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VI MARMOT MEETING MARMOTS IN A CHANGING WORLD

ABSTRACTS



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MARMOT BIODIVERSITY AND TAXONOMY.

Extreme Color Variation in Marmots (*Marmota*)

ARMITAGE K.B.

Albinism, melanism, or both occur in *flaviventris*, *monax*, *baibacina*, *caudate*, *bobak*, and *camischatica*. Non-albino white marmots occur in *marmota*, *bobak*, and *baibacina*. “Blue” forms occur in *bobak* and pale yellow individuals are observed in *flaviventris*. The frequency and persistence of extreme color phases remains largely unknown, but it seems likely that they are uncommon and of short duration. However, melanism has persisted for at least 80 years in a *flaviventris* population at a frequency of 16 to 20% and melanism occurs in about 25% of a *bobak* population. These frequencies suggest that melanism in these populations has some selective advantage which is balanced by its costs. The color variants indicate that mutation occurs frequently in the melanin genes which produce color morphs on which natural selection could act. The ancestral color of the dorsal pelage apparently is shades of brown frequently marked with splotches or streaks of yellow, reddish-brown, white, or black. These patterns indicate that melanin concentrations vary locally, but any selective advantage of these patterns is unknown. Three species have a pelage that is predominantly white (*caligata*), gray (*baibacina*), or dark brown (*vancouverensis*). Given that white or melanistic forms occur at very low frequencies in normally brown-colored species raises the question of what selective factors led to the evolution of light- and dark-colored species. Because pelage color and quality markedly affect thermoregulation, studies of marmot fur and heat transfer are essential for understanding extreme color variations.

Molecular phylogenies of the genus *Marmota* (Rodentia, Sciuridae): comparative analysis

BRANDLER O.; LYAPUNOVA E.

Phylogenetic reconstructions of the genus *Marmota* were made using mitochondrial genes *cyt b* (Thomas and Martin, 1993, Lyapunova et al., 1995, Steppan et al., 1999; Kruckenhauser et al., 1999) and D-loop (our data) sequences, DNA-DNA hybridization (Giboulet et al., 1997) and inter-SINEs nuclear DNA pattern (our data) as molecular markers. All these studies are evidence of a recent origin and North-American origination of marmots. Most of the data show Nearctic and Palearctic groups of species, but their compositions are different. *M.monax* and *M.browley* are grouped with Nearctic or Palearctic marmots on different trees. Existence on mtDNA and nDNA trees of closed related species groups, such as *bobak*- and *camtschatica*-groups, reflects a recent Pleistocene evolution. Low mtDNA and high nDNA genetic distances in pair *M.menzbieri*-*M.caudata* probably indicate their remote hybridization. A genetic affinity of *M. vancouverensis* and *M.caligata* shows short time of their separate evolution for accumulation of species specific molecular differences. Significance of different molecular markers in reconstruction of marmot phylogeny is discussed. A consensus phylogenetic tree of the genus *Marmota* is proposed.

International Union for Conservation of Nature (IUCN)

Review of the pliocene-recent holarctic marmots

ERBAJEVA M.; ALEXEEVA IN.

The detail analysis of the paleontological data has revealed that marmots are of the New World origin. During their long history of evolution from the Late Oligocene to the Recent time there were at least four invasions to Palearctic region and faunal interchanges existed until the end of Pleistocene. The first invasion probably took place at the beginning of the Oligocene, second during the Early Miocene, the third at the end of Pliocene-beginning Pleistocene and the last during Late Pleistocene glaciation. Two centres of marmot diversification could be recognized - North America and Central Asia. Previously marmots were inhabitants of lowland areas, mainly open landscapes with lighted forest. Later on with uplifting of the most of Eurasian and North American high mountains during Pliocene and Pleistocene some group of marmots became inhabitants of alpine environment and the other are adapted to plain steppes. From the beginning of the Miocene more than 25 extinct marmot taxa are known in Europe (8), in Asia (around 14) and North America (7) including the extinct forms of the modern species. Some of them, as *Marmota bobak*, was widely distributed in Eurasia, some of them occupied the restricted area.

In modern faunas 15 extant species of marmots are recognized on the base of complex analysis such as morphological, karyological, biogeographical and others

Accelerated morphological evolution in insular mammals: is it true or not? The case of the Vancouver Island marmot

CARDINI A.; NAGORSEN D.; O'HIGGINS P.; POLLY D.; THORINGTON R. W.; TONGIORGI P.

On islands mammalian morphological evolution is often accelerated and large species tend to become smaller. These trends are attributed generally to rapid adaptation to a new environment after isolation and possibly to genetic drift. The Vancouver Island marmot, the only marmot species endemic to an island, is a rare endangered species, which likely became isolated at the end of the last glaciation. Despite its young evolutionary age and genetic similarity with continental populations of the hoary marmot, it has distinct alarm calls and fur colour. Recent studies have shown that its skull morphology is also highly distinctive. However, how well this fits into the bigger picture of evolution of insular mammals has not yet been examined. Also, the possibility that distinctiveness in modern specimens is an artefact of sampling error has not been excluded. Using skull measurements of modern and prehistoric Vancouver Island marmots we investigated, a) what the evidence is for genetic drift/natural selection in morphological evolution; b) whether size has changed as predicted by the island rule; 3) whether unique aspects of shape are confirmed in modern specimens and occur in subfossils dating from 1000-2500 years ago. We found! a) weak evidence for an exclusive role of genetic drift; b) no appreciable change in size over -2500 years; c) unique shape traits which likely evolved shortly after isolation This study is relevant to our understanding not only of evolutionary processes but also of species responses to isolation, habitat fragmentation and destruction due to human activities and climate change.



Biodiversity and distribution areas of the Transbaikalian marmots in the past

Erbajeva M.

Marmota sibirica is typical steppe dweller species. According to the fossil data from the Transbaikal area the ancestral form of this species appeared in the region during the Middle Pleistocene, around 0.8 MA. It was described from the Dodogol locality as *Marmota sibirica nekipelovi* Erbajeva, 1966. The earliest record of the Transbaikalian marmot had arisen to the Middle Pliocene (*Marmota tologoica*) when in the region was distributed savanna-like forest-steppe with Hipparion fauna. With progressive cooling and aridization of the climate paleoenvironment had changed towards dry and warm. Mosaic type landscapes of the Late Pliocene was replaced by open landscapes with meadow-steppes and dry steppes of the Early Pleistocene and semi-deserts and deserts for the Middle Pleistocene. Marmots were rather abundant, however the dominant elements in the faunas were *Allactaga*, *Eolagurus*, *Meriones*, *Ellobius*, *Ochotona* - inhabitants of extremely dry environment. Towards Late Pleistocene climate in the region continue to be arid, but more continental under influence of the further cooling as in Northern Hemisphere. It is resulted in wide distributions of periglacial arid steppes which probably was favourable habitat for marmots of the Transbaikal area. The dominant forms in the faunas were *Marmota sibirica*, *Lasiopodomys brandti*, *Ochotona daurica*, *Microtus fortis*, *Lagurits lagurus* and *Cricetulus*, the first of which was widely distributed in the Transbaikal area and was represented by a number of diverse taxa which differ by peculiar characters probably even of the subspecies level. During the Holocene the climate changed towards more humid and warm which led to decrease of open areas and widening of forest-steppe landscapes. As a result the distribution area of *Marmota sibirica* became more limited.

MARMOT BEHAVIOUR.

Extra-pair young better perform than within-pair young in the Alpine marmot

ALLAINED.; CORAS A.

The Alpine marmot is a socially monogamous rodent exhibiting a high rate of extra-pair paternity. We investigate whether females gain genetic benefits from extra-pair paternity (EPP) and what kind of genetic benefits they can gain. In previous analyses, we have shown that 1) EPP occurs when the social partner is genetically very similar or very dissimilar to the female and that 2) extra-pair males are more heterozygous and likely less genetically similar to the female than cuckolded males. These results seem to support the genetic compatibility hypothesis. However, a crucial test of this hypothesis is to investigate whether extra-pair young, expected to have a more compatible genome, have better performance than within-pair young. Here, we use capture-recapture methods to compare the survival and the probability to access to dominance (to reproduction) of extra-pair and within-pair young. Using a long-term database, we show that extra-pair young better survive until sexual maturity (two-years old) but not thereafter and tend to have a higher access to dominance than within-pair young. These results suggest that female alpine

Transbaikalian marmots research project

marmot probably gain genetic benefits through extra-pair copulation by producing more compatible young.

Risk-taking, temperament and vigilance behaviour in alpine marmots (*Marmota marmota*)

FERRARI C; VON HARDENBERG A.; REAJLE D.

Predation acts one of the most important pressure on wild population promoting evolution of different strategies that allow animals to cope with predation risk; by this 'assumption' and seeing that individual temperament is playing a central role in several studies about animals' ecology, we study if individuals with different behavioural profiles vary in the degree of risk they take during their foraging activities and how can an individual adjust its antipredator strategy with different degree of risk

Individuals of Alpine marmots represent a good model to study this question because they used to forage around their burrows and vigilance through frequent scanning of the territory surrounding where they have burrows entrance; Furthermore the work-area (Gran Paradiso National Park, Italy) presents two main species of marmots' natural predators, Golden eagle (*Aquila chrysaetos*) and Fox (*Vulpes vulpes*).

I want to evaluate if results from open field test and hormonal analysis are consistent with antipredator strategy carried out in the field by each individual, and understand how variation in the level of risk taken can be adjusted and maintained between individuals studying frequency and length of vigilance events.

The importance of alert distance in flight initiation distance of alpine marmot (*Marmota marmota*): a cost/benefit approach

DUMONT F.; PASQUARETTA C.; REALE D.; VON HARDENBERG A.

