

## ACTUAL PROBLEMS OF PRESERVATION OF THE SAIGA (*SAIGA TATARICA* L.) IN KAZAKHSTAN

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### ABSTRACT

The analysis of dynamics of population of saiga in Kazakhstan testifies that in the first half of the last century under the influence of anthropogenous and ecological factors their number was at the critical level: no more than 3.0 thousand heads. After taking measures to a hunting ban in 1958-1998 this hoofed animal was one of the most numerous hunting-trade types with a population of 1.0 million heads. However, since 2000 years their livestock decreased at 3-10 times owing to unlimited hunting (poaching) and an epizooty of pasteurellosis, which caused a massive die-off.

According to authors the death of saigas from this infection is caused by decrease in the genetic variety which was caused by effect of "a bottle neck". Sharp falling of number of animals led to impoverishment of a gene pool and loss of immunity to this illness. It threatens to decrease in number of saigas soon to an absolute minimum.

For the purpose of preservation of a saiga authors offer a number of urgent measures. Among them implementation of unprecedented aviation vaccination of animals spraying of water solution of an anti-pasteurellosis vaccine of grassy vegetation from helicopters; carrying out genetic researches by DNA analysis methods for studying of genetic distinctions of population and search of the key genes controlling resistance of a species to an infection; realization of strategy of restoration of a genetic variety of a saiga interspecific crossing of nominal and Mongolian subspecies.

Only acceptance of the specified measures will allow keeping steadily a saiga as a species in fauna of mammals of Kazakhstan.

**KEYWORDS:** Saiga, Dynamics of number, Area, Epizooty, Pasteurellosis, Genetic variety, Effect of "a bottle neck", Vaccination, Population genetics, Dna analysis, Interspecific crossing.

### INTRODUCTION

Steady preservation of biological diversity, both in global and in regional aspect is the universal guarantor of existence of organic life on Earth. Kazakhstan in the course of work of Conference of the UN on environment and development signed in 1992 (Rio de Janeiro, Brazil, on July 3-4), and then in 1994 ratified the Convention on biological diversity. This document is fixed by the Resolution of the Cabinet of RK of August 19, 1994 at No. 918. Thereby legal need of the movement of the republic in the direction of preservation of live environment was confirmed. The special importance is gained by fauna of mammals as one of the most essential and vulnerable representatives of fauna in modern conditions. One of essential components of a biodiversity for preservation of in-situ of steppes and deserts is the saiga.

Saiga is the most ancient hoofed animal of Eurasia, the age-mate of a mammoth and woolly rhinoceros who endured a glacial era 20 thousand years ago. In Kazakhstan the most numerous animal among wild hoofed animals is the saiga – *Saiga tatarica* L. In the recent past, it was background specie of hoofed animals, which number exceeded 1.0 million heads. Nowadays three populations of saigas live in the republic, almost completely isolated from each other – betpak-dalinsk-aryssk, ustyurtsk and Ural (Afanasyev, *et al.*, 1953).

Until the end of the last century saigas were widely used as a trade species. Meat was in great demand at the population the skin went for production of high-quality suede. In five years (1981-1985) in Kazakhstan 900 thousand saigas are extracted, about 14 thousand tons of meat received. Production cost (including export of meat and horns) from

this animal made about 19 million rubles, and net profit 10 million rubles. Permissions to shooting were got three specialized State hunting industrial sectors of the republic which prepared various production (Afanasyev, *et al.*, 1953).

## FEATURES OF BIOLOGY

The saiga diet includes plants such as: anabasis (*Anabasis aphylla* L.), bug-infested (*Lepidium*), Kermek (*Limonium vulgare* MILL.), ephedra (*Ephedra distachya* L. 1753) and others who are reluctant or completely not eaten by farm animals.

Saigas are constantly wandering animals, within a year they overcome 3-4 thousand kilometers. The most constant and limited area for them wintering and mass lambing. Very weak contact with pets was noted owing to what the special competition between them is not present. Saigas often change pastures and, as a rule, only partially pit vegetation. Their diet consists of such plants, which are reluctant or completely not eaten by livestock (anabasis, bug-infested, Kermek, ephedra, etc.).

