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Creation of nurseries and veterinary preventive measures for saigas of Betpakdala and Ural populations in Kazakhstan

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Abstract. Preservation and maintenance of biological diversity of Earth's life is one of the key tasks of mankind. Therefore, the search and substantiation of methods that will be able to stabilise and increase the number of endangered species of animals and plants, a key direction of modern science, consisted in the development of organisational and veterinary preventive approaches in the breeding of saigas of the Betpakdala and Ural populations in the conditions of the nurseries "ASAR Live"

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and "Akboken" in the Republic of Kazakhstan. The nursery stock was formed by the internment of new-born saigas removed from the natural population. Control over the growth and development of saigas was carried out by periodic weighing and determining the average daily weight gain. Dimensional characteristics of young animals were determined by selecting the measurements of the sexes of the body. The state of health of the animals in the premises was monitored by determining biochemical and haematological indicators – the content of protein, glucose, cholesterol. Approbation of the developed scheme of feeding new-born saigas in nurseries turned out to be quite effective, which was confirmed by high average daily weight gains at the level of 167-180 g up to 4 months of age and a 6-fold increase in live weight during this period. At the same time, the preservation of the animal population in nurseries was at the level of 97.3%. Accounting for all the necessary parameters to create optimal conditions for saigas in the nursery allowed increasing the population of saigas from 150 to 230 units already in the first year, considering that at the time of the formation of the herd it consisted of new-born animals. A comprehensive approach to solving the problem of preserving the local population of saigas in Kazakhstan allowed developing an effective system of measures tested in nurseries for the preservation and breeding of animals of the Betpakdala and Ural populations. The developed methods of preserving the endangered Tatar saiga population in nurseries, in addition to the reputational image of Kazakhstan as a country that solved the problem with the autochthonous species of fauna, contain recommendations for the development of a population of wild animals with minimal stress and adaptation consequences

Keywords: internment; feeding scheme; preservation of biodiversity; biochemical indicators; body measurements

INTRODUCTION

Humanity, as a social structure, has only recently come to understand that the preservation of plant and animal diversity on the planet is the main guarantor of the existence of all aspects of organic life on Earth. However, industrialisation and the active use of natural resources by humans reduce the habitat of most species of autochthonous representatives of flora and fauna around the world, including the Republic of Kazakhstan. One of the main factors of the decline in the population of Red Book species in the West Kazakhstan region is significant man-made changes in the natural landscape, and, accordingly, in the composition of vegetation that grew in these territories. This provoked both a change in the migration routes of wild animals and a decline in their populations due to a decrease in their range.

No less dangerous factor in preserving the diversity of animals in Kazakhstan is criminogenic phenomena, in particular, poaching in a number of regions and settlements in the range of animal populations, which are already on the verge of extinction. Therefore, special attention is paid to the conservation of biodiversity as one of the key areas of protection against the extinction of rare and endangered species of plants and animals in Kazakhstan. There are the draft laws adopted by the government on the protection of biodiversity, in particular Law of the Republic of Kazakhstan No. 160-I "On Environmental Protection" (1997), Law of the Republic of Kazakhstan No. 175-III "On Specially Protected Natural Areas" (2006), Law of the Republic of Kazakhstan No. 70-VII "On Ratification of the Protocol on the Conservation of Biological Diversity to the Framework Convention for the Protection of the Marine Environment of the Caspian Sea" (2021), and other regulations.

Special attention should be paid to autochthonous species, for which the Kazakh steppes are the main habitat, while preserving biodiversity. One of these species, which is included in a number of international conventions and lists of environmental organisations, is the saiga. *Saiga tatarica* is a species of animal from the family of pronghorn antelopes that inhabit the steppe and semi-desert expanses of Eurasia, they have biological characteristics that help them adapt to the harsh conditions of the Eurasian steppes. Of commercial interest are saiga antlers and derivatives, which are especially appreciated in the culture and medicine of Southeast Asian countries. All countries of the saiga breeding range banned any commercial export of these products more than ten years ago. But despite this ban, the number of offers for the sale of saiga antlers at auctions in countries is quite high, which does not exclude a high percentage of poaching in saiga breeding sites. As of 2023, the Kazakh saiga population makes up the bulk (95%) of the total global population of this species. Therefore, the development of methods and approaches aimed at preserving the Kazakh saiga population is an urgent area of research. The message of A. Serikbayeva *et al.* (2023) indicate that the International Union for Conservation of Nature (UICN) has identified saigas as an endangered species. One of the most effective approaches to the conservation of endangered species is the creation of sanctuaries, nurseries, and other reserves for their breeding.

This approach, according to M. Nurushev *et al.* (2022), allowed to increase the number of national parks from 1 to 11; create 4 natural reserves; achieve the inclusion of 140 species of fauna to protected animals, of which 22 were listed in the Red Book of the Republic of Kazakhstan. In the West Kazakhstan

region, the main distribution area of saigas, according to K. Kenesarina (2019), in recent years there has been an active development of the gas and oil industry, which has led to changes in the landscape and biological diversity of the local territory. The construction of pipelines, roads, railways, and other infrastructure has reduced the population of local mammals, including Red Book animals. In addition, the year 2003 was critical for the saiga population, when the number of animals of this species did not exceed 21.3 thousand units. The main reasons for this change in numbers, according to K. Mukantayev *et al*. (2022), was poaching. From other reasons, A. Serikbayeva *et al*. (2023) note the loss of habitats through human industrial activity, snowy winters, lack of food, diseases, and competition with farm animals. But epizootics turned out to be the most dangerous for the saiga population. Diseases of pasteurellosis, teileriosis, ruminant plague, pasture mites, and other parasitic diseases led to a decrease in the number of animals by 200 thousand units per year according to S. Fereidouni *et al*. (2019).

