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STUDYING THE POPULATION DYNAMICS OF BACKGROUND SPECIES OF SMALL MAMMALS IN TECHNOGENIC POLLUTION ZONES OF THE SOUTH ARAL REGION

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ABSTRACT
The article provides the results of research on the assessment of environmental parameters of small mammals in the conditions of technogenic influences in the territory of the Prearalye. In the conditions of the technogenic landscape of the sanitary protection zone of the Kungrad soda plant, the community of small mammals are characterized by a decrease in the abundance of species by an average of 18%.
KEYWORDS: *populations, small mammals, technogenic influences, environmental parameters, communities, diversity.*

One of the central problems of modern ecology is the discovery of the mechanisms of adaptation of animals to certain environmental conditions. The relevance, first of all, is determined by the need to further develop the issue of the mechanisms of the evolutionary process and the factors influencing them, as well as the development of the scientific basis of the modern approach to the problem of nature conservation and rational environmental management in the conditions of anthropogenic impacts on individual species and their communities. Study of the population of background species of small mammals in zones of technogenic pollution in the Southern Aral Sea region to identify changes in a set of population and morphophysiological parameters, as well as the possibility of using them for practical solutions to biomonitoring problems.

Of particular importance is the study of the structure and dynamics of animal communities under conditions of anthropogenic impacts on individual species and their communities. Of great interest is the study of the fauna of anthropogenic and technogenic contaminated areas. In connection with the increase in anthropogenic and technogenic pollution of the environment by emissions from industrial enterprises, there is a need to conduct environmental diagnostics of the state of natural systems located in a given territory and assess the impact of industrial emissions on these systems.

Studies of individual consequences of the influence of industrial emissions on the living conditions of mammals in a natural environment polluted by pollutants make it possible to determine the degree of significance of adaptive processes.

Traditionally, there is an opinion that technogenic impacts always have negative consequences for the functioning of ecosystems and their productivity. Examination of territories disturbed at different times by economic activities allows us to identify natural analogues of exogenous factors and shows the specificity of emerging ecosystems, characterized by high species diversity, features of successional cycles, productivity and a special landscape structure. The problem of anthropogenic transformation of the natural environment remains insufficiently studied and therefore relevant, especially in the example of the regional impacts of various types of disturbances.

The work is based on the results of studies conducted in 2018–2022. on the technogenic territory of the sanitary protection (impact) zone of the Kungrad Soda Plant (KSZ) and control (background) areas located in the Kungrad region of the Republic of Karakalpakstan.

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The most significant indicator of technogenic impacts is the expansion of the area of moving sands and surfaces devoid of vegetation (the vicinity of the territory of the Kungrad soda plant). The Kungrad Soda Plant (KSZ) is the only large enterprise in Central Asia that produces soda ash (Fig. 1).

Relative counts of small mammals were carried out in several areas remote from the territory of the KSZ:

- at a distance of 1 and 2 km southeast of KSZ;
- at a distance of 2 and 4 km northwest of KSZ.

Rice. 1. Transformation of the ecosystem on the territory of the Kungrad soda plant (2022)

The Kungrad Soda Plant is the only large enterprise in Central Asia producing soda ash. According to the Decree of the President of the Republic, Uzbekistan "On measures to further reform and increase the investment attractiveness of the chemical industry" dated April 3, 2019, 51 percent of the authorized capital of Kungrad Soda Plant LLC was sold to a foreign investor. As a result, the production scale has expanded, the economic condition of the enterprise has improved, which contributes to a further improvement in product quality. The plant's unique production technology consists of several complex stages. The main raw material is lake salt, extracted from the Barsakelmes mine, located on the Ustyurt plateau. The limestone used in production is also of high quality.

Currently, the plant annually produces 200 thousand tons of soda. The product is used as the main chemical additive in the production of glass, detergents, non-ferrous metallurgy, light industry, and water treatment.