Following the economical model by Ydenberg et Dill (Adv. Stud Behav 16:229-249, 1986) the distance at which a prey initiates flight (flight initiation distance or FID) corresponds to the distance at which the risk of predation equals the cost of fleeing. This model predicts that a prey does not initiate flight as soon as it detects a predator. The risk of predation increases quickly when a prey is not aware, and this constrains the prey to monitor the predator's behaviour. Then, the benefit of not fleeing drops to 0 at the alert distance (AD) - the distance at which an animal detects an approaching threat and alters its behaviour. Although rarely mentioned in FID studies, AD should alter FID and be optimised. Here we verify the relationship between AD and FID in alpine marmot (*Marmota marmota*) in the Gran Paradiso National Park (Italy). We also test how AD and FID are affected by environmental variables potentially linked to risk of predation and to the cost of fleeing. Our tests revealed a strong relationship between FID and AD suggesting that alpine marmots flee very little after being alerted of a threat. Our results suggest that the risk of predation increases rapidly right after the beginning of the threat. We conclude that the link between FID and AD can be explained by costs of vigilance.

Yellow-bellied marmots feed selectively

WOODS B.

Understanding how animals select resources provides important information regarding their requirements for survival. One method for studying diet selection is multiple-choice feeding preference experiments, in which animals are offered multiple food items simultaneously. I used multivariate statistics to examine diet selection of yellow-bellied marmots (*Marmota flaviventris*) for the 7 plants most commonly found in their foraging areas. Cafeteria-style feeding trials indicated that dandelions (*Taraxacum officinale*) were selected significantly more often than expected by a random distribution, whereas grasses (*Bromus* spp. and *Poa* spp.) and cinquefoil (*Potentilla gracilis*) were avoided. Use of the remaining species, cow parsnip (*Heracleum lanatum*), yarrow (*Achillea millefolium*), mountain blue bells (*Mertensia fusiformis*), and wild sweet pea (*Lathyrus leucanthus*), did not differ significantly from random, although cow parsnip and wild sweet pea tended to be more preferred and avoided, respectively, than the remaining species. Preferences in these marmots may have been based on fatty acid content, which is important for hibernation.



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MARMOT ECOLOGY.

The temperature niche of the steppe marmot *Marmota bobak*, Mtiller (1776) in the course of hibernation

NIKOL'SKII A.

Before hibernation, marmots close their burrows to prevent convection transfer of heat inside the burrow. As a result, the temperature inside the burrow differ only little from that of the enclosing soil. Using data on the soil temperature published in the "Directory on USSR Climate", I described the temperature regime of the burrows (depth from 140 to 450 cm) of the steppe marmot in the course of hibernation (from August to April), within the species range, and in the subspecies range. Taking into account the entire thickness of the earth enclosing the hibernation chamber, the dates of the beginning and end of hibernation, the steppe marmot starts hibernation at a temperature of 8-16°C, and exits from hibernation at a temperature of 2-4°C. The temperature amplitude of the soil at a depth of hibernation chamber within the hibernation period in local populations of the steppe marmot is 8-10°C. The hibernation temperature regime differs significantly between the subspecies. *M. b. bobak* winters at a temperature of 3-4°C higher than *M. b. schaganemis*. In the range of *M. b. schaganensis* marmots start hibernation one to two months earlier than in the range of *M. b. bobak*. The cause of subspecies differences in the dates of the onset of hibernation appear to lie in the zonal properties of seasonal changes in air temperature. A favorable factor for survival of hibernation by marmots is the temperature dynamics from the onset of hibernation to the advent to the surface. In the course of hibernation, the earth temperature declines gently and at a rate that hardly exceeds 1°C per month.

Home Range Area and Shape in Yellow-Bellied Marmots

ARMITAGE K. B.

Home range is the area that animals traverse to obtain resources necessary for growth, reproduction, and survival. For marmots, the major resources are food and burrows. I investigated the relationship between five factors and home range area (N=792). During regular censuses, the position of each marmot was recorded as a pair of coordinates from a calibrated grid overlain on a photograph of the colony site. Home range area was the product of the area of a grid multiplied by the number of grids a marmot utilized. Excursions, when clearly identified, were not included in the calculation of area. The analysis included 24 years, four ages (adult, two-year-old, yearling, young), two sexes, four colonies (Picnic, North Picnic, River, Marmot Meadow), four categories of residency (adult female, disperser, territorial male, transient), and whether an individual engaged in excursions (yes or no). A general linear model ANOVA revealed that year ($p=0.000$), age ($p=0.000$), residency ($p=0.000$), and colony ($p=0.000$) significantly affected home range area but that

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sex ($p=0.373$) and excursions ($p=0.312$) had no effects. Shape was affected mainly by topography and the presence of other marmots. Area decreased with age: adults > two-year-olds > yearlings > young. Territorial males had the largest area followed by adult females > dispersers, but area did not differ between dispersers and transients. Home range area varied among colonies: Picnic > North Picnic > River > Marmot Meadow. Young and transients made the fewest excursions; adults, the most. Excursions were more frequent in the largest colonies and less frequent among transients. Residency was significantly affected by age, colony, sex, and excursions. Dispersers and transients were male-biased, residents were biased toward females and young.

The effects of elevation on growth rates and body masses of yellow-bellied marmots

BROWN C.; COBB ML; WOODS B.

Growth rates of yellow-bellied marmots (*Marmota flaviventris*) vary significantly with sex, age, and location. The accumulation of fat is strongly influenced by short growing seasons and marmots living at high elevations often have shorter active seasons than populations at lower elevations due to prolonged snow cover. We studied marmot populations at 2900 m elevation and 3400 m elevation to test hypotheses about effects of elevation on growth rates. We compared growth rates and emergence masses of marmots amongst age and sex classes from the two elevation sites. Juvenile growth rates did not differ significantly between populations and regression coefficients were very similar when corrected for weaning date. Emergence masses for yearlings at the high elevation site were significantly higher than the lower elevation site, but there was no difference in growth rates. However, there were sex differences in growth rates of yearlings. Male yearlings at the high elevation site had significantly higher growth rates compared to low elevation yearling males. Low altitude yearling males were twice the size of high altitude yearling males at the beginning of the summer, the higher growth rates in high altitude populations reduced the mass differences between the two groups prior to hibernation. Adult growth rates and masses were not significantly different between elevation sites. Differences in the length of active seasons between both sites may be the strongest influence on variation in growth rates and masses between the populations of marmots.

Habitat selection of alpine marmot (*Marmota marmota*) in southern Pyrenees

LOPEZ. B.C.; LOPEZ A.; POTRONY D.; PINO J.

Alpine marmots (*Marmota marmota*) were introduced in the French Pyrenees between 1954 and 1988. They rapidly moved to southern Pyrenees, probably due to the good conditions and the lack of important predators in the region. In less than 50 years, the marmot population in southern Pyrenees has notably increased, and the only existing estimate calculates a population of around 10000 individuals. In order to understand the reasons for their fast and successful colonisation in southern Pyrenees, an intensive study was carried out in 2007, both at macroscale (800 plots of 1 km²) and at microscale (ca. 60 km²



sory exile of marmot from flat steppe territories to the broken terrain which could not be ploughed up (gullies, i.e. *balki*). This assumption, however, does not prove to be true by the historical evidence (see Savchenko, Ronkin, present edition). We consider that only historical approach in ecology allows to answer many important questions. Such approach is especially necessary for the correct decision of the question “When this or that process began?” In our report, we describe the area of various environmental influence factors, in which the steppe marmot can continue to exist unlimitedly long time. Also, we will make an attempt to answer the main question, whether the change of the basic parameters of the steppe marmot’s ecological niche has taken place in Ukraine during the recent centuries.

The necessary ecological conditions for the steppe marmot in north-eastern Ukraine: an historical approach

SAVCHENKO G.; RONKIN V.

The steppe marmot is considered the original inhabitant of virgin steppes. We have carried out the analysis of ecological environmental factors of the European subspecies of the steppe marmot (*Marmota bobak bobak* Muller (1776)), since the first contemporary sources dated by the XVIII-th century. The results of the analysis show the following facts:

1. All described settlements of marmot were located on the left bank of the Dnieper. The steppes on the left bank of the Dnieper are hilly and richly intersected by rivers and gullies. The most preferred habitats for the steppe marmot there are the gullies (the gully network or gully systems) of the river valleys. The authors have described that such gullies were inhabited by great numbers of marmot individuals. The marmot settlements on the flat steppes were necessarily surrounded with marmot settlements in the gullies, and had direct communication and connection with them. Thus, a necessary condition of the stable existence of modern populations of *M. b. bobak* is the continuity of gully systems network.

2. Since ancient times till the XIX-th century, natural pastoralism remained the most advanced branch of the steppe zone agricultural economy. It is apparent that pastoralism and cattle breeding was mostly developed in the river valley areas and around gully systems. In all historical times, the most progressive settlements of the steppe marmot have been located in the zones of extensive livestock husbandry economy (which was similar to natural pastoralism). On the contrary, the crash of economy of this type correlated with the decline of the steppe marmot settlements. Thus, both historical sources and modern research do not leave doubts in the necessity of natural pastoral livestock pressure on habitats of the steppe marmot (see also Tokarsky et al, present edition).

Ecological and geographical aspects of Himalayan marmot {*Marmota Himalayand*} distribution in Indian Tibet.

KHOLODNA N.

In August 2007 we studied Himalayan marmot distribution in Indian Tibet along the following route: Tso-Moriri Lake (4520m) - Parang La pass (5678m)-Kibar (4205m). We marked GPS coordinates for marmot family ranges and borrows along the distance of



130km We also plotted borrow locations and arrangement within each family range and beafly astimate quantity of marmots in family. As a result, there have been determined the higher and lower bounds for the range of distribution of Himalayan marmot popula- tion [in Ladakh (Jammu and Kashmir) and Spiti (Himachal Pradesh) regions] of Tibetan highland Marmot colonies were found starting at 4350m at high alpine zone. The higher altitudinal limit of range was defined as 4800m with few single borrows found at 4905m. We found 3 main ecological types of marmot population in the studied region: 1) highland semi-desert type; 2) highland swamp type; 3) the type that inhabits narrow alpine vegeta- tion strips along river banks These ecotypes differed significantly in size and structure of family ranges, quantity and size of families, and phenotypes of animals (size, coloration, fur length etc.) According to our observations as well as to results of local people ques- tionnaires, Himalayan marmot population in this region is sustainable; it is not affected by human activity, either hunting or tourism Animals are not afraid of people, and make a convenient target for future research.

