ISSN NO: 2771-8840
December 2025

Method For Determining The Population Dynamics Of Micromammalia In The Southern Aral Sea Region

Yeshchanova S.Sh.- Qoraqalpog'iston qishloq xo'jaligi agrotexnologiyalar instituti "Ipakchilik"kafedrasi dotsenti

Ajiniyazov B. K.- Associate Professor of the Department of "Zooengineering and Veterinary Medicine" of the Faculty of Zooengineering of the Karakalpak Institute of Agriculture and Agrotechnologies

Abstract. The article presents a method for determining the population dynamics of small mammals in the Southern Aral Sea region. Relative calculations of the number of small mammals were carried out using a Gero type recorder, using the trap-line method. To prove the quantitative influence of anthropogenic pollutants on the structure and dynamics of the Microtus Ilaeus population of the studied small mammals, mathematical models were constructed that calculate the coefficient of determination (R2), indicating the degree of influence of each selected factor.

Keywords: ecosystem stability, biological resources, population, dispersion, gameostasis, regressive analysis

Currently, in solving the problem of the sustainability of tugai ecosystems around the world, ecological research of tugai ecosystems within the framework of the theory of population evolution of tugai ecosystems and the further development of the concept of ecotones allows for their promising use as a unique natural model. The study of the number and species composition of carnivores in tugai ecosystems is of great theoretical and practical interest in the field of ecology.

In leading scientific centers of the world, large-scale research is being conducted on the development of methods for predicting the dynamics of ecosystems under conditions of environmental transformation, in which the population of small mammals (Micromammalia) serves as a bioindicator. Depending on the intensity of anthropogenic transformation processes of the environment, the monitoring of ecosystems is of primary importance and determines the research directions of scientists from different countries. The state of the natural environment is the main condition that ensures the existence and sustainable development of humanity, which, of course, allows for the preservation of biological resources and biodiversity.

Monitoring of ecosystems and studying the biodiversity of natural communities in the republic (Convention on biological diversity, 1992; Global biodiversity strategy (1992), important results have been achieved in the conservation of biodiversity and the rational use of natural resources. The importance and relevance of the research are due to the identification of general principles of population and community stability, contributing to the further development of the concept of gameostasis of biological systems in the context of anthropogenic landscape transformation. As material, the results of field studies conducted in 2019-2023 in the natural and anthropogenic habitats of the tugai territories around the Lower Amu Darya State Biosphere Reserve (NASBR), the "Kazakhdarya" state forest-hunting farm of the Muynak district of the Republic of Karakalpakstan were taken (Fig. 1).

