

## Maintaining and breeding the Northern white rhinoceros

*Ceratotherium simum cottoni*

### at Dvur Kralove Zoo

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While the perilous situation of the Northern white rhinoceros *Ceratotherium simum cottoni* in the wild is well known (Hillman-Smith, 1986, 1990; Jones, 1987; Reece, 1990), its management in captivity is less well documented. As far as we are aware there is no published information on housing, management and reproduction relating solely to this subspecies, although some data exist on the southern subspecies *Ceratotherium s. simum* (Lang, 1976; Jones, 1979; Rawlins, 1979; O'Connor, 1986).

A herd of Northern white rhinoceros was established at Dvur Kralove Zoo in 1975 with 2.4 wild-caught animals originating from the Shambe area of southern Sudan. The ♂♂ and three ♀♀ were estimated as three years of age, the fourth ♀ as about one-and-a-half years old. Two further animals, both born in the wild, were obtained from England, a ♀ from the Knowsley Safari Park, Prescott, in 1977 and a ♂ from London Zoo in 1986 (Table 1).

Of the original eight animals, three have died, two ♀♀ from trauma and the London Zoo ♂ which was euthanased at an estimated age of 39. In 1989 1.2 animals were sent to San Diego Wild Animal Park. Four young have been born all to the ♀ from Prescott, which arrived pregnant at the Zoo and gave birth to a ♀ calf three months later; unfortunately, this offspring was sired by a Southern white rhinoceros.

At time of writing the herd at Dvur Kralove Zoo consists of 2.4 (including the subspecific hybrid) of which 1.3 were born at the Zoo. All the surviving ♀♀ are nulliparous.

#### HOUSING

Until 1990, the rhinoceroses indoor quarters were a 59 × 9 × 4.5 m high brick pavilion with nine stalls, measuring 6 × 5–6 m. The floor was of wooden blocks and the stalls were separated from adjoining stalls and the service corridor by wooden-post and steel-pipe railing. Originally the building was provided with electric ductless heating with hot air circulated by fans which maintained an average indoor temperature of 18°C. The ventilation system, however, was inadequate to control the high relative humidity and the odours and gases from waste matter, especially during the winter. Conditions were improved by some remodelling of the system in 1988 but not until the animals were rehoused were the problems completely overcome. Adjoining the pavilion were two outside enclosures, 1100 and 1200 m<sup>2</sup>. One third of each enclosure surface was concreted, the remainder covered with sand and fine gravel. The enclosure walls were brick with a dry ditch protected on the outside edge by a second wall.

In 1990 the animals were moved to a new pavilion, measuring 125 × 12 × 4.35 m which also houses Black rhinoceros *Di-*

<sup>1</sup>This work is dedicated to the memory of Miroslav Svitalsky who worked with rhinoceros for 20 years and was fatally wounded by one of the animals on 20 May 1991.

HOUSE NAME	STBK NO.	SEX	ARRIVED	ORIGIN	BORN (w-b est.)	DIED	SIRE <sup>3</sup>
Sudan	0372	♂	1975	Sudan	w-b	1972	
Saut <sup>1</sup>	0373	♂	1975	Sudan	w-b	1972	
Nola <sup>1</sup>	0374	♀	1975	Sudan	w-b	1973	
Nuri	0375	♀	1975	Sudan	w-b	1972	1982
Nadi <sup>2</sup>	0376	♀	1975	Sudan	w-b	1972	
Nesari	0377	♀	1975	Sudan	w-b	1972	
Nasima	0351	♀	1977	Uganda	w-b	1965	1992
Ben	0019	♂	1986	unk	w-b	1951	1990
Nasi <sup>2</sup>	0476	♀		c-b		1977	unk
Suni	0630	♂		c-b		1980	Saut
Nabire	0789	♀		c-b		1983	Sudan
Najin	0943	♀		c-b		1989	Sudan
		♀			aborted	1991	Sudan

<sup>1</sup>Animals on breeding loan to San Diego Wild Animal Park.

<sup>2</sup>Subspecific hybrid; mating between Nasima and unknown Southern white ♂.

<sup>3</sup>Zoo-born calves; mother Nasima.

