

Abstracts of the Meeting contributions not included in this volume

Abstrakty příspěvků konference nezahrnutých do tohoto sborníku

Torpor bouts: molecular neurobiology

Periody letargie v období hibernace: molekulární neurobiologie

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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 the function 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.

Population monitoring of the European ground squirrel (*Spermophilus citellus*) in Serbia

Monitoring populace sysla obecného (*Spermophilus citellus*) v Srbsku

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Aims: European ground squirrel is a widely distributed European species. Unfortunately, disappearance and fragmentation of 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 within the territory of Serbia. **Methods:** The population monitoring of European ground squirrel in Serbia was realized 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 50×50 m sample plots. Density and abundance were determined for each studied locality during the month of July. Ground squirrels present at the study plot were captured during a single

day by pouring water down their holes. All the captured ground squirrels were kept in cages until the 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 for ground squirrels showed pronounced fluctuations, from only 4 to 88 individuals/ha. The mean value of density at all three localities 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 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 European ground squirrel (*Spermophilus citellus*) in Vojvodina, Serbia

Variabilita mikrosatelitů u sysla evropského (*Spermophilus citellus*) v oblasti Vojvodiny, Srbsko

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Aims: The European ground squirrel (*Spermophilus citellus*) faces the same destiny in Serbia as in other parts of its historical distribution. 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 sizes 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 $He=0.518$) 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 originated from recent habitat fragmentation, but quite high values of He and low values of inbreeding indicate that the populations are still viable.

Monitoring of the European ground squirrel (*Spermophilus citellus*) in the CHKO Cerová vrchovina, Slovakia in the years 2001–2008

Monitoring sysla obecného (*Spermophilus citellus*) na území CHKO Cerová vrchovina v letech 2001–2008

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Aims: During the years 2001–2008 we have been monitoring European ground squirrel (EGS) in CHKO Cerová vrchovina to find out its distribution and to estimate a number of EGS at single habitats. **Methods:** Visually finding out EGS quantity at an area unit: This method is used only in open spaces with low

vegetation covers. In places with relatively high population density this method can be replaced by its strip modification. Only results which have been reached at the same period of a year and the same time of a day are comparable. Finding out EGS density according to a number of dens being used: Actively used exits from the dens are counted. We have used this method at a squared area of 20×20 m. **Results:** In Cerova vrchovina there have been 15 localities monitored between the years 2001–2008. EGS total abundance has been estimated at about 1,500 individuals in Cerova vrchovina. In 2008 we have noticed a growth of EGS populations at 3 localities, stagnation at 7 localities and a drop at 5 localities. **Conclusion:** This year I have personally verified EGS occurrence at fifteen habitats, in two cases the population of EGS is about extinction. The monitoring has proved the drop of abundance in small colonies which are greatly isolated by “ecobarriers” from other colonies and suitable biotopes for settlement. Support of extensive grazing seems to be very important; the best seems to be a combination of sheep, goats and cattle breeding. Absence of grazing causes a drop of abundance or even extinction of EGS. Mowing is usable only as an additional way of area management. On Cerova vrchovina meadows there have been EGS occurrence recorded in places where meadows are of a xerotherm character. During the monitoring between 2001–2008 these negative factors have been recorded: Isolation of populations, absence of grazing, poaching and low public awareness.

Management of European ground squirrel habitats in Lower Austria – origin, options and objectives

Management biotopů sysla obecného v Dolním Rakousku: vznik, možnosti a cíle

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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. According 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 motor highways. Finally we contacted farmers to convince them of taking part in the ÖPUL-programme. **Results:** Ground squirrel needs 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, souslik often totally disappears 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 ground squirrel but most endangered at present. Conservation work has to focus on preservation and re-enlargement of fallow land. Only few time remains to benefit from ÖPUL-programme.

