

An attempt towards the extension of the knowledge on European bison biology based on research in Vologda region

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Abstract: The paper presents information regarding the conservation and a study on European bison biology in natural habitat of the north of the European part of Russia. Particular attention is paid to the successful acclimatization of the species in the new habitat conditions. The paper identifies the main free-breeding European bison populations within the Russian Federation. The issues of further preservation and improvement of free-breeding populations, the direction of future studies on those animals considering the performance of the species in contemporary habitat conditions are discussed.

Key words: European bison, study, free-breeding population, habitat, Vologda region.

Introduction

Contemporary habitats of the species expanded further to the north of Europe in comparison with its historical range (Pucek 1991). Therefore, there is a need for a thorough study on the adaptation of animals belonging to a self-sufficient herd of *E. bison* in the Vologda region. According to the data from the beginning of 2017, there were 1,134 purebred European bison in Russia (European Bison Pedigree Book 2017). The Russian Federation has achieved the reproductive potential of *E. bison* population and there are good prospects for an increase of its numbers. According to the register, at the beginning of 2019 there were 1,177 individuals of purebred animals. Two bison nurseries are located within the territory of the Russian Federation, in the Prioksko-Terrasny Biosphere Reserve (Moscow Region) and in the Oka Biosphere Reserve of the Ryazan Region (Gusarov *et al.* 2016). The main free-breeding populations of European bison in particular regions of Russia at the beginning of 2019, are listed in Table 1.

Table 1. Population numbers of European bison in particular regions of Russia

№	Population (name as in Pedigree Book)	Region	Numbers
1	«Orlovskoe Poles'e» nacional'nyj park – «Орловское Полесье» национальный парк	Oryol Region	401
2	«Kaluzhskije zaseki» zapovednik and nacional'nyj park «Ugra» – «Калужские засеки» заповедник и национальный парк «Угра»	Kaluga Region	238
3	«Brjanskij les» Zapovednik – заповедник «Брянский лес»	Bryansk region	77
4	Kljaz'minsko-Lukhskij zakaznik – Клязьминско-Лухский заказник	Vladimir region	56
5	Sejjskij zakaznik i Severo-Osetinskij zapovednik – Цейский заказник и Северо-Осетинский заповедник	North Ossetia	96
7	Ust'-Kubenskoe okhotkhozjajstvo – Усть-Кубенское охотхозяйство	Vologda region	81

In all those populations, a high degree of inbreeding persists, which raises doubts about the well-being of the state of the species and threatens its future. Viability can be observed only in large freely breeding groups of E. bison (Gusarov 1998). An improvements of population parameters of E. bison should be based upon extension of the knowledge obtained through research on the biology of the species. The spatial distribution of E. bison depends on manmade decisions and in a consequence also habitat conditions in present E. bison ranges. Current level of knowledge on the biology of the species is not sufficient considering the contemporary stage of its conservation and genetic limitations. A majority of studies concern the geographical distribution of E. bison, migration activity, use of habitats, evaluation of the food supply and the diet (Gusarov 2015). There is very little information about the health status of animals, diseases appearing in new habitat conditions, and the biology of reproduction (Novikova 2016). Viability assessment of E. bison would help to improve the creation of new and strengthen existing groups of the species, facilitate their conservation, enhance the reproduction, increase the genetic potential of the population, and determine the impact on biocenoses (Rozhnov *et al.* 2009). The aim of our work was to extend the knowledge about the biology of E. bison considering above mentioned aspects.

The studied object and methods

The study was based upon field expeditions focused on the determination of the state of E. bison, in connection with their introduction to the north of the European part of Russia. The object of research was purebred E. bison originally introduced into the territory of the Vologda region in the amount of three individuals and currently forming the free-breeding herd counting 81 animals.

Determination of the carrying capacity, nutritional value and chemical composition of available food items, and fecal analyses were carried out in the laboratory of chemical analysis of the North-West Scientific Research Institute of Dairy and Grassland-Grazing Husbandry, approved by GOST. The helminthofauna of those animals was studied by the methods of Fulleborn, sequential washing and Berman. The evaluation of E. bison range was done with field surveys and by the analysis of soil, geographical and climatic maps. The duration of the presence of snow cover was determined by measuring its depth in five days intervals and using weather station data. Also meteorological and geobotanical data were collected. Description of meadow flora was carried out according to a standard method on trial plots of 100 square m each along transects, forest flora at plots of 400 sq. m situated along transects. The nutritional value of browse and herbaceous vegetation was also determined. Those data were a basis for the assessment of the status of forests in the European part of Russia. Direct observations of the groupings of E. bison were carried out since 1991 until now.

Results

The Russian Federation has a sufficient number of natural territories with conditions similar to those of the historical E. bison range. The priority area for free ranging of the species in the Russian Federation is the Vologda Oblast, where in 1991 first individuals became acclimatized and the new group of the species north from its historical range was created. The region is characterized by moderately continental climate, a long period of low temperatures in winter, with minimum values of up to -38.6°C , no open water bodies during winter, snow depth on average of up to 65 cm, and in some months up to 1.2 m. Nevertheless, observed constant increase of E. bison numbers there, confirms the suitability of local habitats for this species. The distance between this group home range from habitats inhabited so far by E. bison in Russia can be regarded as insurance against transmission of possible diseases, and animals of Vologda can be considered a "reserve" population.. Due to long

term monitoring and scientific research conducted there, it was possible to collect numerous data on *E. bison* biology and draw some conclusions about the potential viability of the species there. A vast area of available suitable habitats, unlimited access to food resources, and the presence of professional staff supervising this herd suggest potentials for improving and increasing the existing herd of *E. bison*.

