

# Breeding the white rhinoceros at Dvur Kralove Zoo

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## The white or square-lipped rhinoceros -

*Ceratotherium simum*

(Burchell, 1817)

### Taxonomy:

Class:	Mammals ( <i>Mammalia</i> )
Order:	Odd-toed ungulates ( <i>Perissodactyla</i> )
Family:	Rhinoceroses ( <i>Rhinocerotidae</i> )



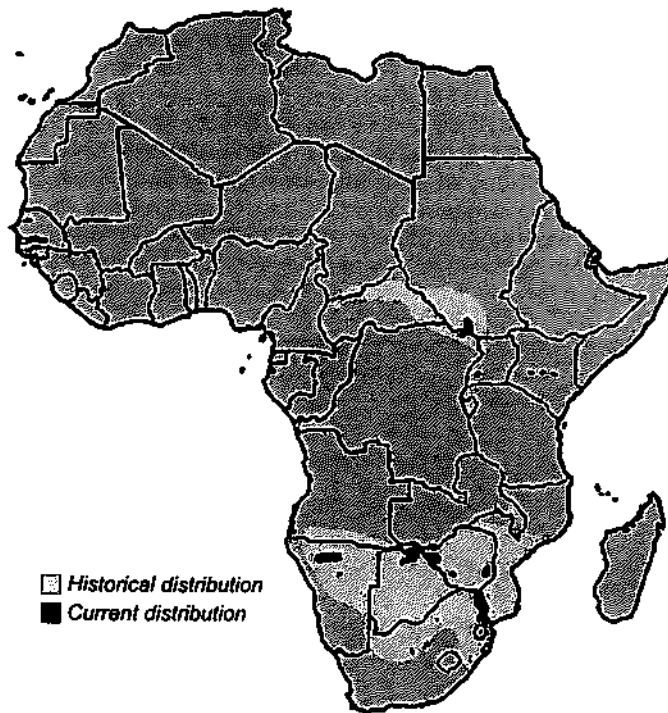
The northern white rhino Sudan in Kenya, 2009 (dh)

## Distribution

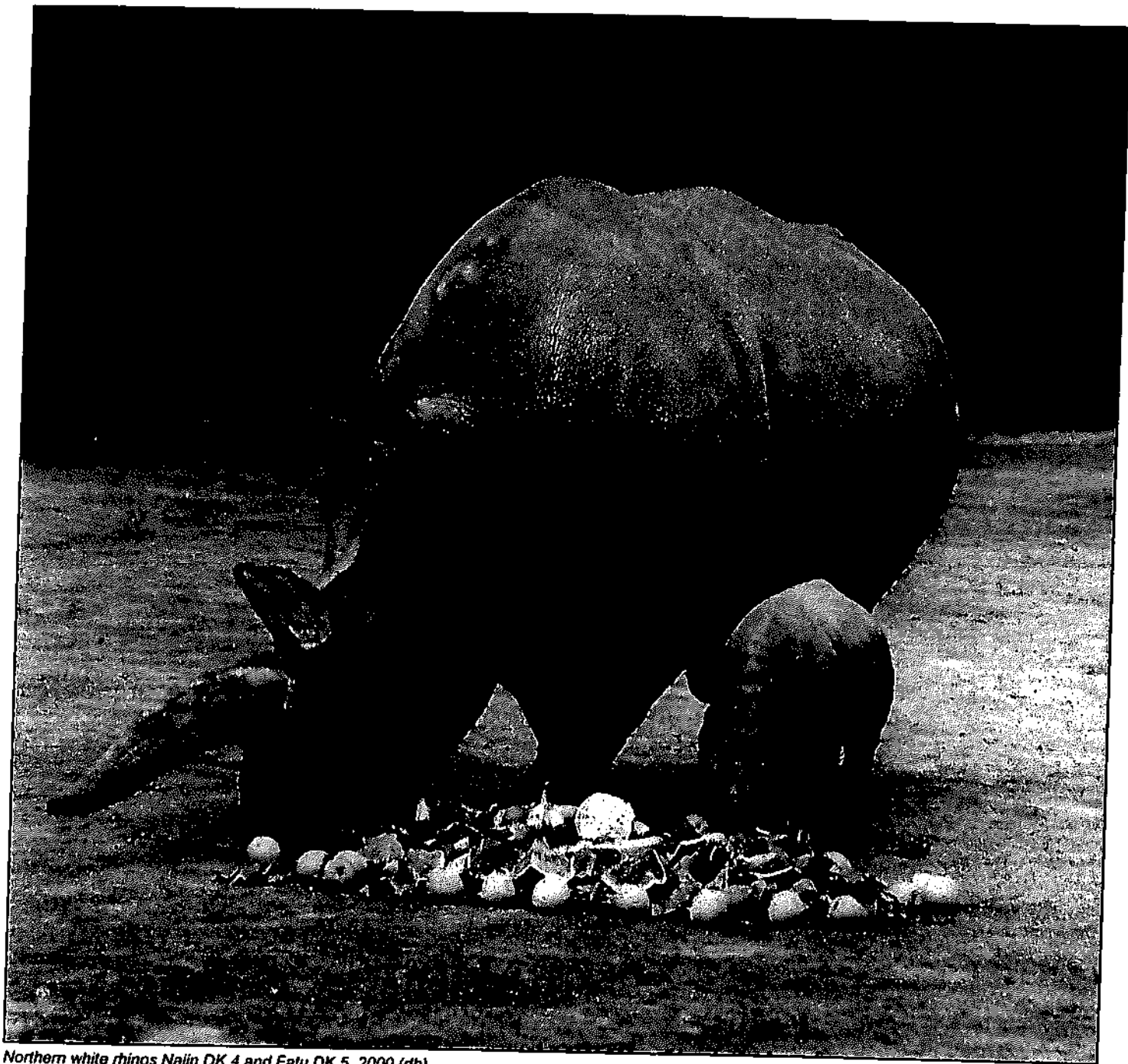
Originally, the white rhinoceros inhabited two separate ranges, from which the northern territory included grassland regions of Central Africa west of the River Nile, in particular Sudan, Chad, Zaire (now Democratic Republic of Congo), Central African Republic and Uganda, while the other part covered the southern portion of Africa south of the Zambezi River with the exception of desert areas, i.e. Angola, Botswana, Zimbabwe, Mozambique, Namibia, Swaziland and the Republic of South Africa. The northern subspecies is now almost extinct in the wild; the southern form was on the brink of extinction around 1900. Once the southern white rhino population was on the increase, reintroductions and introductions took place from SA into both historical range countries as well as those out of range, where the former comprised Botswana, Zimbabwe, Namibia, Swaziland and Mozambique, while the latter covered Zambia, Kenya, Uganda (TRENSE 1989; TENYWA 2009) and Senegal.

## Biological data (GOLTENBOTH *et al.* 1995, PENNY 1988)

Weight:	1,700-2,400 kg.
Wither height:	150-185 cm
Horn length:	The anterior horn is longer in females compared to males (MILLS and HES 1997), measuring up to 101 cm (the greatest length as measured in a male of the northern subspecies: 101.6 cm - LANG 1920), or even up to 201 cm



The range of the white rhinoceros (according to EMSLIE and BROOKS 1999)



*Northern white rhinos Najin DK 4 and Fatu DK 5, 2000 (dh)*

	(southern subspecies); the posterior horn up to 95 cm; record measures: 297.5 cm for the front horn and 279 cm for the rear horn (TRENSE 1989).
<b>Body length incl. head:</b>	360-420 m
<b>Oestrus cycle:</b>	20-45 days (SCHWARZENBERGER 1995b)
<b>Gestation period:</b>	480-514 (548) days; normally 490 days
<b>Number of young:</b>	1
<b>Birth weight:</b>	35-80 kg, 50 kg on average
<b>Eyes opening:</b>	At birth
<b>Nursing period:</b>	12 months, in some cases only 6, in other cases even longer (maximum is 2 years)
<b>Sexual maturity:</b>	Males 7-8 years (however, males become dominant only when 10-12 years old); females 6-7 years
<b>Reproductive age:</b>	Females in the wild 30-35 years, males up to 40 years; females give birth every 2-2.5 (3) years
<b>Longevity:</b>	40-50 years in the wild; 35-40 years in captivity, exceptionally even 48 years.

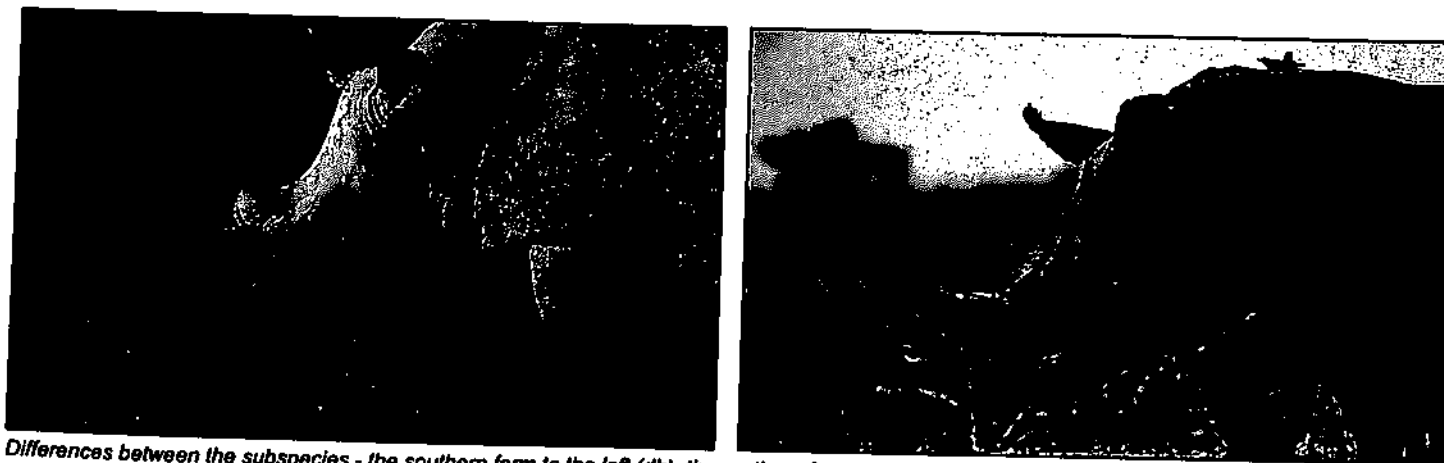
### Subspecies

The species is called white as the Dutch word 'wilde' (wide) was misconstrued in English (white). However, in terms of colour, no difference exists between the species, as both are grey in tone.

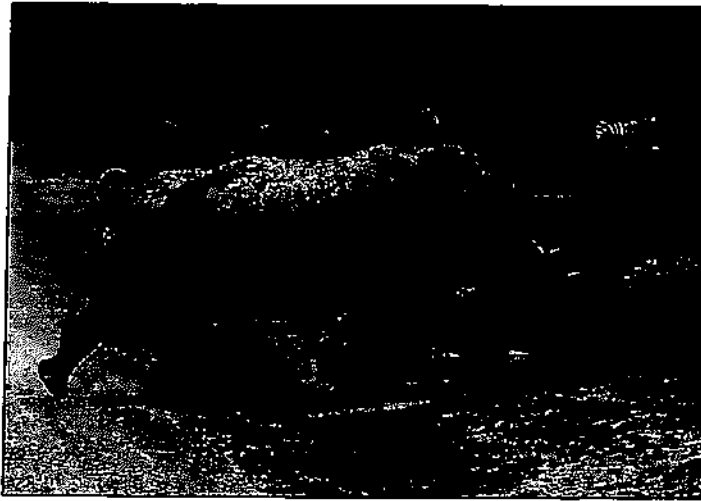
The discovery of the southern subspecies and the species generally happened in Kimberley, South Africa, in 1817, with the northern form identified in Uganda only in 1907 (PENNY 1988) and described in 1908 (ANDERA 1999), although the latter was observed by Major Gibbons as early as 1900 (HELLER 1913). The two range areas were 1,930 km apart (LANG 1920). Given that both populations have been isolated for 1.8 million years, as well as considering the clear morphological differences found especially on the skull, but also in the number of vertebrae (HELLER 1913), each subspecies should rather be considered a separate species (ROBOWSKI pers. comm.). In prehistoric times, they were widely distributed throughout the southern and eastern regions of Africa (MILLS and HES 1997). Besides climate change during the Ice Age, hunting by humans annihilated the white rhino elsewhere (EMSLIE and BROOKS 1999).

- The southern white rhinoceros (*Ceratotherium simum simum*) is currently the most numerous rhino subspecies widespread throughout the southern African sub-region, and has been successfully introduced even into some out-of-range countries of Eastern and Western Africa (Kenya, Uganda, Senegal); reintroduction took place in Botswana, Namibia, Zimbabwe and Swaziland (MILLS and HES 1997).
- The northern white rhinoceros (*Ceratotherium simum cottoni*) used to occur in five countries of Central Africa west of the River Nile - Uganda, Sudan, Chad, Central African Republic and the Democratic Republic of Congo (former Zaire). In Uganda, they were exterminated in 1982 (TENYWA 2009). At present, there are perhaps a few surviving animals in southern Sudan.

Visually, both subspecies do not differ very greatly from each other, with the most visible difference being the shorter facial part in the northern form, which additionally seems to have hairier edges of ears.



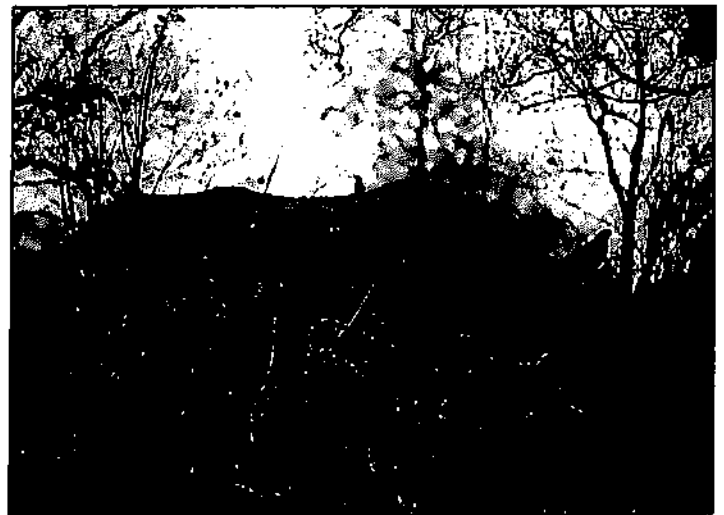
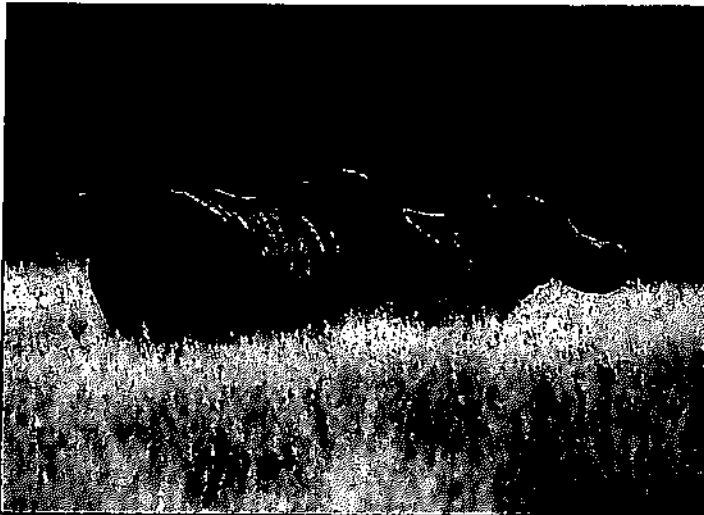
Differences between the subspecies - the southern form to the left (dh), the northern form to the right (agp)



*The southern (left) and the northern white rhino subspecies (right) (dh)*

### **Habitat**

The native habitat of the white rhino consists of open grasslands - steppes and a shrubby savannah with access to water, with medium-length to short grass cover being the most preferred parts.



