Lynx (Praha), n. s., **39**(2): 317–322 (2008). ISSN 0024–7774

Speckled Ground Squirrel (*Spermophilus suslicus*): current distribution, population dynamics and conservation

Současné rozšíření, populační dynamika a ochrana sysla perličkového (*Spermophilus suslicus*)

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received on 15 November 2008

Abstract. The speckled ground squirrel, *Spermophilus suslicus* (Güldenstead, 1770) was formerly a widely distributed species in eastern Europe, and it was even considered a pest species. The distribution range of the speckled ground squirrel is now fragmented, most of its settlements are small and separated from each other. This tendency is observed over most of the species' range. At present, the speckled ground squirrel usually inhabits areas difficult to plough, hills, gullies and lows, often situated on the banks of different water management facilities. Last significant decrease of the species' numbers occurred at the end of the 20th century. However, in recent years a slight tendency to population increase has been observed in some regions. The main causes of the decline are climatic factors – cold and little-snow winters, spring and summer droughts, or increase of humidity. Further threats are changes in land use and habitat fragmentation that, together with application of pesticides and other toxic chemicals, lead to isolation and decrease in the number of settlements. The current state of the speckled ground squirrel can be characterised as unsatisfactory and unstable. To be preserved, this species undoubtedly needs special conservation actions.

Key words. Speckled ground squirrel, *Spermophilus suslicus*, settlements, population dynamics, conservation.

The speckled ground squirrel, *Spermophilus suslicus* (Güldenstead, 1770) was formerly a widely distributed species in eastern Europe, but nowadays its range is fragmented. Two karyotypic forms of the speckled ground squirrel (2n=34 and 2n=36) are currently distinguished. The systematic status of these forms is being discussed, some authors suggest recognition of the western form of the speckled ground squirrel (2n=36) as a separate species (for review see Titov & Ermakov 2004). Having analysed high karyotypic differentiation of ground squirrels and in particular of the speckled ground squirrel, Zagorodnyuk et al. (2005) pointed out its possibility to form relatively small local isolated settlements. They can function well for several generations and can survive the depression periods. The aim of this paper is to describe current state, population dynamics tendencies and protection status of the speckled ground squirrel.

The speckled ground squirrel (further referred to as *S. suslicus*) inhabits open steppe and forest-steppe landscapes. Nowadays pastures, areas difficult to plough, hills, gullies and lows, often situated on the banks of different water management facilities, and waysides are the most frequently used habitats (Titov 2001, Shekarova et al. 2003, Nedosekin & Ushakov 2005, Sa-

PELNIKOV et al. 2007). In the southern parts of the distribution range, *S. suslicus* settlements are reported to occur both in natural habitats in areas difficult to plough and in farmland habitats in perennial legumes (alfalfa and sainfoin) (LOZAN 1970, LOBKOV 1999, 2006).

LOBKOV (2006) described in detail considerable changes of *S. suslicus* population numbers, influence of significant climatic changes and different stages of steppe cultivation on *S. suslicus* habitat conditions in the northwestern Black Sea region in the 19–20th centuries. In the recent decades *S. suslicus* population in the northwestern Black Sea region has been steadily decreasing and its habitat area has been reduced. However, a slight improvement is reported by the author at present. It is due to changes in agricultural practices: replacement of formerly vast one-crop fields with smaller ones, planting of winter grains, late post-harvest stubble ploughing etc., which have created favourable conditions for *S. suslicus* on large areas. In some regions population numbers have already started to increase (LOBKOV 2006).

Nevertheless in a larger part of the species' distribution range the numbers continue to decline, and the populations become even smaller and more separated. Almost 30% of *S. suslicus* settlements disappeared from western Ukraine in the early 1990s and some of the remaining settlements were close to extinction. The *S. suslicus* has practically disappeared from the regions of Ivano-Frankovsk, Chernovtsy and Rovno. Reduction of its numbers and extinction of many settlements has also occurred in the regions of Lvov, Khmelnitskiy and in some districts of the Volyn and Ternopol regions, where the species was known as abundant in the 1950–1960s (ZAGORODNYUK et al. 2005). A similar trend has been observed in Russia. Only single isolated settlements survived in the Moscow region and the northern border of the distribution range here moved tens of kilometres southward (SHEKAROVA et al. 2003). Mosaic-like distribution of *S. suslicus* population and low abundance (up to 4–10 individuals per ha) is reported from the Penza and Saratov regions, as well as from the Chuvash Republic. The best situation is in the Ulyanovsk region. Speckled ground squirrels are found almost everywhere, and their populations are characterised by high density (4–20 animals per hectare). This is due to the presence of large areas of fallow land and a variety of natural habitats. The current border of the distribution range reaches Volga only in the junction area of the Tsivil and Sviyaga rivers (Chuvashiya) (TITOV 2001). A significant wide-ranging decline of the species' numbers has been also recorded in the Lipetsk region in the last 20–30 years (NEDOSEKIN & USHAKOV 2005). In this region, the negative trend started in the first half of the 20th century as a result of total ploughing of the meadow steppes, which led to current fragmentation of available habitats and *S. suslicus* populations. However, in the last 5–6 years a slight tendency of increasing abundance has been observed, with some old settlements growing in numbers and new settlements appearing (NEDOSEKIN 2007).

