



II. European Ground Squirrel Meeting

2008
Czech Republic

Book of Abstracts

Svatý Jan pod Skalou, Czech Republic
1 - 5 October 2008

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2nd European Ground Squirrel Meeting
1-5 October 2008, Svatý Jan pod Skalou

Dear Ladies and Gentlemen,

The organizing committee welcomes you at the II. European Ground Squirrel meeting in Sv. Jan pod Skalou, Czech Republic. We are glad that we can take a share in a tradition of the regular EGS meetings, following the successful I. EGSM in Felsőtárkány, Hungary in 2006 and the conference “Ecology and Conservation of the European souslik (*Spermophilus citellus*)” in Madjarovo, Bulgaria in 2002.

The meeting offers a unique opportunity to present scientific results and conservation experiences concerning the European ground squirrel to a wide group of ground squirrel experts. We hope you will enjoy not only the new information about different aspects of the ground squirrel biology and conservation, but also the surroundings of Sv. Jan pod Skalou.

The organizing committee,

Jan Matějů, Petra Nová, Jitka Uhlíková, Vladimír Vohralík & Eva Cepáková

Partners

Agency for Nature Conservation and Landscape Protection of the Czech Republic

Centre of Ecological Research and Education in Svatý Jan pod Skalou

Department of Zoology, Charles University in Prague, Faculty of Science

Department of Zoology, Faculty of Science, University of South Bohemia, České Budějovice

Institute of Vertebrate Biology, Academy of Sciences of the Czech Republic

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The II. EGSM was supported by the Ministry of the Environment of the Czech Republic (grant VaV, No SP/2d4/61/08).

Programme

1st October

18:00 - 21:00 Registration - St. John's Teacher Training College

2nd October

8:30 - 9:30 Registration - St. John's Teacher Training College

9:30 Opening

Monitoring and distribution (Chairman Ilse E. Hoffmann)

9:40 Váczi O., Bakó B., Gedeon C., Altbäcker V.: Nation-wide monitoring of European Ground Squirrels (*Spermophilus citellus*) in Hungary

10:00 Ambros M., Adamec M.: Current distribution of the European souslik (*Spermophilus citellus*) in the Slovak Republic

10:20 Matějů J., Nová P., Uhlíková J.: Current distribution of the European ground squirrel (*Spermophilus citellus*) in the Czech Republic and relation to environmental factors

10:40 *Coffee break*

Genetics (Chairman Gedeon Czongor)

11:10 Hulová Š., Bryja J., Ďureje L., Galan M., Cosson J-F., Gedeon C., Sedláček F.: Effect of habitat fragmentation on neutral and adaptive population genetic structure in the European ground squirrel in Central Europe

11:30 Hulová Š., Koshev Y., Ćosić N., Ćirović D., Sedláček F., Bryja J.: Range wide phylogeography of the European ground squirrel based on nuclear and mtDNA markers

11:50 Ćosić N., Hulová Š., Bryja J., Penezić A., Ćirović D.: Microsatellite variability of the European ground squirrel (*Spermophilus citellus*) in Vojvodina, Serbia

12:30 *Lunch break*

Conservation and management (Chairman Andrzej Kepela)

14:00 Hoffmann I. E., Brenner M., Turrini T.: Do European ground squirrels in Austria adjust their life history to anthropogenic influence?

14:20 Enzinger K., Holzer T., Walder C.: Management of Ground Squirrel habitats in lower Austria - origin, options and objectives

14:40 Gedeon C., Boros G., Németh A., Váczi O., Altbäcker V.: Burrow entrance angle and grass height influences reintroduction success: the importance of release site preparation in European ground squirrel (EGS) translocations

15:00 Uhlíková J., Nová P., Matějů J.: Action plan for the European ground squirrel in the Czech Republic

15:20 *Coffee break*

16:00 - 18:00 **Poster session**

18:00 *Dinner*

19:00 **EGS cinema**

Róbert Urai et al.: DVD slide show about EGS (50 min)

Jan Hošek et al.: Documentary film about population of EGS on the territory of Prague (20 min)

3rd October

Ecology and behaviour I (Chairman Arjen M. Strijkstra / Elena Volodina)

9:30 Matrosova V. A., Volodin I. A., Volodina E. V.: The cues to individuality, sex and age in alarm calls of the Speckled ground squirrel (*Spermophilus suslicus*)

9:50 Schneiderová I.: Structure and variability of alarm calls in the European ground squirrel (*Spermophilus citellus*)

10:10 Millesi E., Divjak A., Strauss A.: Pre-hibernation fattening and ovarian activity in breeding and non-breeding European ground squirrels

10:30 *Coffee break*

11:00 Strijkstra A. M., Hut A. R., Daan S.: European ground squirrel hibernation: function, behaviour, neurophysiology (review)

11:20 Boerema A. S., van der Zee A. E., Strijkstra A. M.: Torpor bouts: molecular neurobiology

11:40 Németh I., Szabó É., Altbäcker V.: Air-conditioned hibernation

12:00 Gedeon C., Marko G., Németh I., Nyitrai V., Altbäcker V.: Nest material selection affects nest insulation quality in the European ground squirrel (*Spermophilus citellus*)

12:30 *Lunch break*

Ecology and behaviour II (Chairman Jitka Uhlíková)

14:00 Turrini T., Brenner M., Hoffmann I. E., Millesi E.: Home ranges of European ground squirrels differ according to sex, age and habitat alteration

14:20 Zidarova S.: Investigation on natal dispersal and home range size of the European souslik (*Spermophilus citellus*) in a model colony in Western Bulgaria

14:40 Matějů J.: Ecological study of a relict population of the European ground squirrel

15:00 *Best Poster Award*

15:10 *Coffee break*

15:30 **Field excursion to the vicinity of Sv. Jan pod Skalou**

18:30 *Dinner and evening free discussion*

4th October

9:30 **Visit of Koněprusy caves** - the longest and the most known caves in the Czech Republic (the Bohemian Karst Protected Landscape Area)

12:00 *Lunch*

13:00 **Field trip to the Protected Landscape Area České středohoří** - visit of the EGS localities

18:00 *Termination of the II. EGSM and farewell party*

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PRESENT DISTRIBUTION OF THE EUROPEAN GROUND SQUIRREL (*SPERMOPHILUS CITELLUS*) IN THE SLOVAK REPUBLIC.

Ambros M.¹, Adamec M.²

¹ State Nature Conservancy of the Slovak Republic, Ponitrie Protected Landscape Area, Samova 3, 949 01 Nitra, Slovak Republic

² State Nature Conservancy of the Slovak Republic, Lazovná 10, 97401 Banská Bystrica, Slovak Republic

ambros@soprs.sk

Aims: We focussed on actual knowledge on the occurrence and distribution of the ground squirrel in Slovakia on the basis of mapping results since 1996. **Methods:** We used the method of verification and literature reviews as well as unpublished information, including the results of other scientific projects (for example epidemiological) to map and detect the present state of the population. **Results:** Between 1996 and 2008 we detected the ground squirrel in 115 localities of Slovakia. Visits of localities with ground squirrel occurrence listed in older literature showed that the majority of them (87%) were altered and this protected species does not occur there any more. Other localities where we registered ground squirrels were in various succession stages as a consequence of farming technology changes or changes of localities and extinction of these local populations was (or still is) expected in 3 or 4 years. On the basis of literature evidence we reconstructed the occurrence and distribution of the ground squirrel in Slovakia till 1970 and from 1971 to 1995. Comparing the evidence with the results of our mapping it is possible to point out that the species distribution in Slovakia lost its continuous pattern from 1950 and broke into several more or less separated segments. **Conclusions:** Continuous mapping with the application of monitoring elements to the observation of ground squirrel population shows progressing isolation of existing colonies with next atomization of the species distribution in Slovakia. The situation gradually gets into a state when immediate protection action is needed.

MAMMALS (RODENTIA, CARNIVORA) LIVING NEAR EUROPEAN GROUND SQUIRRELS AT M. R. ŠTEFÁNIK AIRPORT IN BRATISLAVA.

Baláz I.¹, Jančová A.², Ambros M.³

¹Department of Ecology and Environmental Sciences, Constantine the Philosopher University, Tr. A. Hlinku 1, 949 74 Nitra, Slovak Republic

²Department of Zoology and Anthropology, Faculty of Natural Sciences, Constantine the Philosopher University, Tr. A. Hlinku 1, 949 74 Nitra, Slovak Republic

³State Nature Conservancy of the Slovak Republic, Ponitrie Protected Landscape Area, Samova 3,

949 01 Nitra, Slovak Republic

ibalaz@ukf.sk

Aims: Airports represent a rich source of the European ground squirrel (*Spermophilus citellus*) individuals for several reasons. High density of *Spermophilus citellus* inhabitation of the airport grassy areas is a result of rich food availability and the absence of anthropic influence. The regular mowing is provided without chemical treatment of grassy areas, affluence of free space for settling of the young before hibernation and regulation of predator pressure. The aim of our research was to find out the mammal diversity (rodents and carnivores) on the grassy area of M. R. Štefánik airport in Bratislava. **Methods:** M. R. Štefánik airport in Bratislava is located 9 km northeast from the city centre, 132 m a. s. l., in the Danube lowland. The grassland consists of a mosaic of grass and herbs and is regularly mowed. The airport is surrounded with agricultural land with wheat and corn production. We detected the presence of mammals by direct observation and by live trapping. During several years of ground squirrel captures with subsequent releasing to original localities of occurrence we determined 4 species of Rodentia and 3 species of Carnivora. **Results:** Concerning rodents we ascertained presence of the common hamster (*Cricetus cricetus*), common vole (*Microtus arvalis*) and in lesser frequency (rare occurrence) of the pygmy field mouse (*Apodemus uralensis*) and wood mouse (*Apodemus sylvaticus*). Carnivores are represented by the European polecat (*Mustela putorius*), steppe polecat (*Mustela eversmanni*) and the least weasel (*Mustela nivalis*). **Conclusions:** In the case of rodents the occurrence of solitarily living common hamsters with colonial ground squirrels is very remarkable. Except the social aspect both species have similar food ecology. The coexistence of two species of predators (*Mustela eversmanni* a *Mustela putorius*) from one gender is interesting. The steppe polecat is a rare and protected species of the Slovak fauna.