In connection with the obligations assumed by the Republic of Kazakhstan within the framework of the ratified International Convention on Biological Diversity and the Memorandum of understanding concerning conservation, restoration and sustainable use of the saiga antelope (*Saiga tatarica*) (2021), the conservation of the animal population of this species is important for the image of the country. Due to the significant incidence of saiga antelopes and poaching, the breeding of these animals in captivity is considered as one of the alternative methods of preserving this species. Therefore, the purpose of this study was to work out the organisational conditions for the creation of nurseries for breeding saigas in captivity, and the development of veterinary and sanitary measures in nurseries to prevent the death of animals.

LITERATURE REVIEW

Kazakhstan is home to the Betpakdala, Ustyurt, and Ural groups of saigas, which belong to the Tatar (Eurasian) subspecies (*Saiga tatarica*), and the Mongolian subspecies (*Saiga tatarica mongolica*), which, according to A. Serikbayeva *et al*. (2023), is distributed in Mongolia. G. Turlybekova *et al*. (2017) indicates that 95% of the population of the Tatar subspecies of saiga is located in Kazakhstan, while in the Betpakdala and Ural groups there was a 45% increase in livestock, while the Ustyurt population practically disappeared. According to M. Shpigelman (2023), the number of saigas in Western Kazakhstan was estimated at 1.13 million units.

E. Milner-Gulland *et al*. (2020) observed a decrease in the number of offspring (from 1.27±0.25 calves to 0.92±0.39) due to female infertility. Therefore, the only method of preserving the population and maintaining its genetic diversity remains the creation of sanctuaries where optimal conditions for breeding saiga are maintained. K. Kushaliev and Zh. Usenov (2022) highlight the importance of veterinary and preventive measures when keeping saigas in captivity, V. Havrylenko *et al*. (2022) focus on the regulatory function of humans when working with the population in the reserve, and L. Dimeyeva *et al*. (2022) are convinced that maintaining high-quality pastures in nature reserves can stimulate the growth of the number of animals. J. Grachev (2022) concludes that when creating sanctuaries for saiga, as a migratory animal, it is necessary to create conditions for desert, semi-desert, and steppe zones. Because these areas are important for wintering, calving, and summer feeding. But the main factor in the increase in the number of saigas in sanctuaries is the systematic prevention of poaching, as indicated by D. Blank and Y. Li (2021). According to O. Baitanaev *et al*. (2014), the main reason for the reduction of the saiga population by 97.9% (from 1 million to 21.3 thousand units) from 1990 to 2003 was related to poaching.

In nature reserves, due to the high crowding of animals, special attention is paid to veterinary safety issues. In particular, pasteurellosis, since, according to O. Baitanaev *et al*. (2014), a significant part of the saiga population died from this disease in the 1980s. S. Fereidouni *et al*. (2019) estimate the number of saigas killed by foot and mouth disease (FMD) and pasteurellosis over a 60-year observation period in Kazakhstan to be 100,000 and 805,700 saigas, respectively. In study by U. Taubaev *et al*. (2022) indicates that almost all adult animals are pasteurellosis carriers. Among other infectious diseases, a significant incidence was observed in the Mongolian population from ruminant plague (Pruvot *et al*., 2020). Parasitic diseases are also frequently reported among saiga. A. Abdybekova *et al*. (2021) found 55 species of endoparasites and about 10 species of ectoparasites of saigas in Kazakhstan. The spread of invasive diseases is also reported by A. Abdybekova *et al*. (2023), M. Khanyari *et al*. (2022). K. Kushaliyev *et al*. (2023) indicate a significant mortality of saigas from parasitic diseases up to 15-17% from cenurosis and 7-9% from moniziosis. Saigas also acted as a source of invasion in pastures for farm animals, which makes sanctuaries not only a method of stabilising the saiga population, but also preventing morbidity among animals.

MATERIALS AND METHODS

The creation of nurseries for breeding and preserving the gene pool of the Tatar subspecies of saiga (Ural and Betpakdala populations) was carried out in West Kazakhstan and Ulytau regions of the Republic of Kazakhstan as part of the programme for breeding and domestication of saigas. Organisational approaches to the maintenance and feeding of new-born saigas were based on the results of scientific research by the staff of the Zhangir Khan University and practical developments of employees of LLP "ASAR Live" (Fig. 1).

Figure 1. *Removal of new-born saiga fawns from the natural environment*
Source: *authors's photo*

The approbation of the developed organisational approaches for the adaptation of animals in captivity and veterinary measures to preserve the health of saigas was carried out in the established nurseries "ASAR Live" in Zhanaarka district, Ulytau region and "Akboken" in the West Kazakhstan region for the breeding of saigas. Before the construction of the nurseries, epizootic monitoring of their territory was carried out to identify pathogens of infectious diseases: anthrax, blackleg, brucellosis, rabies. In the spring of 2022, 150 caught saigas were placed in the "ASAR Live" nursery for breeding saigas of the Betpakdala population, according to the permission received for the use of animals for scientific purposes. The nursery was organised jointly with the "ASAR" farm, located in the habitat of the Betpakdala saiga population and occupies an area of 370 ha (Fig. 2).

Figure 2. *"ASAR Live" nursery*
Source: *authors's photo*

In 2023, the second "Akboken" nursery was opened in the West Kazakhstan region for saigas of the Ural population. It is equipped 20 km from Uralsk, in the area of operation of the Ural agricultural experimental station and is located on an area of 56 ha. 200 new-born young animals were interned from the natural environment for breeding and keeping in the "Akboken" nursery (Fig. 3).

