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Improvement of the elk domestication technology at Sumarokovsky State Nature Reserve

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Abstract. The paper discusses the technology of elk domestication and measures for its improvement at Sumarokovsky state nature reserve, the largest world center for the domestication of elks, as well as an environmental, research, cultural and educational institution. The article contains the data on ethological observations, the evolution of elk behavior in the conditions of ecological tourism, on elk keeping and on the conditions of the food base, on technological processes and suggests possible ways to correct them. It has the description of the organizational structure of the reserve, of the forestlands around and of their forage capacity; gives information about the vegetation composition, the mode of keeping and feeding elks. The reserve, due to its presence in a specially protected area, experiences significant restrictions on forest use on its territory, which leads to a deterioration and decrease in the area and quality of forage land for domesticated elks. The article shows the necessity of improving the regulatory framework as well as of the development and implementation of biotechnological measures to preserve and increase the forage capacity of frestland. It also shows that the technological chain of domestication makes it possible to get a controlled, stress-resistant, calm, friendly and safe animal, to carry out the selection period for the formation of dairy herds earlier, to obtain unique milk with both high nutritional and medicinal properties. Considering the fact that the largest number of domesticated elks in the world is concentrated in the reserve, the technology there is unique. Because of the potential danger of an elk as a source of human infection with various pathogens, the veterinary service requires intensification. It includes monitoring, development of treatment methods, drug application, prevention and control measures for diseases, provision of normative documents, etc. A change in the elk domestication technology under the increasing role of ecological tourism has led to the formation of a new economical type of a reserve, which combines elements of a stationary-exit, multidisciplinary and enclosure types.

Key words: domestication, elk, elk farm.

INTRODUCTION

First attempts to domesticate elks date back to ancient times, as evidenced by cave paintings in the valleys of Siberian Rivers. The information about it appeared later in the Baltic countries, Scandinavia and other regions. However, they were random in nature. Purposeful work in this direction began in the last century in Russia. The first experiments on domestication of elks started in the Moscow Zoo by P.A. Manteifel, and later were continued in the Serpukhov experimental hunting farm. L.G. Kaplanov and S.N. Popov carried out a similar work in Western Siberia. The work of E.P. Knorre from 1937 to 1941 is also of great importance. In the reserve 'Buzuluksky Bor' he first introduced the system of keeping elks on free pasture

The biological and economic features of the European elk are unique. They allow considering this animal as promising for the livestock sector. The moose has a significant weight (up to 500 kg), early maturity, multiple fertility, unpretentiousness, accessibility to a wide range of rough branch feed and forest forbs. A variety of products can be obtained from elks - meat, skin, horns, antlers for the extraction of pantocrine (Baranov et al., 2010; Sokolov, 2012). At first glance, such products are more economically viable when hunting for wild elks, and can be obtained in larger volumes. Products from domesticated elks are very expensive, and their output is very small (Sokolov, 2012). This suggests the unprofitability of elk farming, economic insolvency, and the unjustified costs of domestication of the animal. However, elk domestication is determined by the uniqueness of the main product received from it - milk, which is now also applied in humane medicine. In addition, the elk itself is an object of scientific research and, largely, of meeting the needs of human communication with nature. It has led to the formation of a new direction - ecological tourism.

Elk breeding as an industry in Russia has two directions. The first is the organization of elk farms in the Gorky, Yaroslavl, Ivanovo and other regions according to the principle of traditional livestock farming with a concentration of livestock in limited areas. Limited areas help to reduce the cost of production. The second direction is the formation of elk farms as an integral part of the scientific units: Pechoro-Ilychsky reserve and the elk farm of the Kostroma state regional agricultural station (currently division of 'Sumarokovskiy' state nature reserve) (Smirnov, 2015).

