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**DYNAMICS OF ARGALI POPULATION
(*OVIS AMMON LINNAEUS*, 1758) IN KAZAKHSTAN****V.O. Salovarov, D.N. Yesmukhanbetov, Z.M. Karagoishin**

The research materials are based on the processing and analyzing the official results of the air and ground surveys conducted in 2019, providing departmental materials. The habitats with a high number of mountain sheep include the Karaganda, Turkestan, Dzhambul and Almaty regions of the Republic of Kazakhstan. The paper aims to estimate the changes in argali's number and reveal the basic influencing factors. The total number of wild mountain sheep in Kazakhstan is 17954 heads. The paper shows that the share of the influence of environmental and anthropogenic factors on the number of argalis is 99.7%. The main influence on the number of snow sheep is exerted by anthropogenic factors such as poaching and economic use of the range of wild mountain sheep by humans. From time to time, severe fires affect the deterioration of the habitat. The authors attribute the creation of specially protected natural territories and the inclusion of subspecies in the Red Book of Kazakhstan to the positive impact of human activity on the argali population. In modern conditions, the natural potential viability and survival of mountain sheep and further naturalization are weak, although there is an increase in the number of argalis. These aspects indicate that the anthropogenic factor affects animals intensely. The analysis of variance shows and testifies to the high influence of the anthropogenic factor on the number of argalis in regions of Kazakhstan. Today, to improve the protection of mountain sheep, it is advisable to organize a network of specially protected natural territories in the mountainous regions of the south and south-east of Kazakhstan.

Keywords: Kazakhstan mountain sheep; argali; dynamics of the number; factors

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ДИНАМИКА ЧИСЛЕННОСТИ АРХАРА (*OVIS AMMON LINNAEUS*, 1758) В КАЗАХСТАНЕ

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Материалы исследования основаны на обработке и анализе официальных результатов воздушных и наземных съемок 2019 года и любезно предоставленных ведомственных материалов. К ареалам с высокой численностью горного барана относят Карагандинскую, Туркестанскую, Жамбылскую и Алматинскую области Республики Казахстан.

Целью исследовательской работы является оценка изменений численности архара и выявление основных влияющих факторов. Общая численность диких горных баранов в Казахстане составляет 17,954 головы. В работе показано, что доля влияния экологических и антропогенных факторов на численность архаров составляет 99,7%. Основное влияние на численность снежного барана оказывают такие антропогенные факторы, как браконьерство и хозяйственное использование человеком ареала диких горных баранов, а на ухудшение среды обитания время от времени влияют сильные пожары. Создание особо охраняемых природных территорий и включение всех подвидов в Красную книгу Казахстана авторы связывают с положительным влиянием деятельности человека на популяцию архаров. В современных условиях процесс естественного потенциала жизнеспособности и выживания горных баранов и дальнейшей натурализации идет слабо, хотя и наблюдается увеличение численности архаров. Это свидетельствует о том, что антропогенный фактор настолько сильно влияет на животных, что численность животных в основном зависит от этих факторов. Дисперсионный анализ показывает и свидетельствует о высоком влиянии антропогенного фактора на численность архаров во всех регионах Казахстана. Сегодня для улучшения охраны горных баранов целесообразно организовать сеть особо охраняемых природных территорий в горных районах юга и юго-востока Казахстана.

Ключевые слова: казахстанский горный баран; архар; динамика численности; факторы

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Introduction

Argali (*Ovis attop*) in Kazakhstan is represented by five subspecies: Kyzylkum (*O. a. severtzovi*), Karatau (*O. a. nigrimontana*), Tianshan (*O. a. karelini*), Kazakhstan (*O. a. collium*), and Altai (*O. a. attop*). Several researchers also distinguish Dzungarian (*O. a. littledalei*) and Saurian (*O. a. sairensis*) subspecies. Others believe that the Tianshan, Kazakh, and Dzungarian sheep have not yet reached the subspecies level and combine them with *O. apolii* or *O. a. collium* with *O. a. karelini* [7; 9; 24]. Subspecies of argali are included in the Red Book of the Republic of Kazakhstan [12]. The Altai, Karatau and Kyzylkum argali are in the most threatening condition. The Kazakh argali is included in the Second Annex of the Convention on International Trade in Endangered Species of Wild Fauna and Flora [11].

Materials and methods

However, we obtained the research material from the official information provided by the Committee of Forestry and Wildlife, the Ministry of Ecology, Geology and Natural Resources of Kazakhstan and the Republican State-Owned Enterprise “Okhotzooptom Production Association” [21]. The research is based on the number of wild mountain sheep collected from 2013 to 2019 in the Karaganda, Akmola, Pavlodar, East Kazakhstan regions (Kazakhstan and Altai subspecies of argali), Turkestan and Kyzylorda regions (Karatau argali) and other subspecies.

