

CHARACTERISTICS OF CLOSED BREEDING STATIONS OF BISON (*BISON BONASUS* L.) IN POLAND IN THE YEARS 1997-2000

Dariusz Zalewski, Wiesław A. Szczepański,
Małgorzata Wołkowycka

University of Warmia and Mazury in Olsztyn

Abstract. The objective of this study was to present the general situation and conditions of lowland bison breeding in Poland in the years 1997-2000, at four Closed Bison Breeding Stations, the Wolin National Park in Międzyzdroje, the Forest Culture Center in Gołuchów, the Wildlife Park in Kadzidłowo, Municipal Enterprise for Urban Green Areas Preservation in Leszno, and eight zoological gardens.

Key words: bison, *Bison bonasus* L., closed breeding station, habitat types, enclosure capacity

INTRODUCTION

The genus *Bison* is represented by two species: the European bison (*Bison bonasus* L.) and the American bison (*Bison bison* L.). There are two subspecies within each of these species [Kraśiński 1992]. Two subspecies of *Bison bonasus* L. are the lowland bison (*Bison bonasus bonasus* L.) and the highland or Caucasus bison (*Bison bonasus caucasicus*) [Kraśiński 1978 following Turkin and Satunin 1904]. No pure Caucasus bison exists nowadays, as they became extinct in the wild in 1927, but there exists a lineage of free-ranging Białowieża-Caucasus bison in the Bieszczady Mountains [Jamrozy 1994].

In the 11th c. large populations of bison lived in Europe, whereas in the 19th c. they were present in the Białowieża Primeval Forest and Caucasus only [Kraśiński 1978]. A Caucasus bull (named Caucasus) harvested in 1908, mated to Białowieża females, produced progeny referred to by breeders as the Białowieża-Caucasus lineage.

The lowland bison lived for the longest time under natural conditions in the Białowieża Primeval Forest. There were 727 bison in this Forest before the First World War [Bereszyński 1995]. Almost the entire herd became extinct during the War, and

Corresponding author – Adres do korespondencji: dr inż. Dariusz Zalewski, Department of Sheep, Goat and Game Management of University of Warmia and Mazury in Olsztyn, M. Oczapowskiego 5, 10-718 Olsztyn, e-mail: d.zalewski@uwm.edu.pl

the last bison was shot by a local poacher in 1919 [Bereszyński 1995, Pucek 1993]. However, this subspecies survived in small numbers in zoos. According to Bereszyński [1995], Krasieński [1978] and Olech [1998 a], a list of bison compiled in 1924 shows that only 66 animals (33♂ + 33♀) survived in the zoos around the world, including 54 (29♂ + 25♀) whose descent was well-documented. Most of them can be traced to the Caucasus bull. In 1939 the number of bison in Poland was 40 animals, and after the Second World War it increased to 44 (20♂ + 24♀), which constituted almost half of the total world population, being at that time 103 animals (43♂ + 60♀) [Olech 1998 a]. In the years 1947-1974 Poland became the main center supplying bison for reintroduction to other European states. About 200 bison were provided to 17 countries over this period [Graczyk 1981].

The objective of the present study was to present the general situation and conditions of lowland bison breeding at closed stations in Poland in the years 1997-2000.

MATERIALS AND METHODS

The experimental materials comprised lowland bison populations living in Poland [European Bison 2004]. The data presented in the paper concern the period from 1997 to March 31, 2000. They were collected at 16 closed breeding stations, whose location is shown in Figure 1. The material was gathered on the basis of questionnaires drawn up



Fig. 1. Location of closed bison breeding stations in Poland. WPN – Wolin National Park; OKL – Forest Culture Center; PDZ – Wildlife Park; MZZ – Municipal Enterprise for Urban Green Areas Preservation

