but indirect indications show that there was a strong population decline in the last century. For the trend analysis of the Hungarian EGS population we attempted to gather all historical and recent distribution data that could be accessed from different sources. The database contained a total of 442 line of records, and information about the categorical size of the former colony, and about the causes of local extinction. The results presented strong quantitative evidence showing significant declines of the population over a relatively short period: it estimated to have declined by over 70% in the past 52 years. Markedly large and rapid declines of the last 2 decades were documented, exceeding the substantial historical reductions. Declines were non-random in geographic ranges, and were most prevalent in the periphery in the past, while in these days, the core populations are getting scarce. After 2014 the wave of extinction subsided probably due to the reintroduction and other conservation projects. Although many declines are due to habitat loss and underutilization, other, unidentified processes threaten of this rapidly declining species.

Habitat characteristics of the largest European Ground Squirrel (EGS, *Spermophilus citellus*) colonies in Hungary

Zsófia Szórádi, Sándor Csete, & Vilmos Altbäcker

Land use change resulted in a dramatic decrease and continuing fragmentation of grasslands in Hungary. This is considered as a main cause of population decrease of EGS. We supposed that colony density reflects EGS habitat preference, thus sampled the between and within colony density of the 15 largest remaining Hungarian subpopulations of EGS in May 2018, to determine which characteristics of the land use, vegetation and soil would predict EGS density. We have found that high monocot plant, especially fescue cover, is characteristic in grasslands of above-average EGS density. This supports earlier results where fescue was found as the main and preferred component of EGS nests and was also present in their food. Surprisingly, dicot cover and diversity in general was not correlated to the EGS density, even though dicots are the main food items of EGS. Plant height and soil type had only slight impact on EGS density. We also found that human presence was positively associated with EGS density. We conclude that remaining EGS colonies would benefit from grassland maintenance resulting in high fescue cover should be considered if successful EGS reintroductions are attempted.

Severe habitat loss of European ground squirrel in the Pannonian region of Romania

Tihamér Fülöp & Zsolt Hegyeli

The Pannonian biogeographical region of Romania still holds viable European ground squirrel colonies. These, however, are subject to permanent habitat loss and fragmentation. The destruction of grasslands has been increasing in the region since 2007. EU accession has clearly accelerated this phenomenon, driven by the agricultural and economic potential of the region. The two main reasons for habitat loss are grassland conversion and constructions. We randomly selected a sample (n=30) from the over 210 known ground squirrel colonies, and measured their surface changes in the period between 2007 and 2017, using satellite imagery. The total size of the studied grasslands was 4696 ha in 2007, which decreased by 19.8% over a decade, leading to the total or partial elimination of several ground squirrel colonies. This decrease in grassland surface greatly deviates from the available national statistics. While 40% of the studied grasslands are within protected areas (Natura 2000 sites), 75% of these have lost their original size. Peculiarly, the proportion of grasslands with an unmodified surface was higher outside than inside protected areas.

Endangered agricultural pests: How common pests became strictly protected species?

Attila Németh, Csaba Kiss, Gábor Csorba & Tamás Cserkész

Several rodent species, which were considered as dangerous agricultural pest few decades ago, face higher risk of extinction now. It is also revealing that a species is under protection on one side of the border while in the same time control measures are in use against on the other side, and this trend can be observed both globally and in our region. Most of them are key species in its own ecosystem, but the rapid and large scale transformation of their habitats is quite a challenge for them. The seemingly invulnerable populations of these species were eradicated for decades but nowadays they become endangered since they went extinct in large range. Example of these species give an important lesson for conservation biologist and policymakers. In this review the historical and recent distribution and population sizes of some selected rodents were collected. We were attempting to answer questions about when and what reasons started to drastically decrease, and how fast and in what pattern reduced the range. In addition, we tried to outline a general characteristics of those species which may be threatened by similar risk in the future.

**Overview of the repatriations of European ground squirrel
(*Spermophilus citellus*) at Bulgaria**

**Yordan Koshev, Maria Kachamakova, Simeon Arangelov & Dimitar
Ragyov**

Repatriations of European ground squirrel (EGS) are a commonly used for its conservation in Central Europe, but to now there are no data about these activities in Southeastern Europe.

The current study presents an overview of personal data of the authors and available data (published, unpublished records and etc.) for repatriations of EGS in Bulgaria.

In the period 2011-2018, 8 repatriations of more than 1100 EGSs were performed for different purposes: reintroductions (4), reinforcements (3) and introduction (1), two of all are currently carried out. From 6 finished, 5 (83%) were successful, but 2 of them had a critically low number of individuals.

- The main reasons for failure are probably due to poorly selected and maintained habitats, rainy and coldly climatic conditions.
- In 6 cases there was resettling of the released EGSs from 100 to 720 m. from the release site.
- 7 repatriations are carried out at a difference in altitude between the donor colony and the release site of 470 to 1320 m, which has a hindering effect on the adaptation of EGSs.
- EU funds are of critical importance for repatriation activities.

Releases of European Ground Squirrels within the Czech Action Plan for this species

Jitka Větrovcová, Markéta Jariabková & Jan Matějů

A national action plan (AP) for the European ground squirrel (EGS) has been implemented in the Czech Republic since 2008. Among conservation measures the AP includes also running semi-natural breeding facilities and releasing animals to natural localities. This contribution focuses on such conservation measures of the AP.

First, the current situation in four breeding facilities is described. The program has been established in Zoo Prague in 2006/2011 using animals from the largest Czech colonies, in Zoo Brno and rescue station Vlašim in 2015 and in rescue station Rozovy in 2016, all using animals from Slovakia. Animals in all facilities prosper well, except for Vlašim, where no reproduction occurred in 2017.