*The southern form of the white rhino, Kimberley, SA, 2008 (left); the same in Kruger NP, SA, 1998 (dh)*

### **Diet**

White rhinos are herbivore grazers that eat grass and are the largest existing pure grazers out of all animal species. with lips adapted to make up a sort of bar (hence the alternative name square-lipped). It usually drinks twice a day, but is able to withstand two to four days without water (ESTES 1990).

**The white rhino in Garamba NP, The Democratic Republic of Congo**



*The northern form of the white rhino in Garamba NP, 2000 (fhs)*



*Northern white rhinos in Garamba NP (agp)*

**The white rhino in Garamba NP, The Democratic Republic of Congo**



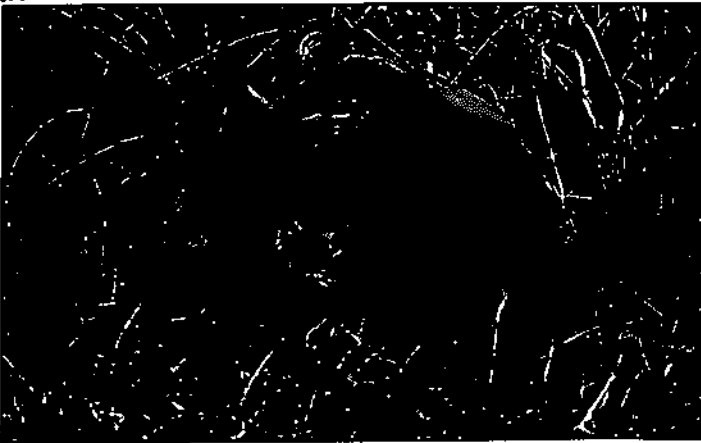
*Rangers in Garamba NP: encountering a rhino (agp)*



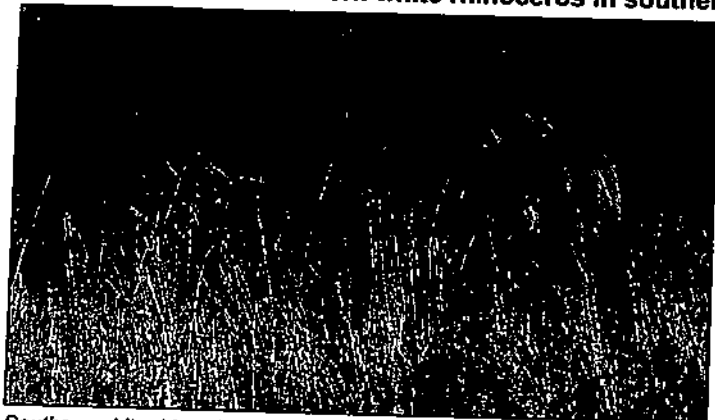
*A. Puttger-Conradt in Garamba NP (left); northern white rhino skulls (right) (agp)*



*A northern white rhino habitat in Garamba NP (agp)*



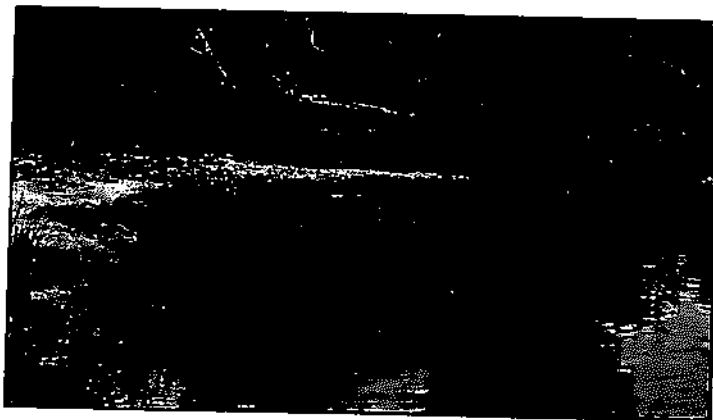
**Native sites of the southern white rhinoceros in southern Africa**



*Southern white rhinos in Kimberley, 2008 (left) and Pilanesberg (right), 1998 (dh)*

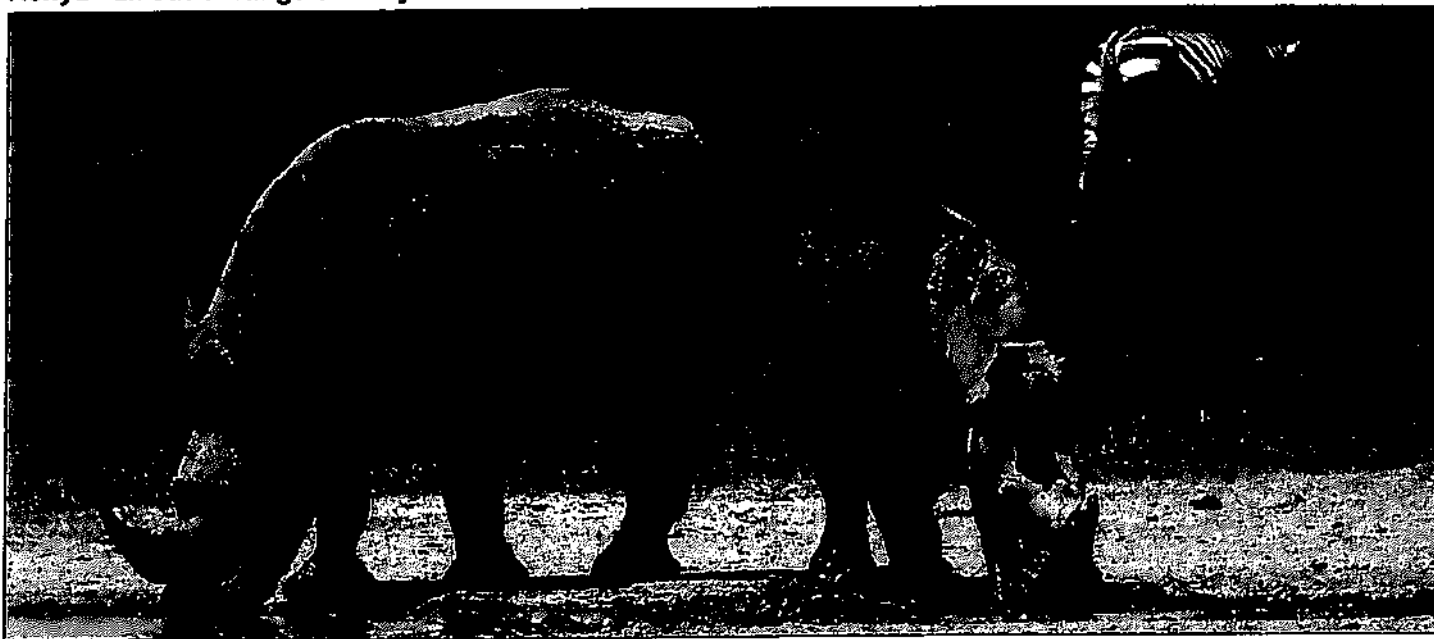


*As regards Swaziland, the southern white rhino was successfully reintroduced into the country - Mkhaya Game Reserve and a boma, 2007. (dh)*



*Southern white rhinos in Swaziland, 2008 (zc)*

Kenya - an out-of-range country for southern white rhinoceroses



*The southern white rhinoceros was introduced into Kenya, which is an out-of-range country for the subspecies; a picture from Ol Pejeta Conservancy. (dh)*





*A southern white rhinoceros, Bandia Reserve, Senegal (dh)*



*A young southern white rhino playing, Ol Pejeta, Kenya (dh)*

## Ecology

The white rhino is more territorial than the black rhino. They can run at speeds up to 40 km/h over a short distance (PENNY 1988). Feeding takes about a half of the active time of the white rhino, taking place both day and night. In the middle of the day, white rhinos are resting in the shade or inside pot-holes. They usually drink at dawn or shortly after dark. If moving over long distances in times of drought, then they drink every 3 to 4 days.

White rhinos are partly social animals. Females and juveniles live rarely a solitary life, usually associating in pairs, when the female is followed by her most recent calf. Adult females with no calves will tolerate one or multiple juveniles; two adult females can also be seen together when without offspring. Unlike females, adult males live separately (ESTES, 1991).

Dominant males occupy exclusive territories, which they share with one or several subordinate males. The territory size depends on the quality and quantity of food and usually varies between 2 and 5 square km. Only dominant bulls demarcate their territory by urine and faeces at the border of their home range and along their paths. Large piles of dung indicate the border of the territory. Outside its home range, the dominant male acts as a subordinate animal, travelling to water and back without urine-marking the area through which it passes outside its territory.

Adult females are found alone only with their recent calf, while juveniles form groups of 3-10 animals. At the same time, the home range of a female covers 6-20 sq km and may overlap with territories of several males.

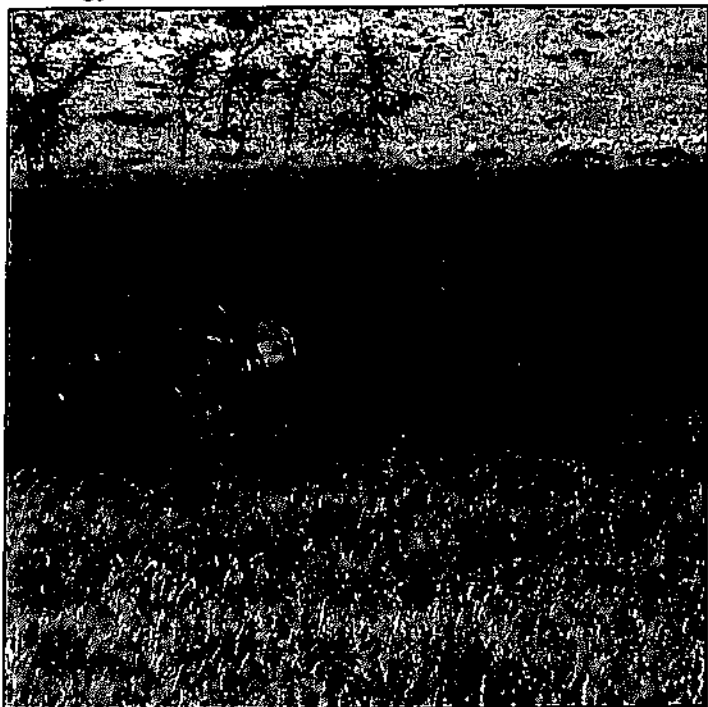
Males reach sexual maturity at 10-12 years of age, while females at 5-7 years. Oestrus takes place at monthly intervals throughout the year, while the majority of calves are born in the dry season (MILLS and HES 1997). The gestation period lasts 16 months. Beginning to graze from 2 months of age, calves are nursed by cows until one year of age (ESTES 1991).

Females enter heat around 6-12 months after the birth of the previous young. Territorial males seek to retain the female in their home ranges 5-10 days before oestrus, as generally only the dominant male will mate. The mating as such lasts 20 minutes or longer (OWEN-SMITH in MILLS and HES 1997).

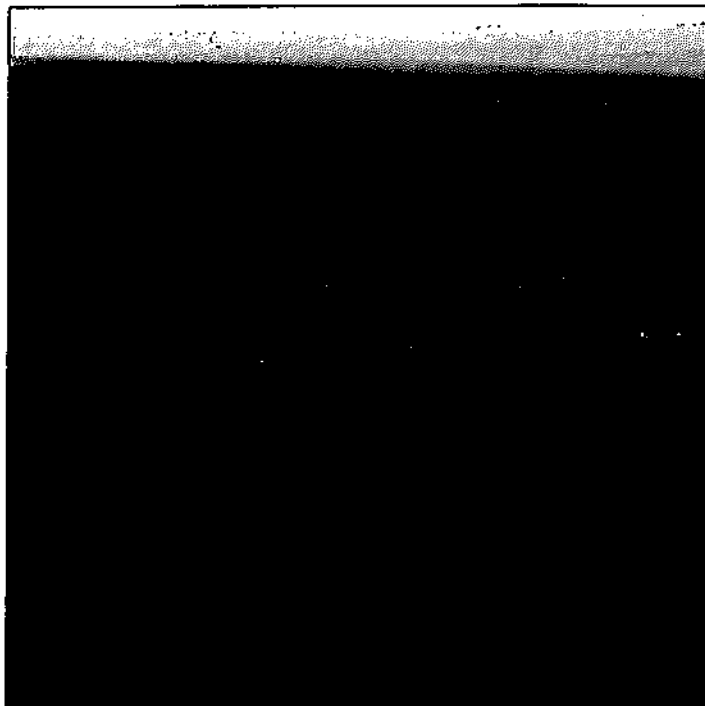
Females are pregnant about 18 months. Normally, the calf will walk in front of the female (ESTES 1991) and remains with its mother 2 to 3 years. The female leaves her most recent calf shortly before the birth, living only with her new young after the delivery. Once a juvenile rhino is driven off from his mother, it tends to associate with other subadult individuals or joins an adult female without a calf, which is typical for the white rhinoceros (PENNY 1988).

When they reach adulthood, white rhinos have no natural enemies, but young may be endangered by young lions and spotted hyenas (ESTES 1991).

## Ecology of the white rhino



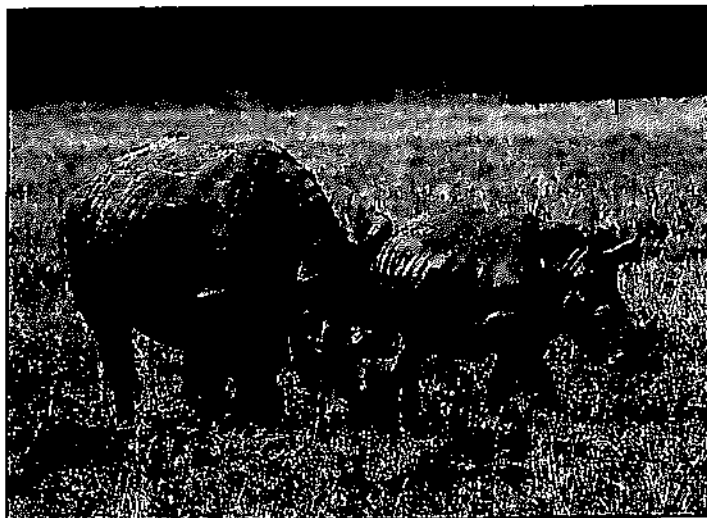
*An oestrous female with a young tracked by three males - Lewa (dh)*



*An oestrous female with a young accompanied by a dominant male, both being tracked by another male from a distance - Ol Pejeta, Kenya (dh)*



*Juvenile males live together - Lewa. (dh)*



*An adult female usually stays with her most recent calf - Ol Pejeta, Kenya. (dh)*

## Conservation

In the list of the most protected species under CITES Appendix I of the Washington Convention, under which the trade in live specimens and their derivatives (including horn) is prohibited, only the northern subspecies was included in 1975, followed by the southern subspecies in 1977.