Forest-steppe marmot in anthropogenic landscapes of Kuzbass

POLYAKOV A.

Now forest-steppe marmot (*Marmota kastschenkoi*) has got the status of an inde- pendent kind. Dwelling at us a new kind (endemic) should change Russia and the general approach in questions of its protection and operation as its number in territory of Kuzbass is small and is made nearby with 5 thousand individuals. Owing to the ecological plasticity this small animal gets on well enough in the close neighbourhood with human being under condition of absence of direct prosecution by the last

On the area of marmot colonies specific structure of plants more richly and more variously, than on adjoining territories, therefore anthropogenous transformation of a mar- mot will promote a vegetative variety anthropocenoses due to introduction to weedy-field plants of elements of local flora. A vegetative variety, here are the important conditions which involve new kinds of insects on a colony of marmots and improve soil fauna.

Our long-term researches of a role of a forest-steppe marmot in destruction of cultur- al plants on fields do not allow to carry it to agricultural pest. As this kind, historically up- holstered in extreme conditions, and being not numerous everywhere, effectively enough uses a forage reserve of manned sites and practically does not leave on fields The marmot can destroy beds with peas, beans, etc.

Thus, activity of a human being person has created conditions owing to which the forest-steppe marmot has been compelled to show as much as possible the biological plasticity which has affected in strengthening of contact to the person (anthropogenous transformation).

MARMOT PHYSIOLOGY, MARMOT AND HEALTH.

To eat or not to eat: AMPK regulation of food intake in marmots

FLORANT G.; HEALY J.; FENN A.

Mammals that hibernate (hibernators) including the yellow-bellied marmot (*Marmota flaviventris*) stop eating throughout winter after nearly doubling their body mass by autumn. The mechanism that regulates food intake in hibernators is unclear. Recently, amp-activated protein kinase (ampk) has been shown to play a role in the regulation of food intake and peripheral energy utilization in mammals, activation of hypothalamic ampk causes animals to feed. We hypothesized that an ampk activator, 5'-aminoimidazole-4-carboxamide 1 β -D-ribofuranoside (aicar), infused intracerebroventricularly (icv) would cause marmots to feed in the winter, when they usually would not. icv infusion of aicar into marmots caused a significant increase in food intake. Once the infusion finished, animals returned to torpor at 5 °C. The control animal (saline infused) did not eat and underwent torpor bouts at a high ambient temperature. Our results suggest that ampk is involved in regulating energy balance and food intake in hibernators and that the neural pathways involved in feeding and eliciting torpor interact in a reciprocal relationship.

Hibernation body temperature record of an alaska Marmot, *Marmota broweri*

LEE T.N.; BARNES B.M.; BUCK C.L.

Little is known about the ecology or physiology of *Marmota broweri* which is endemic to Arctic Alaska. We located a hibernaculum in the northern foothills of the Brooks Range and implanted one female with a data logger in August 2007 to record body temperature (Tb) every 20 minutes. This female initiated heterothermy (Tb < 30°C) on 10 September and terminated heterothermy on 21 April after 224 days. During midwinter, torpor bout length ($\pm$ SD) averaged 15.74 $\pm$ 1.86 days; average interbout arousal duration was 18.46 $\pm$ 2.27 hours. This animal defended a 16°C thermal gradient with a minimum Tb of 1.01°C corresponding to a minimum hibernaculum temperature of -14.97°C in February. Hibernaculum temperature averaged -7.33°C from 22 September to 9 May while minimum air temperatures reached -42.03°C with an average of -14.59°C. Marmots emerged between 21 and 23 April but returned and remained below ground until after 3 May when at least 6 animals (breeding female, 2.85 kg; 2 females, 2.06-2.16 kg; 2 males, 2.22-2.77 kg; yearling) emerged from the hibernaculum. Resting metabolic rates of animals within 15 days of emergence from hibernation averaged 0.364 $\pm$ 0.044 ml O₂/g*h (n=5), slightly lower than the mass-predicted 0.431 ml O₂/g*h. The respiratory quotient of 0.713 $\pm$ 0.013 (n=3) indicates metabolism was fueled by fat reserves. In contrast to the sympatric Arctic ground squirrel, *M. broweri* appears to use communal hibernation as a strategy to maintain above-freezing body temperatures. These differences make this an interesting species in which to study adaptations to extreme conditions.



Epizootic process of sylvatic plague and Mongolian marmots.

PIL'NIKOV A.

In 1938-1939 the Japanese army set up a top-secret, germ-warfare research centre-731 Division in Haerbin (China.) There over 4000 people were exterminated in bestial fashion: some were frozen or infected with bubonic plague and other infections. That time, Japanese army widely used the bacteriological weapon in the China. On a threshold of the Second World War the Soviet Red army carries out anti-epidemic actions in frontier regions with Manchuria. Severe time demanded simple and radical decisions of difficult problems. In 1939 in Dauria the large-scale unknown war began against the Mongolian marmots as "hosts of plague". By different estimations during the period 1939-1956 the population of marmots about one million individuals has been destroyed in Transbaikalia. Till now the Mongolian marmot remains the enemy number one for anti-plague station of transbaikalian region.

Destruction of the most quantities of aborigine-inhabitant of Daurian steppes constrains development of ecological tourism and conducts to catastrophic changes of biocenoses in arid areas. The direct annual damage of economy of areas, according to the most conservative estimates, has measures by millions dollars. In spite of drastic measures to exterminate rodents, and other animals, in the natural foci of plague in the latter half of the 20th century in the Soviet Union, when the areas of rodent extermination covered hundreds and thousands square kilometers, and the use of a great amount of weapon gases, the natural foci of this infection still exist manifest of diseases among humans and animals.

The tragical mistake or ecological crime is based on a dogma of continuous circulation of bacteria *Yersinia pestis* in the natural foci. Breaking of the parasitic chain or mass extermination of the hosts and vectors, although of preventive value, did not produce the expected effect. Analysis of a problem of "sudden" occurrence of plague epizooties shows, that the system of preventive maintenance of infections is based on incorrect system epizootic process. Integrative, complex ecosystems researches of the foci of a sylvatic plague have allowed allocating geological factors, as leaders into provocations epizooties. On the basis of GIS-technologies the electronic map of territory of southeast areas of Transbaikalia is constructed. On the map are anomalous zones, on which, in opinion of the author, are possible epizooties of plague and other optimal ("not plagued") zones of for marmots are made. That in the long term allows having a conversation about restoration of population of the Mongolian marmot in extensive territories of Dauria.

Marmots in the media: a modest proposal.

LENTI BOERO D.; CAMMAROTA G.

As we all know, naturalistic experience is much more than the one gathered by TV watching, because it involves kinesthetic, and full sensorial stimuli, including thermal, mechanical, olfactory and obviously, audio/visual info. However, naturalistic movies and documentaries helped a lot in public information and in raising conservation issue. On the contrary, sophisticated video techniques, like electronic traps, or infra red video monitoring might help in adding informed knowledge to scientists. Here we proposed for open

discussion some video clips and a brochure of a movie project “Marmots: the ultimate movie”. An important question to be answered is: can marmots be made “as attractive as” bears, or polar bears. Some reflexions on how a marmot species may be presented in order to be of interest for the general public, within a folk-biology view, are welcome.

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WORKSHOP. MORNING CHAIR.

Climate change in the Alps: past, present (and future?)

MAGGI V.

Demographic effects of climate fluctuations on an alpine marmot (*Marmota marmota*) population

ALLAINE D.; COHAS A.; BONENFANE C.

Climate shapes demographic rates of a wide range of large herbivore species. The underlying processes most frequently advanced are a variation of resource abundance and quality with precipitation or temperature and the costs of locomotion in snow during winter. Alpine marmot copes with winter by overwintering in burrows (from September to late April) so that consequences of climate maybe less marked than for non-dormant species. We predicted marmot survival and recruitment to depend primarily on summer condition before wintering when they build fat body reserves and less on winter condition. We found that survival of all age- and sex-classes of marmots responded to climate. In summertime, the amount of rain per month was negatively associated with marmot survival. Moreover, winter condition was also important to marmot survival. The average thickness and the extent to which the snow layer lasted in spring were significantly correlated to marmot survival. In contradiction with the current view of climate effects in herbivore populations, summer precipitation decreased survival despite it is generally reported to increase the primary production. We discuss this relationship in terms of too high costs of thermoregulation when foraging under wet conditions. Thermoregulation was also important in winter since the snow layer thickness, acting as an insulation layer, decreased the probability of survival when too thin. Our results suggest that thermoregulation is a key factor in alpine marmot and provide some insights regarding the consequences of climate change on this species.



Climate change impacts on population of menzbier's marmot (*Marmota Menzbieri*) in Uzbekistan

BYKOVA E.; ESIPOV A.

The problem of the climatic change and protection of rare species is poorly developed and currently is confined with a few instances such Menzbier's marmot Uzbekistan shelters almost half of the world population of this species. In Chatkal Ridge, this marmot vanished in the vicinity of heights Takali, Hovli and Chimgan. Comparison current data of number and distribution of Menzbier's marmots in Chatkal nature reserve with data received by V.I. Mashkin (1993) demonstrates tendency of reduction of marmot's population there.