Recreational load leads to disruption of soil and living ground cover [4]. The transformations of phytocenoses occurring in ecosystems should certainly influence faunal complexes, and, in particular, micromammal communities. A number of authoritative authors [9, 11] recommends the use of small mammals as model objects in assessing the genetic and morphophysiological danger to the population of areas contaminated with mutagens.

Small mammals, due to their high numbers, species diversity and ecological lability, exhibit clear responses to natural and anthropogenic changes [1], so it is quite reasonable to use them in determining and assessing changes that occur naturally in natural communities. Analysis of communities of small mammals in technogenic and background territories shows that the species composition and number of individuals of individual species in the compared territories differ. The features of the community structure of the impact and background territories are very well demonstrated by the dynamics of dominance-diversity (Fig. 2).

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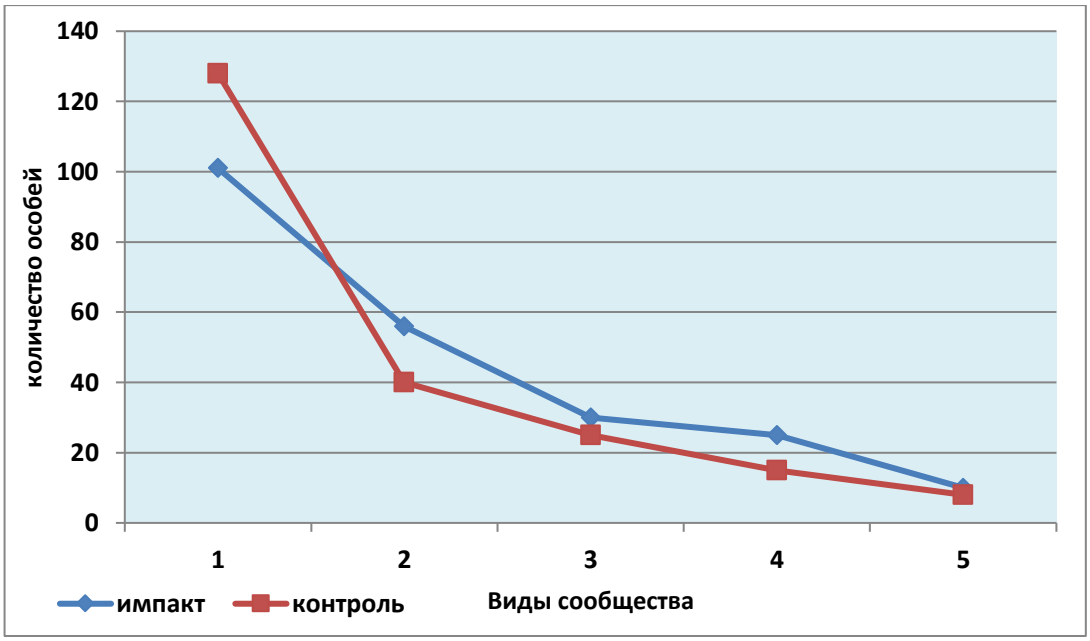

Rice. 2. Dynamics of dominance – diversity of small mammals in technogenic and control territories

The curve of the importance of species in animal communities of technogenic zones reflects the superdominance of species such as Mus musculus and Citellus fulvus, as well as the low abundance of other species. Such a community is subdominant. The significance curve of species in the background area is more leveled, which shows the polydominance of natural communities. In this case, in addition to the dominance of Mus musculus and Citellus fulvus, Rhombomys opimus is also co-dominant. Consequently, the success of the existence of species in these communities is limited by a fewer number of factors compared to communities in impact areas. In the impact zone, a complex of technogenic limiting factors is added.

The sanitary protection zone of the KSP (Kungrad Soda Plant) is a heterogeneous environment, most of which is occupied by fallow fields and wastelands, and occasionally by agricultural crops. The spatial distribution of small mammals is characterized by extreme unevenness and an increased degree of aggregation [5]. The optimal habitats for most species of micromammals are intrazonal biotypes, floodplains and "green" belts, where they find the most favorable microclimatic conditions.

