

**BREEDING EXPERIENCE WITH NORTHERN WHITE RHINOS
(*Ceratotherium simum cottoni*) AT ZOO DVUR KRALOVE**

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The situation of the northern white rhino population in the wild is well known (2, 3, 4, 9). Less is known about its captive population. No information dealing with housing, husbandry, and/or management exists and only very little is published about the southern subspecies in this respect (5, 6, 7, 8). For this reason we decided to publish our experience with breeding of the northern white rhinos in Zoo Dvur Kralove.

The breeding history of the northern white rhinoceros (*Ceratotherium simum cottoni*) in the Zoo Dvur Kralove is based on 8 animals captured in Africa and imported directly or via England (Table 1).

The herd was started in 1975 by a direct import of 6 animals captured in the Shambe area of the southern Sudan. The animals were 4 females, #374 Nola, #375 Nuri, #376 Nadi, and #377 Nesari, and 2 males, #372 Sudan and #373 Saut. The age of #374 Nola was estimated at 1.5 year, the other animals were about 3 years old. The fifth female, #351 Nasima, imported in 1977 from the Knowsley in England was born about 1965 and was captured in Uganda. The third male, #19 Ben, imported from the London Zoo in 1986 was born about 1951, but its exact place of origin is unknown.

Of these 8 animals, the female, #375 Nuri, died of traumatic shock after falling into a ditch around the enclosure and the male, #19 Ben, was euthanized in 1990 due to senile emaciation at the estimated age of 39 years.

In 1989, three animals (the females #374 Nola and #376 Nadi and the male #373 Saut) were sent on breeding loan to the Wild Animal Park in San Diego to improve reproduction conditions and decrease demographic risk.

Since 1977, four young were born, but only from the female #351 Nasima. The first offspring, female #476 Nasi, was conceived in England by a male southern white rhino and was born 3 months after #351 Nasima's arrival to the Zoo Dvur Kralove. The second offspring, male #630 Suni, (father #373 Saut) was born in 1980. The following two females, #789 Nabire and #943 Najin, were conceived by the male #372 Sudan and were born in 1983 and 1989. Currently #351 Nasima is pregnant with its fifth offspring.

From the above mentioned it is obvious that two males and five females (of these female #476 Nasi is hybrid) are currently kept in Zoo Dvur Kralove.

THE RHINO HOUSING

During the years of 1975 to 1990, the animals were kept in a 59 x 9 m brick pavilion divided into 9 boxes with sizes 6 x 5-6 m. The boxes had wooden block floors and were separated by barriers from wooden posts and by steel pipe railing gates from the adjoining boxes and from the manipulation corridor. The pavilion was initially provided with electrical ductless heating with hot air directly circulated by fans. The heating provided an average inside temperature of 18°C. The ventilation system was not very effective and did not eliminate high relative humidity and manure gas and odor levels especially during the winter. After remodeling in 1988, the pavilion microclimate was improved.

The pavilion had two adjoining outside enclosures of 1100 and 1200 m² in sizes. One third of the enclosure surface was covered with concrete, the rest with sand and fine gravel. The

enclosures were surrounded by pavilion walls, masonry walls, and dry ditches again with masonry walls.

In 1990 the animals have been moved to a new pavilion of 125 x 12 m in size. The new pavilion has 3 sections that can be fully isolated from each other. The pavilion has 20 boxes, 5.8 x 5-6.6 m in size. The floors are made of clay tiles, and the concrete walls have washable clay tile surfaces. The boxes are interconnected with steel railing gates and separated from the manipulation corridor by steel pipe railing. The gates between boxes can be kept open to provide more room for animals as needed. The pavilion has a floor water heating system supplemented with a hot air system with ceiling ducts. Ventilation fans are in the ceiling above each box. The system maintains inside temperature 17-18 °C, low relative humidity, and low levels of manure gases.

The pavilion has 5 outside enclosures with a combined size of 5500 m². One fourth to one third of each enclosure has a concrete surface, and the rest is covered with grass. The enclosures are surrounded by pavilion walls, masonry walls, and dry ditches with masonry walls.

THE RHINO HUSBANDRY

During the years of 1975 - 1977, all animals were kept together, both inside the pavilion and in the enclosure. After the arrival of the female #351 Nasima, and especially during the sexual maturation of males, the group had to be split. The males were then kept individually and the females in a group in 3 - 4 connected boxes. The females were separated only during parturition, nursing, and health problems. The female offspring were added to the group of mature females at the age of about 4 years. The female group was joined in the outside enclosure by one male.

Initially only the males #372 Sudan and #373 Saut alternated with the females. After the arrival of the male #19 Ben and the maturity of the male #630 Suni, all 4 males were rotated. The length of the outside stay depended on temperature. In winter the females were outside for 1 - 3 hours and the males joined them only occasionally. In the spring and autumn the females were outside with the male 3 - 10 hours according to weather. During the summer they were often left outside overnight.