POPULATION GENETICS OF THE EUROPEAN GROUND SQUIRREL (*SPERMOPHILUS CITELLUS*) FROM CENTRAL AND SOUTHEASTERN EUROPE.

Ben Slimen, H.¹, Gedeon, I. C.^{2*}, Hoffmann, I.³, Suchentrunk, F.⁴

¹Laboratoire de Génétique Moléculaire, Immunologie et Biotechnologie, Université de Tunis Campus Universitaire El Manar, 2029 Tunis, Tunisia

²Dept. of Ethology, Eötvös Loránd University, Pázmány Péter sétány 1/c, 1117-Budapest, Hungary

³Inst. of Zoology, University of Vienna, Althanstr. 14, 1090 Vienna, Austria,

⁴Research Institute of Wildlife Ecology, University of Veterinary Medicine Vienna, Savoyenstrasse 1, A1160 Vienna, Austria

*csongorg@gmail.com

Aims: The European ground squirrel (EGS) is an endangered species in decline. Populations are more and more fragmented, and only a coordinated conservation effort at the European level can guarantee its long time survival. In this context data on gene pool diversity as well as gene flow between populations and possible inbreeding in local populations are of importance. **Methods:** To obtain a comprehensive picture on a larger geographic scale about population genetic parameters in EGS we screened 116 individuals from 7 local populations in Hungary, Romania, and Austria for variability at 11 microsatellite loci. **Results:** We detected a total of 64 alleles for all loci with an average of 5.82 alleles per locus and a range of 3-9. The proportion of private alleles (i.e., occurring in one population only) was 23.4%. Population-specific expected heterozygosity (0.4234-0.524) as well as allelic richness (2.412-3.462) did not vary significantly across populations, and only the Romanian population exhibited an inbreeding coefficient (f_{is} =29.14%) significantly above zero. But this reflected population sub-differentiation (“Wahlund effect”) rather than true inbreeding. An analysis of molecular variance indicated that 12.5% of the overall recovered allelic diversity was due to partitioning into the seven populations. Relative genetic differentiation was generally low to moderate but considerable for some comparisons, with F_{ST} values between 0.046 and 0.219. Coalescence theory derived maximum likelihood estimates for the current migration rates varied among pairs of populations between 0.16 and 6.624. **Conclusions:** In conclusion, central and south-eastern European ground squirrels appear genetically moderately variable in their nuclear gene pools and show in most cases still enough gene flow between populations to counteract regional erosion of genetic diversity by stochastic effects. However, mainly unidirectional reduction of gene flow between some geographically close populations suggests beginning disconnection of a meta-population structure.

TORPOR BOUTS: MOLECULAR NEUROBIOLOGY.

Boerema A.S.^{1,2}, van der Zee A.E.², Strijkstra A.M.^{1,3}

¹ Department of Chronobiology, University of Groningen, Haren, the Netherlands

² Department of Molecular Neurobiology, University of Groningen, Haren, the Netherlands

³ Department of Cell Biology, University Medical Center Groningen, Groningen, the Netherlands

A.S.Boerema@rug.nl

Introduction: Hibernation is a critical behaviour used by many mammalian species to survive harsh winter conditions. The basis of this behaviour is a physiology allowing animals to maintain life at an extremely low energy turnover. In European ground squirrels, long periods of low metabolic activity (torpor), during which animals cool down to near environmental temperatures, are interspersed with short periods of normal metabolic rate. The function of these energetically very costly euthermic phases is unclear, but it must be related to maintenance of some kind of physiological homeostasis. The brain is a critical organ in torpor regulation, the brain itself is affected by torpor. **Methods:** We examined effects of deep torpor on the state of the brain by means of tissue analysis with biochemical methods. **Results:** We found several indications for functional or neurodegenerative changes in torpor. Neuronal efficacy, as indicated by the amount of synaptic vesicles present in the hippocampus is reduced during torpor, and restored in euthermic phases. Furthermore, we found paired helical filament-like micro tubule associated protein tau hyperphosphorylation in torpor. **Conclusion:** These findings suggest that torpor induces neurophysiological 'damage', suggesting that periodic euthermic phases may be necessary for brain related repair processes. Neuronal connectivity is affected and tau hyperphosphorylation occurs, which in human brains is indicative for neurodegenerative tauopathies, such as Alzheimer's disease. Besides better understanding of limitations of hibernation, the reversal of neurophysiological damage of torpor provides a natural model system for research on neuropathologies, serving possible natural solutions for treatment.

DOES HOME-RANGE OVERLAP IN THE EUROPEAN GROUND SQUIRREL INCREASE WITH ANTHROPOGENIC ALTERATION?

Brenner M.¹, Turrini T.¹, Hoffmann I.E.¹

¹Department of Behavioural Biology, University of Vienna, Althanstraße 14, 1090 Vienna, Austria

ethologie@univie.ac.at

Aims: In Austria, the European ground squirrel inhabits the more or less cultivated landscape of the Pontic-Pannonian zone in the easternmost states of the country. Aggregations occur in nearly natural as well as in strongly altered environments. Aim of this study was to compare the space use of two selected focal populations in habitats exposed to different degrees of anthropogenic alteration, and to determine whether fragmentation and isolation influence home-range overlap. **Methods:** Individuals were live-trapped both in a nearly natural (TD, secondary steppe) and a strongly altered habitat (FB, Alfalfa meadow). After capture, squirrels were categorised (male/female, adult/yearling/juvenile), marked for observation, fitted with radio collars and released. Each individual was radio-tracked for several hours during successive days until the mean percentage home-range size began to stabilize. Coordinates of locations were obtained on a 15x15m grid, and home ranges were calculated with 100% minimum convex polygons. **Results:** In FB, an isolated habitat fragment with an area of about 6ha, each radio-tracked squirrel overlapped with ≥ 1 other individual. In TD, which is a part of >90ha steppe, home ranges were mostly discrete. When only overlapping home ranges were compared, home-range overlap proved to be larger in FB than in TD. In addition, we observed more agonistic interactions in FB than in TD. **Conclusions:** Human alteration may decrease the area of available habitat, resulting in a high degree of home-range overlap, and consequently in behavioural adaptations of European ground squirrels.

POPULATION MONITORING OF THE EUROPEAN GROUND SQUIRREL (*SPERMOPHILUS CITELLUS*, L. 1766) IN SERBIA.

Ćirović, D.¹, Ćosić N.², Penezić A.¹

¹Faculty of Biology, University of Belgrade, Studentski trg 16, 11000 Belgrade, Serbia

²Institute for Biological Research “Siniša Stanković”, Bulevar Despota Stefana 142, Belgrade, Serbia

dcirovic@bf.bio.bg.ac.yu

Aims: The European ground squirrel is a widely distributed European species. Unfortunately, disappearance and fragmentation of its habitat are the main threat factor, both in Serbia and throughout its range. Therefore it is necessary to establish population monitoring, with the goal of observation of the population conditions in this species in Serbia. **Methods:** Population monitoring of the European ground squirrel in Serbia was carried out in the period 2004-2008 at the localities: Neradin, Krušedol and Banatska Palanka. During the five-year period the abundance and density of populations were determined by census method on experimental 50x50 m sample plots. Density and abundance were determined for each studied locality during July. Ground squirrels present at the study plot were captured during a single day by pouring water down their holes. All captured individuals were kept in cages until sunset, when they were returned to the site at which they were captured. The determined abundance per plot was then recalculated for the total surface area of each habitat, resulting in the total abundance of the population. **Results:** Population density of ground squirrels showed pronounced fluctuations, from only 4 to 88 individuals/ha. The mean value of density at all three localities pooled together was 41.6 individuals/ha (Neradin 42.4 individuals/ha, Krušedol 39.2 individuals/ha and Banatska Palanka 43.2 individuals/ha). **Conclusions:** In spite of very pronounced fluctuations in population numbers of the European ground squirrel at the study sites, these populations may be described as viable, indicating that the future survival of this species in Serbia is exclusively determined by conservation of their natural habitats.

MICROSATELLITE VARIABILITY OF THE EUROPEAN GROUND SQUIRREL (*SPERMOPHILUS CITELLUS*) IN VOJVODINA, SERBIA.

Ćosić N.¹, Hulová Š.², Bryja J.³, Penezić A.⁴, Ćirović D.⁴

¹ Institute for Biological Research “Sinisa Stankovic”, Bulevar despota Stefana 142, 11000 Belgrade, Serbia

² University of South Bohemia, Faculty of Biological Sciences, Branišovská 31, České Budějovice 370 05, Czech Republic

³ Institute of Vertebrate Biology, Academy of Sciences of the Czech Republic, 675 02, Studenec 122, Czech Republic

⁴ Faculty of Biology, University of Belgrade, Studentski trg. 16, 11000 Belgrade, Serbia
nadacosic@yahoo.com

Aims: The European ground squirrel (*Spermophilus citellus*) faces the same destiny in Serbia as in other parts of its historical distribution range. Industrialization, urbanization and most of all rapid and intense development of modern agriculture have led to dramatic loss of suitable habitats, decline of population numbers and reduced range of this species in Serbia. Therefore, the current status of this species indicates a clear need to define risk factors and viability for particular populations as well as for the whole species. In this study we have used microsatellite loci to investigate the genetic population structure, degree of fragmentation and level of inbreeding in Serbian populations. **Methods:** In total 145 samples from 7 populations, from the northern part of Serbia (Vojvodina), were genotyped for 12 microsatellite loci. **Results:** We have found quite high genetic variability based on heterozygosity (mean value of $H_e=0.518$) and allelic richness (mean value of $R=4.078$). Inbreeding coefficient (F_{IS}) was quite low (ranged from -0.150 to 0.253). Mean value of $F_{ST}=0.16$ indicates strong genetic differentiation among populations. **Conclusions:** Positive correlation between genetic and geographic distance and higher values of F_{ST} indicate that there are some barriers among populations, probably originating from recent habitat fragmentation, but quite high values of H_e and low values of inbreeding indicate that the populations are still viable.