Second, attention is paid to releases of EGS, which have taken place in the last three years. These include one repatriation to a new locality Písečný vrch (57 ind. released both in 2017 and 2018) and strengthening two relatively small colonies: Karlovy Vary (22 ind. released both in 2016 and 2017) and Hodkovice nad Mohelkou (20 ind. released both in 2017 and 2018). According to regular monitoring, animals have settled down and successfully reproduced at all three sites.

Successes and Lessons: experiences of three decades of resettlement of European Ground Squirrel in Hungary

József Fidlóczky, Tamás Szitta, Lajos Nagy, Miklós Dudás, Zsuzsa Fidlóczky, Kitti Tokaji, Vilmos Altbäcker, Attila Németh & Tamás Cserkész

In Hungary the EGS reintroduction projects have more than three decades' long tradition and experience. Feeding strictly protected bird of preys was the main goal in that early years, however, the protection of the EGS came shortly to the front due to the dramatic decline of the population. Methods have changed considerably over the decades, but the actions were always planned accurately and achieved thoughtfully according to the available best knowledge. Dataset of 93 translocations was collected in this study: 12.622 ind-s were translocated into 58 sites. None of the colonies which had been established before 2000 survived until 2016. For example, a colony which was established in 1984, disappeared in 2014 due to unknown reason. After 2000 another 40 reintroductions were accomplished, and 53% of them have proved successful. Considering the success of the early reintroductions we have to take several factors into account, e.g. the influence of the change of regime in 1989 (changing socio-economic environment, abandonment of meadows); at the same time the number of predators also increased. Maintaining the habitats in an acceptable condition is keyed to the subsistence of EGS.

First results on of *Spermophilus citellus* (EGS) dispersal after translocation in Bulgaria

Maria Kachamakova & Yordan Koshev

In search of more data about the EGS individuals' fate after conservation translocations we equipped 18 animals with radio-collars during new reinforcement project in “Zapadna Strandzha” SPA, Bulgaria.

The animals' location was recorded daily for 13 days (July-September) and the distance to the mean release point was calculated. Analysis of covariance (ANCOVA) was performed to investigate the variation of the mean and the maximal distance travelled among the sexes and the ages.

We found that the male individuals undertake significantly longer dispersal based on both mean (males 217 ± 50 m, females 91 ± 20 m, $p < 0.05$) and maximal (males 252 ± 42 m; females 130 ± 23 m, $p < 0.05$) distance travelled. The age has marginal positive influence ($p < 0.1$). There were no evidences for interaction between age and sex factors.

These preliminary results show that the widely observed pattern of male ESG exhibiting increased boldness and dispersal stays valid also in totally new environment and after an artificial intervention. It should be taken into account while planning of such conservation activities in future.

Sousliks - tips and tricks to support populations

Ervin Hapl, Denisa Lobbova & Monika Chrenkova

Since 2000, conservation of sousliks is implemented at growing number of localities in Slovakia. In 2018, increasing population trend was achieved at 7 localities (3 sites established by restitution). Various management measures were applied and approach to conservation is being modified constantly. The most interesting insights into applied conservation actions will be presented in order to initiate further discussion.

Conditions at 2 sites in E Slovakia were improved under the LIFE13 NAT/SK/001272 ENERGY project (www.lifeenergia.sk) implemented with the support of European Union. The direct impact of the favourable management on both sites is obvious from the high ratio of survival rate after hibernation (compared to the average) and increase in number of individuals by 350 (140%) in total.

The conservation measures in W Slovakia were implemented at 4 sites and management in the form of grazing, mowing, artificial feeding and cooperation with local people are bringing the first positive results. More measures are planned to be implemented in the upcoming months. The activities are realized within the Interreg SK-CZ project “Sousliks for the country, country for sousliks”.

**Successful laboratory breeding, raising and release of
sousliks (*Spermophilus citellus*)**

Zsófia Nagy & Vilmos Altbäcker

Population decrease of European ground squirrel necessitated attempts to establish a laboratory based breeding programme as part of the RAPTORS PREY LIFE project. We captured 32 EGS from the Dunántúl region to establish the breeding stock. Animals were individually caged and overwintered in a climatic chamber at 5 °C. Pairs were connected at the end of hibernation in late March and females gave birth to 78 alive offspring by 4th of May. Among successful individuals, females with larger BW delivered larger litters. Most (67) of the offspring were successfully raised by their mother, however, young from larger litters, and having lower birth weight, lagged in their BW increase compared to others. Youngsters had access to solid food and grass from June and were weaned in July when all individuals were RFID tagged. Some 48 of them were released in the Fertő-Hanság NP in August. The animals occupied the provided holes and established new entrances within a week, so initial success was not impaired by the laboratory breeding, though long term success will be judged by recapturing them next spring. Thus, we were able to establish all necessary steps of a long term breeding programme.

Raptor conservation by conservation of small mammals. Changing attitude towards small mammals. Main achievements of RAPTORSPREYLIFE project.

József Fidlóczky, Lajos Nagy, Zsuzsa Fidlóczky, Miklós Vácz, Zsolt Hegyeli, Vilmos Altbäcker, Attila Németh & Tamás Cserkész

Earlier, ground squirrels were considered as food source of endangered raptors like saker or imperial eagles and work were concentrated on translocations only. Due to sharp decline of their population they became the target of conservation work including trend analyses, genetic, health and stress survey.

