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REPRODUCTIVE SIGNIFICANCE AND SURVIVAL OF DIFFERENT COHORTS IN THE MUSKRAT (ONDATRA ZIBETHICUS L.) POPULATION IN THE SOUTH ARAL REGION

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Abstract

The article discusses the issues of studying the survival and reproductive value of the muskrat population in the conditions of the Southern Aral Sea region. The specific survival rates of males and females remain generally similar to the pattern of changes in survival rates calculated for the generation as a whole.

New indicators of muskrat population parameters have been obtained, characterizing the demographic characteristics of different cohorts.

Keywords: *the Aral region, survival rate, reproductive processes, cohorts, environmental factors, muskrat population*

Introduction

One of the pressing problems of modern ecology remains the study of the organization and dynamics of communities of terrestrial vertebrates. In the recent past, the lower reaches of the Amu Darya were the main base for muskrat farming in Uzbekistan; almost 90–95% of the skins were harvested here (Reimov R., 1985; Reimov R., Nuratdinov T., Shiryaev V., 1989).

All over the world, the problems of sustainability and stability of biological systems are being positively addressed. The decline in biodiversity, its full existence, undoubtedly leads to profound consequences for the evolution of species. A decrease in population dynamics, an increase in their habitability, and the struggle for surviving during the formation of their diversity lead to the fact that natural ecosystems from rodent communities are traditionally widely used as standard objects. In zoological and ecological studies, problems of anthropogenic changes in landscapes, among other things, affect the population composition and population dynamics of representatives of small fauna (Mambetullaeva S.M. 1994; Reimov R., Nuratdinov T., Shiryaev V., 1989).

Muskrat (Ondatra Zibethica) is one of the species from the order of rodents (Rodentia).

At home in North America, in Karakalpakstan, the muskrat has successfully acclimatized. Distributed from the lower reaches of the Amu Darya River to the Aral Sea. It was brought to the Amu Darya delta in 1944 (355 heads) from the Altai Territory (Mambetullaeva S.M. 1994; Reimov R., Nuratdinov T., Shiryaev V., 1989).

It was brought to Karakalpakstan to enrich the fauna and currently lives along the banks of streams and canals, where it digs holes for housing where there is an access to the water. The muskrat's dense and beautiful fur does not get wet and allows it to swim even in winter. On lakes with gently sloping shores, the muskrat builds permanent huts of semi-aquatic plants mixed with silt. A solid house frozen in winter with access to water is inaccessible to any predator (Moiseev V.A., Ametov M.B., 1986).

Material and methods

The material for the research was data from commercial muskrat samples (n = 34 individuals, including 16 males) in the period from 2021 to 2023. in the Dautkul, Zhaltyrbas and Karateren reservoirs, where the unique population of the species were small for 20 years due to the drying out of many reservoirs due to regulation of the flow of the Amu Darya River. Samples were collected annually from mid-September to mid-October (Moiseev V.A., Ametov M.B., 1986). Each trap line consisted of 100 traps, set annually along the same 2 km route. The method is based on the simultaneous usage of information on the number and age of animals in commercial samples taken over several years. Summarizing tables make it possible to reduce the influence of capture selectivity on the sampling structure, since the muskrat, like a number of other rodent species, is predominantly caught in adult individuals (Olenev G.V., Grigorkina E.B., 2014).

The method allows us to obtain an estimation of the absolute number and structure of the population of animals that originally lived in a given territory and were captured not only in the first year of their life, but also over several consecutive years. To do this, to the number of animals caught in the year of capture, the number of animals of 2 and 3 years of age, caught in the next three years, but belonging to a certain cohort by birth date, is added.

The method makes it possible to estimate the total number of animals that lived in the study area, but were not caught in the first year of capturing, and to significantly clarify the population structure (Muskrat. Morphology, sistematics, ecology. 1993).