MONITORING OF THE EUROPEAN GROUND SQUIRREL (*SPERMOPHILUS CITELLUS*) IN THE CEROVÁ VRCHOVINA PROTECTED LANDSCAPE AREA IN 2001 – 2008

Ďurica M.

ObÚ Lučenec, Osloboditeľov 10, 984 01 Lučenec, Slovakia

milanlc@orangemail.sk

Aims: In 2001 – 2008 we monitored the European ground squirrel (EGS) in the Cerová vrchovina Protected Landscape Area to find out its distribution and to estimate numbers of EGS in different habitats. **Methods:** Visual observation of EGS and estimating their quantity at a unit area. This method is used only in open habitats with low vegetation cover. In places with relatively high population density this method can be replaced by its strip modification. Only the results which were obtained in the same period of year and in the same time of day are comparable. The estimate of EGS density was based on the number of burrows used (actively used burrow entrances were counted). We used this method on a sample plot of 20x20 m. **Results:** Altogether 15 localities were monitored in Cerová vrchovina in 2001 – 2008. The total EGS population in the region was estimated at about 1,500 individuals. In 2008 we noticed a growth of EGS populations at 3 localities, stagnation at 7 localities and a decline at 5 localities. **Conclusion:** EGS occurrence was verified at fifteen localities, in two cases the population of EGS is near extinction. The monitoring has proved the decline of numbers in small colonies which are greatly isolated by “ecobarriers” from other colonies and habitats suitable for settlement. Support of extensive grazing seems to be very important; a combination of sheep, goat and cattle breeding appears to provide the best conditions. Absence of grazing causes a drop of abundance or even extinction of EGS. Mowing can be used only as an additional way of area management. In Cerová vrchovina, EGS occurrence was recorded in places where the meadows are of a xerotherm character. During the monitoring in 2001 – 2008, the following negative factors were recorded: isolation of populations, absence of grazing, poaching and low public awareness.

MANAGEMENT OF GROUND SQUIRREL HABITATS IN LOWER AUSTRIA – ORIGIN, OPTIONS AND OBJECTIVES.

Enzinger K.¹, Holzer T.¹, Walder C.¹

¹Austrian League for the Conservation of Nature – Lower Austria (Naturschutzbund Niederösterreich), Alserstraße 21/1/5, 1080 Wien, Austria
karin.enzinger@naturschutzbund.at,

Aims: The European ground squirrel inhabits 5 different habitat types in Lower Austria: dry grassland, fallow land, vineyards, field boundaries and grassland strongly influenced by man. As the European Union has recently changed its policy concerning the obligatory set aside scheme in husbandry, many hectares of fallow-land habitats have been changed into cereal and oil crop fields. The aim of our work is to maintain a high amount of fallow land within the Austrian agri-environmental programme ÖPUL to safeguard this important habitat type for the ground squirrel. **Methods:** Our conservation programme is based on our mapping and on our analysis of habitat structures and endangerments of ground squirrel habitats in Lower Austria in 2005/2006. Appropriate measurements within the ÖPUL programme have been defined. Dispersal routes have been detected by mapping barriers as large rivers and lakes, forests and woodland, human settlements and highways. Finally we contacted farmers to convince them of taking part in the ÖPUL-programme. **Results:** Ground squirrels need short cut grassland to survive. Adjacent to colonies, open landscape with farmland, vineyards or meadows is important for dispersal. If the core area of a colony-site is destroyed by agricultural intensification, ground squirrels often totally disappear from the site. On the other hand, farmers accept ÖPUL measurements in many cases. **Conclusions:** Short cut fallow land is a very important habitat type for the ground squirrel but most endangered at present. Conservation actions have to focus on preservation and re-enlargement of fallow land. Only little time remains to benefit from the ÖPUL programme.

DIFFERENT SPECIES OF GROUND SQUIRRELS IN THE LENINGRAD ZOO (review).

Evdokimova S.

Leningrad zoo, Alexandrovskii park 1, 197198, St. Petersburg, Russia,
acomys@SE13723.spb.edu

The Leningrad Zoo is one of the oldest Russian zoos. It was founded in 1865. Different species of ground squirrels have been kept in the zoo since the late 1940s. Until now, there have been five marmot species (*Marmota baibacina*, *Marmota bobak*, *Marmota sibirica*, *Marmota camtschatica*, *Marmota caudata*), 9 species of sousliks (*Spermophilus citellus*, *Spermophilus undulatus*, *Spermophilus parryi*, *Spermophilus suslicus*, *Spermophilus pygmaeus*, *Spermophilus fulvus*, *Spermophilus major*, *Spermophilus erythrogegens*, *Spermophilopsis leptodactylus*) and one female of the South African ground squirrel (*Xerus inauris*). Unfortunately, ground squirrels were brought occasionally, often as personal gifts. So in some species, only one individual was present in the zoo. A single occasion of breeding of ground squirrels was recorded in *Spermophilus pygmaeus* when a pair of sousliks escaped and made a nest in ground under one of the buildings and then a young animal was caught. The highest longevity was recorded in a gray marmot (*Marmota baibacina*) male, who lived in the zoo for 9 years 10 month and 4 days and died at the age of 10 years. At present, the Leningrad Zoo keeps a pair of bobak marmots (*Marmota bobak*), a group of spotted sousliks (*Spermophilus suslicus*) (one male and two females) and a single male of the pygmy suslik (*Spermophilus pygmaeus*).

BURROW ENTRANCE ANGLE AND GRASS HEIGHT INFLUENCES REINTRODUCTION SUCCESS: THE IMPORTANCE OF RELEASE SITE PREPARATION IN EUROPEAN GROUND SQUIRREL (EGS) TRANSLOCATIONS.

Gedeon, C.¹, Boros G.¹, Németh A.¹, Váczi O.¹, Altbäcker V.¹

¹Dept. of Ethology, Eötvös Loránd University, Pázmány Péter sétány 1/c, 1117-Budapest, Hungary
csongorg@gmail.com

Aims: Conservation management techniques can fail because knowledge of a species is limited or deficient. We investigated a burrow-morphological character in and height of grass in relation to the success of a reintroduction. **Methods:** 50 cm long burrows were dug in a 4 x 4 cell square grid, in grassland. We made a systematic and even distribution of vertical – lateral burrows within the grid. The order was alternating. About 200 individuals were released in even numbers on the site. Animals were released in even distribution, and their exact number and position were recorded at time of the release. As a result of this protocol, we could have an accurate and reliable picture about all burrows, and we could count the ratio of used/ unused and vertical/ lateral burrows without significant error.

In order to see the frequency variation in the use of burrows we checked each grid-cell (1, 2, 3, 7, 37, 72 days) until hibernation. As a direct observation of the animals, we had a visual scan sampling of animals in the activity peak (9:30-11:00). **Results:** Although the first data of the reintroduction shows that animals preferred lateral burrows and unmowed grass within the grid, the difference changes with time (from 1 until 72 days). **Conclusions:** The results underline the importance of release site preparation in animal translocations. EGS has lateral and vertical burrows naturally, and the data implicate that lateral burrows are dug from the surface while vertical ones from the bottom to the surface.

NEST MATERIAL SELECTION AFFECTS NEST INSULATION QUALITY IN THE EUROPEAN GROUND SQUIRREL (*SPERMOPHILUS CITELLUS*).

Gedeon C. I.¹, Markó G.^{1*}, Németh I.¹, Nyitrai V.¹, Altbäcker V.¹

¹Department of Ethology, Eötvös Loránd University, Pázmány Péter sétány 1/c, 1117 Budapest, Hungary

*magvacska@hotmail.com

Aims: Animal nests are considered important in survival and their material may contribute to their insulation quality. We examined the nest material preference of European ground squirrels (*Spermophilus citellus*; EGS) in relation to plant availability, moisture content of the nest material, and nest insulation. **Methods:** Wild EGS nests were collected by an Olympus industrial endoscope to determine the plant species composition. On the basis of the plant availability and composition of collected nests, two species (*Festuca pseudovina* and *Bothriochloa ischaemum*) were provided for nest building to captured EGSs in a nest material choice test. In the next choice experiment we only provided the preferred species (fescue), but their moisture level was manipulated. The behavioral activity of EGSs was coded during the tests. Finally, we measured the insulation quality of intact EGS nests built from fresh, humid *Festuca* in relation to different moisture level (fresh, half-dried, dried and remoisturized). **Results:** The preference for fresh fescue could be explained by better insulation quality. Although we expected that moisture content would influence insulation negatively, our results provided strong evidence that fresh and humid nest material (fescue pieces) has a positive effect on insulation quality, probably due to the stuff nest architecture. **Conclusions:** The results gave an example on a trade off between nest material moisture and nest architecture, and how EGSs rely on its biotic environment, the fescue, which is a common grass species in the different Hungarian EGS habitats.

DO EUROPEAN GROUND SQUIRRELS IN AUSTRIA ADJUST THEIR LIFE HISTORY TO ANTHROPOGENIC INFLUENCE?

