Status of Hamsters:
Cricetus cricetus, Cricetus migratorius, Mesocricetus Newtoni
and other hamster species in Europe

by Gábor Nechay

Convention on the conservation of European wildlife
and natural habitats

Nature and Environment Series, No. 106

French edition :
Statut des hamsters Cricetus cricetus, Cricetus migratorius, Mesocricetus Newtoni et d'autres espèces de hamsters en Europe

Table of contents

Summary

Eight species of hamster are found in Europe, but only the largest species, the Common hamster (*Cricetus cricetus*) became widely known apart from the Golden hamster (*Mesocricetus auratus*), which is also a popular pet, partly because the others occur solely in the east of the continent. Hamsters are small rodents, which originally live in natural or semi-natural steppe-like habitats. They also easily adapt to life in agricultural fields and the increase of agricultural production in Europe has most probably led to the increase in their distribution and population. Hamsters can cause problems in cultivated regions, but generally other small rodents in any given area outnumber them.

Only the Common hamster (*Cricetus cricetus*) is known to periodically "explode" in number. That is why in all of the countries within its area of distribution it was controlled in the first half of this century not only by capturing for its fur but also by pesticides (rodenticides) as is the case even today in several countries. Due to the direct control of hamsters or as an indirect consequence of the use of pesticides for other reasons and because of the changes of agricultural structure and technologies it is now threatened in states of the western part of its range (Belgium, France, the Netherlands, Germany, Austria). *Cricetus* is strictly protected by the Bern Convention and the EC Habitats Directive as well as in Belgium, the Netherlands, certain provinces of Germany and protected in Austria and France. It is also protected in countries where it is rare, being at the edge of the distribution range of the species, even in the case, when there are occasional fresh sightings in new areas e.g. Bulgaria, Croatia, Slovenia. It is a common but protected species in Romania. Its status is uncertain but not protected in the Czech Republic, Poland, Slovakia. *Cricetus* is still reckoned among pest animals and not protected in Hungary, Kazakhstan, Moldova, Russia, Ukraine, Fed. Rep. of Yugoslavia.

The few western populations left are isolated and truly endangered. The situation is generally well documented and most of the countries are planning or implementing a species recovery or protection programme. Legal protection alone is not enough here. The rapid change in the structure of agricultural production, the giving up of traditional cultures and the process of harvesting and tilling in one course could lead to sudden extinction. Maintenance of these isolated populations requires the establishment of agricultural reserves or the compensation of farmers for damage caused by the hamster or for maintaining certain cultures of plants, which are important for the survival of the hamster.

In some of the Central- and East European (CEE) states healthy and vital populations can be found. However, there is hardly any exact data available on the recent distribution and population size. The transition to the market economy has meant, in some respects, disadvantageous processes to the hamster, e.g. the more precise cultivation in private farms. On the other hand, the territory of land left uncultivated for one or two and more years increased in the last decade due to problems in the making use of agricultural products and this provides semi-natural habitats for the hamster where they can survive in small numbers. Presumably the hamster has become a rare rodent in some parts of those countries where it was quite common 20-30 years ago. In this part of the range urgent examination of the situation and monitoring of population-changes should be a priority even in countries like Hungary, where the hamster is

officially considered to date as a pest and its control is obligatory on the basis of the legislation on plant protection, when the population reaches a critical number. Trapping of the hamster for the fur-industry is still a traditional business in these countries and the regulation of this activity would also be necessary (e.g. limitation of the trapping season and areas, registering the numbers caught etc.).

Among other species the Romanian hamster (*Mesocricetus newtoni*) is in need of great attention. It is most probably an endemic species with a small distribution area in Bulgaria and Romania. Even if the Bulgarian and Romanian distribution area may be in connection, the occurrences in both country are probably isolated (island-like) at present. The trend of its population is downwards in all probability considering the fact that last reports on greater population number can be found only from the 1930s and 1950s. In Bulgaria it is protected and it is also listed in Appendix II (strictly protected fauna species) of the Bern Convention. Declaring to be a protected species is also suggested in Romania. However, we lack data on its current numbers and distribution in both countries.

Many thanks to Gérard Baumgart, Kris Decleer, Gunnar Ketzler, Zsolt Kalotás, Katalin Mohai, Attila D. Sándor, Gekko Spiridonov, Anja Weidling and Marie-Christine Wencel , who all helped in various ways.

I am grateful to Gábor Magyar for his useful comments and to Gérard Gorman and Stuart Oldham for reading an early draft .

I would also like to thank Maguelonne Déjeant-Pons and Eladio Fernández-Galiano at the Secretariat of the Bern Convention for their support and encouragement, Sandra Jen who kindly helped in editing the final report and Béatrice Sauvageot for the layout of this brochure. .

Introduction

The hamsters are typical rodents (Family: *Muridae,* Subfamily: *Cricetinae*) of the Eurasian steppe- and forest-steppe region, primarily occupied today by agriculture. Their morphologic characters differ significantly from those of muroid rodents. The body appears to be more stumpy, the tail is short and most of them have cheek-pouches, which are used for gathering the mostly vegetable food. The greater part of the hamster species reduce their activity in winter, spending this period in hibernation. These features have been taken by several authors as grounds for classifying them into a separate Family: *Cricetidae.*

The hamsters were represented by some fossil species throughout Europe in the Ice Age and during the last interglacial period by at least three genera: the *Cricetus* and *Cricetulus*, also living today, and the extinct *Cricetiscus*. Today 3 or up to 8 *Cricetine* rodents can be found in the European region depending on the question of what the boundaries of this region are?

In this report the geographical and biogeographical ranging should be taken into consideration as well as the historical and political development, when describing the study-area. Thus, the borders of the area considered are the Southern-line of the Mediterranean Sea, Turkey, Armenia, Azerbaidzhan and the Caspian-Sea, the *Ural* River and Mountains. The following hamster-species can be found in this territory.

1. Common hamster (*Cricetus cricetus*)
2. Eversman hamster (*Allocricetulus eversmanni*)
3. Dobrudjan or Romanian hamster (*Mesocricetus newtoni*)
4. Turkish hamster (*Mesocricetus brandti*)
5. Golden hamster (*Mesocricetus auratus*)
6. Daghestan hamster (*Mesocricetus raddei*)
7. Gray hamster (*Cricetulus migratorius*)
8. Mouse-like hamster (*Calomyscus urartensis*) .

The task of the present study is to give a summary on the status of hamsters in Europe. The biology, distribution and conservation status of hamsters (including those in the Asian part of Turkey) should be described, analysing the causes of decline of the Common hamster and the state of the Romanian hamster. Ways of dealing with the conservation or management of these species, and in particular the Common hamster should be proposed, one which would be compatible with the temporary control of their population whenever they cause important damage to crops. Accordingly, it is intended to give a detailed description of the situation of these two species and of the Gray hamster, which is also found in Eastern Europe. In addition, information will be given on other hamsters of the area outlined above.

Unfortunately, apart from the West-European states such as France, Germany and the Netherlands, there are hardly any recent documents on *Cricetine* rodents from the greater part of their distribution range, compared to other, widespread rodents such as voles (*Microtus spp.*) or even to fairly rare species (e.g. *Spalacidae*). Therefore, in addition to studying the available scientific papers, Red Lists and other "black and white" sources, information gained through personal communication are also considered for reporting and proposing appropriate actions for the management of problems connected with hamsters.

After the finalisation of the report an important document was published (Stubbe and Stubbe, 1998). It was not possible to take into consideration these proceedings, which provide further scientific data and information to the report on *Cricetus cricetus***.**

The Common hamster (*Cricetus cricetus*) is the largest species of the family. It occurred in the territory of West-European countries for thousands of years and probably gained more and more suitable habitats through the clearing of forests and the expansion of arable-land in the Middle Ages. However, a serious decline of the population has been recorded in the Western part of its range during recent decades. Consequently, the Bern Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979) listed this species in its Appendix II as a strictly protected fauna species. It is also included in the list of species needing strict protection (Annex IV) noted in the Council Directive 92/43/EEC of May 1992 on the conservation of natural habitats and of wild fauna and flora. A controversial situation exists between the state of some fauna species in the western and eastern part of Europe. This makes it not readily understandable for people in several East-European states, why the Bern Convention provides strict protection to these - according to general knowledge in the countries concerned - common species? This is also the case with the hamster. In contrast with the situation of the Common hamster in Western Europe, vital populations of the species survived in some Middle-European countries and throughout the eastern part of its distribution. Is this common belief still in accordance with the recent situation of the Common hamster throughout its Eastern-range?

The *Allocricetulus (Cricetus) eversmanni* occurs in the eastern part of our study-area mainly in the Trans-Ural territory, i.e. from the river Volga to as far afield as the Irtis.

Another hamster recently listed (1996) in Appendix II. of the Bern Convention is the Dobrudjan or Romanian-hamster (*Mesocricetus newtoni*), restricted only to a small area of distribution in Romania and Bulgaria, where – in the latter state – it is a protected species. However, its situation is not well known and it is highly recommended that activity on surveying the Romanian hamster be increased.

Further *Mesocricetus* species live in Turkey and between the Caspian- and Black Sea. In addition to the Turkish hamster (*M. brandti*), the Golden hamster (*M. auratus*) may also be present in Turkey and the taxonomic position of both species is somewhat contradictory, thus the two species will be discussed together under the chapter of *M. brandti*. The Turkish hamster also occurs in Armenia and Georgia (and, south of these countries, in Asia Minor).

Quite a widespread species is the Grey hamster (*Cricetulus migratorius*) living in the south-eastern part of the study-area including Turkey, and also mainly in Ukraine and Russia and in isolated, small populations in Bulgaria, Greece, and Romania. The recent state of the species should be cleared in Greece. In Bulgaria it is protected and it is also in need of protection in Romania.

Finally, the Mouse-like hamsters (*Calomyscus sp.*) will only be mentioned here, in the introduction. They are slightly different from other hamsters treated in this report and systematically more close to the sub-family *Reithrodontomyinae* than the *Cricetinae* (Vorontsov et al. 1979, Pavlinov, 1980). Wilson and Reeder (1993) - following Vorontsov et al. papers - accepted a separate subfamily: *Calomyscinae*. One species, separated recently from the *C. bailwardi* (Thomas, 1905), the *Calomyscus urartensis* (Vorontsov and Kartavtseva sp. n.) lives in the Trans-Caucasian area in Azerbaidzhan (and NW-Iran).

I. *Cricetus Cricetus* (L. 1758) – Common hamster

A/ Biology

a- *Appearance and taxonomy*

The Common hamster is commonly known. The black under part, which is unusual among mammals, the brown and white coloured face and the aggressive appearance when alarmed, the two-legged position, all these made it popular.

The weight of adult specimens is about 200-1000 g (sometimes somewhat more), the body length cca 200-250 mm and the tail is rather short, cca 50 mm.

The geographical variability of the hamster is not significant. In general two sub-species are accepted: the eastern hamster (*Cricetus cricetus cricetus* L., 1758) and the western one (*C. cricetus canescens* Nehring, 1899). Further 9 sub-species have also been described which cannot be upheld, e..g. *C. cricetus nehringi, C. cricetus niger*, the latter for the melanic (black coloured) variety found in Russia. Grulich (1987) ascertains rightly, that the sub-species "...were determined on the basis of a few individuals, where in many cases not even the basic taxonomic characters were known. Many were determined on the basis of slight variations in the colour of the fur." In spite of that, the significance of the hamster present in areas regarded as the distribution of the *C. c. canescens* (Rhine basin and west of the Rhine) should be stressed, since all populations here are isolated and endangered.

The melanic form was also found in Germany and Ukraine. According to Gershenson and Polevoi (1941) 21.2 % of hamsters caught by trappers in a district of the Chernigov province were black. Petzsch (1950) supposed the expansion of the melanic variety in Thüringia (Gotha). Zimmermann (1969) found 1-18 % melanic hamsters in the same district but his research was based on questionnaires to trappers. Recent works in Saxony *(Magdeburg)* show a much smaller proportion of irregular colouring also including white (which was the most frequent) and yellow shaded specimens (Seluga, 1996, Weidling, 1996). Truly melanistics are common today in *Thüringia* (Weidling, in litt.). I have never found the black variety in Hungary, but in Voivodina one specimen was found in 1985 by Krsmanovic et al (1988). The incidence of such variations may significantly differ in the populations of various areas and most of the black specimens could not have been truly melanic but dark coloured ones, as Weidling (1996) concluded. Further details concerning description, variability and taxonomy can be found, e.g.: Ognev (1913), Petzsch (1950), Nechay et al. (1977), Niethammer and Krapp (1982) and especially Grulich (1987).

b- *Habitats*

The *Cricetus cricetus* is one of the characteristic rodents of fertile steppe areas, which have been, at least in the western part of the distribution area almost completely converted to agricultural land. It prefers lowlands and territories with considerable solar radiation. Thus its typical habitats are now within the best zone of agricultural production in perennial cultures such as lucerne, red clover and mixtures of grasses and legumes as well as various annual cultures but ideally grain. The edges of fields, the sides of roads and ditches etc. in croplands are also occupied. It usually does not inhabit soft soils, such as sand, or soils with a high ground-

water level. The hamster mainly lives in areas with heavier, loam, clay-loam, loam-clay and clay-sand soils and does not penetrate into rendzic soils (rendzic Leptosols). It requires soils deeper than 100 cm with a ground water table deeper than 120 cm. Lighter soils are mostly populated where they border upon heavier ones (Grulich, 1975, 1978). In Germany, however, *Cricetus* also inhabits rendzic soils especially in bordering areas to chernozems (Weidling, in litt.).

High population densities leading to migration can spread its occurrence to gardens and around houses, as is experienced in hamster areas in Hungary. Lenders and Pelzers (1985) in The Netherlands also occasionally found hamsters close to human settlement (gardens, cellars of houses etc.) in one case probably caused by the destruction of the original living place through the construction of a motorway. Occasional occurence of *Cricetus* in gardens was also recorded in Germany (Haale) or in the Czech Republic (Brno) (Weidling, in litt.). In the eastern part of its range the hamster is also found to live close to man, in gardens, orchards, etc. (Poljakov, 1968, Lozan, 1972), thus its synantrophy seems to be here more emphasised. However, this merely may be a sign of the fact that the hamster is a culture-follower, since the structure of land and the density of human settlements rather differs in the two regions. Population pressure and sudden changes in croplands (e.g. harvest, plough) certainly lead to "irregular" migration and occurrences of hamsters. At high population numbers they appear in, what is for them, unsuitable places such as barnyards, farm-buildings, railway-embankments (Toth, 1974, Grulich, 1978) and even in rice-fields (Kalotás, 1988).

In original, natural steppes in the vast eastern range *Cricetus* is generally a sub-dominant species. Its abundance is much lower in ("original") grasslands compared to agricultural fields in the same area (Gorecki, 1977, Grulich, 1978, Palotás and Demeter, 1983).

The hamster lives in underground burrow or gallery, which is the deepest and most spacious among field rodents in Europe apart from mole rats – *Spalacidae*. Its depth occasionally exceeds 2 m. The depth of the soil and the ground water level are therefore determinative factors for the *Cricetus* (Grulich, 1975) However, it can temporary live in not so deep burrows, especially in summer. The galleries are quite diverse, depending on the soil, vegetation, sex, age and abundance of the animals and they have one or more holes opening to the surface (Figure 1, from Grulich, 1981)[1].

Hamster generally lives solitary that is one burrow is occupied by one specimen except females with their young. Gorecki (1977) captured by flooding burrows 450 hamsters in the period of 5 years and never found more than 1 hamster per burrow except the nursing females. Old standing burrows are more complex and usually belong to adult females and males, which generally use simpler burrows. Under normal circumstances each hamster can have a few further holes and burrows within its individual territory. These are used as hiding places. According to Karaseva (1962) neighbouring hamsters may commonly use such a hiding burrow. Experienced hamster trappers are able to distinguish the entrances of males from the others, making only a few mistakes in Hungary, and Weidling (1996) concluded the same in Germany. Migrating or young animals excavate only smaller burrows. The typical gallery is several meters long and 0.5-2 m deep (sometimes deeper) and consists of a dwelling chamber, one or

[1] In this report the terms burrow and gallery will be used for the whole underground cavity system and openings, entrances or holes will mean single openings of the burrow.

more food stores and pits for faeces and 2 or more holes opening to the surface. At least one of the holes usually leads slopewise up to the surface, others are vertical. Grulich (1981) thoroughly examined the development and structure of burrows. Temporary or initial burrows are simple, mainly sloping and 0.3-1-2 m long holes. If they remain, a chamber and vertical hole(s) will also be dug out. Permanent galleries consist of several chambers and 1-12 holes. The number of vertical holes is cca. twice as numerous as the sloping ones. The latter usually have soil heaps at the openings. The deepest burrow was 2.3 m. Old females with young usually have more complex galleries. The openings of the burrow are under normal conditions stopped by hamsters with soil prior to their hibernation and sometimes temporarily in the vegetation period as well, e.g. in case of bad (rainy and cold) weather. Females often do the same in the days of parturition.

The abundance of hamsters is usually assessed by taking into account the number of inhabited burrows. Experienced observers are able to distinguish between inhabited and vacant burrows. However, the entrances are regularly to be stopped with soil and suitable material when assessing and the reopened ones are the basis of estimates.

c- *Hibernation*

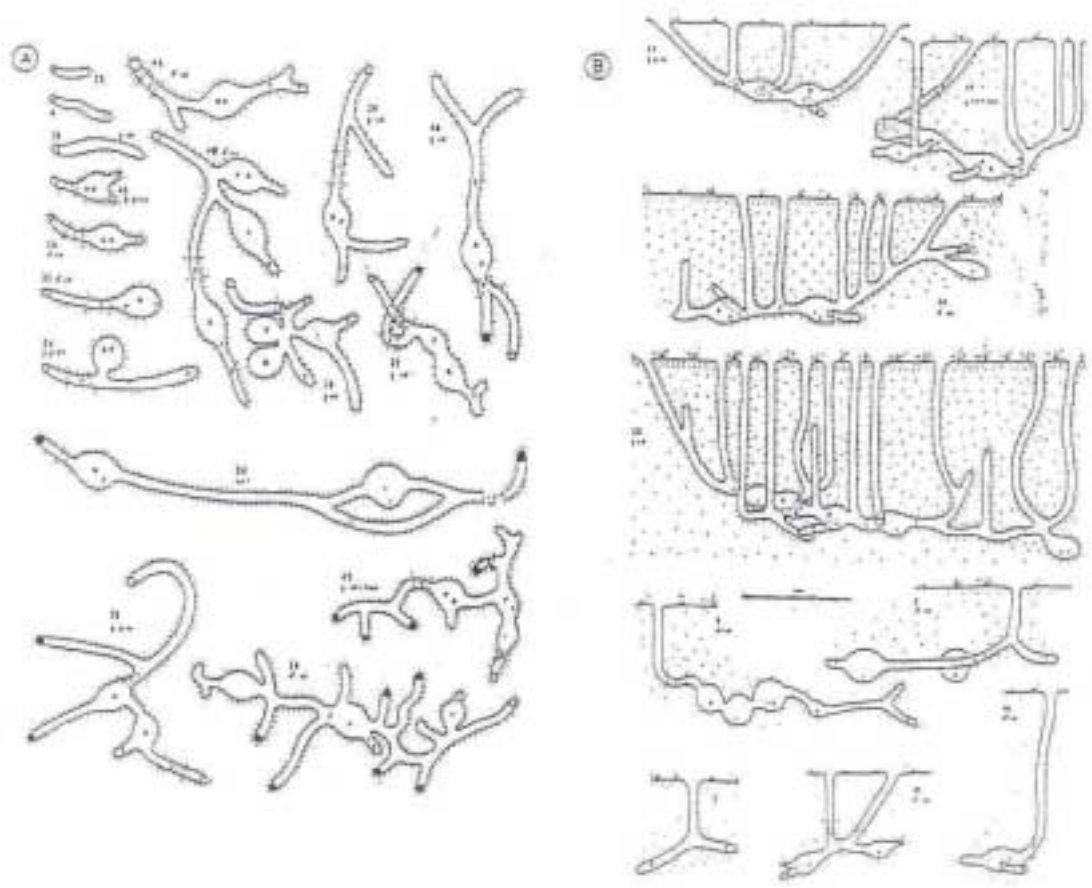
Hamsters are physiologically less active in the winter period. They stop the openings of the burrow and spend their time mostly sleeping in lethargic state (hibernation) in the bottom of the gallery. Such sleeping periods alternate with wakeful phases when hamsters feed on their winter stores or they can even appear leaving the burrow. Thus, *Cricetus* is a facultative hibernator (Canguilhem et al., 1973, Kayser, 1975). The duration of its hibernating is probably significantly influenced by intraspecific, individual and environmental factors (Nechay et al., 1977). In lack of hibernation, under laboratory conditions hamsters are not adversely affected (Canguilhem et al., 1973, Reznik-Schüller et al., 1974). However, Szamos (1972) reported, that span of life of hamsters without hibernation is short (2.5 years) compared to those with normal over-wintering period (4 years). At very high population density no hibernation occurs either in the field, which is due to aggressive interactions and resulting in increased mortality (Grulich, 1973, Tóth, 1974).

Under normal conditions the hibernation period lasts from the end of September to April. However, according to a study in the southern Pannonian plain in Fed. Rep. of Yugoslavia (Ruzic, 1976) entering to and waking up from hibernation happens in September-November and February-May, respectively. The oldest males go first to "winter-sleep" with the first cold weather. They are followed by other adult males and females and last by the young animals. Other observations refer to the adult or nursing females as being the last ones (Kalotás, 1988). Hamsters withdrawing in their burrow certainly remain active for a time. Seluga (1996) and Weidling (1996) recently discuss further questions of the hibernation.

d- *Food*

The main food of the hamster is composed primarily from the vegetative parts of fruits of various plants but it can be regarded as an "omnivorous" animal, depending on the food-supply. Under "normal" circumstances Gorecki and Grygielska (1975) observed mainly green parts and seeds of wheat and poppy: 18.1 % and 17.7 % and 9.7 % respectively, and green parts of clover, rape, beet, maize, lucerne, and 6,2 % invertebrates, in summer. In autumn, in order of importance, green parts of clover (16.8 %), wheat (10.0 %), potato tuber (15.0 %), maize (8.3 %) beet (8.3 %), corns of wheat (5.0 %) and maize (6.7 %) invertebrates (13.4 %) and vertebrates (3.3 %), among others.

Figure 1. Types of burrow of the Common hamster (from Grulich, 1984)
A = projection to the surface **B** = cross-section (55 ♀ grav) = identification
No and parameters of hamsters inhabiting the burrow, **P** = green parts of plant,
r = decaying hay, **R** = fresh hay, **S** = hairs, skin, bones, **T** = excrements, **y** = stop/
filling up from soil, **Z** = fresh stored corn, **z** = decaying stored corn



Holisova (1977) analysed the contents of cheek pouches and of the stomach in an overcrowded population in winter, i.e. under exceptional circumstances. There was probably the highest density of hamsters ever described and most of the animals were straying, without hibernation, due to the population pressure. They invaded also agricultural premises, farmyards and they fed on crops being stored. Thus, 59.6 % of specimens caught on the premises of farms ("farm hamsters") contained food in their cheek pouches (3.2 g, on average), while only 26.8 % of specimens captured in the field held some food in cheek pouches (0.5 g). The "farm hamsters" consumed mainly seeds and an animal component was only found in these specimens (in 5,3 % of cases the remains of hamsters). Lucerne predominated in the stomach content of hamsters captured in lucerne fields in February. It is remarkable, that among the animal component the larvae of the Soft-bodied beetle (*Cantharis fusca*) ranked to the first place (these larvae are also active at winter).

Nechay *et al*. (1977) referred briefly to data on the nutritional requirements of the hamster. In captivity, when adult hamsters were fed only on green lucerne and maize cobs, consumption was relatively low: 6.75±2.41 g of maize and 5.62±2.52 g of lucerne per 100 g

body weight per day. This was examined on 2 females and 2 males in May, during 5 days, by measuring the daily food supply and weight of not consumed food remains and water consumption (drinking water was given *ad libitum*). The weight loss of lucerne and maize during the observation period through becoming dry was controlled under the same circumstances. At the same time another group (2 females and 2 males) was fed on maize broken into pieces (1), on standard pellets for laboratory animals (2) and on lucerne (3). The consumption was 3.2±1.0 g (1), 3.4±1.2 (2) and 5.5±1.2 (3) per 100 g per day. With the maize grains, however, only the germ and this part of the grains were nibbled. The nibbled grains compared to the intact (control) ones showed 7.63 g loss of weight per 100 g, thus the hamsters consumed only 7.63 % of the maize grains (Nechay, unpublished). It was often observed in the field that they took a bite out of the germ-piece, e.g. maize grains gathered in food stores. My assistants drew from this the conclusion that the hamster behaves in this way in order to prevent the germination of the seeds.

Wendt (1989) calculated the daily food requirement for 100g body weight as 3.7 g (females) and 3.8 g (males) from standard food for laboratory animals, on the basis of his examination.

Hamsters store food reserves in their burrows. The content and quantity of these reserves are quite diversified and there is a considerable amount of information on them. The quantity in summer is usually only a handful of green plants: lucerne, green field poppy heads (hamsters prefer them) *Taraxacum* and *Plantago* leaves and grains (wheat, bean, etc.). Autumn stores for the winter are somewhat bulky but usually contain only 1 or 2 kg of grain (wheat, maize, and sunflower) and/or other parts of plants such as potato. Many quantities are exceptional (see also e.g. Gorecki, 1977, Nechay et al., 1977, Grulich, 1981).

The feeding behaviour of hamsters draws the attention of farmers particularly when the growing season commences. Even a few hamsters are able to pick out quite a lot of seedlings or seed grains, as they follow the rows and the farmers leave no stone unturned in order to get rid of them.

e- *Reproduction and development*

There is a great deal of information on the reproduction of *Cricetus*: occasional and regular field observations, field studies, examinations on hamsters bred in the laboratory (e.g. Saint Girons et al., 1968, Szamos, 1972, Mohr et al., 1973, Reznik Schüller et al., 1973, Vohralik, 1974, 1975, Gorecki, 1977, Nechay et al., 1977, Krsmanovic et al., 1984, Grulich, 1986, Kalotás, 1988, Seluga et al., 1996, Weidling, 1996). Grulich (1986) reviewed most of this information. However, data on the reproduction of *Cricetus cricetus* in the field still seem to remain contradictory, while they are the most important characteristics when we try to understand the reproductivity and population-dynamics and to make plans for the management of the species.

The former general opinion is well reflected e.g. by Mohr (1954): she gives the following data on *Cricetus* reproduction in her book (pp.64-65): period of sexual activity and parturition from May to July, gestation 20 days, litters per year 2-3, young per litter 4-18, age

when the eyes open 14 days, life span 10 years. It was also generally accepted that the young hamsters reach sexual maturity only after their first hibernation, although e.g. Sulzer (1774, cit. Vohralik, 1974) and Petzsch (1950) supposed that reproduction of young females is also possible in the year of birth.

Observations in the course of recent decades yielded new material on the period of sexual activity and consequently on the number of litters per year as well as on individual growth and development, including the life span and the age of sexual maturity. These biological parameters certainly vary in accordance with the environmental conditions (weather, habitat etc.) and the population features, among them primarily the population density, which can also play an important role. That is why information on reproduction of *Cricetus* are diverse. Instead of reviewing the relevant ample literature, the basic data will be summarised as follows.

Period of sexual activity or reproductive season

The reproductive activity of the Common hamster might be different in various years, depending on mostly unclear conditions. Its main reproduction period lasts from the beginning of June to the end of August. This applies to its entire range. Reproduction from April to September is characteristic in Central Europe and Grulich (1986) reported about beginning of the breeding season in Slovakia in February, 1971-1972, thus in years of a population explosion (mass multiplication, outbreak, gradation), which finished in the second half of September. There are several observations on reproduction during September in Hungary (Nechay et al., 1977). Krsmanovic (1985) observed reproduction from April to the end of August in Fed. Rep. of Yugoslavia during 1980-1984. Kalotás (1988) found sexually active males in March and October in years of outbreaks and reported that under appropriate weather conditions and population structure parturition of hamsters can exceptionally happen even in November and beginning of December.

In the western part of the distribution area (Germany) recent studies refer to a reproductive period from May to July or mid August while all adult females caught in July and August were nursing ones (Seluga et al., 1996, Seluga, 1996, Weidling, 1996).