Four types represent elk farms focused on industrial livestock breeding. The stationary multidisciplinary type exploits specific territories based on the long-term use of a compound feed base. The stationary exiting type has stationary objects, permanent fodder territories, where elk calves move from summer to winter camps. Forest-nomadic type is designed for a year-round use of the forage base, using portable hedges, and cutting down elks of all ages in groups. Enclosure type is a purely tourist option that does not have industrial significance due to the high cost of production (Baranov et al., 2010).

In all cases, elk breeding technology has a high concentration of animals in limited areas, which leads to depletion of the food supply, violation of the hygienic standards, and insufficient supply of natural feed. Farms also need additional supply with imported animals, which raises the cost of production. Among the difficulties, there is also intensification of the work of the veterinary service due to animals' metabolic disorders, surgical pathologies, and massive diseases of the newborn. Attempts to expand the territories of fodder resources by allowing free grazing outside or by creating giant pens

will lead to a decrease in the efficiency of elk domestication. Animals prone to vagrancy may leave the farm and, as a result, the farm will have a loss of a domesticated livestock due to predators - wolves and poachers (Baranov, 2015).

E. Knorre laid the scientific basis for the implementation of elk domestication of the second direction in 1949 on the elk farm of Pechora-Ilychsky Reserve in the Komi Autonomous Soviet Socialist Republic. He showed the possibility of elk domestication in conditions created by human and developed methods for imprinting elk calves at the tutor and their further manual feeding. E. Knorre paid considerable attention to environmental issues, behavior, physiology, feeding, milk productivity and the quality of elk milk as well as to the development of methods for the prevention and treatment of diseases of various etiologies (Knorre, 1959, 1961; Kozhukhov, 1973). Further experiments on the elk domestication continued in the Sumarokovsky elk farm in the Kostroma region. The work of Mikhailov, Dzhurovich, Vitakova, Baranov, Sokolov and other employees made a significant contribution to the study of the elk biology: behavior, reproduction, morphology. They determined individual physiological and biological indicators, developed machine milking of elks, methods of preserving milk, etc. They developed and implemented in practice the technology of rearing the young animals and keeping the adult, including: imprinting the newborn calves to humans; overexposure of the newborn calves for 2–6 weeks in boxes and then up to 6 months of age in a summer camp, their further transfer to the winter camp when they get one-year-old; keeping in corrals grazing and milking. (Mikhailov, 1973; Dzhurovich et al., 1984; Smirnov, 2015).

In recent years, the elk domestication technology has changed again. The aim of this research is to analyze the new technology and to identify possible ways of its improvement in the reserve.

MATERIALS AND METHODS

The studies were carried out in 2017–2019 at Sumarokovsky nature reserve, which is an experienced elk farm, an elk sanctuary and a forest site. The object of the study is the European elk (Alces alces L).

The research consisted in observation of elks (over 1,200 hours). In total 146 animals took part in it: 57 elk cows; 63 calves (32 females, 21 males); 15 adolescents of first year (12 females, 3 males) and 11 adolescents of second year (8 females, 3 males). Studies included ethological observations, studying the evolution of the behavioral foundations of domesticated elks of various age groups, assessing the food supply, conditions, technological processes and possible ways to correct them.

Currently, the behavior of elks in the farm is accessed by visual observations, by the analysis of photo and video materials, taking into account aggressive and ‘friendly’ actions to a person. As the reserve is at the same time a tourist object, the main attention is paid to collecting materials on the behavior of animals in the presence of tourists. A calf gets excluded from the list of applicants to the milking herd if, when being visited by a group of tourists in the contact pen, it shows excessive aggressiveness (butting, attacking a person, etc.) or, conversely, avoided communication, is shy when crowding a group of people, runs away, etc. Credulity, curiosity, nonfearfulness, lack of aggression towards humans are regarded as positive criteria during the selection for the milking herd.

