

Preliminary observations of the behaviour in two wild species of equids: Przewalski's horse (*Equus ferus przewalskii*) and Hartmann's zebra (*Equus zebra hartmannae*) kept in socially changed groups at Warsaw Zoo

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Abstract: *Preliminary observations of the behaviour in two wild species of equids: Przewalski's horse (*Equus ferus przewalskii*) and Hartmann's zebra (*Equus zebra hartmannae*) kept in socially changed groups at Warsaw Zoo.* Investigations were carried out at Warsaw Zoo to examine general behaviour in two wild equids after social changes. These changes were caused by management procedures. Three Hartmann's zebra and four Przewalski's horses were observed for 117 h throughout the whole year. Three methods of sampling were used: *ad libitum*, scan and focal. Abnormal behaviour in these wild equids was not found. There were several significant differences in frequency of behaviour between Przewalski's horse and Hartmann's zebra. In both species coordination of behaviour also occurred. Social interaction frequency was very low and gave little support for the speculation about social structures in these groups.

Key words: Hartmann's zebra, Przewalski's horse, behaviour, zoo

INTRODUCTION

Przewalski's horse (*Equus ferus przewalskii*) and mountain zebra (*Equus zebra*) are species of hoofed mammals to the great degree similar. Both are large ungulates build for speed and longdistance

movement. Although they are distributed in separate continents both are adapted to open grasslands. Both species are endangered and they were pushed away from their former distribution area to the harsher environment. Przewalski's horse is actually extinct in the wild and it has been reintroduced to some areas of Mongolia and China from 1986. Mountain zebra, with two subspecies, mountain zebra (*Equus zebra zebra*) and Hartmann's zebra (*Equus zebra hartmannae*) is confined to the restricted areas in the south Africa. The last stand of wild Przewalski's horse was also called Dzungarian Gobi, in fact large desert surrounded by mountains covered with dry steppes. Mountain zebra is found in the wild in a subdesert plains and barren rocky uplands (Bouman 1986, Estes 1992).

Przewalski's horse and mountain zebra live in one male (harem) groups. The number of mares per stallion is 3–4 in average in both cases. The young stallions (and fillies in mountain zebra) after abandoning family group form so-called bachelor herds (Bouman 1986, Penzhorn and Novelle 1991). Other behaviours of

both equids are also similar. For example the study of McDonnell and Havilland showed that from 45 forms of agonistic behaviour observed in the equid bachelor herd over 60% was common for Przewalski's horse and zebras (McDonnell and Havilland 1995).

There are adjacent equid exhibits at Warsaw Zoo: for Przewalski's horse (*Equus ferus przewalskii*) later abbreviated as PH and for Hartmann's zebra (*Equus zebra hartmannae*) abbreviated as HZ. These animals were kept in normal social "one male" group. However, in summer 2016 HZ stallion was transferred to the separate enclosure because of its aggressiveness towards mares. On the other hand, to the PH group third mare was introduced. Thus, both groups of equids have changed and could be seen as to some degree socially disturbed. The social manipulation in zebra species could be potentially dangerous for example leading for example to male infanticide (Pluhacek and Bartos 2000).

The purpose of this study was to compare behaviour of captive PH and HZ

performed at Warsaw Zoo including the relations with the visitors. Authors particularly interested in the effect of social change in both groups and on the of abnormal behaviour occurrence in these animals.

MATERIAL AND METHODS

The observations were carried out at Warsaw Zoo during the whole year between autumn 2015 and summer 2016. Detailed information on studied individuals are shown in Table 1.