The analysis of the gene pool of this herd of *E. bison*, especially the theoretically expected number of founders for this group, the average similarity of individuals, and the probability of distribution of the founder alleles in the existing herd indicate that those animals are highly inbred. Potential sources for supplementing the genetic material are nurseries of Prioksko-Terrasny and Oka biosphere reserves where animals have higher level of genetic diversity. Performed supplementation of introduced animals allowed to increase the recruitment rate from 7 to 9.5%. Nevertheless, despite a high level of inbreed, *E. bison* of Vologda have shown high adaptation potential to new habitats.

An important factor facilitating of the adaptation of *E. bison* in Vologda region are rich forage resources. The territory of the Ust-Kubensky district is situated in the zone of middle and southern taiga. The conifers (pine, spruce) cover about 55% of the forest area. A large part of the area is occupied by small-leaved forests, consisting of birch, aspen, alders, and willow trees. These plant communities are relatively rich regarding the species composition. They have well-developed shrub undergrowth and grassy openings.

A considerable part of habitats there are forest glades and meadows of various types. Upland meadows including small-scale fine-grained moderately wet meadows are common there. Apart from this kind of meadows there are also more reach with legumes and good quality grass. They provide the most abundant and nutritional fodder.

Despite the variety of plants consumed by *E. bison*, the basis of their diet consists of cereals, Asteraceae, Rosaceae, beans, Umbelliferae, willows. Food contents of *E. bison* considerably differs depending on the season and time of day. On average, 30% of annual diet consists of woody tissues. In winter, the share of such forage increases up to 70%. An important food item in the diet of *E. bison* are willows. The diameter of the browsed shoots ranges from 1mm to 1.5cm.

The abundance of diversified food resources and supplemental feeding of animals during difficult periods of the year had very positive effect on the reproduction rate of *E. bison* in the Vologda region. According to long-term observations, the first successful covering occurs there at the age of four. The peak of rut in females occurs in early August, and calving takes place at the

end of May – beginning of June. During the process of acclimatization, all females maintained fertility, fecundity, and calving was observed three times. The reproduction coefficient was 1 calf per 1.5 years.

The change of behavioral reactions of *E. bison* occurs as the herd numbers increase. We did not observe any special changes in the migration behavior of those animals, the daily range of movements was between 5 – 30 km, and the distance depended mostly upon the degree of animal restlessness and the depth of snow cover. Regarding the herd dynamics, the fragmentation of the population into smaller mixed groups and single males was observed. All other recorded forms of *E. bison* behavior were characteristic for this species.

According to visual observations, all individuals throughout the year maintained good condition, and correctly set limbs with strong hoofs. The highest condition judged by the level of fat was observed in the summer – autumn period. Free movements of this *E. bison* herd contributes to the prevention of helminth infections. Therefore in general, in free-ranging *E. bison* in the Vologda region, there is low incidence of helminths. Fascioliasis, dicticulosis, tizanesiosis were not detected in the analyzed fecal samples as well as other infectious diseases. There were found ten types of parasites. The majority of them were nematodes, and one type belong to cestodes, characteristic for ruminants. None pathological symptoms in animals of all age and sex groups were observed. Climate factors may play a major role in mitigation the spread of parasites.

Thus, the study on the reintroduced European bison in the North-West of Russia indicates that, despite the long period of breeding in nurseries, *E. bison* maintained high viability, and potential for adaptation to new, not characteristic for the species, living conditions. The territory occupied by *E. bison* in Vologda region has sufficient forage resources to support a free ranging *E. bison* population of at least 500 heads. Those animals are able to acquire food from under the snow, up to 65 cm in depth, and the lack of open water bodies in winter is not an obstacle to their occurrence in the North European part of Russia, as they quench their thirst through the consumption of snow. The activity of their rumen protists makes it possible to synthesize a sufficient amount of protein, securing their metabolic requirements and body condition.

There was also found that free – ranging *E. bison* do not adversely affect the state of the ecosystem. Therefore further development of the population in Vologda region and continuation of studies on its biology will be important contribution an increase of the total number of *E. bison* in the Russian Federation.

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Próba rozszerzenia wiedzy o biologii żubra na podstawie badań stada w regionie Wołody

Streszczenie: W pracy przedstawiono informacje dotyczące ochrony i badań nad biologią żubra w naturalnym środowisku na północy europejskiej części Rosji. Szczególną uwagę zwraca się na udaną aklimatyzację gatunku do tych warunków siedliskowych, poza jego północnym historycznym zasięgiem. Podane są informacje o wielkości głównych populacji żubrów w Federacji Rosyjskiej, których całkowita liczebność wynosi 1177 osobników. Podjęto w pracy dyskusję na temat dalszej ochrony i wzbogacania populacji żubrów w regionie Wołody. Na podstawie prowadzonych obserwacji stwierdzono, że poziom rozrodu w stadzie jest zadowalający, zachowana jest sezonowość rozrodu oraz obliczono, że krowy cielą się 2 razy na 3 lata. Omówiono wyniki monitoringu parazytologicznego i podkreślono dobry stan populacji. Wskazano kierunek przyszłych badań tych zwierząt, biorąc pod uwagę możliwości adaptacyjne gatunku we współczesnych warunkach siedliskowych.
