Analysis Of The Dynamics Of The Number Of Microtus Ilaeus Population In The Lower Amudarya

S.SH.Yeshchanova

basic doctoral student Karakalpak research Institute of Natural Sciences Karakalpak branch Academy of Sciences of the Republic of Uzbekistan

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Abstract- The article presents the results of studies analyzing the population dynamics of Microtus ilaeus in the lower Amudarya. It has been established that in the conditions of the South Aral Sea region, the moisture content of the territory for the vole population is a limiting factor in the autumn period. This confirms that under pessimum conditions, the vole population is very sparse and its abundance is limited mainly by external factors. The effect of all analyzed factors on the dynamics of the vole abundance is always complex, interdependent and variable depending on the population density and the totality of the conditions of its existence.

Index Terms- Southern Aral Sea region, lower reaches of the Amudarya, Microtus ilaeus, environmental factors, dynamics, abundance

I. INTRODUCTION

The dynamics of the population reflects the history and the entire course of the conflicting relationships of the population with the environment. And in these relationships, both the external environment and the adaptive compensatory mechanisms of the studied population are equally involved. Based on our studies, we did not oppose them to each other or, moreover, ignore one of the sides of the dynamic interaction of the environment and the population, but conducted a comprehensive quantitative analysis of all environmental factors explaining the changes in the abundance of one of the small species of the fauna of mammals of the Aral Sea region - the Ili vole. Similar work for the vole population has not previously been carried out.

II. MATERIALS AND METHODS

In the analysis, they used: the size and structure of the population at the present and previous points in time, meteorological conditions (air temperature, wind speed, rainfall, snow cover thickness, etc.), the feed capacity of the land, the Amudarya water regime and the moisture content of the habitat. By hydration is meant a set of abiotic factors, taken as of 1970 for 100% [2, 9]. Of the breeding parameters, the following were analyzed: the proportion of breeding females; total spring and autumn abundance (percentage of animals falling); the number of overwintered individuals; the number of pregnant females (counting all females, regardless of age); fertility (average number of embryos per 1 female). Also used the survival rate of individuals for the winter.

Microtus ilaeus is one of the few species in the mammalian fauna of the South Aral Sea region. In the lower reaches of the Amudarya, the vole inhabits mainly kupaks, moist areas with dense vegetation of reed, cattail, tamarisk, sedge, periodically flooded with water. It is also found in humid areas of tugai, along the banks of river channels, reservoirs, as well as in irrigated fields. Previously, the vole of the lower reaches of the Amudarya was attributed to the Transcaspian vole Micritus transcaspicus Satunin, 1905 [6, 7, 8, 9], or to the Kyrgyz vole Microtus kirgisorum [6, 9]. However, according to modern concepts, it is precisely the Ili vole that lives in the lower reaches of the Amudarya [7].

III. RESULTS AND DISCUSSION

According to the data of R. Reimov (1972; 1987) in 1968-1969. The number of voles in the Amudarya delta was very low, despite the fact that the humid conditions of the delta are optimal for its habitat. Reach for 200-300 traps did not exceed 1-2 animals or 4-6 specimens. on 1 ha [9]. In 1970-1975 the abundance of this species increased sharply, in places by 100 catches / day., the incidence was 10-15% or 15-20 ind. on 1 ha [8, 9]. Due to the change in the hydro regime of the Amudarya delta and the aridization of the habitat conditions of this species, the settlement areas have significantly decreased, and the population has decreased.

In recent years, due to the regulation of the flow of the Amudarya and the increase in the processes of desertification of the delta and aridization, the habitat conditions of the vole have worsened and its abundance has sharply decreased. According to experts [1, 4], this species becomes scarce. At present, it is generally accepted that in optimal living conditions, intrapopulation factors play one of the main roles in the regulation of numbers, and in pessimal conditions, the role of external factors increases. We also performed a quantitative assessment of the main parameters of the dynamics of the vole population for two periods: spring (beginning of the breeding season) and autumn (end of the reproductive cycle).

The analysis showed that the share of the explained variance of all environmental factors in the dynamics of the vole population is quite high and ranges from 88% to 98%. (tab. 1).

Table 1
Distribution of effects determining the size and structurespring Iliys vole population (in %%)

Population characteristics	endogenous factors		exogenous factors				Explained Dispersion
	Previous number	the current number	Climatic conditions	Feed security	Hydro mode of Amu Darya	Humidity of the territory	
Number	23,2	0	20,5	12,14	17,4	15,2	88,44
The proportion of pregnant females	54,8	0	10,4	8,53	9,7	6,3	89,73
Number of wintering	36,6	0	18,7	6,45	11,7	20,3	93,75
Winter Survival	25,8	0	28,3	17,5	7,16	13,3	92,06

The rest of the variance is due to unaccounted factors (disease, predators, cyclic solar activity, etc.). The main contribution to the total variability of spring numbers is made by abiotic factors - 65.24%. The contribution of endogenous factors to the explained variance is somewhat less - 23.2%. The greatest impact of exogenous factors is made by climatic conditions. It was also established that at the beginning of the breeding season, the number of overwintered individuals is also determined by abiotic factors, their contribution to the total explained variance is 57.0%. Exogenous factors contribute up to 34%. In spring, the breeding intensity is mainly determined by the demography of voles in the autumn of the previous year - 54.8%, as well as meteorological conditions (10,4%) in October-November, i.e. during the period when a group of animals leaving for the winter forms in the population and serving as the basis for a new breeding cycle. The mechanism that implements these relationships is still unclear. Probably one of the acceptable explanations is the restructuring of the sex, age and genetic structure of the population under the influence of high weather conditions, aimed at the selective selection of animals (during the winter period), which may have any advantages in reproduction and survival.