Elks on the farm are monitored by radio-tagging according to Minaev & Purikov (2015). Similarly to the IQRF-monitoring system of cattle (Hartova & Hart, 2018), the

method allows to determine the location of animals with an accuracy of several meters. The methods are equal, but in first case the data transmission is carried out in a more economical mode and the equipment can operate in unlicensed frequency ranges.The paper has some archival materials of the reserve as well.

RESULTS AND DISCUSSION

The reserve is an environmental protection center, a unique research center and an educational institution, contributing to the formation of a new direction - ecological tourism. The boundary borders of the reserve include an area of 40,391 ha. The area of the reserve itself is 36,176 hectares, including forestry lands – 9,989.2 hectares and agricultural lands – 26,186.8 hectares. The lands located in the district borders of the reserve, but not included in it count 4,215 hectares. Large forests cover about 52% of the territory. The farmland is interspersed with coppices, clumps of shrubs with the dominance of willow, birch, and alder.

On the territory of the reserve there are 86 settlements (the village of Gridino, the village of Bogovarovo, the village of Sumarokovo, Kharitonovo, Khalipino, etc.), and the land near them is used for grazing. This makes the contact between elks and domestic livestock, and vice versa possible, which to a certain extent determines infectious diseases among them. Invasive diseases are of particular danger. Their hosts are lynxes, wolves, bears, and especially dogs that use slaughter and other wastes for food.

In spring (during calving), the number of elks varies between 40–50 heads, and by winter it decreases to 25–30 due to the sale of young animals. Over the observation period, the reserve obtained 63 calves and sold 71% of them to other reserves and zoos.

Elk farming can be successfully developed only in regions with a sufficient supply and diversity of fodder plants. As Baranov et al. (2015; 2010) say, the fodder land should be accessible to elks, protected from adverse climatic conditions, bloodsucking insects and predators. Remote inaccessible forest areas are the most consistent with these requirements. They are less susceptible to anthropogenic impact and have maximum protective properties. Sumarokovsky elk farm belongs to the group of so-called mosaic lands represented by forests around the regional center, which are protected with fields, meadows and other cultural areas. They are a subject to significant anthropogenic influences and require constant protection from poachers, as well as from packs of feral dogs. Because of this, the farm annually loses 2–3 elk individuals. The forestlands correspond to the III class of bonitet, with the number of about three elk individuals per 100 ha (IV class of bonitet has a critical density of elks of 7–10 animals per specified area) (Baranov et al., 2010 and Shabrov, 2015).

The vegetation composition in the area of the elk farm is represented by 231 species, incl. 89 species used by elks as feed. Animals prefer soft tree species, especially aspen according to Brough et al. (2017), as well as willow, birch, mountain ash, bird cherry, etc., less readily - spruce. The diets may also include aquatic and semi-aquatic plants – codfish, water lilies, horsetail growing on cutting areas – fireweed, sorrel, umbellate, and mushroom, berries, lingberry, and blueberry branches closer to autumn.

Although the elk is a food flexible animal, and with a lack of feed it can switch to food with relatively new plants, there is still a need to feed them. This question is especially acute when concentrating the entire herd in a winter camp, when elks can use only branches and aspen bark for food (independently, only during thaws). In this regard,

young calves and milking queens are fed according to the season of the year during the daytime with green grass (fireweed, meadowsweet, clover, etc.), branch feed of aspen, willow, birch etc., freshly cut aspen bark, steamed oats, etc. In winter, the camp feeding grounds are equipped for these purposes with a cut material, which requires additional processing for sanding aspen logs. Largely it increases the cost of production.

Because of the long-term use of enclosures, elks do not leave the camp for a long time and the food supply is greatly depleted. Restriction of forest use on the territory of the reserve due to entering the recreation zone of Kostroma leads to a deterioration of forestland for elk domestication. The territories with overgrown plantings get bigger (Shabrov, 2015). In this regard, it is necessary to improve the regulatory work aimed at the development and implementation of biotechnological measures to preserve and increase the forage capacity of forestland, taking into account the interests of the forestry and the reserve. As one of the options, this could be the creation of large forage pens for the formation of a forage base for grazing and feeding elks with annual alternation. It is also possible to resolve the issue of engaging the forests of the reserve for harvesting wood in a planned manner, using felling material for elk feed, but followed by forest inventory (planting willow, aspen, shrubs and other fodder plants).