Figure 3. *"Akboken" nursery*
Source: *authors's photo*

In order to reduce the impact of stress on saigas during their internment, it was decided to move only new-born animals to nurseries. The levels and feeding technology were developed by the university staff. All saiga young stock, regardless of sex, were kept in groups of 20 fawns and tamed to bottle feeding. In the early days of life, calves were fed a formula based on Nestogen baby food and cow's milk with fish oil added. From the second month, the young stock was gradually accustomed to eating grain (barley). Control over the growth and development of saigas was carried out by periodic weighing and taking measurements: at birth, at one and four months of age. At birth, weighing was performed at the site of saiga antelope capture using a hand scale with an electronic sensor (Fig. 4a), subsequent measurements were made using an electronic floor scale (Fig. 4b).

Figure 4. *Weighing of saiga calves: a) at capture; b) at the age of one month*
Source: *authors's photo*

Health monitoring was carried out by determining the biochemical parameters of the blood system, while blood for haematological studies was taken from the jugular vein in the morning before feeding. The indicators were determined using automatic analysers Chem Well 2910 and Mindray BC-2800 Vet in the conditions of the veterinary clinic of the Zhangir Khan University (Fig. 5).

Figure 5. *Blood collection from saigas for haematological and biochemical analyses*
Source: *authors's photo*

During rearing, periodic check-ups were also carried out to detect diseases of various aetiologies in saigas. But the main focus was on infectious and invasive diseases.

Diagnostic and coprological studies were carried out on the premises of the Institute of Veterinary Medicine and Animal Husbandry at the Zhangir Khan University.

RESULTS

Monitoring studies. One of the areas of work on the conservation of the saiga population is regular monitoring studies. The dynamics of the number of saigas in different populations over the past 3 years has been consistently positive. According to the materials of the Kazakhstan Association for the Conservation of Biodiversity, by far the largest saiga population in the country is the Ural (Table 1).

Table 1. *Number of saigas in Kazakhstan in 2016-2023*

Year	Population size, units			
	Ustyurt	Ustyurt	Betpakdala	Total
2016	70,200	1,900	36,200	108,300
2017	98,200	2,700	51,700	152,600
2018	135,000	3,700	76,400	215,100
2019	217,000	5,900	111,500	334,400
2020	Quarantine (no monitoring studies have been conducted)			
2021	545,000	12,000	290,000	842,000
2022	801,000	28,000	489,000	1,318,000
2023	1,130,000	39,700	745,300	1,915,000

Source: *developed by the authors*

The Ural and Betpakdala populations have been steadily growing in recent years. The increase in the current year amounted to more than 45.0% compared to 2022. The high growth was facilitated by favourable food and weather conditions of the past two years and fairly effective protection, which has improved markedly over this period. But the main reason for the increase in the number of saigas is their multiplicity (twins and sometimes triplets). On average, there are 1.5 calves per mother. Such a high multiplicity made it possible, without prejudice to both the population and without violating the maternal instinct during subsequent calving, to wean calves from the twin for the increase of numbers of heads in newly formed nurseries. This approach has been successfully tested in the creation of nursery stock for two saiga populations – Betpakdala and Ural.

Organisational arrangements. In the nurseries "ASAR Live" and "Akboken", the technology of feeding calves was developed and tested on a large number of new-born saigas. Since the normal growth and development of saiga calves depends on compliance with feeding norms and intervals, energy balance, and veterinary standards of animal maintenance and condition. Table 2 shows the scheme of feeding new-born calves by the author's team and used in the above-mentioned nurseries.

Table 2. *Feeding scheme for saiga young stock*

Age, days	Volume of milk or milk formula, l	Number of feedings per day	Age, days	Volume of milk or milk formula, l	Number of feedings per day
1-3	0.05-0.1 (Nestogen)	5	61-90	0.4 (CMR)	3
4-10	0.1-0.15 (Nestogen)	4	91-105	0.45 (CMR)	3
11-40	0.25 (whole cow milk)	4	106-120	0.5 (CMR)	2
41-60	0.25-0.3 (CMR)	4	121-150	500 (CMR)	1

Notes: *CMR – calf milk replacer*
Source: *developed by the authors*

The frequency of feeding of calves was determined depending on the appetite and physiological state of the young stock, their activity, the amount of green feed consumed, hay, concentrates, and other factors. In the first ten days of the dairy period, calves were fed with a mixture based on Nestogen infant formula, then feeding was carried out with cow's milk. From the age of one month, milk replacer with the addition of vegetable proteins has already been used to feed young animals. The feeding regime of young animals during the entire dairy period is presented in Table 3.

Table 3. *Feeding regime of calves in the dairy period*

Age of young stock							
1-3 days		4-60 days		61-105 days		106-120 days	
No. of feeding	Time	No. of feeding	Time	No. of feeding	Time	No. of feeding	Time
1st	06:30	1st	06:30	1st	06:30	1st	08:30
2nd	11:30	2nd	11:30	2nd	14:00	2nd	20:00
3rd	14:30	3rd	16:30	3rd	21:00	-	-
4th	18:30	4th	21:30	-	-	-	-
5th	21:00	-	-	-	-	-	-

Source: *developed by the authors*

The sucking reflex was actively manifested in the captured new-born calves, which allowed them to be adapted quite quickly to artificial feeding. Already during the first weeks, it was necessary to increase the dose of the mixture. After 2 months of the suckling period, calves were able to consume from 400 to 500 ml of milk formula in one feeding. During the use of infant formula, there were no signs of gastrointestinal disorders. From the first days of drinking milk, 2 ml of fish oil was added to it once a day. From the second month, calves began to be gradually accustomed to feeding barley grain, and from the age of 4 months, sources of inorganic calcium (feed chalk) were included in the diet. At first, it was added to milk, and in later periods it was added to concentrates. The daily feed requirement of 4-5 month-old saigas consisted of 2.5 kg of coarse feed (hay, straw), 300 g of concentrated feed (medium grinding), salt lick and water without restrictions. Notably, while feeding milk, calves got used to the service staff, but as they grew older, they had an increased instinct for self-preservation. Control over the development of saiga calves in captivity was carried out by weight and height indicators. To do this, animals were systematically weighed and body measurements were determined at birth, at one and four months of age. The results of the weigh-in from birth to 4 months of age are presented in Table 4.