Rys. 1. Położenie hodowli zamkniętych żubra w Polsce. WPN – Woliński Park Narodowy; OKL – Ośrodek Kultury Leśnej; PDZ – Park Dzikich Zwierząt; MZZ – Miejski Zakład Zieleni

for the above bison breeding stations, herds in Międzyzdroje and Gołuchów, and zoological gardens. The questions concerned the number of bison and population dynamics in particular preserves, living conditions, age structure of herds, number of calvings per year, bison exchange between stations, mortality rates and causes. Apart from the above questionnaires, the information was also collected during interviews with the employees of the Bison Breeding Stations in Białowieża, Pszczyna and Smardzewice, the Wolin National Park in Międzyzdroje and the Forest Culture Center in Gołuchów.

The numerical data concerning bison populations, number of calvings, bison exchange between stations, number of bison shot and culled, are given in a tabular form.

RESULTS AND DISCUSSION

Characteristics of closed breeding stations

Table 1 shows the number and area of enclosures for bison in zoos. The enclosure area is the largest in the zoological garden in Gdańsk-Oliwa (37.945 m²), and the smallest – in Bydgoszcz (48 m²) and Poznań (60 m²). At the other centers it varies from 200 to 5.400 m².

Table 1. Number and area of enclosures for bison in zoological gardens and preserves
Tabela 1. Liczba i powierzchnia zagrod dla żubrów w ogrodach zoologicznych i zwierzyńcach

Station Nazwa ośrodka	Number and area of enclosures Liczba i powierzchnia zagród
1	2
Białystok, Municipal Enterprise for Urban Green Areas Preservation Akcent ZOO Białystok, Miejskie Przedsiębiorstwo Zieleni Akcent ZOO	two enclosures covering a total area of 1800 m ² dwa wybiegi o łącznej powierzchni 1800 m ²
Bydgoszcz, Forest Park for Culture and Recreation Bydgoszcz, Leśny Park Kultury i Wypoczynku	one yard, 48 m ² jeden wybieg wolnostanowiskowy o powierzchni 48 m ²
Chorzów, Silesian Zoological Garden Chorzów, Śląski Ogród Zoologiczny	three pens, 5 m ² each two yards, 4800 m ² and 600 m ² trzy boksy każdy o powierzchni 5 m ² dwa wybiegi - 4800 m ² i 600 m ²
Gdańsk-Oliwa, Municipal Zoological Garden Gdańsk-Oliwa, Miejski Ogród Zoologiczny Wybrzeża	one yard (37 945 m ²) with two adjacent pens, 10 m ² and 45m ² jeden wybieg (37 945 m ²) z przyległym do niego okólnikiem podzielonym na dwie zagrody 10 m ² i 45 m ²
Kadzidłowo, Wildlife Park Kadzidłowo, Park Dzikich Zwierząt	one enclosure, 600 m ² jedna zagroda o powierzchni 600 m ²
Leszno, Municipal Enterprise for Urban Green Areas Preservation Leszno, Miejski Zakład Zieleni	one yard, 50 m ² , pen with drinker, 30 m ² , one yard, 4000 m ² okólnik – 50 m ² , Szalasy kryty z poidłem – 30 m ² , jeden wybieg o powierzchni 4000 m ²

1	2
Łódź, Municipal Zoological Garden Łódź, Miejski Ogród Zoologiczny	two stables covering a total area of 30 m ² two yards, 1300 m ² and 280 m ² dwie stajnie o łącznej powierzchni 30 m ² dwa wybiegi - 1300 m ² i 280 m ²
Poznań, Zoological Park Poznań, Wielkopolski Park Zoologiczny	two yards and two stables covering a total area of 60 m ² dwa wybiegi i dwie stajnie o łącznej powierzchni 60 m ²
Toruń, Botanical Garden Toruń, Ogród Zoobotaniczny	one yard, 4000 m ² jeden wybieg o powierzchni 4000 m ²
Warszawa, Municipal Zoological Garden Warszawa, Miejski Ogród Zoologiczny	one yard, 200 m ² , four pens jeden wybieg ekspozycyjny o powierzchni 200 m ² , cztery boksy

Note: habitat types as in the forest management specification.
Uwaga: typy siedlisk przyjęte w operatach urzędzenia lasu.