Gestation (duration of pregnancy)

Data observed in laboratory breeds can only be taken into account. Vohralik (1974) found that 17-17.5 days occurred always with the 1st litter and he considered this as the normal length of gestation for the Common hamster. He also observed significant prolongation of pregnancy in relation with the time of mating. All cases when pregnancy lasted longer: 18-18.5 days and 25-37 days, mating had occurred 10-15 days after the previous parturition and on days 1-2 after the parturition and the *post-partum* rut of the female, respectively. Mohr et al. (1973) reported that "the captured hamsters had a duration of pregnancy between 18 and 21 days but the succeeding generations raised in captivity had pregnancies between 15.5 and 17 days". Thus, the balance of data is for a significant plasticity of *Cricetus* in this respect.

Litter size

Grulich (1986) detailed literary data referring to the number of embryos, which vary from 1 to 19 according to field studies. The litter size (number of new-born animals or young hamsters found in burrows of nursing females) is exceptionally even more (max. 25), which is possibly produced by two females using a common nest or is a result of adoption (?). Certainly, nursing females accepted readily alien young hamsters in the laboratory and they treated them as their own (Vohralik, 1974). In laboratory breeds litter size was 7.6 (4-10) on average (hamsters originating from Bohemia and *Moravia*, Czech Republic - Vohralik, 1974) and 6.75, 9 and 9 with F*p*, F1 and F2, respectively (animals originating from *Braunschweig*, Germany - Reznik-Schüller et al., 1974). In the latter study serum gonadotropin was used for oestrus synchronisation and to overcome the female aggressiveness. The "normal" value may be about 8 since this is the number of nipples.

However, the number of embryos is usually greater in field studies. Grulich (1986) found 10.6 (2-18) in Slovakia and 10.3 (1-15) in *Moravia* in 1972-1973, and Gorecki (1977) assesed 11.4 in 1972 and 9.9 in 1973 in Poland. Nechay (1977) observed 9.88 in overwintered females and 5.00 in "young" females born in the year of their birth in eastern Hungary in 1975 and Kalotás (1988) reported 6.9-12.0 in eastern Hungary between 1983 and 1987. The number of embryos is somewhat smaller in the beginning and before the end of the reproductive season according to each study. It is also smaller in young females. Considering the mortality of young animals, their number is certainly smaller when they become independent (when they leave the mother's nest).

Notwithstanding these, there are several data in the literature on greater litter-size observed by digging out nursing hamster galleries (up to 25 young hamsters). Such findings are curiosities. The number of nestling never exceeded 8 and on average was 6.8±1 (n=5) when hamsters were caught by flooding burrows (Gorecki, 1977). Seluga et al. (1996) could only catch 3.7 (2-7) young hamsters at mother-galleries in live traps and 5-7 by digging out of burrows. In Hungary I was also informed about great numbers of young found in one gallery but I myself never met more than 9 in one burrow. The difference between the number of embryos and litter size can be explained by the mortality at parturition and that of newborn hamsters. The disappearance of 1 or 2 young "without traces" on day 2-3 after parturition was also observed in the laboratory (Vohralik, 1974). The mother animal usually eats the dead young (or certain young) hamsters, although dead young hamsters can often be found put aside in a pit (of faces or old nest etc.), when digging out of mother's burrows.

Sexual maturity

According to the formerly held general view, *Cricetus* does not reach sexual maturity until after its first hibernation and even modern authors share this opinion (e.g. Saint Girons et al., 1968, Szamos, 1974, Gorecki, 1977). However, old works already indicated that young hamsters born in the spring can reproduce during the same year (Sulzer, 1774 cit. Vohralik, 1974, Trouessart, 1884 cit. Saint Girons et al., 1968). An old Hungarian author also mentioned this as a fact in certain years and as an explanation of the "extraordinary multiplication" of hamsters (Hanák Ker, 1853).

In laboratory stocks the males reached sexual maturity at about the age of two months (Reznik-Schüller et al., 1974, Vohralik, 1974) and the females about three months (Reznik-Schüller et al., 1974). Vohralik (1974) reported about one female found in *Moravia* when a burrow had been opened, which could had been 2.5 months old when it became pregnant. He also mentioned Krystal's finding in Ukraine (*Bredicev* province) from 1929, who trapped a very small female with embryos. Krystal doubted that this female was born in the same year but Vohralik confirmed by the body measurements that this was the case (based on his material on development of *Cricetus* - Vohralik, 1975). I found 12 fertile female hamsters in the field in 1975 among them 6 being pregnant, which had upper M*3* not fully developed (Nechay et al., 1977). This indicates an age of 40-50 days (Vohralik, 1975). Thus, females can be conceptive at the age of 1 and 1.5 month (or the growth of *Cricetus* can not be so rapid in the field as in the laboratory or rather the "speed" of development is variable). Krsmanovic (1985) also observed, that females born in the spring reached sexual maturity already in summer. Grulich (1986) thoroughly studied and reviewed the reproduction of *Cricetus* and concluded that "population explosion" can be explained partly by the involvement in reproduction of females of the first and second litters. Recent handbooks accept the possibility of an early sexual maturity as evidence (Niethammer, 1982, Nowak, 1991).

According to recent studies in the western part of the range in Germany (Seluga et al., 1996, Weidling, 1996), such an early maturation has not been observed. A certain population structure (density, presence of males) and other circumstances probably induce this.

Life span

A life span of 10 years can certainly be extremely rare. Vohralik (1975) supposed that the age of the Common hamster in the field does not exceed 4 years. In his laboratory stock, the molars of three year-old hamsters were abraded "to a thin layer of crown covering the roots" and one 4 year-old female had completely abraded molars in the lower jaw. I captured some specimens in the field with rather abraded molars, which partly looked other signs of old age or bad condition. I also had specimens with such molars kept in laboratory and a part of them showed already the signs of senility. Grulich (1988) observed serious paradental disease in hamsters, especially in specimens with abraded molars. The chance of such hamsters to survive is certainly very small in the wild. Karaseva (1962) made observations in the wild on labelled hamsters and estimated that some of the old specimens lived at least four years (but their age was estimated on the seediness of the tail and ears at two years, when first captured). Szamos (1972) observed that hamsters in captivity generally died at 30 months old and concluded that wild populations are usually replaced every two years. Population studies with labelled hamsters show that the mortality of young animals is much higher than that of adults (Karaseva, 1962, Seluga, 1996, Weidling, 1996).

Number of litters

The number of litters can be considered as (1) the individual output of female hamsters during one reproduction season or in their life and (2) on the population level in one reproduction period.

(1) It is a general view that *Cricetus* can produce 2 and occasionally 3 litters a year, i.e. during one reproduction period. However, e.g. Gorecki (1977) considered only one possible and Grulich (1986) calculated up to 9 in one reproductive season as a maximum under favourable conditions (and 14 in the course of a female's life) based on thorough-reviewed data on the reproduction of hamster and on his own large material. Vohralik (1974) observed 2 but also 3 litters in laboratory in the course of around 2 and 3 month and he supposed also 4 litters possible in one reproduction season.

(2) Considering the fact, that *Cricetus* can litter more than 3 times a year and a part of the young coming from the first generations can also reproduce in the year of their birth, 4-5 generations per year are possible and may frequently occur as it was concluded by Nechay et al. (1977). In the light of the duration of the reproductive period (see there) and the possibility for young females to have not only one litter in the year of birth even more generation may be born under favourable conditions. According to Grulich (1986) a young female "born in the same year can have two to three" litters "if she is involved in reproduction in the course of May".

f- *Population dynamics*

The changes of *Cricetus* population numbers, including also some possible factors influencing population dynamics, have been reviewed by several authors, e.g. Dupont, 1932, Werth, 1936, Nechay et al., 1977, Ruzic, 1977, Grulich, 1980, Baumgart, 1996. Detailed information is given by Grulich (1980) on population changes throughout the range.

Where the number of *Cricetus* is low, its population is isolated, and all limiting factors may have significant impact on the population the changes of number can hardly be followed. In other words: where densities are low (1-2 active burrow/ha or below) it is extremely difficult to observe dynamic of numbers. As stated by Ruzic (1977): "The population dynamic in the areas with low number of hamsters is poorly expressed whereas in those with high numbers it is well expressed". (She counted inhabited burrows in August-September (when densities are generally at maximum) within 0.5-2 ha sampling plots in lucerne fields in Fed. Rep. of Yugoslavia in the period of 1968-1975. Data were categorised as follows: below 0.2/ha very low, 0.2-1 low, 2-5 middle, 6-20 high and 21-50 very high. She also found more than 50 inhabited burrows in some plots and regarded this density as an outbreak). Gubbels et al. (1995) searched for burrows in barley and wheat fields after harvest in 1993 in the Netherlands. They found only 30 galleries altogether in 75 hectares of these fields within an area of about 10 square kilometre (= 0.4 burrows/ha). However, just half of the burrows (13) aggregated in one 2.5 ha field and 17 galleries were found in the whole remaining area. Thus, in low density areas, the only possibility in practice is to measure and to chart the land occupied by hamsters and the changes, shrinking or expansion, of this distribution area. Baumgart (1996) has reviewed the state of *Cricetus* in Alsace between 1964-1990 in this way. (The distribution was relatively stable in *Bas-Rhin* up to 1979, when a minimum, and since than a significant shrinking of distribution can be recorded. In *Haut-Rhin* sign of presence can only be observed in 1965 and 1974-1978 and after this period a certain thriving in 1983 which is followed by total absence of hamsters up to now). Similar monitoring of the distribution has been organised by expert groups in Germany and in the Netherlands in the course of the recent years (Krekels and Gubbels, 1996, Stubbe et al., 1997).

The yearly development of such threatened hamster populations can be characterised on the basis of recent research (Seluga, 1996, Weidling, 1996) as follows. The reproduction begins in May or June and finishes in August. There is only one, maximum two litters a year pro females. There were only three females which surely had two litters in the season (Weidling, in litt.). The number of young animals is small: 2-7/female and the juvenile mortality after separation from their mother is high. In the lack of perennials the highest densities (e.g. 8 burrows/ha) develop in wheat and they collapse after harvest in summer. All type of limiting factors (diseases, predators, traffic etc.) may have significant impact on the population and the increase of the population actually can not be detected as a result of the reproductive season. The winter mortality during hibernation is probably the lowest and this can be characteristic under normal circumstances. Thus, surprisingly, the hibernation is the safe period in the life of hamsters. Weather conditions, changes of habitat in the pre-hibernation period and during

hibernation may, however, significantly influence the success of over-wintering. Karaseva (1962) recorded loss of numbers in the spring of 1958 due to flooding of burrows with melting of snow. Wendt (1991, cit. Weidling, 1996) concluded high winter mortality because of the disturbed storing activity and not enough stored food for over-wintering. Studies with marked hamsters reveal that the main cause of mortality is predation, followed by the mortality during hibernation, in various agricultural fields (Weidling and Weinhold, 1998). The highest mortality-rates were found in cultures (sugar beets, peas), which provide good chance to predators and the natality is also low (Weidling and Stubbe, 1998).

In countries where the Common hamster occurs still in greater number and in a larger territory the periodical increase and decrease of numbers was characteristic up to the present. It can be supposed that the conspicuous dynamic of numbers is connected with various changes of the population structure and biological parameters. In Hungary, for example, the year 1985 is considered as the beginning of the decline-phase of a peak in the proceeding years 1983-1984. Kalotás (1988) found in an observation area of 581 ha the following population growth-rates (%): 264.7 in 1983, 409.1 in 1984, 27.0 in 1985, 63.6 in 1986. He observed the following winter-mortality (%): 15.4 (1984), 33.9 (1985), 48.8 (1986) and 83.3 (1987). The abundance was 3.4-37.0 inhabited burrows/ha in the spring and 11.3-83.33 in autumn. The growth of population was yearly disturbed by controls in the spring. The number of hamsters was also dependent on migration evoked by agricultural measures. After harvesting of large fields very high densities (250-300 inhabited burrows/ha) could have been observed in smaller ones, where hamsters could have found feeding possibilities. The possible reasons of changes in winter-mortality were not explained but they were considered crucial in the course of population cycle. At high density the *intra*-specific processes and conflicts play certainly an important role in winter mortality (see e.g. the outbreak in Slovakia, 1971-1972).

The existence of the Common hamster in Central- and Western Europe is now linked up with artificial open areas, i.e. with the agriculture. Considering the biological features it is easy to understand how the species is capable to reach high population density. The coincidence of the (potential) natality and of a minimal mortality rate in certain year(s) with optimal conditions can lead to population explosion (outbreak). In such cases the initial number of hamsters may increase e.g. hundred times more during one vegetation period (Grulich, 1986). The result can be even 500 or occasionally 800 specimens/ha (Grulich, 1986). However, levels of 30-50 inhabited burrows per ha are already regarded as an outbreak, which can often be observed in single fields also in normal years, due to “normal” reproduction and/or migration. Thus, for the management of the Common hamster is extremely important to assess the extension of the population. This is especially important in case of fields with great number of hamsters, together with the adjoining areas. High densities are very often results of gathering of migrating hamsters due to human activities. Such densities can even occur within the distribution area of a critically endangered *Cricetus* population in certain fields.

Human activities make it difficult to predict the development of a certain hamster population especially if the activities coincide with adverse weather changes. The agricultural works (e.g. harvesting, tilling, use of pesticides including treating of seeds) suddenly change the habitat requirements of hamsters. The various measures of land use (in particular breaking up of perennials and transformation of sown area) destroy existing habitats, and at the same time, can

create new ones (e.g. reclaiming land). All the changes force the greater part of hamsters to leave their burrows and to find new grounds. They are exposed to a greater extent to illnesses, predators, traffic and *intra*-specific competition. Consequently, the migration may involve great losses. All these uncertainties are expressed by the mysterious view: hamsters can disappear in some years and some areas and appear elsewhere.

In spite of the influence of human activities some kind of a natural long-cycle fluctuation of numbers can be observed. Thus, *Cricetus* was numerous in its range in the following periods: at the turn of the century, at the beginning of the 1910s and 1920s, around 1930 and in some countries around 1940 and in the 1940s, between 1949 and 1953, 1959 and 1962, and in the first half of the 1970s (Nechay et al., 1977). The increase phase begins in the typical hamster regions. Later on hamsters appear in areas and habitats where they rarely or do not occur in "normal" years. Following the decrease in typical hamster regions the increase of population in outlying districts and areas can still be significant (Nechay et al., 1977, Grulich, 1980, Kalotás, 1988). Recently, decrease of number was characteristic everywhere since the 1980s and during the 1990s. At the time of outbreaks especially in the course of the fifties, sixties and seventies the prolongation of high numbers can be observed which is certainly due to the control of hamsters (use of rodenticides and traps).

The propagation and spreading out of hamsters and the outbreaks were connected with the extension of the agriculture and the increased quantities of plant products (Dupont, 1932, Lenders and Pelzers, 1982) or with changes of the agricultural practices, formation of large fields with monotonous cropping (Kovács and Szabó, 1971) and reclamation of land for cropping (Grulich, 1977, 1981, Tóth, 1974). The relatively great number of *Cricetus* in the fifties in the territory of Moldova, Ukraine, Russia and Kazakhstan (Neronov and Tupikova, 1967) might have been also in connection with similar processes.

At the same time, the rather quick decrease of hamsters in Germany during the 1980s and recently can also be connected with changes of agricultural practices (e.g. harvest and tillage at the same time, decrease in area of perennials and uncultivated small-scale elements of land, use of pesticides particularly the treatment of seeds) and with their exaggerated, all-year-round trapping (Wendt, 1989, Stubbe et al., 1997, Seluga, 1997, Weidling, 1997). Similarly: the recent decrease in Alsace, where even a general control was still organised in 1981 and further local controls during the eighties in the distribution area (Baumgart and Bayle 1984, Baumgart, 1996). However, there are a lot of questions concerning the impact of modern agricultural practices. The mechanisation (the use of machines) by itself certainly can not be valued as primarily dangerous to the Common hamster. The growing intensification of land use, construction of roads and other space-occupying establishments and their use has an important negative influence, as it is also concluded by Lenders and Pelzers (1986) and primarily the land structure: composition of sown area, abandonment of perennials. The size of single fields is not so significant. The large-scale farming can even be more advantageous, if perennials are present.

Just all the information on hamster's population biology are gained on specimens originated or living in agricultural land. Consequently, we do not know the genuine, "natural" status and processes. It would be quite significant to make investigations on *Cricetus* occuring in natural or semi-natural areas (steppes) in order to know the “unaffected” natural history of the species. Today, this is hardly possible elsewhere any more as in the eastern part of the range, similarly to the work done by Karaseva (1962) or recently by Magomedov and Omarov (1995) on the *Mesocricetus raddei.*

g- *Others*

The hamster is a promising species for the theoretical and applied sciences. It is used by many researchers as a model animal to investigate problems of physiology (metabolism, hibernation and thermo-regulation. etc.) e.g. Kayser (1975), Hilfrich et al. (1977), Biewald (1979), Canguilhem et al. (1992, and a series of works), Wollnik and Schmidt (1995). It is a good laboratory animal for special observation, see: Reznik-Schüller et al. (1974), Silverman and Chavannes (1977), Reznik et al. (1979), Kunstyr et al. (1993). Grulich (1988) suggested *Cricetus* for examination of peridental diseases. Allometrical and evolutionary studies were completed by some authors, e.g. Vorontsov (1967), Frahm (1973).

Diseases and parasites of the *Cricetus* are summarised by Nechay et al. (1977) and the importance of infections is touched upon by Grulich (1980) Wendt (1989) and Weidling (1996).

It is worth mentioning the nematode species: *Heligmosomoides travasossi* Schulz, 1926. Its single known host is the hamster and in all likelihood it is the most frequent parasitic helminth of *C.cricetus*. The degree of parasitisation according to a study in Hungary was 70,3%, with an intensity of 200-300 worms, in the small intestine (Mészáros (1977).

The biological characters of *Cricetus* should be stressed in sum, which make it a unique animal for various studies: its systematic uniformity within the vast distribution area, its facultative hibernation, its behavioural and ecological plasticity being held a solitary and aggressive animal but able to reach high density in agricultural areas even in case of monotonous feeding possibility, its varying reproductive features and development (shortened and prolonged pregnancy, ability to conceive *post partum* and to reach reproductive maturity at an actually young age), etc.

B/ History of distribution and the present situation

Fossil remains of hamster (*Cricetus sp.*) are often found in excavations. It has been reported from many strata throughout Europe and Asia in a larger area than its present distribution. Comprehensive literature already appeared towards the end of the 19th century (summarised e.g. by Werth, 1936).

The research and discussion on the evolution and history of distribution continues up to the present day. Janossy (1979) found fossil forms at some locations in Hungary, the centre of the Carpathian basin, in strata from various periods of the Pleistocene. The *Cricetus cricetus* has been recorded since the Middle Pleistocene. *Cricetus* occurred even in England (Tornewtown Cave, Devonshire) as discovered by Kowalski (1967) from the sediment of the penultimate glaciation. Pradel (1981) found remains of *Cricetus* in Southern Poland (*Ojcow*) and concluded that the hamster was able to survive the last glaciation in the southern part of the country and to quickly colonise the now inhabited area.

Thus, the Common hamster and its ancestors lived all over Europe during the Pliocene and Pleistocene periods, from northern Spain and western France to southern Britain and Italy. This can be summarised from the evidence of several authors. The species is an autochtonous element of the European fauna even in the West. The evolution and historic distribution is also well documented in the region east of the Carpathians, together with present related species, which in times past also lived in western Europe (e.g. Gromova and Baranovoj, 1981).

There is a discussion on the question of whether hamsters survived the last glaciation of the Pleistocene in certain territories of Europe, or not. According to Grulich (1987) the last upper Würm glaciation could not have been survived by the hamster in western, central and eastern European territories. He assumes that the *Cricetus* settled the European part of the former USSR as well as central and western Europe 5,000-6,000 years B.C, when recent chernozem soils began to form in the lowlands and many elements of steppe flora and fauna penetrated to the west and north. However, several data are inconsistent with this. The leading edge of the ice sheet, for example, was in northern Poland during the glacial period, and south of this rich rodent fauna existed including two cricetids (Kowalski, 1971). Jánossy (1979) also found *Cricetus* (and other hamsters: *Cricetiscus, Cricetulus*) in strata of the last glacial period, along with (at present) boreal fauna elements, such as *Dicrostonyx* (Lemming) and *Rangifer* (Reindeer).The Common hamster was certainly pushed somewhat by the cold to the south and east and some areas were recolonised in our present age but it was able to survive, with areal fluctuations in conformity with the climatic conditions (see: e.g. Werth, 1934, Pradel, 1981).

It is a common view, however, that the extension of agricultural areas with the clearing of forests and through drainage and later melioration, was favourable to the spreading of *Cricetus.*

In the 19th century Hanák Ker (1853) gave a brief but good description of the species. He writes:

> *"... in certain regions, e.g. in Hungary and in Poland, it lives in great numbers, it likes the rich soils and arable fields to be found on plain areas. In 1769 they reached such a high number, that they were killed in hundreds in the fields. The village Cseged gave up about 1,500 furs to Kassa" (*now *Kosice*, Slovakia).

Several authors summarised the development of the distribution , e.g. Dupond (1932), Werth (1936), Grulich (1980), Baumgart (1996) and the decreasing of hamster populations in the course of recent decades, e.g. Smit and Wijngarden (1981), Lenders and Pelzers (1986), Baumgart (1996), Stubbe et al. (1997). The development of agricultural production led at first to the extension of areas inhabited by the hamster and to the increasing of its numbers. Certain elements of modern agricultural technologies (e.g. prompt harvesting and quick soil cultivation in large areas) and the use of modern rodenticides as well as excessive trapping might have been the causes of the decrease. But the most important is certainly the reduction and breaking up of perennial cultures and the lessening of diversity in agricultural land.

The present distribution in Eurasia is approximately between 45° and 55°N (in Russia further north, up to the 60°) and 5° and 95° E, the hamster being found from Belgium to Siberia from sea level up to a maximum of about 650 - 700 m. Today it inhabits more frequently certain districts of central and eastern Europe in agricultural fields of the grain-growing zone. The occurrence can generally be characterised as follows: isolated and declining populations in the Western part of its range, stable in the Carpathian-basin, widespread and signs of expansion but no mass-occurrences in the Eastern-part of the range.

C/ Situation according to the range countries

a- *Austria*

The hamster occurs only in the North-eastern part of the country (Lower-Austria, *Burgenland*). Data relating to "mass-occurrence" of the hamster are available only from a small region in the Neusiedlersee-area towards Hungary. There was a peak in the numbers in 1949-1951, e.g. 2.000 galleries on 700 Ha according to the Plant Protection (Schreier, 1968). Bauer (1960) described the year 1951 as a hamster-year around the Neusiedlersee, and the abundance in 1959 was again high here, later on in 1966-1967. Kemper (1967) counted hamsters killed by the traffic on the road Podersdorf-Illmitz-Apetlon, in September 1966. On average, he found 40.6 and 39.2 run over specimens over 200 m sections. Schreier (1968) refers to a 6 ha barley and red-clover-field, where during one month 570 hamsters had been caught in 1966. The exact period of catching is not mentioned, it was probably in the spring and most of the specimens caught might have been migrating.

That must have been the last outbreak of the Common hamster in Austria and the population gradually decreased during the 70's. The legal status of the species now is protected and rare (Bauer, 1988).

b- *Belarus*

The hamster is to be found only in the south of the country, the northern limit being roughly the line between Brest and Gomel. The present distribution is probably confined to the South-eastern part of the country lying east and south of the town Gomel, as it was in the 1950s according to the description of Serzjanin (1955). The number of hamsters was low in the period 1930-1939 with no changes in distribution and abundance, that is one "living" hole (burrow) per hectare in agricultural fields. No other data could be brought to light.

Enquiries should be made concerning the recent situation but the species is certainly not included in the list of threatened animals and is not protected.

c- *Belgium*

Belgium is the country where the Common hamster exists to the most western edge within its present range.

Fossil records are known from the older Quaternary period (Dupont, 1932). During the 19th century the species probably expanded the area of its distribution in the province of *Liege* and in the southern part of the province Limburg. Around the turn of the century it was quite abundant here and was considered as a pest at that time. Dupont (1932) describes the end of the 19th century when small-scale agriculture was replaced by larger fields as a consequence of technical development. The higher agricultural production resulted in the extension of the occurrence of hamsters and made it possible for their numbers to increase. Based on the number of hamsters caught the abundance would have been quite high during the last century in 1888, but even higher in 1900 and 1902. The highest recorded number was in 1910, when 36,944 specimens were trapped. On the further evolution of the population no data is available. However, it is certain that its number steadily decreased over recent decades. According to

Holsbeek et al. (1986) since 1950 its presence is sporadic and it is found only in the North-eastern part of the country (from Leuven to South-Limburg). Yet, it is expected that the hamster is still present in its historical distribution area, but is now restricted to isolated areas and small populations. The hamster is an endangered species ("seriously threatened") in Belgium and the main threat is the intensification of agriculture, that is a quick harvest and the deep tillage of the soil directly after harvest.

Considering the reasons of decline, Kretzel (in litt.) directed my attention to the great importance of other land use activities such as mining and subsequent infrastructure and urban development. Settlements and various constructions now occupy large loess area e.g. between Brussels and Leuven. Thus, hundreds of square kilometres are covered with settlements, which are divided only by small corridors of former landscape. There is almost no chance for hamsters to migrate and survive!It is suggested that reserves be established in core areas of its actual distribution, in areas where traditional agricultural practices are still being performed or where a great diversity of crops is pursued. These arable land reserves will be also beneficial for the maintenance of rare weeds and invertebrates. Protection and/or restoration of herb-rich verges, field-edges and derelict vegetation should also be considered. A need for research on the actual distribution and habitat choice of the hamster is also stressed (Criel et al. 1994).

In 1994 an inventory-project was started by a working group and it is planned to establish reservations in arable-land (Jansen, 1995).

d- *Bulgaria*

The Common hamster occurred before today at some localities in the northern part of the country in rural areas of the Danube basin and of its tributaries (Atanassow and Peshev, 1963).

According to Spiridonov (in litt.) the species is still sporadicly to be found in this region, and also the Dobrudjan hamster (*Mesocricetus newtoni),* which is relatively more common.

The Red Data Book (Bulgarian Academy of Sciences, 1985) indicates occurrences of *Cricetus* only in the western side of the *Ludogorsko* Plato or towards the west of that mountain. Formerly it was also found by Simeonov (1966, cit. Schmidt, 1971) near to the Black Sea in pellets of the Long-eared Owl (*Asio otus*). Taking into consideration, that the Long-eared Owl seldom preys on the Common hamster because of its size, *Cricetus* should had been relatively frequent here at that time, in spite of the low frequency compared to other prey (11 out of 8087 = 0.14 %).

It is a protected species and according to the Red Data Book its status is threatened. No recent and detailed reports on the situation of the Common hamster are available, but probably more new occurrences could be found.

e- *Croatia*

The distribution of the Common hamster is restricted to the north-eastern part of the country around the lowland of the river *Drave*. South of the mountains *Bilogora* and *Papuk*, that is in the *Sava* basin the hamster is not to be found. The abundance of the species even in the former decades was medium or low with no sudden rise of numbers (Ruzic, 1978a).

The range of *Cricetus* in Croatia is actually the continuation of the Hungarian distribution to the south.

The Common hamster is a protected species in Croatia and according to the Red Data Book its status is rare (Tvrtkovic, 1978.)