In the new pavilion the sufficient space and the construction arrangement of the pavilion and the enclosures will allow keeping animals individually or dividing or grouping of animals as needed. It is also possible to try to keep females and males in pairs for breeding both inside and outside the pavilion. This should improve the chances for successful reproduction.

THE RHINO NUTRITION

The feeding ration in 1975 - 1980 was gradually changed with respect to the growth and maturation of animals.

Between the years 1980 and 1989, the ration per animal per day contained 2 kg ZOO I granulated concentrate, 3 kg crushed oats, and 50 g mineral supplement. The winter ration contained, in addition, 3-4 kg carrots and meadow hay *ad libitum*. The hay consumption ranged from 10-25 kg/day depending on animal and quality of hay. The summer ration contained, in addition, green forage (meadow grass, clover-grass or vetch-cereal mixtures) fed during the day and hay fed overnight *ad libitum*.

In 1989 the ZOO I granulated concentrate, crushed oats and mineral supplement were replaced by 2.6 kg new granulated feed ZOO C with high mineral content.

Highly pregnant and nursing female are given, in addition, 0.3-0.5 kg dry skim milk daily to increase the protein level of feeding ration.

THE VETERINARY CARE

The scope of health problems in white rhinos is rather narrow. Parasitic infestations are rare and infectious diseases infrequent (1, 5, 10, 11, 12, 13). Most of the health problems encountered in our animals probably resulted from deficiencies in animal housing, husbandry, and nutrition. Veterinary interventions for other reasons were rare. The notable health problems seen included:

- Frequent traumatic excoriations around the horn and on the body surface, lameness, and apparent contusions resulting from animal fighting or from injuries due to pavilion and enclosure walls, gate frames, feed and water troughs, etc.
- Mucopurulent rhinitis in winter due to low temperatures, high humidity, and irritating manure gases in the pavilion. This condition reached almost chronic character before the pavilion remodeling in 1988. (A large group of southern white rhinos had been kept in this pavilion during the years 1970 - 1975 and they seem to be much less susceptible to this disease.)
- Occasional local dermatitis around teats and skin folds resulting from excoriations and subsequent infection with yeasts and saprophytic microflora.
- Isolated enteritis with diarrhea due to poor quality of carrots or green forage.
- In one case a colic due to large intestinal obstipation was diagnosed.

THE REPRODUCTIVE BEHAVIOR

Although only one female of this captive herd gave birth, sexual activity of various intensities was noted in 8 of 10 animals (No sexual activity was observed in the females #376 Nadi and #476 Nasi).

The behavioral signs observed included:

- The male was interested in the female, followed her, sniffed her vulva, and uttered sound signals. The female responded with calm and no aggression, but no further contact was seen (#373 Saut with #374 Nola, #630 Suni with #789 Nabire).
- Mounting attempts by the male without penis erection and intromission attempts. The female was calm without any invitation behavior, and usually walked away (#373 Saut with #374 Nola).
- Mounting with penis erection and intromission attempts. The female was showing signs of estrus behavior, but no copulation was seen (#19 Ben with #351 Nasima, #372 Sudan with #377 Nesari). The male #19 Ben was not apparently able to mount due to age and the female #377 Nesari laid down during the male mounting attempt.
- Completed mounting was seen (#373 Saut with #351 Nasima, #372 Sudan with #351 Nasima).

Thus, out of 6 females kept in Zoo Dvur Kralove, 2 did not show sexual activity at all (#376 Nadi, #476 Nasi), only two showed clear sexual activity (#377 Nesari only occasionally), and only one of the two (#351 Nasima) delivered offspring. This female came to the herd as adult and already pregnant. The females #374 Nola, #376 Nadi, and #377 Nesari matured together in the Zoo, and their low sexual activity may be in some relationship with the conditions of housing, husbandry, and nutrition in captivity. The same or similar situation may be with the females already born in the Zoo (#476 Nasi, #789 Nabire).

Observations in the Zoo Dvur Kralove indicate that the estrous cycle length in northern white rhinos is 29 ± 3.4 days (24 - 37 days, N = 16). The estrus (receptivity) lasts 1 - 1.5 days, but the male is interested in the female starting 1 - 3 days earlier.

The pregnancy length, calculated between the last seen mating and the birth of the two female offspring was 482 and 485 days.

The first estrus after weaning of the 11.5-month-old young was observed in 14 days.

OUTLOOK AND CONCLUSION

The critical situation with the reproduction of the northern white rhino in the Zoo Dvur Kralove herd is well recognized and initial remedial measures have been implemented.

The new pavilion provides sufficient individual space for all animals and allows flexible grouping as needed. Improved pavilion microclimate and outside enclosure quality may also contribute to the desired results.