Population growth as a result of protection of the southern form in South Africa and successful reintroduction into other countries was the reason that in 1994 the southern subspecies was deleted from Appendix I and included in Appendix II of CITES, which has allowed for trade in live specimens, including the export of trophies obtained from legally hunted animals (EMSLIE and BROOKS 1999). According to the IUCN Red List, the northern subspecies nears extinction and the species as such is classified as near threatened, with its population rising (IUCN Red List 2009).

Today, the white rhino is threatened almost exclusively by poaching, which has driven the northern subspecies to the very brink of extinction, devastating currently the southern form population in Zimbabwe (IRF).

Despite the internationally organised protection efforts, the demand for horn is not diminishing in both Yemen and particularly in China and Vietnam, where the powder horn is used in traditional medicine. Price for 1 kg of horn is USD 10,000 in South Africa and even EUR 30,000 in China.

## Conservation measures

Protection of both species is monitored by the African Rhino Specialist Group (AfRSG) to the IUCN. This organization has been publishing statistics on the occurrence by subspecies and country every 2 years since the early 1990s.

### The southern white rhinoceros (*Ceratotherium simum simum*)

In 1892, the southern subspecies came near extinction, as only a few individuals remained in the valley of the River Umfolozi in South Africa. The valley was declared a game reserve by the South African government in 1897. Since then, the numbers started to rise, with about 30 animals living in 1930. Until 1960, the numbers increased to 1,500 rhinos living in the valley of the River Umfolozi as well as in the neighbouring Hluhluwe Reserve. At the same time, the only wild population in 1960 existed in South Africa (EMSLIE 2005). To avoid the risk of devastating the habitat by excessive grazing, about 500 animals were brought with time to other parks and zoos around the world (KLOS 1981). A breeding herd was established in Whipsnade, UK, managed by the Zoological Society of London (PENNY 1988).

In 1984, more than 3,300 southern white rhinos lived in South Africa, and the capacity available at those sites was used up. Consequently, they permitted in the Pilanesberg National Park to shoot up to 10 rhinos per year by trophy hunters, where the price of each was USD 10,000 (PENNY 1988).

By the end of 2003, i.e. roughly 100 years after the start of the strict protection of the remaining wild population of the southern form, there lived 11,320 animals in 379 populations in the wild, which is therefore one of the biggest conservation successes (EMSLIE 2005). According to recent data (EMSLIE *et al.* 2009), the wild population of the southern form comprises about 17,500 individuals. More information about reintroduction and introduction programmes is contained in the Population development chapter.

The latest conservation activities have focused on addressing the "Zimbabwe Crisis", as in Zimbabwe poaching has increased sharply since 2008, which adversely affects the reintroduced population of white rhinos as well ([www.rhino-irf.org](http://www.rhino-irf.org)).

### The northern white rhinoceros (*Ceratotherium simum cottoni*)

The northern subspecies was discovered in the Belgian Congo in 1907 (PENNY 1988). At that time, this form was common in the open grassy habitats of Central and Eastern Africa, within the territories of five countries - Chad, Sudan, Uganda, Zaire (Congo) and Central African Republic (HOLECKOVA and BOBEK 2000). Unlimited killing by sports hunters and later by commercial poachers began led to its extinction in most of the range (PENNY 1988). The civil war in Congo caused a reduction of the residual population from 1,000 to about 100 individuals. In the period from 1961 to 1964, animals were captured from sites in Uganda and moved as part of protecting the remaining population into Murchison Falls National Park, Uganda, where the last individual was however seen in 1982 (TENYWA 2009), as all had been killed by poachers. In 1986, the last location counting 17 individuals remained in Garamba National Park, Zaire (former Belgian Congo, now the Democratic Republic of the Congo). An extensive project to save the species in Garamba NP was supported by the World Wildlife Fund - WWF (PENNY 1988).

As it results from the 2007 Annual Report of the African Parks Foundation (COLLET 2008), Garamba National Park was established in 1938 as one of the first national parks in Africa and lies at the northeast corner of the Democratic Republic of the Congo at Sudanese border. As this park was the last refuge of the northern white rhino and the Congolese giraffe, it was declared a UNESCO World Heritage Site in 1980.

As of 12 November 2005, Garamba NP started to be managed by the African Parks Foundation in cooperation with ICCN (Institut Congolais pour la Conservation de la Nature). In 2007, the Garamba NP population was formed of maximum four animals, with only a few direct and indirect sightings made during the year (COLLET 2008). Surveys were conducted according to FFI's information, and while in 2006-2007 traces were still found, the 2008 survey in cooperation with professional trackers from Kenya failed to locate any rhinos or signs of a rhino. Rhino occurrence was not confirmed even in the course of 2009. Surveys still continue, conducted by park staff patrols and community rangers. FFI also conducted a survey in southern Sudan, where credible reports of observation of three rhinos were received within the November 2008 expedition and further surveys are under preparation for March 2010 (Rob BRETT, pers. comm.). Despite these conservationist activities and significant amount of funds expended, northern white rhinos have found themselves at the brink of extinction in the wild.

There is an ongoing international project titled "Last Chance to Survive", jointly organised by Dvur Kralove Zoo, the OI Pejeta Conservancy, Kenya, Fauna and Flora International, AfRSG, Back to Africa and Kenya Wildlife Service, under which 4 (2.2) individuals from Dvur Kralove Zoo were imported to Kenya on 20 December 2009 (for more details, see page 257 and [www.northernwhiterhinolastchance.com](http://www.northernwhiterhinolastchance.com)).

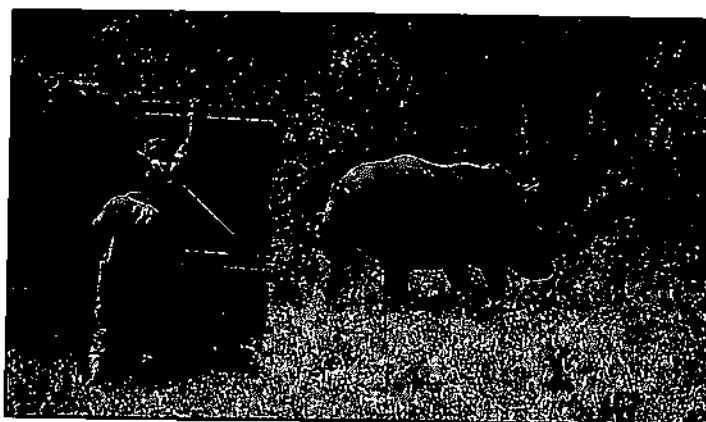


*A cow with a calf (the southern form) in OI Pejeta, Kenya, 2009 (dh)*

**White rhino conservation in the field: rhino translocation in Kenya**



*Conservation activities include dehorning using a handsaw or chain saws. (dh)*



*Crating a heavily sedated rhino using ropes and electric stock-whip and subsequent release at a new site (dh)*

## POPULATION DEVELOPMENT

The development of numbers of the two white rhino subspecies is compiled in the following table.

The abundance of the white rhinoceros in the wild (according to EMSLIE *et al.* 2007)

Population/Year	1920	1960	1970*	1981	1984	1993	1999	2003	2005	2008
Southern wild	110?	1,500	2,000	3,150	3,920	5,700	8,440	11,320	14,543	17,480
Northern wild	3,000	2,250	700	100	17	31	25	10	4	4?
<b>Total wild</b>	<b>3,110</b>	<b>3,750</b>	<b>2,700</b>	<b>3,250</b>	<b>3,937</b>	<b>5,731</b>	<b>8,465</b>	<b>11,330</b>	<b>14,550</b>	<b>17,484</b>

### The southern white rhinoceros (*Ceratotherium simum simum*)

Discovered as a species by Burchell in 1817, this subspecies was subsequently driven to extinction in much of the South African part of the continent. SELOUS described a rapid loss of wild populations between 1872 and 1877, as white rhinos were killed without any restrictions (PENNY 1988). At the end of the 19 and 20 century, the southern form faced the risk of total extinction, as probably 20, according to several authors (EMSLIE and BROOKS 1999), or 15 (Stevenson-Hamilton) or even only 10 (Heller) animals survived in a single wild location within the territory between the White Umfolozi and Black Umfolozi rivers (now Hluhluwe-Umfolozi Park, KwaZulu-Natal, South Africa) (LANG 1920).

Thanks to the strict protection the population was increasing; although there was still only a single wild population remaining in Umfolozi-Natal (EMSLIE 2005) still in 1960, the southern subspecies was saved, and by 1970 its numbers had increased to 2,000 rhinos (MILLS and HES 1997). Surplus animals were successfully moved into Kruger and Pilanesberg national parks in South Africa (MILLS and HES 1997). The first major translocation of rhinos took place in 1963 and 1964, when 97 individuals were captured and transported over a distance of 650 km to Kruger National Park. By 1972, they relocated a total of 203 rhinos to the parks above, plus 1,109 rhinos were moved from the Natal park to the game reserves in southern Africa and zoological gardens or various safari parks (EMSLIE *et al.* 2009). In 1989, the first auction for the sale of rhinos to private game reserves was conducted, and by 2009, 3.5 thousand southern white rhinos from Umfolozi were donated or sold to protected areas or private game reserves; additionally, nearly 1,000 individuals had been moved from Kruger National Park since the mid-1990s (EMSLIE *et al.* 2009).

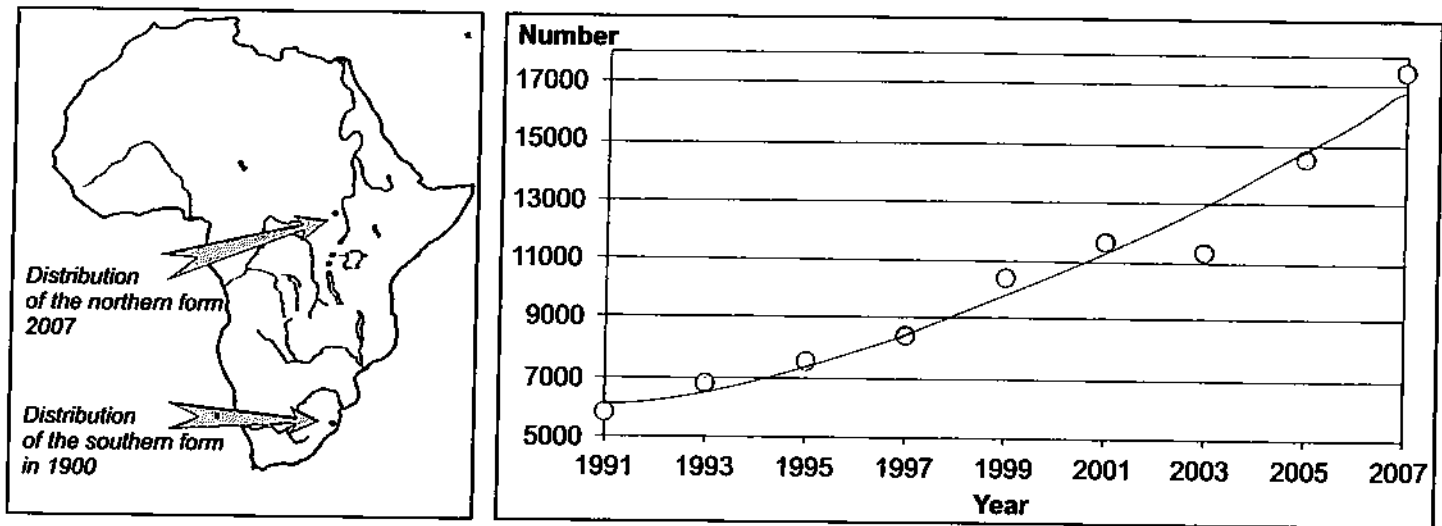
By the end of 2003, about 11,320 rhinos in 379 populations lived in the wild, which is one of the biggest conservation successes (EMSLIE 2005).

(dh)



If the population is protected, it shows annual growth of 6-10% per year (EMSLIE 2008). The progressive increase in numbers in the wild since 1991 is shown by the following chart.

The increase in wild populations of the southern form of the white rhinoceros in 1991-2007 (EMSLIE 2008)



The abundance of the southern white rhinos per African country in the period 1890-2007

(according to EMSLIE and BROOKS' 1999, EMSLIE 2000, EMSLIE 2002, EMSLIE *et al.* 2007, Emslie 2009; supplemented)

Country	1895	1929	1948	1958	1984	1987	1991	1992	1993/4	1995	1997	1998	2001	2003	2005	2007
SA	20	150	550	1,800	3,234	4,137	5,057	5,297	6,376	7,095	7,913	9,754	10,988	10,536	13,521	16,273
Angola	0	0	0	0	?	0	0	0	0	0	0	0	0	0	0	0
Botswana	0	0	0	0	190	125	56	27	18	20	23	31	39	67	99	106
Ivory Coast	0	0	0	0	0	0	5	5	5	4	4	0	0	0	0	0
Kenya	0	0	0	0	33	47	57	74	87	122	137	164	170	218	234	303
Mozambique	0	0	0	0	1	0	0	0	0	0	0	2	0?	2	7	9
Namibia	0	0	0	0	70	63	80	91	98	107	141	164	170	186	293	370
Swaziland	0	0	0	0	60	80	60	46	33	41	50	50	50	61	75	89
Zambia	0	0	0	0	10	6	0	0	6	5	4	5	5	3	2	1
Zimbabwe	0	0	0	0	200	208	250	249	134	138	167	208	218	250	308	341
Senegal	0	0	0	0	0	0	0	0	0	0	0	0	2	27	27	27
Uganda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	6
TOTAL	20	150	550	1,800	3,800	4,685	5,565	5,790	6,760	7,530	8,440	10,377	11,640	11,320	14,543	17,500
Total no of countries	1	1	1	1	9	7	7	7	8	8	8	8	9	9	10	10

### **The Republic of South Africa**

In South Africa, where the southern subspecies was described in the Kimberley region in 1895, a small number survived in a single park - Hluhluwe-Umfolozi Park, KwaZulu-Natal, where the only wild population lived up to 1960s, thanks to strict protection (EMSLIE and BROOKS 1999).