Table 1: State of *Cricetus cricetus* according to countries

	Population Trend	Red Data Book Category	Conservation status	
			Protection	No protection
Austria	D	R	+	
Belarus	?	n		-
Belgium	D	E	++	
Bulgaria	?	T	+	
Croatia	?	R	+	
Czech Republic	D	Ins. known	Prop.	
France	D	R	+	
Germany	D	R and E	+ and ++	
Hungary	D	n		-
Kazakhstan	?	n		-
Moldova	?	n		-
The Netherlands	D	E	++	
Poland	D	?		-
Romania	D	n	+	
Russian Federation	?	n		-
Slovakia	D	n		-
Slovenia	?	R	+	
Switzerland	ext	n		n
Ukraine	?	n		-
Fed. Rep. of Yugoslavia	?	n		-

Remarks:

D = decreasing ? = questionable ext = extinct ins = insufficiently

E = endangered T = "threatened" (Bulgarian Academy of Sciences, 1985)

R = rare n = not included + = strict protection + = protection prop. = proposed to be protected

Figure 2. – Distribution of the Common hamster in the Czech and the Slovak Republics (from Grulich, 1975)

A = According to the estimates of plant protection organisation in 1967 (**1**. 1-5, **2.** 6-10, **3.** 11 and more inhabited burrows/ha)

B = According to Grulich, 1975. (a = absence of *Cricetus*, b/c = max. 1 inhabited burrow/ha in favourable habitats, d = 2-8 inhabited burrows in favourable habitats, e = more than 8 inhabited burrows/ha in favourable habitats. In Slovakia the distribution area only)

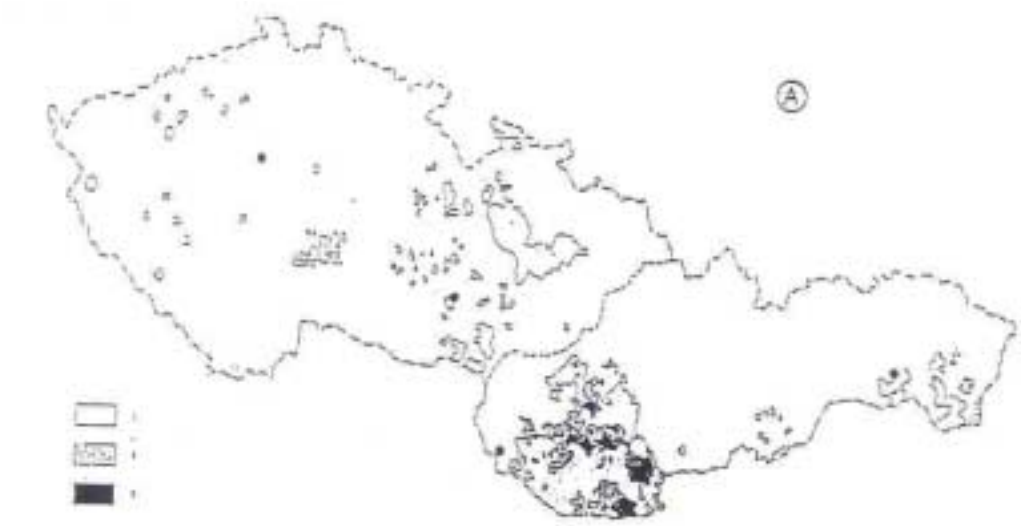


Abb. 8. Karte des Vorkommens von C. cricetus, das im Jahr 1967 von Mitarbeitern des Institutes ÚKZÚZ festgestellt wurde. 1. 1–5 verwendete Ausgänge aus Erdbauten auf 1 ha, 2. 6–10 verwendete Ausgänge aus Erdbauten auf 1 ha, 3. 11 und mehr verwendete Ausgänge aus Erdbauten auf 1 ha.

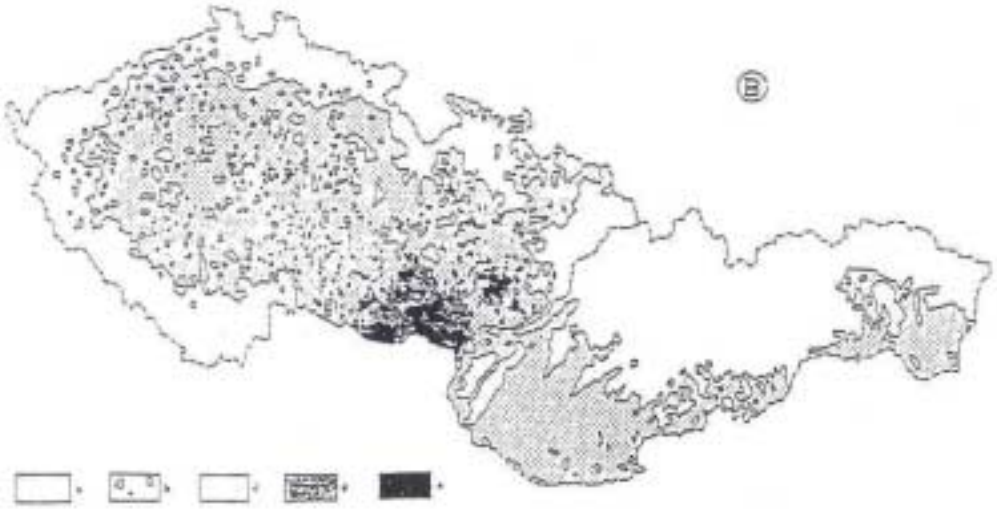


Abb. 1. Das Verbreitungsgebiet der Art Cricetus cricetus in der ČSSR.* Auf dem Gebiet Böhmens und Mährens sind vier Stufen der Populationsdichte ausgeprägt: Weiße Flächen, C. cricetus fehlt, Schütter punktierte Flächen, an günstigen Standorten beträgt die Durchschnittszahl der verwendeten Ausgänge höchstens 1/ha, Dicht punktierte Flächen, Zahl der verwendeten Ausgänge an geeigneten Standorten 2–8/ha, Schwarze Flächen, Zahl der verwendeten Ausgänge an geeigneten Standorten mehr als 8/ha. In der Slowakei wurde nur die von Hamstern C. cricetus besiedelte Fläche festgehalten.

*) Milan Novotný bearbeitete graphisch das Bildermaterial nach den Entwürfen des Autors.

f- *Czech Republic*

In the former Czechoslovakia Grulich (1975) reported on the distribution of the species, based on questionnaires sent out to the territories of *Böhmen*, *Mahren*, and *Schlesien* (= Czech Rep.) in the course of the periods 1948-1953 and 1955-1960 as well as in 1961-1970 and 1971-1974. He also personally checked a considerable number of places of occurrence. He compared the area inhabited by the hamster to various ecological features such as the height above sea level, soil conditions, and the level of ground water, climatic conditions and vegetation. His conclusions are as follows.

During the past centuries the hamster apparently spread on the deforested and drained areas. Its distribution is largely confined to cultivated land and it has inhabited the whole maize and sugar beet area and partly penetrated into the potato growing zones. It occurs primarily in chernozem soils, secondarily in deep brown forest soils of lowlands and hills and rarely podsols. The hamster areas cover the warmest parts of the country and which receive low precipitation (in *Bohemia* and *Moravia* from April to October: 500 mm) and the shortest period of snow cover.

Vohralik and Andera (1976) worked also with questionnaires and based on their own findings during 1972-1975. On the evidence of the two studies the distribution of the post-war period and the 7O's can be compared to some extent (**Figure 2**). No major differences can be found except:

– the larger islets of absence of the species in the Western- and Central parts of the territory, and
– the signs of a small-scale expansion of the range at the Southern-part and towards Bavaria (Germany) in the 1970s.

Grulich (1980) mentions data referring to changes in population numbers. He observed high densities in 1942 and in 1943-1944 at some localities in the Prague basin, around *Hradec Králové* and *Chrudim.* In 1973 high (more than 11 burrow/ha) and medium (6-10 burrows) densities were detected in the Prague and *Brno* region at several localities, even in the Western (*Chomutov*) and Northern part (*Jicin*) of the country. In the *Brno* region 20-40 and in some places even 63 burrow/ha was observed from where 15-36 hamsters were caught by trappers. High and medium densities were also reported in 1975 and in some places of the same regions in 1976 and 1977. Thus the area of hamster with greater population number became smaller and smaller.

Countrywide study on the distribution in the 1980s and 1990s is not available. According to observations in certain areas the hamster is still probably widespread but not a frequent species in the Czech Republic. The observation on mammals of the agglomeration of a town (*Brno*) in 1976 to 1982 revealed that the hamster sporadically occurred in the vicinity but did not penetrate into the immediate proximity of built-up areas. It is not abundant in the wider area of *Brno*, larger numbers can be found in the unforested, open countryside south-east to the town, "...where the arm of the South-Moravian plain reaches out from the south" (Pelikan et al. 1983).

Andera and Cerveny (1994) mapped distribution of mammals in the *Sumava* Mts region (SW-Bohemia). At present the species is reliably documented in three observation grids by remnants of prey in the nest of Eagle owls. Data from questionnaires indicated that it also occurs in other parts of the area but the authors considered them as non-verified reports. They proposed to include *Cricetus* as a rare species in the Red Data List of the *Sumava* region.

Some other experts are also concerned on the status of the species.

Recent study and clarification of the situation in the bordering areas to Germany (e.g. the area south to *Plzen* and also the area of *Furth* in Bavaria or the *Elba/Lobe* area to the north) would be interesting, the more so, since the hamster disappeared from the frontier region here in Germany after 1980 (Stubbe and Stubbe, 1994).

The Hamster is listed in the Red Data List (Barus et al., 1988) as a rare species and the situation on the basis of code numbers in the species list is not clear. According to recent information it will be listed as an insufficiently known or indeterminate species.

g- *France*

During the Pliocene and Pleistocene periods this species lived in the territory of France even in the southern and western regions of the country (Werth, 1934) and, very likely based on Werth's information, Petzsch (1950) mentioned its occurrence around Paris, which was probably the result of an introduction in 1870. The hamster does not occur there now and it also vanished from *Lorraine*, from where Saint-Girons (1973, cit. Smit and Wijngarden, 198l) reported localities in his book.

In the last two decades the only known occurrence of the hamster was in the north-eastern part of the country, in Alsace. Baumgart and Bayle (1984) and recently Baumgart (1996) details the history and latest situation of the species in this province. Information on its occurrence can be found dating from the 14th century. Higher numbers were recorded in 1884, 1891, 1900, 1930-31 and 1957-1964 (Baumgart, 1996). During the first half of the 1960's some thousands of hamsters had been trapped here and until 1990 the hamster was also controlled by Plant Protection agencies with phosphine generating products.

Baumgart (1996) presents maps on the changes of distribution in the two main parts of Alsace in the period of 1964-1990 (*Bas-Rhin*) and 1965-1983 (*Haut-Rhin*, where the hamster recently ceased to exist). It is surprising how long the very small *Haut-Rhin* population survived and how the also small *Bas-Rhin* population was able to tolerate the controlling actions year by year until 1990. Even in the first half of the 1990s this population proved to be vital. In 1996, a laboratory had been granted a permit to capture 350 hamsters. The permit had been suspended, but the laboratory was able to capture 154 hamsters, including 70 females. This signals rather dense population in certain parts of the area. The animals possibly concentrated in these parts, thus their total number could not had been great. It would be significant to know the exact circumstances of this trapping, i.e. the extent of the area and cultures covered and number of trappers involved in the course of the action.

The hamster was declared a protected species by the French Government in 1993, thus to capture or to control it is not allowed so far without authorisation.

The number of hamsters and the area of distribution became rapidly smaller and smaller during the last two decades (see also the chapter on population dynamics). Now the only area where the hamster can be found is in *Bas-Rhin*, SW of Strasbourg, between Strasbourg and the Entzheim-Airfield, on an area of about 20 square km. This area is one of the best agricultural terrains in Alsace, with deep loess-soil where the level of underground water is cca. 30 m (Wencel, personal communication). Thus, the area is an optimal location for the survival of *Cricetus*, as well as for agriculture and is covered by intensely cultivated fields. I had the occasion to take a look at the area in May, 1997. It is not an easy task to succeed in maintaining this last hamster-population of France and to grow crops at the same time. The area is also densely inhabited by man and intensely used for traffic: divided by a highway and some auto-roads. The main products are now maize, beet, cabbage, potato and wheat, which provide only temporarily food and shelter to the hamster. The ratio of perennial plants (e.g. lucerne) and rudimental areas is very small and lessens year in year out in order to gain more and more land to produce maize (Baumgart, 1996, Wencel, personal communication). The population is very small, however, in the rather few and small (1-2 Ha) lucerne-fields which remained, "normal" density can also been recorded. The problem is the critically small size of the population, which is, in my view, near to the limit of the "critically endangered" category (IUCN, 1996). The situation is crucial, there is danger of an imminent extinction of the species here.

Both, the Government and NGOs recognised the situation and increased their activity in order to maintain the hamster. The Government initiated surveys on which to base a conservation and management programme. The first outcome is Baumgart's (1996) detailed review on the history and basic analysis of the decline. Furthermore, a thorough study of the present situation including the interactions with agriculture and an inventory of the occurrence of *Cricetus cricetus* was commenced in 1996, which is of great importance. Based on this study regular monitoring and implementation of a conservation programme should be recommended.

h- *Germany*

With regard to its extension, the territory of Germany is equivalent to the one time most important occurrence of the Common hamster in the Western part of its range. Even in the 1960's *Cricetus* was a frequent field rodent in some middle provinces and now it has become a rare and protected species.

The hamster lived here as early as the Pliocene and Pleistocene (Arnold et al., 1982 cit. Wendt, 1989). According to Werth's (1934) analysis based on diluvial remains it survived the last glacial periods. Nehring (1984) stated that the hamster spread out in some districts of Germany throughout recorded history up to the 19th century. It can be reasonably assumed that the distribution-area of the hamster extended following the clearing of forests and the expansion of cultivated fields.

In the 19th and the 20th century to the 1980s, the hamster was common in appropriate regions of the provinces: *Bayern, Brandenburg, Mecklenburg, Niedersachsen, Rheinland, Sachsen-Anhalt, Sachsen, Thüringen, Württemberg.* In areas where it lived in numbers, especially in *Niedersachsen* and *Sachsen-Anhalt*, thousands of hamsters were caught by the people in the vicinity of some settlements. e.g. :

1817:	111.817	(Gotha and Buttstedt)
1900:	177.500	(Aschersleben)
1913:	70.000	(Gotha and Buttstedt)
1961-1966:	min. 10.856, max. 118.300	(Erfurt)
1953-1966:	192.102 per year on average	(Ascherleben)

Keilbach (1966) estimated the number of hamsters collected during 1952-1956 in the eastern part of Germany (then GDR), to 1 or 2 million. According to Hubert (1968) 1.302.140 specimen were collected annually on average, between 1953 and 1966 in the counties *Magdeburg, Halle* and *Aschersleben*. Likewise, over 1.5 and 1 million in 1967 and 1968 but during the first half of the 1970s less than 0.5 million (Stubbe et al., 1997). Similar decline happened also in the 1960s, but this was followed by an increase, what is not the case since the 1970s.

Figure 3. Distribution of the Common hamster in Germany (Arbeitskreis "Feldhamster", 1995)

- ○ Distribution before 1985
- ● Distribution between 1985 and 1994

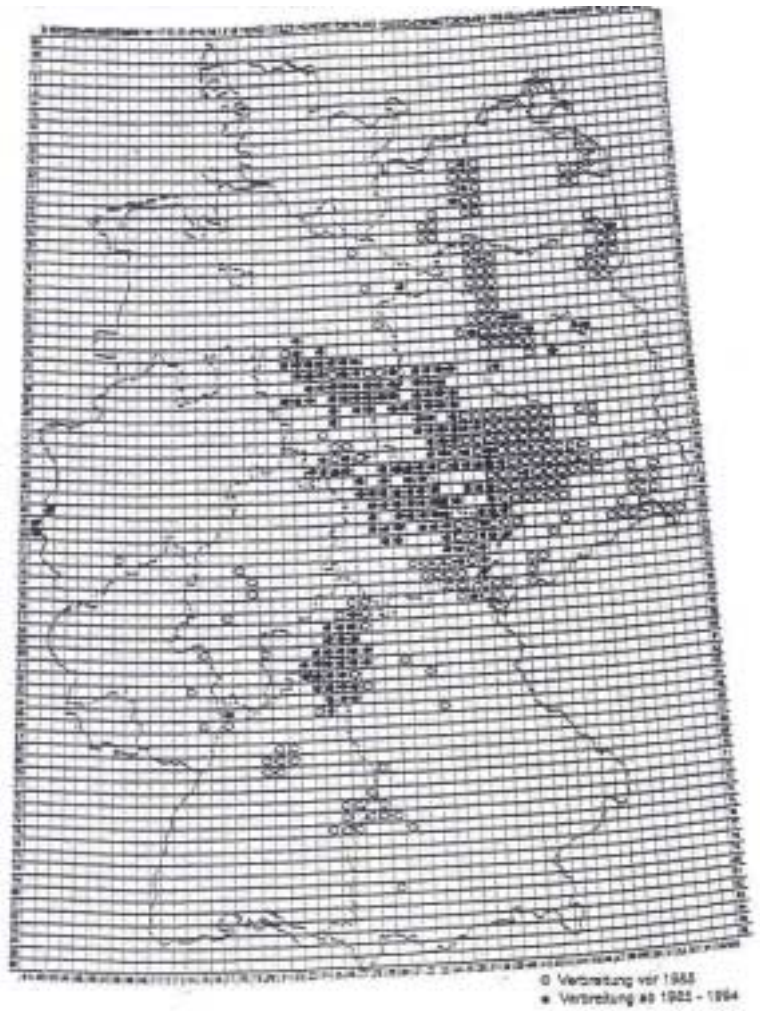


Abb. 3: Vorkommen des Feldhamsters in Deutschland, MTB, Stand: Oktober 1994 (nach ARBEITSKREIS "FELDHAMSTER" 1995).

Two significant or larger populations survived: in *Bayern* (the north western part along with the adjoining border area in *Baden-Württemberg*) and in *Niedersachsen, Sachsen, Sachsen-Anhalt, Thüringen*. Further occurencies: in *Brandenburg*, *Hessen*, *Mecklenburg-Vorpommern*, *Norderhein-Westfalen* and *Rheinland-Pfalz.* However, the shrinking of the range is obvious (Figure 3, Arbeitskreis "Feldhamster" 1995) and the isolated occurrences in *Brandenburg, Mecklenburg* and *Württemberg* are presumably the last remnants, the latter isolated from the population in Alsace, since the area is in the *Heidelberg* region. The *Rheinland* occurrence is possibly connected to that of the Netherlands (*Limburg*). Besides agricultural measures, the other forms of land use is a major risk to the Hamster (and other species), especially in this northwestern area including adjoining areas in Belgium and the Netherlands. The remaining small populations here can survive only if their ecological linkages are maintained. Under such circumstances even the establishment of a single business park on the place of a habitat can result the regional extinction of *Cricetus* (Kretzel, in litt.).

Important research activity begun in the 1980s (e.g. Wendt, 1989, Stubbe and Stubbe, 1994, Weinhold, 1994, Stubbe et al., 1997) which developed into significant national activity and an informal international team for today. Recent surveys (Seluga, 1996, Weidling, 1996, Weinhold, 1996, Stubbe et al., 1997) aimed to clarify not only the distribution but also the spatial organisation and development of the hamster population by exact mapping and the tracking of tagged animals. At the same time, the consequences of agricultural measures were followed carefully. These observations also resulted in new material on the biology of hamsters. They constitute, along with Dutch and French observations, the basis of a management proposal for maintaining the hamster.

The Common hamster is protected and strictly protected in the provinces of Germany, where it occurs.

i- *Hungary*

The *Cricetus* is still widespread in Hungary and its distribution can be considered as continuous in the greater part of the country, based on chains of suitable habitats with a mosaic character. However, it is actually a rare (subdominant or receding) species among rodents on natural or semi-natural areas and in districts of the country with diverse, rolling, wooded landscapes or sandy areas. Thus, in most of *Transdanubia* (west of the river Danube) and in the Northern Hills, it is present, but generally rare, compared to other rodents (e.g. on the basis of studying the diet of raptors - Kalotás, 1983). Fügedi and Szentgyörgyi (1992) found the *Cricetus* only in low-lying (up to 200 m) agricultural fields and only in the southern parts of the middle region of the Northern Hills. Nevertheless, in areas adjacent to the Hungarian Plain and in several tracts of cropland stretching into the Northern Hills, hence areas at the foot of hills, it can be common (Endes, 1991, Haraszthy, 1984, Szentgyörgyi, 1995).

In open agricultural plains, the hamster is able to attain high numbers in some parts of the country, where the structure and ground water level of the soil is suitable, i.e. in the main areas of cereal cultivation. Thus, in the central and eastern parts of the Hungarian Plain, it is the most frequently found rodent in agricultural fields, except during certain years, when other smaller rodents (e.g. Field-vole - *Microtus arvalis*) become dominant.

The situation in natural areas within good hamster regions is well summarised by Palotás and Demeter (1983) in the *Hortobágy* National Park (in the centre of the Hungarian Plain). "A species markedly attached to human presence in that it occurs only in crop fields, none was found in pastures or sodic grasslands. It is trapped for its valuable pelt from spring to

early summer by professional trappers. The hamster is known to exhibit population cycles of a frequency of 4-5 years, but in the less favourable cultivated fields of *Hortobágy* nothing of that nature was observed. In the eastern part of the *Hortobágy* on favourable soils dense population occur, in the puszta autumn populations are moderately high, whereas in fields on the former inundation plains of the River *Tisza*, low populations were trapped" (pp.4l5-4l6). In the *Kiskunság* National Park, between the Danube and river *Tisza*, the *Cricetus* is described as "A common rodent pest in cultivated fields" (Demeter and Topál, 1987). In the *Bükk* National Park, within the mostly wooded Northern Hills, "...only old data from cultivated fields are known" (Csorba, 1996).

The analysis of the feeding of raptors is a well-tested method used to make studies on rodents which gives a representative picture of the landscape. Kalotás (1983) found *Cricetus* to constitute 1.1 % when studying the food of 42 nesting pairs of Common Buzzard (*Buteo buteo*) in a diverse area during 1979-1982 in *Transdanubia* and 3.5 % at the end of summer in 1980-81, in the stomach-contents of 22 buzzards originating from various parts of the country, including also "hamster-areas". Haraszthy (1984) studied the diet of the Eagle Owl (*Bubo bubo*) on the basis of food remains gathered from nests in the Northern Hills in 1983, which was a peak-year for hamsters compared with other years in the same period. *Cricetus* was recorded in 3 out of 45 (3/45) samples at a nest in the *Mátra* range., and 14/71 and 56/82 in the *Zemplén* range. The nests were placed close to open land, where, especially in the latter case, the number of hamsters was high.

In the period after World War II the areas populated by the hamster and its abundance in Hungary were the largest and highest in the years 1952, 1959-1962, 1968-1974 (Nechay et al. 1977) and 1983-1984, and 1989. In the 1990's to date their number was generally low, and increased slightly again in 1997. The period of 1968-1974 deserves special attention. These were the first hamster-years after the large-scale establishment of agricultural co-operatives (more than 90% of cropland fell into co-operatives) and the formation of large fields with monotonous cropping.

The territory of controlled areas (use of rodenticides and trapping) increased year by year. Kovács and Szabó (1971) reported 12-33 burrows/ha on average in about 50.000 ha in the spring of 1970 in a county of easternmost Hungary, in spite of the control in 78.000 and 70.000 ha in 1968 and 1969, respectively. Hamster trappers also controlled large areas. In the 1980s, the controlled area changed between 40.000 and 350.000 ha (Kalotás, 1988). The regular control of *Cricetus cricetus* year in year out certainly reduced its number significantly but did not change the increasing trend and prolonged the peak-years. In 1973 in the vicinity of the town *Tiszavasvári* e.g. 112.920 specimens were caught in a 1,000 ha field (Legány, personal communication) and a minimum of 1.5 million furs were collected mainly in the eastern part of the country in the same year, and 2.4 million in 1974 (Nechay et al, 1977). In the 1990s the numbers were so low, that no use of rodenticides was needed (Mohai, in litt.). However, the trappers were active and e.g. in 1992 cca. 1 million furs had been processed by Hungarian enterprises, in spite of the low number of hamsters in the field. They probably also imported unprocessed hamster coats from Romania, Ukraine and Fed. Rep. of Yugoslavia to meet the increased demand. It merits attention, being linked with the rise in the price of furs, the catching of hamsters in the summer period was (and is) gaining ground, which was not usual in the 1970s.

In Hungary, no significant alteration in the structure of cropping can yet be observed over the last 30 year period, except an increase of fallow land, during the 1990s (initially 66.000 ha in 1990, and min. 191.000 and max. 411.000 ha during 1992-1996). The sudden recent decrease of domestic livestock, will certainly lead to a significant loss of perennial cultures. Likewise, it is still quite common to leave stubble land for a long time after harvest, together with the leftover of crops. This is favourable for the reproduction of summer populations, and for the survival and gathering of food for the hibernation period in sunflower or maize fields. Changes of technology, harvesting and soil cultivation at the same time or in a short time will significantly reduce the chances of hamsters.

The plant protection organisation follows the changes of numbers by counting the inhabited burrows in perennial cultures and cereals. Line-transect method is used to assess number of inhabited burrows on 2.5-5 m wide transects or animals are caught in minimum 1 ha size plots in observed fields at least twice a year: the end of March/early April and in October (Nechay, 1974). Based on aggregate data, national maps were, and are, being made by the Forecast Centre (Benedek and Mohai, 1990, Mohai, 1997 in litt.). By making a comparison between the maps produced in the period of 1973 and 1985-1995) the following can be concluded.

– The year 1973 (**Figure 4**) represents the situation when the hamster occurred in greatest numbers over the period of the last 3 decades. Thus, it can be considered as a good basis for comparison. Large areas had been populated by more than 10 inhabited burrows/ha or 5-10/ha even in some parts of the country west of the Danube.

– In 1985 (**Figure 4**) the registered area of occurrence was large and large areas were observed with burrows between 1-2/ha or above 2/ha. (More than 5/ha, i.e. 5-9/ ha on average observed in October occurred only in certain parts of Central- and Eastern Hungary). The highest numbers in single fields were in the range of 10-30 inhabited burrows per hectare. Because of the mild autumn and winter weather unusual activity of hamsters was observed even in January, and the mortality was probably high. The situation was also similar in 1986 and at the northern part of the area (basin of the river *Hernád*) even higher numbers were observed: 26/ha on average and 20-210 in single fields. However, in other typical hamster areas a decline of numbers was detected.

– In 1990 and 1991 no summary of the situation was prepared but the abundance of hamsters was generally low, similar to 1992. In the spring of 1993 the highest registered numbers were: 3/ha on average and 6-10/ha in certain perennials but the common number was around 1/ha. Densities were low also in October 1994 **(Figure 4)**. The"infestation"was not high in autumn of the year 1996 either.

The first year in the 1990s, when the hamster numbers turned for the better was 1997. In the central part of the Great Hungarian Plain I counted 117.4/km hamsters run over by cars on two roads between the settlements *Besenyõtelek - Poroszló* and *Heves - Jászapáti* on 6 and 8 October, 1997 (walking counts on 20 x 100 m sections, which represent cca. 20 km).Since the 1970s to date a continuous decline of the population can be observed. Thus, both density values and the areal extension of “considerably infested territories” became smaller during peak-years, at least in the western part of the distribution area of *Cricetus* in Hungary. This trend is warning, considering also the trends in west European countries in the same period, where the species became threatened or critically endangered.

The Common hamster is categorised as a "dangerous-pest" species in Hungary according to the order of the Minister for Agriculture No. 5/1988 (IV.26.) MÉM. This means that the control of hamsters is obligatory, when their abundance is above the "dangerous threshold" i.e. 2 inhabited burrows or hamsters per hectare in the spring. Therefore an exception was made by Hungary, on the basis of Article 22 of the Bern Convention in 1990 when the country became a party to the Convention and the Common hamster has been registered as an exception in the case of Hungary (*Magyar Közlöny*, 14-15, 1991). In spite of this, and the international situation of the Common hamster, no recent detailed studies on the species have been carried out in Hungary, except the official assessment made by the plant protection network.

j- *Kazakhstan*

Cricetus is a common rodent in appropriate fertile steppe regions in the northern half of the country. Within our reporting area it inhabits the northern half of the *Oral* territory, west of the river *Zhaiyk* (Ural). Data from Neronov and Tupikova (1966) indicated that in the *Oral* area a vital population of hamsters existed in the 1950s, The recent situation concerning them is not known, but the hamster is not listed in the Red Data Book (Kovshar et al., 1996).

k- *Moldova*

According to Lozan (1971) the Common hamster occurs in the whole territory of the country. It is most frequent in the steppe zones of the country and in the valley of the river *Dnestr*. However, its abundance is generally not high compared to other species and no mass occurrence had been recorded between 1950 and 1970.

Its habitats are noteworthy: unploughed fields, high-grassy areas, pastures, road verges, clearing and fringe of forests, old gardens, lucerne, in summer wheat, barley and sunflower fields. The numbers (walking counts on 10 km) were not great: 2,5 "living" holes along boundaries, country roads, pastures and forest belts, 0,7 in lucerne - at least in the 1960s. In the autumn of 1965 the highest numbers were: 7 holes in boundaries and fields in the *Dnestr* basin, and in grain fields 1 on average Lozan (1971).

When the food of foxes was analysed (Kortsmar, 1967, cit. Lozan, 1970) remains of *Cricetus* occurred 0.7 %. This is rather low compared to that of other similar-sized species, the Brown rat (*Rattus norvegicus*, 5.3 %) and the European souslik (*Spermophilus citellus*, 4.6 %). Likewise, in the food of the Eagle Owl (*Bubo bubo) Cricetus* was found cca. 5 %, whereas *Rattus norvegicus* and *Spermophilus citellus* 44 % and 32 %, respectively (Anisimiow and Lozan, 1968, cit. Lozan, 1970). This probably means that the hamster plays a less important part in the population of rodents in Moldova, compared to other species. Indeed, the European souslik (*Spermophilus citellus*) .is the most important species here in agricultural areas.