- Captive breeding has started.
- Grasslands were purchased, rehabilitated and maintained.
- Translocations and tagging EGS.
- For better coordination the existing blind mole rat advisory board was extended for EGS.
- Airport grassland management guideline was prepared.
- Large scale of PR activities to improve the public awareness.

**Trademarks „Souslik friendly vineyard“ and „Souslik friendly orchard“
– two years’ experience**

Kateřina Poledníková & Lukáš Poledník

In the Czech Republic, there are between 30-40 very small, isolated souslik populations. Half of them are situated in “urban” habitats such as airports, golf yards and camps. Half of the colonies lives on agricultural land: steppe habitat and mosaic of vineyards, orchards and small fields. One of the main reasons of decrease of souslik populations in agricultural land in CZ is loss of habitat connected with prevalent way of farming, which does not provide suitable habitat for souslik. Farming is very intensive, big fields, no bounds and few pastures. Two trademarks were created to promote souslik populations in agricultural landscape. The basic idea is to provide trademark to land users whose activities help to protect/build up environment suitable for souslik. The trademark can help producer in marketing and selling. We conduct activities to promote trademarks to potential consumers in social media, TV, newspapers and by different events.

Social responsibility to maintain the ground squirrel population by an international company

Krisztina Györkő & Zoltán Magyaródi

The environmental protection has a main part in our everyday lives. The sustainable development, to protect the natural environment, to maintenance it, all these are hardly imaginable without the positive, necessary intervention of humans. From this connectedly working system, we are helping, to a small, but important population of ground squirrels living in narrow territories, in favour of the ground squirrel's subsistence, while we keep in mind our possibilities and abilities. Of course, in coordination with the economic and conservationist interests, showing an example to this generation and to the future generation. We want to show our plan, to the attendance, who are committed to save the ground squirrels population.

EGS protection efforts of the Hungarian official nature conservation system

Olivér Váczi & Botond Bakó

Results of long term monitoring dataset of Hungarian Biodiversity Monitoring System shows that EGS has a decreasing population in Hungary. The official nature conservation system of Hungary performs different measures to try to stop this process. Protected status of the EGS has changed from protected to strictly protected species in 2012. Mammal of The Year in Hungary was the EGS in 2015. Specialist Group of EGS (and Mole Rat) was established for country wide coordination of protection efforts of these endangered species in 2017. Because of high isolation level of all of the EGS population in Hungary many translocation actions were achieved in the last decades by different organisations. In every year annual EGS translocation plan synchronize these action to increase the efficiency of them since 20018. Cooperation to RAPTORS PREY LIFE programme resulted many useful practical and theoretical protection measures on EGS too.

EGS translocation: theoretical and practical approaches

Moderators: Olivér Váczi & Lajos Nagy

Many successful and failed translocation actions were performed all around the distribution area of the EGS. Is it a good solution or a dead end line? When or which cases are helpful and when should we avoid it? Which are the pitfalls and what are the inevitable steps of it? What are the secret tricks and what are the best practices? Interactive round table workshop will study the answer for these and similar questions.

IUCN Red List EGS data sheet revision of EGS

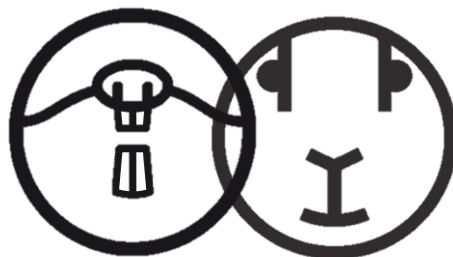
Moderator: Zsolt Hegyeli

Updating official conservation classifications of threatened species might have important implications for legal and practical conservation routines. Despite an increased conservation interest around the European ground squirrel, its IUCN Red List assessment has not been updated in more than a decade. It is currently classified as ‘Vulnerable’, based on the 2008 assessment. During this time, important data have surfaced about its population declines, threats, but also about conservation actions, from most range countries. Many of these data have been published, or presented during previous editions of the EGSM. Here, a round-table discussion about an existing, new assessment proposal is encouraged, as EGSMs provide a suitable platform to update such a document.

POSTER PRESENTATIONS

VII. European Ground Squirrel Meeting & Subterranean Rodents Workshop

ABSTRACTS



In alphabetic order

**Seasonal changes in European Ground Squirrel (*Spermophilus citellus*)
feeding habits on a saline pasture in Vojvodina (Serbia)**

**Maja Arok, Tijana Nikolić, Marko Mirč, Dimitrije Radišić, Barbara
Győri Koós & Duško Ćirović**

Ecology of European ground squirrels is mostly known, but novel data on the species' dietary preferences are scarce. In Serbia, data on this topic dates back to the 1950's. We analyzed leaf epidermal tissue in the animals' faeces, using the microhistological method. Samples were collected in Rusanda Nature Park in Serbia. 15 pellet samples collected during April and 15 collected in June 2015, were used in the analysis. We found that the diet of European ground squirrels is diverse, comprising 32 plant species and animal material. Proportions of eaten plants differed between the seasons. Grasses (especially *Dactylis glomerata*, *Achillea millefolium* and different *Festuca* species) highly dominated the ground squirrel diet in spring, contributing to the diet with 64.5%. Albeit Poaceae were still present in the diet as an important category in the summer, they were replaced by Leguminosae and Plantaginaceae species, that made up to 37% and 20.25%, respectively. The results indicate that ground squirrel diet is dictated by the changing vegetation: summer vegetation provides the animals a more diverse diet with more plant groups that are less dominant.