ISSN NO: 2771-8840
December 2025

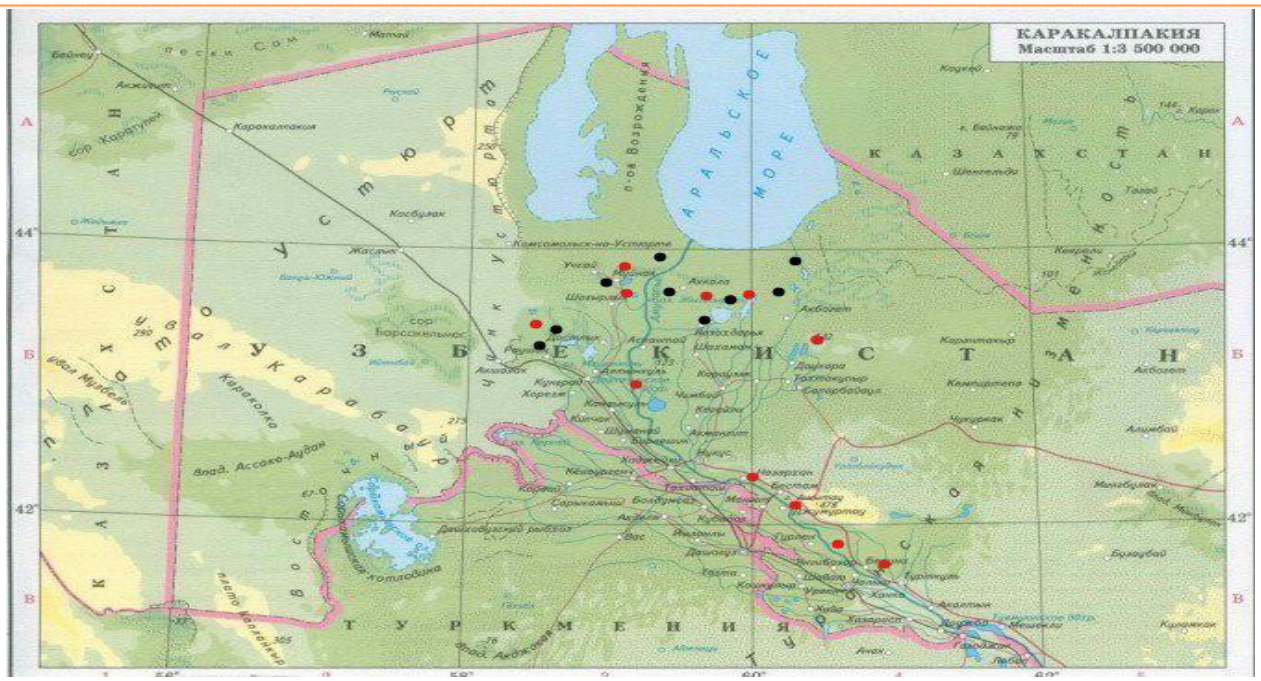

Figure 1. Distribution of the Microtus Ilaeus population in the Southern Aral Sea region

Note: ▲ - Stationary observation post ● References ● According to our own data

Among the exogenous factors influencing the size of the Microtus Ilaeus population, we considered meteorological indicators and quantitative indicators (past and present). Meteorological data are provided by the Hydrometeorological Center of the Republic of Karakalpakstan. The meteorological indicators used in the calculations included: average monthly air temperature (t°C), precipitation for each month of the year (mm), average annual temperature and the sum of annual precipitation, average seasonal temperature and precipitation of the previous winter season (December of the previous year, January and February of the current year), spring (March, April, May), summer (June, July, August) and autumn (September, October, November), as well as the maximum height of the seasonal snow cover (cm).

The number of small mammals (rodents) was estimated based on the results of absolute and relative calculations. Relative calculations of the number of small mammals were carried out using a Gero type recorder, using the trap-line method [6, p. 228; 8.363 b; 11, 501 b, etc.].

In total, 10,640 traps-days (q/s) were processed, and 365 small mammals were captured. According to generally accepted methods, the age and generative state of the animals were determined.

During the statistical processing of the material, the arithmetic mean of M and its error were calculated by the method of calculating m. At the same time, we assessed the number of ground squirrels for a comparative purpose based on the results of falling into traps, that is, to demonstrate various quantitative indicators of this group of small rodents in disturbed and undisturbed territories under anthropogenic influence [4,495 p;10,352 p; 13.364 p.].

We conducted an assessment of the main factors of the quantitative dynamics of the studied species of small mammals in relation to two periods: the beginning and end of the breeding season.

It is known that the viability of a population is determined by the conditions of its formation in the previous period. Among the reproduction parameters, the following were selected: 1) Proportion of reproducing females - pregnant and fertile females were included in the reproducing females; 2) the total spring and autumn quantity - the calculated data of hunting for April and October were used as an indicator; 3) number of pregnant females - the number of all females, regardless of age; fertility - the average number of embryos per female. In the analysis, the survival coefficient for the winter season was also used - the ratio of the spring quantity to the autumn quantity of the previous year. When using the factor analysis model, it would be more appropriate to use the share of the variance of the total factors related to the total generality and to present the share of

ISSN NO: 2771-8840
December 2025

each factor as a percentage.

To prove the quantitative influence of anthropogenic pollutants on the structure and dynamics of the Microtus Ilaeus population of the studied small mammals, mathematical models were compiled that calculate the coefficient of determination (R2), indicating the degree of influence of each selected factor [5, p. 398; 7, p. 736; 10.352 p.]. The general form of the multiple regression equation is as follows:

$$y = b_0 + b_1x_1 + b_2x_2 + \dots b_mx_m \quad (2.2)$$

бунда, b_i – регрессия коэффициентларининг баҳолари.

where, b_i - estimates of regression coefficients.

The coefficient index corresponds to the index of the variable being explained. Thus, when the indicator x1 changes relative to the unit and the remaining variable indicators remain unchanged, the average value of the variables can show the average effect of certain changes, only if the state of its constituents is maintained to a certain extent; b_0 - equalization function.