Table 4. *Dynamics of changes in the live weight of calves of the Ural and Betpakdala populations (M±m), (n=270), kg*

Age, days	Sex	
	Males	Females (M±m)
New-borns	3±0.2	4±0.2
30 days	9.1±0.2	9±0.2
120 days	21±1.5	20.1±0.9

Source: *developed by the authors*

The live weight of new-born saiga antelopes in the Ural population was 3.16 kg, whereas the saiga antelopes of the Betpakdala population were significantly larger – 3.96 kg ($P<0.05$), although the body parameters of new-born animals practically did not differ (Table 5).

Table 5. *Exterior parameters of new-born saigas, M±m (n=100), cm*

Measurements	Ural population (n=50)	Betpakdala population (n=50)
Oblique length of the body	32.5±1.7	33.5±2.1
Chest depth	12.4±0.9	13.5±1.1
Height at withers	41.4±2.5	41.8±3.7
Height at hips	40±2.5	40.9±3.9
Chest width	7.7±0.9	7.9±1
Width at hip bone	6.38±0.8	6.91±1
Chest circumference	33.1±1.9	33.8±2.2
Pastern circumference	4.41±0.5	4.59±0.7

Source: *developed by the authors*

According to the dynamics of the live weight gain of saiga antelopes of two populations, the gains of males were higher than those of females during the entire control period. According to the average daily increase, the difference between animals of different sexes was 4-7 g (Table 6).

Table 6. *Dynamics of live weight gain of calves born in 2023*

Age period	Sex	
	Males	Females
Absolute gain, kg		
From birth to 1 month	5.95	5.08
1-4 months	11.9	11.1
From birth to 4 months	16.89	16.02
Average daily body weight gain, g		
From birth to 1 month	180	173
1-4 months	131	127
From birth to 4 months	142	138

Source: *developed by the authors*

As a result of the conducted research, it can be stated that the growth and development of calves had high indicators. The increase in live weight from birth to 4 months of age averaged 140 g per day. This indicates that the conditions created in nurseries can ensure the normal development of animals from the first days of life. In the "ASAR Live" nursery, when keeping saigas in captivity, females were able to mate in the first year, and males reached puberty at a later age.

Veterinary and preventive measures. The results of the biochemical study of blood serum are presented in Table 7.

Table 7. *Biochemical parameters of saiga blood in the spring and autumn period when growing them in the nursery "ASAR Live" (n=10)*

Indicator	M±m	Lim
Total protein, g/l (spring)	76.7±7	67.2-89.1
Total protein, g/l (autumn)	75.8±2.4	58.2-95.1
Parts by weight Albumins, g/l	53.9±1.4	33.7-79.4
Parts by weight Globulins, g/l	42.02±4.4	29.4-73.2
Protein coefficient	1.6±0.1	0.7-2.3
Glucose, mg/dl (spring)	57.4±2.3*	47.2-69.3
Glucose, mg/dl (autumn)	77.9±4.3*	61.4-101.2
Cholesterol, mg/dl (spring)	186.66±10.1*	139.5-214.6
Cholesterol, mg/dl (autumn)	149.7±13.8*	95.2-178.4
Parts by weight Triglycerides, mg/dl	101.78±20.1	94.9-109.7
Iron, mg/dl	93.4±5.84	42.1-177.6

Notes: ** – P<0.05*
Source: *developed by the authors*

The protein content in the blood of the animals, regardless of the season, was within the physiological norm – from 60 to 115.5 g/l, and in terms of the ratio of albumins to globulins corresponded to animals with active growth. While the concentration of glucose and cholesterol significantly differed between seasons. This may be evidence of the transition of calves feeding from a dairy diet to the use of plant-based feed. Thus, the study of the biochemical parameters of the blood of saigas in the conditions of the nursery revealed an excess concentration of most indicators compared to animals of analogous age of the European population contained in natural conditions. This may indicate the best conditions for animals in the created reserves.

In the nurseries "ASAR Live" and "Akboken" all diagnostic and preventive manipulations are carried out according to the plan of veterinary and preventive measures. Veterinary control of the saiga's health is carried out by clinical examination and analysis of haematological and biochemical blood parameters of the entire animal population. This approach allowed detecting early signs of diseases in animals and carrying out treatment in a timely manner. Thus, due to this approach, immediately after the removal of newborn calves, they showed signs of psoroptosis (scabies), which was eliminated by twice treating the animals with ivermectin. There have been isolated cases of mortality of saiga calves with signs of dyspepsia. Mainly signs of digestive disorders were observed in the first two weeks after their removal from the natural environment, which was a likely consequence of stress in a number of animals. Thus, the problem of stress leads to a malfunction of the immune system, its adaptive and other protective mechanisms. Therefore, in order to reduce the stress state of young animals, they were kept in cages with plastic mesh, 15-20 units in each, which allowed excluding cases of injury. Of the diseases of non-infectious aetiology in nurseries, there were: phlegmon, bronchopneumonia, injuries, limb fractures, enteritis during the preweaning period, hoof diseases, and subsequently, some females had obstructed labour. As a result of keeping saigas in a limited area and the absence of the need for them to move long distances in search of food, the animals in the nurseries had an overgrowth of the hoof horn. As a veterinary measure, it has also been necessary to clean the hooves of saigas.