A study of the state of Menzbier's marmot in high-mountain Angren Plateau, carried out by O.V Mitropolsky (FFI report on climate change impacts on biodiversity in Uzbekistan, 2008), showed that rise in the lower border of snow cover has significantly deteriorated the habitation of this mesophillous species. About 60% of former habitats lie beyond zone of a constant humidification and plant vegetation and to a larger degree became unsuitable for their habitation. The surviving marmots have aggregated near sparse springs, where they are extensively killed by herdsmen. A relative stable number of Menzbier's marmots are noted in colonies located higher than 3000 masl. Despite the prognosis that the effect of the global warming is less manifested in high-mountain areas against the arid zones, the forecasted increase in the level and intensity of snow and glacier melting can lead to a shift of the vertical zonality, a significant reduction and fragmentation of the habitats of the Menzbier's marmot.

The effects of climate on hoary marmot demography: a retrospective analysis

PATIL V.

The Hoary Marmot (*Marmota caligata*) is an alpine specialist that has been proposed as a model species for predicting the effects of climate change on alpine fauna in northern Canada Previous research has shown that Hoary Marmot survival is closely correlated with large-scale climate indices, but it is impossible to make long-term predictions about population dynamics without accounting for the influence of other demographic rates. We are using Life Table Response Experiments based on matrix models parameterized with 8 years of mark-recapture data (1999-2004, 2007-2008) from a population in the Yukon Territory to identify the relative influence of age-specific survival, fecundity, and dispersal on observed variation in population growth. We then examine these models in the context of local climate patterns in order to predict how interactions between climate change and life history are likely to shape the population dynamics of this species. Ultimately, this project will be combined with work using genetic markers to determine the effects of landscape [treeline position] on dispersal patterns to build a climatically and spatially explicit model of Hoary Marmot demography in the southern Yukon. Preliminary results suggest that, while realized population growth (*i*) does not correlate as closely with climate indices as survival, variation in *X* is more strongly linked to adult survival than to any other demo-

graphic parameter. However, immigration appears to contribute significantly to recruitment in most family groups, yet immigration rates appear to be most responsive to social, rather than environmental pressures.

Environmental influences on the hibernation patterns of Eastern woodchucks (*Marmota monax*)

ZERVANOS S.; FLORANT G.; BROWN J.; FENN A.

Animals enter hibernation to cope with low environmental temperatures and lack of food resources. However, we know little about the flexibility of hibernation physiology, i.e., how differences in environmental conditions affect hibernation patterns within a species. Woodchucks (*Marmota monax*) occupy a wide geographic range, thus experience a wide range of ecological conditions. We would expect these mammals to vary in hibernation patterns depending on latitude. We collected body core temperatures (Tb) on a continuous basis from free-ranging woodchucks during 3 hibernation seasons from fall 2005 to spring 2008 at field locations in Maine (43°42'N; 70°14'W), Pennsylvania (40°22'N; 75°22'W), and South Carolina (33°26'N; 81°20'W). We surgically implanted iButton temperature data loggers into animals from each location (11 in ME, 12 in PA, 8 in SC). We released them at the site of capture and recaptured them at the end of each hibernation season to recover the loggers. During the winter of 2007-08, two animals from each location were captured and maintained in the lab under constant temperature conditions. In the field, ME, animals spent 88% of the time in torpor; in PA 80%, and in SC 70%. Dates of first torpor and final arousal, number of torpor bouts, length of torpor and euthermic bouts, and torpor Tb's also differed significantly across populations. Lab animals from the 3 locations exhibited both similarities and dissimilarities in hibernation patterns to their home counterparts. These results reflect the flexibility of hibernation under different environmental conditions and the relative influence of environmental versus genetic factors on hibernation patterns.

Genetic vs. environment: variation in torpor patterns of marmots and woodchucks under constant laboratory conditions

FENN A.; ZERVANOS S.; FLORANT G.

Hibernation is characterized by reduced metabolic rate and multi-day torpor bouts during which body temperature (tb) declines to near ambient temperature (ta) but the animal periodically re-warms to normal tb (37°C). The characteristics of torpor during hibernation at different latitudes are unclear. Woodchucks (*marmota monax*) have a population range extending from the south-eastern united states to northern alaska to determine whether the phenotypic expression of torpor is genetically determined or varies due to environment, we investigated torpor patterns from woodchucks obtained from 3 populations (maine (latitude 43°42'n, n=2), Pennsylvania (latitude 40°22'n, n=2), and south Carolina (latitude 34°40'n, n=2)) and placed all animals at constant ta (5°C) in fort collins (latitude 40°45'n), Colorado, marmots (*marmota flaviventris*) from Colorado were used as a reference out-group (n=2). Body temperature data loggers (i buttons maxim inc.) were surgi-



cally implanted into the animals' abdomen to record tb (every 3 hrs) from September 2007 to april 2008 Food intake was recorded prior to hibernation; during hibernation food was removed monthly body mass measurements were recorded from July 2007 to april 2008. We hypothesized that torpor patterns would be highly variable and therefore indicative of the ta under which the animal was maintained. We found that although there was variation in torpor patterns within each population, basic torpor characteristics were similar to field results. This suggests that torpor patterns have a strong genetic component. This research was supported by nih grant (r25 dk067017)to glf.

Biophilia in young generations: a pilot study in mountain primary schools

LENTI BOERO D.; CLERICI T.; BARBIERO G.

Introduction. Species and habitat conservation need to gather attention from multilevel instances administrative and political, scientific, mass-mediatic and, last but not least, common people. Motivations sensitizing common people to move in order to protect some species or habitat are multidimensional, and only partially explained by media activity. A most important aspect might be biophilia, that is itself a concept to be understood and tested (Wilson 1993, Kahn 2001). Here we present two experiments aimed at better understanding the concept of biophilia using marmots as a model. Methods. First experiments was performed with university students and aimed at comparing differential attractiveness of insect and vertebrate species, including marmots as regards as their potential in attract interest from the public and willingness to spend money in order to support conservation Second experiment was carried in primary schools located in a mountain area and aimed at understanding both the cognitive and affective relationships that children have with marmots Results are discussed in term of the effectiveness of the marmot genus to be an umbrella species, and in term of the possibility of extending those techniques across different countries and cultures in order to understand the effect of cultural environment as regards as the real existence of biophilia References. Kahn PH., *The Human Relationship with Nature: Development and Culture*, MIT Press, 2001; Wilson E. O., *Biophilia and conservation ethic*, in Kellert S R., Wilson E. O, *The biophilia hypothesis*. Island Press, Washington D. C, 1993, pp. 31-41.

A web-based tool for transform" immediate information on marmot

LOPEZ B.C.; BRIA M.; RUIZ OLMOS J.

We will present a web-based tool that allows the immediate introduction of localization data of marmots and, at the same time, permits autenticated users to easily access these data The site has an easy interface so any non-expert can introduce data on the localization of marmots around the world, and has a double use: 1) the main objective is providing an interface for introducing localization points and characteristics of found burrow sites (number of individuals, pictures uploading, .); more, the high level of detail of Google Maps skips the need of having had to acquire any geographical information via GPS; and 2) it will be possible for autenticatd users (administration, university,..) to ac-

cess to the updated databases of introduced data. The site has also a divulgative side, with biological information about the species, sites where they can be observed, and pictures.

Twenty seven years monitoring of an alpine marmot introduction in a rural landscape.

RAMOUSSE R.; MR. LE BERRE M.

Marmots were introduced in the rural landscape of the Mezenc massif (France) in 1980. Since then an annual monitoring was performed. The monitoring protocol included five counts per year for each known family group and new discovered marmot settlements. In 2007, the number of marmots doubled since 2000, despite a population crash in 2001. The 494 marmots distributed into 86 sites spread an area of about 200 square kilometres. Multiple Correspondence Analysis (MCA) analyzed demographic and environmental parameters of each site. Marmot reproduction was high in anthropogenic site (meadows, dry stone walls, elevation under 1200m) instead of null or almost null in more natural landscapes (heathlands, screes and upper elevation). But, although latter sites were not favourable for breeding, some of them were regularly occupied and could act as temporary shelter sites for dispersers. A better understanding of the process of marmot colonization in rural area could eventually reconcile the interests of farmers and tourism players. Maintaining the marmot population would participate in the sustainable development of the Mezenc massif.

The Himalayan marmot *Marmota himalayana*, Hodgson (1841) in the anthropogenic landscape

NIKOL'SKII A.; ULAK A.

The field observations we made in Nepal in the regions of Manaslu, Annapurna and Lower Mustang. The conflict of interests of marmots and humans lies in the fact that both use the same relief features for their settlements, largely populating alluvial terraces with a thick layer of fine soil. Marmots use the fine soil as a substrate in which they dig up their burrows. To humans, alluvial deposits are convenient in that the soils used for farming developed in them. Wide flattened terraces are also convenient for livestock grazing. The major forms of human impact on the marmots are: 1) human settlements and farmlands, which bring about destruction of the habitat and dissection of marmot colonies; 2) livestock grazing; 3) uncontrolled hunting. All the Himalayan marmot colonies are situated on the grazing lands of domestic livestock exposed to grazing digression. The local people use loops to catch marmots. When croplands are abandoned and are not tilled for a long time marmots get back to their original habitats. They may remain in areas adjacent to the croplands and even populate abandoned buildings. In the Lower Mustang, we found non-used marmot burrows. The Lower Mustang is the southern edge of a huge colony of marmots with a center in the Upper Mustang on the border of Tibet and Nepal. In Nepal, the marmot is not regarded as a rare or endangered species. It would be feasible to monitor marmot numbers in Nepal on a regular basis. Its harvest should be regulated or completely banned.



Some measure of Menzbier's marmot (*Marmota menzbieri*) conservation in Uzbekistan

ESIPOVA.; BYKOVA E.

Habitats of Menzbier's marmot are located in mountains of the Western Tien Shan in Tashkent and Namangan provinces within the Chatkal biosphere nature reserve, Brichmul-la, Akhangaranand Namangan forestry farms. The total population of Menzbier's marmots is 5000-7000 individuals. The status of the Menzbier's marmot in Uzbekistan has been somewhat deteriorating in the last 20 years. This species included in national Red Data Book and IUCN Red List. The threats of Menzbier's marmot are:

- a. Persecution by shepherd's dogs.
- b. Poaching by local shepherds hunt marmots for medicinal fat, skin and meat;
- c. Habitat fragmentation;
- d. Competition with domestic livestock; 0 Deterioration of habitats.