The effect of high densities, on the one hand, is expressed in a decrease in reproductive activity and an increase in mortality of adult animals, and on the other hand, in a subsequent decrease in the viability and breeding intensity of voles that were at a high number of stages of embryonic and early stages of postembryonic development [1, 4, 5]. The contribution of such exogenous factors as food supply, the Amudarya hydro regime, and the territory's moisture content were distributed in almost the same ratio from 6.3% to 9.7%. The contribution of the density and structure of the vole population at the moment is negligible and almost no effect was found on winter survival. The prehistory of the population had a more significant effect (up to 25.8%). The total share of exogenous factors is very high and amounted to 66%. Of these: climatic factors up to 28%, forage conditions up to 17.5%, the moisture content of the territory also makes a sufficient contribution - up to 13.3%.

As the results of the study showed, in the autumn period, the distribution of effects affecting the dynamics of numbers sharply differs from their distribution in the spring. From the table. Figure 2 shows that the effect of contributions of external and intra-population factors to the total autumn abundance was distributed almost equally (47.7% and 49.27%, respectively). The proportion of pregnant and breeding females is closely related to population density and breeding intensity in previous periods, as well as to the abundance level in this period. The contribution of intrapopulation factors to the proportion of pregnant and breeding females is very high and ranges from 68% to 70%, respectively. The rest of the total variance is due to exogenous factors. As for fertility, here the main contribution is also made by internal factors - 53%. Of the exogenous factors, the greatest contribution is made by the moisture content of the habitat territory - 12.5% and the hydro regime of the Amudarya - 11.73%.

The materials obtained indicate a significant variability in breeding indicators under the influence of the conditions of existence and the number of animals. The study of the age structure of the vole population allows us to evaluate the biological identity and the specific role of individual generations in the reproduction of species. The relationship between the proportion of immature females born in spring and early summer (3-6 months) with the abundance level in April and the reproductive activity of females of a younger age group (1-2 months) was revealed.

Table 2
The ranking of effects affecting the structure and abundance of the Iliysk vole in autumn, in %%

Population characteristics	endogenous factors		exogenous factors				Explained Dispersion
	Previous number	the current number	Climatic conditions	Feed security	Hydro mode of Amu Darya	Humidity of the territory	

Number исленность	17,3	30,4	7,54	8,63	12,3	20,8	96,97
The proportion of breeding females	36,0	33,41	4,38	6,41	7,4	9,6	89,8
The proportion of pregnant females	32,3	35,5	6,06	3,17	4,26	4,7	85,99
Fertility	34,6	18,48	4,51	4,33	11,73	12,5	86,15
The proportion of females age 1-2 months	51,42	9,74	4,35	2,62	5,65	8,31	82,1
The proportion of females age 3-6 months	47,36	3,46	2,61	7,08	10,3	15,4	86,21
The proportion of females age 7-16 months	43,08	3,81	1,18	4,93	12,45	26,31	91,76

Intrapopulation factors also have the greatest effect on the youngest animals (1-2 months) (61.16%). Of the exogenous factors, a significant contribution is made by the moisture content of the territory - 8.3%, hydro mode Amudarya - 5.65%. Intra-population factors also make a large contribution to the proportion of females of the older age group (7–16 months). I would like to highlight that of the exogenous factors, the moisture content of the habitat territory is 26.3%. This is probably due to the fact that, with increasing aridization and desertification of the Amudarya delta, the moisture content of the habitat is probably a limiting factor.

IV. CONCLUSION

Thus, on the basis of the analysis we can conclude that the combination of abiotic and biotic factors significantly affects the dynamics of the vole population. It was established that the dynamics of the vole population is controlled by the following parameters: a) the structure and population at previous times, b) the current situation in the population, c) weather conditions, d) food supply, e) the moisture content of the territory and e) hydro mode of the Amudarya. The effectiveness of the action of density and weather factors on the population dynamics has a pronounced seasonal specificity. The studies confirm the opinions of scientists that the age structure of the vole population is closely related to the characteristics of reproduction - the rate of puberty, the frequency of birth of broods, etc. The wide variability of the age structure and its focus on a certain level of population size has been established. The breeding processes that form the abundance at the beginning of summer are determined by both the state of the population and the intensity of breeding, and weather conditions in the previous year.

It has been established that in the conditions of the South Ural region, the moisture content of the territory for the vole population is a limiting factor in the autumn period. This confirms that under pessimum conditions, the vole population is very sparse and its abundance is limited mainly by external factors. The effect of all analyzed factors on the dynamics of the vole abundance is always complex, interdependent and variable depending on the population density and the totality of the conditions of its existence.

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AUTHORS

First Author – S.SH.Yeshchanova, basic doctoral student Karakalpak research Institute of Natural Sciences Karakalpak branch Academy of Sciences of the Republic of Uzbekistan