The most selective among pets is the horse. So, by our researches, on Ustyurt from 616 species of plants the aday horse ate only 77, i.e. only every eighth of all herbs. Whereas saigas of betpak-dalinsk population among the big range of vegetation (about 1000 types) of the lower reach of the river Sarytorgay consumed only 20 species of plants, i.e. selectivity of a saiga in a choice of vegetable food very high (1:50), eats only every fiftieth of variety of species of plants. Generally it is juicy grass: Salsola, Ephedra distachya, various species of wormwood (*Artemisia*), wheat grass comb (*Agropyron pectinatum*), Mortuk (*Eremopyrum triticeum*), Kentucky bluegrass (*Poa pratensis*), fescue (*Festuca valesiaca*), Kermek (*Limonium vulgar*), boyalych (*Salsola arbuscula*), Kokpek (*Atriplex cana*), Anabasis salsa (*Anabasis salsa*), kochia (*Kochia scoparia*), sorrel (*Rumex*), which accounted for 98% of the stomach contents. Careful analysis showed that most of them are not only nutritious, but medicinal properties.

If the most selective on vegetation among pets is the horse, eating every eighth of all the grasses, the saiga consumes only 20 of the thousands of species of steppe plants, i.e. every fiftieth. We found it out studying the food behavior of betpak-dalinsk population in lower reaches of the Sarytorgay River. Generally, it is juicy herbs: glassworts, an ephedra, different types of ice-holes, a wheat grass pectineal, Kentucky bluegrass, fescue, Kermek boyalych, Kokpek, Anabasis salsa, kohii, sorrel that made 98% of volume of contents of stomachs. Thus used in food only 12-23 Kg/hectare of vegetation a year (about 1.5-2% of a crop) while pets of 100 and more Kg/hectare (12-18%), it shows a weak load of pastures. The feeding capacity of pastures of the republic in full prosperity can provide an annual ration from 2 to 3 million saigas, without damaging the environment. They partially fertilize the soil, trample seeds, thanks to their hoofs there is a pollination of many rare plants, Steppe endemic. All this testifies to possible enormous prospects of cultivation of steppe antelopes in the territory of Kazakhstan not only as specific variety but also in the long term as trade type of hoofed animals (Baytanayev, *et al.*, 2014)

Thanks to their hoofs there is a pollination of many rare plants, steppe endemic. These materials testify to possible enormous prospects of dwelling of steppe antelopes in the territory of Kazakhstan, not only as specific variety, but also as trade type of hoofed animals.

In Kazakhstan under the influence of anthropogenous and ecological factors the saiga for the last decades is under real threat of disappearance. The first time by 2000 year of the last century only hundreds of individuals of these animals remained in the most remote natural boundaries of deserts Betpak-Dala, Ustyurt and the Volga-Ural interflaves. In this regard hunting for saigas was completely forbidden in 1919 as the rare endangered species was taken under protection. By fortieth years in the Central Kazakhstan it was possible to meet the herd of saigas numbering no more than several hundred individuals in everyone. Only one herd was noted in which there were more than 1000 animals (Baytanayev and Serikbayeva, 2014). In total on this interval of time about 2-3 thousand saigas lived in the republic.

After the taken measures by 1950 the saiga became object of trade hunting again. For 40 years (1958-1998) this hoofed animal was one of the most numerous hunting-trade types. Those years in their Kazakhstan lived about 1 million heads that was a source of million profits for national economy. For these years all 5.5 million saigas are extracted, 90 thousand tons of meat, 1.7 million sq.m. of the most valuable rawhide, 250 tons of horns – exclusively export production are received, the gained income from realization of saiga's trade averaged annually about 3.0 million US dollars (Bykov, 1967).

## MATERIALS AND METHODS

In the course of research were used such main methods as a descriptive method at a laying of the trial areas for collecting field material (biological objects), the description of habitats of saigas and other animal species; a comparative method – by comparison ecological and the epizootic processes also materials of own researches, the published works, including electronic resources (Baytanayev, *et al.*, 2014; Krasota, *et al.*, 2005; Li, 1955; Meka-Mechenko, *et al.*, 2014; Meldebekov, *et al.*, 2009; Meldebekov, *et al.*, 2014; Zietkievich, *et al.*, 1994; www.ztb.kz; www.plus.google.com).

## FEATURES POPULATION DYNAMICS

In the territory of Kazakhstan the main part (80-85%) of a modern world area of this species is concentrated. Insignificant fragments of area of distribution are available in the Russian Federation, Uzbekistan, Turkmenistan and Mongolia. Three geographical populations of saigas live in our republic: betpak-dalinsk (between Balkhash and the Aral Sea), ustyurtsk (between Aral and the Caspian Sea) and Ural (in interflaves of the Ural and Volga rivers). Some part of ustyurtsk population for the winter migrates to the South, to the neighboring Uzbekistan, and to a lesser extent to Turkmenistan. A certain part of the Ural population reaches the border regions of Russia. With approach of spring migration of animals is observed in the opposite direction on the territory of Kazakhstan.

For the last twenty years the area of a saiga was significantly reduced. These animals are practically disappeared or occur singly in the desert Moynkum, Northern and South Balkhash, and also on the most part Aral's Karakumov and Mangistau.