Table 2 shows the location of the bison breeding stations, the Wolin National Park in Międzyzdroje and the Forest Culture Center in Gołuchów. The number and area of yards at closed bison breeding stations are also given, together with types of habitats and their percentages in the forest area of each station. The Bison Breeding Station in Pszczyna covers the largest area – 742.56 ha. This is an enclosed forest complex for free-ranging bison management. The Breeding Station in Białowieża also occupies an extensive area of 274.25 ha, but this includes an exhibition reserve with enclosures for other animal species as well. The smallest are the stockyards in Międzyzdroje (11 ha) and Gołuchów (19.2 ha).

Table 2. Location, area and habitat types of Bison Breeding Stations, the Wolin National Park in Międzyzdroje and the Forest Culture Center in Gołuchów
Tabela 2. Położenie, powierzchnia terenu oraz typy siedliskowe w Ośrodkach Hodowli Żubrów, OKL w Gołuchowie i WPN w Międzyzdrojach

Station Nazwa ośrodka	Location Położenie	Area and number of enclosures Powierzchnia i ilość zagród	Types of habitats (% in the forest area of a station) Typy siedlisk (udział % w pow. leśnej ośrodka)
1	2	3	4
Bison Breeding Station in Białowieża Ośrodek Hodowli Żubrów w Białowieży	Podlasie Province, Białowieża Primeval Forest; preserves 1 and 2 are located in forest divisions 420 BC and 421 AB, north of the Hajnówka-Białowieża road; preserves 3 and 4 are located in forest divisions 425 CD and 450 B Województwo podlaskie, na terenie Puszczy Białowieskiej; rezerwat nr 1 i 2 położony w oddziale 420 BC i 421 AB na północ od szosy Hajnówka – Białowieża; rezerwat 3 i 4 położony w oddziale 425 CD i 450 B	total area – ogólna powierzchnia ośrodka – 274.25 ha Preserve 1 – Rezerwat nr 1: I – 7.92 ha; II and III – 60 ha; IV – 14.16 ha; V – 9.95 ha Preserve 2 – Rezerwat nr 2: I – 1.93 ha; II – 16.67 ha; III – 30.60 ha; IV – 14.16 ha; V – 9.95 ha Preserve 3 – Rezerwat nr 3: I – 1.44 ha; II – 1.60 ha; III – 1.76 ha; IV – 1.34 ha	Lśw i Lw – 55.5% OLJ – 22.9% LMśw – 12.3% BMw i BMśw – 5.7% LMw – 3.6%