Recent information on the hamster was not available to me. Certainly it is not considered a threatened animal and not protected.

l- *The Netherlands*

Cricetus cricetus occurs in the south-eastern part of the country (Province: *Limburg*). Once, this population was in all likelihood connected with the Belgian hamster population, but the present connections are unclear.

Only a few records are known from the last century (Lenders and Pelzers, 1986). However, during the last decades of the 19th century "the number of hamsters in *Limburg* increased tremendously". The cause of this increase, as Lenders and Pelzers (1986) summarised the situation, is possibly the dominant position of grain-cultivation in the southern part of the province and a higher harvest-yield through the use of improved seedlings and a more effective method in the use of fertilisers". A similar, rapid increase was registered in Belgium, with the conclusion that the hamster was spreading out or invading the Eastern part of Belgium at that time (the end of the 19th century). The damage to agriculture brought about the controlling of hamsters and payment for trapped or dead specimens resulting probably in the gradual suppression of the species during the first half of this century. The highest population numbers could have occurred, according to payments for trapped hamsters, in 1880, 1889, later on in reducing numbers around 1900 and in 1913. The multiplication of hamsters was linked to the cultivation of cereals and their increasing crops per hectare. One of the causes of the decrease was probably the increase of the area of meadows while cereal fields decreased (Pelzers et al. 1984). Husson (1949) first tried to assess the distribution of the Common hamster in *Limburg*, based on questionnaires to the municipalities. A second inquiry and an inventory in the 60's (van Mourik and Glas, 1962. cit. Lenders and Pelzers, 1986) showed a dramatic decline. Besides modern agricultural technologies the urban development and infrastructural constructions have played a significant part in the decline. The extension of urban landscape along the river *Maas* and over to the German border resulted an "enormous loss of territory for the Hamster" (Ketzler, in litt.).

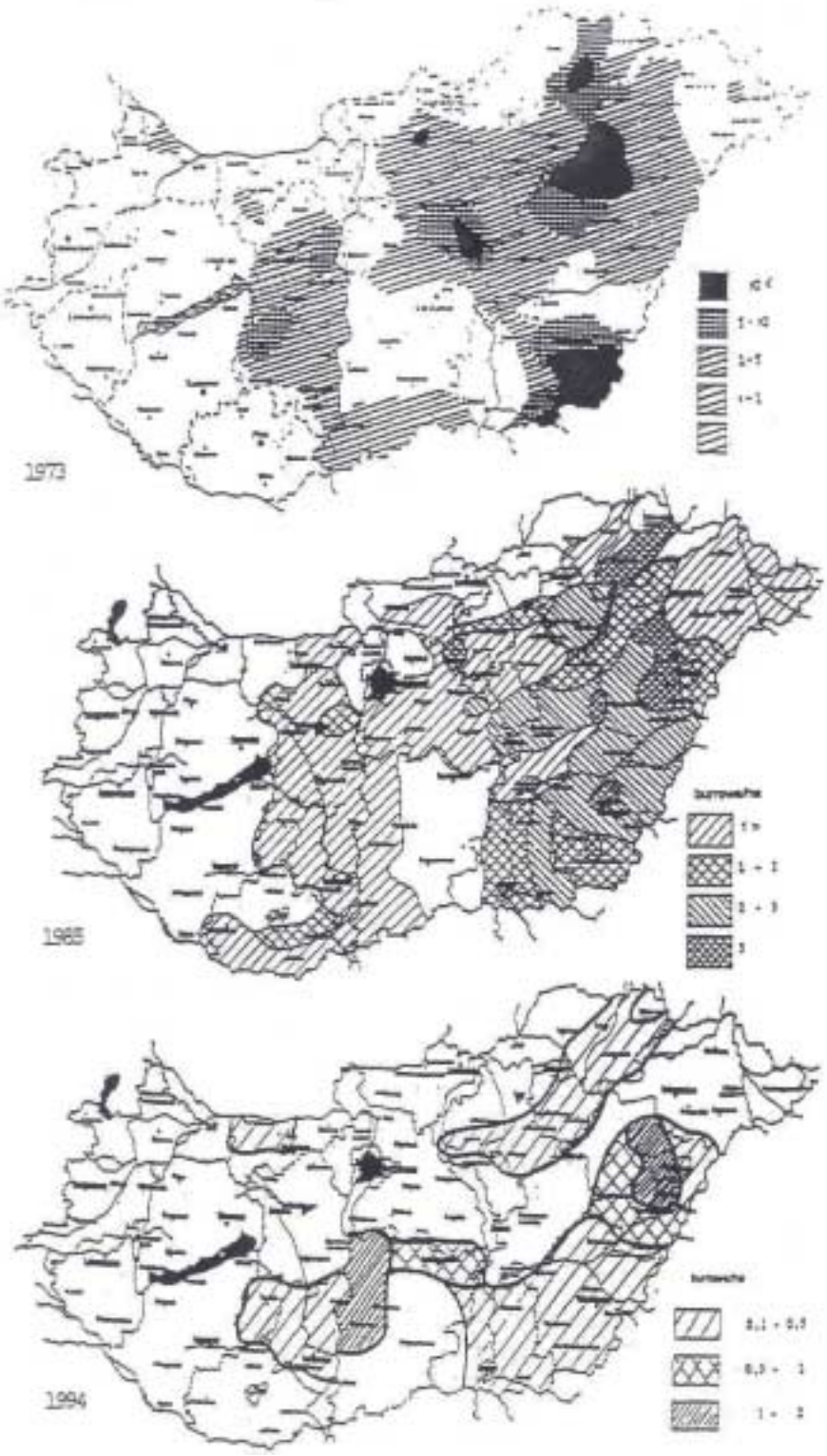
According to Smit and Wijngaarden (1981) small reserves with traditional agricultural methods are suitable for maintaining the hamster and such reserves are present in the Netherlands. However, no such an agrar-reserve has been established so far in order to maintain certain population of *Cricetus.* The survival of the species is jeopardized by especially intensive agriculture and due to destruction and cutting off habitats by urban areas. In 1994 the Natural History Society started an inventory on the occurrence of *Cricetus* in *Limburg* province. According to the preliminary results: the species has sharply declined both in number and in distribution (Krekels and Gubbels, 1996). A Hamster Action Plan in the Netherlands, including transfrontier areas, together with Germany has been established. As in Germany, exact mapping of the distribution and changes is in progress.

The species is endangered and strictly protected. Thelatter is implemented in practice through protection of burrows of the Hamster and that of a few habitats.

m- *Poland*

Cricetus cricetus occurs in the southern half of the country with the exception of the mountainous regions. The northern border of distribution is approximately at the Kalisz - Bialistok line, but *Cricetus* is also present north of Warszawa. Surdacki (1963, 1973) recorded new areas of occurrence compared to the range known before the 1950s. This can probably be considered as an expansion of distribution during the century.

Figure 4. - Distribution and changes of numbers of the Common hamster in Hungary (1973-1994)



Hamsters live "…nearly exclusively in meadows and cultivated fields" (Gorecki, 1977) The present situation is unclear. Pucek (1989) who was one of the best experts in Mammals of Poland did not referred to the Polish situation. Makomaska-Juchiewicz (1993) referred to the plan of inclusion of *Cricetus* in the list of strictly protected species, in relation to the harmonisation of the domestic legislation with the Bern Convention.

n- *Romania*

The Common hamster was a widespread species in suitable habitats and croplands except the mountainous regions (*Bihar* Mts., Carpathians) up to an altitude of about 650 m. It was common in the western and central as well as in the eastern part (northern Moldova and Muntenia) of the country in suitable habitats but absent or rare in *Dobrudja* and rare in *Oltenia* in the South (Vasiliu and Sova, 1968, Hamar, 1974, in litt., **Figure 5**).

The situation of the species in the 1950s and 1970s can be no better illustrated than Dr. Martin Hamar described it to me in 1974: "The hamster is distributed in the entire steppe and sylvo-steppe area at elevations of up to 500-600 m. The highest densities are recorded in the Plateau of Transylvania, in Baragan, northern Moldova and Banat where, during invasion periods there are between 240 and 250 galleries/ha. Perennial grasses, forest belts, sod soils and road borders represent the preferred biotopes of the hamster. During invasion periods, this species penetrates in all cultivated fields, and even in vineyards and irrigated fields, preferring heavy clay soils humus enriched and avoiding stony places". "Invasions" (peak-number) of the hamster occurred in 1899-1900, 1915, 1920, 1924, 1930, 1940, 1945-1948, 1954-1955, 1959-1960, 1973-1974. (Hamar, 1974, in litt.).

There is no published data on the recent general distribution and abundance of *Cricetus*. However, Murariu (1995) describes the situation as follows: it is common in *Moldova, Wallachia* and Transylvania, sporadic in *Oltenia* and absent in Dobrudja and *Banat*. He considers the Common hamster as a species which is not in need of protection. Certainly, observations in various parts of the country show no signes of dramatic change of the *Cricetus* distribution in the course of the last two decades. Popescu et al. (1977) captured and also found it in pellets (0.83 %) of the Long-eared Owl (*Asio otus*) in 1974 and 1975 (peak years, at least 1974), in an area which is situated outside the distribution map (**Figure 5**). It was an amelioration area, improved by an irrigation system, and actually not optimal for hamsters, due to the sandy soil. Considering this, and the fact that the Long-eared Owl only occasionally takes *Cricetus* (Schmidt, 1971) the data is interesting and shows that the hamster (certainly also present formerly undetected in the area) occupied the new suitable habitats and increased in number. It also speaks for the significance of new man-made areas with respect to the survival of the hamster.

In the south-eastern part of the country (lower *Ialomita* river) the hamster is still a common species, often killed on the road running parallel to the river. Its burrows have been frequently observed in lucerne fields (Murariu, 1989). When collecting small mammals in the north-eastern part (*Moldova*), Murariu (1993) found, as the only representatives of rodents, specimens of souslike (*Spermophilus citellus*) and *Cricetus cricetus*.

The situation has certainly changed to some extent in a similar way to the overall decrease of hamsters in Europe during the 1990s. However, the Common hamster is even now one of the most common species and at present not threatened in Romania. Hamster trappers are working and even Hungarian trappers arrive in Romania. In 1997 it was possible to catch 300 specimens a day.

Figure 5. Map of distribution of *Cricetus cricetus* in Romania

Nevertheless, according to the new legislation on nature conservation and hunting *Cricetus cricetus* is a protected species. The value of one specimen is 50,000 *lei* (Annex 2. of the Order No. 103/1996), which is used in procedures in the case of unauthorised actions against the species. (This is very likely a result of the harmonisation of the domestic legislation to the Bern Convention).

o- *Russian Federation*

The status of *C. cricetus* can be discussed only on the basis of data related to the situation in the 1950s and 1960s and indirect information published recently. The area of distribution extends from the Ukraine and the southern part of Belarus to Siberia, to the region stretching over the river *Jenisej* (**Figure 6**, Bobrinskij et al. (1965)). The border is roughly outlined and this reflects the uncertainties on knowledge of the occurrence of the hamster in this large area, as well as the changes of its distribution due to human activities. Neronov and Tupikova (1967) registered the number of hamster-furs carried in each province from 1952 to 1961. Their maps (**Figure 7 and 8**) illustrate not only the region where the hamster was widespread in this period, but the core-areas of the distribution. These are the region from the Black-Sea and Pre-Caucasian to the *Volga* and *Ural* rivers (and in Siberia). The borders of the two distribution maps are somewhat contradictory. It is easy to see that map III of Neronov and

Tupikova does not mean the complete disappearance of the species in regions where it was previously abundant. Trappers are working if their activity is remunerative, which requires a certain abundance of hamsters. Poljakov (1968), who was acquainted with the situation in agricultural areas, gave the broad outlines of the distribution limits as follows: the line *Smolensk, Holm, Jaroslavl', Kirov, Perm* (and the Trans-Ural range) in the north and the Black Sea, the Ciscaucasian steppes and the *Volga* and *Ural* basin in the south, apart from the dry steppe to the Caspian Sea and the semi-desert between the two rivers.

The Common hamster is considered a species, which inhabits areas associated with man and does not occur in such massive numbers as the susliks (*Spermophilus /Citellus/* sp., e.g. with at least 4 numerous species in the area). For comparison: yearly 60-90 million susliks were caught by pouring water into the holes (Poljakov, 1968) and mouse-sized rodents (various voles: *Microtus* spp., *Lagurus lagurus*) occur in 400-1000 specimen/ha in some places (Poljakov and Gladkina, 1978, Poljakov and Chenkin, 1980). The significance of the hamster is low compared to other species. It has even never received such an attention than the dormice (*Gliridae*) and mole rats (*Spalacidae*) which are relatively rare rodents. It lives in the vicinity of human settlements and its presence in the fields and gardens can be easily followed by the people as Poljakov (1968) summarised the situation. However, 52 burrows/ha counts as a great number and in areas where the abundance of susliks is lower, the hamster can heavily damage the various crops (Heptner et al., 1956) and especially cereals (Meyer, 1975).

As to the number of hamsters captured by trappers Bobrinskij et al. (1965) mentioned 2 to 12 million as the yearly catch in the territory of the former USSSR. Exact data referring to the population numbers are available only from the 1950s and 1960s. In the period of the 1950s there was probably the greatest number of hamsters occurring in the country. The peak was in 1952 and 1953 (16,400,000 furs of *Cricetus*) and in 1956-1957 (Neronov and Tupikova, 1967). The comparison of data to those from other periods is not easy, since a similar survey had only been carried out in 1957-1970 (Syrojeckovskij and Rogaceva, 1975, cit. Grulich, 1980). As already pointed out by Grulich (1980), the numbers in the subsequent years were far less. In 1957 the collecting firm bought up 4,052,700 furs, which is 623 times more than in 1970, when only 6,400 furs were bought up. There was a rather rapid trend of decrease from the 1950s to the 1970s. From earlier periods of great numbers of hamster the following data are available. Between 1926-1929, 66 furs/100 km² were bought up within the middle *Volga* region and 51/100 km² between 1956-1959. The similar data in the lower *Volga* area were 46/100 km² in the period of 1926-1929 and 350/100 km² during 1956-1959. In years of low hamster numbers e.g. in 1949 only 605,000 furs had been purchased in the market. Since 1970 no adequate data are available (Syrojeckovskij and Rogaceva, 1975, cit. Grulich, 1980).

Summing up, there was a "protruding peak" in 1952-1954 and probably the situation was similar to that at the end of the 1920s. Since that time the population of *Cricetus* have been generally smaller. A recent report on the mapping of rodent species (Sokolov et al., 1993) does not mention any new surveys on *Cricetus* distribution since the study made by Neronov between 1950-1962 (Neronov and Tupikova, 1967) or Syroeckovskij and Rogaceva in 1960-1970. Thus, similar works in the period of 1970 and our days were essential for the exact estimation of the recent situation of the species.

Figure 6. Distribution of the Common Hamster (*Cricetus cricetus*), the Daghestan hamster (*Mesocricetus raddei*) and the Turkish hamster (*Mesocricetus brandti*) in the territory of the former USSR (partly modified, after Bobrinskij *et al*., 1965)

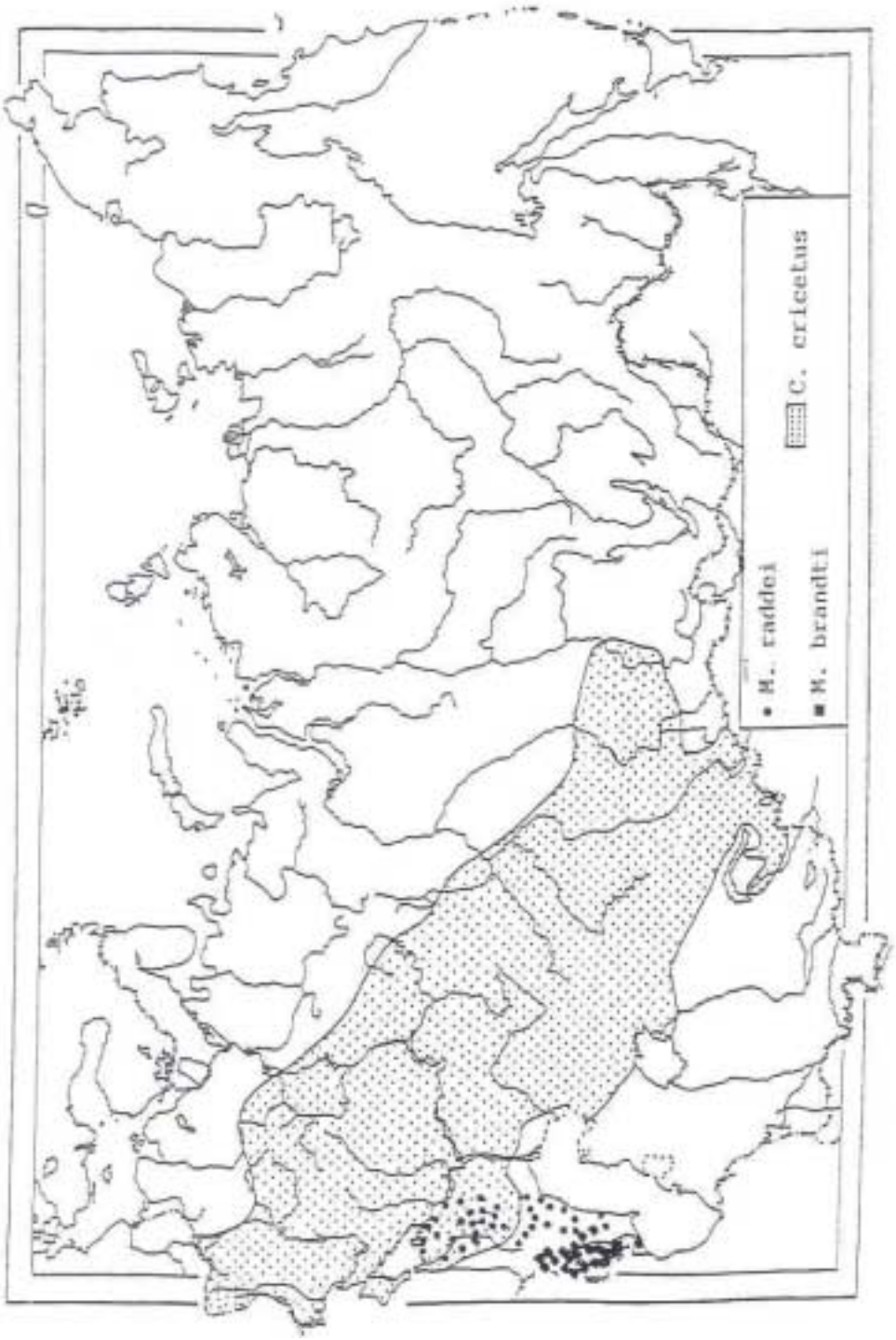


Figure 7. Changes of number of the Common hamster in the territory of the former USSR in the 1950s (Neronov and Tupikova, 1967)

1. less than 1 000 furs prepared per districts
2. 1 000-9 999 " " " "
3. more than 10 000 " " "
4. no data

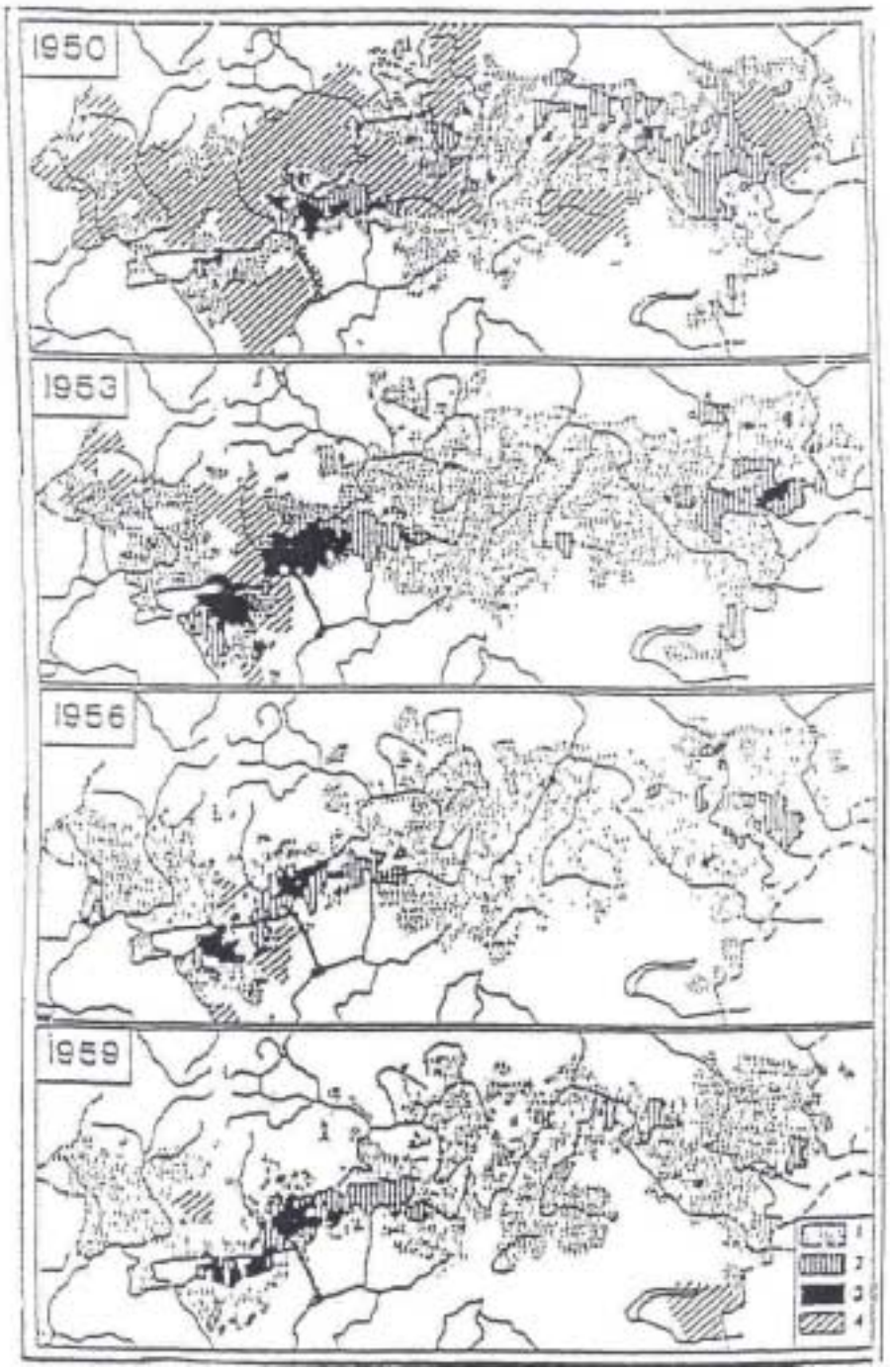
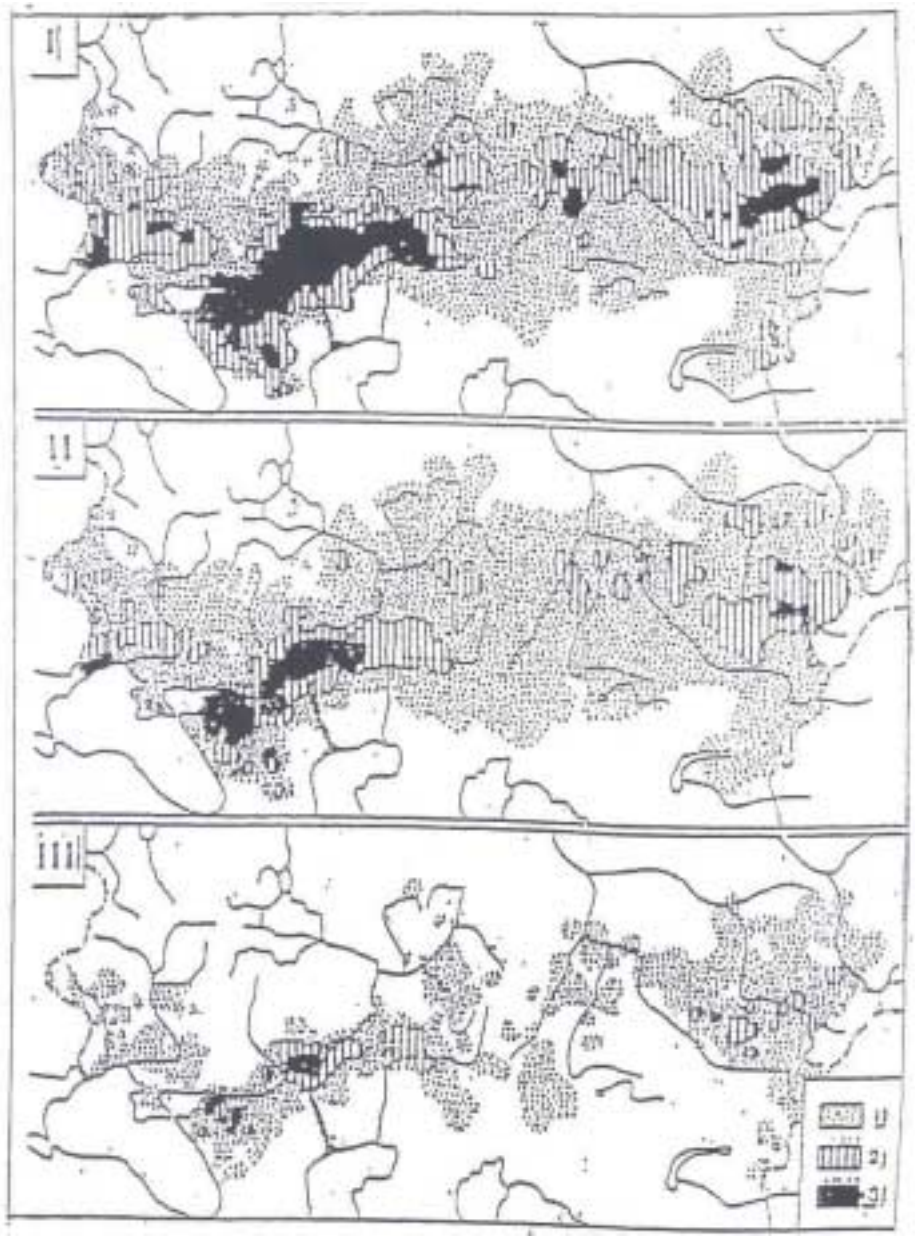


Figure 8. – Quantitative distribution of the Common hamster in the territory of the former USSR on the basis of furs prepared per districts between 1952 and 1961

I. maximum data
II. medium data
III. minimum data

1. 0,1-10,0 furs prepared on average per 100 km²
2. 10,0-100,0
3. more than 100



Regarding the factors influencing the distribution and numbers of the *Cricetus*, the role of the establishment of new areas suitable for hamsters are pointed out by all the experts. The expansion of hamster distribution into the deforested areas or along the canalisation into semi-desert areas has been observed. Sudeikin et al. (1972) reported a mass occurrence in the south-east region of Moscow, from where hamsters were earlier only present several km to the south (Ognev, 1913). The area was situated along the Moscow river and was an amelioration area. The estimated numbers, in dykes/embankments established in former times and overgrown with high grass vegetation, were 77-87 holes/ha in 1971. In dykes established 1-3 years previously the density was low or hamsters were not to be found.

It would be significant to know the recent state of the Common hamster in Russia and Ukraine, considering that the area of distribution in these states is considerably larger than in the other parts of Europe. Unfortunately there is hardly any published data on *Cricetus cricetus*. One of the reasons is most probably that other species (e.g. *Spermophylus, Arvicola*) play a more important role in the economy and as a vector of zoonoses. The forecasting of the plant protection organisation did not even formally monitor the changes of the hamster population (Poljakov, 1968) and this is still the same (Gladkina, 1990, Ivanov, 1990).

Rodents are usually controlled in large territories of Russia. In 1978 1,579 mill. Ha were controlled against sousliks (as in 1979) and 3,460 mill. ha (2.4 mill. in 1979) against other small rodents (Specialists of the Ministry of Agriculture, 1979, Poljakov and Chenkin, 1980) For control rodenticides were in use placed into burrows of rodents or spread to the fields by e.g. aircraft during several decades, such as: *Gliftor* (chlorine and flourine hydrate) Zinc phosphide (5-8 % a.i. prepared on various baits), bacto-rodenticide (*Salmonella typhimurinum*) and others (Poljakov, 1968, Bikovskij, 1986). The use of *Salmonella* has recently been prohibited (Gladkina, 1990). These rodenticides must also have an effect on hamsters present in the controlled area, although the strain of *Salmonella* is sad to be not dangerous to *Cricetus* (Kandubin, 1990).