All three Kazakhstan populations considerably stood apart in territorial scale one from another, and their spatial distribution was strongly separate in the form of many small groups. They previously not stay for a long time in the same area even during calving and constantly wander (Bykov, 1967; Fadeyev, *et al.*, 1988).

The number of a saiga is subject to sharp fluctuations. If in 1991-1993 in Kazakhstan there were 800-900 thousand saigas, in the next six years decrease in their livestock proceeded (Table 1).

During the period from 2005 to 2009 in comparison with 2003 the number of these hoofed animals increased slightly that is a consequence of strengthening of security actions, and also, rather favorable weather and climatic factor on this interval of time. For example, the livestock of betpakdalinsk population increased from 32.3 thousand heads in 2008 to 45.2 thousand in 2009, i.e. for 39.9%. The number of ustyurt population of saigas for this period decreased by 1.2 thousand individuals and continues to decrease gradually. The main reason – inefficient protection and a considerable press of poaching in the territory of Uzbekistan where the saiga migrates on wintering during the winter period. On the contrary, the number of the Ural population increased from 18.3 thousand in 2008 to 26.6 thousand heads in 2009, i.e. for 45.3%. This tendency is observed in recent years when, for example, in 2015 their livestock already almost doubled.

Sharp recession of number of saigas was outlined, since 1988. So, in 1999 their quantity decreased to 34800, and in

**Table 1:** Dynamics of number of saigas in Kazakhstan for 17 summer period (1999-2015)

Years	Name of population, considered, thous.heads			Total
	Ural	Ustyrt	Betpakdalinsk	
1999	84,0	200,0	64,0	348,0
2000	17,5	116,0	150	148,0
2001	9,3	58,0	12,0	79,3
2002	6,9	19,1	4,0	30,0
2003	6,5	12,9	1,8	21,2
2004	8,8	15,0	6,9	30,7
2005	10,0	19,6	9,9	39,6
2006	12,8	17,8	16,8	47,4
2007	15,6	16,4	22,8	54,8
2008	18,3	10,4	32,3	61,0
2009	26,6	9,2	45,2	81,0
2010	39,1	4,9	53,4	97,4
2011	17,9	6,1	78,0	102,0
2012	20,9	6,5	110,1	137,5
2013	26,4	5,4	155,2	187,0
2014	39,0	1,7	216,0	256,7
2015	51,7	1,3	242,5	295,5

Note. The number of saigas by data of Consumer society "Okhotzoprom" by April 30 of the year accounting.

2003 reached a critical point – 21200 heads. Since 2010, the absolute number of saigas began to increase considerably. So, if in 2002-2009 their abundance varied from 30.0 to 81.0 thousand, by their 2015 295,5 thousand are considered already, i.e. is 3.6 times more. In a section of population it should be noted the steady growth of the Ural population of hoofed animals and gradual decrease in the Ustyurt. The major limiting factor of number of saigas on Ustyurt is anthropogenous, their considerable shooting in wintering places, as from the Kazakhstan, and Uzbek part of this plateau.

Places of the main dwelling of saigas, including sites of wintering, Lithuanians, and also a mass lambing occupies the valleys of the rivers Turgay, Zhilanshchik, Baykonyr, vicinities of lakes Teniz, Akkol, Shalkar-Teniz, Priaralsk Karakuma, Northern Ustyurt and a northwest half of the Volga-Ural interflaves (Bykov, 1967) now. Generally noted sites are the least economic mastered and remote from pasturable grounds of settlements.

In the territory of the Volga-Ural interflaves the main livestock of saigas is grouped in recent years in the Aralsors Lake, saline hollow where animals find for themselves the best feeding conditions (Fadeyev and Sludsky, 1982, Grachev, 2009). On Ustyurt these hoofed animals concentrate on a remnant-dining plateau, in sand Big and Small Badgers. On the slopes of the plateau remnant grows richly-motley grass vegetation, which provides a high nutritional value of pastures.

Sites of a mass lambing of saigas remained mainly former except for Betpakdala where because of sharp decrease in their livestock of considerable "maternity" congestions it isn't observed. Main place of lambing shifted far to the northwest, and most are located along the river Zhilanshik and the area between the river and Turgay Lake. Shalkar-Teniz and river Zhilanshik (Fadeyev and Sludsky, 1982).

On the Ustyurt plateau, as well as in former years, the main places of a lambing are vicinities of a well of Tassay, sorov: Asmantay-Matay, Kosbulak, Koshkarata and rivers Manesay and Shagan. Places of a mass lambing of saigas were displaced to the north also in Volga-Uralsk interflaves: to the northeast of the lake Aralsor and in Borsa's natural boundary.