Table 1. History of Northern white rhinoceros *Ceratherium simum cottoni* herd at Dvur Kralove Zoo.

*ceros bicornis* and Indian rhinoceros *Rhinoceros unicornis*. Each of the three sections can be completely isolated from the others. The building contains 20 stalls, 5.8 × 5–6 m, which are separated from the corridor by steel-pipe railing. Steel-rail gates separating adjoining stalls can be left open to give a larger area when required. The floor and the concrete walls have washable tile surfaces. The building has an underfloor water heating system, supplemented by a hot-air system with ceiling ducts. Ventilation fans have been positioned in the ceiling above each stall. The system maintains an indoor temperature of 17–18°C, low relative humidity and low odour levels.

There are five outdoor enclosures with a combined area of 5500 m<sup>2</sup>. A quarter to a third of each enclosure has concrete substrate and the remainder is grassed.

#### HUSBANDRY

Until 1978 the two young ♂♂ were housed with the ♀♀ both indoors and out but after the ♀ 'Nasima' was introduced and the ♂♂ became sexually mature it was necessary to divide the group. The ♂♂

were kept individually and the ♀♀ in a group in three to four connected boxes. The ♀♀ were separated only for veterinary treatment or, in the case of the breeding ♀, during parturition and lactation. The ♀ offspring were introduced into the herd at about four years of age.

The ♀♀ were joined in the outside enclosure by one ♂ at a time, initially one of the two original ♂♂ but after the arrival of 'Ben' and when the zoo-born ♂ 'Suni' reached eight years of age all four were rotated. The length of the herd's stay outside was dependent on temperature. In winter, the ♀♀ could remain outside for one to three hours with a ♂ joining them occasionally. In spring and autumn the herd with a ♂ was outside for three to ten hours depending on conditions and during the summer the animals could often be left in the outside enclosure overnight.

In the new pavilion the additional space and arrangement of the stalls will allow for a more convenient division or grouping of animals and also offers the possibility of housing the animals, both inside and out, in pairs.

#### NUTRITION

In the early years the food ration was changed frequently as the young matured. Between 1980 and 1989 the basic daily ration per animal contained 2 kg ZOO 1 granulated concentrate, 3 kg crushed oats and 50 g mineral supplement. This was changed in 1989 to a new granulated feed ZOO C with high mineral content fed at a rate of 2.5 kg/animal/day. The basic diet has always been supplemented in winter with 3–4 kg of carrots and meadow hay *ad libitum*. Hay consumption varies between 10 and 25 kg depending on the individual and the quality of hay. In summer the ration contains green forage (meadow grass, clover-grass or vetch-cereal mixtures) fed during the day and grass hay fed overnight *ad libitum*.

In late pregnancy and when lactating the breeding ♀ was given 0.3–0.5 kg dry skimmed milk daily to increase the protein level of the diet.

#### VETERINARY CARE

It appears that parasitic infestations are rare and infectious diseases infrequent in White rhinoceroses (Thomson *et al.*, 1949; Young, 1965; Haigh, 1975; Schmidt & Hartfield, 1976; Jones, 1979; Silberman & Fulton, 1979). Most of the comparatively minor problems encountered in our animals probably resulted from deficiencies in housing and/or nutrition. Veterinary interventions for other reasons were rare.

Of the three deaths, one was euthanasia and two were due to trauma; 'Nuri' died after falling into the ditch around the enclosure and the breeding ♀, Nasima, after falling and being unable to rise when her horn was trapped between the bars of the restraint chute. The old ♂ Ben had become senile and lost condition. There were no neonatal deaths but Nasima aborted a ♀ foetus (sired by 'Sudan') in 1991.

Health problems included: (a) injuries around the horn and on body surface, lameness and lesions, apparently resulting from fighting or scraping against walls or

fittings; (b) mucopurulent rhinitis in winter caused by low temperatures, high humidity and irritating gases from animal faeces in the pavilion. This condition became almost chronic before the remodelling of the pavilion in 1988: a large group of Southern white rhinoceroses which had been housed in the same quarters during 1970–1980 appeared to be much less susceptible to the condition; (c) occasional local dermatitis around teats and skin folds from lesions and subsequent infections with yeasts and saprophytic microflora; (d) isolated cases of enteritis with diarrhoea from poor quality of carrots or green forage; (e) one case of colic caused by a large intestinal obstruction; (f) a vaginal prolapse, which resulted in an abortion: the condition itself responded well to treatment.