Persecution by shepherd's dogs is one of main threats of marmots. Habitats of a marmot represent high-mountainous pastures which are intensively used within three summer months, except territory Chatkal Nature Reserve. According local traditions, shepherds practically do not feed the dogs and those are compelled to hunt. Thus marmots are their favorite preys. Effect of shepherd's dogs persecution on marmot's population is considerably highly that total impact natural predators-red fox, wolf, golden eagle and snow leopard.

It is necessary to enter stringent restriction of use shepherd's dogs in habitats of Menzbier's marmot, namely: to hold them on leash during day time. Thus, livestock will be protected as well as damage to a marmot will considerably be reduced. Also it is necessary to limit number of dogs per one herd (no more than 2 dogs). Currently, this number is really exceeded in 2-3 times.

Actual factors determining of current depression of mongolian marmots populations

KOLESNIKOV V.; BRANDLER O.; BADMAEV B.; YANSANJAV A.

There are about 8 million marmots in Mongolia now according to our calculations. The probable maximal number of the population in optimum conditions in the past were 21 million animals. Factors determining of quick decrease of Mongolian marmots population from 2000 to current day were detected. They are (according to the reduction of importance):

- The hunting of marmots caused by active overpriced purchase of marmot's skins;
- The spring hunting of marmots extremely decreasing the ability of populations for recovering;
- The hunting of marmots by the local peoples for food during the whole warm season;

- The use of all products obtained from marmots (skin, meat, fat, brown fat, liver, bile, bones) in the Tibetan medicine which is widely popular at the last years;
- The change of hunter strategy to using traps and loops;
- A plenty of the local people's dogs hunting marmots actively,
- High number of predators, especially wolves and eagles.
- Easier motor locomotion to marmots colonies that became their hunting more intensive;
- Spring droughts lasted every some last years, that probably concerned with global warming of the climate.

There are some additional local factors except these ones

The status of the Siberian marmot in the eastern steppe of Mongolia

TOWNSEND S.E.

Siberian marmots (*Marmota sibirica*) are important members of the Mongolian steppe ecosystem and local human economy. Recent declines in marmot numbers have forced the Mongolian government to ban marmot hunting for four years (2005 through 2008). The main objectives for this study were to develop a baseline understanding of current marmot distribution and density in the Eastern Steppe of Mongolia (Dornod, Sukhbaatar, and Khenti aimags). We conducted line transects across the Eastern Steppe during pup emergence in 2005, 2006 and 2007. These distance sampling surveys detected active and inactive marmot colonies ("burrow clusters"), marmots, and other wildlife (primarily carnivores, ungulates and raptors) along our transects; we used the program DISTANCE to estimate densities. Our density and population estimates indicate a severe decline from other published studies. We discuss our findings on raptors, wild ungulates and raptors and how these taxa may be affected by marmot densities. We present how we measured burrow clusters and determined active and inactive status. Finally, we speculate on how the Siberian marmot functions in the grassland ecosystem and the future of conservation for this marmot species.

Population number of Mongolian marmots (*marmota*, Sciuridae, rodentia) at the beginning of XXI century

KOLESNIKOV V.; BRANDLER O.; BADMAEV B.; ADIYA Y.

Census of marmots was made whole around marmot area in Mongolia in 2007 by Russian-Mongolian complex biological expedition. One year estimation of all Mongolian marmots population was made at first. A research route was carried out on a base of previous studied of Mongolian marmot distribution using a map of marmot area (Adjaa, 2002). Family plots registered on registration routes and areas. Estimated and potential population densities, average share of living family plots, average size of family group were calculated. Population numbers were estimated for both Mongolian marmot species (*M. baibacina* and *M. sibirica*). The marmot distributed territory of Mongolia was divided



to 9 zones according to landscape-climatic, plant associations and anthropogenic factors influencing environment conditions of marmots. According to our data current population number of marmots in Mongolia is 8 million including 930 thousand of *M. baibacina*. Maximum existed population number was about 21 million. Thus there is a quadruple decrease of the whole marmot population during the last years. Whereas Townsend and Zahler (2006) showed tenfold reduction in Eastern part of the country. Comparison with earlier data (Bibikov, 1989; Batbold et al. 2000; Adjaa, 2002, etc.) for the end of the 20-th century (11.5-23 million individuals) may shows periodical fluctuations of the marmot numbers conditioned by social and climatic changes.

Global warming and marmot's hibernation: Mathematical modeling of burrow temperature in changing climate.

BELOVEZHETS K. I.

Temperature inside burrow is mainly determined by surrounding ground temperature, which is, in its turn, determined by temperature of surface and underlying thermo-neutral layers. The most obvious method of burrow temperature estimating in case of climate changes is mathematical modeling, which showed good results in nowadays burrows temperatures' analyses.

Model shows that temperature regime changes depend on burrow depth and speed of climate changes, because deep ground warming is an inertial process.

Since there is no generally accepted global warming forecast we analyzed three possible scenarios:

1. Equal 3°C increase of all mean month temperatures (equal scenario). This amplitude is commonly used in discussions about Holocene climate changes.
2. Rising of only winter half-year temperatures (from October till March, winter scenario).
3. Summer scenario: rising of summer half-year temperatures (from April till September). All three scenarios result in rising of every month's average temperature. In "equal" and "winter" scenarios temperature during hibernation is considerably higher than nowadays. For example, for Ukrainian population of *Marmota bobak* it is shown temperature increase out of optimum range (0..+5°C) at depth from 1.5m to 4.5m. Transbaikalian *Marmota sibirica*'s deep (3m) burrows' temperature remains optimal, and period of negative temperature at 1.5m depth decreases from 6 to 4 months.

"Summer" scenario affects mainly summer and autumn burrow temperatures, so most changes will be in marmots' foraging activities and behavior.

Model shows that climate changes affect marmots' populations variously, depending on environmental conditions. Enhancing precision of climate changes forecast let us make more detailed estimates.

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MARMOT AND HEALTH.

Device “zepper” against the parasitofauna of the marmots

POLYAKOV A.; ZAYTSEV G.

In 1989 Dr. H. Clark has found out, that the organism radiates a variable electromagnetic field with frequencies, characteristic only for it. Parasites have a range from 77 up to 900 kHz. Fleas radiate within the limits of 1-1, 5 MHz. The marmot radiates energy on higher frequencies: from 1, 52 up to 9, 46 MHz. If parasites to influence in electric potential their resonant frequency they perish rather quickly. With the medical purpose to marmots is better to apply a pulse pressure of positive polarity with the frequency of recurrence approximately equal to frequency of the parasite. We invent device “Zepper” designed on the basis of integrated microcircuit KP 1006. It represents the highly stable generator of rectangular impulses of positive polarity with amplitude of a pressure up to 10 V. Influence on parasites was made three times for a session for 7 with 20 minutes break. The second 7 minute influence kills the released bacteria and viruses, however the last appear again, already from the killed bacteria. After the third zepping neither viruses, nor bacteria and, especially, parasites are not tested even later many hours after influence. It is necessary to note, that zepping does not destroy the alive essences which are being contents of a stomach and an intestines as electric impulses pass through walls of bodies of an intestinally-gastric path, but not through their contents. However more intensive course of treatment allows to lower considerably a population of different parasites.

Bacterial and insect present in faeces in different natural and introduced marmot locations

PRIORI P.; MIGNONE W.; SCARAVELLI D.

The ecosystems where the populations of *Marmota marmota* are present is often complex and delicate. The introduction of this rodent can interfere with the availability of forage, with predator diet, with invertebrate and parasite relationship. In order to evaluate the possible role of marmots in this sense a small project was established to collect information on bacterial and insects in different population of marmots belonging to natural or introduced zones. Presence of latrines or different use of the territory for defecation, bacterial and parasite presences and insect faunal composition are researched in different location in Alps and Apennines by visual observation and traditional laboratory system. Information collected will be related with different origin of marmot population, presence of other sources of mammals faeces and landscape characteristic to determine the possible influence of marmot on this ecosystem parts.



MARMOT AND THE MEDIA.

Communication activities about alpine marmot reintroduction in the Dolomiti Bellunesi National Park project

VETTORAZZO E.; BORGO A.

The project of alpine marmot reintroduction in the Dolomiti Bellunesi National Park started in 2006. With the reintroduction project, a communication campaign was carried out, to spread the results and create a personal and “affective” bond between residents, tourists (especially younger people) and the marmots

The marmot was used as an instrument for spreading an environmental awareness. Besides the traditional press bulletins on the local and national media, a “referendum” (by the radio programme “// ruggito del coniglio” by RAI Radio 2) was carried out to give a name to the released animals and to the newly born.

With the local tv Telebelluno, a special report was made, illustrating the steps of capturing and releasing of the animals, and which was successfully broadcasted and replicated. The RAI 2 national television news dedicated a report to the project.

A full page of the Park’s bulletin “Tracce” (56,000 copies) was dedicated to the reintroduction of the marmot.

The project was also inserted in the environmental education programmes “At school in the Park”, with the laboratory “I, too, am a marmot” dedicated to the children. The didactic activity envisages having children experiencing the typical day of a marmot, coping with the problem of finding food, recognizing the sentinels’ alarm calls, escaping in to the burrow, and correctly preparing for the winter hibernation.

In the Park’s website a section dedicated to the project has been created

A technical report and the popular text “Marmots at arms”, illustrating the reintroduction project to very young people, has been published.

MARMOT BEHAVIOUR.

Alpine marmots freeze their memory during hibernation

CLEMENS L.E.; EXNER C; HELDMAIER G.

Alpine marmots (*Marmota marmota*) hibernate 6-8 month each winter in order to survive unfavorable environmental conditions. Since a negative impact of hibernation on memory is debated, we examined learning behavior and memory of a marmot colony housed and bred at the University of Marburg.