1	2	3	4
Bison Breeding Station in Niepołomice Ośrodek Hodowli Żubrów w Niepołomicach	Małopolska Province; the Station is located in the center of the Niepołomice Primeval Forest, Forest Division Niepołomice, Division Wysne województwo małopolskie – jest zlokalizowany w samym centrum Puszczy Niepołomickiej na terenie Nadleśnictwa Niepołomice, Leśnictwo Wysne	total area – ogólna powierzchnia ośrodka – 56 ha. I – enclosure for main herd – zagroda stada podstawowego II – enclosure for bulls – zagroda byków III – isolation enclosure – zagroda izolatka	BMśw – 50% BMw – 28% LMśw – 19% LMw – 3%
Bison Breeding Station in Pszczyna Ośrodek Hodowli Żubrów w Pszczynie	Silesian Province, south-eastern part of the Silesian Forest, Forest Division Pszczyna, Division Jankowice województwo śląskie, południowo-wschodnia część lasów śląskich, na terenie Nadleśnictwa Pszczyna, w Leśnictwie Jankowice	total area – ogólna powierzchnia ośrodka – 742.56 ha three enclosures with feeders covering a total area of – trzy zagrody karmowe o łącznej powierzchni – 4.7 ha	BMw and BMśw – 39% LMw and LMśw – 56% OL – 5%
Bison Breeding Station in Smardzewice Ośrodek Hodowli Żubrów w Smardzewicach	Lódź Province, Pilica Primeval Forest, Range “Książ” Województwo łódzkie - Puszcza Pilicka, uroczysko „Książ”	total area – ogólna powierzchnia ośrodka – 68 ha. I – 8 ha; II – 12 ha; III – 10 ha; IV – 12 ha; V – 13 ha; VI – 1 ha	BMw – 42% BMśw – 28% LMśw – 24% Lw – 6%
Wolin National Park in Międzyzdroje Woliński Park Narodowy w Międzyzdrojach	West-Pomeranian Province, Wolin Island województwo zachodniopomorskie, wyspa Wolin	total area – ogólna powierzchnia – 11 ha one enclosure, including exhibition area jedna zagroda, w tym wydzielona zagroda pokazowa	BMśw – 100%
Forest Culture Center in Gołuchów Ośrodek Kultury Leśnej w Gołuchowie	Wielkopolska Province; the Center is located in a forest complex covering an area of 300 ha, Forest Division Tomaszów województwo wielkopolskie – leży wśród kompleksu około 300 ha lasu Nadleśnictwa Tomaszów	total area – ogólna powierzchnia ośrodka – 19,5 ha two enclosures, 9.6 ha each, exhibition area dwie zagrody o powierzchni 9,6 ha każda, jedna zagroda pokazowa	BMśw – 73.0% LMśw – 18.4% Lw – 8.6%

Bison population dynamics in the years 1997-2000

According to Olech [1998 b], bison populations at closed breeding stations, at the current restitution stage, have reached the numbers corresponding to the capacity of a given station. However, the information collected in this study indicates that in some cases this capacity has been exceeded. For instance, at the Bison Breeding Stations in Niepołomice and Smardzewice the actual numbers of animals are much higher than their estimated capacities.

The estimates capacities of particular breeding stations, and the sex structure of bison kept there, are presented in Table 3.

The most bison (41) live at the Breeding Station in Białowieża. However, due to the fact that 10 of them are kept at the exhibition reserve, the capacity of this Station (27 to 30 bison) has not been significantly exceeded. In the year 2000 bison density at the Breeding Station in Białowieża was 6.7 ha per animal (excluding the bison kept at the reserve). Among the breeding stations analyzed, the Wolin National Park in Międzyzdroje

Table 3. Enclosure capacity and number of bison kept at closed breeding stations
 Tabela 3. Pojemność zagród i liczebność żubrów w ośrodkach hodowli zamkniętej