As the area of a saiga was narrowed, there was a reduction and extent of its migratory ways. In the territory of the Volga-Ural interflaves distance between places of winter and their summer dwelling are located from the northern periphery of sandy massifs to frontier of Kazakhstan. That is, in the northwest it makes 150-200 km, on Ustyurt from border with Uzbekistan to river Zhem – 400-500 km and in the Central Kazakhstan from nizoviya of river of Sarysu to the conditional line of the lake of Sarykop – the lake Teniz of 400-600 km. Terms of spring and autumn migrations of saiga in general didn't change and still depend on weather climatic conditions of concrete year (Bykov, 1967; Fadeyev and Sludsky, 1982).

Saiga is a herd animal. The size of herd changes depending on a season of year and the general level of number of population. During the autumn and winter period there is a

crushing of herds that is connected with formation of harems. In the spring and in the summer, after reproduction the big herds making migrations on summer grounds are formed. In the period of the maximum number of saigas in the 70 years of the last century in April small herds (less than 50 individuals) made 35%, averages (to 500 individuals) – 30% and large (more than 500 individuals) – also 35% (Bykov, 1967; Fadeyev and Sludsky, 1982). At the low level of number in the 2000 years according to aviaaccounts Consumer society "Okhotzooptom" in April small herds made more than 85%, and averages – no more than 10.0% and large totaled in single quantities. Respectively sizes of congestions of saigas in lambing places also considerably decreased.

In the recent past the sexual and age structure of saigas was close to the optimum sizes corresponding to biology of species. For example, on Ustyurt in 1986-1987 in population totaled the 19.6-19.7% of adult males, 39.3-41.2% of adult females and 39.2-41.0% of young both floors (Grachev, 2009). In other words, the ratio of males and females made about 1:2 though on game management canons this size in optimum option allowed 1:3. However, in recent years, owing to strengthening of a press of poaching the sexual structure began to change promptly towards reduction of number of males. Poachers for the purpose of production of the horns, which are in the increased demand in the international market in mass number shot adult males. In some years in the disparate herds of saigas were registered only single males and some herds even appeared without them.

Conducting researches in June, 1986 and 1987 in lower reaches of the river Sarytorgay, we established that saigas very sensitively react to rainfall. After a long pouring rain only loner saigas met here. The similar behavior was registered in 1988 and 1989 (Baytanayev, et al., 2014).

Thus, it is necessary to state the general level of decrease in number of saigas in Kazakhstan, i.e. from 1.0 million to 100 thousand heads on average. Against sharp decrease in a livestock of betpakdalinsk population exponential growth in the Ural population is observed. And ustyurtsk population of these hoofed animals disappears too fast.

### MASS CASES OF SAIGAS

As well as any biological object, population of saigas it is subject to influence of the limiting factors which are traditionally subdivided on abiotic (weather and climatic and natural), biotic (predators, parasites, diseases) and anthropogenous (poaching, economic activity of the person). All specified factors in a varying degree cause sharp reductions of number of the studied hoofed animals on considerable part of an area. In the last decades (60 years), the essential reasons promoted death of saigas, numerous on scales, among which jutes, severe multisnow winters, and also an epizooty of a foot-and-mouth disease and pasteurellosis (Table 2).

During the 70-80th years of the last century mass cases of saigas in the territory of Kazakhstan occurred 8 times. So, in 1971/72, 1972/73, 1975/76, 1976/77, 1983/84, 1984/85, 1987/88, 1993/94. In 1971/72 by all republic about 400 thousand heads were lost, and in the winter of 1976/77 more than 100 thousand saigas fell. After winter of 1987/88 in

**Table 2:** The main reasons for a mass case of saigas (heads) in Kazakhstan during 1955-2015.

Years	Jute	Epizooty	
		Foot-and-mouth disease	Pasteurellosis
1955	-	+	-
1956	-	+	-
1958	-	+	-
1967	-	50 000	-
1969	-	+	-
1971/72	40 000	-	-
1972/73	+	-	-
1974	-	+	-
1975/76	+	-	-
1976/77	100 000	-	-
1981	-	-	100 000
1983/84	+	-	-
1984/85	+	-	-
1984	-	-	100 000-
1987/88	45 000	-	-
1988	-	-	440 000-
1993/94	+	-	-
1996/97	35 000	-	-
2010	-	-	12 000
2011	=	-	401
2012	-	-	3 000
2013	-	-	1 500
2015	-	-	148 800

Note. (+) - the number of the fallen animals isn't determined  
(-) – occasions are absent.

the desert Moyynkum, and also in the foothills of Chu-Iliy mountains occurred a case about 45 thousand hoofed animals. It should be noted that in arctic, multisnow winters perishes to 50-70% of the males who were taking part in rutting. It is known that during rutting males aren't grazed, they take females in temporary harems and spend a lot of energy for pairing (Fadeyev, et al., 1988; Grachev, 2009). In total from jute in Kazakhstan for 60 summer period by our estimates about 700 thousand saigas were lost.

