

Analysis of the sex and age structure of the European bison group in the Oka Reserve

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Abstract: The Bison Breeding Center in the Oka Reserve was established in 1959 and covers an area of 180 hectares. In this work, we used data on 526 individuals for the period from 1960 to 2018, grouped into 3 age groups: calves up to one year old, young E. bison from 1 to 3 years old, adult animals 3 years old and older (males and females). The dynamics of the sex and age structure for particular age groups was analyzed.

Over the entire period, 441 E. bison were born in the nursery, their sex ratio was: 52.6% of males and 47.4% of females. In the group of adult animals, there is a sharp disproportion between sexes, with a predominance of females (25.4% and 74.6%), on average, per 1 male there are 3 females. Analysis of annual data on the age and sex structure of the European bison group in the Oka Reserve from 1962 to 2018 showed the following ratio: adult males – 13.9%, adult females – 41.2%, young animals – 26.0% and calves – 18.9%.

The formation of sex and age structure in the natural groups of E. bison and in the nursery is different. Comparison of data showed that the proportion of calves in the nursery is higher than in nature (respectively 19% and 14%) due to the greater number of adult breeding females. The share of young wisent is equal with free population of E. bison of the Belovezhskaya Pushcha of Byelarus (26% and 26%). The representation of adult females in the nursery is higher than in nature (41% and 39%), and the representation of adult males is lower (14% and 21%), due to the number of males in the nursery limited or not participating in breeding. For the optimal sex and age structure of E. bison group at the nursery, the following proportion can be considered: calves – 20%, young wisent – 25%, adults – 55% (males – 15%, females – 40%).

Key words: European bison, sex and age structure, semi-free group, Oka reserve

Introduction

Sex and age structure are among main parameters that determine the reproductive abilities of the mammalian populations and represent a powerful mechanism in the dynamics of their numbers (Naumov 1967; Schwartz 1967). Those population parameters are equally important in the functioning of both wild populations of animals and their artificially created groups.

To preserve the European bison (*Bison bonasus*) in natural conditions,

nurseries were created with semi-free system keeping of animals, which contributed to achieving the current number exceeding 7 thousand individuals. Optimally formed sex and age structures in semi-free E. bison groups help to improve their life conditions and facilitate more efficient herd productivity.

The purpose of the study is to analyze the dynamics of the sex and age structure of E. bison group in the nursery of the Oksky Reserve.

Materials and methods

The European bison breeding center in the Oka reserve was created in 1959 and covers an area of 180 hectares. Animals are kept in semi-free conditions in large open-air enclosures with natural food supply in summer. All European bison in the nursery of the Oka Reserve are divided into 5 enclosures, in three of which the herd consisted of 1 adult male, 4–6 adult females and calves up to one year. Calves after reaching the age of 1 year are separated from the herd and are kept together with other young wisents in a separate enclosure (Kiseleva 1974; Kiseleva & Tsibisova 2003).

In this work, we used data on 526 European bison for the period from 1960 to 2018. Obtained data were divided into 3 age groups: calves up to one year old, young European bison from 1 to 3 years old, adult animals 3 years old and older (males and females). The dynamics of the sex and age structure of different groups was analyzed. The results obtained were compared with the data of the free population of the European bison of Belovezhskaya Pushcha of Belarus (Bunevich 2004; Kozlo & Bunevich 2009).

Results and discussion

An analysis of the dynamics of the sex and age structure of the European bison groups allowed to identify changes in the structure of the herd at different periods of time (Fig. 1).