Hoffmann I. E.¹, Brenner M.¹, Turrini T.¹

¹Department of Behavioural Biology, University of Vienna, Althanstraße 14, 1090 Vienna, Austria

ilse.hoffmann@univie.ac.at

Aims: While the European ground squirrel in Austria is sometimes near to extinction in its natural habitat, aggregations in altered habitats often achieve exceptional densities. In an effort to clarify this phenomenon, we compared demographic and life-history variations of five focal populations exposed to different environmental conditions. The respective habitat types were: secondary steppe, semi-arid grassland, a meadow renaturated from arable land, a wine-growing area, and a meadow altered by alfalfa. The study plots also differed in the degree of inclination, fragmentation and isolation. **Methods:** Populations have been examined since 2006 by capture-mark-recapture and observation. At initial capture, each ground squirrel was categorised (sex, age, reproductive state), equipped with a PIT tag, and marked with hair dye. Body mass, condylobasal length and reproductive state were recorded continuously. **Results:** Nonjuvenile population densities ranged between 15 and 39 individuals/ha, and seemed to increase with anthropogenic influence, whereas sex ratios varied inconsistently among study plots. Each focal population contained reproductive yearling males. Their highest and lowest percentages, respectively, occurred on the alfalfa meadow (83%) and in the vineyards (40%), indicating that habitat alteration might either delay or accelerate puberty. **Conclusions:** Anthropogenic influence may have beneficial effects on European ground squirrels in terms of population growth. However, this conclusion is ambiguous on short terms. Thorough analyses of our data set will provide information not only on the species' habitat requirements, but also on the artificial constraints it is yet able to cope with.

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EFFECT OF HABITAT FRAGMENTATION ON NEUTRAL AND ADAPTIVE POPULATION GENETIC STRUCTURE IN THE EUROPEAN GROUND SQUIRREL IN CENTRAL EUROPE.

Hulová Š.^{1,5,4}, Bryja J.^{2,3}, Ďureje L.², Galan M.³, Cosson J-F.³, Gedeon C.⁶, Sedláček F.^{1,4}

¹University of South Bohemia, Branišovská 31, České Budějovice, Czech Republic

²Department of Population Biology, Institute of Vertebrate Biology AS CR, Studenec 122; Czech Republic

³Centre de Biologie et Gestion des Populations, Montferrier sur Lez, France

⁴Institute of Systems Biology and Ecology AS CR, Na Sádkách 7, České Budějovice, Czech Republic

⁵Institute of Animal Physiology and Genetics, AS CR, Rumburská 89, Liběchov; Czech Republic

⁶Department of Ethology, Eötvös Loránd University, Budapest, Pázmány Péter sétány, Hungary

spenky@seznam.cz

Aims: (I) To estimate genetic structure of the bottlenecked populations of the European ground squirrel (EGS) on the margin of its distribution in the Czech Republic. (II) To compare genetic structure and variability of the heavily fragmented Czech populations with populations from Slovakia, Hungary and Romania, areas with more abundant populations where metapopulation structure still exists. **Methods:** We investigated the population genetic structure of EGS by analysing neutral and adaptive variation at 12 microsatellite loci and two immune genes (DRB, DQB) of the major histocompatibility complex (MHC) for a total of 470 samples of the EGS. **Results:** We have found very low polymorphism at both MHC genes. The mean expected heterozygosity for the two MHC loci was very low in Czech populations ($H_e=0.156$) compared with populations from Slovakia ($H_e=0.503$), Hungary ($H_e=0.428$) and Romania ($H_e=0.524$). In the 12 studied microsatellite loci we have found very similar results as in the MHC genes. The mean microsatellite heterozygosity in Czech populations was $H_e=0.23$, in Slovak populations $H_e=0.39$, in Hungarian populations $H_e=0.41$, and in Romanian populations $H_e=0.61$. High values of F_{st} showed that the populations are isolated and genetically differentiated in Slovakia (mean value of F_{st} is 0.19) and in the Czech Republic (mean value of F_{st} is 0.16). Lower values were found in populations from Hungary and Romania. **Conclusions:** The Czech populations probably went through serious bottlenecks and the populations would profit from introductions of unrelated individuals from other parts of its Central European distribution. Disappearance and low viability of the Czech populations may be caused by inbreeding depression (F_{is} ranged from 0.27 to 0.91) as a consequence of low effective population sizes and decreased genetic variation.

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RANGE WIDE PHYLOGEOGRAPHY OF THE EUROPEAN GROUND SQUIRREL BASED ON NUCLEAR AND MTDNA MARKERS.

Hulová Š.^{1,4,6}, Koshev Y.², Ćosic N.³, Ćirovic D.³, Sedláček F.^{1,6}, Bryja J.⁵

¹University of South Bohemia, Branišovská 31, České Budějovice, Czech Republic

²Institute of Zoology, Bulgarian Academy of Science 1, Tzar Osoboditel, blvd.1000 Sofia, Bulgaria

³Faculty of Biology, Institute of Zoology, University of Belgrade, Studentski trg 16, 11000, Belgrade, Serbia

⁴Institute of Animal Physiology and Genetics, AS CR, Rumburská 89, Liběchov, Czech Republic

⁵Department of Population Biology, Institute of Vertebrate Biology AS CR, Studenec 122, Czech Republic

⁶Institute of Systems Biology and Ecology AS CR, Na Sádkách 7, České Budějovice, Czech Republic

spenky@seznam.cz

Aims: The European ground squirrel (EGS) is considered an endangered species in Central Europe. This study aims to elucidate (i) genetic structure of its populations across the whole distribution range; (ii) state of the Central-European populations in a phylogenetic context; and (iii) conservation priorities in Central Europe. **Methods:** Twelve microsatellite loci were analysed using a total of 769 samples from different sites across the EGS distribution range and a subset was analysed for mtDNA (cytochrome *b*) as well. **Results:** The reconstructed ancestral area of the species is the European part of Turkey plus Bulgaria and Romania along the Black Sea. Three separate genetic lineages were found, which colonised Central Europe, Romania plus Moldavia, and Greece plus Macedonia, respectively. The populations in Central Europe have very low genetic variability of mtDNA. The probable reason is a bottleneck following migration through the narrow Danube valley. Microsatellite data showed a north to south pattern of increasing genetic variability. The populations in Central Europe have a reduced genetic variability in these markers as well, and show a higher level of inbreeding. Czech populations are the most isolated, while gene flow probably still exists between Slovak and Hungarian populations. **Conclusions:** Populations of EGS in Central Europe belong to a highly uniform lineage which is also the youngest of the main lineages of EGS. The lowest genetic variability is supported by both genetic markers, i.e. mtDNA and microsatellite loci. Transfers and reintroductions aimed at increasing genetic variability of the Central European populations are possible since all these populations represent one phylogenetic lineage.

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FEMALE KIN STRUCTURE IN A COLONY OF THE LONG-TEETH GROUND SQUIRREL (*SPERMOPHILUS FULVUS*).

Kochetkova A.A.¹, Vasilieva N.A.², Tchabovsky A.V.²

¹ Department of Biology, Moscow State University, Moscow, Russia

² A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia

nava-nava@yandex.ru

Aim: Colonies of social ground squirrels are based on matrilineal structure. In contrast to social ground squirrels little is known about kin structure in solitary species. We studied female kin structure in solitary *Spermophilus fulvus*. **Methods:** In 2002-2007 we determined maternity for every litter in a colony of squirrels in Saratovskaya oblast', Russia. We marked pups immediately after emergence before the litters mingled or dispersed. Since young females usually settled within the colony, we could follow the breeding history for the majority of locally born females. Based on pedigrees we produced matrices of relatedness among adult females for each year. We estimated spatial distribution of the squirrels by everyday scanning of the colony and locating individually colored animals. **Results:** 72% of females had ≥ 1 and 51% had ≥ 4 female kin in the colony. Distribution of coefficients of relatedness (r) was bimodal with peaks at 0.5 (41-43% in various years) and 0.125 (25-22%) with dominant frequencies of "mother-daughter" (19-29%), "aunt-niece" (23-19%), and "sister-sister" (22-14%) kinship. Overall degree of relatedness (R , sum of r for each female), as well as reproductive success (R_d , sum of r in descending generations for 3-year old females) varied strongly among females (range: 0-4.125 and 0-3.0, respectively). On average females produced $R_d=1$ at age of 5 (range: 0.375-2.25), close to maximum lifespan. Female kin aggregated in space; distance among centers of activity correlated negatively with r . **Conclusions:** Colonies of solitary *S. fulvus* show matrilineal structure and high degree of kinship similar to those of social ground squirrels.

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EUROPEAN GROUND SQUIRREL (*SPERMOPHILUS CITELLUS*) IN BULGARIA - DISTRIBUTION, RECENT STATUS AND CONSERVATION PROJECTS.

Koshev Y.

Institute of Zoology, Bulgarian Academy of Science, 1 Tzar Osvoboditel Blvd., Sofia, Bulgaria
bgsouslik@gmail.com

Aims: Bulgaria is situated in the southern part of the European ground squirrel range. EGS (*Spermophilus citellus*) occurs at the altitude of up to 2500 m. There is a great number of localities in the country differing by their habitat characteristics, where the EGS has been observed. In different years, status and distribution of the species in Bulgaria differed, depending on numerous factors. The aim of our study was to describe the distribution of the species in the past and nowadays, its recent status and current conservation projects. **Methods:** The distribution over the last 75 years was mapped using own and literature data. Past and present threats were traced and described. **Results:** In Bulgaria there was no systematic investigation of distribution of the species before 1990, thus its status and distribution remained obscure. Since 1990 as a result of the many conservation projects carried out by the newly created NGOs, objective data have been collected. At present there are about 300 colonies of different size and density in the country. The most important threats recorded after 1990 differ from the past ones. **Conclusions:** The present status of the species in Bulgaria is relatively satisfying, except for several regions with restricted distribution and decreasing numbers. It is necessary to assign a higher conservation status to this species and to increase the efforts of its protection.

This study is partly supported by the National Science Found (Bulgaria) and the World Federation of Scientists.