A review of ground squirrel species kept in the Leningrad Zoo since the 1940s

Druhový přehled pozemních veverkovitých chovaných v Leningradské zoo od roku 1940

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The Leningrad Zoo, founded in 1865, is one of the oldest Russian zoos. Many species of ground squirrels have been kept in the zoo since the late 1940s. Until now, they have included five marmot species (*Marmota*

baibacina, *M. bobak*, *M. sibirica*, *M. camtschatica*, *M. caudata*), nine species of sousliks (*Spermophilus citellus*, *S. undulatus*, *S. parryi*, *S. suslicus*, *S. pygmaeus*, *S. fulvus*, *S. major*, *S. erythrogenys*, *Spermophilopsis leptodactylus*) and one female of the South African ground squirrel (*Xerus inauris*). Unfortunately, ground squirrels were brought to the zoo rather 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 the ground under one of the buildings and later a juvenile was caught. The highest longevity was recorded in a gray marmot (*Marmota baibacina*) male, which 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 is keeping 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 souslik (*Spermophilus pygmaeus*).

Burrow entrance angle and grass height influence reintroduction success: the importance of release site preparation in European ground squirrel translocations

Úhel vchodu do nory a výška trávy ovlivňují úspěch reintrodukce: při translokacích sysla obecného je důležitá příprava lokality vypouštění

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Aims: Conservation management effort can fail because of insufficient knowledge of the species' ecology. We investigated morphology of burrows and grass height in relation to the initial sign of reintroduction success. **Methods:** 50 cm long burrows were drilled in a 4 x 4 square grid. We prepared vertical (90°) and slanted (30°) burrows, placed evenly in alternate order within each cell (16 burrows per cell), and an alternate distribution of mown and unmown grass within the grid (8 mown cells). The animals were released in an even distribution pattern, and their exact number and position were recorded at the time of release in each cell. We recorded the number and position of used/ unused, vertical/ slanted predrilled, artificial and new burrows. After the release we recorded the number and type of used burrows 6 times until hibernation began (72nd day). In addition, we carried out a visual census of the animals in the grid-cells during the activity peak (9:30–11:00) and in the afternoon (14.00–16.00). **Results:** The animals preferred slanted burrows, but the difference changed with time. They preferred higher (unmown; 18±12cm) to shorter (mown; 6±3cm) grass upon translocation. **Conclusions:** The results suggest the need of better preparation of release sites and point out the importance of the angle of predrilled burrows and grass height. Around the 37th day after the translocation, the animals began to build new burrows intensively, abandoned their predrilled burrows, and the number of used vertical burrows increased. This indicates spreading of the animals, and that vertical burrows are secondary constructions in burrow systems.

The importance of nest material selection in nest insulation quality in the European ground squirrel (*Spermophilus citellus*)

Význam výběru hnízdního materiálu pro kvalitu izolace hnízda sysla obecného (*Spermophilus citellus*)

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Aims: Animal nests are considered important for survival and the material used determines 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 using the Olympus industrial endoscope to determine the plant species composition. Based on that, two species (*Festuca pseudovina* and *Bothriochloa ischaemum*) were provided to captive EGSs in a nest material choice test. In the next choice experiment the moisture of the preferred species (fescue) was manipulated. The behavioral activity of EGS was recorded during the tests. Finally, we measured the insulation quality of intact EGS nests built of fresh, humid *Festuca* in relation to different moisture-level (fresh, half-dried, dried and remoisturized). **Results:** The preference of fresh fescue by EGSs can be explained by better insulation quality. Although we expected that moisture content would be the most significant factor negatively influencing insulation, our results provided strong evidence that nest architecture and the flexible, fresh, and humid nest material (fescue pieces) have a positive effect on insulation quality. **Conclusions:** The results showed a trade-off between nest material moisture and nest architecture in nest insulation. Although we carried out the experiments in summer, nest insulation quality might be important in the periods of arousal from torpor during hibernation.