#### REPRODUCTIVE BEHAVIOUR

Although only one ♀ has given birth, sexual activity of various intensity has been observed in eight animals. Reproductive behaviour included:

1. ♂ followed ♀, smelling her vulva and vocalizing; ♀ responded calmly without aggression but no further contact seen (Saut/Nola: Suni/Nabire: Suni/Nesari).
2. ♂ mounted ♀ but with no erection or attempt at intromission; ♀ was calm but unresponsive and usually walked away (Saut/Nola: Suni/Nabire: Suni/Nesari).
3. ♂ mounted with erection and attempted intromission; ♀ showed signs of oestrus behaviour but no copulation was observed (Ben/Nasima: Sudan/Nesari); it appeared that Ben was unable to mount properly probably because of his advanced age; Nesari laid down during the mounting attempts.
4. completed mount (Saut/Nasima: Sudan/Nasima: Sudan/Nabire: Suni/Nesari).

Of the six adult ♀♀, two (Nadi, and the hybrid Nasi) showed no sign of sexual activity, three (Nasima, Nesari, Nabire) showed definite signs of activity but only Nasima gave birth. The breeding ♀ came into the herd as an adult and already

pregnant. The ♀♀ Nola, Nadi and Nesari matured in the Zoo and their low sexual activity may be related to conditions there.

Observations at the Zoo indicate that the mean oestrous cycle length in the Northern white rhinoceros is  $29 \pm 3.4$  days (24–37 days  $n=16$ ). Receptivity lasts 1–1.5 days but the ♂ becomes interested in the ♀ one to three days earlier.

Gestation, calculated between the last observed mating and birth of the two ♀ calves was 482 and 485 days. The first oestrus after weaning of the 11.5 month old young was observed at 14 days. The first copulation of the zoo-born ♂, Suni, was seen at the age of 12 years and of the ♀ Nabire at eight years of age.

#### CONCLUSION

It has been recognized that the situation regarding reproduction in the Dvur Kralove Northern white rhinoceros herd is critical and the first remedial measures have been implemented.

The new housing provides sufficient individual space for all the animals and allows flexible groups as needed. The improved air quality inside the building and improvements to the outside enclosures should contribute to the well-being of the herd. In 1989 three animals were sent to the San Diego Wild Animal Park to decrease the risks attendant on holding too many of the small population in one place and in the hope that reproduction would be stimulated in better climatic and housing conditions. At the Park the ♂ and ♀♀ are kept together in a large enclosure but so far no successful mating has been achieved.

The Dvur Kralove Zoo has worked closely with Dr Keith Hodges, Deutsches Primatenzentrum, Göttingen, and Dr Joanne Hindle, Institute of Zoology, The Zoological Society of London, and has recently begun a co-operation with Dr E. Möstl, Institut für Biochemie, Veterinärmedizinische Universität Wien, on determinations of steroid hormone metabolites in urine to monitor the repro-

ductive cycle in ♀♀. We are also in close contact with Dr Oliver Ryder of CRES, Zoological Society of San Diego, to resolve genetic questions. The staff at Dvur Kralove have undertaken rectal and vaginal examinations of the reproductive organs of the ♀♀ and rectal examinations of the ♂♂. The possibilities of hormonal stimulation of the oestrous cycle are being studied. The construction of restraint chutes in both indoor and outdoor enclosures to facilitate the regular examination of the animals is at the planning stage.

The efforts of the staff at Dvur Kralove are concentrated on increasing the reproduction of the Northern white rhinoceros to help save this rare subspecies for us and our descendants.

#### PRODUCTS MENTIONED IN THE TEXT

ZOO I: manufactured by ZZN, Vysoké Mýto, Czech Republic.

ZOO C: manufactured by ZZN, Trutnov, Czech Republic.

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