The intensification of land use and rodent control leads for a general lessening of the numbers of various rodents. While in the 1960s susliks had been controlled on 14-15 million ha, in the 1980s they were controlled only on 1-2 mill. ha (Gladkina, 1990). I think that with the reduction of numbers of other species, especially susliks, the economic importance of the hamster will initially increase in the future, certainly.

The Common hamster is not listed in the Red Data Book (Eliseev et al., 1983) and not protected.

p- *Slovakia*

The distribution is quite well documented in the 1960's and 1970's. According to studies based on questionnaires on captured hamsters in 1966 and 1967 (Hell and Herz, 1969) and on the assessment of inhabited burrows in 1967 (Grulich, 1975) the *Cricetus cricetus* occurs in lowland-territories mainly in the Western (*Komarno, Levice, Nitra, Nove Zamky, Trnava, Galanta*) and Eastern (*Kosice, Trebisov, Mihalovce, Vranov*) parts of the country (Figure 2 A) The occurrences are undoubtedly continuations of the distribution of the species in Hungary and are also connected with the Austrian and Czech and in the east with the Ukranian areas of distribution.

Following chiefly Grulich's detailed reports, the situation of *Cricetus* can be summarised as follows. There are only occasional data on the population number before 1967. In 1930 the number of hamsters increased around *Haniska (Kosice* district). Turcek (1950, cit. Grulich, 1980) described *Cricetus* as a species which often appears in large numbers, when 20-30 hamsters are captured in 1 ha. He mentions as an interesting phenomenon, that the Common hamster "...disappears in some years seemingly without any reason, and appears somewhere else...".

The 1966-1967 period counts as a peak of hamster numbers in Slovakia, and for example in Western-Slovakia on one 25 km road-section between *Tnava* and *Senec* 150 crushed hamsters were found even still in 1968 (Feriancová-Masarová, 1972, cit. Grulich, 1975). The hamster was the most frequently killed animal on roads in some parts of its distribution area. In certain agricultural fields more then 50 specimens per hectare were captured (Hell and Herz, 1969) and 11 or more inhabited burrows per ha were detected on the average (Grulich, 1975). However, the number of hamsters caught by trappers was only 104,916 in Western Slovakia, 3,099 in the middle part of the country and 29,774 in Eastern Slovakia, where, some years later the highest - well-documented - population density developed in the basin of *Kosice* in 1971-1972.

This was the greatest population explosion of *Cricetus*, which has ever been observed and described, in the whole range. That was a large-scale gradation. In the "infested" area of over 200,000 ha occurred at least 35 million hamsters. (About 1 million hamster furs were bought up by the collecting firm in 1971). Apart from cropland, roads and railroad embankments, banks of canals and ditches as well as anti-flood dikes and dams were also occupied and damaged by hamsters. The migrating animals invaded stored crops, farm buildings and human dwellings. This synantropic tendency of the hamsters was observed in 192 villages and lasted up to 10 months (Grulich, 1978). The hamster population was infected with several diseases. Leptospiroses, tularemia listerioses, rickettsioses (Q-fever), some virus diseases including rabies, were detected. Hamsters were controlled in more then 150,000 hectares of cropland with Zn_2P_3 (7-10 % on baits) and further control measures were implemented along roads, embankments, etc. The cost of the control was 9,490,000 *Kcs* only in the course of 23 Mars to 2 May 1972. The estimated damage caused by hamsters was more than 100 million *Kcs.* From May 1972 *Polytanol* was used for control on 20,000-50,000 ha yearly (Grulich, 1980, Tóth, 1974).

Grulich (1988) described high incidence of periodontal disease and periodontal atrophy in hamsters in Nov. 1971–April 1972. Mainly non-hibernating specimens were affected living in large numbers synantropic, without proper food, suffering from cold weather and physical trauma (conflicts, injuries etc.). Even young hamsters (aged 30-40 days) suffered from the disease (e.g. 87.1 % of males were affected). The older groups were got ill more then 90 % and 95 %. As for comparison: in *Moravia* (Czech Republic) in 1973, in an increasing population, the incidence of diseases of *periodontium* was e.g. only 3.4 % in young and 17.7 % in elder hamsters.

Investigating the causes of this explosion of hamsters it is important what Grulich (1978, 1980) concluded. The greater part of the area concerned is the lower basin of the river *Ondava*. The proportion of croplands here was only 8.8 % in 1858 (and forest 15.5 %, swamps and wet grasslands 60.8 %). In 1935 the land structure was already rather different: cropland 65.7 %, forest 0.3 % and swamp 14.0 %. However, even in 1935 the extension of flooded areas was as follows: 48.4 % in the proximity of *Mihalovce*, 50.8 % around *Trebisov* and 19.3 % at *Vranov*.

The reclamation of areas continued after the War II period. The construction of anti-flood banks, drainage of marshes and swamps, decrease of the ground water level due to amelioration, ploughing up grasslands (the "puszta" meadows) and the increased yields and remains of crop in the field after harvest, all contributed to the extension of the range of *Cricetus* and to the increase in its numbers. Until 1972 the Common hamster was actually not even registered as an agricultural pest.

In the second half of the 1970s the establishment (drainage, ditches) sustained significant losses. In 1974-1976 due to the rainy weather, harvesting machines damaged the drains and ditches. The soil became soaking wet and 2-3 tractors were needed to draw in trailers. On the surface accumulated again rainwater. The high ground-water level put an end to the habitat requirements of hamsters in wide areas and in 1977-1978 the density of hamsters remained low.

As one of the consequences of the 1971-1972 hamster outbreak, intensive research activities begun on the *Cricetus*. Grulich, Holisova, Vohralik and other Czech and Slovak experts significantly enriched our knowledge on the Common hamster. In spite of that there are no data on the present situation. The continuation of these research and monitoring of the Slovakian population of hamsters is highly recommended. Hamsters caused no serious problems in Slovakia during the last two decades. There is undoubtedly a decreasing trend in the population. That is all the more reason for the continuation of research activity on the species.

I think that the mass occurrence around *Kosice* in the early 70's left its marks in Slovakia and the species is not protected but it is still not threatened, either.

q- *Slovenia*

Krystufek (1987) found two hamsters in May 198O in the vicinity of the village *Obrez* (between *Ormoz* and *Sredisce* alongside the road) in an area north to the river Drava. This observation was the first scientific record of the species in the territory of Slovenia. The nearest places where the hamster was known to be present are south of the river *Drava* in Croatia at the localities *Vinica* and *Varazdin* (Ruzic, 1978a). No further or most recent papers are available. However, the species is protected and its "official" status is rare (Krystufek, 1992).

r- *Switzerland*

Mohr (1954) mentioned in her book without giving further details or sources, that the Common hamster appears as a rarity in the vicinity of *Basel* and in the Canton *Schaffhausen*. The information was probably derived from Professor Hans Hediger who also mentioned Switzerland as a country of distribution (H.H. 1944) and Petzsch (1950) used also this information when wrote about the occurrence of the species in parts of Switzerland.

If so, the hamster was certainly found in the territory of this country and it could be considered as a "critically endangered" or "extinct in the wild" species, since no recent records are available.

s- *Ukraine*

The Common hamster occurs in the whole territory of Ukraine, except the highlands (Carpathians, Crimean Mts.). The best hamster areas might be the Sub-Carpathian and the middle chernozjom region and the pre-mountainous part of Crimea (see Figure 8).

According to the information given to the question of the Secretariat of the Bern Convention in 1996: the species is widespread in the steppe and forest-steppe zone of the Ukraine. There are two subspecies registered: *Cricetus cricetus nehringi* (Matschie, 1901) distributed westwards of the river *Dnipro*, and *C. c. taurious* (Ognev, 1924) spread between the river *Dnipro* and *Don* and in the Crimea as well. In recent years there has been a tendency of increasing numbers of *Cricetus* in the Sub-Carpathian region, following the draining of wetlands. This has occurred for example around *Simpheropol*."But simultaneously a reduction of the hamster's reproduction and food sites has been noted as a result of contamination or the use of chemical fertilizers and pesticides and the increasing of arable land."

It is worth mentioning, that according to Resetnik (1967, cit. Grulich, 1980) the usual abundance of hamsters in some Sub-Carpathian districts is about 20-30 inhabited burrow per ha, but the number of furs bought up did not reach 1 thousand. The greatest number of furs in the Ukraine was bought in 1956-1957 (Neronov and Tupikova, 1967). Lots of hamsters should have been occured in 1938, at least in the *Chernigov* district, where around one village 11,454 specimens were caught (Gershenson and Polevoj, 139). According to Meyer (1975) the hamster can seriously damage cereal crops in the Ukraine.

The situation is quite similar to that of the Russian Federation. The numerous rodents are still susliks and mouse-sized species (*Spermophilus /Citellus/ suslicus, S. citellus, Citellus pygmeaus, Arvicola terrestris, Microtus arvalis and other Microtus spp.*). For example, the area controlled against susliks in 1979 was 1 million ha and against voles 1.4 million ha (Poljakov and Chenkin, 1980).

The hamster is not a threatened animal in the Ukraine and not protected.

t- *Federal Republic of Yugoslavia*

The range of *Cricetus cricetus* between 1965-1977 was studied by Ruzic (1978). The main distribution area is in the northern part of the country, adjoining the Hungarian and Romanian border (*Backa* region). This region is the southern part of the Pannonian plain, thus the range is an unbroken continuation of the Hungarian and Romanian hamster areas (**Figure 9**). The hamster also inhabits the flat lowland areas south of the Danube, between the *Sava* and Danube and south east of Belgrade along the lower course of the *Velika Morava* river. The southern border of the range roughly coincides with a mountainous region in Serbia. The range of the Common hamster is situated, at the same time, in productive agricultural regions of the country.

The abundance of hamsters was estimated by counting the inhabited burrows in lucerne fields during August and the first half of September. Five categories were distinguished: 1/ very low (below 0.2 burrow per ha), 2/ low (0.2 to 1 per ha), 3/ medium (2 to 5 per ha), 4/ high (6 to 20 per ha) and 5/ very high (21 to 50 per ha).

The greatest hamster numbers were observed in northern and central *Backa,* where low numbers were exceptional and the high or very high abundance could be continued for consecutive years (Ruzic, 1978). According to the maps on the extension of regions with the various density categories (Ruzic, 1977) the most numerous hamster population occurred in 1973 and 1974 during the observation period. This corresponds with the situation in Hungary.

South of the Danube the abundance was low or very low.

Recent works on the distribution of, and the changes to the hamster population are not available. However, studies on the biology of *Cricetus* and on using it as a model for problems of population dynamics indicate that its population did not significantly change during the 1980's (Krsmanovic, 1985, Krsmanovic et al., 1984, 1987, 1989) and the species is not threatened in the country on the whole. But in the southern fringe of the distributional area it is rare and Vasic et al. (1991) proposed the inclusion of *Cricetus cricetus* on the Red List of Serbia. In this part of the country, however, the abundance of hamster was low or very low also in the 1970's.

D/ Recommendations to management of *cricetus cricetus* on the international level for europe and in various parts of its range

A long list of references can be cited if we were to summarise the control of the Common hamster, since this has a long history. Grulich (1977), Nechay et al. (1977) and Poljakov (1968) can be mentioned as reviewing control methods. In the latter case, however, it should be emphasised that Poljakov did not treat the control of *Cricetus* separately, since it was not dealt with as an important rodent with regard to agriculture. On the other hand, it is remarkable, that in France even at the end of the 1980's highly effective rodenticides such as *bromadiolon,* and phosphine generating compounds had been used to control the hamster (Grolleau, 1990). Baumgart (1996) analysing the causes of decline of hamsters in Alsace, gives detailed information on the effect of various control techniques and especially the use of phosphine organised jointly by the municipalities, which could have resulted in a drastic decrease in the hamster population.

The management of the Common hamster as a threatened animal is largely inexperienced. Wendt (1984) proposed that the use of hamsters as fur animals should be managed, that is the trapping of them in summer should be halted to avoid the catching of pregnant or lactating female hamsters in July and August. He also proposed to manage the hamster without chemical control and considered 0,5-2 specimen/ha in the spring not abundant, which does not mean a level, which might pose a danger of damage to crops. He argued for the need to protect *Cricetus* in certain regions of Germany (e.g. *Thüringia*). Smit and Wijngaarden had already proposed in 1981, at least at the fringes of the west European hamster-range, the establishment of "suitable reserves where old-fashioned agricultural methods are maintained" and mentioned, that "Such reserves ... also serve as a refuge for the weed flora of grain fields and old varieties of cultivated plants".

Figure 9. – Distribution of the Common hamster in the territory of the former Yugoslavia (Rusic, 1978)

Karta 1. — Rasprostranjenje hrčka u Jugoslaviji. Lokaliteti u kojima je utvrđeno njegovo prisustvo (crni kružići) i u kojima je traženi ali nije nađen (beli kružići).

Distribution of the common hamster in Yugoslavia. Localities of established (solid circles) and non-established (open circles) occurrence.

1 — Vinica; 2 — Varaždin; 3 — Koprivnica; 4 — Đurđevac; 5 — Ptuj; 6 — Virovitica; 7 — Podravska Slatina; 8 — Donji Miholjac; 9 — Našice; 10 — Osijek; 11 — Vinkovci; 12 — Vukovar; 13 — Beli; 14 — Beli Manastir; 15 — Drnš; 16 — Ridica; 17 — Šajmoški; 18 — Subotica; 19 — Kanjiža; 20 — Sombor; 21 — Apatin; 22 — Titel; 23 — Sivac; 24 — Bačka Topola; 25 — Ada; 26 — Vrbas; 27 — Bečej; 28 — Odžaci; 29 — Pivnice; 30 — Bač; 31 — Bačka Palanka; 32 — Bački Petrovac; 33 — Temerin; 34 — Žabalj; 35 — Bič; 36 — Sremska Mitrovica; 37 — Ruma; 38 — Indija; 39 — Platičevo; 40 — Pećinci; 41 — Stara Pazova; 42 — Zemun; 43 — Banatsko Aranđelovo; 44 — Čoka; 45 — Kikinda; 46 — Novi Bečej; 47 — Bečej; 48 — Nova Crnja; 49 — Žitište; 50 — Zrenjanin; 51 — Perlez; 52 — Bela; 53 — Opovo; 54 — Kovačica; 55 — Šeđanj; 56 — Plandište; 57 — Alibunar; 58 — Omoljica; 59 — Kovin; 60 — Bela Crkva; 61 — Makiš; 62 — Vinča; 63 — Mala Krsna; 64 — Kosjerić; 65 — Pančevo; 66 — Maribor; 67 — Zidani Most; 68 — Rogaška; 69 — Zagreb; 70 — Krčevci; 71 — Bjelovar; 72 — Čazma; 73 — Popovača; 74 — Kutina; 75 — Daruvar; 76 — Pakrac; 77 — Nova Gradiška; 78 — Nova Gradiška; 79 — Slavonska Požega; 80 — Banova; 81 — Slavonski Brod; 82 — Bosanski Brod; 83 — Doboj; 84 — Vrapolje; 85 — Bogatić; 86 — Šabac; 87 — Debrc; 88 — Obrenovac; 89 — Ripanj; 90 — Smederevska Palanka; 91 — Velika Plana; 92 — Aleksandrovac; 93 — Šagrđan; 94 — Majdanpek; 95 — Donji Milanovac; 96 — Takija; 97 — Krnjača; 98 — Radujevac; 99 — Tamnič; 100 — Bor; 101 — Zaječar; 102 — Knjaževac.

Data on the connection of the loss of hamster numbers and the decrease in the area of cereals and perennial legumes and the increase in the area of maize in monoculture at the same time, shows the importance of the structure of the sown-area for the hamster (e.g. Pelzers et al., 1984, Gubbels and Backbier, 1994, Krekels and Gubbels, 1996, Baumgart, 1996, Stubbe et al., 1997) Consequently, the maintenance of, and increase in the area of lucerne and red clover as well as winter wheat, is of major significance for the survival of hamsters. Several experts emphasise the need for the leaving of stubble land unploughed till late autumn, at least in parts or bands. Similarly, to leave strips of land when harvesting for the later getting in of the crop (Seluga and Weidling, 1994, Voith, 1994, Stubbe et al., 1997).

In a region where the occurrence of hamsters is isolated and *Cricetus* is on the verge of extinction every single mortality factor should be taken into account including treatments of seeds, the use of herbicides and other pesticides, the effect of road traffic and the killing by raptors (Wendt, 1989, Voith, 1994, Kerkels and Gubbels, 1996, Baumgart, 1996, Seluga, 1996, Weidling, 1996), along with other practices of agriculture which are disadvantageous to the hamster, such as the irrigation of cultures (Baumgart 1996) or liquid manuring (Weidling, 1996).

As it is pointed out by Kretzel (in litt.) and Weidling (in litt.) the loss of habitats suitable for the Hamster due to other human activities such as mining, urban development and subsequent infrastructure constructions has been a significant factor resulting extinction.

Recently detailed studies have been carried out in Germany, which, in addition to many questions on distribution and biology, also demonstrated the suitability of several measures to support and maintain the *Cricetus* populations. Based on the works of Seluga (1996), Weidling (1996) and Stubbe et al. (1997) measures for conservation management of the *Cricetus* can be summarised as follows (in brackets: one or two comments made by me).

– Harvest. To leave long stubble when harvesting. Some parts of fields: ridges, belts, boundaries should only be harvested 2-3 weeks later.

– Cultivation techniques. Not to plough simultaneously with the harvest or immediately after it. Long-standing stubble land, left till the end of September-middle of October, is favourable to the hamster. It encourages especially the females and young animals to gather appropriate food-stores for the winter. Therefore it is significant to postpone the soil cultivation to as late in autumn as possible or to do it only early in the spring. The ploughing should not go deeper than 25-30 cm. It is also proposed to leave out the deep-ploughing on a year by year basis and replace it by the minimum tillage of stubble land two times a year, but as late as possible after the harvest.

– It is proposed to increase diversity of croplands, and to establish protection belts within the fields, where agricultural activities should be minimised. The dividing of larger fields into smaller ones helps the hamster to locate its most attractive conditions of existence. (However, large fields give also very good, probably even better opportunities for the increase of hamster population. The size of field itself can not be regarded as an unfavourable habitat feature. The main thing is that the structure of sown-area should be diverse providing suitable habitats for migrating hamsters, if the condition of certain fields changes).

– Minimise the use of herbicides and pesticides and do not use rodenticides.

– Not to grow sugarbeet (or mangel) in important areas of hamsters. Sugarbeet entails the use of more pesticides and is also linked with a higher loss of hamsters due to predators. Similarly, adverse cultures are the root plants including (not perennial) legumes. The best habitats are winter-wheat fields and fields of perennial fodder-plants, e.g. lucerne.

– The transfer/introduction of hamsters to other areas can not be considered as a feasible method of maintaining numbers. (Hamsters are attached to croplands, their removal and resettlement is linked with pressure for migration and increased mortality under the circumstances of the West-European land-structure, that is in the absence of extensive grasslands suitable for the hamsters).

– Compensation of farmers for measures taken to maintain the hamster population should be carefully planned and controlled and should be focused on the best hamster habitats within a larger unit of arable land.

The realisation of such measures is obviously not an easy task. Therefore the establishment of "agrar-reserves" that is arable land nature reserves seems to be the only quick solution, as is proposed in Belgium and The Netherlands (Aminal, 1994, Krekels and Gubbels, 1996).

It is also important to take into account the impacts of various other human activities related to habitats of *Cricetus*. The strict protection of the species - where it is strictly protected - should be implemented when planning and establishing space-consuming constructions. "All potential positive change in agricultural techniques will be useless" (Kretzel, in litt.) if other activities neglect the maintenance of good habitats.

In addition, the following problems should not be left out of consideration when thinking of the management of Cricetus cricetus throughout its entire range.

– The especially threatened populations of the *Cricetus* are within the range of the subspecies *C. c. canscens*, described by Nehring in 1899. These populations are important not only because they are at the fringe of the range (of great importance for science and evolution). These isolated populations are to be regarded as gene centres of the *Cricetus.* Genetic research to clarify the possibility of potential reintroduction is obviously inevitable as Weidling (in litt.) also stresses it.

– The Common hamster is likely to be the only rodent species totally dependant now on agriculture, at least in the western part of its range. Arable land and human settlements occupied its original fertile steppe-like natural habitats. The hamster was, however, able to live in croplands amidst the various agricultural activities, such as sudden changes of vegetation cover (harvesting), destroying its burrows and foodstock (ploughing and other agrotechnical activities). Its deep underground holes, its food gathering behaviour and food-stores are partly more deeply located in places which cannot be reached by the plough, its ability to hibernate and survive the winter when croplands are mostly empty or covered only by sparse vegetation insufficient for cover, the lack or small number of natural competitors in arable land, all these help it to survive in "cultivated steppes". The clearing of forests for arable land in Europe in the Middle Ages most probably even increased the areas optimal for the hamster. Similarly, the reclamation of other areas to obtain more arable land created new habitats in the course of the last centuries. As the hamster is able to live on monotonous food for several weeks, the intensification of agricultural production initially even entailed the growing abundance of the

hamster. Several data and a review of the history of the species support this view (e.g. Dupont, 1932, Nechay et al. 1977, Ruzic, 1977, Grulich, 1980, Lenders and Pelzers, 1985). The greatest numbers of *Cricetus* can always be found in croplands or adjacent land structures. Hamster calamities have always been connected to agricultural fields. Outbreaks (mass multiplication) of *Cricetus* occurred in optimal areas (grain producing zones) or following the extension of cropland through drainage of areas and the cultivation of formerly unbroken soils and the stepping-up of yield. (The Common hamster might be a very good model species for studies focused on invasion biology).

– The excessive control of hamsters including trapping in every season and the use of effective "fumigants" (phosphines) combined, above all, with the change of the structure of land cultivation, have resulted in the dramatic decline of the populations.

– Agriculture does not "need" the hamster. The hamster is only a "nuisance" for farmers, even in the case of a few numbers present in the crop, unless the farmer is fond of wildlife and does not make every effort to get rid of every single specimen. (In Germany there is a farmer who decided to establish a small hamster-reserve on his own). There are no direct "benefits" for a farmer from having hamsters in the field, except two facts, the first mentioned by Wendt 1989): it is an alternate prey for raptors instead of small game. The second: the hamster and a few representatives of other species, e.g. the Brown Hare (*Lepus europaeus*), are good indicators of healthy croplands in their range. (There are of course also other “benefits” of hamsters, e.g. formation of soils and balance of nutrients, maintenance of fertility. These, however, can be sustained by agricultural measures - according to the argumentation of farmers).

– In croplands *Cricetus* can reach high reproductivity. Thus, if the initial number of population present suffices, and the weather is optimal, it can become rather abundant in a certain area within the same vegetation period. Thus, the population might also need management, even in countries where the hamster is critically endangered at present. The methods should be elaborated, taking into consideration also the legal aspects (Bern Convention and related Recommendations of the Standing Committee, Habitats Directive, domestic legislation). The guiding principle should be the "sustainable use".

– It is not possible to protect the hamster by establishing steppe-reserves or if this is the case, these should be vast grasslands and they will maintain only a few hamsters. Hamsters cannot be retained in natural or semi-natural grasslands in the same way as the suslike species (e.g. *Spermophilus /Citellus/ citellus*). They will immigrate into the - for them - more advantageous croplands. (*Spermophilus* species cause substantial damage to crops in countries east of the Carpathians, since they have vital populations (colonies) in grassland and ruderal areas. From these reservoir-areas - at the initial or minimum stage of their population cycles - they invade croplands.)

The conservation management of the species will be discussed in two ways: (1) the international actions needed in Europe as a whole, and (2) the actions necessary in various regions or certain countries.

a- *General measures proposed in Europe as a whole to maintain the Common Hamster*

The *Cricetus* is not considered a threatened animal in the World (IUCN, 1996) or in Europe as a whole (Pucek, 1989, ECE, 1991, Beaufort 1993). The rapid changes of its situation in several countries have provided reasons for a reconsideration of its international status. The lack of recent data in the eastern part of the range, from such significant range-states as the Ukraine and Russia, can not be disregarded. It is actually a "data-deficient" species.

Cricetus cricetus is a species listed in Appendix II. of the Bern Convention, thus it should be strictly protected in countries which adopt the Convention. This was in accordance with the state of the Common hamster in most of the West-European countries, when the Convention was adopted in l979. Since then the state of the populations in Belgium, France, the Netherlands and certain parts of Germany have become even worse.

In spite of this, in the Central and East European range-countries the hamster was, and for the most part still is, regarded as a common species causing periodic damage to agricultural crops. Therefore, (and even more in view of other species: e.g. *Spermophilus spp*.) the stipulation of Article 22 of the Convention is significant for states in the CEE region which intend to adopt the Convention. (Paragraph 1: "...Any state may, at the time of signature or when depositing its instrument of ratification, acceptance, approval or accession, make one or more reservations regarding certain species specified in Appendices I to III...". Hungary, for example, has used this possibility in the case of several species including the Common hamster).

Nevertheless, *Cricetus cricetus* is not in Appendix II of the Habitats Directive (92/43 CEE on the Conservation of Natural Habitats and Wild Fauna and Flora) that is among Vertebrates of Community interest whose conservation requires the designation of special areas of conservation. (This can certainly be connected to the fact that the most significant (if not all) habitats of the *Cricetus* are now to be found in agricultural fields). It is listed in Appendix IV and this provides strict legal protection. The implementation of the strict protection shall also be solved in practice. At the same time, the hamster urgently needs special conservation measures in EU member states (Belgium, France, The Netherlands) such as the maintenance of certain perennial cultures. That is, "special areas of conservation" which are unfortunately not natural habitat types (Article 3.1) but agricultural areas. The Common hamster is a special animal in this respect. That is, amendment of the Directive (and relevant directives on agriculture) should be highly recommended in order to be able: (1) to maintain the optimal structure of croplands, and (2) to avoid the use of adverse agricultural technologies in important hamster areas.

Another question is the actual, present state of the hamster in the CEE region. The most recent situation of the species is rather poorly known in this greater part of the hamster range. It can be concluded, that the economic significance of the hamster increased after the 2nd World War period. That is, the numbers of hamster and the area of distribution expanded. This process was characteristic in the period between the 1950's and the 1980's (with fluctuation of numbers and interactions of population development and control measures including intensive trapping of hamsters). Hungary, Romania, Slovakia, Russia, the Ukraine and Fed. Rep. of Yugoslavia serve as examples. The process was (and is) connected with the creation of new agricultural fields e.g. through melioration and breaking up of virgin soils, with the increased productivity of these areas, with the not so careful cultivation under collective farming, i.e. crops remaining out in the fields after harvest or late harvest, long standing stubble lands etc.

It is difficult to appreciate the present situation and the "future trend" of the hamster in this region, particularly as:

– exact data is missing in the 1990s on the areal distribution and population of the hamster, and

– the transition to the market economy entails changes in agricultural practice and the structure of cropland.

There is no doubt, that

– the removal or reduction of the still existing mosaics of land, as the only temporarily cultivated or uncultivated parts within croplands, more careful cultivation, the general use of seeds encased in several layers of pesticides, and especially

– the possible change of the structure of the sown-area, will definitely not be favourable to the hamster and other fauna species dependant on croplands.

Considering these and the dramatic decline of the population in the western and central parts of Europe, it is right to suppose, that the declining trend can also be characteristic in the eastern parts of the range, in the vast distribution area in the Ukraine and Russia. Thus, the evaluation of the situation of the Common hamster should be a priority in all range-states. Official enquiries should be made of these states concerning the situation of hamsters. Better knowledge of present distribution and population numbers and their changes (decrease or extension of area occupied by hamsters) is of major significance.

The Standing Committee of the Bern Convention should consider the adoption of a Recommendation on the Conservation and Management of Certain Hamster Species in Europe. When considering this, the Standing Committee should be aware of the fact, that a recommendation on hamsters will be beneficial to several other species also living in agricultural fields and dependant on agriculture, such as the Brown Hare (*Lepus europaeus*), Partridge (*Perdix perdix*) and - where it exists - the Great Bustard (*Otis tarda*), etc.

The recommendation should include the problems detailed above and those, which are summarised below, under part 2 of this section. But the most significant of these problems is: how to bring into being the appropriate structure of crops (to maintain about 10 % perennials) and to delay the time of ploughing after harvest as long as possible.