The enclosures for both species at Warsaw Zoo were localized side by side near the main alley designed for visitors. The enclosures were also localized far away from the main zoo gate. Enclosure for HZ was rectangular and 3,500 m² in area. In the case of pH the size of enclosure was 4,500 m² and its shape resembled letter "J". Both exhibits seemed to be fairly spacious and their designs enabled performance of various locomotory behaviour. Animal had also access to stables heated in winter. Their stables

TABLE 1. The basic information concerning observed animals at Warsaw Zoo

Przewalski's horse			Hartmann's zebra		
Sex and ID	Birth date/ /acquisition	Birth location	Sex and ID	Birth date/ /acquisition	Birth location
Stallion	26.07.1998	Warsaw Zoo	Stallion***	22.07.2009	Reserve Africaine de Sigean
Mare 1	15.05.1994 24.01.2005*	Rotterdam Zoo	Mare 1	27.06.2011 05.06.2014*	Dvur Kralove Zoo
Mare 2	26.09.2000 19.12.2007*	Cologne Zoo	Mare 2	14.07.2011 05.06.2014*	Dvur Kralove Zoo
Mare 3**	02.08.2011 30.09.2015*	Prague Zoo	Mare 3	13.07.2013 09.10.2014*	Wroclaw Zoo

*Acquisition by Warsaw Zoo; **introduced during observation period; ***exclude from group.

were 46 and 30 m² in area for HZ and PH, respectively. From the alley the visitors had opportunity to observe animals present at all parts of enclosure. Equids were out of view only when they came to stables. Moreover, PH could hide away to some degree in vegetation concentrated near the fence. In the HZ and PH enclosures there were several scattered trees and logs. In both enclosures animals could move on the concrete surface as well on the softer (sand and grass covered) floor. Additionally there is also small pond in the HZ enclosure. The diet of both equids was standard and comprised of oats with other ingredients

Prior to the study observation period three pilot observations of 1 h each were carried out. During the study period observer has occupied determined place near exhibit which enabling the best possible view of animals. One observation lasts for 65 min for each species. In each hour the percentage of time, when animal disappeared from observer sight, was noted. Various characteristics (e.g. size, stripe pattern etc.) were used to differentiate individuals. Specialized equipment in observation (e.g. camera) was not used. Statistical calculations of χ^2 -test were performed using a statistical software package SPSS Statistics 23 Pl.

During single observation following methods of sampling were employed:

- *ad libitum* – for 30 min to examine activity and behaviour repertoire; each occurrence of behaviour performed by each individual were recorded in this case;
- scan – for 15 min – to measure synchronization of behaviour in the group; instantaneous samples were taken on individuals at the same time;

- focal – for 20 min – to investigate occurrence of social interactions in the group; with this sampling one individual was focus of observation for given time, then the second, third etc.

Above-mentioned methods of sampling were in detail described by Altmann (1974).

The list of possible behaviour categories observed in equids was prepared on the basis of literature (McDonnell and Havilland 1995, McDonnell and Poulin 2002) and the pilot observations.

RESULTS AND DISCUSSION

There were 106 observations, which were distributed evenly throughout observation period (28 in summer, 26 each in other seasons). The observation took place usually around noon or in early afternoon. In the winter the animals were observed as the weather allowed, usually in the morning. For the sake of relatively small number of observations in each season in this study the comparative analysis of behaviour was not prepared.

The total data obtained was 117 h of behaviour recording (58.5 h for each species). There was possible to observe animal behaviour for 95.2% of total time in the case of PH and for 88.5% in the case of HZ. In the rest of time animals have disappeared from the observer's sight (came to their stables). The difference in disappearance was highly significant ($P < 0,01$, χ^2 -test was used).

The following categories of behaviour were ascertained in both equids at Warsaw Zoo:

- locomotory behaviour – walk, trot;
- alert – attention of animals was directed to certain stimuli;

- exploration – looking for food, olfactory investigations of surroundings;
- resting – standing in relaxed posture, recumbent resting;
- feeding – grazing, nibbling various plants;
- excretion – defecation and urination;
- comfort-seeking behaviour – scratching self, rubbing, stretching, rolling, response to insect harassment (e.g. stamping); to this category social grooming was included;
- non-aggressive interactions – any affiliate interaction involving physical contact, play;
- agonistic interactions – threat, attack, bite, kick, fight, chase (only incidents with occurrence of all these sequences were recorded);
- vocalization – neigh, snort (only recorded in PH);
- relations with visitors – approach fence via straight path without sign of aggression and exploring.