The most common diseases in wild mammals in Western Kazakhstan are parasitic diseases, in particular, monieziasis. Since insects are involved in the development cycle of this parasite, the peak incidence is manifested in the summer, during their swarming. It is not possible to protect animals from insects on the territory of the nursery. To do this, preventive deworming was performed using ivermectin or albendazole preparations (Fig. 6). To do this, the first use of drugs was carried out at 30-45 days of age, repeated after 15 days and the final treatment of animals was carried out after 25-30 days. This allowed reducing the incidence among animals.

Figure 6. *Lifetime diagnosis of monieziasis*
Source: *authors's photo*

Summing up, all the organisational and veterinary preventive measures carried out during the creation and operation of nurseries for saiga in Kazakhstan ensure the preservation of the genetic diversity of the population by preventing the incidence of animals of various aetiologies, poaching, and the spread of pasture invasions in significant territories. As of today, the nurseries have received good results of joint cooperation with the involvement of University faculty, undergraduates and students of universities of Kazakhstan, zoo specialists, and local media, which increases the effectiveness of conservation of autochthonous, relict species of flora and fauna of Kazakhstan.

DISCUSSION

Since the purpose of creating nurseries for the breeding of wild saiga fauna is to preserve the unique gene pool of the oldest animal species, which is represented almost only on the territory of Kazakhstan, such work becomes not only a national task but also important for the image of the country. The use of nurseries and sanctuaries as a model for the conservation of animal species that are on the verge of extinction is one of the most humane approaches in preserving the biodiversity of living organisms. Modelling of natural and landscape conditions in the reserves allowed creating optimal conditions for the restoration of the number of saigas of the Betpakdala and Ural populations. This approach to preserving the entire biological diversity of living objects characteristic of a particular region is

consistent with the opinion of T. Atemasova *et al.* (2023) and will allow, in addition to animals, to preserve the plant diversity inherent in this territory.

When creating nurseries "ASAR Live" and "Akboken" for breeding saiga in the territory of West Kazakhstan and Ulytau regions of the Republic of Kazakhstan, most of the factors necessary for successful breeding and reproduction of saiga were considered. For this purpose, the nurseries were geographically located in the landscape conditions of the steppe, semi-desert, and desert, since each of them serves as a habitat for saigas during certain seasonal periods. This is consistent with the opinion of B. Chimeddorj *et al.* (2023), that when creating sanctuaries, it is necessary to consider the attachment of interned animals to the conditions of the environment in a natural state and, if possible, create them. In addition, an equally important factor in the creation of nurseries is the size of its territory, especially if further introduction of animals into natural conditions is planned. Chinese researchers Z. Jiang *et al.* (2020) concluded that the small area of reserves for saigas does not allow restoring the number of animals as migratory species. Therefore, this factor must be considered when organising the work of the reserve. This approach of recreating the habitat conditions with floodplain meadows and forests, and the constant increase in the nursery area in the floodplain of the Syrdarya River was tested by M. Suleymenova *et al.* (2017) in Kazakhstan during the reintroduction of Bukhara deer brought from the Karachingil hunting farm.

The period of adaptation of the animals was long and only in 16 years allowed to increase the number of deer in the nursery from 8 to 103 individuals. As saigas were captured within the confines of the nurseries when they were established, there was no adaptation period, but the effects of stress could have a long-term impact on the physiological abilities of the interned saigas. In order to reduce the impact of stress, it was decided to form a nursery population with new-born animals. This approach solved the problem of stress in animals and made it relatively easy to select saiga antelopes for the nursery. This is due to the physiological characteristics of migrating animals, when the mother leaves her new-born offspring for a relatively long period in search of food. The approach used in the development of the livestock of the "ASAR Live" and "Akboken" nurseries is unique, since such reports could not be found in the scientific literature. The relatively easy artificial feeding of young ruminants allows using this method of forming the livestock of sanctuaries in further work while preserving other species. The use of industrially produced whole milk replacers has enabled the feeding of saiga calves to be harmonised and a healthy saiga population to be established in the two reserves. The results of the growth and development of saiga calves were monitored by periodic weighing and taking measurements.

The search for reference values of biochemical and haematological parameters in the scientific literature for captive saigas, depending on sex, age, and physiological condition (disease, stress), did not yield positive results. Therefore, the obtained indicators of the main biochemical and haematological studies of saiga from nurseries were compared with the parameters of new-born saiga in the natural environment, which were measured in study by X. Liu *et al.* (2019). This indicates that the conditions that have been created in the nurseries correspond to the natural needs of saigas. This was also confirmed by later results of the reproductive ability of animals that were kept in captivity. Young females became sexually mature already at 8-9 months and the next year brought offspring. Similar results of the development of reproductive ability were observed in animals in the natural population in the studies by D. Moon (2023). According to the researcher, females became sexually mature at 7-8 months and were ready to mate in the first year of life.

The most dangerous factor in creating an artificial population of animals in a nursery or wildlife sanctuary is the narrowing of genetic diversity in such a group. Similar results were obtained by Z. Jiang *et al.* (2020) and M. Nurushev *et al.* (2020). When, as a result of a decrease in the genetic diversity of the herd, there was a decrease in reproductive ability and immunity in animals. In a broader study of the entire saiga population, A. Rey-Iglesia *et al.* (2022) indicate low genetic variability in the Tatar and Mongolian saiga species, both species also have a low percentage of heterozygosity in the main genes. These studies indicate a significant narrowing of diversity in saiga populations and a further increase in monozygosity may lead to the degeneration of the species. Therefore, when creating a herd in the nurseries "ASAR Live" and "Akboken", the selection of calves was carried out in significant territories of adjacent regions of Kazakhstan in order to expand genetic diversity. No more than two new-born animals were selected from the distribution area of one family. What could guarantee the absence of kinship ties between individuals in the livestock of the nursery. The other side of this approach was to ensure the veterinary well-being of nurseries from infectious problems.