Mammals of the Year in Hungary

Botond Bakó & Vadonleső Team

Mammals of the Year initiative started in 2014 with the hedgehog managed by the Vadonleső (“Wildewatcher”) Program (www.vadonleso.hu) of the Hungarian Ministry of Agriculture, Nature Conservation Department. The aim of the Internet based Vadonleső Program is to involve volunteers to collect distribution data of carefully selected (well distinguishable protected or strictly protected and more or less easily detectable) plant and animal species.

The awareness raising and data collecting function are supported by series of programs like the Mammal of the Year 2015: European Ground Squirrel and 2018: Blind Mole Rat. This program series was running through that year started on early spring with a "wake up ceremony", continuing with illustrations short story writing and cartoon drawing awards for children and adults finishing with a huge ending ceremony by a repertoire of famous artists, presentation of the winners of the competitions and exhibitions from the children's work and professional photographers in late autumn.

It is a working example that huge number of people could be involved to nature conservation actions and awareness raising programmes by appropriate communication channels.

**Long-term monitoring of the population of European hamster
(*Cricetus cricetus*) by roadkill survey (1995–2017)**

**András István Csathó, András János Csathó, Martina Sztankó & Zsolt
Végyvári**

The populations of European hamster (*Cricetus cricetus*) are capable of sudden changes in the number of individuals, but only a few long-term data sets are available which characterize the population peaks numerically. Our roadkill survey was conducted in the administrative area (14,577 ha) of Battonya town (SE Hungary). Significant hamster population lives in the region also at European level. Since 1995 we have done surveying of roadkills which covered several species. The surveying covers all months of the year. For each specimen we recorded the road and the road-section, the time of finding and the estimated time of the animal casualty. Based on the data of more than 650 roadkilled European hamsters, found during the last 23 years, population dynamical conclusions can be made. We have got the highest values in the years of 1998, 1999, 2000, 2001, 2005, 2009, 2014 and 2016 which refer to population peaks. We found the least specimen in the years of 1995, 1996, 2002, 2003, 2004, 2006, 2010, 2012 and 2013. According to our experience this monitoring method is suitable for following up the change in the size of European hamster populations.

The Common hamster (*Cricetus cricetus*) as ‘endangered pest’ – Its current status in Hungary

Tamás Kondor, V. Váczi, T. Szitta, N. Seres & T. Cserkész

The Common Hamster is an endangered rodent in Europe, because it has suffered a dramatic decline probably due to intensification in agriculture, poisoning, and fragmentation of former continuous range. It has disappeared from more than 75% of its range in Europe and the species is probably the fastest-declining rodent in Europe. Within the EU, the hamster has one of the last viable population in E Hungary which can reach even higher densities; so we have considerable responsibility to protect this species. It is ‘partly protected’ in Hungary (derogation) since 2008; it is still legal to eradicate hamsters without permission until 31st of May. A complex survey was accomplished within the RAPTORSPREYLIFE project, which proved that high population density can be still found in several places of the Hungarian Plain but the densities sharply decreased compared to previous years. Moreover, in large areas it became very rare or even disappeared completely. At the same time, some hot spots were detected where the population density was high as Hamsters colonized several villages providing optimal conditions (less predator and inland water / more food). Protection of the Hamster means a complex conservation biological question in Hungary. From ecological point of view it is a protected keystone species, e.g. prey of the Imperial Eagle; however, from economic perspective it can be still an agricultural pest in some regions of Hungary.

Health screening of an European Ground Squirrel (*Spermophilus Citellus*) population in lower Austria

Andrea Fürst, J. Spergser, M. Steiner, I. Drozdowski, A. Mrvicka & A. Posautz

Since 2012, the relatively isolated EGS population located on “Perchtoldsdorfer Heide” has strongly declined (estimated 22 animals in 2017). To find a suitable donor population, a health screening was done. Fecal samples and buccal swabs of 18 animals were collected. To identify the genus/species level of recovered isolates MALDI TOF mass spectrometry and 16S rRNA gene sequencing was done. For parasitology flotation was used. Streptococcus sp.nov. (100%), Corynebacterium sp. nov. (94%), Actinobacillus sp. nov. (88%), Neisseria sp. nov. (50%) and Staphylococcus microti (50%) were the most prevalent in buccal swabs. From 14 fecal samples E. coli and Bacteroides sp. nov (100%), Enterococcus faecalis (64%), Lelliottia amnigena (29%) and Enterobacter cloacae (21%) were identified. 11 animals had nematodes and 73% coccidia. Few other parasites were retrieved. As no truly pathogenic bacteria and parasites were found, results show a healthy population, ready to receive new individuals of a compatible donor population.

More accurate, semi-automated estimation of census population size of protected burrowing rodents by non-invasive proximal sensing

Csongor Gedeon, Zsófia Kovács, János Mészáros & Mátyás Árvai

Background: Burrowing by protected, subterranean European ground squirrels or Lesser mole rats increase landscape heterogeneity and improve availability of resources to other organisms of semi-arid grasslands of Central Europe. Our primary aim is to develop an automated, non-invasive method to detect, count and map animal burrows and estimate population size more accurately.

Problem: According to their monitoring actively used burrow entrances are counted per hectare. First, it considers the animals' distribution even on the entire area, second, the estimated ratio of burrow entrances per each individual is inaccurate.

Innovation: To fulfil our plan we use proximal surface sensing, such as UAV (with RGB camera): for semi-automated burrow entrance or mound recognition and counting. We also apply proximal subsurface sensing, such as GPR (with RTK GPS) up to a depth of 1.0 m: for burrow mapping. Finally, the surface and subsurface models of the burrow systems are interconnected visually.