Station Nazwa ośrodka	Capacity animals Pojemność ośrodka szt.	Number, animals* – Liczebność, szt.*											
		1997			1998			1999			2000		
		r-m	♂	♀	r-m	♂	♀	r-m	♂	♀	r-m	♂	♀
Bison Breeding Station in Białowieża OHŻ Białowieża	27-30	37	12	25	33	8	25	41	9	32	41	9	32
Bison Breeding Station in Niepołomice OHŻ Niepołomice	20	28	9	19	30	9	21	31	11	20	31	11	20
Bison Breeding Station in Pszczyna OHŻ Pszczyna	25	29	13	16	22	8	14	26	7	19	26	7	19
Bison Breeding Station in Smardzewice OHŻ Smardzewice	15	18	6	12	21	7	14	23	6	17	23	6	17
Forest Culture Center in Gołuchów OKL Gołuchów	6-8	11	3	8	8	1	7	9	4	5	9	2	7
Wolin National Park in Międzyzdroje WPN Międzyzdroje	6-7	6	2	4	7	1	6	9	7	2	8	2	6
Białystok ZOO ZOO w Białymstoku	2-3	2	1	1	2	1	1	4	2	2	2	1	1
Forest Park for Culture and Recreation in Bydgoszcz LPKiW Bydgoszcz	4-5	4	1	3	4	1	3	4	1	3	4	1	3
Chorzów ZOO ZOO w Chorzowie	3-4	4	1	3	4	1	3	5	1	4	6	1	5
Gdańsk-Oliwa ZOO ZOO w Gdańsku-Oliwie	4-5	4	1	3	5	1	4	5	1	4	6	2	4
Wildlife Park in Kadzidłowo PDZ Kadzidłowo	2	2	2	-	2	2	-	2	2	-	2	2	-
Municipal Enterprise for Urban Green Areas Preservation in Leszno MZZ Leszno	3	3	1	2	2	1	1	2	1	1	2	1	1
Łódź ZOO ZOO w Łodzi	4-5	4	1	3	3	1	2	4	2	2	5	3	2
Poznań ZOO ZOO w Poznaniu	4-5	6	2	4	3	1	2	3	1	2	3	1	2
Toruń ZOO ZOO w Toruniu	2-3	2	1	1	2	1	1	1	1	-	1	1	-
Warszawa ZOO ZOO w Warszawie	4-5	5	2	3	5	3	2	7	5	2	6	3	3
Total – Razem	131-142	165	58	107	153	47	106	176	61	115	173	51	122

*State as on March 31 each year.

*Stan na 31.03. każdego roku.

and the Forest Culture Center in Gołuchów, the lowest bison density was observed at the Breeding Station in Pszczyna (28.6 ha per bison). At the other stations it varied from 1.4 ha to 3.0 ha per animal. In the year 2000 the capacity of the six preserves examined was 99 to 105 animals, whereas the total bison number was 128 (excluding those kept at the reserve in Białowieża). The total area of four breeding stations, the Wolin National Park in Międzyzdroje and the Forest Culture Center in Gołuchów was 1.171.31 ha and the total number of bison – 128, which means that the actual average area per bison was 9.2 ha, compared with the intended 11.2-11.8 ha. The environmental capacity of all closed bison breeding stations in Poland, in the years 1997-2000, was 131 to 142 animals. The lowest number of bison (153) was recorded in 1998, and the highest (176) – in 1999, which shows that every year it exceeded the capacity. The mean male to female ratio was 1 to 2, reaching the highest level, i.e. 1 to 2.4, in the year 2000 (...). The sex structure at the breeding stations examined, including the Wolin National Park in Międzyzdroje and the Forest Culture Center in Gołuchów, in the years 1997-2000, is shown in Table 4. The mean male to female ratio in successive years varied from 1:1.87

Table 4. Enclosure capacity and male to female ratio at Bison Breeding Stations, the Wolin National Park in Międzyzdroje and the Forest Culture Center in Gołuchów (according to Table 3)
Tabela 4. Pojemność zagród i stosunek samców do samic w OHŻ i ośrodkach w Gołuchowie i Międzyzdrojach (wg tabeli 3)

Station Nazwa ośrodka	Capacity animals Pojemność ośrodka szt.	Sex structure – Struktura płciowa							
		1997		1998		1999		2000	
		total razem	ratio stosunek ♂: ♀	total razem	ratio stosunek ♂: ♀	total razem	ratio stosunek ♂: ♀	total razem	ratio stosunek ♂: ♀
Bison Breeding Station in Białowieża OHŻ Białowieża	27-30	37	1 : 2.08	33	1 : 3.13	41	1 : 3.56	41	1 : 3.56
Bison Breeding Station in Niepołomice OHŻ Niepołomice	20	28	1 : 2.11	30	1 : 2.33	31	1 : 1.82	31	1 : 1.82
Bison Breeding Station in Pszczyna OHŻ Pszczyna	25	29	1 : 1.23	22	1 : 1.75	26	1 : 2.71	26	1 : 2.71
Bison Breeding Station in Smardzewice OHŻ Smardzewice	15	18	1 : 2.00	21	1 : 2.00	23	1 : 2.83	23	1 : 2.83
Forest Culture Center in Gołuchów OKL Gołuchów	6-8	11	1 : 2.67	8	1 : 7.00	9	1 : 1.25	9	1 : 3.50
Wolin National Park in Międzyzdroje WPN Międzyzdroje	6-7	6	1 : 2.00	7	1 : 6.00	9	1 : 0.29	8	1 : 3.00
Total – Razem	99-105	129	1 : 1.87	121	1 : 2.56	139	1 : 2.16	138	1 : 2.73
Total for closed breeding stations Razem dla hodowli zamkniętej	131-142	165	1 : 1.84	153	1 : 2.26	176	1 : 1.89	173	1 : 2.39

