

DAILY ACTIVITY OF EUROPEAN BISON IN ZOOLOGICAL GARDENS

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Abstract. Seven observations of European bison were made between April and July 2009 (from 6.00 to 18.00) at the Municipal Zoological Garden of the Sea Coast in Gdańsk-Oliwa (8 animals) and at the Polish Fauna Garden of Forest Culture and Leisure Park “Myślęcinek” in Bydgoszcz (4 animals). During 12-hour observations, the European bison from zoological gardens spent 31% of their time feeding, 47% standing and moving, and 22% lying down (showing preference for left lateral recumbency), although no statistically significant effect of the animals’ living environment (garden) was found. The age and sex of European bison had a statistically significant effect on the amount of time spent performing basic activities. The longest standing and moving times were observed in calves, while males spent most of their time resting-lying. In both zoological gardens, the increased feed intake activity was closely associated with feeding time, and the number of European bison resting lying was found to increase immediately after feed intake activity.

Keywords: behaviour, European bison, zoological gardens

INTRODUCTION

Bison are herd animals. In the wild they live in herds of 10–15 animals and during the rutting period they aggregate into larger groups of 30–40 animals [Caboń-Raczyńska et al. 1983, Caboń-Raczyńska et al. 1987]. Adult cows, calves and young animals of both sexes form a mixed group, which is led by an older, mature cow. During the growing season, mixed groups consist of a dozen or so animals, and in winter larger groups are formed in supplementary feeding areas. Mixed groups vary in composition, with some animals (mainly young males) moving to other groups when they meet. At the age of 4–6 years, young sexually mature males form small bachelor groups, and older bulls live alone or in pairs [Olech et al. 2008]. Previous research on bison behaviour was conducted in free-roaming

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herds [Caboń-Raczyńska et al. 1983, Caboń-Raczyńska et al. 1987, Daleszczyk 2004, Daleszczyk 2005]. It showed that bison divide their time into different phases of activity, with the circadian rhythm consisting of feeding, resting and ruminating, and moving. Although it is a wild animal, bison is a very attractive species to display. Zoological gardens are interesting sites to observe animal behaviour. Above all they serve an educational and recreational role, but can also form the basis of research on animals. To a certain extent, zoological gardens affect the behaviour of animals, also because of the different age and sex structure compared to free-living populations. The welfare of captive animals must be ensured to meet their biological and behavioural needs, as a result of which they will show good health, high fertility and normal behaviour [Daleszczyk 2004].

The aim of the study was to observe basic forms of European bison behaviour in zoological gardens.

MATERIAL AND METHODS

Observations of European bison were made in two zoological gardens in Poland.

At the Municipal Zoological Garden of the Sea Coast in Gdańsk-Oliwa, observations were made of three male bison [Podrzut (born 22 June 1997), Pomidor (born 5 June 2001), Podrzut II (born 10 November 2006)], 3 female bison [Pompa (born 7 September 1997), Pokrusa (born 14 May 1994), Pompa II (born 19 May 2005)] and 2 female calves [Pokrusa II and Pompa III (born 22 and 25 May 2009, respectively)] [European Bison Pedigree Book 2009].

At the Polish Fauna Garden of Forest Culture and Leisure Park "Myślęcinek" in Bydgoszcz, one male bison [Kord Podryw (born 15 August 1999)] and three female bison [Pola (born 31 May 2000), Postujka (born in 2001), and Porina (born 30 April 2009)] were observed.

In each zoological garden, seven 12-hour observations (from 6.00 to 18.00) were made between April and July 2009, and the following activities of each bison were recorded at 15-minute intervals: standing and walking, left lateral recumbency, right lateral recumbency, and feeding. Recumbent posture was classified according to position of the trunk as related to the legs and the head [Jeziński 1987]. According to Jeziński [1987], in order to compare the duration of long-term activities such as feeding, standing and lying, sufficient accuracy is obtained when the activities are recorded every 10–15 minutes. In both zoological gardens, the observers kept their distance from the animals to avoid influencing their behaviour.

In the Sea Coast zoological garden, bison used two enclosures with a total area of 6584 m². Bison received alfalfa hay at 7.30 and pelleted concentrate with tree bark (5%) at 8.00. About 10.30, bison were fed a mixture of concentrate (flaked oats, flaked wheat) and wet roughage (chopped red beet, fodder beet, cabbage, carrot, parsnip, celeriac, apples and bananas). In May, green rye forage was fed once daily at 13.00. In addition, grass forage was supplemented during the summer period at 10.00 and 14.00.