Given the fact that the outbreak of pasteurellosis at one time almost destroyed the saiga population, a plan of veterinary and preventive measures was drawn up in the nurseries, which provides for the study of livestock for particularly dangerous diseases – brucellosis, FMD, which are indicated in their studies by W. Beauvais *et al.* (2019). Regular coprological examination for the presence of helminth eggs has also become a necessary area of research, since the parasites themselves are able to reduce the immunological status of animals and contribute to morbidity in the population. Thus, the nurseries at the Zhangir Khan University are a modern base for scientific and practical work on the

conservation of the biodiversity of local fauna, which is equipped with modern resources and facilities for conducting veterinary and environmental research. This allows conducting the entire range of work on the study of saigas of the Betpakdala and Ural populations in the conditions of established nurseries. It is a practical school for Kazakh scientists, undergraduates, and doctoral students of national higher educational institutions, where scientific research of ecological, biological and genetic directions is carried out, in compliance with the conditions of zoohygienic standards for the growing of animals in captivity. In this regard, the development and implementation of mechanisms for the conservation and regulation of the number of saigas is an urgent and in-demand task of modern Kazakh science.

Currently, work on the study of saigas in captivity continues. Recently, the main focus has been the investigation of molecular genetic DNA markers in the Betpakdala and Ural saiga populations. In the near future, it is planned to set up a modern genetic laboratory at the Zhangir Khan University to carry out diagnostic tests for diseases of various aetiologies, and to solve the following problems: genomic selection and genetic certification of saiga; identification and evaluation of markers of disease resistance; studying, evaluating, and adjusting the composition of the saiga microbiota, selecting the most effective diet for keeping in nurseries; studying and preserving the gene pool of the population of *Saiga tatarica*; creation of national genomic databases.

CONCLUSIONS

Based on the materials of the conducted research on organisational approaches to the creation of nurseries "ASAR Live" and "Akboken" to preserve the gene pool of the Betpakdala and Ural saiga populations (*Saiga tatarica*) and the development of healthy livestock, the several conclusions and suggestions can be made for future scientific work. An integrated approach to solving the problem of conservation of the saiga population has allowed the authors to develop a system of measures to regulate the number of migratory wild animals in the western regions of Kazakhstan. An analysis of the number of animals in the Ural and Betpakdala populations indicates stable growth in recent years. The increase in livestock in 2022 was more than 45% compared to their number in 2021. The developed mechanism for removing new-born saigas from the natural environment with the subsequent technology of feeding them allowed creating breeding stock with minimal adaptation and stress loads. And the developed feeding scheme for saigas allows obtaining average daily live weight gains in young animals of both populations at the level of 167-180 g from birth to 4 months.

The results obtained indicate high rates of growth and development of saiga calves in nursery conditions, at a level even higher than in natural conditions. The live weight of calves from birth to 4 months of age increased 6 times in both males and females. The developed veterinary and preventive approaches to the maintenance of saigas in the established nurseries allowed maintaining the number of interned animals at the level of 96.4-98.2% in the Betpakdala and Ural saiga populations, respectively. The created conditions for the animals of the Betpakdala population in the "ASAR Live" nursery allowed increasing the population of saigas from 150 units in 2022 to 230 units in 2023, given the fact that the herd consisted of new-born animals. Such results indicate the compliance of the created conditions for the breeding of saigas. In future studies, it is planned to investigate the genetic diversity of the saiga population in nurseries and develop molecular genetic markers characteristic of the rapid typing of animals of the Betpakdala and Ural populations.

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CONFLICT OF INTEREST

None.

REFERENCES

[1] Abdybekova, A.M., Kushaliev, K.Z., Sadenov, M.M., Usenov, Zh.T., Kuzhebaeva, U.Z., & Kozhaeva, A.R. (2021). Study of epizootiology indicators of helminth fauna in the Western region Kazakhstan. In *2nd international scientific and practical internet conference "Ways of science development in modern crisis conditions"* (pp. 123-125). Dnipro: WayScience.

[2] Abdybekova, A.M., Zhaksylykova, A.A., Kushaliyev, K.Z., Kidiraliyev, E.Z., Kozhayeva, A.R., Kuzhebayeva, U.Z., Grachev, A., Shevtsov, A., & Budke, C.M. (2023). A survey of the parasites of Ural saiga antelopes and Turkmenian kulans of Kazakhstan. *International Journal for Parasitology. Parasites and Wildlife*, 21, 232-236. doi: 10.1016/j.ijppaw.2023.06.006.

[3] Atemasova, T.A., Ronkin, V.I., Savchenko, G.O., & Sinna, O.I. (2023). Creation of the National Nature Park "Skhidnyi Steppe" as a means of preserving natural ecosystems in Northeastern Ukraine. *Journal of V.N. Karazin Kharkiv National University*, 40, 26-48. doi: 10.26565/2075-5457-2023-40-3.

[4] Baitanaev, O.A., Abaeva, K.T., & Kentbaev, E.Zh. (2014). Saiga antelope in Kazakhstan: Bottleneck effect? *Steppe Bulletin*, 40, 48-49.

[5] Beauvais, W., Zuther, S., Villeneuve, C., Kock, R., & Guitian, J. (2019). Rapidly assessing the risks of infectious diseases to wildlife species. *Royal Society Open Science*, 6(1), article number 181043. doi: 10.1098/rsos.181043.