Taking into account elk groups, different modes of keeping and feeding animals were developed at the elk farm: a box-pavilion mode (for newborns where they are kept with the mothers for several hours and for calves up to 3–6 weeks of age), summer and winter camp-pasture modes, a free pasture mode and a corral mode. The analysis showed that the main technological technique is the organization of elk keeping in natural conditions.

Below there is a diagram of elk keeping depending on the age and calendar time with a more detailed description of the techniques used in this case.

Farm modes based on the age and calendar time:

1. Newborn elks (birth time is the end of April - beginning of May) - within 3–4 hours after birth with the mother, and then weaned.

2. After weaning from the mother until June 1 (up to 3–6 weeks of age) - a veranda with a canopy and a limited paddock for walking (‘nursery’ with the access only to service personnel in replaceable clothes).

3. From June 1 to mid-January (from 3–6 weeks to 8–9 months of age) - ‘kindergarten’ for young animals, from 10:00 to 15:00 - in the pen, from 15:00 to morning - grazing.

4. From mid-January to mid-April (from 8–9 - to 11–12 months of age) - in the winter camp.

5. From mid-April to mid-January (from 12 to 21 months of age) - adolescents (one year old) are kept in the pen.

6. From mid-January to mid-April (from 21 to 24 months of age) - teenagers (one and a half year old) are kept in a winter camp.

7. From mid-April to August- September (age from 24 to 29 months) - teenagers (two years old) are kept in the pen. Selective - free grazing.

8. From August - September to mid-April (elks and female teenagers 2.5 years of age) are in the summer-winter camp, free-range.

9. Pregnant animals (queens, two-year-old adolescents) two weeks before calving (mainly in mid-April) are in the maternity pad, after calving (three days after the birth) - from 8:00–10:00 to 18:00 in the milking pad (May-August), from 18:00 to 8:00–10:00

- free range. From September until the first half of January - free-range in the summer-autumn camp. From the second half of January up to mid-April - in the winter camp.

As can be seen from the scheme (item 9), mainly in mid-April, all adult and young elk queens that can potentially bring offspring (usually teenage females of sufficient fatness and development at the age of 2 years) are temporarily placed in a maternity shelter with an area of about 4 ha. Before giving birth (in a few hours, days) a pregnant elk cow usually begins to worry - it tries to find a way out of the corral in order to bring offspring away from everyone. Neither before nor after childbirth, she lets anyone in, protecting the future calf. Employees (milking technologists) are waiting for the onset of labor, during which the elk's attention is dulled and people can calmly approach her to attend the birth. This allows them to fall into the so-called 'inner circle'. Milkmaids take a calf and give it a suck on the udder, the first servings of colostrum. After 3–4 hours (leaving elk calves for a longer period with the mother is impractical for domestication) the calf is hidden from the mother and taken away from the paddock and transferred for further care to the caregiver (baby rearing technologist and research assistant) in the 'nursery'. The milkmaid immediately returns to the elk and continues to milk it and let it sniff and lick the traces of the afterbirth from her hands. According to these criteria (appearance at the time of birth, the presence of the smell of a newborn) the elk captures the person as cubs. Having accepted the milkmaid for a calf, an elk cow remembers her personal smell, voice, appearance and even gait and later will distinguish this employee from others.

The first stage of domestication is imprinting. It consists in developing a newborn calf after weaning the imprint of the educator instead of the elk cow (Sokolov, 2012). The foundations of the future attitude of the elk to humans start from the first feeding from the nipple drinkers and at least five times daily (up to 1.5–2 liters).