The recommendation is proposed to be elaborated by an international specialist group, which is *de facto* working, initiated by Dutch and German experts and the Zoological Institute of the Martin-Luther University (Halle).

b- *Measures in various regions or certain countries of Europe*

In the western edge of the range in Belgium, France and The Netherlands and in the southern edge of the range in Bulgaria all possible methods should be taken into account, which are described above and below.

In Belgium and Bulgaria, however, an exact survey of distribution is the highest priority and the immediate actions to be taken in core areas found in the course of such a survey.

In France (Alsace), and in countries where only small localised populations exist, a solution must be recommended for the maintenance of the remaining very small fields of perennial cultures and for the strict surveillance of occasional illegal actions against the hamster. The re-establishment of a nearly optimal structure of the sown-area would be of major significance, and in particular the replanting of lucerne is highly recommended (at least about 10 % of the area should be covered by perennials).

A few hamsters can cause damage especially by removing sown seeds and the picking out of seedlings. This type of damage irritates farmers more than any other. At the same time, feeding on chemically treated seeds certainly entails harmful consequences for the hamster. Therefore, the temporary isolation of such fields should be taken into account, for example by an electric fence (hamsters are usually not initially resident in such areas rather they enter them to feed).

Regarding the intentions of land owners and the present trends in agricultural usage, in brief all the problems of the practical implementation of conservation measures, and an appropriate compensation system should be established. But this should also take into consideration the organisation of an "agrar reserve" in the core-areas of hamster distribution. The latter action is most probably the last chance to revive the species in the *Haut Rhine.*

The management plan of such a reserve (and a plan for the use of compensation or incentives for farmers) should also consider the followings. If the measures introduced will be really effective, the number of hamsters could increase significantly. Consequently, in the long run, allowing for the management of the population may also be required. Thus, the control of certain hamster population, preferably by trapping, may also be seen as an element, in spite of the strict protection of the species, or rather upholding the strict protection at the same time. The principle of "Sustainable Use" (Convention on Biological Diversity) should be applied, on the strength of appropriate authorisation. With respect to the European legislation, Art. 9 of the Bern Convention, and Art.16 of the Habitats Directive offer the possibility. Trapping for research will certainly be permissible.

The continuation of the survey of hamsters in the field, which started e.g. in Alsace in 1996, is also of major significance. It is the basis for the regular surveillance and monitoring of the species.

An alternative, for a long-term solution or for the extension of the existing distribution of the hamster, might be the establishment of new hamster areas in common property, e.g. grounds with a high ground-water level. Several data show that new habitats for the hamster came into being through drainage or reclamation of such areas (e.g. Kovács and Szabó, 1971, Sudeikin et al., 1972, Popescu et al., 1977 Grulich, 1977, 1978, 1980).

Proposed measures in the CEE region

The major problem in this region is the lack of exact and up-to-date knowledge on the hamster distribution and changes in distribution and population numbers. Therefore, increasing the monitoring activity and research on the Common hamster should be a priority in most of these countries. This is necessary irrespective of the "legal" status of the species. Thus in Bulgaria, Croatia and Romania where *Cricetus* is protected, as well as in Hungary, where it is considered a “pest”, and in Russia and the Ukraine, where it is widespread but plays a secondary role in agriculture or as vector of zoonoses, exact status surveys should be initiated. Then the possibilities of taking certain measures for the sake of *Cricetus*, where appropriate, can be examined.

The adoption of an action plan is recommended for Bulgaria, the Czech Republic, Hungary, Romania, Slovakia and Fed. Rep. of Yugoslavia, which should include the following guidelines:

– to increase research activity through the initiation of studies e.g. in the form of diploma-works and dissertations in all countries

– to consider the establishment of an "agrar-reserve" in Bulgaria

– to follow the changes in hamster populations as exactly as possible in all countries, and in countries where the *Cricetus* is not protected

– to avoid its control by rodenticides and to use trapping as the main control method

– to manage the activity of hamster trappers, especially to control or ban summer activity, and/or to define quotas

– to revise the legal status of the Common hamster, if the decline of the population makes this necessary.

II. *Allocricetulus (Cricetus) Eversmanni* (Brandt, 1859) – Eversmann hamster

A/ Biology

a- *Appearance, taxonomy and biological data*

This species is a middle-sized one among hamsters: body-length 120-160 mm and the tail is rather short 20-30 mm. Its belly is white, marked with brown on the chest between the forelegs. The upper part has a light sandy-colour.

Four sub-species have been described but their present acceptance and position is unclear. Gromova and Baranovoi (1981) refer only to two or three: *Allocricetulus. e. eversmanni* (Brandt, 1859), *A. e. beljaevi* (Argyropulo, 1935) and *pseudocurtatus*, which is now considered as independent chromosomal form of *beljaevi*.

The Eversmann hamster lives in grasslands and agricultural fields, fallow land, along roads and other uncultivated parts of cropland. Similarly to other hamsters, it avoids woods. According to observations of Schepotjev (1975) it was most frequent in standing corn and stubble land, in root crops, woody areas, forest belts and other plantations, respectively. The highest percentage related to other captured rodents was in standing corn and stubble land (37,9–75,O %). Its underground burrow is not so deep as in the case of other hamsters, according to Vinogradov and Gromov (1952) rarely deeper than 30 cm. The burrow is also much simpler than that of the Common hamster.

The food consists of various parts and seeds of plants and like the other hamsters it also takes occasionally food of animal origin (insects, maybe also small rodents). It also stores food in its burrow and is a hibernating animal.

The number of litters is 4-6, 2 -probably 3 times a year. Not a numerous species, without mass-occurrences (Vinogradov and Gromov, 1952, Heptner et al., 1956, Poljakov, 1956).

B/ Distribution

The Eversmann hamster mainly inhabits dry steppes between the rivers *Volga* and *Irtis.* Its distribution in our study area is limited to the most eastern part, from the Caspian Sea in the south to Kuybyshev and Orenburg in the north.

Its habitat is the dry steppe but it occasionally inhabits agricultural fields and the surroundings of settlements. According to Vinogradov and Gromov (1952) it appears in its range in Siberia throughout the human settlements further north of its original distribution. In the Pleistocene it occurred also west of the *Volga* (*Don* basin, Crimea).

C/ Recommendations

Since no modern data are available on the Eversmann hamster the attention of researchers should be drawn up to the species. It would be significant to survey the species in its natural habitats and in habitats within agricultural region, like Magomedov and Omarov (1995) have done in the case of the Daghestan hamster (*Mesocricetus raddei*).

IV. *Mesocricetus Newtoni* (Nehring, 1898) – Dobrudjan or Romanian hamster

A/ Biology

a- *Appearance and taxonomy*

Middle-sized hamster, the body length is cca 130-160 mm. The tail is very short and almost invisible: 13-20 mm. Upperparts are grey coloured with a small and not distinct blackish patch or band between the ears and the shoulders. The abdomen is whitish except a black patch on the throat and chest, the extent of which is determining among related *Mesocricetus* species (Figure 10). There are black and yellow markings also on the neck and shoulders on its sides.

Mesocricetus newtoni was first found by A. Newton in Bulgaria in the second half of the last century. Nehring gave much attention to this hamster at the turn of this century and described it as a species. Argyropulo (1933) also accepted it as a separate species of the genus *Mesocricetus* but Ellerman and Morrison-Scott (1951) regarded it only as a sub-species of the Golden hamster (*Mesocricetus auratus*) and even Bulgarian and Romanian authors of standard works on fauna consented to this latter view (e.g. Atanassov and Peshev, 1963, Schnapp, 1963). Russian experts recognised only 2 (*Mesocricetus auratus* and *M. raddei*) or 3 species of the group (*M. auratus, M. brandti* and *M. raddei*) in the 1950-60's. However, a new standard work, Gromova and Baranovoi (1981) lists two species living in the Soviet Union: *M. brandti* and *M. raddei* and mentions also the independent existence of *M. auratus* and *M. newtoni.*

Thus, the taxonomic position of the Dobrudjan hamster was uncertain for a long time and actually the observations of Hamar and Schutowa (1966) and Raicu and Bratosin (1966) are the sole modern studies on the existence of the species. Hamar and Schutowa proposed to consider *M. newtoni* a separate species, based on morphologic differences (colour, size and form

of skulls and other craniometric features). They refer to the different caryotype (2n = 38, in *M. brandti* 42 and *M. auratus* 44 - Raicu and Bratosin, 1966) and to unsuccessful attempts in the laboratory to produce crossbreeds with *M. auratus*. They also refer to paleonthologic finds of *Mesocricetus* from the Pleistocene in Dobrudja and they conclude that the genus has been present there since the upper-Pliocene.

They assume that *M. newtoni* belongs to the highly variable southern or Transcaucasian group of *Mesocricetus* species (*M. auratus, M. brandti* and *M. newtoni*). The northern group (Ciscaucasian *Mesocricetus* species: *M. raddei* and *M. nigriculus* - the latter is now considered also as *raddei*, thus it is not a separated species**)** had been isolated in the Pleistocene period.

The results of further karyotypic examinations (Voicolescu et al. 1972 and Voicolescu, 1974) confirmed the number of chromosomes of the normal, diploid cells (*auratus*: 2n = 44, *brandti:* 42, *newtoni*: 38) and also the similarities in the heterochromatic nature of *auratus* and *newtoni* autosomen and in translocations from which only one was a Robertson-translocation (that is considered to be significant in the karyotypic-evolution of animals).

The modern, standard work on European mammals (Niethammer and Krapp, 1982) accepts the validity of the Romanian hamster. It refers to further attempts at cross-breeding between *M. auratus* and *newtoni, brandti* and *newtoni, auratus* and *brandti* respectively, producing offspring albeit sterile (Raicu et al. 1973 - cit. Niethammer and Krapp, 1982) and also refers to the small, karyotypic distinction found by Voicolescu (1974) related to the Golden hamster. One of the best field-guides (Görner and Hackethal, 1987) also accepts the existence of *Mesocricetus newtoni* and contains good information concerning it. Brink (1975) describes it as *M. auratus*. Reading numerous other popular or encyclopaedic books or guides the situation is not so clear. Pearson and Burton J.A. (1980), Corbet and Ovenden (1982), Schilling et al. (1983), Brown et al. (1984) write about this species, Burton M. (1976), Reichhof (1983), Macdonald (1985), Alderton (1996) do not. Nowak (1991) only mentions it, without giving any information.

b- *Habitats and natural history*

Mesocricetus newtoni can be found most frequently in agricultural fields mainly in lucerne and other perennials, cereals, fallow land and adjacent areas such as forest belts (Hamar and Sutova, 1963). It also occurs in dry grassland and in *Macin*-hill it was found up to the top (467 m) in grassy islands among gravel hillocks. The *Macin*-hill was a new habitat for the species, which was previously a wooded area and cleared in the end of the 19th century. The Dobrudjan hamster came into the area "... in the last decades..." as Hamar and Schutowa (1966) reported in 1966.

Although Marches (1964[1], cit. Ionescu, 1968) made observations on the species in captivity, this work was out of access to me. Other studies on the biology of *Mesocricetus*, on its food, behaviour, reproduction, development and population are hardly to be found. At the beginning of our century Dombrowski (cit. Auslander and Hellwing, 1957a) prepared a monographic survey which was also out of reach.

[1] Marches, G. Contributii la studiul taxonomic, biologic, ecologic si de crestere in captivitate a grivanului sau hamsteruluim (Mesocricetus newtoni Nehring) un nou animal de experimenta – St. si serc. I.I.P.M., 1964. I.

According to Ionescu's description its burrows are 60-80 rarely 150 cm deep. The reproduction begins in April-May and it gives birth to young 2-3 times a year (2-10 young animals/litter). The Dobrudjan hamster is also a hibernating species but there are observations on winter and early spring activity (Auslander and Hellwing, 1957a, 1957b, Schnapp, 1968). Auslander and Hellwing (1957b) supposed that their winter sleep begins in November and they referred to similar observations of Dombrowski (1907)[1]. They also found remains of *Mesocricetus* in December 1955 and February 1956 in pellets of Rough-legged buzzards. The explanation was "the temperature was fairly high" in December and January and the hamsters could have been left the burrows. This means, that the hibernation of *Mesocricetus newtoni* is similar to that of the *Cricetus* and is probably highly dependent on environmental conditions, such as temperature, population structure (e.g. in 1955 they had great population number. Its burrow is sad to be rather long but not deep, so the species might bee sensitive to agricultural activity (Kittel, 1972). Its burrow in winter must be deeper but there are no data.

The food consists primarily of plants, probably similar to that of the Common hamster.

B/ Distribution and present situation

Small range in Bulgaria and Romania, probably changes of distribution as a consequence of human activities (e.g. possible expansion in the Danube-delta?).

In Bulgaria it is present in the lowland between the Danube and the Central Mountains (*Stara Planina*) eastwards to the Black Sea. Thus, the Bulgarian range of the species is connected with the Romanian distribution area in Dobrudja. The western limit of the range could be in the region of *Pleven* where Spiridonov had also observed Dobrudjan hamster in 1978. It occurs in the *Shoumen* Nature Park and according to observations in 1996 and 1997, in north of *Varna* in areas near or along the coastline. It is relatively more common in the *Lodorgosko* region. Among the three hamster species present in Bulgaria the Dobrudjan hamster is relatively the most frequent one. However, formerly it could have been more common. In 1937-1938 some hundreds of Dobrudjan hamsters had been observed at *Beronovo* in a region south of *Sumen* (Spiridonov, in litt.). Its area of distribution in Bulgaria at some parts coincides with that of the *Cricetus cricetus* and the two species can probably be found occasionally in the same field. Niethammer (1982) with reference to Markov (1960) mentions *Svistov* at the Danube as a place of common occurrence.

The present status of *Mesocricetus newtoni* in Bulgaria can be illustrated as follows: "Two small mammals that occur primarily in Bulgaria - the Bulgarian golden hamster (*Mesocricetus newtoni*) and a dormouse (*Myomimus roachi*) - can be considered regional endemics." (Biodiversity Support Program, 1994 - emphasis mine).

In Romania *Mesocricetus newtoni* can be only found in Dobrudja, where it is the only hamster species, since the *C. cricetus* occurs only west of the Danube. Hamar and Sutova (1966) demonstrated the distribution of the Dobrudjan hamster. Former occurrence west of the Danube in *Baragan* (3 specimens collected in 1901, which are in the collection of the Humbold University, Berlin) is disputable (Hamar and Schutowa, 1966). It was also not found west and north of the Danube by Muariu and Andreescu (1979) and Murariu (1989).

Hamar and Sutova (1963) studied various rodents and some aspects of their ecology in Dobrudja between 1954 and 1963. In the period 1955-1958 the *Mesocrictus* was a frequent species in Dobrudja (10-50 burrows/ha as highest densities in lucerne). It might had been even more numerous prior to 1955 and in 1955 (about 50 burrow/ha in fodder-plants) and gradually decreased in 1955-1957 to a minimum in 1958-1959, which continued also in 1961-1963. However, it was the most frequent pray animal of the Steppe polecat (*Mustela putorius)* in 1956-1957. Other observations indicate a similar development of the Dobrudjan hamster population in the course of 1955-1957 (Auslander and Hellwing, 1957, Hellwing and Schnapp, 1960). In the food of other predators the Dobrudjan hamster occurred regularly, i.e. according to Popescu and Sin (1968) the Badger (*Meles meles*) prayed on it (and on other common small rodents such as Common vole - *Microtus arvalis,* Field mouse - *Apodemus sylvaticus*). The Long-eared owl (*Asio otus*) took it among rodents in 2,5-7 % (Schnapp, 1968).

In the area of the *de facto* Danube delta it does not occur (Barbu, 1969). Murariu (1981 and 1996) found it only in the vicinity of *Tulcea* at the hill *Bididia.*

Mesocricetus newtoni today is sad to be most common in the vicinity of *Tulcea.* This can be probably put down to the fact that the presence of experts and consequently the observation of the species here is the most frequent (since here is to be found the Danube-delta Research Institute and now the Directorate of the National Park), However, there are no direct and systematic investigations on *Mesocricetus* carried out in Romania.

According to occasional observations it is still also present in other parts of Dobrudja. On the road between the village I*stria* and *Grindul Lupilor* (cca. 12 km) run over hamsters can be regularly found. It regularly occurs in pellets of Barn owl (*Tyto alba)* and Little owl (*Athene noctua)* and occasionally of the Kestrel (*Falco tinunculus)*. On the basis of observation of pellets localized occurences can be revealed e.g. at the village *Cheia,* the islet of *Dolosman, Grindul Lupilor* (Sándor D. A. in litt.)

C/ Recommendations

Mesocricetus newtoni is listed in Appendix II of the Bern Convention and according to a European Red List its status is rare (ECE, 1991). Its population certainly subsists on steppes and arable land on the lower Danube in Bulgaria and Romania, isolated from ranges of other distant *Mesocricetus* species. Beaufort (1993) and Pucek (1989) rightly number *Mesocricetus newtoni* among the threatened European endemics. The determination of the status of a species is quite significant not only for raising public awareness but for planning possible measures of management.

The species should get increased attention in both countries. In Bulgaria the places of the last observations should be examined regularly in the future and appropriate actions should be initiated for the practical implementation of the protection of *M. newtoni* if necessary. In Romania, in addition to the necessity of modern surveys on the species and monitoring its population, appropriate legal and practical measures should be recommended for considering the special status of this most probably endemic and small ranged species. This species deserves at present much more attention in Romania than the Common hamster and it should be included the list of protected species as this is also suggested by Murariu (1996). In case of decrease of its population appropriate practical and habitat conservation measures should also be established.

Figure 10. - Distribution (*Abb. 15*) and possible formation (*Abb. 17*) of *Mesocricetus* species : Daghestan hamster (*M. raddei*), Turkish hamster (*M. brandti*), Golden hamster (*M. auratus*) and Dobrudjan hamster (*M. newtoni*) – from Hamar and Schutowa, 1996.

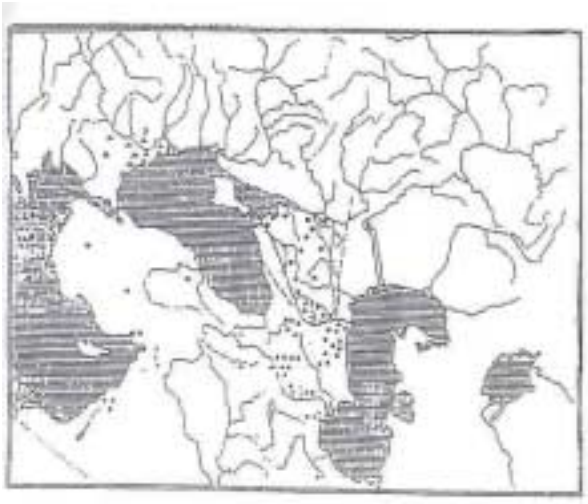


Abb. 15. Verbreitungskarte der *Mesocricetus*-Arten

- Verbreitungsareal von *M. raddei nigriculus*
- *M. raddei*
- *M. brandti*
- *M. auratus*
- *M. newtoni*
- Südgrenze von Cricetus cricetus im europäischen Teil der UdSSR

Abb. 17. Versuch eines Schemas zur Verbreitung und Bildung der *Mesocricetus*-Arten

V. *Mesocricetus Brandti* (Nehring, 1898) – Turkish hamster

A/ Biology

Considering the taxonomic status of the species Corbet (1978) includes *M. brandti* in *M. auratus* as a sub-species, mentioning that it might be a separate species. During the 1970s specimens of *M. brandti* captured in Turkey proved to be quite good laboratory animals and came into general use together with the previous Golden hamster.

Niethammer and Krapp (1982) does not number *Mesocricetus brandti* as an element of the European fauna. However, the Turkish hamster is a separate species in the recent world-list and reference-book of Mammals (Wilson and Reeder, 1993), referring to the morphological, chromosomal and breeding evidence compared to the *M. auratus* by Lyman and O'Brien (1977).

Thus, the species is present in Europe in the territory of Turkey, but all the European lists, guides, handbooks and other documents e.g. Niethammer and Krapp (1982), Görner and Hackethal (1987), Pucek (1989), Beaufort (1993) keep quiet about the genus *Mesocricetus* in Turkey except Brink (1975) and Corbet (1978).

The reason for that might be again, in one respect, the problem of taxonomy. Argyropulo (1933) classified this form as a sub-species of the Golden hamster: *Mesocricetus auratus brandti*. Several authors in the 1950-60's accepted it as a separate species (see: Chapter: *Mesocricetus newtoni*), followed afterwards by some uncertainties in the 7O's and acceptance of the *M. brandti* by Wilson and Reeder (1992). On the other side the biogeographic problem should not be forgotten: the area of distribution of the species in Turkey belongs to the Iranian sub-region of the Palearctic biographical region, thus not counted to the sub-regions in Europe.

B/ Distribution

According to Sichenberg (1971) the species occurs not only in the Eastern part of the country but around *Ankara* as well. In the *Konya*-Plain (40 km NE from Ankara) it is probably the most frequent prey-species of owls. Nadachowski (1990) reports 3 specimens collected 9O km South of *Ankara* and stored in Polish collections. Spitzenberger (1972) also found the species as widespread in Central Anatolia (Turkey). Hir (1992) in the south (*Bolkar* Mountains) examined subfossil material and determined *Mesocricetus auratus (!)* (Golden hamster) as one of the most frequent species. Weidling (in litt.) has recently found *M. auratus* in Turkey and refers also to a Turkish paper on the occurrence of the species. Orlov (1989) listed the Turkish hamster as a rare element in the territory of the (former) Soviet Union. That is understandable, since only the northern part of the range of the Turkish hamster stretches to this area in the territory of Armenia, Georgia and Azerbaidzan and *Mesocricetus brandti* is more widely distributed in the Middle East (see Figure 10 and also Figure 6 p. 39).

C/ Recommmendations

The situation of the wild population is unclear. No recent data were available to me. The form is present in the European fauna, in all probability it is not rare and not threatened in Turkey but "officially" does not exist. Clarifying this absurd situation is highly recommended.It is also necessary to clarify in all respect the status and distribution of these two species (*M. auratus* and *M. brandti*)

VI. *Mesocricetus Raddei* (Nehring, 1989) – Daghestan or Blackish hamster

A/ Biology

a- *Appearance and taxonomy*

The body length is about 150-190 cm, the tail 20-35 mm. Upperparts of the body are greyish brown. The chin, under part of the neck and chest is black as well as the middle part of the abdomen. Under the ears a black stripe stretches downwards and to the cheek which partly surrounds a light coloured spot. Thus, it is quite similar to the Common hamster but it is smaller and its colouring is not so vivid. The coat of this species is also suitable for processing by the fur industry (Heptner et al., 1956).

Three sub-species of the Daghestan hamster have been described on the basis of body measurements and colouring (Vinogradov and Gromov, 1952). The position of them is probably uncertain as in the case of other hamster species.

B/ Distribution and natural history

The range is small if compared to other hamster species (except the *Mesocricetus newtoni*, which has the smallest range). The Daghestan hamster occurs in the Pre-Caucasian region and in Daghestan. The northern limit is about the Rostow - Grosny line and in the south the high massif of the Caucasians (see Figure 10 and also Figure 6).

This hamster is also an inhabitant of the steppes and agricultural fields established within the steppe region. However, it also inhabits mountainous dry grasslands up to 2.300 m. Similarly to the Common hamster it also lives in various cropfields (corn, maize, sunflower, melon) and stripes of land among them. It can occasionally damage these agricultural products (Heptner et al., 1956).

The underground burrow of the *Mesocricetus raddei* has got 1-2 exits and the depth is more than 1 m. This hamster is also a hibernating animal storing food in its burrow. The quantity of stored food is usually 2 kg that may even reach 7 kg (Heptner et al., 1956) containing mainly grains, including seeds of marrow, melon and sunflower. The hibernation period lasts from October to March (Vinogradov and Gromov, 1952). The M. raddei is said to have two litters a year, with 4-12 young per litter.

Merschevskij et al (1992) Magomedov and Omarov (1995) have done recently significant researches on the species. The latter publication is especially important in terms of this report. The feeding and energy consumption of the Daghestan hamster has been examined in natural habitats and in agricultural fields. The observation area was a mountain region in the Caucasus (*Hunzahskoj* plateau, 1700-2200 m above the sea level, in Daghestan) where the typical habitats of this hamster are xerophytic and sub-alpine grasslands. It also inhabits the areas where cereals, leguminous plants, potato, carrot are produced. The feeding level and the consumption of nutrients and energy of *M. raddei* reached the maximum in agroecosystems with abundant grain food. Thus, the better feeding possibilities in croplands resulted the

maximum level of reproduction (89-98 %), the minimum level of winter mortality (22-54 %) and the highest and stable density of hamster (34-35 animals per ha). In the natural areas the feeding levels and consumption was determined by the dynamic of natural foods, which caused significant fluctuations of the intensity of reproduction, mortality and migration for years. Even in optimum natural habitats the population density did not exceed 3-5 animals/ha and varied significantly between years.

Several biological parameters have also been observed, that are similar to that of the Common hamster. The daily activity peaked between 7-10 and 18-21 hours. The hibernation period began already in the end of August in case of adult males. The females gone later for wintering (beginning of September) and the young animals at the latest, with the first frosty days in October. The daily food and energy requirement was 21-22 g dry weight of natural food and 16,5 kJ per individual respectively. The quantity of stored food in the burrows was 2.8-4.3 kg dry weight of grains (the wintering period of this species is longer than the hibernation of the *Cricetus cricetus*).

C/ Recommendations

There is no direct information on problems caused by the species to the agriculture and on control measures against the Daghestan hamster. Its density in the course of the study reviewed above was rather high and according to Magomedov and Omarov (1995) stable in croplands and much lower and fluctuating in natural habitats. Further surveying of the species would be very important and monitoring of its population trend in the future together with the changing future circumstances such as transformation of the agricultural production, increase of cropland, alteration (intensification) of agricultural technologies and the use of natural habitats.

VII. C*ricetulus Migratorius* (Pallas, 1773) – Gray hamster

A/ Biology

a- *Appearance and taxonomy*

The *Cricetulus migratorius* is a small, mouse-sized hamster, which is like a Common vole (Microtus arvalis), but the ears are larger and consequently they are perceivable and the tail is short. Measurements: weight cca. 20-40 g, body length 90-110 mm and the tail is shorter than 1/3 of the body. The back and upper parts are grey or sandy-grey, abdomen and under parts of legs and face white, without any black or other colourisation. The cheek pouches are relatively large. Besides the Grey hamster, the genus *Cricetulus* includes some species, which are distributed outside our study area. This genus is certainly the most diverse within the hamsters. Several, sub-species of *Cricetulus migratorius* have also been described on the basis of measurements and colouring. Vinogradov and Gromov (1952) lists 13 and Sokolov (1963) 14 subspecies.

B/ Distribution, habitats and some biological data

The present range of the Gray hamster extends from Greece, Bulgaria and the part of Romania east of Carpathians towards the east to the *Irtis* and Central Asia. Western Turkey, and probably through the territory of Turkey to Israel, Jordan, Lebanon, Syria, Iran, Afganisthan. Pakistan and Northern China are the countries in the southern part of the range. The question is, whether its area of distribution is continuous in Turkey or disjunct, i.e. the Turkish, Greek and Bulgarian population is isolated or not (**Figure 11**). The northern limit in Ukraine and Russia lies about 100 - 300 km south of the northern border of the *Cricetus cricetus* distribution (**Figure 6**).

The genus *Cricetulus* was present throughout Europe in the Pleistocene. Jánossy (1979) described dwarf hamsters in certain strata of the old Pleistocene as well as of the middle Pleistocene and of the post-glacial phase of the last glaciation (*Würm*) from the territory of Hungary. Similarly, the genus was common in Romania, Moldova Ukraine, Russia (Vinogradov and Gromov, 1952, Lozan, 1971). According to various finds summarised by Niethammer (1982) the genus also occurred during the Pleistocene in West European territories, southern England and France, Germany, Switzerland.

The original (natural) habitats of the Gray hamster are dry grasslands, steppes and semi-deserts. Now, it also inhabits agricultural areas, gardens and sites around farms and lives even in houses similarly to mice. It avoids only the forests and humid areas (Heptner et al. 1956, Poljakov, 1968). In the southern part of the range it have even been found in storey houses and spaces under the roof, e.g. in *Ashabad, Frunze, Yerevan* (Vinogradov and Gromov, 1952). It lives usually in flatland up to 300 m but Felten et al. (1971) and Niethamer (1982) found it also in mountains up to 2100 m in Turkey and up to 3600 m in Afghanistan, respectively. Vinogradov and Gromov (1952) described its occurrence even at an altitude up to 4,000 m. In the northern part of its range (*Kursk* region) it inhabits the southern slopes of cropland, lucerne, wheat, potato and fields under grass (Smirnov, 1955).