[6] Blank, D., & Li, Y. (2021). Sustainable use of wildlife resources in Central Asia. *Regional Sustainability*, 2(2), 144-155. doi: 10.1016/j.regsus.2021.05.001.
[7] Chimeddorj, B., Buuveibaatar, B., Galsandorj, N., Dolgorjav, S., Myanganbuu, N., Bayandonoi, G., & Sundev, G. (2023). *From isolation to integration: Assessing habitat connectivity of the endangered saiga antelope in Mongolia*. doi: 10.21203/rs.3.rs-3257251/v1.
[8] Dimeyeva, L.A., Salmukhanbetova, Z.K., Malakhov, D.V., & Wunderlich, J. (2022). Rangeland diversity as a forage resource for wild ungulates in the Barsa Kelmes nature reserve (Kazakhstan). *Applied Ecology & Environmental Research*, 20(4), 2931-2962. doi: 10.15666/aeer/2004_29312962.
[9] Fereidouni, S., Freimanis, G.L., Orynbayev, M., Ribeca, P., Flannery, J., King, D.P., Zuther, S., Beer, M., Höper, D., Kydyrmanov, A., Karamendin, K., & Kock, R. (2019). Mass die-off of saiga antelopes, Kazakhstan, 2015. *Emerging Infectious Diseases*, 25(6), 1169-1176. doi: 10.3201/eid2506.180990.
[10] Grachev, J.A. (2022). Dynamics of the spatial structure of saiga populations in Kazakhstan. In *Proceedings of the IV international scientific conference "Biological Diversity of Asian Steppe"* (pp. 123-127). Kostanay: A. Baitursynov Kostanay Regional University.
[11] Havrylenko, V.S., Dudok, A.R., Mezinov, A.S., & Yasynetska, N.I. (2022). The formation of a sustainable saiga (*Saiga tatarica* Linnaeus, 1758) semi-free population in the biosphere reserve "Askania Nova", preservation and the peculiarities of its size management. *News Biosphere Reserve "Askania Nova"*, 24, 112-123. doi: 10.53904/1682-2374/2022-24/16.
[12] Jiang, Z., Mallon, D., Foggen, M., Li, C., Cui, S., Zeng, Y., & Ping, X.A. (2020). *Case of reintroducing saiga highlights the conservation needs of migratory species*. Retrieved from https://www.preprints.org/manuscript/202002.0375/v2.
[13] Kenesarina, K.Kh. (2019). Problems of studying and preserving the biodiversity of the city of Uralsk. *Bulletin of West Kazakhstan Innovation and Technology University*, 7, 146-150.
[14] Khanyari, M., Milner-Gulland, E.J., Oyanedel, R., Rose Vinee, H., Singh, N.J., Robinson, S., Salemgareyev, A., & Morgan, E.R. (2022). Investigating parasite dynamics of migratory ungulates for sustaining healthy populations: Application to critically-endangered saiga antelopes *Saiga tatarica*. *Biological Conservation*, 266, article number 109465. doi: 10.1016/j.biocon.2022.109465.
[15] Kushaliev, K.Zh., & Usenov, Zh.T. (2022). *Ecological and pathomorphological aspects of diseases of the saigas of the Ural population in the West Kazakhstan region*. Uralsk: Zhangir Khan University.
[16] Kushaliyev, K., Ussenov, Z., Alimbekov, S., Millakaev, O., Kozhayeva, A., & Khairushev, A. (2023). Study of the saiga helminth fauna and Ural sheep in the western region of Kazakhstan. *Open Veterinary Journal*, 13(4), 485-494. doi: 10.5455/OVJ.2023.v13.i4.11.
[17] Law of the Republic of Kazakhstan No. 160-I "On Environmental Protection". (1997). Retrieved from https://online.zakon.kz/Document/?doc_id=1008107.
[18] Law of the Republic of Kazakhstan No. 175-III "On Specially Protected Natural Areas". (2006). Retrieved from https://online.zakon.kz/Document/?doc_id=30063141.
[19] Law of the Republic of Kazakhstan No. 70-VII "On Ratification of the Protocol on the Conservation of Biological Diversity to the Framework Convention for the Protection of the Marine Environment of the Caspian Sea". (2021). Retrieved from https://adilet.zan.kz/rus/docs/Z2100000070.
[20] Liu, X., Mawolo, J.B., Du, X., Zhou, Y., Wang, H., Liu, F., He, Z., & Marela, H.A. (2019). Investigation of biochemical and physiological parameters of the newborn Saiga antelope (*Saiga tatarica*) in Gansu Province, China. *PLoS ONE*, 15(3), article number e0230095. doi: 10.1371/journal.pone.0224822.
[21] Memorandum of understanding concerning conservation, restoration and sustainable use of the saiga antelope (*Saiga tatarica tatarica*). (2021). Retrieved from https://www.informea.org/sites/default/files/treaties/TRE-144929.pdf.
[22] Milner-Gulland, E.J., Hughes, P., Bykova, E., Buuveibaatar, B., Chimeddorj, B., Karimova, T. Yu., Lushchekina, A.A., Salemgareyev, A., von Meibom, S., & Zuther, S. (2020). *The sustainable use of Saiga Antelopes: Perspectives and prospects*. London: CMS.
[23] Moon, D. (2023). Saiga antelopes (*Saiga tatarica*) in the environmental history of the Qazaq steppe and desert. In *Environmental humanities in central Asia* (pp. 107-128). London: Routledge.
[24] Mukantayev, K., Kanayev, D., Zhumabekova, S., Shevtsov, A., Tursunov, K., Mukanov, K., & Ramankulov, Y. (2022). Optimization of polymerase chain reaction for the identification of Roe deer, Saiga, and Siberian stag living in Kazakhstan. *Veterinary World*, 15(8), 2067-2071. doi: 10.14202/vetworld.2022.2067-2071.
[25] Nurushev, M., Nurusheva, A., & Baibagyssov, A. (2020). The role of climate change in the dynamics of the Kazakhstan population of saiga (*Saiga Tatarica* L.). *Global Journal of Ecology*, 5(1), 146-153. doi: 10.17352/gje.000034.