Weaned elk calves live in a separate box up to 6 days of age, and then move to an enclosure, where they are taught to eat green feed, red clay (a natural source of minerals). (Figs 2, 3).

Figure 1. Teaching calves to the nipple.

Figure 2. Teaching calves to green feed.

Figure 3. Teaching calves to additional mineral forage.

At the age of one month, when they begin to consume green food actively (branches of trees and shrubs, grass), table salt is introduced into the diet, and the assembled elk milk is replaced with a substitute for whole milk, which is drunk from a separate bowl.

On June, 1 elk calves move to a summer camp ('kindergarten') - a barn equipped with feeders and drinking bowls. During this period, combining paddock content with grazing, they develop the skills of submission to a person during grazing, learn to follow a person, get skills of behavior in a group (Figs 4, 5).

Figure 4. Calves in the summer camp.

Figure 5. Obedience to man (following the tutor).

This educational scheme consists in focusing elk calves on one person (as a disadvantage), so when they meet strangers this may lead to an inadequate response (from fear to aggression).

The involvement of ecotourism has led to a change in the technological process of raising elk calves (earlier contact with strangers and targeted selection of elk calves to form a dairy herd), as well as to a change in the behavior of domesticated young animals.

Guided tours in small groups started to visit the farm in 1997/98. Every year, the flow of tourists increased due to individual visitors. So in 2000, 750 people visited the reserve, in 2014 about 40 thousand people, and in 2019 more than 50 thousand people. At the same time, the form of their communication with elks has changed. At first, visitors were admitted to the elks without any hedge, accompanied by specialists. Subsequently, taking into account the safety requirements, a tourist zone was allocated where adult animals can be fed through the hedge (Elokhina & Elokhin, 2015).

Currently, tourists are allowed to communicate with elk cubs from 1.5 months of age (they can go into the pen, but it is forbidden to touch and feed the animals). From 2 months before moving to a winter camp tourists can touch, but cannot feed. (Fig. 6, 7)

Figure 6. Contact with tourists.

Figure 7. Calves in the winter camp.

This technique causes significant changes in the behavior of the young animals. Being in the tourist's attention zone, elk calves become less aggressive, less afraid of a large number of people, screams, camera flashes, noises and traffic (domesticated elks do not get into car accidents), i.e. they become more socialized. This allowed farm employees to evaluate the behavior of young animals in relation to humans, and to conduct an earlier selection for the formation of dairy herds. Observations established that already in the first six months of life people can determine the nature of the calf

without economically expending it for growing up to 2–3 years (at this age, the elk gives its first offspring).

Along with this, elks become more stress-resistant. Before some of them reacted negatively to any stimulus by a decrease in milk yield, refused milking, and did not arrive to the farm. This showed the importance of making a change in the milking technology. Before the staff was not recommended to talk during milking, now it is desirable.

Currently, all elk farms are divided into four groups according to the type of technological processes: stationary multidisciplinary, stationary exiting, forest-nomadic and enclosure. Sumarokovsky elk farm previously related to the second type, but now does not fit into any of them. In this regard, we can talk about the formation of a new, fifth type, combining the characteristics of the second (the presence of the main stationary objects, a constant feeding area, the annual movement of elks in summer and winter camps) with the fourth (cage-driven). To a certain extent, this necessitated changes in the process. Earlier the transfer of animals to the winter camp was carried out in November, but now in connection with tourism, in the second half of January. To some extent, this affected the environmental situation in the pens, and increased the additional costs of procuring the imported feed.

Taking into consideration the positive impact of human communication with elks, some drawbacks should be noted in this case: isolated cases of hypertrophic attention to a person (increased interest, importunity). Some animals show anxiety and even loss of appetite, periodic overeating with unnatural feeds, in particular carrots, and, very significantly, there is an increased risk of the presence of pathogens of infectious diseases that are also dangerous for humans.