The term "cohort" was used in its usual understanding as a set of individuals born in one short period of time (Olenev G.V., Grigorkina E.B., 2014). In other words, the term "cohort" can be defined as "a set of individuals born during a period of mass emergence of broods." During the breeding season, three such aggregates have been identified in the muskrat (Larin B.A., 1966). In the river delta Amu Darya, the first wave of intensive reproduction occurs from the last ten days of April – up to May inclusive (the first cohort); the second wave is June-July (second cohort), the third wave is August-September (third cohort). The term "generation" was the totality of individuals born in the current breeding season (the sum of cohorts of a given year of birth).

Results and discussion

The dynamics of seasonal changes in the size of the muskrat's genital organs shows that in the conditions of the reservoirs of the Southern Aral Sea region, muskrats do not breed all year round.

Activation of reproductive processes begins at the end of winter, with spring warming and partial release of ice from water bodies, i.e. The muskrat is one of the animals that reproduces only during the warm season. In September, the animal's sexual activity dies down. The active breeding period is April-August. In the conditions of the lower reaches of the Amu Darya, muskrat reproduction lasts 6–6.5 months. The size of the broods can be judged by the average number of embryos per female (Reimov R., 1985; Reimov R., Nuratdinov T., Shiryaev V., 1989). The litter size also varies slightly over the years – 7.1–7.8. In the Amu Darya delta, on average there are 9.8 embryos in the first litter, 8.8 in the second, and 7.7 in the third. The minimum litter size is observed in young females of the first litter of the current year –5.5 (Berestennikov D.S., 1979; Bulakhov V.L., Kurennaya M.I., 1976).

In November-December, the muskrat intensively prepares for wintering; the animals are active during the day, building new dwellings and restoring abandoned huts. In winter, when water bodies are covered with ice, muskrats are more active during the day. In the spring, with the first emergence of the muskrat from under the ice, signs of the spring year are observed. At this time, the activity of the muskrat generally increases, pairing and dispersal begins. In summer, the muskrat leads a more active lifestyle than in winter (Reimov R., 1985; Reimov R., Nuratdinov T., Shiryaev V., 1989). However, the decisive factor that determines the intensity of reproduction and population dynamics is the state of reservoirs – water availability throughout the year, the availability of food and places for the construction of dwellings (Komarov A.V., 1990). The natural conditions of the Amu Darya delta have changed dramatically, anthropogenic desertification is occurring, numerous lakes and swampy habitats are drying up, and degradation of reed and cattail thickets is observed.

The noticeable predominance of males in the spring is explained by their activity during the breeding season. The sex ratio in newborns of the early litter is almost equal (49.0% females and 51.0% males) (Ivanter E.V., 1975).

In the Amu Darya delta, due to collector, drainage and waste waters, small lake systems (Lake Akchakul, etc.) and some small reservoirs, the total usable area of which is about 20 thousand hectares, are most regularly supplied with water.

In the life of a muskrat during the year, several stages can be distinguished that are most important for characterizing the reproductive process of the species: rutting and settlement; creation of family settlements and protection of sites; autumn migrations and wintering (Reimov R., 1985; Reimov R., Nuratdinov T., Shiryaev V., 1989). The coefficient of variability in the proportion of females among age groups ranges from 60% to 89% (Bulakhov V.L., Kurennaya M.I. 1976; Bolshakov V.N., Danilov N.N., 1979).

Currently, much attention is paid to assessing the role of various factors in shaping the dynamics of animal populations. It is of particular interest to conduct these assessments on animals living in two environments (aquatic and aquatic). The assessment of the main factors of the population dynamics of Ondatra Zibethica was carried out in two periods: at the beginning and at the end of the breeding season. The highest coefficient of variation falls on the share of young animals (1–8 months). The coefficient of variation among breeding females was also highest for the age of 1–8 months.

Most species of small mammals are characterized by high fertility and short life expectancy (a little more than a year), which depending on the influence of various factors, determines changes in population numbers. Rodents can bear up to three or more litters per breeding season. However, high mortality means that a small part of the population survives the winter. More successful survival of small mammals is facilitated by the mechanism of delayed growth and maturation in the third cohort, which increases its life expectancy. Different authors call this mechanism alternative developmental pathways or different types of ontogenesis (Tsvetkova A.A. 2010; Muskrat. Morphology, sistematics, ecology. 1993).