Impact: Accurate population estimation would give nature conservationists an early warning system so that they can intervene when colonies begin to decline in time.

Preliminary modelling of density of EGS colonies in Hungary between 2000 and 2015

Csongor Gedeon, O. Váczi, A. Laborczi, T. Cserkész, A. Németh & F. Suchentrunk

Local colonies of European ground squirrels may fluctuate or decline rapidly and severely in their census size. Respective risk factors may vary locally and include habitat and weather characteristics or human related factors (e.g., measures connected to the protection status of colonies); they possibly can trigger severe density fluctuations. In this study, densities of 63 Hungarian colonies were quantitatively estimated and monitored by a standardized method of counting operative burrow numbers between 2000 and 2015 once a year (April 22). Soil, habitat, and climate characteristics, land use and legal protection parameters, as well as geographical locations were also recorded for each colony. Generalized least squares modeling of numbers of burrow whole counts indicated a significant overall decline over the years until 2015, and independently negative effects of mean annual temperature and precipitation when accounting for geographical position, landscape and soil parameters and the status of legal protection, whereas airfields had a positive effect. Local spring densities significantly affect respective local densities of the following year.

Survey and population outbreak of the common hamster (*Cricetus cricetus*) in Western Romania

Zsolt Hegyeli & Tihamér Fülöp

One of the last European strongholds of the common hamster is the Great Hungarian Plain, connected with regions from western Romania and northern Serbia. This population still produces outbreaks typical for the species. In western Romania, the status of the hamster was largely unknown until the past few years. Surveys took place between 2015 and 2018 in the lowlands of western Romania, primarily by means of burrows counts. Road-killed hamsters also provided a significant data quantity. From 2017, an exceptionally large population outbreak was observed in the western part of Arad County, also felt in the southern part of the neighbouring Békés County. This phenomenon was monitored by counting road-killed hamsters. The importance of this protected rodent as a prey species is suggested by the high number of imperial eagles foraging in this area, as well as the movements of a young eagle equipped with a satellite transmitter. Saker falcons can also locally feed on hamsters to a large extent, as shown in Timiș County, by data from camera traps and prey remains.

Phylogenetic analysis of European Ground Squirrel populations from the Balkan Peninsula

Cristos Kazilas, D. Ćirović, N. Karaiskou, S. Minoudi, N. Ćosić, T. Nikolić, D. Youlatos & A. Triantafyllidis

The high fragmentation of the range of *Spermophilus citellus* (EGS), along with their rapid population decline over the past decade, has brought up the need to elucidate its phylogeny and phylogeography. Building on previous research, the present study aims to further assess the intra-specific diversity by analyzing the mitochondrial cytochrome b and cytochrome c oxidase subunit I genes. Tissue samples were obtained from populations in Greece, F.Y.R. Macedonia and Serbia to extract DNA. The desired genes were amplified and sequenced, before performing bioinformatics analysis. To enrich these data, sequences from online databases were also considered. The results separate EGS populations into two major groups, a northern and a southern one that vary in their degree of differentiation. The southern group showed the greatest haplotype diversity and higher differentiation among its populations. The northern group haplotypes revealed low diversity, apart from a single lineage consisting of populations from Mt Jakupica and northern Serbia. Our results are consistent with previous studies and could provide a framework for protecting and conserving this threatened species.

Ecological roles of the European Ground Squirrel in grassland ecosystems

**Peter Lindtner, Karol Ujházy, Slavomír Stašiov, Erika Gömöryová,
Marek Svitok & Vladimír Kubovčík**

We summarized ecological roles of the European ground squirrel (EGS) observed in grasslands of Western Carpathians. EGS serves as a prey for number of predators. EGS produces droppings and through their accumulation on the mounds provides nutrient input to the soil. EGS are hosts of several scarab beetles with unique species composition. Burrowing by EGS constructs habitat for burrow dwellers. EGS through mound building creates patches of barren substrate influencing epigeal arthropods. Mound building is accompanied with soil mixing affecting also below-ground communities such edaphic macrofauna or microbial communities. EGS provides disturbances in grasslands influencing niche construction, competition-colonization trade-off, patch dynamics, and activating locally plant succession. This effects result in increased plant diversity with alteration of grass/forb ratio enhancing attractiveness for pollinators. We argue that EGS through the food-web centrality fulfils multiple ecological functions in grassland ecosystems influencing ecological processes and diversity patterns. We guess that EGS can be considered as ecosystem engineer and keystone species.

Connectivity of landscape in Vojvodina is threat for sustainability of European Ground Squirrel (*Spermophilus citellus*; EGS) populations

Tijana Nikolić, Rogier Pouwels, Dimitrije Radišić, Maja Arok, Dusko Cirović & Wieger Wamelink

Habitat fragmentation and loss in an agricultural setting leads to a patchy distribution of species. Several groups of EGS populations are found as non-continuous populations distributed across regional species' range in Vojvodina. Connectivity within and among these groups is variable and mostly poor thus each may become isolated and then decrease in size. Here we investigated sustainability of EGS population based on connectivity among the populations. From local population groups, using spatial modelling tool (LARCH model), we defined 15 sub-regional population networks. It seems only two relatively larger network groups are strongly sustainable and thus highly viable, located in central and southern Banat. This may be because of less disturbance from land conversion and infrastructural development in central and southern areas of Vojvodina, plus better connectivity. Also EGS populations have conditionally 'virgin' distribution since there has been only one single translocation ever. EGS populations' distribution in Vojvodina potentially reflects species response patterns to changing land use conditions.