(1997) to 1:2.73 (2000). The number of females, compared with the number of males, was the highest at the Bison Breeding Station in Białowieża. In the last three years the male to female ratio was there above 1:3. Its mean value for the six stations studied was 1 to 2.29, and for all preserves (Table 4) – 1 to 2.07.

The limited capacity of the stations necessitates periodic reduction of herd size. This concerns sick and weak animals, calves born beyond the reproductive season, animals with some genetic defects. Such bison are shot (Table 5), or transported to other centers, where they can be mated with appropriately selected partners, producing progeny with the lowest possible inbreeding index. Table 5 shows that over the experimental period the highest number of bison were shot at the Breeding Station in Białowieża (18 animals). The total number of bison shot at the stations examined from 1997 to 31.03.2000 was 28, i.e. on average 7 per year, which constitutes 4.2% of the mean annual number of bison (166.75) in the period analyzed. The mean value of this parameter for the Breeding Station in Białowieża was 11.8%. It should be stressed that this level of bison elimination was lower than the expected population growth. According to Krasieński et al. [1994 a] and Krasieński and Krasieńska [1994], the mean annual birthrate among free-ranging bison in the Białowieża Primeval Forest was 14.5 to 17.3% until the 1990s. In order to stabilize the Polish bison population, their number in the Białowieża Primeval Forest was regulated by approx. 10% each year, starting from the early 1970s. This allowed to maintain the bison number in the main herd at a level of 210 to 270 animals [Krasieński et al. 1994 a]. It is believed that in stable bison populations limited exploitation may be 20% a year [Krasieński et al. 1994 b].

Table 5. Number of bison shot at closed breeding stations
Tabela 5. Odstzał żubrów w ośrodkach hodowli zamkniętej

Station Nazwa ośrodka	1997 animals – szt.		1998 animals – szt.		1999 animals – szt.		until 31.03 2000 animals szt.		Total animals Razem szt.
	♂	♀	♂	♀	♂	♀	♂	♀	
	Bison Breeding Station in Białowieża OHŻ w Białowieży	–	1	7	6	1	3	–	
Bison Breeding Station in Smardzewice OHŻ w Smardzewicach	1	1	–	–	–	1	–	–	3
Forest Culture Center in Gołuchów OKL w Gołuchowie	3	–	–	–	–	–	–	–	3
Wolin National Park in Międzyzdroje WPN Międzyzdroje	–	–	1	–	–	–	1	–	2
Warszawa ZOO ZOO w Warszawie	–	–	–	–	–	–	2	–	2
Total – Razem	4	2	8	6	1	4	3	–	28

CONCLUSIONS

The results obtained for the years 1997-2000 allow to formulate the following conclusions:

1. Over the experimental period, the numbers of bison kept at 16 closed breeding stations were as follows:

1997 – 165 animals (♂58; ♀107),

1998 – 153 animals (♂47; ♀106),

1999 – 176 animals (♂61; ♀115),

2000 – 173 animals (♂51; ♀122) (state as on March 31).