This behaviour of equids at Warsaw Zoo is presented only in outline. Authors decided to show rather the categories of behaviour at the beginning and their accordance with ethograms from literature. The frequency of particular kinds of equids behaviour is shown in Table 2.

As may be expected in the case of behaviour repertoire in equids movement, feeding and resting were predominant. This pattern is typical for the wild equids (Souris et al. 2007). On the other hand, there was relatively small number of social interactions in observed individuals. Both, PH and HZ showed positive reactions towards visitors. Authors did not observe any sign of territorial marking. On the other hand, comfort seeking behaviour was fully expressed. In vocalization usually the neigh was recorded probably used by PH to maintain contact between members of group. All above-mentioned behaviours performed by wild equids housed at

TABLE 2. The frequency of behaviour (*N*) and activity (%) of total time of observation recorded in Przewalski's horse and mountain zebra

Behaviour category	Przewalski's horse		Hartmann's zebra		Difference (significance)
	<i>N</i>	%	<i>N</i>	%	
Locomotory	230	15.0	266	17.4	NS
Alert	33	2.2	102	6.7	**
Exploration	14	0.9	154	10.1	**
Rest	143	9.3	319	20.8	**
Feeding	786	51.4	384	24.4	**
Excretion (defecation/urination)	18	1.2	6	0.4	*
Comfort-seeking behaviour	112	7.3	32	2.1	**
Non-aggressive interaction	45	2.9	2	0.1	**
Agonistic interaction	8	0.5	12	0.8	NS
Vocalization	24	1.6	0.0	0.0	**
Relations with visitors	42	2.7	87	5.7	**

* Difference significant at $P > 0.05$; ** highly significant at $P < 0.01$.

Warsaw Zoo are well described in literature (McDonnell and Havilland 1995, McDonnell and Poulin 2002, McGreevy 2004). The reproductive activity and abnormal behaviour especially stereotypic behaviour (aimless repeating of behaviour sequences) were not recorded in this study. It is worth to mention that the stereotypical behaviour is frequently observed in both domesticated and wild equids (Sarrafchi and Blokhuis 2013).

In spite of rather low frequency of many behaviours there was marked difference between their frequency in PH and HZ. For example HZ more time spent resting, exploring and performing alert reaction. In PH feeding was more frequently observed as well as comfort seeking, non-aggressive behaviour acts, excretion and vocalization (not observed in HZ). Locomotory activity and aggressive interactions were at the same level in the both species. Although HZ showed higher frequency as regards relations with the visitors than PH, zebras seemed to be more fearful and rather easily took flight. This observation confirmed general opinion that zebras, particularly mountain zebra is rather fierce animal (MacClintock 1976). On the other hand, PH at Warsaw Zoo appeared more tame and confident towards visitors.

Some findings in this part of study could be explained by the observations in the wild. For example it is known that mountain zebra is less social than other species (plain and Grevy zebra). Herd members maintain a greater individual distance and mutual grooming in this species is infrequent. Individuals rarely formed large aggregations. Mountain zebra is also less vociferous than other zebra species (Estes 1992). Of course it

is need to confirm this conclusion by further observations of captive individuals in zoological garden.

The second method of sampling, used in the study of equids behaviour at Warsaw Zoo, was scan. This method was used to examine coordination of behaviour of the group members. There was interesting to study, if certain behaviours were performed by all individuals at the same time. The results of scan measurement are shown in Table 3.