A variety of products can be obtained from elks, and the main one is milk. By its qualities, it significantly exceeds the cow milk as well as milk obtained from other types of domestic animals. Compared with cow milk it is by 6–7% higher in protein and fat (fluctuations in fat from 7.91% to 13.65%, protein - from 7.66% to 10.95%) and has a lesser extent of casein and globulin (Baranov et al., 2013). In the cow milk, these indicators range from 3.77% to 4.75% (casein) and from 3.14% to 3.75% (globulin), in goat milk - from 3.09% to 5.04% (casein) and 2.74% to 3.96% (globulin) (Michlová et al., 2016; Tatar et al., 2015). The highest level of fat in the milk during lactation for 2017/19 was in July, as evidenced by the data in the Table 1.

Table 1. Fat content in elk milk in 2017/2019 (%)

No.	Month	Fat content (%)			M ± m
		2017	2018	2019	
1	June	9.7	8.0	7.2	8.39 ± 0.74
2	July	13.3	12.2	9.2	11.57 ± 1.23
3	August	10.5	10.2	10.8	10.50 ± 0.17*

Note: * – $P < 0.05$ compared to June.

The use of natural feeds also contributes significantly to the increase of calcium, phosphorus, magnesium and some trace elements. P. Stypinski (2011) analyzed the data of many authors on the influence of forage pastures on the quality and quantity of milk. The data showed that the presence of grass with a large botanical diversity contributes to the production of milk with a higher content of fatty acids and antioxidants that are beneficial to human health. All this significantly increases its nutritional value, and in combination with a pronounced bacteriostatic and bactericidal action due to the high lysozyme content of 70–80,[3] (Savin & Sokolov, 2015), it opens the way for using it in human medicine in the treatment of radiation sickness, stomach ulcer and other

gastrointestinal diseases. In practice, this is implemented in the health resort of Ivan Susanin in Kostroma region.

During the lactation period (from May to September) elk cows give from 134.3 to 302.5 liters of milk. Over the past 3 years the farm has received 7,382.8 liters of milk. Milking elks is carried out manually using the same technology as cows (Ugodskaya & Sokolov, 2015). The milking process itself has several features. It is carried out inside the milking hangar, located in the pen of the same name and divided into several sections. Availability of premises is necessary to separate elk cows from each other and to avoid conflicts between them for a milkmaid, who is simultaneously recognized as an "elk calf" for several elk cows. In one room, as a rule, they milk up to two elks at a time. The elk cows stand in a special machine, where they are also fed a treat. Due to the high growth of the animal and the small size of the udder (even during lactation the mammary gland along with the nipples protrudes only a few centimeters from the abdominal line) employees milk either standing up or slightly leaning on the longitudinal poles of the machines. Several technologists practice milking elk cows at the same time (no more than four). At this time, the entrance to the premises of other personnel is extremely undesirable. Since the elk cow considered the milkmaid to be her calf, she will not only give milk, but also protect her like a real elk calf.

A characteristic feature of technology in recent years is that between morning and evening milking, animals stay in the pen, and not released for grazing. This allowed to reduce the number of passes ('no shows') for milking in 2017/2019 by 27.2%; 9.8%; 12.7%, respectively, compared to 2014, and to increase the average annual milk yield from 180.9 liters in 2017 to 197.6 liters and 205.9 liters in subsequent years. Along with this, the new technology made it possible to normalize the work schedule of milkmaids. Before early morning milking was in the period from 7 to 12 o'clock in the morning, evening milking was from 18 o'clock until the last elk cow arrived. This necessitated the payment of overtime work, which reached 5–7 extra days a month. The regulation of evening milking from 6 p.m. to 9 p.m. avoided this, made it possible to reduce labor costs and the cost of milk. Thus, it can be assumed that the new milking technology influenced the production of milk according to Cielava L. et al. (2017) who argued that milk production directly depended on the system of keeping and feeding animals.

Work with adult males due to their absence on the farm for the past seven years was not carried out.