During their active season (May-September), the marmots were trained in an operant and a spatial learning task. Animals firstly learned to walk through a tube and to jump on

two boxes to obtain a food reward. After six month of hibernation in a climate chamber with a ta of 6°C, performance was tested again In both tasks, skills were found to be unimpaired after hibernation (*boxes*: first training day: $890,3 \pm 91,8$ s, before hibernation: $298,0 \pm 35,7$ s, after hibernation: $299,3 \pm 14,4$ s; *tube*: first training day: $330,8 \pm 52,9$, before hibernation: $158,4 \pm 9,0$ s, after hibernation: $137,7 \pm 6,3$ s).

We further investigated habituation during repeated open field exposure. In the first run, all animals showed a high locomotor activity ($61,4 \pm 8,6$ crossed squares), whereas in the second run, animals immediately moved into one comer and remained there ($7,2 \pm 1,6$ crossed squares). This habituation was not altered even after the 6 month of hibernation ($6,1 \pm 1,1$ crossed squares). Despite the unimpaired performance after hibernation, we observed that memory was less fixed during the summer period, since changes in test procedure or prolonged gaps between training sessions resulted in a slight impairment of test performance.

We thus conclude that Alpine marmots freeze their memory during hibernation and retain skills entirely after arousal.

Adaptation of marmots

MASHKIN V.

When preparing for winter 1.5-1 months before hibernation and after intensive feeding healthy and most fattened sexually mature and two-year-old individuals remain in a state of stupor for 3-8 days. At this period the temperature of their body falls up to 12-24°C, and the reaction to external stimuli decreases. During the time between a homoiothermal phase and hibernation gonads of sexually mature individuals prepare for the next (spring) reproduction. In females the follicular apparatus begins activating that resulted in increasing the number of primordial follicles. In males the mass of testicles and epididymises begins growing, the number of seminiferous tubules and their diameter increase. During hibernation the body temperature falls up to 4-6°C, the breathing rate up to 4-5 breaths a minute, and breathing pauses make up one breath in 2-3 minutes. The pulse rate decreases up to 2-3 beats per minute. In winter 1-3 times a month the temperature of marmot's body rises up to 22-24°C, and the animal goes to urinate the products of metabolism on «autopilot» (eyes and ears are closed with a black viscous mass, there are no reactions to external stimuli). During hibernation blood coagulability in animals sharply decreases After recovering from hibernation and when body temperature of marmots rises up to 36°C blood coagulates normally.

The effect of amplitude modulation on the structure of the acoustic signal spectrum in marmots

NLKOL'SKIL A.

The amplitude modulation (AM) is a temporal change in the signal. The relationship between the AM and the spectrum of the sounds produced is exemplified by the alarm call of three marmot species (*Marmota sibirica*, *M. menzbieri*, *M. caudata*). In the case of AM



higher and lower than the carrier frequency (F_0), side frequencies are formed ($F_0 \pm Of$, $i=1, 2, 3, \dots$). In signals devoid of AM, side frequencies are absent. In case AM is present only in some part of the signal, the side frequencies, too, are only present in that part of the signal. The interspecies frequency distinctions are accordingly accompanied by interspecies distinctions of the carrier frequency in relation to the modulating oscillation frequency, F_0 / I & That ratio in *M. sibirica* is 10, y *M. menzbier* 18, in *M. caudata* 34. The lower frequency of the modulating oscillation, the signal spectrum of *M. caudata* has a greater number of side frequencies. The modulating oscillation is almost periodic. In all cases, the frequencies of the modulating oscillation higher than 1 (Φ_2 , & 3) were almost divisible to the first-order frequency (Q). In the signals of *M. sibirica* and *M. caudata* the ratio of $Q/2, 3 / \& i$ differed the integer by 0.02-0.08 In the signal of *M. menzbier* it differed by 0.21- 0.25. It is not yet clear whether AM ensures adaptive advantages for the marmots. Potentially, it opens up great opportunities for increase in the jam resistance of the message being transmitted and information encoding as is the case in radio-engineering.

Unusual behaviour of marmots in conditions of prosecution

POLYAKOV A.; BRANDLERO.; KOVALENKO S.

The unique settlement of marmots with unusual behaviour and a way of life is revealed us in territory of area Topkinsky of the Kemerovo area. Earlier by poachers for one season about 50 individuals were extracted. In the afternoon people have ceased to mark marmots. Us a fact in evidence of displacement of their activity for night time. Using the device of night vision, we repeatedly observed marmots during feeding with 12 up to 3 one o'clock. Cases of an attack on them by night of badgers, foxes and bearded owl are noted. The sound signal system at night was limited to unitary, short singing. Marmots laid down on the ground, hid, not undertaking attempts to be covered in holes though were from them on distance no more than ten meters. Life cycle at these marmots proceeds only in winter hole. Years and fodder holes (on plain) are not visited any more by marmots. Courses between holes pass at top of a slope among a birch wood under original arches from vegetation which height reaches 15 meters in the summer. Hills are not appreciable almost. In this settlement marmots do not visit the next fields of grain crops. The strengthened feed feeding female marmot is noted by a nettle. It eat female marmot and before hibernation. The nettle is a strong stimulator of formation of milk.

Thus, marmots in conditions of prosecution are capable to change not only behaviour, but also a way of life, for them not typical.

Home range size, foraging behaviour and risk of predation in Alpine marmots (*Marmota marmota*).

LABRIOLA M.C.; PASQUARETTA C; BOGLIANI G.; VON HARDENBERG A.

In hibernating mammals such as alpine marmots, summer body weight gain is one of the primary factors influencing overwinter survival. It has been shown that body weight gain of these animals is influenced by abundance and quality of food resources, and the

exploitation of resources within their territories, leads marmots to feed away from the main burrow, increasing the risk of being predated upon (Holmes, 1984).

In this study we investigated the trade off between Home range size and Body weight, testing the follow hypothesis: the less the individual weighs the more it risks feeding further away from the main burrow, in order to obtain higher energy intake (better food resources) despite the higher risk predation.

We took observation during all summer 2007 on marked individuals of alpine marmots and we daily calculated the distances between foraging localizations from the main burrow and from the nearest burrow; the localizations, registered using a range finder, a clinometer and a goniometer, had been also used to calculate the individual home range size. The body weights were been registered during the capture and with electronic scales at the entrance of burrows. The analysis reveal that only juveniles support our hypothesis.

Spatial utilization were analyzed: every family group shares a common home range ($1,048 \pm 0,22$ ha), slightly overlapped ($9,3 \pm 3\%$) to family with adjacent territories.

When marmots forage, the distance from the main burrow is age-dependent; they reduce the distance from the nearest burrow in the afternoon: it could be due to differences in daily activities of predator or to different environmental conditions and other studies are nowadays working on these hypothesis.

Moreover, the more the marmot lives and forages near the wood line, where vigilance is higher, the more it weights: this could be due to a possible trade off between an earlier snow-melting, which allows marmots to have access during a longer period to rich and abundant food resources, and an higher risk of predation However this hypothesis needs more studies.

MARMOT BIODIVERSITY AND TAXONOMY.

Marmot in Slovakia-brief overview

ADAMEC M.; ONDRUS S.; KACEROVA V.; RADUCH J.

Tatra marmot (*Marmota marmota latirostris*) is recognized as a separate subspecies, endemic to the Carpathians, especially Tatra Mountains (Slovakia and Poland). In Slovakia, this subspecies occurs in two different mountain ranges, both designated as national parks - Tatransky NP (High Tatra Mts.) and NP Nizke Tatry (Low Tatra Mts). Individuals of both populations are autochthonous, confirmed by information from historical and fossil data.

In total, the estimation of Marmot number in Slovakia is about 800-1000 individuals, from which 300-350 is in Low Tatra Mts and 500-650 is in High Tatra Mts.

Tatra marmot is strictly protected species threatened by many factors-mostly by human activities

To prevent negative impacts and to secure suitable protection of the species, Management plan for Tatra marmot was adopted by Ministry of Environment of SR. for the period of 5 years (2003-2008) and actualizing this document recently. The key tasks of



this document were to propose and point out necessary activities for mentioned period, which are: to establish permanent and regular monitoring of the species in the whole range (including study of ethology, ecology, winter survival, mortality, food preference) - monitoring should include also spatial activity based on radio-tracking research, cooperate with relevant institutions, organizations and individuals and to prepare proper training for them, realize serious research aimed on confirming the taxonomy status of the subspecies on the genetic base, research also health status of individuals (parasites, heavy metals, habitat contamination, etc.), identification of main threats and their elimination

On the marmot resources reconstruction in Orenburg oblast of Russia

LEVYKIN S.; FEDORENKO O.; KAZAKOV G.

Orenburg oblast is the steppe region of 124 thou ha square situated in the south of Urals. Over 1 million specimens of steppe baibac (*Marmota bobac* Midler, 1776) inhabited only the eastern part of the oblast before virgin land masses were ploughed. The pioneering of 1,8 million ha virgin lands in the oblast in 1954-1963 has become the main cause of baibac resources fall because the habitats destruction and the direct extermination.

In 1970's steppe baibac of the oblast was counted for the first time, its resources was estimated as 86050 specimens. Six protected areas of 314,3 thou ha in total were established for the species by oblast authorities in 1975-1984. There are 2600 baibac specimens in the reserve (zapovednik) "Orenburgskiy" established in 1989. A public organization has taken on lease the steppe plot "Orlovskaya step" of 16 thou ha, where the baibac population is successfully recovering itself. The main baibac resources of the oblast inhabit agricultural lands

Recent years exhibit the tendency of baibac resources stabilization. Taking the whole limiting factors system into consideration, it is possible and a-priori tolerable to increase the number of baibac specimens to approximately 500 thou.

Being one of key (title) biological objects constituting the steppe, the baibac is merit to be one of priority objects in steppe ecosystems reconstruction.