The maximum specific survival rate is typical for the age interval 0^{+} 1^{+}. During the period from the starting point of capturing until the following autumn, 43.5% of muskrats survive.

In the next age interval, the specific survival rate sharply decreases; only 26% of one-year-old animals survive to age 2^{+}. An even sharper decrease in specific survival rate is observed in the last age interval – only 4.2% of two-year-old animals survive to age 3^{+} (Melnikov Yu. I., Dunaev V.V., 1990; Larin B.A., 1966).

The specific survival rates of males and females remain generally similar to the pattern of changes in survival rates calculated for the generation as a whole. Females are characterized by a slightly higher specific survival rate in all age classes. This leads to a slight predominance of females in the adult (1^{++}) part of the population. The higher survival rate of females may be associated with selective (increased) catching of males due to the characteristics of their behavior – guarding the area, going out first to feed, etc. The highest specific survival rate in the first year

of life (0.62) was found in the first cohort, the lowest – the second (0.36), the most numerous (Table 1). The survival rate of the third cohort (0.44) took an intermediate position.

Table 1. *Specific survival rate (px) of muskrats belonging to different cohorts*

Age class	1 cohorts		2 cohorts		3 cohorts	
	Sx	***px***	***Sx***	***px***	***Sx***	***px***
0+	12	0.62	8	0.36	9	0.44
1+	16	0.07	11	0.21	8	0.42
2+	–	–	5	0.22	8	0.24
3+	–	–	0.s3	–	1	–

Note: *Sx – number of age classes 1^+; 2^+; 3^+; px – survival rate per unit of time, in this case – per year*

The following year, the specific survival rate of animals belonging to the first cohort decreases, and in the age interval $1^+ – 2^+$ it is the lowest. Only about 9% of 1^+ animals survive to age 2^+, or about 6% of the original autumn cohort size. In the second cohort, 22% of animals 1^+ survive to age 2^+, or about 8% of the initial autumn number. The specific survival rate of the third cohort is quite high both in the first year of life and in the second. Almost half of the animals 1^+ or 21.8% of the initial autumn number survive to age 2^+ in this cohort. Such a sharp change in specific survival rates in different cohorts as age increases lead to a significant redistribution of the share of different cohorts in the generation as it ages (Table 2).

Table 2. *Ratio of cohort sizes as generation age increases,%*

Age class	Cohort size,% of the total generation size		
	1 cohort	2 cohort	3 cohort
0^+	19.5	43.0	37.5
1^+	28.4	36.6	35
2^+	8.5	26.7	64.8
3^+	0	20.8	70.2

The large reproductive contribution of females of the third cohort to the total number of descendants of the generation is ensured by their higher survival rate. The high specific survival rate of the third cohort in the first year of life can be partly explained by the relatively weak fishing pressure on it (Bulakhov V.L., Kurennaya M.I. 1976; Bolshakov V.N., Danilov N.N., 1979). It is much more difficult to find an explanation for the high specific survival rate of representatives of the third cohort in adulthood, when these muskrats practically do not differ in size from representatives of the other cohorts. A priori, it can be assumed that at least the commercial component of mortality in these animals should have been the same as in representatives of other cohorts (Bolshakov V.N., Danilov N.N., 1979; Komarov A.V. 1990; Reimov R., 1985).

Thus, as a result of the undertaken research, new, previously unknown, values of muskrat population parameters were obtained, characterizing the demographic characteristics of different cohorts. It was revealed that there are no statistical differences in the fertility of animals of different cohorts. Among the three cohorts formed in a generation, the maximum average specific survival rate is typical for representatives of the third cohort. This leads to the fact that in the second or third year of life, the share of the third cohort in the total number of the generation turns out to be the largest.

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