Among diseases of saigas of the infectious nature on decrease to their livestock render a foot-and-mouth disease and pasteurellosis. Etiologies, exactly the presence of causative agents of a foot-and-mouth disease and pasteurellosis are proved by a bacteriological method, allocation of pure cultures from the fallen animals in 1956, 1958, 1967, 1969 and 1974. Among the dead mainly registered females and also young growth. The foot-and-mouth disease caused the greatest loss to betpakdalinsk population in 1967 when about 50 thousand saigas were lost (Fadeyev, et al., 1988).

Epizooty of pasteurellosis for the first time started registering since 1981. In total 8 cases of this infection are noted. In the territory of the Kostanay region in May, 1981 about 100 thousand, in May, 1988 and 2015 respectively 440,0 and 148,8 thousand saigas were lost. The last epizooty captured also Akmolinsk and Aktyubinsk areas. These are the most large-scale cases of a case. Also large epizooty took

place and in the West Kazakhstan region where in February-March, 1984 the death toll of hoofed animals exceeded 100,0 thousand heads.

In total from a foot-and-mouth disease and pasteurellosis for 60 summer period of observation in Kazakhstan respectively about 100,0 and 805,7 thousand saigas were lost. Generally, from three mentioned factors about 1,505 million heads were lost. Predation, mainly wolves has no so noticeable impact on populations of saigas. This factor has constant character and eliminates generally drop, old, sick, among them wounded, and also young individuals. In general, no more than 1-2% of population within a year are lost. Whereas from the above reasons the loss can reach the enormous sizes: from 10% to 50% of population.

Poaching, especially in the last decades, starts gaining crucial importance in decrease in number of saigas. Especially it is noticeable in ustyurtsk population where a livestock of hoofed animals in 2015 exceeded 1.0 thousand heads, and in comparison with 1999 decreased almost by 200 times. It is clear that scales of poaching can't objectively be estimated in quantitative expression. However, judging by frequent messages in mass media on detention of poachers with their catching the saiga carcasses and horns, this phenomenon has mass character till today. Ejection of manufacturing males (in days of a number depression their share in herds doesn't exceed 3,0-6,0%) poachers break an optimum ratio of floors, changing thereby reproductive ability of population. As a result fertility decreases as many females stay single, and rate of an annual gain or level of reproduction of a species also decreases (Bykov, 1967).

The last large-scale epizooty is noted in May, 2015 in the territory of three areas at once. First case of mortality (117th goal.) saigas was registered on May 11 in the natural boundary of the ZholabaZhangeldinsk Area of Kostanay region (Figure 1).

At the same time, mass case was noted in the Aktyubinsk and Akmolinsk areas. In total for June 22, 2015 148800 carcasses of saigas were utilized. From them in the Kostanay region 127775, Aktyubinsk 10358 and Akmolinsk 10667 heads.

Large-scale epizooty of pasteurellosis (May, 2015) caused ambiguous reaction and a rough public response. There were many hypotheses which interpret the version of the reasons



**Figure 1:** The mass death of saiga in the south Kostanay region.

of emergence of a mass case of a saiga. The majority of the version has the right for existence, until the true reason of this catastrophic natural phenomenon won't be established.

1. Tympany of a hem of saiga stomach occurs when there swelling owing to fermentation in it when eating a green grass.
2. The anaerobic enterotoxemia arising also while eating by animals of the juicy green grass moistened with a plentiful atmospheric precipitation. Fermentation of forage in a gastrointestinal tract of saigas provokes rough reproduction of the corresponding bacteria emitting the toxins getting through blood vessels into all internals, also striking a nervous system (Kock, et al., 2012).
3. Group of versions which try to explain cases of a saiga from infectious (bacteria and viruses) and parasitic diseases. It is intestinal clostridiosis; haemolytic septicemia; the epizootic hemorrhagic illness of the virus nature transmitted by blood-sucking mosquitoes; theileriasis, caused by the protozoan blood parasites. Their carriers ixode ticks (Ixodidae) of the sort Hyalomma; unknown to science virus infection; hemorrhagic septicemia or pasteurellosis (Grachev, 2009; Jenkins, 2001; Krasota, et al., 2005; Li, 1955; Meka-Mechenko, et. al., 2014; Meldebekov, et al., 2009).
4. Heptyl hypothesis according to which the death of saigas occurs owing to poisoning with rocket fuel heptyl which contains poisonous components at start of rockets from the Baikonur spaceport and other grounds.
5. The remnants of the Soviet biological weapons containing pathogenic microorganisms (the assumption of the astronaut T. Aubakirov).