Thus, the *S. suslicus*, which was formely widespread in suitable habitats and its population numbers used to be so high that wide-ranging pest control was carried out by both medical and agricultural services across its range. However, in the middle of the 20th century the intensity of this effort decreased in some regions (e.g. in the Moscow region) because of significant decline of the species. Then in the 1980s it was officially recommended to omit the *S. suslicus* from pest control in Moldova, right-bank Ukraine and the central Chernozem region of Russia (GLADKINA 1984, SHEKAROVA et al. 2003). The current *S. suslicus* distribution is fragmented. In the late 20th century this species was included in the IUCN Red List (listed as Vulnerable), as well as in the Red List of Moldova and 5 regional Red Lists of the Russian Federation: Tatarstan, Bryansk, Moscow, Nizhny Novgorod and Penza regions (LEONTJEVA & BAKKA 1999; KRASNIY SPISOK 2004, SHEKAROVA 2006, IUCN 2007).

The paradoxicality of the situation is evident in agricultural services still speaking about the *S. suslicus* as a pest, outlining harmfulness zones on the distribution maps of this species (Karlik & Saulich 2003). The causes of the species' decline include both natural and anthropogenic factors: (1) climatic factors – cold and little-snow winters, spring and summer droughts or increase of humidity, (2) anthropogenic influence – transformation of pastures into arable land and other habitat fragmentation that leads to isolation and decrease in the number of settlements, (3) pest control and application of toxic chemicals (Lobkov 1999, 2006, Titov 2001, Shekarova et al. 2003, Nedosekin & Ushakov 2005, etc.).

Extreme weather conditions (cold and little-snow winters, spring and summer droughts) are known to lead to excessive mortality of *S. suslicus*. Long-term spring and summer droughts (their duration reached in the past up to 8–18 years) caused increased mortality rate and subsequently population depression already before the onset of the agricultural use of steppes (Lobkov 2006). Most settlements went extinct in some districts of the Volga region as a result of the severe little-snow winter of 1979 (Stoiko et al. 1980, Abrakhina 1987). General increase of precipitation rate and humidity, leading to increased density and height of herbage and thus causing decline of *S. suslicus* population, has been observed in the Lipetsk region (Nedosekin & Ushakov 2005).

The reduction of settlements and habitat fragmentation is discussed in many publications (Lobkov 1999, Titov 2001, Shekarova et al. 2003 etc.). Habitat loss occurred mainly due to field ploughing, building-up and reduction of pasture areas. *S. suslicus* population is greatly influenced by changes in agricultural practices. Thus, for example the introduction of perennial legumes (alfalfa and sainfoin) into crop rotation has prevented *S. suslicus* extinction in the southwestern part of its range. The replacement of large monoculture fields with smaller ones, predominant planting of winter grain, late post-harvest stubble ploughing etc. have also favourably influenced the *S. suslicus* population numbers (Lobkov 2006).

In the past, wide-ranging and long-term direct pest control was focused on *S. suslicus*, as well as on other species of ground squirrels. Pest control, which was carried out at high population density of rodents, caused a decrease in rodent population numbers, but usually did not lead to total extirpation of the rodents, since adaptive population reactions take effects in response to the decline in the remaining populations (cf. Kriltsov 1970, Shilova 1993).

Actuation of population mechanisms including destruction of spatial population structures and forced migration of *S. suslicus* as a result of habitat loss is described by Lobkov (1999, 2006). Thus in new settlements, formed for example by migrant animals whose habitat was destroyed by ploughing, fertility of females in the first few years is considerably higher and the animals are bigger than in old maternal settlements, which according to the author is caused by heterosis. In long-existing stable settlements the fertility of females considerably decreases, which is caused by the increase in consanguineous crossing. Inbreeding depression affects viability of offspring and fertility of females (Lobkov 1999, 2006). Sapelnikov et al. (2007) also explained the success of *S. suslicus* settlements along road embankments in the Tambov region by their low level of inbreeding because of large distance migration of young animals in search of places for burrowing.

CONCLUSION

In general, the current state of the *S. suslicus* can be described as unsatisfactory and unstable, despite some positive tendencies in certain parts of its distribution range. Appropriate mana-

gement actions are undoubtedly needed to preserve this species. However, simple excluding of the areas occupied by the *S. suslicus* from human use may not lead to the desirable results, but in some cases may even have an opposite effect (for example, population decline in abandoned pastures because of significant increase of tall grass) (Soldatov & Rumiantsev 2003). When planning effective conservation of this species, it is necessary to take into account the peculiarities of its ecology and population features.

SOUHRN

Sysel perličkový, *Spermophilus suslicus* (Gűldenstead, 1770) byl dříve ve východní Evropě široce rozšířeným druhem, který byl dokonce považován za škůdce. Nyní má areál jeho rozšíření mozaikovitý charakter, většina existujících lokalit je malá a izolovaná. Tento trend lze pozorovat na většině území jeho areálu rozšíření. V současnosti sysel perličkový obvykle osídluje těžko obdělatelnou půdu, pahorky, strouhy a prolákliny, často situované na březích různých vodohospodářských struktur. K poslednímu významnému poklesu početnosti jeho populace došlo na konci 20. století. V posledních letech byl však v některých oblastech pozorován slabý trend nárůstu populace. Hlavními příčinami úbytku tohoto druhu jsou klimatické faktory – studené zimy s malou sněhovou pokrývkou, jarní a letní sucha, nebo naopak zvýšení vlhkosti. Další hrozby představují změny využívání půdy a fragmentace vhodných biotopů, které spolu s používáním pesticidů a dalších toxických látek vedou ke snížení počtu osídlených lokalit a jejich izolaci. Současný stav populace sysla perličkového lze označit za neuspokojivý a nestabilní. Pro ochranu tohoto druhu je nepochybně třeba učinit speciální kroky.

ACNOWLEDGEMENTS

This work was supported by the RFBR Grant No 08-04-00507 and by the Program of the Department of General Biology, Russian Academy of Sciences "Fundamental Principles of Biological Resources Management".

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