Effect of habitat fragmentation on neutral and adaptive population genetic structure in the European ground squirrel in Central Europe

Vliv fragmentace biotopu na neutrální a adaptivní genetickou strukturu populace sysla obecného ve střední Evropě

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Aims: (I) To estimate the level of population 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 the population 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 for 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 for Czech populations was $H_e=0.23$, for Slovak populations $H_e=0.39$, for Hungarian populations $H_e=0.41$, and for the 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 could indeed 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. **Acknowledgements:** The study was supported by ESF (CONGEN no. 1141), GA JU (53/2006/P-BF), GA AV ČR (KJB601410816).

Range wide phylogeography of the European ground squirrel based on nuclear and mtDNA markers

Celoareálová fylogeografická studie sysla obecného založená na analýze jaderné a mitochondriální DNA

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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 906 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 the Black Sea region of Bulgaria and Romania. Three separate genetic lineages were found, which colonised Central Europe, Romania plus Moldavia, and Greece plus Macedonia, respectively. The populations in Central Europe show 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 suggested by both genetic markers, i.e. mtDNA and microsatellite loci. Transfers and reintroductions aimed to enhance genetic variability of the Central European populations are possible since all these populations represent one phylogenetic lineage. **Acknowledgements:** The study was supported by ESF (CONGEN no. 1141), GA JU (36/2007/P-BF), GA AV ČR (KJB601410816).

Female-kin structure in a colony of the Yellow ground squirrel (*Spermophilus fulvus*)

Príbuzenské vztahy mezi samicemi v kolonii sysla žlutého (*Spermophilus fulvus*)

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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 litters mingling or dispersal. Since young females usually settled within the colony, we could follow the breeding history for the majority of locally born females. Basing on pedigrees we produced matrices of relatedness among adult females for each year. We estimated spatial distribution of squirrels by everyday scanning 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 maximal 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. **Acknowledgements:** Supported by RFBR 07-04-00721 and Russian Science Support Foundation.

Social interactions, prehibernation fattening and adrenal activity in juvenile European ground squirrels (*Spermophilus citellus*)

Sociální interakce, předhibernační tloušťnutí a aktivita nadledvinek u mláďat sysla obecného (*Spermophilus citellus*)

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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. Socio-positive 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 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 prehibernatory fattening, after the termination of structural growth.

The cues to individuality, sex and age in alarm calls of the Speckled ground squirrel (*Spermophilus suslicus*)

Odráz individuality, pohlaví a věku ve varovných signálech sysla perličkového (*Spermophilus suslicus*)

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Aims: Ground-dwelling sciurid, 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 a caller. Aim of this study was to investigate the within-species 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 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 to sex 56% calls (for adults 66%, for juveniles 74%), to age 74% calls (for males 74%, for females 81%), to individual 76% calls (for adults 81%, for juveniles 82%, for males 79%, for females 83%). All the assignment values were higher 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' alarm calls suggest the lack of selection pressure toward the prolonged personal interrelationships in this species. **Acknowledgements:** Supported by RFBR grant 06-04-48400.

Pre-hibernation fattening and ovarian activity in breeding and non-breeding European ground squirrels

Předhibernační tloušťnutí a aktivita vaječníků u rozmnožujících se a nerozmnožujících se samic syla obecného

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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 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

Hibernace podmíněná klimatem

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

Structure and variability of alarm calls in the European ground squirrel (*Spermophilus citellus*)

Struktura a variabilita varovných signálů sysla obecného (*Spermophilus citellus*)

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Aims: Ground squirrels, including the European ground squirrel (*Spermophilus citellus*), emit acoustic alarm calls in presence of predators. The alarm calls of some species of genus *Spermophilus* are relatively well studied, but this is not true in the case of the European souslik. Aim of this study is to describe structure and variability of alarm calls of this species. **Methods:** Alarm calls of 15 different individuals were recorded on the locality Letňany in Czech Republic. Alarm 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 analysed using Avisoft SASLab Pro 4.38 and spectrograms with following parameters 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 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 the small one in the second element. The harmonics were present in both elements. **Conclusions:** The study presents description of structure and variability of 15 individuals of European ground squirrels alarm calls and there is an indication, that these alarm calls are individually distinct.