The majority of the given hypotheses are rejected by researchers as not confirmed. For example, heptyl hypothesis according to which the death of saigas occurs owing to poisoning with rocket fuel heptyl, which contains poisonous components at start of rockets from the Baikonur spaceport including the remnants of the Soviet biological weapons containing pathogens are without scientific justification. The latest accident of the carrier rocket "Proton-M" took place on May 16th and the first death cases of Saiga noted earlier, on May 10-11 of 2015year, in a completely different area. In particular, according to Russian Agricultural Supervision in reference laboratory by especially dangerous diseases as a result of carried out on June 1-2, 2015 analyses of pathological material from saigas from Akmolinsk, Aktyubinsk and Kostanay areas in all tests Pasteruellamultocida a type B, the activator of a hemorrhagic ssepticemia or pasteurellosis is found. This illness also became the reason of a mass case of a saiga in Kazakhstan (Li, 1955). Finally from a timpany of a hem of a stomach and an anaerobic enterotoxemia somehow did not die pets, grazing near the saiga.

The first as the main was based on the climate change when in this zone in one week dropped out 3-4 norms of precipitation,

caused by the western cyclone change to the southern cyclone. Kazgidromet's data demonstrate the exceeding norm of precipitations on a place of the mass case of a saiga in the Kostanay region that was followed by a sharp fall of temperature and strengthening of a wind. Therefore, according to an area of meteorological station for the first decade of May dropped out from 17 to 75 millimeters of rainfall at norm of 8-10 mm. (Eki-dyn – 17 mm, Railway – 35 mm, Zhitigara – 75 mm and Karabalyk – 53 mm). These stations are located in ways of migration of betpak-dalinsky population.

Certainly, it is the major factor, which caused a sharp tympanum of a hem of a stomach of a saiga with transition to an anaerobic enterotoxemia and pasteurellosis. The illness is caused by eating animals of the juicy green grass moistened with a plentiful atmospheric precipitation. Fermentation of food in the digestive system stimulates rapid reproduction of the corresponding bacteria (swelling) emitting the toxins which gets through the blood vessels and internals, striking the nervous system (Table 3).

A significant weakening of the maternal organism of saiga was promoted also by age biology of a fetus. In the last month of pregnancy the mass of a fetus increases in weight twice. In the bulk the maternal livestock fell, and their certain quantity fell at a stage of childbirth.

Sharp decrease in immunity of an animal brings to pasteurellosis (pasteurellosis; a synonym of a hemorrhagic septicemia) – the infectious disease relating to group of zoonoses, proceeding as a septic disease. The causative agent of pasteurellosis are Pasteurella bacteria of families Brucellaceae. They possess pathogenicity. The disease is followed by a septicemia, symptoms of damage of the top airways and enteritis. The carriage of bacilli is very widespread.

Thus, among all set of the abiotic, biotic and anthropogenous factors making the limiting impact on population of saigas, first of all a pasteurellosis epizooty has the most essential value biotic.

## EFFECT OF "A BOTTLE NECK"

Pasteurellosis epizooty often arises in May when saigas lambing comes to an end. Females, which already gave birth, and their newborn posterity are physically weak for some time. The exhausted gene pool of population causes weakening of the general immunity of this species. Decrease in resilience of an organism to the banal microflora, pasterella (which are often present at an organism of healthy animals), provokes fast increase of a virulence of these microbes and as a result a high lethality of individuals of saigas (females and an offspring).

In our opinion exhaustion of a gene pool of a saiga is caused by close inbreeding (closely related crossing) of individuals in a lineage for the last 60 years. Initial Kazakhstan population of saigas in the late forties of the XX century didn't exceed 2-3 thousand heads. This phenomenon in population of animals in genetics is called effect of "a bottle neck".

The concept of effect of "a bottle neck" reflects sharp decrease in a genetic variety or a gene pool of population that occurs between two next cycles of dynamics of number (critical recession and rise). The curve of the presence of livestock in the most narrow part similar to a bottle neck and got such figurative name.

Initially, the multiplicity and breadth of the area of population has the highest and peculiar to it genetic diversity. And at catastrophic decrease in its number, in the conditions of an unregulated press of hunting or adverse ecological factors, there is an impoverishment of a gene pool of a species. Further, there are conditions for inbreeding and a casual variation of frequencies of alleles in a genotype.