Subsequently, animals were exported to both other countries and zoological parks (KLOS 1981). In the period from 1967 to 1981, translocation of 2,648 rhinos occurred, which by 1996 had increased to a total of 4,350 individuals moved. In terms of genetics, all southern white rhinos' origin is the Umfolozi population (EMSLIE and BROOKS 1999). Despite exports of hundreds of animals to both zoos (KLOS 1981) and other African countries, the wild population in South Africa is on the increase; in 2007, it comprised more than 16 thousand animals (EMSLIE 2009). At the same time, a limited number of southern white rhinos are hunted by trophy hunters annually. Unfortunately, poaching organised from China and Vietnam, outfitted with modern weapons and helicopters, has recently occurred even in South Africa (CURRIE pers. comm.). From January until the end of November 2009, 100 rhinos were poached in South Africa, with additional 150 animals legally shot by trophy hunters (EUSTAGE 2009).

### **Angola**

Angola used to be a part of the historical range of the southern form, which however became extinct in this territory in 1895. In the 1980s, reintroduction activities took place in the area, but the animals were wiped by poachers (EMSLIE and BROOKS 1999).

### **Botswana**

In Botswana, the southern form became extinct during the 19 century. Since the late 1960s until 1981, 94 individuals were reintroduced and the population increased to 190 rhinos by 1984. However, intense poaching reduced the populations to 17-27 animals by 1992. Gradually, several holding facilities were established where the remaining animals lived under protection, so in 1997 23 animals lived in Botswana (EMSLIE and BROOKS 1999). In 1999, Botswana hosted 31 rhinos, which by 2001 increased to 39 and by 2007 to 106 animals (EMSLIE 2009).

### **Mozambique**

The historical range of the southern form was reaching as far as Mozambique before 1895. In 1972, 83 rhinos were reintroduced to two sites. As the entire population had been wiped by poachers by 1987, the white rhino already became extinct twice in the country (EMSLIE and BROOKS 1999). The next reintroduction attempt took place around 1999, and in 2007, 9 rhinos lived in Mozambique (EMSLIE 2009).

### **Namibia**

The original Namibia's population of the southern form was extinct, but recovered through reintroduction. In 1993, there were 99 animals in one national park and six private wildlife reserves. By 1999, the numbers increased to 141 individuals in ten populations (EMSLIE and BROOKS 1999). The stock continues to rise, formed of 370 rhinos in 2007 (EMSLIE 2009).

### **Swaziland**

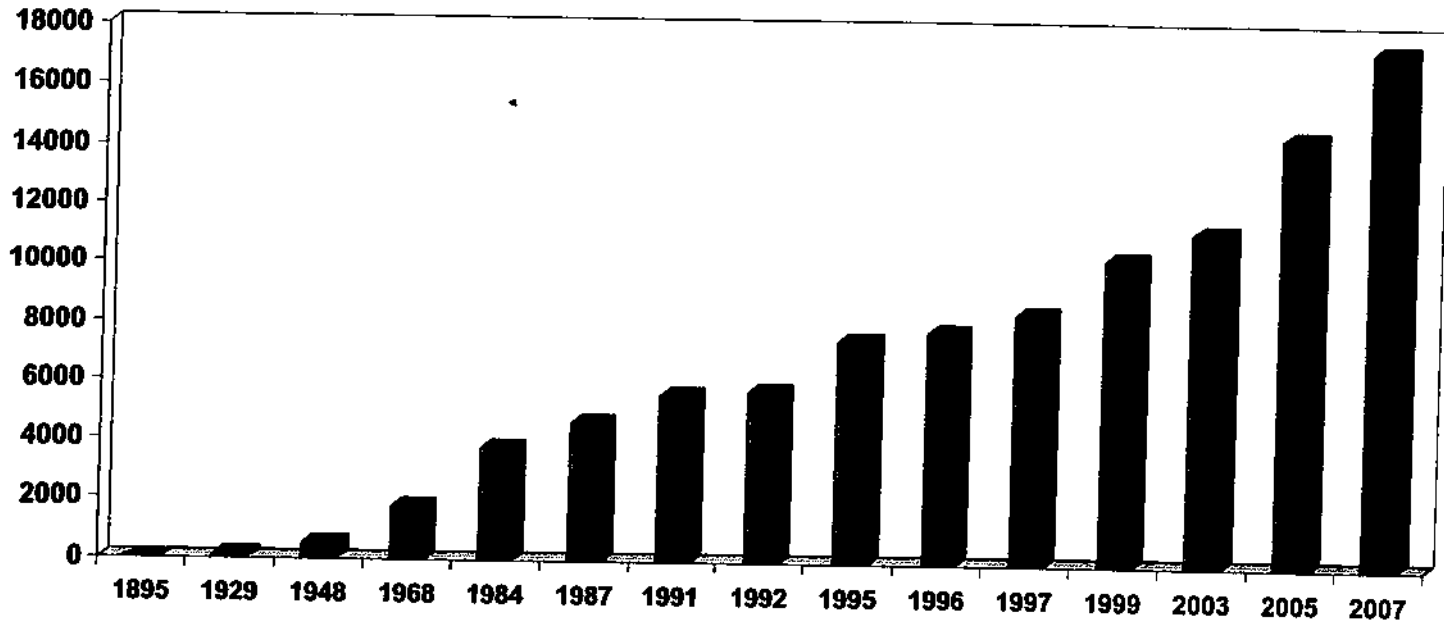
The southern form was reintroduced to Swaziland in the early 1980s, with 80 rhinos living here in 1987. As a result of poaching, 50 rhinos were killed in 1990-1992. Since December 1992, when the protection was improved, no rhino has been killed. Thanks to the effective protection, the numbers have gradually increased, so 50 animals ranged in Swaziland in 1997 (EMSLIE and BROOKS 1999) and already 89 rhinos lived in the country in 2007 (EMSLIE 2009). This can be attributed to the adoption of the law under which poaching is punishable by death, promoted with the help of Ted Reilly, the legendary defender of Swaziland's wildlife (HOLECKOVA 2008).

### **Zimbabwe**

With the original population wiped out in 19 century, a new stock of southern white rhinos was reintroduced from South Africa in the 1970s and 1980s. In 1984, the wild population consisted of 200 individuals, and even 250 animals in 1991. Subsequently, poaching reduced the numbers to 134 in 1993-1994. In 1997, Zimbabwe had 167 white rhinos, and over a third (35%) of them was a private property (EMSLIE and BROOKS 1999). In 2007, there were 341 southern whites (EMSLIE 2009). However, there has been a significant increase in poaching since that time, which is referred to "Zimbabwe Crisis", as dozens of both black and white rhinos have been killed ([www.rhino-irf.org](http://www.rhino-irf.org)).



## Development of southern white rhino numbers in the wild



### The northern white rhinoceros (*Ceratotherium simum cottoni*)

The northern white rhinoceros occurred in five countries, where it was more common than the southern subspecies still in 1960, with the latter living only in a single population in South Africa at that time. As a result of poaching since the early 1950s until the late 1960s, the population was severely decimated, with only some 29 wild individuals left by 1984 (PENNY 1988).

In 1920, the population of this subspecies was still estimated to contain 2-3 thousand animals; discussions concerning the need to protect the northern white rhino in game reserves and the possibility of trapping animals and importing them into captivity already began at that time (LANG 1920). In 1938, Garamba National Park was founded in Congo, where there were 100 individuals. Due to conservation measures, this population had enlarged by 1961 to 1,000-1,300 individuals. As a result of a civil war, the population declined to 100 animals in the early 1960s. By 1976, the numbers increased to 490 +/- 270 rhinos (i.e. 220 to 760 animals). Continued poaching, with even employees of the park involved, led to a decline to 13-20 individuals and 14 individuals in 1983 and 1984, respectively (PUTTGER-CONRADT 2008). Most animals were killed in just 6 years in the period 1980-1986, when the initial population numbered about 821 individuals, which eventually dropped to only 17 animals (PENNY 1988). Subsequently, a conservation project started with the support of many international institutions, granted in 1984-1995 with a total of USD 3,078,686, which in particular came from WWF, FZS, UNESCO, and the IRF. The population reached its peak in 1992, when it consisted of 32 animals. In 1995, the group contained only four breeding females, following the natural death of the fifth one (Smith *et al.* 1995). Without the activities of the German zoologist Armin Puttger-Conradt, the northern white rhino would have been probably poached already by 1990 (PUTTGER-CONRADT 2008, in: HOLECKOVA 2008).

In the 1990s, two civil wars followed. During the first war, in 1997, soldiers and rhino poachers killed several rhinos, the park rangers were disarmed and even did not receive wages a few months. During the second war, which began in August 1998, rangers in the park still continued the work, but did not have enough vehicles or even a good radio connection. The local authorities were well-disposed to rhino protection and regular financial support of the International Rhino Foundation (IRF), as well as supplies and medicines from the World Wildlife Fund (WWF) were successfully managed for Garamba. Aerial census in July and August 2000 found 25 animals (HOLECKOVA 2001).

Unfortunately, the status got worse and the population dropped to about 10 animals. At that time, it was agreed that five animals would be captured and moved to the Ol Pejeta Conservancy, Kenya, where they had built bomas for the rhinos. The action above failed due to ungrounded scandalizing of the conservation activities in the Congolese press, with the rhinos left to the mercy of poachers, as both foreign workers and park rangers were no longer safe in the territory of Garamba NP (HOLECKOVA 2008).

Currently, this form of a rhinoceros stands on the brink of extinction, as the 2008 and 2009 efforts to locate any individuals in Garamba National Park failed. Sporadic reports of 2 to 3 animals came periodically only from southern Sudan (VIGNE pers. comm.).

As part of the Last Chance to Survive project, 4 (2.2) individuals were imported from Dvur Kralove Zoo to Kenya in December 2009 (see more details on page 257 and [www.northernwhiterhinolastchance.com](http://www.northernwhiterhinolastchance.com)).

#### **Chad**

The northern form once ranged as far as southern Chad; by the 1960s, there was evidence of only a few animals and by 1983, there has been no evidence (EMSLIE and BROOKS 1999).

#### **Democratic Republic of the Congo (formerly Zaire)**

The historical range in the former Belgian Congo comprised the north-eastern parts of the country, where the only surviving population remained in Garamba National Park on the northern border with Sudan. In 1938, there lived about 200 northern white rhinos in the park, which increased to between 1,000 and 1,300 animals by 1960. Once the Congo achieved independence from Belgium, a civil war broke out (1960-1963), and most of the rhino in Garamba NP were killed by poachers so the Garamba's rhino population fell to approximately 100-200 animals by 1965. In 1976, the population in Garamba NP was estimated at 490 individuals (+/- 270). In eight following years, the majority of them were killed, with last 15 surviving animals in 1984, which subsequently increased to 31 rhinos by 1995. In 1997, another civil war broke out, Zaire was declared the Democratic Republic of the Congo and poaching in the park increased. In 1998, at least 25 rhinos lived in Garamba, indicating that the rhino population had not been so much affected by poachers as those of elephants and buffaloes. The outbreak of another civil war in 1998 caused further problems to the northern white rhino status (EMSLIE and BROOKS 1999).

During the first war in 1997, soldiers and rhino poachers killed several rhinos, the park rangers were disarmed and even did not receive wages a few months. During the second war, which began in August 1998, rangers in the park still continued the work despite the consultants left, lacking enough vehicles and even a good radio connection. Given that the local authorities were in favour with rhino protection, Garamba could receive regular financial support from the International Rhino Foundation (IRF), as well as supplies and medicines from the World Wildlife Fund (WWF). With just two aerial counts, in 1998 and 2000, three calves under 6 months were discovered during the latter. Total 2000 population was formed from 25 (12.11.2) animals (HOLECKOVA 2001).

#### **The population of northern white rhinos in Garamba NP in 2000 (processed according to 2000 IRF data)**

	<b>Males</b>	<b>Females</b>	<b>Sex not determined</b>	<b>Total</b>
<b>Number of adults</b>	6	7	-	13
<b>Number of subadults</b>	2	3	-	5
<b>Number of juveniles</b>	4	1	2	7
<b>Total</b>	<b>12</b>	<b>11</b>	<b>2</b>	<b>25</b>

Sadly, the population continued to decline, and in 2007, Garamba was estimated to have four last rhinos (EMSLIE 2009). However, none was found again throughout 2009 (Rob BRETT, pers. comm.).

### Uganda

The northern form once ranged over parts of north-western Uganda. In the 1960s, there were still 80 animals living there; however, the subspecies is thought to be nationally extinct as of 1982 (EMSLIE and BROOKS 1999). The last individual was seen in the territory of Murchison Falls in 1982 (TENYWA 2009).

### Central African Republic

The original range of the northern form was extending as far as the eastern part of the Central African Republic. Only a few animals were recorded in the period from 1960 to 1983; by 1984, the white rhino was exterminated in the country (EMSLIE and BROOKS 1999).

### Sudan

The northern form once ranged over south-western Sudan, with estimated 1,000 animals still roaming the country back in 1960. By 1971, only some 400 animals were left, while ten years later, there were less than 300 rhinos and in 1983, less than 50 individuals remained. Since 1984, there have been unconfirmed reports of a few rhinos in southern areas in the Shambe region (EMSLIE and BROOKS 1999). The latest report on the observation of three animals from a helicopter comes from the end of December 2009 (CURRIE pers. comm.).

### Kenya

In Kenya, white rhinos never lived in the modern times. The Ol Pejeta Conservancy, a private reserve in Kenya, was selected as a site for planned translocation of five northern white rhinoceroses from Garamba National Park, the Democratic Republic of the Congo. Originally, ten remaining animals were considered for the move. However, this activity, which might have saved the last surviving animals from Garamba failed, disapproved by the Congolese authorities. In December 2009, 4 (2.2) last individuals with breeding potential were imported to the same place from captivity, from Dvur Kralove Zoo, within the project named Last Chance to Survive (for more details, please see page 257 and [www.northernwhiterhinolastchance.com](http://www.northernwhiterhinolastchance.com)).