**Case series of metacestode infestations in European Ground Squirrels
(*Spermophilus citellus*)**

Annika Posautz, A. Hodžić, G. Duscher & F. Suchentrunk

European ground squirrels were collected as road kills in the province of Lower Austria. During necropsy in 10 animals several tapeworm cysts were found. In 6 animals the cysts were in/close to the liver, 1 was attached to the sternum, 1 free in the thorax, 1 was found in the brain, and in 2 other cases cysts were found free in the abdomen. In 9 of the 10 cases a PCR targeting 880 bp long fragment of the *cox1* gene was performed followed by sequencing *Taenia crassiceps* and *Versteria* sp. were confirmed in 5 and 2 animals, respectively. In 3 cases PCR could not give any clear results. This is the first case report of infestations with tapeworm metacestodes in this animal species. As histopathology is still ongoing the degree of lesions caused by the cysts are unclear. As they most likely serve as an alternate host the impact will most probably not be too large. However, in individuals with a poor nutritional state and/or stressed by other factors, cysts in the brain, or liver could lead to a multifactorial poor health status and even death.

Vigilance behaviour of European Ground Squirrels in Northern Greece

Dimitra-Linda Rammou & D. Youlatos

Although *Spermophilus citellus* (EGS) live mainly underground, the risk of predation is increased during the active period above ground. Thus, vigilance (visual scanning) is one of the dominant activities and the main antipredator behavior. In this study, we analyzed the different scanning postures in relation to environmental parameters, in a population of EGS inhabiting an open field in Thessaloniki, Greece. Behavioral data were collected at 1-min intervals between April and October for 3 years. Our results show that juveniles EGS used more quadrupedal posture and less bipedal extended postures. In contrast, adults used similar proportions of quadrupedal posture with significant sex differences in the bipedal posture profiles. In females, the fully-extended posture dominated, whereas males considerably used the bipedal extended posture. Of all environmental parameters only the distance from burrow and vegetation height were correlated to different postural profiles. Juveniles and females scanned mainly near burrow (0-0.5m), while males scanned at 0.5-5m. Quadrupedal posture was preferred at low vegetation (0-0.1m) and bipedal extended postures at higher (0.1-0.3m).

Evaluating the success of blind mole rats' translocation in Hungary

János Ruzsa, Viktor Schneider & Attila Németh

Blind mole rats are among the most threatened mammals of the Carpathian Basin. Due to their special lifestyle their conservation is a great challenge. A conservation program is started at 2013 in order to increase the number of blind mole rat populations in Hungary. Since then, 4 new populations were started to be created, two of them are already finished. We are not only evaluating the success of each, but based on a dataset, also tried to explain the success and lessons of these conservation actions. The translocation to Bagamér was surprisingly successful, the number of individuals are tipped until recently. However, translocation to Öttömös or Pocsaj seem to be less successful; as number of individuals are stagnated or only slightly increased. Nevertheless, status of blind mole rats saved from the Baja solar investment territory is the less encouraging; population is continuously declining. There are many factors influencing the success of these actions. It seems that the number of the relocated individuals, geomorphology, features of the vegetation and the soil of the target habitat are all important, as well as the professional decisions during the actions.

**Lifetime reproductive success in yellow ground squirrel females:
insights from a long-term study**

**Nina Vasilieva, Ludmila Savinetskaya, Nikita Vasiliev & Andrey
Tchabovsky**

Lifetime reproductive success (LRS) is a crucial life-history parameter, but is not easily estimated in the wild.

We studied LRS in yellow ground squirrel females (*Spermophilus fulvus*, N=396) in Saratovskaya oblast', Russia, in 2002-2015. We analysed the variation in LRS measured as a) N weaned litters, b) N weaned juveniles, and c) N juveniles survived to maturation in relation to female a) lifetime reproductive effort (total mass of weaned juveniles), b) longevity, and c) natal dispersal distance.

25% of mature females weaned no offspring and in 62% of females no offspring survived to maturation. Thus, the majority of females had LRS=0, indicating reproductive skew. In mammals, the high reproductive skew is common in males and in females of communally breeding species. However, *S. fulvus* lives solitarily and such skew is unexpected. LRS did not depend on female dispersal distance ($p < 0.01$ for all LRS estimators), increased with female longevity ($p < 0.01$), and the offspring survival to maturation was positively affected by female lifetime reproductive effort ($p < 0.01$). So, the best way for *S. fulvus* female to achieve high LRS is to be a long-liver. Supported by RFBR (16-04-01376).

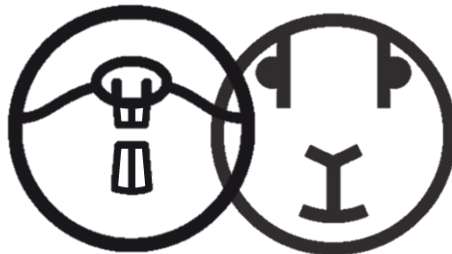
Translocation of a colony of the European Souslik (*Spermophilus citellus*), doomed by construction of Luda Yana dam in the Panagyurishte Region, Bulgaria

Sirma Zidarova, V. Stefanov, A. Vlasseva & I. Krusteva

A translocation of a colony of the European Souslik (*Spermophilus citellus*), doomed by the construction of Luda Yana water supply reservoir in a mountain area in Bulgaria, was done in June-July 2018. The sousliks were released by several methods in the periphery of an existing colony located 10 km from the dam. Data on population characteristics of the relocated colony (relative density, sex and age structure) and the recipient colony (relative density) were collected. The used released methods are discussed in the light of the specific circumstances of such an urgent translocation. The primary monitoring data show that the released in the periphery sousliks settled in the colony and their integration into it was tracked out by GPS. The realized translocation is the largest in Bulgaria (the higher number of individuals relocated for the shortest time) and has a practical contribution that could be helpful in planning such urgent relocations. Future monitoring after the first hibernation of the translocated individuals will allow us to evaluate the final results of the translocation.