The analysis of history of dynamics of population of a saiga in Kazakhstan shows existence of double effect of "a bottle neck". The first took place in the 40-50th of the XX century. However in the 50th years, thanks to the taken measures for a hunting ban their number quickly increased and reached 1.0 million heads. Then trade was organized.

**Table 3:** The sums of an atmospheric precipitation (May, 2015) according to meteorological stations Kostanay region, mm

Station	Area	Index	Norm	May (decade)		
			Fact	I	II	III
Arshalinsk temporary storage warehouses	Denisov	28948	Norm	9	10	13
Arshalinsk temporary storage warehouses	Denisov		Fact	57	35	12
Dokuchaevka atmospheric weather service	Altynsarinsk	63517	Norm	10	7	12
Dokuchaevka atmospheric weather service	Altynsarinsk		Fact	43	50	14
Esenkul	Karabalyk	63506	Norm	9	10	13
Esenkul	Karabalyk		Fact	64	20	10
Railway (Zheleznodorozhnyi)	Karasu	35064	Norm	9	8	14
Railway Zheleznodorozhnyi)	Karasu		Fact	35	17	8
Zhitigara	Zhetikary	35042	Norm	8	11	14
Zhitigara	Zhetikary		Fact	75	19	13
Kamysty	Kamystinsk	63509	Norm	9	10	13
Kamysty	Kamystinsk		Fact	64	20	13
Karabalyk	Karabalyk	28843	Norm	9	10	11
Karabalyk	Kamystinsk		Fact	53	27	4

The second effect of "a bottle neck" arose during the period from 1990 to 2003 when the number of a saiga from about 1.0 million fell to 21.3 thousand heads mainly from poaching. The number of antelopes was reduced by 97.9%. Restoration of number of the saiga which was twice on the verge of disappearance was followed also by double decrease in a genetic variety of the species caused by effect of "a bottle neck". Impoverishment of a genetic variety, as a rule, conducts a species to extinction. The effect of "a bottle neck" affects by laws of genetics mainly viability of animals. Earlier it was proved on the example of cheetahs. The similar situation led them to sensitivity and diseases.

In the conditions of a depression of number of saigas close inbreeding of crossing of "fathers" with "daughters", "sons" with "mothers" and "brothers" with "sisters", and also inbreeding of the 2nd order when crossing cousin relatives, gradually led to loss of a number of alleles in loci of chromosomes. For example, alleles responsible for immunity of an organism in relation to some infections. And also "damages" of the loci conducting to other diseases of the genetic nature.

Mass pasteurellosis epizooty, and also it is possible other infections, for example a foot-and-mouth disease can repeat among populations of the saigas which are already allocated with weak immunity as a result of effect of "a bottle neck". And in the next decades their number can decrease to the minimum sizes.

In our point of view, "feeding" the population of saigas with salmonella bacteria initially happened in the territory of deserts Moyynkum, Kyzyl Kum and Ustyurt where there are combined natural centers of plague and pasteurellosis. In the period of the highest number of the studied antelopes, they wintered exactly there. Since 60th years of the last century, strains of pasteurellosis allocated from big sandworts according to all Moyynkum, and also in the northwest of Kyzyl Kum and northern part of an Ustyurt plateau. In this interval of time their genetic variety was at high level and therefore cases of mass diseases of pasteurellosis isn't noted. And only from 80th years the outbreaks of a pasteurellosis infection at a saiga as a result of action of effect "a bottle neck" began to arise. Meanwhile the Moyynkum center continues to be active in present time also. So, from 2010 to 2015 only from a big sandwort the antiplague service isolated 285 strains of the causative agent of plague. Unfortunately researches on pasteurellosis were conducted irregularly. In the Kyzylkum only in 2015 in its south-eastern part at serological research of 410 rodents in 3 cases of test on pasteurellosis were positive. Therefore we can confidently say about activization of the combined centers of plague and a pasteurellosis.

To date, there is only one experimental study on the susceptibility and immunity of animals to pasteurellosis, L. T. Bykov and others in this publication for the first time assumed that extinction of big sandworts in Moyynkum comes from this infection. Some experiments were also made for the purpose of verification of this assumption. It is established that at alimentary infection of rodents with different doses of *Pasteurella* occurred their survival. And only after

provocation (bathing in cold water) from 15 sandworts 3 or 20,0% fell. From them cultures of the causative agent of pasteurellosis from all bodies, and also urine and excrement are allocated. Unfavorable living conditions for most of sandworts, such as overcooling, promotes the sharp course of the infectious process which is followed by their death. The same happened to saigas. In the spring at a sharp cold snap, accompanied by rains, they overcooled, weakened and developed pasteurellosis that led to a mass case. The starting mechanism is the called genetic syndrome. Therefore if in May 2016 in places of their mass lambing there will be a cold and rainy weather, the death of saigas from pasteurellosis is inevitable. Such a the negative forecast. In this case there is an urgent problem-how to avoid new death of animals, to keep population and that is necessary to undertake.