Landscape distribution as taxonomic character of marmots of «bobak» group

TARANENKO D.

It is known, that the complex of standard criteria allowing to differentiate separate species in some belief is traditionally used in systematics (Zavadsky, 1968). Morphological, physiological, ecological, ethological and geographical types of taxonomic characters correspond to these criteria (Mayr, 1971). The set of used criteria or types of characters depends on specificity of investigated group of organisms.

Morphological characters (variations of coloration, the size and proportions of body,

a complex of craniological attributes) always played the main role in development of systematics of marmots of “bobak” group and other representative.

MARMOT ECOLOGY.

The observations after the duration of the activity on the earth surface and the leaving into the marmots' hibernation in the batyrevskiy colony

DIMITRIEV A.; GUSAROVA M.

The Batyrevskiy relict colony is known by the science since the middle of the XYIIth century. Since 2000 the regular scientific researches are being carried out.

Awakening on the day surface lasts 122-140 days, absence on the day surface - 139-226 days. The anomalous were: 2002 - repeated awakening and going out on the day surface; 2005 and 2006 -restless leaving into the hibernation

The observations after the duration of the activity on the earth surface and the leaving into the marmots' hibernation in the Batyrevskiy relict colony

The observation years	The period of the appearance after the winter hibernation	The number of the active days on the day surface	The period of the leaving into the hibernation	The duration of the absence on the day surface, no data of the days
2001	10-15.04	123	17-25.08	
2002	11-14.01; 13-17 02; 02-04.03; 11-24:03*	133	05-18.08	139-226
2003	31.03-04.04	122	05 -22.08	200
2004	15.03-08.04	127	14.08-06.09	211
2005	06-09.04	130	18.08-04.10**	177
2006	31.03-06.04	130	15.08-10.10**	161
2007	21.03-25.03	140	13.08-15.09	177
2008	11.03-18 03			

Note:

* - the marmots on the different lots went out to the day surface in different periods,

** - during this period the holes closed several times and opened.

What happens to ptarmigans when marmots arrive?

FIGUEROA AGUILAR I.; DALIT RECASENS A.; LOPEZ B.C.; LOPEZ A.; POTRONY D.

The population of ptarmigans (*Lagopus muta*) in southern Pyrenees is endangered and vulnerable. The most optimistic estimates calculate no more than 400 individuals in



the Pyrenees. They are very sensitive to landscape changes and their population is limited to few points at the highest altitudes of the Pyrenees. These sites are being occupied by alpine marmots (*Marmota marmota*) since 1980, with a very high expansion rate. Some personal observation of forest services point at a possible negative effect of the presence of marmots on ptarmigans. We will present the preliminary results of a meta-analysis about preferences of habitat of both species. Overlapping areas can thus be detected through GIS analysis. To complete this approach, we will also present results on interactions of both species based on observations in sites where they cohabit.

Distribution and present state of *Marmota bobak* settlements in Nizhny Novgorod region

MOROZOVA N. M.

The steep marmot (*Marmota bobak* Mull.) had been released in Nizhny Novgorod region during 1983-1984. The newly formed settlements of marmot in Nizhny Novgorod region is the extreme north-west outpost of the species in Volga region. Marmots have populated most of suitable habitats near place of release and active settling a new places. At present time they live in 5 south-east districts in the region - Krasnooktyabrsky, Sergachsky, Gagin'sky, Bolshebaldinsky, Sechenov'sky.

This article deals with estimation of present state of marmot settlements and analysis of main factors defining appearance and well-being a new marmots colonies. Considered such factors as a cattle grazing, predators pressure and the some climatic conditionals.

MARMOT IN CAPTIVITY.

Experimental interspecies hybridization in marmots

FEDOSEEVA G.; BRANDLER O.

An experimental hybridization of bobak-group marmots was carried out in a cage keeping conditions. Captured in the wild *Marmota baibacina* female and *M. kastschenkoi* male bred in 2007. They gave birth 6 young: 3 males and 3 females. Next couple - captured in the wild *M. baibacina* female and born in a captivity *M. bobak* male gave birth 4 young in 2008. Exterior, morphological and behavioral characters of hybrids are discussed.

Age of sexual maturity and sex interrelation in marmot population of cage breeding

FEDOSEEVA G.

On a base of registration since 1995 to 2007 an analysis of age of the first reproduction, and also duration of a seasonal activity of females and males separately have been carried out. It has been established, that age of the first reproduction is 2 years. In this period 9 (10,1 %) from 89 females had young. 41 (46,1 %) of 3 years old females had young.

This number decreases after 5 years age Marmot females reproduce from 2 till 8 years old

The age of the first breeding of males is 2 years. From 76 males 10 (13,2 %) took part in reproduction. The highest number is noted at the age of 4 years-19 (25,0 %). The activity age lasts till 9 years old. The number of breeding males 6 years older considerably decreases (2,6 against 15,8 %) Simultaneously an sex interrelation in marmot population of cage breeding was studied 759 young have been gotten for all period: females - 394 (51,9 %), males-365 (48,1 %) This data shows that sex interrelation is 1:1 in marmots during domestication.

Age of sexual maturity and sex interrelation in marmot population of cage breeding

FYODOROVA O.

In 2001-2002 regularity of a linear growth of marmots from day of their birth to 18-month's age have been studied. Researches have established length of a body of new-borns marmot babies (9-10 sm) and their average alive mass (29-30 g). Intensity of growth at the first month of marmot life is high The alive mass increases more than in 10 times to 30 days and amounts on the average 383,6 g in females and 432,0 g in males. The body length increases to this age in 2,5 times At females it averages 22,9 sm, at males - 24,7 sm. From 1,5-month's age (after wean) measurements of the basic parts of a body of young marmots were made. For 100 days (from 45 to 145 days age) the length of a body of females has increased by 61,3%. The length of a head young (males and females) has increased in 1,5 times. The length of a hand to an elbow joint has increased from 9 to 13 sm at females and from 8,2 to 13,5 sm at males. The breast volume behind scapulas at females has increased by 86%, at males by 93%. The greatest intensive growth is noted at young marmots in alive mass. For 100 days the alive mass of females has increased in 5,2 times, of males - in 5,8 times To 145-day age females had 4580 g and males had 4642 g. According studying of regularity of young marmots growth from birthday to the first hibernation (150 days) the augmentation of alive mass for this period in 150 times and of body lengths in 5 times are established. More intensive growth of young marmots has been registered in the first 45 days. The sex dimorphism in the body size was not found at the first year of their life

Sampling and preparation for cryoconservation of genetic material in marmot (*marmota bobak* mull., 1776) males

PLOTNIKOV I.; FEDOSEEVA G.

We studied a possibility of taking sperm from marmot (*Marmota bobak* Mull., 1776) males 2-10 years of age weighing 3.6-9.4 kg (≤ 17). Since we failed to take sperm from these by masturbation, we applied electroejaculation. The electroejaculator electrode is a plastic rod with 4 current conducting rings. It was wetted in a physiological solution before introducing into the animal's rectum. The alternative current was first switched on with a low voltage (1-2 V), then the current was gradually increased to 6-9 V. Current



impulses and intervals between them were 3-5 s. Sperm was taken from the animals that were preliminarily immobilized. The period of electroirritation of nervous centers in animals made up 2-4 min. In the majority of cases ejaculation took place when the electrode was introduced into the rectum as deep as 6-8 cm and the current at 7-8 V was carried to both pairs of current conducting rings. From marmot males ejaculates were taken in 53 % of cases, and they were white and grey in colour. The volume of ejaculate was 0.25-12 ml, spermatozoa concentration varied from 46 to 555 millions per ml, with their mobility equal to 5-8 points. For obtaining ejaculate of high quality and eliminating stress in the animals, these must be deeply anesthetized.

Genetic-Biochemical Characteristic of Marmot Population during the Process of Domestication

TINAEVA G.; FEDOSEEVA G.; MARKOVICH L.

The researches held by means of electrophoresis division of proteins, have allowed to reveal of blood polymorphic proteins, to characterize structure of the closed population of marmots during their adaptation to conditions of the cage breeding, to establish a spectrum of concentration alleles and genotypes, a level of homozygosis, and also to track relation of polymorphic systems of blood with some parameters of efficiency of animals. We found out genetic variety of 5 loci of blood. The cage breeding marmot population at farm "Pushkinskiy" is characterized by the certain structure of distribution of allele frequencies of polymorphic loci and frequencies of genotypes of five studied polymorphic systems of blood. The population of marmots is characterized by the balanced structure on frequencies alleles of polymorphic loci albumin and transferrin. Steady, statistically significant excess of homozygous genotypes on the genes determining proteins of blood, above theoretically expected, i.e. essential shift of genes balance in loci postalbumin, posttransferrin and hemoglobin is revealed. The level of actual homozygosity in a locus albumin reached 90 %. Possibly, such distribution not only reflects a direction of selection, but also has adaptive value during formation of the population which is made multiple copies in conditions of the cage breeding. At research of the genotypes structural organization of a population of marmots 67 complex genotypes have been revealed. A low degree of populations consolidation of marmots, a high level of a genetic variety can testify about possible diversify selection in a population, for example, long use of animals and big litter size, the general number of descendants during short term of reproduction. Relationship between homozygous genotype Hb4-4 and litter size of females has been shown.

MARMOTS IN POPULAR TRADITIONS.

About Ethnosocial marmotology

DIMITRIEV A.; GUSAROVA M.