From 1960 to 1965 in the nursery, the breeding stock of European bison was forming, and the increase in the number of animals was due to appearance of young individuals. In the years 1966–1985, in the heyday of the nursery, the age structure of the herd of European bison had the following ratio: calves – 21.8%, young bison – 24.5%, adult bison – 53.7% (males – 11.7% and females – 42.0%). From 1986 to 1999, the number of females increased (from 17 years and older), the number of offspring decreased and the export of young bison almost stopped. The age structure changed as follows: calves – 14.2%, young E. bison – 27.6%, adult animals – 58.2% (males – 21.2%, females – 37.0%). In the past two decades, 2000–2018, the situation in the nursery has stabilized,

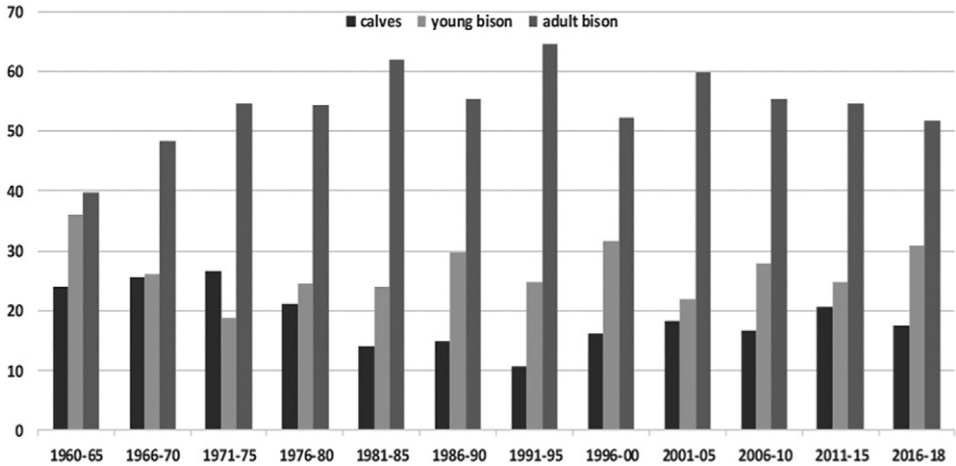


Figure 1. Dynamics of the age structure of European wisent herd in the Oka Reserve from 1960 to 2018

and the proportion of E. wisent in each age group was: adult – 55.3% (males – 14.0%, females – 41.3%), young animals – 25.1% and calves – 19.6%.

To explain the reasons for the change in the sex ratio in each age group, the dynamics of the sex composition of the offspring was analyzed. Sex ratio among newborn calves from 1960 to 2018 changed in different years in both directions (Fig. 2).

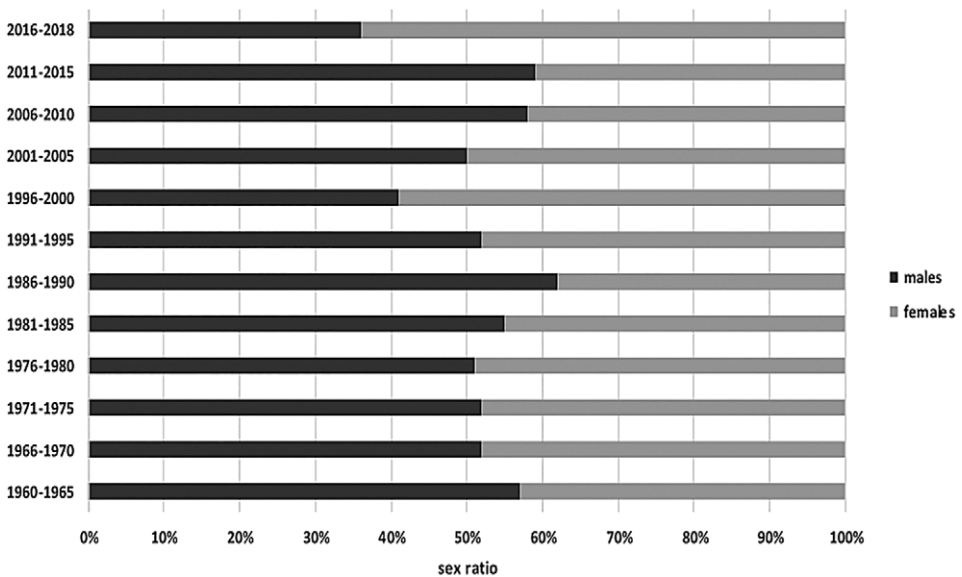


Figure 2. Dynamics of the sexual structure of newborn calves in the nursery of the Oka Reserve in 1960–2018