Eight behaviours were to some degree synchronized, but only in the three cases of behaviour their frequency were visibly high: feeding in PH, locomotory and rest behaviour in HZ. The similar pattern of PH social activity was also obtained in the case of wild individuals (Souris et al. 2007). Moreover, in both species there was also highly coordinated reaction of coming to the stable. The analysis using χ^2 -test revealed that differences in coordinated behaviour between both equids were highly significant ($P < 0.01$) in the case of feeding, rest and coming to the stable.

The focal sampling turned out to be inconclusive in this study. As it is shown in Table 1 there was relatively small number of interactions (aggressive and non-aggressive) in both equids. From the authors point of view more interesting were aggressive interactions, because they offered some insight into hierarchy. In HZ all agonistic interactions were recorded between Mare 1 and younger Mare 3. Mare 1 initiated the sequence of aggressive behaviour acts described above. It was clearly interaction which signal dominant position of Mare 1. In PH only small number of agonistic interactions was observed between stallion and

TABLE 3. Frequency of all recorded behaviour performed simultaneously in both species of equids at Warsaw Zoo

Behaviour category	Przewalski's horse				Hartmann's zebra		
	simultaneous behaviour frequency observed in number of individuals						
	2	3	4	Σ	2	3	Σ
Feeding	109	213	172	494	102	83	185
Locomotory	36	12	10	58	20	8	28
Rest	23	5	1	29	43	42	85
Comfort-seeking behaviour (not in social context)	16	1	0	17	1	0	1
Alert	0	1	0	1	4	2	2
Exploration	0	0	0	0	1	0	1
Vocalization	1	0	1	2	0	0	0
Coming to the stable	40	18	2	60	164	20	184

freshly introduced Mare 3. Both specimens initiated this interaction, which was limited to threat, bite and kick. On the basis of these data there is hard to speculate about social hierarchy. This finding is partly confirmed by observations of Feh (1988) on PH in semi-reserve conditions revealing agonistic interaction between stallion and mare leading even to subordination of male horse.

Findings concerning PH agonistic behaviour and reaction towards visitors recorded at Warsaw Zoo are contrary to certain speculation that this horse in captive environment have higher level of aggression than domesticated or feral horse (McGreevy 2004).

CONCLUSIONS

1. After the social manipulation which changed the structure of Przewalski's horse and Hartmann's zebra groups at Warsaw Zoo these animals did not show abnormal behaviour during the observation period.

2. As a whole ethogram of captive individuals at Warsaw Zoo resembled patterns of behaviour described in the wild equids.

3. Observed individuals showed also some differences in behaviours and their frequencies between Przewalski's horse and Hartmann's zebra at Warsaw Zoo. They were present in spite of similar husbandry practices, enclosure design and localization, feeding etc. There is need for further more detailed examination of social behaviour in Hartmann's zebra and Przewalski's horse.

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Przewalskiego (Equus ferus przewalskii) i zebry Hartmanna (Equus zebra hartmannae) utrzymywanych w zmienionych pod względem społecznym grupach w Miejskim Ogrodzie Zoologicznym w Warszawie. Badania przeprowadzono w Warszawskim Ogrodzie Zoologicznym, aby zbadać ogólne zachowanie się dwóch dzikich koniowatych po zmianie społecznej. Zmiany te podyktowane były procedurami zarządzania zwierzętami w zoo. Trzy zebry Hartmanna i cztery konie Przewalskiego obserwowano przez 117 h przez cały rok. Zastosowano trzy metody próbkowania: *ad libitum*, scan i focal. Nie stwierdzono występowania zachowania anormalnego. Odnotowano natomiast kilka bardzo istotnych różnic między częstością występowania form zachowania między zebry Hartmanna a koniem Przewalskiego. U obydwóch gatunków zaobserwowano również koordynację behawioru w obrębie grupy. Częstość zachowań społecznych u obu gatunków była mała i nie dała podstaw do rozważań na temat struktury społecznej.

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Streszczenie: *Wstępne obserwacje dotyczące zachowania się dwóch dzikich koniowatych: konia*