European ground squirrel hibernation: function, behaviour, neurophysiology (review)

Hibernace sysla obecného: funkce, chování, neurofyziologie (přehled)

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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 brain repair.

European ground squirrel Action plan in the Czech Republic

Záchranný program sysla obecného v České republice

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Aims: During first half of the 20th century, the European ground squirrel (*Spermophilus citellus*) had been a common species in farmland areas of the Czech Republic. After significant changes in agricultural management in the 1950s and 1960s, when main part of its natural habitat was destroyed, abundance of European ground squirrel (EGS) rapidly decreased and area of its distribution was fragmented. In 2002, there were only 26 known localities of its occurrence and EGS became one of the most endangered mammals in the Czech Republic. The main aim of the Action plan is to ensure 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 author's experience. The review was focused on identification and evaluation of main reasons for EGS exposure and on finding their possible solutions. **Results:** Six factors were identified to be the most severe threats for existence of the species: habitat loss due to destruction of sites as well as absence of management of vegetation cover, meteorological events such as torrential rain or rapid snow melting, inbreeding caused by isolation of individual populations, predators and parasites. For the first stage of the Action plan there are six partial goals: To provide regular management of the sites where EGS occurs and regular monitoring of EGS populations, to prepare catalogue of sites for possible EGS reintroduction, to 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. Establishment of five wild living metapopulations of the European ground squirrel with abundance of more than 2.500 individuals each was designated to be the final objective of the Action plan. **Conclusion:** In 2008, the Action plan was adopted by Ministry of Environment of the Czech Republic and its implementation has started. **Acknowledgements:** The study was supported by the Ministry of the Environment of the Czech Republic (grant No. VaV/620/1/03 and No.VaV – SP/2d4/61/08).

Nation-wide monitoring of the European ground squirrel (*Spermophilus citellus*) in Hungary

Národní monitorovací program sysla obecného (*Spermophilus citellus*) v Maďarsku

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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 yearly volunteer actions 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 can be filled out on Red Squirrel occurrence in www.mokusleso.net. **Results:** The data of the EGS programme are clearly shows 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:** HBMS EGS monitoring programme gives us valuable long-term basic data but it need to be extended at least two different ways: exploring unknown EGS populations e.g. by an on-line survey and expand spatial cover to involve international participants to the monitoring system.

Density of juveniles and synchronization of their first emergence influence juvenile survival in the Yellow ground squirrel (*Spermophilus fulvus*)

Přežívání mláďat sysla žlutého (*Spermophilus fulvus*) ovlivňuje jejich hustota a synchronizace během prvního opuštění nory

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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 the 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 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 number of died 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 survived juveniles ($r_s = -0.33$, $p = 0.006$) and the greater was the number of died juveniles in the litter ($r_s = 0.48$, $p < 0.0001$). **Conclusions:** Aggregation and synchronization of emergence of juvenile long-teeth ground squirrels produced negative effect on their survival. Possibly, newly-emerged youngs in aggregations attracted predators and suffered higher predation (in particular, cats killed many young). **Acknowledgements:** Supported by RFBR 07-04-00721 and Russian Science Support Foundation.

Investigation on natal dispersal and home range size of European souslik (*Spermophilus citellus*) in a model colony in West Bulgaria

Studium disperze mláďat a velikosti domovských okrsků v modelové kolonii sysla obecného (*Spermophilus citellus*) v západním Bulharsku

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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 assessment of the current status of souslik populations and preparation of management plans for their conservation are made. 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 3) to elucidate what factors influence its home range size. **Methods:** Observations on the spatial aboveground activity and movements of ground squirrels were carried out for three years period. The studied colony was situated near Sofia, Bulgaria, at the southern slope of Stara Planina Mountain (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. Significant negative correlation between body length and 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: the first one in the period of mating and the second – 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 the season (i.e. the period of annual activity), sex and population density. It is relevant most of all to the individual energy needs and specific behavioral patterns for a particular period.



Spermophilus citellus (photo by J. MATĚJŮ).