2. In Poland almost 70% of bison are kept at the Breeding Stations in Białowieża, Niepołomice, Pszczyna and Smardzewice.

3. Among the zoos examined, the zoological garden in Gdańsk-Oliwa is characterized by the largest bison enclosure area (37.945 m²), and the Forest Park for Culture and Recreation in Bydgoszcz – by the smallest (48 m²).

4. The Bison Breeding Station in Pszczyna covers the largest area (742.56 ha), and the bison enclosure area in the Wolin National Park in Międzyzdroje is the smallest (11 ha). At the stations examined, in the year 2000, the actual average area per bison was 9.2 ha. The total number of bison was 128.

5. The sex structure at particular closed bison breeding stations was as follows:

1997 r. – 1♂ : ♀1.84,

1998 r. – 1♂ : ♀2.26,

1999 r. – 1♂ : ♀1.89,

2000 r. – 1♂ : ♀2.39.

The mean male to female ratio over the period analyzed was 1:2.07.

6. 28 bison were shot from 1997 to March 31, 2000, as many as 18 of them at the Breeding Station in Białowieża.

7. The total number of bison shot at the stations examined over the experimental period constituted 4.2% of the mean annual number of bison (166.75).

REFERENCES

- Bereszyński A., 1995. Żubr – polska duma. Przynr. Pol. 1, 5-6.
- European Bison. Status Survey and Conservation Action Plan. 2004. IUCN The World Conservation Union. Ed. Z. Pucek.
- Graczyk R., 1981. Der Wisent (*Bison bonasus bonasus*, Linnaeus 1758) in Polen und die Perspektiven seiner Restitution in Waldern Europas. Z. Jagdwiss. 2, 91-101.
- Jamroz G., 1994. Postępy w rekolonizacji Polskich Karpat przez łosia, żubra i bobra. Przegl. Zool. 38, 344-348.
- Kraśiński Z., 1978. Restytucja i ewolucja wolnych populacji żubra w Polsce. Człow. Nauka 14, 207-228.
- Kraśiński Z., 1992. Żubr – dawniej i dzisiaj. Syst. Cechy Budowy 4, 11-12.
- Kraśiński Z., Bunevich A., Kraśińska M., 1994 a. Charakterystyka populacji żubra nizinnego w polskiej i białoruskiej części Puszczy Białowieskiej. Parki Nar. Rez. Przynr. 13/4, 25-67.
- Kraśiński Z., Kraśińska M., Leniec H., 1994 b. Żubry w Puszczy Knyszyńskiej. Parki Nar. Rez. Przynr. 13/4, 107-114.

- Kraśński Z., Kraśńska M., 1994. Funkcjonowanie populacji żubra nizinnego w Puszczy Boreckiej. Parki Nar. Rez. Przyr. 13/4, 89-106.
- Księga Rodowodowa Żubrów. 1997.
- Olech W., 1998 a. Hodowla Żubra w Polsce (1). Łow. Pol. 9, 18-19.
- Olech W., 1998 b. Hodowla Żubra w Polsce (2). Łow. Pol. 10, 20.
- Pucek Z., 1993. Ochrona żubra. Aura 5, 15-17.

CHARAKTERYSTYKA HODOWLI ZAMKNIĘTYCH ŻUBRA (*BISON BONASUS* L.) W POLSCE W LATACH 1997-2000

Streszczenie. Zbadano warunki i stan zamkniętych hodowli żubra nizinnego w Polsce w latach 1997-2000, utrzymywanych w czterech Ośrodkach Hodowli Żubrów (OHŻ): w Wolińskim Parku Narodowym (WPN), Ośrodku Kultury Leśnej (OKL) w Gołuchowie, Parku Dzikich Zwierząt (PDZ) w Kadzidłowie, Miejskim Zakładzie Zieleni (MZZ) w Lesznie i w ośmiu ogrodach zoologicznych (ZOO).

Słowa kluczowe: *Bison bonasus* L., hodowla zamknięta, typy siedlisk, pojemność zagród

Accepted for print – Zaakceptowano do druku: 21.03.2005 r.