ENDOPARASITES OF EUROPEAN GROUND SQUIRRELS (*SPERMOPHILUS CITELLUS*) IN THE CZECH REPUBLIC AND SLOVAKIA.Kvičerová J. ^{1,2}

¹ Biological Centre, Institute of Parasitology, Academy of Sciences of the Czech Republic, Branišovská 31, 370 05 České Budějovice, Czech Republic

² Faculty of Science, University of South Bohemia, Branišovská 31, 370 05 České Budějovice, Czech Republic

janaq@paru.cas.cz

Aims and methods: During 2006-2008, fresh faecal samples of European ground squirrels (*Spermophilus citellus*) from all available localities in the Czech Republic and several localities in Slovakia were collected and preserved in 2.5% K₂Cr₂O₇ solution. Faeces were examined for the presence of endoparasites. **Results and conclusions:** Oocysts of the genus *Eimeria* (Apicomplexa: Eimeriorina: Eimeriidae) were found in all examined samples (prevalence 100%). Three different *Eimeria* species were recorded. Mixed infections with these species often occurred. Furthermore, *Trichuris* eggs (Nematoda: Enoplida) and oocysts of pseudoparasites of the genus *Adelina* were found in some samples. Stains for *Cryptosporidium* were negative in all samples.

This study was supported by project VaV No. SP/2d4/61/08.

SOCIAL INTERACTIONS, PREHIBERNATION FATTENING AND ADRENAL ACTIVITY IN JUVENILE EUROPEAN GROUND SQUIRRELS (*SPERMOPHILUS CITELLUS*).Mascher E.¹, Strauss A.¹, Millesi E.¹¹Department of Behavioural Biology, University of Vienna, Althanstrasse 14, 1090 Vienna, Austriaelvira.mascher@yahoo.com

Aims: European ground squirrels are obligate hibernators with a distinctive endogenous annual cycle. Juveniles are born in early May, emerge at about 4 weeks of age and enter hibernation in early October. During the limited active season juveniles have to grow, construct suitable hibernacula and store body fat to survive over winter. Leaving the natal burrow after weaning, digging an own one and defending it against conspecifics could cause high stress levels in the ground squirrels. We investigated relationships between faecal cortisol metabolites (FCM), growth rate, body mass changes, activity levels and social interactions. **Methods:** Juvenile ground squirrels were monitored from natal emergence until hibernation in semi-natural outdoor enclosures. Body weight and head length were measured in weekly intervals and faecal samples were collected at capture. Behaviour was observed throughout the active season. Three phases of juvenile development were compared. Phase 1 (age 6-11 weeks) lasted until all animals were weaned. In phase 2 (age 12-17 weeks) juveniles had left the natal burrow and were digging and defending their own hibernaculum. In phase 3 (age 18-20 weeks) prehibernation fattening occurred. **Results:** Activity levels were high in the first two phases and decreased in the last weeks before hibernation. Sociopositive interactions were frequently observed in phase 1 and decreased thereafter. Aggressive encounters peaked during phase 2 and were rarely observed in phase 3, particularly in males. FCM levels were baseline in both sexes from natal emergence until an age of about 14 weeks. Thereafter, cortisol excretion increased significantly and remained elevated until hibernation. We found no significant relationships among activity levels, sociopositive and aggressive interactions and FCMs. However, the period of elevated FCM levels coincided with the termination of structural growth and the onset of fattening. **Conclusions:** Our results do not support the hypothesis that the increased adrenal activity in the late part of the active season is related to high locomotor activity or aggressive interactions. We suggest that elevated cortisol secretion may positively affect prehibernation fattening, after the termination of structural growth.

ECOLOGICAL STUDY OF A RELICT POPULATION OF THE EUROPEAN GROUND SQUIRREL.

Matějů J.

Department of Zoology, Faculty of Science, Charles University, Viničná 7, Prague, Czech Republic

Agency for Nature Conservation and Landscape Protection of the CR, Bezručova 8, Karlovy Vary, Czech Republic

honzamateju@seznam.cz

Aims: The European ground squirrel (*Spermophilus citellus*) is a critically endangered species of the Czech fauna. The recent population is estimated at about 3,000 individuals living in 35 mostly highly isolated populations. The aim of the study was to identify basic ecological and demographic characteristics of a long-term isolated European ground squirrel population living on the periphery of its distribution range. **Methods:** The study was carried out at the westernmost place of the European ground squirrel occurrence – a golf course near Karlovy Vary, in 2002-2004. The fieldwork was restricted to an approximately 2.5 ha site in the central part of the locality. The animals were studied using the standard capture-mark-recapture method and observation. Micro-tags were used for permanent marking. When the captured animals were identified or marked, body mass and the place of their capture were recorded. Home range size was calculated using the method of maximum convex polygon. **Results:** The early summer density varied strongly among the years from 4 to 18 individuals per 1ha. The sex ratio varied between 0.5:1 and 1.6:1 (male per female) in adults and between 1:1 and 1.5:1 in juveniles. The observed mortality in adults was 30 % between the seasons 2002 and 2003, and 80 % between 2003 and 2004, that in juveniles was 85.7 % and 95.5 %, respectively. Only a low level of mortality (max. 18.2 %; in juvenile males) was observed during the active season. Both at emergence and before immergence, adult males were significantly heavier ($U = 0.14$; $p < 0.05$ and $U = 5.0$; $p < 0.001$, respectively) than adult females (emergence: males mean 312 g, $n = 8$; females mean 239 g, $n = 12$; immergence: males mean 440 g, $n = 11$; females mean 311 g, $n = 11$). Before immergence, juvenile males were significantly heavier than juvenile females ($U = 102.0$; $p < 0.05$). The home range size varied from 2577 to 5308 m² in adult males and from 1338 to 3234 m² in adult females. **Conclusion:** Abundance, sex ratio and mortality in the isolated population varied considerably among years, but they stayed within the range reported from other sites. High rate of mortality between the seasons 2003 and 2004 was probably exceptional and was caused by rapid snow melting and consequent flooding of some ground squirrel burrows. Higher body mass of individuals from the studied population compared to those reported from other parts of the species distribution range may be explained by the Bergmann's rule.

CURRENT DISTRIBUTION OF THE EUROPEAN GROUND SQUIRREL (*SPERMOPHILUS CITELLUS*) IN THE CZECH REPUBLIC AND RELATION TO ENVIRONMENTAL FACTORS.

Matějů J.^{1,2}, Nová P.¹, Uhlíková J.³

¹Department of Zoology, Faculty of Science, Charles University, Viničná 7, Prague, Czech Republic

²Agency for Nature Conservation and Landscape Protection of the Czech Republic, Bezručova 8, Karlovy Vary, Czech Republic

³Agency for Nature Conservation and Landscape Protection of the Czech Republic, Nuselská 39, Prague, Czech Republic

honzamateju@seznam.cz

Aims: The area of distribution of the European ground squirrel (EGS) in the Czech Republic decreased dramatically during the second half of the 20th century and the EGS became a critically endangered species. The aim of this study was to summarise detailed knowledge on the EGS distribution in the Czech Republic and to investigate its relation to some environmental factors. **Methods:** Occurrence of the EGS was mapped throughout the country in 2003-2008 and the actual area used by each colony in the particular season was marked on a map. The ArcGIS 9.2 program was used for the analyses of maps and environmental factors. **Results:** In 2008, the occurrence of the EGS was reported from 35 sites. The mean area of a EGS colony (area with EGS burrows) was 11.2 ha (range 0,06 – 52,0 ha). The average altitude of localities with EGS occurrence was 317 m (range 155 – 648 m), 60% of them being situated under 300 m a. s. l. The location of EGS colonies in relation to climate and soil type is significantly non-random ($X^2 = 11505944.0$; $p < 0.000001$ and $X^2 = 8664162.0$; $p < 0.000001$, respectively). EGS colonies are found mostly in the warm climatic zones and in areas with specific soil types, particularly molisol (i. e., black soil). More than 90% of EGS colonies are located in areas affected by high anthropogenic pressure (airports 43%, vineyards and gardens 20%, camping sites and sport areas 11%, and mowed meadows and pastures 17%). Only 3 (9%) colonies are found in natural steppe habitats. **Conclusions:** The current distribution of the European ground squirrel in the Czech Republic is highly fragmented and has a relict character. In spite of this, an effect of environmental factors on the EGS distribution could be observed. Majority of the EGS populations are found in man-made habitats in lowlands with mild climate conditions and specific soil types.

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THE CUES TO INDIVIDUALITY, SEX AND AGE IN ALARM CALLS OF THE SPECKLED GROUND SQUIRREL *SPERMOPHILUS SUSLICUS*.

Matrosova V.A.¹, Volodin I.A.^{1,2}, Volodina E.V.²

¹Department of Vertebrate Zoology, Faculty of Biology, Lomonosov Moscow State University, Vorobiev Gory, Moscow, 119991, Russia

²Scientific Research Department, Moscow Zoo, B. Gruzinskaya, 1, Moscow, 123242, Russia
matrosova_zoo@mail.ru

Aims: Ground-dwelling sciurids, diurnal and inhabiting open areas, represent an ideal model to study the adaptive significance of the alarm call. The main function of alarm call is warning conspecifics, but it can bear concomitant information about sex, age and identity of the caller. The aim of this study was to investigate the intraspecific variability of alarm calls in the speckled ground squirrel to estimate their potential for establishing personalized social relations in this species. **Methods:** The alarm calls were recorded in the natural colony of the speckled ground squirrels in spring-summer 2003-2006 in the Moscow region, Russia, from 96 marked individuals, captured singly in live-traps and calling toward a human. We analyzed 949 calls (up to 10 per individual) from 52 adult (26 males, 26 females) and 44 juveniles (23 males, 21 females). **Results:** Discriminant analysis correctly assigned 56% calls to sex (for adults 66%, for juveniles 74%), 74% calls to age (for males 74%, for females 81%), and 76% calls to individual (for adults 81%, for juveniles 82%, for males 79%, for females 83%). All the assignment values were higher than the random value, but the assignment to individual exceeded it 10 times, whereas the assignment to age and sex were close to the random values. **Conclusions:** The found weak cues to age and individuality, integrated with previous data about instability of cues to individuality in the speckled ground squirrel's alarm calls suggest the lack of selection pressure toward the prolonged personal interrelationships in this species.

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PRE-HIBERNATION FATTENING AND OVARIAN ACTIVITY IN BREEDING AND NON-BREEDING EUROPEAN GROUND SQUIRRELS.