The research aims to estimate the changes of argali's number and reveal base influencing factors. Research objectives were a collection of modern data about argali's number in Kazakhstan; retrospective description of argali's number changes; a consideration of the influence of natural and anthropogenic factors on the argali's numbers.

All accounting work and accounting of the number of ungulates were carried out in accordance with the Methodological Recommendations for the accounting of individual species of wild animals and the instructions for the accounting of animal species in the territory of the Republic of Kazakhstan [18].

The data of argali's numbers were received using the method of avia-counting and route counting or horse counting. The fly speed for avia-counting was not more than 100 km per hour. We made the avia route according to the possibility of observing mountain pastures and slopes. Each route was done for two persons. Subsequently, an extrapolation model of argali distribution was developed [25].

The estimating of numbers was detected by the formula: $M=A \times B: C$, where A and B – numbers of animals, detected by the first and second accoun-

tants; C – the number of animals, detected twice. All met animals were fixed during the foot route. Received data was extrapolated to 1 km of the route for all similar habitats.

Results

Based on the processing and analysis of the official results of air and ground surveys conducted in 2019 and the materials of protected areas, we established that the number of Kazakhstan mountain sheep in Central and Eastern Kazakhstan currently stands at 12,632. Moreover, 7,275 argalis live in the Karaganda region, 389 in the Akmola region, 1435 argali live in Pavlodar, and 3533 argalis live in the East Kazakhstan region. Compared to 2013, in 2019, the number of Kazakhstan mountain sheep increased by 12.4%, 58.7%, 30.4%, and 7.7% in the Karaganda, Akmola, Pavlodar and East Kazakhstan regions, respectively. The number of Altai argali does not exceed five individuals (see Table 1).

Table 1.

Dynamics of the number of mountain sheep in Kazakhstan for 2013–2019

Argali subspecies	Region	Number (of individuals) by years						
		2013	2014	2015	2016	2017	2018	2019
Kazakhstan mountain sheep	Karaganda	6472	6528	6852	6900	6968	7184	7275
	Akmola	245	249	245	250	364	389	389
	Pavlodar	1100	1140	1387	1392	1555	1422	1435
	East Kazakhstan	3282	3292	3306	3379	3450	3500	3533
Altai	East Kazakhstan	10	10	10	10	10	10	5
Karatau argali	Turkestan, Kyzylorda	313	318	320	331	479	565	643
Tien Shan argali	Turkestan, Dzhambul, Almaty	1743	1830	2127	2217	2467	2472	2574
Ustyurt Mouflon	Mangistau	1360	1370	1463	1500	1509	1523	2100
TOTAL:		14525	14737	15710	15979	16802	17065	17954

Note*: The Kyzylkum mountain sheep currently do not constantly live in Kazakhstan. Only occasionally visits from neighboring Uzbekistan are noted.

Currently, the number of Karatau argali in the Turkestan and Kyzylorda regions is 643 individuals. Compared with 2013, in 2019, the number of Karatau argali increased by 105.4% in the Turkestan and Kyzylorda regions. Today, the number of Tien Shan argali in Turkestan, Dzhambul and Almaty regions

amounts to 2574 individuals. Compared to 2013, in 2019, the number of Tien Shan argali increased by 47.7% in the Turkestan, Dzhambul and Almaty regions. The number of Ustyurt mouflon in the Mangistau region is currently 2100 individuals. Compared to 2013, in 2019, the number of Ustyurt mouflon increased by 54.4% in the Mangistau region. Moreover, we determined that the Kyzylkum mountain sheep do not constantly live in Kazakhstan, occasionally visiting from neighboring Uzbekistan [5; 27]. Based on the accounting and monitoring of mountain sheep populations in Kazakhstan in 2013–2019, we indicated an increase in Karatau and Tien Shan mountain sheep. The number of Ustyurt urial increased slightly (see Table 1).

Discussion

However, habitats with high abundance include the Karaganda, East Kazakhstan region, Dzhambul and Almaty regions. In such places, the number of wild mountain sheep reaches from 2000–7000 individuals. In 2019, the total number of Kazakhstan argali in the Karaganda region was 7275 individuals, in Pavlodar – 1435, in Akmola – 389, and East Kazakhstan – 3533 argali. The number of Altai argali currently does not exceed five individuals. In Kazakhstan, Karatau, Tyanshan, and Ustyurt argali, the increase in 2019 compared to 2013 was 13.8%, 105%, 47.7% and 54.4%, respectively. The population growth of Kazakh argali in East Kazakhstan was 21.4%, and in Central Kazakhstan – 22.0%. The natural increase in argali population in different geographical populations varied from 14.5% in the Dzungarian Alatau to 27.2% in south-eastern Balkhash [20; 21].