In 1989, three animals (the females #374 Nola and #376 Nadi and the male #373 Saut) were sent to the San Diego Wild Animal Park to decrease demographic risk and in the hope that reproduction would be stimulated in better climatic and housing conditions (females kept with the male all the time in a large enclosure). Unfortunately so far this expectation has not materialized.

The Zoo Dvur Kralove cooperates closely with Dr. Hodges (Deutsches Primatenzentrum, Göttingen) and with Dr. Hindle (The Zoological Institute of the Zoological Society of London) on determination of steroid hormone metabolites in urine to monitor the reproductive cycle in females.

The Zoo Dvur Kralove staff performed rectal and vaginal examinations of reproductive organs in females and rectal examination of males. Possibilities of semen collection and hormonal stimulation of the estrous cycle are studied.

Construction of indoor and outdoor fixation chutes is planned to allow regular examination of animals and semen collection for long-term freezing storage and possibly artificial insemination.

We realize that time is running out since our wild born animals are now about 20 years old. In addition, current dramatic political and economical changes in Czechoslovakia have put the Zoo into a critical financial situation with uncertain future which may thwart our plans.

For these reasons I challenge you all to get involved in close international cooperation in the reproduction of northern white rhinoceros which may substantially contribute to saving this rare subspecies for us and our descendants.

REFERENCES

1. Haigh, J.C. (1975). Case of constipated rhino. *Veterinary Record* 97: 282
2. Hillman-Smith, K. (1986). A last chance to save the northern white rhino? *Oryx* 20(1): 20 - 26
3. Hillman-Smith, K. (1990). Rhino conservation in Garamba National Park. *Pachyderm* 13: 39- 41
4. Jones, D.M. (1987). Developing strategies for northern white rhino. *Pachyderm* 9: 19 - 23
5. Jones, D.M. (1979). The husbandry and veterinary care of captive rhinoceros. *Int. Zoo. Yb.* 19: 239 - 252
6. Lang, E.M. (1976) Nashörner. Pp. 164 - 172. In: Klös, H. and E.M. Lang. (eds.). *Zootier Krankheiten von wildtieren im Zoo, Wildpark, Zirkus und in Privathand sowie ihre Therapie.* pp.365. Berlin/Hamburg: Paul Parey.
7. O'Connor, S.M. (1986). Activity cycles of the southern white rhinoceros (*Ceratotherium simum simum*) in captivity - implication for management. *Int. Zoo. Yb.* 24/25: 297 - 303
8. Rawlins, C.G.C. (1979). The breeding of white rhinos in captivity - a comparative study. *Der Zoologische Garten* 49(1): 1 - 7
9. Reece, R.W. (1990). Encouraging news from Zair. *Rhino Conserv. Newsletter* 1(2): 4

10. Schmidt, R.E. and D.A. Hartfield. (1976). Disseminated bacterial infection in an infant rhinoceros. *J. Zoo. Anim. Med.* 7(2): 15 - 17
11. Silberman, M:S. and R.B. Fulton. (1979). Medical problems of captive and wild rhinoceros - a review of the literature and personal experience. *J. Zoo. Anim. Med.* 10(1): 6 - 16
12. Thomson, J.K., Priestley, F.W. and J.P. Polding. (1949). Enteritis of a white rhinoceros associated with *Pseudomonas pyocyanea* infection. *Veterinary Record* 61:341
13. Young, E. (1965). Lesion in the vicinity of the eye of the white rhinoceros, *Diceros simum*. *Int. Zoo. Yb.* 5: 194 - 195

TABLE 1

Name	Birth date	Birth place	Dam	Sire	Transfer from	Transfer to	Death date
Sudan (M) #372	00-00-72	Sudan	wild	wild	Africa 00-00-75		
Saut (M) #373	00-00-72	Sudan	wild	wild	Africa 00-00-75	S.Diego	10-13-89
Nola (F) #374	00-00-74	Sudan	wild	wild	Africa 00-00-75	S.Diego 10-13-89	
Nuri (F) #375	00-00-72	Sudan	wild	wild	Africa 00-00-75		01-04-82
Nadi (F) #376	00-00-72	Sudan	wild	wild	Africa 00-00-7	S.Diego 10-13-89	
Nesari (F) #377	00-00-72	Sudan	wild	wild	Africa 00-00-75		
Nasima (F) #351	00-00-65	Uganda	wild	wild	England 08-27-77		
Nasi (F) #476	11-11-77	ZOO D.K.	#351 Nasima	southern white r.			
Suni (M) #630	06-08-80	ZOO D.K.	#351 Nasima	#373 Saut			
Nabire (F) #789	11-15-83	ZOO D.K.	#351 Nasima	#372 Sudan			
Ben (M) #19	00-00-51	Africa	wild	wild	England 08-19-86		06-25-90
Najin (F) #943	07-11-89	ZOO D.K.	#351 Nasima	#372 Sudan			