Considering the technology of elk domestication in the reserve at the present stage, we believe that the issue of imprinting should be considered somewhat more broadly. In addition to the effect of imprinting, 'self-studies' play a large role in the socialization of elk calves with an increasing flow of tourists. At the same time animals also 'analyzing' the situation, understand that the presence of a person next to them creates a favorable forage base (top dressing with branches of trees, shrubs, grass, steamed crushed oats). In addition, near people it is less likely to meet predators. As a result, this leads to a loss of migration and to the development of elk attachment to one territory. A similar point of view belongs to R. Found et al (2019).

Considering the above, it can be assumed that at the same time as the elk milkmaid is perceived as a calf, and a calf perceives a caregiver as a mother, animals also receive additional information about the favorable environment (good food base that a human creates, the absence of predators), which also contributes to that animals remain in the reserve.

One of the main problems in elk breeding are the diseases of various etiology. They appear because of the high concentration of elks in a limited area, because of the content of animals of different ages in the boxes, because of the inevitable undermining of the natural food supply when sanitary and hygiene rules are not followed, because of the contact with livestock, because of the uniformity of the imported feed when keeping animals in the pens, and because of apparent inactivity of elks. According to Baranov et al., (2015), metabolic disorders and the birth of non-viable offspring take place, and the incidence of newborn calves has reached up to 50%. Also 62% of the elk population is infected with helminthes (Okunev et al., 2012). The current research showed that elk calves up to 20 days of age had diseases, accompanied by diarrheal and respiratory syndromes. Injuries to organs and tissues of various origins were quite widespread in the reserve too. Diseases of the hooves (wounds of the sole, phlegmon of the corolla, deformation of the hoofed horn) were also a relatively common phenomenon. This issue requires further discussion. Because of the potential danger of moose as a possible source of human infection with various pathogens, it is necessary to improve the system of veterinary service for elk breeding (monitoring, development of treatment methods, prevention and control measures for diseases of various etiologies, drugs and their application schemes, ensuring events normative documents, etc.)

CONCLUSIONS

1. Sumarokovsky state nature reserve is the world's largest center for domestication of elks, an environmental research and education institution.

2. The widespread introduction of ecological tourism in the elk domestication technology has contributed to the formation of a new type of elk farming, combining the elements of a stationary-exiting and multidisciplinary.

3. The technological process of growing young animals in the conditions of ecological tourism contributed to:

- changes in the behavior of elk calves, which made it possible to get controlled, stress-resistant, calm animals with a positive reaction to strangers at an early age;
- the possibility of conducting targeted selection at the age of 4–5 months for the formation of dairy herds, which can help to avoid the cost of growing an unpromising breeding stock;
- an increase in the tourist season by three months (from June until first half of January instead of from June until first half of November) and in the number of visits (from 40000 visitors in 2014 to 56000/65000 visitors in 2018/2019, respectively).

4. The reserve is the only farm in the world that receives a unique product from elks - milk. Optimization of elk milking technology (their content in the pen between morning and evening milking, free grazing only at night) contributed to:

- a decrease in the number of ‘no shows’ for milking in 2017–2019 by 27.2%, 9.8% and 12.7%, respectively, compared with 2014;
- the positive dynamics of an increase in the average annual milk yield per head from 180.9 liters in 2017 to 197.6/205.9 liters in 2018/2019;
- rationing the working time of milkmaids and reducing the cost of paying overtime hours, which before reached 5–7 extra working days per month.

5. Restriction of forest use on the territory of the reserve leads to a deterioration, decrease in the area and quality of forage land for a herd of domesticated elks. In this regard, it is necessary to improve the regulatory framework aimed at the development and implementation of biotechnological measures taking into account the interests of the forestry and the reserve.

6. Because of the potential danger of elks as possible sources of human infection with various pathogens, it is necessary to develop new diagnostic methods as well as measures of their prevention and control.

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