In the periods 1960–1965, 1981–1990 and 2006–2015 in this European bison grouping, newborn males prevailed, and in 1996–2000 and 2016–2018 females dominated in the offspring. A number of researchers (Korochkina 1968; Zhegalov 1950) explained the prevalence of male individuals by a lack of feed.

Over the entire period, 441 European bison were born in the nursery, their sex ratio was 52.6% males and 47.4% females, respectively. The mortality of calves up to one year was at the level of 19.2%, the maximum mortality was noted in the first 2–3 days (Tsibisova 2009). At the same time, males died more frequently than females (54.7% and 45.3% respectively) and the sex ratio among one year old was 52.1 : 47.9%. Such sex ratio is typical for a group of young animals up to 3 years old.

While in natural conditions young immature European bison would continue to join the herd, then in the nursery the main part of the young 1.5–3 year old animals is taken to the places where free populations are created. A small number of individuals (1–3) remains to maintain reproductive potential of the breeding herd. For this reason, in the group of adult E. bison in the nursery, there is a sharp disproportion between the sexes, with a predominance of females (25.4% ♂ and 74.6% ♀), on average, there are 3 females per 1 male (Fig. 3).

In 1986–1995 a sharp increase in the proportion of males (up to 37%) in relation to females was noted. During this period, except for 1986–1987, the

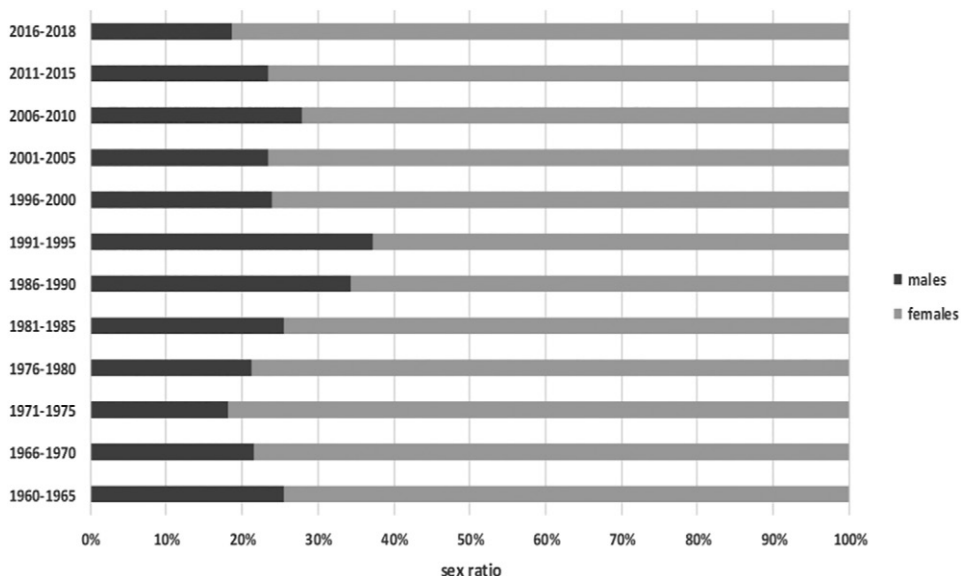


Figure 3. Dynamics of the sexual structure of adult European bison in the nursery of the Oka Reserve in 1960–2018