*Dvur Kralove Zoo's northern white rhinos in the bomas of the Ol Pejeta Conservancy, 21 December 2009, Kenya (dh)*

**The abundance of the northern white rhinos per African country in the period 1960-2009**  
(according to EMSLIE and BROOKS 1999, PENNY 1988, EMSLIE *et al.* 2009, supplemented)

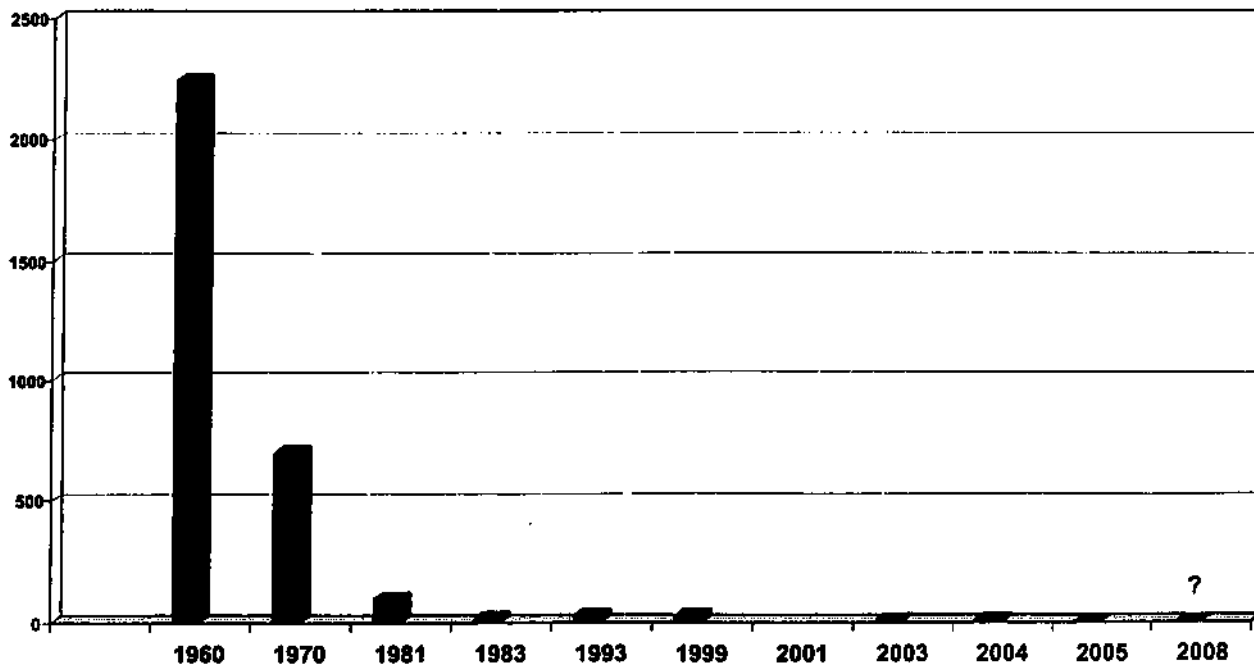
Country	1960	1971	1976	1983	1984	1991	1997	2003	2008	2009
Zaire/DRC	1,150	250	490	13-20	17	30	25	10	4	0 ?
Sudan	1,000	400	?	< 50	10	0 ?	0	0	0 ?	3 ?
Uganda	80	Several	Several	2-4	1	0	0	0	0	0
Central African Rep.	Several	Several	Several	Several	1	0	0	0	0	0
Chad	Several	Several	?	0 ?	0	0	0	0	0	0
Kenya	-	-	-	-	-	-	-	-	-	4
<b>TOTAL</b>	<b>2,230</b>	<b>650</b>	<b>500 +</b>	<b>&lt;&lt; 70</b>	<b>28</b>	<b>30</b>	<b>25</b>	<b>10</b>	<b>4</b>	<b>7 ?</b>
No. of countries	5	5	3	4	4	1	1	1	1	2

**Development of wild northern white rhino numbers since 1900**

(FOOSE 1993, HOLECKOVA and BOBEK 2000, EMSLIE *et al.* 2007, MILLIKEN *et al.* 2009; supplemented)

Year	1900	1960	1970	1981	1983	1993	1999	2003	2004	2005	2008	2009
Numbers	Thousands	2,250	700	100	15	31	25	10	14	4	?	3 ?

**Development of northern white rhino numbers in the wild**



## CAPTIVE BREEDING

### First zoo animal:

- Southern form 1946 Pretoria, South Africa (OCHS 2005)
- Northern form 1949 Khartoum, Sudan (OCHS 2005)

### First animal born and reared in the zoo situation:

- Southern form 1967 Pretoria, South Africa (OCHS 2005)
- Northern form 1980 Dvur Kralove, the Czech Republic (OCHS 2005)

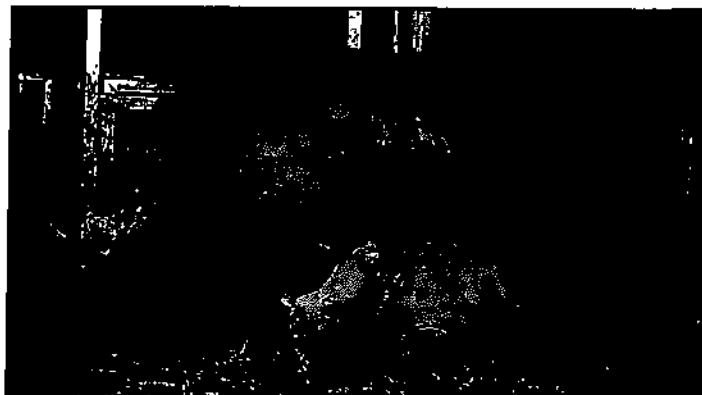
According to the International Studbook (OCHS 2005) and BLASZKIEWITZ (1991), the first animal kept in captivity was female Zuluana (Stdbk #58) of Umfolozi origin, who was imported into Pretoria Zoo, SA, on 25 July 1946. Zuluana lived to be 41 years old there, as she died on 21 March 1987 (OCHS 2005). The first northern form animal (Stdbk #1252) lived at Sudanese Khartoum Zoo, where this animal, wild-caught in southern Sudan, however died on 29 January 1949 around two weeks upon arrival even prior being transported into Europe. The very first captive-born individual of the southern form as reported by the International Studbook (OCHS 2005) was a male Zapele (named "Dutch" later on, stdbk #61). This rhino was born to female Umfazi in Pretoria Zoo on 8 June 1967, who however had been pregnant when she arrived in Pretoria from Natal. Dutch lived 20 years. The first calf conceived at a zoo situation was born on 23 October 1969, which happened in Pretoria as well - named Seventy (Stdbk #76) in his native zoo, this male was later on called Balthazar in Antwerp, Belgium, and the Dutch Beekse Bergen Safari Park. Balthazar lived for 34 years and died in 2003. The first individual of the northern form was born at Dvur Kralove Zoo in 1980 (Suni DK 5, Stdbk #630). This animal is still alive, even though held since 2009 in the OI Pejeta Conservancy, Kenya. The most recent ISB release (FRESE 2009) registered 1,672 (777.883.12) white rhinos as per 2 December 2009, including 27 (10.16.1) pure northern white rhinos.

### Captive population

As following 1960 a decision was adopted to reduce the wild-ranging population of the southern subspecies in South Africa, dozens of animals were shipped to zoological parks all over the world (KLOS 1981). Projected activities included establishing a breeding population within the grounds of the Whipsnade Animal Park managed by the Zoological Society London. Transfer of 40 animals by truck and ship was planned in the beginning; however, only 20 (8.12) southern white rhinos entered Whipsnade, with 34 calves born by 1970 (PENNY 1988). The increased captive white rhino numbers result from the table below showing that while in 1969 only 86 white rhinos were kept in zoos, the 1980 number already reached 562 animals (i.e. increase by 553%), whereas 405 rhinos were brought in from the wild and 121 calves were born in captivity (KLOS 1981).



*A southern form at Budapest Zoo, Hungary, 2009 (ek)*



*A calf born following artificial insemination with its mother in the outdoor enclosure at Budapest Zoo, Hungary, 2009 (ek)*

**Development of the global white rhino stock in captivity**  
[according to KLOS (1981), updated based upon studbooks]

Year	Imported from the wild	Born	Died	Status as per 1 Jan
1969	8 (5.3)	1 (1.0)	-	86 (42.44)
1970	57 (23.34)	1 (1.0)	1 (0.1)	95 (48.47)
1971	101 (30.71)	2 (2.0)	1 (0.1)	152 (72.80)
1972	58 (24.34)	5 (4.1)	-	254 (104.150)
1973	43 (18.25)	8 (4.4)	5 (1.4)	317 (132.185)
1974	58 (25.31)	14 (8.6)	5 (3.2)	363 (153.210)
1975	41 (17.24)	5 (3.2)	9 (6.3)	428 (183.245)
1976	17 (7.10)	17 (10.7)	7 (1.6)	465 (197.288)
1977	14 (6.8)	16 (9.7)	1 (0.1)	492 (213.279)
1978	9 (5.4)	17 (11.6)	7 (3.4)	521 (228.293)
1979	1 (0.1)	27 (16.11)	6 (1.5)	540 (241.299)
1980	0	8 (3.5)	12 (6.6)	562 (256.306)
<b>TOTAL 1969-1980</b>	<b>405 (160.245)</b>	<b>121 (72.49)</b>	<b>54 (21.33)</b>	<b>—</b>
1991				709 (346.362.1)
1993	0	12 (4.8)	8 (5.3)	698 (343.355)
1994	0	11 (5.6)	7 (2.5)	702 (342.360)
1996	5 (2.3)	14 (5.7.2)	41 (22.19)	697 (334.361.2)
1998	17 (4.13)	18 (8.10)	24 (12.12)	714 (338.375.1)
2000	5 (3.2)	26 (12.14)	23 (10.13)	772 (350.422)
2004	14 (9.3.2)	14 (9.3.2)	12 (7.5)	756 (226.419.1)
2005	?	24 (12.12)	21 (11.10)	758 (338.417.3)

On 31 December 1990, there were a total of 709 (346.362.1) white rhinos living in 245 collections, including 12 animals of the northern form, of which 10 (3.7) were held by Dvur Kralove Zoo, while 2 (2.0) stayed at San Diego WAP. From 1987 to 1990, 45 (24.20.1) calves were born and 31 (11.20) animals died (KLOS and FRESE 1991).

On 1 January 1995, the International Studbook registered 562 (235.327) southern white rhinos imported from the wild and 459 (252.205.2) born in captivity, making a total of 1,021 (487.532.2) animals registered, which included 694 (340.354) live individuals. In addition, 49 (23.26) southern white rhinos had been born in the second generation (F2) in captivity by that time; on 1 January 1995, 34 (17.17) of that number were live animals that had never reproduced.

According to the International Studbook (GOLTENBOTH and OCHS 1997), 696 (334.360.2) southern white rhinos and 11 (5.6) northern white rhinos lived in captivity on 1 January 1997. The latest ISB release (LANGE and OCHS 2005) reports that on 1 January 2005, the captive stock comprised 747 (334.410.3) animals, with 82 calves born, 77 deaths and 46 white rhinos imported from nature reserves from 1 January 2001 to 31 December 2004. The above information shows the determination of the population increase by imports from Africa's nature reserves. At the same time, the global captive stock decreased by 3.2% compared with 2000 - see the following table.

On 31 December 2009, 8 (3.5) individuals of the northern form lived in captivity, of which 7 (2.5) animals were owned by Dvur Kralove Zoo; the group included 2 (1.1) rhinos at San Diego WAP, 2 (0.2) at Dvur Kralove Zoo and 4 (2.2) in the Ol Pejeta Conservancy, Kenya.

#### The history of the white rhino captive stock per region (according to the International Studbook)

Region	1989 (no. of indiv./%)	1998 (no. of indiv./%)	1998 (no. of indiv./%)	2000 (no. of indiv./%)	2004 (no. of indiv./%)
Africa	46 / 6.5%	64 (36.26.2) / 9.2%	53 (30.22.1) / 7.4%	45 (17.28) / 5.8%	35 (12.20.3) / 4.7%
Asia	131 / 18.6%	157 (74.83) / 22.5%	158 (72.86) / 22.1%	170 (75.95) / 22.0%	162 (72.80) / 21.7%
Australia	14 / 2.0%	13 (8.5) / 1.9%	14 (9.5) / 2.0%	28 (13.15) / 3.6%	39 (19.10) / 5.2%
Europe	245 / 34.9%	227 (103.124) / 32.6%	234 (109.125) / 32.8%	249 (116.133) / 32.3%	240 (105.135) / 32.1%
North & Central America	193 / 27.5%	217 (104.113) / 31.1%	237 (110.127) / 33.2%	263 (121.142) / 34.1%	254 (118.136) / 34%
South America	49 / 7.0%	19 (9.10) / 2.7%	18 (8.10) / 2.5%	17 (8.9) / 2.2%	17 (8.9) / 2.3%
Middle East	25 / 3.6%	-	-	-	-
Total (increase in %)	709 (346.362.1)	697 (334.361.2) (-1.7%)	714 (336.375.1) (+2.4%)	772 (350.422) (+8.1%)	747 (334.410.3) (-3.2%)

#### EEP

The European conservation breeding programme for the species was established in 1992, with RNDr Kristina Tomasova of Dvur Kralove Zoo as coordinator. In 1994, the EEP associated 54 zoos with a total of 169 (73.96) white rhinos and a single birth recorded throughout the year (TOMASOVA 1996). By comparison, the 2006 EEP population consisted of 223 (93.130) white rhinos held in 71 collections as per 31 December 2006 (VERSTEEGE 2007), with 5 (3.2) calves born during the year, which represents 2.3% of the stock reported as per 1 January 2006, i.e. 220 (93.127). The total number above included 8 (3.5) northern white rhinos with one hybrid held at Dvur Kralove Zoo.

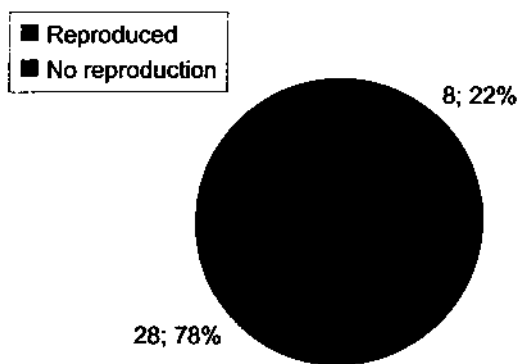
On 1 January 2008, the EEP contained 236 (99.137) white rhinos in 69 zoos, when 5 (2.3) calves were born and 6 (2.4) rhinos died prior to 28 August 2008. As 2 (0.2) females were imported from Africa, the stock comprised 237 (99.138) animals on 28 Aug 2008 (VERSTEEGE pers. comm. 2008, HOLECKOVA 2008), i.e. 3.43 animals per collection. Despite some breeding successes, the EEP population has been stagnating. If a population increase was 6.5-10% as in the wild, then the EEP should see 15 to 23 calves born per year.

The most recent studbook (FRESE 2009) shows that on 30 November 2009 there were a total of 286 (113.173) white rhinos in 85 institutions throughout Europe, including EEP non-members, when 43 (22.21) calves born and 42 (18.24) deaths were recorded in the period from 2005 to 2009, confirming insufficient reproduction of the species in captivity.

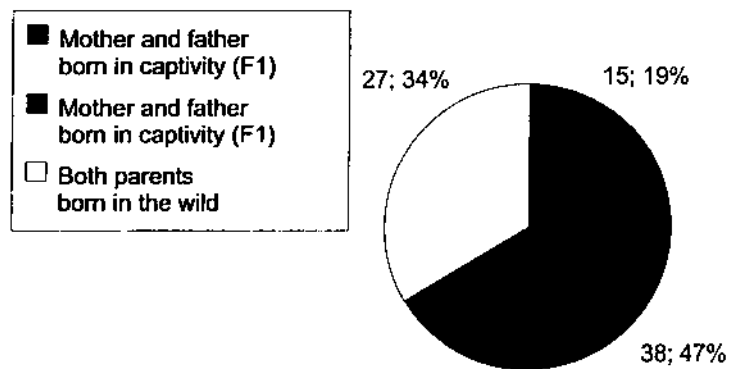
It results from the following diagrams that a major part of wild-born white rhinos kept within the EEP does not breed, and, at the same time, there is still a large part of the animals born with both or at least one parent from the wild.