At the Forest Culture and Leisure Park "Myślęcinek" in Bydgoszcz, the enclosure has an area of 7649.2 m². During the summer, bison received young oat forage. Around 8.00 animals received concentrate feed (oat bran, ground maize) and chopped vegetables and fruit,

and around 12.00 they were fed a mixture of concentrate and roughage (forage). Hay was provided in the morning (around 8.00) and replenished all day.

In both zoological gardens, the keeper started his morning round at 7.00 and his evening round at 19.00. The outside yard was cleaned at 19.00.

The results were analysed statistically using the GLM procedure of SAS package [SAS Institute Inc. 2008]. Analysis was made of the time spent standing, walking, lying on the left side, lying on the right side and feeding, depending on the location (Municipal Zoological Garden of the Sea Coast, Forest Culture and Leisure Park "Myślęcinek"), age and sex of animals (calves less than two years old, males aged between 4 and 13 years, females aged between 5 and 16 years), and season of the year (spring, summer). Significant differences were analysed using the Scheffe test.

RESULTS AND DISCUSSION

No statistically significant differences were found in the duration of different activities depending on the zoological garden (Table 1). Between 6.00 and 18.00, bison spent 341 minutes standing and moving (47% of observation time). They rested lying for a total of over 2.5 hours (about 22% of the time), showing preference for left lateral recumbency. Bison spent about 31% of their time feeding.

Table 1. Mean duration of different activities performed by European bison at the Municipal Zoological Garden of the Sea Coast in Gdańsk and at the Forest Culture and Leisure Park "Myślęcinek" in Bydgoszcz

Tabela 1. Średni czas trwania poszczególnych czynności wykonywanych przez żubry w Miejskim Ogródku Zoologicznym „Wybrzeża” w Gdańsku i Leśnym Parku Kultury i Wypoczynku „Myślęcinek” w Bydgoszczy

Activity Czynności	Mean duration of activity Średni czas trwania czynności			
	Municipal Zoological Garden of the Sea Coast Miejski Ogród Zoologiczny „Wybrzeża”		Forest Culture and Leisure Park “Myślęcinek” Leśny Park Kultury i Wypoczynku „Myślęcinek”	
	min.	%	min.	%
Standing and walking Stanie i chodzenie	341	47.36	340	47.22
Left lateral recumbency Leżenie na lewym boku	113	15.70	109	15.14
Right lateral recumbency Leżenie na prawym boku	43	5.97	65	9.03
Feed intake Pobieranie paszy	223	30.97	206	28.61
Total – Ogółem	720	100	720	100

Statistically significant differences were found for the time spent standing and walking as well as lying in different age and sex groups (Table 2). Calves stood and moved 77 minutes longer than male bison and 63 minutes longer than female bison. Regardless of age and sex, animals spent more time lying on the left side when resting. Males spent more time resting lying (174 minutes) compared to females (162 minutes). There were no significant differences in the duration of feeding, which ranged from 212 minutes (calves) to 227 minutes (males).

Table 2. Mean duration of different activities performed by European bison according to sex and age

Tabela 2. Średni czas trwania poszczególnych czynności wykonywanych przez żubry w zależności od płci i wieku

Activity Czynności	Mean duration of activity Średni czas trwania czynności					
	calfs cielęta		male bison żubry		female bison żubrzyce	
	min.	%	min.	%	min.	%
Standing and walking Stanie i chodzenie	396 ^{ab}	55.00	319 ^a	44.30	333 ^b	46.25
Left lateral recumbency Leżenie na lewym boku	91 ^a	12.64	120 ^a	16.67	106	14.73
Right lateral recumbency Leżenie na prawym boku	21 ^a	2.92	54 ^a	7.50	56	7.77
Feed intake Pobieranie paszy	212	29.44	227	31.53	225	31.25
Total – Ogółem	720	100	720	100	720	100

Menans marked with the same letters in rows, differ significantly: a, b – at $P \leq 0.05$.

Wartości oznaczone tymi samymi literami w wierszach różnią się istotnie: a, b – at $P \leq 0,05$.

Analysis of the mean duration of different bison activities in spring and summer showed small, statistically insignificant differences (Table 3).