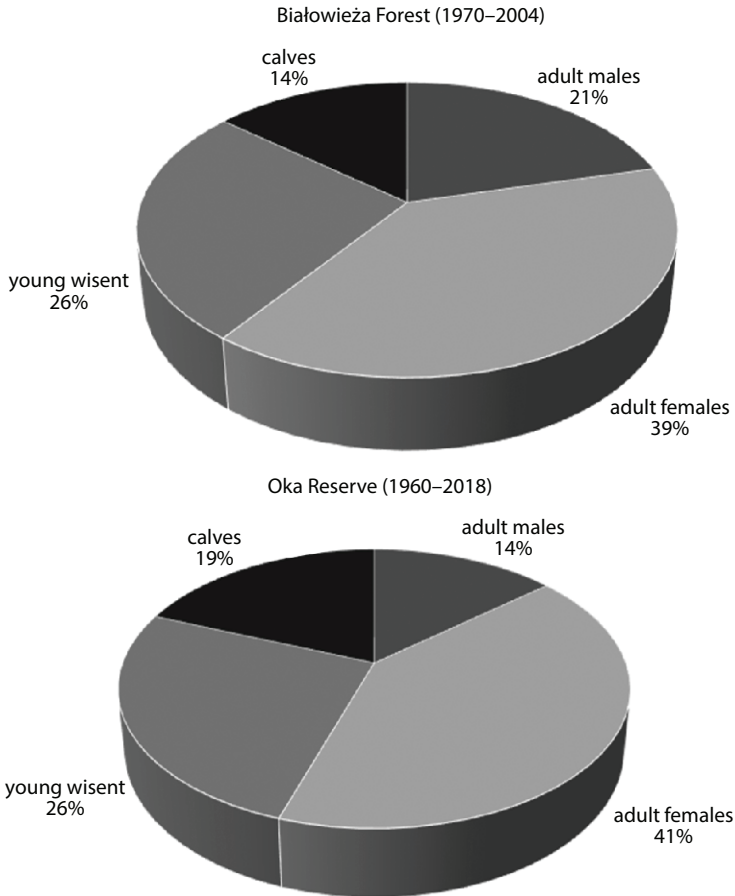


Figure 4. Comparative analysis of the sex and age structure of European wisent population of Belovezhskaya Pushcha of Belarus and the nursery of the Oka Reserve

transfer of *E. bison* into the wild was suspended, which led to an increase in the number of adult mature animals in the nursery. To change the situation the regulation of the number of animals by selective culling was implemented (Tsibisova *et al.* 2014). In total, 23 *E. bison* were eliminated.

In 1971–1975 and 2016–2018 the lowest number of males was observed (18%). During this period, only 3 males were included in breeding groups and 1–2 individuals were kept for replacement, in case of illness, death or advanced age of the main reproducers.

The analysis of annual data on the age and sex structure of *E. bison* group in the Oka Reserve from 1960 to 2018 showed the following ratio: adult males – 13.9%, adult females – 41.2%, young animals – 26.0% and calves – 18.9% (Fig. 4).

At the same time the sex and age structure of the E. bison population of the Belovezhskaya Pushcha of Belarus was: adult males – 21%, adult females – 39%, young animals – 26% and calves 14% (Kozlo & Bunevich 2009).

The formation of sex and age structure in the natural groupings of E. bison and in the nursery is different. Comparison of data for those two types of groups, allows to draw the following conclusions:

- 1) The share of calves in the nursery is higher than in nature (19% and 14%) due to the higher number of adult breeding females.
- 2) The share of young E. bison in the nursery is equal to the free population of E. bison of the Belovezhskaya Pushcha (26% and 26%).
- 3) The representation of adult females in the nursery is slightly higher than in nature (41% and 39% respectively), and the representation of adult males is lower (14% and 21% respectively), due to limited number of males participating in the reproduction.
- 4) In fact, adult males and females in the nursery (14% and 41% respectively) are a group of animals actively participating in breeding, which is similar to the data on the reproduction of E. bison in the natural population (15% and 42% respectively) (Kozlo & Bunevich 2009).