In the field, the Gray hamster lives in an 1-2 m long and 0.2-1 m deep underground burrow which contains holes for nesting and storing food (cca. 500 g) and opens to the surface with at least one vertical and one slanting hole. It often occupies burrows of voles or mice and also natural holes and cracks. The Gray hamster is usually not hibernating only in the northern part of the range or in mountain habitats if the winter is hard (Vinogradov and Gromov, 1952). Establishing food reserves is the habit throughout the year (as with other hamster species).

Its food is primarily composed of various seeds and plant leaves but also beetles and snails, in agricultural territory the crops, wheat, etc. (Niethammer, 1982). Its food depends obviously on the structure of vegetation. Smirnov (1955) found in July mainly oats and vetch (and wheat) in cheek pouches, and Lozan (1971) found besides grains (e.g. maize, sunflower) and green plants also fruits (cherry, plum). Basenina (1951, cit. Lozan, 1971 and Niethammer, 1982) determined 45 plant species in the food.

a- *Reproduction and population dynamic*

The pregnancy lasts certainly cca. 3 weeks (Flint, 1966) but Heptner (1956) gave 11-13 days, others (cit. Lozan, 1971) 16-18 days. The Gray hamster throws 2 times a year 6 young on average (Heptner, 1956) or 3-4 times 5-7 (Lozan, 1971). Most probably there are more than two litters a year (e.g. according to Poljakov (1968) every 1.5-2 month), since the reproduction lasts

from April to September in Ukraine and in the southern part of the range all year round (Niethammer, 1982). Lozan (1971) in Moldova found pregnant females from the end of April in May, June, July. The age of sexual maturity is obscure: 20-27 days (Flint, 1966) or the next year after the year of birth (Heptner, 1956). It is very likely that specimens from the first litter(s) will be engaged in the reproduction in the same year (Vinogradov and Gromov, 1952). According to Lozan (1971), who referred also to observation in Ukraine, females participate in the reproduction when their body length reaches 90 mm and the weight 22 g and males participate with 22-24 g. He observed higher abundance in wheat fields in years, when the number of House mouse (*Mus musculus*) and Wood mouse (*Apodemus sylvaticus*) was low. However, it is strange, that in spite of the quite high reproductivity the Gray hamster is said by all authors never to occur in great numbers (masses). As for the mortality factors, Lozan (1971) regarded the climatic conditions most important. Thus, winters with limited snow cover and cold rains early in the spring and autumn are unfavourable for the Gray hamster.

b- *Distribution and status in range countries*

In Greece Niethammer (1974) demonstrated on the basis of owl pellets its occurrence in a larger area than Ondrias (1966, cit. Niethammer). This is probably only a sign of the better knowledge of the distribution and not of an expansion of the range. The Gray hamster is present in the southeastern part of the mainland and *Peloponisos* (**Figure 11**).

The official status is not known.

The distribution in Turkey is also poorly known. Felten et al. (1971) summarised the occurrences in the western part of the country. These observations were mainly made in mountain habitats between 1215-2100 m such as dry, scattered standing pine and oak wood or stony slopes with dolinas. Sichenberg (1971) and Spitzenberger (1972) found it in Central-Anatolia in the *Ankara* region. Hir (1992) examined sub-fossil remains of rodents in the *Bolkar* Mountains (3,000 m above the sea level, south-central part of Turkey) and found also *Cricetulus migratorius*.

The official status of the species is not known.

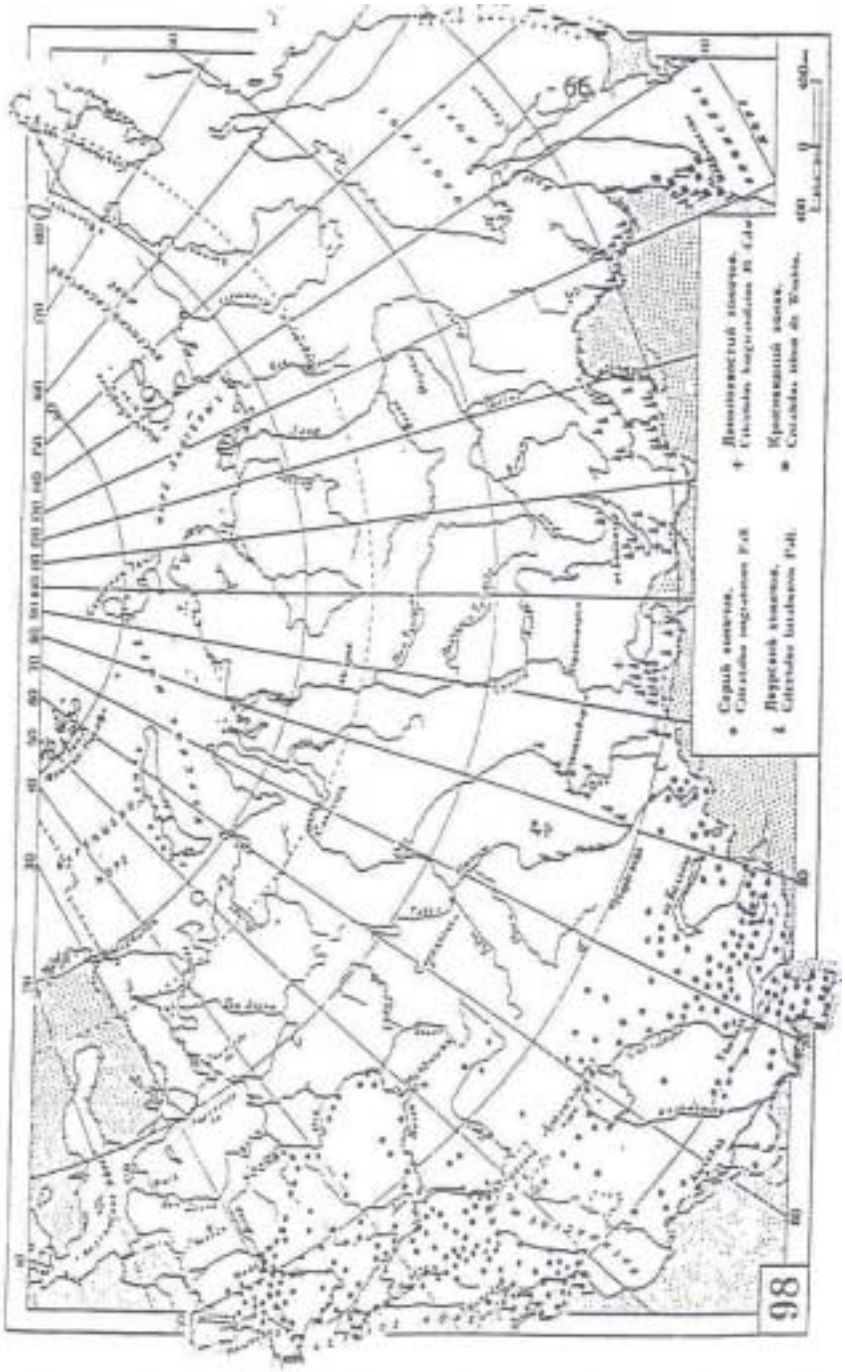
In Bulgaria **(Figure 11)** Peshev et al. (1960) discovered the Gray hamster in the southeastern part of the country, in 1959 and Simeonow (1962/63, cit., Niethammer, 1982) at *Sliven.* Hamar (1963) referred to a personal communication of Markov in 1962, according to whom Cr. *migratorius* also occurred in the northeastern part of Bulgaria, near to the Danube region. According to the Red Data Book (Bulgarian Academy of Sciences, 1985) it is a very rare species, living in agricultural fields adjoining grassy areas. The countrywide sample material consists of 10 specimens. Spiridonov (in litt.) expressed the situation that among the three hamster species the Gray hamster is the rarest one, it is a real rarity.

The official status of the Gray hamster in Bulgaria is rare and it is protected.

Figure 11. –

(A) Western edge of the distribution of the Gray hamster (*Cricetulus migratorius*) – Niethammer and Krapp, 1982.

(B) Its range within the territory of the former USSR – Bobrinskij *et al*., 1965



In Romania **(Figure 11)** Hamar (1963) found it first in owl pellets in the vicinity of *Perieni,* between the rivers *Prut* and *Siret.* He also captured 3 dwarf hamsters here later on (Hamar, 1965) and he identified these specimens belonging to the smallest subspecies *Cr. migratorius bellicosus*. The river *Siret/Putna* might be the western limit of the range in Romania. Murariu (1976) collected Grey hamster also in the vicinity of *Rastoaca* (southeast of *Focsani*) in 1973 and mentioned it to occur in sugar peas and wheat cultures. However, it was not observed by Murariu and Andreescu (1979) when they extensively studied small mammals in *Vrancea* and other districts west of this river (668 collected individuals of small mammals by means of traps, and plate cylinders buried in the ground (height = 25 cm, at m. 17 cm). The number of traps during 106 collecting nights was 15.848 (14.230 traps and 1618 cylinders). Niethammer (1982) does not refer to that observation, when he draws the western limit of the species in Romania.

The species is not listed as a threatened animal and not protected in Romania, although Murariu (1995) has proposed its protection, and illustrated the situation as follows: "...It became a rare species, being distributed only in Moldova. It has to be protected as a species critically endangered".

Notwithstanding this, in the larger part of the range the *Cr. migratorius* is certainly not threatened.

In Moldova it occurs in the whole country in appropriate habitats, but is usually not a dominant species and its economic significance is also unimportant when compared to other rodents. The situation is likely to be the same in the Ukraine (Lozan, 1971) and in the Russian Federation as well as in parts of Georgia, Armenia, Azerbaidzhan and the western part of Kazakhstan within our reporting area (**Figure 11**). The Gray hamster is a widespread but not overly common rodent. Schepotjev (1975) observed it most frequently in standing corn and stubble lands (8,7-23,9 % of captured rodents) and weedy areas (3,1-12,6 %), bushy areas (1,3-8,5 %), forest belts and other plantations (3,1-5,1 %), root crops (1,9-4,3 %). The highest percentages were in semi-desert regions (1,8-29,6 %). According to a survey by Tarasov et al. (1989) it was one of the less common rodent species, (only 0.1 % among 1,323 animals belonging to 10 species) in the vicinity of *Saratov*. Presumably the observed area was not optimal for *Cr. migratorius.* But Shilova et al. (1994) came to a similar result when they observed the rodent fauna of natural steppes. The result was that the relative incidence of *Cr. migratorius* was 0.2 % out of 936 animals. (They concluded, that the islands of natural feather-grass steppe are too small for the preservation of the steppe faunal associations of small mammals since the species common in agricultural land were the most abundant in all studied biotopes).

C/ Recommendations

The current situation of the Gray hamster is actually rather poorly known in the range countries. Considering that the western fringe of the species distribution lies in Bulgaria, Greece and Romania and populations are most probably isolated in these countries, an examination to determine the true status of this species should be a priority. The same should be suggested for Turkey, where the species distribution is also poorly known and its occurrence is in all probability only sporadic.

The Gray hamster is not listed in any international Red List or other document on threatened mammals except for a review by Beaufort (1993) on Mammals of Europe. Although he qualified this rodent as a common species, he considered it vulnerable and its distribution range to be in regression. Most probably this is the real state today of this dwarf hamster species in Europe or rather in four countries: Romania, Bulgaria, Greece and Turkey. Unfortunately there are no recent and detailed data available from these countries. An examination of the situation of the species is highly recommended.

References

Agarkov V.M., Pantsenko L.A. 1989. Dlja borjba s gruzunami (On the control of Rodents) - Zast. Rast., 6 : p. 13. (in Russ.)

Alderton D. 1996. Rodents of the World - Blandford, London, 192 pp.

Andera M., Cerveny J. 1994. Atlas of Distribution of the Mammals of the Sumava Mts.. Region (SW-Bohemia). Acta Sc. Nat. Brno, 28 : 2-3. 1-111.

Arbeitskreis "Feldhamster (1995): "Forschungsprojekt Feldhamster" - Kurzberichte anlasslich der Arbeitstreffen vom 25.01.-26.01. und 20.10.-21.10.1994 in Heidelberg/Oberflockenbach. - Heidelberg, 24 pp.

Argyropulo A.I. 1933. Die Gattungen und Arten der Hamster (Cricetidae, Murray, 1800) der Paläarktik - Z. Säugetierk., 8 : 130-149.

Atanassov N., Peshev T. 1963. Die Säugetiere Bulgariens - Säugetierkdl. Mitt., 13 : 101 - 112.

Ausländer D., Hellwing S. 1957a. Observations écologiques sur les petits mammifères des ecrans forestiers de protection de "Valul Traian" références spéciales concernant leur dynamique – Trav. Mus. Hist. Nat. "Grigore Antipa", 1 : 11-139.

Ausländer D., Hellwing S. 1957b. Beiträge zur Variabilität und Biologie der Streifenmaus (Sicista subtilis Nordmanni Keys. et Blas. 1840) - Trav. Mus. Hist. Nat. "Grigore Antipa", 1 : 255-274.

Barbu P. 1969. Sur la systématique et la distribution des petits mammiferes du delta du Danube - Anal. Univ. Bucuresti, 18 : 89 - 99.

Barbu P. 1978. Contributions á l'écologie des petits mammiferes du sud de la R.S. Roumanie. - Anal. Univ Bucuresti, Biol., 27 : 101-104.

Barus V., Donát O., Trpák P., Zavázal V., Zima J. 1988. Red Data List of Vertebrates of Czechoslovakia - Acta Sc. Nat. Brno, 22 : 3. 1.33.

Baumgart G., Bayle P. 1984. Hamster (in: Encyclopedie de l'Alsace, Vol. 6.) - Strasbourg, pp. 3703-3707.

Baumgart G. 1996. Le Hamster d'Europe (Cricetus cricetus L. 1758) en Alsace - Rapport réalisé pour l'Office National de la Chasse, 267 pp.

Bauer K. 1960. Die Säugetiere der Neusiedlersee-Gebietes - Bonn. Zool.Beitrage, 11 : 2-4. 141-344.

Bauer K. ed. 1988. Rote Liste der gefährdeten Vögel und Säugetiere Österreichs - Öst.Ges.f.Vogelkunde, 58 pp.

Beaufort F. 1993. The threatened Mammals of Europe - Council of Europe, Strasbourg, 113 pp.

Benedek P., Mohai Gy. 1990. (The situation of some cultures in arable land from the point of view of the plant protection in 1989) (in Hung.) - Növényvédelem, 26 : 3.

Bern Convention (1979) on the Conservation of European Wildlife and Natural Habitats - Bern

Monaco Declaration (1994) on the role of the Bern Convention in the implementation of world-wide international instruments for the protection of biodiversity – Monaco

Recommendations of the Standing Committee:

No. 16. 1989, on areas of special conservation interest

No. 25. 1991, on the conservation of natural areas outside protected areas proper

No. 43. 1995, on the conservation of threatened mammals in Europe

Bikovskij V.A. 1986. Borjba s musevudnimi gruzinami (Control of small rodents) - Zast. Rast., 8 : pp.13-16. (in Russ.)

Biewald G.A. 1979. Reflexwirkungen von Herzkammerrezeptoren des normothermen und aus dem Winterschlaf erwachenden Feldhamsters (Cricetus cricetus L.) - Zool. Jb. Physiol., 83 : pp. 57-70.

Biodiversity Support Program 1994. Conserving Biological Diversity in Bulgaria: The National Biological Diversity Conservation Strategy - Washington , D.C.: Biodiversity Support Program c/o WWF

Bobrinskij N.A., Kuznetzov B.A., Kuziakin A.P. 1965. Opredelitel mlekopitajusih SSSR - Moscow, 382 pp.

Brink F.H. 1975. Die Säugetiere Europas westlich des 30 Längegrades - Hamburg-Berlin, 217 pp.

Brown R.W., Lawrence M.J., Pope J. 1984. The Country Life Guide to Animals of Britain and Europe, their tracks, trails and signs - Country Life Books/Hamlyn, Feltham, 320 pp.

Bulgarian Academy of Sciences. 1985. Red Data Book of the People's Republic of Bulgaria, Vol.2. Animals - Sofia, 1985.

Burton M. 1976. Guide to the Mammals of Britain and Europe - Elsevier Phaidon, Oxford-London, 256 pp.

Canguilhem B., Schieber J-P., Koch A. 1973. Rythme circannuel pondéral du Hamster d'Europe (Cricetus cricetus) - Arch. Sci. physiol., 27 : 1. 67-90.

Canguilhem B., Masson-Pevet M., Pevet P., Bentz I. 1992. Endogenous, photoperiodic and hormonal control of the body weight rhythm in the female European hamster, Cricetus cricetus. - Comp. Biochem. Physiol. A. Comp. Physiology, 101 : 3. pp. 465-470.

Chenkin A. F., Djachenko V.F., Belozerova G.S. 1989. Prognoz na 1989 god (Prognose to the year 1989) - Zast. Rast., 33 : pp. 36-38. (in Russ.)

Council of Europe, UNEP, European Centre for Nature Conservation 1996. The Pan-European Biological and Landscape Diversity Strategy

Convention on Biological Diversity (1992) - Rio de Janerio

Corbet G.B. 1978. The Mammals of the Palearctic Region: a taxonomic review - British Mus. (Nat.Hist.), Cornell Univ.Press, London - Ithaca, pp.
Corbet G., Ovenden D. 1982. Pareys Buch der Säugetiere. Alle wildlebenden Säugetiere Europas – Hamburg-Berlin, 240 pp.
Council Directive 92/43/EC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
Council Directive 97/62/EC of 27 October 1997 adapting to technical and scientific progress Directive 92/43/ EEC on the conservation of natural habitats and of wild fauna and flora
Criel et al. 1994. Rode lijst van de zoogdieren van Vlaanderen - AMINAL, 79 pp.
Csorba G. 1996. Insectivores and Rodents of the Bükk National Park. - In: Mahunka S. (ed.) The Fauna of the Bükk National Park - Hung. Nat. Hist. Mus. (Budapest), 2 : pp. 603-606
Demeter A., Topál Gy. 1987. Mammals of the Kiskunság - In: Mahunka S. (ed.): The Fauna of the Kiskunság National Park - Akadémia (Publishing House), Vol. 2. pp. 446-452.
Dupond C. 1932. La propagation du Hamster en Belgique - Bull. Mus. Roy. Hist. Nat. Belg., 8 : 26. 1-43.
Economic Commission for Europe 1991. European Red List of Globally Threatened Animals and Plants and recommendations on its application as adopted by the ECE at its forty-sixth session (1991) by decision D (46) - United Nations, New York, 153 pp.
Eliseev N. V. et al (eds). 1983. Krasnaja kniga RSFSR – Moscow, 455 pp..
Endes M. 1991. (The Mammalian Fauna of the Tokaj-Zemplén Region) A Tokaj-Zempléni hegyvidék emlõsfaunájáról - Calandrella (Debrecen), 5 : 2. 40-55. (in Hung.)
Felten H., Spitzenberger F., Storch G. 1971. Zur Kleinsaugerfauna West-Anatoliens. Teil I. - Senckenbergiana biol., 52 : 6. pp. 393-424.
Földi J. 1801. Természeti historia. A Linné Systémája szerént (Natural History following the System of Linné) - Pozson, pp. 61-62. (in Hung.)
Frahm H. 1973. Metrische Untersuchungen an den Organen von Hamstern der Gattungen Phodophus, Mesocricetus and Cricetus - Zool. Jb. Anat., 90 : pp. 55-159.
Fügedi L., Szentgyörgyi P. 1992. (Mammalian Fauna of the Eastern and Middle Part of of the Borsod-Hills) A Borsodi-dombság keleti és középsõ részének emlõs (Mammalia) faunája - Calandrella (Debrecen), 6 : 1. 49-60. (in Hung.)
Gershenson G., Polevoi V. 1941. Mating system in a natural population of the Common Hamster (Cricetus cricetus L.) - C.R. (Doklady) de l'Acad. des Sci. de l'URSS, 30:1. pp. 64-65
Gladkina T.S. 1990. Puti optimmizacii borjbi s gruzunami (Ways of optimization the rodent control) - Zast. Rast., 10/1990 : pp. 16-18. (in Russ.)
Goldman B.D. 1981. Effects of sex hormons on hibernation in Mesocricetus auratus and Cricetus cricetus - Am. Zool., 21 : 4. 950 /Abstract only/
Gorecki A., Grygielska M. 1975. Consumption and Utilization of Natural Foods by the Common Hamster - Acta Theriol., 20 : 18. 237-246.
Gorecki A. 1977. Energy flow through the Common Hamster population - Acta Theriol., 22 : 2. 25-66.
Görner M., Hackethal H. 1987. Saugetiere Europas - Neumann Vlg., Leipzig-Radebeul, 371 p.
Grolleau G. 1990. Les moyens chimiques de lutte contre les rongeurs champetres. Legislation actuelle. - Défense des Végétaux (Paris), 44:260-261, pp. 9-11.
Gromov I.M. 1967. (The anthropogen history of the recent fauna of rodents of the USSR) - Zool. Zh., 46:10. pp. 1566-1584.
Gromova I.M., Baranovoi G.I. (eds.) 1981. Katalog mlekopitajuschih SSSR (Pliocene - our age) - Nauka, Leningrad, 455. pp.
Grulich I. 1975. Zum Verbreitungsgebiet der Art Cricetus cricetus (Mamm.) in der Tschechoslowakei - Zoologické Listy, 24 : 3. 197-222.
Grulich I. 1977. (A populations outbreak of Cricetus cricetus L. in Eastern Slovakia during 1971-1972.) - Bjuleten Moscovskovo Obsestva Ispytatelej Prirodi, Otdel Biologitseskij, 82:6. pp. 16-25. (Russ., Engl. sum.)
Grulich I. 1978. Standorte des Hamsters (Cricetus cricetus L. Rodentia, Mammalia) in der Ostslowakei - Acta Sc. Nat. Brno, 12 : 1. 1-42.
Grulich I. 1980. Populationsdichte des Hamsters (Cricetus cricetus, Mamm) - Acta Sc. Nat. Brno, 14 : 6. 1-44.
Grulich I. 1981. Die Baue des Hamsters (Cricetus cricetus, Rodentia, Mammalia) - Folia Zool.(Brno), 30 : 2. 99-116.
Grulich I. 1982. (Population dynamics, habitat and liquidation of the population-boom of the Hamster (Cricetus cricetus Linn.) - Vertebr. Zpravy, 28-30.
Grulich I. 1986. The reproduction of Cricetus cricetus (Rodentia) in Czechoslovakia - Acta Sc. Nat. Brno, 20 : 5-6, 1-56.
Grulich I. 1987. Variability of Cricetus cricetus in Europe - Acta Sc. Nat Brno, 21 : 7, 1-53.
Grulich I. 1988. Periodontal disease in Cricetus cricetus (Cricetidae, Rodentia) - Acta Sc. Nat. Brno, 22 : 1, 1-34.
Gubbels E.J., Backbier L.A.M. 1994. Ein Jahr Feldhamsterforschung auf einem Acker in der Limburger Börde - "Forschungsprojekt Feldhamster", Kurzberichte der Arbeitstreffen 1994 in Heidelberg/Oberflockenbach,
Gubbels E.J., Gubbels J.E., Gubbels-Broers S.L.M., Backbier L.A.M. 1995. De Korenwoof, Cricetus cricetus. I.Eeen eerste verkenning – Eliomys, 20 : 4. Pp.25-28.

Gubbels E.J., Backbier L.M., Gubbels J.E. 1995. De Korenwoof, Cricetus cricetus II. Winterwaarnemingen – Eliomys, 20 : 4. pp. 29-32.
Gubbels Ed.J., Backbier L.A.M., Gubbels J.E., Gubbels J. S. 1995. De Korenwoof, Cricetus cricetus III. Winterburchten – Eliomys, 20 : 4. pp. 33-38.
Hamar M. 1963. Die Anwesenheit von Cricetulus migratorius (Pallas, 1773) in Gewöllen von Asio otus (L.) und Athene noctua (Scop.) in Rumanien - Acta Theriol. 6 : 11. pp. 306-307.
Hamar M., Sutova M. 1963. (Ecologic study of the Rodents (Glires) from Baragan and Dobrudja) - Analele Sect. Prot. Plantelor, Inst. Centr. Cercetari Agricole Vol. I. 195 - 216.
Hamar M. 1965. Grivanul cenusiu (Cricetulus mmigratorius Pall. 1773, Fam. Cricetidae, Ord. Rodentia) specie noua in fauna Republicii Socialiste Romania - Natura, Ser. Biologe, Nr. 5/1965, pp. 81-85. (Engl. and Russ. sum.)
Hamar M., Schutowa M. 1966. Neue Daten über die geographische Veränderlichkeit der Gattung Mesocricetus Nehring, 1898 (Glires, Mammalia) - Z. Säugetierk., 31 : 237-251.
Hanák Ker J. 1853. (The illustrated Natural History of Mammals and Birds) - Pest, pp. 106-107. (in Hung.)
Haraszthy L. 1984. On the feeding conditions of the Eagle owl (Bubo bubo) in Hungary - Puszta, 2 : 11. 53-59. (in Hung., Engl., Germ. sum.)
H.H. 1944. Die Jugendentwicklung des Hamsters (Cricetus cricetus L.) - CIBA-Zeitschrift, 93 : 3327-3328.
Hell P., Herz J. 1969. Prispevok k taxonomii a rozsireniu chrcka rolného eurázijského (Cricetus c. cricetus L., 1758) na Slovensku - Biológia, 24: pp. 839-851.
Hellwing S., Schnapp B. 1960. Populations-ökologische Forschungen an Kleinsaugern zu Valul Traian in den Jahren 1955-1957. - Trav. Mus. Hist. Nat. “Grigore Antipa”, 2 : 337-378.
Heptner V.G., Morozova-Turova L.G., Zalkin V.I. 1950. Vrednie i poleznie zveri rainov polezasitnik nasazdenij - Moskva (Moskovskovo Universiteta), 452 pp.
Hermann-Pendzich C. 1978. Biometrische und ökologische Untersuchungen an einer rheinischen Hamsterpopulation (Cricetus cricetus) - Staatsexamensarbeit Köln, 1978
Hilfrich J., Züchner H., Reznik-Schüller H. 1977. Studies of the ovaries of hibernating and non-hibernating European hamsters (Cricetus cricetus) - Z. Versuchstierk., 19 : pp. 304-308.
Hir J. 1992. Subfossil Mesocricetus population from the Toros Mountains (Turkey) (Mammalia) - Fol. Hist.-nat. Mus. Matr., 17 : pp. 107-130.
Holisova V. 1977. The food of an overcrowded population of the Hamster (Cricetus cricetus) in winter - Fol. Zool. (Brno), 26 : 1. 15-25.
Holisova V., Obrtel R. 1986. Vertebrate causalties on a Moravian road - Acta Sc.Nat. Brno, 20 : 9. 1-44.
Holsbeek L., Lefevre A., Van Gempel J., Vantorre R. 1986. Zoogdiereninventaristie van Vlanderen (1976-85). - Euglena, (special issue), Jeugbond voor Natuurstudie en Milieubescherming, Gent, 116 pp.
Ionescu V. 1968. Vertebratele din Romania – Bucuresti, 496 pp.
IUCN Cons.Mon.Centre 1988 IUCN Red List of Threatened Animals - IUCN, Gland, Switzerland
IUCN 1996. 1996 IUCN Red List of Threatened Animals - IUCN, Gland, Switzerland
Ivanov O.A. 1990. Borjbu s gruzunami - na agroekologicheskuju osnovu (Control of rodents - on an agro-ecological basis) - Zast. Rast., 2/1990 : pp.3-5. (in Russ.)
Jacques R., Montandon D. 1982. Changes in lipid composition of the brain cellular membrans of an hibernating mammal during its circannual rhytm - Comp. Biochem. Physiol. B.. Comp. Biochem., 71 : 3. 409-416.
Jansen K. 1995. Hamsteren, Momenteel een zware opdracht - Wielewaal, 61 : 4. 121-122.
Jánossy D. 1979. (Dividing the Pleistocene in Hungary on the basis of Vertebrata-Faunas) - (in Hung.) Akadémia, Budapest, 207 pp.
Kalotás Zs. 1983. Über die jagdwirtschaftliche Rolle der Mausebussarde (Buteo buteo L.) in mit Niederwild angereicherten Jagdgebieten - Puszta, 1:10, pp. 19-35.
Kalotás Zs. 1988. (The Common Hamster (Cricetus cricetus Linne, 1758)) - Manusscript, (in Hung).
Kanduebin I.V. 1990. Legtse zapretitj i otchitatjsja, tsem v szuti razobratjsja (It is easier to ban and scold than to understand the substance) - Zast. Rast., - 2/1990 : p. 5. (in Russ.)
Karaseva E.V. 1962. (A study of the peculiarities of territory utilization by the hamster in the Altai territory carried out with the use of labelling) – Zool. Zh., 41:2. 275-285.
Kayser Ch. 1975. Le cycle annuel du métabolisme de base des hibernants - Rev. suisse Zool., 82: 65-76.
Kemper H. 1967. Einige Freilandbeobachtungen am Hamster (Cricetus cricetus L. 1758) - Saugetierk. Mitt., 15 : 1. 165-169.
Kittel R. 1972. Der Goldhamster Mesocricetus auratus - Neue Brehm Bücherei 88, Wittenberg Lutherstadt, 60 pp.
Kovács V., Szabó L. 1971. (The multiplication of the Common Hamster (Cricetus cricetus L.) in the County Hajdú-Bihar, the possibilities of its control and their evaluation) - Növényvédelem, 7:2. pp. 77-80. (in Hung.)
Kovshar A.F., Bekenov A.B. Dukravec G.M. (eds) 1996. The Red Data Book of Kazakstan, Vol 1. Animals, Part I. Vertebrates - Almaty, 325 pp.
Kowalski K. 1967. Lagurus lagurus (Pallas, 1773) and Cricetus cricetus (Linnaeus, 1758) (Rodentia, Mammalia) in the Pleistocene of England - Acta Zoologica Cracoviensa, 12 : 6. pp.111-122.
Krause T., Kunstyr I., Mutters R. 1989. Characterization of some previously unclassified Pasteurellaceae isolated from hamsters - J. Appl. Bacteriol., 67 : 2. pp. 171-175.