Figures 1 and 2 present daily frequency of different bison activities depending on the zoological garden. During 12 hours of observation, three peak periods of standing and walking were found in bison from the Sea Coast zoological garden (7.00–9.00, 10.00–12.00 and 13.30–15.00). An increase in feeding activity, noted around 8.00, 11.00 and 14.00, was strictly related to the time of feeding. At 7.30–9.00 and 10.00–12.00, none of the bison observed rested lying. Most animals were recumbent at 12.30–13.30 and 15.30–18.00. In the “Myślęcinek” zoological garden, the greatest locomotor activity was found between 7.00 and 9.00. Feeding activity of the bison increased (8.00–9.00) right

after feeding at 8.00. The next increase in feeding activity by animals from the “Myślęcinek” zoological garden was observed between 11.00 and 12.00. In both zoological gardens, the number of bison resting lying increased immediately after the periods of feeding activity.

Table 3. Mean duration of different activities performed by European bison according to season of the year

Tabela 3. Średni czas trwania poszczególnych czynności wykonywanych przez żubry w zależności od pory

Activity Czynności	Mean duration of activity Średni czas trwania czynności			
	summer – lato		spring – wiosna	
	min.	%	min.	%
Standing and walking Stanie i chodzenie	344	47.77	330	45.84
Left lateral recumbency Leżenie na lewym boku	97	13.48	119	16.53
Right lateral recumbency Leżenie na prawym boku	48	6.67	53	7.36
Feed intake Pobieranie paszy	231	32.08	218	30.27
Total – Ogółem	720	100	720	100

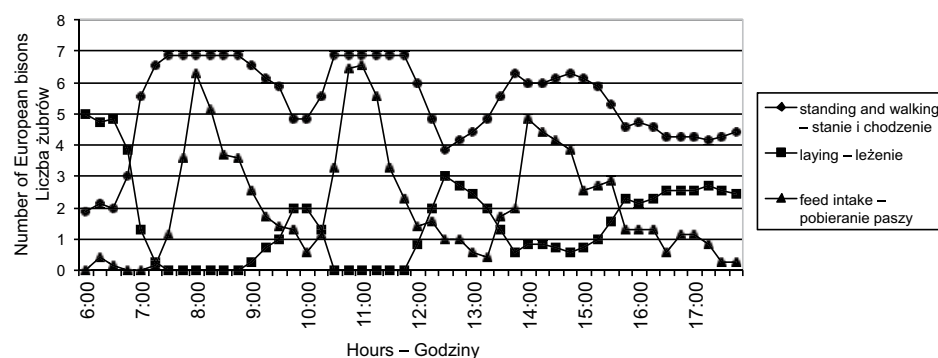


Fig. 1. Daily distribution of different European bison activities in Municipal Zoological Garden of the Sea Coast in Gdańsk-Oliwa

Rys. 1. Dzienny rozkład różnych czynności u żubrów utrzymywanych w Miejskim Ogrodzie Zoologicznym „Wybrzeża” w Gdańsku

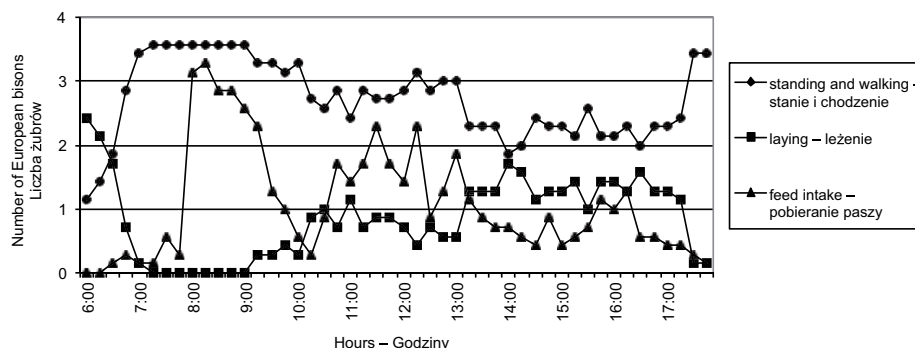


Fig. 2. Daily distribution of different European bison activities in Polish Fauna Garden of Forest Culture and Leisure Park in Bydgoszcz

Rys. 2. Dzienny rozkład różnych czynności żubrów w Leśnym Parku Kultury i Wypoczynku w Bydgoszczy