LIST OF PARTICIPANTS

VII. European Ground Squirrel Meeting & Subterranean Rodents Workshop



In alphabetic order

Surname	First name	Institution	Country	E-mail address
Altbäcker	Vilmos	Kaposvár University	Hungary	altbacke@gmail.com
Arok	Maja	Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad	Serbia	maja.arok@dbe.uns.ac.rs
Bakó	Botond	Ministry of Agriculture, Department of Nature Conservation	Hungary	bakoenator@gmail.com
Bakos	Anita	Ceetrus Hungary Kft.	Hungary	abakos@ceetrus.com
Balogh-Roth	Melinda	Körös-Maros National Park Directorate	Hungary	melinda.roth@kmp.hu
Barna	Krisztián	Körös-Maros National Park	Hungary	krisztian.barna@kmp.hu
Begall	Sabine	University of Duisburg-Essen	Germany	sabine.begall@uni-due.de
Bernand	Maelle	DAPHNE Institute of Applied Ecology	France	maelle.bernand@wanadoo.fr
Boldog	Gusztav	Körös-Maros National Park Directorate	Hungary	gusztav.boldog@kmp.hu
Chrenkova	Monika	DAPHNE Institute of Applied Ecology	Slovakia	chrenkova@gmail.com
Csathó	András István	-	Hungary	csatho@verge.hu
Cserkész	Tamás	BEKE	Hungary	cserkeszt@gmail.com
Csorba	Gábor	Hungarian Natural History Museum	Hungary	csorba.gabor@nhmus.hu
Czabán	Dávid	Eötvös Loránd University	Hungary	david.czaban@gmail.com
Dudás	Miklós	Rónaőrző Természettudományi Egyesület	Hungary	dudasm1@yahoo.com
Fidlóczy	József	FHNPD/FENCON Consulting Ltd. (LIFE project manager)	Hungary	fidlojo@gmail.com
Fülöp	Tihamér	"Milvus Group" Bird and Nature Protection Association	Romania	tihamer.fulop@milvus.ro
Győri-Koósz	Barbara	University of Sopron	Hungary	gyorikoosz@gmail.com
Györkő	Krisztina	Ceetrus Hungary Kft.	Hungary	kgyorko@ceetrus.com
Haberl	Werner	Wildlife Biologist	Austria	conservation@chello.at
Halász	Dóra Vera	Independent researcher	Hungary	dora.halasz@gmail.com
Hapl	Ervin	Raptor Protection of Slovakia	Slovakia	ervin.hapl@gmail.com
Hegyeli	Zsolt	"Milvus Group" Bird and Nature Protection Association	Romania	zsolt.hegyeli@milvus.ro
Hegyí	Zoltán	Duna-Ipoly National Park Directorate	Hungary	hegyiz@dinpi.hu
Hoffmann	Ilse (Eva)	University of Vienna, Department of Behavioural Biology	Austria	ilse.hoffmann@univie.ac.at
Horáková	Sylvie	Faculty of Science, University of South Bohemia in České Budějovice	Czech Republic	sylvie.horakova@seznam.cz
Horvath	Marton	MME BirdLife Hungary	Hungary	horvath.marton@mme.hu
Hrouzková	Ema	University of South Bohemia	Czech Republic	ema.knotkova@seznam.cz
Jariabková	Markéta	Jihočeská zoologická zahrada Hluboká nad Vltavou	Czech Republic	jariabkova@zoohluboka.cz
Kachamakova	Maria	Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences	Bulgaria	Maria.nkachamakova@gmail.com
Kazilas	Christos	Aristotle University of Thessaloniki	Greece	ckazilas@gmail.com
Kertész	Zsófia	Budapest Airport	Hungary	zsafia.kertesz@bud.hu
Kettnerová	Lucie	Prague Zoo	Czech Republic	lucka.kett@gmail.com
Kis	Ferenc	Budapest Airport	Hungary	ferenc.kis@bud.hu
Kiss	Csaba	Eötvös Loránd Tudományegyetem, BEKE	Hungary	kisscsaba@caesar.elte.hu
Kiss	Izolda	ABKTCS	Hungary	kiss.izolda@gmail.com
Konkoly	René	Sólyom Environment and Nature Protection Club	Hungary	concolee@web.de
Koshev	Yordan	Institute of Biodiversity and Ecosystem Research of the Bulgarian Academy of Sciences	Bulgaria	bgsouslik@gmail.com
Kovács	Zsófia Adrienn	MTA ATK Talajtani és Agrokémiai Intézet	Hungary	zsafia901028@gmail.com