Millesi E.¹, Divjak A.¹, Strauss A.¹

¹Department of Behavioural Biology, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria

eva.millesi@univie.ac.at

Aims: In this study we compared the course of prehibernation fattening, hibernation onset and duration in reproductive and non-reproductive female ground squirrels. Previous studies have demonstrated that female European ground squirrels enter a second oestrus cycle after weaning, including a spontaneous ovulation and an active luteal phase. Therefore, potential relationships between oestradiol and progesterone secretion and prehibernation fattening were investigated. **Methods:** The ground squirrels were born and kept in semi-natural conditions in outdoor enclosures. One group of females could mate and the other had no access to males. Females were captured in weekly intervals, weighed and their reproductive status was determined. Vaginal smears and blood samples were taken at capture. **Results:** The course and extent of fattening were similar in both groups. In non-reproductive females, however, fattening started earlier and the females entered hibernation 4-6 weeks earlier than the individuals that had lactated. Accordingly, non-breeding females hibernated longer than reproductive ones. In both groups the onset of fattening coincided with peak progesterone levels but continued when luteolysis had already started. Mass increase rates were positively related to progesterone levels during fattening in breeding females. Oestradiol levels were elevated during fattening in all individuals. **Conclusions:** In general, our results demonstrate that the lack of reproductive effort in female ground squirrels led to a shift in the seasonal timing of fattening and earlier immergence into hibernation. Elevated progesterone and estrogen levels during summer may facilitate fattening in female *Spermophilus citellus*.

AIR-CONDITIONED HIBERNATION.

Németh I^{1,2}, Szabó É¹, Altbäcker V¹.

¹Department of Ethology, Institute of Biology, Eötvös Loránd University; Pázmány Péter sétány 1/C, Budapest XI, Hungary

²Department of Drug Metabolism and Pharmacokinetics, Gedeon Richter Plc. Gyömrői út 19-21, Budapest X, Hungary

furgeur@gmail.com

Aims: The effect of climate change on viability of hibernating animals is a preferred topic in climate change researches. The obvious point is hibernation itself. It seems that hibernation makes hibernating species defenceless against climatic effects. These assumptions were confirmed by many eco-physiological models. **Methods:** To test the predictions of the eco-physiological model for the European ground squirrel we used our former results of lab hibernation experiments and the field data from our study site in the extraordinary winter of 2006-07. **Results:** The results of lab experiments confirmed the prognoses of the model that elevated ambient/environment temperature might cause loss in overwinter survival and/or decreased reproductive abilities. **Conclusions:** Results of field observations emphasise that we have to interpret carefully the results of lab and model systems although they support each other.

**THE SPECKLED GROUND SQUIRREL (*SPERMOPHILUS SUSLICUS* GÜLDENSTAEDT, 1770):
CURRENT STATUS, DYNAMICS, CONSERVATION.**

Shekarova O.N.

A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences,
Leninskiy prospect 33 Moscow, 119071, Russia
shekar@mail.ru

Aims: To study current status and dynamics of the speckled ground squirrel, we observed five sites of the northern subspecies *S. s. guttatus* (2n=34) in the Zaraisk district, Moscow region. **Methods:** Counting of dwelling burrows on constant line tracks and geobotanic description. **Results:** Most habitats of this species are used as pastures. Significant decline of the species began in the second half of the 20th century and the process was most intensive in the nineties (SHEKAROVA et al., 2003). The species is included in the IUCN Red List as “Vulnerable”, and in regional Red Books (SHEKAROVA et al, 2006, IUCN Red List, 2007). The sites in the Zaraisk district are compact (0,5-120 ha) and isolated. In 1999 all sites were inhabited. Then two of them have disappeared. Significant parts of the sites were ploughed up and built up at the end of the last century. Both places are very actively used as a pasture. The vegetation has undergone succession changes. The other two sites were small and were not used as pastures, with the burrow density of 124 ± 27 and 90 ± 24 burrows/ha. Flora and phytocenosis fluctuations are moderate. The largest site in the floodplain of the Osetr river is the most stable, burrow density reaching 237 ± 51 burrows/ha. This place is used as a pasture and mowed meadow. **Conclusions:** Decline of *S. s. guttatus* has been continuing. Not only ploughing up and building up of the grasslands but also significant excessive pasture is among the anthropogenic factors, negatively affecting numbers of this species. (SHEKAROVA et al., 2008).

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STRUCTURE AND VARIABILITY OF ALARM CALLS IN THE EUROPEAN GROUND SQUIRREL (*SPERMOPHILUS CITELLUS*).

Schneiderová I.

Department of Zoology, Faculty of Science, Charles University, Viničná 7, Prague,
Czech Republic
fieldy@centrum.cz

Aims: Ground squirrels, including the European souslik (*Spermophilus citellus*), emit acoustic alarm calls in presence of predators. The alarm calls of some species of the genus *Spermophilus* are relatively well studied, but this is not true in the case of the European souslik. The aim of this study is to describe structure and variability of alarm calls in this species. **Methods:** Alarm calls of 15 different individuals were recorded on the locality Letňany, Praha, Czech Republic. The calls were recorded using an unidirectional microphone Audio-Technica ATR55 Telemike and SONY MZ-RH10 digital recorder. The recorded alarm calls were emitted by ground squirrels sitting in their burrows and watching a person sitting next to their burrows. The calls were visualized and analyzed using Avisoft SASLab Pro 4.38 and spectrograms with the following parameter settings: hamming window, FFT-length 512, frame size 50%, overlap 93,75%. **Results:** The mean duration of alarm calls was 96.75 ms and they were repeated with the interval from 2.77 to 39.49 s (mean 9.22 s). The alarm calls consisted of two different elements, which could be fused, overlapped in time or separated by maximum interval of 50.7 ms. In several cases, one of these elements was missing too. The mean duration was 66.69 ms for the first element and 38.55 for the second one. The main frequencies of the elements were 8 and 12 kHz. There was no frequency modulation in the first element and a small one in the second element. The harmonics were present in both elements. **Conclusions:** The study describes structure and variability of alarm calls of 15 individuals of the European ground squirrel and there is an indication that these alarm calls are individually distinct.

EUROPEAN GROUND SQUIRREL HIBERNATION: FUNCTION, BEHAVIOUR, NEUROPHYSIOLOGY
(review).

Strijkstra A.M.^{1,2}, Hut A.R.¹, Daan S.¹

¹ Department of Chronobiology, University of Groningen, Haren, the Netherlands

² Department of Cell Biology, University Medical Center Groningen, Groningen, the Netherlands

A.M.Strijkstra@rug.nl

Hibernation is a critically important behaviour serving survival. In European ground squirrels, hibernation elongates life span, both by high survival rates and increased longevity. However, all behaviours have costs as well as benefits. In European ground squirrels, hibernation impinges on reproduction, affects behavioural function (memory performance, circadian organization), and has consequences for brain function and integrity (neuronal connectivity, neurodegeneration). All of these effects are reversed, some of these in energetically expensive and crucial euthermic phases during hibernation. In this paper, function, behaviour and neurophysiology of European ground squirrel torpor and euthermic phases are presented and discussed. Hibernation is an expensive behaviour, and euthermic phases are the most costly items. Function of euthermic phases is unproven, but likely to be associated with brain repair.

HOME RANGES OF EUROPEAN GROUND SQUIRRELS DIFFER ACCORDING TO SEX, AGE AND HABITAT ALTERATION.

Turrini T.¹, Brenner M.¹, Hoffmann I.E.¹, Millesi E.¹

¹Department of Behavioural Biology, University of Vienna, Althanstrasse 14, 1090 Vienna, Austria

tabea.turrini@gmx.at

Aims: Aim of our study was to specify sex and age differences in home-range sizes of European ground squirrels, and to determine how habitat alteration and population density affects their movement patterns. **Methods:** We radio-collared comparable numbers of individuals in two different study sites, a highly altered one (FB) and one with relatively low anthropogenic influence and habitat fragmentation (TD). Subsequently, movements were recorded during approximately one week. **Results:** Home ranges of ≥ 1 year-old males were larger than those of females at both sites, and exhibited high intrasexual variation in TD. In the nearly natural habitat, where population density was relatively low, home ranges were larger than in the altered habitat. In TD, one yearling male even moved > 600 m. In juveniles, we observed long-distance movements in both sexes. In FB, individual juveniles utilized more space than older ground squirrels. The opposite was true for TD, where juvenile movements were shorter than those of older individuals, and often directed towards a nearby grain field. **Conclusions:** We conclude that spacing behaviour in males during the mating period is aimed at contacting as many females as possible as often as possible (scramble-competition polygyny). Thus, long-distance movements were more pronounced at low population density, where males had to cover larger home ranges to find numbers of females comparable to high-density conditions. Juveniles, however, benefit from selective foraging to promote growth and fattening, and thus, additional food resources may motivate them to forage outside their natal home ranges.

ACTION PLAN FOR THE EUROPEAN GROUND SQUIRREL IN THE CZECH REPUBLIC.