The distribution of species in the communities of micromammals within the village boundaries was radically different from those in the desert. Inside settlements, *Mus musculus* dominated in all areas, making up about 57% in the general community, and about 80% in the "green" zones. The second most abundant species in the demutating ecosystem was the population of *Rhombomys opimus*, (just over 18%), followed by *Citellus fulvus* (about 11%) [6].

To study the reaction of the organism of small mammals to changes in environmental factors, we used the method of morphophysiological indicators (Schwartz et al., 1968). This method is very widely used in practical ecology and bioindication to determine the possible effects of environmental conditions on the body.

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Dominance in desert and semi-desert ecosystems in terms of species composition and values occupied an intermediate position between desert and intra-village communities. On the first transects, closest to the development, *Mus musculus* dominated everywhere.

Thus, based on all of the above, we can conclude that despite the effect of increased anxiety present on the first lines of all sites [5, 7], this does not always entail the almost complete disappearance of desert species, a noticeable dominance of *Citellus fulvus* and, as a consequence, a decrease in the diversity of communities.

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There is an opinion [7] that species diversity in communities exposed to stress decreases, however, as follows from our results, this does not always happen. In some cases, the increased diversity of communities in frontiers that are more susceptible to anthropogenic impact appears to be a result of their ecotonic nature. The penetration of hemi-synanthropes into the vicinity of the city led to an increase in the number of animal species living there [8].

The analysis made it possible to establish that the different nature of the response to the consequences of natural catastrophic impacts indicates a decrease in the population size of *Meriones erythrourus* and *Citellus fulvus* during the middle stages of restoration succession and, on the contrary, an increase in the abundance of *Mus musculus* and *Allactaga elator* populations. Because of the natural transformation of the microhabitat environment, conditions are created that meet the ecological requirements of species that were not numerous before natural catastrophic impacts.

The species spectrum and population density of rodents within demutating landscapes depend on the intensity of the impact of these factors and the level of environmental pollution (Reimov, 2000). During the indicated period, the house mouse and red-tailed gerbil were recorded in the demutating ecosystems. Among them, the house mouse occupies a dominant position (9.8% incidence). Of the elements of the anthropogenic microrelief, the most important ecological significance for rodents is the open collector-drainage network. These structures are the main habitats and reserves for 5 species of rodents: house mouse, lamellar rat, and occasionally, red-tailed gerbil.

Sewer embankments and dams that have loose soil are preferred burrowing sites for lamellar-toothed rats.

The residential landscape of the desert-plain zone is represented by settlements and livestock complexes. Settlements and livestock farms are inhabited by 3 types of rodents: the house mouse, the plate-toothed rat, and the gray hamster. They mainly inhabit household plots and stacks in fields, occasionally found in storerooms (2.2% of hits). High house mouse density in the period 2019-2022. was noted in residential buildings, cowsheds, outbuildings (66.4% of the total catch), and the maximum number of house mice and plate-toothed rats was in livestock complexes (up to 48% of the catch). Currently, in the dissolving ecosystems of the Southern Aral Sea region, xerophytization of the territory of settlements is observed due to the drainage of canals and other excessively moist places, and the desolation of the once developed system of ditches and canals. Concreting the beds of canals and irrigation ditches flowing through regional settlements violates the ecological integrity of the waterways of villages, farms in cities and district territories, which leads to isolation and degradation of its individual elements.

Thus, in the conditions of the technogenic landscape of the sanitary protection zone of the KSP, communities of small mammals are characterized by a decrease in the abundance of species by an average of 18%. Under the conditions of technogenic pressure, monodominant communities are formed with a predominance of a single species – *Mus musculus*, which has the greatest plasticity and resistance to technogenic factors. Despite the effect of increased anxiety present in the first lines of all sites, this does not always entail the almost complete disappearance of forest micromammal species, a noticeable dominance of *Mus musculus*, and, as a consequence, a decrease in the diversity of communities. The ecotone conditions of the "green" zone created additional conditions for greater species diversity of the lower layers of vegetation and, accordingly, communities of small mammals, which is consistent with the general provisions on ecotones.

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