Surname	First name	Institution	Country	E-mail address
Kovács	Zsófia	MTA ATK TAKI	Hungary	kovacs.zsofia.adrienn@gmail.com
Laczkó	Levente	University of Debrecen, Department of Botany	Hungary	nagyonlevente@gmail.com
Lánczos	Zsuzsanna	----	Hungary	zsuzsanna.lanczos@gmail.com
Lindtner	Peter	Technical University in Zvolen	Slovakia	peter.lindtner1@gmail.com
Lobbova	Denisa	Živá planina	Slovakia	goblin.denn@gmail.com
Lovy	Matej	University of South Bohemia	Czech Republic	mates.lov@gmail.com
Magyaródi	Zoltán	Ceetrus Hungary Kft.	Hungary	zmagyarodi@ceetrus.com
Marešová	Martina	Prague Zoo	Czech Republic	maresmartina@seznam.cz
Matějů	Jan	Museum Karlovy Vary	Czech Republic	honzamateteju@seznam.cz
Matur	Ferhat	Dokuz Eylül University	Turkey	ferhat.matur@gmail.com
Millesi	Eva	University of Vienna, Department of Behavioural Biology	Austria	eva.millesi@univie.ac.at
Mizsei	Edvárd	University of Debrecen	Hungary	edvardmizsei@gmail.com
Moldován	Orsolya	Hortobágyi National Park Directorate	Hungary	moldovanoorsolya@hnp.hu
Molnár	Zoltán	Budapest Zoo and Botanical Garden	Hungary	molnar@zoobudapest.com
Nagy	Lajos	Balaton Uplands National Park Directorate	Hungary	lajos.tihany@gmail.com
Nagy	Attila	Milvus Group Association	Romania	attila.nagy@milvus.ro
Nagy	Zsófia Eszter	Kaposvár University, Institute of Environmental Science and Nature Conservation	Hungary	nagy.zsofia@ke.hu
Németh	Attila	Fertő-Hanság National Park Directorate, Hungarian Natural History Museum	Hungary	dr.attila.nemeth@gmail.com
Nikolic	Tijana	BioSense	Serbia	tijanaeco@gmail.com
Papp	Sándor	BFNPD	Hungary	sandorpapp83@gmail.com
Pazonyi	Piroska	MTA-MTM-ELTE Research Group for Paleontology	Hungary	pinety@gmail.com
Petróczi	Imre	Balaton-felvidéki Nemzeti Park Igazgatóság	Hungary	petroczi@bfnp.hu
Pleštilová	Lucie	University of South Bohemia, Faculty of Science	Czech Republic	lucie.plestilova@seznam.cz
Poledníková	Kateřina	ALKA Wildlife, o.p.s.	Czech Republic	katerina.polednikova@alkawildlife.eu
Posautz	Annika	Research Institute of Wildlife Ecology	Austria	Annika.Posautz@vetmeduni.ac.at
Prommer	Mátyás	Madárvilág Nonprofit Kft.	Hungary	mprommer@yahoo.com
Rammou	Dimitra-Lida	Aristotle University of Thessaloniki	Greece	rdimitra@bio.auth.gr
Ruzsa	János	Eötvös Lóránd Science University	Hungary	ruzsajanek@gmail.com
Sándor	Attila D.	University of Agricultural Sciences and Veterinary Medicine Cluj	Romania	adsandor@gmail.com
Scantlebury	Michael	Queen's University Belfast	United Kingdom	m.scantlebury@qub.ac.uk
Schneider	Viktor	Szent István Egyetem	Hungary	viktor.schneider95@gmail.com
Schneiderová	Irena	Prague Zoo; Czech University of Life Sciences in Prague	Czech Republic	irena.schneid@gmail.com
Solak	Halil Mert	Bülent Ecevit University	Turkey	mr.solak@hotmail.com
Sós	Endre	Budapest Zoo	Hungary	drsos@zoobudapest.com
Sós-Koroknai	Viki	Budapest Zoo	Hungary	drkoroknai@zoobudapest.com
Sramkó	Gábor	MTA-DE "Lendület" Evolutionary Phylogenomics Research Group	Hungary	sramkog@gmail.com
Suchentrunk	Franz	Research Institute of Wildlife Ecology, University of Veterinary Medicine Vienna	Austria	franz.suchentrunk@vetmeduni.ac.at

Surname	First name	Institution	Country	E-mail address
Sugár	Szilárd	Milvus Group	Romania	szilard.sugar@milvus.ro
Sumbera	Radim	University of South Bohemia	Czech Republic	sumbera@prf.jcu.cz
Szűcs-Vásárhelyi	Nóra	MTA ATK Talajtani és Agrokémiai Intézet	Hungary	vasarhelyinora.21@gmail.com
Tölgyesi	Zoltán	Hortobágyi Nemzeti Park Igazgatóság	Hungary	tolgyesizoltan@hnp.hu
Váczi	Olivér	Nature Conservation Department, Ministry of Agriculture	Hungary	volivoli@gmail.com
Vajda	Zoltán	Kiskunsági Nemzeti Park Directorate	Hungary	vajdaz@knp.hu
Vasilieva	Nina	A.N. Severtsov Institute of Ecology and Evolution	Russian Federation	ninavasilieva@gmail.com
Vejmělka	František	Faculty of Science; University of South Bohemia in České Budějovice	Czech Republic	frvej@seznam.cz
Vers	József	BFNPD	Hungary	versjozsef@gmail.com
Větrovcová	Jitka	Nature Conservation Agency of the Czech Republic	Czech Republic	jitka.vetrovcova@nature.cz
Virág	Attila	MTA-MTM-ELTE Research Group for Paleontology	Hungary	viragattila.pal@gmail.com
Vlasseva	Albena	Bulgarian Academy of Sciences	Bulgaria	mirchevaa@yahoo.com
Yanchukov	Alexey	Bulent Ecevit University	Turkey	yawa33@gmail.com
Zana	Roland Reginald	Budapest University of Technology and Economics	Hungary	zanaroland120@gmail.com
Zidarova	Sirma	Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences	Bulgaria	s.zidarova@gmail.com





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