## Information on white rhino breeding within the EEP, 1995-2007 (VERSTEEGE 2008)

### Involvement of wild-born individuals in breeding



### Origin of the animals born



### Assisted insemination

IZW Berlin has been experimenting in the field of assisted insemination in rhinos a number of years, with a total of 57 insemination sessions carried out in 35 different females (33 white rhinos, including 2 northern whites, and 2 black rhinos) until summer 2008 (HILDEBRANDT 2008). Hormonal induction of oestrous was performed 49 times and the natural cycle was underway in 8 cases. Pregnancy was achieved in five cases, of which one involved the use of frozen semen and two cases involved a successful birth of a mature calf. In total, 4 calves were born to 2-females as a result of artificial insemination (Budapest and Madrid), all of the young were males. To impregnate a female, male sperm is employed, collected immediately prior insemination or frozen (HERMES *et al.* 2005, HERMES *et al.* 2007, HILDEBRANDT *et al.* 2007, HILDEBRANDT 2008a) and b), SILINSKI 2003).

### Poor reproduction of the white rhino in captive conditions

Although white rhinos reproduce very well in the wild, with an annual increase somewhere between 6 and 10%, provided the population is not threatened by poaching (EMSLIE and BROOKS 1999, HOLECKOVA 2008), breeding in captivity has been rather rare; according to the most recent release of ISB (2005), there was only a single rhino bred in the captive generation 3 (F3).

The latest international studbook for the white rhino (LANGE and OCHS 2005) shows that from 1 January 2001 to 31 December 2004, a total of 82 (33.44.5) individuals were born and 77 (35.40.2) died in captivity, while 46 (17.29) rhinos were imported from African nature reserves, meaning that being there no imports, the captive stock would have increased only by 5 animals (i.e. 0.7%) over those 4 years, which indicates that the population would be stagnating or coming to extinction without the wild-caught rhinos. On 1 January 2005, 758 (338.417.3) white rhinos were held in captive breeding institutions, when only 14 (9.3.2) calves were born throughout 2004 (LANGE and OCHS 2005), i.e. 1.85% of the captive population. At the same time, only a single generation 3 captive white rhino (F3) lived in the zoos worldwide. Given that the wild stock grows by 6.5-10% annually, that year should have seen 49 to 75 calves born in captivity (HOLECKOVA 2008).

By contrast, the black rhino (*Diceros bicornis*) reproduces in captivity already in generation 5 (LANGE and OCHS 2005, HOLECKOVA 2008).

According to ISIS, a global record-keeping system, which is however not used by every zoo, thus does not contain data of all holders worldwide, there were 114 institutions holding white rhinos registered in the system prior to 30 Jun 2007, with a total of 429 (187.241.1) individuals held, when 15 calves, i.e. 3.5% of the registered stock, were born over the period of preceding 12 months. As reported by the most recent international studbook (FRESE 2009), 102 (52.48.2) calves were born and 91 (50.41) individuals died from 2005 to 2009, which supports a stagnating population as a result of poor normal reproduction.

As results from ARKS (ISIS), the international record-keeping system, the UK-based Whipsnade Animal Park - importers of 25 (10.15) wild-caught southern white rhinos in 1962-1972, with subsequent import of a female from Blackpool Zoo in 1974, a male from Knowsley Zoo in 1988 and a male from the wild in 1991 - is the Europe's major white rhino breeder. Until March 2008, Whipsnade recorded 55 (31.24)



calves born, from which 11 (6.5) individuals, i.e. 20.4%, died within two days after the birth and additional 7 (3.4) calves within 7 years, so this park successfully reared 66.7% of the calves born, i.e. 37 (22.15) rhinos. A total number of females that became involved in breeding included 8 wild-caught animals, of which three gave a single birth, one gave two births, one gave four births, two gave six births and one female delivered eight times, and four captive-born females (F1), of which one gave ten births, two gave four births and one animal gave three births. The young were fathered by a total of four males, all of which were wild-caught animals (born in 1960, 1964, 1968 and 1988), from which one male became father two times, the second 15 times, the third 18 times and the last male fathered 19 calves.

The Beekse Bergen Safari Park is another important breeder, with 6 (2.4) southern white rhinos imported from the wild in 1970, of which 3 (1.2) animals participated in breeding. Later on, 3 unrelated males were imported (born in Pretoria, Paris and Cabarceno), from which two became breeding animals. For females, only 2 animals from the wild became breeding animals, where the first gave 9 births and the other gave 13 births. Until 2006, 22 (13.8.1) calves were born in Beekse Bergen, from which 17 (12.5), i.e. 77.3% were reared. At the same time, all the young were a mere captive-born generation 1 (F1) and all efforts to involve any of the young females that remained in the stock failed (females born in 1985, 1988, 1990 and 1998).

The first southern white rhino in generation 3 in captivity (F3) was born in Knowsley Safari Park, the UK, which imported 10 (4.6) wild-caught animals from 1972 to 1995 and subsequently in 1996 a female born in Edinburgh (Meru, stdbk #1026). In Knowsley, a total of 14 (9.5) (31.24) calves were born, from which 7 (3.4) individuals, i.e. exactly 50%, died within two years after the birth and 7 (6.1) southern white rhinos were successfully reared. A number of breeding females was four, including three wild-caught animals (one of them gave 3 births, the second also three births and the third animals gave two births) and a single female born in captivity (Meru), who gave five births. Knowsley had two breeding males, although there was a case where identification of the sire was impossible, as a female got pregnant in a group of multiple males. The first breeding male named Arthur (Stdbk #355, born 1966 in Umfolozi NP, SA) became a father to 4 (4.0) calves; an interesting fact is that the same male fathered a subspecific hybrid - female Nasi DK 2 born in Dvur Kralove, as he had mated Nasima, the northern white rhino female (Stdbk #351, born 1965 in Uganda), when both rhinos were kept together back in Knowsley. The other stud male was alone born in Knowsley (F1, dam Maggie, stdbk #352, and sire Arthur, stdbk #355, both animals born in 1966 in Umfolozi NP) and mated three females, including Meru born in Edinburgh (F2), which is why Meru's descendant became the first ever white rhino born in generation 3 in captivity (F3) according to the 2005 release of the studbook. All the data above were compiled based on the ARKS (ISIS) international record-keeping system and the 2005 release of the International studbook (LANGE and OCHS 2005).

Once a female rhino fails to get pregnant in time, which normally takes place before year 10-12, they very often begin to suffer serious health problems preventing them to reproduce; this in particular involves ovarian cysts and uterine tumours (HERMES *et al.* 2001, HERMES *et al.* 2004, HERMES *et al.* 2006, HERMES 2008).

The fact that healthy females held in captivity very frequently do not cycle, more specifically, their hormonal curve is flat (Schwarzenberger 2008), which may be due to the management methods that fail to take necessary social and territorial behaviour into account, is the major reproduction issue in captive white rhinos. Nevertheless, clear management technique still has not been determined. Even animal parks located in very warm areas, where animals can access spacious enclosures, have not been successful in breeding rhinos in multiple generations. In many cases, only a limited number of individuals within a larger group will breed, though repeatedly. Therefore, emphasis needs to be put on finding a method of unblocking this effect preventing successful reproduction.

### **Breeding in Czech and Slovak zoological parks**

With the exception of Prague and Bratislava Zoo, breeding the white rhino in the former Czechoslovakia was always associated with activities of Dvur Kralove Zoo, who was a supplier of 9 (4.5) southern white rhinos to additional four animal parks from 1974 to 1980.

Prague Zoo obtained their 3 (1.2) animals by importing them from Umfolozi, SA, in 1971. This trio was reduced upon departure of female Paturi (Stdbk #162) to the French zoo in Port Saint Pere in 1993, while the remainder (male Patrys, stdbk #160 and female Pongola, stdbk #161) left to Opole, Poland, following the high-water in 2002, when their house was fully flooded.

Ostrava Zoo obtained a pair native to Umfolozi (male Natal, stdbk #371 and female Dinah, stdbk #208) from Dvur Kralove Zoo in 1974. While Dinah died in 2008, when she was 36, Natal (39) is still alive.

Liberec Zoo acquired their first southern white rhino from Dvur Kralove in 1976 (female Edita, stdbk #113), with subsequent import of a male born in Whipsnade in October the same year (Stdbk #279, born 15 Oct 1974, named Rushden in its native park). Sadly, this male, who had spent two months in Dvur Kralove Zoo's quarantine facility before arriving in Liberec, died in May 1977. The left-over female Edita was sold to Cairo Zoo, Egypt, in 1983. In 1984, Liberec imported a male Niko (Stdbk #669) born and reared in

Munster, Germany, and a female of Umfolozi origin (Tombi, stdbk #847). Niko left to Bratislava Zoo in 2002, while Tombi was sent to Peaugres in 2005.

Lesna Zoo obtained a southern white rhino pair native to Umfolozi (male Joe - stdbk #110 and female Zuzi - stdbk #112) from Dvur Kralove in 1979. As Joe died in 2003 when he was 38 and the female died in 2005 being 39 years old, two young females born in SA were imported to this zoo in 2006, to which however no male could be found until the end of 2009.

Usti n/L Zoo held a male (Dan, stdbk #111) with two females (Sasha, stdbk #114 and Zamba, stdbk #209); these rhinos originated from the wild and came together to Dvur Kralove. The first birth took place only in 1986, when female Sash delivered for the first time when she was 20. This female reared her calf successfully, giving another birth in 1991 and then in 1993, when she was approximately 26 years old. Both Sasha and Dan died in 2008, leaving a single female Zamba at Usti nad Labem Zoo.

Bratislava Zoo imported three (1.2) subadults (Tobi, stdbk #1153, Ada, stdbk #1154 and Sena, stdbk #1155) from Namibia (Oiwa Reserve) in 1986, which following a death of Tobi (2000) was completed in 2002 by a male from Liberec Zoo (Niko, stdbk #669, born 1981 in Munster, Germany). Sena died in 2006, so Bratislava has since kept a pair.

#### White rhinos held in Czech and Slovak zoos prior to 31 December 2009: overview

Zoo	Holding period	Import	1st birth	Last birth	Total born	Total reared	Status as per 31 Dec 2009
Dvur Kralove	1970-2009	26 (10.16)	1976	2000	9 (3.6)	7 (2.5)	2 (0.2)
Prague	1971-2002	3 (1.2)	-	-	0	-	0
Ostrava	1974-2009	2 (1.1)	-	-	0	-	1 (1.0)
Liberec	1979-2005	4 (2.2)	-	-	0	-	0
Lesna	1979-2009	4 (1.3)	-	-	0	-	2 (0.2)
Usti n/L	1980-2009	5 (1.4)	1986	1993	3 (3.0)	3 (3.0)	1 (0.1)
Bratislava	1986-2009	4 (2.2)	-	-	0	-	2 (1.1)
<b>TOTAL</b>	<b>1970-2009</b>	<b>48 (18.30)</b>	<b>1976</b>	<b>2000</b>	<b>12 (6.6)</b>	<b>10 (5.5)</b>	<b>6 (2.6)</b>

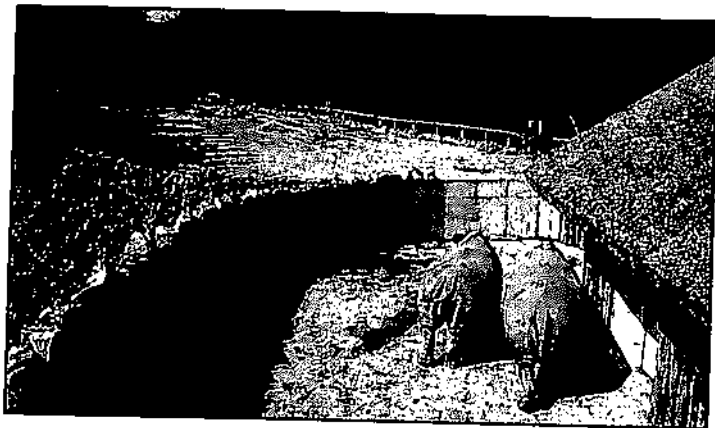


Male Natal at Ostrava Zoo, 2009 (dh)



Male Niko - previously held at Liberec Zoo, the male has been kept in Bratislava since 2009. (dh)

Southern white rhinos in the Czech and Slovak Republics



*Lesna Zoo - 1995 (left) and 1999 (right) (lh)*



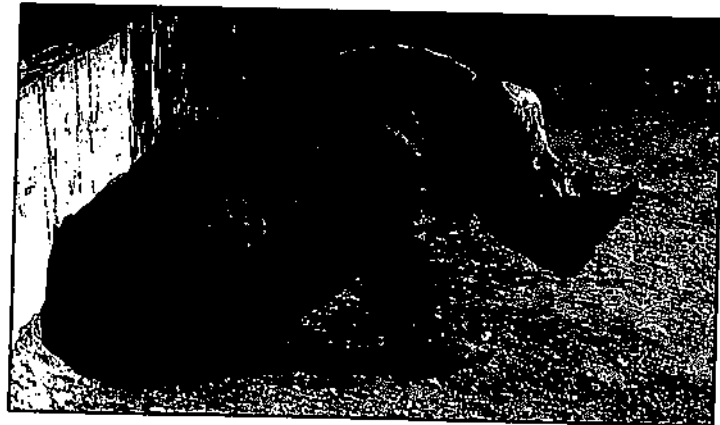
*Libarec Zoo - 1993 (lh)*



*Ostrava Zoo - 1986 (lh)*



*Prague Zoo, 2000 and 2003 (lh)*





*Prague Zoo, 1977 (lh)*



*Usti n/L Zoo, 2007 (lh)*



*Usti n/L Zoo, 2007 and 1997 (lh)*



*Bratislava Zoo, 2009 (dh)*



## THE HISTORY OF THE DVUR KRALOVE ZOO RHINO STOCK

### Southern form

The southern white rhino subspecies was acquired through capture in the wild in Africa, imported in three shipments from Umfolozi National Park, South Africa. In 1970, 1972 and 1973, a total of 13 (4.9) animals were imported, of which two animals died still in the quarantine period. This first involved one of the females (Stdbk #1158), who probably died of pneumonia a mere 2 weeks after the arrival in 1970; in 1972, a male Faru (Stdbk #890) died of injuries that had probably occurred during the transportation. The remainder adapted well to the captive situation without any troubles. A pair (mother and son) from the latest - 1973 - transport (Natal and Uzima) was sold a year after, with the male shipped to Ostrava Zoo, while the female was purchased by Demmer (private). In 1977, female Smudla was imported, who was initially loaned to the zoo by Demmer, and later exchanged for the zoo's first raised white rhino - female Fatty (HOLECKOVA *et al.* 1994). In 1976, a two-month-old male lived in the zoo's quarantine facility (Rushden, Stdbk #277); imported by Liberec Zoo from England where bred at Whipsnade Animal Park, this animal never got in contacts with other local rhinos and was not a Dvur Kralove property. Once the animal's quarantine period was over, the rhino left for Liberec.