Uhlíková J. ¹, Nová P. ², Matějů J. ^{1,3}

¹Agency for Nature Conservation and Landscape Protection of the Czech Republic, Nuselská 39, Prague, Czech Republic

²Department of Zoology, Faculty of Science, Charles University, Viničná 7, Prague, Czech Republic

³Agency for Nature Conservation and Landscape Protection of the Czech Republic, Bezručova 8, Karlovy Vary, Czech Republic

jitka.uhlikova@nature.cz

Aims: During the first half of the 20th century, the European ground squirrel (*Spermophilus citellus*) was a common species in farmland areas of the Czech Republic. After significant changes in agricultural management in the 1950s and 1960s, when most of its habitat was destroyed, numbers of the European ground squirrel (EGS) dramatically decreased and the area of its distribution became fragmented. In 2002, there were only 26 known localities of its occurrence and EGS was classified as one of the most endangered mammals in the Czech Republic. The main aim of the Action plan is to ensure long-term survival of the EGS as a wild species in the Czech Republic. **Methods:** The Action plan was prepared during the years 2005 and 2006 in a form of a review compiling all relevant published information about EGS and the personal authors' experience. The review was focused on identification and evaluation of the main reasons for EGS decline and finding their possible solutions. **Results:** Six factors were identified to be the most severe threats for the species' existence: habitat loss due to the destruction of sites as well as absence of management of the vegetation cover, meteorological events such as torrential rain or rapid snow melting, inbreeding caused by isolation of individual populations, predators and parasites. Six objectives were identified for the first stage of the Action plan: to provide regular management of the sites of EGS occurrence and regular monitoring of EGS populations, to prepare a catalogue of sites suitable for future EGS reintroduction, to test and establish captive breeding of the species, to study the EGS demography, ecology and genetics to improve the knowledge of its bionomics, and to increase the public awareness of the species' protection needs. Existence of five wild living metapopulations of the European ground squirrel with the abundance of more than 2,500 individuals each was identified as the final goal of the Action plan. **Conclusions:** In 2008, the Action plan was adopted by the Ministry of Environment of the Czech Republic and its implementation has started.

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NATION-WIDE MONITORING OF EUROPEAN GROUND SQUIRRELS (*SPERMOPHILUS CITELLUS*) IN HUNGARY.

Váczi, O.¹, Bakó, B.¹, Gedeon, C.², Altbäcker, V.²

¹Hungarian Ministry of Environment and Water; Fő u. 44-50. 1011 Budapest, Hungary

²Department of Ethology, Eötvös Loránd University, Budapest, Hungary
volivoli@gmail.com

Aims: Since the middle of the 20th century the Hungarian EGS population has dramatically decreased as a consequence of the loss of suitable habitats. Based on a country-wide survey of the species, a monitoring programme was developed as a part of the Hungarian Biodiversity Monitoring System (HBMS) in 2000. The main aim of the programme is the early detection of further changes in population quantity and quality. As an additional method, Internet-based survey was tested on the Red Squirrel (*Sciurus vulgaris*), for further localization of unknown EGS populations. **Methods:** Surveys of the national monitoring programme (HBMS) are based on simultaneous volunteer actions organised yearly in the week of Earth Day since 2000. The relative estimation is realized by burrow entrance counting according to a rigorous estimation protocol. As a test phase, on-line data sheets on Red Squirrel occurrence can be filled out at www.mokusleso.net. **Results:** The data of the EGS programme clearly show that no drastic change has been observed in the Hungarian population, however, ground squirrels have disappeared from certain localities in the past few years. Additional results indicate the effects of background variables on density of EGS. **Conclusions:** The HBMS EGS monitoring programme provides valuable long-term basic data but it needs to be extended at least in two ways: exploring unknown EGS populations e.g. by an on-line survey and expanding spatial coverage to involve international participants in the monitoring system.

DENSITY OF JUVENILES AND SYNCHRONIZATION OF THEIR FIRST EMERGENCE INFLUENCE JUVENILE SURVIVAL IN THE LONG-TEETH GROUND SQUIRREL (*SPERMOPHILUS FULVUS*).

Vasilieva N.A.¹, Savinetskaya L.E.¹, Vasiliev N.S.², Popov V.S.², Tchabovsky A.V.¹

¹A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia

²Department of Biology, Moscow State University, Moscow, Russia
ninavasilieva@gmail.com

Aim: Group-living is assumed to have costs and benefits for an individual, and optimal group size results from the cost/benefit balance. Juveniles of ground squirrels are especially vulnerable to predation at their first emergence. Spatial clustering of litters combined with synchronization of their emergence may be beneficial to juveniles via group-size effect on one hand, and incur costs associated with high attractiveness to predators or food shortage, on the other hand. We analyzed the effect of spatio-temporal distribution of young long-teeth ground squirrels on their survival rate. **Methods:** We studied permanently marked squirrels in Saratovskaya oblast', Russia, in 2004-2005. For every litter (n=67) we estimated the number of juveniles that emerged closer than 100 m from the litter's natal burrow and within ± 2 days from the date of the litter's emergence, as well as the percentage of young in the litter that were still alive after 2 weeks after emergence (before dispersal starts) and the number of dead juveniles. **Results:** The correlation between local density of synchronously emerging juveniles and their survival was linear and negative: the more juveniles emerged around the litter, the smaller was the percentage of surviving juveniles ($r_s = -0.33$, $p = 0.006$) and the greater was the number of dead juveniles in the litter ($r_s = 0.48$, $p < 0.0001$). **Conclusions:** Aggregation and synchronization of emergence of juvenile long-teeth ground squirrels had negative effect on their survival. Newly-emerged juveniles in aggregations may attract predators and suffer higher predation (in particular, cats killed many young).

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TO LIVE IN CROWD – TO CALL HIGHER? TESTING THE “ACTIVE SPACE” HYPOTHESIS FOR THE SPECKLED GROUND SQUIRREL *SPERMOPHILUS SUSLICUS*.

Volodin I.A.^{1,2}, Volodina E.V.², Matrosova V.A.¹, Savinetskaya L.E.³, Schekarova O.N.³, Voytsik V.A.¹

¹Department of Vertebrate Zoology, Faculty of Biology, Lomonosov Moscow State University, Vorobiev Gory, Moscow, 119991, Russia

²Scientific Research Department, Moscow Zoo, B. Gruzinskaya, 1, Moscow, 123242, Russia

³Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Leninski pr., 33, Moscow, 119071, Russia

volodinsvoc@yahoo.com

Aims: For colonial mammals, the “active space” hypothesis predicts higher-frequency alarm calls at higher population densities. The high-frequency sounds propagate at shorter distances compared to the low-frequency calls, so they are less audible for predators but still reach the warned conspecifics at close distances, occurring at high population densities. In a natural colony of the speckled ground squirrel, we investigated the relations between the alarm call fundamental frequency and population density. **Methods:** The alarm calls were recorded on a 0.5 ha study plot in the Moscow region, Russia in spring-summer 2003-2005, from 28 marked individuals, captured singly in live-traps and calling toward a human. To characterize population density, we used the total number of adults captured per year at the study plot, and minimum distances between centers of individual territories, calculated for 52 animals in 2003, 44 animals in 2004 and 23 animals in 2005. **Results:** During the three successive study years, the population density decreased from 300 to 100 individuals per hectare, whereas the distance between the nearest neighbors increased correspondingly from 6.1 to 10.2 m. However, the alarm call fundamental frequency did not show the expected decrease with the increasing distance between neighbors. **Conclusions:** These data do not support the “active space” hypothesis, suggesting that the speckled ground squirrels do not use the mechanism, lowering the predation risk for the account of manipulation of the call pitch depending on the distance to the nearest conspecific neighbors.

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ALARM CALLS ARE NOT SIMILAR WITHIN MOTHER-DAUGHTER DYADS OF THE YELLOW GROUND SQUIRREL *SPERMOPHILUS FULVUS*.

Volodina E.V.¹, Matrosova V.A.², Volodin I.A.^{1,2}

¹Scientific Research Department, Moscow Zoo, B. Gruzinskaya, 1, Moscow, 123242, Russia

²Department of Vertebrate Zoology, Faculty of Biology, Lomonosov Moscow State University, Vorobiev Gory, Moscow, 119991, Russia

volodinsvoc@yahoo.com

Aims: Young female yellow ground squirrels remain at close vicinity to their mother burrow, forming cohesive natal groups of breeding females with matriarchal social relations. Whereas the primary function of alarm calls is warning closely related kin about predator presence, we expected to find some similar features in alarm calls of mothers and their daughters, as signs of matrilineal groups, allowing the parent-offspring recognition. **Methods:** The alarm calls were recorded from 30 individually marked animals, representing 15 mother-daughter dyads, in a natural colony in the Saratov region, Russia in May-June 2005-2006. The adult mothers and their juvenile daughters were recorded when captured singly in live-traps and calling toward a human. We analyzed 10 alarm calls per animal (five individuals provided only 5-8 calls), 285 calls in total. The individual call samples were subdivided half-and-half and the halves (143 calls and 142 calls correspondingly) were used to compare the calls of related (15 mother-daughter dyads) and non-related (15 adult-juvenile dyads) females. To avoid pseudoreplication, each call was used in the analysis only once. **Results:** With 8 measured call parameters included into the discriminant function analysis, we calculated Mahalanobis distances for each of the 30 dyads. Comparison of the distance samples for calls of the related and the non-related female dyads did not reveal any significant differences between them (Mann-Whitney test, $U=96$, $p=0.49$). **Conclusions:** The alarm call structure did not show family similarity, suggesting indirectly the irrelevance of vocal keys to kinship in the yellow ground squirrel.

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INVESTIGATION ON NATAL DISPERSAL AND HOME RANGE SIZE OF THE EUROPEAN SOUSLIK (*SPERMOPHILUS CITELLUS*) IN A MODEL COLONY IN WESTERN BULGARIA.

Zidarova S.

Department of Biology and Ecology of Terrestrial Animals, Institute of Zoology, Bulgarian Academy of Science, 1, Tzar Osvoboditel blvd., 1000 Sofia, Bulgaria
sirmazidarova@zoology.bas.bg

Aims: Populations of the European Souslik (*Spermophilus citellus* L.) are declining throughout the species range because of habitat loss. As a result, the increasing isolation between separate colonies could cause inbreeding depression. Dispersal could be the only way for the population to survive in such a situation. Therefore the knowledge of spatial structure and dispersal ability of the species could be essential when the current status of souslik populations is assessed and management plans for their conservation are prepared. The present study aimed to: 1\ investigate the patterns of natal dispersal of the European Souslik; 2\ to study the temporal dynamics of its home range size; and 3\ to elucidate which factors influence its home range size. **Methods:** Observations on the spatial aboveground activity and movements of ground squirrels were carried out for the period of three years. The studied colony was situated near Sofia, Bulgaria, at the southern slopes of the Stara Planina Mts. (altitude 690 m). **Results:** The mean distance of natal dispersal of the observed sousliks was 17.7 m. No sex differences were found in natal dispersal distances. A significant negative correlation between body length and the distance of natal dispersal was found. The temporal dynamics of the home range size showed sex differences in adult sousliks. Home range size reached a peak value during pregnancy in adult females and two peaks in adult males: one in the period of mating and another one during emergence and natal dispersal of juveniles. The territory of activity of juveniles gradually increased till their own home ranges were set up. **Conclusions:** Larger and probably dominant juvenile sousliks tend to disperse at shorter distances. The home range size of the European souslik is related to season (i.e. the period of annual activity), sex and population density. Most of all, it corresponds to the individual energy needs and specific behavioral patterns for a particular period.