In regression analysis, the total variance (S) of the dependent variable is divided into two organizational states: the variance (S_r) of the actual factors included in the regression, and the residual regression consisting of the variance arising from random errors of observation and the variance of certain variables not included in the analysis (S_l).

$$S = S_r + S_l \quad (2.3)$$

$R^2 = S_r / S$ - coefficient of determination.

It performs two functions: the first reflects the contribution of the variability arising from the regression of the dependent variable in the total variance; the second is a qualitative criterion of regression.

If R^2 is statistically significant, then the calculated regression equation reflects the real relationship between the analytical characteristic and the obvious variables. To determine the significance of R_2, we used a special transformation [5, p. 398; 7, p. 736; 10, 352 p.]. It is necessary to note another property of the multiple determination coefficient - it is equal to the sum of the products of the normalized regression coefficients (bí) and the correlation coefficients (rí) [5, p. 398; 7, p. 736; 10, 352 p.]. The components of this sum are quantitative estimates of the contribution of each factor to the formation of the dependent variable. If any addend is larger, then the corresponding variable makes a large contribution to determining regression and covers a large part of the dispersion of the analyzed demographic characteristic.

In pairwise linear correlation, the correlation coefficient characterizes the density of connections between xvau. The corresponding indicator in multiple regression is the multiple correlation coefficient, or the overall correlation coefficient. In this case, we calculated it as a correlation coefficient between the actual values of the factor and their estimates. The square of the multiple correlation is called the coefficient of multiple determination [5, p. 398; 7.736 b; 10, 352 p.].

Quantitative estimates obtained using multifactorial analysis, characterizing the strength of the constellation factors influencing the dynamics of the number of rodent populations, allow us to determine their quantity with high accuracy.

The coefficient of multiple determination consists of several addends, and each of them makes its contribution. By the coefficient of multiple determination, it is possible to determine which part of the factor variance consists of variables, and which part remains abstract. Usually, the coefficient of determination is expressed as a percentage. Without making a large error, it is possible to exclude variables that make a small contribution to the variance of the factor when evaluating it [5, 398 б; 7,736 б; 10,352б].

If the coefficient of determination is statistically significant, then the calculated regression equation reflects the real relationship between the analytical characteristic and many intelligible variables, and at the same time it is equal to the sum of the products of the normalized regression coefficients (b_i) and the correlation coefficients (r_i)

References

1. Абдинасырова, Н. А. (2023). Роль Факторов В Формирование Динамики Численности И Структуры Популяции Microtus Ilaeus. Central Asian Journal of Theoretical and Applied Science, 4(10), 5-9.

ISSN NO: 2771-8840
December 2025

2. Ешчанова, С. Ш., & Рзаев, Р. М. (2024). ИЗМЕНЕНИЕ ФАУНЫ МЛЕКОПИТАЮЩИХ В УСЛОВИЯХ ТРАНСФОРМАЦИИ ПРИРОДНОЙ БИОТЫ ПРИАРАЛЬЯ. Экономика и социум, (4-2 (119)), 679-683.
3. Ешчанова, С. Ш. К. (2022). ОЦЕНКА ВЛИЯНИЯ ВНЕШНИХ И ВНУТРИПОПУЛЯЦИОННЫХ ФАКТОРОВ В ФОРМИРОВАНИЕ ДИНАМИКИ ЧИСЛЕННОСТИ И СТРУКТУРЫ ПОПУЛЯЦИИ MICROTUS ILAEUS. Universum: химия и биология, (5-1 (95)), 37-41.
4. Ешчанова, С. Ш. К. (2022). Экологические особенности популяций мелких млекопитающих тугайных экосистем Южного Приаралья. Universum: химия и биология, (3-1 (93)), 16-20.
5. Mirzamuratovna, M. S., Najimatdinovna, U. G., Kalibekovna, K. U., Mirzabaevich, B. B., & Abdrasulievna, A. N. (2023). Analysis of The Dynamics of The Number of Mammalian Populations in The Conditions of The Southern Aral Sea. Journal of Advanced Zoology, 44.
6. Mambetullaeva, S. M., Utemuratova, G. N., & Yeshchanova, S. S. (2021). ECOLOGICAL TRANSFORMATIONS IN THE SOUTHERN ARAL SEA REGION AS A FACTOR OF POPULATION DYNAMICS (ON THE EXAMPLE OF RHOMBOMYS OPIMUS AND ONDATRA ZIBETHICA). Annals of the Romanian Society for Cell Biology, 25(4), 13428-13436.