Following the import in 1970, the southern white rhinos were placed in the quarantine facility over several months, spending the summer in the enclosures of an exhibit called the African camp that had been constructed for them. Throughout the winter, the animals stayed inside the wintering facility; later on, this structure was used as a central store and from 2000, it served as a giraffe house. The summer months of 1971 and 1972 the rhinos again spent in the exhibit imitating an African wildlife capture camp. From 1973, the group was kept in the rhino house 1, split into two boxes, 6 m per 6 m each, where one box was designated for a group of 6 (2.4) older animals, males Joe and Dan and females Zuzi, Edita, Sasha and Vanda, while the other contained 4 younger rhinos (0.4), females Zamba, Faith, Tessa and Dinah. Outdoors, all the animals were kept together in a large enclosure, with additional young 8 (3.5) black rhinos. In 1973, this group comprised 18 rhinos, including 10 (2.8) southern whites, while in 1974 there were even 21 rhinos kept together outdoors, of which 12 (3.9) were those of the southern form.

After a pair was imported (Uzima and Natal, who were mother and son) in July 1973, the rhinos were distributed into three indoor stables, with Natal added to the four younger females, while Uzima, who had been dispelling her son Natal and attacking even older females, stayed on her own in a separate box. In the late 1974, 3 (1.2) rhinos left - a pair formed of male Natal and female Dinah left for Ostrava Zoo, and female Uzima who was shipped to abroad via Demmer (private), leaving two groups housed in two stalls - the original 6 rhinos (2.4) and the reduced group of three females (0.3), who had been staying together in the group of five (1.4). All those animals were still kept together with the black rhinos in the outdoor enclosure, meaning that two in fact mature white rhino males were permanently kept inside the group - Joe and Dan, born 1965 and 1966, respectively. As a result of the white rhino departures mentioned above, a social change occurred within the group, as three females (Faith, Tessa and Zamba) started being kept indoors without a male from 30 November 1974 in a single box, which they permanently shared with male Natal and female Dinah until that time. In additional 12 days, Uzima was housed in a separate box, accompanying the other rhinos only outdoors, left as well. Subsequently, all females were introduced outdoors only to a single male - Dan from January 1975, meaning that seven females of two groups, namely the older females, 8 to 9 years old Zuzi, Edita, Sasha and Vanda, and the younger cows, about 5 years old Zamba, Tessa and Faith, were released outdoors daily together with a single male Dan, at that time a nine-year-old rhino. Dan was kept indoors together with the four older females. Already from February 1975, Dan mated or at least attempted to mate all the three young females, i.e. only those who were not kept with the male indoors in a permanent situation, but whom he could join only outdoors. One of these (Faith) did conceive following a single mating that was recorded (6 April 1975). However, as the female was not showing any obvious signs of pregnancy or nearing birth, and the keepers were still lacking experience of how pregnant females should be handled, Faith continued being kept in the indoor box together with females Tessa and Zamba. Then Faith gave unexpected birth on 15 August 1976 in the night, and a newborn male Fall DK 1 was found dead inside the box in the morning. The post mortem examination proved that the male was alive when born, but then died of lung rupture as a result of being trampled. Since that time, every rhino female suspected pregnant was timely separated prior any expected or assumed birth based on that lesson learned.

In summer 1977, northern white rhinos were moved to the neighbouring stalls in the same house; however, both subspecies were kept separately from each other at all times inside the house and outdoors. In the same year, a southern white female Smudla arrived, who was initially loaned to the zoo as Demmer's property, but later exchanged for the zoo's first raised white rhino - female Fatty (HOLECKOVA *et al.* 1994). In 1980, this female left for Poland.

In the meantime, Faith became obviously pregnant again. This time the rhino was isolated for the birth into a separate box. On 4 April 1978, Faith delivered her second calf - female **Fatty DK 3**, and raised the calf without problems. Tessa got pregnant as well, giving birth to male **Teny DK 4** on 16 December 1978; the calf was reared completely without troubles. Dan even routinely mated Zamba, the last of the tree young females, but Zamba never got pregnant.

Unfortunately, Dvur Kralove Zoo had been criticised by that time by certain zoos and conservationists, without any support and justification, to be intentionally crossing the northern and southern form of the white rhino, which was not truth. This criticism was one of the reasons why the southern white rhino stock was discontinued, despite the promising development, to provide breeding capacities for the rare northern form imported in 1975. Therefore, all southern white rhinos including the breeding trio were sold or given away to other zoos in 1979 and 1980 (HOLECKOVA *et al.* 1994).

The breeding male Dan accompanied by Zamba and Sasha departed to Usti nad Labem Zoo; however, Zamba who had been mated by Dan in Dvur Kralove since 1975 (on 6 February for the first time), never got pregnant. On the other hand, Sasha was not mated by the male in Dvur Kralove at that time; this female only bore her first young (male Sagan - Stdbk. #865) several years after in Usti nad Labem in 1986. The Sasha's mating earlier in 1985 was preceded by her intentional separation from both the group and the male. Later on, when the first Sasha's offspring was weaned, this female became pregnant even two times, giving birth to two additional males - Doran, Stdbk #970 in 1991, and Dino, Stdbk. #1029 in 1993. Due to space issues, Doran was loaned to Dvur Kralove Zoo, while Dino left for Poznan Zoo, Poland, where he fruitfully mated their female soon after arrival, thus becoming one of the youngest sires amongst captive white rhinos, being 4 years and 7.5 months old at that time (FRESE 2009). Regrettably, none of the rest of southern white rhinos that were originally imported to Dvur Kralove has ever bred after the stock was terminated. Even more unfortunate was the fact that the extension of space failed to result in reproducing the other northern white rhino females kept in Dvur Kralove, when at the same time the departure of the southern breeding females was a great issue for the keepers, as the zoo sent out the only breeding females and the first offspring produced, while the black rhino stock was at that time undergoing a crisis, which was to culminate in deaths of several animals.

New southern white rhinos were imported only in 1990 - this involved a loan of male Frankie, 21, and female Sanni, 24, from Cologne Zoo. These animals however arrived to stimulate potential sexual activities of the northern form animals that still had not reproduced rather than for breeding purposes.

The most recent imported animal was male Doran produced by male Dan and Sasha at Usti nad Labem Zoo, who had been supplied to Usti Zoo from Dvur Kralove in 1980. This male was sent on temporary loan to Dvur Kralove in 1990 due to a lack of space at the zoo of his origin (HOLECKOVA *et al.* 1994).

Doran as well as Frankie & Sanni left Dvur Kralove in 1996 on the basis of loan terminating.

Details of all southern white rhinos imported, loaned and born are summarised in the tables below.



*In the summer of 1971 and 1972, young southern white rhinos were held in the African Camp exhibit. (az)*

**A list of southern white rhinos imported to Dvur Kralove Zoo prior to 31 December 2009**

Key: Stdbk # - the international studbook number of the animal, M - male, F - female

No.	Sex	Name	Stdbk #	Arrival	Born	Departure / Death in DK	Comments
1	M	Joe	110	2 Jun 1970 Umfolozi, SA	1965, Umfolozi, SA	12 Jul 1979, Lesna	† Lesna
2	F	Zuzi	112	2 Jun 1970 Umfolozi, SA	1966, Umfolozi, SA	16 Jul 1979, Lesna	† Lesna
3	F	Edita	113	28 Jun 1970 Umfolozi, SA	1966, Umfolozi, SA	3 Jun 1976, Liberec 12 Mar 1983, Cairo, Egypt	
4	F	Sasha	114	28 Jun 1970 Umfolozi, SA	1966, Umfolozi, SA	19 Nov 1980, Usti n/L	Proven breeder in Usti n/L † 2008 Usti n/L
5	F	—	1158	7 Sep 1970, v.d. Bring, Soest	1967, SA	1 Sep 1970, Dvur Kralove	† Pneumonia
6	M	Dan	111	15 Oct 1970 Umfolozi, SA	1966, Umfolozi, SA	4 Dec 1980, Usti n/L	1st breeding male † 2008 Usti n/L
7	F	Vanda	118	15 Oct 1970 Umfolozi, SA	1967, Umfolozi, SA	27 Apr 1979, Gelsenkir- chen, Germany	
8	F	Dinah	208	31 May 1972 Umfolozi, SA	1970, Umfolozi, SA	30 Oct 1994, Ostrava	† Ostrava
9	F	Zamba	209	31 May 1972 Umfolozi, SA	1970, Umfolozi, SA	19 Nov 1980, Usti n/L	Still alive
10	F	Tessa	110	31 May 1972 Umfolozi, SA	1970, Umfolozi, SA	1 Oct 1980 Wroclaw, Poland	2nd breeding female
11	F	Faith	110	9 Jul 1973 Umfolozi, SA	1970, Umfolozi, SA	29 Oct 1980 Katowice, Poland	1st breeding female
12	M	Faru	892	31 May 1972 Umfolozi, SA	1971, Umfolozi, SA	12 Jun 1989 Dvur Kralove	† Trauma
13	M	Natal	371	9 Jul 1973 Umfolozi, SA	1971, Umfolozi, SA	30 Oct 1994, Ostrava	Still alive
14	F	Uzima	910	9 Jul 1973 Umfolozi, SA	1966, Umfolozi, SA	12 Nov 1974, Demmer	
15	M	Rushden	277	7 Sep 1976, Gelsen- kirchen, Germany	15 Oct 1974, Whip- snade, England	19 Oct 1976, Liberec	Quarantined for Liberec Zoo
16	F	Smudla	307	5 Oct 1977 Demmer, Langato	1973, SA	3 Oct 1980 Wroclaw, Poland	† 1985, Wroclaw
17	F	Frankie	127	24 Aug 1980 Cologne, Germany	14 Jul 1968, Loos- kopdam, SA	9 Jul 1996 Aywaille, Belgium	
18	F	Sanni	199	24 Aug 1990 Cologne, Germany	18 May 1966 Umfolozi, SA	9 Jul 1996 Aywaille, Belgium	
19	F	Doran	970	21 Apr 1980, Usti n/L	13 Jan 1980 Usti n/L	25 Jun 1996 Belo Horizonte, Brazil	Son of Dan and Sasha

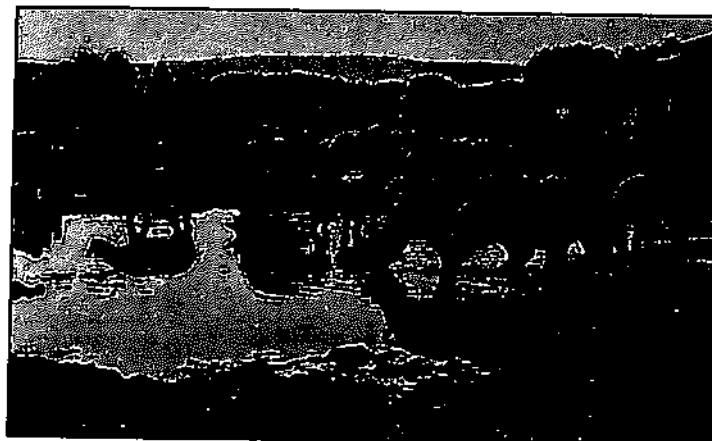
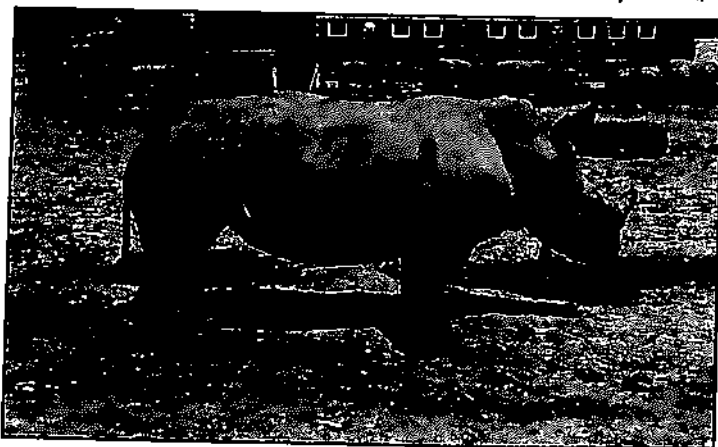
A total of 19 (7/12) animals were imported, including 1 (1/0) for Liberec Zoo kept only over a quarantine period.

**Southern white rhinos born at Dvur Kralove Zoo prior to 31 December 2009**

No.	Sex	Name	Stobk #	Dam	Sire	Born	Comments
1	M	Fali DK 1	??	Faith	Dan	15 Aug 1976	Died of trauma after the birth
2	F	Fatty DK 3	530	Faith	Dan	4 Apr 1978	
3	M	Teny DK 4	531	Tessa	Dan	16 Dec 1978	

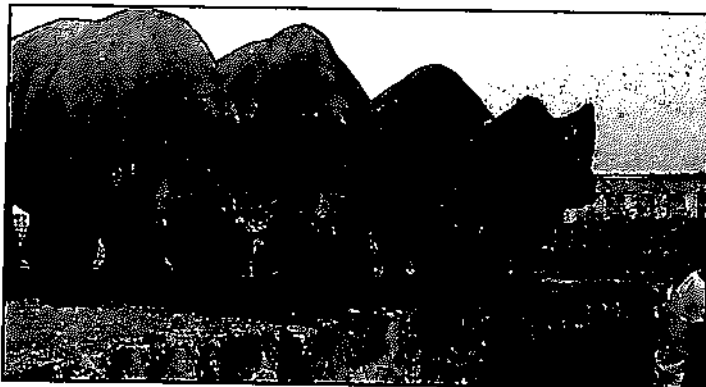
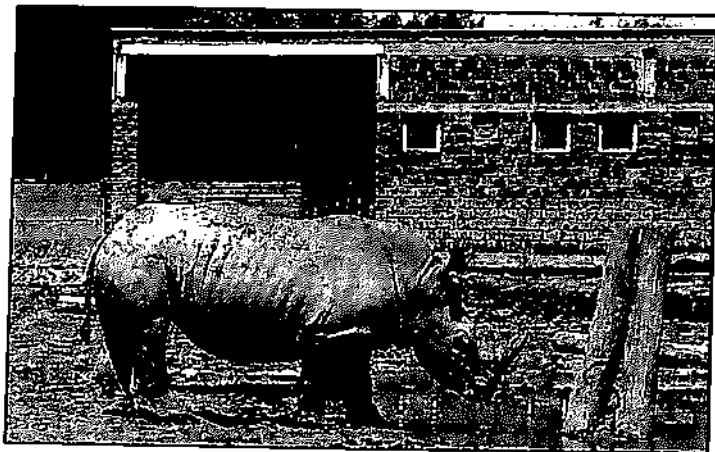


*Southern white rhinos from the first transport in the African Camp exhibit, 1970 (jov/az)*



*Even though already kept at the rhino house in 1973, southern white rhinos still used a mixed outdoor enclosure together with black rhinos. (vd/jh)*