The increase in the number of mountain snow sheep in the last two decades is indicated by studies conducted on the territory of the Russian Federation, Tajikistan, and Mongolia [1; 10; 15; 19; 23; 26]. One should note that in general, the trends in the number of these species of hornbills are similar between Kazakhstan and the Russian Federation: a decrease in the number in the 1970s, 1980s of the last century and an increase from the late 1990s to the present. In some cases, in the local territories of the Altai (Mongun-Tai-ga, Tsagan-Shibetu), the population decline continued until the 2010s of the century [14; 16].

Pointing out some differences in the accounting work, we agreed with the opinion of other researchers that the inhabitation of the species depends on the distribution of protective and feeding stations, and is also due to the availability of the latter, which depends on the height and density of the snow cover, which, in turn, affects the size of the site. At the same time, in

snow-covered years in the second half of winter, small groups of rams can stay in the pre-summit part of the slopes and can not be recorded by the accountants. The spatial placement of animals depends on the type of surrounding vegetation. In areas with dense vegetation and many sediments, where forage and protective stations are located nearby and form large territories, the animals feel comfortable and live on the slopes and in the valley throughout the year [2; 13]. The timing of the counts can also affect the overall assessment of the number of animals during their migration, especially in the cross-border aspect [16].

Anthropogenic factors largely determine the current state of the snow sheep population. Our research shows a significant preponderance of the snow sheep population over natural ones (see Table 2). According to various researchers, limiting the number of mountain sheep can significantly depend on natural factors despite the predominance of anthropogenic factors. Thus, according to E. R. Baidavletov [7], the main causes of death of the Karatau argali are poaching (34.48%) and wolves (24.14%). Moreover, we determined deaths from foxes and large birds of prey. Newborn lambs die when low temperatures return [4; 8]. E. V. Gvozdeva and E. R. Baidavletov pointed out the significant influence of natural environmental factors, noting the cases of death of argali from starvation in snowy winters, from snow avalanches and itchy scabies. In addition, the author pointed out that the mortality rate in natural populations of argali, especially among young animals, is high [3; 6].

As a factor limiting the growth of the snow sheep population, hunting, including illegal hunting, is noted by almost all researchers. However, along with poaching, pasture, cattle breeding had a significant impact, especially in the 70s and 80s of the last century. Thus, the reduced grazing of domestic animals in the Altai by the 21st century provoked the migration of argali from Mongolia to vacant pastures [16]. In Verkhoyansk, the reduction of reindeer herding teams by the end of the 90s led to an increase in the number of snow sheep due to a decrease in grazing of domestic animals and a decrease in illegal production by reindeer herders [13]. On the territory of Kazakhstan, the economic development of argali habitat areas results in a significant reduction in the places suitable for their habitat, displacement from their habitats and available water sources, changes in migration routes or their termination altogether [6]. Systematic fires have a significant impact on mountain sheep. Thus, we can indicate the consequences of steppe fires, after which large areas are practically unsuitable for wintering argali. Fires in the northern regions cover large areas due to the good development of steppe vegetation. In addition, when leaving the burning,

the animals are forced to use areas that are winter pastures of domestic animals and where, in addition to competing with sheep, they become more accessible to wolves and poachers [6]. As a result of these factors, the areas of protective and feeding stations decreased, the spatial distribution of individuals also changed, and the distribution of rams in such areas took on a local character. One can also assume that the restoration of the original density in places damaged by fires will take more than a dozen years.

The creation of specially protected natural territories and, in special cases, the inclusion of argali in the Red Book [5; 16] is considered as an anthropogenic factor that positively affects the change in the population of snow sheep. In addition, we determined a positive experience of the effectiveness of such measures on the territory of Kazakhstan [17; 22].

Conclusion

In general, the dynamics of the argali population in Kazakhstan tend to increase. The growth in the number of subspecies living in the territories of the administrative regions of Kazakhstan over the past five years has averaged more than 30%. The dynamics of the argali population are currently influenced by anthropogenic environmental factors, which account for 99.7%. The main human influence that affects the number and spatial distribution of wild mountain sheep is poaching, trophy hunting, fires, and the economic activity of the animal's habitat. The availability of food, the presence of predators, and unfavorable weather conditions do not determine or regulate the size of the argali population. Factors affecting the population size of ungulates are closely interrelated and reflect the current state of population in specific environmental conditions.

One should take comprehensive and system-based measures in the form of creating specially protected natural areas in their habitats and providing forage and protective conditions, or systematically increase and strengthen measures for the protection and restoration of the number and reproduction of ungulates in existing specially protected areas to increase the natural viability of wild mountain sheep. Today, to improve the protection of mountain sheep, it is advisable to organize a network of specially protected natural territories in the mountainous regions of the south and south-east of Kazakhstan. Today's actions on the part of the state to support the state inspection services for the protection of the animal world and the toughening of penalties for poaching gives an opportunity and real hope for the preservation of the positive dynamics of the number of rare ungulate mammals.

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