Under natural conditions, sunlight exerts the greatest effect on the circadian activity of animals. Intensive activity of animals begins right after sunrise and ends at sunset [Jezierski 1987, Sablik et al. 2010]. According to Olech et al. [2008], bison rest lying on brisket, rarely on the side with extended legs. They rest mainly on hills, in shaded areas, to reduce their exposure to insects. Daily activity of bison observed in zoological gardens differs from that described for free-living herds [Pucek et al. 2003]. Bison in free-living herds spend most of their time feeding (about 60% during summer) [Caboń-Raczyńska et al. 1983, Caboń-Raczyńska et al. 1987], compared to about 31% in bison from zoological gardens investigated in our study. In nature, most of the observed behaviour is directed towards foraging, but the animal's behaviour changes when it becomes confined in a limited space. The relatively short time that the bison spent feeding in zoological gardens is probably due to the fact that feed was provided by humans and the animals did not have to search for food. According to Olech et al. [2008], the basic equipment of a pen should be a feeding rack (for hay), a feeding place (for concentrates and root crops) and a water trough. When observing (from 6.00 to 18.00) the behaviour of Polish Holstein-Friesian cows depending on the housing system, Neja et al. [2010] found that pasture cows spent almost 60% of their time eating pasture sward compared to less than 36% spent feeding in the barn.

In our study, the small differences in the duration of individual activities between spring and summer resulted from the fact that all observations were made during the growing season, and greater differences in bison activity could be expected if the winter period were also accounted for. In free-roaming herds during the growing season, bison spent about 60% time of the day foraging, 30% resting, and 10% moving without feeding. During winter, when bison are given supplementary feed, they spend 30% of their time eating and 60% resting [Caboń-Raczyńska et al. 1983, Caboń-Raczyńska et al. 1987].

According to Olech et al. [2008], bison prefer to eat just after sunrise and just before sunset. Animals living in the wild move continuously as they eat, with the herd spaced several metres apart. Feeding is always begun by a dominant male, followed by mature and

healthy females, and the youngest animals. In enclosed reserves outdoor areas such as pasture are expensive, which is why they are only used as an addition and for a short time. Animals receive feed at specified hours (morning and afternoon) and consume it only then. The findings of Jezierski [1987], who compared the behaviour of domestic cattle and żubroń (a hybrid of domestic cattle and European bison), point to genotype differences in the rhythm of feed intake. Żubroń began grazing 40 minutes earlier on average than domestic cattle. Cows with 75% bison blood started to graze still before sunrise. At the same time, animals with 75% and 50% bison blood were characterized by higher grazing activity before sunset.

CONCLUSIONS

It is concluded that the time spent by European bison from zoological gardens performing basic activities (standing and moving, lying, feeding) differed from that reported by other authors for free-living herds. During 12-hour observations, bison spent 31% of their time feeding, 47% standing and moving, and 22% lying down (showing preference for left lateral recumbency), although no statistically significant effect of zoological garden was found. The age and sex of bison had a statistically significant effect on the amount of time spent performing basic activities. The longest standing and moving times were observed in calves, while males spent most of their time resting-lying. In both zoological gardens, the increased feed intake activity was closely associated with feeding time.

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DZIENNA AKTYWNOŚĆ ŻUBRÓW W OGRODACH ZOOLOGICZNYCH

Streszczenie. W okresie IV–VII 2009 roku przeprowadzono po siedem obserwacji żubrów (od 6.00 do 18.00) w Miejskim Ogrodzie Zoologicznym „Wybrzeża” położonym w Gdańsku-Oliwie – 8 osobników oraz w Ogrodzie Fauny Polskiej w Leśnym Parku Kultury i Wypoczynku „Mysłęcinek” w Bydgoszczy – 4 osobniki. Podczas 12-godzinnych obserwacji żubry w ogrodach zoologicznych przeznaczały na żerowanie 31% czasu, na stanie i ruch 47% czasu, a na leżenie 22% czasu (preferując leżenie na boku lewym), przy czym nie wykazano potwierdzonego statystycznie wpływu miejsca przebywania zwierząt (ogrodu). Wiek oraz płeć żubrów istotnie statystycznie wpływały na czas wykonywania przez nie podstawowych czynności. Najdłuższy czas stania i poruszania się stwierdzono u cieląt, natomiast najwięcej czasu na odpoczynek w pozycji leżącej przeznaczały samce. W obydwu ogrodach zoologicznych wzrost aktywności związany z pobieraniem paszy był ściśle związany z porą jej zadania, ponadto stwierdzono, że tuż po okresach aktywności związanej z pobieraniem paszy zwiększała się liczba żubrów odpoczywających w pozycji leżącej.

Słowa kluczowe: ogrody zoologiczne, zachowanie, żubry

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