The saiga under the influence of the person began to possess, as well as any breed of animals depleted by gene pool. The only difference is that the selection or by thoroughbred breeding cultivation inbreeding is applied purposefully, and in the case of the saiga it happens compelled, because of a population depression. Therefore need of a compulsory forced inbreeding (interrelated crossing), as a rule, conducts to weakening of a gene pool. Nowadays saigas turned with all consequences, from a species to breed. Among them: vaccinal prevention against infectious diseases, treatment of sick animals, and also traditional zootechnical actions. Therefore there is a task to carry a saiga from a condition of breed back to a bosom of a species (Williams, *et al.*, 1990; Zietkiewicz, *et al.*, 1994).

O. B. Pereladova considers that it isn't necessary to be afraid of effect of "a bottle neck". In her opinion during two-three generations there is a rejection of recessive genes and surge in variability because of unclear reasons, but the fact is established ([www.ztb.kz](http://www.ztb.kz); [www.inform.kz](http://www.inform.kz)). In particular, the example is given that for the last 12 years population of saigas in Betpakdala increased by 50 times, i.e. with 3 to 150 thousand. However, the author held back that here in 2012 and 2013 the mass case of antelopes—about 4500 heads took place. If there was "a rejection of recessive genes", what price? In this regard strategy of minimization of effect of "a bottle neck" is necessary. In essence rescue of a saiga as endangered species of mammals in fauna of Kazakhstan is required.

## URGENT MEASURES FOR PRESERVATION OF SAIGA

Currently the saiga is exposed to continuous threat of developing of a mass epizooty of pasteurellosis, owing to easing of immunity against this infection. The reason is exhaustion of a genetic variety of the species caused by effect of "a bottle neck". On the basis of the conducted researches, we consider necessary carrying out the following urgent measures:

1. To carry out spraying of water solution with a saiga serotype of the anti-pasteurellosis vaccine developed at faculty of veterinary science of the Kazakh national agricultural university from helicopters at the small height of grassy vegetation. The unprecedented avia vaccination should be carried out in April in territories

of a mass lambing of saigas. After eating animals of the grass processed by a vaccine in their organism develop resistant immunity against pasteurellosis within several months. It will give to saigas the chance to endure the adverse period of year.

2. To create comfortable conditions to a uterine livestock for childbirth in places of a mass lambing, especially to strengthen the protection of "rest zones". In such zones any economic activity (a cattle pasture, movement of cars, etc.) 10-15 days before a lambing and 15-20 days after that has to be forbidden. An urgent task is fight against wolves and stray dogs.
3. For confirmation or a denial of a genetic syndrome to conduct researches in the field of population genetics of a saiga. For this purpose on the basis of the Kazakhstan-Japanese innovative center at the Kazakh national agricultural university to realize the project on this subject. This center is equipped with high-precision devices and the modern equipment allowing to conduct gene and molecular researches. First of all, on the basis of test system to study genetic distinctions of populations of a saiga with use the multilocus DNA markers, ISSR test systems for search of the key genes controlling resistance of a species to infectious diseases ([www.kaztag.kz](http://www.kaztag.kz); [www.dixinews.kz](http://www.dixinews.kz)).
4. To carry out the strategy of restoration of a genetic variety of a saiga by intraspecific crossing of Kazakhstan (S.t. tatarica) and Mongolian (S.t. mongolica) subspecies. Expediently "cast-blood" in small volumes, about 100-200 Mongolian saigas for replenishment of the exhausted gene pool. Further they will simply "be dissolved" in nominal subspecies and initial subspecific accessory remains without changes. It should be noted that genetic variety of the Mongolian saigas are normal as there wasn't noted effect of "a bottle neck" and their number smoothly decreased to depressive level for many decades. Unfortunately, their number now is very low also there's a fear that this species of a saiga can disappear.
5. To make experiments on infection of saigas with the causative agent of pasteurellosis in norm and the subsequent their overcooling (their bathing in cold water) for studying of a course of infectious process at various temperature and humidity.
6. It is necessary to provide coordination of scientific maintenance which higher education institution (university) can afford and where experts are exist and where is possible space monitoring. All these composed are inherent in the Eurasian National university by L. N. Gumilyov (Astana) – to a recognized leader of domestic science and education (the first place in a rating of higher education institutions of the republic). Exactly they have to be coordinators of the Program for rescue of saigas.

Only acceptance of the specified measures can give the chance to steadily keep a saiga as a species in fauna of mammals of Kazakhstan.

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