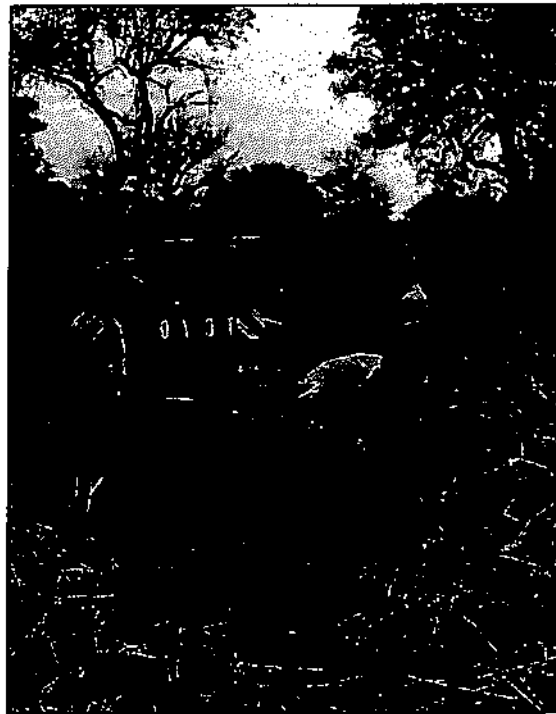




*Southern white rhinos in front of the rhino house #1 with keeper Mirek Svitalsky (lh)*

### Northern form

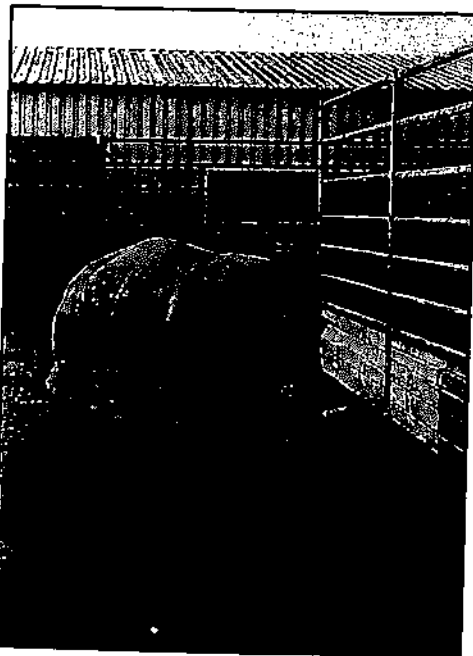
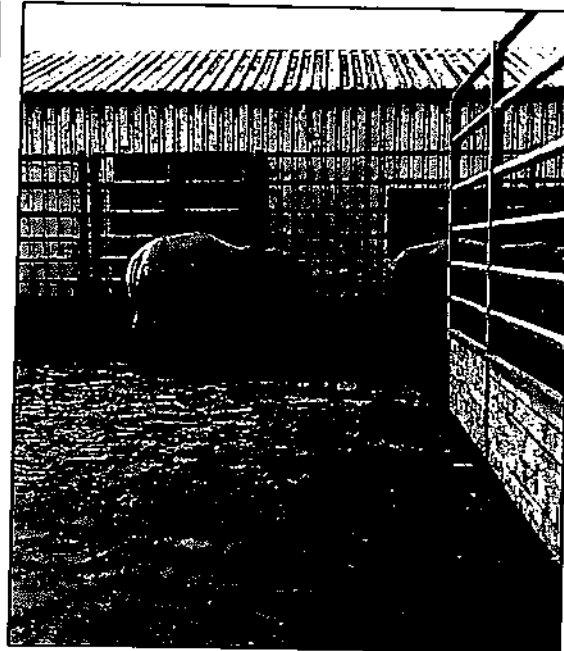
In 1975, 6 (2.4) northern white rhinos were imported from southern Sudan; the animals had been caught for Dvur Kralove Zoo in the swamp Upper Nile area near Shambe in April by Chipperfield, England. The young rhinos - about 1.5 years old - were first shipped up the River Nile to Juba and then carried by trucks to Nabiswa, Uganda, where kept four months in a quarantine facility. Transported by railroad to Kenyan Mombasa via Tororo, the animals continued to Hamburg, Germany, by an ocean cargo ship, where they were transferred to a Czechoslovak river boat that sailed down the Elbe River as far as the port in Decin, Czechoslovakia, and then by trucks to the city of Frantiskovy Lazne, where they were kept in a state-owned quarantine. Having stayed there for a month, the rhinos finally reached Dvur Kralove Zoo on 20 September 1975 (VAGNER unpublished). Concerning the transport, Dvur Kralove was subject to critics suggesting that protecting the remainder of rhinos in Sudan would have been a better option; it was believed there were about 780 individuals ranging in the country at that time (VAGNER unpublished). However, within ten subsequent years, northern white rhinos became almost extinct in the wild.



*Capture of northern white rhinos in Sudan, 1975 (az)*

Following arrival, the entire group was located in the central wintering facility where all animals were staying together day and night. In May 1977, all individuals were relocated into the rhino house 1 next to the southern white rhinos. Each of the white rhino forms walked separately into the adjoining outdoor enclosures (see page 49). The rhino house 1 became a final destination for a northern white female Nasima imported from England in late August 1977. At that time, the northern white rhinos continued to be kept permanently together not only outdoors, but also inside the house, when all six individuals (males Saut and Sudan, females Nesari, Nadi, Nola and Nuri) inhabited two interconnected stalls. Nasima was introduced to the herd outdoors on 29 September 1977, that is one month after arrival, but was attacked by Saut and subsequently Nasima attacked the male; over the next days, the situation became more relaxed and the rhinos were respecting each other when held outdoors. From 3 October on, Nasima who was kept in a stall next to the herd was refusing to walk outdoors with the remainder of the northern whites, and thus putting the female together with other animals discontinued.

**Northern white rhinos at the central wintering facility over the first winter (1975/1976)**



*Northern white rhinos in the pen of the central wintering facility, winter 1976 (pb)*

Nasima, who had been caught in the wild (Uganda) in 1965, was imported from Knowsley Safari Park, Prescott, England and arrived in the high period of pregnancy, as was found later on, with however no-one being aware of that. As the female prevented any attempts of making a company to any other northern female or rhino as such, she was isolated in a separate box where she gave surprising and unexpected birth to female **Nasi DK 2** on **11 November 1977** as early as 2.5 months upon her arrival at the zoo. Nasi's father was Arthur (Stdbk #355), a southern white rhino male, with whom Nasima had been kept in Knowsley for several years. Mating probably occurred anywhere between 15 and 20 July 1976. Nasi was historically the first and only crossbred offspring of the two white rhino forms that was ever born around the world.

Nasima was kept with Nasi DK 2 in a separate part of the house, without any contact with the northern form group. When reached 11 months of age, Nasi was separated from her mother on 16 October 1978 and on the next day relocated to the rhino house 2 inhabited by black rhinos, and thus weaned. Nasima was on 9 November 1978 put together with the northern white rhino herd consisting of two males and four females that were still being kept together permanently, not only outdoors, but also indoors, housed in interconnected stalls. As early as 20 and 22 November, Nasima mated with Saut outdoors and got pregnant. At the same time, the female again refused staying in the group, so was still kept in a separate box inside the house next door to the northern white rhino herd. During the spring, Nasima was repeatedly united with the group, but still isolated at night as she was fighting with every rhino. Additionally, Sudan was retained in the herd as of February 1979 as a single male due to escalating aggression between both male rhinos aged at that time 6 and 7 years; this male was permanently staying together with the females both outdoors and indoors. In April 1980, the 2.5-year-old Nasi joined the northern white rhino group, i.e. male Sudan and females Nesari, Nadi, Nuri and Nola. On 10 May 1980, Nasima was showing behaviour as if in oestrus, so was put together outdoors with Sudan; both rhinos treated each other as if ready for mating. In the days to follow, Nasima went out with male Saut, but was attacked by the male on 13 May and thus separated and any reuniting discontinued. Less than a month later, on **8 June 1980** early in the morning, Nasima bore her second calf - male **Suni DK 5**, the first pure northern white rhino born in captivity. At that time, enlarged udder and milk secretion was the only known indication of coming birth as other methods of determining if a female was pregnant were unknown. However, the signs above often could not be seen earlier than a month prior delivery or even later.

As of November 1981, Sudan was separated from the rest of herd indoors into a self-contained box; since that time, only females were kept together indoors (at night), joining the male only outdoors.

In January 1982, attempts to reunite Nasima and her calf with the group of five females (Nesari, Nola, Nadi, Nuri and Nasi DK 2) failed, thus this female rhino was continued being kept separately with her son Suni DK 5.

At the same time - early January 1982, Nuri died of shock as a result of trauma following slipping on glazed ice, when her pubic symphysis ruptured.

The young Suni DK 5 was weaned from Nasima on 11 May 1982 when he was 1 year and 11 months old. On 22 May, Nasima was paired with Sudan as she seemed to have entered oestrus; the animals mated immediately. Mating took place again on 23 and 24 June, and then on 18 July, when Nasima became pregnant. At the same time, Nasima and the rest of females were kept together indoors in three interconnected stalls as of 29 May. Nasima was isolated on 27 April 1983 into a separate box as she appeared to have been pregnant, being attacked by male Sudan in the outdoor enclosure. On **15 November 1983** in the night, this female gave birth for a third time, to **Nabire DK 6**, her second daughter, whom Nasima reared without problems as well as she did in the case of her previous calves. When Nabire was 6 months old, she was put together with the rest of herd as well as her mother, but attacked by Sudan. Therefore, Nasima and the calf still continued being housed separately both indoors and outdoors. Nabire was weaned when 12.5 months old (09-12-1985) and Nasima subsequently paired with male Saut; nonetheless, this female was still lactating at that time. As early as 25 December 1985, Nasima was successfully reunited with the group of females and kept since indoors in the group situation, which involved a total of five females (Nasima, Nesari, Nadi, Nola and Nasi), despite showing unrest and aggression towards the remainder in early January. Ever since Nasima was kept permanently in the female group, this female did mate with Sudan, even repeatedly, but each time failed to be pregnant (mating occurred on 12 August, 18 September, 17 October and 18 November 1986). Mating attempts continued in 1987 as well, when Nasima was noted by the keepers to show periods of some kind of false oestrus, similarly as the remainder of the females within the herd. Mating also occurred on 12 May and 10 June 1987.

In the meantime, male Ben who had already reached 36 years was imported from London in late August 1986 with the aim to involve the rhino being the last Europe's remaining member of the northern form in the breeding scheme. Ben was united with the group in June 1987, with an attempt to mate Nasima registered on 14 July 1987. However, as this male rhino was unable to copulate, the females were split, with Nasima staying indoors with Nasi and Nesari only and paired with Sudan. Mating of Nasima and Sudan oc-

curred on 12 August and 13 September 1987, with subsequent replacement of the male, when Saut was put together with Nasima and other females, trying repeatedly breed Nasima in October 1987. In November, Sudan was being united with the female group again, trying to breed Nasima on 15 December 1987. Mating took place outdoors within the female group on 14 January, 13 February and 17 March 1988, when Nasima finally became pregnant. This female began attacking the other rhinos as early as 24 May, thus held separately in a special box. Any subsequent introductions of the male were full of aggression, so Nasima stayed alone. On 11 July 1989 in the afternoon, this female bore her third daughter - Najin DK 7, who was reared by the mother without complications.

Today it appears that it was the permanent keeping within the group of other female rhinos with whom Nasima stayed night and day both indoors and outdoors, for many months (total 1.5 years) what had the negative impact on the female's oestrus in 1986 and 1987, as a result of which this rhino failed to get pregnant, yet still mating. Afterwards, social changes occurred within the group, induced by uniting with the male imported from London and splitting the group into two parts. The return of Nasima's full oestrus resulting in the female's pregnancy could probably be invoked by the division of the female group, particularly the separation of Nasima and Nabire - her 3.5-year-old daughter, with additional factors being the arrival of and the uniting with the new male Ben.

By that time, however, intense efforts were underway to make the remainder of the females reproduce; the first international meeting concerning the northern white rhino took place in Dvur Kralove on 5-7 February 1986, with participating representatives of CBSG/IUCN, where the critical status in the wild was reviewed and a necessity declared of involvement of additional individuals in breeding, including the aged male Ben (Stdbk #19) held since 1955 at London Zoo, where following the death of Bebe, a northern form female (Stdbk #290), the male was kept totally alone since 1964, i.e. 22 years. Alike Bebe, male Ben was born in Uganda in 1950, from where this pair travelled in 1955 to London Zoo.

Based on the February 1986 meeting, it was decided to build a new house just for the northern white rhino and design work was launched. At the same time, a new department involved in the rhino propagation was set up within the zoo's research institute, with staff starting to explore a method of female cycle detection and seeking to collect and examine sperm of the males. The adult females Nasi, Nadi and Nesari, so far non-breeders, and males Suni and Sudan were anaesthetised on 4 August 1986 to undergo examination of their reproductive tracts under the attendance of experts from London and the USA. During the session, the non-breeding females were found to have probably been not cycling due to hypertrophic hymen (VAHALA 2008) and it was suggested that their hymens had become hypertrophied because the females were not mated; as a result, their hymen could act as contraception, so the females failed to enter oestrus. Therefore, the females were anaesthetised and their hymen perforated by veterinarians. The same treatment was carried out in the southern form females Sasha and Zamba (formerly kept in Dvur Kralove) at Usti nad Labem Zoo in 1986 in cooperation with Dvur Kralove vets, where Sasha became successfully pregnant not very long after. It should be however noted from today's perspective that both Sasha and Zamba were actually mated in Dvur Kralove when they were still young, so hypertrophic hymen might have been related to the fact that these females had not been mated for a long time and namely never gave birth rather than being never mated. In 1987, hormonal stimulation of the females was underway.

In the same period, research in hormonal cycles was underway in Dvur Kralove from 1986, with females sampled for vaginal swabs and morning urine, with samples being subsequently investigated for suitable metabolites of sexual hormones. Early in the morning, keepers, veterinary assistants and vets were waiting inside the house for the rhinos to wake up, collecting personally urine into beakers to avoid contamination of urine on the box floor, which was not very easy, but essential for the research of cycles in females.

The next meeting with the representatives of the Captive Breeding Specialist Group (CBSG) to the IUCN was held at Dvur Kralove Zoo on 24-26 February 1988, with participants including Drs Ulysses Seal, CBSG Chairman, and David Jones, a CBSG member and Director of the Zoological Society London. It was stated during the meeting that there were 18 free-ranging northern white rhinos in Garamba NP, Zaire, 5 animals in Sudan and possibly 1-2 individuals in the Central African Republic, while in captivity there were 4 males, 5 females and 1 crossbred animal at Dvur Kralove Zoo, a single old male in San Diego and male at Khartoum Zoo, about 10 years old. Further, results achieved within the research as agreed in 1986 were summarised as follows:

- Research activities were underway in Dvur Kralove, London and San Diego, when the most success concerning oestrus detection was achieved by Dvur Kralove personnel through using hormonal metabolites in female's urine, while other partners had come only to particular and non-applicable results. It was agreed that Dr Hodges, London's veterinarian, would come to Dvur Kralove to study the local methods used, while transferring his own experience from London.
- Dr Seal initiated the efforts to establish a second group of northern white rhinos.
- In addition, visits were paid to the construction site of the new rhino house and labs of the Institute for Genetic Pool Conservation at Dvur Kralove Zoo.