Krekels R.F.M., Gubbels R.E.M.B. 1996. Hamsterinventarisatie 1994 en soortbeschermingsplan - Natuurhistorisch Genootschap, Limbourg, 80 pp.
Krsmanovic L., Mikes M., Habijan V., Mikes B. 1984. Reproductive activity of Cricetus cricetus L. in Vojvodina - Fed. Rep. of Yugoslavia - Acta Zool. Fennica, 171 : pp. 173-174.
Krsmanovic L. 1985. Seasonal cycle in reproductive activity of the Common Hamster (Cricetus cricetus L.) - Jugoslav. Physiol. Pharmacol. Acta, 21 : Suppl. 4. pp. 149-150.
Krsmanovic L., Buzasi T., Popovic E., Soti J. 1987.Velicina populacije hrcka (Cricetus cricetusL.) - Zbornik za prirodne nauke Matice srpske 73 : 69-80.
Krsmanovic L., Purger J.J., Soti J.P. 1988. Color variations of fur in common hamster Cricetus cricetus (Linnaeus, 1758) and common vole Microtus arvalis (Pallas, 1779). - Arh. biol. nauka, 40 : 1-4. 15-16.
Krsmanovic L., Popovic E., Soti J., Buzasi T. 1989. About the Hamster (Cricetus cricetus L.) population size in Vojvodina: Jolly's method. - Priroda Vojvodine, 12-14: 64-73.
Krystufek B. 1992. (The Red List of endangered Mammalia in Slovenia) - Varstovo navare (Ljubljana), 17 : 19-27.
Krystufek B. 1987. Hrcek (Cricetus cricetus Linnaeus, 1758, Rodentia, Mammalia) edine stepski sesalec v slovenski fauni - Varstvo navare, 13 : 93-98.
Kunstyr I., Poppinga G., Friedhoff K.T. 1993. Host specifity of cloned Spironucleosis sp. originating from the European hamster - Lab. Animals, 27 : 1. pp. 77-80.
Lenders A., Pelzers E. 1982. (The occurence of the Common Hamster Cricetus cricetus (L.) on the Northern Limits of its Distribution Area in the Netherlands) - Lutra, 25 : 2. 69-80.
Lenders A. 1985. (The occurence of the Common Hamster Cricetus cricetus (L. 1758) in relation to soil texture and soil type) - Lutra, 28 : 2. 71-94.
Lenders A., Pelzers E. 1985. (Some data on the presence of the Common Hamster Cricetus cricetus (L. 1758) in or near man-made objects in the Netherlands) - Lutra, 28 : 2. 95-96.
Lenders A. Pelzers E. 1986. Distribution of the Common hamster (Cricetus cricetus L.) in The Netherlands – Z. f. Säugetierk. 51 : 2. 90-96.
Lin Yuguang, Hung Liuxian, Guan Jiazhen 1984. (Aprostatandrya /Sudarikovina/ cricetuli sp. nov. (Cestoda: Anoplo-Cephhalidae) from Cricetulus migratorius Pallas, and its life cycle in Haiyuang district Linxia) - Acta Zool. Sin., 30 : 3. 254-260.
Lozan M. N. 1970. Grüzuni Moldavii, Vol. 1. - Stiinca, Kisinev, pp. 17-23.
Lozan M. N. 1971. Grüzuni Moldavii, Vol. 2. - Stiinca, Kisinev, pp. 33-56.
Macdonald D. (ed.) 1985. The Encyclopedia of Mammals - Vol. 2., George Allen and Unwin, London/Sydney, pp. 672-673.
Magomedov M.R.D., Omarov K.Z. 1995. (Feeding behavior and the state of populations of Ciscaucasian hamster (Mesocricetus raddei avaricus) in mountain agroecosystems) - Zool. Zh., 74 : 3. pp. 123-133.
Makomaska-Juchiewicz M. 1993. The present situation of threatened animal and plant species in Poland and problems of their protection - Workshop on Nature Conservation in Central and Eastern Europe: present situation, needs and role of the Bern Convention (Budapest, 15-18 February, 1993), Council of Europe, T-PVS (93) 7, pp. 22-42.
Meschersky I.G., Omarov K.Z. Feoktistova N.Yu. 1992. (Urine concentration and feeding habits of Mesoccricetus raddei in nature) - Zool. Zs., 71 : 11. pp. 102-106.
Mészáros F. 1977. The parasitic Nematodes of the Hamster (Cricetus cricetus L.) in Hungary - Acta Zool.Ac.Sci. Hung., 23 : 1-2. 133-138.
Mohr E. 1954. Die freilebenden Nagetiere Deutschlands und der Nachbarlander - 3.Aufl. Jena, 212 pp.
Mohr U., Schuller H., Reznik G., Althoff J., Page N. 1973. Breeding of European Hamsters - Lab. Anim. Sci., 23 : 6. pp. 799-802.
Mosansky L. 1985. Fauna drobnych zemnych cicavcov Kosic - Zbornik Vychodoslovensko Muzee v Kosiciace, 255 : 125-142. (Germ. and Russ. sum.)
Murariu D. 1976. Cl. Mammalia in contribution á la connaissance de la faune du département Vrancea - Trav. Mus. Hist. Nat. "Grigore.Antipa", 17 : 335-340.
Murariu D., Andreescu I. 1979. Notes on the ecology of some representatives of the orders Insectivora and Rodentia (Mammalia) from Vrancea, Buzau, Prahova and Arges districts (Romania) - Trav. Mus. Hist. Nat. "Grigore Antipa", 20 : 485-497.
Murariu D. 1981. Contribution á la connaissance de la distribution et de l'ecologie des Mammiferes de la zone du Delta du Danube et du Lac Razelm - Trav. Mus. Hist. Nat. "Grigore Antipa", 23 : 283-296.
Murariu D. 1984. La liste des Mammiferes actuels de Roumaine: noms scientifiques et roumains - Trav. Mus. Hist. Nat. "Grigore Antipa", 26 : 251-261.
Murariu D. 1989. Les mammiferes de la zone du cours inférieur de la riviére Ialomita (Roumanie) - Trav. Mus. Hist. Nat. "Grigore Antipa", 30 : 247-256.
Murariu D. 1993. Les petits mammiferes (Mammalia, Insectivora et Rodentia) du Nord de la Moldavie (Roumanie) - Trav. Mus. Hist. Nat. Grigore Antipa, 33 : 411-419.
Murariu D. 1995. Mammal species from Romania. Categories of conservation - Trav. Mus. Hist. Nat. "Grigore Antipa", 35 : 549-566.

Murariu D. 1996. Mammals of the Danube Delta (Romania) - Trav. Mus. Hist. Nat. “Grigore Antipa”, 36 : 361-371.
Nadachowski A. et al.1990. Mammals from the Near East in Polish collections - Acta Zool. Cracov. 33 : 6. 91-120.
Nechay G. 1974. (The Hamster) in: Benedek P. ed.: (Forecasting in plant protection) (in Hung.) Budapest, pp. 70-73.
Nechay G., Hamar M., Grulich I. 1977. The Common Hamster (Cricetus cricetus L.): a Review - EPPO Bull. 7 : 2. pp. 255-276.
Neronov V.M., Tupikova N.V. 1967. (How is indicated the population number of animals by the regional collection of furs (for example the Common hamster) – Fauna and Ecology of the Rodents (Moscow University), 8 : pp. 188-196. (in Russ.)
Niethammer J. 1974. Zur Verbreitung und Taxonomie griechischer Saugetiere - Bonn. Zool. Beitr., 25 : pp. 28-55.
Niethammer J., Krapp F. eds. 1982. Handbuch der Säugetiere Europas, Vol. 2 - Akad.Vrlg.Ges., Wiesbaden, pp. 1-50.
Nowak R.M. 1991. Walker’s Mammals of the World, 5th Ed. Vol II. - J.Hopkins Univ. Press, Baltimore/London, pp. 701-707.
Ognev S.I. 1913. Fauna Mosquensis. Opity opisanija faunü - Vol. 1. Mlekopitajustsija, Chiroptera, Insectivora, Rodentia - Moscow, pp. 246-255.
Orlov V.N. 1989. Rodents of Conservation Concern in the Soviet Union Region - in: Lidicker W.Z. ed. Rodents. A World Survey of Species of Coservation Concern - IUCN Occ. P. 4 : 40 - 41.
Palotás G., Demeter A. 1983. Mammals of the Hortobágy _ In: Mahunka S. (ed.): The Fauna of the Hortobágy National Park - Akadémia (Publishing House), Vol. 2. pp. 413-421.
Pavlinov I. Ya. 1980. Taxonomic status of Calomyscus Thomasi (Rodentia, Cricetidae) on the basis of structure of auditory ossicles - Zool. Zhurn. 59 : 312-316.
Pearson B., Burton J.A. 1980. Wild animals - Collins GEM Guides, London-Glasgow pp. 240.
Pelikán J., Zejda J., Homolka M. 1983. Mammals in the urban agglomeration of Brno - Acta Sc. Nat. Brno, 17 : 9. 1-49.
Pelzers E., Van Der Reest P.J. 1984. (On the effect of relief and vegetation on the occurrence of the common hamster (L., 1758) - Lutra, 27 : 2. 157-169.
Pelzers E., Coenders F., Lenders A. 1984. (Some aspects of the population increase of the Common Hamster (Cricetus cricetus L.) in South-Limburg, The Netherlands, 1879-1915.) - Natuurhistorisch Maandblad, 733 :11. pp. 207-213.
Peshev T., Angelova V., Dinev T. 1960. Cricetulus migratorius Pall. (Cricetidae) - a new species of mammal to the fauna of Bulgaria - Bull. Inst. Zool. Acad.Sci. 2 : 393-396.
Petrov B. 1979. Somme questions of the zoogeographical division of the western Palaearctic in the light of the distribution of Mammals in Fed. Rep. of Yugoslavia - Folia Zoologica, 28:1. pp. 13-24.
Poljakov I.Ya. 1968. Vrednije grizuni i borjba s nimi (Harmful rodents and their control) - Kolos, Leningrad, 2nd Ed., 255 pp. (in Russ.)
Poljakov I.Ya., Gladkina T.S. 1978. Misevidnije grizuni: prognoz rasprostranenija i meri borjbi (Small rodents: prognosis on the distribution and the extent of control) - Zast. Rast., - 4/1978 : pp. 43-45. (in Russ.)
Poljakov I.Ya., Chenkin A.F. 1980. Prognoz na 1980 god (Prognose to the year 1984) - Zast. Rast., 1/1980 : pp. 44-49. (in Russ.)
Popescu A., Sin G. 1968. Les terrier et la nourriture du blaireau (Meles meles L.) dans les conditions de la steppe de Dobrudja - Trav. Mus. Hist. Nat. “Grigore Antipa”, 2 : Pars II. 1003-1012.
Popescu A., Barbu P., Cociu M. 1977. La succesion des populations de petits Mammiferes dans le complexe d’irrigations Sadova-Corabia, dans la periode 1973-1975. - Analele Univ. Bucuresti Biologie, 26 : pp. 1-6.
Petzsch H. 1950. Der Hamster - Leipzig - Wittenberg/Lutherstadt, 56 pp.
Pott-Dörfer B. 1994. Kurze Zusammenfassung der Schutzmassnahmen für den Feldhamster in Niedersachsen - “Forschungsprojekt Feldhamster”- Kurzberichte der Arbeitstreffen 1994 in Heidelberg/Oberflockenbach
Pradel A. 1981. Cricetus cricetus (Linnaeus 1758) (Rodentia, Mammalia) from the Pleistocene-Holocene Deposits of Saspowska Cave (Ojcow, Southern Poland) - Acta Zool. Cracov., 25 : 12. pp. 293-306.
Pradel A. 1985. Morphology of the hamster *Cricetus cricetus* (Linnaeus, 1758) from Poland with some remarks on the evolution of this species - Acta Zool. Cracov. 29 : 3. 29-52.
Pucek Z. 1989. A preliminary Report on Threatened Rodents in Europe - in: Lidicker W.Z. ed. Rodents. A World Survey of Species of Conservation Concern, IUCN Occ. P. 4 : 26 - 32.
Raicu P., Bratosin S. 1966. Le caryotype chez le Mesocricetus newtoni (Nehring, 1898) - Z. Säugetierk., 31 : 251 - 255.
Randik A., Sebela M., Zima J. 1980. Contributions to the knowledge of small mammals (Insectivore, Rodentia) of the Danube Delta. - Cas. Mor. muz., 65 : 191-198.
Reichhof J. 1983. Säugetiere - Mosaik Vlg, München (Hung. transl.: Schmidt A. 1996. 287 pp.)
Reznik G., Reznik-Schüller H., Dickhaus S. 1979. Bronchoskopy in the European Hamster (Cricetus cricetus) Lab. Animal Sci., 29 : 1. pp. 85-87.
Reznik-Schüller H., Reznik G., Mohr U. 1974. The European hamster (Cricetus cricetus L.) as an experimental animal: Breeding methods and observations of their behaviour in the laboratory - Z. Versuchtierk., 16 : pp. 48-58.

Ruzic A. 1976. Some pecularities in the hibernation of the hamster (Cricetus cricetus L.) and their importance for the control of the pest - Plant Protection (Beograd) 27 : 397-417.
Ruzic A. 1977. Study of the population dynamics of common hamster (Cricetus cricetus L.) in Vojvodina - Plant Protection (Beograd) 28 : 289-300.
Ruzic A. 1978a. Distribution and abundance of the common hamster (Cricetus cricetus Linnaeus,1758, Rodentia, Mammalia) in Fed. Rep. of Yugoslavia - Biosistematika 4 : 203-208.
Ruzic A. 1978b. The Biology of the Common Hamster (Cricetus cricetus) in Fed. Rep. of Yugoslavia - Congr. Theriol. Int., 2 : 202.
Saint Girons M.Ch., Mourik W.R., Bree P.J.H. 1968. La croissance ponderale et la cycle annuel du hamster, Cricetus cricetus canescens Nehring, 1899, en captivite - Mammalia, 32 : 4. pp. 577-602.
Schepotjev N.V. 1975. (An outline of the distribution and stational location of some muriform rodents in the lower Volga region) – Fauna and Ecology of Rodents (Moscow University), 12 : pp. 62-97. (in Russ., Engl. Sum.)
Schilling D., Singer D., Diller H. 1983. Säugetiere. 181 Arten Europas - BLG Vlg., München-Wien-Zürich, 286 pp.
Schmidt E. 1971. Hamsterfunde in Eulengewöllen - Zool.Abh.Mus.Tierk. Dresden, 30 : 16. 219-222.
Schnapp B. 1963. The mammals of the Rumanian People's Republic–Trav. Mus.Hist.Nat."Grigore Antipa, 4: 473-496.
Schnapp B. 1968. The Fauna of Micromammals from Valul-lui-Traian (Dobrudja) in the years 1958-1962, according to Asio otus (L.) pellets - Trav. Mus. Hist. Nat., "Grigore Antipa", 2 : Pars II 1045-1063.
Schreier O. 1968. Die Bekampfung der Hamsterplage - Pflanzenarzt (Wien), 21 : 5. 69-71.
Seluga K., Weidling A. 1994. Hamsterprojekt in Sachsen-Anhalt - "Forschungsprojekt Feldhamster" Kurzberichte der Arbeitstreffen 1994 in Heidelberg/Oberflockenbach
Seluga K. 1996. Untersuchungen zur Bestandssituation und Ökologie des Feldhamsters, Cricetus cricetus L. 1758, in den östlichen Bundeslandern Deutschlands - Halle (Saale), Martin-Luther Univ., 106 pp.
Seluga K., Stubbe M., Mammen U. 1996. Zur Reproduktion des Feldhamsters (Cricetus cricetus L.) und zum Ansiedlungsverhalten der Jungtiere – Abh. Ber. Mus. Heineanum, 3 : pp. 129-142.
Serzanin I.N. 1955. Mlekopitajustie Beloruskoj SSR (Mammals of Belarus)- Minsk, pp.127-128.
Shilova S.A., Kalinin A.A., Schipanov N.A., Savinetskaya L.E., Oleynichenko V.Yu. 1994. (Anthropogenic Transformation of the Fauna of Small Mammals in Northern Part of Rostov on Don District) - Zool. Zh., 73 : 3. pp. 98-103.
Sichenberg O. 1971. Über das Vorkommen des Goldhamsters Mesocricetus auratus brandti (Nehring, 1898) in Zentralanatolien - Säugetierkd. Mitt., 19 : 4. 362-363.
Silverman J., Chavannes J-M. 1977. Biological values of the European Hamster (Cricetus cricetus) - Lab. Animal Sci., 27 : 5. pp. 641-645.
Simionescu V. 1972. Untersuchungen über die dynamischen, innerartlichen und intraartlichen Beziehungen der Kleinsäugerpopulationen der Wiese "Valea lui David" Iasi (Jassy) mit Hilfe individueller Markierung - Ann. Stintif. Univ."Al.I..Cuza" din Iasi (S..N.II a Biol.) 18 : 331-350.
Smit C.J., Wijngaarden A. 1981. Threatened Mammals in Europe (Ed. by the European Committee for the Conservation of Nature and Natural Resources, Council of Europe) - Akademische Vrlg., Wiesbaden, 259 pp.
Smirnov P. K. 1955. Fauna gruzunov lesnih polezaschitnih polos Kurskoj oblasti (Rodent fauna of forest belts in ther Kursk county) - Uchenie zapiski Leningradskovo Universiteta No. 181. Cerija Biologitseskih Nauk, Leningrad, 38 : pp. 164-195.
Sokolov I.I. (ed.) 1963. Mlekopitajuschije fauni SSSR, Vol. 1. – Akademija Nauk, Moscow-Leningrad, pp. 48O-5O7.
Sokolov V.E., Tupicova N.V., Karaseva E.V. 1993. The Methods of Working out Cadastres of Rodent Species - Zool. Zsurnal, 72 : 12. pp. 92-101.
Specialists of the Ministry of Agriculture USSR. 1979. Prognoz na 1979 god (Prognosis to the year 1979) - Zast. Rast., 1/1979 : pp. 40-44. (in Russ.)
Spitzenberger F. 1972. Der Hamster Mesocricetus brandti (Nehring, 1898) in Zentralanatolien - Z. Säugetierk., 37 : 4. 229-231.
Straton C., Danila I., Straton A. 1973. Contributions á la connaissance de la distribution du Cricetulus migratorius Pallas, 1773 (famille des Cricetidae) en Moldavie - Stud.Conon Sti. Natur.Muz.Jud..Suceava, 3 : sans pagination
Stubbe M., Stubbe A. 1994. Säugetierarten und deren feldökologische Erforschung im östlichen Deutschland - Tiere im Konflikt, 3. 52 pp. Martin-Luther Universitat, Halle-Wittenberg.
Stubbe M., Stubbe A. (eds.) 1998. Ökologie und Schutz des Feldhamsters: Materialien des 5. internationalen Workshops "Grundlagen zur Ökologie und zum Schutz des Feldhamsters" in Halle/Saale vom 08. 11.-09. 11. 1997. - Wissentschaftliche Beitrage/Martin-Luther-Universitat, Halle/Wittenberg, 480 pp.
Stubbe M., Seluga K., Weidling A. 1997. Situation and ecology of the European hamster Cricetus cricetus (L., 1758) - Tiere im Konflikt, 5 : pp. 5-60.
Sudeikin V.A., Liapunova U.L., Tikhomirov S.S. 1972. (Cases of mass reproduction of Cricetus cricetus in Moscow) - Zool. Zh., 51 : 8. 1258-1253.
Surdacki S. 1963. The Northern Limit of the Range of Cricetus cricetus (Linnaeus, 1758) in Eastern Poland - Acta Theriol., 6 : 11. pp. 309-311.
Surdacki S. 1973. The North and the South Border of the Range and the Area of Occurrence of European Hamster Cricetus cricetus (Linnaeus, 1758) in Poland - Przeglad Zoologiczny 17 : 1. 86-88.

Szentgyörgyi P. 1995. (Vertebrate Fauna of the Northern part of the "Borsod" flood-plain) - A Borsodi-ártér északi részének gerinces faunája - Calandrella, 9 : 1-2. 36-52. (in Hung.)
Szamos V. 1972. (Growth and development of Cricetus cricetus L.) - Vest. Zool. 4 : pp. 86-89.
Tarasov M.A., Varsavskij S.N., Alekseev E.V., Shilov M.N., Ubovckov A.I., Efimov S.V., Hotyko N.I., Bistrickaja G.M., Chekashov B.N., Garanin O.A. 1989. (Rodent's species structure and distribution by biotopes in the sites of haemorrhagic fever with renal syndrome) - Ekologija, 1989/3 : pp. 85-87.
Toth S. 1974. (The Calamity Occurence of Hamster (Cricetus cricetus L.) in Eastern Slovakia in 1971-1972.) - Sbor. UVTI, Ochr. rostl., 10:7. pp. 69-74. (Engl, Ger, Russ. sum)
Tvrtkovic, N. 1994. Cricetus cricetus (Linnaeaus, 1758) (in: Draganovic, E. ed. 1994: Crvena knjiga zivotinjskih svojti Republike Hrvatske - Sisavci - pp. 74-75.) - Zagreb, 84 pp.
Ulehla J., Pelikan J. Zichová L. 1974. Rodent burrowing activity and heterogeneity of a lucerne stand -Zool. listy, 23: 113-121.
Vasic V., Dzukic G., Jankovic D., Simonov N., Petrov B., Savic I. 1991. Preliminari spisak vrsta za crvenu listu kicmenjaka Srbije - Zastita Prirode, 43-44: pp.121-132.
Vasiliu G.D., Sova C. 1968. Fauna Vertebratica Romaniae (Index) - Muzeul Judetean, Bacau, pp. 229-230.
Vinogradov B.S., Gromov I.M. 1952. Grüzunü fauni SSSR - Moskva-Leningrad, pp.156-213.
Voicolescu I., Vogel W., Wolf U. 1972. Karyotyp und Heterochromatinmuster des rumanischen Hamster (Mesocricetus newtoni) - Chromosoma (Berl.), 39 : 215-224.
Voicolescu I. 1974. A comparative study of the chromosome banding patterns of Mesocricetus newtoni and Mesocricetus auratus - Z. Säugetierk. 39 : 211 -219.
Vohralik V. 1974. Biology of the reproduction of the common hamster Cricetus cricetus (L.) - Vest. Cs. spol. zool., 38 : 3. 228-240.
Vohralik V. 1975. Postnatal development of the Common hamster Cricetus cricetus (L.) in captivity - Rozpravy Ceskoslovenské Akademie VÉD, 85 : 9. 48 pp.
Vohralik V., Andera M. 1976. Distribution of the common hamster, Cricetus cricetus (L.) in Czechoslovakia - Lynx (Praha)(N.S.) 18 : 85-97. (in Czech, Engl. sum.)
Voith J. 1994. Bestandeserfassung des Feldhamsters in Bayern 1990 - "Forschungsprojekt Feldhamster" - Kurzberichte der Arbeitstreffen 1994 in Heidelberg/Oberflockenbach
Vorontsov N.N. 1967. (Evolution of the alimentary system of Myomorph Rodents) - Novosibirsk, 235 pp. (in Russ.)
Vorontsov N.N., Kartavtseva I.V., Potapova E.G. 1979. Systematics of the genus Calomyscus (Cricetidae) 1. Caryological differentiation of the sibling species from Transcaucasia and Turkmenia and a review of species of the genus Calomyscus - Zool. Zh.. 58 : 1213-1221.
Vorontsov N.N., Potapova E.G. 1979. Taxonomy of the Genus Calomyscus (Cricetidae) 2. Status of Calomyscus in the System of Cricetinae - Zool.Zhurn. 58 : 1391-1397.
Weidling A. 1996. Zur Ökologie des Feldhamsters Cricetus cricetus L., 1758 im Nordharzvorland - Halle (Saale), Martin-Luther Univ., 120 pp.
Weidling A., Stubbe M. 1998. Endangering of a Common Hamster Population - Abstracts, Euro-American Mammal Congress, Santiago de Compostela, 19-24 July, 1998
Weidling A., Weinhold U. 1998. Mortality Studies on the Common Hamster - Abstracts, Euro-American Mammal Congress, Santiago de Compostela, 19-24 July, 1998
Weinhold U. 1994. Untersuchung zur Verbreitung des Feldhamsters (Cricetus cricetus L.) im Raum Mannheim-Heidelberg - "Forschungsprojekt Feldhamster" - Kurzberichte der Arbeitstreffen 1994 in Heidelberg/Oberflockenbach
Weinhold U. 1996. Zur Erfassung des Feldhamsters (Cricetus cricetus) im Raum Mannheim-Heidelberg - Schr.-R. f. Landschatspfl. u. Natursch., (BfN, Bonn-Bad Godesberg) 46. 105-110.
Wencel M-C. 1997. Enquete sur la présasence du grand hamster en Alsace - Paysan du Haut-Rhin, 52 : 12. p.10.
Wendt W. 1989. Feldhamster Cricetus cricetus (L.) - In: Stubbe H. ed. Buch der Hege, Haarwild, 4. bearb., erw. Aufl., Dtsch.Landwirtsch. Vrlg. DDR, Berlin, 1989. pp. 667-684.
Wendt W. 1991. Winterschlaf des Feldhamsters Cricetus cricetus (L. 1758) - Energetische Grundlagen und Auswirkungen auf die Populationsdinamik - Populationsökologie von Kleinsaugerarten, Wiss. Beitr. Univ. Halle, 1990/34, pp. 67-78.
Werth E. 1936. Der gegenwärtige Stand der Hamsterfrage in Deutschland - Arb. biol. Reichsanstalt Land- u. Forstwirts., Berlin, 21:2. pp.201-254.
Wilson D.E., Reeder D.M. (eds.) 1993. Mammal species of the World (A taxonomic and Geografical Reference) - Smithsonian Inst. Press., 2nd. ed., Washington - London, 1207 pp.
Wollnik F., Schmidt B. 1995. Seasonal and daily rhythms of body temperature in the European hamster (Cricetus cricetus) under semi-natural conditions - J. Comp. Physiol., B. 165 : pp. 171-182.
Zima J., Král B. 1984. Karyotypes of European Mammals II. - Acta S. Nat. Brno, 18 : 8. 1-62.
Zimmermann W. 1969. Die gegenwärtige Verbreitung melanistischer Hamster (Cricetus cricetus L.) in Thüringen und Bemerkungen zu deren Morphologie - Hercynia, 6:1. pp. 80-89.
Zimmermann W. 1994. Der Feldhamster (Cricetus cricetus L. 1758) in Thüringien - "Forschungsprojekt Feldhamster"-Kurzberichte der Arbeitstreffen 1994 in Heidelberg/Oberflockenbach
Zolotarenko G.S. (ed.) 1989. Katalog kollekcij zoologischekovo muzeja - Biol. Inst. SO AN SSSR, Novosibirsk

4th cover page

This report deals with the biology and status of the six species of hamsters present in Europe. Conservation measures are proposed for the most threatened populations.