Marmots people love for peace character, "diligence", a constancy of habitats, a collective way of life, skill to communicate, similarity to people, as well as on cleanly utilitarian motives. Therefore marmots were fixed in mythology and folklore, toponymies and

geography, religious and social and economic concepts. The longer people communicate and live in an area of dwelling of marmots, the more last leave a trace in language, the literature, folklore, mythologies, religious concepts, in names of plants, animal, stones, mountains, natural boundaries, in household goods, utensils, toys, clothes, behaviour, holiday ceremonies, proverbs, sayings, legends, etc. In revealing and generalization of all of it is engaged-ethnosocial мармотология, first which official representation was at the international meeting on marmots (Bibikov, etc., 1999; Bibikov et al., 1999). The given direction is deduced by us from laws гомологических numbers and beam symmetry of scientific disciplines (Dimitriev, 1999, 2006; Bibikov, etc., 1999). In this science cooperates a cultural and natural heritage, material and spiritual, art, the literature, a science and practice. Ethnosocial мармотология cooperates with ethnography, sociology, biology, botany, zoology, philology, linguistics, mythology, history, geography, a demography, statistics, psychology, pedagogics, ethnopedagogics, archeology, etc.

It is possible to conclude - existence ethnosocial marmotology is historically prepared and there is all tendencies for its further progress.

Folk using of marmots in Mongolia

KOLESNIKOV V.; BRANDLER O.; BADMAEV B.

Marmots are traditional objects of hunting. Fossil of marmots found at archeological excavations show long time using of marmots by the people. People use not only marmot skin. Various and valuable productions were a reason for hunting of these animals. Modern man is losing necessity to get all from the nature. But folk experience should be saved as a memory and a part of the culture. People active use old knowledge in those regions where-in marmots are hunted till now. Questioning and interviewing of local population were used as a one of research methods during expedition on studding of tarbagan populations in Mongolia in 2007. There were questions about using of production of hunting for marmots in 72 collected questionnaires. Besides local population was asked and the received information was wrote down. Thus an aboriginal experience in use of marmots in medical practice and cookery has been collected. The Tibetan medicine and traditional national dishes became very popular in Mongolia again at the last time. The information on use of skin, meat, fat, liver, bones, brown fat, and bile of marmots in Mongolia will be reported.

POPULATION DYNAMICS AND CONSERVATION.

Dynamics of the colonization process in reintroduced populations of alpine marmot

BORGIO A.; VETTORAZZO E.

The project of marmot reintroduction in the Dolomiti Bellunesi National Park started in 2006. In May 2006 and May 2007 80 marmots (20 ind./year/area) ear-marked (by sex and family of origin) were released in two separated areas. We expose here data concerning the colonisation process carried out by animals released in 2006.



The mean dispersion distance from release sites to settlement sites was 1047 m, greater in males (mean 1047 m, range 0-3300) than in females (mean 665 m, range 0-1295). The 61% of the settlement was composed by pairs, 33% by single males, and 6% by a trio (marmots from different families of origin). The single males settled farther (1619 m) than coupled males (665 m). The 77,6% of all the possible "same-family composed" pairs occurred. Only one pair (same-family composed) bred successfully in the same year of release, but 87.5% of the survived pairs bred the following year (mean litter size 4.6, range 3-7), included the one breeding at previous year too. We also recorded the reproduction of a single female (no-pair copulation), and the acceptance of the cubs by the male settled with her after the second release.

Mortality rates of the animals released in 2006 was 39% before the first winter, raising 53.6% after the second summer. The first summer mortality of animals released in 2007 was higher, probably because of a greater predation by Golden eagle.

The populations density at last summer 2007 was 2.8 and 5.5 winter burrows/1 OOha, and 9.8 and 7.8 marmots/1 OOha respectively.

Landscape perspective in territory choose: an analysis for an introduced marmot population in Lessinia (Northern Italy)

SCARAVELLI D.; PRIORI P.; GAZZANI V.

In Lessinia plateau a introduced population of *Marmota marmota*, originated from 73 specimens released in 1995-97 in 4 areas, is actually widespreading. From 2002 the populations are monitored by visual census to assess the increasing of the numbers, density and territorial characteristics. Actually the population reach around 270 individuals in 44 dens groups on 19 different zones. In order to understand the influence of vegetation type and human disturbs in the evolution of the families, the landscape characteristics of territories were monitored. Soil and vegetations were detected on the bases of previous studies and assessed to each family used land. Also the availability of the different vegetations and landscape peculiarities were assigned also for the surroundings zones. To assess disturb, a series of possible human generated pressure were analyzed per each family. Also experimentally was detected the minimum time for alarming, checking the seconds for a standardized answer to a produced disturb (presence of a human close to the dens). Confronting also the results with the stable alpine populations is clear the importance of vegetation as the families are strictly related to different pastures and avoid the forested areas showing the interest to widespread along the proximal series of similar vegetations belts. *Marmota marmota* presence in the Regional Park is strongly related to human presence that created in the past centuries the pasture actually inhabited by the sciurid at this lower altitude (from 1300 to 1700 m). The experiment show families level of adaptation and the similar fitness answer

Demonstration of the marmots' reproduction in the batyrevskiy colony

DIMITRIEV A.

On the Batyrevskiy relict colony which since 2000 has become as protected are being made regular scientific researches. Since 1996 has been stopped the regular pasturage of the cattle. Since 2000 the controlled pasturage is taking place only after the ripening of the seeds steppe plants. The marmots from the hibernation go out on the 02d.03 - 15th. 04 and in the anomalous winter 2002 went out in the middle of the winter twice - 11.01., 13.02. The little marmots (children) appear on the day surface on the 21-31st of May. The demonstration of the marmots' reproduction while the continuation of the reserve routine a little went down, but the colony exists in the stable routine.

Demonstration of the marmots' reproduction in the Batyrevskiy colony

The observation years	The date of the marmots' (children) appearance on the Earth surface	The period of appearance after the winter hibernation	The greatest number of the marmots in the moment of observation		The number of the marmots in the family
			The adult marmots	The little marmots (children)	
2001	21.05	10-15.04	47	23	4-5
2002	23.05	11-14.01; 13-17.02; 02-04 03; 11-24:03	33	26	4-6
2003	20.05	31.03-04.04	31	26	3-8
2004	27.05	15.03-08.04	47	10	5
2005	31.05	06-09.04	42	11	3-5
2006	28.05	31 03-06.04	38	20	2-4
2007	30.05	21.03-25.03	39	10	2-3
The average data	25-26.05	11.03-18.03	39	IS	3-5

An increase in the aberration rate of the acoustical signal in peripheral populations of the *Marmota bobak*, Muller (1776)

NIKOL'SKII A.

Analysis of the alarm call of the *Marmota bobak* Muller, 1776 has revealed aberrations - deviations from the species-normal signal type. In contrast to the normal, the signal shows a different type of frequency modulation: the gentle frequency change is disturbed by its rapid increase and attenuation. The above character is, presumably, recessive: related individuals may demonstrate both a presence and an absence of the aberrant signal. The animals with an aberrant signal form loose groups. Chrono-populations may show variation in aberration frequency, nevertheless the difference between local populations remain. The aberration rate is higher in peripheral populations (western Ukraine and eastern Kazakhstan) compared with the central part of the range. In local populations the aberration rate ranges from 9 to 61%. The peripheral populations are isolated for a long time.



educational purpose in the wild Here the marmot genus, and particularly the alpine marmot is proposed as a model for animal related environmental education. In fact marmots are among the few mammals that can be easily observed during the day The result of a simple questionnaire is presented.

Variability of the mandible linear sizes of the bobak marmot (*Marmota bobak* Mull.) as the characteristic of population structure of this species in the Asian part of area.

CHASHCHIN P.; CHASHCHINA O.

The analysis of the variability of bobak marmot mandible sizes is carried out on the base of seven absolute and six relative characters Five samples of the adult males were taken from west, centre and east of the Asian part of area The statistical data processing was carried out by methods of the discriminant and cluster analysis.

The received results allow to suppose that marmots from the Southern Urals (samples "Bredy" and "Svetly") and from Northwest Kazakhstan (sample "Arkalyk"), on the one hand, and from Northeast Kazakhstan (sample "Bogembay"), on the other hand, concern to different populations Marmots from Northern Kazakhstan (sample "Rusaevka") are in intermediate position Thus, such natural boundaries as Turgay Hollow and the valleys of rivers Tobol, Ayat and Ishim are not the borders between populations, as assumed V.J. Rumjantsev (1991). More probably, the isolation by distance takes place in this case. Clinal reduction of the mandible sizes in a direction from the west to east and from the south to north also proves this hypothesis.

History and present condition of European bobak marmot (*Marmota bobak* Muller, 1776) in Rostov Region

TOKARSKY V.

Let us analyze objective laws of the structure of range of European subspecies of bobak marmot over a period of 20-21st century in region of Rostov.

There is no doubt that the agricultural usage of land contributed to the inhabitation of big quantity of bobak marmots, namely keeping big quantities of horses and cattle stock which had large territories used as grabobak marmotlands. Before 1825 in the region of Don troops there were 385 commercial stables, totaling about 83 000 horses Before 1917 each Don cossacks village had its own horse fetal herds which totaled more than 56600 horses The dynamics of the livestock population of separate kinds of Don livestock breeding in post-revolutionary period suffered a row of serious changes and it influenced the population of bobak marmot in region of Rostov

Progrebobak marmotive growth during some periods (collectivization. World War II) was accompanied by the decrease of quantity of domestic animals. The most remarkable was the substantial decrease of quantity of domestic animals during the World War I and during the collectivization and in the middle of 80's that was connected to the transition



to the market economy relations. During these periods we see substantial decreases of population of bobak marmots despite of full prohibition of hunt (from year 1929 the industrial hunt on bobak marmots did not took place). In first case during 30 years period the bobak marmots completely disappeared on the territory of Rostov region. The revival of the previous quantity and of the previous inhabitation area began in the end of 60's and in the beginning of 70's in Millerskiy and Chertkovskiy regions During last decades of 20th century in Rostov region was intensive growth of range and population of bobak marmot but in the beginning of 21st century we can see a rapid decrease in the process The second perion is not over yet. Here we can foresee two variants of development of the situation We are in the middle of our period of procebobak marmot of disappearance of bobak marmot. If quantity of cattle stock and horses remains the same we surely can make forecast of continued decrease of population. But if cattle livestock breeding increases the population of bobak marmots will be able to restore its range of inhabitation in previous size.

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