List of Participants

Adamec Michal, State Nature Conservancy of the Slovak Republic, Lazovná 10, 97401 Banská Bystrica, Slovak Republic, michal.adamec@sopsr.sk

Ambros Michal, State Nature Conservancy of the Slovak Republic, Ponitrie Protected Landscape Area, Samova 3, 949 01 Nitra, Slovak Republic, ambros@sopsr.sk

Baláž Ivan, Department of Ecology and Environmental Sciences, Constantine the Philosopher University, Tr. A. Hlinku 1, 949 74 Nitra, Slovak Republic, ibalaz@ukf.sk

Boerma S. Ate, Department of Chronobiology, University of Groningen, Haren, 9751N, the Netherlands, A.S.Boerema@rug.nl

Brenner Michaela, Department of Behavioural Biology, University of Vienna, Althanstraße 14, 1090 Vienna, Austria, ethologie@univie.ac.at

Bryja Josef, Department of Population Biology, Institute of Vertebrate Biology AS CR, Studenec 122; Czech Republic, bryja@brno.cas.cz

Ceballos Ericka, Belmont Street 617, P.O.Box 16021, New Westminster, BC V3M-6W6 Canada, iwccites@hotmail.com

Ćirović Duško, Faculty of Biology, University of Belgrade, Studentski trg 16, 11000 Belgrade, Serbia, dcirovic@bf.bio.bg.ac.yu

Ćosić Nada, Institute for Biological Research “Sinisa Stankovic”, Bulevar despota Stefana 142, 11000 Belgrade, Serbia, nadacosic@yahoo.com

Đurica Milan, ObÚ Lučenec, Osloboditeľov 10, 984 01 Lučenec, Slovakia, milanlc@orangemail.sk

Enzinger Karin, Austrian League for the Conservation of Nature – Lower Austria (Naturschutzbund Niederösterreich), Alserstraße 21/1/5, 1080 Wien, Austria, karin.enzinger@naturschutzbund.at

Evdokimova Svetlana, Leningrad zoo, Alexandrovskii park 1, 197198, St. Petersburg, Russia, acomys@SE13723.spb.edu

Franěk Borek, Správa CHKO České Středohoří, Michalská 260/14, 412 01 Litoměřice, Czech Republic, borek.franek@nature.cz

Gedeon Csongor, Dept. of Ethology, Eötvös Loránd University, Pázmány Péter sétány 1/c, 1117-Budapest, Hungary, csongorg@gmail.com

Gündüz Islam, Department of Biology, Ondokuz Mayıs University, TR – 55139 Kurupelit / Samsun, Turkey, gunduzi@omu.edu.tr

Hapl Ervín, Múrárska Dlhá Lúka 78, 050 01, Slovakia, [hagl.ervin@zoznam.sk](mailto:hapl.ervin@zoznam.sk)

Hodošová Zuzana, Magnezitárov 1205, 050 01 Revuca, Slovakia, bosorkazuzka@centrum.sk

Hoffmann E. Ilse, Department of Behavioural Biology, University of Vienna, Althanstraße 14, 1090 Vienna, Austria, ilse.hoffmann@univie.ac.at

Hulová Štěpánka, University of South Bohemia, Branišovská 31, 370 05, České Budějovice, Czech Republic, spenky@seznam.cz

- Jančová Alena**, Department of Zoology and Anthropology, Faculty of Natural Sciences, Constantine the Philosopher University, Tr. A. Hlinku 1, 949 74 Nitra, Slovak Republic, ajancova@ukf.sk
- Kala Borys**, The Polish Society for Nature Protection, Salamandra, ul. Szamarzewskiego 11/6, 60-514, Poznań, Poland, borys@salamandra.org.pl
- Kefelioglu Haluk**, Department of Biology, Ondokuz Mayıs University, TR – 55139 Kurupelit / Samsun, Turkey, halukkefe@omu.edu.tr
- Kepel Andrzej**, The Polish Society for Nature Protection, Salamandra, ul. Szamarzewskiego 11/6, 60-514, Poznań, Poland, andrzej@salamandra.org.pl
- Kochetkova A. Aleksandra**, Department of Biology, Moscow State University, Moscow, Russia, nava-nava@yandex.ru
- Koshev Yordan**, Institute of Zoology, Bulgarian Academy of Science, 1 Tzar Osvoboditel Blvd., 1000, Sofia, Bulgaria, bgsouslik@gmail.com
- Kosheva Miroslava**, Bulgarian Society of Natural Research, 1000, Sofia, Bulgaria, miroslava_vasileva@abv.bg
- Krivošík Dušan**, Katedra ekologie a environmentalistiky FPV UKF v Nitre, Tr. A. Hlinku 1, 949 74, Nitra, Slovakia, dukrivosik@gmail.com
- Kvičerová Jana**, Biological Centre, Institute of Parasitology, Academy of Sciences of the Czech Republic, Branišovská 31, 370 05 České Budějovice, Czech Republic, janaq@paru.cas.cz
- Lampe Tanja**, Research Center of Wildlife Ecology in Viena, Wilhelminenberg, Austria, Tanja.Lampe@fiwi.at
- Markó Gábor**, Department of Ethology, Eötvös Loránd University, Pázmány Péter sétány 1/c, 1117 Budapest, Hungary, magvacska@hotmail.com
- Mascher Elvira**, Department of Behavioural Biology, University of Vienna, Althanstrasse 14, 1090 Vienna, Austria, elvira.mascher@yahoo.com
- Matějů Jan**, Department of Zoology, Faculty of Science, Charles University, Viničná 7, 128 44, Prague, Czech Republic, honzamateju@seznam.cz
- Matrosova A. Vera**, Department of Vertebrate Zoology, Faculty of Biology, Lomonosov Moscow State University, Vorobievsky Gory, Moscow, 119991, Russia, matrosova_zoo@mail.ru
- Millesi Eva**, Department of Behavioural Biology, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria, eva.millesi@univie.ac.at
- Németh István**, Department of Ethology, Institute of Biology, Eötvös Loránd University; Pázmány Péter sétány 1/C, 1117, Budapest XI, Hungary, furgeur@gmail.com
- Nová Petra**, Department of Zoology, Faculty of Science, Charles University, Viničná 7, 128 44, Prague, Czech Republic, nova-petra@centrum.cz
- Nyitrai Viktor**, Alkotás u. 25/VII., 1123, Budapest, Hungary, viktor.nyitrai@gmail.com
- Penezić Aleksandra**, Faculty of Biology, University of Belgrade, Studentski trg 16, 11000 Belgrade, Serbia, aleksandrapenezic@yahoo.com
- Říčánková Věra**, Faculty of Biology, University of South Bohemia, Branišovská 31, České Budějovice, Czech Republic, ricankova@seznam.cz

Shekarova N. Olga, A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences, Leninskiy prospect 33 Moscow, 119071, Russia, shekar@mail.ru

Schmelzer Elke, Österreichischer Naturschutzbund - Landesgruppe Burgenland Haydngasse 11, 7000 Eisenstadt, elke.schmelzer@gmx.at

Schneiderová Irena, Department of Zoology, Faculty of Science, Charles University, Viničná 7, 128 44, Prague, Czech Republic, fielady@centrum.cz

Strijkstra M. Arjen, Department of Chronobiology, University of Groningen, P.O. Box 14, 9751N, Haren, the Netherlands, A.M.Strijkstra@rug.nl

Szabó Éva, Department of Ethology, Institute of Biology, Eötvös Loránd University; Pázmány Péter sétány 1/C, Budapest XI, Hungary, teltancoss@gmail.com

Tchabovsky Andrey, A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia, tiusha2@mail.ru

Turrini Tabea, Department of Behavioural Biology, University of Vienna, Althanstrasse 14, 1090 Vienna, Austria, tabea.turrini@gmx.at

Uhlíková Jitka, Agency for Nature Conservation and Landscape Protection of the Czech Republic, Nuselská 39, 140 00, Prague, Czech Republic, jitka.uhlikova@nature.cz

Urai Robert, Hungarian Ministry of Environment and Water; 1 Átlós u. Str., 2040, Budaörs, Hungary, urai@mail.kwm.hu

Vácz Olivér, Hungarian Ministry of Environment and Water; Fő u. 44-50. 1011 Budapest, Hungary, volivoli@gmail.com

Vasilieva A. Nina, A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia, ninavasilieva@gmail.com

Vohralík Vladimír, Department of Zoology, Faculty of Science, Charles University, Viničná 7, 128 44, Prague, Czech Republic, vohralik@natur.cuni.cz

Volodin A. Ilya, Department of Vertebrate Zoology, Faculty of Biology, Lomonosov Moscow State University, Vorobievy Gory, Moscow, 119991, Russia, volodinsvoc@yahoo.com

Volodina V. Elena, Scientific Research Department, Moscow Zoo, B. Gruzinskaya, 1, Moscow, 123242, Russia, volodinsvoc@yahoo.com

Zidarova Sirma, Department of Biology and Ecology of Terrestrial Animals, Institute of Zoology, Bulgarian Academy of Science, 1, Tzar Osvoboditel blvd., 1000 Sofia, Bulgaria, sirmazidarova@zoology.bas.bg