Thus, for the optimal age and sex structure of E. bison grouping, the following relationship in breeding groups is recommended: calves – 20%, young wisent – 25%, adults – 55% (males – 15%, females – 40%).

References

- Bunevich A.N. 2004. Sex and age structure of European bison of Bialowieza Forest and its dynamics. The dynamics of the biological diversity of fauna, problems and prospects for the sustainable use and protection of the animal world of Belarus. Abstracts of the IX Zoological Scientific Conference. Minsk: 132–134.
- Kiseleva E.G. 1974. European bison breeding in the nursery of the Oka Reserve. "Berezinsky Reserve". Research Issue 3. Minsk: 103–138.
- Kiseleva E.G., Tsibisova E.L. 2003. The movement of numbers and the state of the European bison gene pool in the nursery of the Oka Reserve. Works OGPBZ. Issue 22. Ryazan: 367–387.
- Kozlo P.G., Bunevich A.N. 2009. European bison in Belarus. Minsk: 318.
- Korochkina L.N. 1968. Factors affecting the sex ratio of European bison. Bialowieza Forest. Research. Issue 2. Minsk: 139–147.
- Naumov N.P. 1967. Population structure and number dynamics of terrestrial vertebrates. Zoological journal. 46,10, 1470–1486.

- Schwartz S.S. 1967. Population structure of the species. Zoological journal. 46, 10, 1345–1467.
- Tsibizsova E.L., Aksenova P.V., Ermakov A.M. 2014. Methods of regulation of the age and sex composition of bison in the nursery of the Oka Reserve. Veterinary pathology, 1 (47),. 49–54.
- Tsibisova E. 2009. The sex and age-related characteristic and the analysis of the natural reasons of death of European bison (*Bison bonasus L.*) in the breeding station of the Oksky reserve. European Bison Conservation Newsletter 2 : 71–79.
- Zhegalov S.B. 1950. Patterns of gender inheritance in animals. Successes of modern biology 30,1: 130–144.

Analiza struktury płci i wieku żubrów w Okskim Rezerwacie

Streszczenie: Ośrodek Hodowli Żubrów w Rezerwacie Okskim zajmuje powierzchnię 180 hektarów a został założony w 1959 roku. W pracy wykorzystano dane z lata 1960 – 2018 dotyczące 526 osobników. Żubry podzielono na 3 grupy wiekowe: cielęta do jednego roku życia, młode żubry od 1 do 3 lat, dorosłe zwierzęta w wieku 3 lat i starsze (samce i samice). Przeanalizowano dynamikę struktury płci w poszczególnych grupach wiekowych.

W całym okresie w rezerwacie urodziło się 441 osobników, w tym 52,6% samców i 47,4% samic. W grupie dorosłych zwierząt jest duża dysproporcja proporcji płci z przewagą samic (74,6%), średnio na 1 samca przypadają 3 krowy. Struktura średnia w stadzie w Okskim Rezerwacie w latach 1962–2018 była następująca: dorosłe samce – 13,9%, dorosłe samice – 41,2%, młode zwierzęta – 26,0% i cielęta – 18,9%.

Kształtowanie się struktury płci i wieku w naturalnych populacjach i w stadach w rezerwacie jest inne. Na podstawie porównania wyników można stwierdzać, że odsetek cieląt w zagrodach jest wyższy (odpowiednio 19% i 14%) ze względu na większy udział dorosłych samic. Udział młodzieży w stadzie rezerwatowym jest taki sam jak w wolnej populacji z Puszczy Białowieskiej Białorusi (26%). Udział dorosłych samic w rezerwacie jest wyższy niż w naturze (41% i 39%), natomiast samców niższy (14% i 21%). Jako optymalną strukturę płci i wieku żubrów w rezerwacie można uznać proporcję: cielęta – 20%, młodzież – 25%, dorosłe osobniki – 55% (samce – 15%, samice – 40%).
