

Alien mammalian species in Russia: ancient and modern invasions

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Abstract

There are about 70 alien species of mammals in Russia. Some species had occupied wide ranges before the 19th century, but most ones have penetrated into the new areas in the 20th century. Ancient invasions (before the 19th century) are known for rodents of human settlements (*Mus musculus*, *Rattus rattus*, *Rattus norvegicus*) and arable lands (*Microtus levis*, *Microtus arvalis*). In the European part of Russia these rodents are now common animals that cause harm to humans. In some regions they are continuing to expanding their ranges. The modern invasions are usually caused by human activities, and to a lesser extent by climate change. About half of the modern invasions represents self-spreading, intentional introductions constitute 23%, 16% are reintroductions, and 13% are accidental introductions. In the second half of the 20th century intentionally introduced mammals: (*Neovison vison*, *Ondatra zibethicus*, *Nyctereutes procyonoides*) occupied the largest areas. Among the self-spreading mammals, the greatest enlargements in geographical range were by *Sus scrofa*, *Martes foina*, and *Pipistrellus kuhlii*. These species have high reproductive potential and the ability to make long-distance movements. The distributions of invading mammals in Russian territory in the second half of the 20th century are illustrated in maps.

Keywords: alien species, ancient and modern invasions, mammal, Russia

Introduction

There are about 70 species of mammal that are invasive aliens in different regions of Russia. Some had occupied extensive ranges before the 19th century (archeoinvaders), but most ones have penetrated into the new areas in the 20th century (neoinvaders). The aim of our research is to identify the causes of ancient and modern invasions of mammal species to help prevent further invasions.

Materials and methods

The main criterion used to classify species as alien is an extension of their area, that is, the appearance of a species in places that it did not inhabit previously. Distribution maps, including original GIS Rodent and Pika Populations of Russia (<http://www.sevin.ru/vertebrates/>; Tupikova et al., 1999; Khlyap et al., 2000), and literature data were used. Additionally, information was received from 37 Russian biosphere reserves that are located throughout the country and have a long history of protecting biodiversity and monitoring different environment components. Some results of analysis of these materials have been published (Bobrov et al., 2008; Khlyap et al., 2010; Khlyap and Warschavsky, 2010; Neronov et al., 2008).

Results

Ancient invasions (before the 19th century) are known for rodents of human settlements (*M. musculus*, *R. rattus*, *R. norvegicus*) and arable lands (*M. levis*, *M. arvalis*, and perhaps *Apodemus agrarius*). Stable populations of house mice and black rats existed in modern Russia in ancient times (BC) in the ancient states located in the northern Caucasus, at the mouth of the Don and the adjacent coasts of Azov Sea. In late 18th century they occupied most of the European part of Russia and *M. musculus* had penetrated to the south of Eastern Siberia. *R. norvegicus* penetrated the European part of Russia in the 17th century, occupied most of it by the early 19th century and reached Western Siberia at the end 19th the century. Agrophilic rodents reached the boundaries of their geographical range at the end of the 19th century. In some regions synanthropic and agrophilic rodents are expanding their ranges even today. Range expansions of all other alien mammal species (neoinvaders) have occurred since the mid 19th century. The modern invasions are usually caused by a desire to transform the fauna (intentional introduction, 18 species); to restore endangered species (reintroduction, 15 species); human environment transformations

and (rarely) climate changes (self-spreading, 42 species); casual delivery, domestic animals and mammals that escaped from captive (accidental introduction, 9 species).

Discussion

A few species of mammals were invasive in ancient times, particularly synanthropic and agrophilic rodents. Synanthropic rodents are accidental introduced mammals. They settled over all continents accompanying people. Expansions of agrophilic rodents occurred with increasing areas occupied by crops. The modern ranges of agrophilic rodents are limited by the placement of arable land (Neronov et al., 2001). In the European part of Russia these rodents are now common animals which cause harm to humans. The number of neoinvader species is an order of magnitude greater. Most are self-spreading species. This means that the most important factor for modern invasions is an anthropogenic transformation of the environment. In the second half of the 20th century the largest areas were invaded by the intentionally introduced mammals: *N. vison* (Fig. 1), *O. zibethicus*, and *N. procyonoides*. Among the self-spreading mammals, the greatest enlargements in geographical range have been by *S. scrofa*, *M. foina*, *P. kuhlii*. These species have high reproductive potential and the ability to make long-distance movements.



Fig. 1 Modern area of *N. vison* in Russia (by Khlyap et al., 2011)

Questions of limitations of mammal invasions are far from being solved. People can and should impose bans on the intentional introduction of mammals and restrictions on reintroductions. But much more effort is needed to curb self-spreading and accidental introductions of mammal species.

References

- Bobrov VV, Warshavsky AA, Khlyap LA 2008. Alien Species of Mammals in ecosystems of Russia. Moscow, KMK, 1-232
- Khlyap LA, Bobrov VV, Warshavsky AA 2010 Biological Invasions on Russian territory: mammals. Russian Journal of Biological Invasions 1: 127-140
- Khlyap LA, Warshavskiy AA 2010 Synanthropic and agrophilic rodents as invasive alien mammals. Russian Journal of Biological Invasions 1: 301-312
- Khlyap LA, Warshavsky AA, Neronov VM, Tupikova NV 2000 Biodiversity of rodents and pikas of Northern Eurasia (creation of GIS and analysis using faunistic complexes). In: Kolchanov N et al. (eds.) Biodiversity and Dynamics of Ecosystems in North Eurasia. Parts 1,2, p. 177-179, Novosibirsk
- Khlyap LA, Warshavskiy AA, Bobrov VV 2011 Diversity of alien mammalian species in different regions of Russia. Russian Journal of Biological Invasions, in press
- Neronov VM, Khlyap LA, Tupikova NV, Warshavsky AA 2001 Formation of rodent communities in arable Lands of northern Eurasia. Russian Journal of Ecology 32: 326-333
- Neronov VM, Khlyap LA, Bobrov VV, Warshavsky AA 2008 Alien species of mammals and their impact on natural ecosystems in the biosphere reserves of Russia. Integrative Zoology 3: 83-94
- Tupikova NV, Warshavsky AA, Khlyap LA 1999 Rodent and pika populations south of the former USSR. In: Zhang ZB, Hinds L, Singleton G, Wang ZW (eds.) Rodent biology and management. ACIAR Technical Reports No. 45, Canberra, Australia.