[26] Nurushev, M.Zh., Makysheva, A.D., Nurgalieva, A.Zh., Toiymbaeva, Zh.A., & Kasymbekov, N.Zh. (2022). Conservation of biodiversity as a goal of strategic development of Kazakhstan (methods of implementation). In *Proceedings of the IV international scientific conference "Biological Diversity of Asian Steppe"* (pp. 132-136). Kostanay: A. Baitursynov Kostanay Regional University.
[27] Pruvot, M., Fine, A.E., Hollinger, C., Strindberg, S., Damdinjav, B., Buuveibaatar, B., Chimeddorj, B., Bayandonoi, G., Khishgee, B., Sandag, B., Narmandakh, J., Jargalsaikhan, T., Bataa, B., McAloose, D., Shatar, M., Basan, G., Mahapatra, M., Selvaraj, M., Parida, S., Njeumi, F., Kock, R., & Shiilegdamba, E. (2020). Outbreak of peste des petits ruminants among critically endangered Mongolian saiga and other wild ungulates, Mongolia, 2016-2017. *Emerging Infectious Diseases*, 26(1), 51-62. doi: 10.3201/eid2601.181998.
[28] Rey-Iglesia, A., Hjort, J., Silva, T.L., Buuveibaatar, B., Dalannast, M., Ulziisaikhan, T., Chimeddorj, B., Espregueira-Themudo, G., & Campos, P.F. (2022). Genetic diversity of the endangered Mongolian saiga antelope *Saiga tatarica mongolica* (Artiodactyla: Bovidae) provides insights into conservation. *Biological Journal of the Linnean Society*, 137(1), 100-111. doi: 10.1093/biolinnean/blac074.
[29] Serikbayeva, A.T., Akimzhanov, D.S., Iskakova, Z.A., Karagoishin, Z., Akoyev, M.T., Dauletaliyev, T.N., & Baitanayev, O.A. (2023). Saiga (*Saiga tatarica*) conservation strategy in Kazakhstan. *Brazilian Journal of Biology*, 83, article number e275397. doi: 10.1590/1519-6984.275397.
[30] Shpigelman, M. (2023). Biocoenotic relationships of saigas with large birds of prey. *Raptors Conservation*, 2, 138-141. doi: 10.19074/1814-8654-2023-2-138-141.
[31] Suleymenova, M.T., Tazhiyeva, A.D., Polatbekova, G.A., Yesenbekova, A.Sh., & Oskenbayeva, U.E. (2017). The pecularities of distribution and ecology of Bokharan deer (*cervus elaphus*) on the territory of Syrdarya-Turkestan state regional natural park. *Science and World*, 44(4), 15-17.
[32] Taubaev, U., Ichshanova, A., Bayantassova, S., Nurzhanova, F, Shamshidin, A.S., Ulyanova, T.V., & Ulyanov, V.A. (2022). Determination of virulence of *pasteurella multocida* bacteria isolated from saiga in the West Kazakhstan region. *Science and Education*, 68(3-1), 169-178. doi: 10.56339/2305-9397-2022-3-1-169-178.
[33] Turlybekova, G.K., Turlybekova, A.A., Akhmetova, A.N., & Gorbacheva, D.A. (2017). Ecological features of saiga *Saiga tatarica* L. var. *tatarica* of Betpakdaly population of the Central Kazakhstan. *Bulletin of Karaganda University. Series: Biology. Medicine. Geography*, 85(1), 40-48.

Створення розсадників та ветеринарно-профілактичні заходи для сайгаків бетпакдалінської та уральської популяції в Казахстані

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Анотація. Збереження та підтримання біологічного розмаїття життя Землі одне з ключових завдань людства. Тому пошук та обґрунтування методів, які зможуть стабілізувати та збільшити чисельність видів тварин і рослин, що зникають, ключовий напрямок сучасної науки, полягали у розробці організаційних та ветеринарно-профілактичних підходів при розведенні сайгаків бетпакдалінської та уральської популяції в умовах розсадників «ASAR Live» та «Akboken» в Республіці Казахстан. Поголів'я розплідників формувалося шляхом інтернування вилучених із природної популяції новонароджених сайгаків. Контроль за зростанням та розвитком сайгачат проводили шляхом періодичного зважування та визначення середньодобового приросту ваги. Габаритні характеристики молодняку визначали шляхом добору промірів статей тіла. Стан здоров'я тварин в розпліднику контролювали шляхом визначення біохімічних та гематологічних показників – вміст білка, глюкози, холестерину. Апробація розробленої схеми годівлі новонароджених сайгачат у розплідниках виявилася досить ефективною, що підтвердилося високими середньодобовими приростами ваги на рівні 167-180 г до 4-х місячного віку і збільшенням живої ваги за цей період в 6 разів. При цьому збереження поголів'я тварин у розсадниках перебувало на рівні 97,3 %. Облік всіх необхідних параметрів для створення оптимальних умов для сайгаків у розпліднику дозволив вже в перший рік збільшити популяцію сайгаків зі 150 до 230 голів, враховуючи, що на момент формування стада воно складалося з новонароджених тварин. Комплексний підхід у вирішенні проблеми збереження місцевої популяції сайгаку в Казахстані дозволив розробити ефективну систему заходів, апробовану в розплідниках щодо збереження та розведення тварин бетпакдалінської та уральської популяції. Розроблені методи збереження зникаючої популяції татарського сайгака в розплідниках, крім репутаційного іміджу для Казахстану, як країни, що вирішила проблему з автохтонним видом фауни, містять рекомендації щодо формування популяції диких тварин з мінімальними стресовими та адаптаційними наслідками

Ключові слова: інтернування; схема годування; збереження біорізноманіття; біохімічні показники; проміри тіла